APPENDIX C

Terminal Planning Study

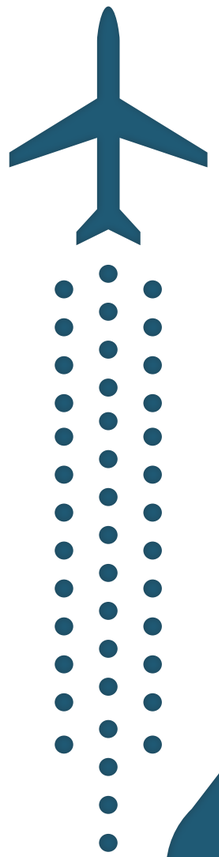
Mead & Hunt

FSD
Sioux Falls Regional Airport

SIOUX FALLS REGIONAL AIRPORT

(FSD) TERMINAL PLANNING STUDY

OCTOBER 2023



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CONTENTS

1. PROJECT OVERVIEW

1.1 BACKGROUND

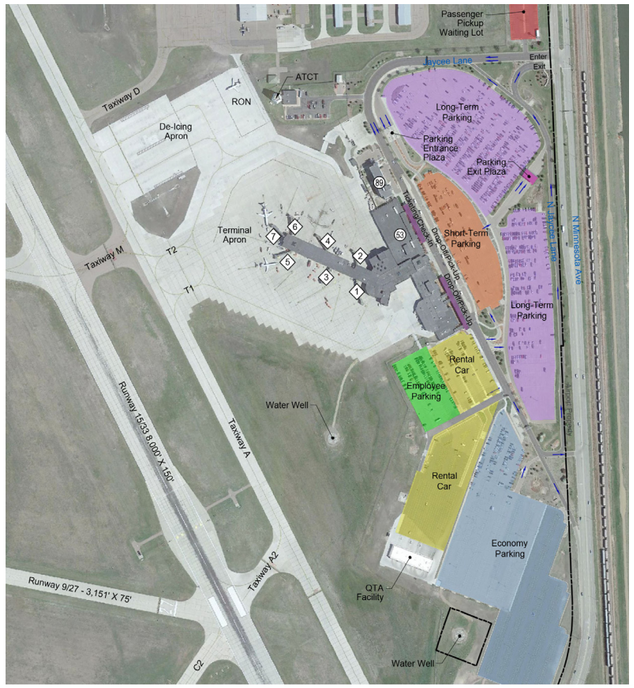
Sioux Falls Regional Airport (the Airport or FSD) is a small-hub primary airport two miles north of downtown and three miles southeast of the junction of Interstate 29 and Interstate 90 **(Figure 1-1)**. The existing terminal building, constructed in 1968 has undergone many incremental improvements since then to address evolving industry standards and passenger demand. Some major terminal enhancements since 2000 include:

- 2001: 9,200 square-foot (SF) expansion for baggage claim, Federal Inspection Services (FIS), and rental car offices
- 2004: Security Screening Checkpoint (SSCP) remodel with meet/greet areas, restroom remodels, additional airport administration rooms, seating on lower level
- 2009: Addition of in-line baggage system, and ticketing area modifications
- 2012: Terminal concourse expansion and renovation completed (holdrooms, new Passenger Boarding Bridges (PBBs), and departure lounge areas)
- 2016: SSCP expansion with vertical circulation rehab
- 2018: Baggage Claim Expansion

Figure 1-1 Sioux Falls Regional Airport

Since these major capital improvements, the Airport has experienced significant passenger growth requiring further evaluation of terminal expansion.

The terminal area addressed in this study includes the apron, commercial terminal, arrivals/departure curb, employee parking, short-term parking, long-term parking, and rental car lots as shown in Figure 1-2.



Existing Buildings/Facilities	
53	Terminal Building
89	AeroStay Hotel
1	Gates 1-7

Figure 1-2 FSD Terminal Area

1.2 TERMINAL PLANNING STUDY ORGANIZATION

A **Terminal Planning Study (TPS)** is a comprehensive report that provides guidelines for improvement of the airport terminal building, the terminal apron, and vehicle access. The Federal Aviation Administration (FAA) has developed the airport planning process to assist the nation's airports in developing plans for expansion and improvement to facilities, with the goal of meeting both existing and future aviation demand and safety requirements. This TPS was completed with guidance from the FAA Advisory Circulars and industry references for airport terminal planning and design.

The TPS is organized into the following sections:

- Project Overview (previous page)
- Terminal Facility Inventory
- Forecasts
- Terminal Programming
- Improvement Alternatives
- Implementation

Section 2, Terminal Facility Inventory. The purpose of the terminal facility inventory is to identify facilities and conditions that currently exist within the terminal area at FSD. An inventory of the existing facilities provides the baseline required to evaluate performance and anticipate future need.

Section 3, Forecasts. The peaking demand analysis will be based on the forecasts that were approved by the FAA in March 2022 as part of FSD's Airport Master Plan. A peaking demand analysis will evaluate the amount of peak departing and arriving seats the Airport experiences through an average day of the peak month. This evaluation will be the foundation of the terminal facility requirements.

Section 4, Terminal Programming. This section identifies terminal facility requirements anticipated for FSD through the year 2041. The capacity of the existing terminal is described and assessed against aviation demand planning activity levels, providing the basis for making recommendations for appropriate sizes of terminal building components and aircraft parking layout. This analysis determines requirements for future facility improvements based on industry standards and guidelines developed by the FAA.

Section 5, Improvement Alternatives. This section follows the development of alternative layouts for both the terminal complex and terminal building. The layouts are assessed for expected aeronautical utility, fiscal feasibility, and operational performance. A recommended alternative is indicated.

Section 6, Implementation. This section of the TPS demonstrates FSD's ability to finance the projects discussed in terms of funding sources and eligibility for FAA funding. A plan for implementation includes a project schedule, phasing plan, and opinion of probable construction cost.

2. TERMINAL FACILITY INVENTORY

This section describes existing conditions. The terminal building was inventoried, and its layout was assessed for overall performance. Physical and operational deficiencies of the existing terminal building and its systems were identified. Additional references for this section include airport meetings, examinations of plans, and a review of previous planning documents.

2.1 TERMINAL BUILDING

The inventory and evaluation occurred in June 2022 to determine the existing capacity and viability of potential expansions. The passenger terminal building consists of approximately 180,000 square feet on two levels—the lower level accommodates ticketing, airline ticket offices (ATO), pre-secure concessions, general aviation facility (GAF), baggage screening, mechanical rooms, baggage claim, and rental car services; and the upper level consists of passenger screening, administrative space, meeter /greeter waiting areas, post-secure concessions, and gate departure lounges.

On the lower level, the ticketing area, queuing space, ATOs, outbound baggage area, and baggage screening are on the north portion of the facility as shown in **Figure 2-1**. Baggage claim, GAF, and rental car offices are on the south portion of the building. The building's center accommodates pre-secure concessions and a grand vertical circulation core that facilitates the transfer of passengers from the lower level to the upper level. Most of the lower level is non-secure except the areas designated for baggage screening, inbound baggage make-up, and outbound baggage make-up.

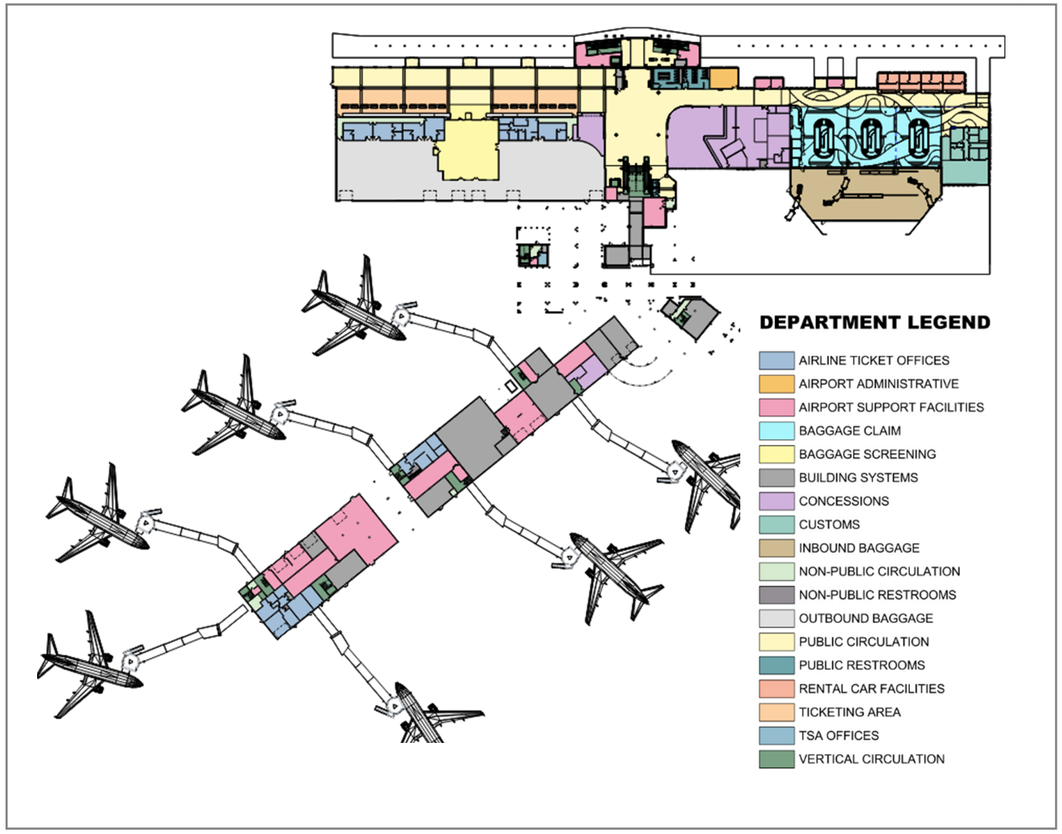


Figure 2-1 Lower Level Floor Plan

Figure 2-2 shows the upper, or concourse level. The concourse level consists of passenger screening, administrative offices, a meeter/greeter area, and the concourse. The concourse has six departure lounges with seven passenger boarding bridges, a full-service restaurant and bar area, business lounge, play area for kids, retail shop, two restroom modules, and a Service Animal Relief Area (S.A.R.A.).

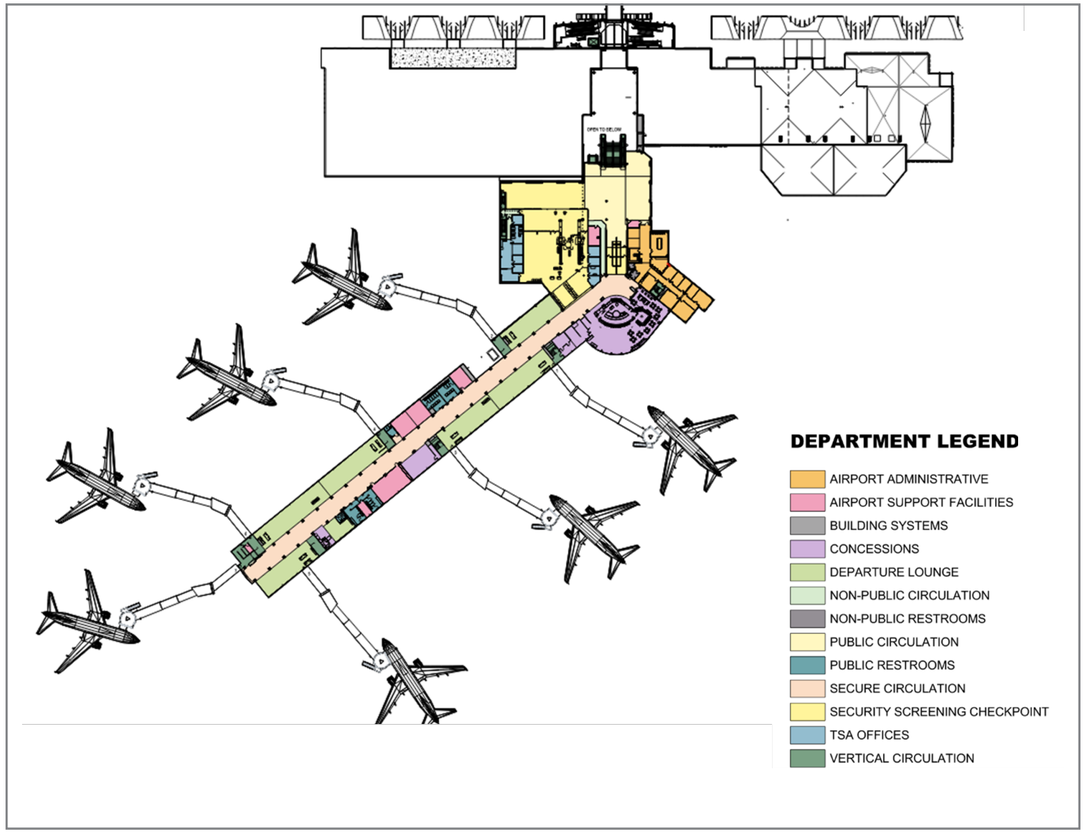


Figure 2-2 Upper Level Floor Plan

FSD - Existing Terminal Program

The breakdown of terminal space by functional category and elements is shown in **Table 2-1**.

Space Description	Level 1	Level 2
Ticketing Area		
Ticket Agent Positions (# of)	38	-
Ticket Counter Length (ft)	195	-
Ticket Counter Area (sf)	1,899	-
Ticketing Queueing (sf)	3,367	-
Kiosks (# of)	6	-
Airline Ticket Office Space and Administration (sf)	6,413	-
Total Ticketing Area	**11,679**	**0**
Bagging Service Areas		
Bag Claim Carousel, Floor Area & Oversize (sf)	8,982	-
Baggage Services Offices (sf)	655	-
Bag Claim Carousel Frontage (lf)	315	-
Bag Claim Carousel (Slope Plate) (# of)	3	-
Outbound Baggage (sf)	15,630	-
Inbound Baggage (sf)	7,871	-
Total Public Baggage Areas	**33,138**	**0**
Airport Support Area		
Operations (sf)	-	151
Badging (sf)	-	193
Administrative (sf)	636	3,871
Storage/Maintenance (sf)	12,072	924
Total Airport Area	**12,708**	**5,139**
Ground Transportation Area		
Car Rental Ticket Counter Area (sf)	782	-
Car Rental Office Area (sf)	978	-
Total Car Rental Area	**1,760**	**0**
General Spaces		
Non-Secure		
Public Circulation (sf)	23,064	4,086
Meeter Greeter (sf)	-	2,031
Restroom Area (M+F+Family)(sf)	1,231	-
M+F+Family Restroom Fixtures (# of)	12+7+2	-
Sub Total Public Areas	**24,295**	**6,117**

Space Description	Level 1	Level 2
Secure		
Secure Public Circulation (sf)	-	10,039
Airport Amenities* (sf)	-	2,296
Restroom Area (M+F+Family)(sf)	-	1,548
Service Animal Relief Area (sf)	-	109
Mother's Room (sf)	-	30
M+F+Family Restroom fixtures (# of)	-	11+10+1
Sub Total Public Areas	**0**	**14,022**
Non-Public		
Non-Public Circulation (sf)	3,063	688
Restroom Area (sf)	217	132
Sub Total Non-Public Areas	3,280	820
Vertical Circulation	4,066	3,455
Total General Area	31,641	24,414
Concessions		
Pre-Secure		
Food and Beverage (sf)	4,207	-
Retail (sf)	924	-
Storage and Support (sf)	3,250	-
Sub Total Pre-Secure Concessions	**8,381**	**0**
Post-Secure		
Food and Beverage (sf)	-	4,528
Retail (sf)	-	786
Storage and Support (sf)	-	1,011
Sub Total Post-Secure Concessions	**0**	**6,325**
Total Concessions Area	**8,381**	**6,325**
Departure Lounges		
# of Gates (# of)	-	7
Gate Departure Lounges (sf)	-	10,062
Total Departure Lounge Area	0	10,062

Space Description	Level 1	Level 2
Transportation Security Administrative (TSA) Areas		
Security Screening Checkpoint (SSCP)		
Number of Lanes (w/PreCheck) (# of)		2
Checkpoint (sf)		6,437
Checkpoint Queue (sf)		2,500
Checkpoint Exit Lane (sf)		678
TSA Admin Offices and Support Space (sf)		2,009
Sub Total SSCP Area	**140**	**11,624**
Baggage Screening Areas		
EDS Devices (# of)	3	
TSABag Screening Floor Area	4,409	
Sub Total Baggage Screening Area	4,409	
Total TSA Area	4,549	11,624
U.S. Customs and Border Protection (USCP)		
U.S. Customs and Border Protection (sf)	2,820	-
Total USCBP Area	**2,820**	**0**
Building Support		
Building Systems and Major Chases	559	1,079
Mechanical, Electrical, and Plumbing	12,780	1,548
Sub Total Building Support Space	**13,339**	**2,627**
TOTAL TERMINAL FACILITY AREA	120,015	60,191

* Airport Amenities include Business Lounge, Sanford Play Area, and Float Seating adjacent to Play Area

Table 2-1 FSD Terminal Program Take-Offs

2.1.1 TICKETING AREA AND AIRLINE TICKET OFFICES

The Ticketing Area **(Figure 2-3)** is on the north portion of the terminal on the lower level with space for passenger circulation, queuing for kiosks and full-service positions, and space for ticket counters and kiosk machines. The ticketing area at FSD consists of 38 full-service ticket counters, four kiosks, 1,889 SF of ticket counter space, and 3,367 SF of queuing space. The majority of ticket counters at FSD consist of a two-person, seven-foot-wide counter accompanied by a three-foot-wide baggage scale. Additionally, the distance between the ticket counters and baggage screening feeder belts is approximately five feet for airline personnel to conduct passenger processing functions.

Figure 2-3 FSD Airline Ticket Counter Positions

Queuing space is defined as the space designated for passengers to queue as they wait to be serviced by a full-service ticket position or kiosk machine. The depth of queuing space in the ticketing area is approximately 17 feet. Between the queuing space and terminal façade is a 20-foot passenger circulation corridor. Depending how airlines configure their queuing systems, the passenger circulation corridor can become congested during peak times when queued passengers overflow into the circulation space.

FSD has two separate ATO spaces directly behind the ticket counter space with the outbound in-line baggage screening system between. This space includes offices that the airlines use for operations, and training, and storage. United and Allegiant currently operate out of the south ATO space, while Delta, American, and Frontier operate out of the north ATO space. The non-public circulation corridors that provide separate access to the north and south ATO areas can be accessed on the north and south ends of the ticketing area respectively.

2.1.2 OUTBOUND BAGGAGE SCREENING AND MAKE-UP AREA

Behind the ticket counters is an in-line baggage handling system that transfers checked baggage from the ticketing area to the Transportation Security Administration (TSA) baggage screening area. FSD currently has three explosive detection systems, located in the baggage screening room that can each screen up to 180 bags per hour. The baggage screening room is configured with two EDS scanners on the north portion of the room serving airlines utilizing the north ticket counter area and one EDS scanner (with space to accommodate two) on the south portion of the room serving bags from airlines utilizing the south ticket counter area. The south matrix was designed to accommodate two EDS machines and originally included both. Running through the center of the baggage screening area is an in-line baggage belt serving oversized bags. Manual screening also occurs in this room when baggage is alarmed for secondary level screening. Once baggage is cleared, the screening system transfers baggage to the outbound baggage make-up area.

Similar to the baggage screening area configuration, FSD's two outbound baggage make-up areas are divided by the airlines operating at the north ticket counters and the airlines operating at the south ticket counters. The outbound baggage make-up areas **(Figure 2-4)** are directly behind and adjacent to the baggage screening area. Each area has a flat-plated carousel accommodated on each side by a staging lane and by-pass lane. The double-loaded carousel to the north is 56 feet in length and the double-loaded carousel to the south is 51 feet in length. With this carousel length, each carousel can accommodate approximately eight baggage carts simultaneously (parked parallel) for baggage to be loaded. Once carts are loaded, baggage carts use the bypass lane to exit the make-up area.

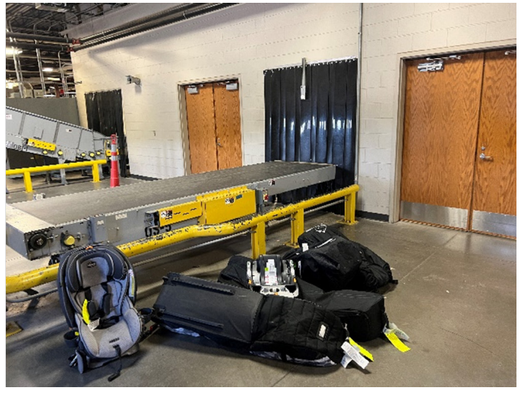


Figure 2-4 Outbound Baggage

2.1.3 PASSENGER SECURITY SCREENING CHECKPOINT

The SSCP was expanded in 2016 to provide sufficient space for up to six screening lanes if the TSA offices on the north side of the SSCP area are relocated. The SSCP currently consists of two lanes, two travel document check (TDC) stations, one walk-through metal detector, one ProVision advanced imaging technology scanner, and two advanced technology, HI-SCAN 6060 CTIX X-Ray scanners **(Figure 2-5)**. Employees and PreCheck passengers use the south lane for screening while standard passengers utilize both. Space for queuing is just east of the SSCP. South of the SSCP are TSA Administrative offices and a private screening room, while north of the SSCP are training rooms and TSA breakrooms.

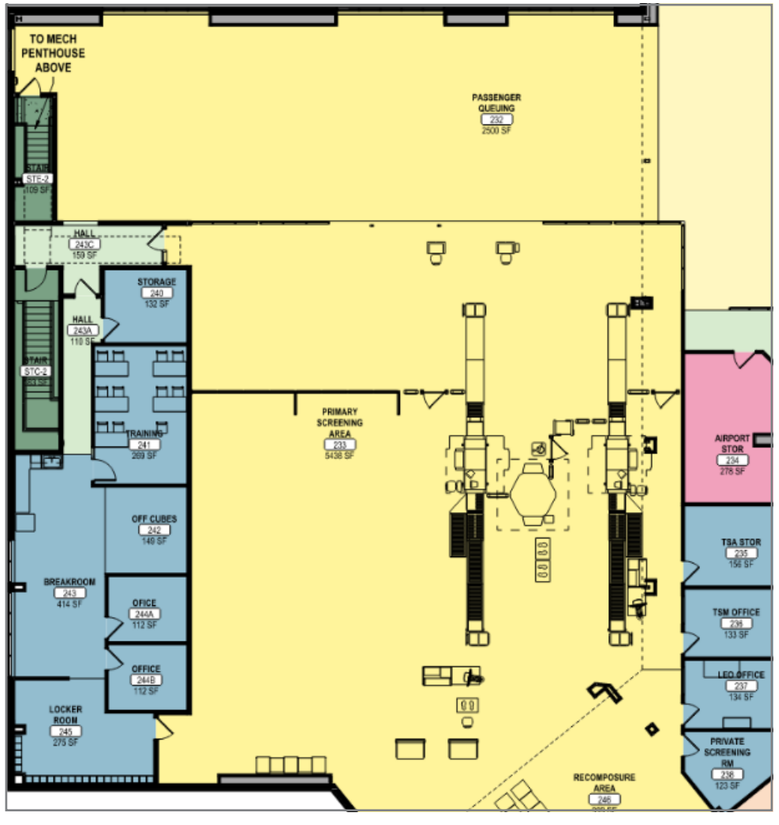


Figure 2-5 Security Screening Checkpoint

2.1.4 INBOUND BAGGAGE MAKE-UP AREA

The inbound baggage make-up area is on the lower level of the south portion of the terminal **(Figure 2-6)**. Makeup area for inbound baggage consists of three feeder belts accompanied by a staging lane and by-pass lane. Baggage carts enter the area either from north or south of the terminal. Oversized baggage doors are adjacent to each carousel. Vehicles and other ground service equipment (GSE) often stage on the west wall.

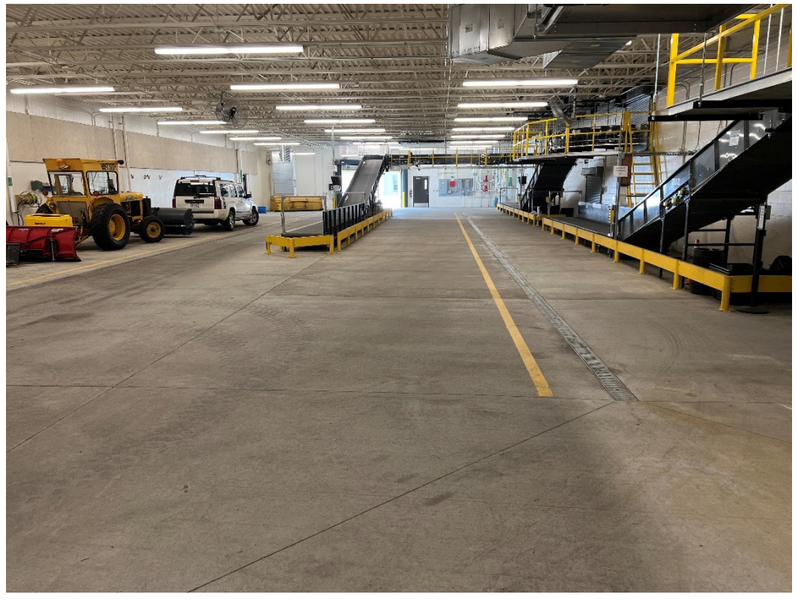


Figure 2-6 Inbound Baggage Area

2.1.5 BAGGAGE CLAIM AREA

The baggage claim area **(Figure 2-7)** consists of the baggage carousels, oversized baggage access doors, baggage service offices, and dwelling areas for passengers. The baggage claim area at FSD was modified in 2018 to include three, slope-faced baggage carousels spaced 30 feet apart, and four baggage service offices and a three-position bag service counter. Having approximately 105 lineal feet (LF) of baggage belt, each carousel can accommodate approximately 180 people at once, or 540 people for the entire baggage carousel area. Baggage Claim 3 provides sterile corridor capabilities for FIS activities as it has a rolling curtain wall surrounding it. When not being used for sterile activities, the curtain wall is stored in the structural columns surrounding the claim area.

The baggage service offices are located on the north wall of the baggage claim area. When facing the baggage claim wall, Frontier and Allegiant occupy the furthest left office, followed by American occupying the second left office, Delta occupying the third, and United occupying the fourth. Next to United's baggage service office area is a baggage service counter. The most southern part of the baggage claim area provides seating for meeters and greeters.

Figure 2-7 Baggage Claim Area

2.1.6 RENTAL CAR COUNTERS

Several companies operate from four rental car counters conveniently located directly east of the baggage claim area. The rental car companies are Alamo, Avis, Budget, Enterprise, Hertz, and National. Each company's administrative office is located behind the counter. Since designated markings for queuing systems do not exist at the rental car counters, rental car queuing routinely disrupts passenger flow for arriving passengers trying to access the baggage claim area and departing passengers entering from the south entrance **(Figure 2-8)**.

Figure 2-8 Rental Car Companies

2.1.7 DEPARTURE LOUNGES

Departure lounges include the areas where passengers dwell before boarding. These areas consist of seating, agent podiums, queuing space, baggage circulation, and passenger circulation. FSD has seven contact gates where a PBB connects to the aircraft from the terminal building with three gates acting as swing gates, or gates that serve two aircraft parking positions. Currently, Gate 4 and Gate 6 are the only gates exclusively leased by an airline with Delta occupying Gate 4 and United occupying Gate 6.

FSD's double-loaded concourse is configured with 20-foot depth departure lounges separated by a 18-foot wide passenger circulation corridor. The departure lounge depth is visibly undersized as passengers overflow into the circulation corridor when waiting to board their flight, causing passenger flow challenges as shown in **Figure 2-9**.

Figure 2-9 Departure Lounges and Secure Circulation

2.1.8 CONCESSIONS

The concessions program at FSD consists of pre-security and post-security concessions. Pre-security concessions include all concessions located before the SSCP, while post-security concessions are located beyond the SSCP. FSD currently has 50 percent of passenger-facing concession space post-security, leaving 50 percent pre-security. Pre-security concessions include a sit-down, full-service bar and restaurant called Skydine, a Subway, and a retail shop on the lower level. The bar and restaurant are accompanied by a food-prep area, storage space, and concessionaire office space. **Figure 2-10** shows a view of the pre-secure full bar and restaurant.

Figure 2-10 Pre-Secure Food and Beverage Concessions (Looking West)

Post-security concessions **(Figure 2-11)** include a full-service bar and restaurant called Skydine directly beyond the SSCP. The restaurant is equipped with a full kitchen and storage for food and beverages. Concessions are delivered to the restaurant via the SSCP or a concessions dumbwaiter located adjacent to the kitchen.

Passengers are more willing to experience an airport's concessions program after they get processed through security. With the current concessions program split, FSD has opportunities to generate additional revenue through their concessions program as part of this TPS.

Figure 2-11 Post-Security Concessions (Left: Red Stone Pizza Company, Right: Retail Shop)

2.1.9 GENERAL AVIATION FACILITY (GAF)

The Airport's GAF facility is in the southernmost corner of the terminal building, adjacent to the baggage claim area, with direct access to the air carrier apron. U.S Customs and Border Protection (USCBP) provide immigration processing for passengers arriving from abroad on a general aviation flight. The GAF facility also accommodates the baggage screening and baggage claim functions for international passengers and includes office space for USCBP. USCBP does not currently accept international air carrier or large charter flights at FSD.

2.1.10 AIRPORT ADMINISTRATIVE AREAS

Airport administrative offices include any space that airport staff uses to conduct daily job responsibilities. This space can include offices, conference rooms, office lobbies, storage for office supplies, and dispatch centers. Airport administrative offices at FSD are primarily located in the non-secure area on the upper level adjacent to the meeter/greeter area. This area includes a conference room, training room, one vacant cube space, building support office, operations office, the deputy director's office, the executive director's office, a storage/file room, break room, badging area, the office manager's office, restrooms, and a stairwell leading to the apron level. The board room is located on the lower level adjacent to the pre-secure restrooms to the south of the main entrance/exit.

2.1.11 RESTROOMS

Restrooms in an airport are typically divided into pre-security, post-security, and non-public. Additionally, restroom facilities also include Service Animal Relief Areas (SARA) and nursing mother stations. Restrooms are measured in modules, or one restroom for men and one restroom for women. Within each module are fixtures, or the number of commodes, in each male, female, family, or all-gender restroom.

PRE-SECURITY RESTROOMS

Pre-Security restrooms are accessible to the public in a non-secure area before the SSCP. These restrooms are generally meant for passenger use; however, employees often use these facilities as well. FSD has one main restroom module located adjacent to the primary entrance/exit of the Airport. This module has 12 fixtures in the male restroom and seven fixtures in the female restroom. Two family restrooms are located just south of the primary vertical circulation core in the center of the facility. Additionally, there is a pre-security nursing mother station adjacent to the women's restroom.

POST-SECURITY RESTROOMS

Post-Security restrooms are accessible to the public in the secure area after the SSCP. FSD has two main restroom modules, male and female, post-security. One module is between Gates 2 and 4 and includes a male restroom with six fixtures, and a female restroom with six fixtures. The second module is between Gates 3 and 5 and includes a family restroom with one fixture, a male restroom with five fixtures, and a female restroom with four fixtures.

NON-PUBLIC RESTROOMS

Non-public restrooms are for employees and TSA officers. The only non-public restrooms are in the administrative areas, and in United and Delta's operations area under the concourse.

NURSING MOTHER STATIONS

FSD currently has one nursing mother station pod post-security adjacent to the Sanford Play Area as shown in **Figure 2-12**.

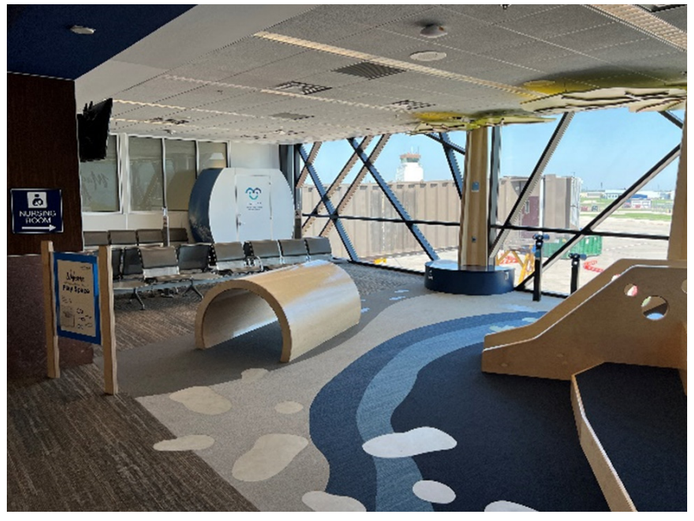


Figure 2-12 Nursing Mother Station

SERVICE ANIMAL RELIEF AREA (S.A.R.A.)

A SARA **(Figure 2-13)** is located between Gates 2 and 4.

Figure 2-13 Service Animal Relief Area

2.1.12 PASSENGER AMENITIES

Amenities are offered throughout the terminal to enhance the passenger experience. Kids can enjoy a play area between Gates 1 and 3 and all passengers can access a business lounge between Gates 4 and 6. There is also an arcade adjacent to the Red Stone Pizza Company.

2.1.13 BUILDING SYSTEMS

The building systems evaluated as part of the TPS include structural, Mechanical/Engineering/Plumbing (MEP), Fire Protection, Technology, and Security.

STRUCTURAL SYSTEMS

The existing structure was constructed in multiple previous projects. The original project was in 1968. The second project was an outbound baggage expansion, and some minor concourse work in 2009. The third project was a concourse expansion in 2010. A security checkpoint expansion was completed in 2016, and the baggage claim remodel was completed in 2020. The roof is enclosed with metal deck.

The roof's primary framing is bar joist bearing on steel beams and, in some exposed areas, framing for both primary and secondary members. Steel columns support the structure throughout. The second floor of the structure is precast concrete slab, beams, and columns. The lower-level lateral force resisting system is masonry or concrete shear walls. The foundation system is shallow spread concrete footings.

On-site observation of the exposed structure was completed in June 2022. During the observation, the presence or absence of vertical components of the lateral force resisting system was noted where possible. Damage to the structural system was noted under the floor at the expansion joint near gate 4 **(Figure 2-14)**. The beam that spans the joint has a large crack with significant concrete spalling. The spalling is so significant that the bottom rebar of the beam has become exposed and is rusting **(Figure 2-15).**

Figure 2-14 Damaged Concrete Floor Beam

Figure 2-15 Rusting Rebar Showing Through Large Crack in Beam

Figure 2-16 Boiler Point

Figure 2-17 Hot Water Pumps

MECHANICAL

The building heating plant consists of four gas-fired hot water boilers **(Figure 2-16)**, Thermal Solutions Model EVA-3000. Three of the boilers were installed in 2010, and the fourth boiler was installed under the Checkpoint addition project. All four boilers appear to be in fair condition. The boilers are non-condensing and operate at approximately 85 percent efficiency. Facility staff reports that all four boilers need to operate during extreme cold conditions. Boiler water is circulated to the building by two 40-horsepower, base-mount pumps **(Figure 2-17)**. The pumps also appear to be in fair condition.

Figure 2-18 Cooling Tower

Primary cooling for the building is provided by a chilled water-cooling plant. The plant consists of one water-cooled centrifugal chiller and one air-cooled screw chiller. The air-cooled chiller was added under the Checkpoint Addition. This unit has a remote condensing unit located on the roof of the concourse. The water-cooled machine is considerably older. Heat is rejected from the water-cooled machine via an induced draft cooling tower located on grade **(Figure 2-18)**. The cooling tower was installed in 2010 and appears to be in good condition.

Figure 2-19 Top Left: Chiller No.1 (Water-Cooled), Top Right: Chiller No. 2 (Air-Cooled), Bottom Left: Chiller No. 1 (Primary-Pump), Bottom Middle: Water Condenser, Bottom Right: Chiller No. 2 & Building Loop Pumps

The chilled water pumping arrangement is primary with each chiller having a single, dedicated primary pump **(Figure 2-19)**. Two base-mounted secondary pumps circulate chilled water to the building. The speed of the secondary pumps is controlled by a variable frequency drive and loop differential pressure sensor. Condenser water is circulated to the outdoor cooling tower by a single, base-mounted pump. All pumps appear to be in fair condition with the exception of the primary pump for Chiller No. 1. This pump appears much older than the others.

Figure 2-20 Roof-Mounted Air Handling Units

Air-handing systems consist of a mixture of indoor and roof-mounted air handling units **(Figure 2-20)** that are fed from the building boiler and chilled water plants. The baggage claim areas on the south side of the building area are served by packaged roof-mounted units with direct expansion (DX) cooling and hydronic heating coils.

Primary zoning is accomplished by single zone terminals with hydronic heating coils. Many areas have hydronic radiant ceiling panels at exterior walls.

Figure 2-21 Domestic Water Service

Figure 2-22 Water Heaters

FIRE PROTECTION

The building is protected throughout with automatic sprinkler protection and a manual standpipe system. Fire protection water service enters the building in the same room as the domestic water service. The building is divided into multiple fire protection zones. A dry-pipe system serves the open area below the concourse.

PLUMBING

The building water service **(Figure 2-21)** is located in an equipment room on grade level near the escalators (door to room is labeled “Electrical Room 117”). The system includes an approved backflow prevention device.

Domestic hot water is generated by two gas-fired water heaters **(Figure 2-22)** located in the boiler room. The system includes a recirculation pump. It was noted that much of the water piping near the water heaters is not insulated. Heaters are AO Smith Model GPVL-50 200, 40 MBH input, 50-gallon storage tank.

ELECTRICAL

The facility is currently served by one utility-owned electrical transformer (480Y/277 volt, 3-phase, 4-wire), located under the concourse (exterior) underneath the checkpoint addition. The service electrical utility is the City of Sioux Falls. The transformer serves three different service main switches in the main electrical room (Elec Room 107). The first of three **(Figure 2-23)** is a 2000A switchboard (MSB1 – House/480V), the second **(Figure 2-24)** is an 800A switchboard (Kitchen 480V), and the third **(Figure 2-25)** is a 600A switchboard (House 208V). The meters are #90200070 (MSB1 – House/480V), #1630004 (Kitchen 480V), and #90200110 (House 208V). The demand for the 480V House load is 281.1KW or approximately indicating available capacity is available to add load to the service. The demand for the 208V House load is 31.32KW or approximately indicating available capacity to add load to the service.

Figure 2-23 Main Service Switchboard MSB1-House/480V

Figure 2-24 Main Service Switchboard Kitchen 480V

Figure 2-25 Main Service Distribution Panelboard House 208V

ELECTRICAL MAIN DISTRIBUTION SYSTEM

The three main service distribution switchboards, MSB1 – House/480V, Kitchen 480V, and House 208V are all located in Elec Room 107. Both the MSB1 – House/480V and Kitchen 480V switchboards are GE Spectra Series type with a Power Break II main breaker. The MSB1 – House/480V switchboard has 47 inches of space adjacent to the west end of the gear. The House 208V distribution is a Spectra Series Power Panelboard and feeds a 208V switchboard with tenant meters.

EMERGENCY DISTRIBUTION SYSTEM

An existing 300kW diesel generator is currently serving emergency egress lighting and specific plug loads throughout the building. The generator is currently located in the sub-basement boiler room, under the concourse and feeds multiple transfer switches located throughout the building. Demand information on the existing generator is not available. A new 800kW diesel generator has been ordered by the Airport. The gen-set will be located on the exterior between Gates 1 and 3. The gen-set will have a 48-hour skid base tank.

INTERIOR LIGHTING

The interior lighting in the building is comprised of multiple lamp sources. Most of the existing lighting in the concourse area is fluorescent with LED lighting being installed in the most recent remodel projects. The Security Checkpoint and Baggage Claim areas are lighted with LED fixtures. Most lighting is at 277 volts and at a 35K color.

LIGHTING CONTROLS

The majority of the lighting in the airport is on 24/7 and controlled by the circuit breaker in the corresponding electrical panel serving the designated area. The office areas have local switches to turn lights on and off. The LEDs in the Baggage Claim change colors and have a single-point independent color wheel control. The parking lot lighting is connected to the airport by the Baggage Claim area to lighting contactors that are controlled by photocells. The new parking ramp exterior lighting will be controlled from the electrical room in the ramp in a similar fashion. The garage style lights within the ramp will have integral motion sensors to adjust the light level in the parking areas along with emergency lights that will always maintain full brightness.

TECHNOLOGY

The existing cabling and network infrastructure occupies several locations throughout the facility. Currently the access points for two internet service providers enter the facility in different rooms and have demark/protection equipment. From there, services are extended to different areas through different means.

Within the facility, there is a mix of mostly multi-mode, but also some single-mode, fiber optic cable. The existing fiber backbone cabling is at about 60 percent capacity, with some available strands for expansion.

Most of the copper cabling is CAT5e with some newer runs that are CAT6. The facility has a common use network that supports the information displays. This network is also used by the tenant airlines and for the Amadeus system. Gates 4 (Delta preferential) and 6 (United preferential) are not on the common use network.

The "main" equipment room is 118B **(Figure 2-26)**. The SDN fiber is extended here from the entrance in the old equipment room on the ground floor of the concourse. The Mid-Co fiber optic enters the building in room 100G **(Figure 2-27)** by the main entrance and is extended from there but can be disconnected. The equipment in 100G will be relocated in the future. The fiber comes in through a hand hole in front of the building.

Room C220 (Laundry) on the upper level feeds the concourse cabling infrastructure. This is where primary distribution for flight information display systems terminates. There is no hard-wired connectivity on the bridges.

The restaurant and TSA have their own telecommunications room (TR) separate from the facility.

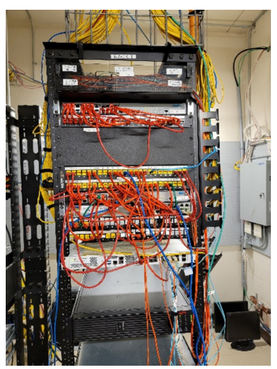


Figure 2-26 Network Rack Room 118B

Figure 2-27 Hand Hold Outside 100G

The airport provides network for the GAF. Future work should take this into account to keep them operational through planned outages. The GAF area is fed from the TR in the baggage claim area.

SECURITY

The existing access control is Lenel S2 OnGuard and will support both analog and IP based solutions. Both proximity cards and Weigand wiring are no longer secure technologies, nor are they FIPS-201 compliant. All airports, and most organizations in general, are replacing these technologies as rapidly as practicable. They are currently using mercury switches.
The Access Gates use wireless links.

The existing video surveillance system is Milestone and is relatively new. This will support IP cameras. The current camera layout covers all areas of concern. The system has ample capacity for future additions.

PAGING

The existing system is analog with a TOA amplifier (Figure 2-28). This system has issues occasionally. There are no record drawings of how the system is wired, which causes problems for trouble shooting. The system is being reset often to correct problems.

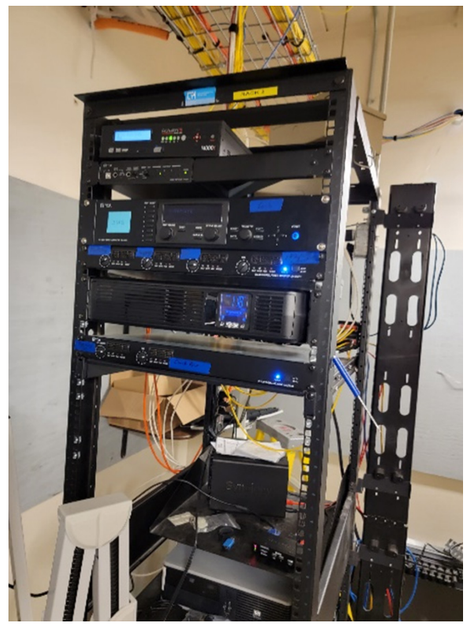


Figure 2-28 TOA System Head End

MASS NOTIFICATION

The existing mass notification system is UltraVoice with the head end located in room 118B **(Figure 2-29)**. Several radio antennas, owned and operated by the airlines, are on the roof of the concourse to serve the airlines. These must remain operational if gates are in use during improvements.

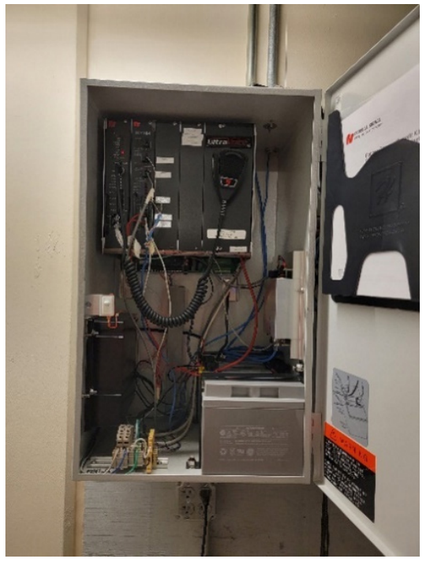


Figure 2-28 TOA System Head End

2.2 AIRFIELD ELEMENTS

Terminal concept development also considers the evaluation of existing and future airfield elements such as terminal apron gates, airspace clearances, aircraft ground equipment, and PBBs.

2.2.1 TERMINAL APRON GATES

FSD's commercial apron is located on the east portion of the airfield and connected to the airfield by Taxiway A. FSD terminal has seven contact gates with three gates acting as swing gates that provide up to 10 parking positions around the terminal. One additional parking position is located adjacent to Gate 1 providing access to the Airport's GAF. Additionally, two Remain Overnight (RON) positions are located on the northern portion of the apron for a total capacity of thirteen aircraft **(Figure 2-30)** around the terminal area.

Figure 2-30 FSD Terminal Apron

The current aircraft fleet mix used by the airlines operating at FSD is a mix of regional and narrow body jet aircraft. FSD currently services a variety of types of aircraft ranging from the A321-Neo with a 118-foot wingspan to the CRJ-200 with a wingspan of 70 feet. Additionally, Gate 7B is marked for a B757.

An ADG III Object Free Area clearance of 79 feet must be maintained from the two ADG III taxilane centerlines on the north and south side of the terminal, and 110 feet from the ADG IV taxilane centerline on the west side of the terminal to aircraft tails parked at the terminal according to separation standards mentioned in AC 150/5300-13B. No designated vehicle service road is marked on the terminal apron.

2.2.2 PASSENGER BOARDING BRIDGES

The existing terminal has seven PBBs available in service. **Table 2-2** defines the existing passenger boarding bridge equipment schedule at FSD.

FSD Passenger Boarding Bridge Equipment Schedule	
Gate	Model
1	JBT AT2 56/58-125R
2	JETWAY A2-55/80-125R
3	FMC AD2-65/99-125R
4	JBT AT3 53/116-125R
5	SA2 73/107-125R
6	JBT AT3 61/127-125RR
7	A2 76/119-125R

Table 2-2 FSD Passenger Boarding Bridge Equipment Schedule

2.3 LANDSIDE ELEMENTS

The landside components of the terminal area include access to the terminal building, the arrivals/departure curb, parking lots including employee parking. These facilities serve as the primary access point for passengers, employees, and concession goods to enter and exit the terminal facility.

2.3.1 AIRPORT ACCESS ROAD

Airport access is provided directly from Minnesota Avenue via Jaycee Lane. Minnesota Avenue is one of the primary north–south roadway corridors in Sioux Falls. To the south, Minnesota Avenue continues through Sioux Falls and eventually becomes SD Highway 15 accessing the community of Harrisburg. Minnesota Avenue can be accessed from Interstate 29 both north and south of the Airport. Exit 83 West 60th Street North is adjacent to the Airport just north of the Airport property, and Exit 81 Russell Street / Maple Street from the south. The intersection of Minnesota Avenue and Russell Street is located approximately 1.2 miles south of the Terminal.

2.3.2 ARRIVALS/DEPARTURES CURB

The arrivals/departures curb **(Figure 2-31)**, or the curb front, is accessed by airport users via Jaycee Lane from Minnesota Avenue. The curb front runs a length of approximately 650 feet and consists of two bypass lanes with an additional staging lane for the loading and unloading of passengers. One of the bypass lanes is used for vehicle circulation and during peak hours serves as a secondary passenger loading and unloading. East of the passenger pick-up and drop-off lanes is a pedestrian island for passengers to wait for ride share vehicles or other commercial vehicles. Five crosswalks evenly spaced along the front of the Terminal exist for passengers to cross the curb front to access public parking facilities.

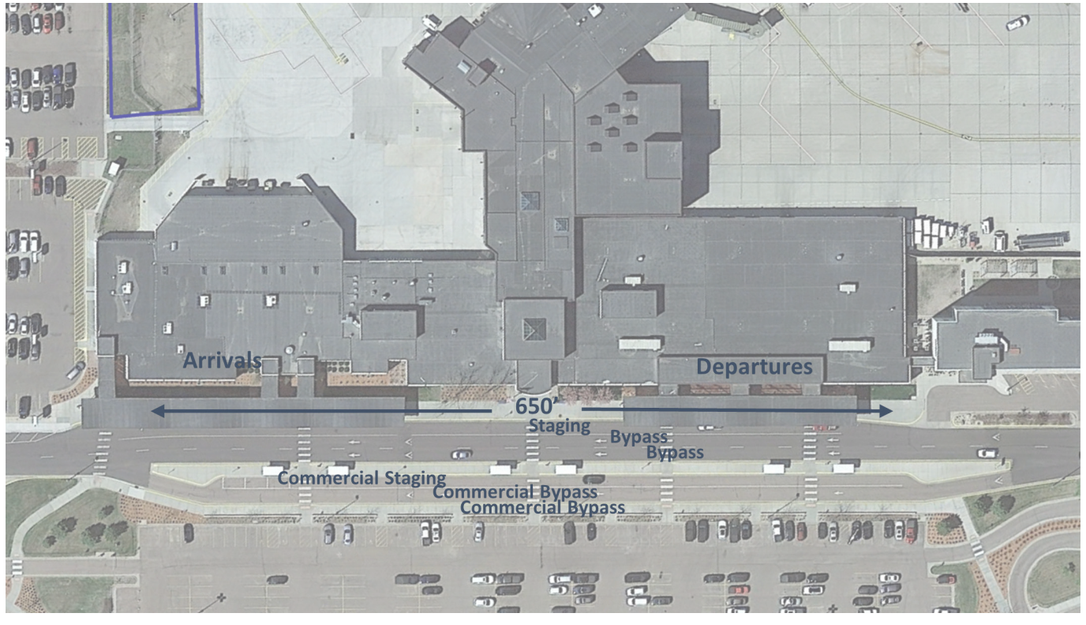


Figure 2-31 Arrivals/Departures Curb

2.3.3 PARKING

FSD currently provides fee pay public short-term, long-term, and economy parking. Public parking options include 300 short-term stalls, approximately 1,400 long-term stalls, and 1,360 economy stalls. The existing access entry plaza consists of a two-lane entrance each for the long- and short-term parking. A “waiting lot” with a capacity of 93 parking stalls is located near the intersection of N. Minnesota Avenue and Jaycee Lane. Employee parking is located just south of the terminal and provides approximately 190 stalls. The rental car ready/return lot is adjacent to the south end of the terminal and has a 170 stall capacity. The rental storage lot is roughly 400 feet south of the terminal and provides approximately 150 parking stalls along with 19 linear parking lanes north of the QTA.

FSD is planning to construct an above-ground parking structure in 2023 that has the potential to increase parking availability by over 800 stalls. The parking garage would be located just east of the main terminal entrance.

2.4 UTILITIES

The storm sewer, water, sanitary sewer, lighting, communications, natural gas, and pavement consist of the utilities that were evaluated as part of the TPS. The following utility maps were created using data obtained from the City of Sioux Falls Utility GIS website.

2.4.1 STORM SEWER

The existing storm sewer in the vicinity of the Terminal is shown in **Figure 2-32**. The Sioux Falls Airport is located in an area of flat terrain that includes a major drainageways located adjacent to or across the street from the airport property on three sides. The Big Sioux River flows southerly and bounds the Sioux Falls Airport along the west side of the airfield. At the northwest corner of the airport, a diversion structure directs flow from the Big Sioux River to the Big Sioux River Diversion Channel that flows east along the north property line of the Airport and then south on the east side of Minnesota Avenue just east of the Airport.

The drainage basins throughout the developed areas on the east side of Airport and the majority of the airfield are served by a storm sewer pipe network with four major storm trunklines that discharge to the Big Sioux River Diversion Channel on the east side of Minnesota Avenue. These trunklines range from 48 to 72 inches in diameter. Several flat open grass areas throughout the airfield do not have any drainage systems and rely solely on infiltration into the ground.

Storm runoff in the terminal area is routed by inlets and a storm pipe system through four different detention ponds before discharging to the storm trunklines that leave the Airport. The ponds provide storage volume to reduce peak flows for significant storm events and to provide brief runoff retention time for smaller events to allow sediment to settle out. The ponds are all designed to fully drain within 48 hours.

City design standards require that storm water collection systems provide flow capacity for a 5-year storm event and that significant property damage or loss of life does not occur during a 100-year storm event. The majority of the storm sewer system in the developed areas of the airfield only provide for a 5-year storm event. Future improvements that add significant impervious areas to the Airport will be required to provide storm detention facilities so that peak flows are maintained to current levels. Additionally, as City drainage design standards require, any development that adds more than one acre of new impervious area will be required to route the ensuing drainage through a water quality facility.

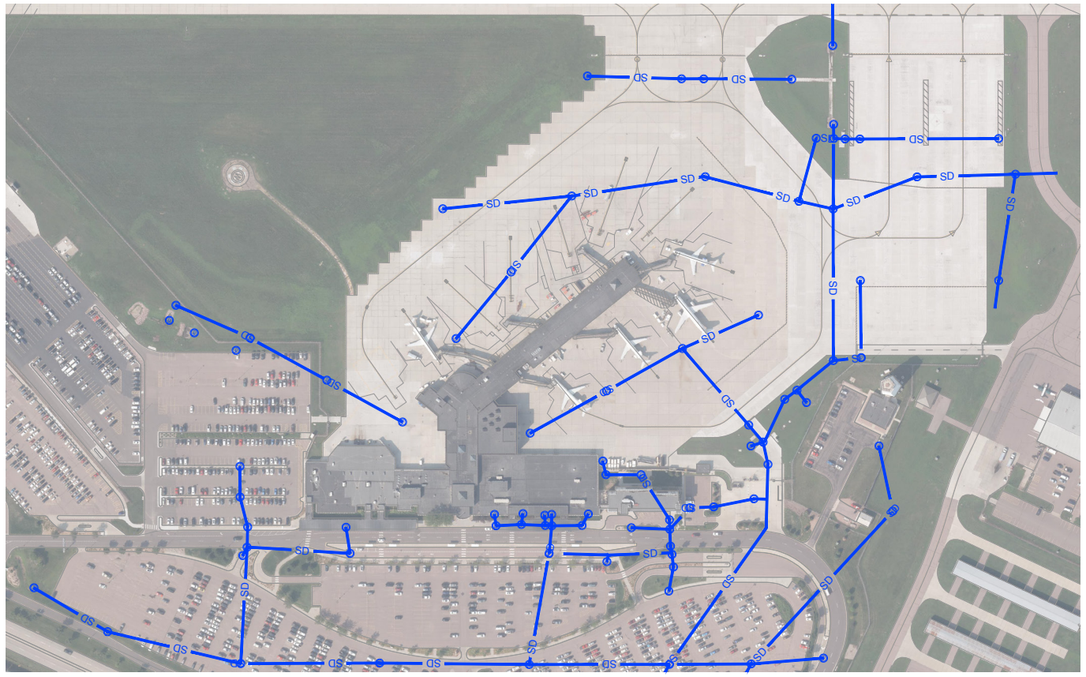


Figure 2-32 Storm Sewer System

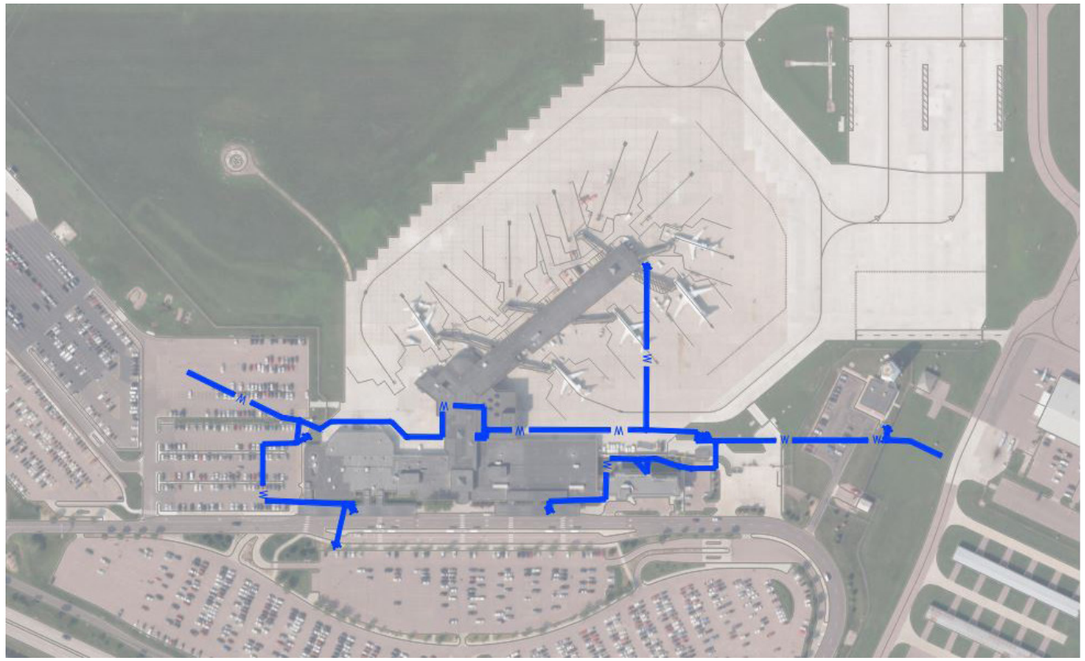


Figure 2-33 Water System

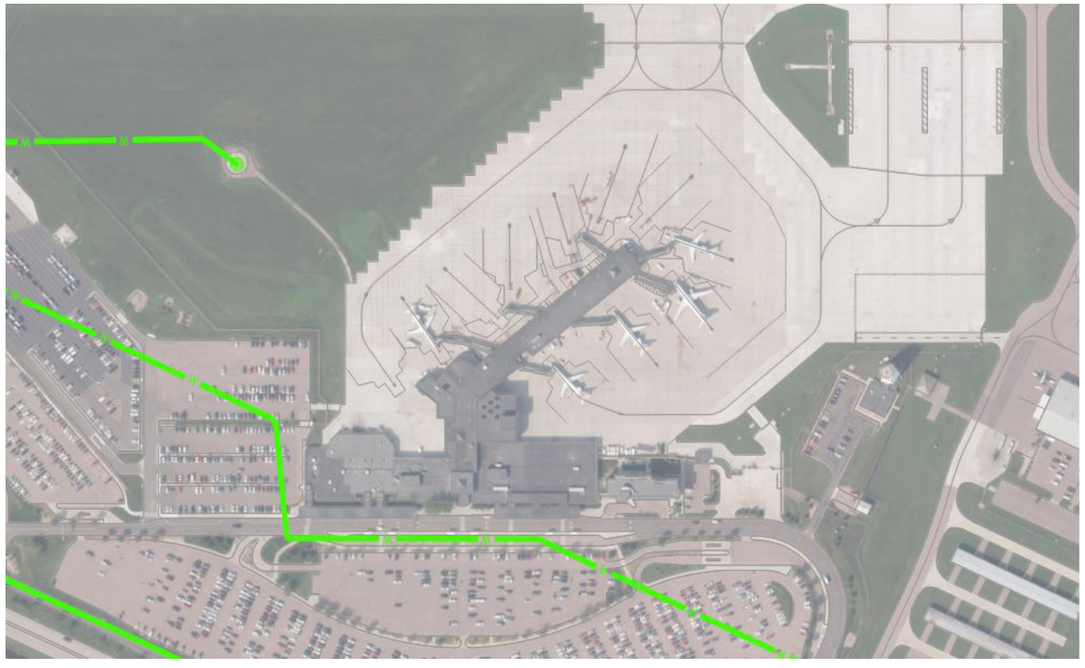


Figure 2-34 Water Well Transmission Mains

2.4.2 WATER

The Airport is situated over a primary water source for the City of Sioux Falls. The City's Water Department operates approximately 18 water pumping wells into the Big Sioux Aquifer that feed main lines constructed within the property. The City of Sioux Falls Water Treatment Plant is located immediately southeast of the Airport. The City also provides water service for domestic use and fire protection for the Airport. An existing water main loops around the entire airfield with a 10-inch diameter main along the Terminal area and 8-inch diameter main throughout most of the remainder of the airfield. According to state and city design standards, the minimum main size for fire protection is an 8-inch pipe. The Airport is served with sub-standard mains in areas that include a 6-inch main along the east cargo building. The Army Guard facilities are also fed from an 8-inch main coming from the south. A 24-inch well main runs north-south, which has affected development in the east hangar area of the Airport. The water system in the vicinity of the Airport can be found in **Figure 2-33** and the well transmission mains in **Figure 2-34**.

2.4.3 SANITARY SEWER

The existing sanitary sewer in the vicinity of the Terminal is shown in **Figure 2-35**. Sanitary sewer is provided by the City of Sioux Falls. All developed areas of the airfield except for the east General Aviation T-hangar areas currently have access to the sanitary sewer system. There are several lift stations throughout the airfield with the main lift station located near the southwest corner of the Terminal building. A 6-inch diameter force main runs south from the lift station and exits the airport property at the corner of Minnesota Avenue and Maple Street. The eastside gravity sewer mains were installed in 1966 and follow the same utility corridor as the water main along the west side of the terminal, under Aviation Avenue and along the east edge of the East Cargo Apron. Several sewer services are in the vicinity of the Terminal and include four servicing the Terminal building, two serving the concourse area, and one with apron access. The Airport replaced the main lift station in 2019 and most of the sanitary lines in the terminal area have been replaced with the various projects over the last 14 years.

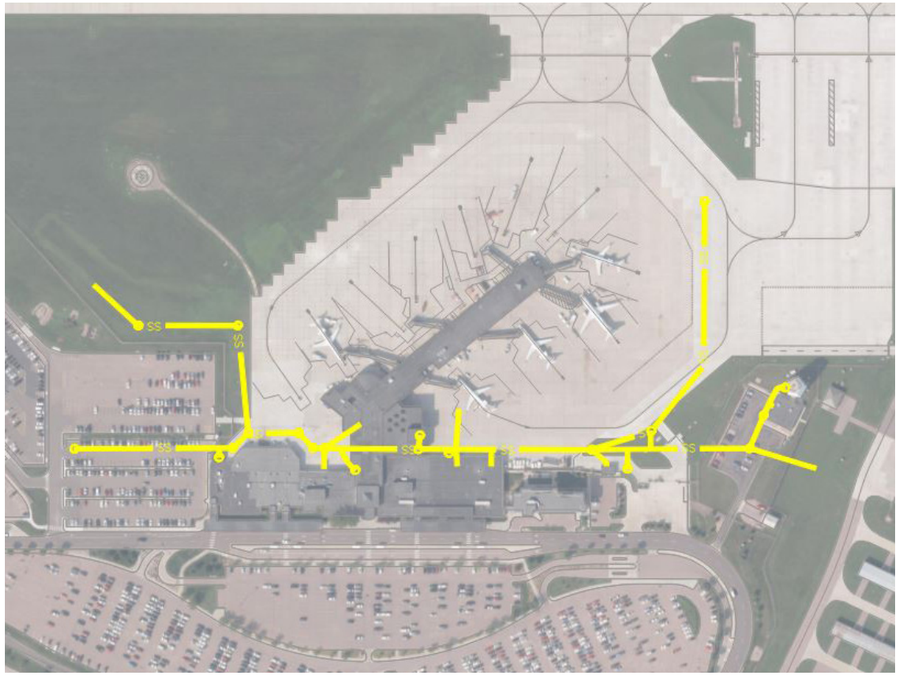


Figure 2-35 Sanitary Sewer System

2.4.4 COMMUNICATION, GAS, AND POWER

Services for gas, power, and communications are provided to Airport facilities by a combination of private and public companies. A network of these utilities is in place serving airport users. Each utility is general metered at each individual property.

2.4.5 PAVEMENT

Inspections to assess the condition of airfield pavements are conducted every three years by South Dakota Department of Transportation Office of Aeronautics with the latest conducted in 2021 **(Figure 2-36)**. These assessments document the type and severity of surface distresses and are used to formulate a Pavement Condition Index (PCI). The PCI is a numerical value ranging from 0 to 100 with 100 representing a flawless section of pavement. The assessments are incorporated into a pavement maintenance plan to determine the need for rehabilitation or reconstruction. The apron pavements with the exception of section 4106 in the southwest of the concourse is nearing the end of its useful life as it was originally constructed in 1999.

Figure 2-36 Terminal Apron Pavement Condition Index
Source: SDDOT 2021 Pavement Condition Index (PCI) Study

2.5 SUMMARY

As activity at FSD continues to grow, the terminal complex will have to be modified to keep up with the demand and continue offering an acceptable level of service. For functionality, the ticketing area will have to be modified to account for longer queues as the Airport handles larger aircraft. Additionally, outbound baggage and baggage screening will be evaluated to handle this additional surge in baggage demand.

In the concourse, additional concessions and concession storage space will have to be added as the concourse expands. This will allow greater revenue generating opportunities for the Airport and enhance the passenger experience. Any additional gates will have to be served by departure lounges of sufficient size to accommodate the larger seating capacity of flights at FSD. This will alleviate congestion in the primary circulation corridor.

Electrically, the building has available electrical capacity to handle any additional load associated with a renovation. Distribution panel MDP2 and all panels are approaching the 22 year mark which is nearing the end of a panels life expectancy of 25 to 40 years. That being said, these panels have seen regular inspections and don't show any external signs of advanced wear/deterioration . Lighting throughout the facility is fluorescent, providing a great opportunity to switch to either LED retrofit fixtures or LED bulbs and save money on energy and replacement bulbs.

Mechanically, the building's utilities are reaching the end of their useful design life. Replacements, expansions, or relocations of these systems will be evaluated as the study identifies facility requirements and feasible alternatives.

3. FORECASTS

As part of the 2021 master plan, a comprehensive forecast study was completed that evaluated the future demand levels for enplanements and operations for air carriers, charters, air taxis, and general aviation traffic. These forecasts were officially approved by the FAA on March 21, 2021. The forecast is a critical piece of data used in the terminal planning study as the size of the terminal facility is heavily dependent on passenger activity levels, operations, and peaking characteristics. Due to the master plan forecast referencing the most current data of 2021 activity levels, the terminal planning study and terminal programming calculations will utilize the projected activity levels referenced in the FAA approved forecasts.

3.1 PEAK HOUR SUMMARY FROM MASTER PLAN

Determining the peak hour activity level of a terminal is crucial when programming for future space. As part of the master plan, this metric was identified by the traditional method of determining the peak hour of the average day of the peak month. Once the percentage of peak month enplanements to annual enplanements, percentage of average day enplanements to peak month enplanements, and percentage of peak hour enplanements to average day enplanements were calculated, these values were applied to future annual enplanements to forecast peak hour. The results are shown in **Table 3-1** which was taken from the master plan's forecasts chapter.

Year	Annual Enplanements	Peak Month	Average Day of Peak Month	Peak Hour % of Daily	Peak Hour Enplanements
2021	506,211	52,045	1,733	20.3%	351
2026	718,232	73,843	2,459	20.3%	498
2031	803,692	82,630	2,751	20.3%	557
2036	894,468	91,963	3,062	20.3%	620
2041	987,480	101,526	3,381	20.3%	685

Table 3-1 Peak Hour Enplanements

The average day peak month in 2021 was a Wednesday in July. **Table 3-2** shows that July 28, 2021 is the best representation of the average day as it has 49 departing seats greater than the average day. Therefore, the peak hour from this day was evaluated which resulted in 351 enplanements as shown in **Table 3-3**. The peak hour of July 28, 2021 occurred between 5:10 P.M. to 6:05 P.M. The time of day of the peak hour will vary throughout the planning horizon as airline schedules fluctuate often.

July, 2021 Departing Seats Per Day			
Travel Date	Day of Week	Seats	Difference from Avg.
July 1, 2021	Thursday	2,423	227
July 2, 2021	Friday	1,886	(231)
July 3, 2021	Saturday	2,333	216
July 4, 2021	Sunday	2,013	(104)
July 5, 2021	Monday	1,913	(204)
July 6, 2021	Tuesday	2,096	(21)
July 7, 2021	Wednesday	2,346	229
July 8, 2021	Thursday	2,322	205
July 9, 2021	Friday	1,800	(317)
July 10, 2021	Saturday	2,276	159
July 11, 2021	Sunday	2,272	155
July 12, 2021	Monday	1,800	(317)
July 13, 2021	Tuesday	2,010	(107)
July 14, 2021	Wednesday	2,352	235
July 15, 2021	Thursday	2,322	205
July 16, 2021	Friday	1,800	(317)
July 17, 2021	Saturday	2,352	235
July 18, 2021	Sunday	2,302	185
July 19, 2021	Monday	1,800	(317)
July 20, 2021	Tuesday	2,010	(107)
July 21, 2021	Wednesday	2,352	235
July 22, 2021	Thursday	2,322	205
July 23, 2021	Friday	1,800	(317)
July 24, 2021	Saturday	2,328	211
July 25, 2021	Sunday	2,272	155
July 26, 2021	Monday	1,800	(317)
July 27, 2021	Tuesday	1,824	(293)
July 28, 2021	Wednesday	2,166	49
July 29, 2021	Thursday	2,322	205
July 30, 2021	Friday	1,811	(306)
July 31, 2021	Saturday	2,196	79
	Average	2,117	
Source: Diio Mi, July 2021			

Table 3-2 Peak Month Departing Seat by Day

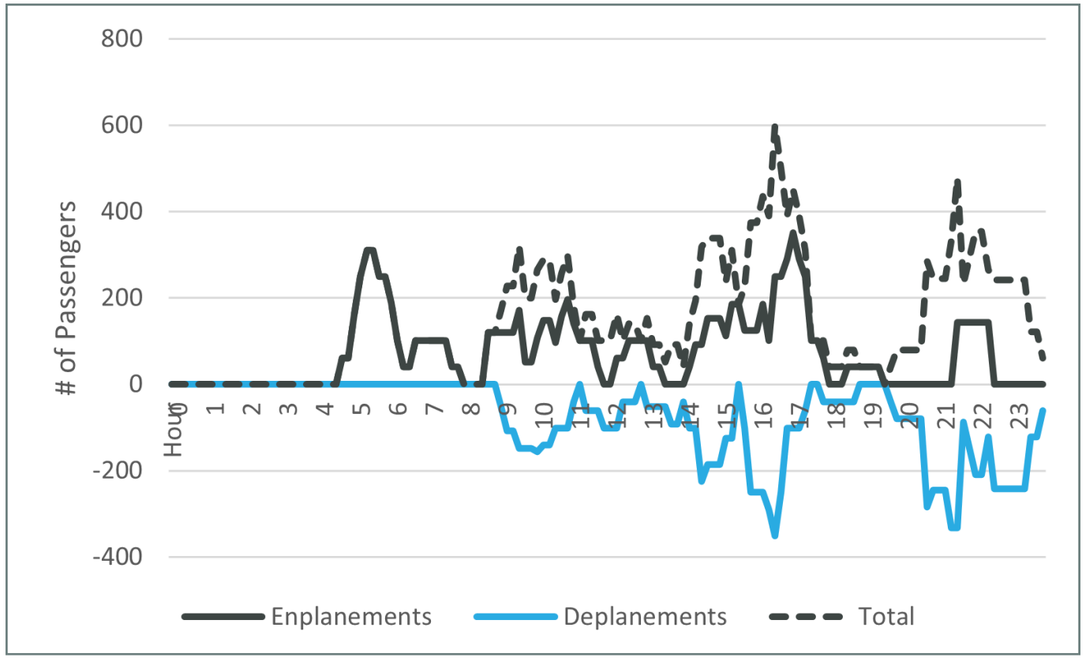


Table 3-3 Peak Hour of July 28, 2021

Throughout the planning horizon it is assumed the terminal's peak departing hour will be 20.3% of the overall average day of the peak month. This will result in an estimated 685 enplanements during FSD's peak hour in 2041. FSD's terminal program will be sized to ultimately handle these peaking characteristics.

4. TERMINAL PROGRAMMING

The following section summarizes assumptions used to develop facility requirements for the key functional areas of the terminal building. Terminal facility requirements were developed based on meetings with FSD staff, TSA, concessionaires, airlines, and rental car companies, a walk-through site evaluation, knowledge of industry-wide trends, and published guidelines including International Air Transport Association (IATA) Airport Development Reference Manual (ADRM), FAA Advisory Circular (AC) 150/5360-13, Planning and Design Guidelines for Airport Terminal Facilities, and ACRP-25 Airport Passenger Terminal Planning and Design. Facility requirements were generated for aircraft parking positions/gates, ticketing area and airline ticket offices, passenger security screening, departure lounges, concessions, restrooms, baggage handling systems and baggage makeup areas, baggage claim, and airport administrative areas. Terminal facility requirements are developed for the peak hour, identified in the forecast section of this document to determine the Airport's needs to accommodate future growth. Secondary functions such as circulation and "back of house" space were also considered in the analysis.

4.1 AIRCRAFT GATE PARKING POSITIONS

The number of gates necessary to support forecast activity is a critical element in determining the overall size and configuration of the terminal complex. There are currently seven gates at FSD with three gates acting as a swing gate which totals 10 parking positions around the terminal. The preferential-leased gates are Gate 4 held by Delta Air Lines and Gate 6 held by United Airlines. All other gates are common use. There are two RON aircraft parking positions north of the terminal building. However due to the inclement climate of Sioux Falls, South Dakota and staffing issues, towing aircraft on and off the remote apron remain a challenge.

To forecast gating requirements for future activity at FSD, an aircraft gate allocation analysis was completed based on the design day schedule for an average peak weekday of the peak month in 2021. For the existing design day schedule, July 28, 2021 was used, as discussed in Chapter 3.

According to the existing design day flight schedule as shown in **Figure 4-1**, the peak hour for the greatest gate demand at FSD occurs during the overnight period with 9 arrivals in the evening and departures the following morning. Often times, an Allegiant flight remains overnight increasing this gate demand to 10.

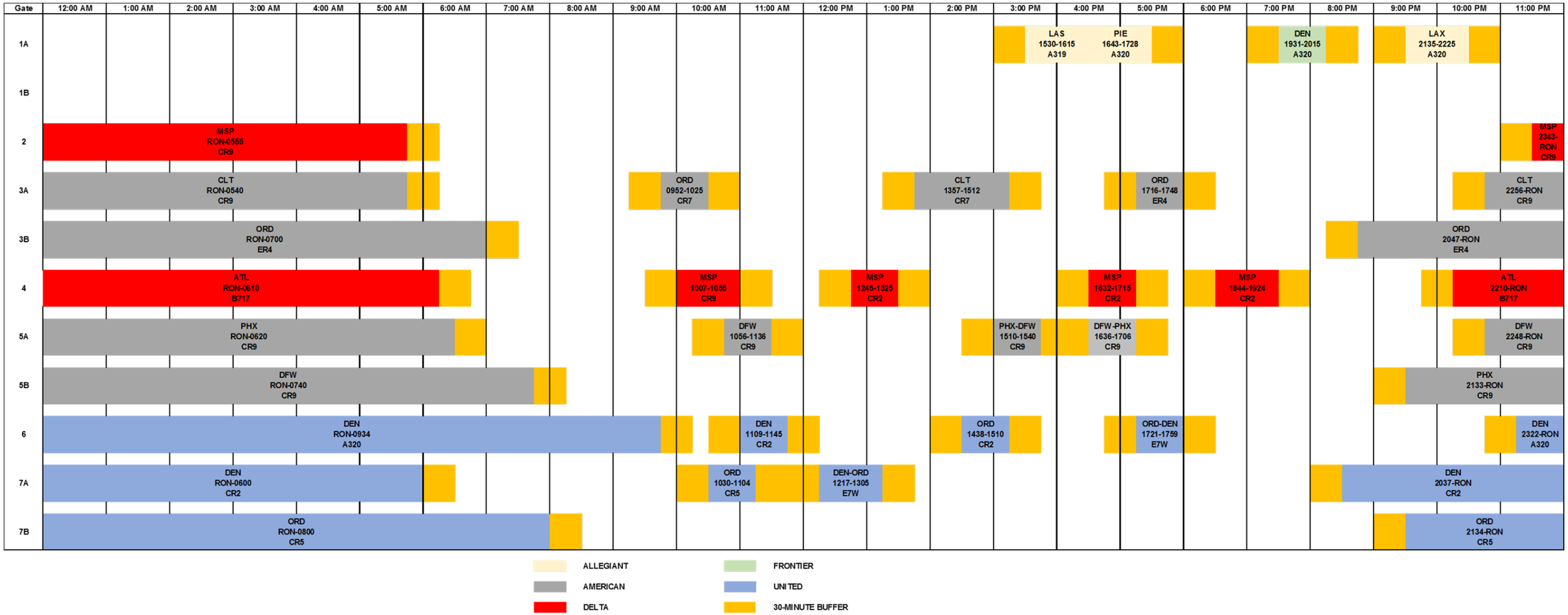


Figure 4-1 Existing Baseline Current Flight Schedule
Source: Diio, Mi July 28, 2021

To determine future gating requirements, a future design day schedule was developed based on operational growth rates defined in the forecasts, conversations with the air carriers, and a route demand analysis. The route demand analysis consisted of evaluating passenger demand to unserved markets and defining the number of passengers that travel to these destinations per day each way. As shown in **Table 4-1**, MCO, SEA, DCA, CUN, and PDX are FSD's most demanded, unserved markets. The future design day schedule included these routes to provide a sense of how the new service would impact gate requirements.

FSD Quarterly Route Analysis		
Rank	Destination	Passengers per Day
1	AZA	100.4
2	DEN	88.4
3	LAS	88.3
4	PHX	49.3
5	ORD	40.7
6	DFW	37.1
7	SFB	32.9
8	MCO	29.1
9	ATL	26.9
10	PIE	26.1
11	LAX	24.3
12	SEA	21.0
13	BNA	18.8
14	DCA	18.5
15	SAN	17.4
16	CUN	16.3
17	MSP	15.9
18	PDX	15.0
19	TPA	13.7
20	CLT	13.2
21	IAH	13.0
22	RSW	12.6
23	SFO	12.5
24	SLC	12.2
25	SNA	11.9
26	LGA	11.7
27	BOS	11.5
28	AUS	11.4
29	SMF	10.6
30	FLL	10.2

Seasonal

Not Served

Table 4-1 FSD Quarterly Route Demand Analysis
Source: Diio, Q1 2019 - Q4 2021

Using these sources, the following modifications and assumptions were made to the existing design day schedule to develop the future design day schedule:

Overall

1. 30-minute buffer before arrival time to allow for delay and 30-minute buffer following departure time to allow for flight delays.
2. No tow-on/tow-off operations.
3. Two gates were considered common-use, or first right-of-refusal, to accommodate new entrant carriers

Allegiant

1. Add service to AUS
2. More frequent service to LAS, AZA, and PIE
3. LAS and AZA flights were replaced with B737 MAX

American

1. Add service to DCA
2. Routes currently served on an E145 or CRJ-700's now being served on E175-EWT aircraft
3. Remain Overnights (RON's) to CLT, PHX, and DFW were upgauged to A319

Delta

1. Added service to SLC
2. Added an afternoon departure to ATL
3. Upgauge all regional aircraft to either E175-EWT or mainline aircraft

Frontier

1. More frequent service to DEN and MCO

United

1. Upgauge all regional aircraft to an E7W or mainline aircraft.

New Entrant Carrier #1: Added service to MDW, HOU, and LAS
New Entrant Carrier #2: Added service to BNA and SFO
New Entrant Carrier #3: Added service to PDX

The future design day schedule had an increase of daily departures from 28 in 2021 to 43 and departing seats from 2,166 in 2021 to 4,987. **Figure 4-2** further shows the future aircraft gate allocation analysis based on the future design day schedule and how the future gate requirement increases to 14 over the planning period with 14 aircraft remaining overnight.

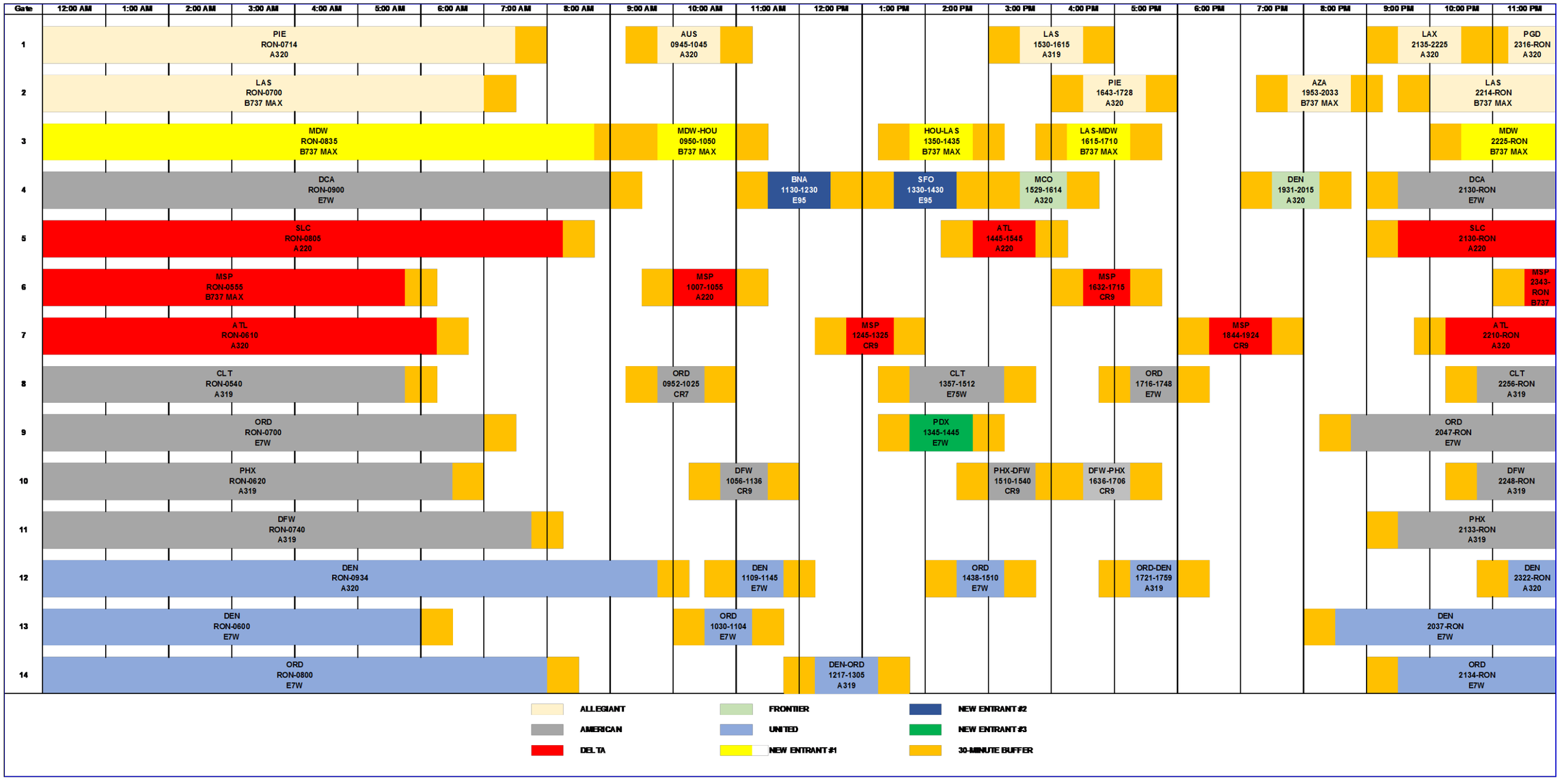


Figure 4-2 Future Design Day Flight Schedule
Source: Diio Mi, 2022

Gate utilization is measured by average turns per gate, or the average amount of turns at each gate on an average day of the peak month. This value is typically an indication if additional gates are needed in the future. For this gate requirement analysis, a comparison study was completed of average turns per gate for FSD and ten small-hub primary airports that had greater enplanements than FSD in 2021 and ten small-hub primary airports that had less enplanements than FSD in 2021. Additionally, it was noted what airports are currently under a construction program for expansion to identify what Airports are adding gates to improve their average turns per grate. **Figure 4-3** shows that FSD is currently on the higher side of gate utilization compared to the sampled airports not currently undergoing construction with 3.9 average turns per gate compared to the average 2.8. When FSD's future design day schedule is accommodated by 14 gates, this value lowers closer to the average with 3.0 average turns per gate. This comparison analysis shows that 14 gates provide an optimum balance of not over-designing while maintain flexibility for growth.

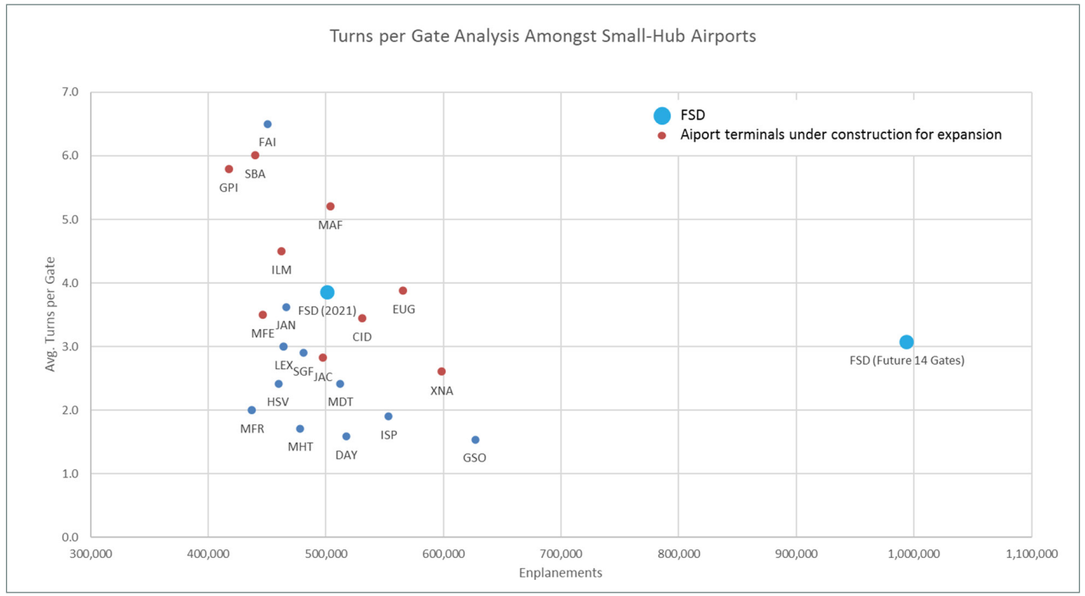


Figure 4-3 Turns Per Gate Analysis for Small Hub Primary Airports
Source: Diio Mi, 2021

4.2 AIRLINE CHECK-IN

Currently, most passengers checking in at FSD require using the check-in area by either getting processed at a full-serve position or kiosk. Over the planning period, it is assumed more self-service options will be available at FSD with airlines offering more self-serve kiosks and bag-drop positions for passengers checking bags. Therefore, the facility requirements for the check-in area include space needed for full-service positions, self-serve kiosks, and bag-drop stations.

Five airlines currently serve FSD (Allegiant, Frontier, American, United, and Delta). Airline check-in operations are exclusive to each airline. While programming for check-in facilities, conversations were held with Allegiant, Frontier, American, and Delta to discuss their requirements in the check-in area during the planning period. The majority of Airlines favored an exclusive-use operation in the check-in area to maintain their proprietary systems and branding strategies, however, some were open to a common-use system in the future. During these conversations, the airlines provided a defined number of full-service positions that will be required to handle existing demand and future growth, in the event the Airport continues with an exclusive-use arrangement with the Airlines throughout the planning horizon. These requirements were calculated to accommodate each individual airline's peak hour activity instead of the airport's combined peak hour activity. The reason for using this methodology is to provide enough check-in counter and queuing space for each airline's peak hour with their projected staffing requirements in the future. For instance, Allegiant advised they will not staff more than 5 full-service positions for their future activity levels. Additionally, FSD's current peak hour is around 350 enplanements with 43% of the peak hour being made up of an A320 from Allegiant. This airline also only has 2 full-service positions and around 400 SF of queuing space versus Delta or United who have more than 700 SF of queuing space with less than 20% of the peak hour activity. Having this proportion of the peak hour activity to the amount of ticket queuing space and full-service positions available to that airline results in insufficient queuing space and passengers queuing into the passenger circulation corridor. Instead of projecting how many positions are required since this was already provided by the airline, this methodology of considering each airline's specific peak hour will calculate how much queuing space is required based on the staffing requirement provided by the airline and the future design day schedule activity. The other variables to calculate check-in area requirements are as follows:

- **Percent of the peak hour passengers showing up in the peak 30-minutes:** 70 percent
- **Percent of passengers checking bags:** 70 percent
- **Average processing time of passenger at a full-service position:** 2.5 minutes
- **Desired wait time in queue for LOS C:** 10 minutes

- **Passenger space required for LOS C:** 16 SF per passenger
- **Area for full-service position:** 50 SF
- **Area for kiosk footprint:** 44 SF per kiosk
- **# of bag-drop positions:** 1 per airline
- **Area for bag-drop position:** 50 SF per position
- **Area for bag-drop position queuing:** 100 SF per position

Table 4-2 displays the results of the check-in area program. The Existing column lists the current amount of full-service positions, existing queuing space, and peak-30 minute passengers that utilize the check-in area. The 2021 column shows how much queuing space is required with the full-service positions identified in the existing condition. The future columns show the amount of space needed with the expected full-service positions provided by the airlines. As shown, the current number of full-service positions and ticket counter area are sufficient through the planning horizon. Additionally, another 1,600 SF is recommended for check-in queuing space, and 640 SF is recommended for bag-drop queueing space.

Check-In Area Facility Requirements							
		Exis.	2021	2026	2031	2036	2041
American Airlines (AA)	Peak 30-Minutes	60	60	65	70	75	80
	Full-Service Positions (#)	2	2	4	4	4	4
	Ticket Counter Area (SF)	100	100	200	200	200	200
	Ticket Counter Queueing (SF)	232	803	405	469	535	600
	Self-Service Kiosk	-	-	2	2	2	2
	Kiosk Footprint (SF)	-	-	88	88	88	88
	Bag-Drop Position (#)	-	-	1	1	1	1
	Bag-Drop Station Area (SF)	-	-	50	50	50	50
	Bag-Drop Station Queueing (SF)	-	-	80	80	80	80
Frontier (F9)	Peak 30-Minutes	76	76	76	76	76	76
	Full-Service Positions (#)	4	4	4	4	4	4
	Ticket Counter Area (SF)	200	200	200	200	200	200
	Ticket Counter Queueing (SF)	375	548	548	548	548	548
	Self-Service Kiosk	2	2	2	2	2	2
	Kiosk Footprint (SF)	88	88	88	88	88	88
	Bag-Drop Position (#)	-	-	1	1	1	1
	Bag-Drop Station Area (SF)	-	-	50	50	50	50
	Bag-Drop Station Queueing (SF)	-	-	80	80	80	80
Delta Air Lines (DL)	Peak 30-Minutes	79	79	92	107	124	143
	Full-Service Positions (#)	7	7	7	7	7	7
	Ticket Counter Area (SF)	350	350	350	350	350	350
	Ticket Counter Queueing (SF)	757	307	448	626	841	1,091
	Self-Service Kiosk	2	2	2	2	2	2
	Kiosk Footprint (SF)	88	88	88	88	88	88
	Bag-Drop Position (#)	-	-	1	1	1	1
	Bag-Drop Station Area (SF)	-	-	50	50	50	50
	Bag-Drop Station Queueing (SF)	-	-	80	80	80	80
United Airlines (UA)	Peak 30-Minutes	40	40	45	50	55	63
	Full-Service Positions (#)	6	6	6	6	6	6
	Ticket Counter Area (SF)	300	300	300	300	300	300
	Ticket Counter Queueing (SF)	742	96	97	115	149	217
	Self-Service Kiosk	-	-	2	2	2	2
	Kiosk Footprint (SF)	-	-	88	88	88	88
	Bag-Drop Position (#)	-	-	1	1	1	1
	Bag-Drop Station Area (SF)	-	-	50	50	50	50
	Bag-Drop Station Queueing (SF)	-	-	80	80	80	80
Allegiant Air (G4)	Peak 30-Minutes	74	74	150	150	150	150
	Full-Service Positions (#)	2	2	5	5	5	5
	Ticket Counter Area (SF)	100	100	250	250	250	250
	Ticket Counter Queueing (SF)	392	1,254	2,007	2,007	2,007	2,007
	Self-Service Kiosk	-	-	2	2	2	2
	Kiosk Footprint (SF)	-	-	88	88	88	88
	Bag-Drop Position (#)	-	-	1	1	1	1
	Bag-Drop Station Area (SF)	-	-	50	50	50	50
	Bag-Drop Station Queueing (SF)	-	-	80	80	80	80
Common-Use/ New Entrants	Peak 30-Minutes	-	-	69	115	115	145
	Full-Service Positions (#)	17	-	4	8	8	12
	Ticket Counter Area (SF)	850	-	200	400	400	600
	Ticket Counter Queueing (SF)	869	-	456	625	625	626
	Self-Service Kiosk	-	-	2	4	4	6
	Kiosk Footprint (SF)	-	-	88	176	176	264
	Bag-Drop Position (#)	-	-	1	1	1	1
	Bag-Drop Station Area (SF)	-	-	50	50	50	50
	Bag-Drop Station Queueing (SF)	-	-	80	80	80	80

Table 4-2 Check-In Area Requirements

4.3 OUTBOUND BAGGAGE SCREENING

Checked baggage screening accommodates the facilities and equipment used to transfer bags from the check-in area to the baggage screening area, and from the baggage screening area to the outbound baggage area. The baggage screening room accommodates explosive detection system (EDS) units, on-screen resolution stations, explosive trace detection stations, baggage circulation, and storage for TSA supplies.

Checked baggage screening space requirements for checked baggage screening considers the number of baggage screening devices and conveyor equipment system configuration, baggage processing rates, and clear and/or alarm bag rates. For FSD, the following parameters were obtained from TSA and the Airport, and were used to project future space requirements for checked baggage screening:

- **Percent of passengers checking bags:** 70 percent
- **Average bags per passenger:** 1.3 bags per passenger
- **EDS screening equipment throughput rate:** 180 bags per hour

Table 4-3 displays the results of the future space requirements for checked baggage screening. By 2041, the facility will need to be reconfigured or expanded to accommodate two additional EDS units.

Outbound Baggage Screening Requirements						
	Exist.	**2021**	**2026**	**2031**	**2036**	**2041**
Number of Bags Required Through EDS Units	395	395	544	603	664	727
Number of EDS Units	3	3	4	4	4	5
Number of Bags Required Through OSR Stations	99	99	136	151	166	182
Number of OSR Stations	2	1	2	2	2	2
Number of Bags Through ETD Units	32	32	45	49	54	59
Number of ETD Units	1	1	1	2	2	2
Peak Hour Passengers Checking-In	351	351	501	561	624	689
Total Bags to Process in Peak Hour	395	395	544	603	664	727
Area (Square Footage)						
Square Footage for Baggage Screening	-	2,540	3,380	3,480	3,480	4,280
Baggage Screening Circulation	incld.	762	1,014	1,044	1,044	1,284
Grand Total Area	4,409	3,302	4,394	4,524	4,524	5,564
Est. surplus/deficiency compared with existing	-	1,107	15	(115)	(115)	(1,155)

Table 4-3 Baggage Screening Requirements

4.4 OUTBOUND BAGGAGE MAKEUP

Outbound baggage makeup consists of the areas designated for outbound bags to be sorted, handled, and placed on baggage carts for the departing flight following the baggage screen process. This area also consists of ground service equipment circulation. This function occurs just west of the checked baggage screening areas. As mentioned in Chapter 2, the outbound baggage makeup area consists of two matrices—each matrix serving the north and south ticket counters. The north matrix consists of a112 LF flat-plated carousel that allows a four-cart tug to stage parallel to the belt on each side with two carts parked perpendicular at the end of each carousel, providing space for a total of 12 carts per carousel. The south matrix consists of a 102 LF flat-plated carousel. Separating each matrix is the make-up area for the oversized baggage belt. The number of gates, the number of departures per gate, and the number of carts per gate are evaluated to determine outbound baggage requirements. The following assumptions and space allowances were used in this analysis:

- **Number of departures in a two-hour period:** the number of departures in a two-hour period determines how many carts are staged per departure and arrival.
- **Number of carts per gate:** Approximately three carts are required per turn was assumed.
- **Linear feet of make-up carousel per cart:** 10 LF of carousel per staged cart
- **Linear feet of carousel per device:** Currently FSD has 120 LF per device. This was carried forward through the planning period
- **Area per device, equipment, and GSE circulation:** 8,100 SF per device

Outbound baggage make-up requirements are presented in **Table 4-4**. According to the future design day schedule, outbound baggage will need to accommodate enough space to handle nine departures within the peak two-hour period. Therefore, 18,225 square feet is required for outbound baggage facilities. In 2041, 270 LF of carousel will be needed, however, instead of adding a third make-up carousel, the expansion of the two existing carousels can be an option.

Outbound Baggage Makeup Area						
	Exist.	**2021**	**2026**	**2031**	**2036**	**2041**
Departures						
Expected # of Departures (Within a Two-Hour Staging Area)	6	6	7	7	8	9
# of Carts Staged (3 Per Departure)	12	12	14	21	24	27
LF of Make-Up Carousel	240	120	140	210	240	270
# of Make-Up Devices	2	1	2	2	2	2
Area Totals (Square Footage)						
Baggage Make-Up Device, Equipment, and GSE Maneuverability Area	15,630	8,100	16,200	16,200	16,200	18,225
Grand Total Area	**15,630**	**8,100**	**16,200**	**16,200**	**16,200**	**18,225**
Est. surplus/deficiency compared with existing	-	**7,530**	**(570)**	**(570)**	**(570)**	**(2,595)**

Table 4-4 Outbound Baggage Screening Requirements

4.5 SECURITY SCREENING CHECKPOINT

FSD currently has a two-lane configuration with enough space to add two additional lanes with no additional renovation and another two lanes (for a total of 6 lanes) that will require relocating TSA offices. Programming space requirements for the security screening checkpoint includes evaluating existing and future peak hour demand, throughput rates, achieving optimal wait times, and screening equipment requirements. The following assumptions were assumed with the Security Screening Checkpoint program:

- Passenger Demand: the peak 30-minute passenger demand was used for the future design day schedule.
- Additional Demand: A 12% factor was added to account for employees and crew going thought the checkpoint
- Type of Passengers: A 40%/60% split was used to determine Pre-Check/Standard passenger demand. Each lane type had its own processing rate and queue wait times.
- Passenger Throughput: A throughput of 150 passengers per hour per lane was used for standard lanes. A throughput of 240 passengers per hour per lane was used for PreCheck lanes.
- Maximum Wait Times: Passengers using standard lanes had a maximum wait time of 10 minutes while passengers using PreCheck lanes had five minutes. This wait time is consistent with the recommendation in IATA ADRM for an optimum level of service.
- Security equipment space requirements: standard space allowances from the Checkpoint Requirements and Planning Guide were used. A two-lane security screening module occupies 2,400 square feet.

Security Screening Checkpoint Requirements						
	Exist.	2021	2026	2031	2036	2041
Lanes						
Regular Checkpoint Lanes	1	2	2	2	2	3
Pre-Check Lanes	1	1	2	2	2	2
Total Checkpoint Lanes Required	2	3	4	4	4	5
Area Totals (Square Footage)						
Checkpoint Screening Area	6,437	3,600	4,800	4,800	4,800	6,000
Checkpoint Queue Area	2,500	1,800	2,400	2,400	2,400	3,000
Exit Lane	678	600	600	600	600	600
Grand Total Area	9,615	6,000	7,800	7,800	7,800	9,600
Est. surplus/deficiency compared with existing	-	3,615	1,815	1,815	1,815	15

Table 4-5 Security Screening Checkpoint Requirements

The security screening checkpoints requirements are shown in **Table 4-5**. By the end of the planning period, the number of lanes will need to increase from two to five to handle expected passenger flows. The existing SSCP area is sufficient throughout the planning horizon.

4.6 DEPARTURE LOUNGES

The basis for calculations of departure lounge requirements is the number of gates. Departure lounge space requirements are a function of the aircraft seating capacity per gate, average aircraft load factor, the physical layout of the departure lounge, and the number of seated vs. standing passengers. The departure lounge requirements are shown in **Table 4-6**.

Future Departure Lounge Programming	
Aircraft Seats	180
Load Factor	80%
Design Passengers (pax)	144
Passengers @90% Seated (pax)	130
Passengers @10% Standing (pax)	14
Seating Area @20 SF Per Passenger (sf)	2,600
Standing Area @16 SF Per Passenger (sf)	230
Departure Lounge Depth (feet)	35
Gate Agent Positions (ea)	2
Two (2) Gate Agent Podium (sf)	195
Boarding/Egress Aisle (sf)	210
Waiting Area (sf)	2,547
Total Area Require Per Narrowbody Gate	2,953
Existing Holdroom Area	10,062
Area Required for Terminal Program (14 Gates)	41,342
Est. surplus/deficiency compared with existing	(31,280)

Table 4-6 Departure Lounge Requirements

A 180-seat aircraft requires 2,953 square feet of departure lounge space. This results in a total requirement of 41,342 square feet of departure lounge space by the end of the terminal planning period, an increase of 31,280 square feet over the existing terminal building.

4.7 BAGGAGE CLAIM AND INBOUND BAGGAGE HANDLING

Baggage claim requirements are a function of peak 20-minute for deplanements, number of passengers checking bags, number of bags per passenger, number of additional people in the claim area, linear feet of carousel per carousel, and baggage service offices.

The current amount of linear feet of claim display at FSD will be sufficient through the planning period, however, circulation and additional space to account for baggage service offices should be added. The bag claim area will need to encompass approximately 10,000 square feet, which includes space for baggage service office expansion in the event more carriers come to FSD.

Space designated for inbound baggage includes space used for GSE circulation and equipment facilitating the transfer of bags from the baggage carts to the carousel. Currently, FSD has three slope-faced carousels where ground operators pull the baggage carts parallel to the feeder belts in the inbound make-up area and offload bags. This type of operation is assumed to continue throughout the planning horizon. **Table 4-7** shows the baggage requirements.

Baggage Claim and Inbound Baggage Makeup Area Requirements						
	Exist	2021	2026	2031	2036	2041
Unit Totals						
Peak 20-Minute Terminating Passengers Checking Bags	175	175	251	280	312	345
Total Number of People at Claim	147	147	210	235	262	289
Total Claim Frontage Required	315	147	210	235	262	289
Number of claim units (105 lf/carousel)	**3**	**2**	**3**	**3**	**3**	**3**
Area Totals (Square Feet)						
Baggage Claim Area	8,982	6,000	9,000	9,000	9,000	9,000
Baggage Service Offices	655	655	750	750	1,000	1,000
Inbound Baggage Offload Area	7,871	6,000	6,000	6,000	6,000	6,000
Grand Total Area	**17,508**	**12,655**	**15,750**	**15,750**	**16,000**	**16,000**
Baggage Claim Area - Estimated surplus/ deficiency (-) compared with existing facility	-	**2,982**	**(113)**	**(113)**	**(363)**	**(363)**
Inbound Baggage Area - Estimated surplus/ deficiency (-) compared with existing facility	-	**1,871**	**1,871**	**1,871**	**1,871**	**1,871**

Table 4-7 Baggage Claim and Inbound Baggage Makeup Requirements

4.8 CONCESSIONS

A concessions program includes food and beverage, retail, and concessions support space throughout the Airport. In general, the potential commercial demand at an airport is driven by the passenger characteristics and the travel profiles of enplaning passengers. Future required concession space is typically expressed in square feet per 1,000 enplanements. Currently, FSD's concessions program has a 50%/50% split between pre-secure and post-secure passenger-facing concessions space. To enhance revenue-generating opportunities, future concessions space is programmed to achieve a 30%/70% pre-secure vs. post-secure concessions split. Additional metrics used for concessions space planning include:

- **Retail Concessions Space:** 4.1 SF per 1,000 Annual Enplanements
- **Food and Beverage Concessions Space:** 10.6 SF/1,000 Annual Enplanements
- **Storage (% of Total Space):** Retail-15%, Food and Beverage-20%
- **Pre-Secure vs. Post-Secure:** 30%/70% Split

Concession space requirements can be found in **Table 4-8**.

Concessions						
	Exist.	2021	2026	2031	2036	2041
Pre-secure concessions						
Food & Beverage	4,207	1,610	2,284	2,556	2,844	3,140
Retail	924	623	883	989	1,100	1,215
Concessions Support and Storage	3,250	1,116	1,584	1,772	1,972	2,177
Post-secure concessions						
Food & Beverage	4,528	3,756	5,329	5,963	6,637	7,327
Retail	786	1,453	2,061	2,307	2,567	2,834
Concessions Support and Storage	1,011	1,302	1,848	2,067	2,301	2,540
Rental car concessions						
Rental car offices	1,760	1,100				
Queueing area	0	880	880	880	880	880
Grand Total Area	**16,466**	**11,840**	**15,969**	**17,634**	**19,402**	**21,214**
Est. surplus/deficiency compared with existing		**4,626**	**497**	**(1,168)**	**(2,936)**	**(4,7478)**

Table 4-8 Concessions Space Requirements

4.9 RESTROOMS

Programming for restroom spaces consists of defining the space required to accommodate demand for men's and women's fixtures, family restrooms, janitor closets, and mother's nursing stations. Programming for restroom facilities at FSD followed guidance from ACRP Report 226: *Guidebook for Airport Terminal Restroom Planning and Design* and used the following assumptions:

- 70 SF per fixture, 70 SF per family restroom, 100 SF per janitor's closet, 80 SF per nursing station
- Pre-security restroom requirements are based on the peak hour of passengers with a 1.25 visitor ratio.
- Post-security requirements are based on the peak 20-minute passenger demand assuming 60% of passengers are using the restrooms.
- Gender restroom splits include a proportion of 40 percent men to 60 percent women.
- Projections included a mother's nursing station.

The results of the analysis are shown in **Table 4-9**. By the end of the planning, a total of 5,059 square feet of restroom space will be required.

	Exist		2021		2026		2031		2036		2041	
Pre/Post-security restrooms	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
Fixtures												
Men's	12	11	9	8	11	11	12	12	12	13	13	15
Women's	7	10	12	10	14	14	15	15	15	17	17	19
Family/Module	2	1	2	2	2	3	2	3	2	3	2	3
fixtures sub total	**21**	**22**	**23**	**20**	**27**	**28**	**29**	**30**	**29**	**33**	**32**	**37**
Restroom area (Square Feet)												
Men's	552	738	630	560	770	770	840	840	840	910	910	1,050
Women's	555	710	840	700	980	980	1,050	1,050	1,050	1,190	1,190	1,330
Family	154	100	140	140	140	210	140	210	140	210	140	210
Nursing Room	-	30	30	30	60	60	60	60	60	60	60	60
Animal Service Relief Area	-	109	-	109	-	109	-	109	-	109	-	109
restroom area subtotal	**1,261**	**1,687**	**1,640**	**1,539**	**1,950**	**2,129**	**2,090**	**2,269**	**2,090**	**2,479**	**2,300**	**2,759**
Grand Total Area	**2,948**		**3,179**		**4,079**		**4,359**		**4,569**		**5,059**	
Estimated Surplus/Deficiency Compared with Existing Facility	**-**		**(231)**		**(1,131)**		**(1,411)**		**(1,621)**		**(2,111)**	

Table 4-9 Restroom Requirements

4.10 CIRCULATION

Adequate circulation is critical to move passengers from one functional area to the next in an efficient and comfortable manner. Often times, circulation is based on available space created by another functional area or constraint such as concourse width or limited area adjacent to a check-in or passenger security screening functions due to changes in processes over the years. Circulation is typically split into two areas: secure and non-secure. Minimum clear circulation widths for public areas are 20-feet between major functional elements such as check-in. For a double-loaded concourse, 20-feet minimum is recommended. For non-public areas, such as back of house spaces, office space, etc. the width should be determined by the function (i.e. moving supplies in a corridor near a loading dock) life safety/egress, accessibility and local building codes. The current double-loaded concourse is less than 18' in corridor width. Assumptions for circulation are as follows:

- **Public Circulation:** 20% of all public-serving space including pre-secure concessions, pre-secure restrooms, baggage claim, baggage service offices, check-in area, rental car offices, security screening checkpoint, and meeter and greeter areas.
- **Non-Public Circulation:** 10% of all non-public space including airline ticket offices, administrative offices, back-of-house concessions areas, and airport support spaces.
- **Vertical Circulation:** 5% of all gross space.

4.11 SUPPORT AND BUILDING SYSTEMS

Support functions, such as operations, maintenance and building systems are typically based on a percentage of the overall facility or incremental growth throughout the planning period based on passenger growth. For these areas, the following percentages were applied to building systems and maintenance areas:

- Building Systems and Utilities: 9% of all gross space
- Maintenance and storage: 9% of all gross space

For airport administrative areas an approximate 800 SF was added to airport administrative offices to accommodate employment growth as passenger activity grows.

4.12 TERMINAL FACILITY REQUIREMENTS RESULTS

The terminal space requirements are summarized in Terminal Table 4-10.

Terminal Functions	Units	Terminal Requirements					
		Exis.	2021	2026	2031	2036	2041
Enplanements		506,211	506,211	718,232	803,692	894,468	987,480
Check-In Hall							
Full-service counter positions	ea	38	21	30	34	34	38
Check-in area (includes active check-in)	sf	1,899	1,050	1,500	1,700	1,700	1,900
Check-in queue area	sf	3,367	3,008	3,961	4,390	4,705	5,089
Kiosks positions	ea	4	4	12	14	14	16
Kiosks footprint area	sf	0	176	528	616	616	704
Bag-drop position	ea	0	5	6	7	7	8
Bag-drop position area	sf	0	290	348	406	406	464
Bag-drop queueing area	sf	0	400	480	560	560	640
Airline ticket office area	sf	6,413	5,250	7,500	8,500	8,500	9,500
Subtotal	sf	11,679	10,174	14,317	16,172	16,487	18,297
Outbound Baggage Screening and Baggage Make-up							
Number of Level 1 EDS units	ea	3	3	4	4	4	5
Level 1 EDS area	sf	(incl.)	2,400	3,200	3,200	3,200	4,000
Number of Level 2 OSR stations	ea	2	1	2	2	2	2
Level 2 OSR area	sf	(incl.)	40	80	80	80	80
Number of Level 3 ETD units	ea	(incl.)	1	1	2	2	2
Level 3 ETD area	sf	(incl.)	100	100	200	200	200
Baggage screening circulation	sf	(incl.)	762	1,014	1,044	1,044	1,284
TSA baggage screening room	sf	4,409	3,302	4,394	4,524	4,524	5,564
Outbound baggage make-up area	sf	15,630	8,100	16,200	16,200	16,200	18,225
Subtotal	sf	20,039	11,402	20,594	20,724	20,724	23,789
Security Screening Checkpoint							
Checkpoint lanes	ea	2	3	4	4	4	5
Checkpoint screening area	sf	6,437	3,600	4,800	4,800	4,800	6,000
Checkpoint queue area	sf	2,500	1,800	2,400	2,400	2,400	3,000
Checkpoint exit lane	sf	678	600	600	600	600	600
U.S. Customs Border and Protection	sf	2,820	2,820	2,820	2,820	2,820	2,820
Subtotal	sf	12,435	8,820	10,620	10,620	10,620	12,420
Departure Lounge							
Gates	ea	7	10	11	12	13	14
Departure Lounge	sf	10,062	29,530	32,483	35,436	38,389	41,342
Subtotal	sf	10,062	29,530	32,483	35,436	38,389	41,342
Baggage Claim and Inbound Baggage Handling							
Number of carousels	ea	3	2	2	3	3	3
Claim area (carousels)	sf	8,982	6,000	6,000	9,000	9,000	9,000
Baggage service offices	sf	655	655	750	750	1,000	1,000
Inbound baggage offload area	sf	7,871	6,000	6,000	6,000	6,000	6,000
Subtotal	sf	17,508	12,655	12,750	15,750	16,000	16,000
Concessions							
Pre-secure concessions							
Food & Beverage	sf	4,207	1,610	2,284	2,556	2,844	3,140
Retail	sf	924	623	883	989	1,100	1,215
Concessions Support and Storage	sf	3,250	1,116	1,584	1,772	1,972	2,177
Post-secure concessions							
Food & Beverage	sf	4,528	3,756	5,329	5,963	6,637	7,327
Retail	sf	786	1,453	2,061	2,307	2,567	2,834
Concessions Support and Storage	sf	1,011	1,302	1,848	2,067	2,301	2,540
Rental car concessions							
Rental car offices	sf	1,760	1,100	1,100	1,100	1,100	1,100
Queueing area	sf	0	880	880	880	880	880
Subtotal	sf	16,466	11,840	15,969	17,634	19,402	21,214
Restrooms							
Pre-security men fixtures	fixtures	12	9	11	11	12	13
Pre-security women fixtures	fixtures	7	12	14	14	15	17
Pre-security restroom area	sf	1,231	1,640	1,950	1,950	2,090	2,300
Post-security men fixtures	fixtures	11	8	11	12	13	15
Post-security women fixtures	fixtures	10	10	14	15	17	19
Post-security restroom area	sf	1,548	1,539	2,129	2,269	2,479	2,759
Mother's Nursing Stations	sf	30	60	60	60	60	60
Animal service relief area	sf	109	109	109	109	109	109
Subtotal	sf	2,918	3,348	4,248	4,388	4,738	5,228
	men fixtures	23	17	22	23	25	28
	women fixtures	17	22	28	29	32	36
Support Functions							
TSA administration and staff support	sf	2,419	3,000	3,000	3,000	3,000	3,000
Operations and maintenance	sf	12,996	13,352	15,870	16,941	17,676	18,961
Loading Dock	sf	0	2,500	2,500	2,500	2,500	2,500
Airport administrative areas	sf	5,200	6,397	7,276	7,489	8,116	8,349
Lounge/Play Area/Additional Seating	sf	2,296	3,304	4,388	4,551	4,724	4,903
Subtotal	sf	22,641	28,553	33,034	34,481	36,016	37,712
Circulation							
Public Circulation	sf	26,006	27,442	27,442	27,442	27,442	27,442
Secure Public Circulation	sf	10,039	12,169	13,533	14,725	15,954	17,211
Non-Public Circulation	sf	3,751	5,598	7,242	7,558	7,738	8,374
Meeters/Greeters	sf	3,175	1,463	2,078	2,326	2,588	2,858
Subtotal	sf	42,971	46,672	50,296	52,051	53,722	55,885
Other Areas							
Vertical Circulation	sf	7,521	7,385	8,801	9,388	9,789	10,504
Building Systems and Utilities	sf	15,966	13,945	16,574	17,693	18,460	19,803
Subtotal	sf	23,487	21,330	25,375	27,081	28,250	30,307
TOTAL AREA		180,206	184,324	219,686	234,337	244,348	262,194
Estimated surplus/**deficiency** (-) compared with existing facility			**4,118**	**39,480**	**54,131**	**64,142**	**81,988**

Table 4-10 FSD Terminal Facility Requirements

4.13 CURBSIDE REQUIREMENTS

During the design and programming of the future parking garage, FSD evaluated the utilization of the current curb front and compared it to future demand. That same methodology of applying a certain percentage of various transportation modes to the peak hour activity was used for this study. However, the updated peak hour demand and passenger activity levels defined in Chapter 3 were used. Once the space for each mode of transportation was defined, the capacity level of service (LOS) of the existing curb front and the amount of space required for LOS C were calculated. As shown in **Table 4-11**, the existing 1,040-foot curb front will require some type of modification or expansion after 2031 to sustain a LOS C.

Peak Hour Demand		2021 701	2026 995	2031 1,113	2036 1,239	2041 1,367
Curbfront Analysis	**% of Peak 15 Minute**					
Private Auto	32%	224	319	357	396	438
Taxi Stand	5%	35	47	59	59	59
Taxi Drop-Off	1%	6	8	9	9	9
Hotel Shuttle	3%	19	26	32	32	38
Airport Shuttle	3%	18	24	27	31	34
TNC Stand	10%	70	99	114	122	135
TNC Drop-Off	4%	25	36	41	44	51
Total Peak 15-Minute Demand		397	558	638	693	774
Existing Capacity Ratio		0.38	0.54	0.61	0.67	0.74
Existing LOS		A	B	C	D	D
LOS C Min Length Needed (ft.)		**611**	**858**	**982**	**1,067**	**1,191**
LOS C Max Length Needed (ft.)		**722**	**1,014**	**1,160**	**1,261**	**1,407**

Table 4-11 Curbside Requirements Analysis

4.14 SUMMARY

Overall, the future demand calls for the existing terminal facility to expand by an additional 75,000 square feet to accommodate a peak hour of 685 enplanements and a 14-gate concourse. These requirements are the foundation for the development of various alternatives in the terminal area. The concourse will be a primary focus area during concept development as this area requires the most significant expansion with the recommendation to add seven gates over the planning horizon. Additionally, the ticketing area and baggage make-up will be a significant area of focus as airlines begin replacing their current fleet with larger aircraft which have significant impacts on the peak hour and the demand for space in these areas of the terminal. Lastly, adding more concessions and concessions support/delivery space post-security will be evaluated to accommodate the growing gate demand.

5. IMPROVEMENT ALTERNATIVES

Planning airport terminal facilities involves many operational, financial, and environmental considerations. The arrangement of the terminal complex is based on functional relationships between its different components. These components include the landside (vehicle access and parking), the terminal building, and the airside (aircraft access and parking). Likewise, the arrangement of areas inside the terminal building is also based on functional relationships. The primary components of the terminal building include the non-secure area, security screening, and the secure areas. Spaces within these components have interrelated functions. The planning process is iterative, and alternatives are generated to determine the most beneficial overall arrangement for the airport.

This section follows the process of developing alternative layouts for the terminal building, exploring and identifying the options that best meet the projected facility requirements. The layouts are assessed for expected aeronautical utility, operational performance, construction feasibility, and alignment with Sioux Falls Regional Airport's (FSD) sustainability goals. The Airport's sustainability goals are described in the Sustainability Plan developed as part of FSD's 2023 Master Plan. A recommended layout has been developed in conceptual level detail.

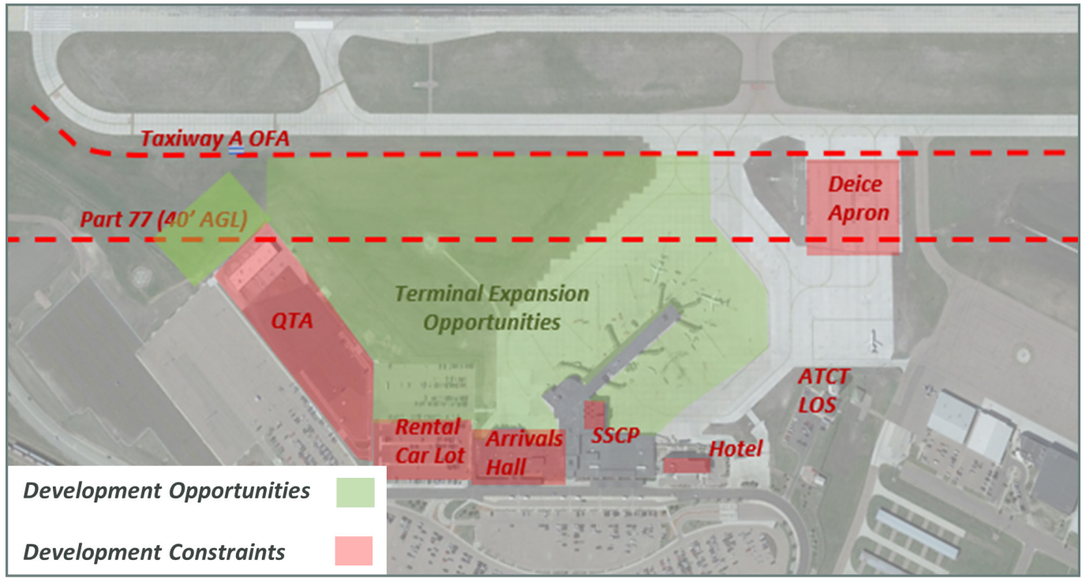


Figure 5-1 Terminal Area Development Opportunities and Constraints

5.1 DEVELOPMENT AREA GOALS

To clearly define a project that will provide suitable facilities, goals are established for both the terminal building and terminal complex. The Terminal Area at FSD provided a variety of development opportunities and constraints as shown in **Figure 5-1**.
The opportunities in the terminal area include the areas directly around the existing concourse, north of the terminal, and north of the Quick-Turnaround (QTA) facility. The development constraints reflect recently constructed infrastructure around the terminal facility such as the QTA, Arrivals Hall, Security Screening Checkpoint (SSCP), and hotel. Additionally, the Deice Apron is being maintained due to the costly expense required to relocate it. Other elements considered during this alternatives analysis include the Airport Traffic Control Tower (ATCT) Line-of-Sight, Part 77 Airspace Surfaces, and the Taxiway A Object Free Area.

5.2 TICKETING AREA CONCEPT DEVELOPMENT

As mentioned in previous chapters, the ticketing area requires modifications to accommodate future demand and keep up with emerging technologies. Although the ticketing area consists of the primary check-in functional areas such as space for circulation, queuing, and passenger processing, this area impacts baggage screening, Airline Ticket Office (ATO) space, and outbound baggage make-up. Therefore, these areas were included into concept development for the ticketing area. Currently, the ticketing area experiences long queues that overflow in front of the primary vertical circulation core during the peak hour due to the current depth available for passengers to queue in front of the counters shown in **Figure 5-2**. This is amplified when mainline aircraft are operating during the peak hour. Additionally, baggage throughput on the south end of ticketing is restricted to the processing rate of the one Explosive Detection System (EDS) machine in the south side of the baggage screening room creating challenges during the peak times for United and Allegiant Airlines. Additionally, there is no redundancy for the South EDS. Oversize baggage also overflows in the makeup area due to the short belt runs beyond the baggage screening room. Developed concepts will focus on expanding the depth of the queuing area, baggage screening rooms, and outbound baggage makeup area by pushing the west façade towards the apron.

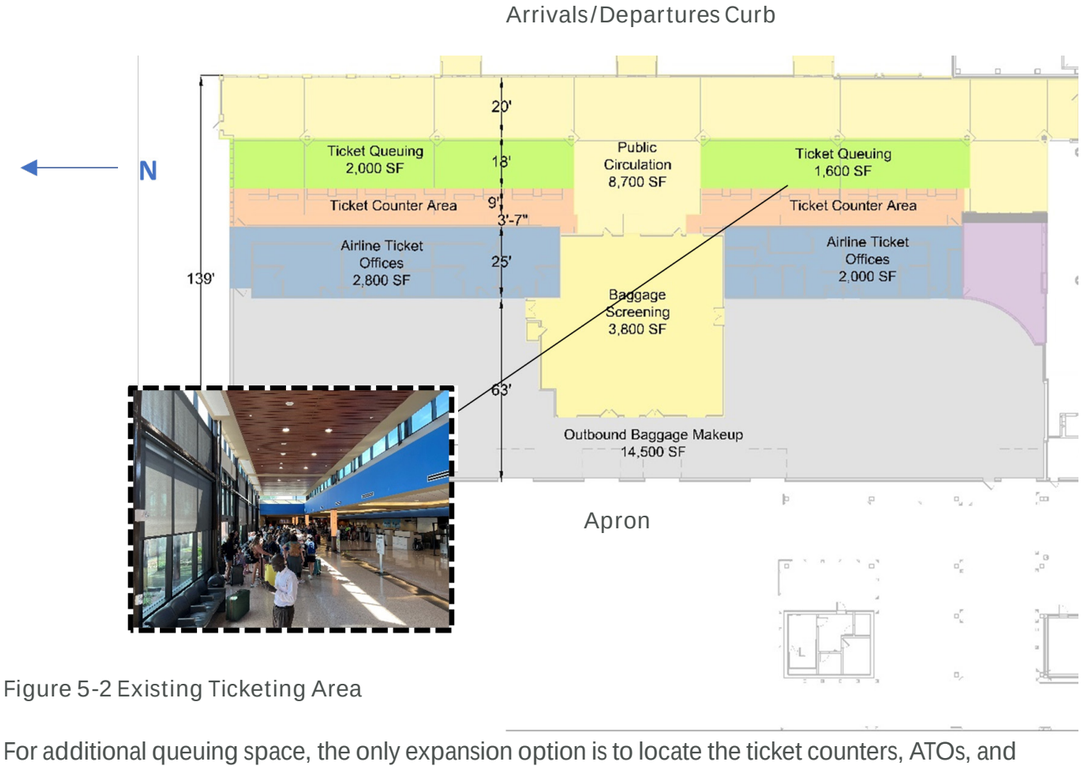


Figure 5-2 Existing Ticketing Area

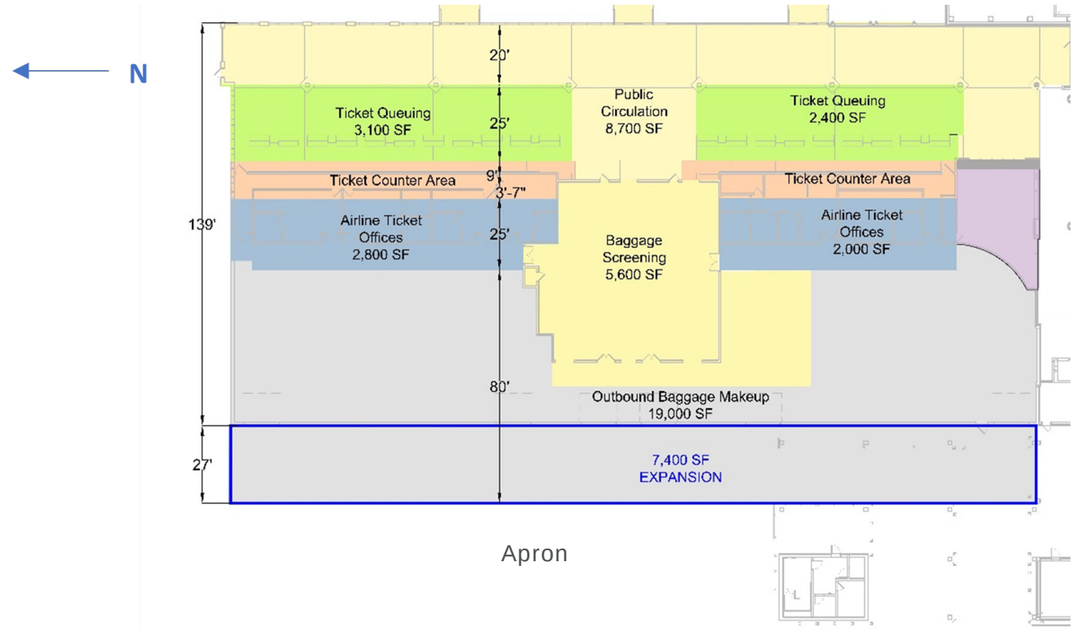


Figure 5-3 Ticketing Area Alternative

For additional queuing space, the only expansion option is to locate the ticket counters, ATOs, and baggage make-up area further west. Airport Cooperative Research Program (ACRP) Report 25, Airport Passenger Terminal Planning and Design, Volume 1 recommends 25-feet of queuing space between the ticket counters and primary circulation area. Therefore, the concept, as shown in Figure 5-3, relocates the ticket counters and ATOs 7 feet to the west. Baggage Makeup is also expanded 20 feet to the west to accommodate additional screening infrastructure on the south side and more makeup depth for Ground Support Equipment (GSE) staging/circulation. This concept was carried forward in the concourse expansion alternatives below.

Expansion of the baggage screening and baggage make-up areas is required to accommodate future demand and to address existing conveyor grade issues in the current system. Additionally, more oversized baggage storage is anticipated to be part of the future baggage system concept so the oversized belt has more capacity. Figure 5-4 shows the outbound baggage make-up area expansion.

This option provides an oversized baggage scanner in the ticketing area. This allows the oversized baggage belt to have more conveyor capacity beyond the scanner. Additionally, this configuration utilizes slope plate makeups to give more baggage storage following baggage being processed through security.

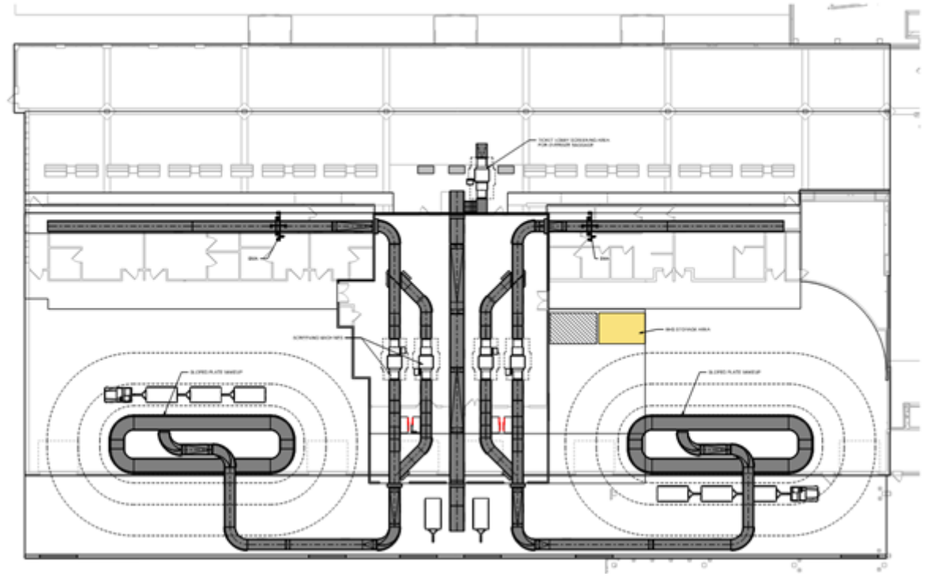


Figure 5-4 Baggage Screening and Outbound Baggage Make-Up Area Expansion

5.3 RENTAL CAR OFFICE CONCEPT DEVELOPMENT

To alleviate congestion in the arrivals hall and rental car area, one concept was developed focusing on separating queues for the rental car counters from the adjacent passenger circulation corridor and additional passengers waiting for their bags on carousel 3. Without expanding the facility further south and impacting rental car parking, the only option is to relocate the existing United States Customs and Border Protection (USCBP) facilities and relocate rental car offices to the space shown in **Figure 5-5**. This concept utilizes the existing rental car office space for passenger circulation and baggage claim seating. The concourse expansion alternatives will evaluate options of accommodating the new USCBP space. This rental car relocation concept will be included in all concourse expansion alternatives discussed in the next section.

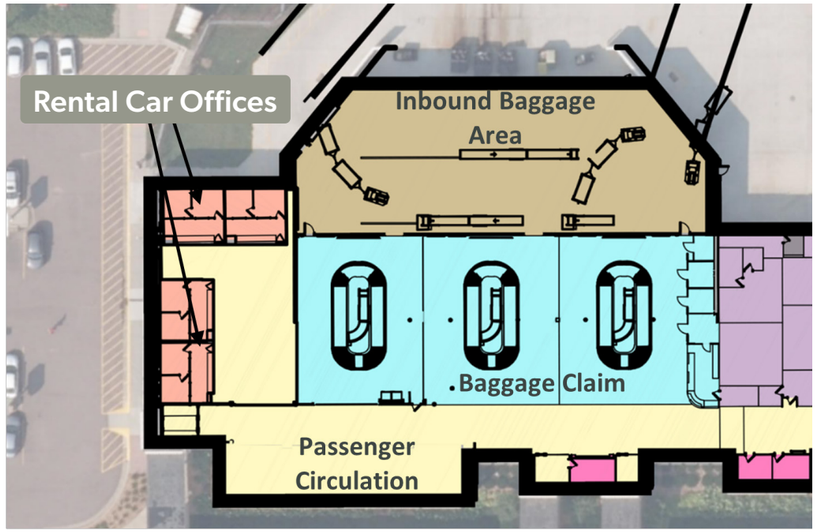


Figure 5-5 Rental Car Office Relocation

5.4 CONCOURSE EXPANSION ALTERNATIVES

Three concourse expansion alternatives that met the development goals and achieved the proposed requirements mentioned in Chapter 4, Facility Requirements were developed for expansion. These alternatives were then evaluated against Airport-defined criteria.

The concourse expansion alternatives focused specifically on gate expansion to ultimately 14 gates while minimizing gate closures during construction and avoiding impacts to previously mentioned constraints. The alternatives also focused on providing an 85-foot-wide single-loaded concourse with any new development to provide a code-compliant circulation corridor, deeper departure lounges, and additional space for terminal support functions. Additional goals considered include:

1. Add departure lounge seating and depth
2. Expand post-security concessions program
3. Expand circulation corridor width to meet building code
4. Improve passenger experience by providing a better sense of place and more amenities
5. Add space for more ticket queuing space.
6. Expand outbound baggage make-up area to serve future demand
7. Improve concessions delivery services
8. Limit gate closures to one passenger boarding bridge during construction
9. Develop alternatives with consideration of sustainability goals.

5.4.1 CONCOURSE EXPANSION ALTERNATIVE #1

Alternative 1 evaluated the feasibility of the preferred concept identified in the 2016 Master Plan with a T-shaped concourse expansion at the existing restaurant with a north/south orientation, as shown in **Figure 5-6**. In the previous Master Plan, the sites that currently accommodate the Deice Apron and QTA were designated for terminal uses. With the construction of these facilities, the reconfigured terminal site presents challenges to accommodating current Alternative 1. This 162,000-square-foot (SF) alternative includes a full 14-gate build out. The north hammerhead will be double-loaded, and the south hammerhead has the option of being double-loaded with impacts to employee parking. Concession deliveries occur directly at the south hammerhead of the concourse and accessible via a newly constructed landside road that connects to Minnesota Avenue. **Figures 5-7** and **5-8** show the proposed upper-level and lower-level interior layouts of Alternative 1. The interior includes a circulation corridor post-security to where the concourse breaks into a "T." The 85-foot-wide concourse includes 35-foot-wide departure lounges with sweeping airfield views, a 20-foot-wide circulation corridor, and a centralized concessions core at the center of the "T." The lower level has space to process Federal Inspection Services (FIS) activities. Passengers access this space through a sterile corridor and vertical circulation core from a gate on the south expanded concourse. Once processed, they will use the vertical circulation back to the concourse level where they will exit the concourse similar to domestic passengers. The pros and cons of Alternative 1 include:

PROS:

1. Program includes all new concourse facilities
2. No impact to parking facilities
3. Concessions delivery does not require escort

CONS:

1. Program costs
2. Phasing challenges to existing operations
3. Surplus of concourse and apron space

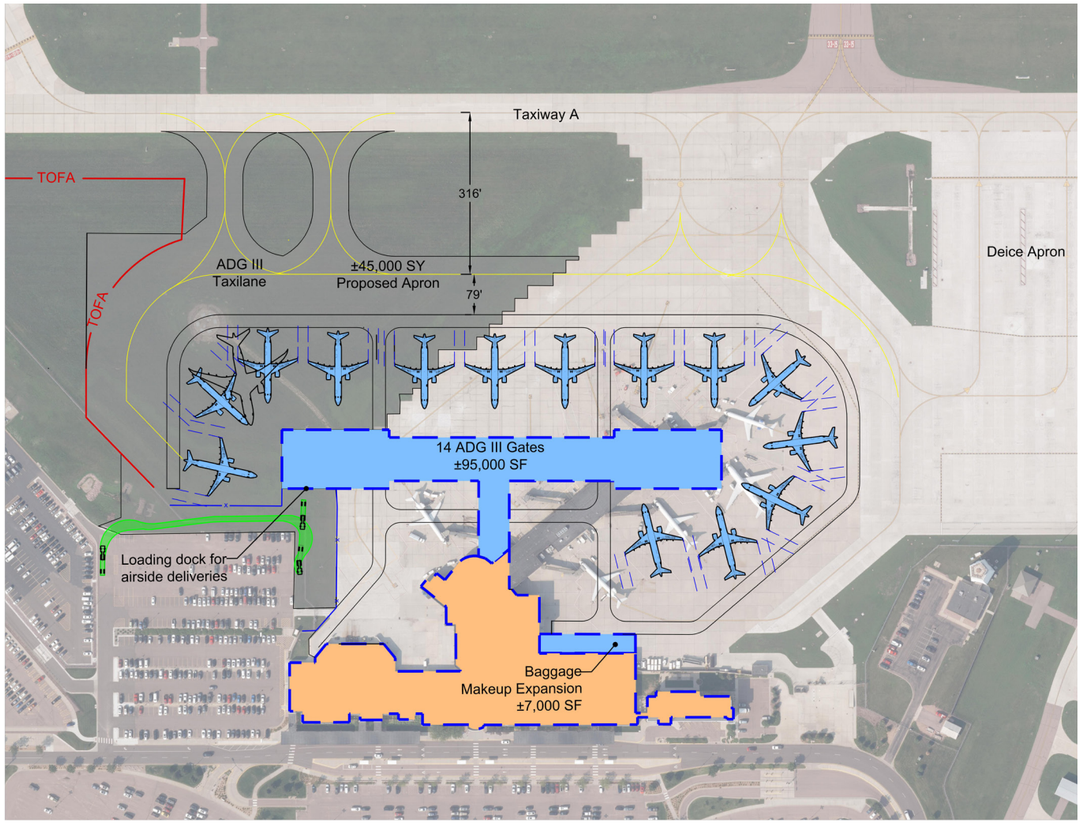


Figure 5-6 Alternative 1 Overview

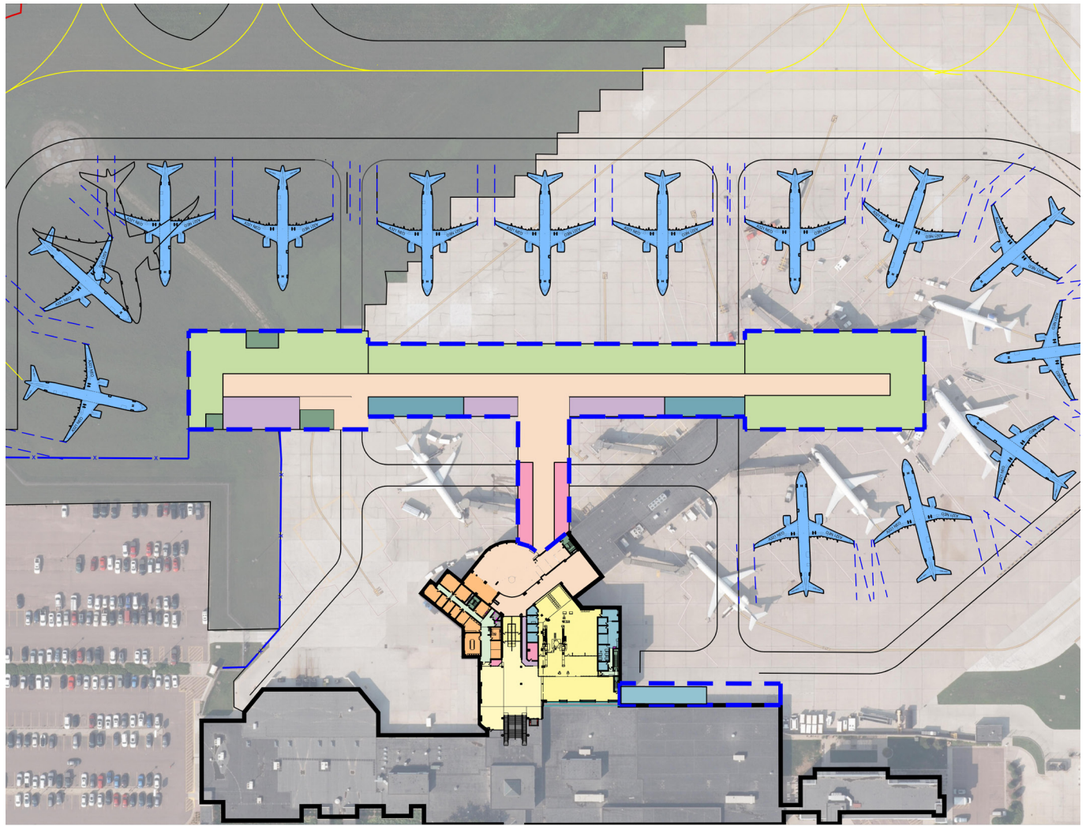


Figure 5-7 Alternative 1 Upper Level

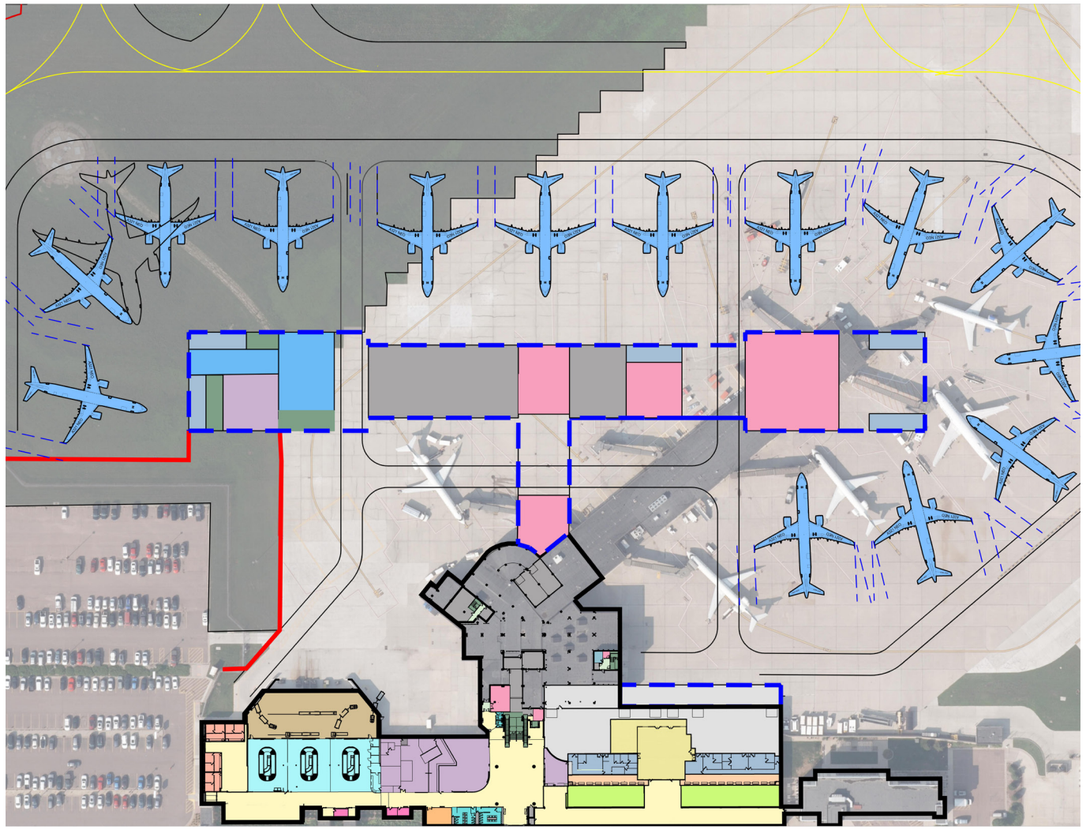
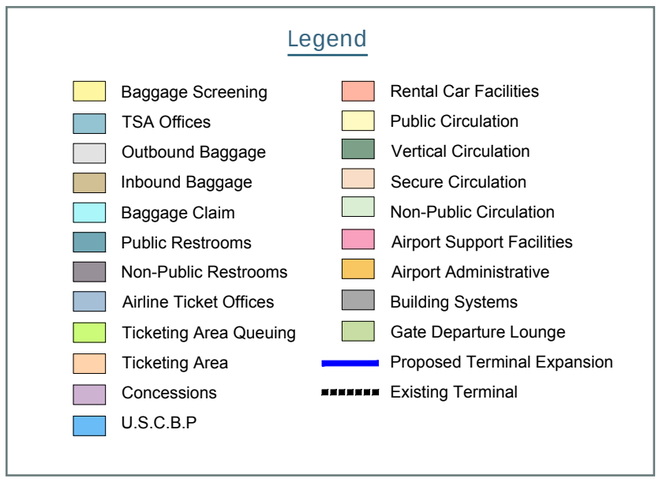


Figure 5-8 Alternative 1 Lower Level



5.4.2 CONCOURSE EXPANSION ALTERNATIVE #2

Alternative 2 is a Y-configured, 151,000 SF expansion, with a seven-gate south concourse coming out of the post-secure restaurant and a seven-gate north concourse connected to the existing departure lounge of Gate 2, as shown in **Figure 5-9**. Both concourses require an apron expansion beyond the existing apron. The north concourse is built offset from the existing concourse to allow the south side and end of the existing concourse to remain open during construction of the north concourse, limiting impacts to existing operations. Concession deliveries occur directly at the east-facing side of the south concourse that is accessible via a newly constructed landside road that connects to Minnesota Avenue. **Figures 5-10** and **5-11** show the proposed upper-level and lower-level interior layouts. A concessions core connects both concourses and expands the existing concessions core. The lower level has space to process FIS activities. Passengers access this space through a sterile corridor and vertical circulation core from a gate on the south expanded concourse. Once processed, they will use vertical circulation back to the concourse level where they will exit the concourse similar to domestic passengers. The pros and cons of Alternative 2 include:

PROS:

1. Program includes all new concourse facilities
2. No impact to parking facilities
3. Concessions delivery does not require escort
4. One centrally located concessions core

CONS:

1. Program costs compared to Alternative 3
2. Half of all gates remain on existing concourse after Phase 1
3. Impact to existing concessions and admin spaces
4. North apron expansion impacts deicing storage tank facilities

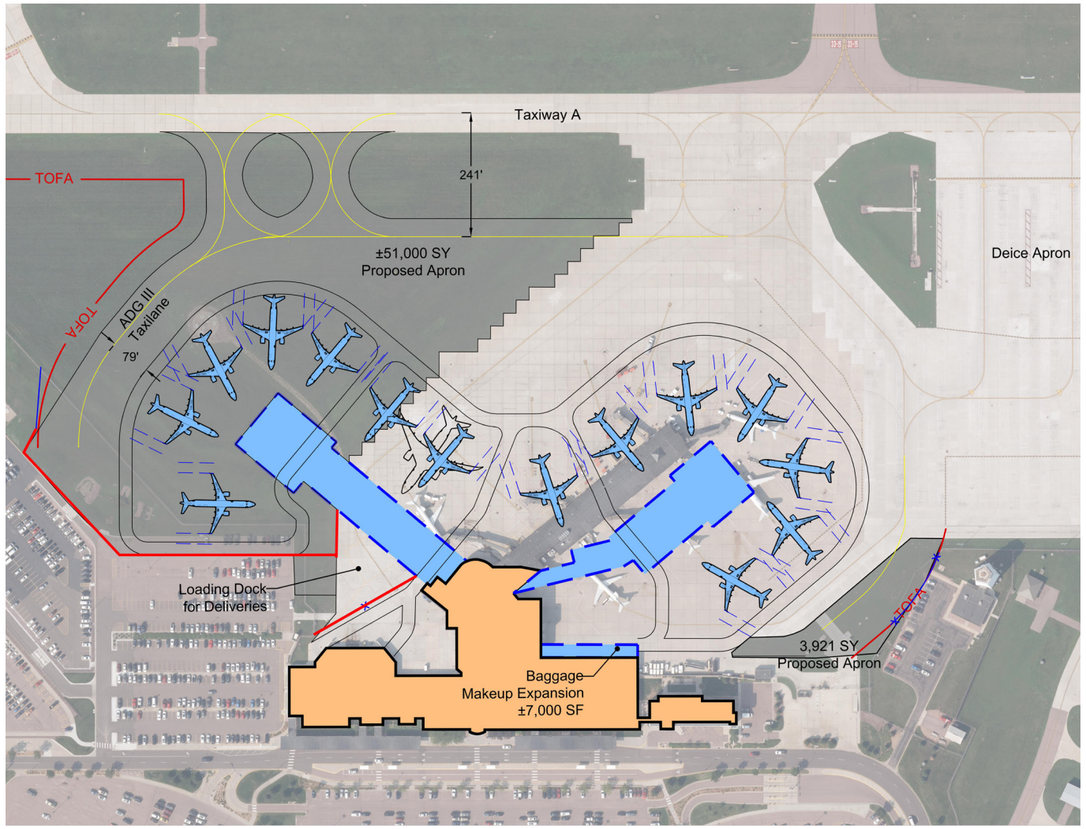


Figure 5-9 Alternative 2 Overview

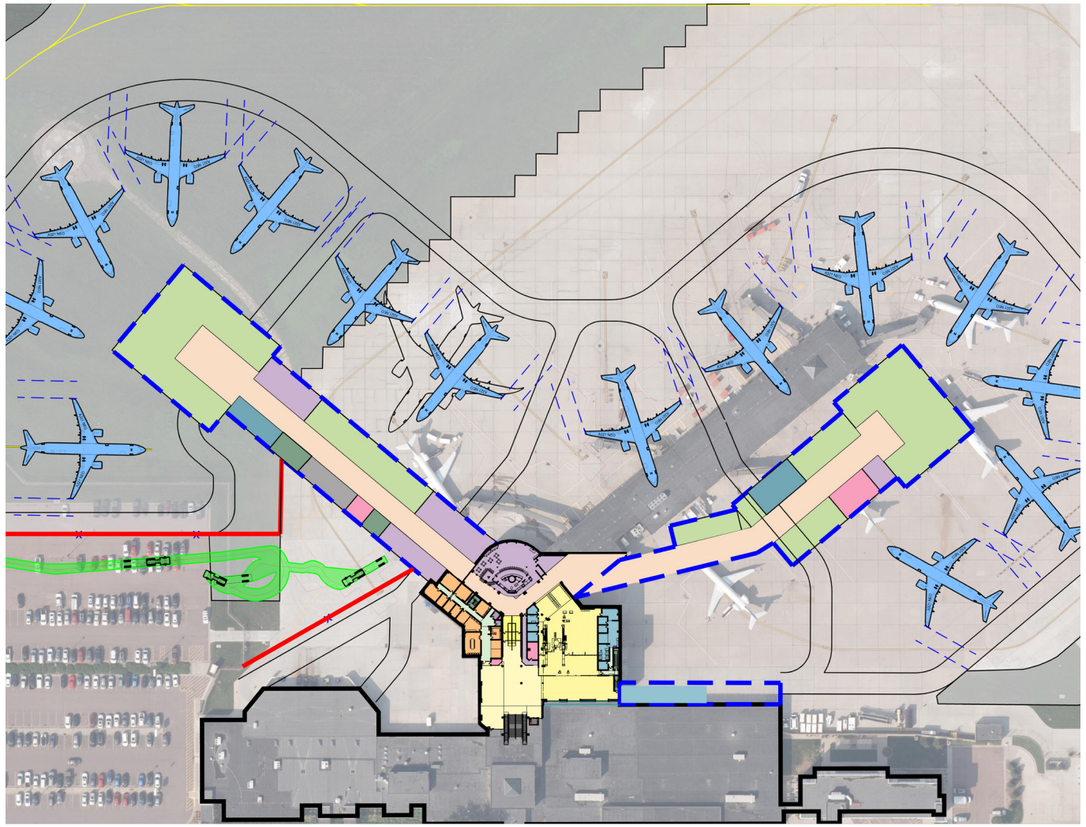


Figure 5-10 Alternative 2 Upper Level

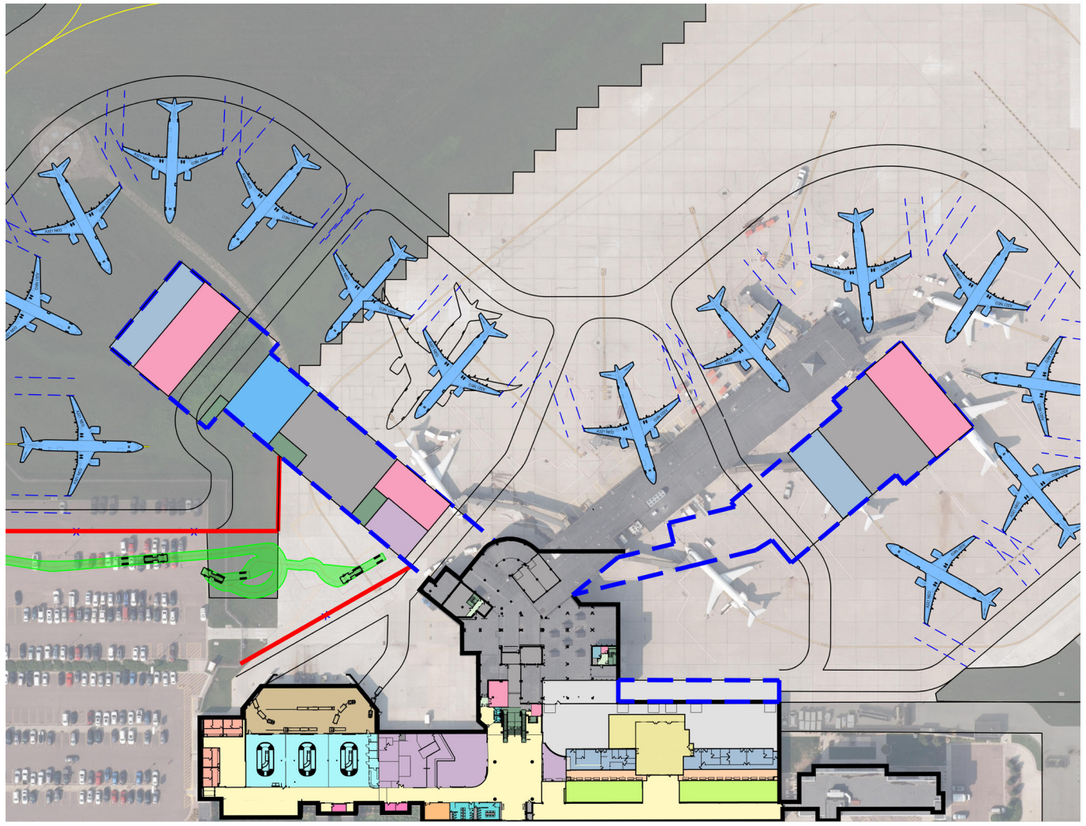
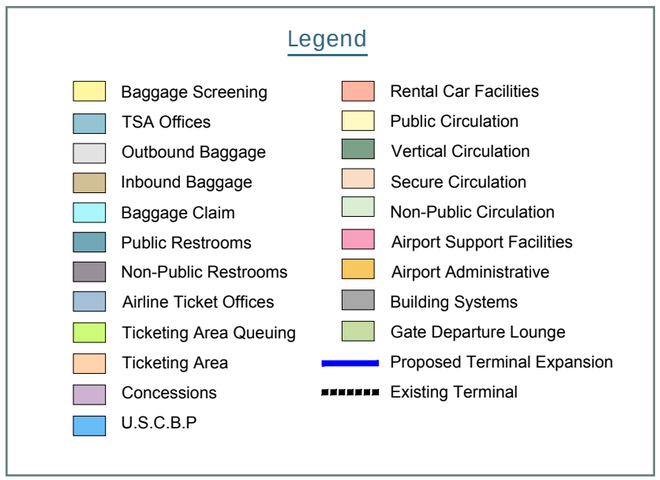


Figure 5-11 Alternative 2 Lower Level



5.4.3 CONCOURSE EXPANSION ALTERNATIVE #3

Alternative 3 is a 105,000 SF expansion off the existing concourse in a triangle configuration, as shown in **Figure 5-12**. This alternative utilizes the majority of the existing concourse, but converts the departure lounge space of Gates 1 and 3 into circulation space where the south expansion connects into the existing facility. Once passengers are processed at security, a centralized open atrium space welcomes them to various amenities and circulation space. A hammerhead south of the atrium accommodates seven gates with a center concessions core. To provide additional departure lounge area in the existing concourse, its end expands into a hammerhead to accommodate five gates. Similar to other alternatives concession deliveries occur directly at the facing side of the south concourse accessible via a new landside road described previously. The lower level has space to process FIS activities. Passengers access this space through a sterile corridor and vertical circulation core from a gate on the south expanded concourse. Once processed, they will use vertical circulation back to the concourse level where they will exit the concourse similar to domestic passengers. **Figures 5-13** and **5-14** show the proposed upper-level and lower-level interior layouts. The pros and cons of Alternative 3 include:

PROS:

1. Program costs compared to other alternatives
2. Central atrium space with concessions and passenger amenities
3. Majority of gates will be on new concourse after south concourse is built
4. Maintains recently renovated concessions
5. Actual gate count will be evenly split between concourses.

CONS:

1. Reusing existing concourse structure
2. Maintenance of two concession cores
3. Impact to employee parking

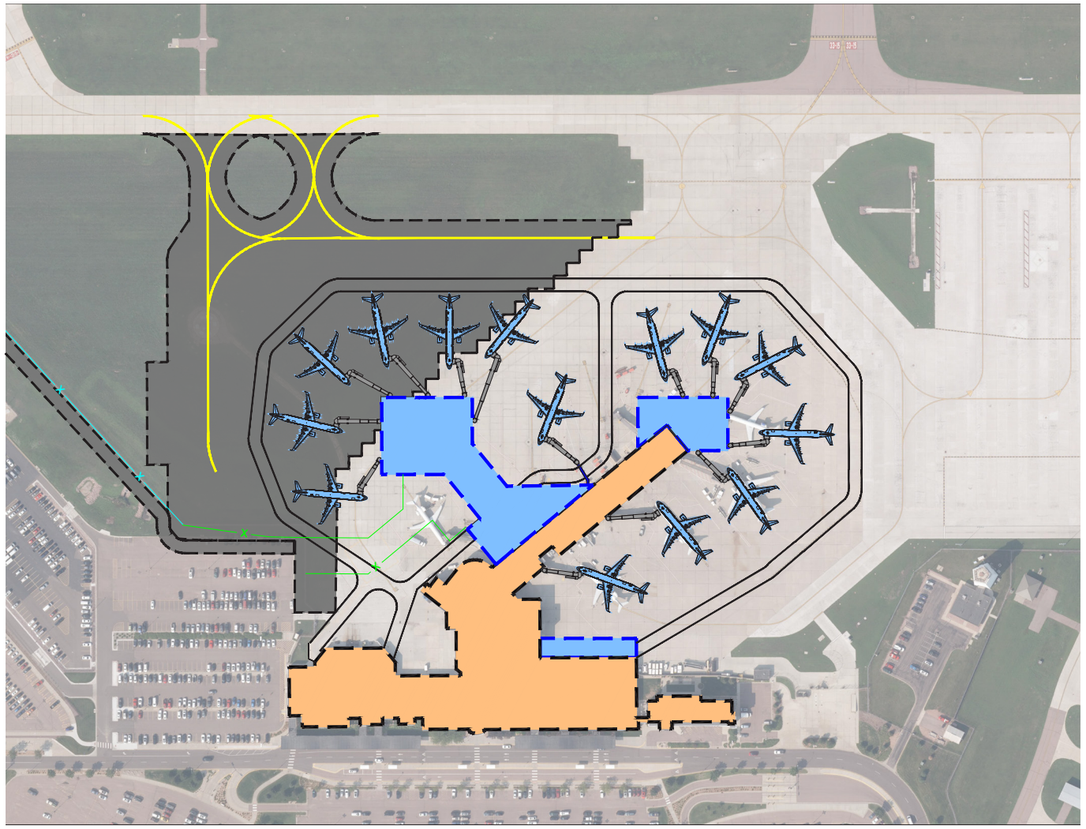


Figure 5-12 Alternative 3 Overview

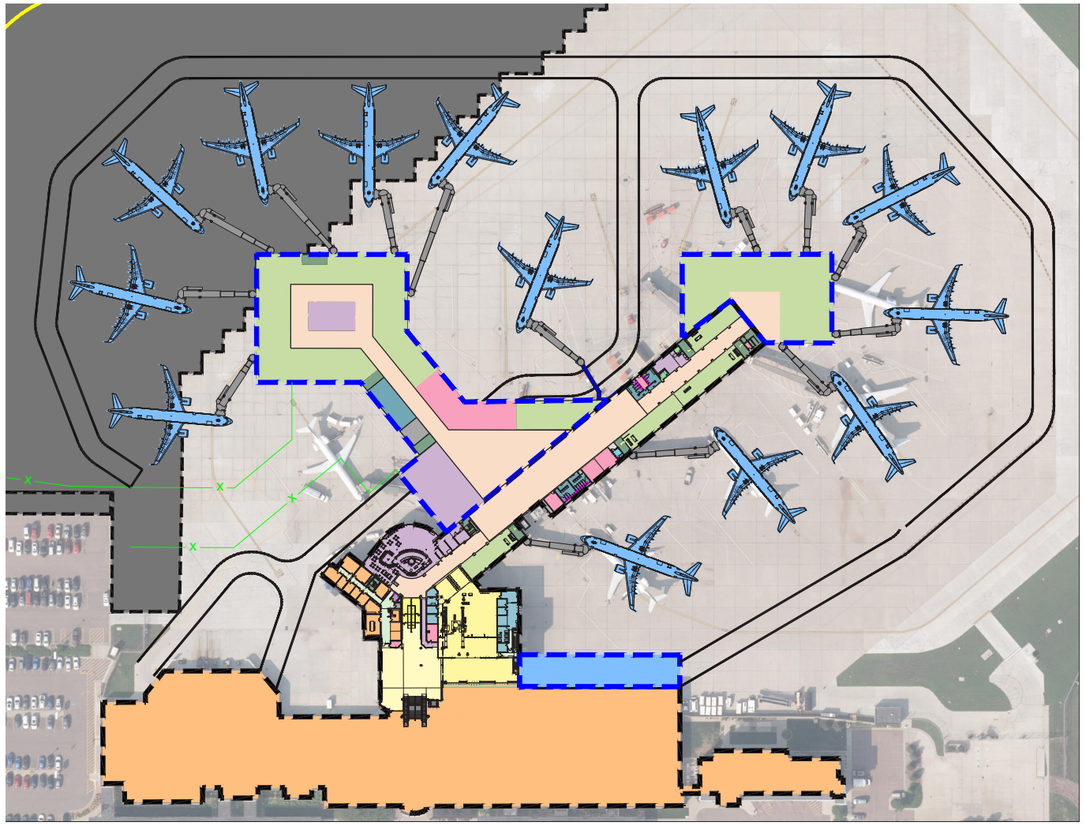


Figure 5-13 Alternative 3 Upper-Level

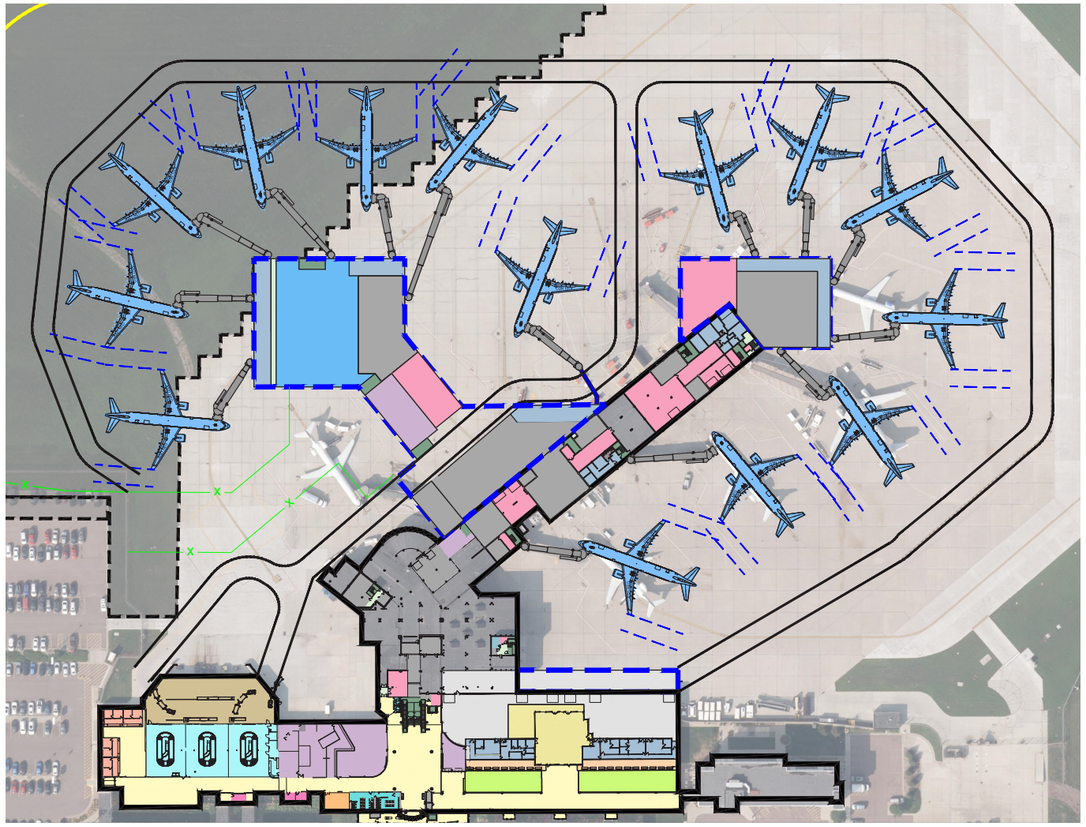
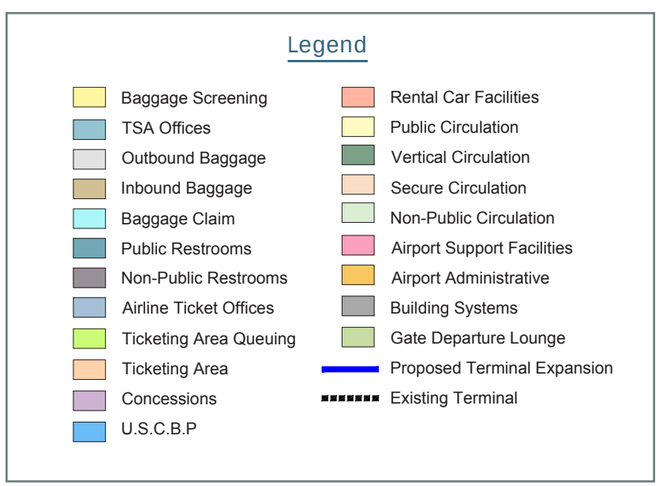


Figure 5-14 Alternative 3 Lower-Level



5.5 SUMMARY OF CONCOURSE EXPANSION EVALUATION MATRIX

To identify a preferred alternative, the three concourse expansion alternatives were evaluated against a set of criteria developed by the stakeholders. The criteria identified in **Table 5-1** show how the alternatives met each specific component that stakeholders considered important. The alternatives were also screened against sustainability criteria that align with FSD's sustainability goals and focus areas as shown in **Table 5-2**. Alternative 3 was selected as the preferred alternative as it provides the stakeholders with a functional terminal layout that can meet the passenger demand and tenants' facility needs and aligns with FSD's sustainability goals. Additionally, the construction of this alternative will allow for existing operations to be minimally disrupted. Alternative 3 will be used to evaluate financial feasibility and implementation.

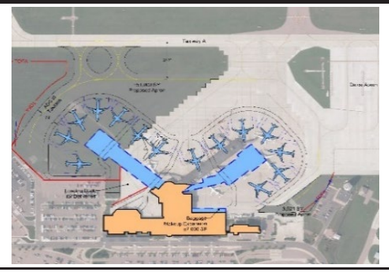
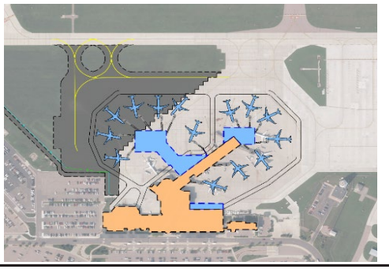
	Alternative 1	Alternative 2	Alternative 3
			
# of Gates Open at Final	14	14	14
Size of Concourse (round to nearest 1,000 SF)	162,000	151,000	105,000
OPC Cost Estimate (Concourse Only)	$215,750,000	$201,900,000	$154,400,000
Apron	$17,000,000	$20,400,000	$17,800,000
Pros	1. Program includes all new concourse facilities 2. No impact to parking facilities 3. Concessions delivery does not require escort	1. Program includes all new concourse facilities 2. No impact to parking facilities 3. Concessions delivery does not require escort 4. One centrally located concessions core	1. Program cost compared to Alternative 2 2. Central atrium space with concessions and views to majority of gates and airfield enhances passenger experience 3. Majority of gates will be on new concourse after Phase 1 4. Maintains recently renovated concessions
Cons	1. Program cost compared to Alternative 3 2. Phasing challengers to existing operations 3. Surplus of concourse space 4. Surplus of apron space 5. ATCT view partially blocked with aircraft tails	1. Program cost compared to Alternative 3 2. Half of gates on existing concourse after Phase 1 3. Impact to existing concessions and admin spaces 4. North apron expansion impacts deicing storage tank facilities 5. ATCT view partially blocked with aircraft tails	1. Reusing existing concourse structure (Gates 2 and 4) 2. Maintenance of two concession cores (enough demand/staffing challenges) 3. ATCT view partially blocked with aircraft tails

Table 5-1 Concourse Alternative Evaluation Matrix

Terminal Alternatives Sustainability Screening Criteria	Alt. 1	Alt. 2	Alt. 3
Waste			
Maximizes reuse of existing facilities	✗	✗	✓
Improves waste diversion	■	■	■
Preserves recent terminal renovation investment	✓	✗	✓
Energy			
Maximizes opportunities to increase energy efficiency	✓	✓	✓
Optimizes size of expansion footprint to minimize energy consumption	■	■	✓
Operations and Maintenance			
Minimizes size of expansion footprint to operate and maintain	✗	✗	✓
Incorporates resiliency measures and opportunities for redundancies, such as an additional generator	✓	✓	✓
Passenger Experience			
Minimizes impact to passengers and operations during construction	✗	■	■
Enhances the passenger experience with improved terminal facilities and amenities, including accessibility	✓	✓	✓

Source: Mead & Hunt, 2023.

Table 5-2 Concourse Alternative Sustainability Screening Matrix

Legend

✓	Strength of the Alternative.
■	Neutral Characteristic of the Alternative.
✗	Weakness of the Alternative.

Figures 5-15 through **5-17** display renderings of the proposed expansion.

Figure 5-15 Preferred Alternative-Exterior View (Top View)

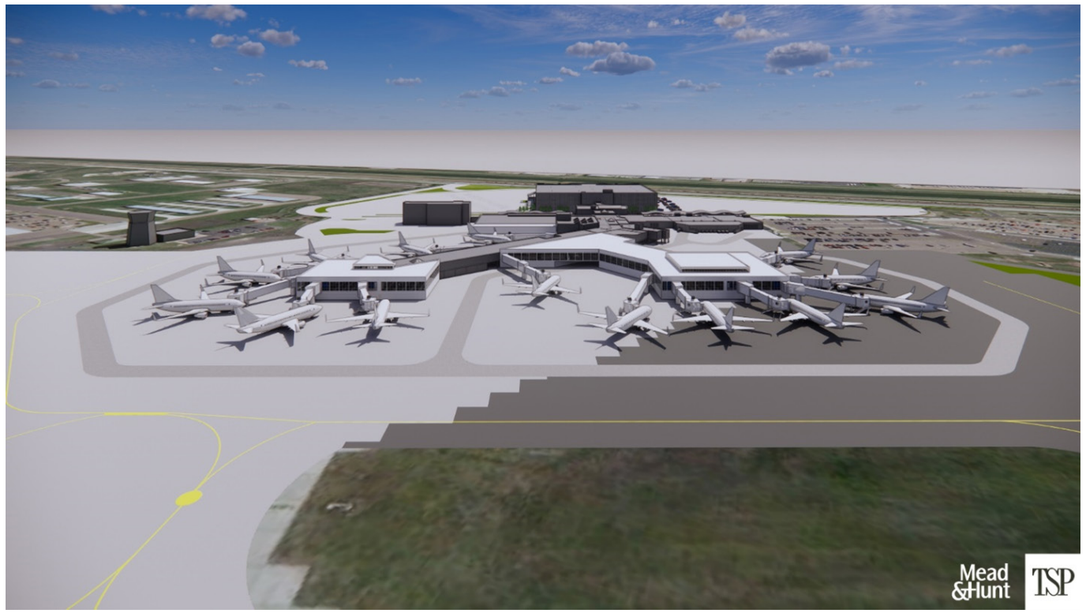


Figure 5-16 Preferred Alternative-Exterior View (Bird's Eye)

Figure 5-17 Preferred Alternative-Interior View (South Expansion)

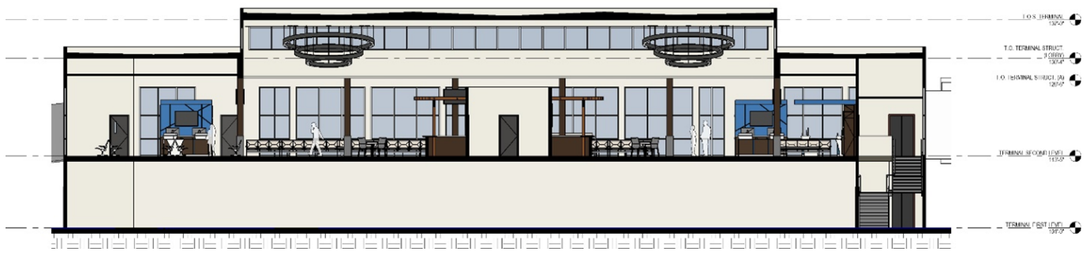


Figure 5-18 Preferred Alternative – Section View

5.6 CONCEPT BUILDING SYSTEMS

The following sections describe the extents of building system work needed in order to expand and reconfigure the existing terminal facility.

5.6.1 STRUCTURAL

Column grids will be designed for all existing and new columns during schematic design for the next design project.

The new roof and second floor framing will match the existing structure. The second floor and supporting framing will be precast concrete. The foundations will be spread concrete footings.

5.6.2 MECHANICAL

The mechanical system consists of the heating plant, chilled water plant, and airside and Terminal HVAC systems.

Heating

The building heating plant consists of four gas-fired hot water boilers, Thermal Solutions Model EVA-3000 – 3000 MBH input and 2580 MBH rated output capacity. Three of the boilers are approximately 15 years old, the 4th boiler was installed under the SSCP expansion project. All four boilers appear to be in fair condition. The boilers are non-condensing type and operate at approximately 85-86% efficiency. Facility staff reports that all four boilers need to operate during extreme cold conditions. Boiler water is circulated to the building by two 40 HP base-mount pumps. Pumps also appear to be in fair condition.

Recommendations

The existing plant has minimal spare capacity. The recommendation is to add more boilers to create a single, larger plant. Boiler make and model are to match the existing for commonality, although other manufacturers could be considered to allow competition. The heating pumps are to be replaced with new, larger, base-mounted pumps. Two new boilers will be provided each at 3,000 MBH input.

Heating pumps will be base-mounted, end-suction type. Pump speed will be controlled by a variable frequency drive to maintain system pressure.

Chilled Water Plant

Primary cooling for the building is provided by a chilled-water cooling plant. The plant consists of one water-cooled centrifugal chiller and one air-cooled screw chiller:

Chiller No. 1 (Water-Cooled)
Trane Model Unknown (no nameplate)
230 Tons nominal capacity
Cooling Tower: Evapco Model USS 19-314

Chiller No. 2 (Air-Cooled)
Trane Model RTUD-120F
120 Tons nominal capacity

The air-cooled chiller was added under the SSCP expansion project. This unit has a remote condensing unit located on the roof of the Concourse. The water-cooled machine is considerably older. Heat is released from the water-cooled machine via an induced draft cooling tower located on grade. The cooling tower is newer and appears in good condition.

Facility staff reviewed the loading on the two chillers on a hot day in July of 2022. This summary indicates that the plant is nearly fully loaded with no spare capacity:

Date: July 5, 2022
Time: 1:15 PM
Outdoor Temp: 90 deg F.
Chiller No. 1 Load: 98%
Chiller No. 2 Load: 93%

The chilled water pumping arrangement is primary-secondary with each chiller having a single, dedicated primary pump. Two base-mounted, secondary pumps circulate chilled water to the building. A variable frequency drive and loop differential pressure sensor controls the speed of the secondary pumps. Condenser water is circulated to the outdoor cooling tower by a single, base-mounted pump. All pumps appear to be in fair condition with the exception of the primary pump for Chiller No. 1. This pump appears much older than the others.

Recommendations

A second chiller plant will be created to serve the building additions. Chillers will be air-cooled rotary screw indoor units with remote, air-cooled condensing units. Two units will be provided and designed to operate in tandem. The approximate total plant capacity required for the additions is 300 tons. However, as the existing cooling plant is fully loaded, the recommendation is to consider upsizing the new plant to serve portions of the existing building to reduce the load served by the existing plant. The engineer of record should consider feasibility and economics of incorporating ice storage into the plans.

The location of the outdoor refrigerant condensers will need to be determined.

The piping arrangement will be variable-primary with redundant, base-mounted pumps. The chilled water loop will contain 30% propylene glycol for freeze protection at the air handling unit coils. Pumps will be controlled by variable frequency drives to reduce system flow during partial loads.

Airside and Terminal HVAC Systems

Air-handling systems consist of a mixture of indoor and roof-mounted air handling units fed from the building boiler and chilled water plants. The baggage claim areas on the south side of the building are served by packaged roof-mounted units with DX cooling and hydronic heating coils. Units serving the existing concourse are located in the equipment rooms on the lower level.

Recommendations

Ventilation and air-conditioning will be provided by multiple, indoor, central station air handling units. It is anticipated that all air handlers will be located in equipment rooms on the lower level. Supply and return air ducts will be routed in chases to the ceiling of the upper level.

Zoning will be accomplished by single-zone, variable air volume boxes with hydronic heating coils. Ventilation air quantity will be designed to comply with the latest version of ASHRAE 62.1 standard.

Hydronic fin-tube radiation or radiant ceiling panels will be used to offset heat loss at areas with large external glass. Hydronic unit heaters and cabinet unit heaters will provide space heating to unoccupied spaces including equipment rooms and stairwells.

Each air handling unit will consist of:

- Direct drive plenum supply and return fans.
- Airside economizer.
- Hydronic heating and cooling coils.
- Marine light and window in all accessible sections.
- Double-wall construction.
- MERV-13 and carbon filter banks.

5.6.3 PLUMBING

The building water service is located in an equipment room (Electrical Room 117) on the lower-level near the escalators. Service size appears to be 4" and connects to a single water meter. The system includes an approved backflow prevention device. Lawn irrigation piping does not appear to be separately metered. Domestic hot water is generated by two gas-fired water heaters located in the Boiler Room. The system includes a recirculation pump. Much of the water piping near the water heaters is not insulated. The recommendation is to insulate this piping to minimize heat loss and reduce energy consumption. Heaters are AO Smith Model GPVL-50 200, 40 MBH input, with a 50-gallon storage tank.

Recommendations

The existing water service can be used to serve the building additions. A distributed concept will be utilized for domestic hot water by providing multiple water heater systems located close to the areas served. New water heaters are to be natural gas-fired condensing with integral storage tanks.

Due to the large distance between the additions, two new sanitary sewer services are anticipated to be necessary. Services are to be extended to the city mains as designed by the civil engineer.

Primary roof drains are to be piped below grade and extended to site storm sewer piping. Overflow roof drains are to terminate above grade. Additionally a water heater will be installed for the future restaurant.

5.6.4 FIRE PROTECTION

The building is protected throughout with automatic sprinkler protection and a manual standpipe system. The water service for fire protection enters the building in the same room as the domestic water service. The building is divided into multiple fire protection zones. A dry-pipe system serves the open area below the concourse.

Recommendations

All areas of the building will be served by a wet-pipe fire sprinkler system. System design and installation shall comply with NFPA-13. The area under the upper-level that is exposed to the outdoors will need to be served by a dry-pipe system. The designer will need to evaluate and determine if the existing service is adequate to serve the additions or if a new fire service is needed or advantageous.

5.6.5 ELECTRICAL

The facility is currently served by one utility-owned electrical transformer (480Y/277 volt, 3-phase, 4-wire), located on the lower-level (exterior) underneath the SSCP. The service electrical utility is the City of Sioux Falls. The transformer serves three different service main switches in the main electrical room (Electrical Room 107). The first of three is a 2000A switchboard (MSB1 – House/480V), the second is an 800A switchboard (MSB1 – Tenant 480V), and the third is a 2000A switchboard (House 208V). The demand for the 480V House load is 281.1KW (339A as power factor is not known). The demand compared to the supply indicates there is capacity to add load to the service. The demand for the 208V house load is 31.32KW (87A as power factor is not known). This indicates there is capacity to add load to the service.

Recommendations

The recommendation is that a new utility transformer be set and a new 480V service be brought into the new planned expansion. The three main service distribution switchboards, MSB1 – House/480V, Tenant 480V, and House 208V are all located in Electrical Room 107. The MSB1 – House/480V and Tenant 480V are both switchboards, GE Spectra Series with a Power Break II main breaker. The MSB1 – House/480V switchboard has 47" of space adjacent to the west end of the gear. The House 208V distribution is a Spectra Series Power Panelboard and feeds a 208V switchboard with tenant meters.

This new 480V switchgear would be similar to the existing with House loads separated out from Tenant loads. Individual Airline services will be metered separately. A new step-down dry transformer is recommended along with a Switchboard to serve the new 208V loads in the expansion.

Emergency Distribution System

An existing 300kW diesel generator is currently serving emergency egress lighting and specific plug loads throughout the building. The generator is currently located in the sub-basement boiler room, under the concourse and feeds multiple transfer switches located throughout the building. A new 800kW diesel generator has been ordered by the Airport. The generator set will be located next to Gate 2 and the SSCP. The generator-set will have a 48-hour skid base tank. The generator should break out the life safety and optional loads as required by current code.

Recommendations

The recommendation is to add a second diesel generator to serve the new emergency loads. Emergency loads will need to be coordinated with the Owner.

Interior Lighting

The interior lighting in the building is comprised of a couple different lamp sources. Most of the existing lighting in the concourse area is fluorescent with LED lighting being installed in the most recent remodel projects. The SSCP and Baggage Claim areas are lighted with LED fixtures. Most lighting is at 277 volts and at a 35K color.

Recommendations

The recommendation is that all new lighting shall be LED and match the existing color temperature of the existing lighting. Lighting in the departure lounges will consist of decorative pendant lighting in association with down lights and wall sconces. In the remodeled spaces, lighting updates will match the new lighting theme as required. The new lighting system design criteria will consist of the following:

- The lighting system will be designed to provide average illuminance levels in compliance with IES Lighting Library recommendations.
- All lighting design and fixture selection shall be coordinated with the Architect/Owner.
- The lighting system will be designed to enhance visual quality while minimizing connected lighting power density and lighting energy use.
- Illumination quality will enhance the visual experience of visitors and staff by providing orientation cues and addressing visual comfort needs.
- Vertical surfaces will be accented to encourage the sense of brightness and openness.
- Luminaires will use primarily high-efficacy, long-life, and high-color rendering LEDs.
- The vocabulary of lighting techniques will include ambient, task, and accent lighting using leading-edge technologies.
- All luminaires will be high quality specification grade equipment by reputable manufacturers and CE/UL/IP-listed for the application, unless otherwise noted.
- All LED lighting must adhere to the requirements and guidelines of the IESNA testing standards of LM-79 – IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products and LM-80 – Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and modules.
- All LED luminaires shall meet or exceed 70% lumen output for a minimum of 50,000 hours. Overall lumen output shall not depreciate more than 20% after 10,000 hours of use.
- All interior LED luminaires shall maintain color consistency utilizing a maximum 3-step MacAdam Ellipse binning process. Exterior fixtures shall maintain a maximum 5-step MacAdam Ellipse binning process.
- Emergency and exit/egress lighting will be provided in accordance with IBC and NFPA 101 and local codes. The required path of egress routes and locations will be coordinated with Architect.

Lighting Controls

The majority of the lighting in the airport is on 24/7 and controlled by the circuit breaker in the corresponding electrical panel serving the designated area. The office areas have local switches for on/off operation. Color changing LEDs in the Baggage Claim have independent color wheel controls. The parking lot lighting comes into the airport by the Baggage Claim area to lighting contactors controlled by photocells. The new parking ramp exterior lighting will be controlled from the electrical room in the ramp in a similar fashion. The garage style lights within the ramp will have integral motion sensors to adjust the light level in the parking areas along with emergency lights that will always maintain full brightness. The lobby spaces within the ramp will be on 24/7. Many of the concourse and other areas are controlled with a local light switch.

Recommendations

The lighting controls will remain on 24/7 and back-of-house lighting controls shall have occupancy sensors and/or local switches for on/off operation.

Fire Alarm

The existing Fire Alarm System is manufactured by Gamewell and maintained by Midwest Alarm. The existing system is an addressable, multi-plexed, microprocessor-based, electrically supervised fire management type system. It will be complete with power supplies, data gathering panels (transponders), remote annunciators, audible (voice evacuation) and visual signal devices, manual stations, automatic devices including ionization smoke detectors, combination fixed temperature/rate of rise detectors, OS&Y switches, etc.

Recommendations

The recommendation is that the existing Fire Alarm System be extended into the areas and modified as needed to accommodate the remodeled areas. The system extension shall comply with the following items.

- The fire alarm system will comply with requirements of NFPA 72 and Life Safety Codes.
- Audio/visual devices will be installed in all areas of the building in accordance with the NFPA and ADA guidelines. All areas of the building will be covered by audible device coverage as required by NFPA 72 and the International Building Code. Visual devices will be installed in those public and shared areas as recognized by the ADA such as corridors, bathrooms, waiting rooms, break areas, and lobbies. Visual devices will also be provided in mechanical areas as a supplement to the audible devices.
- Smoke detectors will be installed as required by the National Fire Protection Association and the International Building Code. Smoke detectors will be installed in, but not limited to, the following locations: air handling units, elevator shafts, elevator lobbies, elevator machine rooms, and electrical equipment rooms.
- Heat detectors will be installed in areas that are not feasible for smoke detectors.
- Manual pull stations will be installed adjacent to all exit doors in each elevator lobby.

Telephone/Data Systems Recommendations

Telecommunications rooms with two-post racks will be added as required to keep cable runs within standards. Backbone fiber cabling shall be provided for each Airline as required. Horizontal cabling shall consist of Cat 6 plenum rated cable.

Video Distribution

The recommendation is to extend the existing video (cable TV) system to the new areas as required to accommodate Owner furnished monitors.

Paging System

The recommendation is that the existing paging system be expanded with new amplifiers and speakers as required to accommodate the new areas.

Access Control

The recommendation is to provide a rough-in system (conduit and boxes) as required to accommodate the Owner-furnished, door access hardware. The inclusion of biometrics will also be incorporated into the Airport's access control system as necessary.

Video Surveillance System

The recommendation is to provide a rough-in system (conduit and boxes) as required to accommodate the Owner-furnished video surveillance system. Installation of all these options will be determined during design phase.

5.6.6 PASSENGER BOARDING BRIDGES

The preferred concept recommends a total of 11 new passenger boarding bridges on the proposed expansions of the facility. The make and model of these bridges will be determined during the design of the project. Each bridge is anticipated to be accompanied by a point-of-use (POU) 400Hz, Pre-Conditioned Air (PCA) unit, potable water cabinet, stair chute, and ground-power unit (GPU). All gates are expected to serve regional jets such as CRJ 2/7/9, ERJ 145, E170/175, and mainline aircraft such as B737, A319/320/321/220. The Airport will also have the option to install Automated Visual Docking Guidance System (A-VDGS), which is a device that assists the pilot in parking the aircraft when pulling into the gate. The installation of the A-VDGS will be determined during the design phase.

6. IMPLEMENTATION

The previous chapters evaluated and identified the future development needs of the terminal area and the terminal building at the Sioux Falls Regional Airport (FSD or the Airport). This chapter builds upon previous chapters and presents the long-term implementation plan for FSD's terminal area, which establishes a conceptual phasing program and opinion of probable costs for each phase (OPCs). This study focused solely on creating opinion of probable cost estimates for the terminal development projects and defining the areas of the proposed terminal that are eligible for federal funding. This information will then be incorporated into the Master Plan's evaluation of the future Capital Improvement Program (CIP) to determine the financial timeline of funding the terminal development. This information serves as a critical planning tool for the Federal Aviation Administration (FAA) in establishing priorities and budgeting expenditures at FSD when compared with the needs of other airports. The overall concept is to maximize opportunities to receive federal funds, within the context of and in recognition of the amount of local funds available to support capital needs. While the FAA uses the CIP for programming purposes, the federal government is not financially obligated to provide funding for this terminal concept.

6.1 PHASING PLAN

Terminal building expansion projects occur in phases with corresponding commercial apron aircraft parking improvement projects. Some considerations in developing the project phasing plan include minimizing disruptive scheduling to avoid making a portion of the facility inoperative due to construction and preventing extra costs resulting from improper project scheduling. The primary factors that will likely drive the timing of project implementation include the actual demand for certain facilities and improvements, as well as the economic feasibility. Providing adequate lead-time for detailed planning and construction will be important to accommodate demand as it increases over time.

At the time of this report, the City of Sioux Falls Water Division was currently in legal proceedings prohibiting the relocation of any water well until the outcome of a separate, unrelated legal case dealing with water wells was settled in the State of Florida. Therefore, two Phase 1A's were conceptually designed with one assuming the water well could be relocated, and another alternative showing an apron expansion that does not impact the water well.

Phase 1A – Impact to Water Well

Phase 1A – Impact to Water Well, as shown in **Figure 6-1**, consists of constructing a portion of the apron expansion that provides a route for aircraft to access the United States Customs Border and Protection (USCBP) General Aviation Facility (GAF) while the south terminal expansion gets constructed. This phase also has impacts to the water well and assumes the Airport can relocate this environmental feature.

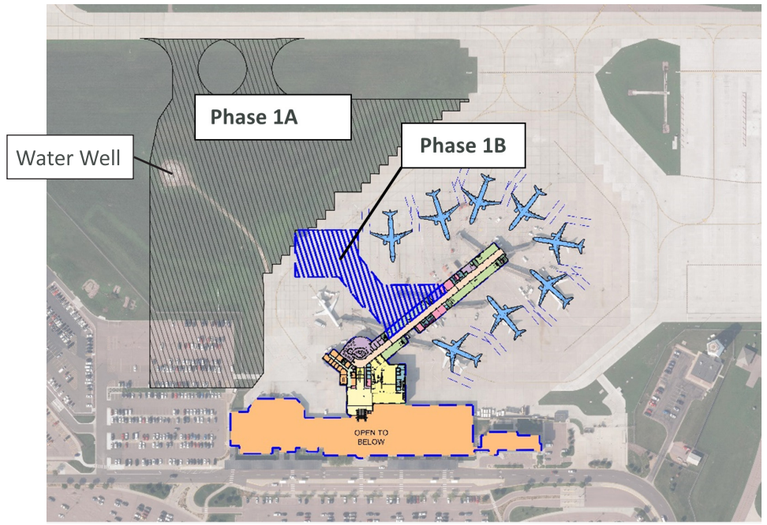


Figure 6-1 Phase 1A-Impact to Water Well

Phase 1A – No Impact to Water Well

Phase 1A – No Impact to Water Well, as shown in **Figure 6-2**, consists of constructing the apron expansion around the water well to provide access to the southeast gates on the hammerhead. A 15-foot buffer was established around the water well to provide area for maintenance vehicles to be staged outside the taxilane object free area.

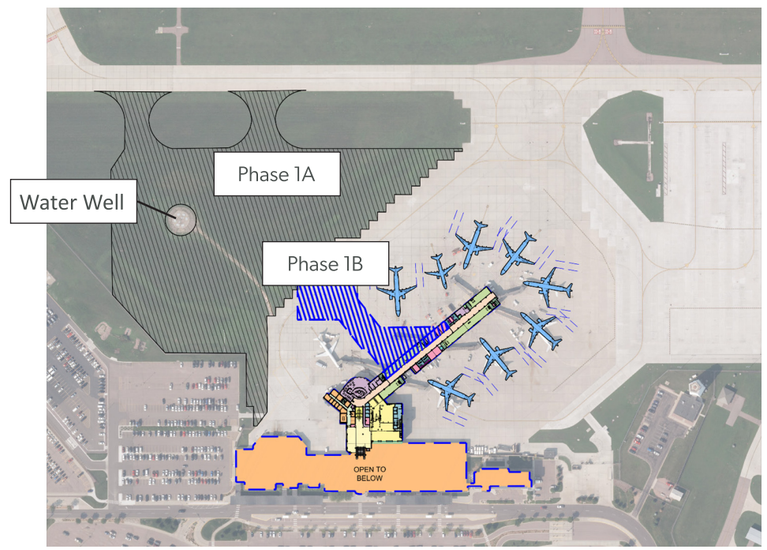


Figure 6-2 Phase 1A-No Impact to Water Well

Once the water well can be relocated, the additional apron can then be converted into a future deice apron or aircraft parking apron for remain overnight (RON) aircraft.

PHASE 1B

Phase 1B is the first phase of terminal expansion. The phasing details include:

- Close Gate 1 and position 3A to begin construction of the open atrium in the new terminal.
- Connect new construction into the existing facility at the current Gate 1 departure lounge. The Gate 3 departure lounge remains open, as shown in **Figure 6-3**, until the gates south of the hammerhead are operational. Once the south gates open, the rest of the atrium is constructed, and the departures lounges for Gates 1 and 3, existing retail space, and business lounge are converted into circulation space.
- Construct the rest of the 46,300 SY Terminal Apron.

Total Gates During Construction of Phase 1: 6 Passenger Boarding Bridges (6 PBBs) + 2 swing positions
Total Gates After Construction of Phase 1: 12 PBBs + 1 Swing Position

Figure 6-4 depicts the terminal at the conclusion of Phase 1 with the apron surrounding the water well.

PHASE 2

Phase 2, as shown in **Figure 6-5**, results in the second and final phase of terminal expansion. The phasing details of this phase include closing Gates 5 and 6. Gate 7 remains open. Once the hammerhead opens, the remaining gates open.

Total Gates During Construction of Phase 2: 10 Passenger Boarding Bridges (10 PBB's)
Total Gates After Construction of Phase 2: 14 PBB's

OTHER PHASES

The remaining terminal improvement projects, such as the check-in area expansion and rental car relocation expansion, can occur along with any of these phases; however, the timing of implementation is independent of the concourse expansion and dependent on additional funding availability.

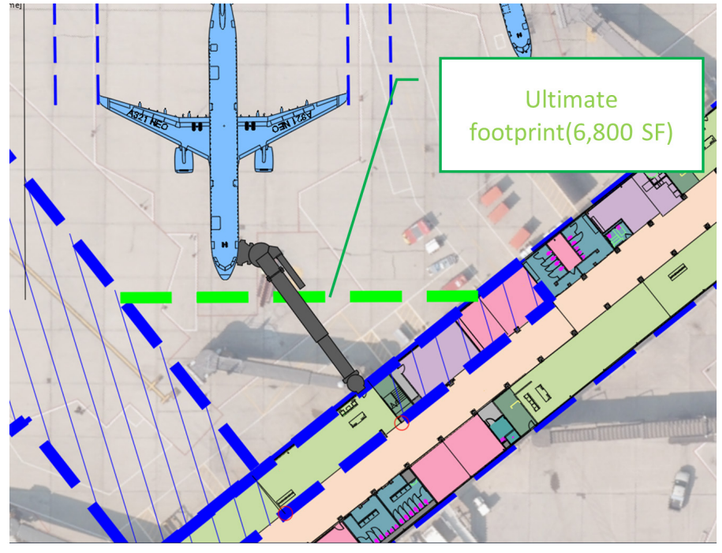


Figure 6-3 Phase 1B Gate 3 Layout

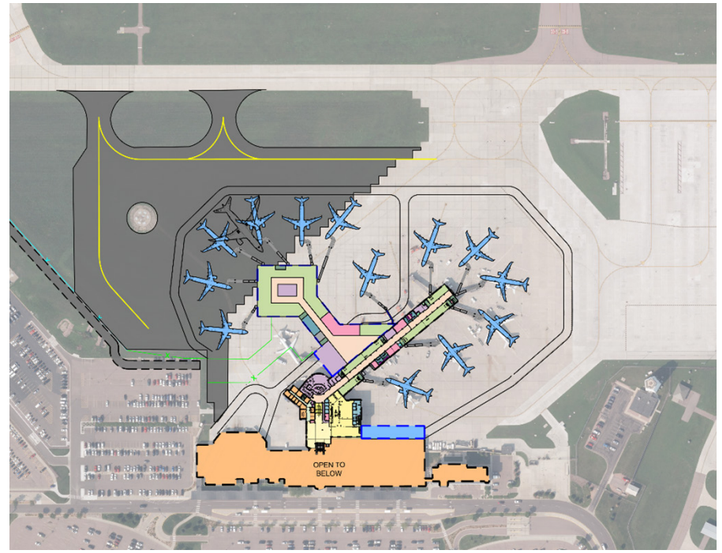


Figure 6-4 Phase 1B Completion (No Impact to Water Well)

6.2 PROJECT IMPLEMENTATION SCHEDULE

The project implementation schedule is driven by the need for the particular space and the funding available. For the purposes of this study, the schedule is developed based on duration of design and construction without identifying specific years since the funding availability for the listed projects will be determined at later dates and dependent on project prioritization. **Table 6-1** identifies the duration of design and construction for each phase.

Project	Duration (Design/Construction)
Phase 1A, Apron	6 months/8 months
Phase 1B, 7-Gate Concourse and Existing Terminal Renovation	14 months/20 months
Phase 2, 5-Gate Hammerhead Expansion	12 months/18 months
Ticketing Area, Airline Ticketing Office (ATO), Baggage Make-up Expansion	10 months/14 months
Rental Car Office Reconfiguration	8 months/10 months

Table 6-1 Terminal Program Schedule

6.3 PROJECT COST ESTIMATES

Table 6-2 presents the proposed projects and the Opinion of Probable Costs (OPCs). The phases and prioritization of projects in each phase will change as local and federal priorities and funding change over time; therefore, the years of implementation are not identified.

The details of the implementation timeframe, including the capital improvement project list, project cost estimates, and the finalized phasing list were formulated with consideration of comments and input received from the Airport staff.

Planning level cost estimates were prepared for projects identified during each phase. The CIP cost estimates presented in this chapter are based on 2022 dollars and account for inflation. These estimates are intended for planning purposes only; they are not construction cost estimates, which can only be compiled following the preparation of detailed engineering design documents.

Project	Opinion of Probable Cost
Phase 1, 7-Gate Concourse and Existing Terminal Renovation	$111,200,000
Apron	$17,800,000
PHASE 1 SUBTOTAL	$129,000,000
Phase 2, 5-Gate Hammerhead Expansion	$43,200,000
PHASE 2 SUBTOTAL	$43,200,000
Additional Projects	
Ticketing Area, ATO, Baggage Make-up Expansion	$31,000,000
Rental Car Office Reconfiguration	$3,200,000
SUBTOTAL OF ADDITIONAL PROJECTS	$34,200,000
TOTAL PROGRAM COSTS	$206,400,000

Table 6-2 Terminal Program Opinion of Probable Cost Estimate

6.4 CAPITAL FUNDING SOURCES

In the past, the Airport has used a combination of FAA Airport Improvement Program (AIP) grants, Passenger Facility Charges (PFCs), State grants, and cash reserves/net operating revenues to fund capital improvements. These funding sources, as well as additional sources of capital funding, are anticipated to fund the terminal expansion program. Each federal and state funding source funds specific areas of the terminal based on the use of that space. Each capital federal funding source is described below. The funding source allocations will be determined at the time of implementing the program when the amount of available funding is known. For the purposes of this study, the study team identified eligible and ineligible areas of the Airport based on AIP and PFC requirements, **(Figures 6-6 and 6-7)**.

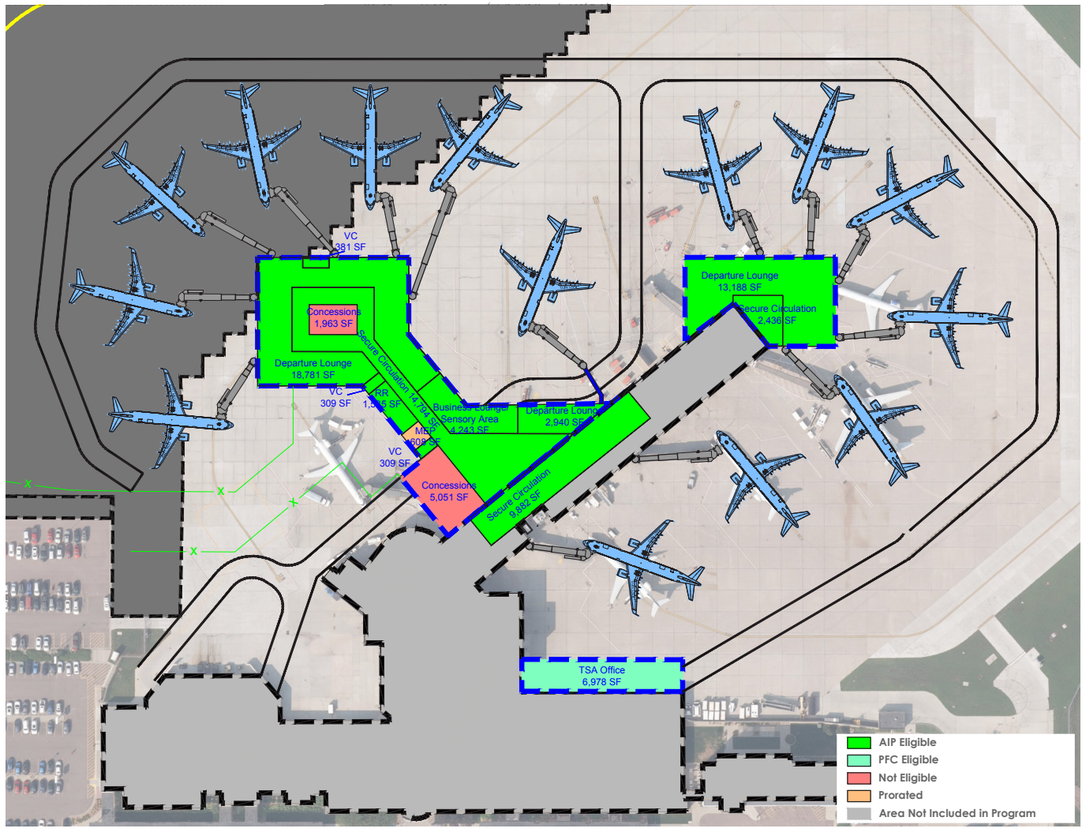


Figure 6-6 Terminal Funding Eligibility (Upper-Level)

Figure 6-7 Terminal Funding Eligibility (Lower-Level)

AIRPORT IMPROVEMENT GRANTS – ENTITLEMENT, CARGO, AND DISCRETIONARY FUNDING. The Airport receives grants from the FAA to finance the eligible costs of certain capital improvements. These federal grants are allocated to commercial passenger service airports through the AIP. AIP grants include passenger entitlement grants, which are allocated among airports by a formula that is based on passenger enplanements, and discretionary grants, which are awarded in accordance with FAA guidelines. After several years of continuing budget resolutions and other short-term legislative measures implemented by Congress, the FAA Reauthorization Act of 2018 was enacted on October 5, 2018. The Act authorized funding for the AIP through September 30, 2023.

Under current AIP authorization legislation, eligible projects are funded on a 90 percent AIP grant/10 percent local match basis for small and nonhub airports.

In addition to AIP passenger entitlement grants, Airports with more than one million pounds of landed all-cargo weight annually are also eligible to receive AIP cargo entitlements, based on the airport's pro rata share of total U.S. landed cargo weight. At FSD, the Airport was apportioned approximately $207,178 in cargo entitlements for 2022.

The approval of AIP discretionary funding is based on a project eligibility ranking method the FAA uses to award grants, at their discretion, based on a project's priority and importance to the national air transportation system. In recent years, the Airport has received discretionary funds to support runway, taxiway, and apron projects. It is reasonable to assume that the Airport will receive additional discretionary funding during the planning period for higher priority, eligible projects.

BIPARTISAN INFRASTRUCUTURE LAW – AIRPORT INFRASTRUTURE GRANTS (AIG) AND AIRPORT TERMINAL PROGRAM (ATP). The Infrastructure Investment and Jobs Act of 2021, known as the Bipartisan Infrastructure Law (BIL), was signed into law on November 15, 2021. The legislation included $25 billion in funding for the FAA to invest in airport terminals, airport infrastructure, and air traffic facilities over the next five years. The BIL includes two programs that may provide capital funding to FSD.

The first is the AIG program. This program is similar to AIP Entitlements as funds are allocated to airports based on passenger enplanements. AIG funds are non-competitive and may be used for projects based on PFC eligibility requirements.

The second program, the ATP, is a discretionary grant program providing $1 billion per year to replace aging terminals and airport-owned towers, increase terminal energy efficiency and accessibility, and other terminal projects. These grants will be awarded through a competitive process based on a Notice of Funding Opportunity (NOFO) annually, and no more than $200 million per year may be allocated to Small Hub airports such as FSD.

PASSENGER FACILITY CHARGES. The Aviation Safety and Capacity Expansion Act of 1990 established the authority for commercial service airports to apply to the FAA for imposing and using a PFC of up to $3.00 per eligible enplaned passenger. With the passage of AIR-21 in June 2000, airports could apply for an increase in the PFC collection amount from $3.00 per eligible enplaned passenger to $4.50. The proceeds from PFCs are eligible to be used for AIP-eligible projects and for certain additional projects that preserve or enhance capacity, safety, or security; mitigate the effects of aircraft noise; or enhance airline competition. PFCs may also be used to pay debt service on bonds (including principal, interest, and issue costs) and other indebtedness incurred to carry out eligible projects. In addition to funding future planned projects, the legislation permits airports to collect PFCs to reimburse the eligible costs of projects that began on or after November 5, 1990.