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APPENDIX B

Purpose & Need and Alternatives Supporting Information

Purpose and Need Technical Report

Sustainable Airport Master Plan – Near-Term Projects

Purpose and Need Technical Report

June 2024

PREPARED FOR
Port of Seattle

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1. Purpose & Need

This technical report provides supplemental information used in the development of the Purpose and Need. The "need" is defined as the problem being addressed and describes the "purpose" that the Port of Seattle (Port) is trying to achieve.

1.1 Purpose and Need Statement

The purpose and need for the Proposed Action is to accommodate 56 MAP (million annual passengers) at an optimal level of service and projected cargo levels; provide airfield infrastructure that meets current Federal Aviation Administration (FAA) airport design standards; enhance the efficiency of the overall taxiway layout; and to meet projected fuel storage demand including sustainable aviation fuel (SAF) initiatives. While the Near-Term Projects were designed to accommodate 56 MAP at an optimal level of service (LOS), the Constrained Operating Growth Scenario shows a higher passenger demand. The Port acknowledges passenger levels above 56 MAP would be served at a lower LOS.

1.2 Needs

The Proposed Action addresses five independent needs that affect the future ability of Seattle-Tacoma International Airport (SEA) to maintain its essential function as the primary commercial airport in the Pacific Northwest. The five needs are:

1. Insufficient passenger processing facilities and gates to accommodate 56 MAP at an optimal LOS[1]
2. Insufficient facilities to accommodate projected cargo levels
3. Portions of the airfield no longer meet current FAA airport design standards
4. Inefficient/inadequate taxiway layout
5. Lack of fuel storage to meet projected demand and the Port's SAF initiative

1.2.1 Insufficient Passenger Processing Facilities and Gates to Accommodate 56 MAP at an Optimal Level of Service (LOS)

For the purposes of this analysis, the passenger processing facility needs were grouped into two areas:

A. Passenger terminal facilities and gates
B. Ground access and automobile parking facilities

After carefully considering the financial capacity of the Port, the airfield/airspace constraints, and the time it would take to construct passenger processing facilities, it was determined that the appropriate level of demand to plan for is 56 MAP and approximately 480,000 annual operations. This level of activity is reasonably foreseeable and can be accommodated at SEA without further study of airfield or airspace changes.[2] While the Near-Term Projects (NTPs) were designed to accommodate 56 MAP at an optimal LOS, the Constrained Operating Growth Scenario shows a higher passenger demand in 2032. However, the Port acknowledges passenger levels above 56 MAP would be served at a lower LOS. The remainder of this section discusses the specific needs that are derived from the forecasted 56 MAP.

[1] See explanation of "optimal (optimum) level of service" in Advanced Planning Terminal Needs Assessment.
[2] SAMP Technical Memorandum No. 7, Facilities Implementation and Financial Feasibility. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-no-7-facilities-implementation/

1.2.1.1 Passenger Terminal Facilities and Gates

Passenger terminal facilities aid in moving passengers and their bags between the front door of the terminal and the aircraft. The size, location, and orientation of the various elements of an airport's passenger terminal facilities determine the efficiency of the process for passengers (customer experience), as well as the functional passenger handling capability of the facility. The following three elements are critical to the efficiency and function of an airport's passenger terminal facilities:[3]

1) Passenger check-in facilities
2) Security screening checkpoints
3) Aircraft parking positions (gates)

Table 1 summarizes the existing facilities for the three elements, and what would be needed to support 56 MAP. Evaluations of these elements examined both the functional space available and the LOS for passengers using the facility. LOS, in this context, is a qualitative measure used to represent the overall quality of service a passenger experiences at an airport. The existing facilities information, presented in Table 1, was calculated in the Sustainable Airport Master Plan (SAMP) for 2014 conditions, updated in 2019 to include significant changes in technologies and operating practices for terminal check-in and security screening area requirements that significantly changed since 2014, and validated in 2022 to ensure it accurately reflects current conditions.

LOS parameters and ranking systems vary; for passenger terminal facilities, the Port utilized the LOS standards developed by the International Air Transport Association (IATA). The IATA LOS standards are widely considered the industry benchmark for passenger terminal facilities and are utilized by major airports throughout the world. The IATA LOS standards are based on three key performance indicators: space per passenger, maximum waiting times, and occupancy (relating to boarding gates only).

Using the IATA standards, "optimal" LOS for passenger facilities is defined as that which provides sufficient space/systems to accommodate necessary functions in a comfortable environment, while providing stable passenger flows with acceptable waiting times.[4] When passenger facilities reach "sub-optimal" LOS passengers begin to experience crowding and long lines as they attempt to check-in, drop bags, and move through security. These standards are established for an individual passenger's typical experience. Peak travel days may result in higher wait times, but those should be notable exceptions to satisfy this standard. The Port is planning to provide an optimal LOS for 56 MAP.

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[3] In addition to the three primary elements there are associated infrastructure and utility needs.
[4] IATA & Airports Council International (ACI) Improved Level of Service Concept, 2017.

TABLE 1: PASSENGER TERMINAL FACILITY NEEDS (56 MAP)

Passenger Terminal Facility Element	Existing	Required	Additional Needed
Passenger Check-in			
Check-in Lobby			
Kiosk "No Bag" Check Positions	40	82	42
Agent "With Bag" Check Positions	214	229	15
Garage Kiosk Positions	15	11	-4[2]
Curb Kiosk Positions	15	16	1
Total Check-in Positions[1]	284	338	54
Square Footage[3]	37,700	66,200	28,500
Security Screening Checkpoints			
Number of Screening Lanes[1]	31	37	6
Square Footage[3]	45,400	80,500	35,100
Aircraft Parking Positions			
Aircraft Boarding Gates[4]	88	107	19
Remote Parking Positions[5]	34	35	1

1 Numbers of check-in positions and security screening were calculated in the SAMP in 2014 and are included in this table to provide a complete record of analysis.
2 The four kiosks would be removed.
3 Check-in hall square footage estimates were calculated using the Advanced Planning Terminal Needs Assessment data and were based on ACRP 25 and IATA Airport Development Reference Manual (11th Edition) design standards. Advanced Planning analysis supersedes the SAMP planning analysis for terminal check-in and security screening area requirements as technologies and operating practices have changed significantly since 2014. This report used the SAMP unconstrained forecasts when determining the requirement needs at 56 MAP.
4 The existing terminal ramp can accommodate a range of aircraft as illustrated on Exhibits 3 and 4. The 88 aircraft boarding gates represent the baseline condition for analysis. Passenger aircraft gates also require interior holdroom and circulation space to allow for passenger waiting, boarding, and access. The holdroom space requirement for 19 additional narrowbody equivalent gates would range from approximately 56,000 square feet up to 69,000 square feet. Likewise, the circulation space requirement would range from approximately 43,000 square feet up to 86,000 square feet.
5 While remote aircraft parking positions in cargo areas are primarily used for cargo freighter operations, they are often used for Remain Overnight (RON) parking of passenger aircraft. To provide a conservative estimate of existing remote parking positions, this table includes only those off-gate aircraft parking positions that are either dedicated exclusively to RON use or are within airline aircraft maintenance and belly cargo facility lease areas also available for RON.
Sources: SAMP Technical Memorandum No. 5 (available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-no-5-facility-requirements/), Facility Requirements; Advanced Planning Terminal Needs Assessment, Port of Seattle, 2019; ACRP 25 (available for review at: https://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_025v1.pdf).

1) Passenger Check-in Facilities

The main terminal has a check-in hall that offers passengers access to airline agents and ticketing kiosks to drop-off luggage and print boarding passes. IATA defines optimal LOS for a check-in hall as one that provides wait times of no more than 5 minutes for self-service check-in and between 10 to 20 minutes when using a staffed check-in counter. Optimal LOS provides enough space to keep queuing passengers in their designated areas.[5] As shown in Table 1, existing passenger check-in areas do not provide the necessary check-in kiosks nor the amount of space for proper circulation around the kiosks. Not meeting these standards results in long lines of passengers extending into and blocking passenger

5 IATA Airport Development Reference Manual (11th Edition).

circulation areas during peak periods, which is expected to worsen as SEA approaches 56 MAP. **Exhibit 1** shows an example of the check-in facilities in 2015 during times of sub-optimal LOS.

EXHIBIT 1, CHECK-IN FACILITIES WITH SUB-OPTIMAL LOS

Source: Port of Seattle

The SAMP analysis determined that an additional 54 check-in positions would be needed to accommodate 56 MAP and meet the IATA optimal LOS standard. The Port has conducted additional advanced planning since SAMP in an effort to optimize the existing main terminal check-in hall, which concluded that the check-in facilities were undersized for the 2022 level of activity and performed at an "under-provided" LOS.[6] Forecast growth would make this situation even less acceptable with longer lines and increasing passenger bottlenecks in the terminal. The Port's advanced planning analysis of check-in space reconfirmed the need for additional check-in area, finding that a total of approximately 66,200 square feet of space (an increase of about 28,500 square feet) would be needed to provide an optimal LOS at 56 MAP.

2) Security Screening Checkpoints

After leaving the check-in hall, passengers move to the security screening area. Based on IATA standards, optimal LOS for security screening checkpoints would provide a 10-minute maximum wait in queue[7] for passengers and would provide enough space to accommodate security screening functions without impeding other terminal uses. During peak periods in 2022, there were not enough security screening areas, and the size of the screening areas were too small to handle peak passenger volumes. With longer wait times, the passenger lines/queues spilled out into passenger circulation areas behind the ticket counters and severely restricted access to the checkpoints, food, beverages, concessions, and vertical circulation corridors (such as stairs and escalators). **Exhibit 2** shows an image of the security screening facilities in 2018 during times of sub-optimal LOS.

[6] For public departure and arrivals halls, LOS Under-Provided results when the space per occupant is 80% or less than the targeted optimum LOS parameter. - IATA Airport Development Reference Manual (11th Edition).
[7] IATA & Airports Council International (ACI) Improved Level of Service Concept, 2017.

EXHIBIT 2, SECURITY SCREENING FACILITIES WITH SUB-OPTIMAL LOS

Source: Port of Seattle

The SAMP analysis determined that SEA would need an additional six screening lanes to accommodate 56 MAP at an optimal LOS. As passenger growth occurs in the future, the limited size of the security screening areas is expected to cause further congestion, thereby increasing passenger processing times and encroaching on passenger circulation areas, which restricts access to other passenger facilities and concession areas.

Security screening technology is rapidly evolving, with some of the newer systems requiring more square footage within the terminal but fewer total lanes due to more efficient screening. The Port's advanced planning of security screening found that approximately 80,500 total square feet of space (an additional 35,100 square feet) would be needed to maintain an optimal LOS with the next generation of security screening systems that would be installed as part of the project.

3) Aircraft Parking Positions (Gates)

After passing through security, passengers make their way to their boarding gate. There are two types of aircraft parking positions where passengers may board an aircraft: (1) aircraft boarding gates, which are either ground loaded or have a jet bridge connection to allow passengers to board and deplane the aircraft at the terminal concourses and (2) remote parking positions, which are located away from the terminal and requires busing of passengers to the airplane.

Exhibit 3 and **Exhibit 4** illustrate the maximum and minimum number of aircraft parking positions at the aircraft boarding gates under the SAMP baseline condition.[8] As illustrated in these exhibits, the baseline aircraft boarding gates have the flexibility to accommodate a range of aircraft types (or sizes)

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[8] Using information available as of July 2019 (validated in 2022), the baseline condition includes anticipated striping for aircraft parking positions following completion of the previously approved International Arrivals Facility and the North Satellite Redevelopment program. The existing 15 remote parking positions are also included in the baseline condition.

within the terminal ramp area. The existing terminal ramp area is limited and constrained by adjacent facilities, taxilanes, and taxiways. Additionally, adjacent aircraft parking positions can be affected by the type and size of aircraft being parked at a gate (i.e., the narrowbody equivalent of a widebody aircraft is two, because the widebody aircraft require approximately the same length of ramp frontage as two narrowbody aircraft). Given these constraints, existing aircraft boarding gates cannot accommodate the forecast future year, peak demand.

The gate allocation analysis used for the SAMP is an industry-standard approach to determining gate requirements. Scheduled flights for the design day are assigned gates based on various factors, including gate compatibility with aircraft type, rules governing sharing of gates among airlines, and buffer times between gating operations. The objective is to provide every aircraft that requires a gate for enplaning or deplaning passengers, an aircraft boarding gate at the scheduled time.

Actual aircraft arrival and departure times can vary considerably from scheduled arrival and departure times; often due to inclement weather, aircraft maintenance, or airfield congestion. Schedule disruptions occur on a routine basis at congested international airports such as SEA, and the Port desires to minimize the impact of these disruptions, thereby improving the customer experience. Industry guidance recommends adding buffer time or spare gates to accommodate disrupted schedules.[9] Gate buffers enhance gate availability when schedule deviations occur. Insufficient gate availability negatively impacts customer LOS. For example, arriving passengers on a flight without an available gate are forced to wait on the aircraft until a gate is available.

Departing passengers are also impacted when gate availability is insufficient to accommodate increased activity and schedule disruptions. SEA is one of 27 large, high density U.S. airports slated to be subject to FAA surface metering procedures in the near-term.[10] As activity increases, these procedures require aircraft to hold at their gates for increased periods of time to manage airfield congestion and maintain efficient movement of aircraft. Holdrooms become overly crowded when aircraft boarding is delayed, and additional passengers arrive for subsequent flights.

In accordance with industry recommended best practices, the SAMP analysis used standard buffer times for domestic flights and analyzed historical departure and arrival distributions to determine appropriate earliness and lateness buffers for long-haul international flights. Larger buffers for long-haul international flights are necessary to ensure gate availability as disrupted schedules are common at

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[9] ACRP Research Report 163, p. 57-60, advises the following regarding spare gates or longer buffers: "Buffer times and spare gates are intended to address the same issue: to provide additional gate capacity in case flight schedules are disrupted and off-schedule flights result in a higher demand for gates than anticipated under the original schedule. Therefore, it is not realistic to be too generous or too conservative with both buffer times and spare gates. If an airline has long buffer times, it can operate with fewer spare gates. If it has short buffer times, more spare gates will be required." In addition, "[s]ome airlines, especially those that operate connecting hubs, lease spare gates to accommodate disrupted schedules...There are no general rules regarding the need for spare gates [but spare gates have historically ranged from 2-7%] of gates at large-hub airports....However, instead of designating certain gates as unscheduled spare gates, airlines are now more likely to schedule all gates, but with some additional buffer time to better accommodate irregular operations." Ultimately, factors to consider in determining gate requirements include "the effect of weather, the need to add more buffers between flights if the schedule is tight, and the availability of common-use or other gates on a per-use basis to accommodate peaks." Available on-line: https://nap.nationalacademies.org/read/23692/chapter/8#57

[10] https://www.faa.gov/air_traffic/technology/tfdm/implementation/ SEA is scheduled for Terminal Flight Data Manager (TFDM) full functionality, including surface metering, by October 2024. The implementation dates are as of October 2022 and include COVID-19 impacts to the program deployment schedule.

congested, international airports such as SEA.[11] SAMP gate allocation analysis determined the peak demand for terminal ramp area and the corresponding mix of aircraft types for the planning activity levels that correspond to 2019 (45 MAP), 2024 (52 MAP), 2029 (59 MAP), and 2034 (66 MAP).[12] The 105 aircraft parking positions required at the peak for 56 MAP (21 regional jet positions, 51 narrowbody positions, 11 larger narrowbody/widebody positions, and 22 widebody positions) were derived from an interpolation between the requirements for 52 MAP and 59 MAP. The aircraft boarding gates under the SAMP baseline condition can accommodate 88 of these aircraft parking positions as illustrated in **Exhibit 5**. The remaining 17 aircraft would need to be accommodated at new aircraft boarding gates. As shown in Table 1 and on Exhibit 5, these 17 additional aircraft include two widebody aircraft, which require the same space as four narrowbody aircraft, resulting in a need for a total of 19 additional narrowbody equivalent gates.

Passenger aircraft gates also require interior holdroom and circulation space to allow for passenger waiting, boarding, and access. Holdrooms typically include seating and standing areas, airline agent gate podiums, boarding/deplaning queuing spaces, and access/egress aisleways to and from the gate. IATA standards indicate that holdroom space requirements per narrowbody gate range from 2,970 square feet up to 3,620 square feet, depending on the exact configuration.[13] Circulation spaces provide access between holdrooms and other terminal functions, such as moving walkways and wide corridors for walking. IATA standards indicate that circulation space requirements per narrowbody gate range from 2,250 square feet up to 4,500 square feet, depending on the concourse configuration and length.[14] The holdroom space requirement for 19 additional narrowbody equivalent gates would range from approximately 56,000 square feet up to 69,000 square feet. Likewise, the circulation space requirement would range from approximately 43,000 square feet up to 86,000 square feet.[15]

There are currently 15 remote aircraft parking positions that are used for Remain Overnight (RON) passenger aircraft parking, holding aircraft waiting for a gate, and in some cases remote boarding and deplaning of passengers. There are an additional 19 remote aircraft parking positions within airline exclusive lease areas that are also available for RON use (for a total of 34 existing RON positions). SAMP gate allocation modeling determined that 35 remote parking positions would be needed to accommodate RON aircraft at 56 MAP. With the SAMP NTPs, 10 of these existing 34 remote aircraft positions would be eliminated and 11 new positions added for a new total of 35 remote aircraft positions available to RON aircraft.

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[11] ACRP Research Report 163, p. 59, explains that “disrupted schedules are more likely at highly congested airports, and increased buffer times will be more appropriate in those instances.” In addition, “[l]ong-haul flights, because of head-winds and other contingencies, tend to have more unpredictable arrival times than short-haul flights and may, therefore, warrant a longer buffer time.” Available on-line: https://nap.nationalacademies.org/read/23692/chapter/8#59

[12] SAMP Technical Memorandum No. 5, Facility Requirements, Appendix B, Gate Requirements Summary. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-no-5-facility-requirements/

[13] IATA 11th edition requirements for holdroom space were calculated using a range for seated and standing passengers to achieve an optimum LOS.

[14] IATA 11th edition requirements for circulation space differ for single loaded gates (gates on one side) vs double loaded (gates on both sides), and if moving walkways are provided.

[15] Advanced Planning Terminal Needs Assessment, Port of Seattle, 2019.

EXHIBIT 3, AIRCRAFT GATE LAYOUT (MINIMUM AIRCRAFT MIX)

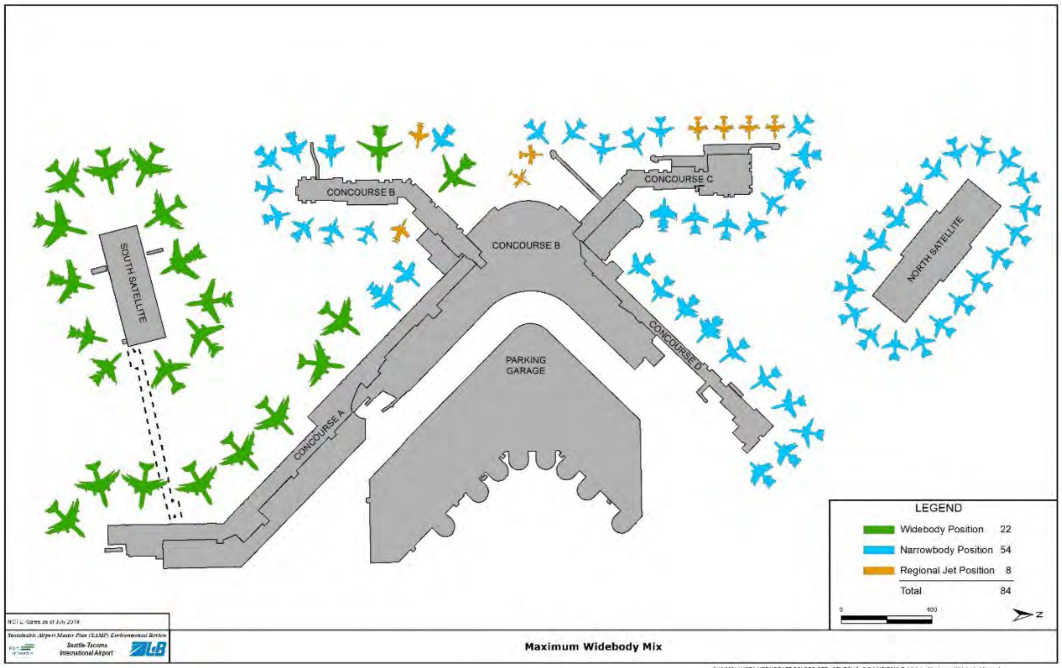


EXHIBIT 4, AIRCRAFT GATE LAYOUT (MAXIMUM AIRCRAFT MIX)

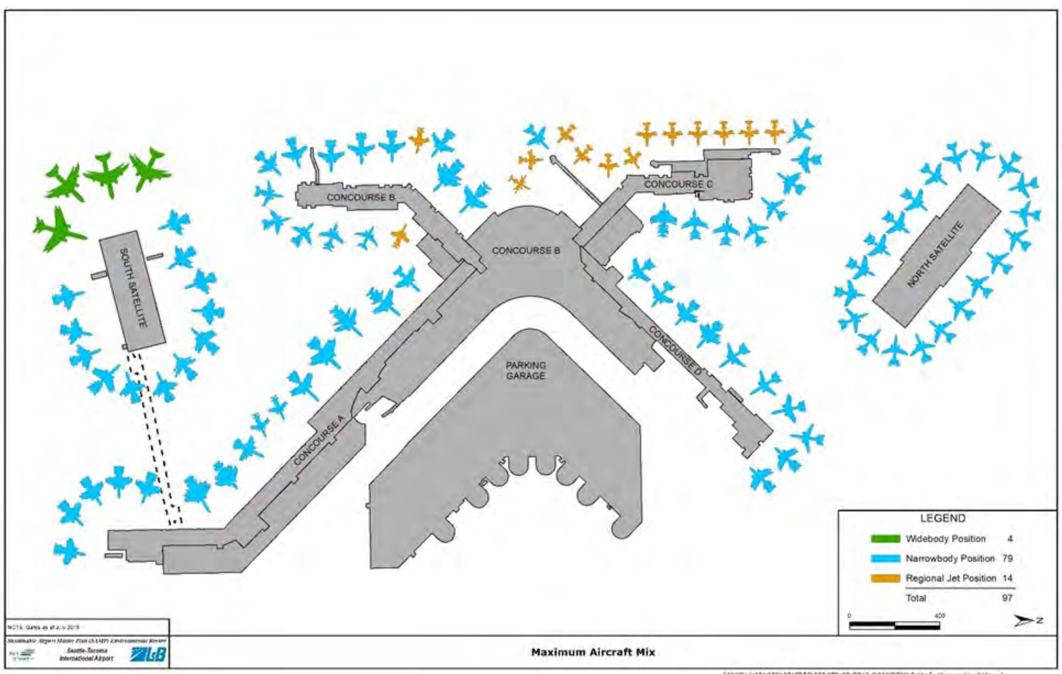
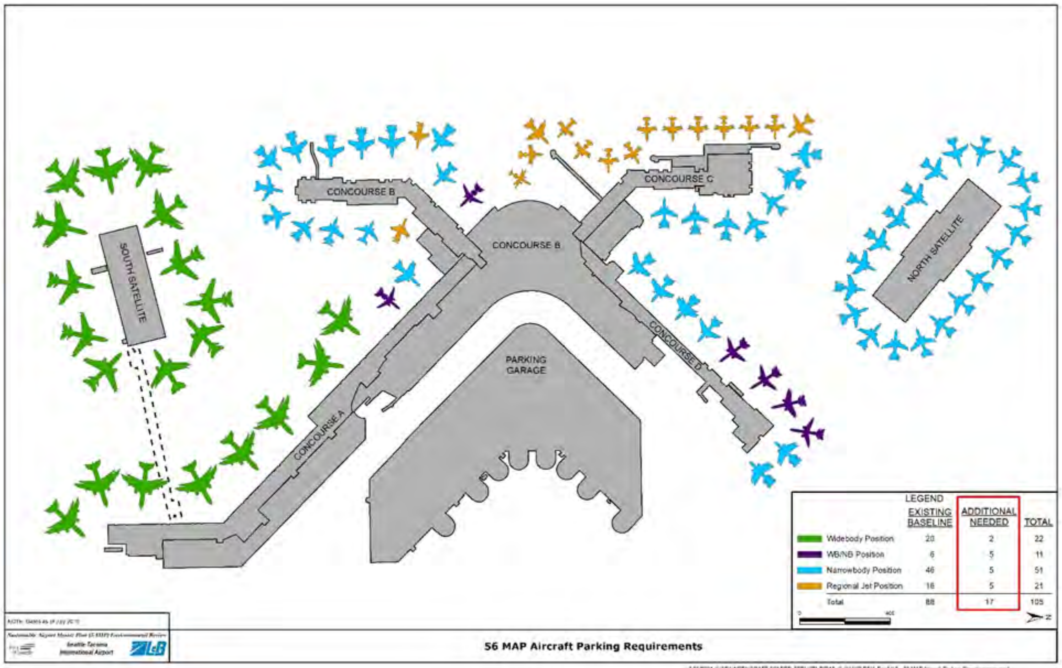


EXHIBIT 5, AIRCRAFT GATE LAYOUT (56 MAP AIRCRAFT PARKING REQUIREMENTS)



1.2.1.2 Automobile Parking and Ground Access Facilities

Parking and ground access facilities provide the means for passengers and employees to access an airport and, if necessary, to park their vehicles. These include public and employee parking; facilities to serve general transportation needs (such as charter buses, taxis, and transportation network companies [e.g. Uber, Lyft and Wingz]); roadway networks; and curbside access. The size, location, and orientation of the various elements of these facilities are important to the ability of an airport to provide the necessary access. The following three elements are critical in evaluating the efficiency and capacity of an airport's parking and ground access facilities, and were specifically addressed in the development of the Proposed Action:

1) Public parking facilities for passengers
2) Employee parking facilities
3) Curbfronts in the departures and arrivals areas for dropping off and picking up passengers

Table 2 summarizes the existing parking and ground access facility elements and the future requirement at 56 MAP. Evaluations of these elements involved comparing the functional space available against the 56 MAP requirement to determine the estimated need, and the LOS these facilities would provide.

TABLE 2: PARKING AND GROUND ACCESS NEEDS (56 MAP)

Parking and Ground Access Element	Existing[1]	Required	Additional Needed
Parking			
Passenger Stalls	13,720[2]	12,440	-
Employee Stalls[3]	4,870	6,250	1,380
Curbside Roadways (linear feet)			
Departure Curb (upper drive)	1,200	1,300	100
Arrival Curb (lower drive)	1,630	2,250	620
Curbside Roadways (number of lanes)			
Departure Curb (upper drive)	4	4	-
Arrival Curb (lower drive)	5	6	1

1 Existing is the year 2022 unless otherwise noted.
2 Total includes the Main Garage (12,100 spaces) and the Doug Fox Parking Lot (1,620 spaces).
3 Total existing includes employee parking at the terminal garage (15% of total) and the remote North Employee Parking Lot (NEPL) (85% of total). Requirements assume a continuation of the same split between terminal garage and NEPL parking.
Source: Analysis of SAMP Technical Memorandum No. 5, Facility Requirements (available for review at: https://www.portseattle.org/plans/sustainable-airport-master-plan-samp)

1) Public Parking Facilities for Passengers

The availability of public parking is an important component of the overall passenger experience. When parking facilities are at or near capacity, it can be difficult and time consuming to find available parking, often creating bottlenecks within the parking areas and access roads and can generate additional trips on adjacent roads when drivers are forced to exit the facilities to search for off-airport parking options.

There are currently two on-airport parking facilities for passengers (see **Exhibit 6**), and a large number of privately owned off-airport parking lots used by passengers. The largest on-airport lot is the Main Garage located adjacent to the terminal, which is owned and operated by the Port. This garage offers approximately 12,100 parking spots; the exact number varies based on different uses of garage space and parking configurations.[16] The second on-airport parking facility for passengers is the Doug Fox Lot. While this lot is on-Airport-owned land, it is operated by a private parking operator. It has 1,620 parking spots with shuttle access to the main terminal. Combined, the Main Garage and Doug Fox Lot provide 13,720 on-airport parking spaces. SEA also has a cell phone lot where drivers may park free for 20 minutes while awaiting the arrival of airline passengers. The cell phone lot has approximately 200 spaces.

The SAMP analysis indicated that 12,440 public parking stalls would be required to accommodate the need associated with 56 MAP, resulting in a surplus of 1,280 spaces. However, several preliminary alternatives would require the removal of the Doug Fox Lot for new terminal facilities, meaning that those parking spaces would no longer be available. If the Port proceeds with any of these alternatives, an additional 340 public parking spaces would be required to meet the projected demand.[17]

[16] Port of Seattle website: https://www.airportprojects.net/sampenvironmentalreview/parking-at-sea-airport/.
[17] The projected 340-space need results from the 1,280-space surplus combined with the loss of the 1,620-space Doug Fox Lot.

EXHIBIT 6, AIRPORT PARKING FACILITIES

2) Employee Parking Facilities

Terminal employee parking is provided on Level 1 of the Main Garage and at the North Employee Parking Lot (NEPL). The two parking facilities allocate approximately 4,870 parking spaces for employee parking, with 750 in the Main Garage and 4,120 in the NEPL. The Port provides shuttle service between the NEPL and the parking garage service tunnel. The SAMP analysis determined that at least an additional 1,380 employee parking spaces would be needed to accommodate future employee parking demand (180 additional terminal garage parking and 1,200 additional remote parking spaces), assuming current mode choice and vehicle occupancy levels remain the same. Failure to provide sufficient employee parking would make it increasingly difficult for employees to find on-airport parking, which would likely result in employees utilizing off-airport parking lots, parking on local streets, and/or utilizing mass transit options. These options could result in higher costs to employees and/or impacts on nearby streets.

3) Curbfronts in the Departures and Arrivals Areas

For passengers not parking in the parking garage or using public transportation, the curbfront (i.e., the area available for vehicles to stop to drop-off or pick-up passengers) is where they enter or leave the terminal. The primary elements that determine the efficiency of the curbfront operation are the available length of the curbfront for departing and arriving passengers, as well as the number of lanes available for drop-off, pick-up, and bypass of the curbfront. The curbfront is divided into two areas, one for the departing passengers (upper level road) and one for the arriving passengers (lower level road). During peak periods, the curbfronts become congested, causing delays for passengers being dropped off or picked up as well as vehicles accessing the parking garage and entering SEA on the NAE.

Using the Transportation Research Board Highway Capacity Manual standards, LOS at an airport curbside roadway is defined by the ability of a motorist to freely enter and exit the curbside space of their choice (for example, a space located closest to the relevant airline for departure) and is based on specific traffic flow times. LOS ranges from A to F, with A representing a free flow condition (with no interference from other vehicles or pedestrians), and F representing a breakdown in traffic flow with demand volumes greater than capacity.

For the SAMP, the Port selected LOS C as the goal, as it represents a stable condition and good overall service to passengers but still balances cost with passenger expectations. LOS on curbside roadways is estimated separately for through traffic and for curbside loading and unloading traffic, but the overall LOS is governed by the poorer of the two components.[18] In 2018 the arrival and departure curbfronts both experienced an overall LOS of F during the peak hour.[19] Passenger demand in 2022 was approximately two percent below 2018 levels. Therefore, as passenger demand returns from COVID, the demand for access to the curbfronts will grow, causing even more congestion and delays.

SAMP analysis determined that at least an additional 100-linear feet of departure curb, 620-linear feet of arrival curb, and one additional lane on the arrival curb would be needed to maintain LOS C for future 56 MAP demand levels. Failure to make the necessary improvements to the arrival and departure curbsides would result in an increasingly poor customer experience and would result in additional driving and idling time for vehicles using the curbside roadways.

1.2.2 Insufficient Facilities to Accommodate Projected Cargo Levels

Air cargo facilities at SEA are located to the north and south of the terminal area with approximately 411,600 square feet of cargo warehousing space spread across several buildings.[20] Total ground lease area designated for cargo tenants is approximately 2.6-million square feet (59.6 acres). Within these locations are hardstands designated as Cargo 1 to Cargo 7, with a combined capacity for 18 to 20 cargo aircraft.[21] Cargo aircraft currently park on four of these seven ramp areas, designated as Cargo 2, 3, 4, and 6 (all located north of the terminal area). Cargo 1, 5, and 7 are not currently used by cargo aircraft. Cargo 1 is used primarily for equipment storage and Cargo 5 is used primarily for RON parking for passenger aircraft and remote boarding and deplaning of passengers.[22] Cargo 7 is used primarily for RON, de-icing, and remote boarding and deplaning of passengers. **Exhibit 7, *Existing Cargo Facilities***, depicts the location of the existing cargo facilities and **Table 3** summarizes the cargo requirements for 2032 conditions.

TABLE 3: CARGO AIRCRAFT PARKING POSITION AND WAREHOUSING REQUIREMENTS

Cargo Facilities	Existing	2032 Required	Additional Needed
Cargo Aircraft Parking Positions	18-20[23]	22	2-4
Cargo Warehousing (square feet)	411,600	707,700	296,100

Source: Air Cargo Growth Potential and Facility Requirements Assessment – Final Report, pg. 24, 2018, Port of Seattle Analysis using 2023 Updated Forecast.

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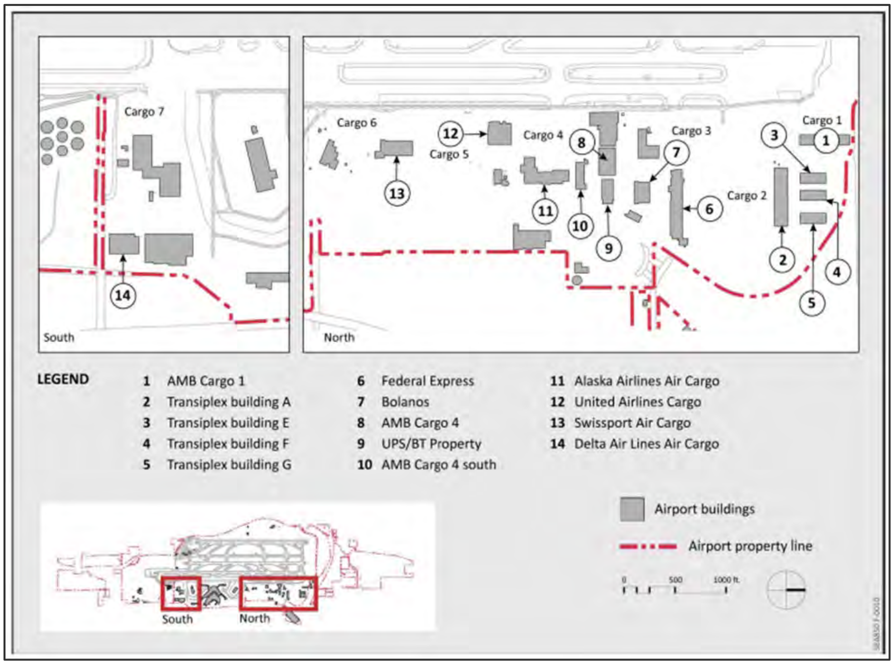
[18] SAMP Technical Memorandum No. 5, Facility Requirements, page 4-36. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-no-5-facility-requirements/.
[19] Port of Seattle, Landside Level of Service Analysis, Arrival and Departure Curbside and Roadway LOS (2019).
[20] Air Cargo Growth Potential and Facility Requirements Assessment – Final Report, SEA-TAC Cargo Forecast, pg. 24, 2018.
[21] Information provided by the Port of Seattle.
[22] RON refers to aircraft that are parked at the airport overnight.
[23] As stated in the text above, Cargo 1 hardstand is currently used primarily for equipment storage. The Port has striping plans that demonstrate the ability to accommodate two additional B767 freighter parking positions for a potential existing total of 20 cargo aircraft parking positions.

The existing cargo facilities at SEA are approaching their capacity limits as demonstrated by the warehouse utilization and facility requirements calculated in the Air Cargo Growth Potential and Facility Requirements Assessment – Final Report. Failure to address this need would result in the continuation of inefficient cargo operations and potential traffic delays. Cargo circulation areas are also lacking, reducing the ability of cargo trucks to move efficiently throughout the cargo areas.

EXHIBIT 7, EXISTING CARGO FACILITIES



Source: SAMP Technical Memorandum No. 2, Inventory of Existing Conditions (available for review at: https://www.portseattle.org/plans/sustainable-airport-master-plan-samp)

An updated cargo tonnage forecast was prepared for SEA to reflect future market conditions. This forecast predicts continued strong growth in terms of the amount of cargo tonnage passing through SEA in the future. Demand is growing because of the increase in e-commerce, which requires time-sensitive deliveries. The growth in passenger aircraft, which can accommodate cargo in the belly of the aircraft, also provides a greater capability for cargo to flow to and from SEA. In 2022, over 456,000 metric tons of cargo were processed. Future cargo demand is projected to increase to approximately 644,400 metric tons by 2032.[24]

[24] Aviation Activity Forecast Update, Seattle-Tacoma International Airport, Table 5, September 2023 (included in Appendix A).

This increase in cargo tonnage and cargo aircraft operations would require additional cargo aircraft parking positions and warehousing. Based on the ratio of increased cargo operations to cargo parking positions currently at SEA, up to 22 cargo parking positions (an increase of up to four) would be needed to accommodate the 2032 level of cargo demand.[25] The 2032 projected cargo tonnage would also require approximately 707,700 square feet of total cargo warehousing space (an increase of 296,100 square feet).[26] Therefore, to meet the projected cargo demand, the development of new cargo handling facilities would be required.

1.2.3 Portions of the Airfield No Longer Meet Current FAA Airport Design Standards

As part of the SAMP, the Port evaluated the airfield to identify areas where the facilities do not meet current FAA guidance and requirements. The Port identified three areas where improvements were recommended for the near-term.

1.2.3.1 Non-Standard Runway 16R/34L Blast Pads

A runway blast pad is a surface at the end of a runway that provides erosion protection from aircraft jet blast. According to FAA Advisory Circular (AC) 150/5300-13B, Airport Design, standard blast pads for Runway 16R/34L should be 220 feet by 400 feet to comply with runway design standards for the aircraft operating at SEA.[27] Currently the blast pads on the ends of Runway 16R/34L are 200 feet by 200 feet, which complied with the requirements in place when constructed. Therefore, the blast pads on both ends of Runway 16R/34L need to be expanded to meet current FAA standards.

1.2.3.2 Taxiway Geometry

FAA AC 150/5300-13B, Airport Design, Chapter 4, provides updated guidance for taxiway design. Section 4.3.3 of the AC discusses a three path concept (formerly known as the three-node concept) for taxiway intersections in order to increase pilot situational awareness at complex intersections by limiting a pilot to no more than three choices. Currently the intersection of Taxiway A with Taxiways C and D near the Runway 16L threshold does not adhere to this requirement. **Exhibit 8, *Taxiway Geometry – Three Path Concept***, depicts these issues on the airfield. The additional pavement north of Taxiway C can reduce situational awareness as it does not align with the rest of the airfield. Therefore, this intersection needs to be reconfigured to meet current standards.

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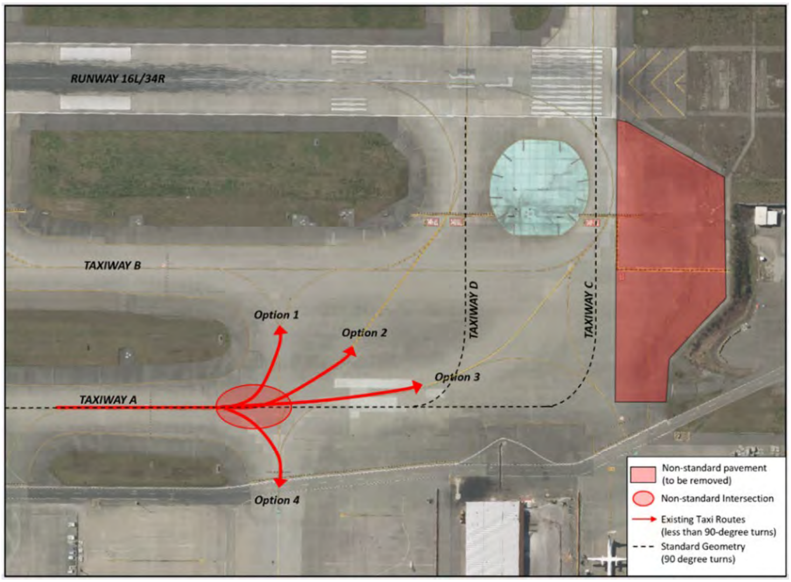
[25] Aviation Activity Forecast Update, September 2023, Table 6, cargo aircraft operations are forecast to increase by approximately 24% from 2022 (14,851 operations) to 2032 (18,557 operations). A corresponding 24% increased need for cargo parking positions from 18 positions in 2022 results in a need for up to 22 positions in 2032.
[26] Cargo warehousing space requirements were calculated using Operating Concept #1 as described in SAMP Technical Memorandum No. 5, Facility Requirements, page 5-7. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-no-5-facility-requirements/.
[27] FAA AC 150/5300-13B, Airport Design, Appendix G, Table G-11. Runway Design Standards Matrix, C/D/E – V, 2022.

EXHIBIT 8, TAXIWAY GEOMETRY – THREE PATH CONCEPT



1.2.3.3 Taxiway B Separation to Runway 16L/34R

The FAA has established standard dimensions for airfield components based on the type of aircraft that operate at an airport. At SEA, the required separation between the Runway 16L/34R centerline and Taxiway B centerline is 500 feet, to meet applicable design standards when aircraft are approaching the runway in certain visibility conditions.[28] Currently, Taxiway B, which is the parallel taxiway immediately east of Runway 16L/34R, has 400 feet of separation from the Runway, and operates under a FAA approved Modification of Standards (MOS). The MOS was issued as larger aircraft began using SEA on a more regular basis. This MOS addresses occurrences when the larger aircraft are taxiing on Taxiway B and another similar sized aircraft is landing on Runway 16L/34R. Under the existing MOS, the taxiing aircraft is held until the arriving aircraft has landed to maintain required separations. Based on the terms of this MOS, any future improvements along Taxiway B must be built to full FAA standards. The Proposed Action include improvements to the north end of Taxiway B (see Non-Standard Taxiway Geometry, above) and on the south end of Taxiway B (see Section 1.2.4.1, South End of Runway 16L/34R). Therefore, the runway to taxiway separation of Taxiway B within the area of proposed improvements needs to comply with the 500 feet separation distance.

1.2.4 Inefficient/Inadequate Taxiway Layout

The SAMP analysis identified several areas on the airfield where the lack of taxiways or inadequate aircraft holding areas result in inefficient operations that can contribute to aircraft delays.

[28] FAA AC 150/5300-13B, Airport Design, Appendix G, Table G-12. Runway Design Standards Matrix, C/D/E – VI, 2022.

1.2.4.1 South End of Runway 16L/34R

Currently, a single taxiway (Taxiway B) serves the south end of Runway 16L/34R, which results in a long line of aircraft queuing on Taxiway B during peak departure periods in north flow (departures on Runway 34R). Based on observations made during peak periods, the Port found that the line of aircraft regularly extends north of Taxiways Q and P, potentially delaying access to the terminal for arriving aircraft that need to cross the airfield.[29] This line of aircraft also prevents aircraft from accessing the gates in the southern portion of the terminal, which causes delay. Conditions become worse when an aircraft becomes disabled or is held on the taxiway and other aircraft in the queue are unable to pass the aircraft to access the runway end or terminal. In addition, aircraft in the queue that are issued a ground-hold and need to return to the terminal area are forced to wait in the departure queue and then taxi on the runway to loop back to the terminal. All of these issues combined make this taxiway layout inefficient and a contributor to airfield delays. As operations increase in the future, these problems are expected to worsen.

1.2.4.2 West of Runway 16C/34C

Currently, there is a need to provide a more efficient connection from the portion of the airfield west of the center runway (Runway 16C/34C) to the terminal area. During peak operating periods, the taxiways west of Runway 16C/34C become congested due to a lack of taxiways, holding areas, and taxiways crossing Runway 16C/34C, resulting in delays to taxiing aircraft. An aircraft landing on Runway 16R/34L takes approximately eight minutes to reach the terminal if there is no interference from other aircraft (referred to as the unimpeded taxi time). Observations made during peak periods found that arriving aircraft took an average of 24 minutes to reach the terminal from the point at which they left the runway due to the number of other aircraft waiting to travel to the terminal.[30]

1.2.5 Lack of Fuel Storage to Meet Projected Demand and the Port's Sustainable Aviation Fuel (SAF) Initiative

As part of the SAMP, the Port evaluated the Airport's fuel storage capacity to identify future fueling demand and needs. SEA's main fuel storage is located in a tank farm and is supplied by Olympic Pipeline Company. This fuel tank farm feeds SEA's underground hydrant fuel system. SEA's fuel storage system currently has a capacity to hold approximately 17-million-gallons of Jet A fuel. Based on average day peak month operations, the fuel farm has approximately seven days of fuel reserves.[31]

The Port considers less than seven days of fuel reserve to be unacceptable due to the potential for adverse impact to aircraft operations in cases of supply disruption. As a result, a range of future fuel storage requirements was calculated based on a fuel reserve of 7 to 10 days as well as the projected growth in aircraft and cargo operations to support the forecast cargo tonnage levels. The analysis shows that 22 to 31-million-gallons of fuel capacity would be needed in order to provide approximately 7 to 10 days of fuel reserve, respectively.

[29] Field observations were made from July 15 through 18, August 12 through 14 and August 27 through 30 of 2019 and April 17 through 21 of 2023. These lengthy taxi times observations are generally supported by available ASPM data for this period.
[30] Ibid.
[31] SAMP Technical Memorandum No. 5, Facility Requirements, page 6-2. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-no-5-facility-requirements/.

The Port has set a goal to power every flight fueled at SEA with at least 10 percent SAF by 2028,[32] which is accomplished by blending approved fuels from sustainable sources with traditional aviation fuel. In 2019, approximately 668-million-gallons of Jet A were dispensed.[33] The projected annual fuel usage for the activity levels served by the Proposed Action would be approximately 743-million-gallons.[34] To meet the 10 percent goal, the Port would need to allocate space for approximately 74.3 million gallons of Jet A to be formulated on-site from SAF sources, or it would need to enter the Olympic pipeline supply chain from off-airport locations.

These needs exceed the current capacity of the fuel storage system. The addition of new tanks and a staging area for fueling vehicles and equipment would be needed to meet future needs.

1.3 Purpose

Based on the various deficiencies (needs) discussed in the previous section, the purposes of the Proposed Action are to provide:

- Additional passenger processing facilities and gates to accommodate projected 56 MAP at an optimal LOS
- Additional cargo facilities to accommodate projected cargo demand
- Airfield infrastructure to meet current FAA airport design standards
- Improvements to enhance the efficiency of the overall taxiway layout
- Additional fuel storage facilities to meet projected demand and the Port's SAF initiative

[32] https://www.airportprojects.net/sampenvironmentalreview/sustainable-aviation-fuels/.
[33] Data provided by the Port, August 2020.
[34] Based on the same ratio of fuel used per operation, with 501,400 annual operations.

APPENDIX B

Purpose & Need and Alternatives Supporting Information

Alternatives Technical Report

Sustainable Airport Master Plan – Near-Term Projects

Alternatives Evaluation Technical Report

June 2024

PREPARED FOR

Port of Seattle

PREPARED BY

Landrum & Brown, Incorporated

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1. Alternatives Evaluation Information

This technical report provides information used in the identification and evaluation of potential action alternatives.

1.1 Introduction/Background

This technical report describes the process used to identify and evaluate alternatives to the Proposed Action for the Seattle-Tacoma International Airport (SEA) Near-Term Projects (NTPs). The identification and evaluation of alternatives during the environmental review process is the heart of the National Environmental Policy Act (NEPA) process, and it includes identifying reasonable and feasible alternatives that meet the Purpose and Need.

1.2 Regulatory Requirements

The review of alternatives was conducted in accordance with the Council on Environmental Quality regulations, FAA Order 1050.1F, and FAA Order 5050.4B, which require a thorough and objective assessment of the Proposed Action, the No Action Alternative, and reasonable and feasible alternatives that would achieve the stated Purpose and Need.

1.3 Range of Alternatives Considered

This Environmental Assessment (EA) identified and evaluated alternatives for each of the five areas of need for the NTPs:

- Insufficient passenger processing facilities and gates to accommodate 56 million annual passenger (MAP) at an optimal level of service (LOS).
- Insufficient facilities to accommodate projected cargo levels.
- Portions of the airfield no longer meet current FAA airport design standards.
- Inefficient/inadequate taxiway layout.
- Lack of fuel storage to meet projected demand and the Port of Seattle's (the Port's) sustainable aviation fuel initiative (SAF).

1.4 Alternative Evaluation Process

Alternatives were evaluated using a two-step screening process. The first level screening examined whether the alternative met the Purpose and Need. If the alternative satisfied the Purpose and Need, it moved to the second level. The second level screening evaluated which alternatives were reasonable and feasible based on a qualitative evaluation of factors related to operational impacts and cost. Alternatives that were determined to be reasonable and feasible were carried forward for detailed review. An alternative is reasonable if it is technically and economically feasible and meets the Purpose and Need.

The alternatives considered in this EA were derived from the Sustainable Airport Master Plan (SAMP) process, as well as public input during the scoping process. In accordance with NEPA, a No Action Alternative is included.

1.4.1 Alternatives Derived from the SAMP

The SAMP included an extensive evaluation of a full-range of alternatives for each of SEA's primary functional areas. As part of the alternative evaluation process, the SAMP alternatives were reviewed to determine which ones should be brought forward. These alternatives are described in Section 2.6, Potential Action Alternatives.

1.4.2 Alternatives Suggested During Scoping Process

During the scoping process, several commenters suggested alternatives to be considered as part of the EA. After careful consideration and review, most of the suggestions received during scoping were not carried forward for further evaluation because they would not address the Purpose and Need and/or were found to not be reasonable or feasible. The suggestions that were received during scoping, reviewed, and ultimately eliminated from further consideration are:

1.4.2.1 Alaska Airlines Suggestions

Alaska Airlines submitted a variety of materials during and after the scoping comment period, suggesting different elements than what is included in the Port's SAMP NTPs. In general, the suggestions included:

- Phased Construction of Passenger Gates: Suggested phasing the construction of gates (9 or 10 gates to serve 56 MAP in the first phase and additional gates in a second phase that would accommodate up to 110 operations per hour). The first phase included an extension of Concourse D, not a separate concourse as proposed by the Port. A new concourse was included as part of the second phase. This suggestion does not meet the Purpose and Need because it would not provide the required number of gates needed to address the forecasted demand.
- Terminal Processing Facilities: Suggested a smaller expansion of terminal processing facilities for passengers than what was determined to be needed during the SAMP process and subsequent studies. To address the shortfall, Alaska suggested additional Transportation Security Administration screening employees and operational measures could resolve the issues. This suggestion does not meet the Purpose and Need because it does not meet the LOS goals.
- Roadway and Curbside: Numerous physical and operational changes to landside facilities (termed "interventions") were packaged into several combinations of "Options." It was not clear from Alaska's submittals which Option Alaska suggests would enable the Airport to achieve an optimal LOS. In addition, the material provided did not demonstrate that any of the Options could meet the Purpose and Need.
- Fully Comply with Taxiway Separation Requirements Immediately (Not Phased): Suggested an approach to meeting the 500-foot separation between the centerline of Runway 16L/34R and the adjacent taxiway, as required by the current design standards, by providing a full 500-foot separation between Runway 16L/34R and Taxiway B. This suggestion was found to meet the Purpose and Need but was eliminated in the second level of screening due to operational impacts and costs associated with implementation (see Alternative 3-C2).

- Terminal Connection: Suggested a secure-side (post-security) connection between the Main Terminal and the proposed new gates. This suggestion on its own does not directly meet Purpose and Need. However, the Passenger Terminal and Concourse alternatives carried forward includes an option with a secure-side connection to Concourse D, as well as a secure-side connection form the proposed north gates to the North Satellite.

While the submittal by Alaska provided details on certain aspects, other critical project elements (necessary to achieve Purpose and Need) were either not addressed or not fully developed. Therefore, it was not possible to consider the submittal as a complete alternative to the SAMP NTPs. However, the Port did review the elements in detail and included concepts from the Alaska suggestions in the evaluation of alternatives where feasible and appropriate.

1.4.2.2 Limited or Reduced Growth (General)

Several commenters in the scoping process suggested the Port should reduce the project size or put in place policies to limit growth versus accommodating growth. Both the Port and FAA have a limited ability to enact growth reduction strategies due to airline deregulation, which allows airlines to set their own routes, service frequency, and type (or size) of aircraft. The Port has agreed to grant assurances every time it has accepted a grant from the FAA. Grant Assurance 22(a) requires the airport to be available for public use on “reasonable terms and without unjust discrimination to all types, kinds and classes of aeronautical activities, including commercial aeronautical activities offering services to the public at the airport.” Similarly, Grant Assurance 39 requires airports to report if they cannot accommodate requests by air carriers for access to gates or other facilities, along with reasons why and what steps are being taken to grant the access. In severe circumstances where there is systemic overscheduling of available hourly runway and airspace capacity, the FAA has the authority to impose a cap on the number of flights at an airport; however, the FAA does not support flight caps as a long-term solution that is in the public interest. Failure to provide the necessary facilities could effectively constrain air service as well as result in a poor overall customer experience and LOS. Given these reasons, this alternative was eliminated from further consideration.

1.4.2.3 Use of Other Airports (Existing)

Several commenters suggested using existing airports instead of expanding facilities at SEA. The Puget Sound Regional Council (PSRC) prepared a Regional Aviation Baseline Study to provide a clear picture of the aviation activities and needs in the region and set the stage for future planning efforts. Although there are several other small-hub and reliever airports in the Puget Sound region, none of these, either individually or collectively, could accommodate the current and projected passenger and cargo demands that in theory might be diverted from SEA within the timeframe of the Proposed Action. There are two commercial service airports in the vicinity of SEA:

- King County International Airport-Boeing Field (BFI): BFI is located approximately nine miles (by road) from SEA. It is designated as a non-hub primary commercial service airport in the FAA’s National Plan of Integrated Airport Systems (NPIAS), 2023-2027. The Airport has two parallel runways: Runway 13R/31L (10,000 feet in length) and Runway 13L/31R (3,710 feet in length). BFI provides limited passenger service today. However, BFI does not have traditional passenger processing facilities, and the ability to develop such facilities is restricted by the available land. In addition, there are airspace interactions between BFI and other airports in the region that could limit reliable service for a substantial amount of passenger traffic. Also, BFI does not have facilities to meet the current and projected cargo demand that might be diverted from SEA.

- Paine Field/Snohomish County Airport (PAE): PAE is located approximately 38 miles (by road) from SEA. It is designated as a non-hub primary commercial airport in the FAA's NPIAS, 2023-2027. The airport has two passenger gates and is serviced by two air carriers, providing daily service to 11 United States destinations. It is also home to the Boeing manufacturing plant for several aircraft and is one of the largest third-party aircraft inspection and repair facilities in the United States. The airport has three runways: Runway 16R/34L (9,010 feet in length), Runway 16L/34R (3,004 feet in length), and Runway 11/29 (4,504 feet in length). Although Paine Field provides limited passenger service, it does not have terminal or runway capacity to accommodate the growth projected at SEA. Construction of a new runway and major terminal facilities would not be feasible within the timeframe of the Proposed Action. Also, PAE does not have facilities to meet the current and projected cargo demand that might be diverted from SEA.

Most importantly, as discussed previously, neither the Port nor FAA have the authority to require users to use another airport. Therefore, relying on another airport cannot be reasonable or feasible, and would not address the specific needs identified at SEA. Therefore, this alternative has been eliminated from further consideration.

1.4.2.4 Build a New Airport

Several commenters suggested constructing a new airport instead of expanding facilities at SEA. The construction of an entirely new commercial airport is not a reasonable and feasible solution to satisfy the current or projected needs at SEA and would not address any of the Airport's near-term needs. The potential for a new airport to serve the Puget Sound region has been studied for decades and continues to be studied today.

- In 1994, the PSRC Executive Board adopted Resolution EB-94-01, which concluded that no feasible sites for a major supplemental airport could be found in the four-county region.
- As mentioned above, the PSRC prepared the Regional Aviation Baseline Study to provide a clear picture of the aviation activities and needs in the region and set the stage for future planning efforts.
- The Commercial Aviation Coordinating Commission (CACC), established by the state of Washington studied a regional airport. The Commission's submitted a final report on June 15, 2023, with no recommended site.
- In April 2023, legislation was signed (Engrossed Substitute House Bill 1791) replacing the CACC creating a work group that would continue to analyze Washington's future aviation needs and analyze possible solutions.[1]

Given the fact a site for a new regional airport has not been selected and the time it would take to open a new regional airport, this option was not a reasonable or feasible alternative to address the near-term needs at SEA. For these reasons, this alternative has been eliminated from further consideration.

1.4.2.5 Utilize Other Modes of Transportation

Several commenters suggested using other modes of transportation or technologies instead of expanding facilities at SEA. This suggestion would rely on the development of other modes of transportation to supplement or replace projected aircraft operations at SEA. The options suggested during scoping included high-speed rail to connect Seattle to other cities in the Pacific Northwest, or the development of a "hyperloop" system to accomplish the same. In addition, other modes of

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[1] https://wsdot.wa.gov/travel/aviation/commercial-aviation-coordinating-commission

transportation may include automobiles, buses, and regular train service. The use of other modes of transportation is not a reasonable or feasible alternative because other transportation modes serve a complementary role to air travel, and do not represent a viable replacement. Research has shown that other modes of transportation such as rail are viable alternatives to air travel up to approximately 300 to 475 miles depending on the speed of the rail.[2] Beyond this point the use of rail or other modes of transportation either does not connect to the desired destinations or does so inefficiently. Based on this conclusion, the use of other modes of transportation would only address a small portion of the demand for short distance trips. Of the top 20 markets being served, all but two (Boise and Spokane) are over 475 air miles from SEA. Therefore, supplementing or replacing aircraft operations with other modes of transportation would not provide the efficient long-distance connections that customers expect from SEA and this alternative was eliminated from further consideration.

1.4.2.6 Limit the Project to Only the FAA Compliance Needs

The suggestion to limit the proposed NTPs to only those that address FAA compliance needs was eliminated from further consideration because it would only address one of the five areas of needs and therefore does not meet the Purpose and Need.

1.4.2.7 Incorporate North Employee Surface Parking Lot (L06) into Adjacent Employee Parking Structure (L07)

Several commenters suggested eliminating the proposed north employee surface parking lot (L06) and either relocating it to a new location or implementing incentives to reduce the need for the lot. The ability of the Port to incentivize the use of mass transit exists, and the Port is actively exploring initiatives to reduce employee use of single-occupancy vehicles; however, it is unlikely to eliminate the need for additional parking. Therefore, the suggestion to solely rely on incentives was not feasible as an alternative to building additional employee parking. However, the Port did review other potential locations for L06 as a result of these comments and decided to combine L06 and L07. The Proposed Action was updated after scoping to eliminate L06 and instead accommodate all employee parking needs through construction of the employee parking garage (L07).

The alternatives received during scoping that were reviewed, evaluated, and eliminated from further consideration are listed in **Table 1**.

TABLE 1: EVALUATION OF ALTERNATIVES FROM THE SCOPING PROCESS

Scoping Suggestion	Does it meet Purpose and Need? (Level 1 Screening)	If Yes, Other Considerations (Level 2 Screening)
Phased Construction of Passenger Gates: Suggested phasing the construction of gates (9 or 10 gates to serve 56 MAP and additional gates in a second phase that would accommodate up to 110 operations per hour) and an extension of Concourse D in the first phase rather than a second terminal. A new concourse was included as part of the second phase.	NO Does not provide the required number of passenger gates and holdrooms to meet the need for serving 56 MAP at an optimal LOS. A connection to Concourse D is included in Alternatives 1-B and 1-E.	N/A

[2] https://icas.org/ICAS_ARCHIVE/ICAS2004/PAPERS/037.PDF

TABLE 1: EVALUATION OF ALTERNATIVES FROM THE SCOPING PROCESS (CONTINUED)

Scoping Suggestion	Does it meet Purpose and Need? (Level 1 Screening)	If Yes, Other Considerations (Level 2 Screening)
Terminal Processing Facilities: Suggested smaller expansion of terminal processing facilities.	No Would result in sub-optimum LOS, inconsistent with Purpose and Need.	N/A
Roadway and Curbside Changes: Suggested greater reliance on mass transit, a set of roadway/curbside changes, and operational options, but with no preferred option provided.	No The material provided did not demonstrate that any of the submitted options could meet Purpose and Need.	N/A
Fully Comply with Taxiway Separation Requirements Immediately (Not Phased): Suggested to include a full 500-foot separation between Runway 16L/34R and Taxiway B.	Yes	No Eliminated due to operational impacts and cost associated with implementation (Alternative 3-C2).
Limited or Reduced Growth: Suggested to reduce the project size, put in place policies to limit growth versus accommodating growth, or restrict usage of Runway 16R/34L.	No Does not meet the stated needs and the Port/FAA have limited authority to restrict access to SEA.	N/A
Use of Other Existing Airports: Suggestion to use existing airports instead of expanding facilities at SEA.	No Neither the Port nor FAA have the authority to require users to use another airport. In addition, none of the other existing airports, either individually or collectively, could accommodate the current or projected passenger and cargo demands within the needed timeframe.	N/A
Build a New Airport: Several commenters suggested constructing a new regional airport instead of expanding facilities at SEA.	No Does not meet the stated need for serving 56 MAP at an optimal LOS at SEA.	N/A
Utilize Other Modes of Transportation: Suggestion to use other modes of transportation or technologies instead of expanding facilities at SEA. Examples included high-speed rail, “hyperloop,” and mass transit.	No Replacing aircraft operations with other modes of transportation would not provide the efficient long-distance connections needed to address current and future demand.	N/A
Limit the project to only the FAA compliance needs	No The suggestion does not address the other identified needs.	N/A

TABLE 1: EVALUATION OF ALTERNATIVES FROM THE SCOPING PROCESS (CONTINUED)

Scoping Suggestion	Does it meet Purpose and Need? (Level 1 Screening)	If Yes, Other Considerations (Level 2 Screening)
Eliminate North Employee Surface Parking Lot (L06): Suggestion to eliminate the proposed north employee surface parking lot (L06) and relocate them to new locations.	Yes	The Proposed Action was updated after scoping to eliminate L06 and instead construct a larger employee parking garage (L07).
Public/Private Transit Incentives: Suggestion to implement incentives to reduce the need for the lots.	No This suggestion on its own does not directly meet Purpose and Need. Reducing the amount of parking to force a shift in modes was not feasible, given employee shift times, transit availability, and historic employee behavior when demand has exceeded capacity.	N/A
Terminal Connection: Suggestion of a secure-side (post-security) connection between the Main Terminal and the proposed new gates.	N/A This suggestion on its own does not directly meet Purpose and Need. However, as part of the Passenger Terminal and Concourse alternatives carried forward, the EA includes an option with a secure-side connection to Concourse D, as well as a secure-side connection from the proposed north gates to the North Satellite.	N/A

Source: Analysis completed by Landrum & Brown, 2020

1.5 No Action Alternative

The No Action Alternative assumes none of the federal actions or the additional physical improvements included in the Proposed Action would occur at SEA, but includes projects that have recently been constructed, or will be constructed by 2032, as part of the future base case (which is the same for all alternatives carried forward). These projects include: North Satellite Redevelopment program, International Arrivals Facility, Terminal Renovations, C Concourse Expansion, A Concourse Building Expansion, Widen Arrivals Drive project, and Runway Renumbering. These projects are independent from the Proposed Action in this EA and have received separate environmental reviews and approvals.

1.6 Potential Action Alternatives

Because the Proposed Action reflects five separate and distinct areas of need, the alternatives development process considered each need separately. The potential action alternatives were developed from the range of alternatives considered during the SAMP process, scoping comments, and a separate assessment of potential options conducted specifically for this EA.

1.6.1 Need #1: Insufficient Passenger Processing Facilities and Gates to Accommodate 56 MAP at an Optimal Level of Service (LOS)

Passenger processing alternatives were developed to address Need #1. These alternatives all include the following primary elements:

- **Passenger Terminal and Concourse**: Construct adequate passenger check-in facilities, baggage processing facilities, security screening checkpoints, and aircraft boarding gates to serve 56 MAP at an optimal LOS.
- **Passenger Parking and Ground Access Facilities**: Construct sufficient passenger parking facilities and arrival and departure curbs to accommodate 56 MAP at an optimal LOS. Passenger parking facilities and arrival and departure curbs are dependent on the terminal concourse option, due to space limitations. As a result, those elements do not have a separate alternatives analysis.
- **Employee Parking**: Construct sufficient employee parking facilities to accommodate 56 MAP at an optimal LOS. Employee parking, which is not dependent on the terminal concourse option, has a separate alternatives evaluation to determine the Employee Parking Option carried forward into each of the terminal alternatives evaluated in this EA.

1.6.1.1 Employee Parking Options

During scoping, several commenters requested that Proposed Action element L06 Employee Parking Surface Lot be removed or altered due primarily to concerns about additional traffic in the adjacent neighborhoods and impacts to North SeaTac Park. L06 would be located near the intersection of S. 136th St. and 18th Ave. S., which is surrounded by residential uses and located within North SeaTac Park. The Port decided to eliminate L06 as an option for employee parking in response to the comments. To address the need for employee parking the Port developed three Employee Parking Options:

- **Employee Parking Option 1**: This option would provide incentives for employees to use mass transit. These incentives would include transit subsidies, promotion of ride-share opportunities, or other similar programs with an intent to reduce the overall number of employee vehicles being parked at the Airport, thereby eliminating the need to provide more employee parking capacity.
- **Employee Parking Option 2**: This option would locate employee parking in an area on the south side of the Airport.
- **Employee Parking Option 3**: This option would add additional employee parking in area on the north side of the Airport.

The Port evaluated each of the Employee Parking Options to determine if they could feasibly be implemented and if so, what the benefits and drawbacks of each option would be. The evaluation focused on the following screening criteria:

- **Criterion 1: Feasibility and Reliability** – An Employee Parking Option must provide Airport employees with reliable and efficient transport to their intended destinations.
- **Criterion 2: Operational Considerations** – An Employee Parking Option must not create an operational impact to the Airport, tenants, or employees that exceeds the intended benefits.

Each Employee Parking Option was evaluated against these criteria:

Employee Parking Option 1:

This option would rely on incentives by the Port and likely other agencies (e.g., SoundTransit) to create transit options that would equal or exceed the convenience employees have by driving their own vehicle. While there are mass transit options that provide service to and around the Airport, to change employee transportation habits there would need to be dedicated service from near their home to the Airport with few if any stops. Furthermore, to motivate change, that service would need to operate at the times that are convenient for their individual work schedules and at a notably lower cost than driving. The Airport has employees that start work at unusual hours and need to leave cars parked for longer than eight hours (e.g., pilots and flight attendants). There are also Port (and likely airline) staff who need to be able to attend to operational and other emergencies at any hour, sometimes in the middle of the night. Transit availability to/from the Airport is only available on a limited set of routes (8 bus lines, 1 light rail line) and those options are generally available 24 hours per day. Given that Airport employees do not all live in the same area and do not begin and end work at the same times during the day, it is unlikely that transit options would be available that would reduce the demand for employee parking. Therefore, Employee Parking Option 1 is not a feasible option to fully accommodate employee parking needs and is eliminated from consideration. However, the Port will continue to explore incentivized transit options for employees and passengers to reduce traffic at and around the Airport as part of its overall sustainability goals.

Employee Parking Option 2:

This option would locate the proposed employee parking to the former south employee parking lot, south of S. 188th St., north of S. 200th St. and west of 28th Ave. This area has several current uses such as the fuel farm, Alaska Airlines office building, Port-owned logistics parking lots, and contractor parking lots. If these uses were not currently on the site, the site would be large enough to construct an employee parking garage. However, the current uses would have to be relocated to another location during and after construction. There are no Port-owned sites that could accommodate these uses without causing further relocation needs. There is currently no employee parking in this area, so additional shuttle service would need to be provided to get employees from this parking area to their work location. Running multiple employee shuttle services to both the north and south of the Airport would result in duplication of services and more shuttle buses on the roads than if all the employee parking was in the same general area. Therefore, a south location for the required additional employee parking is not considered reasonable and is eliminated from consideration.

Employee Parking Option 3:

This option includes the construction of an employee parking garage (L07) to accommodate the required employee parking spaces. The site of L07 is immediately west of the current North Employee Parking Lot (NEPL) located at the intersection of S. 142nd St. and 24th Ave. S. Given that there is currently employee parking in this area it is feasible that additional employee parking could be constructed in the area and offer a similar level of reliability that exists today for employees. From an operational perspective, consolidating employee parking into one general area provides an opportunity to operate fewer shuttle buses than if there were lots on both the north and south of the Airport (like Option 2), which would reduce traffic on the roadways at and around the Airport.

Based on the evaluation of each of the Employee Parking Options, the Port identified Employee Parking Option 3 as it was the only reasonable and feasible option. As a result, this Employee Parking Option is included as part of the other Need #1 alternatives.

1.6.1.2 Passenger Terminal and Concourse Options

The key factors influencing development of the passenger processing facility and gate alternatives were the existing terminal area configuration and the built environment surrounding SEA. The Port considered how the terminal facilities could be expanded in all directions. The areas north and south of the existing terminal were found to provide the only reasonable opportunities for development. Expansion to the east would be infeasible given the location of SR 99, and the heavy development along that corridor. Relocation to the west is infeasible because it would either require a shift of all three parallel runways and associated taxiways, or the elimination of Runway 16L/34R, the primary departure runway at SEA.

Once a general development area was identified, extensive planning and concept development occurred as part of the SAMP process. In the initial stages, 16 different terminal concepts were identified and evaluated. These concepts included "one-terminal" and "two-terminal" concepts. One-terminal concepts maintain all passenger processing within the existing Main Terminal, modifying it to the extent possible to accommodate the forecast growth in passenger demand. Two-terminal concepts add a second passenger terminal and minimize modifications to the existing Main Terminal.[3] The alternative identification and evaluation efforts produced the following preliminary alternatives:

- **Alternative 1-A (Proposed Action)**: Construct a new second terminal and gates to the north of the Main Terminal
- **Alternative 1-B (Main Terminal Option)**: Expand the Main Terminal and add new gates to Concourse D
- **Alternative 1-C (Hardstand Option)**: Expand the Main Terminal and build a satellite hardstand[4] concourse to provide passenger holdrooms and remote boarding served by busing to/from the Main Terminal processor
- **Alternative 1-D (South Option)**: Construct a new second terminal and gates to the south of the Main Terminal
- **Alternative 1-E (Hybrid Option)**: Construct a new second terminal and gates to the north of the Main Terminal connected to Concourse D

The descriptions of the alternatives include the elements to address the Purpose and Need and the actions that would be necessary to construct each alternative. Each of the preliminary action alternatives would trigger the need to relocate or replace existing functions to provide an area suitable for construction.

1.6.1.3 Preliminary Alternatives

ALTERNATIVE 1-A (PROPOSED ACTION): CONSTRUCT A NEW SECOND TERMINAL TO THE NORTH OF THE MAIN TERMINAL

This alternative includes the construction of a new second terminal and gates to the north of the existing Main Terminal, with the following elements:

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[3] SAMP Technical Memorandum No. 6, Alternatives; Chapter 1. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-alternatives/.

[4] A hardstand is a paved area where passengers can board and deplane aircraft using movable steps or ramps, in lieu of traditional passenger gates and loading bridges. Passengers are transported to and from the hardstand position via buses.

- Terminal Concourse
    - New concourse providing 19 narrowbody equivalent aircraft boarding gates along with holdroom, circulation, and concessions space
    - Passenger check-in, security screening, and baggage processing facilities to support the new aircraft gates
    - Elevated post-security pedestrian walkways from the north gates to the terminal and to the North Satellite
- Automobile Parking and Ground Access Facilities
    - Separate ground transportation center/parking garage and vehicle curb immediately adjacent to the new terminal
    - Employee parking structure north of SR 518
- Connected projects include the North Hold Pad, Central Hardstand, NAE Relocation, Northeast Ground Transportation (GT) Center, North GT Holding Lot, Primary Aircraft Rescue and Firefighting (ARFF), Secondary ARFF, Fuel Rack Relocation, Triculator, De-icing Tanks, and CRDC.

The new processing facilities in this alternative are connected to the existing Main Terminal through a non-secure-side connection provided by project L02 - Elevated Busway and Stations. Alternative 1-A is depicted on **Exhibit 1**.

ALTERNATIVE 1-B (MAIN TERMINAL OPTION): EXPAND THE MAIN TERMINAL, ADDING NEW GATES TO CONCOURSE D

This alternative includes the construction of a new concourse to the north of the existing Main Terminal, connected to Concourse D, to provide 19 additional narrowbody equivalent aircraft boarding gates.

- Terminal Concourse
    - Additional passenger processing capability for security screening is provided through expansion of the existing Main Terminal on the east side of Concourse D where the current Concourse D Annex is located
    - Elevated post-security pedestrian walkway from the new gates to the North Satellite
- Automobile Parking and Ground Access Facilities
    - Existing passenger parking, curb width, and curb length are maintained[5]
    - Employee parking structure north of SR 518
- Connected projects include the North Hold Pad, Central Hardstand, NAE Relocation, Northeast GT Center, North GT Holding Lot, Primary ARFF, Secondary ARFF, Fuel Rack Relocation, Triculator, De-icing Tanks, and CRDC.

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[5] Vehicle curb widening is not feasible under this alternative because the curb is confined between the main terminal and main garage. Vehicle curb lengthening is not feasible within the timeframe it is needed because of complex construction phasing to bring the approach drives up to the same grade as the curb. In addition, prolonged closures of the existing curbside road would be necessary during construction.

The new concourse gates in this alternative are physically connected to existing gates, providing a secure-side connection to the rest of the existing Main Terminal. A non-secure-side connection is provided through project L02 - Elevated Busway and Stations. Alternative 1-B is depicted on **Exhibit 2**.

ALTERNATIVE 1-C (HARDSTAND OPTION): EXPAND THE MAIN TERMINAL AND BUILD A SATELLITE HARDSTAND CONCOURSE TO PROVIDE PASSENGER HOLDROOMS AND REMOTE BOARDING SERVED BY BUSING TO/FROM THE MAIN TERMINAL PROCESSOR

This alternative includes the construction of a new satellite hardstand concourse to the north of the Main Terminal, providing 19 additional ground loading aircraft parking positions.

- Terminal Concourse
  - Additional passenger processing capability for security screening is provided through expansion of the existing Main Terminal on the east side of Concourse D where the current Concourse D Annex is located
- Automobile Parking and Ground Access Facilities
  - Existing passenger parking, curb width, and curb length are maintained[6]
  - Employee parking structure north of SR 518
- Connected projects include the Northeast GT Center, North GT Holding Lot, Fuel Rack Relocation, Triculator, De-icing Tanks, and CRDC.

The new concourse gates in this alternative are connected to existing gates through a busing operation, providing a secure-side connection to the rest of the existing Main Terminal. Alternative 1-C is depicted on **Exhibit 3**.

ALTERNATIVE 1-D (SOUTH OPTION): CONSTRUCT A NEW SECOND TERMINAL TO THE SOUTH OF THE MAIN TERMINAL

This alternative includes the construction of a new second terminal and gates in the south area of SEA with the following elements:

- Terminal Concourse
  - New concourse providing 19 narrowbody equivalent aircraft boarding gates along with holdroom, circulation, and concessions space
  - Passenger check-in, security screening, and baggage processing facilities to support the new aircraft gates
- Automobile Parking and Ground Access Facilities
  - Separate parking garage and vehicle curb adjacent to the new terminal
  - Employee parking structure north of SR 518

[6] Vehicle curb widening is not feasible under this alternative because the curb is confined between the main terminal and main garage. Vehicle curb lengthening is not feasible within the timeframe it is needed because of complex construction phasing to bring the approach drives up to the same grade as the curb. In addition, prolonged closures of the existing curbside road would be necessary during construction.

- Connected projects include the Second Terminal Roadside/Curbside, Northeast GT Center, North GT Holding Lot, Fuel Farm, and relocated support facilities.

The new concourse gates are physically connected to existing gates, providing a secure-side connection to the rest of the existing Main Terminal. Alternative 1-D is depicted on **Exhibit 4**.

ALTERNATIVE 1-E (HYBRID OPTION): CONSTRUCT ADDITIONAL CONCOURSE TO THE NORTH OF THE MAIN TERMINAL CONNECTED TO CONCOURSE D AND CONSTRUCT A NEW SECOND TERMINAL TO THE NORTH

This alternative includes the construction of a new second terminal and gates to the north of the existing Main Terminal to provide passenger processing facilities. The new terminal in Alternative 1-E has the following elements:

- Terminal Concourse
    - New concourse to the north of the existing terminal complex and connected to Concourse D, providing 19 new aircraft parking positions as well as holdrooms, circulation, and concessions space
    - Passenger check-in, security screening, and baggage processing facilities to support the new aircraft gates
    - Elevated pedestrian walkways from the north gates to the terminal and to the North Satellite
- Automobile Parking and Ground Access Facilities
    - Separate parking garage and vehicle curb adjacent to the new terminal
    - Employee parking structure north of SR 518
- Connected projects include the North Hold Pad, Central Hardstand, NAE Relocation, Northeast GT Center, North GT Holding Lot, Primary ARFF, Secondary ARFF, Fuel Rack Relocation, Triculator, De-icing Tanks, and CRDC.

The new concourse gates are physically connected to existing gates, providing a secure-side connection to the rest of the existing Main Terminal. A non-secure-side connection is provided by project L02 - Elevated Busway and Stations. Alternative 1-E is depicted on **Exhibit 5.**

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EXHIBIT 1, ALTERNATIVE 1-A: PROPOSED ACTION

Note: NAE = North Airport Expressway; GT = ground transportation; ARFF = aircraft rescue and firefighting

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EXHIBIT 2, ALTERNATIVE 1-B: MAIN TERMINAL OPTION

Note: NAE = North Airport Expressway; GT = ground transportation; ARFF = aircraft rescue and firefighting

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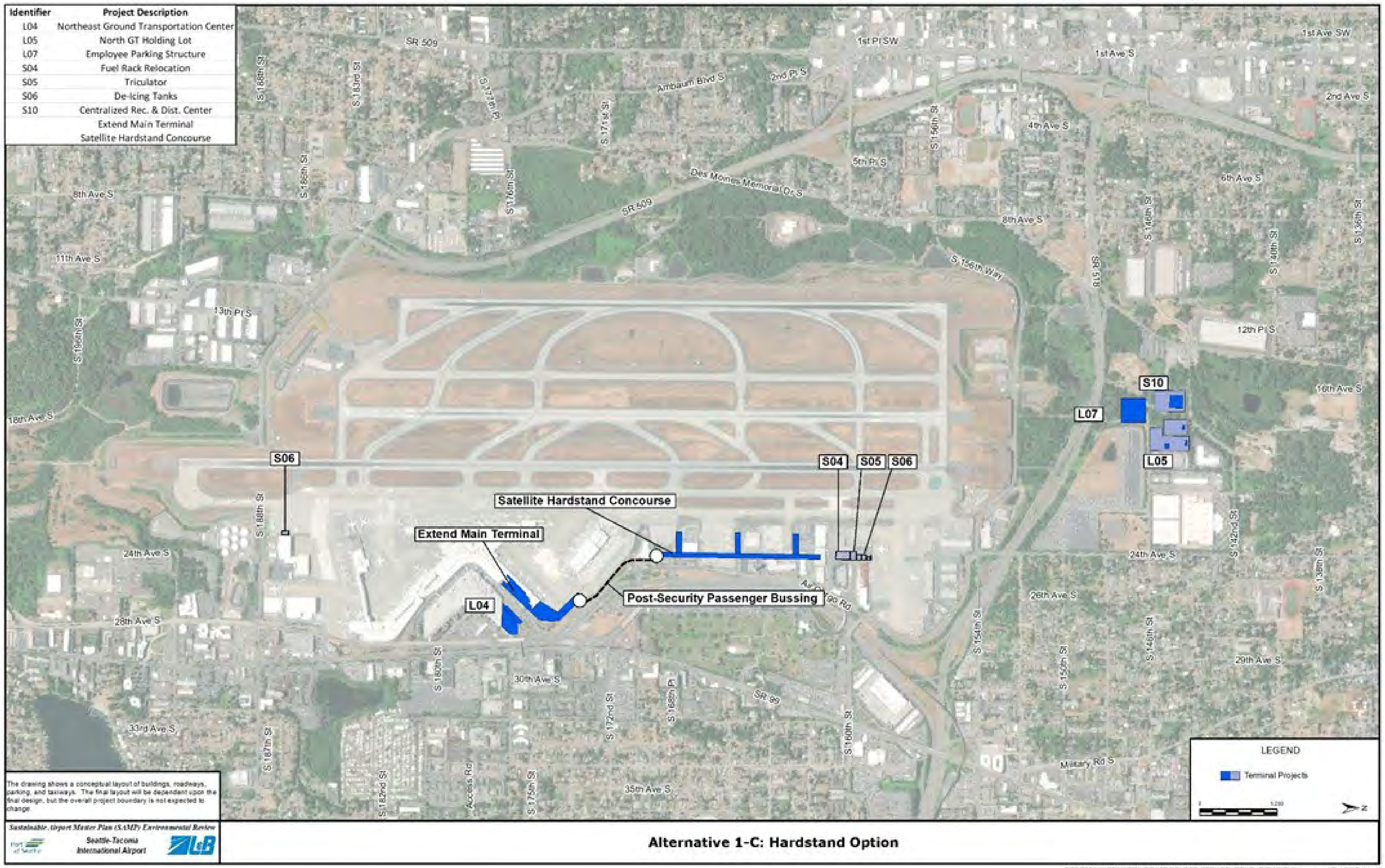
EXHIBIT 3, ALTERNATIVE 1-C: HARDSTAND OPTION



Note: GT = ground transportation

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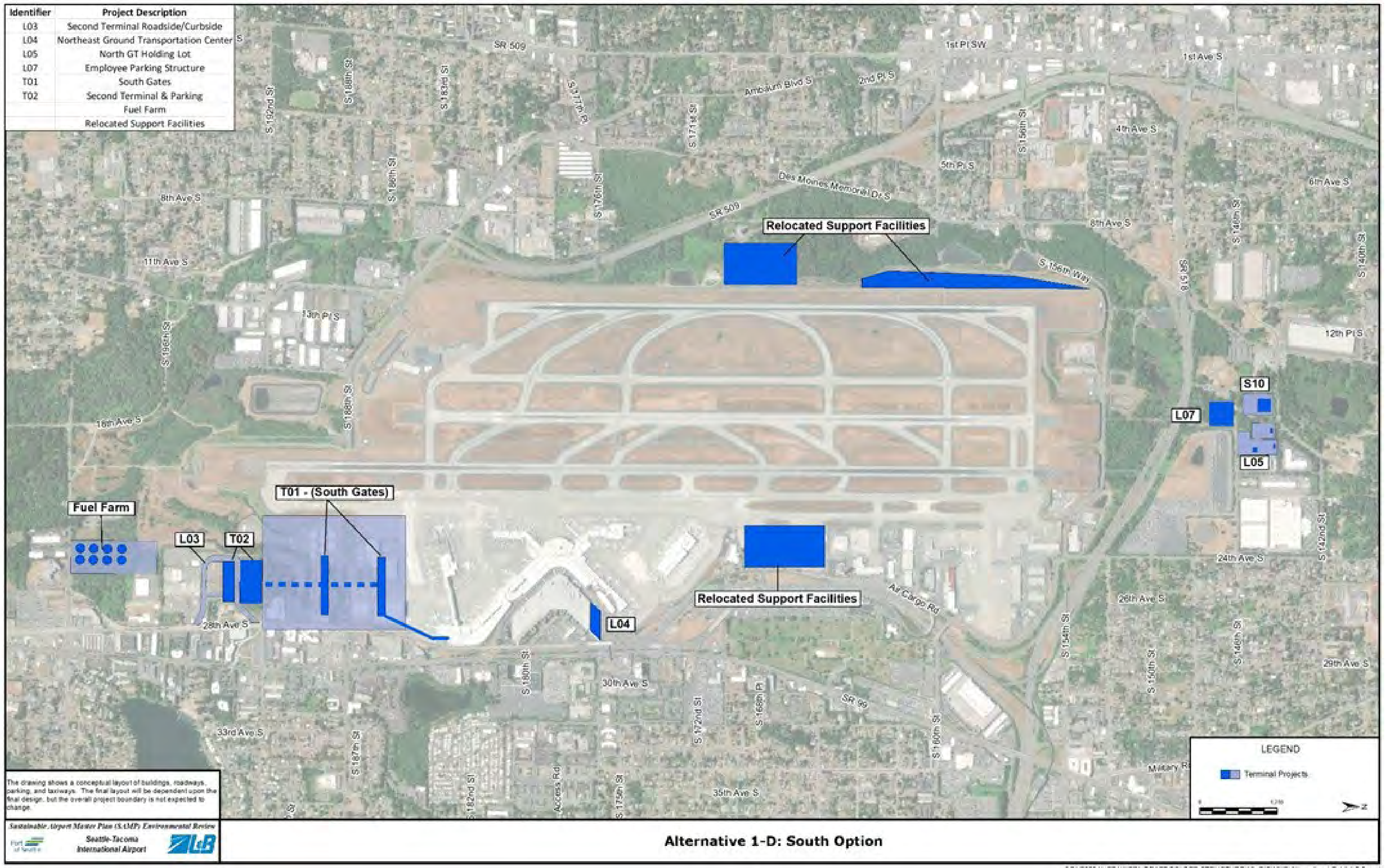
EXHIBIT 4, ALTERNATIVE 1-D: SOUTH OPTION



Note: GT = ground transportation

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EXHIBIT 5, ALTERNATIVE 1-E: HYBRID OPTION

Note: NAE = North Airport Expressway; GT = ground transportation; ARFF = aircraft rescue and firefighting

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1.6.1.4 First Level of Screening

The passenger processing facility alternatives were screened to eliminate the ones that would not fulfill the terminal-related Purpose and Need. Each preliminary alternative was evaluated based on specific criteria presented in Chapter 1, Purpose and Need:

- **Criterion 1 (Passenger Check-in Facilities)**: Would the alternative provide a total of 66,200 square feet of space (an additional 28,500 square feet) to accommodate 56 MAP at the desired optimal LOS?[7]
- **Criterion 2 (Security Screening Checkpoint)**: Would the alternative provide a total of 80,500 square feet of space (an additional 35,100 square feet) to accommodate 56 MAP at the desired optimal LOS?[8]
- **Criterion 3 (Aircraft Gates/Parking)**: Would the alternative provide 107 aircraft boarding gates (including 19 additional narrowbody equivalent aircraft boarding gates) to accommodate 56 MAP at the desired optimal LOS with flexibility to accommodate Remain Over Night (RON) aircraft parking?[9]
- **Criterion 4 (On-airport Public Parking Facilities for Passengers)**: Would the alternative provide a total of approximately 12,440 on-airport parking stalls to accommodate 56 MAP?[10]
- **Criterion 5 (Departing and Arriving Curbs for Dropping off and Picking up Passengers)**: Would the alternative provide four lanes with 1,300-linear feet of departure curb (an additional 100-linear feet) and six lanes with 2,250-linear feet of arrival curb (an additional 720-linear feet and one additional lane) to accommodate 56 MAP at the desired optimal LOS?[11]

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[7] The Port's 2022 Advanced Planning Terminal Needs Assessment analysis of check-in space found that a total of approximately 80,500 square feet of space (an increase of about 28,500 square feet) would be needed to provide an optimal LOS at 56 MAP.
[8] The Port's 2022 Advanced Planning Terminal Needs Assessment analysis of security screening found that, given the lack of existing space to accommodate queueing needed to support higher throughput and larger new equipment, approximately 80,500 total square feet of space (an additional 35,100 square feet) would be needed to maintain an optimal LOS with the next generation of security screening systems that would be installed as part of the project.
[9] The 56 MAP requirement for 19 additional narrowbody equivalent gates was calculated from the 52 MAP and 59 MAP requirement found in the SAMP Technical Memorandum No. 5, Facility Requirements, Appendix B, Gate Requirements Summary. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-no-5-facility-requirements/.
[10] SAMP Technical Memorandum No. 5, Facility Requirements. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/tm-no-5-facility-requirements/.
[11] Ibid.

ALTERNATIVE 1-A (PROPOSED ACTION)

Alternative 1-A (Proposed Action) met the first level screening criteria because it would provide the required additional passenger check-in facilities and security screening checkpoints within the proposed second terminal. The proposed second terminal concourse would provide the required number of aircraft boarding gates. Adequate on-airport public parking would be provided by the proposed second terminal parking garage. The required employee parking would be provided by a new employee parking structure. Terminal curbside needs (for arriving and departing passengers) would be met by constructing new departing and arriving passenger curbs in front of the new second terminal. For these reasons, Alternative 1-A was found to meet the Purpose and Need of the project and was carried forward for second level screening.

ALTERNATIVE 1-B (MAIN TERMINAL OPTION)

Alternative 1-B (Main Terminal Option) did not meet the first level criteria because it fails to provide the required passenger check-in and security screening space, as well as the required departure and arrival curb capacity. The expansion of the Main Terminal would provide some, but not all, of the space required to meet the passenger check-in facilities and security screening checkpoint needs. In addition, the departure and arrival curb in this alternative cannot be expanded (widened or lengthened) in the timeframe that would support the rest of the program. For these reasons, Alternative 1-B would not meet the Purpose and Need and therefore was not carried forward for further consideration.

ALTERNATIVE 1-C (HARDSTAND OPTION)

Alternative 1-C (Hardstand Option) did not meet the first level criteria because it provides sub-optimal passenger facilities, fails to provide the required passenger check-in and security screening space, and fails to provide the required departure and arrival curb capacity. Ground-loaded aircraft positions without passenger loading bridges would result in a sub-optimal LOS to passengers. The expansion of the Main Terminal would provide some, but not all, of the space required to meet the passenger check-in facilities and security screening checkpoint needs. In addition, the departure and arrival curb in this alternative cannot be expanded (widened or lengthened) in the timeframe that would support the rest of the program. For these reasons, Alternative 1-C would not meet the Purpose and Need and therefore was not carried forward for further consideration.

ALTERNATIVE 1-D (SOUTH OPTION)

Alternative 1-D (South Option) met the first level screening criteria because it would provide the required additional passenger check-in facilities and security screening checkpoints within the second terminal to the south. The proposed south terminal concourse would provide the additional 19 aircraft boarding gates. Adequate on-airport public parking would be provided by the proposed south terminal parking garage. The required employee parking would be provided by a new employee parking structure. Terminal curbside needs (for arriving and departing passengers) would be met by constructing new departing and arriving passenger curbs in front of the new south terminal. For these reasons, Alternative 1-D was found to meet the Purpose and Need of the project and was carried forward for second level screening.

ALTERNATIVE 1-E (HYBRID OPTION)

Alternative 1-E (Hybrid Option) met the first level screening criteria because it would provide the required additional passenger check-in facilities and security screening checkpoints within the proposed second terminal. The proposed new concourse connected to Concourse D would provide the required number of aircraft boarding gates. The required on-airport public parking would be provided by the proposed second terminal parking garage. The estimated requirements for employee parking would be met by a new employee parking structure. Terminal curbside needs (for arriving and departing passengers) would be met by constructing new departing and arriving passenger curbs in front of the new second terminal. For these reasons, Alternative 1-E was found to meet the Purpose and Need of the project and was carried forward for second level screening.

Table 2 to provides context for the additional information.

TABLE 2: NEED #1 – FIRST LEVEL SCREENING (DOES ALTERNATIVE MEET THE AIRPORT'S NEEDS?)

Alternative Description	Criterion 1: Passenger Check-in Facilities	Criterion 2: Security Screening Checkpoint	Criterion 3: Aircraft Gates/ Parking	Criterion 4: On-airport Public Parking	Criterion 5: Departing and Arriving Curbs
Alternative 1-A: Proposed Action Construct a new second terminal to the north of the Main Terminal	Yes	Yes	Yes	Yes	Yes
Alternative 1-B: Main Terminal Option Expand the Main Terminal	No	No	Yes	Yes	No
Alternative 1-C: Hardstand Option Hardstand Approach – Expand Main Terminal and build satellite hardstand concourse	No	No	No	Yes	No
Alternative 1-D: South Option Construct a new second terminal to the south	Yes	Yes	Yes	Yes	Yes
Alternative 1-E: Hybrid Option Construct additional concourse north of the existing terminal complex and connected to Concourse D, and construct a new second terminal to the north	Yes	Yes	Yes	Yes	Yes

Source: Analysis completed by Landrum & Brown, 2020

1.6.1.5 Second Level of Screening

The following provides additional supporting documentation of the second level screening of the preliminary passenger processing facility alternatives.

<u>ALTERNATIVE 1-A (PROPOSED ACTION)</u>

Alternative 1-A would result in operational impacts during construction on the roadways as there would be road closures and traffic rerouting for several years. The alternative would avoid major airfield operational impacts during construction because it would construct new facilities away from the existing terminal area on a site that would be cleared of other functions and uses. Once constructed, the Proposed Action would provide a fully functioning second terminal and concourse which would increase the Airport's operational efficiency.

The costs associated with Alternative 1-A would include construction of a new terminal, aircraft gates, aircraft apron, vehicle parking, and other infrastructure. The costs are expected to be commensurate with the magnitude of the proposed construction.

ALTERNATIVE 1-D (SOUTH OPTION)

Alternative 1-D would result in operational impacts on the Airport roadways during construction, because the new roadways would require extended closures and there would be relocations of existing Airport roads. Once constructed, this alternative would further exacerbate airfield congestion because it would add 19 aircraft gates and associated activity in the south area of the Airport. This area is already heavily congested during peak times by aircraft in queue to depart from Runway 34R during north flow or arriving on Runway 16L during south flow. The additional activity in this area would be detrimental to airfield operations.

The costs associated with Alternative 1-D would be substantially higher than the Proposed Action because it would require relocation and/or replacement of several facilities that would not require relocation under the Proposed Action, including:

- SEA Fuel Farm
- The Port's Transit Operations Center
- The Port's Maintenance Distribution Center
- Alaska Airlines Flight Training Center
- Alaska Airlines Aircraft Maintenance Facility
- Delta Air Lines Cargo and Aircraft Maintenance Facilities
- Natural Gas Vehicle Filling Station
- Parking Lots, Engineering Storage Yards, and Other Storage Areas

Alternative 1-D would require extensive earthwork to bring the south terminal site up to a level surface. It would also require construction of additional aircraft apron pavement and taxiway/taxilanes to provide connections to the airfield.

These costs would be in addition to the costs for the Proposed Action. While formal cost estimates have not been prepared for Alternative 1-D, it can conservatively be estimated that the increase in cost for the additional demolition, new facility construction, airfield construction, and earthwork would be hundreds of millions of dollars. This option would not be feasible to achieve in the timeframe when the improvements are needed.

ALTERNATIVE 1-E (HYBRID OPTION)

Alternative 1-E would have more operational impacts than the other two alternatives during construction because it would require aircraft gates to be taken out of service during construction. Once constructed, this alternative would provide a fully functioning second terminal and additional gates that would increase SEA's operational efficiency. The costs associated with Alternative 1-E are similar to those for the Proposed Action because the two alternatives have similar elements in similar locations.

SCREENING SUMMARY

Alternative 1-A fully meets the Purpose and Need, having similar or better operational and cost considerations when compared with the other action alternatives. Therefore, this alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.

Alternative 1-B did not meet the Purpose and Need because it fails to provide the required passenger check-in and security screening space, as well as the required departure and arrival curb capacity. Therefore, this alternative was not carried forward for detailed environmental impact analysis.

Alternative 1-C did not meet the Purpose and Need because it provides sub-optimal passenger facilities, fails to provide the required passenger check-in and security screening space, and fails to provide the required departure and arrival curb capacity. Therefore, this alternative was not carried forward for detailed environmental impact analysis.

Alternative 1-D was found to meet the Purpose and Need but would result in detrimental operational impacts to the airfield after completion. It would also result in substantially higher costs and take substantially longer to construct than the Proposed Action. Therefore, Alternative 1-D is not reasonable and was not carried forward for detailed environmental impact analysis.

Alternative 1-E fully meets the Purpose and Need. It would have greater operational impacts during construction than the other action alternatives but would have similar or better operational impacts after completion. It was also found to have similar cost considerations when compared with the other action alternatives. Therefore, this alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.

Table 3 provides a summary of the screening.

TABLE 3: NEED #1 – SECOND LEVEL SCREENING

Alternative Description	Operational Criteria	Cost Criteria	Carried Forward?
Alternative 1-A: Proposed Action Construct a new second terminal to the north of the Main Terminal	• Impacts to Airport roadways during construction • Limited impacts to operation of existing terminal and concourses during construction • Improved LOS to passengers and users once constructed	Commensurate with the magnitude of the proposed construction	Yes. This alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.
Alternative 1-D: South Option Construct a new second terminal to the south	• Impacts to Airport roadways during construction • Substantially higher operational impacts after construction due to the additional gates and associated activity in an area that is already heavily congested during peak times, exacerbating airfield congestion • Improved LOS to passengers and users once constructed	Construction costs would be substantially higher than the Proposed Action due to relocation and/or replacement of additional facilities, extensive earthwork, and construction of additional airfield pavement	No. This alternative is not reasonable and was not carried forward for detailed environmental impact analysis.

TABLE 3: NEED #1 – SECOND LEVEL SCREENING (CONTINUED)

Alternative Description	Operational Criteria	Cost Criteria	Carried Forward?
Alternative 1-E: Hybrid Option Construct additional concourse to the north of the Main Terminal connected to Concourse D and construct a new second terminal to the north	• Impacts to Airport roadways during construction • Operational impacts due to temporary gate closures during construction • Improved LOS to passengers once constructed	Similar to the Proposed Action	Yes. This alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.

Source: Analysis completed by Landrum & Brown, 2020

1.6.2 Need #2: Insufficient Facilities to Accommodate Projected Cargo Levels

Cargo alternatives developed to address Need #2 include the necessary facilities to meet the projected warehousing facility needs and related feasible cargo aircraft parking needs. The alternatives from the SAMP formed the initial list of potential alternatives for this analysis. The key factors that influenced the development of air cargo alternatives are the existing cargo conditions, projected cargo needs, the impact on airfield operations, and the impact of future passenger facilities in the area where the cargo functions are currently located. Alternatives were also limited by the physical constraints at SEA and the space requirements of the cargo facilities. Given these factors, the only viable alternatives would place new facilities in the north or south areas of SEA.

The alternative identification and evaluation efforts produced the following preliminary alternatives, which were developed to address the projected cargo needs:

- **Alternative 2-A (Proposed Action)**: Construct new cargo facilities in the north cargo area and on the Port's L-shaped parcel of land north of State Route (SR) 518
- **Alternative 2-B (South Option)**: Construct new cargo facilities on the south side of SEA to supplement the current cargo facilities (south aviation support area)

The descriptions of each of the preliminary alternatives include the elements to address the cargo-related Purpose and Need. Each of the preliminary action alternatives would trigger the need to relocate or replace existing functions to provide an area suitable for construction.

<u>ALTERNATIVE 2-A (PROPOSED ACTION): CONSTRUCT NEW CARGO FACILITIES IN THE NORTH CARGO AREA AND ON THE PORT'S L-SHAPED PARCEL OF LAND NORTH OF SR 518</u>

This alternative includes construction of new cargo facilities in the north cargo area of SEA, with a new cargo aircraft hardstand area providing three additional cargo aircraft parking positions (for a total of 21 to 23 positions). It also includes the construction of new cargo warehouse space on the Port's L-shaped parcel of land north of SR 518. Alternative 2-A is depicted on **Exhibit 6**.

<u>ALTERNATIVE 2-B (SOUTH OPTION): CONSTRUCT NEW CARGO FACILITIES ON THE SOUTH SIDE OF SEA TO SUPPLEMENT THE CURRENT CARGO FACILITIES.</u>

This alternative involves constructing new cargo facilities in the southeast area of the airfield to supplement the existing cargo facilities. An additional three to five cargo parking positions and warehousing would be constructed on the south site. Alternative 2-B is depicted on **Exhibit 7**.

EXHIBIT 6, ALTERNATIVE 2-A: PROPOSED ACTION

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EXHIBIT 7, ALTERNATIVE 2-B: SOUTH OPTION

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1.6.2.1 First Level of Screening

The cargo alternatives were screened to eliminate the ones that would not fulfill the cargo-related Purpose and Need. Each preliminary alternative was evaluated based on specific criteria:

- **Criterion 1 (Cargo Aircraft Parking Positions)**: Would the alternative provide up to 22 cargo parking positions with direct taxiway airfield access?
- **Criterion 2 (Warehousing Facilities)**: Would the alternative provide a total of 707,700 square feet of total cargo warehousing with direct roadway landside access?
- **Criterion 3 (Support Facilities)**: Would the alternative provide space to accommodate aircraft maintenance buildings, and store and maintain ground service equipment, such as tugs and cargo storage containers?

The preliminary alternatives, and their ability to meet the screening criteria, are summarized in **Table 4**.

TABLE 4: NEED #2 – FIRST LEVEL SCREENING

Alternative Description	Cargo Aircraft Parking Positions (with airfield access)	Warehousing Facilities (with landside access)	Support Facilities
Alternative 2-A: Proposed Action Construct new cargo facilities in the north cargo area, and on the Port's L-shaped parcel of land north of SR 518	Yes	Yes	Yes
Alternative 2-B: South Option Construct new cargo facilities on the south side of SEA (south aviation support area)	Yes	Yes	Yes

Source: Analysis completed by Landrum & Brown, 2020

<u>Alternative 2-A (Proposed Action)</u>

Alternative 2-A (Proposed Action) met the first level screening criteria because it provides the required square feet of cargo warehouse and three cargo aircraft parking positions with a new north cargo area hardstand. Warehousing facilities are provided in this alternative by redeveloping portions of the existing cargo area and constructing new facilities on the Port's L-shaped parcel of land north of SR 518. Support facilities would be provided by redeveloping portions of the existing north cargo area. For these reasons, Alternative 2-A was found to meet the Purpose and Need of the project and was carried forward for second level screening.

<u>Alternative 2-B (South Option)</u>

Alternative 2-B (South Option) met the first level screening criteria because it constructs the required square feet of cargo warehouse and three to five cargo aircraft parking positions, and support facilities needed to meet the cargo-related Purpose and Need within a new area in the south site. For these reasons, Alternative 2-B would meet the Purpose and Need of the project and was carried forward for second level screening.

1.6.2.2 Second Level of Screening

The results of the second level screening for the preliminary cargo alternatives are summarized in **Table 5**. Alternative 2-A was found to fully meet the Purpose and Need and would have substantially fewer operational impacts and less cost when compared with Alternative 2-B. Therefore, this alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.

TABLE 5: NEED #2 – SECOND LEVEL SCREENING

Alternative Description	Operational	Cost	Carried Forward?
Alternative 2-A: Proposed Action Construct new cargo facilities in the north cargo area, and on the Port's L-shaped parcel of land north of SR 518	• Limited impacts to operation of existing Airport during construction • Increased cargo facilities once constructed	Commensurate with the magnitude of the proposed construction.	Yes. This alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.
Alternative 2-B: South Option Construct new cargo facilities on the south side of SEA (south aviation support area)	• Impacts to Airport roadways during construction • Increased cargo facilities once constructed • Substantially higher operational impacts after construction due to additional congestion on Taxiways A and B near the passenger terminal area from having more cargo aircraft and support vehicles moving between the two cargo sites	Construction costs would be substantially higher than the Proposed Action due to the need for new access roads, bridges, and additional cargo apron; additional earthwork, and relocation/replacement of facilities. The level of additional cost would preclude construction in the timeframe when the improvements are needed.	No. This alternative is not reasonable or feasible and was not carried forward for detailed environmental impact analysis.

Source: Analysis completed by Landrum & Brown, 2020

<u>ALTERNATIVE 2-A (PROPOSED ACTION)</u>

Alternative 2-A would result in operational impacts during construction because several maintenance and Airport support functions would have to be relocated to accommodate the cargo expansion. After construction, the cargo operations would benefit from additional facilities; however, the maintenance and support functions moved to the west side of the Airport would be farther from the Main Terminal and cargo areas than they are today. The costs associated with Alternative 2-A would include the construction of additional aircraft parking, warehousing, and support facilities.

ALTERNATIVE 2-B (SOUTH OPTION)

Alternative 2-B would result in similar operational impacts during construction as the Proposed Action because several facilities located in the south site would have to be relocated to the west and north side of the Airport. After construction, the cargo facilities would be split on the north and south side, causing inefficiencies and duplication of services. The airfield may experience additional congestion due to having more cargo aircraft and support vehicles moving between the two cargo sites, resulting in additional congestion on Taxiways A and B near the passenger terminal area.

The costs associated with Alternative 2-B would be substantially higher than the Proposed Action due to the additional earthwork required to bring the site up to a level grade suitable for construction of a cargo facility, the possible need for new access roads, the need for new bridges to connect aircraft and ground equipment from the proposed site to the airfield, and the need for additional cargo apron. This alternative would also require the relocation or replacement of several existing facilities currently in the south area of the Airport. Although formal cost estimates have not been prepared, it is conservatively estimated that the additional cost as compared to the Proposed Action would be in excess of $1 billion. The SAMP evaluated this option and found the costs would make it infeasible to achieve the development in the timeframe when the improvements are needed.

SCREENING SUMMARY

Alternative 2-A fully meets the Purpose and Need and would have substantially fewer operational impacts and less cost when compared with the other action alternative. Therefore, this alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.

Alternative 2-B fully meets the Purpose and Need but would result in negative operational impacts to cargo operators and create more congestion on Taxiways A and B near the passenger terminal area. It would also result in substantially higher costs. These costs mean it would be infeasible to complete construction in the timeframe of when improvements are needed. Therefore, Alternative 2-B is not reasonable or feasible and was not carried forward for detailed environmental impact analysis.

1.6.3 Need #3: Portions of the Airfield No Longer Meet Current Federal Aviation Administration (FAA) Airport Design Standards

Preliminary alternatives were developed to address the areas of the airfield that are no longer in compliance with FAA design standards (Need #3). One of the key factors that influenced the development of the FAA airfield design standards alternatives is the ability to bring an area up to standards without unreasonable impacts to other important airport functions.

The following preliminary alternatives were developed to address the three portions of the airfield that no longer meet current FAA airport design standards (grouped by area of need):

- **Non-standard Blast Pad Alternatives**: According to FAA standards, blast pads, which provide erosion protection from aircraft jet blast, should be 220 feet wide by 400 feet long. The existing Runway 16R/34L blast pads (200-foot wide by 200-foot long) do not meet this standard.
- **Non-standard Taxiway Geometry Alternatives**: According to FAA standards, taxiway intersections should have no more than three paths (or potential choices to turn) to increase pilot situational awareness. The intersection of Taxiway A with Taxiways C and D near the Runway 16L threshold does not meet this standard.
- **Taxiway B Separation Alternatives**: The FAA-required separation between the centerlines of Runway 16L/34R and Taxiway B is 500 feet when aircraft are approaching in certain visibility

conditions.[12] Taxiway B has 400 feet of separation to the centerline of Runway 16L/34R, so it does not meet this standard.

The descriptions of each of the preliminary alternatives include the elements needed to meet current FAA airport design standards.[13] Each of the preliminary alternatives is depicted on **Exhibit 8.**

Alternative 3-A1 (Proposed Action): Expand Blast Pads for Runway 16R/34L

This alternative would extend/expand the blast pads for Runway 16R/34L from 200 feet by 200 feet to 220 feet by 400 feet in order meet FAA standards.

Alternative 3-A2 (Existing Blast Pad Option): Convert existing Runway 16R/34L Pavement into a Blast Pad

This alternative would meet current FAA standards by converting existing runway pavement into a blast pad, thereby shortening the usable length of the runway.

Alternative 3-B (Proposed action): Reconfigure non-standard taxiway geometry

This alternative would reconfigure non-standard taxiway geometry by correcting non-standard intersection angles, and reconfiguring intersections with more than three nodes. Only one alternative was developed because no other physical or operational options exist to comply with the standard.

Alternative 3-C1 (Proposed action): Reconfigure Taxiway B in the areas where other project elements are being constructed

This alternative would reconfigure Taxiway B in the areas where other project elements are being constructed to provide 500-foot separation to partially meet standards. This alternative does not address the full length of Taxiway B and would require part of the taxiway to continue to operate under an existing Modification of Standards (MOS).[14]

Alternative 3-C2 (Full Separation Option): Provide a standard 500-foot separation along the entire length of Taxiway B

This alternative would provide a standard 500-foot separation along the entire length of Taxiway B by shifting the taxiway 100 feet closer to Concourses B and C. This shift would result in the aircraft parking positions at these gates extending into the taxiway, requiring their elimination. Therefore, this alternative includes the relocation of 8 to 20 aircraft gates currently located on Concourses B and C. These gates would be replaced either as part of a new concourse or an extension to existing concourses.

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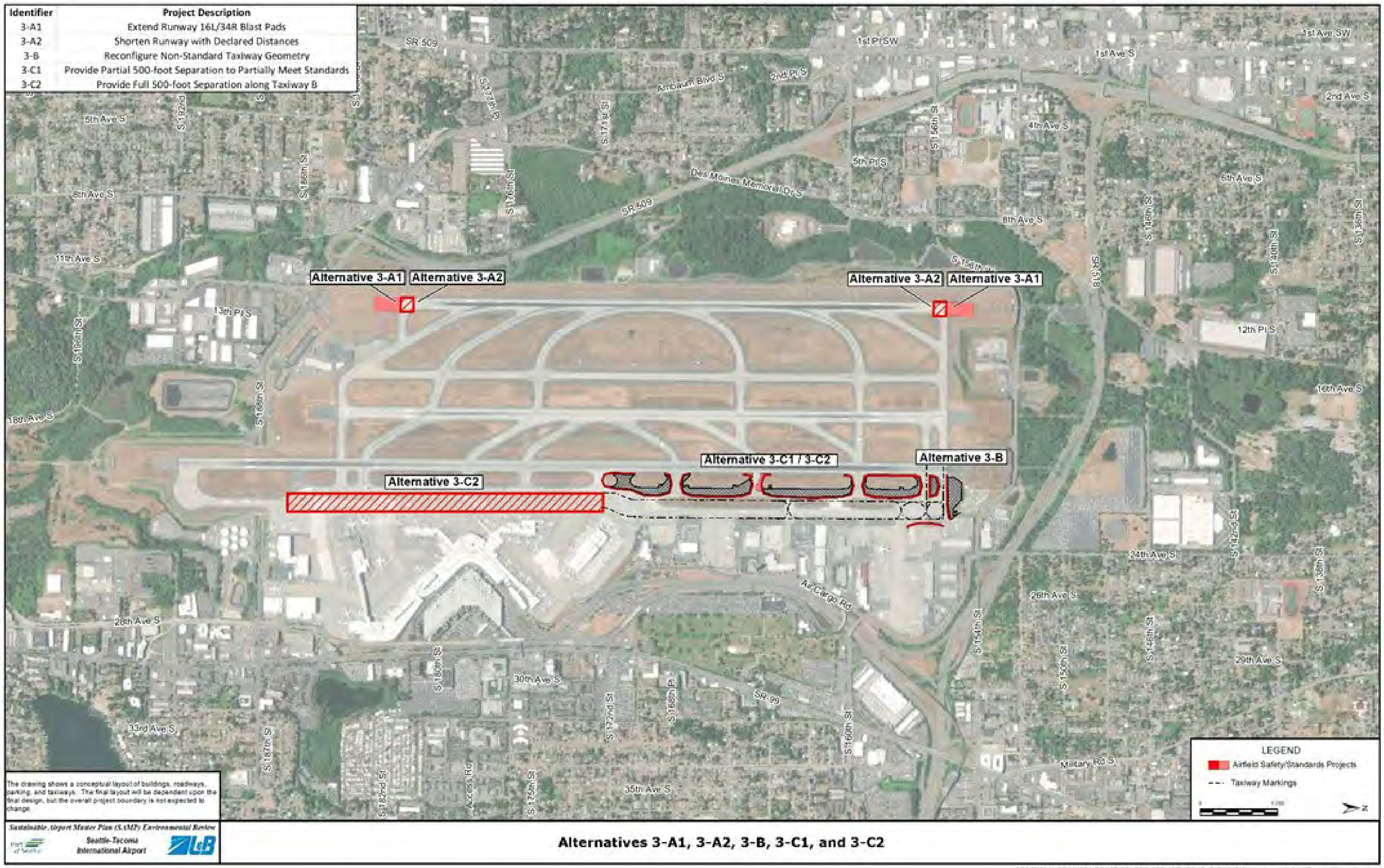
[12] FAA Advisory Circular (AC) 150/5300-13B, Appendix G, Table G-12. Runway design standards matrix, C/D/E – VI, 2022. Appendix B9

[13] FAA AC 150/5300-13B, Airport Design, Appendix G, Table G-11. Runway Design Standards Matrix, C/D/E – V, 2022. Appendix B9

[14] The proposed Taxiway A/B extension would incorporate current FAA standards, and if implemented, would bring that portion of the taxiway system into compliance.

EXHIBIT 8, ALTERNATIVES 3-A1, 3-A2, 3-B, 3-C1, AND 3-C2



Note: RIM = Runway Incursion Mitigation

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1.6.3.1 First Level of Screening

The FAA design standards alternatives were screened to eliminate those that would not fulfill the airport design Purpose and Need. Each preliminary alternative was evaluated based on specific criteria identified in the Purpose and Need:

- **Criterion 1 (Non-standard Blast Pads Alternatives)**: Would the alternative provide standard 220-foot by 400-foot blast pads that satisfy FAA design standards for C/D/E-V runways?
- **Criterion 2 (Taxiway Geometry Alternatives)**: Would the alternative provide standardized geometry in accordance with FAA design standards?
- **Criterion 3 (Taxiway B Separation Alternatives)**: Would the alternative provide the standard 500-foot separation between the runway centerline and taxiway centerline?

The preliminary alternatives, and their ability to meet the screening criteria, are summarized in **Table 6**.

TABLE 6: NEED #3 – FIRST LEVEL SCREENING

Alternative Description	Runway 16R/34L Blast Pads	Taxiway Geometry	Taxiway B Separation
Non-Standard Blast Pads Alternative 3-A1 (Proposed Action): Expand Runway 16R/34L blast pads to meet standards	Yes	N/A	N/A
Non-Standard Blast Pads Alternative 3-A2 (Existing Blast Pad Option): Meet standards by using existing runway pavement, with a shortened usable length for takeoffs	Yes	N/A	N/A
Non-standard Taxiway Geometry Alternative 3-B (Proposed Action): Reconfigure non-standard taxiway geometry	N/A	Yes	N/A
Taxiway B Separation Alternative 3-C1 (Proposed Action): Reconfigure Taxiway B in the areas where other project elements are being constructed to provide 500-foot separation to partially meet standards	N/A	N/A	Yes
Taxiway B Separation Alternative 3-C2 (Full Separation Option): Provide full 500-foot separation from Taxiway 16L/34R	N/A	N/A	Yes

Note: None of the alternatives meet all needs. The alternatives only meet a specific FAA Airport Design Standard need.
Source: Analysis completed by Landrum & Brown, 2020

<u>Alternative 3-A1 (Proposed Action)</u>

Alternative 3-A1 (Proposed Action) met the first level screening criteria for Runway 16R/34L blast pads by constructing new runway pavement to expand the existing blast pad from 200 feet by 200 feet to 220 feet by 400 feet. For this reason, Alternative 3-A1 was found to meet the Purpose and Need of the project and was carried forward for second level screening.

Alternative 3-A2 (Existing Blast Pad Option)

Alternative 3-A2 (Existing Blast Pad Option) met the first level screening criteria for Runway 16R/34L blast pads by converting a portion of the runway pavement to blast pad, to create a blast pad area that is 220 feet x 400 feet. For this reason, Alternative 3-A2 was found to meet the Purpose and Need of the project and was carried forward for second level screening.

Alternative 3-B (Proposed Action)

Alternative 3-B (Proposed Action) met the first level screening criterion for taxiway geometry by correcting non-standard intersection angles and reconfiguring intersections with more than three nodes. For this reason, Alternative 3-B was found to meet the Purpose and Need of the project and was carried forward for detailed environmental impact analysis. Because there are no additional alternatives for the taxiway geometry needs, second level screening was not required.

Alternatives 3-C1 (Proposed Action)

Alternatives 3-C1 (Proposed Action) met the first level screening criteria for Taxiway B separation by reconfiguring Taxiway B in the areas where other project elements are being constructed to provide full 500-foot separation, with the remainder of the taxiway continuing to operate under an existing MOS. For this reason, Alternative 3-C1 was found to meet the Purpose and Need of the project and was carried forward for second level screening.

Alternative 3-C2 (Full Separation Option)

Alternative 3-C2 (Full Separation Option) was found to satisfy the first level screening criteria for Taxiway B separation by reconfiguring the full length of Taxiway B to provide full 500-foot separation. For this reason, Alternative 3-C2 was found to meet the Purpose and Need of the project and was carried forward for second level screening.

1.6.3.2 Second Level of Screening

Alternative 3-B (Proposed Action for Reconfigure Non-standard Taxiway Geometry) was found to satisfy the first level screening criteria and there are no additional alternatives identified (aside from the No Action Alternative). Therefore, second level screening was not required. The results of the second level screening of the FAA design standards for the remaining alternatives are summarized in **Table 7**. Based on the second level screening, Alternative 3-A1 and Alternative 3-C1, in addition to Alternative 3-B, are carried forward for detailed evaluation.

TABLE 7: NEED #3 – SECOND LEVEL SCREENING

Alternative Description	Operational Criteria	Cost Criteria	Carried Forward?
Non-Standard Blast Pads Alternative 3-A1 (Proposed Action)	• Limited impacts to operation of existing Airport during construction • No impact after construction	Minor cost	Yes. This alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.
Non-Standard Blast Pads Alternative 3-A2 (Existing Blast Pad Option)	• Limited impacts to operation of existing Airport during construction • Reduction in airfield capability after construction	Minor cost	No. This alternative is not reasonable and was not carried forward for detailed environmental impact analysis.
Taxiway B Separation Alternative 3-C1 (Proposed Action)	• Limited impacts to operation of existing Airport during construction • Bring more of the airfield into compliance with FAA requirements; FAA MOS would continue	Minor cost	Yes. This alternative is reasonable and feasible and was carried forward for detailed environmental impact analysis.
Taxiway B Separation Alternative 3-C2: (Full Separation Option)	• Substantial impacts to existing Airport due to permanent and temporary aircraft gate closures • Brings entire taxiway into compliance with FAA requirements	Construction costs would be substantially higher than the Proposed Action due to the closure and replacement of up to 20 gates at Concourses B and C, in addition to the 19 gates proposed and relocating two taxiways	No. This alternative is not reasonable and was not carried forward for detailed environmental impact analysis.

Note: None of the alternatives meet all needs. The alternatives only meet a specific FAA Airport Design Standard need.
Source: Analysis completed by Landrum & Brown, 2020

RUNWAY 16R/34L BLAST PADS

The evaluation of Alternative 3-A1 (Proposed Action) is as follows:

- **Operational Factors**: Alternative 3-A1 would result in minor construction related impacts that include temporary closure of Runway 16R/34L during active construction periods. After construction there would be no change to the operating environment from current conditions.
- **Cost Factors**: The costs associated with Alternative 3-A1 would be minor and include materials and construction costs for the additional blast pad pavement.

The evaluation of Alternative 3-A2 (Existing Blast Pad Option) is as follows:

- **Operational Factors**: Alternative 3-A2 would result in minor construction related impacts that include temporary closure of Runway 16R/34L during active construction periods. After construction, this alternative would result in a reduction in the usable runway length for landings and takeoffs of up to 400 feet, because a portion of the runway would be converted to blast pad. Runway 16R/34L is primarily used for landing aircraft, but when needed, it is used for departures.

The reduction in length for arrivals could reduce the ability of larger aircraft to use it for landings during wet and snowy conditions. The reduction in length for departures could reduce the ability for aircraft to use it for takeoff during hot weather conditions. This reduction in runway length could result in a detrimental impact in the operational capability of the entire airfield; therefore, Alternative 3-A2 is not reasonable.

- **Cost Factors**: Alternative 3-A2 cost would be minor and would involve restriping of existing pavement and additional costs associated with formally changing the runway end location in various FAA databases.

SCREENING SUMMARY

Alternative 3-A1 fully meets the Purpose and Need and would have similar or better operational and cost considerations when compared with the other action alternative. Therefore, this alternative was found to be reasonable and feasible and was carried forward for detailed environmental impact analysis.

Alternative 3-A2 fully meets the Purpose and Need but would result in a reduction in runway length and airfield capability. Therefore, Alternative 3-A2 is not reasonable and was not carried forward for detailed environmental impact analysis.

TAXIWAY B SEPARATION

The evaluation of Alternative 3-C1 (Proposed Action) is as follows:

- **Operational Factors**: Alternative 3-C1 would result in minor operational impacts during construction, primarily associated with closures during actual construction periods. After construction, this alternative would address FAA design standards for the full length of Taxiway B through the continued implementation of procedures documented in the FAA MOS (which currently permits use of Taxiway B with the partial 500-foot separation) while working with the FAA to identify a permanent solution.
- **Cost Factors**: The construction costs associated Alternative 3-C1 would include relatively minor construction activities to relocate the taxiway.

The evaluation of Alternative 3-C2 (Full Separation Option) is as follows:

- **Operational Factors**: Alternative 3-C2 would result in substantial impacts during construction, particularly when construction occurs immediately west of the terminal area. During this time up to 20 aircraft gates would have to be closed permanently and more gates would be temporarily closed or limited in use. After construction, there would be no operational impacts if there was not a separate need for additional aircraft gates. Given that there is a need for an additional 19 narrowbody equivalent aircraft boarding gates, this alternative would result in substantial operational impacts after completion, most likely to cargo operators as the gates would most likely be placed in the north cargo area and those facilities would require relocation.
- **Cost Factors**: Alternative 3-C2 would be substantially more expensive than the Proposed Action because it would require the closure of up to 20 aircraft boarding gates at Concourses B and C. These gates would require replacement and would be in addition to the 19 narrowbody equivalent aircraft boarding gates currently proposed. The most likely location for these additional gates would be in the north cargo area, resulting in substantial cost to remove and replace those facilities. In addition, this alternative would require the entire taxiway to be shifted and the relocation of Taxilane W, both of which would increase the cost above the Proposed Action. Although formal cost

estimates have not been prepared, it is conservatively estimated that the additional cost as compared to the Proposed Action would be in excess of $1 billion.

SCREENING SUMMARY

Alternative 3-C1 fully meets the Purpose and Need and would have better operational and cost considerations when compared with the other action alternative. Therefore, this alternative would be reasonable and feasible and was carried forward for detailed environmental impact analysis.

Alternative 3-C2 meets the Purpose and Need but would result in a substantial increase in costs over the Proposed Action. Therefore, Alternative 3-C2 cannot be reasonable and was not carried forward for detailed environmental impact analysis.

1.6.4 Need #4: Inefficient/Inadequate Taxiway Layout

Alternatives to address Need #4 focused on two areas of the airfield (the south end of Runway 16L/34R and west of Runway 16C/34C). These areas were examined because operational efficiency could be improved, projected future airfield traffic would flow in these areas, and improvements can be provided without affecting other airfield or Airport functions.

The alternative identification and evaluation efforts produced preliminary alternatives. Because each area is part of an existing taxiway system, the range of alternatives was limited to the general area where the inefficiency occurs. System-wide changes that would relocate or replace entire taxiways or runways were not considered as part of the NTPs because they would result in substantial disruption and construction costs and are beyond the identified need.

- **South end of Runway 16L/34R**: Currently a single taxiway serves the south end of Runway 16L/34R, which results in long lines of queuing aircraft during peak periods and can prevent aircraft from accessing gates in the southern portion of the terminal. A single alternative was developed to address this condition given the airfield and facility constraints present in this area of Runway 16L/34R.
- **West of Runway 16C/34C**: Currently there is a need to provide a more efficient connection from the portion of the airfield west of the center runway to the terminal area. A single alternative was developed to provide a more efficient operation given the geometry of the airfield and FAA airfield design requirements.

Exhibit 9 and **Exhibit 10** show each of the preliminary alternatives.

Alternative 4-A (Proposed Action): Taxiway A/B Extension

This alternative extends Taxiway A/B at the south end of Runway 16L/34R, creating a new parallel taxiway system. This would provide additional space for aircraft queuing, better runway access, and more flexibility in situations where aircraft are held or disabled. Temporary closures of the taxiways during construction would likely be required.

Alternative 4-B (Proposed Action): Runway 34L High-Speed Exit

This alternative involves constructing a new high-speed taxiway exit from Runway 16R/34L and a new crossing of Runway 16C/34C. These taxiways would provide a more efficient connection to the terminal area and create additional holding areas for taxiing aircraft. Temporary closures of the taxiways during construction would likely be required.

1.6.4.1 First Level of Screening

For each of the preliminary taxiway efficiency alternatives, a first level of screening was performed to eliminate those alternatives that would not fulfill the Purpose and Need. Each preliminary alternative was evaluated based on specific criteria identified in the Purpose and Need:

- **Criterion 1 (South End of Runway 16L/34R)**: Would it decrease congestion during peak operating periods on the taxiways near the south end of Runway 16L/34R?
- **Criterion 2 (West of Runway 16C/34C)**: Would it decrease congestion during peak operating periods on the taxiways west of Runway 16C/34C?

The preliminary alternatives, and their ability to meet the screening criteria, are summarized in **Table 8**.

TABLE 8: NEED #4 – FIRST LEVEL SCREENING (DOES ALTERNATIVE MEET SEA'S NEEDS?)

Alternative Description	South End of Runway 16L/34R	West of Runway 16C/34C
South End of Runway 16L/34R Alternative 4-A (Proposed Action) for South End of Runway 16L/34R): Taxiway A/B Extension at south end of Runway 16L/34R	Yes	N/A
West of Runway 16C/34C Alternative 4-B (Proposed Action) for West of Runway 16C/34C): Construct new high-speed taxiway exits from Runway 16R/34L, and a new crossing of Runway 16C/34C	N/A	Yes

Source: Analysis completed by Landrum & Brown, 2020

1.6.4.2 Second Level of Screening

Both Alternatives 4-A (Proposed Action for South End of Runway 16L/34R) and 4-B (Proposed Action for West of Runway 16C/34C) were found to satisfy the first level screening criteria related to their specific area of need, and there were no additional alternatives identified (aside from the No Action Alternative). Therefore, second level screening was not required.

EXHIBIT 9, ALTERNATIVE 4-A: PROPOSED ACTION

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EXHIBIT 10, ALTERNATIVE 4-B: PROPOSED ACTION

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1.6.5 Need #5: Lack of Fuel Storage to Meet Projected Demand and the Port's Sustainable Aviation Fuel (SAF) Initiative

Alternatives were developed that would provide the necessary facilities to meet the projected fuel storage demand at SEA and meet the Port's SAF initiative (Need #5). The key factors that influenced the development of fuel storage alternatives are location and security, given the potential risks associated with the storage of large quantities of fuel. Airport-related fuel facilities are typically located in areas with substantial security, lighting, fencing, and access control, and away from aircraft activity. The Port studied potential options related to integrating biofuels into SEA's fuel distribution system. That study concluded a small biofuel receiving and blending facility at the SEA fuel farm would be the most cost-effective solution in the short-term and would also fulfill an existing critical need for additional local fuel receipt and storage capacity that is not dependent on the Olympic Pipeline.[15] Given the results of that study and the general requirements for fuel storage, the areas available to meet the need within the existing land envelope of SEA were explored.

The alternative identification and evaluation efforts produced the following alternatives to address the lack of fuel storage, and to meet the Port's SAF initiative needs. Each of these alternatives are depicted on **Exhibit 11*.***

Alternative 5-A (Proposed Action): Expand Existing Fuel Farm

This alternative would expand the existing fuel farm to meet projected demand, including additional storage tanks, a blending tank, a SAF receipt tank, and associated support areas, utilizing the existing fuel distribution system connection.

Alternative 5-B (New Facility Option): Construction of New Fuel Facilities

This alternative would construct new fuel facilities at the South 156th Way construction staging area (on the northern side of SEA) to supplement or replace the existing facilities. The facilities include storage tanks, a blending tank, a SAF receipt tank, and associated support areas. Alternative 5-B would result in the displacement of a temporary construction staging area used for multiple past and current Airport projects. This location has no access to the Olympic Pipeline and would require significant infrastructure to connect.

1.6.5.1 First Level of Screening

The fuel storage alternatives were screened to eliminate the ones that would not fulfill the Purpose and Need. Each preliminary alternative was evaluated based on specific criteria identified in the Purpose and Need:

- **Criterion 1 (Size of Site)**: Would the alternative accommodate four additional fuel storage tanks (adding 10-million-gallons of storage capacity), a 500,000-gallon blending tank, a 100,000-gallon SAF receipt tank, and vehicle support areas?
- **Criterion 2 (Fuel Distribution)**: Would the alternative be able to tap into the existing on-airport fuel distribution system?
- **Criterion 3 (Access)**: Would the alternative have public and airside access for trucks and other support vehicles entering or exiting the site?

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[15] Aviation Biofuels Infrastructure Feasibility Study, prepared for Port, Boeing, and Alaska Airlines, November 2016. Available for review at: https://www.airportprojects.net/sampenvironmentalreview/aviation-biofuel-infrastructure-report/.

The preliminary alternatives and their ability to meet the screening criteria are summarized in **Table 9**.

TABLE 9: NEED #5 – FIRST LEVEL SCREENING (DOES ALTERNATIVE MEET SEA'S NEEDS?)

Alternative Description	Size of Site	Access to Existing Fuel Delivery System	Vehicular Access
Alternative 5-A (Proposed Action): Expand existing fuel farm	Yes	Yes	Yes
Alternative 5-B (New Facility Option): Construct new facilities to supplement or replace the current facilities at the South 156th Way staging area	Yes	No	Yes

Source: Analysis completed by Landrum & Brown, 2020

1.6.5.2 Second Level of Screening

Because only Alternative 5-A satisfied the first level screening criteria (aside from the No Action Alternative), no second level screening was necessary.

EXHIBIT 11, ALTERNATIVE 5, FUEL STORAGE ALTERNATIVES

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1.7 Alternatives Being Carried Forward

Based on the analysis of the alternatives for the individual needs, the following alternatives were carried forward for detailed environmental impact analysis:

- **Alternative 1: No Action**: The No Action Alternative provides a baseline for comparison to the other action alternatives even though it would not meet the Purpose and Need.
- **Alternative 2: Proposed Action**: The Proposed Action represents a composite of the following elements:
    - Alternative 1-A: Construct a new second terminal and gates (T01, T02) to the north of the existing terminal to provide the necessary facilities at an optimal LOS[16]
    - Alternative 2-A: Construct new cargo facilities in the north cargo area (A08, C01, S08, S09) and on the Port's L-shaped parcel of land (C02, C03) to meet the projected cargo demand, and construct the Westside Maintenance Facility (S07) west of the airfield
    - Alternative 3-A1: Extend/expand the blast pads for Runway 16R/34L from 200 feet by 200 feet to 220 feet by 400 feet to meet FAA standards (A02)
    - Alternative 3-B: Reconfigure non-standard taxiway geometry to meet FAA standards (A03, A10)
    - Alternative 3-C1: Reconfigure Taxiway B in the areas where other project elements are being constructed to provide 500-foot separation to partially meet FAA standards (A04)
    - Alternative 4-A: Extend Taxiway A/B at south end of Runway 16L/34R, creating a new parallel taxiway system to improve efficiency in the south airfield (A01)
    - Alternative 4-B: Construct a new high-speed taxiway exit from Runway 16R/34L (A06), and a new crossing of Runway 16C/34C (A07) to provide a more efficient connection to the terminal area and create additional holding areas for taxiing aircraft
    - Alternative 5-A: Expand existing fuel farm to meet projected demand, including additional storage tanks, a blending tank, a SAF receipt tank, and associated support areas, utilizing the existing fuel distribution system connection (S01)
- **Alternative 3: Hybrid Terminal Option**: The Hybrid Terminal Option includes the same elements as Alternative 2: Proposed Action except for terminal and gate location. Alternative 1-E replaces Alternative 1-A to provide the necessary terminal and gate facilities. For consistency, the complete description is as follows:
    - Alternative 1-E: Construct a new second terminal and gates (T01, T02) to the north of the Main Terminal connected to Concourse D to provide the necessary facilities at an optimal LOS[17]
    - Alternative 2-A: Construct new cargo facilities in the north cargo area (A08, C01, S08, S09) and on the Port's L-shaped parcel of land (C02, C03) to meet the projected cargo demand, and construct the Westside Maintenance Facility (S07) west of the airfield
    - Alternative 3-A1: Extend/expand the blast pads for Runway 16R/34L from 200 feet by 200 feet to 220 feet by 400 feet to meet FAA standards
    - Alternative 3-B: Reconfigure non-standard taxiway geometry to meet FAA standards (A03, A10)
    - Alternative 3-C1: Reconfigure Taxiway B in the areas where other project elements are being constructed to provide 500-foot separation to partially meet FAA standards (A04)

[16] Also includes projects A05, A09, L01, L02, L03, L04, L05, L07, S02, S03, S04, S05, S06, and S10
[17] Also includes projects A05, A09, L01, L02, L03, L04, L05, L07, S02, S03, S04, S05, S06, S10, and an extension of the Main Terminal

- Alternative 4-A: Extend Taxiway A/B at south end of Runway 16L/34R, creating a new parallel taxiway system to improve efficiency in the south airfield (A01)
- Alternative 4-B: Construct a new high-speed taxiway exit from Runway 16R/34L (A06), and a new crossing of Runway 16C/34C (A07) to provide a more efficient connection to the terminal area and create additional holding areas for taxiing aircraft
- Alternative 5-A: Expand existing fuel farm to meet projected demand, including additional storage tanks, a blending tank, a SAF receipt tank, and associated support areas, utilizing the existing fuel distribution system connection (S01)

APPENDIX B

Purpose & Need and Alternatives Supporting Information

Advanced Planning Terminal Needs Assessment Report

Notes:

In December of 2019 the Port of Seattle prepared a Advanced Planning Terminal Needs Assessment report (independent of the SAMP EA) to refine terminal needs identified by the SAMP because terminal check-in and security screening area requirements, technologies and operating practices changed significantly since 2014. This report used the SAMP unconstrained forecasts when determining the requirement needs at 56 MAP. The information from this report was used in the calculations of the terminal check-in and security screening area requirements in the Purpose and Need Chapter.

March 2022

Seattle-Tacoma International Airport

Advanced Planning Terminal Needs Assessment

Prepared for:

Port of Seattle

Prepared by:

RICONDO & ASSOCIATES, INC.

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LIST OF EXHIBITS

1. NEEDS ASSESSMENT INTRODUCTION

The Main Terminal (MT) at Seattle Tacoma International Airport (the Airport) is approaching and occasionally exceeding capacity. The study summarized in this document determined the capacity of the existing MT and identified a strategy to optimize the existing footprint and infrastructure prior to additional gate facilities, as presented in Section 2.

Advanced planning studies furthered the proposals of the Sustainable Airport Master Plan (SAMP), which identified the need for 19 new narrow-body equivalent (NBE) contact gates (North Gates) to meet near-term demand. Preliminary holdroom and circulation requirements for the proposed North Gates are provided in Section 3.[1]

2. MAIN TERMINAL REQUIREMENTS SUMMARY

Capital improvement projects to improve operational efficiency, passenger experience, and stakeholder flexibility at the MT are being studied or are already underway. The Port of Seattle (Port) initiated advanced planning studies to provide a strategic plan for the optimization of the existing footprint and infrastructure of the MT to accommodate growing demand during the gap between present-day and reasonable implementation of enhancement initiatives; and to create a balanced, flexible paradigm for MT campus facilities beyond the planning horizon.

2.1 PROJECT DESCRIPTION

Current capabilities and efficiency of the existing facilities were assessed, future MT requirements were identified, and an overall integrated strategy for the MT in coordination with Airport campus plans was defined.

Analysis of terminal facilities over a planning horizon determine how critical facilities accommodate existing and future passenger demand. This analysis informed the development of terminal configuration concepts that seek to optimize existing infrastructure and processing elements, and balance individual component processing efficiencies at an appropriate LOS within the existing MT.

A consensus optimized plan and overall Airport Campus strategy defined an approach and provided a road map for the reorganization of MT elements and process flows. This approach comprised a series of incremental improvement projects. The plan presented in these findings is intended to provide a framework for future Airport development, based on leveraging existing areas and infrastructure; developing intuitive connectivity within the MT, between adjacent facilities and the overall Airport; mitigate future constraints and impacts by providing flexible, adaptable configurations; and inform future financial decisions.

Each individual project area will require additional study and refinement to fully understand impacts, schedule, cost, and other considerations.

2.1.1 PROJECT OBJECTIVES

The primary objective this advanced planning effort was to provide a framework for the optimization of the existing footprint and infrastructure of the MT to accommodate growing demand during the gap between present-day and

[1] Advanced planning studies provided a strategic plan for optimization of the existing Main Terminal footprint and developed the north terminal program beyond the master plan level of detail to further evaluate site constraints and opportunities.

reasonable implementation of Airport enhancement initiatives, and to create a balanced, flexible paradigm for MT campus facilities beyond the planning horizon. The results of this analysis were meant as a guideline for future decisions regarding incremental enhancements of the terminal components, correlated to ongoing Airport initiatives, and resulting in a balanced, appropriately-sized facility. The following summarizes the overall goals and objectives for this advanced planning effort:

- Set MT requirements with consideration for long-term Airport development initiatives
- Develop a gap analysis of MT functional areas over time, illustrating capacity imbalances between processor throughput and demand, and the resulting impact on passenger LOS
- Highlight the MT's interrelationships with other Airport plans and initiatives
- Develop near- and long-term strategies for MT optimization that anticipate new technologies and innovation, consider the impact of these developments on existing facilities and current system imbalances
- Determine optimal functional capacities of the existing MT campus to inform the development of other strategies or projects
- Provide implementation and phasing strategies for the preferred solution

2.1.2 STRATEGIC VISION

The Strategic Vision is a connectivity strategy between future activity centers and key access nodes across the Airport. It serves as a roadmap to help maintain the flexibility of terminal and landside systems. The Strategic Vision is based on a configuration that optimizes the existing MT's functionality and its compatibility with other Airport facilities, as shown on **Exhibit 2-1**. This configurational strategy and interconnectivity of campus elements at the MT provides a flexible, forward-thinking solution based on industry trends, government agency initiatives, LOS goals defined by both the Port and industry standards, stakeholder objectives, as well as other priorities including landside access, intermodal opportunities, overall connectivity between current and future Airport facilities, and commercial programs.

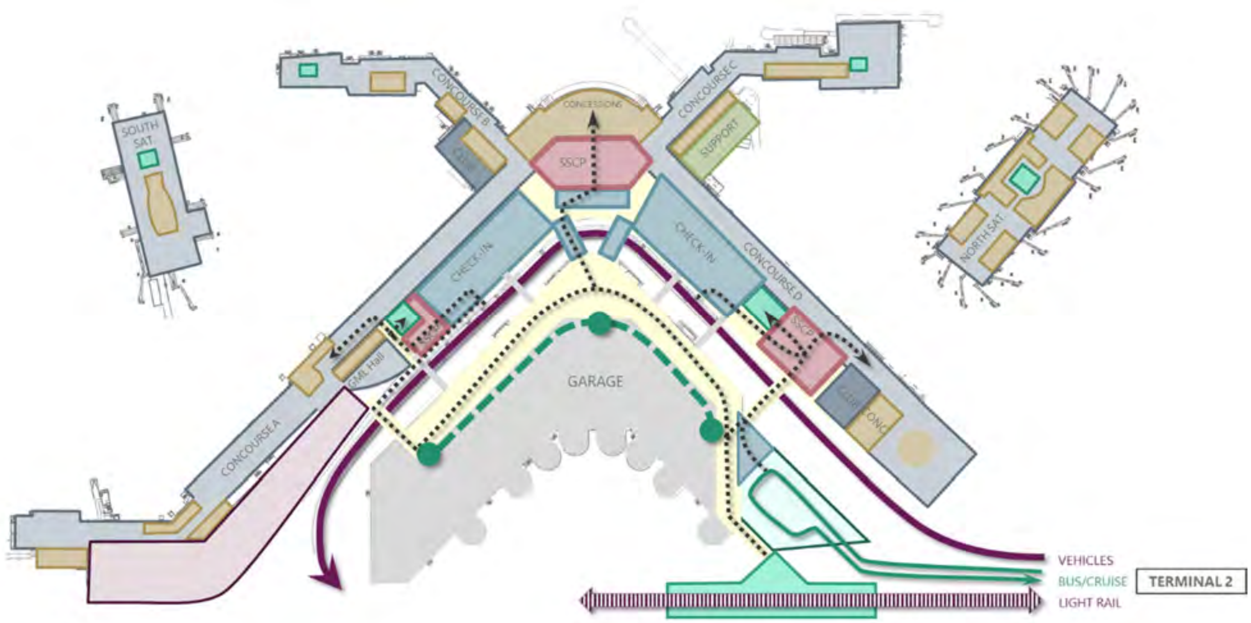
2.1.2.1 AIRPORT CONNECTIVITY AND KEY NODES

Exhibit 2-2 illustrates anticipated connectivity points and passenger movement throughout the Airport campus, following improvements defined in other Airport plans and initiatives. To maximize Airport efficiency, it is critical to maximize overall Airport connectivity and develop key activity nodes (areas of concentrated passenger activity) with intuitive access and wayfinding. These connectivity initiatives can enhance passenger and vehicle circulation, enable more efficient adaptation of evolving modes of transportation (e.g., automated vehicles, ride shares, high occupancy vehicle options), and maintain a consistent Airport experience throughout the campus.

Exhibit 2-3 illustrates an enlarged view of the key activity nodes throughout the MT (South, Central, and North). The distinct characteristics of each node (passenger types and transportation activity) should inform and guide MT enhancements.

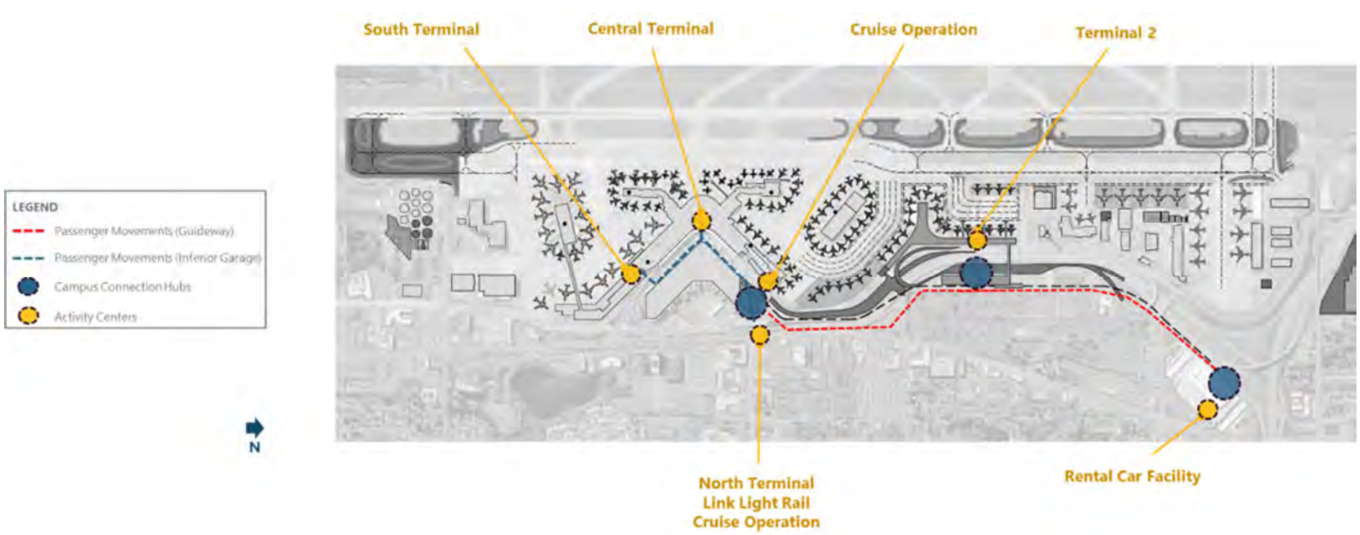
Known activity centers should be supported by Airport connection hubs that provide a sense of place and a destination that are easily accessible for intuitive passenger flows and access to transportation. By coordinating the development of individual Airport elements—specifically in the MT—with these key nodes will promote overall Airport connectivity and facilitate the enhancement of the passenger experience.

EXHIBIT 2-1 STRATEGIC VISION FOR THE MAIN TERMINAL COMPLEX



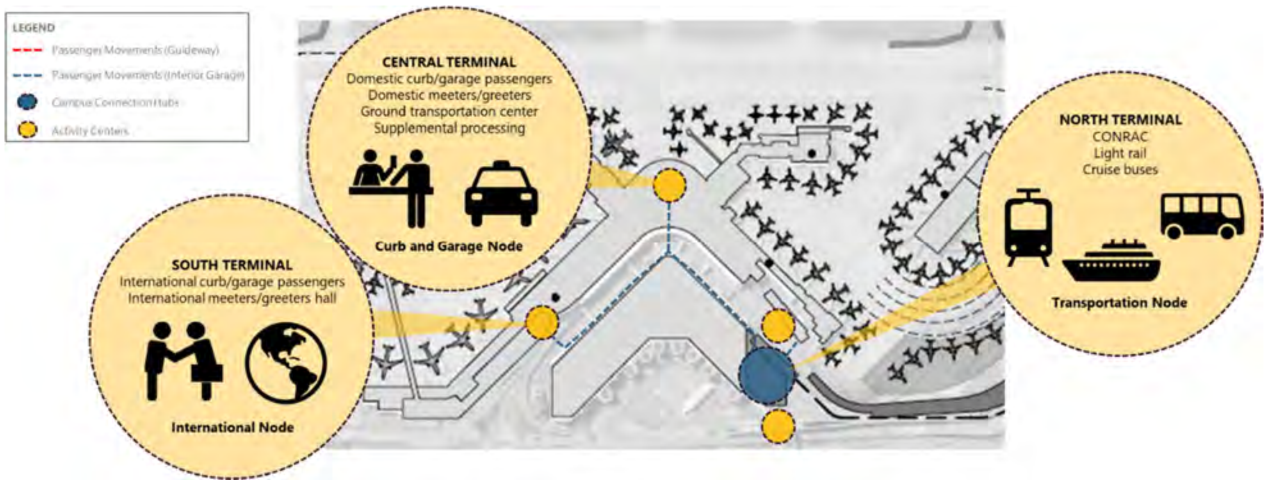
SOURCE: Ricondo & Associates, Inc. November 2018.

EXHIBIT 2-2 AIRPORT CONNECTIVITY AND KEY NODES



NOTE: Exhibit is not to scale.
SOURCE: Ricondo & Associates, Inc. August 2018.

EXHIBIT 2-3 MAIN TERMINAL NODES



NOTE: Exhibit is not to scale.
SOURCE: Ricondo & Associates, Inc. August 2018.

Key activity nodes at the Airport include:

- **South Terminal –** with the new International Arrivals Facility (IAF) to be completed in Y2020 and the existing Gina Marie Lindsey Hall (GML Hall), this area is expected to be the focal point for international passenger activity.
- **Central Terminal –** activity is primarily domestic and this area is situated for easy access between ground transportation in the garage and curbs, departure processing, and premier commercial areas.
- **North Terminal –** during the peak cruise season (April to October),[2] charter buses pick-up and drop-off passengers in the northeast garage area. The cruise facilities include bus curbs as well as luggage and tour assistance. Additionally, Link Light Rail picks up and drops off passengers in this area, with pedestrian access provided between the station and the MT via a pedestrian bridge and walkway through the garage. In the future, this area becomes a more critical connectivity node as other Airport initiatives propose connectivity to the future 2nd terminal from this area as well.
- **Terminal 2 –** Other Airport initiatives propose additional passenger processing and gate improvements north of the MT in the existing Doug Fox Parking Lot, becoming another key activity node.
- **Rental Car Facility (RCF) –** in addition to passenger activity associated with the RCF, other Airport initiatives propose an elevated bus guideway between the MT and future Terminal 2 from this site. This introduces additional opportunities to further leverage this site as a key activity node, considering technology adaptation and enhanced connectivity.

2.2 FUNCTIONAL GAP ANALYSIS

Each functional area was assessed based on its current operational efficiency, and ability to handle current and future design basis activity for passenger and baggage demand, as defined by industry-accepted metrics for wait time goals and functional area requirements. The analysis of each area considered discrete characteristics of current operators and existing configurations. These discrete criteria were used to evaluate processor deficiencies or surpluses over time, based on available facilities and equipment for each area.

2 Port of Seattle, Cruise Schedule 2018, 20 March 2018, https://www.portseattle.org/file-documents/cruise-schedule-2018.

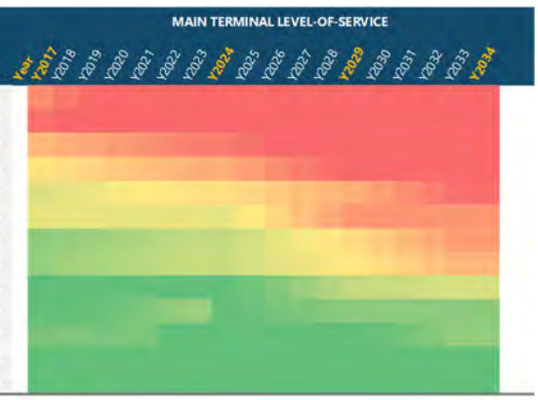
2.2.1 SPATIAL REQUIREMENTS

The results are organized according to three general facility types: airline processing facilities, Department of Homeland Security (DHS), and support spaces. The current inventory for each facility reflects existing plans and planned improvements at the time of this study. The spatial requirements refer to the physical space needed to accommodate an optimum LOS at projected activity levels during peak times.[3] The gap analysis compares the future requirements to the current airport facilities, analyzing processing efficiencies for each functional area.

Exhibit 2-4 summarizes the projected performance for each facility based on estimated LOS for a given demand throughout the planning horizon. The facilities are listed sequentially, starting with those providing the lowest LOS. For clarity, green indicates facilities providing optimum LOS for the given demand. Yellow represents sub-optimum LOS, and red indicates under-provided LOS. Color transitions indicate the increasing strain on LOS as Airport traffic grows.

EXHIBIT 2-4 SPATIAL REQUIREMENTS AND LEVEL OF SERVICE

		INVENTORY		REQUIREMENTS			
	Units	Existing	Future	Y2017	Y2024	Y2029	Y2034
Passenger Screening Checkpoint	sq ft	45,400	-	64,300	76,200	83,300	92,800
Check-in Hall	sq ft	37,700	-	55,800	60,600	70,000	77,800
Holdroom	sq ft	244,200	-	322,200	354,100	388,900	426,600
Commercial Support	sq ft	30,900	-	37,600	41,500	47,100	52,500
Public Restrooms	sq ft	65,300	-	74,300	80,300	87,900	97,100
Airport Support	sq ft	393,500	-	452,500	452,500	549,000	549,000
Commercial Program	sq ft	189,900	-	187,700	207,300	235,700	262,600
Airline Support	sq ft	271,700	-	272,200	298,900	328,100	359,600
Airline Ticket Office (ATO)	sq ft	22,600	-	18,200	20,000	24,600	25,400
Domestic Bag Claim	sq ft	30,800	34,300	26,300	31,100	33,700	33,700
Outbound Bag Make-up	carts	410	520	385	420	460	520
Baggage Service Office (BSO)	sq ft	6,000	-	2,300	2,700	2,900	2,900
Bag Screening	bags	7,200	7,500	5,200	4,000	4,500	5,400



LEGEND
- Optimum
- Sub-optimum
- Under-provided

NOTES:
Area requirements listed in the table reflect maximum spatial need and are rounded to the nearest 10 sq ft or 5 bags/cart.
Baggage handling system based on proposed Optimization Plan (online in Y2022).
ATO, BSO, and commercial spaces do not reflect individual airline or tenant needs.
Bag make-up does not include analysis of space efficiency, unit life cycles, and work environment.
Requirements based on approved LeighFisher, Sustainable Airport Master Plan, forecast and design day flight schedules.
Data based on time of analysis.
SOURCE: Ricondo & Associates, Inc., August 2018

NOTES:
Area requirements listed in the table reflect maximum spatial need and are rounded to the nearest 10 sq ft or 5 bags/cart.
Baggage handling system based on proposed Optimization Plan (online in Y2022).
ATO, BSO, and commercial spaces do not reflect individual airline or tenant needs.
Bag make-up does not include analysis of space efficiency, unit life cycles, and work environment.
Requirements based on LeighFisher, Sustainable Airport Master Plan, forecast approved by FAA in 2015 and design day flight schedules available at the time of study.
Data based on time of analysis.
SOURCE: Ricondo & Associates, Inc., August 2018.

2.3 PREFERRED OPTIMIZATION PLAN

After identifying relative building and functional area constraints through a gap analysis, initial concept alternatives were developed for enhancing passenger screening and check-in facilities in the context of the Strategic Vision. The alternatives were evaluated to determine whether, and to what degree, each approach could 1) optimize the efficiency of the existing MT footprint and infrastructure, 2) minimize the impact on current operations, and 3) provide incremental enhancements of functional areas. Under these criteria, the preferred strategy involved

[3] Peaking assumptions are based on peak-month-average-day (industry standard) calculations, as planning to the absolute peaks would result in space requirements that are higher than necessary for an optimum LOS.

consolidating passenger security screening into three checkpoints that flanked two check-in areas (which were also consolidated). This decision resulted from coordination with Port staff and aligned with multiple ongoing Service Directives (SDs), SAMP elements, and local stakeholder input.

The proposed improvements balance cost and opportunity while optimizing the efficiency of the existing MT footprint. The preferred plan was based on industry trends, government agency initiatives, predefined LOS goals, and stakeholder objectives. Other considerations included landside access, intermodal opportunities, overall connectivity between current and future Airport elements, and commercial programs.

2.3.1 PREFERRED PLAN: EARLY PROJECTS

A sequence of Early Projects that provided the most benefit in the shortest amount of time were identified. Given the complexities of the north MT area and adjacent areas, certain components of the proposed solution will be deferred. These include expansion of the MT to accommodate the north consolidated passenger security screening checkpoint, as well as connections to related projects in the existing parking garage and a proposed North Ground Transportation Center (GTC) Lot.

The Early Projects configuration is illustrated on **Exhibit 2-5**. The configuration includes two new consolidated checkpoints in the south and center areas of the MT, a new checkpoint on the baggage level, and maintains three ASLs at existing Checkpoint 5 until additional enhancements can be implemented.

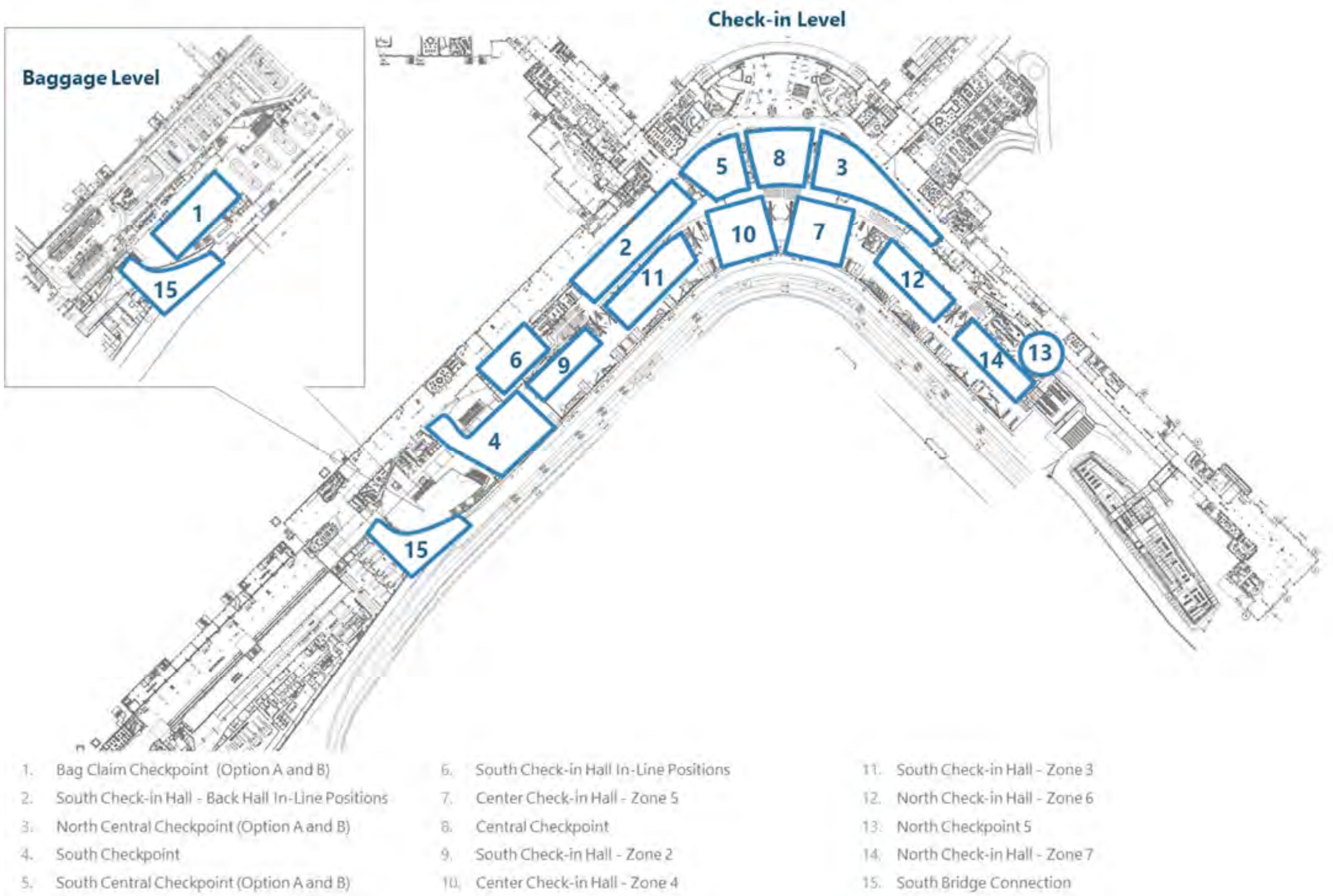
EXHIBIT 2-5 PREFERRED OPTIMIZATION PLAN

SOURCE: Ricondo & Associates, Inc., December 2018.

2.3.2 IMPLEMENTATION AND PHASING

Discrete project areas were identified to inform the implementation of improvement projects. Individual project areas shown on **Exhibit 2-6** were sequenced and evaluated based on three key considerations: mitigation of impacts to existing operation; prioritization of functional efficiency with each project (while minimizing the reduction of existing capacity); and mitigating dependencies between projects by maintaining independent utility of operation at the completion of each phase.

EXHIBIT 2-6 DISCRETE PROJECT AREAS



NOTE: Exhibit is not to scale.
SOURCE: Ricondo & Associates, Inc., October 2018.

The MT lacks sufficient space to replace all non-essential operations that would be displaced by enhancements on the check-in level. Building systems and support areas critical to functional spaces will be prioritized within the MT project areas. However, further studies will be needed for the relocation of certain displaced facilities, including commercial program areas and Airport support. These will be required through design development and other commercial development initiatives. It is anticipated that accommodation of non-processing areas in the MT would be considered in follow-on MT studies, resulting from the findings of this effort.

Based on the implementation timeline and improvements of the Early Projects, **Exhibit 2-7** illustrates the estimated change in LOS by facility if those projects are implemented. [4]

[4] LOS impacts are illustrated by year for indicative purposes only, and do not indicate a proposed construction schedule.

EXHIBIT 2-7 OPTIMIZED MAIN TERMINAL LEVEL OF SERVICE IMPROVEMENTS

	Units	Existing	Future	MTOP Improvements
Passenger Screening Checkpoint	sq ft	45,400	-	73,600
Check-in Hall	sq ft	37,700	-	57,200
Holdroom	sq ft	244,200	-	244,200
Commercial Support	sq ft	30,900	-	30,900
Public Restrooms	sq ft	65,300	-	67,500
Airport Support	sq ft	393,500	-	389,200
Commercial Program	sq ft	189,900	-	171,300
Airline Support	sq ft	271,700	-	265,600
Airline Ticket Office (ATO)	sq ft	22,600	-	7,800
Domestic Bag Claim	sq ft	30,800	-	30,800
Outbound Bag Make-up	carts	405	520	520
Baggage Service Office (BSO)	sq ft	6,000	-	5,300
Bag Screening	bags	7,200	7,500	7,500

LEGEND
- Optimum
- Sub-optimum
- Under-provided

NOTES:
Baggage handling system based on proposed Baggage Optimization Plan (online in Y2022).
Outbound Bag Make-up and Bag Screening facilities include additional capacity planned under the Baggage Optimization Plan.
ATO and BSO do not reflect individual airline needs.
Bag make-up does not include analysis of space efficiency, unit life cycles, and work environment.
Data based on time of analysis.
SOURCE: Ricondo & Associates, Inc., January 2019.

3. NORTH GATES REQUIREMENTS SUMMARY

The subsequent section outlines the assumptions for typical holdroom requirements and adjacent circulation requirements based on industry standards.[5] The purpose of identifying these assumptions and requirements is to determine the range of required area per gate. Each airport is unique; therefore, additional study and analysis will be necessary to determine comprehensive requirements in the post-planning period. Estimated holdroom and adjacent secure circulation requirements were determined for 19 narrow body equivalent gates (NBEGs) independent of concourse configuration to represent the anticipated SAMP North Gates.

[5] International Air Transport Association, *Airport Development Reference Manual*, 11th edition, March 2019; International Air Transport Association, *Airport Development Reference Manual*, 9th edition, January 2004 (level of service).

3.1 HOLDROOM AND CIRCULATION REQUIREMENTS

Holdrooms provide space for passenger accumulation and boarding, including seating and standing areas, airline agent gate podiums, boarding/deplaning queuing spaces, and access/egress aisleways to and from the gate portal. **Exhibit 3-1** lists the minimum and maximum metrics and assumed seating ratios used to derive typical holdroom requirements and total holdroom area by aircraft design group (ADG) and illustrates relative spatial requirements in an indicative holdroom configuration. Holdroom areas should be calculated based on the seating capacity of the largest ADG capable of using the gate. Additionally, preboarding areas should be included in the holdroom area calculation, which provides space for passengers to queue by boarding position without obstructing the egress of passengers debarking from the aircraft or occupying space in the circulation corridor. Holdroom level of service (LoS) factors for each ADG were developed from published industry recommendations and were based on assumptions for the ratio of standing, seated, and queued passengers.[6]

The following definitions apply to the primary holdroom elements displayed on Exhibit 3-1.

- **Aircraft Load Factor –** A percentage of the total number of seats on the largest aircraft a gate can accommodate, used to determine the number of enplaning passengers within the preboarding area.
- **Seated and Standing Passenger Population –** A percentage of enplaning passengers that are seated or standing within the holdroom area.
- **Queue Area –** A percentage of the enplaning passengers assumed to be standing in queue within the holdroom.
- **Airline Podium** – Small agent workstations.
- **Boarding Pass Readers –** Future operating parameters (utilized in the maximum suggested requirements) plan for self-boarding pass readers similar to those depicted on **Exhibit 3-2.**
- **Adjacency Credit –** A recommendation that holdrooms should be paired or grouped together, which allows the total amount of seating and standing space to be shared, and reduces the total space required for the composite area. Holdrooms that do not have a line-of-sight or are not within hearing distance of another holdroom cannot qualify for this credit.

3.1.1 LOS UPDATE

Holdroom LoS is measured by square foot per passenger for seated and standing passengers as well as standing passengers in queue. This metric is based on the International Air Transport Association (IATA), Airport Development Reference Manual (ADRM), 11th Edition, for an optimum LoS range, as identified on **Table 3-1**.

The 11th Edition includes recent changes to holdroom passenger LoS. The previous ADRM (10th Edition, 5th Release) recommended approximately 25 percent less area per passenger than the current ADRM. **Table 3-2** compares the optimum LoS range between the two editions. The change only applies to seated and standing areas. The average increase to area per holdroom by ADG was 20 percent.

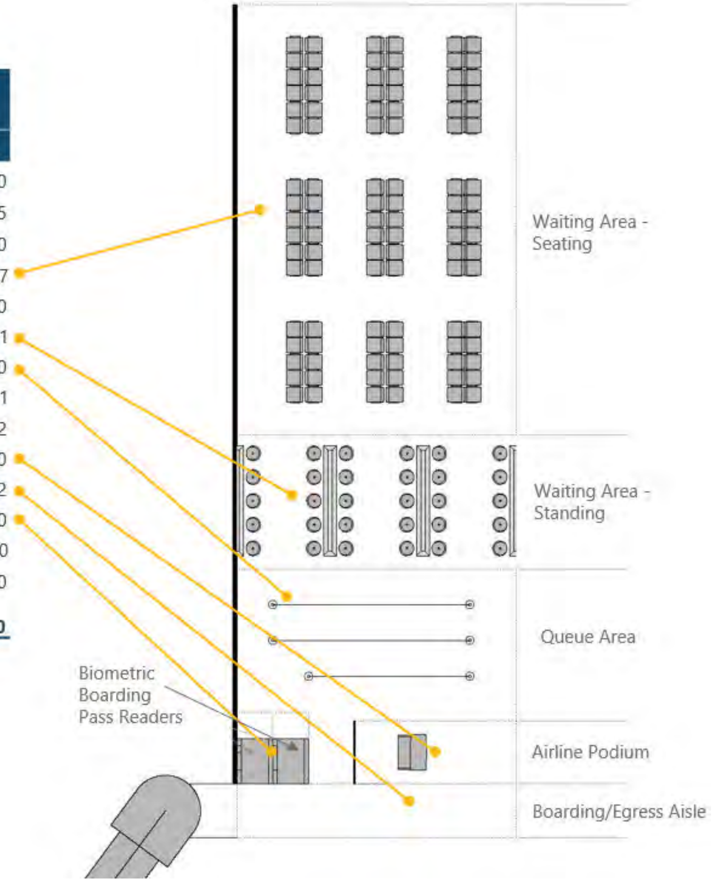
3.2 CIRCULATION REQUIREMENTS

Assessment of the circulation requirements between holdroom areas is related to the concourse dimensions. The length and width of the concourse is determined by specific criteria such as moving walkways, hub or non-hub airports, and aircraft parking. The subsequent text reviews the variables that impact the dimensions of a typical concourse.

6 International Air Transport Association, *Airport Development Reference Manual*, 9th edition, January 2004 (level of service).

EXHIBIT 3-1 INDICATIVE HOLDROOM CONFIGURATION

	Units	Small ADG III 0.9 NBEG		ADG III 1.0 NBEG		ADG V 1.9 NBEG		ADG VI 2.2 NBEG	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Aircraft Seats	seats	90	90	187	187	310	310	540	540
Load Factor	percent	95	95	95	95	95	95	95	95
Seated Passenger Population	percent	60	60	60	60	60	60	60	60
Area per Seated Passenger	sq ft	19.4	23.7	19.4	23.7	19.4	23.7	19.4	23.7
Standing Passenger Population	percent	20	20	20	20	20	20	20	20
Area per Standing Passenger	sq ft	12.9	16.1	12.9	16.1	12.9	16.1	12.9	16.1
Standing Passenger in Queue Population	percent	20	20	20	20	20	20	20	20
Area per Standing Passenger in Queue	sq ft	12.9	16.1	12.9	16.1	12.9	16.1	12.9	16.1
Airline Podium	each	1	1	1	1	1	1	2	2
Area per Podium	sq ft	100	100	100	100	100	100	100	100
Boarding/Egress Aisle Width	feet	6	6	6	6	6	6	12	12
Boarding Pass Readers	sq ft	-	40	-	40	-	40	-	40
Area per Holdroom	sq ft	1,720	2,090	3,260	3,990	5,230	6,400	9,180	11,200
Adjacency Credit[1]	percent	10	10	10	10	10	10	10	10
Area per Holdroom (including credit)	**sq ft**	**1,570**	**1,910**	**2,970**	**3,620**	**4,730**	**5,800**	**8,320**	**10,140**



NOTES:
Each aircraft design group can be normalized to a NBEG coefficient (ACRP Report 25).
Square footages rounded to the nearest 10 square feet, with adjustments based on layout.
Program area does not identify specific airline utilization.
1 Credit applied to seated and standing areas only.
SOURCES: Airport Cooperative Research Program. Report 25, Airport Passenger Terminal Planning and Design, Volume 1: Guidebook. 2010 (critical dimensions); International Air Transportation Association, Airport Development Reference Manual, 11th Edition, Effective March 2019 (LoS); Ricondo & Associates Inc., December 2019 (space template).

EXHIBIT 3-2 SELF-BOARDING PASS READER

SOURCE: United Airlines Boston Airport United Airlines Newsroom, http://newsroom.united.com/BOS, accessed March 2018.

TABLE 3-1 INDUSTRY GUIDELINES FOR GATE HOLDROOM LEVEL OF SERVICE

PASSENGER TERMINAL PROCESSOR	SPACE GUIDELINES (ft^2/passenger unless otherwise noted) IATA				
ADRM 9th Edition	A	B	C	D	E
ADRM 11th Edition	Over-Design		Optimum	Sub-Optimum	Under-Provided
Seated	>23.7		19.4–23.7	<19.4	
Standing	>16.1		12.9–16.1	<12.9	

NOTE:
* The space requirements for Gate Holdrooms have been updated incorporating the Maximum Occupancy factor in the space requirements.
SOURCE: International Air Transport Association, Airport Development Reference Manual (ADRM), 11th Edition, Effective March 2019

TABLE 3-2 IATA COMPARISON

GATE HOLDROOMS – OPTIMUM RANGE	10TH EDITION	11TH EDITION
Seated	16.2-18.3	19.4–23.7
Standing	10.8-12.9	12.9–16.1

SOURCES: International Air Transport Association, Airport Development Reference Manual (ADRM), 10th Edition, 5th Release, Effective May 2017 (10th Edition); International Air Transport Association, Airport Development Reference Manual (ADRM), 11th Edition, Effective March 2019 (11th Edition).

Exhibit 3-3 illustrates an example concourse and identifies recommended ranges for circulation corridor dimensions. The recommended minimum depth for a holdroom is 30 feet[7] to allow for flexibility of seating arrangements and boarding activities. Additional depth (maximum 50 feet) may be preferable for holdrooms serving multiple gates or located at the end of a concourse.

Concourses are either single-loaded (gates on one side) or double-loaded (gates on both sides). A single-loaded concourse can act similarly to a double-loaded concourse if it provides functions on the non-gate side. Adequate clear corridor width is imperative to the functionality and life-safety requirements of a concourse and can include moving walkways to aide passengers where long walking distances are perceived. Recommendations for clear circulation width with and without moving walkways are as follows:

- **Concourses without moving walkways:** A minimum 20-foot wide corridor for single-loaded concourses and 30-foot wide corridor for double-loaded concourse is recommended. This width will provide the appropriate dimension for most medium- to high-volume concourses.
- **Concourses with moving walkways:** A minimum15-foot wide corridor is recommended on each side of the moving walkway to allow for bidirectional movement on either side. High-volume terminals or a significant number of electric carts in use may require wider corridors. The overall width range for each single direction moving walkway is 5′-6″ to 7′-0″.

Circulation requirements will depend on concourse configuration and length. Length is determined by the sequential number of gates on the concourse and ADG. Exhibit 3 show a typical multi-aircraft ramp system (MARS) gate layouts in relation to the holdroom and other concourse areas such as concessions and restrooms. Other facilities to consider within the aircraft wingspan are mechanical, electrical, and plumbing. The secure circulation area, as listed in **Table 3-3**, can range from 2,250 to 4,500 square feet per narrow body equivalent gate (NBEG). Circulation for double loaded gates provide for half the width to match the corresponding gate across the corridor. Circulation is dependent on the placement and frequency of commercial offerings, building system areas, egress components, and other support areas. These areas should be coordinated with gate apron locations and adjacency requirements and consider overall holdroom configurations.

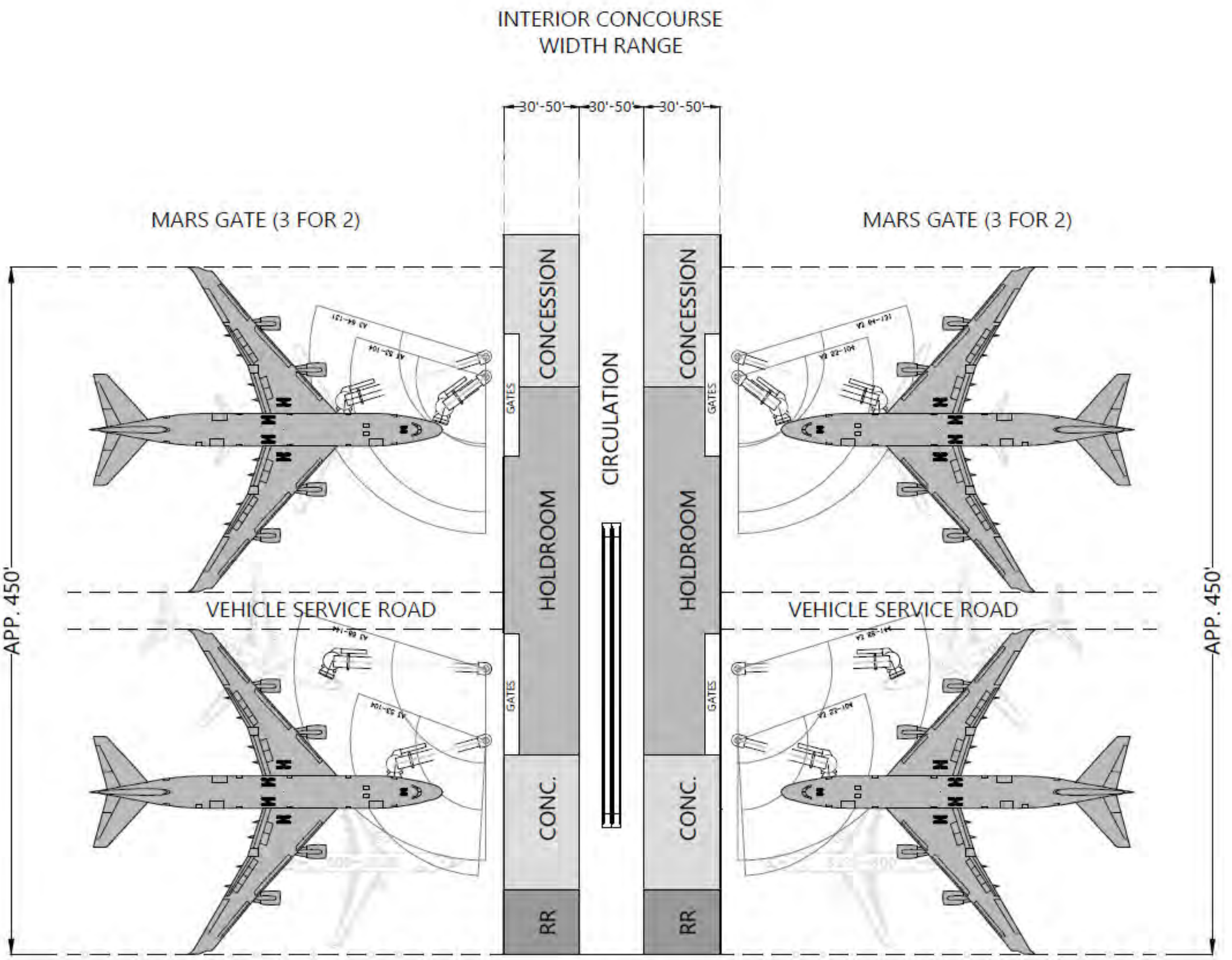
3.3 ESTIMATED REQUIREMENTS

The range of estimated holdroom and circulation requirements were determined based on the need for 19 NBEGs, as shown on **Table 3-4**. Holdroom requirements were based on assumptions outlined in Exhibit 1 and range from 56,000 to 69,000 square feet. It was assumed that the holdrooms would be contiguous and therefore include an adjacency credit allowance.

Minimum and maximum requirements for secure circulation adjacent to the holdrooms were determined using the assumptions listed in Table 3. The requirement range (43,000 to 86,000 square feet) for secure circulation was established independent of concourse configuration. The range represents a minimum condition with a double-loaded concourse and no moving walkway, and a maximum condition with a single-loaded concourse that can accommodate moving walkways.

[7] Airport Cooperative Research Program, Report 25 – Airport Passenger Terminal Planning and Design Volume 1: Guidebook (page 209), 2010.

EXHIBIT 3-3 CONCOURSE WIDTH



NOTE: A single-loaded concourse without a moving walkway is a recommended minimum width of 20 feet.
SOURCE: Ricondo & Associates, Inc. December 2019.

TABLE 3-3 SECURE CIRCULATION AREA PER NBEG

	UNITS	DOUBLE LOADED GATE[1]		SINGLE LOADED GATE	
		MINIMUM (NO MOVING WALKWAY)	MAXIMUM (MOVING WALKWAY)	MINIMUM (NO MOVING WALKWAY)	MAXIMUM (MOVING WALKWAY)
Circulation Width	feet	15 (30' corridor ÷ 2 sides)	17.5 (35' corridor ÷ 2 sides) + 7.5 (15' moving walkway ÷ 2 sides)	20 (corridor)	15 (corridor) + 15 (moving walkway)
MARS Length	feet	450	450	450	450
Number of NBEGs	each	3	3	3	3
Concourse Length per NB	feet	150	150	150	150
Secure Circulation Area per NBEG	**sq ft**	**2,250**	**3,750**	**3,000**	**4,500**

NOTE:
1 Circulation for double loaded gates provide for half the width to match the corresponding gate across the corridor.
SOURCE: Ricondo & Associates, Inc. December 2019.

TABLE 3-4 ESTIMATED HOLDROOM AND CIRCULATION REQUIREMENTS

	UNITS	MINIMUM	MAXIMUM
NBEGs	each	19	19
Holdroom Area per NBEG (including credit)	sq ft	2,970	3,620
Total Holdroom Area for 19 NBEGs	**sq ft**	**56,000**	**69,000**
Circulation Area per NBEG	sq ft	2,250	4,500
Total Secure Circulation Area Adjacent to 19 NBEGs	**sq ft**	**43,000**	**86,000**

NOTE: Total areas are rounded to the nearest thousand square feet.
SOURCE: Ricondo & Associates, Inc., December 2019.

APPENDIX B

Purpose & Need and Alternatives Supporting Information

Air Cargo Growth Potential and Facility Requirements Assessment

Notes:

In March of 2018, the Port of Seattle completed Air Cargo Potential and Facility Requirements Assessment (independent of the SAMP EA). This report was used to identify existing cargo facilities.

Air Cargo Growth Potential and Facility Requirements Assessment –

Final Report

Logistics CAPITAL & STRATEGY

Port of Seattle

Seattle-Tacoma International Airport

3/12/2018

Introduction to the air cargo growth potential and facility requirements assessment

- The Sea-Tac air cargo portfolio must be fully considered during the Sustainable Airport Master Plan (“SAMP”) planning process because, in addition to maximizing economic contributions, cargo in the belly of passenger planes helps enable the financial feasibility of select passenger routes
- Near-term allocation of airport space has been dedicated to expanding passenger terminal facilities and related infrastructure. Sea-Tac is a land constrained airport, so passenger expansion activities share space with cargo facilities
- Interviews with tenants confirm facilities are at maximum capacity. Inelastic tenant capacity means any disruptions, whether from throughput growth or decreased facility space, can lead to industrial accidents, operational inefficiencies, and increased cost-to-serve
- LogCapStrat has partnered with cargo leadership to combine cargo forecasts with facility management projects in a way that will allow Sea-Tac to manage facility capacity utilization in the face of increased cargo demand while accommodating passenger expansion
- One possible scenario has been outlined for the purpose of stimulating discussion around the future of air cargo and facility development at Sea-Tac

Cargo growth is coinciding with rapid passenger growth and on-airport real estate available for expansion is limited

CARGO GROWTH: 12-17

- *Cargo increased 16.2% from 2016

	2012	2013	2014	2015	2016	2017	CAGR 12-17
Metric Tons	283,609	292,709	327,239	332,636	366,431	425,856	8.5%
Year-Over-Year Growth	1.3%	3.2%	11.8%	1.6%	10.2%	16.2%	-

PASSENGER GROWTH: 12-17

- Passenger travel increased 2.6% from 2016

	2012	2013	2014	2015	2016	2017	CAGR 12-17
Passengers (000s)	33,223	34,827	37,498	42,341	45,737	46,934	7.2%
Year-Over-Year Growth	1.1%	4.8%	7.7%	12.9%	8.0%	2.6%	-

SEA-TAC AIRPORT FACILITIES AND CARGO LOCATIONS

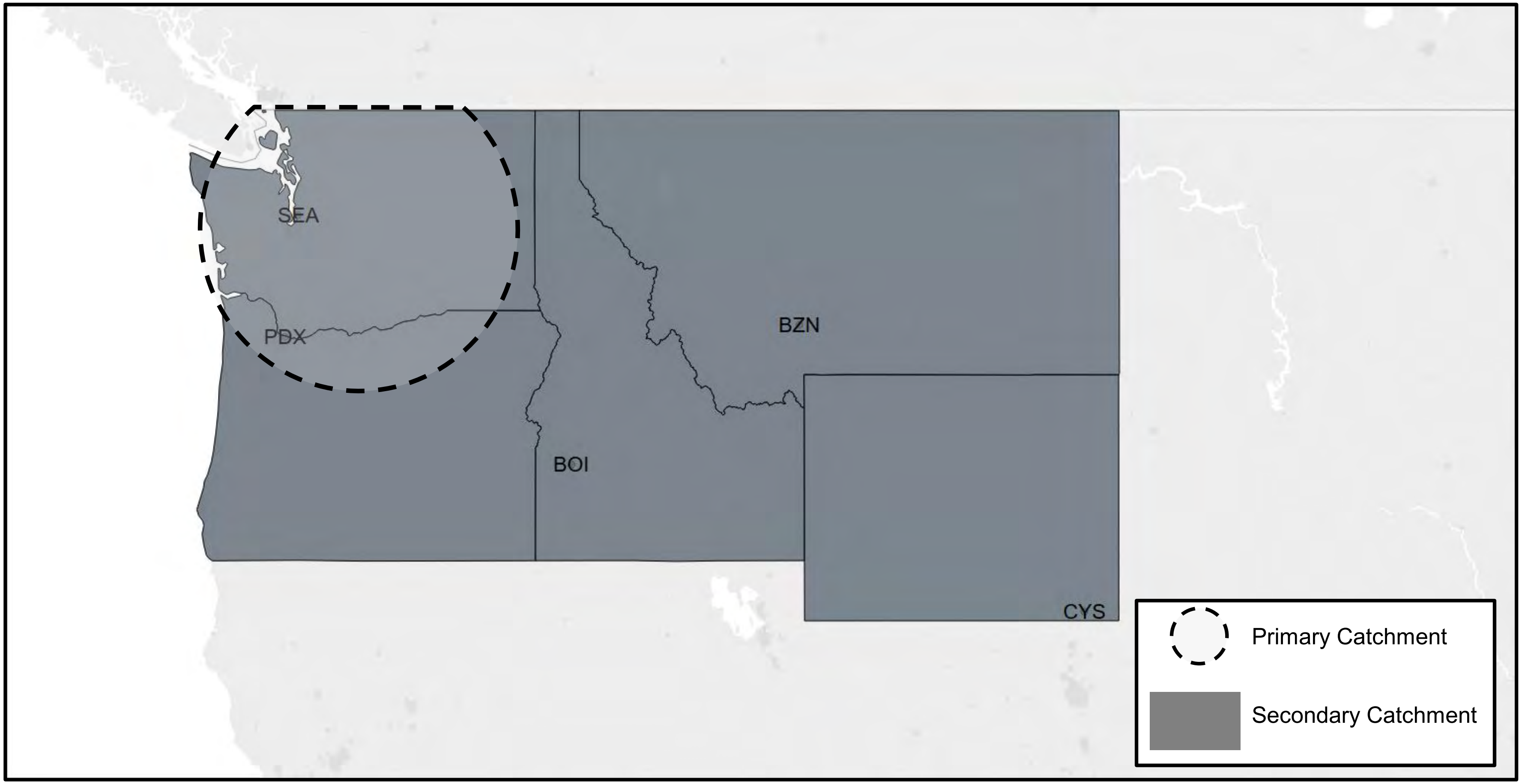
Passenger Area | Non-Passenger Area | Cargo Facility | Cargo Parking

Notes: *Cargo = freight + mail

Sources: LogCapStrat analysis, Port of Seattle Airport Statistics

Sea-Tac addressable air cargo market is defined by its primary and secondary catchment areas

SEA-TAC PRIMARY AND SECONDARY CATCHMENT AREA



Primary Catchment Area: addressable geographic area for express freight pick-up & delivery services (same-day and over-night service delivery time window)

Secondary Catchment Area: addressable geographic area for deferred freight pick-up & delivery services (multi-day service time window, including international service)

Note: LogCapStrat estimates that Canada-related air cargo flowing inbound and outbound via Sea-Tac are de minimis (approx. 2% of total volume)

Sources: LogCapStrat analysis

Inbound market is driven by Seattle local economy and outbound market by manufacturing and distribution

CATCHMENT AREA SUPPLY & DEMAND FRAMEWORK

Inbound "demand-pull"	Sea-Tac Market	Outbound "supply-push"
Local demand "pulls" shipments inbound to fulfill in-market demand ▪ Consumer demand for goods – High population wealth – Ecommerce derived shipments ▪ Production inputs – Aircraft parts for Boeing – High tech inputs	**Local market & geography provides unique logistics-factor endowments** ▪ Unique geographic isolation from rest of US ▪ High number of intermodal connections including seaport access	**Local production "pushes" shipments outbound to fulfill out-of-market demand** ▪ Seattle area seasonal cherry harvest ▪ Wild caught seafood and aquaculture products ▪ Aerospace products

Sources: LogCapStrat analysis

Several long term structural trends will impact future air cargo demand patterns

RECENT HISTORICAL DEMAND DRIVERS

Personal wage growth	▪ Wage growth triggers end-user demand ▪ Stimulates demand from ecommerce and brick-and-mortar retailers, especially for air cargo commodities (high-value & consumers products) ▪ US median wage growth has been increasing since 2010
Slow-growing episodic demand	▪ Amplified industry cyclicality leads to greater volatility in demand ▪ Volatility in consumer demand for instant-gratification delivery ▪ Volatility in manufacturing with process impairing parts/replacements
Declining length-of-haul	▪ Reduction in supply chain length (ex. Ecommerce fulfillment) ▪ Seek to lower freight costs ▪ Reduced pipeline inventory ▪ Increased customer service levels
Rising shipment densities	▪ Product design optimization to maximize shipping density, handling efficiency and shock protection ▪ Reduced demand for volumetric transportation capacity ▪ Reduced storage footprint requires less distribution center capacity and retail shelf space
Shift to hybrid strategies	▪ Low interest rates reduce opportunity cost of pipeline inventory and safety stock ▪ Reduced shipping frequency and increased average shipment size ▪ Shipment consolidation and extensive use of modal substitution ▪ Priority express -> deferred express; Air freight -> sea freight; Truckload -> intermodal; LTL -> multi-stop truckload

Sources: LogCapStrat analysis

Macro trends will impact the level and share of belly capacity and freighter supply

GLOBAL AIR CARGO SUPPLY DRIVERS & TRENDS

Drivers

Global freighter capacity: Air cargo supply is a product of the global freighter fleet capacity

Passenger derived belly capacity: Belly capacity is cargo supply in the lower holds of passenger airplanes

Trends

Integrator share of the freighter fleet:

- Account for more than half of the world freighter population
- Own the door-to-door transportation networks
- Large number of freighters and network control give the integrators an unequal impact on world air cargo supply

Wide-body passenger aircraft design:

- New widebody passenger airplanes are being designed with significant lower-hold capacity
- Allows passenger fleets to increase their share of air cargo traffic with low-cost supply

Outlook

Overcapacity

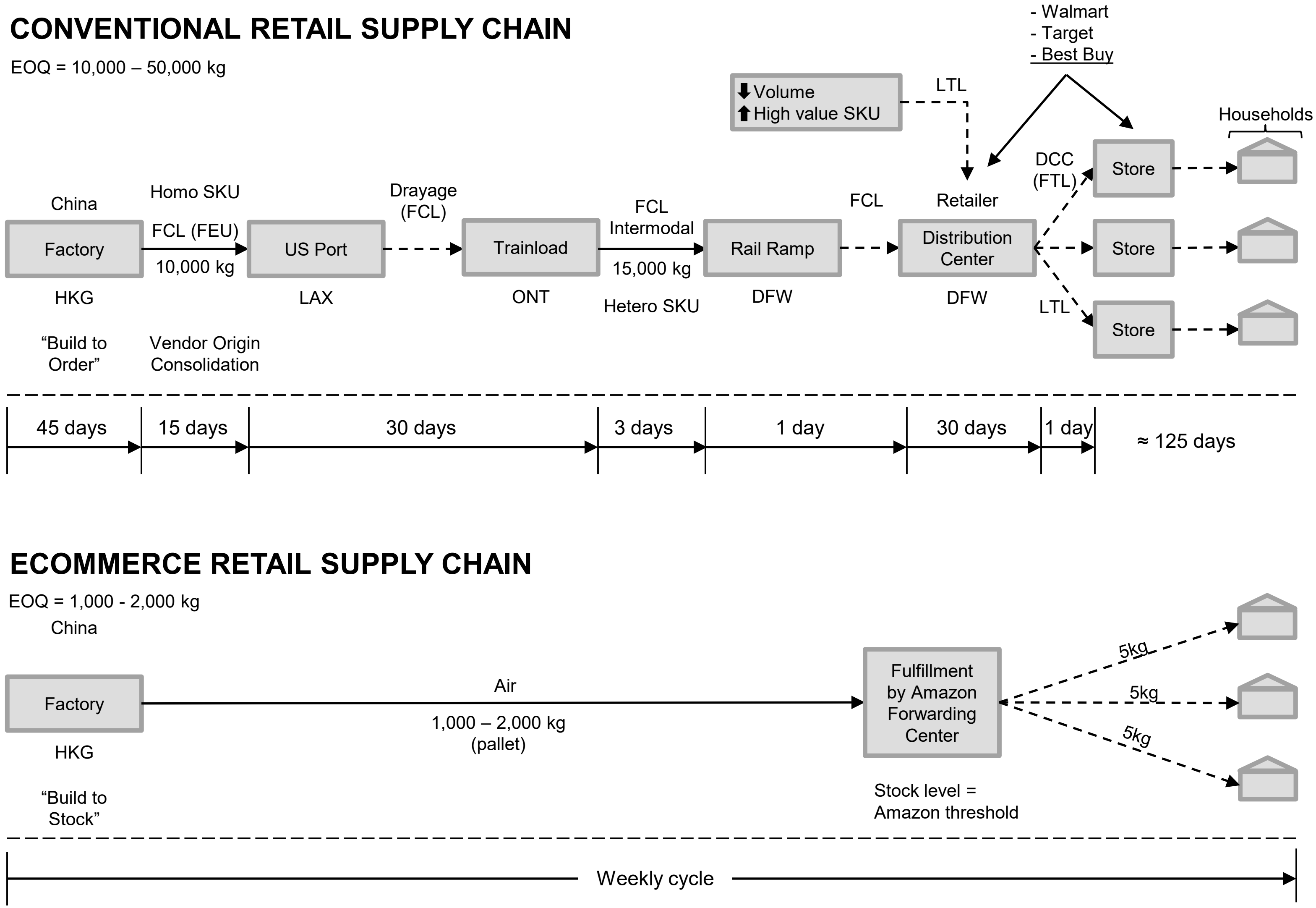
- As passenger operations increase, belly capacity increases.
- Rising glut in cheap and widely available belly-capacity. +650 freighters delivered over next 20 years.
- The combined effect of additional belly-capacity and freighters could result in overcapacity and downward pressure on air freight prices

Dedicated freighter routes

- Certain routes will continue to require freight. Reasons for dedicated freighter routes include seasonality (such as the cherry harvest season), directional imbalances, or routes that do not have passenger demand and therefore are not belly-capacity addressable

Sources: LogCapStrat analysis, Airbus, Boeing

Ecommerce demand is pushing the supply chain towards faster, lighter shipments



Structural changes in the supply chain are creating a renaissance for international cross-border ecommerce

EMERGING ECOMMERCE SUMMARY

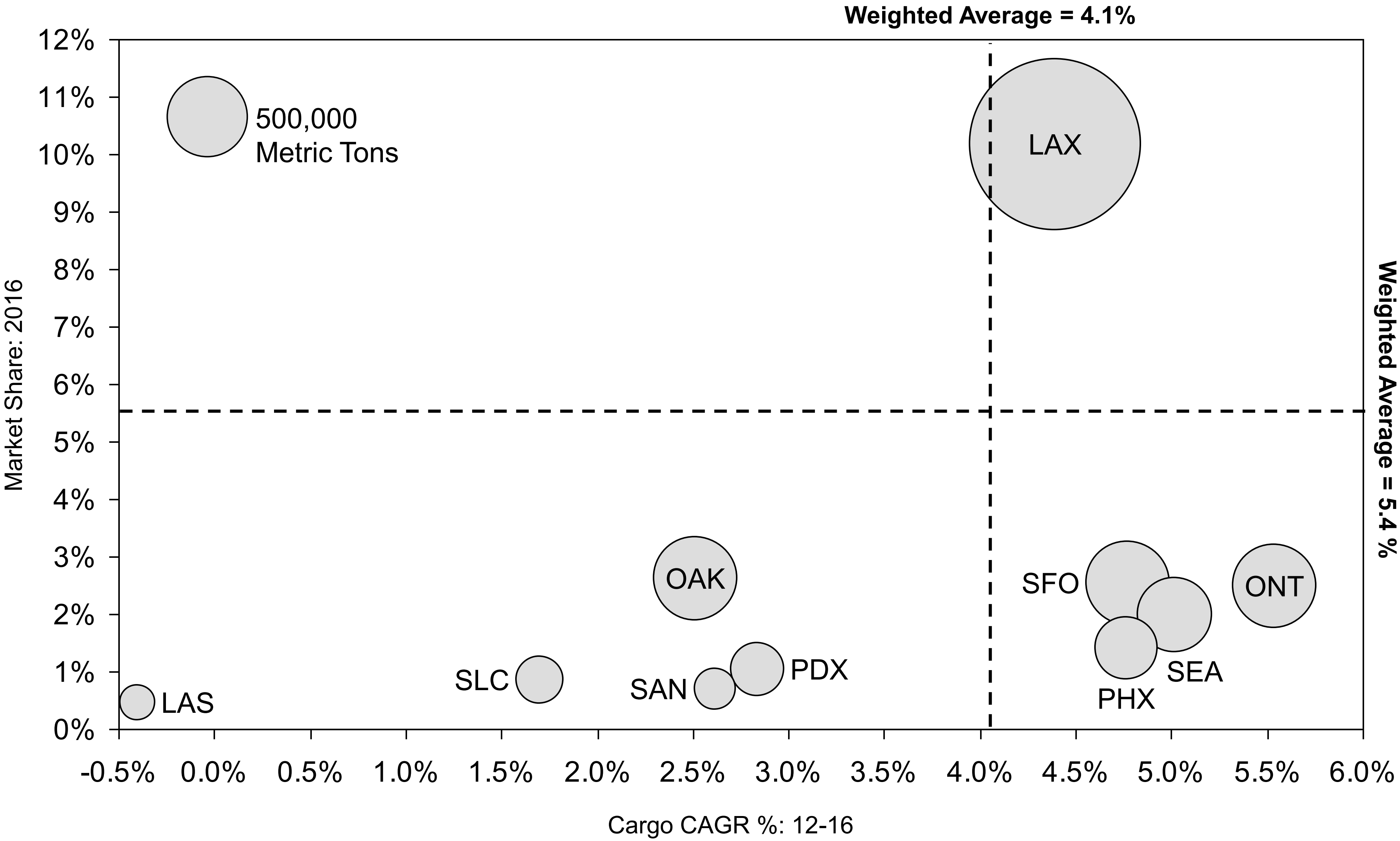
- Manufacturers with long supply chains are shifting to online product sales fulfilled by Amazon or other online retailers
- Suppliers use air mode because they must meet the short cycle times required for online fulfillment
- Manufacturers send weekly palletized shipments to online fulfilment centers by air. Previously, origin-consolidated full container loads would travel for weeks on multi-modal supply chains before reaching a distribution center
- The shift to air mode has the following effects:
  - Less ocean freight, less origin vendor consolidation
  - Increased “customer urgency” (e.g. instant-fulfillment and gratification)
  - Lower EOQ
- As ecommerce continues to gain a material share in retail sales, additional online retail demand will develop

Source: LogCapStrat analysis

Sea-Tac cargo is the fastest growing international gateway airport on the west coast

WEST COAST AIRPORT CARGO GROWTH: 12-16

CAGR %, MARKET SHARE %

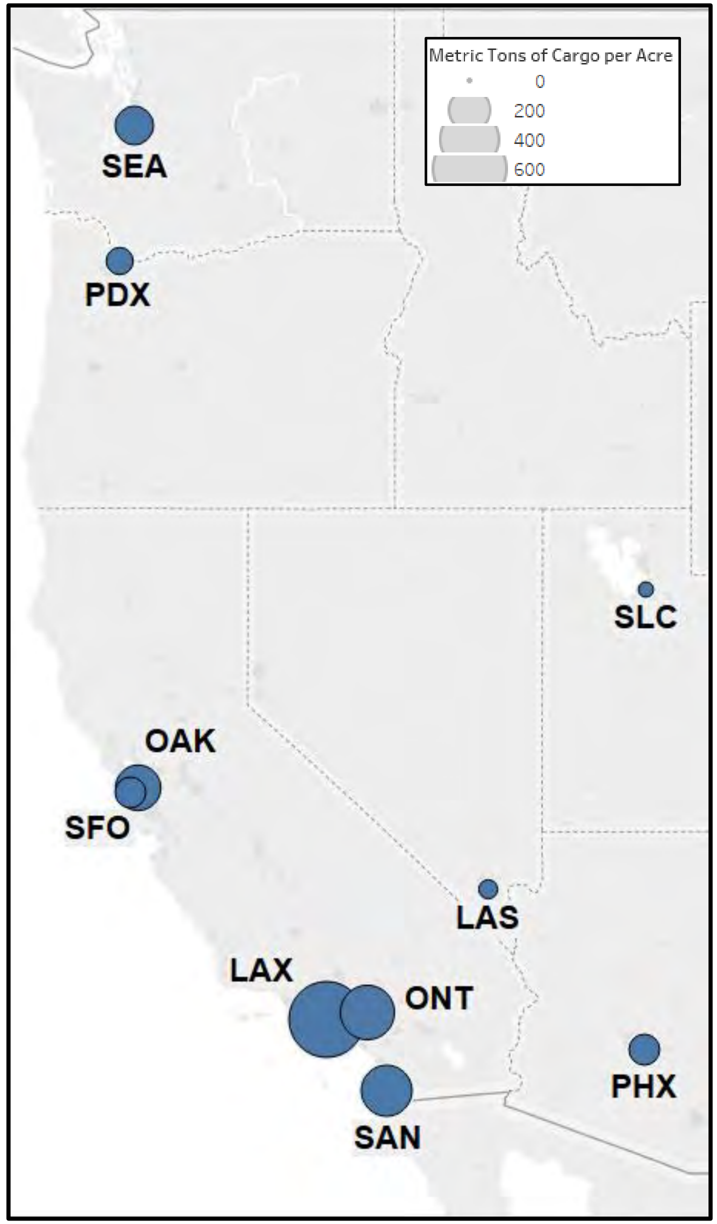


Sources: LogCapStrat analysis, LogCapStrat CargoMetrix – Concept 7

Sea-Tac achieved its cargo growth with smallest real estate footprint among west coast gateway airports

WEST COAST AIRPORT INFRASTRUCTURE PROFILE: 2016

Airport	Code	Land Area (Acres)	Metric Tons of Cargo Per Acre	Runways	Passenger Terminals	Hubs	FAA Hub Type
Salt Lake City International	SLC	7,700	23	4	3	Delta	Large
San Francisco International	SFO	5,200	93	4	4	Alaska, United, Virgin	Large
San Diego International	SAN	5,000	259	1	2	-	Large
Los Angeles International	LAX	3,500	572	4	9	Alaska, American, Delta, Southwest, United	Large
Phoenix Sky Harbor International	PHX	3,400	95	3	3	American	Large
Portland International	PDX	3,000	73	3	1	Alaska	Large
McCarran International	LAS	2,800	36	4	2	-	Large
Oakland International	OAK	2,600	206	4	2	FedEx	Medium
Seattle–Tacoma International	**SEA**	**2,500**	**147**	**3**	**3**	**Alaska, Delta**	**Large**
Ontario International	ONT	1,740	296	2	2	UPS	Medium



Notes: Large hubs are >1% of annual passenger boardings, Medium are 0.25%-1.0%

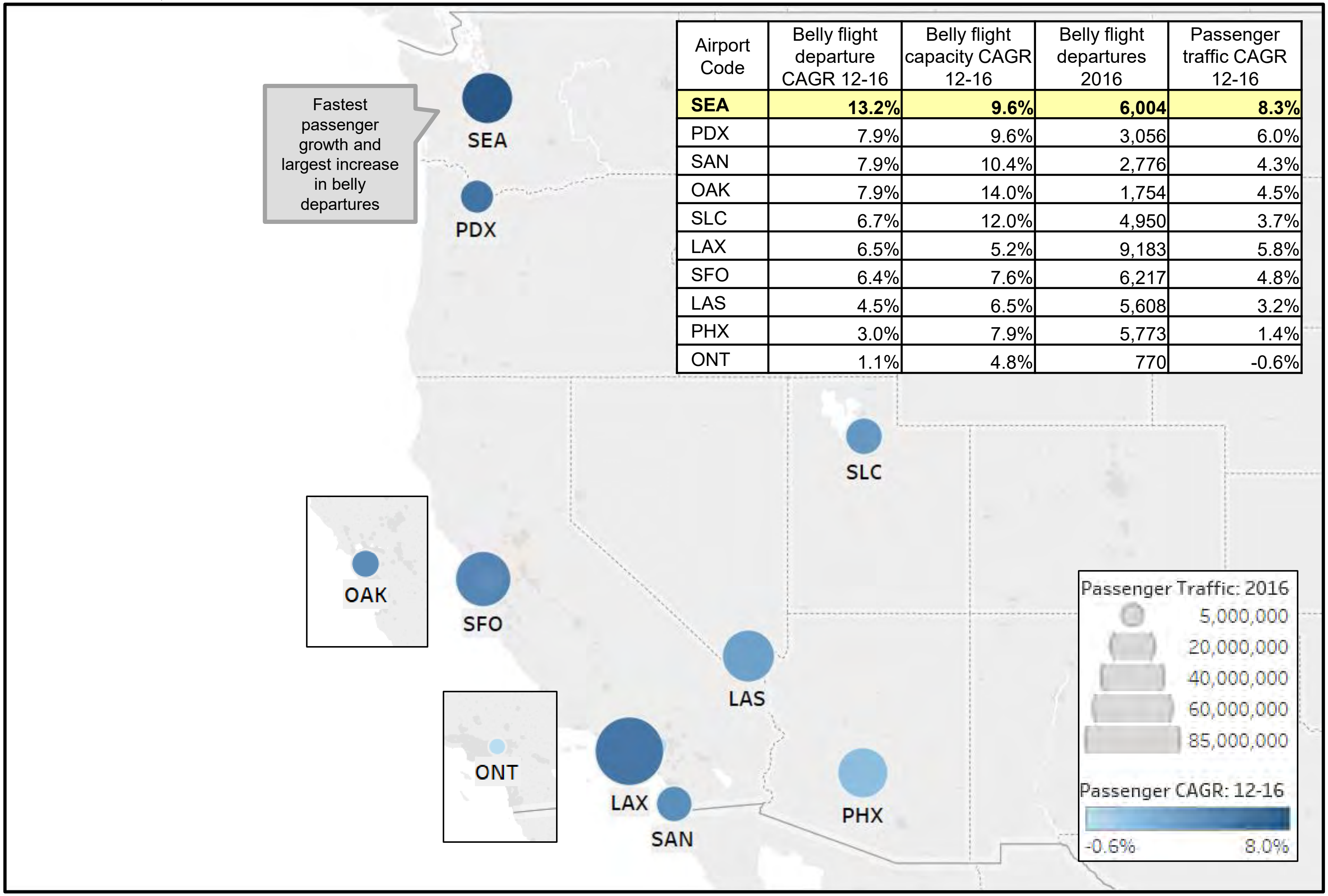
Sources: LogCapStrat analysis, Federal Aviation Administration, Respective airport traffic statistics

Passenger growth at Sea-Tac has enabled cargo growth through significant increases in belly cargo capacity

PASSENGER AND BELLY FLIGHT GROWTH BY AIRPORT: 12-16

PASSENGERS, CAGR %

Airport Code	Belly flight departure CAGR 12-16	Belly flight capacity CAGR 12-16	Belly flight departures 2016	Passenger traffic CAGR 12-16
SEA	**13.2%**	**9.6%**	**6,004**	**8.3%**
PDX	7.9%	9.6%	3,056	6.0%
SAN	7.9%	10.4%	2,776	4.3%
OAK	7.9%	14.0%	1,754	4.5%
SLC	6.7%	12.0%	4,950	3.7%
LAX	6.5%	5.2%	9,183	5.8%
SFO	6.4%	7.6%	6,217	4.8%
LAS	4.5%	6.5%	5,608	3.2%
PHX	3.0%	7.9%	5,773	1.4%
ONT	1.1%	4.8%	770	-0.6%

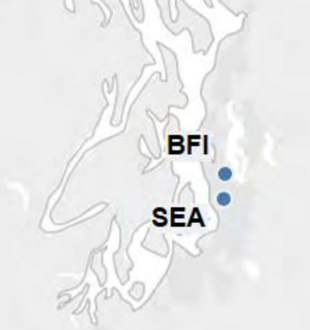


Sources: Respective airport air traffic statistics, LogCapStrat CargoMetrix – Concept 7

Total Seattle market is handled by two airports, Seattle-Tacoma and King County International Airport, of which Sea-Tac is by far the largest

SEATTLE MARKET AIRPORT PROFILE: 2016

King County International Airport (Boeing Field)
- 634 acres
- 2 runways
- 5 cargo aprons (2 Boeing-dedicated)
- Cargo tenants: Kenmore, Airpac, Ameriflight, UPS
- 2016 cargo carrier airlines: 8



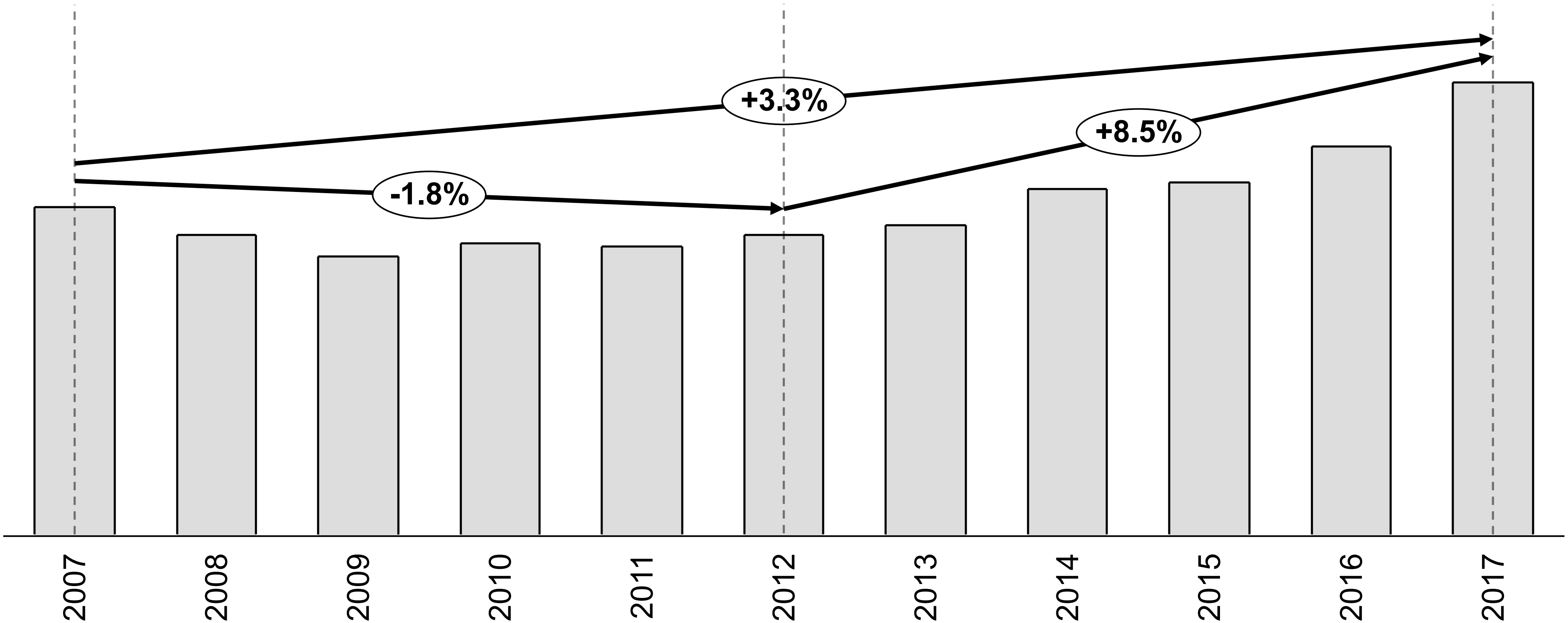
Seattle-Tacoma International Airport
- 2,500 acres
- 3 runways
- 6 cargo aprons
- Cargo tenants: Alaska, Amazon, CAS, Delta, FedEx, Hanjin, Matheson, Southwest, Swissport, Others
- 2016 cargo carrier airlines: 50+

Sources: kingcounty.gov, BFI Master Plan, Port of Seattle Airport Statistics, LogCapStrat analysis

Over the last decade, Seattle cargo market has gone through three phases: decline, rebound and acceleration

SEA-TAC HISTORICAL CARGO VOLUME AND GROWTH RATES: 07-17

CAGR %



Key Points:

- Sea-Tac historical CAGR declined with the Great Recession and, with the exception of 2010, was characterized by steady year-over-year negative growth. This decline was indicative of larger trends in the air cargo industry
- Historical CAGR from 12-16 was 6.6%, and the result of domestic recovery and increased integrator volumes
- One-time structural demand events, combined with a global economic recovery, are currently driving a massive growth in cargo at Sea-Tac
- As the one-time structural events resolve Sea-Tac will continue to grow from a higher baseline, albeit at a necessarily lower growth rate

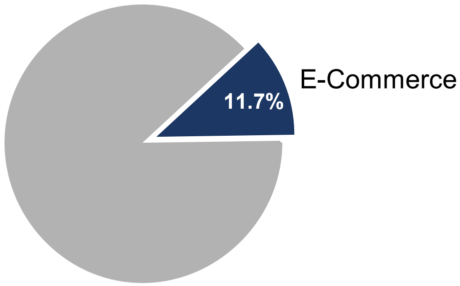
Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Cargo rebound is being driven by structural changes in demand and an acceleration in economic growth

STRUCTURAL GROWTH DRIVERS SUMMARY

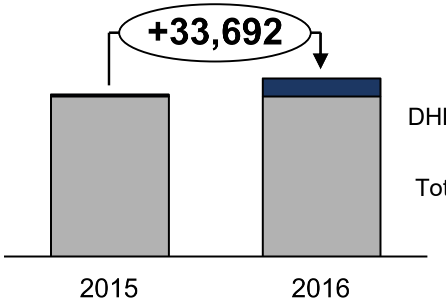
US E-COMMERCE SHARE OF RETAIL SALES: 2016

E-Commerce Percent



*DHL & AMZ FREIGHT VOLUME AT SEA-TAC: 15-16

Metric Tons



	2015	2016
DHL & AMZ freight	1,731	35,423
Total cargo	332,636	366,431

AMAZON

- Amazon accounts for 43% of US e-commerce gross-merchandise value
- Amazon moves express packages at Sea-Tac via DHL and FedEx, in addition to Prime Air shipments on ABX, ATI, and Atlas Air

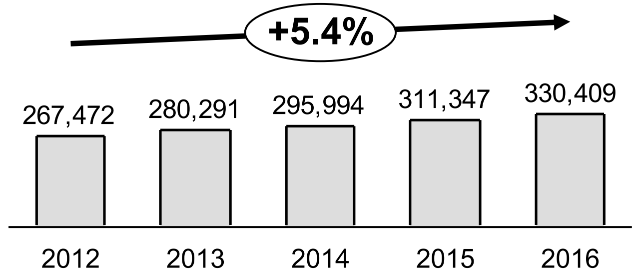
CHERRY EXPORTS

- 12,700 metric tons of cherries exported from Sea-Tac in 2017
- Required an estimated 100 additional cargo flights
- Export time-window creates increased freighter demand

CYCLICAL GROWTH DRIVERS SUMMARY

SEATTLE-TACOMA-BELLEVUE GDP: 12-16

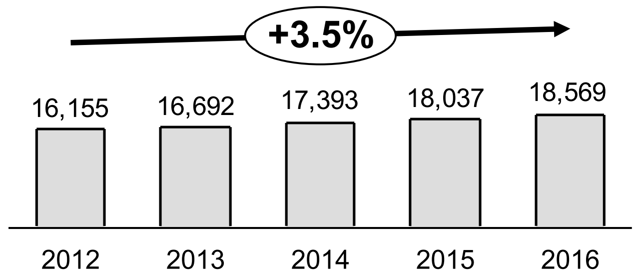
USD (millions)



Sea-Tac Inbound Growth (12-16)	Sea-Tac Inbound Growth Multiple
7.0%	1.3

US GDP: 12-16

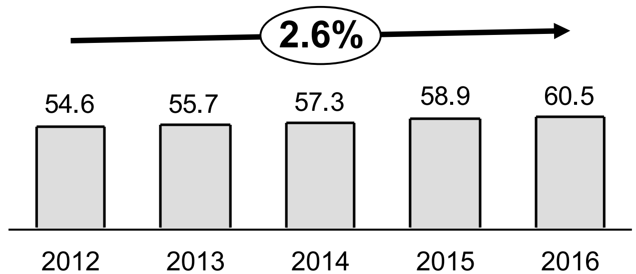
USD (billions)



Sea-Tac Domestic Outbound Growth (12-16)	Sea-Tac Domestic Outbound Growth Multiple
5.2%	1.5

WORLD GDP (NON-US): 12-16

USD (trillions)



Sea-Tac International Outbound Growth (12-16)	Sea-Tac International Outbound Growth Multiple
8.2%	3.2

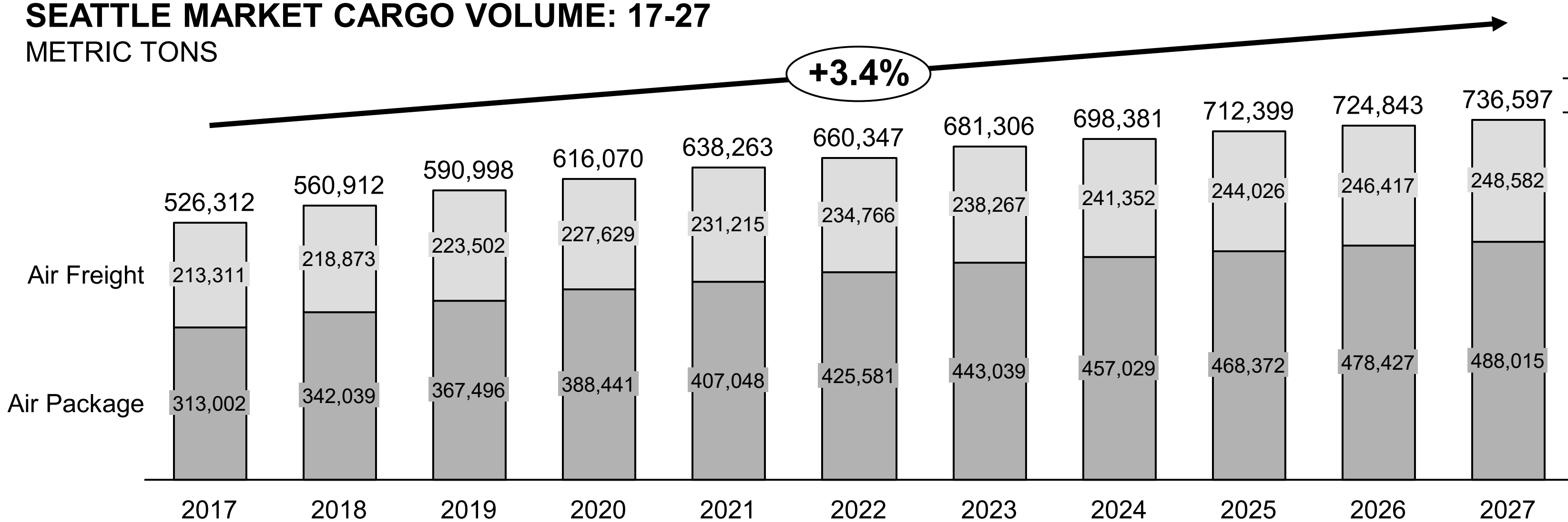
Notes: *Where DHL & AMZ is freight from ABX Air, Air Transport International, & Atlas Air

Sources: Department of Commerce, Port of Seattle Airport Statistics, LogCapStrat analysis, Bureau of Economic Analysis, World Bank

Market is forecast to grow at 3.4% CAGR and reach 737,000 metric tons in 2027, with Sea-Tac capturing increasingly larger share of package volume

SEATTLE MARKET CARGO VOLUME: 17-27

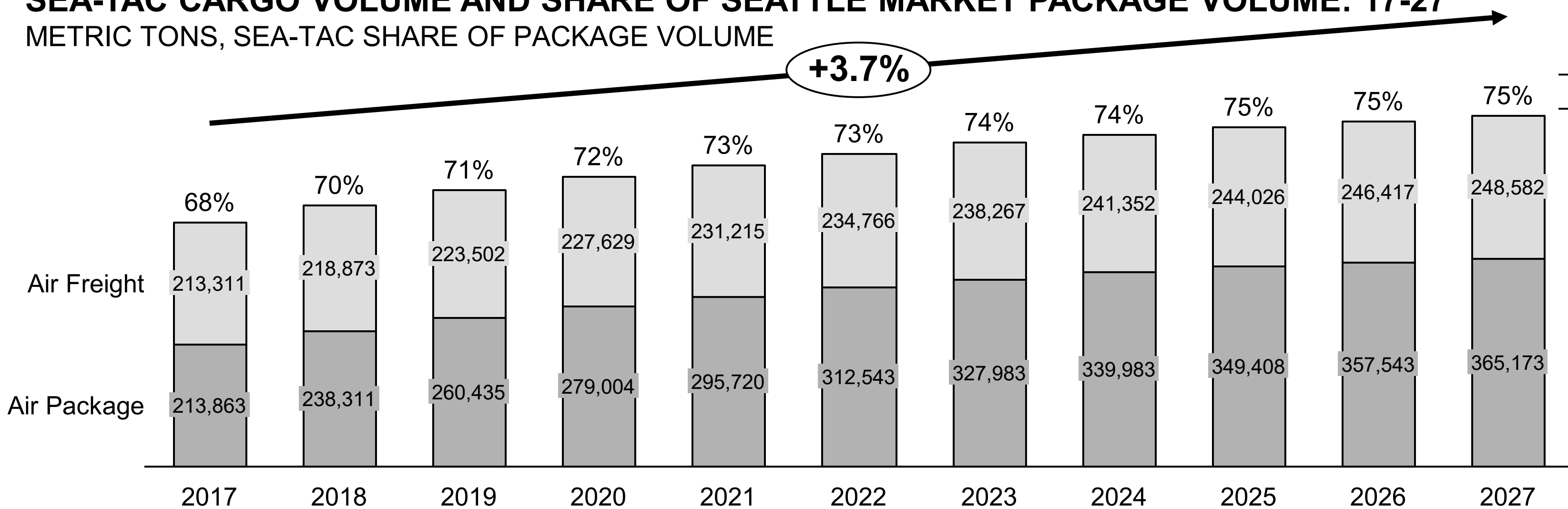
METRIC TONS



	CAGR	Absolute Growth
Total	3.4%	210,284
	1.5%	35,271
	4.5%	175,013

SEA-TAC CARGO VOLUME AND SHARE OF SEATTLE MARKET PACKAGE VOLUME: 17-27

METRIC TONS, SEA-TAC SHARE OF PACKAGE VOLUME



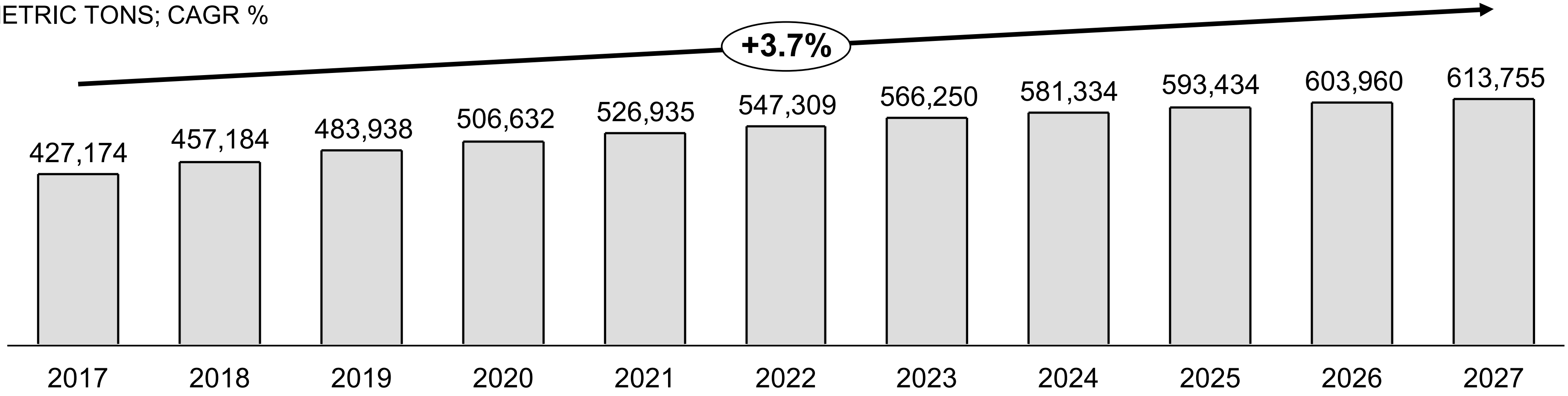
	CAGR	Absolute Growth
Total	3.7%	186,581
	1.5%	35,271
	5.5%	151,310

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Cargo throughput is forecast to reach 614,000 metric tons in 2027 by growing an average of 3.7% per year

SEA-TAC CARGO FORECAST: 17-27
METRIC TONS; CAGR %



SEA-TAC CARGO FORECAST GROWTH BY FLOW SEGMENT: 17-27
CAGR %

Flow Segment	17-22	22-27	17-27
Domestic Outbound	1.2%	0.3%	0.8%
Domestic Inbound	1.0%	0.2%	0.6%
Domestic Total	1.1%	0.3%	0.7%
International Outbound	1.9%	1.3%	1.6%
International Inbound	3.1%	2.1%	2.6%
International Total	2.5%	1.7%	2.1%
Integrator Outbound	7.1%	2.6%	4.9%
Integrator Inbound	8.5%	3.6%	6.0%
Integrator Total	7.9%	3.2%	5.5%
Total Outbound	4.4%	1.9%	3.1%
Total Inbound	5.7%	2.7%	4.2%
Total	**5.1%**	**2.3%**	**3.7%**

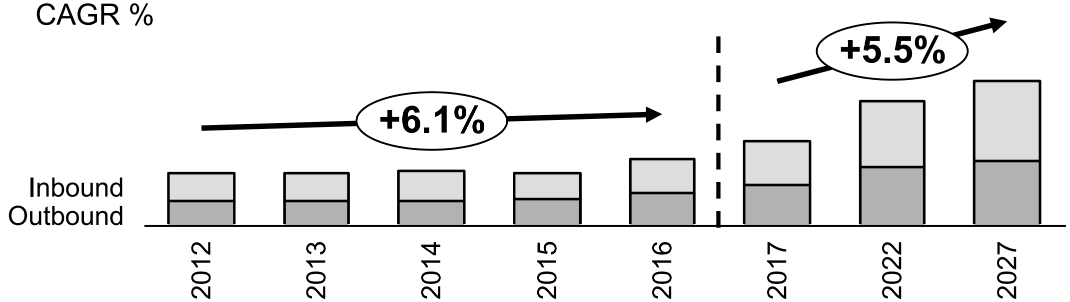
Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Cargo growth will come from integrated carrier, international and domestic air freight

SEA-TAC INTEGRATED CARRIER AIR PACKAGE: 12-27

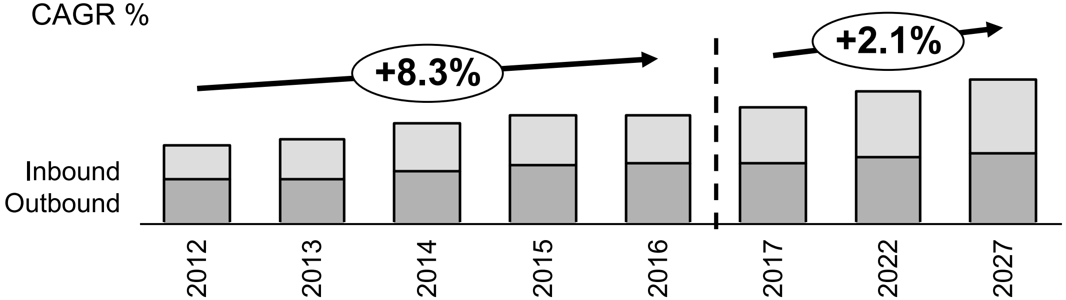
CAGR %



CAGR	12-16	17-22	22-27	17-27
Inbound	6.0%	8.5%	3.6%	6.0%
Outbound	6.3%	7.1%	2.6%	4.9%
Total	6.1%	7.9%	3.2%	5.5%

SEA-TAC INTERNATIONAL AIR CARGO: 12-27

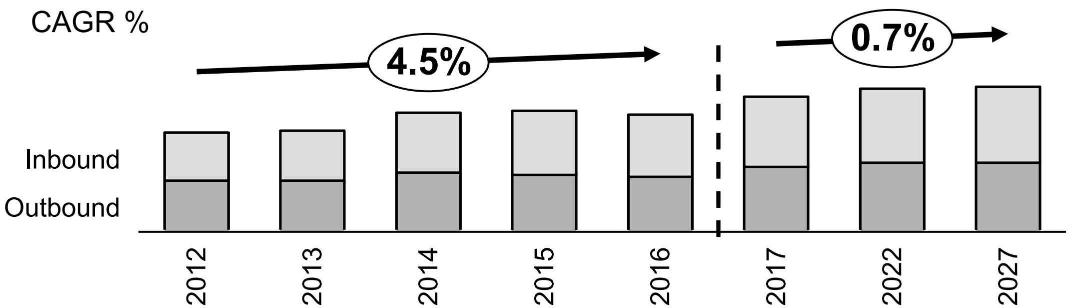
CAGR %



CAGR	12-16	17-22	22-27	17-27
Inbound	8.6%	3.1%	2.1%	2.6%
Outbound	8.1%	1.9%	1.3%	1.6%
Total	8.3%	2.5%	1.7%	2.1%

SEA-TAC DOMESTIC AIR CARGO: 12-27

CAGR %



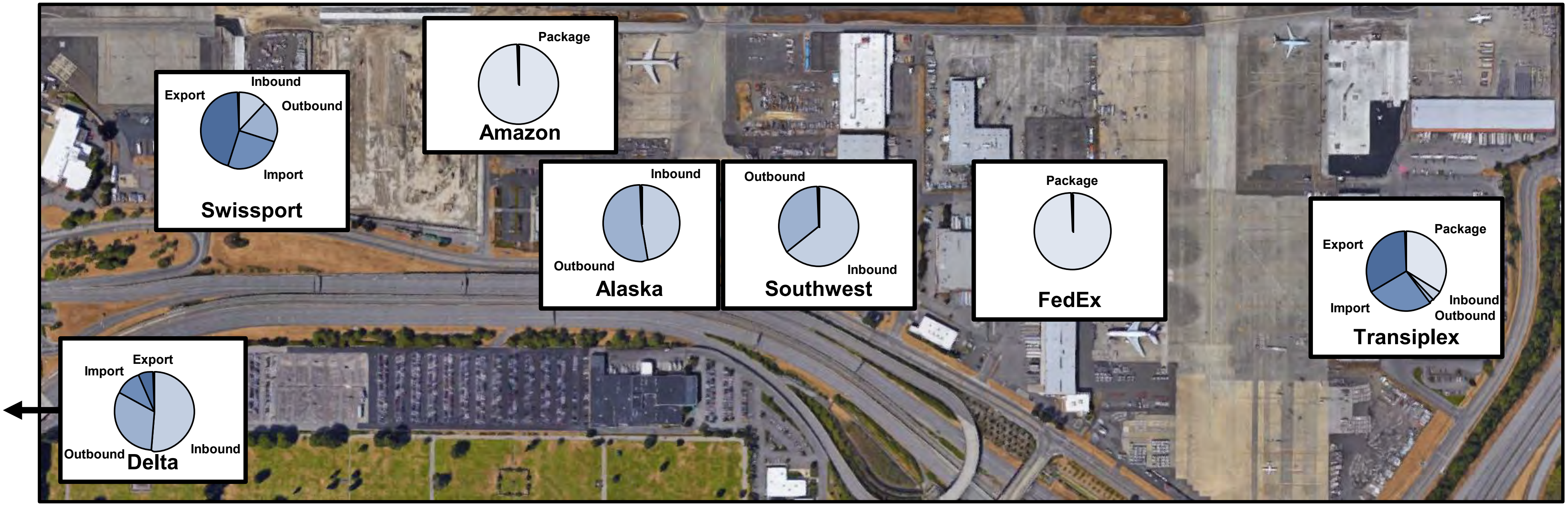
CAGR	12-16	17-22	22-27	17-27
Inbound	5.2%	1.0%	0.2%	0.6%
Outbound	3.9%	1.2%	0.3%	0.8%
Total	4.5%	1.1%	0.3%	0.7%

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Facility cargo throughput consists of package, domestic inbound & outbound, and international import & export flows

FREIGHT FLOWS BY PRIMARY TENANT: 2016



PRIMARY TENANT PROFILE

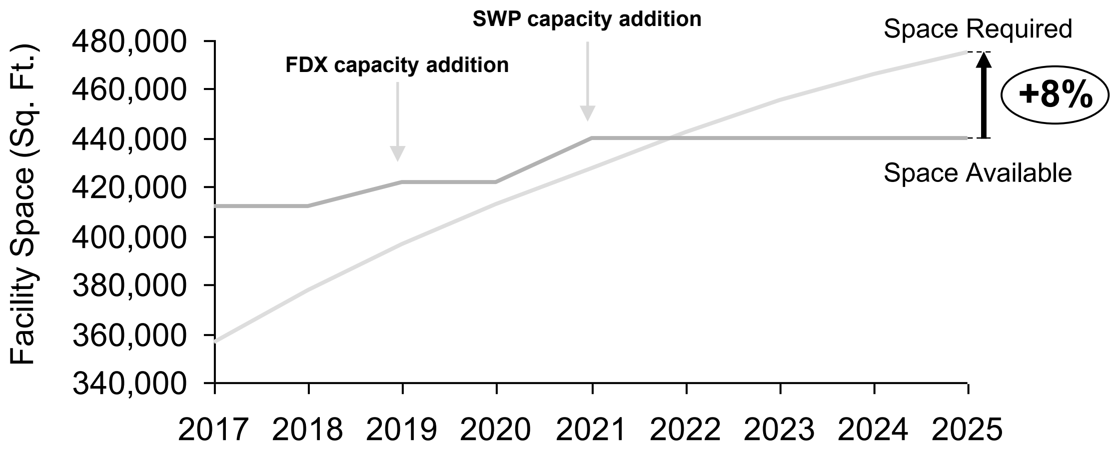
Tenant	Largest Carriers	Flow Type	2016 Metric Tons / Sq. Ft.
Swissport	China Airlines, EVA Air, United	Domestic & International	1.39
Amazon	ATI, ABX, Atlas	Integrated Carrier	1.17
Alaska	Alaska, Horizon, SkyWest	Domestic	0.61
Southwest	Southwest	Domestic	0.60
FedEx	FedEx, Empire	Integrated Carrier	1.05
Transiplex	Korean Air, Lufthansa, American	Domestic, International, & Integrated Carrier	1.10
Delta	Delta	Domestic & International	0.63

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac has a near term and growing air cargo facility capacity deficit

AGGREGATE FACILITY DEFICIT BY YEAR: 17-25

SQUARE FEET

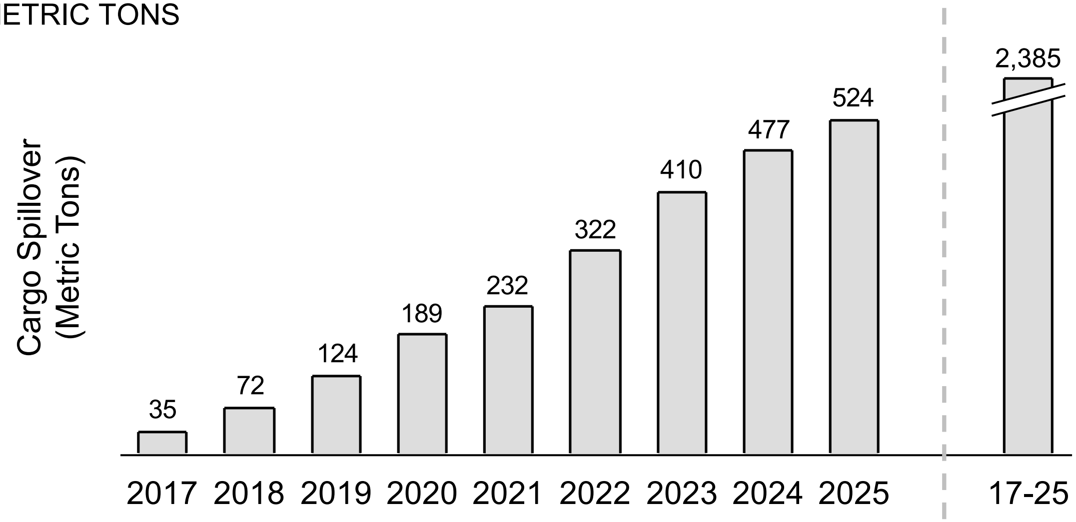


Key Points: Facility Deficit

- Space required is tenant throughput divided by tenant handling productivity (annual metric tons of cargo processed per square foot)
- Space available changes with the addition, demolition, or relocation of cargo facilities, such as when FedEx relocates to the current Bolanos building
- Sea-Tac aggregate facility space is forecast to exceed 100% capacity utilization in 2022

AGGREGATE FACILITY CARGO SPILLOVER BY YEAR: 17-25

METRIC TONS



Key Points: Cargo Spillover

- Facility cargo spillover is the sum of spillover from individual facilities
- Individual facility spillover occurs when a tenant is over 100% capacity utilization at their facility
- Spillover volume is the throughput that is processed above 100% capacity utilization
- Spillover is processed at sub-optimal economic efficiency or may be not processed due to lack of space

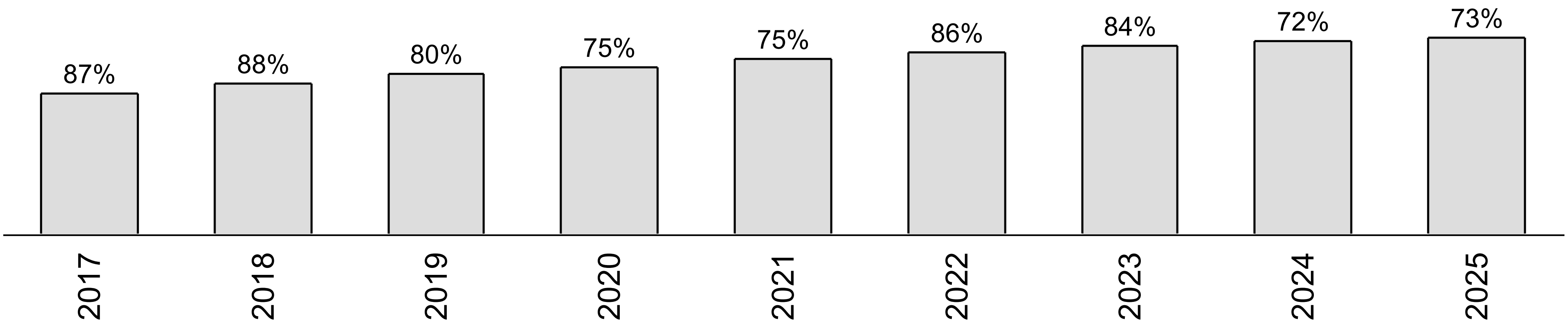
Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Facility expansion options, including the development of the off-airport L-Shape site, will prepare Sea-Tac to process forecasted throughput

SEA-TAC CARGO VOLUME AND CAPACITY UTILIZATION FORECAST: 17-27

AGGREGATE FACILITY CAPACITY UTILIZATION PERCENT



CAPACITY UTILIZATION BY PRIMARY TENANT: 17-27

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	126%	Off-Airport	43%	53%	62%	72%	80%	85%	88%
Alaska Airlines	81%	82%	83%	84%	85%	85%	86%	86%	86%
Consolidated Aviation Services	107%	111%	114%	117%	120%	123%	126%	129%	131%
DHL	91%	100%	106%	111%	115%	119%	74%	38%	39%
Delta Airlines	79%	81%	82%	84%	85%	87%	88%	89%	90%
FedEx	98%	102%	95%	97%	99%	101%	102%	104%	106%
Hanjin Shipping	87%	89%	90%	92%	94%	95%	74%	38%	39%
OTH	26%	56%	59%	40%	41%	61%	62%	49%	49%
Southwest Airlines	83%	85%	87%	88%	89%	90%	90%	91%	91%
Swissport	151%	154%	158%	161%	103%	61%	62%	49%	49%
Worldwide Flight Services	81%	83%	84%	86%	87%	61%	62%	49%	49%
Total	87%	88%	80%	75%	75%	86%	84%	72%	73%

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Timeline for air cargo facility optimization will rearrange and renovate the landscape of North Cargo

SEA-TAC DEVELOPMENT TIMELINE: 2017

CARGO FACILITY OPTIMIZATION RECOMMENDATIONS

- Eliminate non air cargo handling activities in facilities on and near the tarmac
- Accommodate Amazon with temporary-warehousing space until passenger terminal expansion plans are finalized
- Use additional temporary-warehousing as needed to accommodate tenants during construction or as a short term solution
- Develop the L-Shaped parcel into facilities for tenants with low airport proximity need
- Accelerate renovation of Transiplex so the capacity is available in the near future

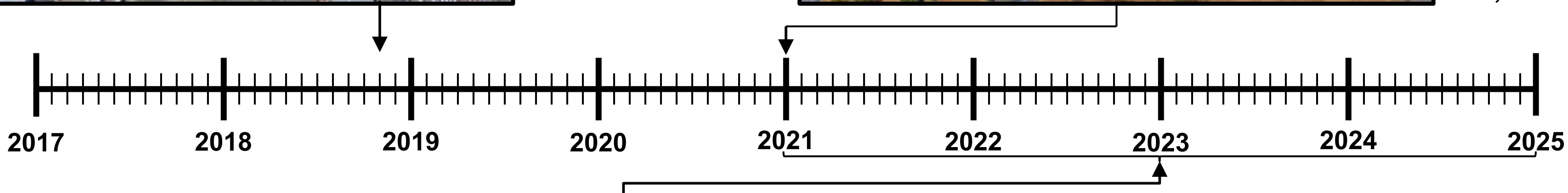
Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Aggregate facility capacity utilization is forecast to exceed 100% in 2022. Multiple SAMP events shape the cargo facility profile before that time

SELECT SAMP NORTH CARGO EVENTS: 17-25

FedEx relocates from the Prologis building at Cargo 1 to the Bolanos building by end-of-year (net gain +10,100 sq. ft.)

The Swissport building is demolished and Swissport relocates to the entire Prologis building at Cargo 1 (net gain +18,440 sq. ft.)



The North Hardstand construction project replaces POS and UAL maintenance with additional parking capacity

CARGO FACILITY PROFILE WITH SAMP PROJECTS: 17-25

	2017	2018	2019	2020	2021	2022	2023	2024	2025
Facility Sq. Ft.	411,644	411,644	421,744	421,744	440,184	440,184	440,184	440,184	440,186
Capacity Utilization	87%	92%	94%	98%	97%	**100%**	**103%**	**106%**	**108%**
Parking Spots	18	15	17	18	16	18	16	18	21

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

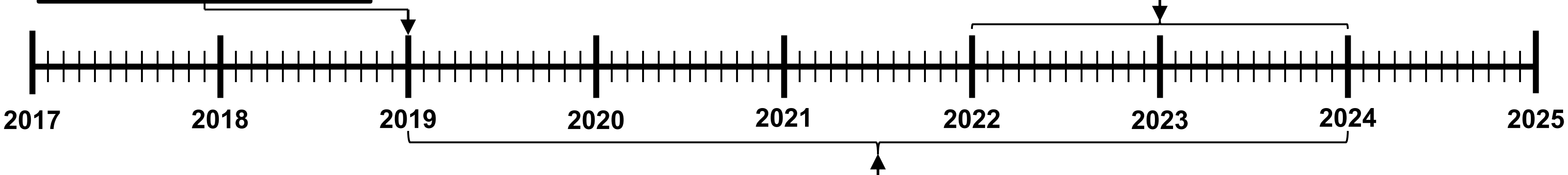
Three potential facility projects will help accommodate cargo growth

FACILITY EXPANSION PROJECTS: 17-25

Amazon stays at its current location in a 90,00 sq. ft. temporary warehouse after the current facility adjacent to Cargo 4 hardstand is demolished

The Transiplex area is renovated with an approximately 200,000 sq. ft. facility

2022-2024



The North Cargo-Off Airport "L-Shape" site is developed with 5 facilities for accommodating rearranged non-cargo tenants and cargo tenants with non-proximal airport need

CARGO FACILITY PROFILE WITH FACILITY EXPANSION PROJECTS: 17-25

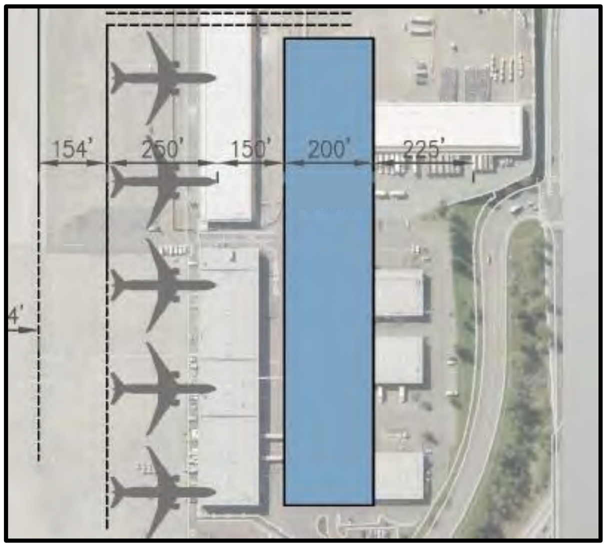
	2017	2018	2019	2020	2021	2022	2023	2024	2025
Facility Sq. Ft.	411,644	395,644	495,744	551,544	569,984	515,784	540,784	648,784	648,784
Capacity Utilization	87%	88%	80%	75%	75%	86%	84%	72%	73%
Parking Spots	18	15	17	18	16	18	16	18	21

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Permanent facility construction initiatives are already included in current SAMP drafts

PERMANENT FACILITY PROJECTS



FACILITY CONSTRUCTION MODEL ASSUMPTIONS

North Cargo Off-Airport "L-Shape" site

- Five facilities totaling 289,200 sq. ft.
- Assumed 50% dedicated for cargo capacity addition – remaining 50% supports non-cargo activity or rearranged non-cargo tenants
- Construction in three phases:
  - 55,800 sq. ft. cargo capacity addition in 2020
  - 55,800 sq. ft. cargo capacity addition in 2022
  - 33,000 sq. ft. cargo capacity addition in 2024
- Construction does not reduce aggregate cargo facility sq. ft.

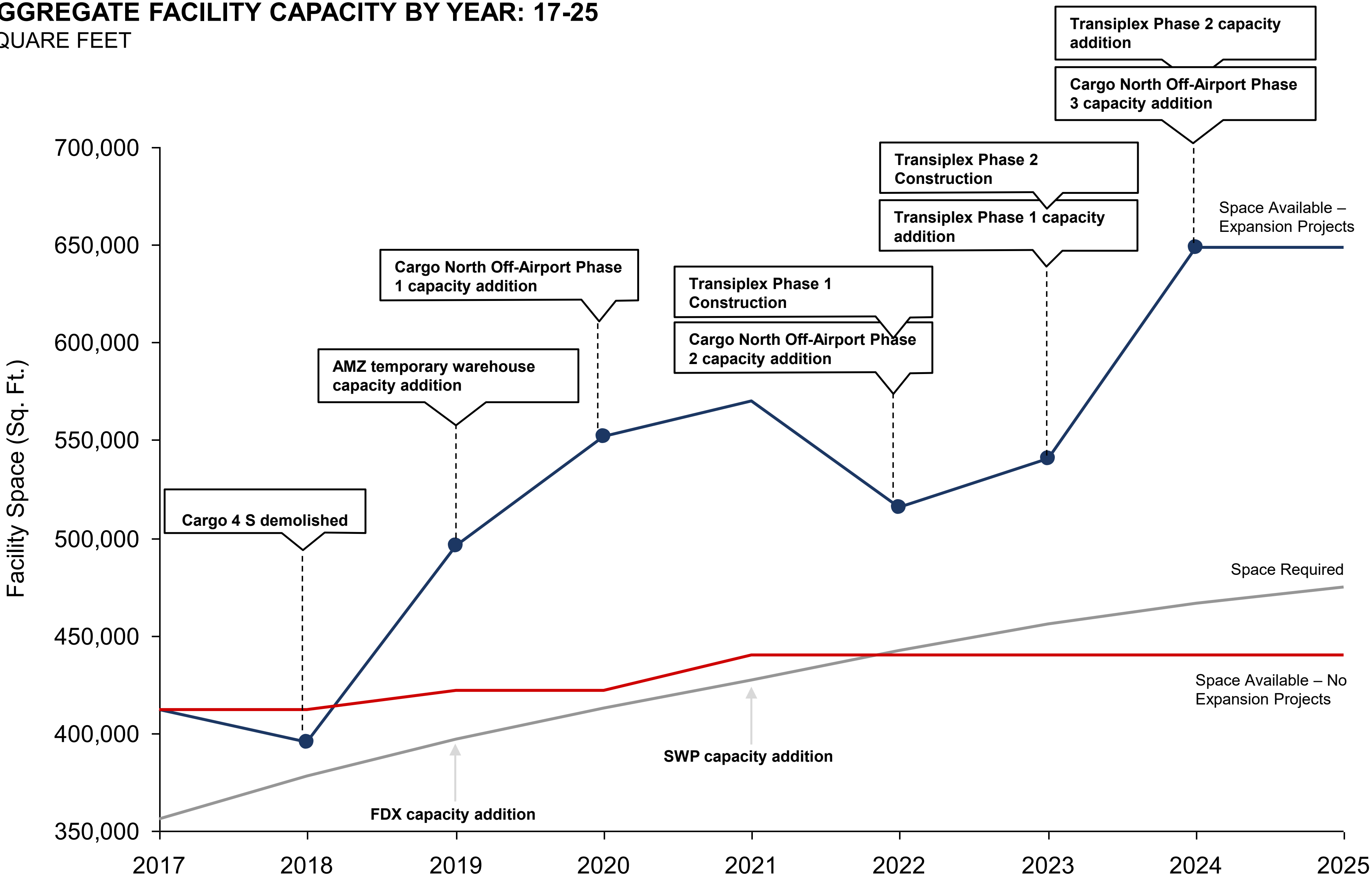
Transiplex Redevelopment

- One facility totaling 200,000 sq. ft.
- Adjacent to hardstand 2, in place of Transiplex A, E, F, G, & Prologis Cargo 1
- Assumed 75% dedicated for cargo capacity addition – remaining 25% is flexible
- Construction in two phases:
  - 75,000 sq. ft. cargo capacity addition in 2023
  - 75,000 sq. ft. cargo capacity addition in 2024
- Construction temporarily reduces aggregate cargo facility sq. ft.

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model, Sea-Tac SAMP Updates

Cargo expansion projects will meet facility space requirements and keep aggregate facility throughput below 100% capacity utilization

AGGREGATE FACILITY CAPACITY BY YEAR: 17-25
SQUARE FEET



Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac's inability to accommodate existing & new customer air cargo growth has direct implications on its cargo development and potential collateral damage to its passenger air service development

- **Lack of adequate cargo facilities and infrastructure is putting at risk Sea-Tac's air cargo franchise and international passenger air service expansion**
  - Current cargo facilities operators are not seeking new business, turning away potential new customers, and contemplating pushing existing customers out
  - Inevitably air cargo service standards will suffer
  - Air cargo is critical to profitability of international widebody passenger operations

- **Sea-Tac's air cargo constraints may limit growth of economic development, employment, and Washington exports which could be lost to competing airports in other states**
  - Impacts on hometown companies - Alaska Airlines, Amazon & Boeing
  - Degradation of express and small package services
  - Seasonal air cargo operations for cherry exports
  - Lack of practical airport alternatives to Sea-Tac (BFI & PAE are full)

- **Critical need for immediate action to address cargo facilities and freighter hardstand issues**
  - Multiple operators stating need for planning/action due to long lead times
  - Assess options for turnkey solution for facilities and infrastructure investments by third-parties and through public private partnerships

Sources: LogCapStrat analysis

Discussion Points and Next Steps

- Air cargo development options and timing in the context of SAMP and Environmental Review
  - North Cargo
  - L-shape

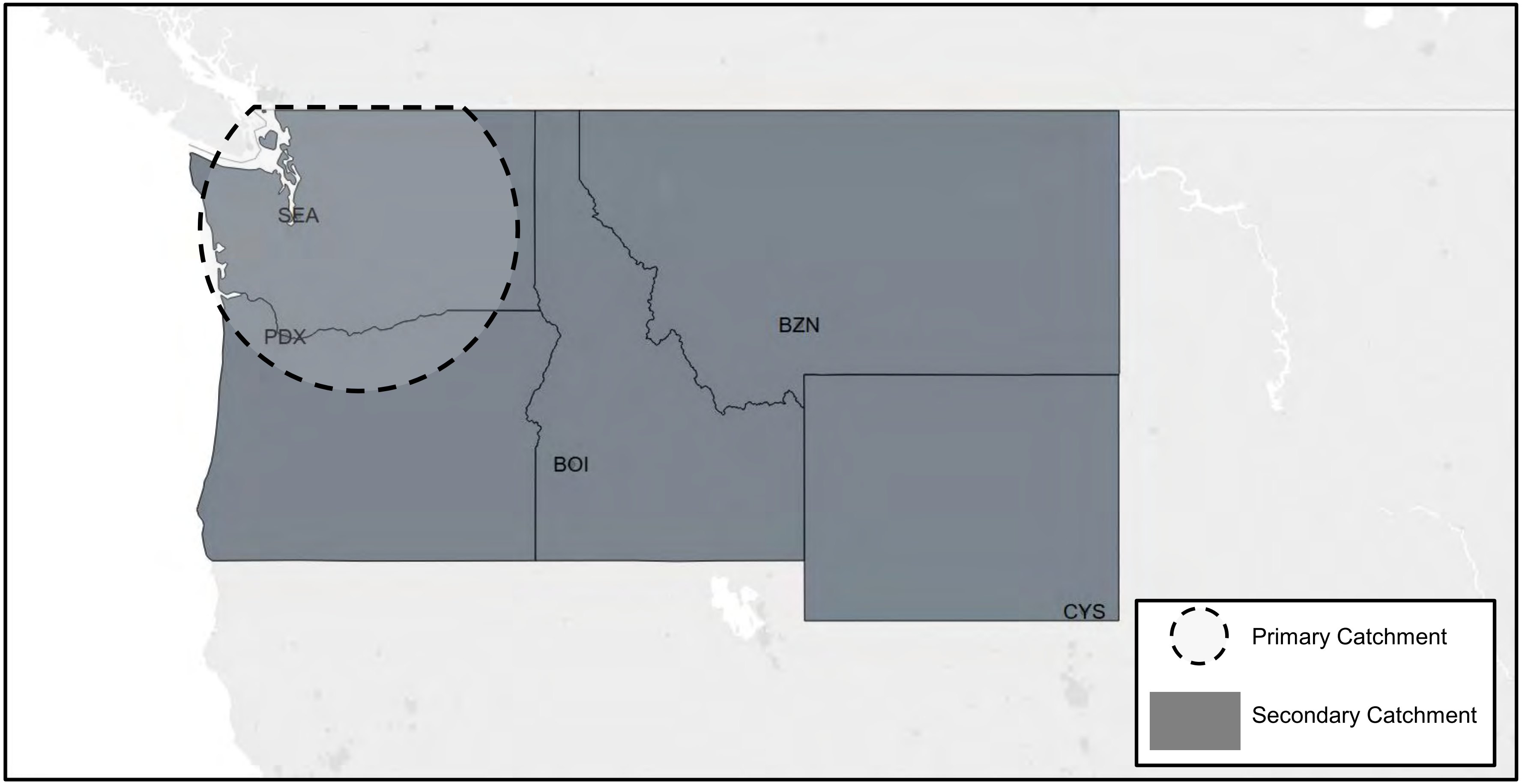
- Financing options for air cargo development
  - PPP – define and outline; likely participants
  - Federal Infrastructure Improvement Program

- Sea-Tac management internal consensus

- Air cargo stakeholder communications and coordination

Sea-Tac addressable air cargo market is defined by its primary and secondary catchment areas

SEA-TAC PRIMARY AND SECONDARY CATCHMENT AREA



Primary Catchment Area: addressable geographic area for express freight pick-up & delivery services (same-day and over-night service delivery time window)

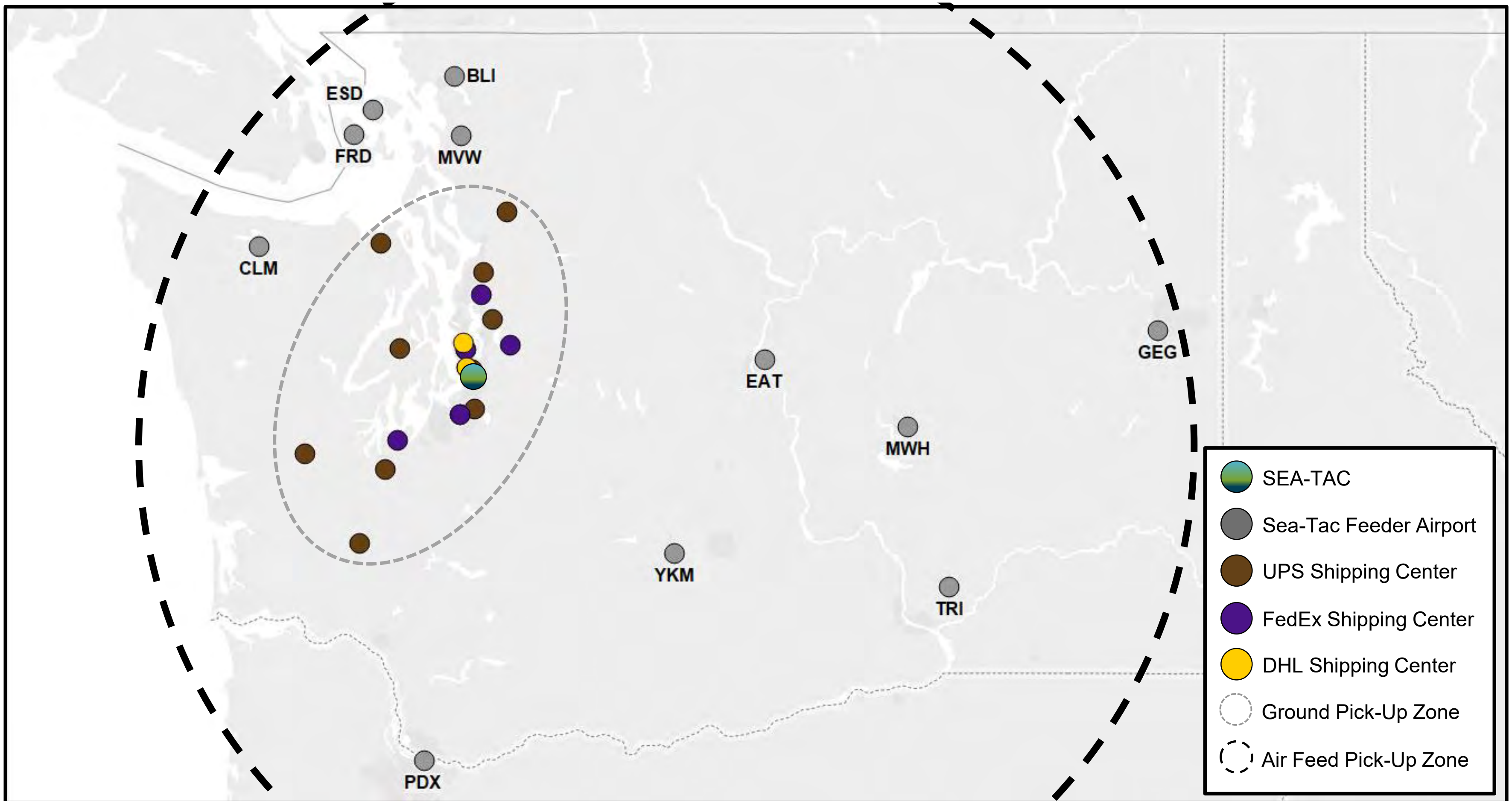
Secondary Catchment Area: addressable geographic area for deferred freight pick-up & delivery services (multi-day service time window, including international service)

Note: LogCapStrat estimates that Canada-related air cargo flowing inbound and outbound via Sea-Tac are de minimis (approx. 2% of total volume)

Sources: LogCapStrat analysis

Primary catchment area is determined by the express carrier package pick-up area and air feeder nodes

SEA-TAC PRIMARY CATCHMENT AREA PICK-UP ZONES



Ground Pick-Up Zone: The domestic catchment area where express cargo shipments are able to reach Sea-Tac via roadway

Air Pick-Up Zone: The domestic catchment area where express cargo shipments are able to reach Sea-Tac via feeder airplanes from local airports

Sources: LogCapStrat analysis, UPS, FedEx, DHL

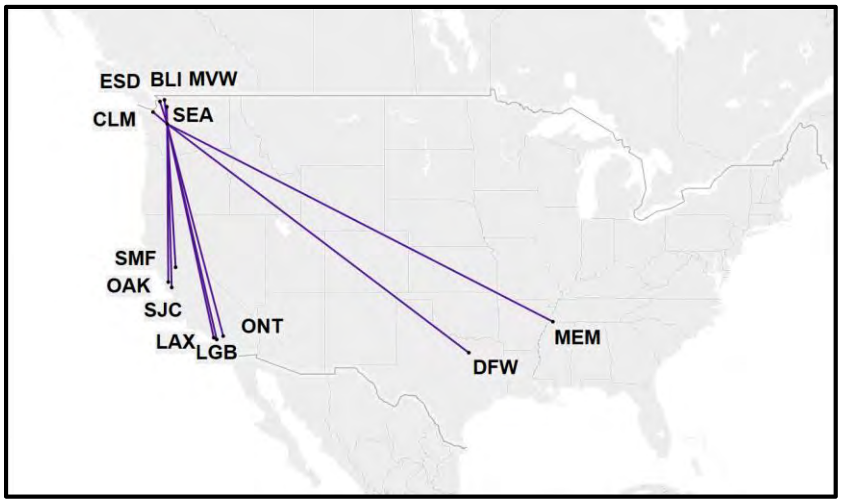
All four integrators serve their national hubs from the Seattle area

OUTBOUND AIR PACKAGE FLOWS FROM SEA-TAC AND BFI: 2017

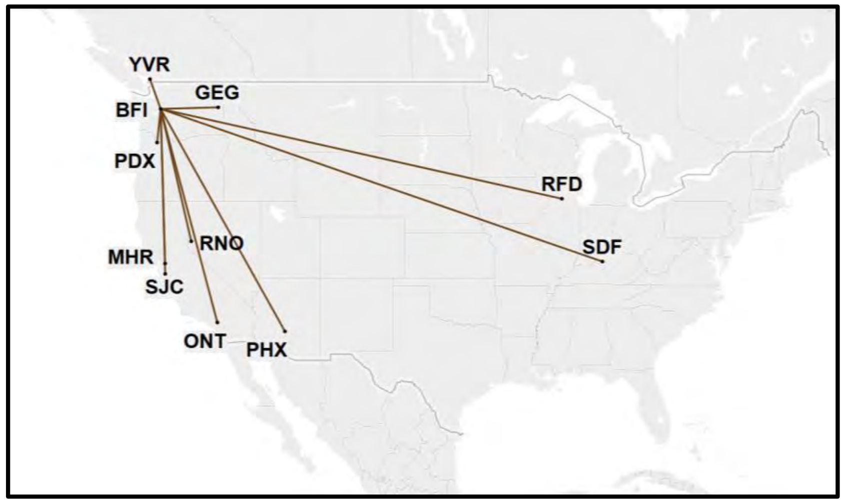
Amazon: SEA-TAC OUTBOUND

DHL: SEA-TAC OUTBOUND

FedEx: SEA-TAC OUTBOUND



UPS: BFI OUTBOUND

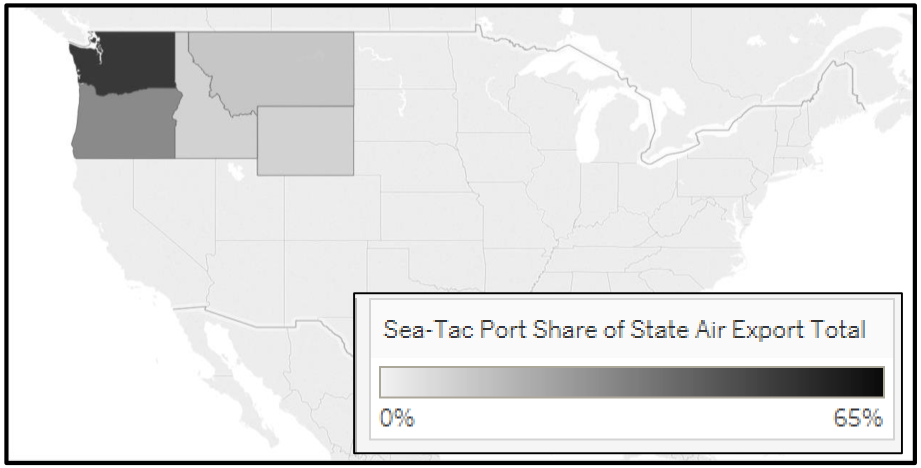


Notes: BFI Outbound Departures for Week 39, 2017; SEA-TAC Outbound Departures for Week 15, 2017

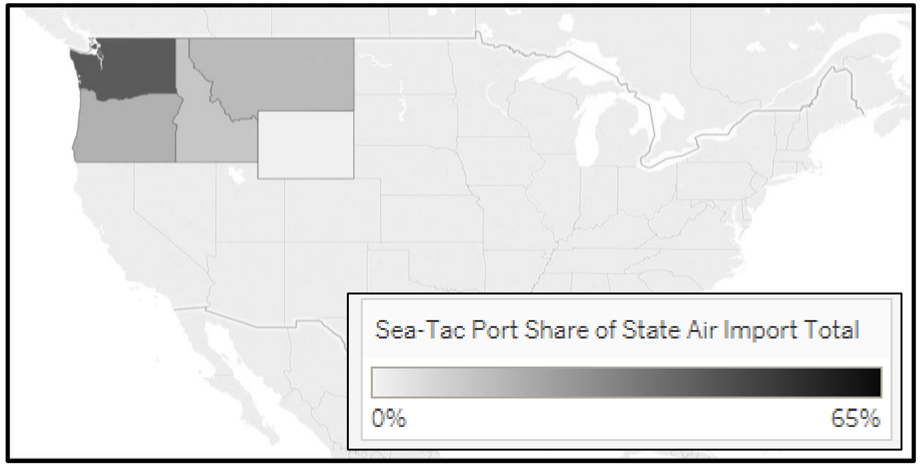
Sources: FlightAware, Sea-Tac freighter data, LogCapStrat analysis

Sea-Tac secondary catchment area for international air cargo consists of five states in Pacific Northwest which generate 80% of port throughput

SEA-TAC PORT AIR EXPORT SHARE BY STATE: 2016



SEA-TAC PORT AIR IMPORT SHARE BY STATE: 2016



SEA-TAC PORT SHARE OF STATE AIR EXPORTS: 2016

State	Sea-Tac Port Metric Tons	Share of State Total	Percent of Sea-Tac Port Exports
WA	54,940	62%	66%
OR	15,628	34%	19%
ID	932	10%	1%
MT	274	14%	<1%
WY	30	10%	<1%
All Other US	11,997	<1%	14%
Total	*83,802	3%	100%

SEA-TAC PORT SHARE OF STATE AIR IMPORTS: 2016

State	Sea-Tac Port Metric Tons	Share of State Total	Percent of Sea-Tac Port Imports
WA	33,847	50%	60%
OR	5,963	21%	11%
ID	864	14%	2%
MT	198	18%	0%
WY	3	<1%	0%
All Other US	15,789	<1%	27%
Total	*56,664	1%	100%

Notes: *Sea-Tac port exports & imports include nearby customs points in Blaine, WA (US-Canada border) and Everett, WA (Boeing manufacturing)

Sources: LogCapStrat CargoMetrix - Concept 3

Inbound market is driven by Seattle local economy and outbound market by manufacturing and distribution

CATCHMENT AREA SUPPLY & DEMAND FRAMEWORK

Inbound "demand-pull"

Local demand "pulls" inbound shipments to fill shortfalls in supply not met by local production. Demand pull includes the demand for consumer goods, which is a function of the wealth of the local population. The Seattle area (Snohomish, King, and Pierce county) has a wealthy consumer profile with low unemployment rates (4.5% vs 5.0% national) and 23% higher average hourly wages than the US average. Inbound e-commerce shipments (B2C) are increasingly being used to meet consumer demand. Demand-pull examples include:

- Seattle's large aircraft parts and manufacturing industry, which includes companies like Boeing and Aviation Technical Services, imports aircraft parts as production inputs (B2B)
- Radio, television, and other wireless communications equipment are used for local manufacturing (B2B). Similarly, high-valued electronic products are imported to meet local consumer demand (B2C)
- Shellfish and other aquaculture products are part of Seattle-area production. Regional industries are supported by hatchery/farming equipment air imports (B2B)

Outbound "supply-push"

Local production shipments are "pushed" outbound to meet shortfalls in supply not met by external producers. Supply-push examples include:

- Washington state is the largest producer of cherries in the US. Cherries are a perishable product and therefore addressable by air cargo, and subsequently constitute a large portion of Sea-Tac exports during the harvest season
- Seattle's largest demand-pull industries, while requiring imports to support production, also produce outbound "supply-push" products such as aircraft parts and seafood
- Sea-Tac is a center for exports across the entire catchment area, such as semiconductor machinery from Micron Technology in Boise, Idaho, and aluminum production in Washington State by Alcoa
- Consumer apparel goods that reach the Seattle area via ocean import are redistributed by air across the US

Sources: LogCapStrat analysis, Northwest Seaport Alliance, World Institute for Economic Research, US Census Bureau, Bureau of Labor statistics

Air cargo use cases include shippers with perishable, high-valued, process impairing, or international e-commerce derived products

AIR CARGO USE CASE SEGMENTS

Physically Perishables	Products that physically deteriorate or spoil overtime, making them ineligible for long shipment and storage times
High Value and High Unit-Value	Products with a high ratio of value to weight/density, and travel by air to mitigate the risk of transportation
Economic Process Impairment	Products which may be low values but are tied to a larger production process that is time-critical or has costly service disruptions
International E-commerce	Products where demand is driven by increasing globalization and usually have small lot size, low unit value, and an intercontinental origin and destination

Sources: LogCapStrat analysis

Several long term structural trends will impact future air cargo demand patterns

RECENT HISTORICAL DEMAND DRIVERS

Personal wage growth	▪ Wage growth triggers end-user demand ▪ Stimulates demand from ecommerce and brick-and-mortar retailers, especially for air cargo commodities (high-value & consumers products) ▪ US median wage growth has been increasing since 2010
Slow-growing episodic demand	▪ Volatility in consumer demand ▪ Amplified industry cyclicality leads to greater volatility in demand ▪ Volatility in manufacturing
Declining length-of-haul	▪ Reduction in supply chain length (ex. Asia to Mexico manufacturing) ▪ Seek to lower freight costs ▪ Reduced pipeline inventory ▪ Increased customer service levels
Rising shipment densities	▪ Product design optimization to maximize shipping density, handling efficiency and shock protection ▪ Reduced demand for volumetric transportation capacity ▪ Lowered freight costs ▪ Reduced storage footprint requires less distribution center capacity and retail shelf space
Shift to hybrid strategies	▪ Low interest rates reduce opportunity cost of pipeline inventory and safety stock ▪ Reduced shipping frequency and increased average shipment size ▪ Shipment consolidation and extensive use of modal substitution ▪ Priority express -> deferred express; Air freight -> sea freight; Truckload -> intermodal; LTL -> multi-stop truckload

Sources: LogCapStrat analysis

Long term trends impact air cargo shipper segments differently

USE CASES BY SHIPPER VERTICAL

Characteristic	High Value Density Product	Physically Perishable Product	Economic Process Impairment	E-commerce
Definition of usage driver	High value products use air cargo to minimize inventory carrying costs, risk of damage and theft	Low value products that have limited physical shelf life	Medium or low value component or part that is tied to a larger production process and cost of impairing the process is substantial	Shipments requiring air freight due to risk of delay in transportation process (e.g. border crossing delay, etc.)
Diversified Vehicles & Parts	◔	○	●	●
Government	◑	○	●	◑
Healthcare	●	●	◕	●
High Tech	◕	○	◔	◑
Industrial Manufacturing & Distribution	◑	○	●	●
Professional Services	◕	○	●	○
Retail and Consumer Goods	◔	◕	◕	◕

○ Minimal Impact ● Significant Impact

Sources: LogCapStrat analysis; NAFTA Market Demand Model

Perishables and e-commerce flows will be the biggest generators of incremental demand

AIR CARGO PRODUCT SEGMENTS

Segment	Outlook	Strategic Implications	Examples
Physical Perishables	**Physical perishables:** Perishables will continue to grow with population increases and rising incomes. Perishables will become a very important airfreight segment because it can absorb higher transportation costs with volatility in oil prices **The healthcare industry:** The healthcare industry addresses consumer demand via air cargo across the three core segments: life sciences, pharmaceuticals, and medical equipment – and will experience structural tailwinds due to the aging population of the developed world	High cost of doing business in the near-term but refrigeration technology will enable mode shift – carbon footprint risk in EU	▪ Fresh fruit ▪ Seafood ▪ Flowers ▪ Temp-controlled healthcare
High Value & High Unit-Value	**High Value & High-unit-value:** Products from industries such as technology, healthcare, specialized machinery, and aerospace which will continue to remain a primary driver of airfreight. The high-tech market has experienced both form-factor density (more-compact products), functional consolidation (e.g., phone, camera, disk drive, music in single device), and reduction in value due to globalization and low interest rates. As a result, future high-tech growth will be contingent upon product launches and investments	Highest unit value products remain air freight users while lower unit value shift to ocean and/or near shoring – highly granular supply chain segmentation	▪ Mobile phones ▪ IT equip
Economic Process Impairment	**Economic process impairment**: Economic-process demand (i.e., supplying emergency parts to prevent plant shut-down) is closely linked to industry production with frequent sporadic contingencies mandating on-demand parts. The need for factory repair and maintenance could be a likely future-growth driver. Specific activities such as oil drilling, mining, and agriculture also require emergency parts in order to maintain operations. Moreover, marketing processes – e.g., samples for trade shows, inventory supplies following advertising campaigns– will continue to necessitate the timely availability of products and parts	Continued growth in air travel demand will increase aircraft installed base and attendant assembly and spare parts flows. Natural resource extraction in remote locations will fuel spare parts flows. Rebounding industrial production triggers increased plant shutdown risk	▪ Spare parts ▪ Components
International Ecommerce	**International e-commerce:** Growth could likely be a catalyst for air cargo usage. In light of recent US, European, and Asian intra-regional e-commerce growth, the globalization of e-commerce could trigger the demand for a deferred intercontinental transportation service. Given the small lot size and relatively low product value of e-commerce purchases, accompanied by the consumer expectation of accelerated delivery, air cargo will likely emerge as the dominant transportation option. Moreover, a slow, fragile, and unpredictable sea-freight network affected by structural overcapacity, consolidation, and decelerated transit times makes airfreight an attractive choice for international e-commerce expansion	It is likely that shipment sizes forwarders handle will decrease in favor of integrated B2C supply chains. Investments will be made in automation, IT, and analytics to better serve customers and expedite the shipping process	▪ Apparel ▪ Consumer electronics

Sources: LogCapStrat analysis

Several macro trends will impact the level and share of belly capacity and freighter supply

GLOBAL AIR CARGO SUPPLY DRIVERS & TRENDS

Drivers

Global freighter capacity: Air cargo supply is a function of the global freighter fleet capacity. Boeing and Airbus are the two largest manufactures of freighters while UPS, FedEx, and DHL own the largest freighter fleets. The freighter fleet capacity supply is sold either directly to shippers or through freight forwarders

Passenger derived belly capacity: Belly capacity is cargo supply in the lower holds of passenger airplanes. Belly capacity supply is growing as airline operations expand to meet rising passenger demand for air travel. Belly-cargo is considered a "zero-cost" option because the cost of the flight is already paid for by passenger ticket revenues. Therefore, ancillary revenue from cargo is quickly becoming an important revenue source for passenger airlines

Trends

Integrator share of the freighter fleet: Integrator fleets account for more than half of the world freighter population and the integrators contract additional freighter lift-capacity from independent carriers and airlines. Furthermore, the integrators own the door-to-door transportation networks that are being used to meet the needs of shippers and customers and are playing a larger role as trends like ecommerce stimulate demand. Their large number of freighters and dedicated networks give the integrators an unequal impact on world air cargo supply, especially as freighter capacity becomes increasingly important in highly specialized supply chains

Wide-body passenger aircraft design: New widebody passenger airplanes are being designed with significant lower-hold capacity. This allows passenger fleets to increase their share of air cargo traffic with low-cost supply. In recent years, this has been most prevalent on international routes such as flights to and from the Middle East, as well as city-pairs served with newer generation aircraft such as the B787 and A350

Outlook

Overcapacity

- As passenger operations increase, belly capacity increases. There is a rising glut in cheap and widely available belly-capacity. Globally, an additional 650 freighters are expected to be delivered over the next 20 years. The combined effect of additional belly-capacity and freighters could result in overcapacity in the market, putting downward pressure on air freight prices

Dedicated freighter routes

- Certain routes will continue to require freight. Reasons for dedicated freighter routes include seasonality (such as the cherry harvest season), directional imbalances, or routes that do not have passenger demand and therefore are not belly-capacity addressable

Sources: LogCapStrat analysis, Airbus, Boeing

Freighter capacity will adjust to meet the underlying demand, but will continue to re-balance with available belly capacity

RECENT HISTORICAL SUPPLY DRIVERS

Fuel prices

- Major cost component of supply and a determinant of overall price
- OPEC volatility
- Fracking keeps US oil prices low

Lane-level dynamics (freighter dedicated)

- Expansion of non-pax routes (E.g. Middle East)
- Directional imbalances
- Specialized cargo supply-chains

Belly capacity growth

- Recent design trends have increased capacity per seat (wide-body configuration) and the ratio of belly capacity per seat may continue to increase due to aircraft design
- Slot constraints increasing at airports for freighters
- Belly capacity will outpace freighter capacity growth as passenger air-travel demand grows and freighter orders remain at an all-time low

Non-integrated freighter demand

- Demand drivers include lot/shipment size, directionality, seasonality
- Pallet configuration reduce some economies of scale on passenger/non-integrated planes
- Belly capacity has yet to exceed freighter total capacity and has its limitations (e.g. B777 belly pallet space makes it difficult for forwarders to achieve economies of scale)

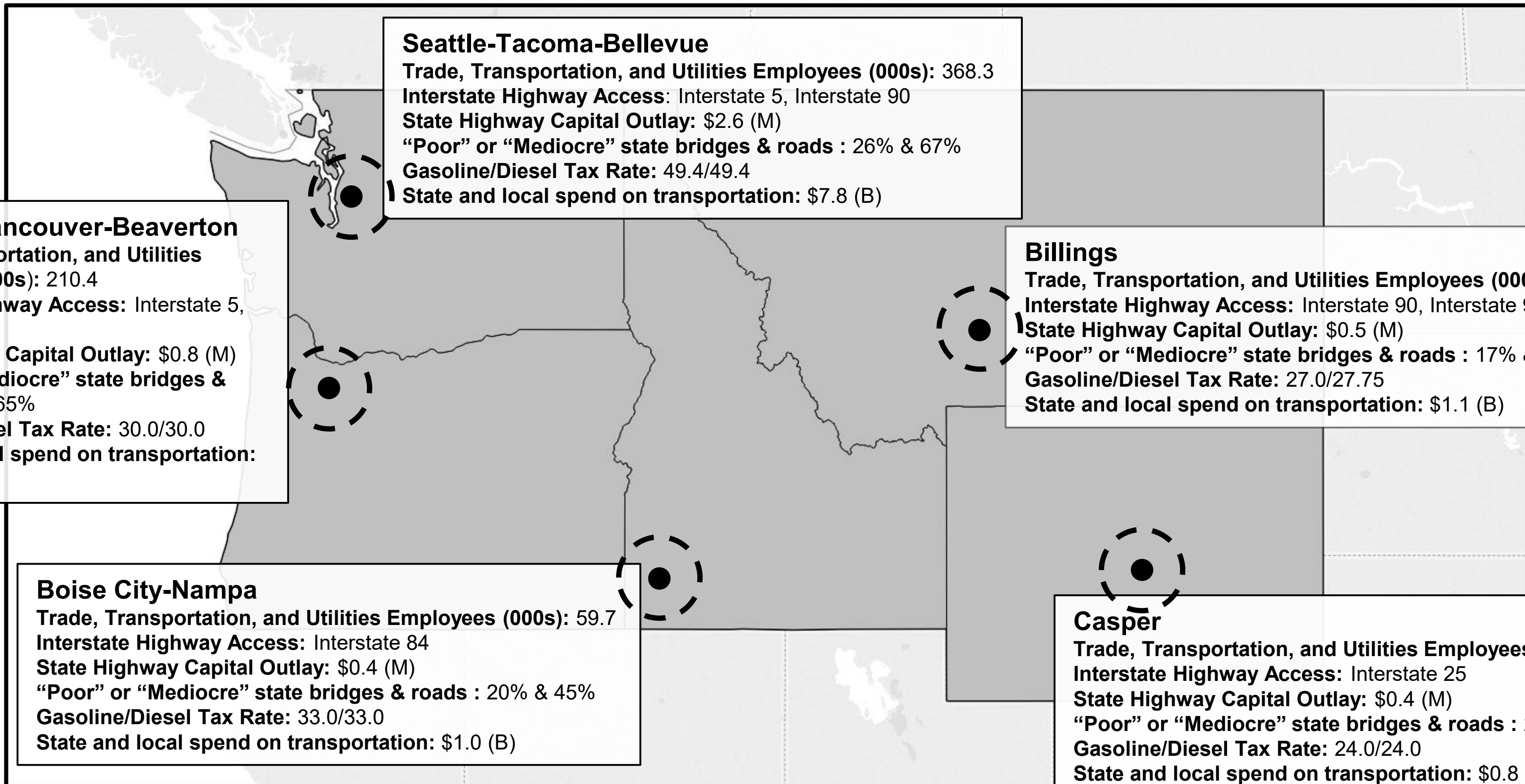
Integrator fleet composition

- UPS, FDX and DHL control significant portion of freighter fleet with Chinese integrators and Amazon as new market entrants
- Integrators will likely augment fleets with B777s over B747-8s; the future supply curve will look different as the B747-400 retires and capacity shrinks

Sources: LogCapStrat analysis

Sea-Tac catchment area has a large logistics industry cluster that supports several air-centric shipper industries

CATCHMENT AREA LOGISTICS PROFILE: 2016



Seattle-Tacoma-Bellevue
Trade, Transportation, and Utilities Employees (000s): 368.3
Interstate Highway Access: Interstate 5, Interstate 90
State Highway Capital Outlay: $2.6 (M)
“Poor” or “Mediocre” state bridges & roads : 26% & 67%
Gasoline/Diesel Tax Rate: 49.4/49.4
State and local spend on transportation: $7.8 (B)

Portland-Vancouver-Beaverton
Trade, Transportation, and Utilities Employees (000s): 210.4
Interstate Highway Access: Interstate 5, Interstate 84
State Highway Capital Outlay: $0.8 (M)
“Poor” or “Mediocre” state bridges & roads: 23% & 65%
Gasoline/Diesel Tax Rate: 30.0/30.0
State and local spend on transportation: $3.0 (B)

Billings
Trade, Transportation, and Utilities Employees (000s): 8.7
Interstate Highway Access: Interstate 90, Interstate 94
State Highway Capital Outlay: $0.5 (M)
“Poor” or “Mediocre” state bridges & roads : 17% & 52%
Gasoline/Diesel Tax Rate: 27.0/27.75
State and local spend on transportation: $1.1 (B)

Boise City-Nampa
Trade, Transportation, and Utilities Employees (000s): 59.7
Interstate Highway Access: Interstate 84
State Highway Capital Outlay: $0.4 (M)
“Poor” or “Mediocre” state bridges & roads : 20% & 45%
Gasoline/Diesel Tax Rate: 33.0/33.0
State and local spend on transportation: $1.0 (B)

Casper
Trade, Transportation, and Utilities Employees (000s): 21.2
Interstate Highway Access: Interstate 25
State Highway Capital Outlay: $0.4 (M)
“Poor” or “Mediocre” state bridges & roads : 23% & 47%
Gasoline/Diesel Tax Rate: 24.0/24.0
State and local spend on transportation: $0.8 (B)

TOP NAICS6 AIR INDUSTRIES BY MSA LQI: 2016

Seattle-Tacoma-Bellevue	Portland-Vancouver-Beaverton	Boise City-Nampa	Billings	Casper
Seafood Products	Semiconductor Machinery	Computer Storage Devices	Industrial Crane, Hoist, and Monorail Equipment	Oil and Gas Field Machinery
Aircraft Parts and Equipment	Electronic Computers	Semiconductor Machinery	Sporting and Recreational Goods	Fluid Meter and Counting Devices
Electrometrical and Electrotherapeutic Apparatus	Dental Equipment and Supplies	Printed Circuit Assembly	Specialty Foods	Industrial Machinery and Equipment

Sources: LogCapStrat Air Cargo Workbench, Bureau of Labor Statistics, Department of Transportation

Cargo growth at Sea-Tac is further bolstered by advantages unique to the greater Seattle area

SEA-TAC CARGO AND PASSENGER SHARE DETERMINANTS

Import flows for production and fulfillment center operations

- **Inbound supply chain flows to support SEA-TAC area production**
  - High technology goods are a high demand import items important in local production
  - Seattle's largest international trading partner by value is Canada due to close proximity
  - The availability of port space allows Seattle to be the largest point of ingress for raw materials and passenger vehicles from Asia into Washington
- **Import supply chain flows to support SEA-TAC fulfillment center operations**
  - Connections to interstate highways and intermodal rail services
  - Fourth largest warehouse and distribution hub in the US
  - Union Pacific Railroad's Argo Rail yard and Burlington Northern Santa Fe Railway's Seattle International Gateway intermodal facility

Local industry and geography

- **Unique geographic isolation from rest of US**
  - Proximity to Alaska, and is able to siphon off freight demand to/from the Far East. It has the closest US port to Alaska, Hawaii, and Guam
  - Largest west coast airport near Canada allows cross border shipments and access to Canadian markets
  - Sea-mode access through the Port of Seattle enables modal substitution and an easy integration of air into larger and more complex supply chains
- **Local industry mix**
  - High technology global corporations Boeing, Microsoft, and Amazon located in Seattle
  - Washington state agriculture leads US in production of apples, milk, cherries, grapes, and others
  - Washington is the leading US aquaculture producer and Seattle has ocean proximity

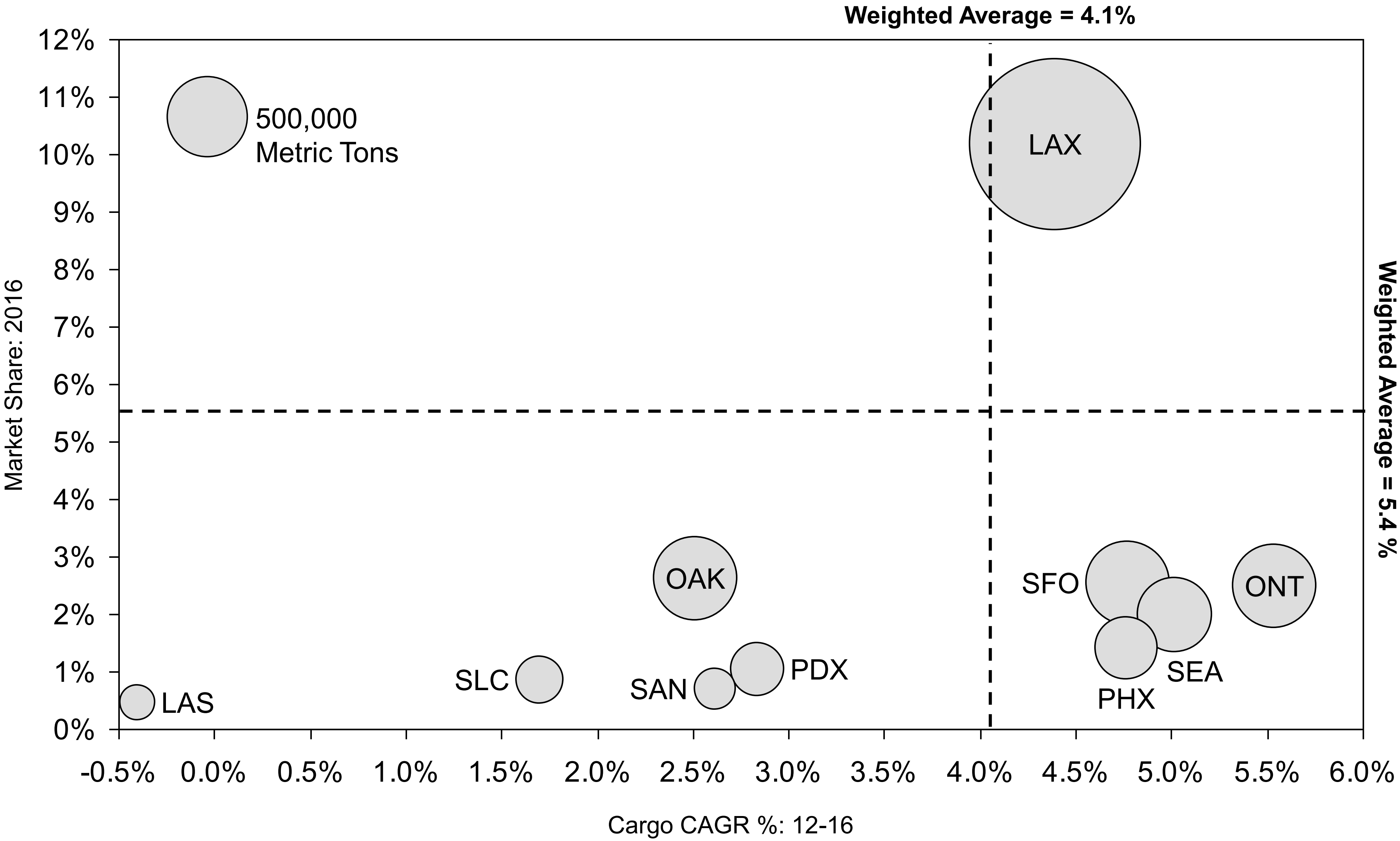
Population and tourism

- **Population and local economy growth**
  - City of Seattle population growth leads nation as fastest growing big city
  - Job growth for Washington state was 3.1%, 5th in the nation, and per capita income grew 2.9%
  - Tenth in nation in real per capita GDP with five consecutive years of growth
- **Tourism**
  - Record 38.9 million tourists in 2016, up 2.2%
  - Visitors generated 718 million in 2016 tax revenues, up 3.7% from 2015
  - Hosts high profile events like 2018 Special Olympics, Washington State Convention Center enables event capacity

Sources: LogCapStrat analysis, US Census Bureau, Washington State Economic Climate Study, Washington State Department of Agriculture

Sea-Tac cargo is the fastest growing international gateway airport on the west coast

WEST COAST AIRPORT CARGO GROWTH: 12-16
CAGR %, MARKET SHARE %

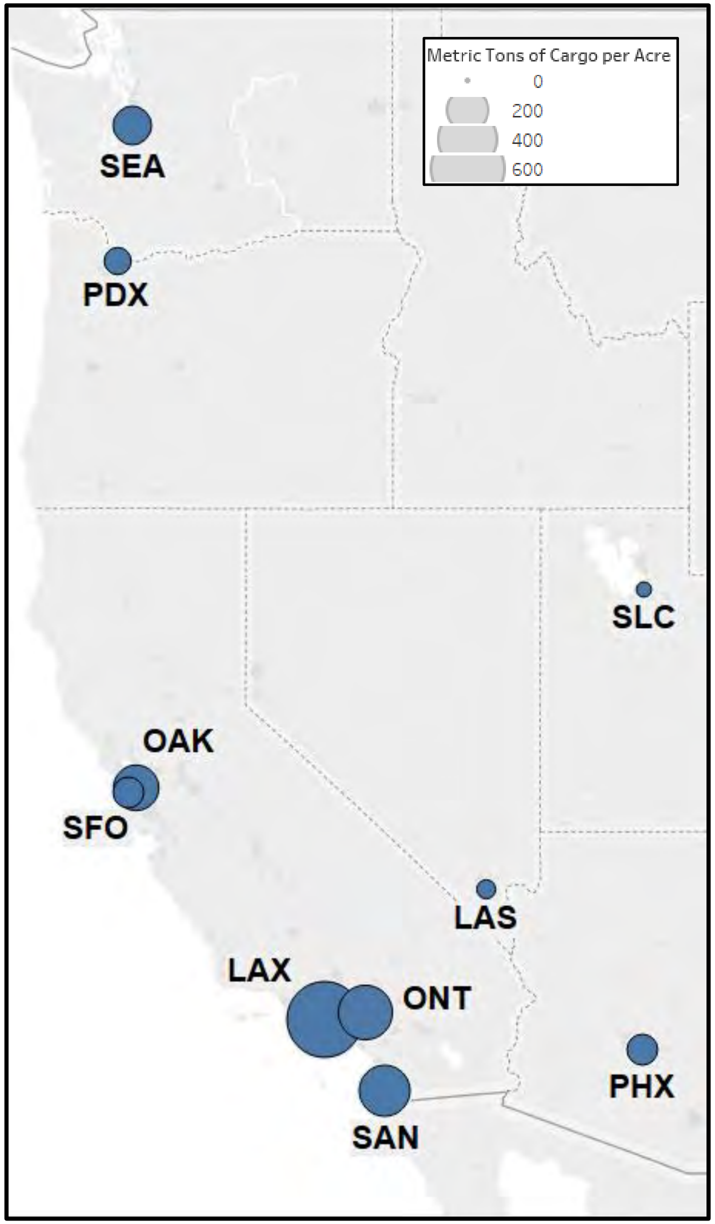


Sources: LogCapStrat analysis, LogCapStrat CargoMetrix – Concept 7

Sea-Tac achieved its cargo growth with smallest real estate footprint among west coast gateway airports

WEST COAST AIRPORT INFRASTRUCTURE PROFILE: 2016

Airport	Code	Land Area (Acres)	Metric Tons of Cargo Per Acre	Runways	Passenger Terminals	Hubs	FAA Hub Type
Salt Lake City International	SLC	7,700	23	4	3	Delta	Large
San Francisco International	SFO	5,200	93	4	4	Alaska, United, Virgin	Large
San Diego International	SAN	5,000	259	1	2	-	Large
Los Angeles International	LAX	3,500	572	4	9	Alaska, American, Delta, Southwest, United	Large
Phoenix Sky Harbor International	PHX	3,400	95	3	3	American	Large
Portland International	PDX	3,000	73	3	1	Alaska	Large
McCarran International	LAS	2,800	36	4	2	-	Large
Oakland International	OAK	2,600	206	4	2	FedEx	Medium
Seattle–Tacoma International	**SEA**	**2,500**	**147**	**3**	**3**	**Alaska, Delta**	**Large**
Ontario International	ONT	1,740	296	2	2	UPS	Medium



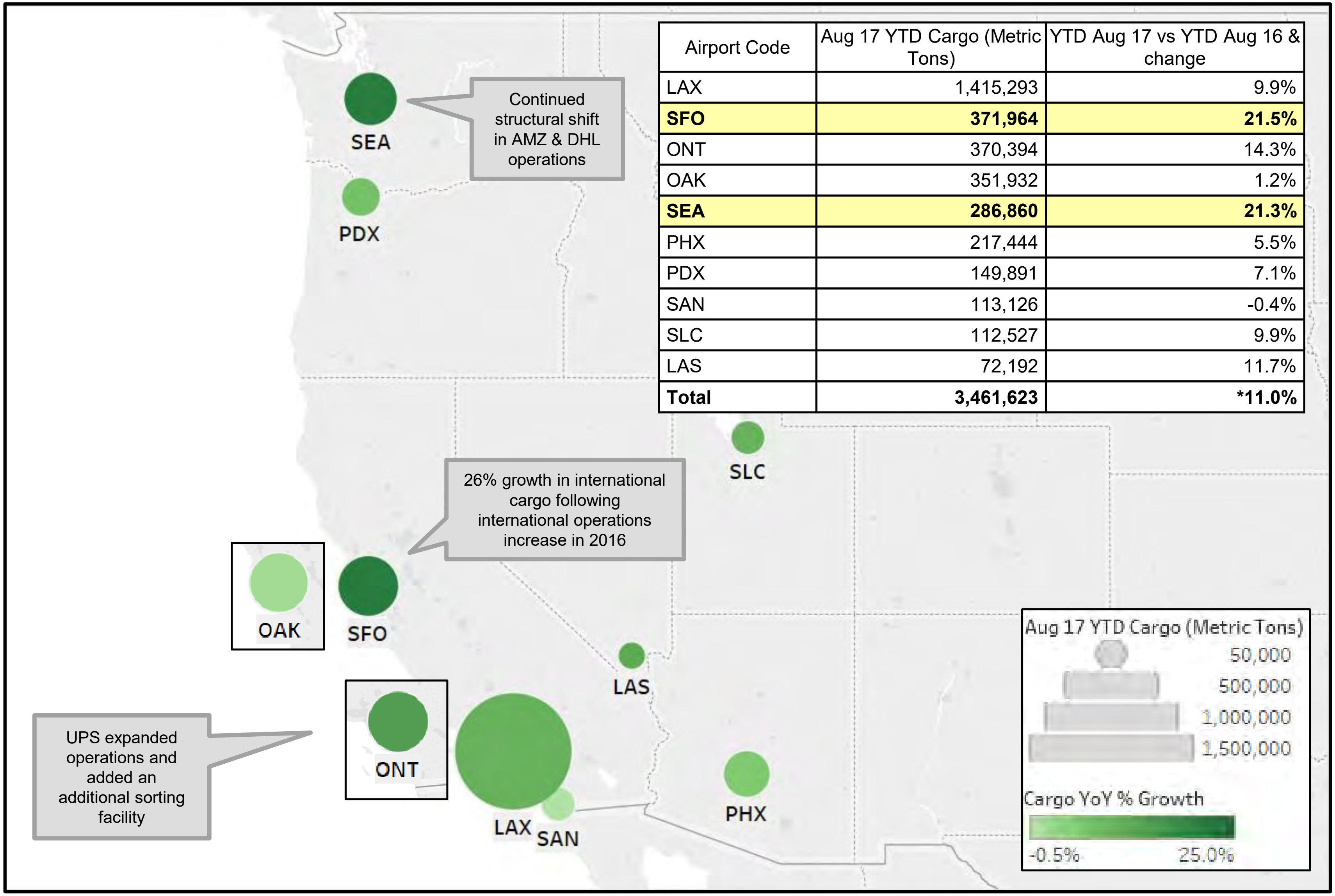
Notes: Large hubs are >1% of annual passenger boardings, Medium are 0.25%-1.0%

Sources: LogCapStrat analysis, Federal Aviation Administration, Respective airport traffic statistics

Sea-Tac continues to generate significant traffic growth relative to other airports in 2017

YEAR-TO-DATE CARGO AND CARGO GROWTH BY AIRPORT: AUGUST 2017

METRIC TONS, % CHANGE AUG 16 - AUG 17



Airport Code	Aug 17 YTD Cargo (Metric Tons)	YTD Aug 17 vs YTD Aug 16 & change
LAX	1,415,293	9.9%
SFO	**371,964**	**21.5%**
ONT	370,394	14.3%
OAK	351,932	1.2%
SEA	**286,860**	**21.3%**
PHX	217,444	5.5%
PDX	149,891	7.1%
SAN	113,126	-0.4%
SLC	112,527	9.9%
LAS	72,192	11.7%
Total	**3,461,623**	***11.0%**

Notes: *Weighted Average

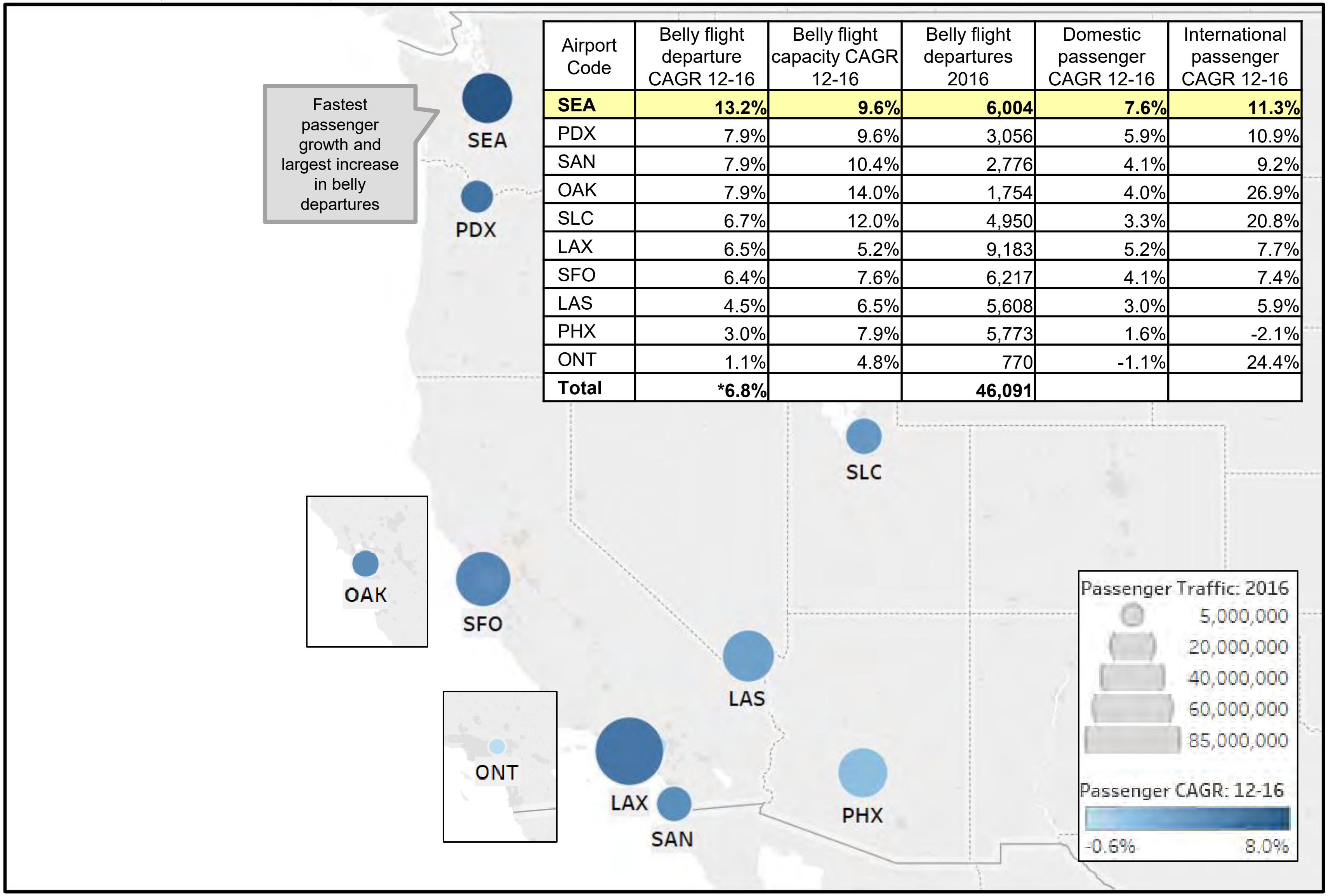
Sources: LogCapStrat analysis, Respective airport traffic statistics

Passenger growth at Sea-Tac has enabled cargo growth through significant increases in belly cargo capacity

PASSENGER AND BELLY FLIGHT GROWTH BY AIRPORT: 12-16

PASSENGERS, DEPARTURES, CAGR %

Airport Code	Belly flight departure CAGR 12-16	Belly flight capacity CAGR 12-16	Belly flight departures 2016	Domestic passenger CAGR 12-16	International passenger CAGR 12-16
SEA	**13.2%**	**9.6%**	**6,004**	**7.6%**	**11.3%**
PDX	7.9%	9.6%	3,056	5.9%	10.9%
SAN	7.9%	10.4%	2,776	4.1%	9.2%
OAK	7.9%	14.0%	1,754	4.0%	26.9%
SLC	6.7%	12.0%	4,950	3.3%	20.8%
LAX	6.5%	5.2%	9,183	5.2%	7.7%
SFO	6.4%	7.6%	6,217	4.1%	7.4%
LAS	4.5%	6.5%	5,608	3.0%	5.9%
PHX	3.0%	7.9%	5,773	1.6%	-2.1%
ONT	1.1%	4.8%	770	-1.1%	24.4%
Total	***6.8%**		**46,091**		

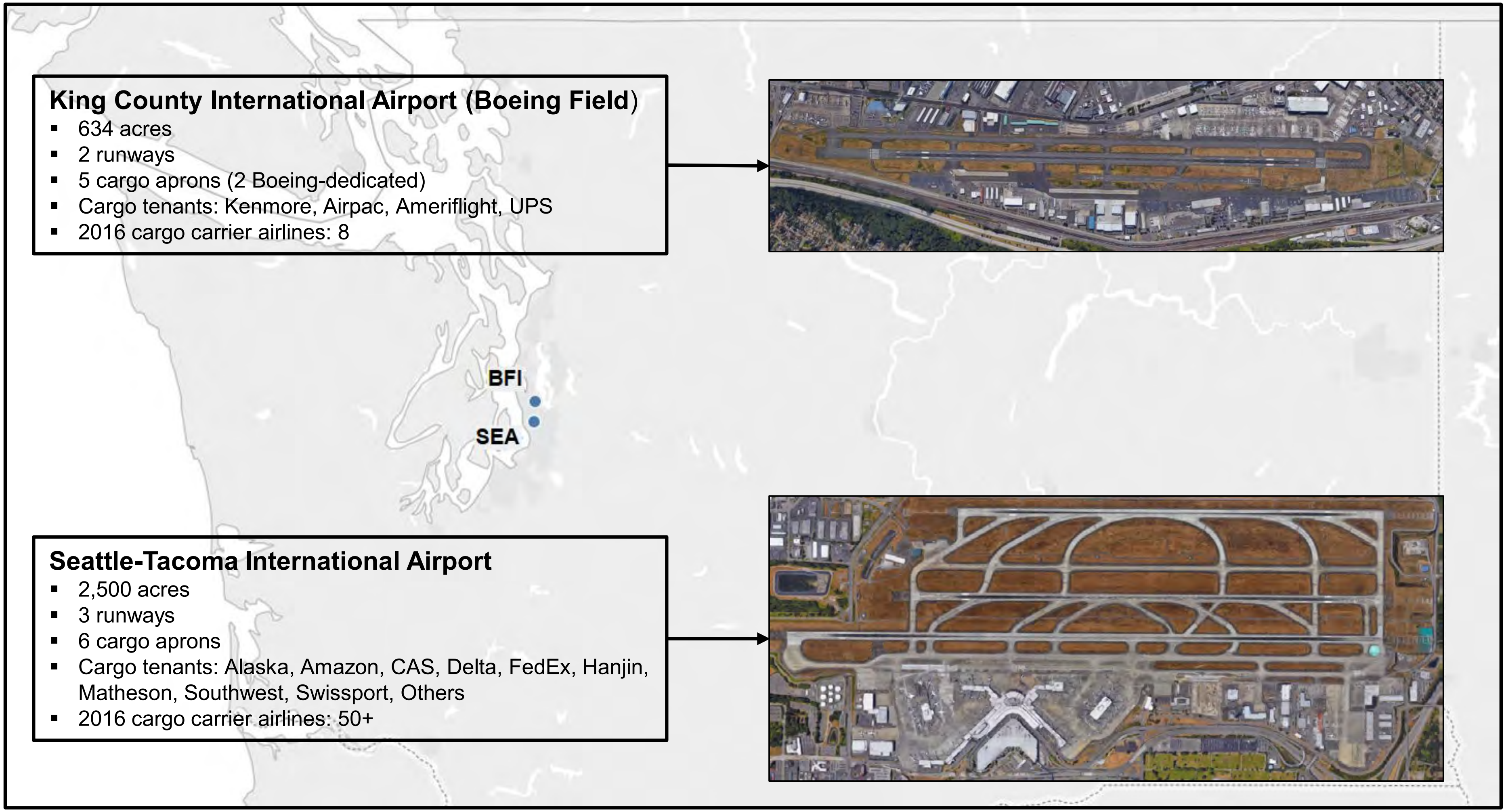


Notes: *Weighted Average

Sources: Respective airport air traffic statistics, LogCapStrat CargoMetrix – Concept 7

Total Seattle market is handled by two airports, Seattle-Tacoma and King County International Airport, of which Sea-Tac is by far the largest

SEATTLE MARKET AIRPORT PROFILE: 2016



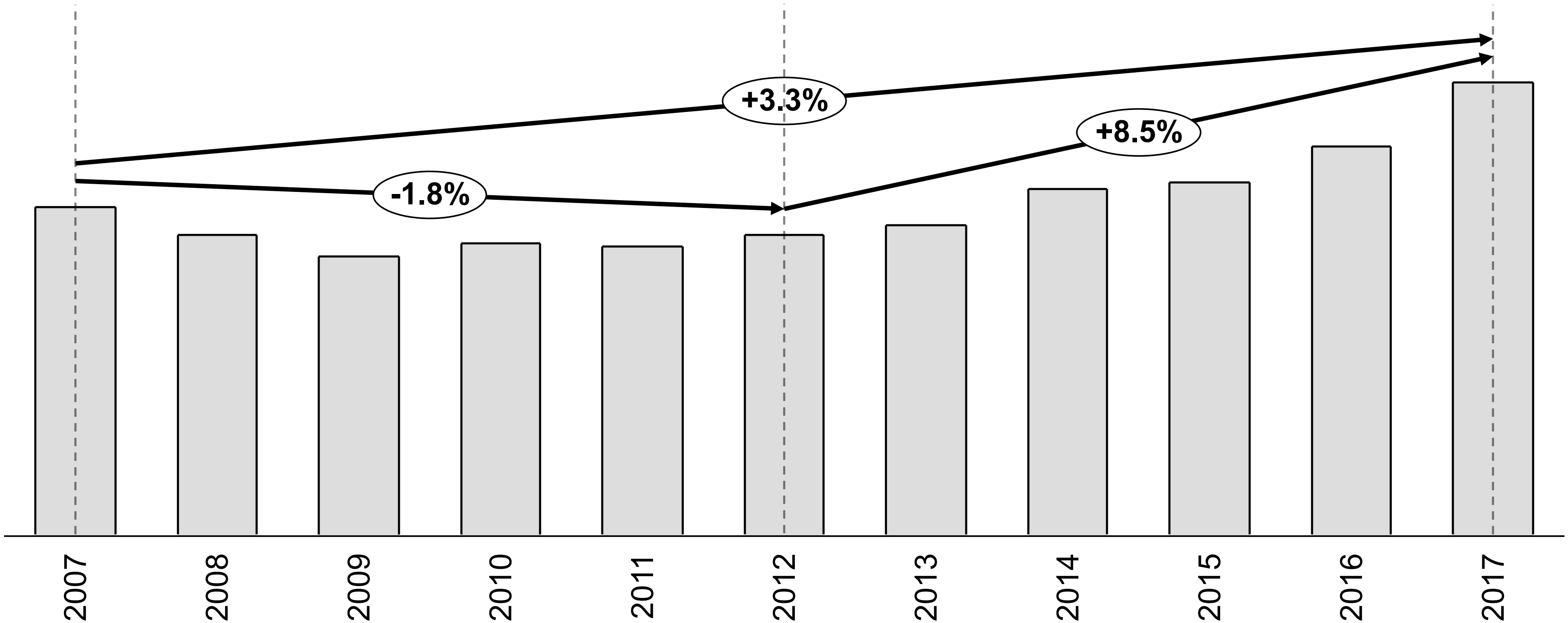
King County International Airport (Boeing Field)
- 634 acres
- 2 runways
- 5 cargo aprons (2 Boeing-dedicated)
- Cargo tenants: Kenmore, Airpac, Ameriflight, UPS
- 2016 cargo carrier airlines: 8

Seattle-Tacoma International Airport
- 2,500 acres
- 3 runways
- 6 cargo aprons
- Cargo tenants: Alaska, Amazon, CAS, Delta, FedEx, Hanjin, Matheson, Southwest, Swissport, Others
- 2016 cargo carrier airlines: 50+

Sources: kingcounty.gov, BFI Master Plan, Port of Seattle Airport Statistics, LogCapStrat analysis

Over the last decade, Seattle cargo market has gone through three phases: decline, rebound and acceleration

SEA-TAC HISTORICAL CARGO VOLUME AND GROWTH RATES: 07-17
CAGR %



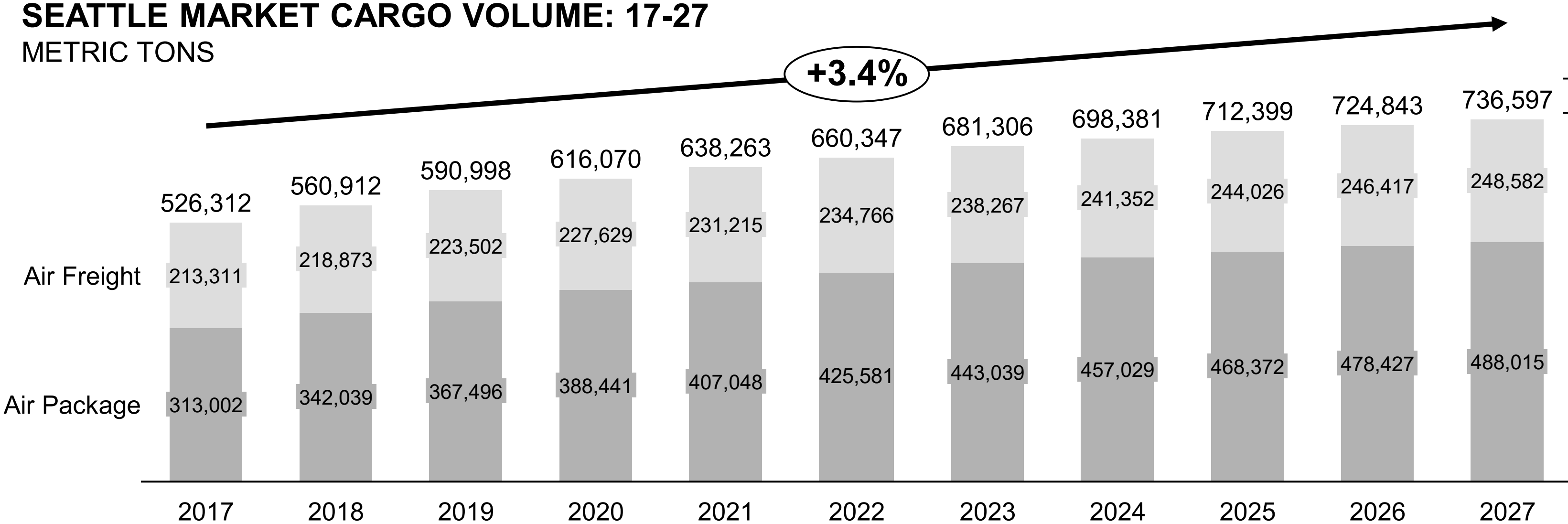
Key Points:

- Sea-Tac historical CAGR declined with the Great Recession and, with the exception of 2010, was characterized by steady year-over-year negative growth. This decline was indicative of larger trends in the air cargo industry
- Historical CAGR from 12-16 was 6.6%, and the result of domestic recovery and increased integrator volumes
- One-time structural demand events, combined with a global economic recovery, are currently driving a massive growth in cargo at Sea-Tac
- As the one-time structural events resolve Sea-Tac will continue to grow from a higher baseline, albeit at a necessarily lower growth rate

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

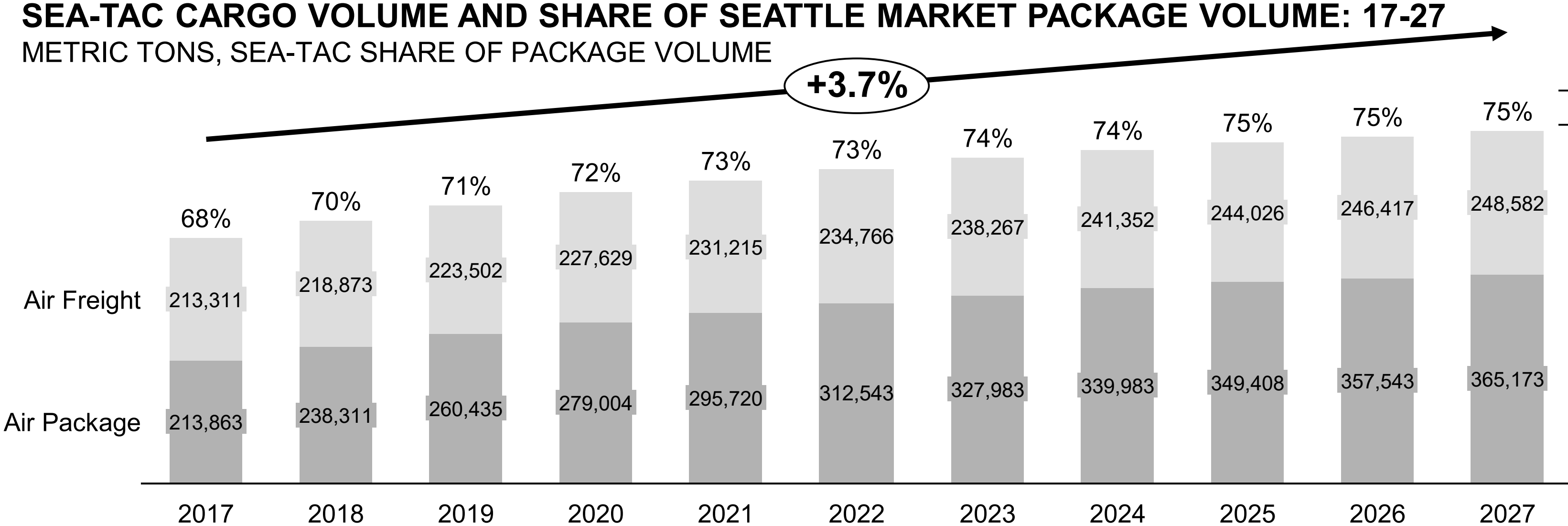
Market is forecast to grow at 3.4% CAGR and reach 737,000 metric tons in 2027, with Sea-Tac capturing increasingly larger share of package volume

SEATTLE MARKET CARGO VOLUME: 17-27
METRIC TONS



	CAGR	Absolute Growth
Total	3.4%	210,284
	1.5%	35,271
	4.5%	175,013

SEA-TAC CARGO VOLUME AND SHARE OF SEATTLE MARKET PACKAGE VOLUME: 17-27
METRIC TONS, SEA-TAC SHARE OF PACKAGE VOLUME

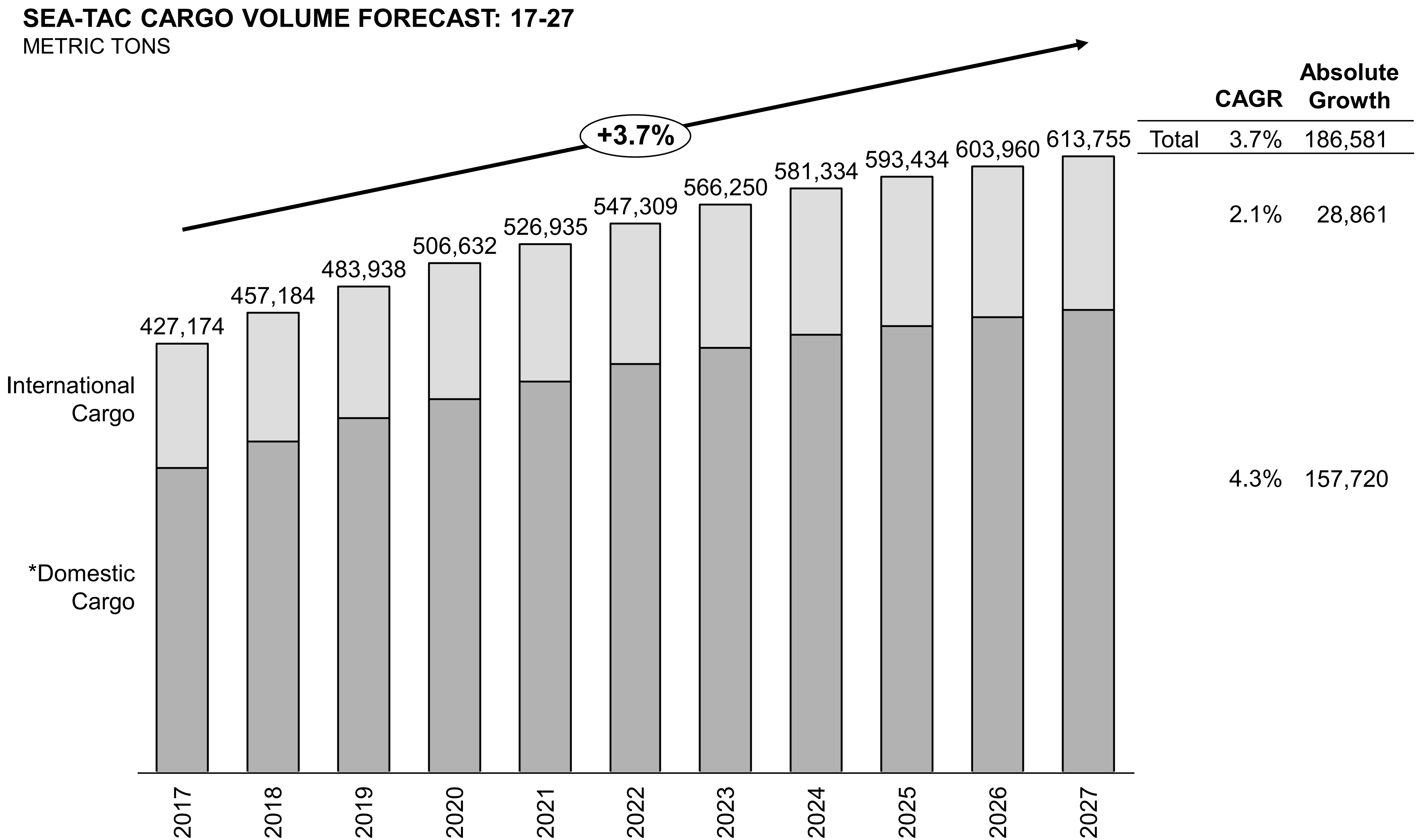


	CAGR	Absolute Growth
Total	3.7%	186,581
	1.5%	35,271
	5.5%	151,310

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac cargo is forecast to reach 614,000 metric tons in 2027

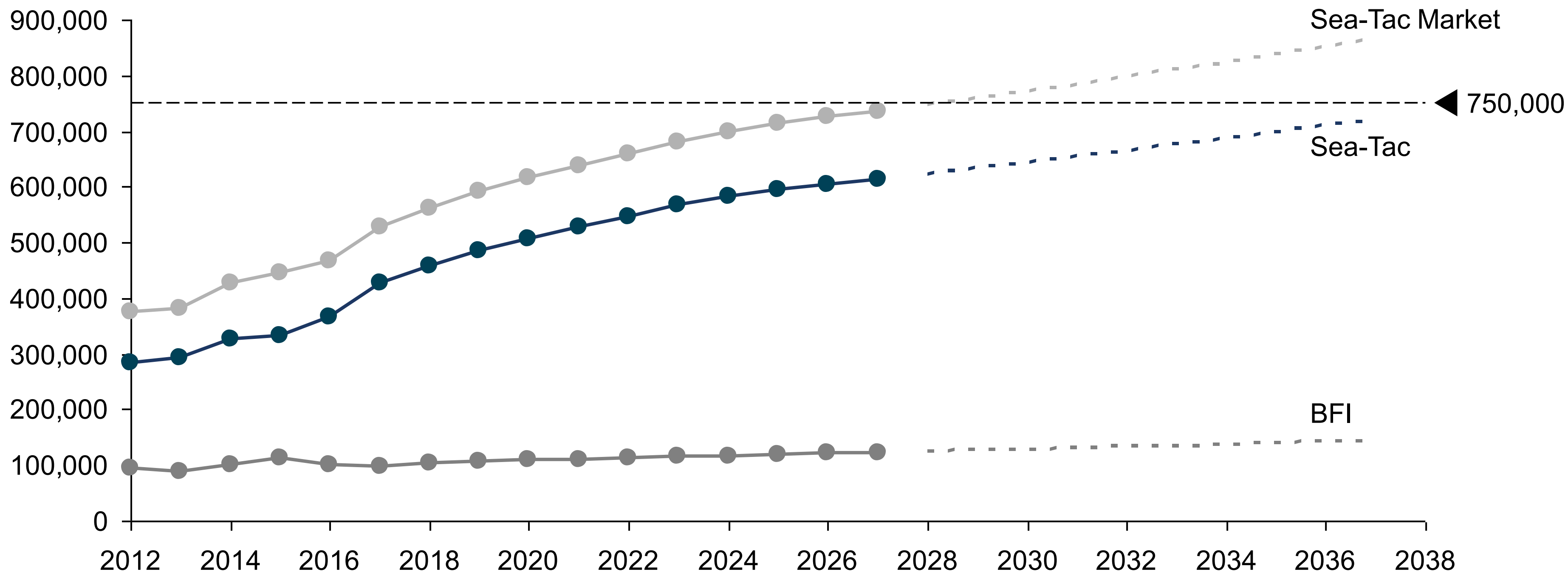


Notes: Domestic Cargo is domestic cargo + integrator packages. Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Despite growth, Sea-Tac is not forecast to reach the Century Agenda goal of 750,000 metric tons in the near future

SEATTLE MARKET AIR CARGO VOLUME: 12-37
METRIC TONS



Key Points:

- The Century Agenda goal is 750,000 metric tons of cargo throughput at Sea-Tac
- Current facility capacity is not adequate to address the Century Agenda goal
- Sea-Tac will need to experience significant structural change to reach 750,000 metric tonnes of throughput, similar to the growth seen in recent years
- The Sea-Tac market is on pace to reach 750,000 metric tons by 2029

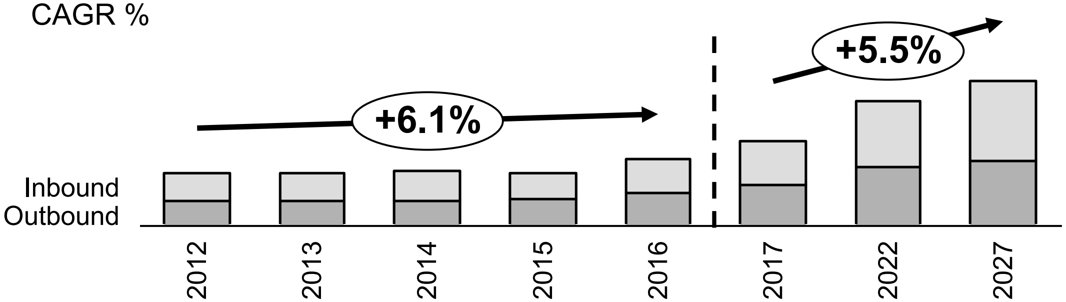
Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Cargo growth will come from integrated carrier, international and domestic air freight

SEA-TAC INTEGRATED CARRIER AIR PACKAGE: 12-27

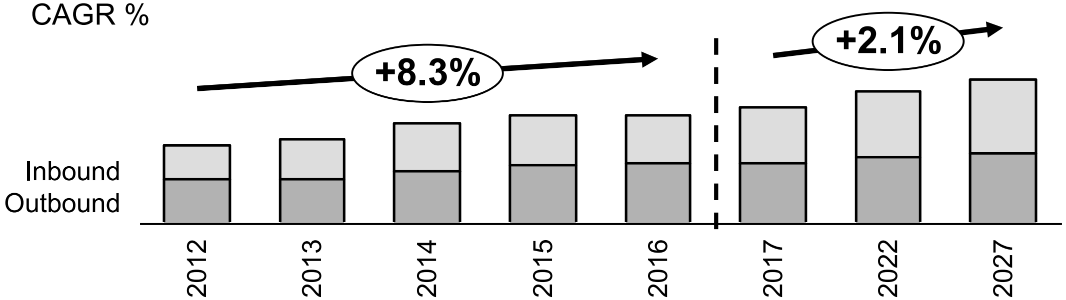
CAGR %



CAGR	12-16	17-22	22-27	17-27
Inbound	6.0%	8.5%	3.6%	6.0%
Outbound	6.3%	7.1%	2.6%	4.9%
Total	6.1%	7.9%	3.2%	5.5%

SEA-TAC INTERNATIONAL AIR CARGO: 12-27

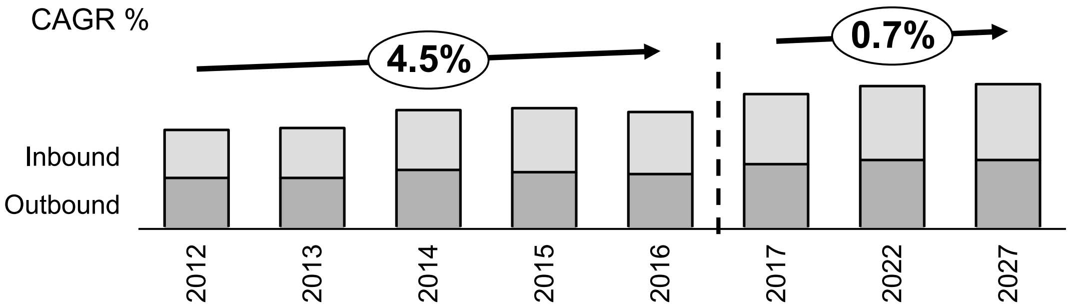
CAGR %



CAGR	12-16	17-22	22-27	17-27
Inbound	8.6%	3.1%	2.1%	2.6%
Outbound	8.1%	1.9%	1.3%	1.6%
Total	8.3%	2.5%	1.7%	2.1%

SEA-TAC DOMESTIC AIR CARGO: 12-27

CAGR %

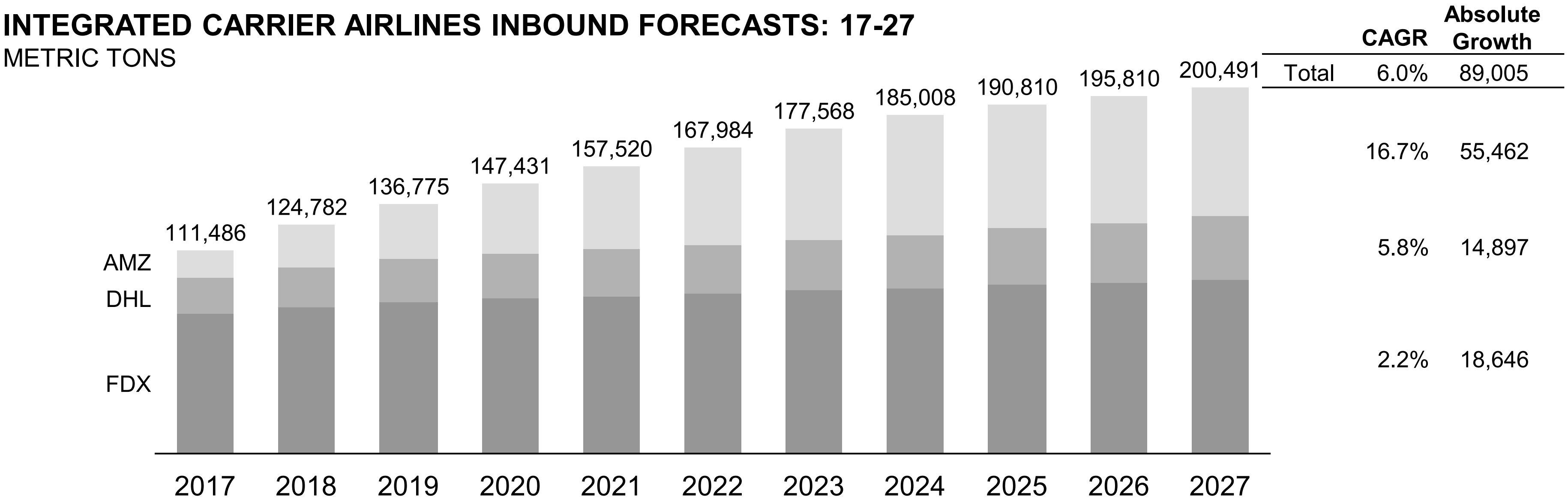


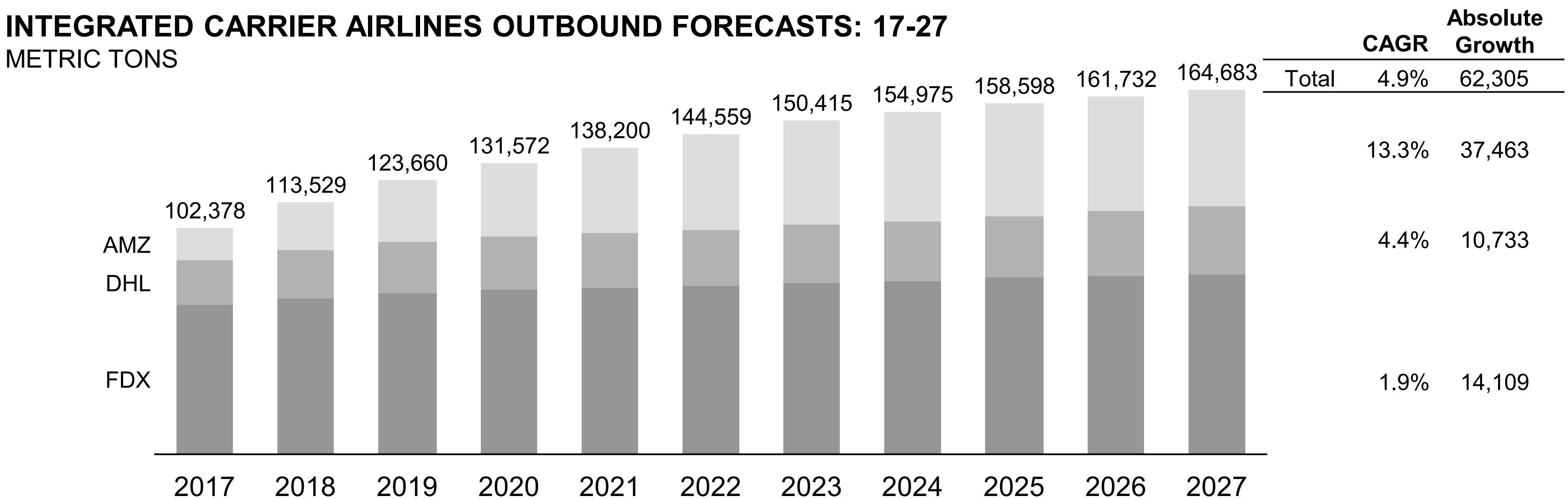
CAGR	12-16	17-22	22-27	17-27
Inbound	5.2%	1.0%	0.2%	0.6%
Outbound	3.9%	1.2%	0.3%	0.8%
Total	4.5%	1.1%	0.3%	0.7%

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Integrator packages are the largest and fastest growing cargo flow





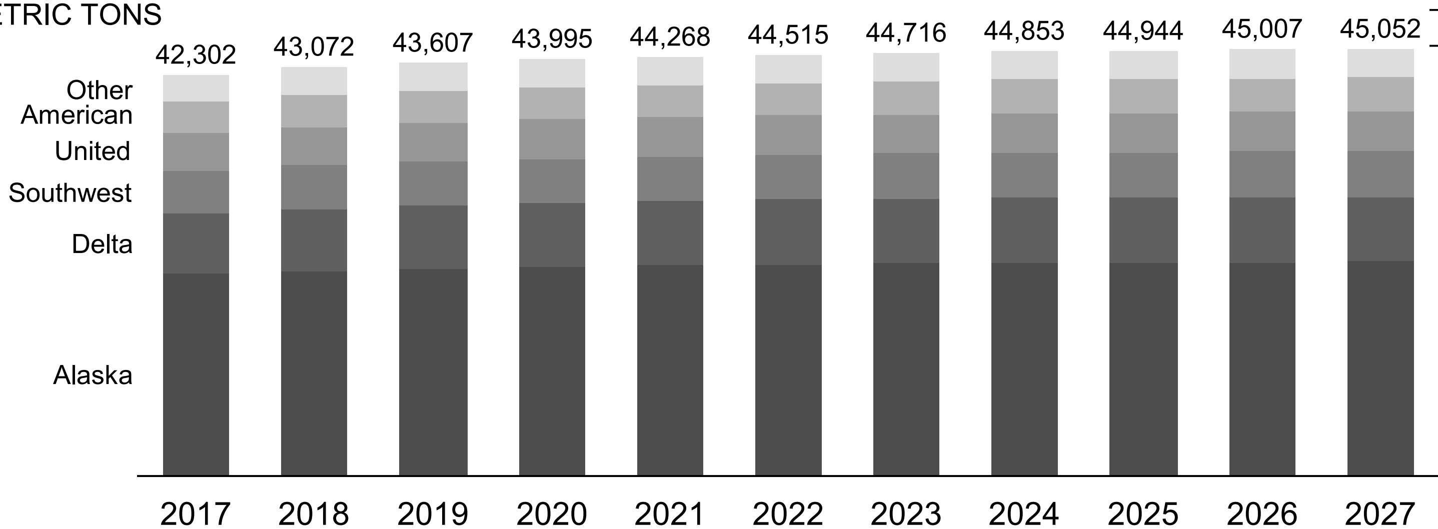
Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Domestic inbound and outbound are relatively small segments in a more mature market, with most growth coming from Alaska Airlines

DOMESTIC INBOUND FORECAST BY AIRLINE: 17-27

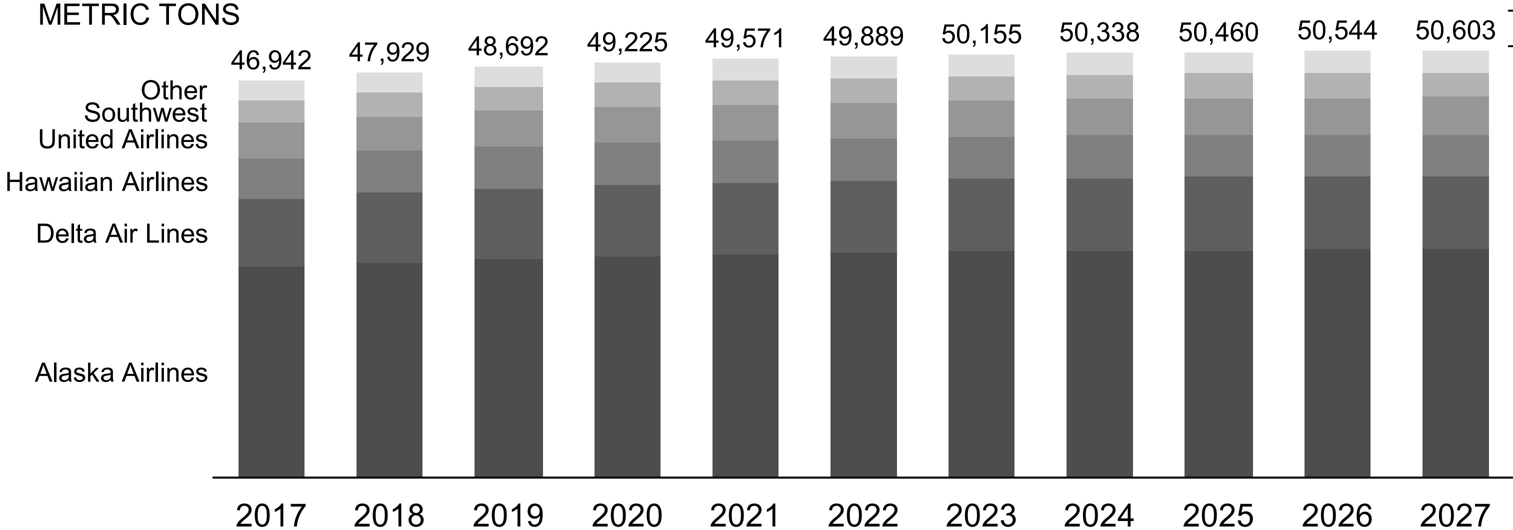
METRIC TONS



	CAGR	Absolute Growth
Total	0.6%	2,750
Other	0.7%	203
American	0.8%	288
United	0.4%	163
Southwest	0.8%	384
Delta	0.7%	485
Alaska	0.6%	1,228

DOMESTIC OUTBOUND FORECAST BY AIRLINE: 17-27

METRIC TONS



	CAGR	Absolute Growth
Total	0.8%	3,661
Other	0.9%	231
Southwest	1.2%	337
United Airlines	0.4%	170
Hawaiian Airlines	0.8%	395
Delta Air Lines	0.5%	439
Alaska Airlines	0.8%	2,089

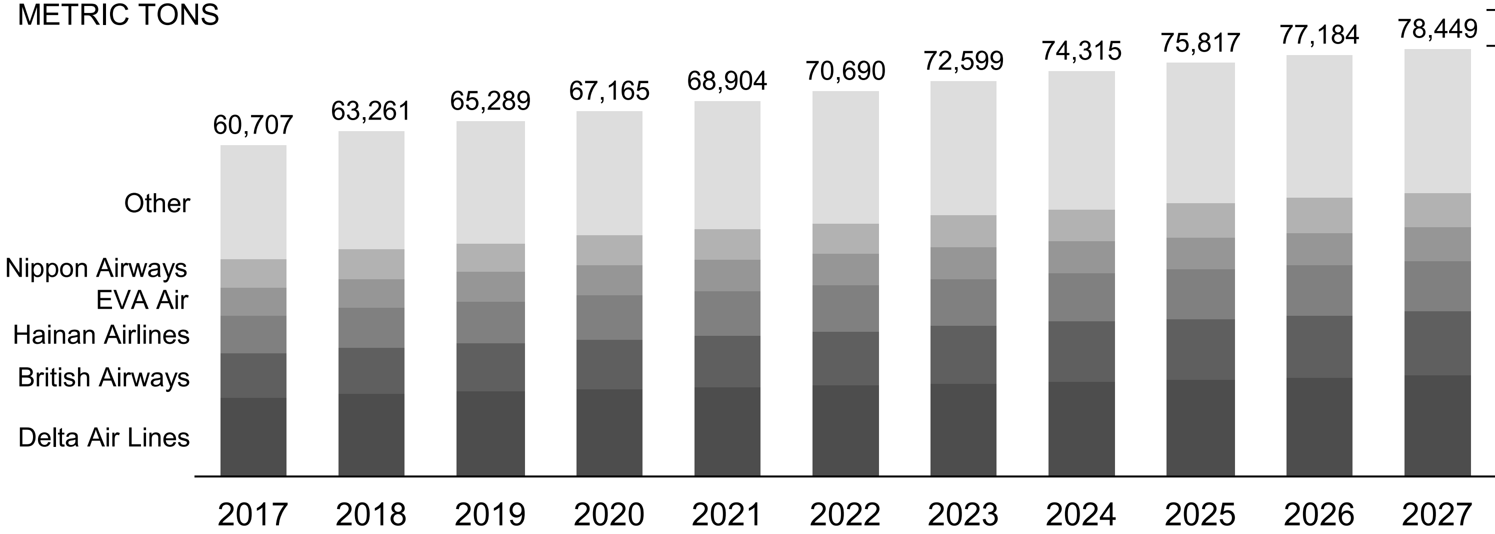
Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

International imports grew significantly and will experience GDP plus growth levels over the next decade

INTERNATIONAL INBOUND FORECAST BY AIRLINE: 17-27

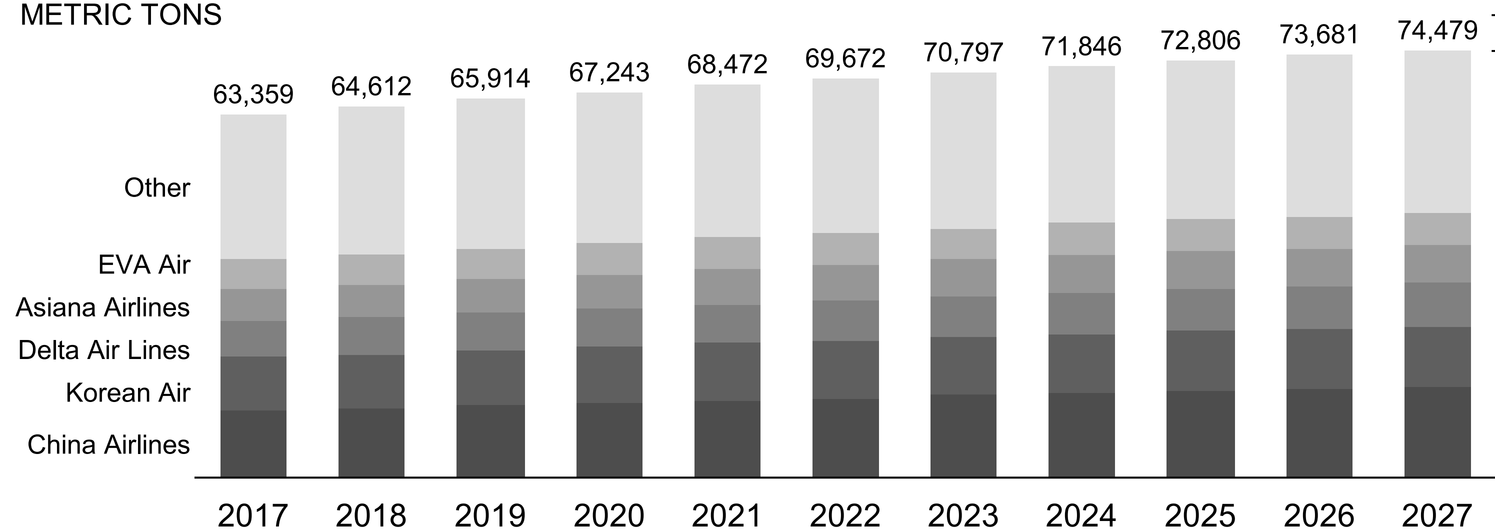
METRIC TONS



	CAGR	Absolute Growth
Total	2.6%	17,741
	2.4%	5,523
	2.4%	1,339
	1.3%	723
	3.0%	2,399
	4.1%	3,951
	2.4%	3,806

INTERNATIONAL OUTBOUND FORECAST BY AIRLINE: 17-27

METRIC TONS



	CAGR	Absolute Growth
Total	1.6%	11,119
	1.1%	2,976
	0.5%	291
	2.0%	1,233
	1.7%	1,186
	1.4%	1,358
	3.1%	4,076

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac's air cargo facilities are concentrated in the North Cargo portion of the airport

SEATTLE-TACOMA INTERNATIONAL AIRPORT CARGO LAND AREA: 2016

Cargo/cargo development site

Sources: LogCapStrat analysis

North Cargo has 18 buildings and 6 parking areas

SEA-TAC NORTH CARGO: 2016

Cargo facilities at-a-glance

Facility	Size	Owner
Alaska Cargo	63,734	ASA
Cargo 4 E (SWA)	9,400	POS
Cargo 4 S	16,000	POS
CAS	32,699	Prologis
Delta Cargo	50,000	DAL
FedEx	73,251	FDX
FedEx/Prologis N2	25,000	Prologis
Hanjin/ Transiplex A1	25,000	Transiplex
Matheson/Transiplex G	25,000	Transiplex
Matheson/USPS/ Prologis N1	25,000	Prologis
Swissport	31,560	POS
Transiplex A3	25,000	Transiplex
WFS/Transiplex E1	10,000	Transiplex

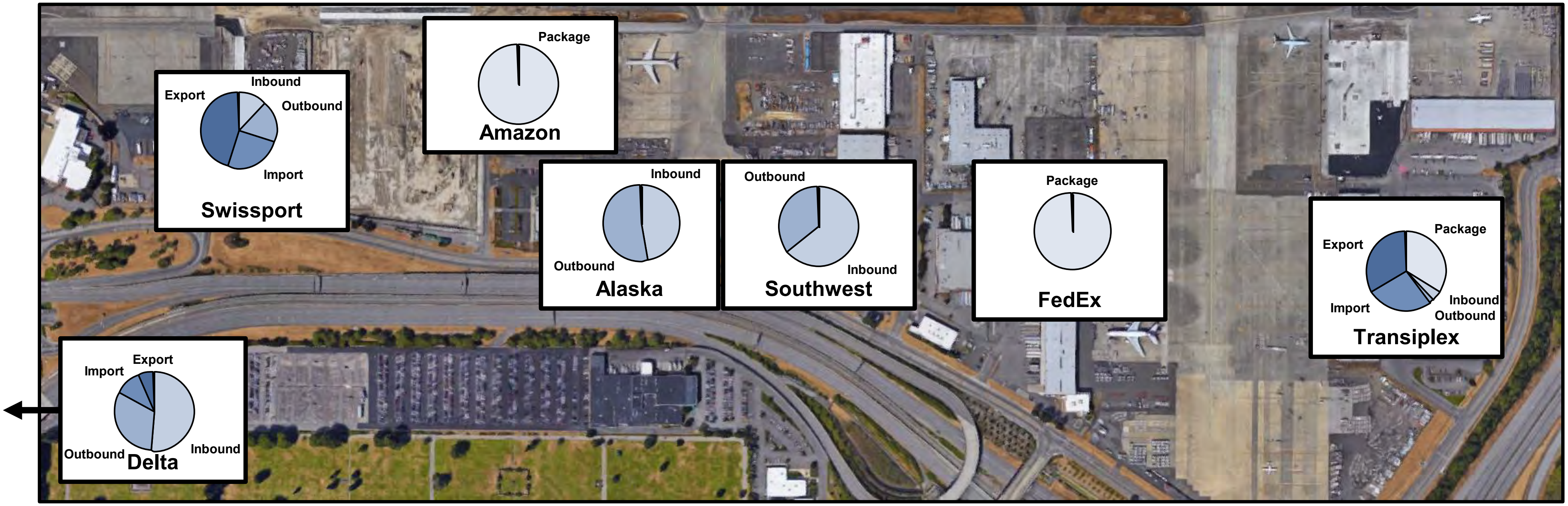
Cargo Facilities
2. Swissport
3. Cargo 4
5. Alaska Air Cargo
6. Southwest
13. Federal Express
14. Transiplex A
15. AMB/AFCC
16.Transiplex E
17. Transiplex F
18. Transiplex G

Other Buildings
1. Fire Department
4. Air Traffic Control
7. Port of Seattle Maintenance
8. AMB Seattle Air
9. BT Properties
10. Pump House
11. United Airlines Maintenance
12. Bolanos

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model, Port of Seattle, LogCapStrat analysis

Facility cargo throughput consists of package, domestic inbound & outbound, and international import & export flows

FREIGHT FLOWS BY PRIMARY TENANT: 2016



PRIMARY TENANT PROFILE

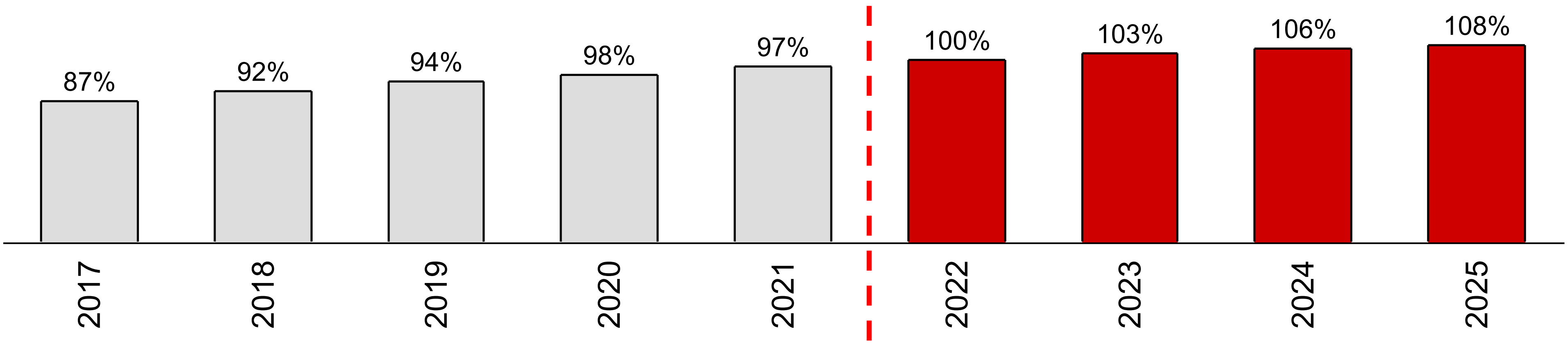
Tenant	Largest Carriers	Flow Type	2016 Metric Tons / Sq. Ft.
Swissport	China Airlines, EVA Air, United	Domestic & International	1.39
Amazon	ATI, ABX, Atlas	Integrated Carrier	1.17
Alaska	Alaska, Horizon, SkyWest	Domestic	0.61
Southwest	Southwest	Domestic	0.60
FedEx	FedEx, Empire	Integrated Carrier	1.05
Transiplex	Korean Air, Lufthansa, American	Domestic, International, & Integrated Carrier	1.10
Delta	Delta	Domestic & International	0.63

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac aggregate facility space is forecast to reach 100% capacity utilization in 2022

SEA-TAC CARGO VOLUME AND CAPACITY UTILIZATION FORECAST: 17-27

AGGREGATE FACILITY CAPACITY UTILIZATION PERCENT



CAPACITY UTILIZATION BY PRIMARY TENANT: 17-27

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	126%	185%	245%	299%	351%	404%	448%	477%	495%
Alaska Airlines	81%	82%	83%	84%	85%	85%	86%	86%	86%
Consolidated Aviation Services	107%	111%	114%	117%	120%	123%	126%	129%	131%
DHL	91%	100%	106%	111%	115%	119%	124%	129%	135%
Delta Airlines	79%	81%	82%	84%	85%	87%	88%	89%	90%
FedEx	98%	102%	95%	97%	99%	101%	102%	104%	106%
Hanjin Shipping	87%	89%	90%	92%	94%	95%	97%	98%	99%
OTH	91%	100%	106%	111%	115%	119%	124%	129%	135%
Southwest Airlines	83%	85%	87%	88%	89%	90%	90%	91%	91%
Swissport	151%	154%	158%	161%	103%	105%	107%	109%	110%
Worldwide Flight Services	81%	83%	84%	86%	87%	87%	88%	89%	89%
Total	87%	92%	94%	98%	97%	100%	103%	106%	108%

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac's inability to accommodate existing & new customer air cargo growth has direct implications on its cargo development and potential collateral damage to its passenger air service development

- **Lack of adequate cargo facilities and infrastructure is putting at risk Sea-Tac's air cargo franchise and international passenger air service expansion**
  - Current cargo facilities operators are not seeking new business, turning away potential new customers, and contemplating pushing existing customers out
  - Inevitably air cargo service standards will suffer
  - Air cargo is critical to profitability of international widebody passenger operations

- **Sea-Tac's air cargo constraints may limit growth of economic development, employment, and Washington exports which could be lost to competing airports in other states**
  - Impacts on hometown companies - Alaska Airlines, Amazon & Boeing
  - Degradation of express and small package services
  - Seasonal air cargo operations for cherry exports
  - Lack of practical airport alternatives to Sea-Tac (BFI & PAE are full)

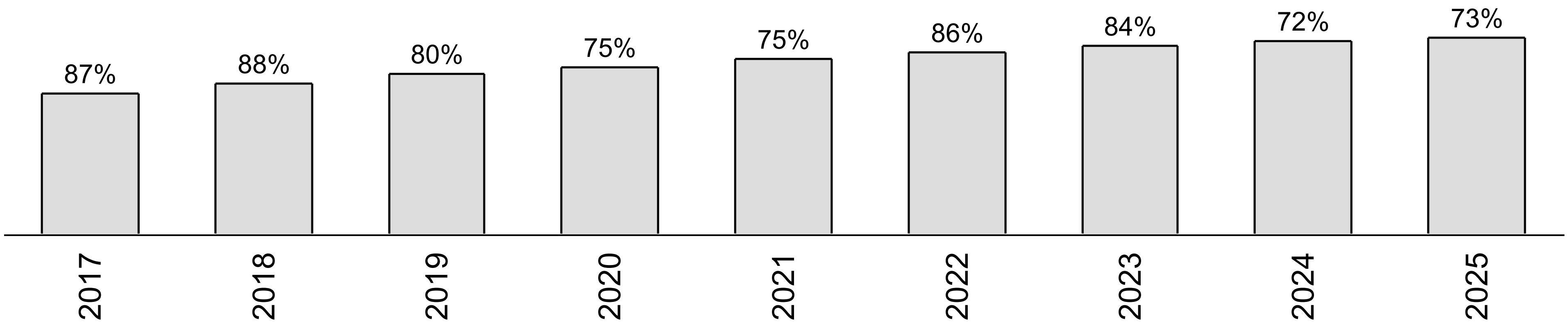
- **Critical need for immediate action to address cargo facilities and freighter hardstand issues**
  - Multiple operators stating need for planning/action due to long lead times
  - Assess options for turnkey solution for facilities and infrastructure investments by third-parties and through public private partnerships

Sources: LogCapStrat analysis

Facility expansion options, including the development of North Cargo Off-Airport, will prepare Sea-Tac to process forecasted throughput

SEA-TAC CARGO VOLUME AND CAPACITY UTILIZATION FORECAST: 17-27

AGGREGATE FACILITY CAPACITY UTILIZATION PERCENT



CAPACITY UTILIZATION BY PRIMARY TENANT: 17-27

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	126%	Off-Airport	43%	53%	62%	72%	80%	85%	88%
Alaska Airlines	81%	82%	83%	84%	85%	85%	86%	86%	86%
Consolidated Aviation Services	107%	111%	114%	117%	120%	123%	126%	129%	131%
DHL	91%	100%	106%	111%	115%	119%	74%	38%	39%
Delta Airlines	79%	81%	82%	84%	85%	87%	88%	89%	90%
FedEx	98%	102%	95%	97%	99%	101%	102%	104%	106%
Hanjin Shipping	87%	89%	90%	92%	94%	95%	74%	38%	39%
OTH	26%	56%	59%	40%	41%	61%	62%	49%	49%
Southwest Airlines	83%	85%	87%	88%	89%	90%	90%	91%	91%
Swissport	151%	154%	158%	161%	103%	61%	62%	49%	49%
Worldwide Flight Services	81%	83%	84%	86%	87%	61%	62%	49%	49%
Total	87%	88%	80%	75%	75%	86%	84%	72%	73%

Notes: Forecast volume is unconstrained

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Timeline for air cargo facility optimization will rearrange and renovate the landscape of North Cargo

SEA-TAC DEVELOPMENT TIMELINE: 2017

CARGO FACILITY OPTIMIZATION RECOMMENDATIONS

- Eliminate non air cargo handling activities in facilities on and near the tarmac
- Accommodate Amazon with temporary-warehousing space until passenger terminal expansion plans are finalized
- Use additional temporary-warehousing as needed to accommodate tenants during construction or as a short term solution
- Develop the L-Shaped parcel into facilities for tenants with low airport proximity need
- Accelerate renovation of Transiplex so the capacity is available in the near future

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

2018: Diminished parking capacity while FedEx and Amazon relocate in anticipation of additional facility capacity

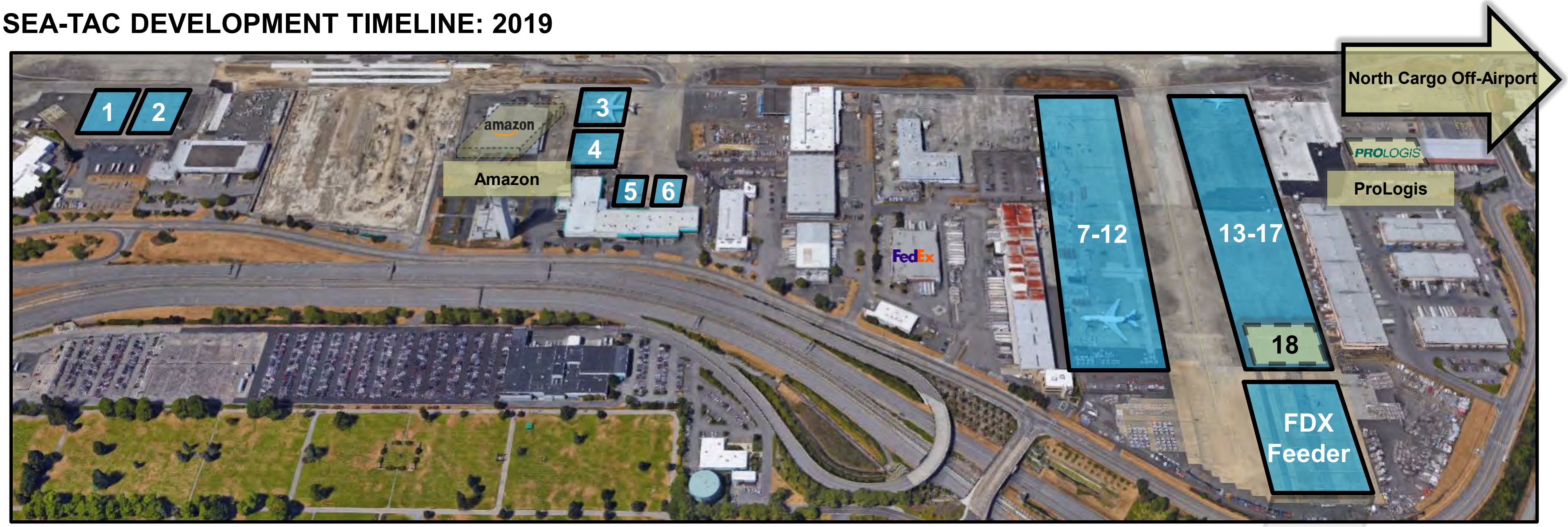
SEA-TAC DEVELOPMENT TIMELINE: 2018

- The current Amazon facility, located adjacent to the Cargo 4 hardstand, is demolished. Amazon trucks from three to four aircraft parking spaces ("3", "4", "13", "17") to an off-airport facility. Construction begins on a semi-permanent warehouse facility for Amazon in the location of the current Cargo 4 building. Alternatively, Sea-Tac acquires a privately owned cargo building for Amazon during Cargo 4 site redevelopment.
- Hardstand parking spots "1" & "2" are out of service from April to May for taxiway construction
- Hardstand spot "18" is out of service from June to March 2019 for IAF bridge construction
- FedEx vacates the ProLogis space at Cargo 1 and moves into the 31,500 sq. ft. Bolanos building by the end of the year
- Sea-Tac selects a development partner, if necessary, for North Cargo Off-Airport facility development
- The SAMP undergoes environmental review
- A "through-the-fence" freight portal consultant study is conducted on freight portal size, number, location, operation details, and the potential fee structure

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

2019: Amazon in a new facility and a new tenant in ProLogis Cargo 1

SEA-TAC DEVELOPMENT TIMELINE: 2019



- Amazon relocates into a 90,000 sq. ft. temporary warehouse at the site of it's former facility. The length of stay depends on passenger terminal expansion
- Hardstand spot "18" is again available when IAF bridge construction ends in March
- ProLogis is assumed to have re-leased the 25,000 sq. ft. of FedEx-vacated space at Cargo 1 if it is not acquired by the airport
- North Cargo Off-Airport Phase 1 construction begins at the L-Shape site and will add 55,800 sq. ft. for cargo throughput in 2020
- The Sustainable Airport Master Plan is completed by 12/19

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

2020: North Cargo Off-Airport capacity becomes available and the Capital Project Lease Termination Clause ("CPLT") is invoked

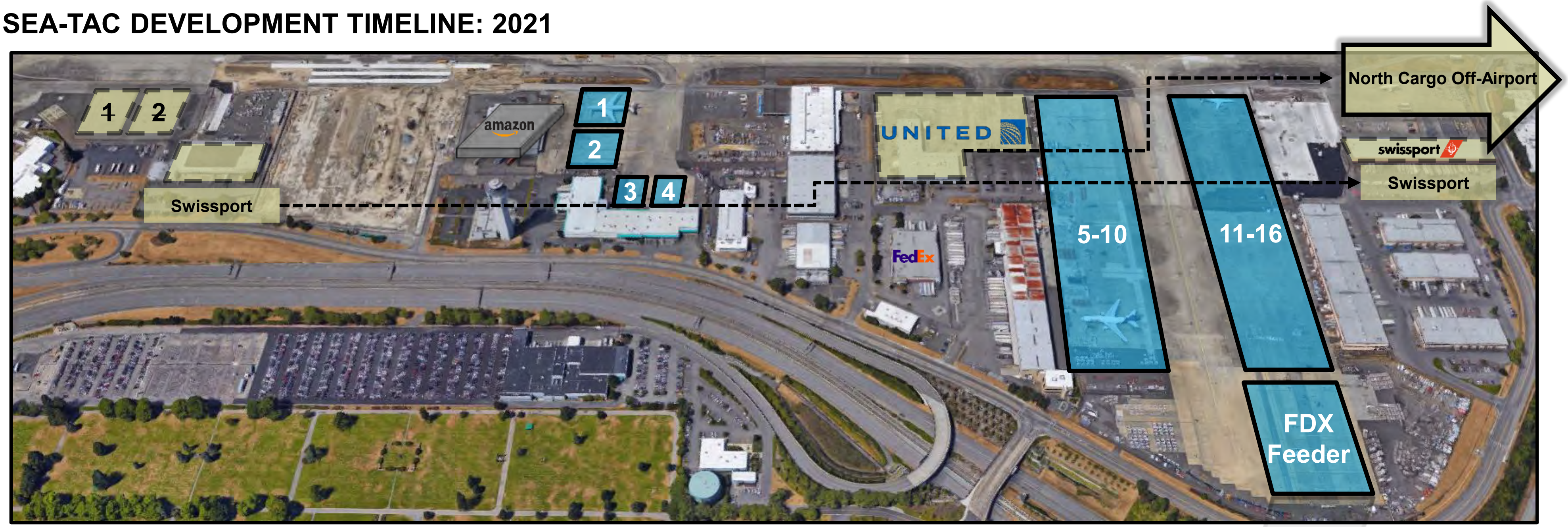
SEA-TAC DEVELOPMENT TIMELINE: 2020

- North Cargo Off-Airport Phase 1 construction is completed. An additional 55,800 sq. ft. of facility space is available to process cargo throughput for tenants capable of operating off-airport via Freight Portal. Additional space is reserved to accommodate rearranged non-cargo tenants such as Sky Chefs or USPS
- If not already acquired by the port, Sea-Tac invokes the 12-month Capital Project Lease Termination Clause ("CPLT") or enters buyout negotiations at ProLogis Cargo 1 to obtain control by 2021 in anticipation of Swissport tenant relocation
- Transiplex is given the 18-month (CPLT) notice-to-vacate in anticipation of redeveloping facilities in the current location of Transiplex A, E, F, G, and ProLogis Cargo 1
- United Airlines is given the 12-month (CPLT) notice-to-vacate in anticipation of North Cargo Hardstand Construction Phase 1 in the location of the current UAL Maintenance building

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

2021: Swissport relocates and preparation for North Cargo hardstand construction begins as two freighter parking spots are demolished

SEA-TAC DEVELOPMENT TIMELINE: 2021



- Swissport operations are relocated to the former ProLogis building at Cargo 1. USPS and any other ProLogis tenants vacate the building and are able to relocate to North Cargo–Off Airport if acceptable. Swissport gains access to 50,000 sq. ft. in the Cargo 1 facility
- The United Airlines Maintenance building is demolished and Phase 1 of the North Hardstand construction project begins
- The former Swissport facility (31,500 sq. ft.) is demolished. The two Group VI parking spots ("1" & "2") are eliminated and the area is redeveloped for passenger use
- North Cargo-Off Airport Phase 2 construction begins in the L-Shape site and will add another 55,800 sq. ft. for cargo throughput in 2022

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

2022: Two freighter spots are completed as Port of Seattle ("PoS") Maintenance construction and Transiplex renovation begin

SEA-TAC DEVELOPMENT TIMELINE: 2022

- Phase 1 North Hardstand construction is complete. Two additional hardstand spots are available in the area of the former United Airlines Maintenance building
- Non-airfield dependent tenants in Transiplex A, E, F, G, & ProLogis Cargo 1 relocate to North Cargo Off-Airport. DHL, Hanjin Shipping, Swissport and other airfield-dependent tenants are consolidated as Transiplex Renovation Phase 1 construction begins
- The new Port of Seattle Maintenance building construction begins (off-map location) in anticipation of North Hardstand Phase 2
- North Cargo Off-Airport Phase 2 construction is completed. An additional 55,800 sq. ft. of facility space is available to process cargo throughput for tenants capable of operating off-airport or accommodate rearranged non-cargo tenants

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

2023: The first phase of Transiplex renovation is complete as an alternate PoS maintenance facility is under construction

SEA-TAC DEVELOPMENT TIMELINE: 2023

- Transiplex Renovation Phase 1 construction is completed. An additional 75,000 sq. ft. of facility space is available to process cargo throughput for tenants requiring on-airport facility space and accommodate tenants during Phase 2 redevelopment
- Transiplex Renovation Phase 2 construction begins
- The new Port of Seattle Maintenance building construction continues
- North Cargo Off-Airport Phase 3 construction begins in the L-Shape site and will add 33,000 sq. ft. for cargo throughput in 2024

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

2024: Transiplex-area renovation is complete and construction on North Hardstand Phase 2 is underway

SEA-TAC DEVELOPMENT TIMELINE: 2024

- Transiplex Renovation Phase 2 construction is completed. An additional 75,000 sq. ft. of facility space is available to process cargo throughput for tenants requiring on-airport space
- The new Port of Seattle Maintenance building is completed and staff relocated. The old maintenance building is demolished
- North Hardstand Phase 2 construction begins in the area of the former Port of Seattle maintenance building
- North Cargo-Off Airport Phase 3 construction is completed. An additional 33,000 sq. ft. of facility space is available to process cargo throughput for tenants capable of operating off-airport or accommodate rearranged non-cargo tenants

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

2025: Three additional freighter parking sports are added when North Hardstand Phase 2 construction is complete

SEA-TAC DEVELOPMENT TIMELINE: 2025

- North Hardstand Phase 2 construction ends and the former Port of Seattle Maintenance building has been completely replaced with 3 addition freighter parking spots

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Table of Contents

TABLE

Total Market Volume

THROUGHPUT BY MARKET SEGMENT: 17-27

KILOGRAMS

Airport	Flow	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	CAGR 17-22	CAGR 22-27	CAGR 17-27
SEA	Domestic Freight	89,244,119	91,000,742	92,299,454	93,220,203	93,838,708	94,404,110	94,871,082	95,190,703	95,404,019	95,551,122	95,654,585	1.1%	0.3%	0.7%
SEA	International Freight	124,066,478	127,872,492	131,202,821	134,408,318	137,376,226	140,361,575	143,395,949	146,161,075	148,622,366	150,865,508	152,927,152	2.5%	1.7%	2.1%
BFI	Domestic Freight	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BFI	International Freight	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEA	FDX Package	143,983,778	150,441,224	155,144,130	158,449,999	161,046,552	163,380,202	166,137,574	168,856,249	171,472,657	174,083,066	176,738,237	2.6%	1.6%	2.1%
SEA	UPS Package	-	-	-	-	-	-	-	-	-	-	-			
SEA	DHL Package	39,690,762	43,585,704	46,568,777	48,742,547	50,493,989	52,099,911	54,219,563	56,569,340	59,119,741	61,997,616	65,320,832	5.6%	4.6%	5.1%
SEA	AMZ Package	30,188,948	44,283,952	58,722,461	71,811,246	84,179,599	97,062,749	107,626,219	114,557,133	118,815,568	121,462,203	123,114,423	26.3%	4.9%	15.1%
BFI	FDX Package	-	-	-	-	-	-	-	-	-	-	-			
BFI	UPS Package	99,138,403	103,728,177	107,060,414	109,437,508	111,328,298	113,038,524	115,055,650	117,046,621	118,964,426	120,883,982	122,841,326	2.7%	1.7%	2.2%
BFI	DHL Package	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BFI	AMZ Package	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEA	Total	427,174,085	457,184,114	483,937,643	506,632,312	526,935,075	547,308,547	566,250,386	581,334,499	593,434,350	603,959,516	613,755,228	5.1%	2.3%	3.7%
BFI	Total	99,138,403	103,728,177	107,060,414	109,437,508	111,328,298	113,038,524	115,055,650	117,046,621	118,964,426	120,883,982	122,841,326	2.7%	1.7%	2.2%
Seattle Market	**Total**	**526,312,489**	**560,912,291**	**590,998,056**	**616,069,821**	**638,263,373**	**660,347,071**	**681,306,037**	**698,381,121**	**712,398,776**	**724,843,498**	**736,596,554**	**4.6%**	**2.2%**	**3.4%**

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac Volume

THROUGHPUT BY FLOW TYPE: 17-27

KILOGRAMS

Flow Type	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Domestic Outbound	46,941,870	47,928,845	48,692,107	49,225,346	49,570,604	49,888,970	50,155,119	50,337,759	50,460,004	50,543,857	50,602,665
Domestic Inbound	42,302,249	43,071,897	43,607,347	43,994,857	44,268,104	44,515,140	44,715,964	44,852,943	44,944,016	45,007,265	45,051,920
Domestic Total	89,244,119	91,000,742	92,299,454	93,220,203	93,838,708	94,404,110	94,871,082	95,190,703	95,404,019	95,551,122	95,654,585
International Outbound	63,359,329	64,611,686	65,913,896	67,243,463	68,472,324	69,671,940	70,797,127	71,845,697	72,805,840	73,681,365	74,478,531
International Inbound	60,707,149	63,260,806	65,288,925	67,164,855	68,903,902	70,689,635	72,598,822	74,315,378	75,816,526	77,184,143	78,448,621
International Total	124,066,478	127,872,492	131,202,821	134,408,318	137,376,226	140,361,575	143,395,949	146,161,075	148,622,366	150,865,508	152,927,152
Integrator Outbound	102,377,652	113,528,728	123,660,097	131,572,309	138,199,912	144,559,306	150,415,264	154,975,199	158,597,882	161,732,434	164,682,928
Integrator Inbound	111,485,836	124,782,153	136,775,271	147,431,483	157,520,228	167,983,556	177,568,091	185,007,522	190,810,083	195,810,452	200,490,564
Integrator Total	213,863,488	238,310,880	260,435,368	279,003,792	295,720,140	312,542,862	327,983,355	339,982,722	349,407,965	357,542,886	365,173,492
Total Outbound	212,678,850	226,069,259	238,266,099	248,041,118	256,242,840	264,120,216	271,367,510	277,158,656	281,863,725	285,957,656	289,764,123
Total Inbound	214,495,235	231,114,855	245,671,544	258,591,194	270,692,234	283,188,331	294,882,877	304,175,844	311,570,625	318,001,860	323,991,105
Total	427,174,085	457,184,114	483,937,643	506,632,312	526,935,075	547,308,547	566,250,386	581,334,499	593,434,350	603,959,516	613,755,228

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac YoY Growth Rates

THROUGHPUT PERCENT CHANGE BY FLOW TYPE: 17-27

YEAR-OVER-YEAR PERCENT CHANGE

Flow Type	2017	2018	2019	2020	2021	2022	2023	2025	2026	2027
Domestic Outbound	19.1%	2.1%	1.6%	1.1%	0.7%	0.6%	0.5%	0.2%	0.2%	0.1%
Domestic Inbound	16.6%	1.8%	1.2%	0.9%	0.6%	0.6%	0.5%	0.2%	0.1%	0.1%
Domestic Total	17.9%	2.0%	1.4%	1.0%	0.7%	0.6%	0.5%	0.2%	0.2%	0.1%
International Outbound	1.0%	2.0%	2.0%	2.0%	1.8%	1.8%	1.6%	1.3%	1.2%	1.1%
International Inbound	19.0%	4.2%	3.2%	2.9%	2.6%	2.6%	2.7%	2.0%	1.8%	1.6%
International Total	9.1%	3.1%	2.6%	2.4%	2.2%	2.2%	2.2%	1.7%	1.5%	1.4%
Integrator Outbound	31.7%	10.9%	8.9%	6.4%	5.0%	4.6%	4.1%	2.3%	2.0%	1.8%
Integrator Inbound	30.5%	11.9%	9.6%	7.8%	6.8%	6.6%	5.7%	3.1%	2.6%	2.4%
Integrator Total	31.0%	11.4%	9.3%	7.1%	6.0%	5.7%	4.9%	2.8%	2.3%	2.1%
Total Outbound	18.2%	6.3%	5.4%	4.1%	3.3%	3.1%	2.7%	1.7%	1.5%	1.3%
Total Inbound	24.2%	7.7%	6.3%	5.3%	4.7%	4.6%	4.1%	2.4%	2.1%	1.9%
Total	21.1%	7.0%	5.9%	4.7%	4.0%	3.9%	3.5%	2.1%	1.8%	1.6%

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Sea-Tac CAGR

THROUGHPUT COMPOUND ANNUAL GROWTH RATE: 17-27

CAGR % GROWTH

Flow Type	17-22	22-27	17-27
Domestic Outbound	1.2%	0.3%	0.8%
Domestic Inbound	1.0%	0.2%	0.6%
Domestic Total	1.1%	0.3%	0.7%
International Outbound	1.9%	1.3%	1.6%
International Inbound	3.1%	2.1%	2.6%
International Total	2.5%	1.7%	2.1%
Integrator Outbound	7.1%	2.6%	4.9%
Integrator Inbound	8.5%	3.6%	6.0%
Integrator Total	7.9%	3.2%	5.5%
Total Outbound	4.4%	1.9%	3.1%
Total Inbound	5.7%	2.7%	4.2%
Total	5.1%	2.3%	3.7%

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Throughput by Tenant

CARGO THROUGHPUT BY PRIMARY TENANT: 17-27

METRIC TONS

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	30,189	44,284	58,722	71,811	84,180	97,063	107,626	114,557	118,816
Alaska Airlines	46,246	47,154	47,829	48,306	48,625	48,917	49,158	49,323	49,433
Consolidated Aviation Services	43,874	45,404	46,698	47,934	49,081	50,255	51,471	52,575	53,555
DHL	39,691	43,586	46,569	48,743	50,494	52,100	54,220	56,569	59,120
Delta Airlines	35,339	36,285	37,059	37,751	38,356	38,941	39,525	40,045	40,493
FedEx	143,984	150,441	155,144	158,450	161,047	163,380	166,138	168,856	171,473
Hanjin Shipping	19,544	19,975	20,362	20,734	21,077	21,425	21,768	22,078	22,355
OTH	6,487	6,636	6,784	6,933	7,066	7,183	7,291	7,395	7,489
Southwest Airlines	7,022	7,218	7,362	7,465	7,536	7,600	7,653	7,689	7,714
Swissport	47,519	48,736	49,805	50,795	51,684	52,579	53,467	54,256	54,955
Worldwide Flight Services	7,280	7,466	7,603	7,709	7,789	7,865	7,935	7,990	8,032
Total	**427,174**	**457,184**	**483,938**	**506,632**	**526,935**	**547,309**	**566,250**	**581,334**	**593,434**

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Space Required by Tenant

SPACE REQUIRED BY PRIMARY TENANT: 17-27

SQUARE FEET

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	20,126	29,523	39,148	47,874	56,120	64,708	71,751	76,371	79,210
Alaska Airlines	51,384	52,394	53,144	53,674	54,028	54,352	54,620	54,803	54,926
Consolidated Aviation Services	35,099	36,323	37,358	38,347	39,264	40,204	41,177	42,060	42,844
DHL	22,680	24,906	26,611	27,853	28,854	29,771	30,983	32,325	33,783
Delta Airlines	39,266	40,317	41,177	41,946	42,618	43,267	43,916	44,494	44,993
FedEx	95,989	100,294	103,429	105,633	107,364	108,920	110,758	112,571	114,315
Hanjin Shipping	21,715	22,194	22,624	23,038	23,419	23,806	24,187	24,532	24,839
OTH	6,487	6,636	6,784	6,933	7,066	7,183	7,291	7,395	7,489
Southwest Airlines	7,802	8,020	8,180	8,295	8,373	8,444	8,503	8,544	8,571
Swissport	47,519	48,736	49,805	50,795	51,684	52,579	53,467	54,256	54,955
Worldwide Flight Services	8,089	8,295	8,448	8,566	8,655	8,739	8,817	8,878	8,924
Total	**356,157**	**377,637**	**396,708**	**412,954**	**427,446**	**441,976**	**455,469**	**466,229**	**474,849**

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Facility square footage – development timeline

SQUARE FOOTAGE BY FACILITY AND PRIMARY TENANT – DEVELOPMENT TIMELINE: 17-25

OCCUPIED CARGO FACILITY SQUARE FOOTAGE

Facility	Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Alaska Cargo	Alaska Airlines	63,734	63,734	63,734	63,734	63,734	63,734	63,734	63,734	63,734
Cargo 4 S	Amazon	16,000	-	-	-	-	-	-	-	-
Temporary Warehouse	Amazon	-	Off-Airport	90,000	90,000	90,000	90,000	90,000	90,000	90,000
CAS	Consolidated Aviation Services	32,699	32,699	32,699	32,699	32,699	32,699	32,699	32,699	32,699
Delta Cargo	Delta Airlines	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Bolanos	Bolanos	-	-	-	-	-	-	-	-	-
Bolanos	FedEx	-	-	35,100	35,100	35,100	35,100	35,100	35,100	35,100
FedEx	FedEx	73,251	73,251	73,251	73,251	73,251	73,251	73,251	73,251	73,251
FedEx/Prologis N2 - "Cargo 1"	FedEx	25,000	25,000	-	-	-	-	-	-	-
FedEx/Prologis N2 - "Cargo 1"	ProLogis Tenant	-	-	-	-	-	-	-	-	-
FedEx/Prologis N2 - "Cargo 1"	Swissport	-	-	-	-	25,000	-	-	-	-
USPS - AFCC	USPS	-	-	-	-	-	-	-	-	-
USPS - AFCC	Swissport	-	-	-	-	25,000	-	-	-	-
Swissport	Swissport	31,560	31,560	31,560	31,560	-	-	-	-	-
Cargo 4 E (SWA)	Southwest Airlines	9,400	9,400	9,400	9,400	9,400	9,400	9,400	9,400	9,400
WFS/Transiplex E1	WFS	10,000	10,000	10,000	10,000	10,000	-	-	-	-
Hanjin/ Transiplex A1	Hanjin Shipping	25,000	25,000	25,000	25,000	25,000	25,000	-	-	-
Transiplex A3	DHL	25,000	25,000	25,000	25,000	25,000	25,000	-	-	-
Matheson/USPS/ Prologis N1	Other	25,000	25,000	25,000	25,000	25,000	-	-	-	-
Matheson/Transiplex G	Other	25,000	25,000	25,000	25,000	25,000	-	-	-	-
Transiplex 2 - Phase 1	DHL & Hanjin Shipping	-	-	-	-	-	-	75,000	75,000	75,000
Transiplex 2 - Phase 2	DHL & Hanjin Shipping	-	-	-	-	-	-	-	75,000	75,000
North Cargo-Off Airport: Phase 1	WFS, Swissport, & Others	-	-	-	55,800	55,800	55,800	55,800	55,800	55,800
North Cargo-Off Airport: Phase 2	WFS, Swissport, & Others	-	-	-	-	-	55,800	55,800	55,800	55,800
North Cargo-Off Airport: Phase 3	WFS, Swissport, & Others								33,000	33,000
Total		**411,644**	**395,644**	**495,744**	**551,544**	**569,984**	**515,784**	**540,784**	**648,784**	**648,784**

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Facility square footage – no expansion

SQUARE FOOTAGE BY FACILITY AND PRIMARY TENANT – NO EXPANSION: 17-25

OCCUPIED CARGO FACILITY SQUARE FOOTAGE

Facility	Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Alaska Cargo	Alaska Airlines	63,734	63,734	63,734	63,734	63,734	63,734	63,734	63,734	63,734
Cargo 4 S	Amazon	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000	16,000
Temporary Warehouse	Amazon	-	-	-	-	-	-	-	-	-
CAS	Consolidated Aviation Services	32,699	32,699	32,699	32,699	32,699	32,699	32,699	32,699	32,699
Delta Cargo	Delta Airlines	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Bolanos	Bolanos	-	-	-	-	-	-	-	-	-
Bolanos	FedEx	-	-	35,100	35,100	35,100	35,100	35,100	35,100	35,100
FedEx	FedEx	73,251	73,251	73,251	73,251	73,251	73,251	73,251	73,251	73,251
FedEx/Prologis N2 - "Cargo 1"	FedEx	25,000	25,000	-	-	-	-	-	-	-
FedEx/Prologis N2 - "Cargo 1"	ProLogis Tenant	-	-	-	-	-	-	-	-	-
FedEx/Prologis N2 - "Cargo 1"	Swissport	-	-	-	-	25,000	25,000	25,000	25,000	25,000
USPS - AFCC	USPS	-	-	-	-	-	-	-	-	-
USPS - AFCC	Swissport	-	-	-	-	25,000	25,000	25,000	25,000	25,000
Swissport	Swissport	31,560	31,560	31,560	31,560	-	-	-	-	-
Cargo 4 E (SWA)	Southwest Airlines	9,400	9,400	9,400	9,400	9,400	9,400	9,400	9,400	9,400
WFS/Transiplex E1	WFS	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Hanjin/ Transiplex A1	Hanjin Shipping	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Transiplex A3	DHL	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Matheson/USPS/ Prologis N1	Other	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Matheson/Transiplex G	Other	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Transiplex 2 - Phase 1	DHL & Hanjin Shipping	-	-	-	-	-	-	-	-	-
Transiplex 2 - Phase 2	DHL & Hanjin Shipping	-	-	-	-	-	-	-	-	-
North Cargo-Off Airport: Phase 1	WFS, Swissport, & Others	-	-	-	-	-	-	-	-	-
North Cargo-Off Airport: Phase 2	WFS, Swissport, & Others	-	-	-	-	-	-	-	-	-
North Cargo-Off Airport: Phase 3	WFS, Swissport, & Others	-	-	-	-	-	-	-	-	-
Total		**411,644**	**411,644**	**421,744**	**421,744**	**440,184**	**440,184**	**440,184**	**440,184**	**440,184**

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Capacity utilization – development timeline

SPACE UTILIZATION BY PRIMARY TENANT – DEVELOPMENT TIMELINE: 17-25

UTILIZATION PERCENT

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	126%	Off-Airport	43%	53%	62%	72%	80%	85%	88%
Alaska Airlines	81%	82%	83%	84%	85%	85%	86%	86%	86%
Consolidated Aviation Services	107%	111%	114%	117%	120%	123%	126%	129%	131%
DHL	91%	100%	106%	111%	115%	119%	74%	38%	39%
Delta Airlines	79%	81%	82%	84%	85%	87%	88%	89%	90%
FedEx	98%	102%	95%	97%	99%	101%	102%	104%	106%
Hanjin Shipping	87%	89%	90%	92%	94%	95%	74%	38%	39%
OTH	26%	56%	59%	40%	41%	61%	62%	49%	49%
Southwest Airlines	83%	85%	87%	88%	89%	90%	90%	91%	91%
Swissport	151%	154%	158%	161%	103%	61%	62%	49%	49%
Worldwide Flight Services	81%	83%	84%	86%	87%	61%	62%	49%	49%
Total	87%	88%	80%	75%	75%	86%	84%	72%	73%

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Capacity utilization – no expansion

SPACE UTILIZATION BY PRIMARY TENANT – NO EXPANSION: 17-25

UTILIZATION PERCENT

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	126%	185%	245%	299%	351%	404%	448%	477%	495%
Alaska Airlines	81%	82%	83%	84%	85%	85%	86%	86%	86%
Consolidated Aviation Services	107%	111%	114%	117%	120%	123%	126%	129%	131%
DHL	91%	100%	106%	111%	115%	119%	124%	129%	135%
Delta Airlines	79%	81%	82%	84%	85%	87%	88%	89%	90%
FedEx	98%	102%	95%	97%	99%	101%	102%	104%	106%
Hanjin Shipping	87%	89%	90%	92%	94%	95%	97%	98%	99%
OTH	91%	100%	106%	111%	115%	119%	124%	129%	135%
Southwest Airlines	83%	85%	87%	88%	89%	90%	90%	91%	91%
Swissport	151%	154%	158%	161%	103%	105%	107%	109%	110%
Worldwide Flight Services	81%	83%	84%	86%	87%	87%	88%	89%	89%
Total	87%	92%	94%	98%	97%	100%	103%	106%	108%

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Cargo spillover – development timeline

CARGO SPILLOVER BY PRIMARY TENANT – DEVELOPMENT TIMELINE: 17-25

METRIC TONS

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	7,785		0	0	0	0	0	0	0
Alaska Airlines	0	0	0	0	0	0	0	0	0
Consolidated Aviation Services	3,220	5,032	6,654	8,280	9,855	11,535	13,345	15,052	16,615
DHL	0	0	3,000	5,562	7,784	9,944	0	0	0
Delta Airlines	0	0	0	0	0	0	0	0	0
FedEx	0	3,128	0	0	0	858	3,691	6,576	9,439
Hanjin Shipping	0	0	0	0	0	0	0	0	0
OTH	0	0	0	0	0	0	0	0	0
Southwest Airlines	0	0	0	0	0	0	0	0	0
Swissport	24,028	26,524	28,792	30,957	1,741	0	0	0	0
Worldwide Flight Services	0	0	0	0	0	0	0	0	0
Total	**35**	**35**	**38**	**45**	**19**	**22**	**17**	**22**	**26**

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

Cargo spillover – no expansion

CARGO SPILLOVER BY PRIMARY TENANT – NO EXPANSION: 17-25

METRIC TONS

Primary Tenant	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amazon	7,785	37,427	84,958	143,058	211,079	295,486	375,016	432,249	469,399
Alaska Airlines	0	0	0	0	0	0	0	0	0
Consolidated Aviation Services	3,220	5,032	6,654	8,280	9,855	11,535	13,345	15,052	16,615
DHL	0	0	3,000	5,562	7,784	9,944	12,975	16,576	20,769
Delta Airlines	0	0	0	0	0	0	0	0	0
FedEx	0	3,128	0	0	0	858	3,691	6,576	9,439
Hanjin Shipping	0	0	0	0	0	0	0	0	0
OTH	0	0	437	791	1,089	1,371	1,745	2,167	2,631
Southwest Airlines	0	0	0	0	0	0	0	0	0
Swissport	24,028	26,524	28,792	30,957	1,741	2,712	3,707	4,618	5,446
Worldwide Flight Services	0	0	0	0	0	0	0	0	0
Total	**35**	**72**	**124**	**189**	**232**	**322**	**410**	**477**	**524**

Sources: LogCapStrat Sea-Tac Integrated Facilities Forecast Model

APPENDIX B

Purpose & Need and Alternatives Supporting Information

References

IATA & Airports Council International (ACI) Improved Level of Service Concept
TFDM Schedule
Port of Seattle, Landside Level of Service Analysis, Arrival and Departure Curbside and Roadway LOS
2022 Annual Disclosures

Is Your Airport Terminal Operating At An Optimum Level?

IATA Consulting

IATA's Level of Service (LoS) Concept is the industry benchmark for optimum passenger terminal facilities.

DEPARTURE

As featured in the IATA ADRM.
iata.org/adrm

CHECK-IN

Proper arrangement of self-service options such as self-tagging and bag drop stations are cutting down wait times, improving passengers' travel experience and resulting in increased efficiency in terms of space utilization and operations.

SECURITY

The introduction of risk-based security concepts, advanced screening technologies and process innovations will enable passengers to proceed with minimal inconvenience while optimizing security resources and airport facilities.

PASSPORT CONTROL

Improved border control solutions in the areas of passenger data / document verification and other regulatory requirements makes emigration hassle-free and comfortable for passengers and for border officers.

BOARDING GATES

Having adequate space while passengers wait for boarding is also a vital component of the passenger travel experience.

50 - 70% to be seated

Seating space 1.8 m² - 2.2 m²
Standing space 1.2 m² - 1.5 m²

ECONOMY CLASS	Check-in: Self-Service – Boarding Pass and Tagging	Check-in: Self-Service – Bag Drop Desk/Station	Check-in: Check-in Desk	Security	Passport Control: Automatic Border Control	Passport Control: Staffed Emigration Desk
OPTIMUM Queuing Times	1 - 2 min	1 - 5 min	10 - 20 min	5 - 10 min	1 - 5 min	5 - 10 min
OPTIMUM Space per passenger	1.3 - 1.8 m²			1.0 - 1.2 m²	1.0 - 1.2 m²	

More optimum departures mean more future arrivals!

ARRIVAL

PASSPORT CONTROL

The right mix of self-service technologies with border officers provides a seamless and pleasant welcome for passengers at your airport.

BAGGAGE CLAIM

No matter the size of your terminal, passengers expect to claim their baggage in a timely manner. After all, it's often the last touch-point you have with passengers. Why not end it on a high note?

CUSTOMS CONTROL

These waiting times refer to a procedure when 100% of the passengers are being checked by Customs.

ECONOMY CLASS	Passport Control: Automatic Border Control	Passport Control: Staffed Immigration Desk	Baggage Claim: Narrow Body (First passenger to first bag / Last bag on belt (from first delivery))	Baggage Claim: Wide Body (First passenger to first bag / Last bag on belt (from first delivery))	Customs Control
OPTIMUM Queuing Times	1 - 5 min	5 - 10 min	0 / 15 min	0 / 25 min	1 - 5 min
OPTIMUM Space per passenger	1.0 - 1.2 m²		1.5 - 1.7 m²		1.3 - 1.8 m²

Do you know your Level of Service?

Contact us for a professional assessment of your current passenger terminal or expansion plan.
For more information, e-mail us at consulting@iata.org or visit www.iata.org/los

TFDM Implementation Map and Timeline

TFDM Implementation

TFDM capabilities will be implemented incrementally in a phased approach throughout the life of the program beginning in 2022. The TFDM System will be deployed to a subset of National Airspace System (NAS) Air Traffic Control Towers (ATCTs). ATCTs will receive TFDM capabilities based on operational needs and the impact of installation and deployment on the NAS. Other FAA facilities will also have access to the TFDM Surface Situational Awareness (SSA) data, including Terminal Radar Approach Control Facilities (TRACONS), Air Route Traffic Control Centers (ARTCCs), and the Air Traffic Control System Command Center (ATCSCC).

TFDM provides two configurations that consist of different levels of TFDM capabilities which can be achieved by turning functions on and off through adaptation.

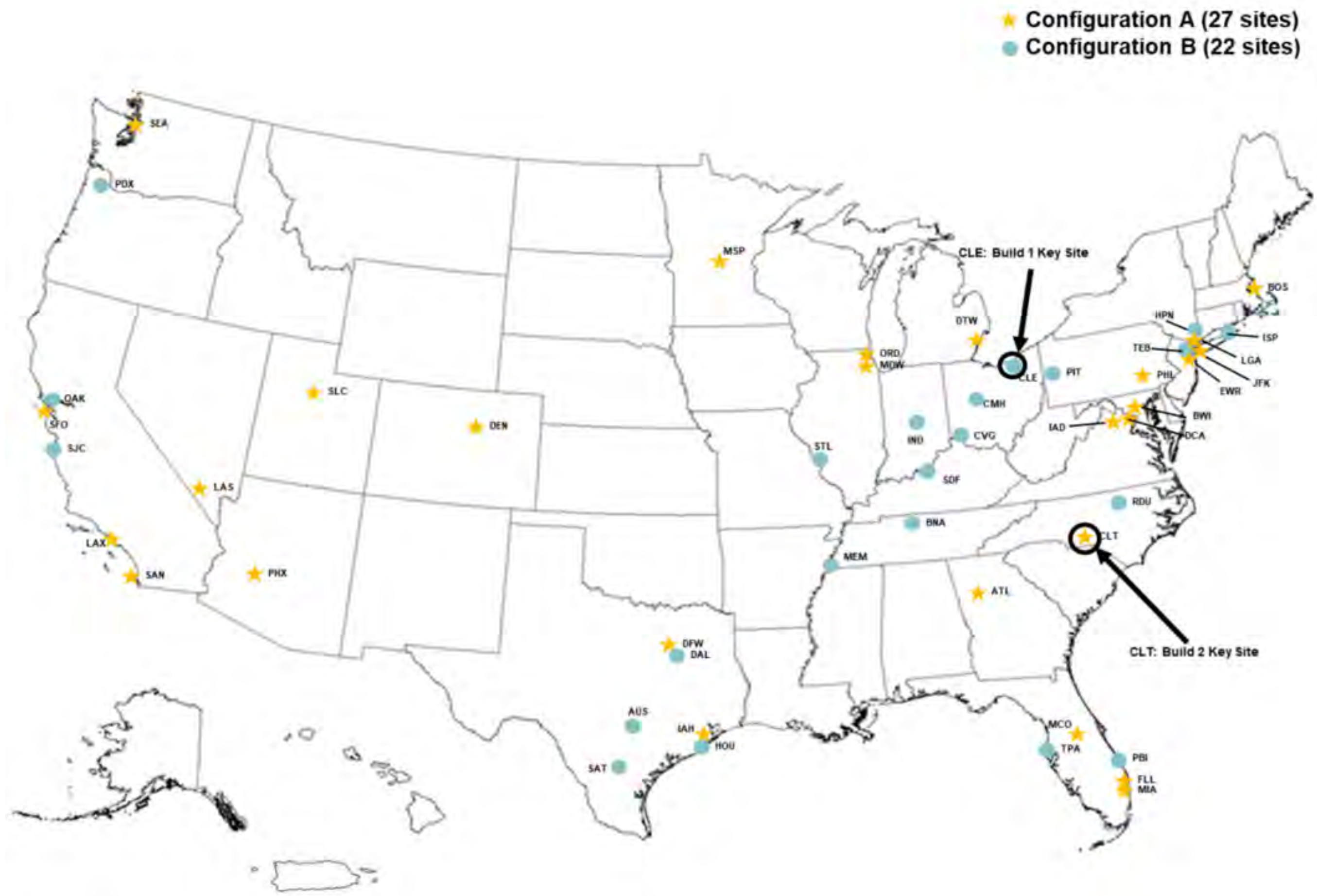
Configuration A: Full Functionality (27 Sites: Large, high density airports)

- Improved Electronic Flight Data (EFD) exchange and electronic flight strips in towers
- Surface surveillance data integration
- Full Decision Support Tools (DSTs), including surface scheduling/metering
- Traffic Flow Management (TFM) data exchange and integration
- SSA on TFMS Traffic Management Unit (TMU) displays in the TRACON, ARTCC, and ATCSCC

Configuration B: Improved EFD and Electronic Flight Strips (22 Sites)

- Improved EFD exchange and electronic flight strips in towers
- Limited SSA capability on TFMS TMU displays (only airports with surface surveillance)
- Scheduling Capability

The below map shows which configuration will be installed at the 49 sites and the below table shows when each airport will be receiving TFDM.



TFDM Deployment Waterfall

Airport	Airport ID	City, State	Configuration	Initial Operating Capability
Cleveland Hopkins International Airport (EFS Key Site)	CLE	Cleveland, Ohio	B	Operational as of October 24, 2022
Indianapolis International Airport	IND	Indianapolis, Indiana	B	Operational as of April 24, 2023
Phoenix Sky Harbor International Airport	PHX	Phoenix, Arizona	A	EFS operational as of June 5, 2023 Surface Management: December 2024
Raleigh–Durham International Airport	RDU	Raleigh Durham, North Carolina	B	Operational as of July 24, 2023
John Glenn Columbus International Airport	CMH	Columbus, Ohio	B	Operational as of September 11, 2023
McCarren International Airport	LAS	Las Vegas, Nevada	A	EFS operational as of October 30, 2023 Surface Management: February 2025
Norman Y. Mineta San Jose International Airport	SJC	San Jose, California	B	Operational as of February 27, 2024

Airport	Airport ID	City, State	Configuration	Initial Operating Capability
Charlotte Douglas International Airport (Surface Metering Key Site)	CLT	Charlotte, North Carolina	A	Operational as of May 14, 2024
Los Angeles International Airport	LAX	Los Angeles, California	A	EFS operational as of May 14, 2024; Surface Management: April 2025
Tampa International Airport	TPA	Tampa, Florida	B	July 2024
Seattle–Tacoma International Airport	SEA	Seattle, Washington	A	March 2025
San Francisco International Airport	SFO	San Francisco, California	A	April 2025
George Bush Intercontinental Airport	IAH	Houston, Texas	A	June 2025
Chicago Midway International Airport	MDW	Chicago, Illinois	A	July 2025
Oakland International Airport	OAK	Oakland, California	B	August 2025
Miami International Airport	MIA	Miami, Florida	A	October 2025
Logan International Airport	BOS	Boston, Massachusetts	A	March 2026
Austin-Bergstrom International Airport	AUS	Austin, Texas	B	March 2026
Hartsfield Jackson Atlanta International Airport	ATL	Atlanta, Georgia	A	April 2026
William P. Hobby Airport	HOU	Houston, Texas	B	June 2026
Salt Lake City International Airport	SLC	Salt Lake City, Utah	A	July 2026
San Diego International Airport	SAN	San Diego, California	A	August 2026
Cincinnati/Northern Kentucky International Airport	CVG	Cincinnati, Ohio	B	September 2026
Denver International Airport	DEN	Denver, Colorado	A	September 2026
Dallas/Fort Worth International Airport	DFW	Fort Worth, Texas	A	October 2026
Dallas Love Field	DAL	Dallas, Texas	B	March 2027
Minneapolis-Saint Paul International Airport	MSP	Minneapolis, Minnesota	A	March 2027
Louisville International Airport	SDF	Louisville, Kentucky	B	April 2027
Chicago O'Hare International Airport	ORD	Chicago, Illinois	A	June 2027
Nashville International Airport	BNA	Nashville, Tennessee	B	July 2027
Washington Dulles International Airport	IAD	Washington, D.C	A	August 2027

Airport	Airport ID	City, State	Configuration	Initial Operating Capability
Memphis International Airport	MEM	Memphis, Tennessee	B	August 2027
Fort Lauderdale–Hollywood International Airport	FLL	Fort Lauderdale, Florida	A	September 2027
Orlando International Airport	MCO	Orlando, Florida	A	October 2027
San Antonio International Airport	SAT	San Antonio, Texas	B	February 2028
Detroit Metropolitan Airport	DTW	Detroit, Michigan	A	March 2028
Long Island MacArthur Airport	ISP	Ronkonkoma, New York	B	April 2028
Baltimore/Washington International Thurgood Marshall Airport	BWI	Baltimore, Maryland	A	May 2028
Palm Beach International Airport	PBI	Palm Beach, Florida	B	June 2028
Ronald Reagan Washington National Airport	DCA	Washington, D.C.	A	July 2028
Portland International Airport	PDX	Portland, Oregon	B	August 2028
Philadelphia International Airport	PHL	Philadelphia, Pennsylvania	A	September 2028
Newark Liberty International Airport	EWR	Newark, New Jersey	A	October 2028
LaGuardia Airport	LGA	New York, New York	A	February 2029
Teterboro Airport	TEB	Teterboro, New Jersey	B	March 2029
John F. Kennedy International Airport	JFK	New York, New York	A	April 2029
Westchester County Airport	HPN	White Plains, New York	B	May 2029
Pittsburgh International Airport	PIT	Pittsburgh, Pennsylvania	B	June 2029
St. Louis Lambert International Airport	STL	St. Louis, Missouri	B	July 2029

Last updated: Thursday, June 6, 2024

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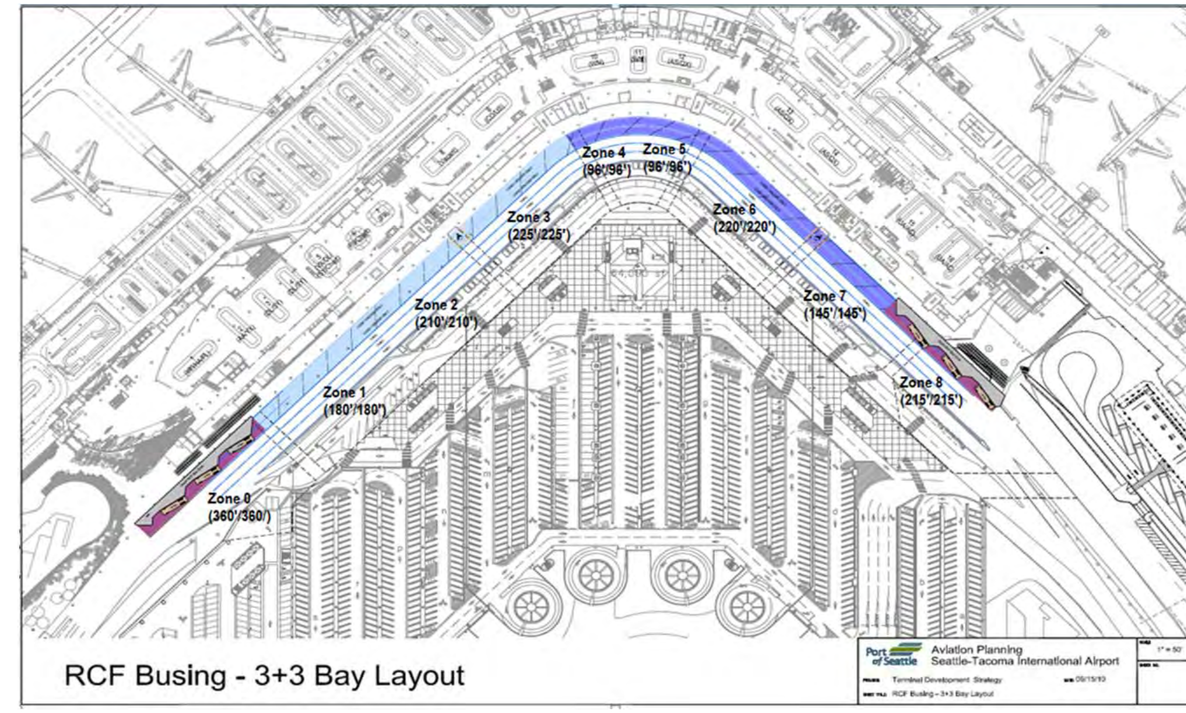
Landside Level of Service Analysis

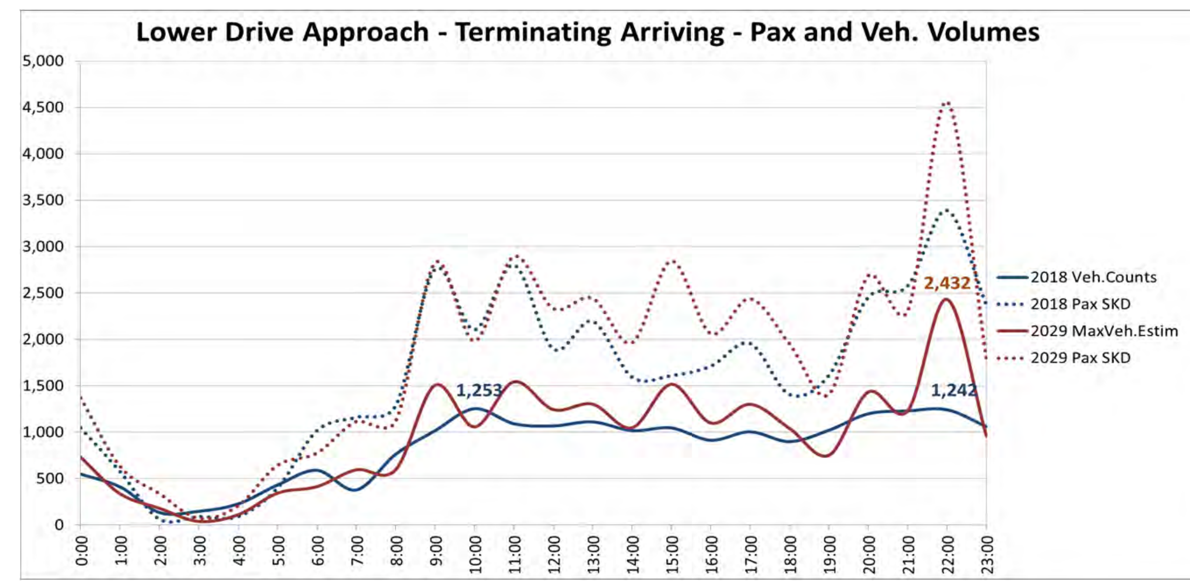
Arrival Curbside and Roadway Level of Service - Night Peak Hour

Port of Seattle / Aviation Planning

	Existing 2018		Existing 2018 Max Volume		80% Existing 2018 Max Volume		Future Year Pre - 2nd Terminal		50% Future Year Pre - 2nd Terminal	
MAP	**49.85**		**49.85**		**49.85**		**58.92**		**58.92**	
Peak Volume (vph)	**1,242**		**1,657**		**1,160**		**2,432**		**973**	
Peak Time	**10:00 PM**		**10:00 PM**		**10:00 PM**		**10:00 PM**		**10:00 PM**	
Zone 8 N	10		13		9		14		6	
Zone 7	171		228		159		294		118	
Zone 6	342		456		319		588		235	
Zone 5	29		39		28		38		15	
Zone 4	114		151		106		76		30	
Zone 3	328		437		306		879		352	
Zone 2	162		216		151		385		154	
Zone 1	52		70		49		101		40	
Zone 0 S	34		46		32		58		23	
AVG POV Dwell Times (min)	**2.4**	**1.5**	**2.4**	**1.5**	**2.4**	**1.5**	**2.4**	**1.5**	**2.4**	**1.5**
Roadway LOS	**D**	**C**	**F**	**D**	**C**	**B**	**F**	**F**	**C**	**B**
Zone 8 N	B	B	C	C	B	B	D	D	B	B
Zone 7	C	C	E	D	B	B	F	F	B	B
Zone 6	D	C	F	D	B	B	F	F	B	B
Zone 5	B	B	C	C	B	B	D	D	B	B
Zone 4	C	C	F	D	B	B	E	D	B	B
Zone 3	D	C	F	D	C	B	F	F	C	B
Zone 2	C	B	D	C	B	B	F	F	B	B
Zone 1	B	B	C	C	B	B	D	D	B	B
Zone 0 S	B	B	C	C	B	B	D	D	B	B
Curbside LOS	**F**	**D**	**F**	**E**	**F**	**D**	**F**	**F**	**F**	**D**
Zone 8 N	A	A	A	A	A	A	A	A	A	A
Zone 7	E	D	F	D	D	A	F	E	D	A
Zone 6	F	D	F	E	D	C	F	F	D	C
Zone 5	A	A	A	A	A	A	A	A	A	A
Zone 4	E	D	F	E	A	A	D	A	A	A
Zone 3	F	D	F	E	F	D	F	F	F	D
Zone 2	D	A	E	C	D	A	F	E	D	A
Zone 1	A	A	A	A	A	A	C	A	A	A
Zone 0 S	A	A	A	A	A	A	A	A	A	A

Curb Length (feet)		**1,747**	**1,747**	**1,747**	**1,747**	**1,747**
Zone 8 N	676	215	215	215	215	215
Zone 7		145	145	145	145	145
Zone 6		220	220	220	220	220
Zone 5		96	96	96	96	96
Zone 4	1071	96	96	96	96	96
Zone 3		225	225	225	225	225
Zone 2		210	210	210	210	210
Zone 1		180	180	180	180	180
Zone 0 S		360	360	360	360	360





VEHICLE LENGTHS AND DWELL TIMES - ASSUMPTIONS ARRIVALS ROADWAY		
Vehicle class	**Vehicle Parking Length (feet)**	**Average dwell time (minutes)**
Private vehicles and TNCs	25	2.40 or 1.50
Taxis	20	1.90
Limousines	30	5.50
Shuttle vans	30	2.70
Buses	50	3.50
Courtesy vehicles	30	2.80

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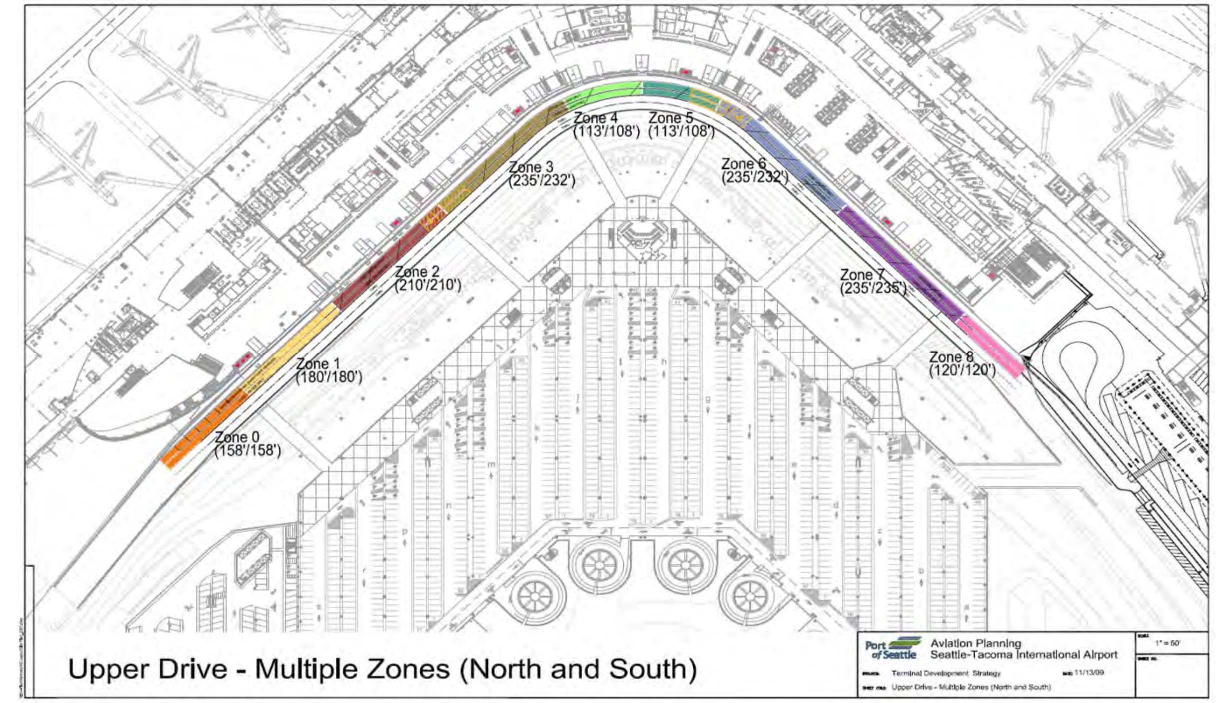
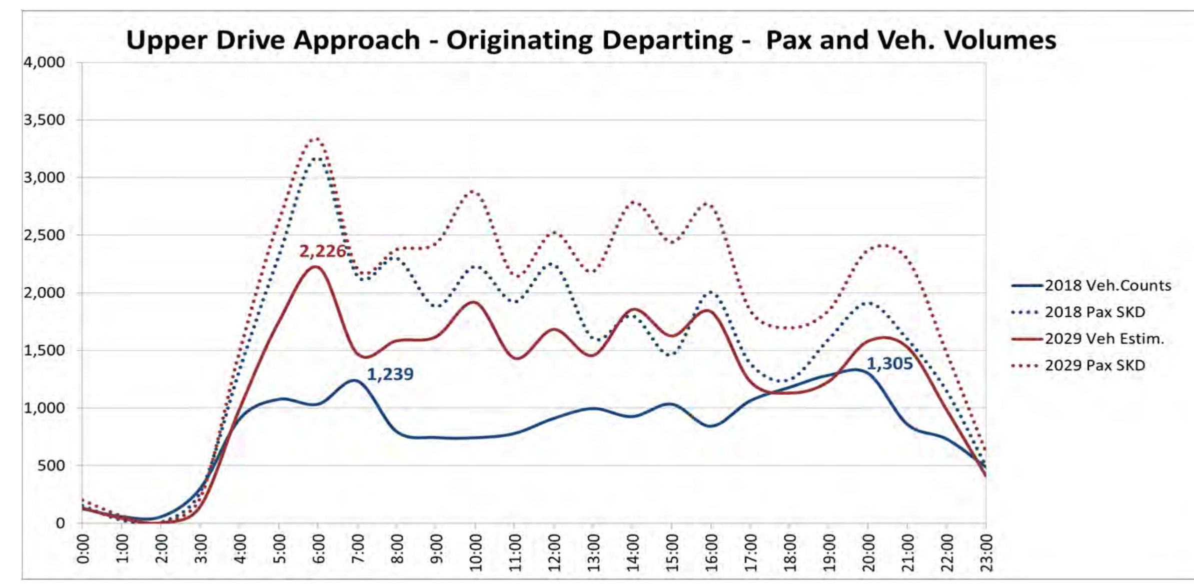
Landside Level of Service Analysis
Departure Curbside and Roadway Level of Service - Morning Peak Hour
Port of Seattle / Aviation Planning

	Existing 2018		Existing 2018 Max Volume		80% Existing 2018 Max Volume		Future Year Pre - 2nd Terminal		50% Future Year Pre - 2nd Terminal	
MAP	**49.85**		**49.85**		**49.85**		**58.92**		**58.92**	
Peak Volume (vph)	**1,239**		**1,239**		**1,113**		**2,226**		**1,113**	
Peak Time	**7:00 AM**		**7:00 AM**		**7:00 AM**		**6:00 AM**		**6:00 AM**	
Zone 8 N	0		0		0		0		0	
Zone 7	222		222		168		336		168	
Zone 6	443		443		336		671		336	
Zone 5	90		90		107		214		107	
Zone 4	45		45		64		128		64	
Zone 3	267		267		361		722		361	
Zone 2	100		100		74		148		74	
Zone 1	73		73		3		6		3	
Zone 0 S	0		0		0		0		0	
AVG POV Dwell Times (min)	**2.4**	**1.5**	**2.4**	**1.5**	**2.4**	**1.5**	**2.4**	**1.5**	**2.4**	**1.5**
Roadway LOS	F	D	F	D	E	C	F	F	E	C
Zone 8 N	C	C	C	C	B	B	E	E	C	C
Zone 7	C	C	C	C	B	B	F	E	C	C
Zone 6	F	D	F	D	E	C	F	F	E	C
Zone 5	C	C	C	C	C	B	F	F	D	C
Zone 4	C	C	C	C	B	B	F	F	C	C
Zone 3	D	C	D	C	C	B	F	F	E	C
Zone 2	C	C	C	C	B	B	E	E	C	C
Zone 1	C	C	C	C	B	B	E	E	C	C
Zone 0 S	C	C	C	C	B	B	E	E	C	C
Curbside LOS	F	E	F	E	F	D	F	F	F	D
Zone 8 N	A	A	A	A	A	A	A	A	A	A
Zone 7	D	C	D	C	D	A	F	D	C	A
Zone 6	F	E	F	E	F	D	F	F	F	D
Zone 5	E	C	E	C	D	A	F	F	E	D
Zone 4	A	A	A	A	A	A	F	E	C	A
Zone 3	E	D	E	D	D	C	F	F	F	D
Zone 2	A	A	A	A	A	A	C	A	A	A
Zone 1	A	A	A	A	A	A	A	A	A	A
Zone 0 S	A	A	A	A	A	A	A	A	A	A
Curb Length (feet)	**1,599**		**1,599**		**1,599**		**1,599**		**1,599**	
Zone 8 N (703)	120		120		120		120		120	
Zone 7	235		235		235		235		235	
Zone 6	235		235		235		235		235	
Zone 5	113		113		113		113		113	
Zone 4 (896)	113		113		113		113		113	
Zone 3	235		235		235		235		235	
Zone 2	210		210		210		210		210	
Zone 1	180		180		180		180		180	
Zone 0 S	158		158		158		158		158	





VEHICLE LENGTHS AND DWELL TIMES - ASSUMPTIONS DEPARTURES ROADWAY		
Vehicle class	**Vehicle Parking Length (feet)**	**Average dwell time (minutes)**
Private vehicles	25	2.40 or 1.50
Taxis	25	1.90
Limousines	30	1.90
Shuttle vans	30	3.50
Buses	50	1.00
Courtesy vehicles	30	1.20

Top 25 Domestic Origin and Destination Markets in 2022

Rank	Market [1]	Approximate air miles from Seattle	Share of market, based on enplaned passengers (%) [2]	Average daily non-stop departures
1	Los Angeles, CA (3)	952	10.8	37
2	San Francisco Bay, CA (4)	674	8.0	40
3	Las Vegas, NV	866	4.9	17
4	Phoenix, AZ	1,107	4.8	16
5	New York City, NY (5)	2,450	4.3	14
6	San Diego, CA	1,050	3.7	11
7	Denver, CO	1,024	3.4	16
8	Chicago, IL (6)	1,761	3.0	14
9	Dallas / Ft. Worth, TX (7)	1,722	2.5	11
10	Honolulu, HI	2,676	2.1	6
11	Sacramento, CA	2,378	2.1	12
12	Boston, MA	2,496	2.1	7
13	Washington, DC (8)	2,408	2.0	6
14	Atlanta, GA	2,182	1.8	9
15	Salt Lake City, UT	689	1.8	10
16	Orlando, FL	2,553	1.7	5
17	Minneapolis, MN	1,399	1.7	8
18	Houston, TX (9)	1,909	1.5	5
19	Austin, TX	1,770	1.5	5
20	Anchorage, AK	1,434	1.4	20
21	Kahului, HI	2,639	1.4	5
22	Boise, ID	404	1.3	14
23	Spokane, WA	223	1.3	18
24	Palm Springs, CA	986	1.2	4
25	Detroit, MI	1,927	1.1	5
		Subtotal	71.3	316
		All other cities	28.7	154
		Total	**100.0**	**470**

Note: Totals may not add due to rounding.
(1) Each market includes the major airports within the market.
(2) Compiled by the Port from U.S. Department of Transportation Statistics
Sources: U.S. DOT OD1A database; Official Airline Guide (OAG)

Preparer Notes

Non-stop scheduled passenger departures only; does not include arrivals or scheduled all-cargo flights
Market share (generally >1%) drives ranking
Used air miles from 2015
Comments below (↓) to assist preparer, but not included in Disclosure document

[3] Los Angeles International (LAX), Bob Hope/Burbank (BUR), John Wayne/Orange County (SNA), Ontario Inte
[4] San Francisco International (SFO), Oakland (OAK), and Mineta San Jose International (SJC) airports
[5] John F. Kennedy International (JFK), LaGuardia (LGA), and Newark-Liberty International (EWR) airports
[6] O'Hare International (ORD) and Midway (MDW) airports
[7] Dallas/Ft. Worth International (DFW) and Love Field (DAL) airports
[8] Dulles International (IAD) and Reagan-National (DCA) airports
[9] George Bush Intercontinental (IAH) and Houston-Hobby (HOU) airports