Chapter 2

Terminal Capacity Analysis

2.

2.1. Introduction

The objective of this capacity analysis is to measure existing component capacity against current peak demand, which is defined in this study as the peak hour on January 2, 2021. The future space program for all terminal components is included at the end of this report. This program is tied to specific Planning Activity Levels (PAL), which are summarized in **Appendix A**, and identify the amount of additional capacity needed to meet a potential range of future demand, with the current FAA Terminal Area Forecast (TAF) serving as a lower limit and more aggressive definitions of growth serving as upper limits.

The results of the first objective are quantified in this report, while those of the second objective are quantified in a terminal facility program tied to PALs of annual enplanements. The PALs will be used to plan ultimate build-out of the existing terminal complex within a phased development framework up to the limits of the current site.

For the purposes of this study, the following references are used in determining the above:

- 14 CFR Part 77: Safe, Efficient Use and Preservation of Navigable Airspace
- FAA Advisory Circular 150/5070-6B: Airport Master Plans
- FAA Advisory Circular 150/5360-13A, Airport Terminal Planning
- 10th and 11th Editions of the IATA Airport Development Reference Manual (ADRM)
- ACI Best Practice Guidelines: Airport Service Level Agreement Framework
- ACRP Report 25, Vols. 1 & 2, 2010
- ACRP Report 39, Guidebook for Evaluating Airport Parking Strategies
- ACRP Report 40, Airport Curbside and Terminal Area Roadway Operations, 2010
- Airport Development Reference Manual, 10th & 11th Editions, IATA
- TSA Checkpoint Requirements and Planning Guide, December 17, 2018
- TSA Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, Version 6.0

2.2. Summary of Capacity Analysis Findings

The 2015 terminal expansion project was built to meet minimum requirements due to budget constraints. This TAP capacity analysis finds significant capacity deficiencies in component equipment and space allocation for curbside, parking, ticketing, baggage check-in, checked baggage screening, airline ground handling and passenger services support operations, security screening checkpoint operations and queueing, and baggage claim systems and handling operations. In addition, public circulation is insufficient in the departures hall and baggage claim areas. The aircraft apron parking area is sufficient for the current air carrier fleet operating at the Airport, but options will be considered in later planning elements for adding apron capacity in the event it is needed.

Terminal Area Plan Site & Building Capacity Assessment: Level of Service

This TAP site and building capacity assessment assigns level of service (LOS) categories to each component. LOS represents the performance of each component based upon quantifiable measures of component processes in time and area and serves as a guide for Airport management to meet passenger experience expectations by setting goals that use specific terminal capacity measures. Airport managers rely on facility program and LOS assessments to justify terminal planning requirements to the FAA when seeking funding support for terminal projects.

This capacity assessment analyzes component capacity to determine capacity limits of and LOS provided by each existing terminal functional component, in most cases using the peak day of January 2, 2021, as a reference point for current demand. The flight schedule for the peak day is provided in **Appendix A**. This study also assesses whether the components function together adequately as a system to meet airline and passenger demand. Summary results of the first part of this assessment are provided in **Table 2-1**.

Table 2-1: Existing Terminal Component Capacity Level of Service Summary

Functional Component	Practical Capacity Components	Practical Capacity		
Terminal Curbside	Limited by two lanes, one for curbside, the second for pull-out and bypass; insufficient curb length.		Limited	
Public Parking	Parking demand exceeds capacity during both peak and off-peak seasons.	Over		
Terminal Aircraft Apron	Apron meets demand now. Will become an issue with additional flights in the early morning and midday banks.			Available
Aircraft Gates	Meets current demand. Aircraft gate capacity limited by runway modification of standard, apron, and departures lounge area.			Available
Ticketing & Check-In	Airline ticketing insufficient to meet demand for more than one flight. Bag Check-In requires CBIS system.	Over		
Ticketing & Check-In	Airline ticketing insufficient to meet demand for more than one flight. Bag Check-In requires CBIS system.	Over		
Checked Baggage Inspection System	Manual system requires five TSA officers to operate during daily peak periods. In-line system required.	Over		
Airline Outbound Baggage Area	Insufficient to meet airline needs. Wholly undersized to accommodate baggage, equipment, and supplies.	Over		
Security Screening Checkpoint	Operating above capacity, resulting in long queues. A second screening lane is required for the operation.	Over		
Departures Lounge	Larger aircraft filling out schedule at early morning and midday peaks require adding lounge area and seats.	Over		
Departures Lounge Restrooms	Restrooms are inadequate to meet demand. Additional space and fixtures required.	Over		
Arrivals & Departures Restrooms	Restrooms are at capacity. Additional flights and higher load factors will require additional fixtures.		Limited	
Baggage Claim	Claim device insufficient to meet demand above one flight. Dynamic device and additional space required.	Over		

Source: Mead & Hunt, 2021.

Notes: Level of Service: Green = A/B; Yellow = C; Red = D/F.

Table 1 shows most components operating at or above capacity necessary to efficiently process demand, resulting in longer passenger queues and wait times, resulting in a low LOS for passengers. Definitions for each LOS are as follows:

- LOS A: Excellent. Conditions of free flow, no delays, and an excellent level of comfort.
- LOS B: High. Conditions of stable flow, very few delays, and high levels of comfort.
- LOS C: Good. Conditions of stable flow, acceptable delays, and good levels of comfort.
- LOS D: Adequate. Conditions of unstable flow, acceptable delays for short periods of time, and adequate levels of comfort.
- LOS E: Inadequate. Conditions of unstable flow, unacceptable delays, and inadequate levels of comfort.
- LOS F: Unacceptable. Conditions of cross-flows, system breakdown and unacceptable delays, and unacceptable level of comfort.

Given the number of areas operating at an LOS of D or F, the collective terminal functional system is failing to provide a minimum acceptable LOS to passengers. Taken together, the terminal component processing system has a potential to cause flight delays.

Passenger demand at SUN is complex. Passengers arrive at the terminal for their departing flights within a smaller window prior to the flight than is typical at non-resort airports, which places a greater demand on terminal components. Airline and TSA staff must be very efficient in processing passengers with less time to do so and must add staff to generate more capacity for higher load events. This may seem to be a management issue, but it is an indication of insufficient hard asset capacity. Ticketing counters typically have more than two positions, as is currently the case for each airline at SUN, to allow for an increase in staffing levels when demand is high. Airlines may operate at a different LOS based on their staffing models. However, when demand consistently exceeds the capacity of available ticket counters, airlines are limited in their ability to increase capacity by adding more ticketing agents.

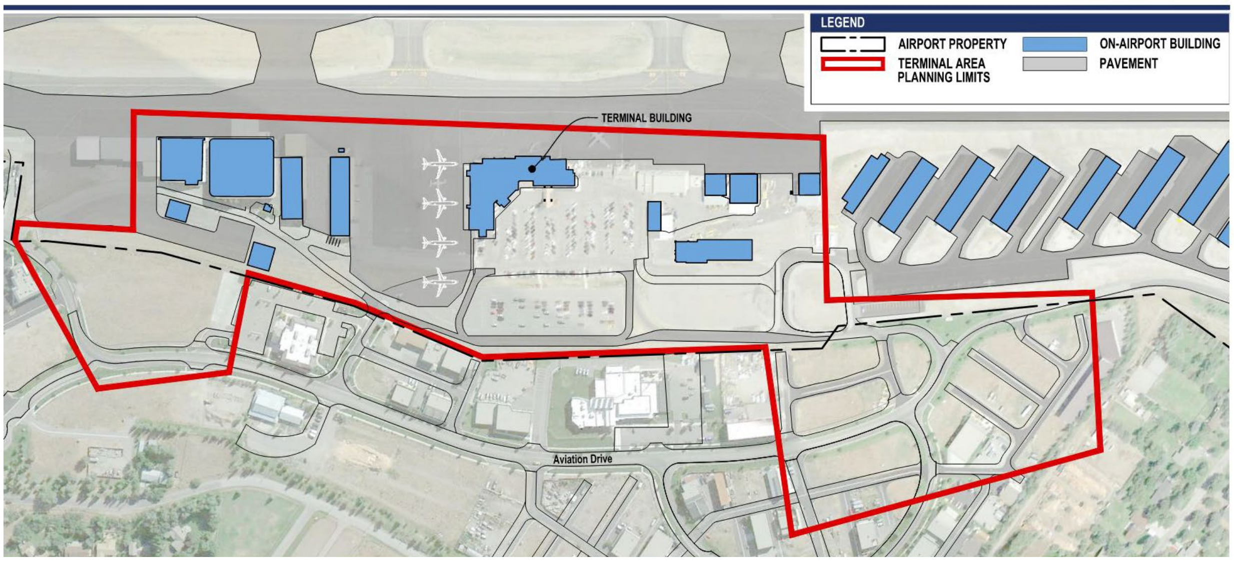
For the TSA, undersized assets also require a higher level of staffing to manage higher than normal demand driven by a passenger population which arrive at the Airport with little time to spare. TSA increases staffing to move baggage through the explosion detection system (EDS), or device, to the outbound baggage rooms so the carriers can meet departure times. TSA also increases staffing to assist passengers moving through the single-lane security screening checkpoint (SSCP), which blends Pre-Check passengers into the standard processing queue, moving them to the front of the queue but not impeding the process. TSA staff aid passengers in keeping bins close together in the screening queue, quickly taking bags away from the baggage screener to resolve issues off-line so the line can keep moving. This requires adding staff at the advanced imaging technology (AIT) machine to manage secondary passenger searches while a single officer remains at the AIT machine, then clearing bins from the roller conveyor as quickly as passengers release them.

Terminal Area Plan Site & Building Capacity Assessment: TAP Site Perimeter

The TAP study area is shown in context to the surrounding facilities, airfield movement and non-movement areas, and hangars to the north and south, in **Figure 2-1**. The red outline shows the limits of the TAP study area, which includes hangars just north of the terminal apron site, and undeveloped land to the northwest and southwest of the site. While long-term planning may recommend relocation of the terminal in the future, it is very likely the existing terminal will have to support air carrier operations at its current site for at least the next 10 years. It has been five years since the most recent terminal expansion project, which moved aircraft gates to the north side of the building as a part of the Runway Safety Area project.

For the purposes of this report, it is assumed that the point at which the TAP study area will be unable to accommodate demand is at least 10 years in the future. Once the site cannot function at an acceptable LOS[1] and/or cannot accommodate airline schedules, the terminal building and supporting facilities will have to be relocated. This level of activity will be defined during subsequent study components that evaluate development alternatives for the terminal area.

Figure 2-1: Terminal Area Plan Study Site Limits



Source: Mead & Hunt, 2021.

2.3. Capacity Assessment: Vehicle Roadways, Curbside and Parking

Vehicle Roadways

The Airport loop road was reconfigured in 2018 when a fourth aircraft parking position was built on the west side of the air carrier apron. The Airport entrance is currently off Airport Road at the northwest corner of the parking lots. After entering the gate, vehicles must circumnavigate the parking lot in a counter-clockwise fashion to access the terminal curbside. Once vehicles drop off or pick-up passengers at the curbside, they then head west and south along the lower roadway to the exit the terminal area at the southwest corner of the lots.

Vehicles circumnavigating the loop road must merge at several locations, foremost immediately after they enter the roadway at the entry gate where they must merge with vehicles leaving the terminal heading to the exit gate. This requires that entering vehicles change lanes to the left while exiting vehicles simultaneously change lanes to the right. With merging traffic, vehicles may have to enter the lower lot further to the south after allowing departing vehicles to clear the lane. There is also a series of merges along the loop road and curbside surrounding the upper parking lot.

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[1] *Defined in this document and elsewhere for the purposes of this study as a facility which is capable of processing passengers and baggage within a given time frame and space such that passengers are unimpeded in their journey through the terminal and the system does not cause airline flight delays. A higher LOS is mandated solely based upon facility investment return yielding sufficient capacity and time before another expansion is necessary, given normal airport activity and growth.*

This configuration is unusual because terminal access roadways are typically separated from the parking lot, with one entrance, one exit, and internal perimeter lanes for access to parking spaces. At SUN, separating parking from the roadway would incur a loss of parking spaces, which would be detrimental because the lot is already undersized relative to demand. This configuration creates congestion, requiring a speed limit along the upper portion of the loop road. Vehicles wishing to access the terminal curbside may experience delays due to vehicles touring the lot for a space and thereby entering the loop road to gain access the next row of parking.

Employees and visitors to the administration and operations area must exit this area either by driving along the terminal curb or through the upper lot to merge into the loop road, then merge again at the lower-level roadway.

Separating the access roadway from parking would increase roadway capacity. There would then be specific points of entry into and exit out of the parking lot which would allow a free flow of traffic for vehicles accessing the curbside. Expanding parking immediately south of the lower lot may add pedestrians making their way to the terminal on the eastbound portion of the loop. Directing passengers from the south lot across the access roadway to a sidewalk running west along the length of the upper and lower lots would provide a safe route to the terminal. Providing separate entries and exits for all lots increases safety, and would be the preferred option for the two lower lots, assuming traffic moves faster at the lower than upper portion of the loop road.

A single-story parking deck above the lower lot would be accessible from the upper lot. A taller structure may require building into the hill between the two lots to provide ramps to upper levels. In this scenario, traffic exiting the deck should do so at the north side to avoid the terminal curbside. However, this would create additional congestion at peak flight arrivals periods by creating a high-volume merge location.

Terminal Curbside

The terminal curbside is located along the front of the terminal building where passengers and their baggage are picked up by and dropped off from vehicles at the curb. By splitting the curb at the first curve after the departures entrance, the departures curb and arrivals curb at SUN are both approximately 150 feet long. The building entrances effectively reduce curb length by an average of fifteen feet each to accommodate crosswalks from parking. This reduces both the departures curb and the arrivals curb to approximately 135 linear feet. The arrivals curb extends just beyond the building to the west, allowing passengers to exit the west doors to the curb. An additional 100 feet of curb and walkway extend to the west, parallel to rental car shuttle parking. This curb should be assigned to shuttles, transportation network company (TNC) vehicles (i.e., Uber and Lyft), and large buses, to allow curb adjacent to the building to serve private vehicles, taxis, and smaller four-to-six passenger shared ride services vehicles.

Additional circulation lanes at airport terminals allow parked vehicles to stack along the curb while moving vehicles flow around stacked vehicles during busy times. The existing curb capacity at SUN is limited to a single lane at the curb. The second lane serves as pull-out and bypass lanes in one, further adding to congestion during peak travel periods. Without a stacking lane and with drivers tending to double-park at the curb, or at least slow down to await an open space at the curb, a full traffic stop occurs when drivers double-park. This requires other drivers who have dropped off passengers at the departures curb to wait for the blockage to clear before they can proceed. The porte-cochère at the departures hall entrance can restrict traffic flow at times due to the crosswalk that bisects the departures curb.

To function properly, curbside capacity depends upon sufficient curb length, typically with a minimum of three lanes and low average curbside utilization times. Vehicles using the departures curb tend to require less time than vehicles using the arrivals curb. Cell phone lots, temporary parking lots at which drivers await a phone call from their parties before picking them up, can reduce average arrival curb utilization times. Airport ambassadors at SUN keep vehicles moving, which may create more congestion as drivers recirculate the loop road back to the curb. If a cell phone lot were created, ambassadors would have another option for directing waiting drivers. This would help the ambassadors with managing curbside use and lessen traffic congestion during peak periods.

The curb would be more manageable if parallel parking spaces were striped. Drivers would tend to park in the spaces, spreading the vehicles out along the curb and reducing double-parking. Large shuttles and buses also use the curb but take up to twice the curb space of a private vehicle. A second curb allocation for these vehicles may be set within parking or moved to the end of the arrivals curb beyond the building's west arrivals hall entrance. These options will be evaluated during development of alternative concepts.

Coordination with shuttle and bus operators to schedule arrivals at the Airport and to allot maximum time and/or space at the curb or within shuttle parking spaces may improve efficiency during peak travel seasons. There are presently two large shuttle/bus positions and one smaller shuttle space in the small lot across from the terminal arrivals entrance.

Widening some of the crosswalks from the curb to the parking lot would also lower curbside congestion. These should be a minimum of ten feet wide, allowing drivers clear sightlines to passengers and visitors using the crosswalk.

Buses transporting diverted passengers to and from diverted Twin Falls Airport are picked up and dropped off from the public lounge between TSA offices and airline ticketing through the airside doors. These vehicles do not access the terminal curb.

Curbside Capacity Calculations

Twenty-five-foot-long striped parking positions for private vehicles would yield about five (5) spaces per curb. Assuming a standard vehicle dwell rate of three minutes at the departures curb, each space can theoretically accommodate approximately twenty (20) vehicles per hour, resulting in a total departures curb capacity of 100 vehicles per hour. Assuming a standard five-minute dwell time per vehicle at the arrivals curb[2] yields twelve vehicles per hour per space, for a total arrivals curb capacity of 60 vehicles per hour. With variations in vehicle arrival and dwell times, actual capacity is likely less than these theoretical maximums. Curb capacities are reduced if the spaces are all occupied and vehicles stack in the by-pass lane, blocking other vehicles from exiting a space.

The Airport may want to consider adding a third, outside lane to increase effective curb length. This will impact available parking. Adding drive-through pick-up and drop-off lanes would also increase curb length, with a commensurate reduction in the amount of parking capacity.

Temporary Parking Demand: Cell Phone Lot

The arrivals curb usually requires more length, double-parking, or dedicated parking due to a longer dwell time required to await passengers and load their baggage. The curb can become more congested if passengers are not awaiting pick-up at the curb when their party arrives. Creating a cell phone lot would increase capacity during peak seasonal travel periods by lowering the average vehicle dwell time at the arrivals curb. A cell phone lot is a temporary lot where vehicles may not be left unattended. Its primary purpose is to reduce demand and congestion at the

[2] *A five-minute dwell time assumes time waiting for passengers to exit the building, assuming they may be waiting inside during inclement weather.*

arrivals curb, and to reduce recirculating traffic volumes. Cell phone lots are typically located near the main access road but not within walking distance to the terminal to discourage their use as a no-cost, short-term lot. In addition, cell phone lots do not require the same number of spaces as other parking lots because vehicle do not park there for long periods of time. Industry standards for cell phone lots recommend a site that accommodates between thirty (30) and sixty (60) parking stalls[3].

Because vehicles must take a ticket to enter the loop road, a cell phone lot would be best located within the loop road perimeter to accommodate drivers directed away from the curb to the cell phone lot by Airport ambassadors. However, this is not the best use of space within the loop road perimeter, given the limited area available for parking other vehicles. With free 30-minute parking for those who bypass an off-airport cell phone lot, drivers directed from the curb to the cell phone lot may choose to wait in the main parking lots. Therefore, free 30-minute parking may need to be eliminated to make a cell phone lot an effective strategy for reducing congestion at the curb while keeping as many parking spaces available as possible.

The increased utilization of TNCs requires additional consideration for vehicle staging. While TNCs do not necessarily require striped stalls, the co-location of TNC staging with the cell phone lot is current industry practice. Some airports also require traditional taxi service to stage in the cell phone lot.

Public Parking Capacity

Topography splits the loop road and parking lots into upper and lower levels. A lack of expansion space and sharing the lots with rental ready cars, public transport, private shuttles, and employee parking causes congestion and insufficient parking capacity even during off-peak airport activity. Rental ready car stalls are in both the upper and lower lots, as well as in the small lot immediately west of the baggage claim exit doors. This small lot is also used by Airport shuttles. Overflow rental car lots for each company are located north and south of the terminal complex, with some parked off Airport property. Airport staff parking is located near the airport administration, cold storage, and maintenance buildings.

Parking capacity is measured by the total number of stalls available for parking. Public parking requirements are typically calculated by factoring historical usage and duration of stay applied to forecast annual enplanements. However, this ratio is difficult to establish for SUN given that the parking lots are at capacity in most scenarios, making it hard to distinguish between peak and off-peak parking needs.

Parking occupancy is recorded by the Airport parking concessionaire, The Car Park, Inc., on a half-hour schedule in both percentage terms and actual spaces occupied. This represents all parking, including rental car, hotel and resort shuttles, and taxi spaces. To determine existing parking capacity, parking occupancy was taken as a whole, and a factor of 85 percent was used to determine when the lot was at capacity. Current parking capacity at SUN is summarized in **Table 2-2**.

The upper and lower parking lots serve stakeholders and visitors with a total of 377 parking spaces. 231 spaces are reserved for visitors and passengers, with specialty needs parking spaces included.

There are 110 commercial parking spaces serving airport buses and shuttles from the hotels and resorts in the area; taxicab spaces, and car rental ready and return as well as shuttle spaces.

[3] *National Academies of Sciences. "Guidebook for Evaluating Airport Parking Strategies and Supporting Technologies." National Academies Press: Open Book, 21 Jan. 2010.*

Employee spaces are limited to 36 total with 10 at the upper-level lot adjacent to the cold storage shed and 26 spaces at the south end of the lower-level lot. Employee spaces are the first to give over to surges in passenger demand which require additional spaces, with employees parking at the lower south gravel lot.

There are 377 total spaces, including those rental car spaces reserved for customer loyalty program guests located at the west side of the terminal, adjacent to the rental car counters in the building.

Table 2-2: Terminal Area Public & Commercial Parking By Use (Public, Commercial, and Employee), 2021

Type	Spaces
ADA Accessible	*8*
Short-Term Pick-up/Drop-off	*20*
Short-Term – Upper Lot	*138*
Long Term – Lower Lot	*65*
Total Public	**231**
Shuttle	*3*
Taxi	*10*
Rental Car - Shuttle	*6*
Avis	*36*
Enterprise	*19*
Hertz	*36*
Total Commercial	**110**
Upper and Lower Lots	*36*
Total Employee	**36**
Total Public, Commercial, Employee	***377***

Source: Airport Records, C.A. Johnson, Inc., & The Car Park, Inc.

Best practices for managing parking supply and demand suggest that available parking should be considered full when it reaches 85 percent utilization. This is considered the effective parking supply and should be used to determine the parking surplus or deficit. The remaining 15 percent of inventory is the flow factor, providing enough spaces to accommodate peak period overlap of arrival and departure passengers. This limits the time vehicles spend cycling the lot in search of a parking space.[4]

The Airport's parking consultant noted that, prior to the COVID-19 pandemic, 76 percent of all access tickets were used for less than 30 minutes, which is free to visitors. This includes visitors using the curb, other terminal area facilities, and short-term parking. This indicates that 24 percent of all Airport visitors park for more than 30 minutes.

Parking demand is a function of how many visitors enter and exit the parking lot each day, with the profile of passengers entering the Airport (roughly 3:1 ratio for passengers using the curb rather than parking at SUN) determining daily parking demand. This ratio is variable but is a benchmark for the airport. Turnover of longer-term vehicle parking is indicated when more vehicles exit than enter the lots. Periods when fewer vehicles enter than exit indicate longer duration of stay and lower availability of parking.

The Airport began planning for additional parking in 2020. The plan should be incorporated into the TAP to increase public parking.[5] Total demand exceeded capacity of the lots 17 times in 2019 and the parking

[4] *Mead & Hunt, 2020.*

[5] *Terminal South Parking Lot Expansion Construction Plan, T-O Engineers, Boise, Idaho, 23 June 2020.*

concessionaire had to work to locate spaces for visitors and passengers by relocating employee parking to the south gravel lot and parking at the end of rows in the upper and lower lots.

During the peak summer travel season, the lots fill early and remain full through mid-day and mid-afternoon. During these periods, public parking demand is at or above capacity, requiring additional parking spaces. This is estimated at 80 to 120 spaces over the next five to seven years, assuming moderate growth in passenger enplanements.

Air Carrier Apron and Aircraft Operations

Air Carrier Aircraft Apron

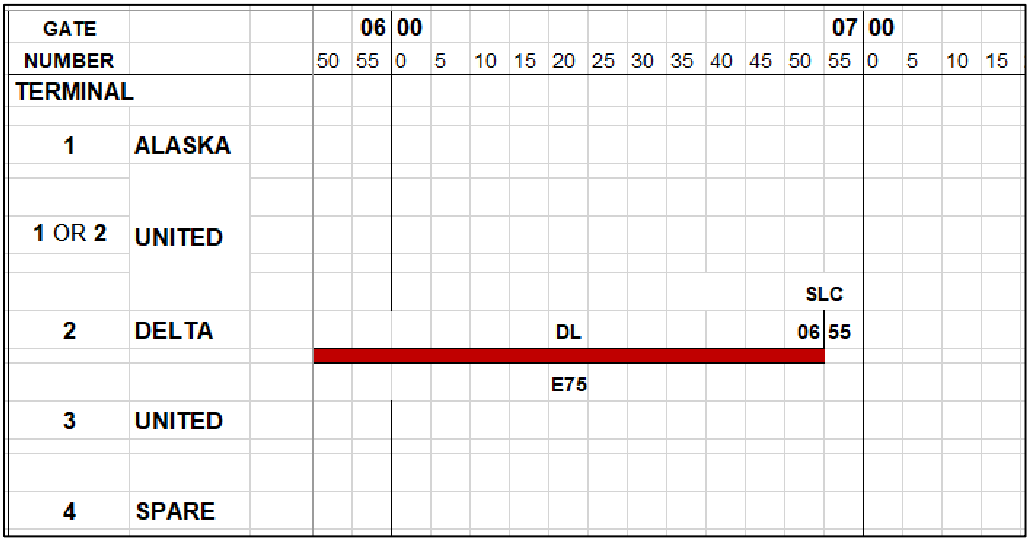
The air carrier aircraft apron was built to handle four aircraft with an apron taxilane serving all gate stands. Aircraft are maneuvered onto the apron taxilane from Taxiway B and proceed to their designated stand. The apron taxilane is dependent, relying on other aircraft to clear the taxilane before they can push back from the parking position. The aircraft are ground-boarded, with passengers boarding and disembarking through three gate doors. Aircraft operating from the airport are limited due to runway restrictions on aircraft size, with a 100-foot wingspan set as the maximum wingspan that will meet airfield requirements. This results in an effective capacity of fewer than 100 seats per flight.

Aircraft Apron Gate (Parking Position) Schedule Capacity

Airlines prefer to arrive and depart SUN during the late morning to late afternoon to meet their respective hub bank timing requirements, particularly during winter operations. Winter flight schedules at mountain resorts are typically limited to mid-day because winter weather can ground an aircraft, stranding passengers and removing the aircraft from schedule rotations. Working with the airlines, the Airport has maintained separation by limiting banks to two aircraft on-the-ground at a time such that flight operations do not overload the departures lounge, which can only comfortably accommodate two flights at a time. During the 2020-2021 winter peak season, there were two such simultaneous arrivals and departures banks. The first occurred in the late morning, as shown **in Figure 2-3**, and the second occurred in the early afternoon, as shown in **Figure 2-4**. The size of the departures lounge places limits on air carrier scheduling flexibility at SUN, as the Airport currently has more gate capacity than departures lounge space to support it.

Alaska typical operates from Parking Position 1, Delta typically operates from Position 2, United typically operates from Position 3, and Position 4 is used primarily as a spare gate. However, all parking positions are technically available on a first come first serve basis. On January 2, 2021, eleven flights operated out of the four parking positions at SUN. There are five distinct banks of flights at SUN. A review of ramp charts for the January 2 schedule provides a view of time-on-ground for the flights, beginning with **Figure 2-2**, Delta's early morning departure to Salt Lake City International Airport (SLC).

Figure 2-2: Early AM Departure, Delta Airlines Salt Lake City Flight from Overnight at Gate, 2 January 2021

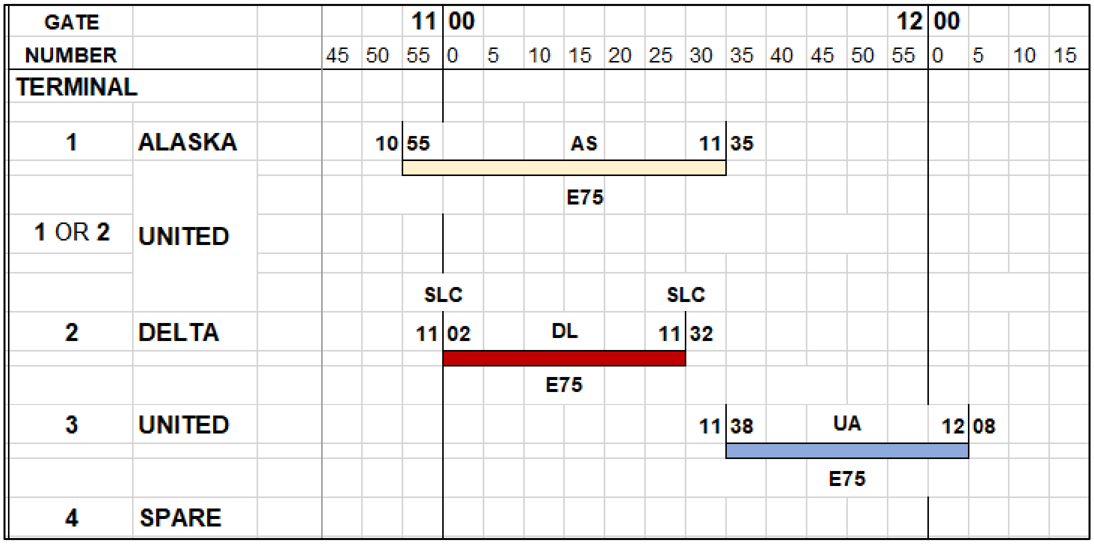


Source: Mead & Hunt, 2021.

Delta is the only carrier that uses a position for a remain overnight operation (RON) during the winter, with the last flight arriving at 21:35 hours from SLC and returning to SLC the next morning at 06:55 hours. All other flights are scheduled to arrive and depart within the period from about 11:00 to 18:30 hours. Delta operates the most flights, at five, with United operating four and Alaska operating two flights.

The late morning arrivals and departures banks in **Figure 2-3** began with Alaska's arrival from Seattle-Tacoma International Airport (SEA) at 10:55 hours and departure at 11:35 hours; Delta's SLC flight in at 11:02 hours and out at 11:32 hours; and United's arrival from San Francisco International Airport (SFO) in at 11:38 hours and out at 12:08 hours. This is the first of two periods with stacked flights, representing peak demand on terminal facilities at SUN.

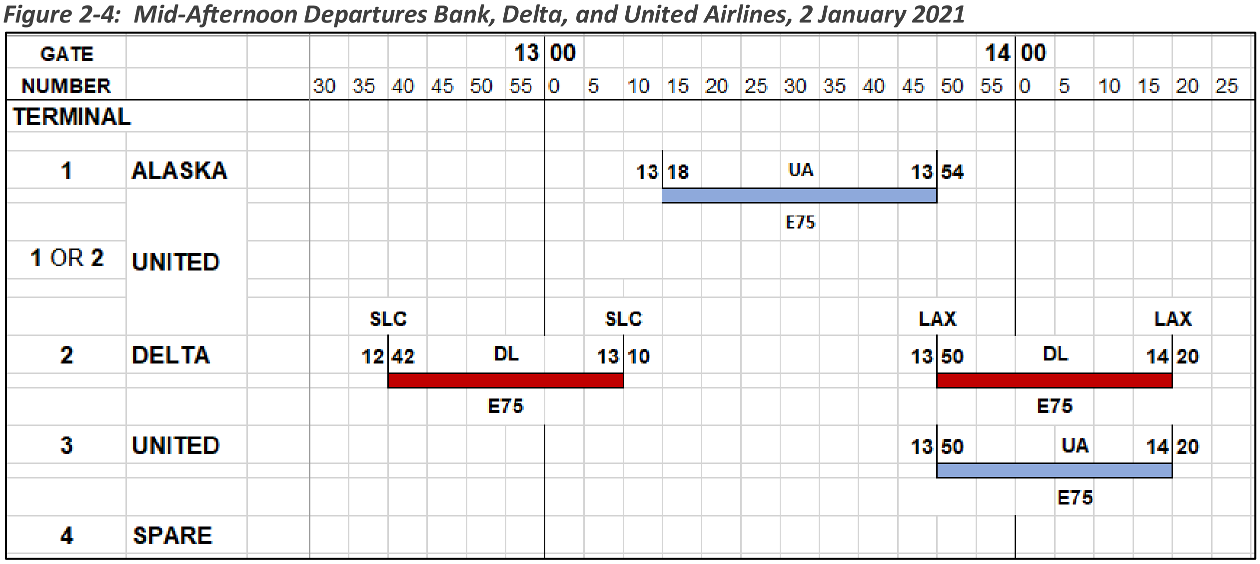
Figure 2-3: Late Morning Departures, Delta, Alaska and United Airlines, 2 January 2021



Source: Mead & Hunt, 2021.

The early afternoon departures bank, shown in **Figure 2-4**, includes two Delta flights, including a third SLC flight and a flight to Los Angeles International Airport (LAX) operating between 12:42 and 14:20 hours. This bank also includes two United flights, one to Chicago-O'Hare International Airport (ORD) and one to Denver International Airport (DEN), operating between 13:18 and 14:20 hours. This is the second of two periods in which flights stack, with passengers on all four flights overlapping while waiting in the departures lounge. The two simultaneous arrivals at 13:50 hours represent peak demand for the baggage claim device and arrivals hall, which provide insufficient capacity to manage this demand. The two simultaneous departures at 14:20 also impact outbound terminal facilities including departures curb, ticketing and baggage check, security screening, departures lounge, restrooms, and concessions.

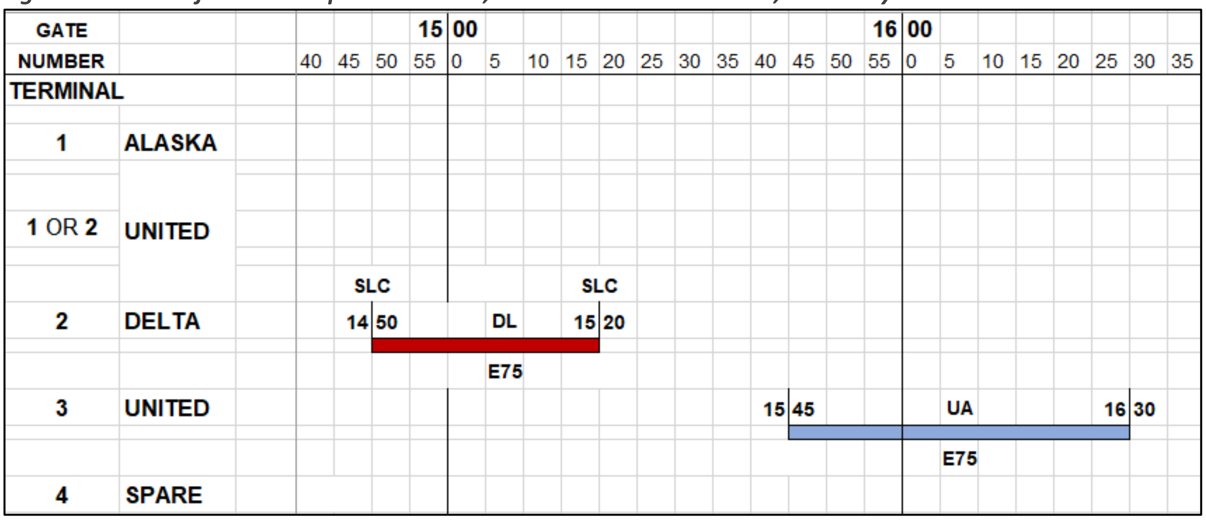
Figure 2-4: Mid-Afternoon Departures Bank, Delta, and United Airlines, 2 January 2021



Source: Mead & Hunt, 2021.

A late-afternoon bank, shown in **Figure 2-5**, includes Delta's fourth flight to SLC and United first flight to LAX departing at 16:30 hours bound for Los Angeles.

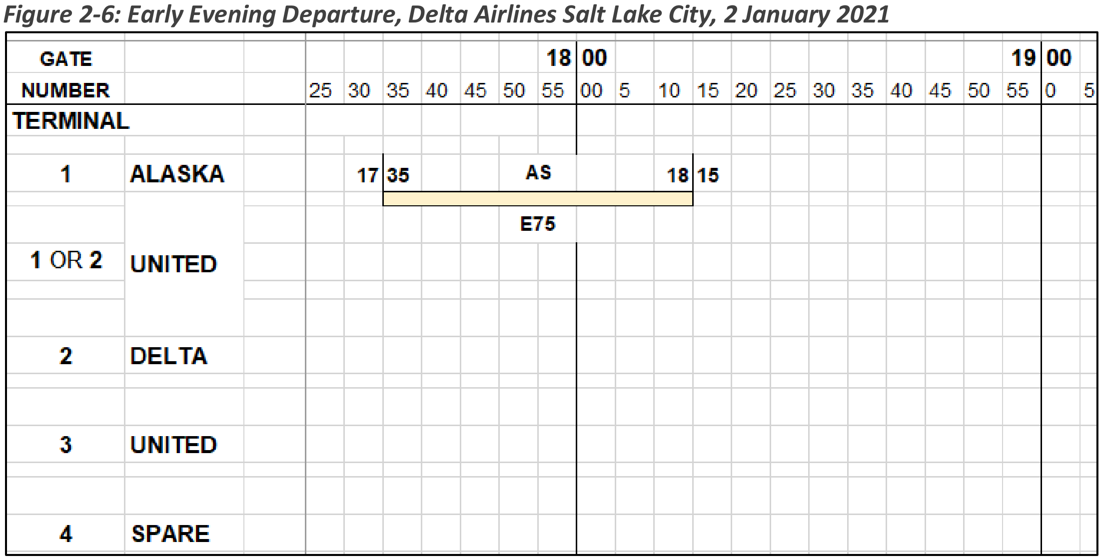
Figure 2-5: Late Afternoon Departures Bank, Delta and United Airlines, 2 January 2021



Source: Mead & Hunt, 2021.

The last departure out of SUN is Alaska's second flight to SEA, departing at 18:15 hours, shown in **Figure 2-6**. This marks the close of the preferred winter operations window, framing the period from about 11:00 hours to 18:30 hours.

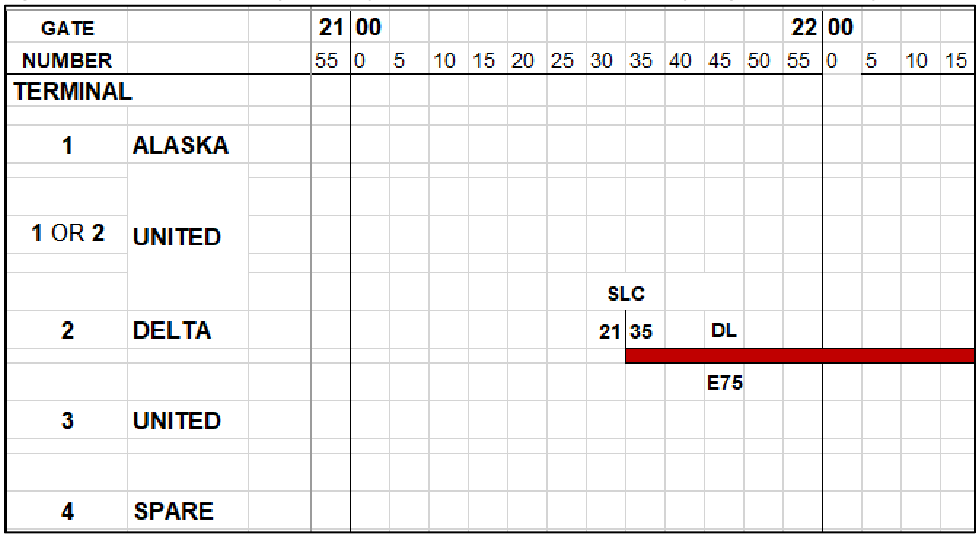
Figure 2-6: Early Evening Departure, Delta Airlines Salt Lake City, 2 January 2021



Source: Mead & Hunt, 2021.

The final operation of the day occurs with Delta’s SLC arrival to RON at the gate, shown in **Figure 2-7**. Most terminal services have closed at this time, with the previous Alaska flight arriving three hours prior to this flight.

Figure 2-7: Final Arrival of the Day, Delta Airlines Salt Lake City Flight, 2 January 2021



Source: Mead & Hunt, 2021.

The gate ramp charts show available capacity throughout the operating day, with periods when additional flights could arrive and depart the gate stands. However, practical capacity is less than shown due to flight block times (the total time between a flight’s pushback from its departure gate and arrival at its destination gate), distance between destinations, and location of the airlines’ hubs. The direction of travel and time of day govern the ability to add capacity to current destinations, which must be timed to their corresponding hub flight schedules. New destinations may have more scheduling flexibility into and out of SUN; however, their block times would also be dependent on the new destination’s flight banks and timing, affecting ground time at SUN. Finally, departures after 17:00 hours can only be conducted to western destinations while maintaining a reasonable arrival time. In determining a gate’s practical capacity in turns per gate, Delta’s flight schedule offers a view into how many flights a gate at SUN can manage, given these considerations.

A window is available at Position 2 for two additional flights between the periods from 07:30 to 10:30 hours, and one additional flight from 16:00 to 19:00 hours, with the destination limitations noted above. This would establish a theoretical maximum capacity of eight flights per gate. However, this may require Delta to add a third destination, as the current schedule may provide sufficient seat capacity to meet current demand into SLC and its flight into LAX, when combined with United’s LAX flight, may also provide sufficient seat capacity to this destination. This limitation provides for a practical capacity of between six to seven flights per parking position or gate depending on flight block times, hub schedules, and available gates at the hub airport.

Delta’s RON operation at SUN is the only one scheduled during the winter season.[6] The airlines can add to summer flight schedules by expanding their preferred operating windows due to longer daylight hours. Summer schedules include more late-night arrival and RON operations scheduled for early morning departures. To limit

[6] *Winter 2020-2021 flight schedule.*

their impact on the terminal building, the Airport and airlines have worked together to accommodate the flight schedule by increasing time between departures. Expanding the daily operating window also provides a better view into a potential practical capacity of the gates, noted above.

When airlines schedule multiple flights at the same time of day, or request to operate at a specific time of day but are limited by the building's capacity to handle this additional demand, further review of total gate capacity should be considered. As it stands today, the fourth gate stand provides a five-to-six flight buffer to grow the flight schedule. However, as with flights stacking shown in Figures 4 and 5, adding a flight to one of the two-flight departures banks would adversely impact departing passenger services, with passengers experiencing higher than normal congestion, wait times, and longer queues, and possibly missing their flights. Rebuilding and expanding existing components to accommodate today's schedules and potential additional flights is necessary to provide the LOS that the Airport wishes to maintain. While all terminal building components currently require more equipment or space, as described in subsequent sections of this report, the existing departures lounge ultimately limits schedule growth as the airlines primarily evaluate this space when considering additional flights.

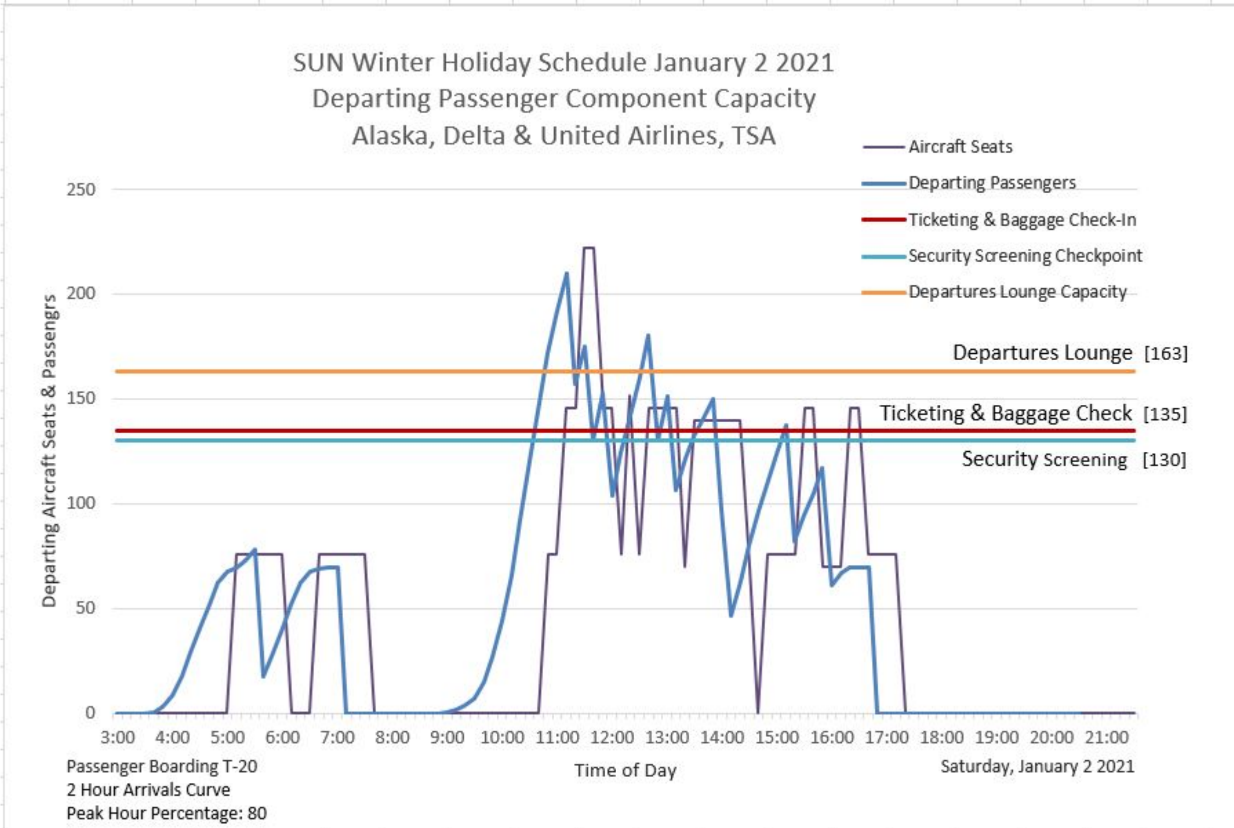
2.4. Capacity Assessment: Terminal Building

Departing Passenger Services & Functions

Passengers departing SUN engage airline personnel at ticket counters, move on to the security screening checkpoint (SSCP), and arrive in the departures lounge. These constitute the three major terminal components from a departure standpoint. All of these components are relatively close together and moving from one to another requires only a short walk. However, processing through the first two components can be time-consuming. A chart showing passenger demand over the course of the day compared to component functional capacity is shown in **Figure 2-8**. Passengers arriving on January 2nd, 2021, are plotted in blue in time-series across the day, with peak periods showing the maximum number of passengers processed through a function or occupying a space, either in queues or seated in the departures lounge.[7] The capacity of each functional component is shown as a fixed horizontal line representing the maximum hourly passenger processing capacity. Passenger demand extends beyond the capacity limits shown for each function, demonstrating that demand exceeds capacity for all three functional components. Discussion of capacity deficiencies and inherent inefficiencies in the component processes in subsequent sections are based upon this chart.

[7] *Plotted time-series represents passengers arriving at components with the departures lounge component as a basis with ticketing and security screening assumed to occur at intervals prior to arriving at the lounge area.*

Figure 2-8: Ticketing & Baggage Check-In, Security Screening Checkpoint, and Departures Lounge Demand-to-Capacity



Source: Mead & Hunt, 2021.

Departures Hall

The departures hall includes airline ticketing and baggage check-in, TSA baggage screening, airline ticket offices, and line cargo ground operations. The departures hall does not provide adequate passenger and visitor gathering and waiting area just beyond the hall entrance. A gathering and waiting area provides an opportunity for departing passenger groups to assemble and orient themselves to the space before proceeding to the ticketing queue. The departures hall was built at a time when aircraft carried fewer passengers who tended to arrive at the Airport with time to spare.

The TSA baggage screening operation is located directly behind the ticket counters, and airline ticket offices are located on the north and south sides of the baggage screening area. The ticketing queues are short and narrow, resulting in passenger queues blocking access to adjacent queues and leaving passengers confused as to which queue they should enter. As shown in **Figure 2-8**, ticketing and baggage check-in functions have an approximate capacity of 135 passengers per hour based upon ticket counter positions and equipment for all carriers. The space provided is significantly less than is needed for these functions to operate efficiently, especially with leisure passengers checking multiple bags. A contributing factor to congestion is that passengers at SUN tend to prefer a full-service experience rather than self-check and bag-tagging. Exacerbating congestion, a large vertical mechanical chase in the middle of the circulation area constrains passenger movement, line of sight, and queueing. As a result, the departures hall is very crowded during peak periods, with queues blocking circulation flow to the north of the hall, where the SSCP is located.

Ticketing / Check-In

SkyWest occupies the first ticket office from left to right, facing the counters from the passenger side, followed by Alaska/Horizon Air. SkyWest has two airline ticketing and baggage check-in counters with two computer terminals for each of its mainline partners, Delta and United, for a total of four counters.

At many airports, departing passengers typically arrive at an airport from an hour-and-a-half to two hours prior to their flights' departure. At SUN, the airlines report that passengers often arrive at the Airport 25 to 30 minutes prior to their flight's departure with many very large bags to check at the ticket counters.[8]. To calculate capacity, passengers arriving no more than 90 minutes prior to departure is used to determine demand on facilities. This compressed arrivals curve includes the 30 minute period prior to departure when passengers should already be at the Airport. This means approximately 80% of passengers arrive at the Airport within the hour prior to this final 30-minute period. This atypical behavior may be due to the ease of access to and close spacing of functions within the terminal.

Ticketing and baggage check-in capacity calculations were developed using worksheets to determine the number of passengers in the peak hour and the number of staffed ticket counter positions required to process this population.[9] **Table 2-3** shows requirements for SkyWest, operating for Delta and United. The carrier requires an additional two counters to meet today's demand. The table also lists a required queue depth at 22 feet set five to eight feet back from the counters. This is necessary to provide an LOS C at 15 square feet per passenger.

[8] *From airline stakeholder interviews, November 2020.*

[9] *ACRP Report 25, Vols. 1 & 2.*

Table 2-3: Ticketing & Baggage Check-In Summary Ticket Counter Check-in Requirements

Passenger Ticketing & Baggage Check Peak Hour 10 Minute Service Level Existing Capacity	
Demand Profile	
Design Hour Departing Passengers	205
Percent of Passengers in Peak 30 Min. Period	47%
Percent of Passengers Using Ticketing	80%
Peak Hour Originating Passengers at Ticket Counter	148
Peak 30-Minute Originating Passengers	77
Processing Time Per Passenger (Rounded Average Minutes)	3
Service Level Maximum Wait Time (Minutes)	10
Required Number of Staffed Positions	6
Queue Results	
Number of Staffed Service Positions	6
Average Queue Wait Time (Minutes)	4.5
Maximum Queue Wait Time (Minutes)	8.3
Maximum Number of Passengers in Queue	19
Ticket Counter Requirements	
Number of Ticket Counter Positions Required	6
Average Width of Ticket Counter Position (LF)	4
Depth of Check-In Queue (LF)	22
Length of Check-In Counter (LF)	24
Existing Queue Area (SF)	288
Passenger Level of Service	
Passenger Space Required Level of Service (LOS, SF)	15
Required Queue Area Per LOS (SF)	375
Passenger Space (Average SF/Passenger)	15
Average Demand	
Design Hour Passengers Per Position	25

Source: Mead & Hunt, 2021.
Notes: Includes SkyWest/Delta & United Airlines, Three-Departures Check-in as Shown in Figure 2-4 (Delta-1 Flight & United-2 Flights).

A similar study was performed for Alaska/Horizon's ticket counter requirements for one departure, shown in **Table 2-4**.

Table 2-4: Ticketing & Baggage Check-In Summary, Ticket Counter Check-in Requirements, Single Aircraft

Passenger Ticketing & Baggage Check Peak Hour 10 Minute Service Level Existing Capacity	
Demand Profile	
Design Hour Departing Passengers	68
Percent of Passengers in Peak 30 Min. Period	47%
Percent of Passengers Using Ticketing	80%
Peak Hour Originating Passengers at Ticket Counter	54
Peak 30-Minute Originating Passengers	26
Processing Time Per Passenger (Rounded Average Minutes)	3
Service Level Maximum Wait Time (Minutes)	10
Required Number of Staffed Positions	2
Queue Results	
Number of Staffed Service Positions	2
Average Queue Wait Time (Minutes)	6.5
Maximum Queue Wait Time (Minutes)	11.6
Maximum Number of Passengers in Queue	8
Ticket Counter Requirements	
Number of Ticket Counter Positions Required	3
Average Width of Ticket Counter Position (LF)	4
Depth of Check-In Queue (LF)	18
Length of Check-In Counter (LF)	12
Existing Queue Area (SF)	96
Passenger Level of Service	
Passenger Space Required Level of Service (LOS, SF)	15
Required Queue Area Per LOS (SF)	146
Passenger Space (Average SF/Passenger)	12
Average Demand	
Design Hour Passengers Per Position	27

Source: Mead & Hunt, 2021.

Checked Baggage Inspection System (CBIS)

The 340-square-foot space allocated for checked baggage screening is located directly behind the ticket counters and consists primarily of one computed tomography CTX-80DR standalone explosive detection system (EDS machine), TSA staff areas, and stacks of bags awaiting screening. This is not a mini-inline system in which automated conveyors take baggage from the counters to the EDS machine. Ticket agents must stack bags on the floor next to the EDS infeed conveyor to make up for a lack of floor space and TSA must manually load and unload each bag on and off the conveyor. After passing through the EDS machine, TSA officers must then carry each bag to one of two transfers leading directly to SkyWest and Horizon's outbound baggage make-up rooms located behind the baggage screening area, or to a secondary area for manual screening. Airline employees stage bags in this area and backups often occur, creating a potential trip hazard for TSA employees. The make-up rooms have direct access to the aircraft apron east of the building.

The EDS machine is rated at approximately 200 to 220 bags per hour, but these rates are attainable only if the device is a part of an automated in-line checked-baggage inspection system. Local TSA staff indicate they can process a maximum of approximately 100 average size bags plus 60 oversize bags per hour using the EDS machine.[10] Passengers check significantly more oversize bags at SUN than at other airports, estimated at approximately 20 to 25 percent of the total checked baggage volume. TSA must increase the number of officers staffing the device during peak check-in periods to clear all bags before a flight's departure. TSA staff have reported up to five officers staffing the CBIS at one time. There are two secondary screening podiums behind the device used by TSA agents to clear alarmed bags. A summary of peak period baggage volumes is presented in **Table 5**.

Table 2-5: TSA Checked Baggage Security Screening Summary of Occurrences from 150 to 450 Bags Screened in a Period for Calendar Year 2019[11]

Outbound Baggage Screening Summary						
Total Bags	151-200	201-250	251-300	301-350	351-400	401-450
Occurrences	98	37	17	7	4	2

Sources: TSA and Mead & Hunt, 2019.

Close coordination between TSA and airline staff has been instrumental in providing enough time for airline ground service personnel to sort and load the bags following TSA screening. The current operation is undersized, is labor-intensive to operate, and has inadequate floor space for baggage staging. For these reasons, the current operation poses potential safety risks to both TSA and airline personnel.

To handle the current peak volumes of bags that must be processed, a new, automated mini-inline CBIS should be installed. There is no redundancy in the current screening system, which is mandatory at larger airports. [12] A second machine is necessary and should be provided to avert downtime and to divide load during high volume periods. A second machine could also manage a larger input load, sorting higher numbers of bags independently between the carriers. This would also allow the addition of a new carrier, which cannot be done effectively when all four carriers depart during the same departures bank without two devices.

[10] *Based on TSA Statistics, Interviews and Correspondence.*

[11] *Typical half-day period beginning at 05:30 hours and ending at 12:00 hours; the afternoon shift is from 12:00 hours – 18:00 hours.*

[12] *TSA's redundancy initiative for system resiliency in required number of machines plus a back-up machine from their design guide. A new system will likely be comprised of necessary TSA operating space and provide two machines, each able to screen baggage volume from two carriers during a peak hour.*

Table 2-6: TSA Checked Baggage Level 1, 2 & 3 Screening Unit and Recommended Minimum Area Requirements

Passenger Ticketing & Baggage Check Peak Hour 10 Minute Service Level Existing Capacity	
Demand Profile	
Design Hour Departing Passengers	205
Percent of Passengers Checking Bags	80%
Average Bags Per Passenger	1.2
Total Number of Bags to Process	197
Ten Minute Baggage Flow Rate	33
Percent Bags Odd or Over-Size (O.S.)	20%
Number of Odd & O.S. Bags Requiring Level 1 ETD	39
Number of Bags Screening in Level 1 CT-80DR EDS Unit	157
Demand Processing Results	
Level 1 CT-80DR EDS Screening Process Rate	150
Number of Level 1 CT-80DR Screening Units Required	2
Number of Level 2 Alarmed Bags	31
Number of Level 2 OSR Resolution Bags (Estimate)	10
Number of Level 3 ETD Resolution Bags	21
Total Number of Bags Requiring EDT Screening	31
Level Screening Unit Requirements	
Level 1 CT-80DR EDS Screening Units	2
Level 2 OSR Stations	1
Level 3 EDT Screening Units	2
Recommended Area Requirements	
Per Level 1 CT-80DR Screening Units (SF)	800
Per Level 2 OSR Stations (SF)	40
Per Level 3 ETD Stations (SF)	100
Total Area Requirement (SF)	1,840

Sources: TSA and Mead & Hunt, 2021.

Baggage check-in averages approximately 0.75 bags per passenger overall, including passengers who do not check bags, which is about 0.25 percent higher than the industry standard for domestic airports. The metric noted above is higher, in the range of 1.25 to 1.5, when passengers who check baggage are separated out as an independent group. The airlines report passengers often bringing three to four bags to check for their flight. This is because SUN is a mountain resort airport where passengers often check skis and other gear during the winter, and large backpacks and bicycles during the summer.

Airline Outbound Baggage Area

Airline outbound baggage make-up is also a manual operation and there is not a common-use baggage make-up device in a shared room from which to work. Instead, once cleared through the CBIS, TSA officers place baggage onto a conveyor into SkyWest's make-up room or onto a slide into Horizon's make-up room. The make-up rooms have several columns obstructing movement and are too small for baggage tugs to drive through. Instead, baggage carts must be pushed into and out of the rooms. Furthermore, the floor heights in these two rooms are different, making it difficult to combine them and improve circulation. The rooms are also used for employee radio charging stations and storing heavy weather gear, wheel chocks, signal wands, some maintenance tools, and limited replacement parts.

The outbound baggage room should be a separate, central area for the carriers to retrieve checked baggage. Storage space for ground handling operations equipment, including space to store tugs, baggage carts and loaders during the winter, should be provided in a separate location.

Security Screening Checkpoint

The TSA SSCP is located north of the departures hall. It consists of one standard screening lane with an Advanced Imaging Technology (AIT) machine used for most passenger screening and an adjacent magnetometer used for screening Pre-Check authorized passengers. The SSCP uses a blended screening operation in which both sets of passengers are processed through one lane. Pre-Check passengers typically have a shorter wait in queue, and can keep belts and shoes on and laptops in their carry-on bag. The TSA typically operates the SSCP between 05:00 a.m. and 06:00 p.m., but they have opened it as early as 04:30 a.m. and closed as late as 09:30 p.m. when necessary to accommodate seasonal demand. If there is a wide gap between flights, the SSCP will be closed. In these cases, TSA will typically re-open the SSCP 90 minutes prior to the next flight's departure.

Using rule-of-thumb measures for processing capacity, the standard screening lanes are rated, on average, between 150-to-180 passengers per hour. A blended screening operation may increase throughput due to lower processing times for Pre-Check passengers. The percentage of Pre-Check passengers at SUN is significant, above the national average, which aids in increasing passenger throughput. Difficulties occur when the process stalls, slowing the line down, due to the lack of redundant systems. This occurs when passengers take longer to divest their personal belongings or forget to divest items from their pockets, or when TSA officers require more time to interpret a scan and refer a carry-on bag to secondary screening. In addition, passengers carry-on over two bags on average at SUN. These factors all affect throughput, placing this system at the lower end of the range at 150 passengers per hour, dropping to as low as 130 passengers per hour during peak periods.[13]

[13] *TSA figure of 150 passengers per hour; Mead & Hunt estimated figure for 130 passengers per hour based on peak loading.*

Table 2-7: TSA SSCP Performance and Level of Service with Two Lanes, 15-Minute LOS Goal

Passenger Security Screening Peak Hour 15-Minute Service Level Requirement	
Demand Profile	
Design Hour Departing Passengers	205
Peak 30-Minute Period Total Traffic Percentage	61%
Peak 30-Minute Period Total Passenger Traffic	125
Throughput Rate Passengers Per Hour Per Lane	150
Passengers Processed Per Minute Per Lane	2.5
Maximum Target Wait Time	15
Minimum Required Number of Screening Lanes	2
Queue Results	
Number of Screening Lanes	2
Maximum Queue Wait Times (Mins)	5.0
Maximum Number of Passengers in Queue	25
Recommended Space Requirements	
Security Queue (SF)	600
Security Screening Checkpoint Lanes & Reinvest (SF)	2,700
Total Checkpoint Area (SF)	3,300
Passenger Level of Service	
Per Passenger in Queue (SF)	15
Minimum Required Queue Area Per LOS (SF)	325
Passenger Space (Average Queue SF/Passenger)	24

Source: Mead & Hunt, 2021.

The months of January, March, July, and August 2019 were peak months for the TSA, with March logging the most passengers and carry-ons for the year.[14] December has an abridged peak, beginning December 17 and running through December 31, 2020, continuing into the first week of January 2021. This period is included in the list due to very high historic passenger volumes associated with holiday travel demand.

The analysis in **Table 2-7** shows the need for a two-lane checkpoint for processing passengers in the peak hour. This is derived based on three closely spaced departures within an hour, with all three flights operating at a 90 percent passenger load factor. It is also based on achieving a maximum wait time in queue of fifteen minutes per passenger, requiring a higher performance standard than currently provided by the single lane. With most passengers presenting at the checkpoint during a single hour, the model projects up to 25 passengers in queue. This is only acceptable with a maximum wait time in queue of about 7.3 minutes, which cannot be accommodated with a single lane. As important, there must be sufficient queue space to manage this number of passengers, which the checkpoint at SUN does not currently have. If passengers see the line moving with adequate space for them in the queue, they are less likely to be concerned about their wait time in queue and whether they will be late for their flight. Oftentimes at SUN, the checkpoint queue stalls due to the slow throughput rate and spills out from the designated queueing area, creating frustration and a heightened awareness of the longer wait time.

If space is not available for a second lane, options for increasing throughput capacity depend on upgrading screening equipment. Though less of an impact than adding a second lane, upgrading equipment would also require additional space. Upgrading a standard security screening lane to an automated screening lane (ASL) would increase

[14] *Passenger figures from the Airport; carry-on ratio from TSA stakeholder discussions.*

throughput by allowing passengers who can divest faster to place their belongings on the conveyor and move immediately to the passenger screening machines. Standard screening lanes queues are slowed when passengers take longer to divest their belongings. An ASL system provides multiple take-away stations for divesting belongings directly into the system, bypassing passengers who require more time to divest their belongings.

Adding SSCP capacity would be best achieved by adding lanes to an existing layout.[15] This will also provide increased throughput per lane as other efficiencies are incorporated into the two-lane system. The SSCP is boxed-in to the north by the departures lounge, to the south by ticketing, and the west by checkpoint queueing. Therefore, adding a second lane at the checkpoint's current location can only be done by expanding to the east. The Airport should do all it can to create space for a second standard screening lane because the TSA will fund standard equipment but will not fund an ASL system. The cost of a new ASL system was estimated at $300,000 in 2019.[16]

A complementary option is to add a CTX machine for carry-on baggage. Adding a CTX machine would increase capacity by reducing the number of scanned images that must be read by a TSA officer, increasing passenger throughput as fewer carry-on bags require secondary screening. A CTX machine creates a 3D image and uses algorithms to identify the contents of a carry-on bag, resolving more bags internally than a standard X-ray machine and reducing the number of bags that that require secondary screening. However, TSA management at SUN indicates that CTX cannot currently perform well enough to speed up the screening process, but that a CTX option could be incorporated into either a standard or ASL screening lane in the future when they meet their promoted ratings.

A second standard SSCP lane should be added to the east under the former baggage claim drop-off area, as recommended by the latest Airport master plan. If this is not possible, the adjacent pre-queueing waiting area could be used for a second lane but may require queues to extend beyond the SSCP area into the arrivals hall corridor.

Gates (Parking Positions) and Departure Lounge

There are currently three boarding gates serving four aircraft parking positions at SUN, the latter located parallel to the departures lounge on the north side of the building. Passengers ground-board the aircraft, walking across the apron and up mobile ramps. This has been an acceptable LOS in the past, when fewer, smaller aircraft operated at SUN. The increased amount of scheduled flight activity by larger aircraft warrants consideration of boarding bridges. Alaska's Q400 requires more care in operating bridges close to the aircraft, which must park perpendicular to the building for the bridge to extend straight out to the aircraft. However, it is expected that Alaska will eventually replace the Q400 with an E-175 aircraft to make a jet bridge docking operation safe for their aircraft and customers.

The departures lounge was originally programmed to accommodate two 70-seat CRJ-700 and one 76-seat DHC8-Q400 aircraft, which were flown into SUN at the time of the building's expansion. The most recent Airport Master Plan indicates the lounge could accommodate future schedule demand of 192 departing passengers in master plan forecast year 2034 at an "acceptable level of service"[17]. The Airport notes that the lounge often fills to capacity during current peak periods and additional space should be provided to make it more comfortable. The master plan recommended long-term expansion of the departures lounge to the east and west. Expansion of the departures lounge area in necessary to comfortably accommodate current departing passenger demand, as well as to meet the 88-seat design aircraft forecasted by the Master Plan.[18]

[15] *Follow-On Discussion with TSA, February 2021.*

[16] *Cost for an ASL checkpoint system from consultant's work at another small hub airport where airport management was considering ASL due to space limitations. The estimated cost is for the equipment only; electrical and IT work is an additional cost.*

[17] *An acceptable level of service was that of "C," a lower overall amount of area per passenger. A lower number of passengers in the lounge results in a higher level of service estimated at "B." With growth in the benchmark peak period, level of service will drop to level of service "D" for extended periods until a majority of passengers are boarded, clearing the lounge.*

[18] *The Embraer E-190 aircraft has a wingspan of 94'-3", which is under the 100-foot wide wingspan runway restriction.*

Restrooms

Airport terminal restrooms should be sized to accommodate a peak surge in use immediately following flight arrivals when passengers disembark and enter the departures lounge. While not all will use the restrooms, this is the peak use scenario that requires sufficient fixtures to accommodate demand. However, the numbers of fixtures provided in new departures lounges are often lower than recommended due to the space the restrooms occupy and maintenance costs for fixtures.

Capacity of the restrooms is insufficient to accommodate anticipated use by arriving passengers, which is currently at 75 percent of estimated peak demand. This demand estimate is based on two flights arriving simultaneously in two separate arrivals banks over an operating day.

A departures lounge restroom capacity analysis for two arriving flights is shown in **Table 2-8**. The arriving passenger population is calculated using a 90 percent load factor, reflecting peak season travel. This population is factored again to determine the peak 20-minute demand, which, in this case, is 75% of the total arriving passenger population.[19] A comparison to existing fixtures is used to show 25% fewer fixtures, in this case, one of each type, necessary to meet this demand.

Table 2-8: Departures Lounge Restroom Fixtures Requirements

Departures Lounge Area Restrooms	
Secure Public Area Restrooms	
Total Arriving Aircraft	2
Peak Hour Arriving Aircraft Seats	154
Peak Hour Design Load Factor	90%
Peak Hour Arriving Passengers	139
Peak Hour Arriving Passengers Plus Meeter/Greeter 1.05 Factor	146
Peak Hour Arriving Passengers Terminating	100%
Peak Hour Terminating Travel/Destination Passengers	146
Peak 20-Minute Passenger Demand Percentage	75%
Peak 20-Minute Passenger Demand	109
Design Factor (50%)	55
Men's Fixtures	4
Women's Fixtures	4
Departures Lounge Restroom Fixtures By Type	
Water Closets (M)	2
Water Closets (W)	4
Urinals (M)	2
Lavatories (M)	4
Lavatories (W)	4

Source: Mead & Hunt, 2021.

Two simultaneous departing flights were also used to evaluate the central arrivals hall restroom's capacity. A portion of arriving passengers are included to account for those who bypass the departures lounge restrooms and use the non-secure restrooms before leaving the Airport. This group is estimated at about 30 percent, or 45 arriving passengers, with departing passengers and well-wishers at 10 percent of the total population. Arrivals and

[19] *A case can be made to provide a higher level of service by using 100% of arriving passengers for small and non-hub airports.*

departures non-secure area restroom capacity is sufficient to meet passenger and visitor demand with the number of existing fixtures, as shown in **Table 2-9**.

Table 2-9: Departures & Arrivals Halls Public Restroom Fixtures Requirements

Departures & Arrivals Public Area Restrooms	
Non-Secure Public Area Restrooms	
Total Arriving Aircraft	2
Total Departing Aircraft Seats	154
Flight Planning Load Factor	90%
Total Departing Passengers	139
Peak Hour Departing Passengers	111
Peak Hour Departing Passengers Plus Well-Wishers (1.1 Factor)	122
Arriving Passengers During the Departures Peak Hour Percentage	30%
Arriving Passengers During the Departures Peak Hour	42
Total Passengers in Public (Non-Secure) Areas	164
Peak Hour Fixtures Required	5
Men's Fixtures	5
Women's Fixtures	5
Departures Lounge Restroom Fixtures By Type	
Water Closets (M)	2
Water Closets (W)	5
Urinals (M)	3
Lavatories (M)	5
Lavatories (W)	5

Source: Mead & Hunt, 2021.

A fifth lavatory sink would improve LOS in each restroom by reducing waiting time. Given the above, the standard number of fixtures programmed for a restroom is no less than six fixtures per restroom.[20]

Passenger Services

There are many non-revenue-producing amenities and services for certain segments of the passenger population that are beneficial and/or necessary for the Airport to provide the public, such as flight information display systems (FIDS). These can provide weather at destinations as well as flight status updates. Public address and paging systems with access beyond the departures lounge can also serve to keep passengers informed of Airport updates and assist in finding passengers when necessary.[21]

Two areas becoming more available at airports include mothers' lactation rooms, which are now required by federal legislation at medium and large airports, and service animal relief areas (SARA),[22] which are required for airports serving more than 10,000 annual enplanements and receiving Federal AIP or PFC funding. A SARA can be located either inside or outside the building. Most larger terminals provide a SARA in the secure area when getting outside is time-consuming or impractical due to the weather.

[20] *Guidebook for Airport Terminal Restroom Planning and Design, Report 130, Airport Cooperative Research Program, Transportation Research Board, 2015.*

[21] *This system should be in place at SUN airport, although the FIDS system may no longer be active.*

[22] *SARA guidelines were added to the FAA Advisory Circular "Access to Airports by Individuals with Disabilities."*

Other potential amenities include small business lounges, concessions and retail shops, and art and human-interest exhibits. Community outreach ambassadors are volunteers who assist passengers and visitors. Ambassadors typically work from information desks or kiosks and serve as ombudsmen for the airport and community.

A relatively recent addition at larger airports is a sensory room, a quiet space for people with sensory processing disorders such as autism, but also for passengers who need a place to recharge. A small chapel can also serve passengers who seek a quiet place. For children, a children's play area can assist parents who need a place to play with their children while awaiting their departure. With cellphones becoming an accessory as well as a necessity, game rooms can be provided for children and parents when the machines are scale replicas of the games on their phones, such as a large format PlayStation 5 gaming station (with headphones).[23]

A first-aid station or room provides a place for someone who becomes ill to await their family or an emergency medical team. This would be more appropriately located adjacent to an airline operations space such that it can serve passengers arriving at the airport who need assistance, the airline personnel likely to be the first people with whom they will come into contact. Passenger health emergencies during a flight are met on the apron by an emergency medical team (EMT).

Valet parking is a service for which passengers are willing to pay to make their travel easier. The Airport has a plan which it will implement when it is feasible to do so. It has an additional benefit in easing some public parking congestion and demand, although it may impact curb capacity, depending on how successful it becomes.

The Airport is distinct due to its on-going art exhibit in the central great room and throughout the terminal. In fact, the art is spread throughout the terminal due to our relationship and participation with the SUN Airport Arts Commission (SAAC). The main lobby was designed for passengers to gather and meet their parties upon arriving at the Airport, as well as a place to hold Airport functions. However, the space has not been utilized as the terminal design team had intended. The space will be reallocated to a higher and best use in this current terminal area planning.

Circulation

Passenger circulation space in the departures hall is undersized for most current demand scenarios. The departures hall was not expanded as part of the 2015 project and will be a focus for near-term expansion and/or upgrades.

Like the departures hall, baggage claim queuing and device length do not provide sufficient space for passengers claiming bags. The circulation area is quickly consumed, becoming a part of the claim waiting area. Given an appropriate size and a dynamic claim device such as a baggage carousel, circulation would become more efficient.

Beyond the checkpoint in the departures lounge, the circulation corridor cuts an efficient path from the checkpoint exit into the departures lounge and on to the secure area exit, passing restrooms and the concession along the way.

Future building expansion will require circulation area to be expanded to serve arriving and departing passengers, and to ensure passenger and visitor safety when exiting a building during an emergency.

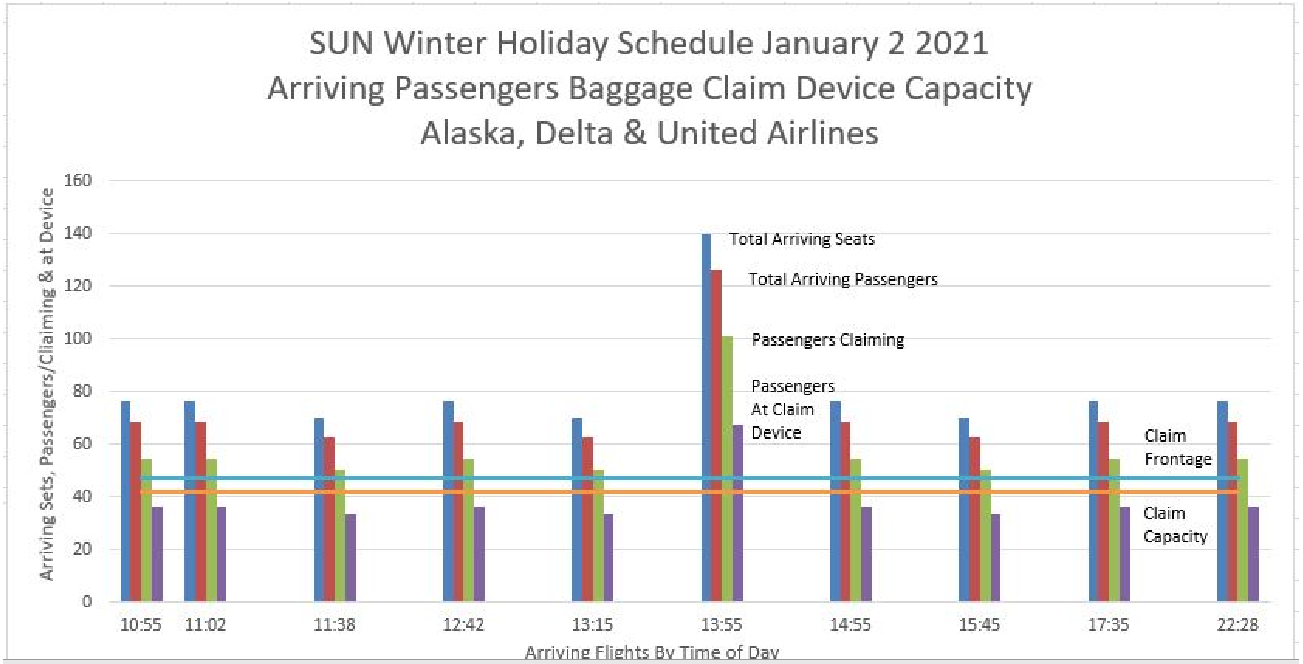
Arrivals Hall and Baggage Claim

The arrivals hall is where passengers claim baggage, connect with their parties, and gather prior to boarding hotel/resort shuttles or picking up rental cars. It includes baggage claim, seating, car rental counters and queuing space, and restrooms. It also includes space for non-public functions that support these public functions, such as the airline baggage off-loading lane.

[23] *Based upon the commercial venue "Gameway," at DFW Airport, this could just be a console which is available for use without charging a fee. The airport would have to pay for the game subscriptions, equipment and maintaining the machine.*

The chart in **Figure 2-9** presents arriving banks of flights over the operating day on January 2, 2021, including their total arriving seats and factored by a load factor of 90 percent to obtain total arriving passengers, of which 80 percent typically check bags. Passengers queued at the device to claim the bags are derived using a factor of 1.5 to yield the number of passengers in parties, including those passengers who will claim bags at the device as well as those who will stand away from the device.

Figure 2-9: Baggage Claim Demand to Capacity, Peak Winter Holiday Travel, 2 January 2021



Source: Mead & Hunt, 2021.

The chart in **Figure 2-9** shows that there is one period at midday when total demand exceeds capacity, consisting of two simultaneous arriving flights. The claim process is complicated by the static claim device, which limits the number of bags that can be unloaded on to it. Airline personnel typically use only one door to deliver bags to the slide device, waiting for passengers to pull bags off the slide so more bags can be loaded onto it. This lag in delivery increases passenger wait times, which begin with a delay due to a short walk from the aircraft to the arrivals hall when compared to the time required to unload and deliver bags to the device.

This device and process cannot meet passenger expectations in claiming their luggage, delivering a low LOS. A dynamic device such as a flat-palette (plate) or sloped palette claim device is necessary to correct this deficiency. Either would provide a higher LOS, with the latter increasing device capacity per length of palette by a theoretical factor of 1.5 due to the device's ability to stack bags. However, a practical capacity factor of between 1.25 to 1.35 would be more appropriate to reflect actual use as passengers claim their bags as they are loaded onto the device.

The area available for passengers claiming bags is typically determined by an offset of 15 square feet from the device frontage, as passengers will use space up to approximately 11 feet away from the device. The first seven feet or so is occupied by passengers claiming and queueing to claim, while their parties will await in the eight feet beyond this, where bags can be staged while awaiting remaining bags to be claimed. This can be more fluid due to limited depth within which passengers can queue and wait for space at the device to be able to claim their luggage; however, a queue also forms on the opposite side of the space in front of the car rental counters. If the airline uses only one opening to drop bags and skis, the claim area can quickly become congested, with bags on the device that passengers are blocked from retrieving by other passengers waiting for their bags to be loaded on the device. During peak periods, the baggage claim area becomes very crowded and incoming bags often accumulate, filling the slide. The airlines have also noted that a tug queue forms in the baggage drop-off lane, causing them to miss their required aircraft delivery-to-device metric.[24]

The effective claim frontage is derived by subtracting from the total claim frontage the areas that do not correlate with overhead doors. The baggage claim critical lengths are as follows:

- Inbound Bag Drop-off Zone: 63 linear feet of drop off lane
- Public Claim Device Frontage: 53 linear feet
- Effective Display Frontage: 47 linear feet

Using a standard 13 square feet per passenger for passengers standing with luggage and a percentage of this space added for circulation through the claim area, the baggage claim space can support the following number of passengers in the hall:

- Baggage Claim Hall: 60 passengers
- Baggage Claim Device: 42 bags[25]

The existing claim device and hall cannot meet the demands of two flights and provide a low LOS for passengers claiming baggage, as only 47 linear feet of effective claim device frontage is available but 126 linear feet is required for two simultaneous arriving flights. This existing device can only serve one flight at a time. Using a slide may serve well for skis, backpacks, and golf clubs due to their size, but not for personal baggage which stacks two to three bags high on the slide.

If a flat-plate claim device is used, additional device length is required for the baggage drop belt located outside on the ramp. This is approximately one-third the length of the claim area of the belt. With security a high priority, this same amount of device length is built inside the building to serve as a recirculation belt, which keeps bags within the building and away from re-entering the ramp area.

[24] *Airline stakeholder interviews, November 2020.*

[25] *As noted, capacity is based upon an airline using only one overhead door to unload bags at the claim device.*

Table 2-10: Baggage Claim Demand to Capacity, Two Flights, Peak Winter Holiday Travel, 2 January 2021

Passenger Baggage Demand & Capacity Requirement	
Passenger Demand	
Peak Hour Deplaning Passengers	137
Percent Deplaning in Peak 20 Minutes	100%
Percent Terminating Passengers	100%
Peak 20 Minutes Terminating Passengers	137
Percentage of Passengers Checking Bags	80%
Passengers Checking Bags	110
Average Traveling Party Size	1.5
Number of Parties (Groups)	73
Percent Additional Passengers at Claim	30%
Total People at Claim	84
Claim Device Requirements	
Claim Frontage Per Person (LF)	1.5
Total Claim Frontage Required	126

Source: Mead & Hunt, 2021.

A sloped palette carousel claim device obviates a need for a recirculating belt and provides more baggage capacity as bags can stack on the device. A sloped palette device provides full access along its perimeter, making it more efficient than the flat-plate device. The feed belt is located under the floor and device, delivering bags at two points along the length of the device, which allows more bags to be delivered. This becomes key to meeting demand from simultaneous arrivals, allowing airlines to meet their delivery metrics. With passengers arriving at the claim hall within ten to fifteen minutes of a flight's arrival, waiting on delivery to the device would be reduced with two bag drop belts.

Car Rental Offices & Parking

Car rental operations occupy the south area of the baggage claim hall. There are three car rental companies serving the airport: Enterprise, Hertz, and National. The car rental offices and counter areas are 670 SF in total area. Enterprise has noted that their office is too small to house three people and needs to be larger. Also, passengers gathering at the baggage claim device create congestion in front of the rental car counters, making it difficult for the companies to serve their customers.

At this time, it is not clear how well rental car companies will respond to the current travel crisis nor is it guaranteed that all will survive the prolonged downturn in aviation travel resulting from the COVID-19 pandemic. In setting priorities for passenger service, leisure travelers represent a majority of car rental companies' business, which would indicate the car rental market at SUN should recover sooner. The business travel market may return to its former strength or become a smaller segment of the business. With enplanements growth will come higher demand for rental cars during peak periods. For SUN, balancing public and car rental parking within the same lots will become a challenge over time if the car rental companies need additional parking spaces at the upper and lower parking lots.

A high LOS for car rental customers has been established at medium and large airports through provision of immediate access to vehicles, often without having to stop at a rental office and counter. At these airports, customers can walk directly to a car parked close to the terminal and drive it off the lot, stopping only at the security booth to check identification and to ensure their contract is in order. The rental car process at SUN is similar, with ready cars parked in the upper and lower lots.

With public parking requiring additional spaces, the removal of employee parking is an apparent first step in obtaining additional parking, with upwards of 36 spaces at both lots becoming public access. Creating a long-term or economy public parking lot could be provided south of the lower parking lot. When this lot's capacity becomes strained by demand, car rental may need to provide ready cars at the upper lot for preferred customers only, with all other customers bused to a common-use remote lot.

Building a parking structure at the lower lot is an option for rental cars and public parking. This would allow both to continue to operate from the upper and lower lots. Over time, parking will require remote lots. The Airport's plan to introduce valet parking provides an opportunity to offer a high level of service to passengers. To work for the airport and save space, vehicles would likely be parked in single file and the valet operator would stage vehicles based upon passengers' scheduled return dates and approximate times. Other longer-term options involve acquiring additional land or relocating hangars. The alternatives phase of this TAP study will help the Airport determine whether providing adequate parking, when combined with other triggers, may require relocation of the terminal complex to another site.

2.5. Capacity Assessment: Snow Removal Equipment

Snow removal equipment (SRE) at SUN is stored in a multi-purpose Operations Center facility located south of the terminal building. The facility, constructed in 2015, is approximately 14,000 square feet and has direct access to the AOA from the doors of the building, as do other functions of the Operations Center including Aircraft Rescue and Fire Fighting (ARFF), Airport administration and operations, equipment maintenance and cold weather storage buildings.

The portion of the Operations Center used for SRE storage and maintenance is approximately 7,000 square feet and contains four vehicle bays which are designed for equipment to pull or back into the facility. Additional SRE spaces include a restroom, maintenance office, welding shop, combustible liquid storage, maintenance storage, and maintenance shop.

The Operations Center is not large enough for the existing and planned equipment. This section provides a detailed analysis of the SRE, their attachments, associated space, and related facilities to determine the amount of space SUN requires for its existing and planned future equipment. Several spaces in the SRE facility are analyzed below to determine their sufficiency include:

- Vehicle Storage
- Vehicle Circulation
- Maintenance Shop and Wash Bay
- Sand and Chemical Storage
- Office and Personnel Support Space
- Additional Support Space
- Parts and Equipment Storage

Snow Removal Equipment (SRE) Eligibility

SRE at SUN are currently stored in the south end of the Operations Center building. As discussed previously, the facility has four vehicle bays reserved for SRE with secured airside access. SRE vehicles must maneuver around two large corporate hangars adjacent to Taxiway B to access the rest of the airfield.

The required response time to clear snow from an airport environment is based on the number of annual operations at the airport. Based on guidance in Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5200-30D, *Airport Field Condition Assessments and Winter Operations Safety*, because SUN has more than 10,000 operations but fewer than 40,000 operations, it should have enough equipment to clear priority areas within one hour. While the existing SRE fleet at SUN exceeds the FAA's max justifiable quantity for airfield clearance times, due to the inherently complex nature of operating a high-elevation, mountainous airport with opposite direction aircraft operations (ODO), SUN faces snow-removal challenges that "standard" airports do not.

SUN's air carriers require field conditions to be maintained at a far higher standard than most airports. The only way that SUN can retain reliable commercial air service in the winter months is to exceed the FAA recommendations for justifiable SRE.

In addition to the high minimum standards required by Air Carriers, SUN's geographic constraints and resulting limited space, disallows standard snow removal techniques. In order for SUN to maintain compliance with FAA guidance on snow profiles and wingtip clearances, SUN requires additional equipment for snow relocation and hauling.

The SRE fleet, as it exists now, is the minimum quantity required to maintain reliable air service during winter months, and as such, a greater building-footprint is needed to house and protect this investment.
FAA Order 5100.38D, *Airport Improvement Program (AIP) Handbook*, allows for acquisition of SRE for Part 139 certified airports. According to the AIP Handbook, "any equipment required for clearing snow and ice from the runways, principal taxiways, aprons, and emergency access roads is eligible." An FAA Snow Removal Calculation spreadsheet is used to calculate the AIP-eligible SRE and associated vehicle storage area. Eligibility is determined based on calculations for primary runway, taxiways, and critical apron area. According to the AIP Handbook, FAA funding for SRE facilities is limited to space in the facility that is necessary for eligible SRE as well as storing abrasive or chemicals used in the treatment of paved areas. All other areas and equipment recommended in AC 150/5220-18A, *Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials*, must be paid for by the sponsor. AIP-eligible equipment for SUN, according to the FAA Snow Removal Calculation spreadsheet are shown in **Table 2-11**.

Table 2-11: Identification of Justifiable (AIP Eligible) Snow Removal Equipment[1]

Eligible Items[2]	Max Justifiable Quantity[3]	SUN Existing Quantity	SUN Needs
Snow Blower	1	2	0
Plow	2	3	0
Sweeper	3	3	0
Hopper Spreader	3	2	1
Front End Loader	0	4	0
Total Quantities	9	14[4]	1

Source: Mead & Hunt, 2021.
Notes:
[1] Justifiable equipment means that the equipment is AIP-eligible.
[2] Equipment eligibility is based on guidance found in the AIP Handbook.
[3] Inputs used to determine the max justifiable quantity include average annual snow fall, airport level of service, annual operations, Priority 1 snow removal square footage, critical snow removal square footage, and AC 150/5220-20A, Figure 2-6.
[4] Two SRE vehicles serve multiple purposes such as a sweeper/plow or a hopper-spreader/plow, which accounts for the difference between the existing quantity in Table 11 and the number of vehicles used for eligible area calculations in subsequent tables.

Vehicle Storage

SRE are costly pieces of complex and technologically advanced equipment for the control of snow, slush, and ice. To protect and service this expensive investment, the FAA recommend specifically designed maintenance buildings with adequate storage areas. These buildings would provide a protected environment to prolong the useful life of the investment. Storing vehicles outside or in cold storage facilities degrades the vehicles and attachments and can shorten the useful life.

The existing vehicle storage and circulation area is approximately 5,800 square feet, of which 4,680 square feet is for vehicle storage and 1,120 square feet is for vehicle circulation. The facility has a back-in design with four equipment stalls. According to AC 150/5220-18A, a back-in aisle design is an efficient building design for airports with small equipment fleets; however, the existing layout is not conducive to efficient circulation and vehicle storage for two reasons: 1) facility doors are too narrow and too short, and 2) there is not enough space to store existing eligible equipment.

The Airport has indicated that many pieces of equipment must be stored elsewhere due to the small size of the existing vehicle bays. Out of the four vehicle bays, three bays can accommodate one vehicle per bay which are currently used for two sweepers and a combination sweeper plow. The fourth bay accommodates operations vehicles as well as deicing equipment. The remainder of the SRE fleet is stored in two hangars elsewhere on Airport. One hangar is located directly east of the ARFF/SRE facility, and another hangar is located north of the terminal apron. The hangar closest to the existing ARFF/SRE facility is 6,700 square feet while the hangar to the north is 3,600 square feet. In general, all vehicles and attachments are stored inside except for certain attachments that only require a short amount to time to mount, specifically smaller plow blades and front loader buckets. According to Airport staff, these aircraft hangars can generate substantial revenue for the Airport totaling approximately $84,000 per year. Not utilizing these aircraft hangars for their intended purpose negatively affects Airport revenue.
AC 150/5220-18A stipulates that storage of the vehicles and equipment is determined by calculating the eligible area needed to house each vehicle including the Equipment Safety Zone (ESZ) required on each side of the vehicle. According to AC 150/5220-13A, Table 3-2, equipment parallel to other equipment requires an ESZ of 10 feet, or 5 feet per side. According to AC 150/5220-18A, Table 3-1, the ESZ for parked equipment is calculated without attachments. During the winter months, SRE vehicles have their equipment attached to allow Airport staff to respond quickly to winter events. It is unreasonable to have to retrieve equipment from multiple locations and attach equipment each time a winter event occurs. Single or dual drive-through lanes require a larger ESZ than the current design. To accommodate single or dual drive-through lanes for existing SRE at SUN, the eligible square footage would be greater than the existing footprint of the vehicle storage and circulation area. Based on AC 150/5220-18A, Table 3-1, single drive-through lanes require an ESZ of 15 feet, while the ESZ of dual drive-through lanes depends on the size of plow and sweeper attachments. SUN currently parks vehicles parallel to other vehicles which requires an ESZ of 10 feet.

The existing equipment stalls are approximately 45 feet long and 26 feet wide. The four stalls in the existing facility provide approximately 1,170 square feet per vehicle. To park just one of the Airport's combination plow/sweeper, the dimensions of the vehicle, plow, and sweeper attachment must be taken into consideration along with an ESZ of 10 feet. To accommodate an ESZ of 10 feet, approximately, 2,109 square feet of storage area is required, which is approximately 939 square feet more than the existing equipment stalls provide. The size of the combination plow/sweeper and the required ESZ contribute significantly to the overall inefficiency of the existing vehicle storage area.The smallest SRE vehicle that SUN owns is a Ford L9000 which measures 26 feet long and 9 feet wide. With the required ESZ, the space needed for the vehicle is 684 square feet; however, as discussed previously, the Airport often leaves plows and buckets outside of the storage facilities as the three separate facilities combined cannot accommodate the vehicles and their attachments.

SUN's existing SRE and maintenance equipment includes: three snow blowers, seven plows, four sweepers, four hopper spreaders, and four front end loaders (**Table 2-11**). An ESZ of 10 feet, or five feet per side, was used to calculate SRE eligible area. **Table 2-12** and **Table 2-13** presents SRE vehicles by vehicle make/model and their primary vehicle function, the dimensions of each vehicle, their attachments, the dimensions including the ESZ, and the total estimated eligible area required. **Table 2-12** and **Table 2-13** also include SRE vehicles and attachments that the Airport intends to purchase in the next five years (2021-2025) according to the Capital Improvement Plan (CIP). According to the AIP Handbook, Table O-3, at the time an SRE facility is programmed for construction, expansion, modification, improvements, or rehabilitation, the eligible equipment must be owned, on order, or budgeted by the airport within the next five years to be considered in the eligible area for AIP funding.

Due to the size of SRE, their attachments, and the required ESZ, the space needed to effectively store equipment is larger than the existing space in the vehicle storage area. To demonstrate the space needed to store all existing and future SRE vehicles with their equipment attached, **Table 2-14** is included to show the length and width of each vehicle and its equipment attached including an ESZ of 15 feet, or 7½ feet per side, from parked equipment that includes a safe walk around zone in front of at least three feet. **Table 2-14** also depicts the modified eligible area needed to house all SRE vehicles with their equipment attached.

Table 2-13 indicates that existing parking stalls are long enough for several SRE vehicles; however, SUN has several pieces of equipment that are too long to fit into the stall when considering the required ESZ. While there may be enough room in existing stalls to store the vehicles there is not enough room to store vehicles with their equipment attached. Furthermore, Airport staff have indicated that three of the vehicle stalls only accommodate one vehicle per stall. As shown in **Table 2-14**, parking vehicles with their equipment attached requires a significant increase to the size of the equipment stalls. Several pieces of equipment and their attachments would also be too wide for the existing stalls when parked parallel to other equipment. Additionally, the Airport staff has indicated that the vehicle doors are too short for some of the larger pieces of equipment; three pieces of equipment are at least 22 feet tall.
As SUN cannot feasibly accommodate all pieces of existing SRE and their attached equipment due to the size and number of the equipment stalls, in addition to the short bay doors, it is recommended SUN consider expanding the facility to accommodate more vehicles that are sized appropriately to house vehicles with their equipment attached.

Table 2-12: SUN Snow Removal Equipment and Eligible Area – Vehicles

Year	Equipment Type	Make	Model		Dimensions (feet, h x l x w)	Dimensions and ESZ (feet, l[1] x w[1])	Eligible Area (square feet)
	Existing Vehicles						
1985	Dump Truck	Ford	L9000		12x26x9	36x19	684
1996	Plow	Oshkosh	Sweepster		12x 37x24	47x34	1,598
1996	Snow Blower	Ford/New Holland	Tiger Tractor		11x15x9	25x19	475
2001	Plow	Case	921C		12x 2x10	38x20	760
2002	Snow Blower	Kodiak	3500 TPH		12x12x12	22x22	484
2004	Hopper/Spreader	Batts	1100 Gallon		22x9x9	19x19	361
2006	Front End Loader	Case	621 D		11x23x8	32x18	594
2009	Hopper/Spreader	Suzuki	Carry Super Stalker		4x22x4	32x14	448
2010	Sweeper	Wausau	Everest MTE		25x39x12	49x22	1,078
2010	Snow Blower	Oshkosh	5000 TPH		9x35x12	45x22	990
2012	Front End Loader	Case	921F		11x28x10	38x20	760
2015	Sweeper	Wausau	SnowDozer		25x39x12	49x22	1,078
2017	Snow Blower	Kodiak	5252		7x12x11	22x21	462
2018	Tractor	New Holland	Tractor		6x13x6	23x16	368
2019	Sweeper	Oshkosh	H-Series XF		12x40x25	50x35	1,750
2020	Sweeper/Plow[2]	M-B Companies	MB-5 MTE		12x47x27	57x37	2,109
2018	Front End Loader	-	972M		13x27x10	37x20	740
2020	Front End Loader	-	972M		13x27x10	37x20	740
2018	Skid steer loader	-	279D		7x12x7	22x17	374
	Total Existing Estimated Eligible Area: Vehicles						***15,853***
	Future Vehicles						
2022	Sweeper/Plow[2]	M-B Companies	MB-5		14x72x24	82x34	2,788
2024	MTE[3]	-	-		14x72x24	82x34	2,788
	Total Future Estimated Eligible Area: Vehicles						***5,576***
	Total Existing and Future Area: Vehicles						**21,429**

Source: SUN Snow and Ice Control Plan; Mead & Hunt, 2021.
Notes:
[1] The Eligible Area includes the ESZ of 10 feet, or 5 feet per side, found in AC 150/5220-18A, Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials, Table 3-1.
[2] According to the AIP Handbook, an MTE counts as two pieces of equipment for eligibility purposes.
[3] This piece of equipment will replace an existing sweeper and plow to be determined in the future.
ESZ = Equipment Safety Zone
MTE = Multi-Tasking Equipment
SRE = Snow Removal Equipment

Table 2-13: SUN Snow Removal Equipment Attachments and Eligible Area

Year	Equipment Type	Make	Model	Dimensions (feet, h x l x w)	Dimensions and ESZ (feet, l[1] x w[1])	Eligible Area (SF)
Existing Attachments						
1996	Plow	-	-	22x8	27x13	351
2001	Plow	-	-	22x8	27x13	351
2001	Plow	-	-	20x8	25x13	325
2001	Plow	-	-	20x8	25x13	325
2001	Plow	-	-	30x8	35x13	455
2006	Plow	-	-	5x24x8	29x13	377
2010	Sweeper	-	-	20x8	25x13	325
2010	Plow	-	-	22x8	27x13	351
2012	Plow	-	-	22x8	27x13	351
2012	Plow	-	-	20x8	25x13	325
2012	Plow	-	-	30x8	35x13	455
2018	Front End Loader	-	-	5x24x8	29x13	377
2012	Front End Loader	-	-	5x24x8	29x13	377
					Total Existing Estimated Eligible Area: Attachments	***4,745***

Source: SUN Snow and Ice Control Plan; Mead & Hunt, 2021.
Notes:
[1] The Eligible Area includes the ESZ of 5 feet, or 2 ½ feet per side, found in AC 150/5220-18A, Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials, Table 3-1. ESZ = Equipment Safety Zone
SF = Square Feet

Table 2-14: SUN Snow Removal Equipment and Attachments: Modified Eligible Area for Single Drive-Through Lane

Year	Equipment Type	Make	Model	Dimension (feet, l x w)	Attachment	Dimensions (feet, l x w)	Dimensions and ESZ[1] (Feet, l x w)	Total Eligible Area (SF)
Existing Vehicles and Attachments								
1985	Plow	Ford	L9000	26x9	-	-	41x24	984
1996	Plow	Oshkosh	Sweepster	37x24	Plow	22x8	74x47	3,478
1996	Snow Blower	Ford/New Holland	Tiger Tractor	15x9	-	-	30x24	720
2001	Plow	Case	921C	28x10	Plow[2]	30x8	73x33	2,409
2002	Plow	Kodiak	3500 TPH	12x12	-	-	27x27	729
2004	Hopper/Spreader	Batts	1100 Gallon	9x9	-	-	24x24	576
2006	Front End Loader	Case	621D	23x8	Plow	24x8	47x31	1,457
2009	Hopper/Spreader	Suzuki	Carry Super Stalker	22x4			37x19	703
2010	Sweeper/Plow	Wausau	Everest[3]	39x12	Plow[2]	22x8	76x35	2,660
2010	Snow Blower	Oshkosh	5000 TPH	35x12	-	-	50x27	1,350
2012	Front End Loader	Case	921F	28x10	Plow[2]	30x8	73x33	2,409
2015	Sweeper	Wausua	SnowDozer	39x12	-	-	54x27	1,458
2017	Plow	Kodiak	5252	12x11	-	-	27x26	702
2018	Front End Loader	New Holland	Tractor	13x6	Front End Loader	24x8	56x29	1,624
2019	Sweeper	Oshkosh	H-Series XF	40x25	-	-	55x40	2,200
2020	Sweeper/Plow[3]	M-B Companies	MB-5	47x27	-	-	62x42	2,604
2018	Caterpillar	-	972M	27x10	-	-	42x25	1,050
2020	Caterpillar	-	972M	27x10	-	-	42x25	1,050
2018	Caterpillar	-	279D	12x7	-	-	27x22	594
							Total Existing Estimated Eligible Area: Vehicles + Attachments	***28,757***
Future Vehicles and Attachments								
2021	Sweeper/Plow	M-B Companies	MTE	47x27	-	-	62x42	2,604
2021	Hopper/Spreader/Plow	-	-	47x27	-	-	62x42	2,604
							Total Future Estimated Eligible Area: Vehicles + Attachments	5,208
							Total Estimated Existing and Future Eligible Area: Vehicles + Attachments	33,965

Source: Airport Staff; Mead & Hunt, 2021.
Notes:
[1] The combined dimensions and ESA are indicative of each vehicle with its corresponding equipment attached plus the ESZ of 15 feet, or 7½ per side, for parked equipment from other parked equipment that includes a safe walk around zone in front of at least three feet according to guidance in AC 150/5220-18A, Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials, Table 3-1.
[2] These pieces of equipment have two or more attachments. Dimensions for the attachment represent the largest attachment for these pieces of equipment.
[3] According to the AIP handbook, an MTE counts as two pieces of equipment for eligible purposes.
ESZ = Equipment Safety Zone
SRE = Snow Removal Equipment

Vehicle Circulation

Due to the undersized vehicle storage area and the back-in equipment stall design, the vehicle circulation in the existing facility is inefficient and too small for existing and future SRE at SUN. According to AC 150/5220-18A, the back-in design is an efficient building design for airports with small equipment fleets, usually consisting of one to three equipment bays.

As discussed previously, three of four bays in the SRE facility accommodate one vehicle in each bay, while the fourth bay holds a variety of de-icing equipment. The three pieces of equipment that are stored in the existing facility include two sweepers and the Multi-Tasking Equipment (MTE) vehicle. According to AC 150/5220-18A, Chapter 3, Section 3-2, “the design goal of the configuration is to facilitate the duties of personnel, expedite the movement of equipment, and provide ready access to materials and supplies.” The current facility design does not meet this goal. SUN has an equipment replacement program in place to phase out equipment that has reached the end of its useful life and replace it with modern SRE designed to better meet the Airport’s needs. Modern SRE is often larger than older equipment, and often MTE is preferred over single function equipment. MTE maximize staff efficiency by increasing the equipment’s functions with multiple attachments to each vehicle. The existing vehicle circulation is insufficient to accommodate an increased vehicle size corresponding to modern SRE such as MTE. If SUN continues to replace aging equipment with modern MTE, the existing vehicle circulation will significantly impede the ability of SUN to respond quickly to snow events and it is likely more SRE will have to be stored in locations spread out across Airport property.

While modification of the existing SRE facility would aid in reducing the existing storage and circulation issues, it is unlikely that modification to the existing facility will be sufficient for the Airport long-term. Any modern equipment the Airport acquires long-term are likely to be larger than existing equipment to fulfill multiple functions; for this reason, the existing vehicle storage area will continue to be constrained unless it is expanded.

Maintenance Shop and Wash Bays

The existing SRE facility includes 572-square-foot maintenance shop on the southwestern side of the facility behind existing vehicle bays. While there is no separate vehicle wash bay, the Airport owns a portable pressure washer that can be moved throughout the facility to wash vehicles. The existing vehicle bays have overhead air lines, electricity, and fluid dispensers that meet the needs for maintenance.

AC 150/5220-18A, Chapter 1, Section 1-2 classifies airport size by their “total paved runway as identified by the airport operator’s winter storm management plan that will be clear of snow, ice, and/or slush.” SUN has over 1,000,000 square feet of total paved runway which means that SUN is classified as a very large airport. According to AC 150/5220-18A, Table 3-3, very large size airports should have two maintenance bays that are 1,000 square feet per bay. Wash bays for large and very large-sized airports should measure 1,000 square feet as well.

Maintenance shops and wash bays are eligible under guidance found in the AIP handbook, although the Handbook only allows for one maintenance bay sized for safety or security equipment (i.e., ARFF equipment). According to Airport staff, the maintenance area is sufficiently sized for the needs of the Airport; however, the Airport desires an overhead hoist/crane system, which is also AIP-eligible.

Parts and Equipment Storage

There is minimal storage in the main SRE and maintenance facilities for additional equipment and vehicle attachments. The existing 117-square-foot storage room located in the mezzanine level of the SRE facility is used to store small parts for SRE and maintenance equipment and at capacity. Cores for sweeper equipment are stored in hangars on the Airport discussed previously. Additional spare parts for SRE vehicles are stored in a variety of buildings around the Airport. As discussed previously, bucket and plow attachments are stored outside to accommodate vehicles in storage facilities. The Airport desires new storage areas to replace the multiple facilities being used to house parts and equipment, which would ideally be heated and properly insulated to protect and extend the useful life of equipment.

According to AC 150/5220-18A, it is ideal to designate storage areas in one location for parts and equipment collocated with SRE and maintenance facilities. While there is room dedicated to parts storage in the SRE and maintenance facilities, it is undersized and is only large enough for small equipment parts. According to AC 150/5220-18A, Table 3-3, very large airports have a typical space allocation for a parts area associated with snow removal operations of 1,000 square feet. Additionally, parts areas associated directly with snow vehicles should be at least 400 square feet. While AC 150/5220-18A provides typical space allocations, the final floor allocations for SRE parts and equipment should be determined by the airport operator.

Based on AC 150/5220-18A, the Airport's needs, and the existing parts storage, SUN requires an additional 1,000 square feet to accommodate existing SRE parts and attachments. Based on guidance in the AIP Handbook, parts and equipment storage is not AIP-eligible. Should the Airport add additional parts and equipment storage space, the Airport will be required to fund it themselves or through other avenues, such as state funding.

Sand and Chemical Storage

AC 150/5220-18A and current AIP eligibility requirements allow for funding of indoor sand and chemical storage areas. Heated sand storage areas prevent moisture in the sand from freezing, which requires more effort to load and may hamper response times during snow events. According to AC 150/5220-18A, sand and chemical storage should be sized to reduce restriction or difficulty of loading solid materials onto spreader trucks and ensure that solid material does not spill outside the limits of the storage floor area during delivery. AC 150/5220-18A stipulates that space allocation for solid de/anti-icers and sand should be determined by the Airport's operational requirements and historical usage amounts. Additionally, FAA guidance stipulates that caution should be taken when determining floor areas to consider the approach that the Airport uses to combat the type of winter storms that occur at the Airport. The difficulty in receiving new material deliveries and replenishing them during storms also needs to be considered. At SUN, there is no existing sand storage because there is no space available for sand and the Airport does currently not use sand.

SUN staff require storage for liquid chemicals. SUN requires the following space allocations for chemicals:

- One 6,500-gallon tank of liquid deice chemicals
- Two 3,000-gallon tanks of liquid deice chemicals

Based on these factors, approximately 400 square feet of chemical storage is required by the Airport and is AIP-eligible under current FAA guidance.

Office and Personnel Support Space

Although office and personnel support spaces are not eligible for FAA funding under current AIP guidelines, they are important to consider when determining facility needs. AC 150/5220-18A recommends that the building configuration include areas for administrative and operational functions such as training rooms. The existing personnel area in the SRE facility is approximately 178 square feet which includes an SRE/maintenance office and a unisex restroom. This does not include administration offices located in the north end of the building. The Airport does not require additional office and personnel support space to meet the existing and future needs of the Airport.

Additional Support Space

Lastly, the existing SRE facility contains approximately 278 square feet of space reserved for miscellaneous support functions including combustible liquid storage and a welding shop. While these spaces are not eligible for FAA funding under current AIP guidelines, they are important to consider when determining facility needs. Airport staff has indicated that the additional support space is sufficient for the existing and future needs of the Airport.

SRE Capacity Assessment Summary

SRE and maintenance space requirements are summarized in **Table 2-15**. The existing facility does not have adequate vehicle storage and the vehicle storage layout is inadequate to store all of the Airport's AIP-eligible SRE and attachments. Development of alternatives for SRE and maintenance space will seek to satisfy these requirements. Subsequent sections evaluate alternatives that provide additional space in the areas identified and more efficient vehicle storage and circulation.

Table 2-15: SRE and Maintenance Facility Space Requirements

Functional Area	Existing SF	Additional Required SF	Total Required SF	AIP Eligible
Vehicle Storage	4,680	29,285	33,965	Partially[1]
Vehicle Circulation	1,120	2,500	1,380	Yes[1]
Maintenance Shop and Wash Bay	572	0	572	Yes
Parts and Equipment Storage	117	1,000	1,117	No
Sand and Chemical Storage	0	400	400	Yes
Office and Personnel Support Space	178	0	178	No
Additional Support Space	278	0	278	No
Total	**6,945**	**33,185**	**36,510**	**-**

Source: Airport Staff; Mead & Hunt, 2021.
Notes:
[1] Eligibility of specific vehicle storage and circulation spaces would be dependent on the building design and space may not be eligible for storing large vehicles with attachments on the vehicle.
SF = Square Feet

2.6. Terminal Complex Capacity Summary

This capacity analysis has determined that nearly all functional components in the terminal building and surrounding area are not operating at an acceptable LOS. Achieving a highly functioning facility that adequately meets passenger demand will require renovation and expansion of the terminal. The Airport's immediate priorities for expansion are the ticket counters and airline ticket office space, baggage screening and outbound baggage make-up, passenger security screening checkpoint, and departures lounge. This near-term focus is appropriate, given how these areas affect four major departures processes. Airline and TSA staff must work within very limited spaces and delays in any one process has potential to cause flight delays.

With new instrument approach procedures reducing flight diversions, repurposing the bus lounge and adjacent spaces to other uses would allow the Airport to expand three departures processing components and raise LOS in the terminal. Addressing the departures lounge and baggage claim capacity constraints will also improve passenger

LOS and allow expansion of the flight schedule. Adding aircraft gates is a challenge and expanding vehicle parking expansion are challenges of greater magnitude and may require relocating hangars and other Airport structures and functions.

Alternatives for expanding SRE storage capacity may include construction of a new building near the existing Operations Center. Impacts to the adjacent upper-level terminal parking lot should be carefully considered before the size and location of this facility is finalized. Terminal building, parking, and SRE storage alternatives should also consider the need to relocate the air traffic control tower to the west side of the runway, several options for which were studied as part of the recent master plan update. Expansion of the terminal curb should also be considered, either directly along the present curb or by creating drive-through pickup and drop-off spaces in the parking lot.

Upgrading aircraft boarding operations by installing passenger boarding bridges would provide another LOS and safety improvement. Boarding bridges would affect existing ground service operations on the apron. Providing a covered walkway along the north face of the building may provide a near-term option until this project becomes viable.

Completing the departures process component projects will provide a better passenger experience, as will the building's updated interior design. The Airport will then be able to move forward with addressing other issues, particularly those that involve growing the Airport and its ability to bring more visitors to the Valley while maintaining a high LOS and value to its local population.