Paine Field Master Plan 2040

3

Chapter 3 | Forecast

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Chapter 3 Aviation Forecasts

This chapter of the Master Plan provides forecasts of airport activity for Paine Field Airport (PAE). Forecasting provides an airport with a projection of the magnitude of growth that can be expected over a 20-year forecast period. The forecasts will help PAE determine existing and planned future facility needs based on airport activity level projections. The forecasts will be used to adequately plan, size, and phase the development of future facilities to meet future projected growth. Forecasts attempt to develop a realistic estimate of future changes. When conditions dramatically change, forecasts should be reviewed and updated.

To develop aviation forecasts, a technical review has been completed using several methods to help quantify the potential aviation activity over the next 20 years. The forecasts for this Airport Master Plan 2040 study were prepared by Landrum & Brown.

The passenger activity and passenger aircraft operations forecast will be different as compared to most forecasts. This is because commercial air service only started at PAE in March 2019 and there is little historical activity. Because of this, we reviewed more closely the broader Seattle economy and air service market. This included benchmarking the Seattle Metropolitan Statistical Area (MSA) and air service market versus other similarly sized MSAs to gauge the relative strength of the Seattle economy and subsequently the air service market. We took a closer look at the region within the Seattle MSA most likely to use PAE. We reviewed the Air Service Area which is defined as the five-county area of Island, King, Kitsap, Skagit and Snohomish counties. The Air Service Area is the region mostly likely to use PAE, although even within this region, it is expected that most of the travel demand will come from Snohomish and northern King County. Because of this, we relied on what is defined as the PAE Catchment Area to develop the passenger activity forecast. This area is defined as a 15-mile radius around PAE. This Catchment Area's air travel demand was benchmarked against other "secondary airports" within multi-airport cities to generate passenger activity forecasts.

PAE however differs from all other "secondary markets" in that the primary airport serving the region, Seattle-Tacoma International Airport (SEA) will likely not be able to supply adequate capacity to meet passenger demand sometime in the next 20 years. At some point this most likely will impact PAE as an outlet for this unmet passenger demand.

FAA Forecast Review Criteria

Forecasts developed for airport master plans and/or federal grants must be approved by the Federal Aviation Administration (FAA). It is the FAA's policy, listed in Advisory Circular 150/5070-6B, *Airport Master Plans*, that FAA approval of forecasts at non-hub airports with commercial service should be consistent with the Terminal Area Forecasts (TAF). Master plan forecasts for operations, based aircraft and passenger volumes are consistent with the TAF if they meet the following criteria:

- Forecasts differ by less than 10% in the five-year forecast and by less than 15% in the 10-year period, or
- Forecasts do not affect the timing or scale of an airport project, or
- Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3, *Field Formulation of the National Plan of Integrated Airport Systems.*

Furthermore, FAA Order 5090.3C, Field Formulation of the National Plan of Integrated Airport Systems (NPIAS) Document Information, states forecasts should be:

- Realistic
- Based on the latest available data

- Reflect the current conditions at the airport
- Supported by information in the study
- Provide an adequate justification for the airport planning and development

The TAF model used for this report is from the 2021 FAA TAF that was made available in May 2021. This is the latest data available when the forecasting effort began for this airport master plan. The TAF model is flawed in that it uses year-ending September 2019 as its base year. PAE did not initiate passenger service until March 2019 and as such was only in operation for seven months through September 2019, instead of a 12-month time period.

3.1 Economic Base for Air Traffic

Air travel demand is typically correlated with a region's demographic and economic characteristics. The economic strength of the air service area has a major impact on the aviation activity at the Airport. This section provides a review of economic trends and conditions in the PAE air service area and presents data indicative of the air service area's capability to generate growing demand for air transportation throughout the forecast period.

3.1.1 Socio-Economic Overview

Over the past decade (2010-2019), the city of Seattle added a net increase of 145,000 people, which corresponds to a 23.8% growth rate. This made Seattle the fastest-growing major U.S. city of the 2010s. The region, including Redmond and Bellevue, grew even faster. Between 2010 and 2019, the Seattle region added over 220,000 jobs and has 31 Fortune 500 companies that operate research and engineering hubs, up from 7 in 2010. As recently as 2017, Seattle was experiencing its most rapid rate of population increase since the Klondike Gold Rush around 1900.

The Boeing Company is the world's largest manufacturer of commercial aircraft and has been the largest exporter in the country for the last several decades. Most of the company's airplane production is based in Everett and the Greater Puget Sound region.

Boeing's Everett site contains the company's largest manufacturing building and is the Aerospace Capital of the World. This site produces the 747, 767, 777, 777X, 787 aircraft, the KC-46 tanker, defense derivatives and Air Force One. Boeing has consolidated the 787 production to its Charleston, South Carolina facility, and in 2022 Boeing will cease production of the 747 aircraft.

Snohomish County anticipates the future capacity in the building will be used to support the development and production of the Boeing Company's Midmarket Airplane. Snohomish County believes in partnerships and working together. Snohomish County will work with the State of Washington, the City of Everett and the Port of Everett to ensure a competitive business environment, custom logistics chain and workforce to support Boeing's Midmarket Airplane.

Everett has numerous competitive advantages including a gold-plated, highly skilled workforce, custom infrastructure and the unwavering support of the community. Snohomish County is developing a Master Plan which will support the continued, and robust, Aerospace manufacturing at Paine Field.

Development continues on the 777X program and certain 737 MAX derivatives. The FAA has indicated that an updated version of the 777 will not be ready for certification until late 2023. This is in line with Boeing's current outlook that would push the 777X's commercial debut into late 2023 or early 2024. Boeing currently estimates a production rate of two 777s per month through 2021, although this would likely increase over the next few years once the aircraft is certified.

The grounding of the 737 MAX and the associated suspension of 737 MAX deliveries significantly slowed Boeing operations in 2019 and coupled with COVID-19, reduced 2020 to a standstill. But with the resumption of 737 MAX deliveries in December 2020 and the recent 200-aircraft order by United Airlines, deliveries and production should start improving.

Approximately 38,000 people worked at Boeing Everett as recently as 2017, although with curtailed production cutbacks tied to COVID-19, the current workforce is closer to 30,000 people.

This workforce supports aircraft fabrication and production; product development; and aviation safety and security and aircraft certifications. Other production areas at the site include paint hangars, a flight line, and Boeing's customer delivery center.[1]

Another major aerospace company located at PAE is Aviation Technical Services (ATS). ATS maintains aircraft for some of the industry's largest airlines including Southwest, Delta and Air Canada. ATS also does maintenance on larger business jets. ATS is one of the largest suppliers of 737 airframe maintenance in the world, on average redelivering 450 aircraft in a typical year. ATS delivers approximately 15,000 aircraft components annually to more than 250 customers.

While Boeing and the aerospace-related industry has faced some challenges over the past few years, the Seattle region's tech companies have been flourishing and that will likely continue into the foreseeable future. The largest manufacturer in the Seattle area is the Microsoft Corporation, the world's largest maker of computer operating systems and applications such as word processing and spreadsheet programs. As of September 2019, Microsoft had 51,854 employees in the region. Although it has offices throughout the world, Microsoft does most of its research and product development at its corporate headquarters in suburban Redmond.

According to Business Travel News, Microsoft had the 8th largest corporate travel budget in the U.S. in 2019, at approximately $1.1 billion worldwide. Its presence has attracted many software firms to the Seattle area and spurred much infrastructure development, including the construction of reliable broadband fiber-optic networks.

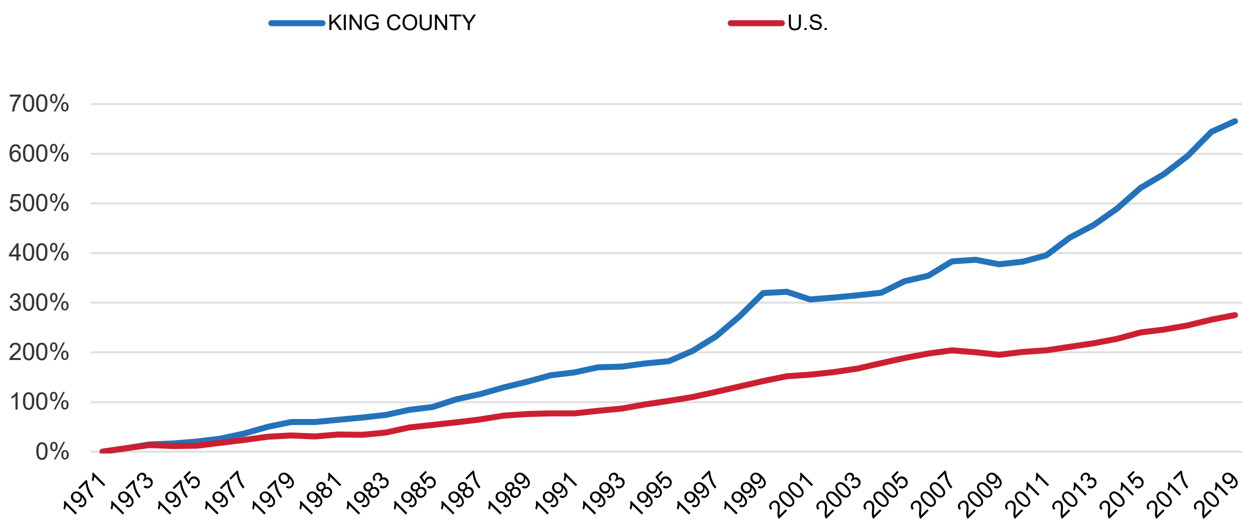
Amazon has risen to become one of the Seattle region's top employers, surpassing Microsoft as its top tech employer in the region with almost 54,000 employees, increasing from 5,000 employees as recently as 2010. As of June 2020, Amazon had more than one million employees worldwide. With respect to hotel sales alone, as recently as 2017, Amazon itself bought 330,000 hotel nights in the city, at an average of $200 a night. According to Business Travel News, Amazon ranked as having the 2nd largest corporate travel budget in the U.S. in 2019 with a budget well in excess of $1 billion. Amazon indicates that they've saved over $1 billion in travel expenses in 2020 due to COVID-19.

Seattle is considered the cloud computing capital of the world, with the Amazon and Microsoft headquarters, in addition to Google's significant local presence. The cloud computing revolution has come to define Seattle's tech scene. While cloud computing was among the fastest growing business segments in the world pre-COVID-19, post-COVID-19 that trend has only been magnified. Depending on the day, Amazon and Microsoft are the two most valuable companies in the U.S., and a big part of that is their dominance over the lucrative cloud computing market. Amazon is the clear leader in cloud computing, commanding a 32% market share as of the end of last year, per a recent study from Canalys. Microsoft is growing its presence, though it still trails Amazon by a wide margin, with a 16% market share.

King County drives much of the Seattle economy and will also generate a sizable portion of demand using PAE. King County's Gross Regional Product (GRP) has far outgrown the national average (about twice as fast). This is in part due to the influx of major tech companies settling into the area such as Amazon, Tableau, Cray, Zulily, and Redfin, as well as Google and Microsoft continuing to be major players.

Exhibit 3-1 below illustrates the relative economic growth of King County as compared to the U.S.

Exhibit 3-1 Gross Regional/Domestic Product Growth Indexed to CY 1971: King County vs U.S.



Source: Woods & Poole 2020

3.1.2 Longer-Term Socio-Economic Trends and Forecasts

The previous section illustrated socio-economic highlights and drivers. This section includes a more comprehensive longer-term review of socio-economic trends from the region, including forecasts. This includes data for population, age distribution, educational attainment, income, and GRP for the air service area. Parallel data for Washington and the U.S. is also shown to provide a basis of comparison to trends in the air service area. Where available, historical data is presented for the 2009-2019 period, which is representative of a longer-term trend and the most recent 10 years of historical data available. Also, forecast data is presented through 2039 to be consistent with air traffic and financial forecasts presented later in this chapter.

It should be noted that this section will be driven by data and forecasts that were completed early in 2020, before the COVID-19 pandemic became relevant in the U.S. Subsequent to this, a shorter section will be devoted to post-COVID-19 economic trends, including a 10-year forecast conducted by the King County Office of Economic and Financial Analysis. This study was completed in March 2021.

Historical and Forecast Population

Population is a significant source of demand for air travel. **Table 3-1** includes 2009 and 2019 population data and provides population trends in the air service area, Washington, and the U.S. during this period. Data forecasts for 2039 are also included. Data in Table 3-1 show that between 2009 and 2019, the population in the air service area increased by 16.5% from 3,061,919 to 3,565,877. During that same period, the overall U.S. population increased by 7.3%, or at less than half as fast as the air service area.

Table 3-1 Historical and Forecast Population (2009-2039)

Area	Historical Population		Forecast Population 2039	% Change 2009-2019	CAGR[1]	
	2009	2019			2019	2039
Island County	78,248	84,964	95,697	8.6%	0.8%	0.6%
King County	1,912,012	2,255,859	2,711,275	18.0%	1.7%	0.9%
Kitsap County	248,800	271,692	306,648	9.2%	0.9%	0.6%
Skagit County	116,557	129,118	148,794	10.8%	1.0%	0.7%
Snohomish County	706,302	824,244	1,016,490	16.7%	1.6%	1.1%
Air Service Area	**3,061,919**	**3,565,877**	**4,278,904**	**16.5%**	**1.5%**	**0.9%**
Washington	6,667,426	7,608,258	9,083,250	14.1%	1.3%	0.9%
United States	306,771,490	329,308,907	371,031,481	7.3%	0.7%	0.6%

[1] Compound annual growth rate.

Source: Woods & Poole Economics, Inc., Data Profiles for U.S., Washington, and Island, King, Kitsap, Skagit and Snohomish counties. Compiled by Landrum and Brown, November 2020.

The air service area added approximately 500,000 people to its population between 2009 and 2019 (approximately 50,000 per year). Population growth was led by King County, followed closely by Snohomish County. In total, the air service area's population between 2009 and 2019 increased at a compounded annual growth rate (CAGR) of 1.5%—more than double that of the U.S. (0.7%). In 2019, the air service area accounted for approximately 47% of Washington's population.

The forecasted population increase in the air service area for the period 2019 to 2039 reflects a CAGR of 0.9% and is 50% higher than the U.S. rate during the same period (0.6%). The increase in new residents in the air service area is forecast to be approximately 713,000 between 2019 and 2039. While King County was the fastest growing county within the air service area over the past decade, it is forecast that Snohomish County will be the fastest growing county in the air service area over the next 20 years. Additionally, with COVID and the work-from-home (WFH) transition, it is likely that Snohomish County's relative growth will only increase. Early reports are that home sales within Snohomish County have skyrocketed over the past few months, as people move away from the heart of King County in or near downtown Seattle.

Age Distribution

Table 3-2 includes 2019 age data for the air service area, Washington and the U.S. The median age in air service area is 40.0 years, compared with 37.9 years in Washington and 38.4 years in the U.S. Demand for air travel varies by age group. According to the Consumer Expenditure Survey from the U.S. Bureau of Labor Statistics, people between the ages of 45 and 64 account for 44% of all air travel expenditures.[2]

Table 3-2 Age Distribution (2019)

	Air Service Area	Washington	United States
Total Population	3,565,877	7,608,258	329,308,907
Age Range			
19 and under	23.0%	24.4%	24.9%
20 to 24 years	5.8%	6.2%	6.6%
25 to 34 years	16.8%	15.3%	14.0%
35 to 44 years	14.6%	13.5%	12.7%
45 to 54 years	12.8%	12.1%	12.4%
55 to 64	12.4%	12.6%	12.9%
65 and above	14.6%	16.0%	16.5%
Total	100.0%	100.0%	100.0%
Median Age	**40.0 years**	**37.9 years**	**38.4 years**

Source: Woods & Poole Economics, Inc., Data Profiles for U.S., Washington, and Island, King, Kitsap, Skagit and Snohomish counties, November 2020; Esri Market Profiles for air service area, Washington and U.S., November 2020. Compiled by Landrum & Brown, November 2020.

In 2019, residents in the air service area aged 45 to 64 made up 25.2% of the population, compared with 26.0% of the population in both Washington and the U.S. This is the age group that generates the most expenditure on air travel and it is represented in the air service area in a proportion that is commensurate with both Washington and the U.S.

Educational Attainment

Table 3-3 includes 2019 educational attainment data for the air service area, Washington, and the U.S. The air service area is home to a substantial number of educated adults. More than 1.2 million people, or 52.0% of the air service area's population, over the age of 25 have a post-secondary degree (associate, bachelor's, or graduate).

This percentage is much higher than that of both Washington and particularly the U.S. where respectively, 43.9% and 38.6% of the population over the age of 25 have a post-secondary degree. The Seattle MSA is the 8th most educated in the U.S. per WalletHub.

According to Consumer Expenditure Survey data from the U.S. Bureau of Labor Statistics, persons with a college degree generate a high percentage of expenditures on air travel. Data indicates that 77% of airline tickets are purchased by college graduates, while 17% are purchased by consumers who have had some college or have earned an associate degree. The remaining 6% of airline tickets are purchased by consumers who never attended college.[3]

In addition to having a highly educated population, the air service area is home to more than 40 universities, colleges, and technical institutions. Several of these are located in Snohomish County, including City University of Seattle, Cascadia College, Central Washington University-Lynwood, Columbia College, Embry-Riddle Aeronautical University, Edmonds College, Everett Community College, Everett University Center, Everest College, Lake Washington Technical College, University of Washington Bothell, and Washington State University North Puget Sound at Everett. Everett Community College also provides its Aviation Maintenance Technology program with 48,000 square feet of training space on PAE property. In addition, Edmonds College offers job training programs at the Paine Field-based Washington Aerospace Training and Research Center. Educational institutions in the air service area have a total enrollment of approximately 137,000 students.

Table 3-3 Educational Attainment (2019)

	Air Service Area	Washington	United States
Population 25 years and over	2,407,308	5,001,943	218,446,071
Less than 9th Grade	3.1%	3.7%	5.3%
9th - 12th Grade, No Diploma	4.1%	5.1%	7.1%
High School Graduate	18.3%	22.2%	27.1%
Some College, No Degree	21.3%	23.7%	20.6%
Post-Secondary Degree	53.3%	45.3%	39.9%
Associate Degree	9.1%	10.0%	8.4%
Bachelor's Degree	27.4%	22.1%	19.4%
Graduate or Professional degree	16.8%	13.2%	12.1%
Total	100.0%	100.0%	100.0%

Source: Woods & Poole Economics, Inc., Data Profiles for U.S., Washington, and Island, King, Kitsap, Skagit and Snohomish counties, Esri Market Profiles for air service area, Washington and U.S.

Household Income

Table 3-4 includes 2019 and 2039 median household income data for the air service area and the U.S. The air service area's 2019 median household income of $94,027 was 43% higher than for the U.S. The Seattle MSA had the 5th highest median household income in the U.S. ranking behind only San Jose ($130,865), San Francisco ($114,696), Washington, D.C. ($105,659) and the Boston MSAs ($94,430).

The air service area's median household income is forecast to grow much faster as compared to the U.S. over the next 20 years. The air service area is projected to reach a median household income level of $124,510 by 2039, growing at a 1.35% CAGR, compared to $73,896 for the U.S. (0.6% CAGR). The air service area's median household income growth over the next 20 years is expected to again be one of the fastest growing in the U.S.

Table 3-4 **Median Household Income and Income Distribution (2019-2039)**

	Air Service Area	Washington	United States
2019 Median Household Income	$94,027	N/A	$65,712
2039 Median Household Income	$124,610	N/A	$73,896
2019 Household Income			
Less than $19,999	12.0%	14.3%	17.8%
$20,000 to $44,999	18.6%	21.6%	24.0%
$45,000 - $74,999	20.9%	23.4%	23.2%
$75,000 - $99,999	15.9%	15.2%	13.1%
$100,000 - $199,999	25.6%	20.8%	17.4%
$200,000 or more	7.0%	4.7%	4.5%
Total	100.0%	100.0%	100.0%
2039 Household Income			
Less than $19,999	10.7%	11.9%	13.5%
$20,000 to $44,999	16.6%	18.0%	18.5%
$45,000 - $74,999	19.0%	23.3%	24.9%
$75,000 - $99,999	21.4%	23.6%	20.2%
$100,000 - $199,999	42.0%	35.7%	28.7%
$200,000 or more	11.4%	7.9%	7.3%
Total	100.0%	100.0%	100.0%

Notes: 2019 data are shown in 2012 dollars and 2039 data are shown in 2012 dollars.
Source: Woods & Poole 2019 for air service area, Washington and U.S. Compiled by Landrum and Brown, November 2020.

As shown in **Table 3-5** below, the percentage of higher income households (defined as those earning $100,000 or more annually) within the air service area is another key indicator of potential demand for air travel. In 2019, approximately 461,000 air service area households had an income of $100,000 or more. This is equal to approximately 35% of all air service area households. According to Consumer Expenditure Survey data from the U.S. Bureau of Labor Statistics, 54% of airline ticket expenditures are made by households with an annual income of $100,000 or more. Between 2019 and 2039, the air service area will gain an additional 295,000 households with an annual income of greater than $100,000.

Household income trends in Snohomish County, where PAE is located, are similar to trends in the air service area. The 2019 median household income of $89,260[4] in Snohomish County is projected to continue increasing. Approximately 30% of Snohomish County households earned $100,000 or more in 2019; this is projected to increase to 42% by 2039.

SEA has been among the fastest growing airports in the U.S. over the past decade. Much of this growth has been driven by the relative strength of the Seattle-area economy, in particular the growth in high income jobs throughout the region. This relative economic strength is expected to continue over the next 20 years and should provide for strong air travel demand offered at both SEA and PAE.

Table 3-5 Households with Income of $100,000 and Above (2019-2039)

	Air Service Area	Washington	United States
2019 estimate	1,415,115	2,992,587	128,769,109
2039 forecast	1,713,059	3,605,238	145,712,078
Increase in households	297,944	612,651	16,942,969
CAGR 2019-2039[1]	1.0%	0.9%	0.6%
Households with Income of $100,000 and Above[2]			
2019 estimate	461,060	764,611	28,168,639
2039 forecast	755,762	1,304,985	46,378,089
Increase in households with income of $100,000 and above	294,702	540,374	18,209,450
CAGR 2019-2039	2.5%	2.7%	2.5%
% of Households with Income of $100,000 and Above[2]			
2019 estimate	32.6%	25.6%	21.9%
2039 forecast	44.1%	36.2%	31.8%

1 Compound annual growth rate.
2 In current dollars.
Source: Woods & Poole 2019 for air service area, Washington and U.S. Compiled by Landrum & Brown, November 2020.

3.1.3 Labor Market Trends

Civilian labor force data and unemployment rates for the air service area is presented in this section. Parallel data for Washington and the U.S. is also included to provide a basis of comparison for trends in the air service area.

2009 – 2019 Labor Force and Unemployment Trends

Table 3-6 includes annual civilian labor force and unemployment data from 2009 through 2019 for the air service area, Washington, and the U.S. Data shows that between 2009 and 2019, the air service area labor force grew at a CAGR of 1.4%—above the labor force CAGR in both Washington (1.0%), and more than double that for the U.S. (0.6%). In absolute terms, the labor force in the air service area increased by approximately 278,000 workers between 2009 and 2019.

The air service area's annual unemployment rate was comparable to that of the U.S. in all years from 2009 through 2019. In 2019, the unemployment rate in the air service area was 4.3% (non-seasonally adjusted).[5] This is identical to the U.S. unemployment rate of 4.3% for 2019.

Table 3-6 Civilian Labor Force and Unemployment Rate (2009-2019)

Year	Civilian Labor Force			Unemployment Rate		
	Air Service Area	Washington	United States	Air Service Area	Washington	United States
2009	1,893,623	3,535,200	154,142,000	9.2%	9.3%	9.2%
2010	1,888,260	3,511,326	153,889,000	10.0%	9.6%	10.0%
2011	1,879,856	3,461,428	153,617,000	9.3%	8.9%	9.3%
2012	1,895,302	3,472,727	154,975,000	8.1%	8.1%	8.1%
2013	1,910,377	3,464,760	155,389,000	7.0%	7.4%	7.0%
2014	1,943,316	3,492,866	155,922,000	6.1%	6.2%	6.1%
2015	1,979,584	3,544,242	157,130,000	5.6%	5.3%	5.6%
2016	2,033,141	3,644,456	159,150,000	5.3%	4.9%	5.3%
2017	2,077,598	3,726,472	160,320,000	4.7%	4.4%	4.7%
2018	2,121,437	3,806,814	162,070,000	4.5%	3.9%	4.5%
2019	2,172,038	3,912,667	163,540,000	4.3%	3.7%	4.3%
CAGR[1]						
2009-2019	1.4%	1.0%	0.6%			

[1] Compound annual growth rate.
Source: Bureau of Labor Statistics, U.S. Department of Labor. Compiled by Landrum & Brown, February 2021.

3.1.4 Regional Economic Profile

This section discusses the air service area's business climate; major employers; and the aerospace, life sciences, information technology, and tourism industries.

Major Employers

Fortune magazine publishes an annual list of the top 1,000 publicly traded companies in the U.S., ranked by revenue. **Table 3-7** shows 15 Fortune 1000 corporations that are headquartered in the air service area including: Costco (ranked 15th); Amazon.com (18th), Microsoft (25th); Starbucks (146th); Nordstrom (197th); Weyerhaeuser (373rd); Expedia (385th); and Alaska Air Group (459th). The air service area's Fortune 1000 companies have a combined annual revenue of approximately $407.5 billion.

This list is comprised of some of the leading and most valuable (based upon equity value) companies in the world. These companies are generally considered as leaders in their respective industries and have been among the fastest growing companies in the world over the past 10 to 20 years. Much of this growth ties to Seattle's lead as one of the largest technology hubs in the world. As described previously, some of these companies, such as Amazon and Microsoft, have historically had among the highest travel budgets in the world.

Table 3-7 Seattle Fortune 1000 Company Headquarters[1]

Company	Rank	Revenue ($billions)	Location	Industry	Total Employees
Costco	15	$116.2	Issaquah	Retail	205,000
Amazon.com	18	$107.0	Seattle	Internet Services/ Retail	230,000
Microsoft	25	$93.6	Redmond	Software	118,000
Starbucks	146	$19.2	Seattle	Food Service	238,000
PACCAR Inc.	147	$19.1	Bellevue	Motor Vehicle Parts	23,000
Nordstrom	197	$14.4	Seattle	Retail	72,500
Weyerhaeuser	373	$7.1	Federal Way	Forest/Paper Products	12,600
Expedia	385	$6.7	Bellevue	Internet Services	18,730
Expeditors	390	$6.6	Seattle	Transportation/ Logistics	15,397
Alaska Air	459	$5.6	Seattle	Airlines	13,858
Puget Energy	711	$3.0	Bellevue	Utilities	2,800
TrueBlue	791	$2.7	Tacoma	Staffing Services	5,500
Outerwall	922	$2.2	Bellevue	Vending Machines	2,670
Symetra	926	$2.1	Bellevue	Financial Services	1,400
F5 Networks	990	$2.0	Seattle	Networking Equipment	4,395

1 Based on 2015 revenue.
Source: Fortune.com; Michigan State University Global Edge, www.globaledge.msu.edu; Company Filings, U.S. Securities and Exchange Commission, www.sec.gov/edgar/searchedgar/companysearch.html, March 2017. Compiled by Landrum and Brown

Major employers in the air service area for which employment data is available are shown in **Table 3-8**. These firms represent a variety of industries including: aerospace (Boeing); internet services/retail (Amazon); software (Microsoft); food service (Starbucks); retail (Costco, Nordstrom); education (University of Washington, Washington State University, Olympic College), airlines (Alaska Air); and medical equipment (Philips Healthcare). In addition to contributing to the air service area's diverse economic base, these companies depend on air passenger and freight service for the continued health and expansion of their business enterprises.

Table 3-8 Major Air Service Area Employers

Company	Approx. Employees	Location	Industry
Boeing	78,225	Seattle	Aerospace
Navy Region Northwest	46,693	Silverdale	Government
Microsoft	43,618	Redmond	Software
Amazon	24,000	Seattle	Internet Services/ Retail
University of Washington	23,639	Seattle	Education
Wal-Mart	19,484	Seattle	Retail
Providence Health & Services	17,669	Renton	Health Care
Fred Meyer Stores	15,500	Seattle	Retail
King County Government	13,800	Seattle	Government
Starbucks	12,610	Seattle	Food Service
CHI Franciscan Health	11,847	Tacoma	Health Care
Nordstrom	10,867	Seattle	Retail
Costco	10,500	Issaquah	Retail
City of Seattle	10,343	Seattle	Government
Swedish Medical Center First Hill	9,627	Seattle	Health Care
United States Postal Service	7,645	Federal Way	Government
Alaska Air	7,150	Seattle	Airlines
Washington State Government	7,146	Seattle, Everett	Government
Group Health Cooperative	6,587	Seattle	Health Care
Seattle Public Schools	6,317	Seattle	Education
United Parcel Service	6,000	Seattle	Transportation/Logistics
Washington State University	5,915	Everett, Mt. Vernon	Education
Target	5,493	Seattle	Retail
Providence Everett Medical	3,500	Everett	Health Care
Tulalip Tribes Enterprises	3,200	Tulalip	Gaming/Retail
Snohomish County Government	2,700	Everett	Government
Harrison Hospital	2,442	Bremerton	Health Care
Premera Blue Cross	2,400	Everett	Health Care
Everett Clinic	2,150	Everett	Health Care
Everett School District	2,025	Everett	Education
Skagit Regional Health	2,000	Mount Vernon	Health Care
Philips Healthcare	1,900	Bothell	Medical Equipment
Central Kitsap School	1,469	Silverdale	Education
Olympic College	1,206	Bremerton	Education
South Kitsap School	1,176	Port Orchard	Education
Kitsap County Government	1,126	Port Orchard	Government

Source: 2016 Book of Lists, Puget Sound Business Journal; 2015 Comprehensive Financial Annual Report, Kitsap County; 2015 Comprehensive Financial Annual Report, Snohomish County; 2016 Economic Report, Skagit County. Compiled by Landrum & Brown.

Aerospace Industry

With 1,350 aerospace-related companies, the highest concentration of aerospace engineers in the world, and the largest aerospace workforce nationwide, the air service area is the center of commercial airplane production in the U.S. Aerospace production in the air service area also encompasses military aircraft, unmanned aerial systems, and space exploration vehicles. In total, air service area companies manufacture approximately 700 civilian and military aircraft (fixed wing and rotorcraft), and 700 unmanned aerial vehicles in a typical year.

The firms located in the air service area specialize in a diverse number of applications such as wing panels, composite materials, avionics, design, testing, and calibration. In addition to Boeing, Honeywell, and Crane, other aerospace companies with operations in the air service area include ATS, Esterline Control Systems, SANFRAN Aerospace Company, Zodiac Northwest Aerospace Technologies, Panasonic Avionics, Electroimpact, Dassault Systems, Mitsubishi Aircraft, Toray Composites, AIM Aerospace, and Collins Aerospace Systems. The local aerospace industry employs approximately 120,000 workers and generates approximately $85 billion in business revenue annually in the air service area.[6] Within Snohomish County alone, there are over 200 aerospace companies that employ approximately 43,900 people.[7]

Information Technology Industry

The air service area is internationally renowned as a hub for the information technology industry. IT jobs include software development, web services, interactive media technologies, wireless technologies, and smartphone applications among others. Led by homegrown firms such as Microsoft, Amazon, and Expedia, other tech companies that have operations in the air service area include Facebook, Google, Apple, Twitter, eBay, Salesforce.com, Groupon, Hulu, Jawbone, Zynga, and Adobe. These companies employ more than 165,000 workers and produce approximately $16 billion annually in IT exports. Established firms as well as startups are attracted by the talent pool that is generated by the air service area's universities and internationally recognized research institutions such as the University of Washington, Washington State University, DigiPen Institute of Technology, and the Allen Institute for Artificial Intelligence.[8]

Life Sciences Industry

The air service area has a large cluster of life sciences firms which have developed innovations such as medical ultrasound, the portable heart defibrillator, and predictive/preventive medicine driven by genomics. Generally, these life sciences companies and institutions are focused on research and development (R&D) and medical equipment and devices. Private sector firms such as Philips Healthcare, CMC Biologics, Sonosite, Juno Therapeutics, and others generate total annual revenue of approximately $25 billion. Research institutions include the Fred Hutchinson Cancer Research Center, Allen Institute for Brain Science, University of Washington, and the Pacific Northwest National Laboratory. Led by the Gates Foundation, approximately 170 organizations in Washington promote improvements to global health. The air service area's life sciences industry employs approximately 29,000 workers.[9]

Tourism Industry

PAE has numerous attractions such as the Future of Flight Aviation Center & Boeing Tour, the Museum of Flight Restoration, and Paul Allen's Flying Heritage Collection and Combat Armor Museum. Sightseeing destinations in Snohomish County include downtown Snohomish (the antiques capital of the Pacific Northwest with 350 dealers), Tulalip Resort Casino, Imagine Children's Museum (largest children's museum in the state), Serpentarium/The Reptile Zoo (most extensive collection of reptiles in the Pacific Northwest), and The Outback Kangaroo Farm.

Arts and performing arts are found at Schack Arts Center (workshops and gallery), Pilchuck Glass School, Everett Performing Arts Center, and Edmonds Center for the Arts.

Snohomish County has numerous museum and heritage sites such as the Historic Mukilteo Lighthouse, Tulalip Tribes' Hibulb Cultural Center, Western Heritage Center Interactive Museum, Stillaguamish Valley Pioneer Museum, Snohomish County Historical Society Museum, Blackman House Museum, and Heritage Park.

Refuges for wildlife viewing include; Jetty Island, Snohomish River Estuary ("Everett Everglades," largest wetland in Puget Sound), Edmonds Underwater Park, and Edmonds Marsh Wildlife Sanctuary. Outdoor recreation activities in Snohomish County range from golf, cycling, hiking, whale watching, birding and whitewater rafting to kayaking, kiteboarding, skydiving, hot air ballooning, and rock climbing.[10]

Beyond Snohomish County, travelers can enjoy visiting the Seattle Space Needle, Pike Place Market, Seattle Waterfront, Pioneer Square, Seattle Great Wheel, Chief Seattle Statue, Seattle Sculpture Park, Discovery Park, Chinatown, Tillicum Village, Smith Tower, Seattle Central Monorail, Seattle Aquarium, Pacific Bonsai Museum, Chihuly Garden and Glass, and Woodland Park Zoo,

The air service area is home to a rich variety of cultural and educational attractions. These include the Seattle Central Library, Seattle Art Museum, Seattle Asian Art Museum, Wing Luke Museum of the Asian Pacific American Experience, Burke Museum of Natural History and Culture, Pacific Science Center, Museum of History & Industry, Northwest African American Museum, Living Computer Museum, Museum of Pop Culture, Henry Art Gallery, LeMay American Car Museum, and the Northwest Railway Museum.

The air service area's performing arts offerings include Pacific Northwest Ballet, Seattle Symphony, Seattle Opera, Seattle Chamber Music Society, Seattle Repertory Theatre, and Teatro ZinZanni. The air service area also hosts the two-week Seattle International Film Festival, the country's largest international film festival, as well as the two-week Seattle International Dance Festival.

Tourists and business travelers can also explore major outdoor attractions in and around the air service area such Mt. Rainier, Snoqualmie Falls, Woodinville Wine Country, the San Juan Islands, and North Cascades National Park.

PAE is connected by ferry service (auto/passenger) to Island County (Clinton Ferry Terminal to Mukilteo Ferry Terminal) and Kitsap County (Port of Kingston to Edmonds Ferry Terminal). Clinton is located on the southern end of the 55-mile long Whidbey Island and provides easy access to the island's thriving arts community. In addition, a popular retirement destination, Whidbey Island is known as the largest artists' colony in Puget Sound. It offers galleries and studios, art classes, an historical museum, farm tours and farmers markets, beaches, kayaking, hiking, cycling, horseback riding, and whale watching. Whidbey Island is also the venue of numerous festivals throughout the year.[11]

Located on the Kitsap Peninsula, Kingston is a picturesque tourist and retiree community known as "The Monterey of Seattle."[12] Kingston is a gateway to the numerous state and national parks, forests, and wilderness areas of the Olympic Peninsula. These include Olympic National Park, Olympic National Forest, and Washington Islands Wilderness. State parks include Fort Flagler, Fort Worden, Kitsap Memorial, Lake Cushman, Manchester, Mystery Bay, Old Fort Townsend, Potlatch, Sequim Bay, Shine Tidelands, and Triton Cove. In addition to its scenic beauty, visitors to Kitsap County can enjoy birdwatching, wildlife viewing, hiking, camping, cycling, diving, fishing, sea kayaking, golf, accessible coastline, lighthouses, historic sites, museums, and festivals.[13]

Professional and major university sports teams based in the air service area include the University of Washington Huskies; Minor League Baseball's Everett Aquasox (A) and Tacoma Rainiers (AAA); the National Football League's Seattle Seahawks; Major League Baseball's Seattle Mariners; Major League Soccer's Seattle Sounders FC; the National Hockey League (NHL) Hockey Team the Seattle Kraken; the Women's National Basketball Association (WNBA) franchise the Seattle Strom, and the National Women's Soccer League's OL Reign.

In addition, the Seattle Thunderbirds and Everett Silvertips are junior ice hockey teams in the Western Hockey League.

Numerous travel magazines and web sites such as *U.S. News & World Report*, *Travel + Leisure*, *Lonely Planet*, *Condé Nast Traveler*, *National Geographic*, *Outside*, and TripAdvisor.com have named Seattle a top destination. Seattle has also been cited for its leading restaurants, distilleries, outdoor recreation, cycling, seafood, culture, music festivals, sustainability, walkability, scenery, and aviation attractions by BusinessInsider.com, *Forbes*, WalletHub.com, *Food & Wine*, Inc.com, *The New York Times*, *Women's Running*, *Zagat*, Shape.com, *Cruise Critic*, *USA Today*, *Time*, Thrillist.com and others.[14]

The air service area's wide array of cultural choices and entertainment options is an important factor supporting repeat visitation. The ability to see attractions or undertake activities that were missed on a previous visit has been cited as a significant element in a visitor's intent to return to a travel destination.[15]

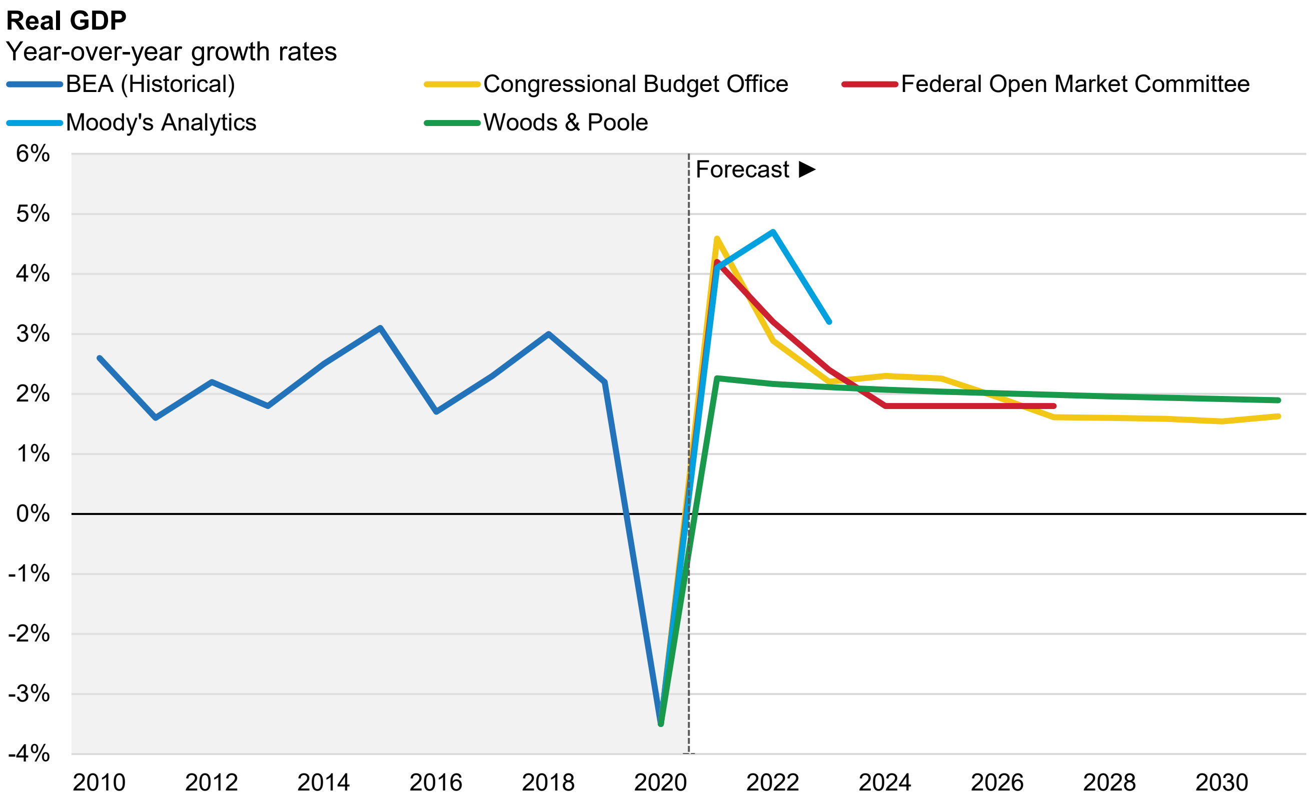
3.1.5 Post-COVID: Recent Economic Trends and Updated Economic Forecasts

The following section summarizes recent national economic forecasts, in addition to reviewing recent forecasts prepared by the King County Office of Economic and Financial Analysis. The King County forecast focused upon key economic metrics over the next ten years. It was completed in March 2021 and takes into account recent pandemic impacts.

3.1.5.1 Real GDP Growth Forecasts: Recent National Forecasts

Exhibit 3-2 shows real GDP growth forecasts for the U.S. between 2021-2031 from the Congressional Budget Office (CBO), Federal Open Market Committee (FOMC), Moody's Analytics, and Woods & Poole Economics. For the year of 2021, real GDP growth forecasts range from 2.3% (Woods & Poole Economics) to 4.6% (CBO); Moody's expects real U.S. GDP to grow at a rate of 4.1% and the FOMC projects 4.2% growth. While Moody's predicts real GDP growth of 4.7% in 2022, the other forecasters expect real GDP growth in 2022 to range from 2.2% (Woods & Poole Economics) to 2.9% (CBO) to 3.2% (FOMC). The forecasts project lower real GDP growth in 2023, 2024, and 2025 compared to 2022. From 2026-2031, the CBO, FOMC, Moody's, and Woods & Poole Economics forecasts expect real GDP growth in the U.S. to range from 1.5% to 2.0%.

Exhibit 3-2 U.S. Real GDP Growth Forecast



Sources: Bureau of Economic Analysis, Annual Real Gross Domestic Product, Chained 2012 Dollars, January 2021; Congressional Budget Office, Budget and Economic Data, 10-Year Economic Projections, February 2021; Board of Governors of the Federal Reserve System, Federal Open Market Committee, Summary of Economic Projections, December 2020; Moody's Analytics, U.S. Real Gross Domestic Product Forecast, December 2020. Compiled by Landrum & Brown, February 2021

The most recently published forecast by business economists from the National Association for Business Economics (NABE) indicates consensus for real GDP growth of 3.8% in 2021 and an average annual U.S. unemployment rate of 6.3%.[16]

3.1.5.2 King County Economic Forecasts

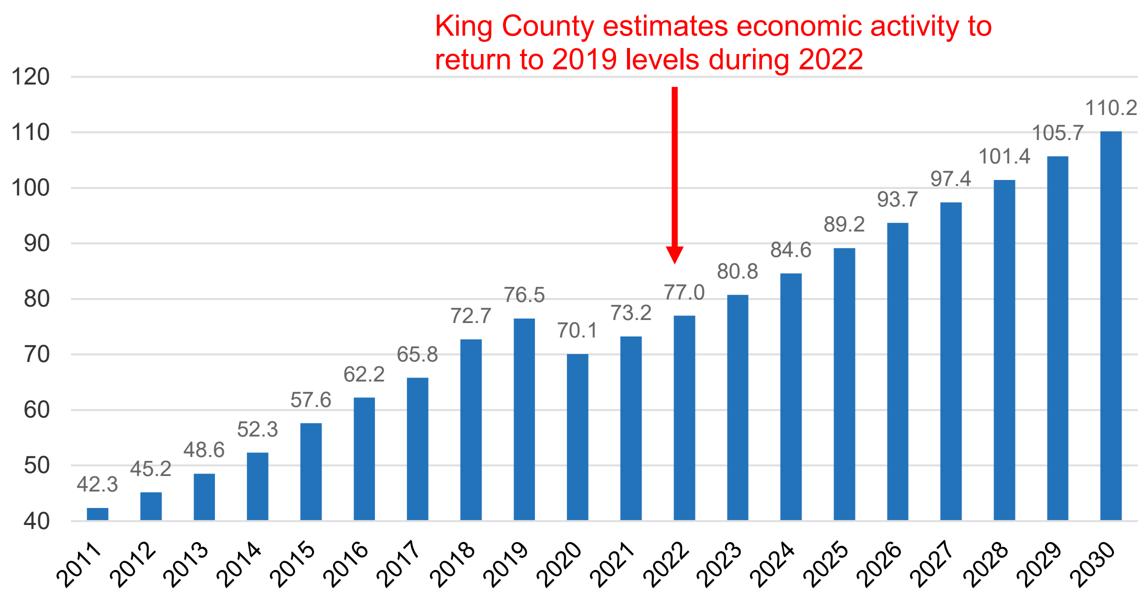
The King County forecasts were used for 3 reasons: 1) Northern King County will contribute a significant portion of PAE air traffic, 2) King County is a key economic driver from the region. Historically, if King County is generating strong economic activity, the rest of the region is also growing. 3) This forecast was completed In March 2021, which was very timely with regard to the impact of COVID-19 upon the region.

The King County economy suffered massive contractions early on after the pandemic but has partially recovered as shown in **Exhibit 3-3**. King County unemployment peaked at 14.9% in the 2nd Quarter of 2020 but is now back to roughly 6% (March 2021). While overall taxable sales fell 8.4% in 2020 and employment fell 5%, different sectors of the economy have been affected far differently. Information industry jobs stood at about 127,000 in King County pre-pandemic and ended the year at just over 130,000.

Construction jobs were at approximately 80,000 pre-COVID-19; these jobs fell to 65,000 shortly thereafter but have increased sharply since, ending the year at about 85,000. Home prices are also up 13% year over year.

Manufacturing jobs fell from about 102,000 pre-COVID-19 to just over 90,000 at year-end, although have grown slightly over the past two to three months. The biggest hit was taken by the leisure and hospitality industry, where jobs stood at 140,000 pre-COVID-19, bottomed at just over 80,000 in the 2nd Quarter of 2020, and have only risen marginally since, now at 90,000.

Exhibit 3-3 King County: Sales and Use Taxes (in Billions) 2011-2030

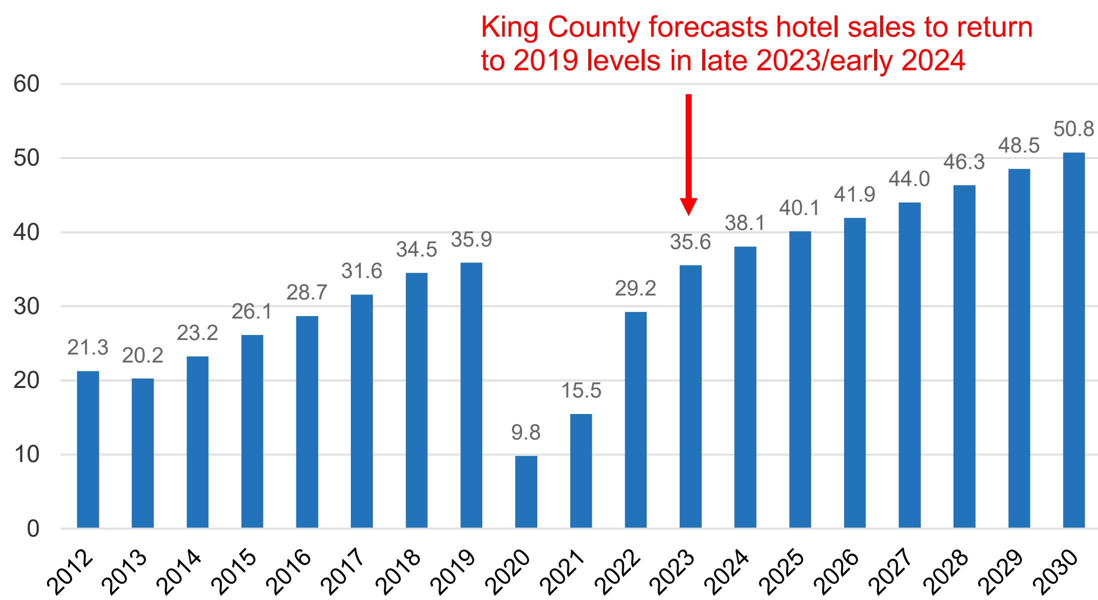


Source: King County Office of Economic and Financial Analysis (March 2021)

King County consumer spending fell almost 40% during the first month of the pandemic with almost all segments down similarly. As the economy slowly opened, spending improved with King County taxable sales down 10% to 15% from July until October. Since then, taxable sales have further improved, ending the year down 8.71%. Going forward it is estimated that taxable sales will get back to 2019 levels by the end of 2022. This is a year earlier than the most recent forecast that was completed in August 2020. The change in the forecast was based upon an earlier and more effective vaccine rollout than was considered in August. In addition, the regional and national economies have bounced back quicker than originally estimated.

As shown on **Exhibit 3-4**, the King County Office of Economic and Financial Analysis forecasts that hotel stays will return to 2019 levels by late 2023 (or 2024 on a full year basis). Over the entire 11-year period (2030 vs 2019) they are estimating that hotel sales taxes will increase at a 3.21% CAGR. Closer-in, after declining 72.7% in 2020, it is expected that hotel sales will grow 58.16% in 2021, 83.9% in 2022 and 21.92% in 2023. The 11-year growth rate is less than half the 7.7% growth rate generated between 2011 and 2019. It would be expected that air travel demand would somewhat reconcile to hotel stay activity.

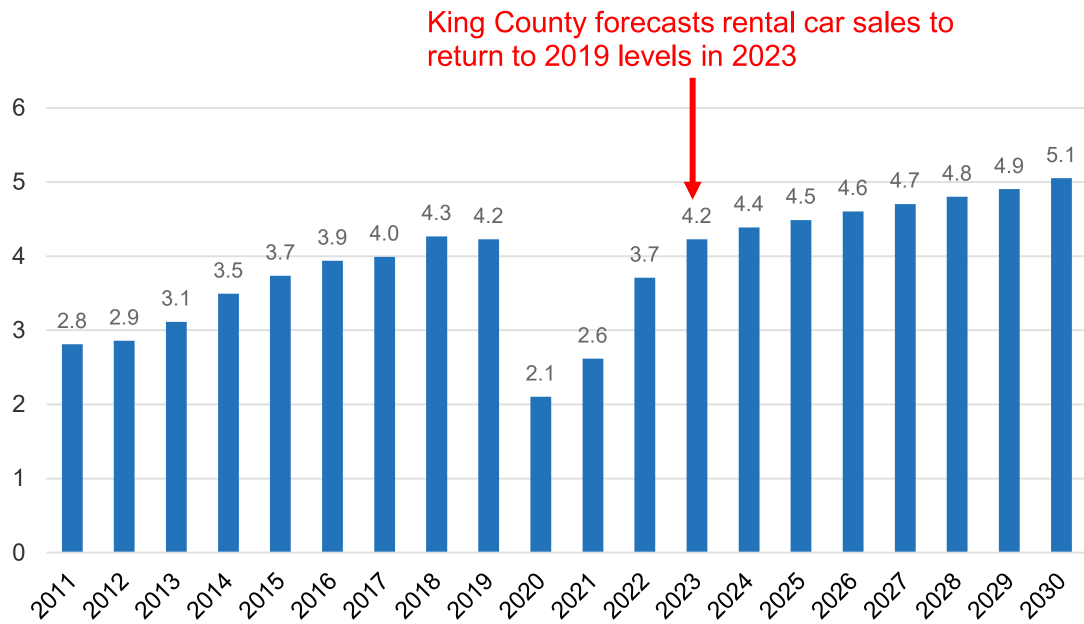
Exhibit 3-4 King County: Hotel Sales Tax (in Millions) 2012-2030



Source: King County Office of Economic and Financial Analysis (March 2021)

In addition, a forecast was done of rental car activity (see **Exhibit 3-5**). Rental car activity increased at a 5.2% CAGR from 2011 through 2019. Then with the pandemic, rental car activity declined 50.0% in 2020, increasing in 2021 and 2022, and getting back to 2019 levels in 2023. From 2019 to 2029, the CAGR is 1.78%. The divergence between hotel stays and rental car activity is likely tied to increased Uber and Lyft activity by visitors to the Seattle region.

Exhibit 3-5 King County: Rental Car Sales Tax (in Millions) 2012-2030



Source: King County Office of Economic and Financial Analysis (March 2021)

To review, King County is estimating hotel activity to increase at a 3.21% CAGR and rental car activity to increase at a 1.78% CAGR from 2019 to 2030, even after considering the massive 2020 decline. For comparative purposes, total passenger volume at SEA increased at a 6.9% CAGR over the past five years, 4.9% over the past ten years and at a 3.0% CAGR over the past twenty years. Likewise, SEA's Domestic origin and destination (O&D) passengers have grown at a 2.6% CAGR over the past twenty years and a 4.4% CAGR over the past ten years. It is this domestic market that PAE will cater to.

Air travel demand forecasts can generally be expected to track rental car and particularly hotel forecasts. The King County forecasts predict travel indicators will return to 2019 levels by 2023 or 2024. This ties closely to industry forecasts, which generally assume a return to 2019 levels in 2024 (some are summarized on page 49).

In summary, while the U.S. and Seattle economies have been hit hard by the COVID-19 pandemic, the fundamentals of the Seattle economy remain strong. The Seattle tech sector, particularly the cloud computing industry has likely benefited from the pandemic, which has resulted in a quickening of what was an already fast-growing industry. The Seattle region's economy had been among the fastest growing in the U.S. over the past decade. This has been a function of a growing, young, highly educated population base that benefits from very high incomes – resulting in GDP growth that is two times the levels of the broader U.S. market. Given the market's strength, it is likely that this growth will continue in a post-COVID-19 environment, resulting in the Seattle market bouncing back more quickly than the general U.S. market, as supported by the King County forecast.

Currently, most industry forecasts are estimating a return to 2019 levels by 2023 or 2024, although the current bounce back in traffic demand has been better than expected. Alaska Airlines has indicated that they expect their system traffic to return to 2019 levels by sometime in 2022.

3.2 Passenger Trends and Air Service at Seattle-Tacoma International Airport

The future of PAE passenger demand levels will be determined by the strength of, and growth in, air travel demand to and from the Seattle Metropolitan Area. As such, this section evaluates and describes the state of air service at SEA, focusing upon pre-COVID-19 periods, as that will likely be the most indicative of what air travel will look like over the entire forecast period. Additionally, a short section will also evaluate the post-COVID-19 period, including benchmarking Seattle versus other large U.S. airports and the U.S. in general.

3.2.1 Air Service Traffic Trends and Analysis

Per the U.S. Department of Transportation (DOT) Report T-100 and shown below in **Table 3-9**, approximately 49.8 million passengers were generated at SEA in the 12-month period ending December 31, 2019, ranking SEA as the 8th largest airport in the U.S.[17] Of this passenger traffic, approximately 32.2 million (65%) were origin and destination (O&D) passengers, which ranks SEA as the 11th largest O&D airport in the U.S.

Table 3-9 Top 20 U.S. Airport Passenger Rankings (Calendar Year 2019)

Rank	Airport	Code	Total Passengers	Passenger Rank	Total O&D Passengers	O&D Rank
1	Atlanta GA	ATL	107,052,888	1	39,231,469	5
2	Los Angeles CA	LAX	86,021,956	2	53,220,703	1
3	Chicago IL	ORD	81,222,342	3	41,730,771	3
4	Dallas-Fort Worth TX	DFW	71,365,794	4	30,494,816	12
5	Denver CO	DEN	67,043,320	5	41,791,900	2
6	New York-JFK NY	JFK	62,033,880	6	33,563,250	8
7	San Francisco CA	SFO	55,422,174	7	35,572,857	7
8	**Seattle WA**	**SEA**	**49,743,264**	**8**	**32,239,604**	**11**
9	Las Vegas NV	LAS	49,175,574	9	39,052,325	6
10	Orlando FL	MCO	49,015,230	10	41,060,484	4
11	Charlotte NC	CLT	48,152,622	11	14,645,002	29
12	Newark NJ	EWR	45,846,218	12	32,815,249	10
13	Phoenix AZ	PHX	44,891,786	13	29,086,596	13
14	Houston-Intercontinental TX	IAH	43,465,772	14	20,166,799	21
15	Miami FL	MIA	42,369,350	15	20,798,984	19
16	Boston MA	BOS	41,163,874	16	33,414,325	9
17	Minneapolis MN	MSP	37,956,300	17	22,958,696	16
18	Detroit MI	DTW	35,977,588	18	20,564,790	20
19	Fort Lauderdale FL	FLL	35,786,234	19	27,460,619	14
20	Philadelphia PA	PHL	31,788,866	20	21,369,052	18

Source: Diio Mi. Compiled by Landrum & Brown.

SEA predominately serves domestic traffic, which comprised approximately 90% of its passenger traffic in calendar year (CY) 2019. Historically, SEA has primarily served O&D traffic. This is largely a result of SEA's geographic location, which limits domestic connecting traffic opportunities. Recently, however, connecting traffic has increased due largely to the growth of Delta Air Lines at SEA.

SEA also ranks highly in terms of air cargo and aircraft operations. SEA ranked as the 20th busiest cargo airport in the U.S per Airports Council International-North America (ACI-NA) data, with approximately 354,541 metric tons of freight and mail in CY 2018 (most current). ACI-NA data also indicates SEA had 331,408 aircraft movements or operations in CY 2018, ranking SEA 13th in the U.S. **Table 3-10** presents ACI-NA's rankings for cargo and aircraft movements. SEA's cargo results are largely driven by Asian markets, particularly as it pertains to linking supply chains, with an emphasis from the region's tech sector.

Table 3-10 Top 25 U.S. Airport Cargo and Aircraft Movement Rankings (CY 2019)

Rank	Airport	Code	Metric Tons	Rank	Airport	Code	Aircraft Movements
1	Memphis TN	MEM	4,322,740	1	Chicago IL	ORD	919,704
2	Louisville KY	SDF	2,790,109	2	Atlanta GA	ATL	904,301
3	Anchorage AK	ANC	2,745,348	3	Dallas/Fort Worth	DFW	720,007
4	Miami FL	MIA	2,092,472	4	Los Angeles CA	LAX	691,257
5	Los Angeles CA	LAX	2,091,622	5	Denver CO	DEN	631,955
6	Chicago IL	ORD	1,758,119	6	Charlotte NC	CLT	578,263
7	New York NY	JFK	1,311,164	7	Las Vegas NV	LAS	552,962
8	Cincinnati OH	CVG	1,132,643	8	Houston TX	IAH	478,070
9	Indianapolis IN	IND	917,006	9	San Francisco CA	SFO	458,496
10	Dallas/Fort Worth TX	DFW	893,441	10	Phoenix AZ	DVT	456,790
11	Newark NJ	EWR	805,537	11	New York NY	JFK	456,060
12	Ontario CA	ONT	700,050	12	Toronto ON	YYZ	453,040
13	Atlanta GA	ATL	640,276	**13**	**Seattle WA**	**SEA**	**450,487**
14	Oakland CA	OAK	587,015	14	Newark NJ	EWR	446,320
15	Philadelphia PA	PHL	551,112	15	Phoenix AZ	PHX	438,891
16	San Francisco CA	SFO	546,436	16	Boston MA	BOS	427,176
17	Honolulu HI	HNL	545,227	17	Miami FL	MIA	416,773
18	Toronto ON	YYZ	516,020	18	Minneapolis MN	MSP	406,076
19	Houston TX	IAH	513,378	19	Detroit MI	DTW	396,909
20	**Seattle WA**	**SEA**	**453,549**	20	Philadelphia PA	PHL	390,321

Source: Airports Council International-North America, http://www.aci-na.org/content/airport-traffic-reports (accessed February 2021). Compiled by Landrum & Brown.

In terms of aircraft movements, SEA's #13 ranking is a bit below both SEA's total passenger and O&D passenger rankings. This is because SEA's average gauge (aircraft size) is relatively large, particularly with regard to international operations. In terms of scheduled departing seats for CY 2019, SEA ranked as the 8th largest airport in the U.S., consistent with their passenger ranking.

While SEA is among the nation's largest airports, it has also been among the fastest growing. As shown in **Table 3-11**, SEA was the 5th fastest growing airport in the U.S. in terms of the total change in the number of passengers over the past ten years.

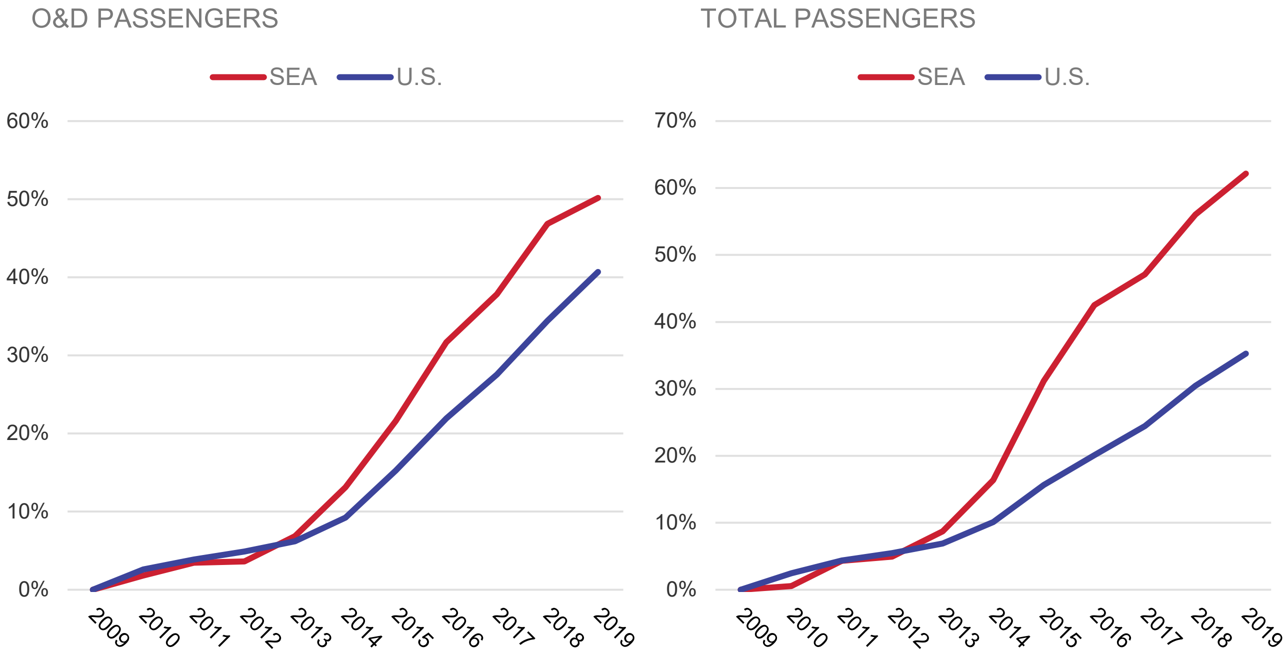
Since 2009, as shown in **Exhibit 3-6**, SEA's total passengers have grown about twice as fast as compared to the U.S. in aggregate, while O&D passenger growth has grown about 25% faster as compared to the U.S. This relatively strong growth is a function of both SEA's economic growth, in addition to the buildup of Delta Air Lines at SEA, which generated growing connecting traffic volumes.

Table 3-11 Top 20 Fastest Growing Large & Medium Hub Airports – Total Passengers (3rd Quarter 2019 vs 3rd Quarter 2009)

Rank	Market	Code	Total Passengers			
			3Q 2019	3Q 2009	Change	% Change
1	Los Angeles	LAX	22,414,232	14,204,998	8,209,236	58%
2	Atlanta	ATL	28,175,762	21,955,806	6,219,956	28%
3	Chicago-O'Hare	ORD	21,650,348	16,390,304	5,260,044	32%
4	San Francisco	SFO	14,643,706	9,552,404	5,091,304	53%
5	**Seattle**	**SEA**	**12,927,088**	**7,943,786**	**4,983,302**	**63%**
6	Denver	DEN	17,278,434	12,476,486	4,801,950	38%
7	New York-JFK	JFK	16,429,702	11,774,050	4,655,652	40%
8	Boston	BOS	11,124,870	6,549,674	4,575,196	70%
9	Dallas-Fort Worth	DFW	18,311,476	13,821,910	4,489,566	32%
10	Fort Lauderdale	FLL	9,110,000	5,100,338	4,009,662	79%
11	Orlando	MCO	12,574,422	8,596,886	3,977,536	46%
12	Charlotte-Douglas	CLT	12,401,554	9,111,970	3,289,586	36%
13	Newark	EWR	11,945,104	8,714,028	3,231,078	37%
14	Newark-La Guardia	LGA	8,144,656	5,582,752	2,561,904	46%
15	Las Vegas	LAS	12,733,626	10,274,264	2,459,362	24%
16	Miami	MIA	10,436,500	7,993,594	2,442,906	31%
17	Nashville	BNA	4,811,560	2,483,754	2,327,808	94%
18	Austin	AUS	4,502,816	2,175,516	2,327,300	107%
19	Dallas Love Field	DAL	4,241,340	2,118,526	2,122,814	100%
20	San Diego	SAN	6,565,416	4,463,286	2,102,130	47%

Source: Diio Mi. Compiled by Landrum & Brown.

Exhibit 3-6 Total O&D and Total Passenger Growth – SEA vs U.S. (Indexed to 2009)



Source: Diio Mi. Compiled by Landrum & Brown.

Historically, connecting traffic growth at SEA has been driven largely by Alaska Air Group's hub operation and most recently by Delta Air Lines. Delta started a hub operation at SEA in 2014 and has subsequently added several nonstop flights to multiple domestic and international destinations. From 2013 to 2019, Delta's seat capacity is up 202% at SEA. PAE is not expected to serve connecting passenger traffic and is expected to almost exclusively serve domestic O&D passenger traffic, particularly in high demand routes such as Los Angeles (LAX), San Francisco (SFO) and Portland (PDX), in addition to selected leisure destinations such as Las Vegas (LAS) and Phoenix (PHX). Alaska Air Group is likely to use PAE to partially augment current domestic service from SEA.

SEA's growth in passenger volume has been in both O&D and connecting passengers over the last five years. O&D passengers at SEA have increased at a CAGR of 5.9%, whereas connecting passengers have increased at a CAGR of 9.1%. As shown in **Table 3-12** below, Alaska Air Group and Delta Air Lines were the primary airlines contributing to this increase in passenger volume. Most of Alaska Air Group's traffic gains have been driven by SEA O&D traffic, while Delta Air Lines' traffic gains have primarily been driven by connecting traffic (see **Exhibit 3-7**).

Exhibit 3-7 SEA Five-Year O&D and Connecting Passengers (in millions)

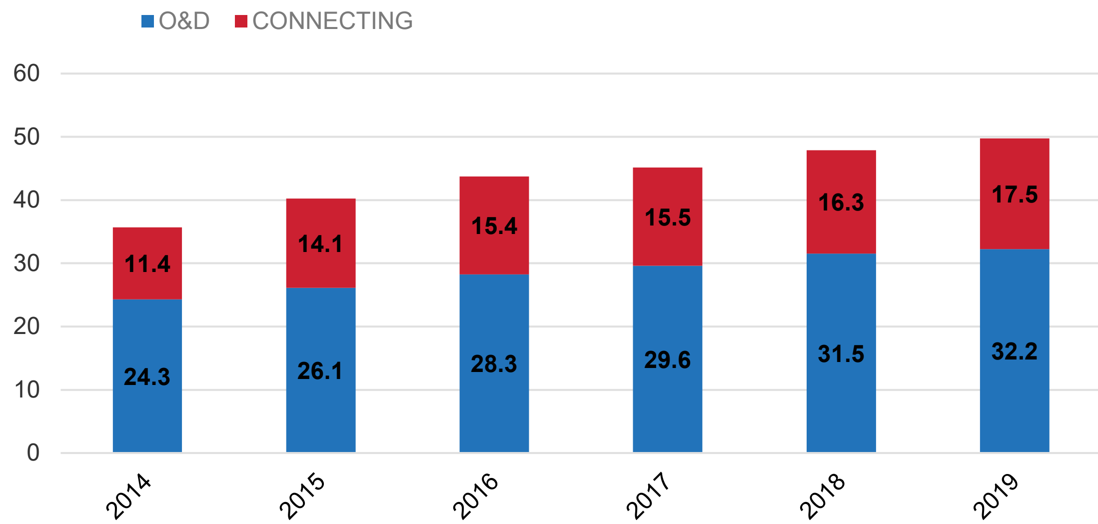


Table 3-12 Change in SEA Passengers by Airline by Traffic Type (2019 vs 2014)

Airline	O&D	Connecting	Total
Alaska Air Group	4,496,756	1,797,314	6,294,070
Delta Air Lines	3,326,022	3,233,478	6,559,500
All Other*	130,262	1,065,778	1,196,040
Total	**7,953,040**	**6,096,570**	**14,049,610**

Source: Diio Mi. Compiled by Landrum & Brown.

* Connecting traffic includes international traffic on foreign flag carriers that isn't accounted for in O&D figures.

3.2.2 SEA Top O&D Markets

Approximately 65% of SEA's passenger activity consisted of O&D passengers in 2019. **Table 3-13** presents SEA's top 20 O&D markets, including passenger activity and the average directional fare paid (net of taxes and fees) for CY 2019. The table also presents daily departures and daily nonstop seats for each market. Nonstop flights operated in all of SEA's top 25 O&D markets in 2019, and all but nine of SEA's top 100 O&D markets were also served with nonstop flights in 2019 before COVID-19.

Table 3-13 SEA Top 25 O&D Markets (Calendar Year 2019)

Rank	Market	Miles	Avg Daily O&D Passengers	Avg Fare	Avg Daily Depts	Avg Daily Seats
1	Los Angeles[1]	954	4,561	$129	49.1	6,920
2	SF Bay Area[2]	679	2,724	$124	36.8	5,397
3	Las Vegas	866	1,890	$99	19.2	3,090
4	New York[3]	2421	1,742	$238	14.5	2,482
5	Phoenix	1107	1,731	$116	17.0	2,803
6	San Diego	1050	1,507	$111	13.5	2,138
7	Denver	1024	1,407	$123	18.5	2,864
8	Chicago[4]	1721	1,334	$169	17	2,792
9	San Jose	697	1,312	$123	16.5	2,201
10	Dallas[5]	1660	1,082	$172	14.4	2,294
11	Sacramento	605	907	$103	14.7	1,866
12	Wash, D.C.[7]	2306	815	$253	7.0	1,148
13	Boston	2496	802	$232	6.2	1,028
14	Minneapolis	1399	730	$165	9.5	1,765
15	Spokane	223	716	$92	22.7	2,147
16	Honolulu	2677	706	$247	5.6	1,149
17	Salt Lake City	689	692	$150	11.9	1,782
18	Atlanta	2182	673	$272	8.8	1,677
19	Anchorage	1448	613	$187	19.4	3,298
20	Houston[6]	1874	607	$196	6.6	1,084
21	Boise	399	561	$88	15.1	1,301
22	Orlando	2553	542	$245	2.8	508
23	Kahului	2640	473	$260	4.1	807
24	Austin	1770	470	$184	3.0	460
25	Detroit	1927	438	$232	6.3	1,191
Total/Average for all Markets		**1,496**	**44,164**	**$192**	**579.5**	**81,256**

1 Includes Los Angeles International (LAX), LA/Ontario International (ONT), John Wayne-Orange County (SNA), Long Beach (LGB), and Bob Hope (BUR) Airports.
2 Includes Metropolitan Oakland International (OAK) and San Francisco International (SFO).
3 Includes La Guardia (LGA), John F Kennedy International (JFK), and Newark Liberty International (EWR) Airports.
4 Includes Chicago O'Hare International (ORD) and Chicago Midway International (MDW) Airports.
5 Includes Dallas/Fort Worth International (DFW) and Dallas Love Field (DAL) .
6 Includes George Bush Intercontinental (IAH) and William P Hobby (HOU) Airports.
7 Includes Ronald Reagan Washington National (DCA) and Washington Dulles International (IAD) Airports.

Source: Diio Mi. Compiled by Landrum & Brown.

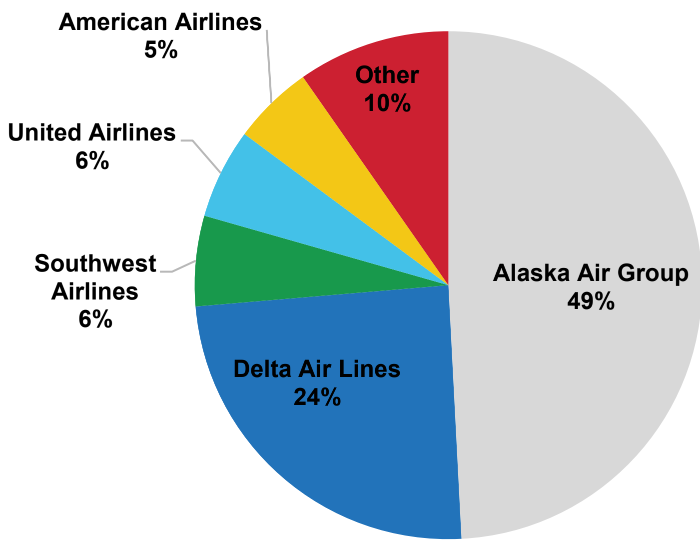
PAE markets that were flown in 2019 include many of SEA's top O&D markets (Los Angeles, San Francisco, Portland, San Jose, San Diego, Denver, Orange County and Spokane). PAE also served major destination markets such as Las Vegas, Phoenix and on a limited basis, Palm Springs.

3.2.2.1 Role as a Hub for Alaska Air Group

Alaska Air Group is the parent company for both Alaska Airlines and Horizon Airlines. SEA serves as a hub for these airlines. Alaska Air Group generated a system-wide operating profit margin of 12% in 2019. Historically, Alaska has been among the most profitable airlines in the U.S., with some of the strongest finances. In general, Alaska Airlines serves the longer-haul, larger markets from SEA; whereas, Horizon Airlines typically serves smaller markets and closer-in markets.

For the calendar year 2019, Alaska and Horizon had a combined market share of roughly 49% of SEA's total passengers, as shown in **Exhibit 3-8**. SEA is by far Alaska Air Group's most important market and drives their profitability. Combined with recently added Oneworld Alliance partner American Airlines, the two comprise approximately 54% of passenger traffic. With the recent added capacity from American Airlines, this market share will likely increase going forward.

Exhibit 3-8 SEA Passenger Market Share (Calendar Year 2019)



Notes: 1. Regional affiliates, as applicable, have been included with their appropriate mainline partner.
2. American Airlines data includes data for the former US Airways, which was merged with American Airlines in April 2015.
3. Amounts may not add due to rounding.

Source: Diio Mi. Compiled by Landrum & Brown.

Table 3-14 illustrates how important the SEA market is to Alaska. As shown, for the 12-month period ending December 31, 2019, the SEA O&D market generated more than two times as much as the 2nd ranked airport in Alaska's system (Portland). Seattle is larger than the next two largest airports combined in their system and is 86% as large as the next three combined. The long-term viability of the Seattle market is integral to the long-term success of Alaska Air Group.

Table 3-14 Alaska Air Group – Top O&D Airports (Calendar Year 2019)

Rank	Market	Round Trip (Calendar Year 2019)		
		O&D Passengers	Fare	Revenue
1	**Seattle**	**14,665,058**	**$322**	**$2,356,959,946**
2	Portland	6,408,646	$308	$985,683,270
3	San Francisco	5,721,630	$302	$864,401,936
4	Los Angeles	5,397,166	$306	$825,287,244
5	San Diego	3,287,344	$284	$465,932,148
6	Anchorage	2,835,138	$440	$624,700,292
7	San Jose	2,651,922	$282	$374,689,306
8	Las Vegas	1,900,232	$240	$227,958,292
9	Orange County	1,638,018	$272	$222,689,668
10	New York-JFK	1,450,948	$416	$302,457,916

Source: Diio Mi. Compiled by Landrum & Brown

Delta Air Lines and Alaska Air Group had been long-term alliance partners, combining Alaska's extensive domestic network along the west coast with Delta's long-haul domestic network and particularly its international gateway to Asia. The partnership allowed for enhanced connectivity between the two airlines, in addition to worldwide frequent flier and lounge reciprocity agreements.

The partnership ended in 2017 and has subsequently resulted in Delta adding significant capacity into SEA from both a domestic and international perspective. While United's primary Asian gateway is from SFO, Delta plans to serve the fast-growing Asian market from both LAX and SEA on the west coast.

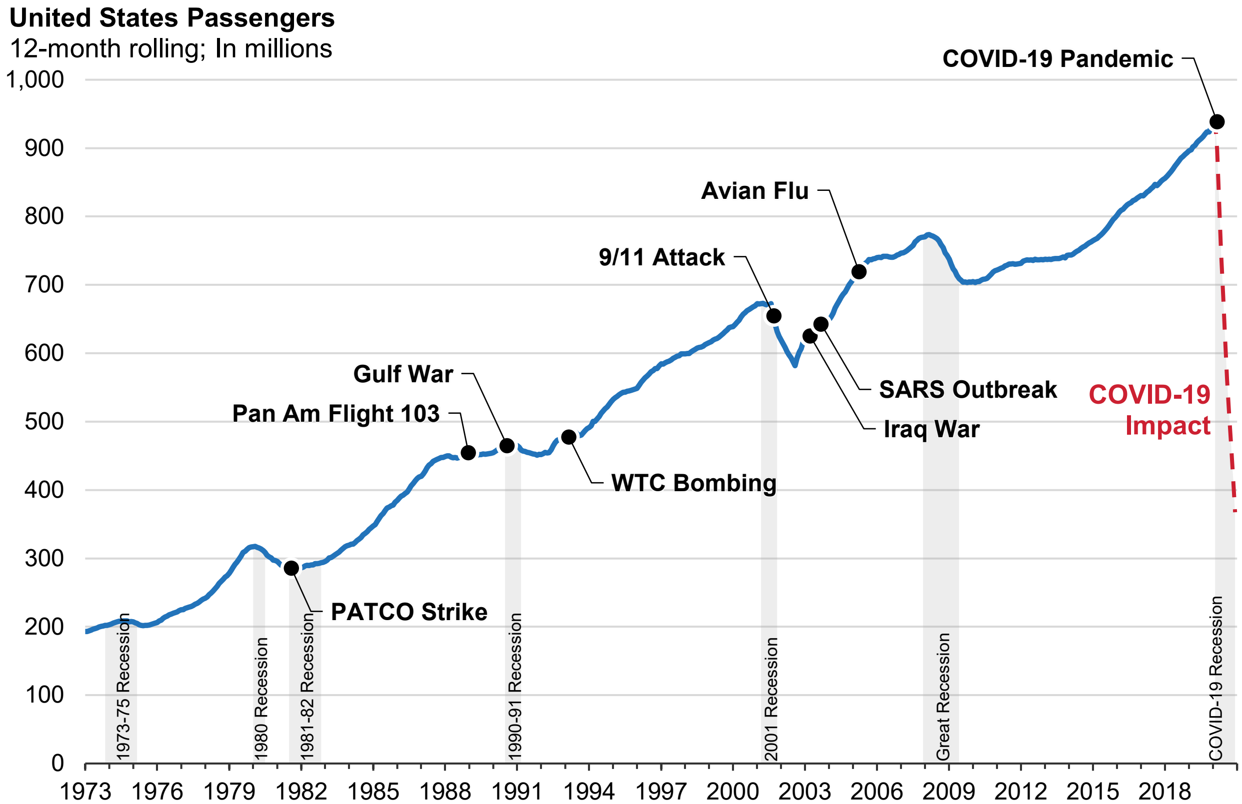
Both LAX and particularly SEA had been among Delta's fastest growing markets prior to the COVID-19 outbreak due to their strategic importance in serving Asia. While both markets have experienced significant capacity reductions due to COVID-19, based upon recent Delta scheduled capacity into both markets, it appears that the strategic importance of these two markets to Delta has not been diminished.

3.2.2.2 Capacity and Passenger Trends at SEA: Post-COVID

During the ten years prior to the COVID-19 pandemic, the Seattle Metropolitan Area had among the fastest growing economies in the U.S. In conjunction with that, air traffic into/out of SEA was also among the fastest growing in the U.S.

COVID-19 has had a devastating impact on economies across the U.S., including Seattle as noted earlier. The impact has been more impactful than prior industry shocks and will likely have a longer-term impact. **Exhibit 3-9** illustrates the impact of various shocks and recoveries to the U.S. aviation system. Nothing has been close to what COVID-19 has wreaked on the commercial aviation industry.

Exhibit 3-9 U.S. Aviation System Shocks and Recoveries



Note: Excludes non-revenue passengers.
Source: U.S. Bureau of Transportation Statistics, U.S. Air Carrier Traffic Statistics; National Bureau of Economic Research, U.S. Business Cycle Expansions and Contractions

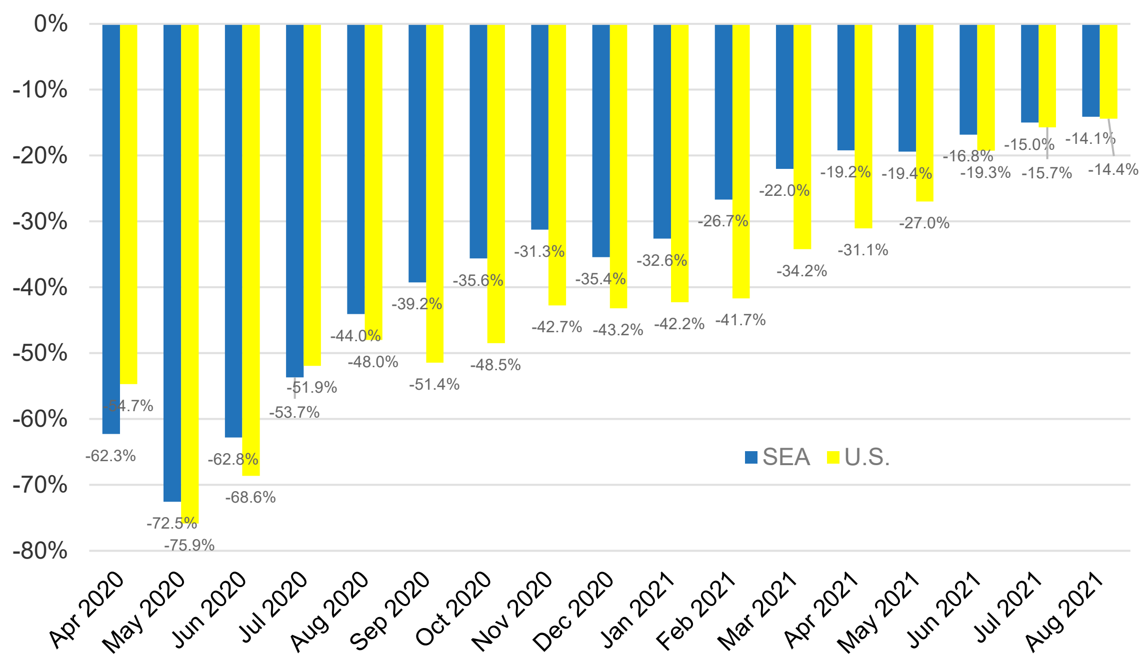
As shown in **Exhibit 3-10,** SEA has generally followed U.S. capacity trends during the pandemic, albeit with moderately higher capacity levels versus 2019. This has generally been because of Alaska Airlines not pulling capacity back as much as compared to Delta, United Airlines and American Airlines. This spread (SEA vs U.S.) has narrowed over the past few months as Delta, United Airlines and American Airlines started adding capacity back as traffic demand improved.

SEA passenger volumes have been down more than capacity. May 2021 passenger volumes at SEA were down 31.8% versus May 2019, while May 2021 year-to-date (YTD) traffic is down 45.9% versus May 2019 YTD. For SEA, this would imply that load factors dipped by about 16.5% versus May 2019. Through June 26, 2021, SEA passenger volumes are 30% below the same period for 2019.

SEA passenger comparisons to 2019 are again similar to U.S. results, where May 2021 YTD was down 46.8% versus May 2019 YTD and May 2021 was down 33% versus May 2019 (U.S. results based upon Transportation Security Administration -TSA (Throughput).

At the carrier level, Alaska has been the most aggressive, driving relative SEA results. For the most recent month where schedules are completed (August 2021), Alaska’s scheduled seat capacity at SEA is down about 3.3%, with Delta down 18.3% versus August 2019. All other airlines in aggregate are down 28% versus August 2019.

Exhibit 3-10 SEA and U.S. Scheduled Seat Capacity Change: 2020/2021 versus 2019



Source: Diio Mi. Compiled by Landrum & Brown.

3.2.3 Commercial Passenger Service at Paine Field Airport (PAE)

Commercial passenger service was initiated at PAE on March 4, 2019 by Alaska Air Group. United Airlines started service on the last day of March 2019. Over the 12-months ending March 3, 2020, PAE generated 1,022,046 passengers (round-trip; source: Snohomish County Airport files). During that time, Alaska Airlines served ten markets nonstop, while United Airlines served two markets nonstop.

The Airport reported that the two airlines generated 16,660 operations for the year-ending March 3, 2020. When accounting for United not serving PAE until the last day of the month and that Alaska did not fly its full schedule in March 2019, it is estimated that PAE would have had 17,344 commercial passenger operations for a typical 12-month period. All commercial passenger operations were on 76-seat Embraer 175 aircraft (E-175).

Once communication of PAE being open for commercial passenger service was made, the following airlines expressed interest in flying to PAE: Alaska Airlines, United Airlines, Southwest Airlines and Delta Air Lines. This was likely due to a very strong economic growth picture which was driving the strength of the Seattle air service market at SEA, with SEA's potential capacity limitations also being a factor.

Table 3-15 shows U.S. DOT Report T-100 operations and passengers at the route level for the year-ending February 2020. It should be noted that these figures do not match Airport figures, as T-100 is not available daily. It needs to be noted that Airport-reported statistics will be the most accurate available although that data is not available at the route level. To reiterate, PAE statistics indicate that 1,022,046 passengers were served during the first year of operations.

Table 3-15 PAE By Carrier and Route Overview (Year-ended February 2020)

Airline	Destination	Annual Operations	Total Passengers	Load Factor
Alaska Air Group	Spokane International (GEG)	230	14,187	81
	Las Vegas McCarran International (LAS)	1,410	91,970	86
	Los Angeles International (LAX)	2,221	133,674	78
	Portland International (PDX)	2,589	109,241	54
	Phoenix Sky Harbor (PHX)	1,086	72,342	88
	Palm Springs International (PSP)	229	14,532	75
	San Diego International (SAN)	1,419	89,752	82
	San Francisco International (SFO)	1,218	66,246	71
	San Jose International (SJC)	1,473	83,557	75
	John Wayne-Orange County (SNA)	704	44,378	83
United Airlines	Denver International (DEN)	1,344	84,813	84
	San Francisco International (SFO)	2,440	112,550	61

Source: Diio Mi. Compiled by Landrum & Brown

Carrier results indicate that PAE-served routes were generally solid for a first year of operation, with an overall load factor of 80.7%. After the first three months of operations, the overall PAE load factor never dropped below 77% until the pandemic hit in March 2020.

The targeted markets were typically high demand markets on the west coast. Most markets generated load factors near or above 80%. The exceptions were: PDX, which operated at a relatively low 55%. This low load factor occurred because four daily flights were offered in what is considered a high frequency feeder market by Alaska, in-part for connecting options over AS's PDX hub. SFO-PAE for United generated lackluster results. This was because this was a competitive route between Alaska and United, with Alaska having the advantage due to its relative strength from its SEA hub. The PAE market performed at or above airline expectations and over time is expected to accommodate high demand markets mostly along the west coast and the mountain region.

Table 3-16 below illustrates PAE's top O&D markets for the year-ending March 2020 and SEA's comparable O&D demand. The chart shows total passengers (both directions) and the average round-trip air fare net of taxes and fees. As shown, nonstop service was initiated at PAE in 11 of SEA's top 15 O&D markets.

Alaska Airlines (AS) is the key airline operating at PAE and this is expected to continue into the foreseeable future. While there were many reasons for AS targeting PAE, a key reason was that PAE created an avenue for AS to defend the broader Seattle (SEA/PAE) market from fast-growing and larger, Delta Air Lines.

Currently, Alaska Airlines enjoys strong brand loyalty from its frequent flyer base that resides largely in the southern half of the Seattle metro area. As the Seattle metro grows into the future, it is expected that the northern half of Seattle will experience most of this growth. This growth is expected to be generated by migration from other parts of the U.S. People moving to Seattle would most likely have strong tie-in's to other airline frequent flyer programs, due to Alaska Airlines relative position across most of the U.S. as compared to carriers like Delta.

Through the convenience of PAE, Alaska Airlines would naturally attract these new residents of Seattle, which would also result in these same travelers more likely to utilize Alaska Airlines at SEA. In other words, Alaska Airlines patronage at PAE is part of a larger strategic plan as it pertains to the entire Seattle market, which is a very important market to Alaska Airlines.

Table 3-16 Top PAE & SEA O&D Markets (Year-ended 1st Quarter 2020)

Destination	PAE		SEA	
	Passengers	Fare	Passengers	Fare
Los Angeles, CA, U.S.	122,062	$236	1,566,152	$248
San Francisco, CA, U.S.	103,110	$214	1,288,356	$252
San Diego, CA, U.S.	92,376	$222	1,054,020	$220
Las Vegas, NV, U.S.	91,364	$246	1,313,038	$194
Phoenix, AZ, U.S.	78,120	$262	1,221,694	$220
San Jose, CA, U.S.	76,450	$240	905,340	$242
Portland, OR, U.S.	64,194	$168	288,144	$222
Orange County, CA, U.S.	48,412	$302	739,732	$280
Denver, CO, U.S.	36,960	$250	987,154	$240
Palm Springs, CA, U.S.	18,664	$296	267,842	$270
Spokane, WA, U.S.	15,148	$158	501,978	$182
Oakland, CA, U.S.	5,482	$308	575,044	$228
Houston-Intercontinental, TX, U.S.	4,856	$328	382,688	$394
Orlando, FL, U.S.	4,146	$462	380,264	$494
Ontario, CA, U.S.	3,864	$252	321,432	$254
Honolulu/Oahu, HI, U.S.	3,842	$494	498,162	$490
Chicago-O'Hare, IL, U.S.	3,818	$334	828,264	$340
Austin, TX, U.S.	3,388	$382	335,950	$362
Tucson, AZ, U.S.	3,228	$264	155,804	$272
Kahului/Maui, HI, U.S.	3,066	$444	346,392	$498
Burbank, CA, U.S.	2,926	$254	377,268	$266
Cleveland, OH, U.S.	2,792	$408	111,666	$384
Dallas/Fort Worth, TX, U.S.	2,718	$340	585,614	$350
San Jose del Cabo, MX	2,688	$440	144,236	$424
Tampa, FL, U.S.	2,676	$318	227,024	$412
Puerto Vallarta, MX	2,610	$412	112,180	$426
Reno, NV, U.S.	2,570	$258	167,778	$274
Wichita, KS, U.S.	2,330	$344	49,392	$376
Atlanta, GA, U.S.	2,294	$458	471,102	$544
Mazatlan, MX	2,266	$444	16,128	$424
Sacramento, CA, U.S.	2,132	$258	638,954	$206
Boston, MA, U.S.	2,104	$518	565,772	$466
Salt Lake City, UT, U.S.	2,034	$296	497,756	$288
Omaha, NE, U.S.	1,998	$254	109,256	$320
Boise, ID, U.S.	1,932	$242	404,456	$172
Albuquerque, NM, U.S.	1,904	$282	151,060	$290
Washington-Dulles, VA, U.S.	1,896	$458	368,598	$478
Newark, NJ, U.S.	1,876	$452	466,386	$484

Source: Diio Mi. Compiled by Landrum & Brown

3.3 Seattle Metro Need for Additional Commercial Passenger Service Capacity

There are several factors that support the need for additional commercial service capacity from the region, including at PAE. Capacity constraints at SEA, in addition to worsening traffic congestion within the Seattle metropolitan area, make it difficult to get from the northern metropolitan area to SEA. The relative convenience offered by PAE will be a major factor in drawing air travelers to the Airport.

3.3.1 Gate Constraints at Seattle-Tacoma International Airport

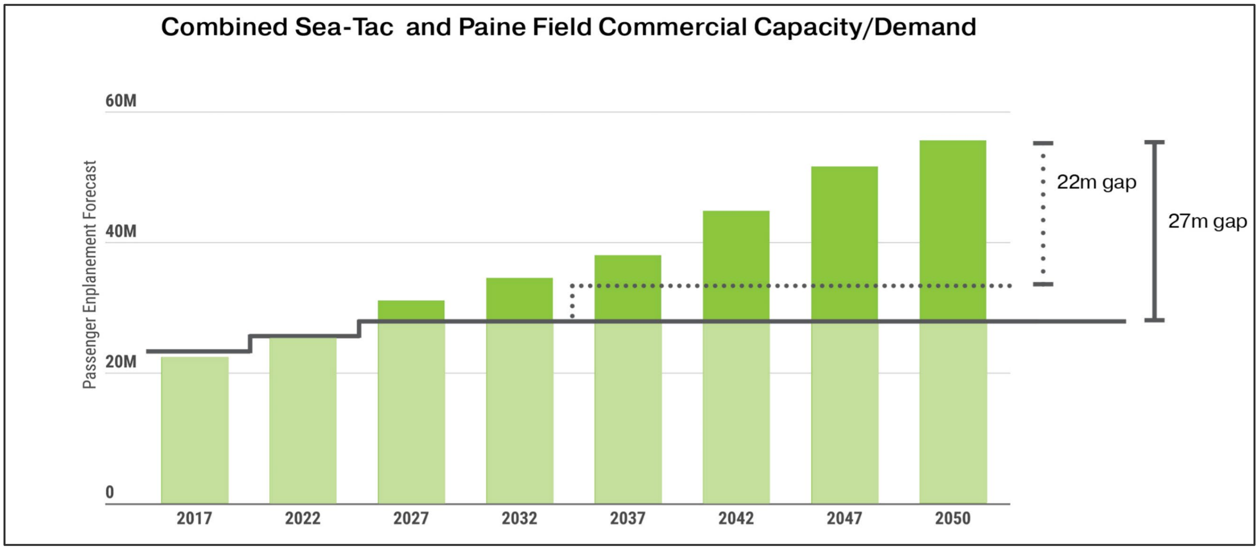
The Port of Seattle completed a Sustainable Airport Master Plan (SAMP) for SEA in May 2018. Prior to that, the last formal master plan for SEA was developed in the mid-1990s and was focused primarily on the third runway. Since 1995, passenger activity has more than doubled to 49.7 million annual passengers (MAP) in 2019 (source: U.S. DOT Report T-100).

Based on the SAMP, total passengers at SEA are projected to grow to 66 million annual passengers (MAP) by 2034. Accounting for COVID-19, this could arguably be pushed back to the 2037-38 time period. SEA's rapid growth has created challenges, particularly in the terminal with gates and ticket counter availability. While the Port is actively undertaking a number of major projects that will provide needed terminal-related capacity in the near-term (International Arrivals Facility (IAF), North Satellite Expansion (NSAT), and Baggage Optimization), SEA's facilities are becoming increasingly strained from the surge in activity. This is due in large part to a growing regional economy, steady growth from Alaska Air Group, and Delta Air Lines' increase in service as they build an international gateway hub.[18]

Based on the SAMP, SEA is expected to experience a severe shortage of aircraft contact gates over the next decade. The SAMP forecasts that 50% more aircraft parking positions will be needed by 2034 at SEA to accommodate the projected passenger growth. As a result, an additional 35-gate terminal is being considered to address the increased demand.

Still, a recent study conducted by the Puget Sound Regional Council, as illustrated in **Exhibit 3-11,** estimates that SEA may not be able to accommodate air travel demand as early as 2027 (2030-2032 when factoring in COVID-19). When considering longer-term considerations, the shortfall could reach 27 million (annual) enplaned passengers in 2050 and beyond. As shown in Exhibit 3-11, the solid horizonal line illustrates when SEA reaches capacity assuming that only shorter-term SEA projects are completed. The dotted line illustrates when SEA will hit capacity assuming that yet to-be-determined longer-term projects take place. The columns above the line illustrate unmet total passenger volumes. As shown, unmet passenger demand at SEA will be significant in the coming years.

Exhibit 3-11 Seattle Area Projected Passenger & Capacity Demand: Pre-COVID-19



Source: Puget Sound Business Council Aviation Study 2019

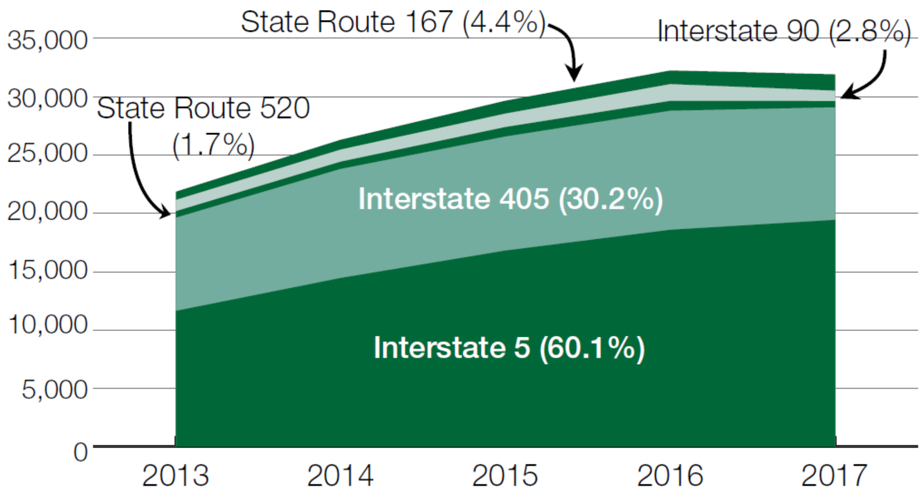
Given the current limitations and continued passenger growth, the need for additional terminal capacity within the Seattle region is expected to become exacerbated. While the timing of this shortage in needed airport capacity can be debated, it is likely to be a major issue over the next ten to twenty+ years.

3.3.2 Seattle Area Traffic Congestion

According to the TomTom Traffic Index (a top U.S. GPS manufacturer), Seattle ranks as the 4th most traffic-congested U.S. city, behind Los Angeles, San Francisco, and New York.[19] This same index found that drivers spent an average of 148 hours of extra travel time delayed in traffic, or roughly 30% more travel time than during uncongested periods. This results in approximately 39 minutes of extra travel time per day, during peak periods, for a one-hour drive during uncongested periods. These figures are consistent with a Washington State Department of Transportation (WDOT) study done in conjunction with the INRIX data company earlier in the decade. This study ranked Seattle as the 8th most traffic congested city in the U.S.[20]

As with most large, growing metropolitan areas, and in the absence of alternative transit solutions, traffic congestion generally worsens over time. According to the 2016 Corridor Capacity Report prepared by WDOT, of the five monitored freeway corridors in the central Puget Sound region, three (I-5, I-405 and I-90) saw congestion increases of 59%, 28% and 74%, respectively, compared to 2007 pre-recession levels.[21] **Exhibit 3-12** shows the increases in the number of vehicle hours of delay per weekday for I- 5, I-90, and I-405 and State Routes 167 and 520 from 2011 to 2015. As shown, traffic congestion on Interstates I-5 and I-405; the primary north/south highway routes in the region, increased by roughly 57% and 33%, respectively from 2011 to 2015. While more recent studies are not available, there is little doubt that congestion has worsened since then.

Exhibit 3-12 Central Puget Sound Vehicle Hours of Delay per Weekday (2013-2017)



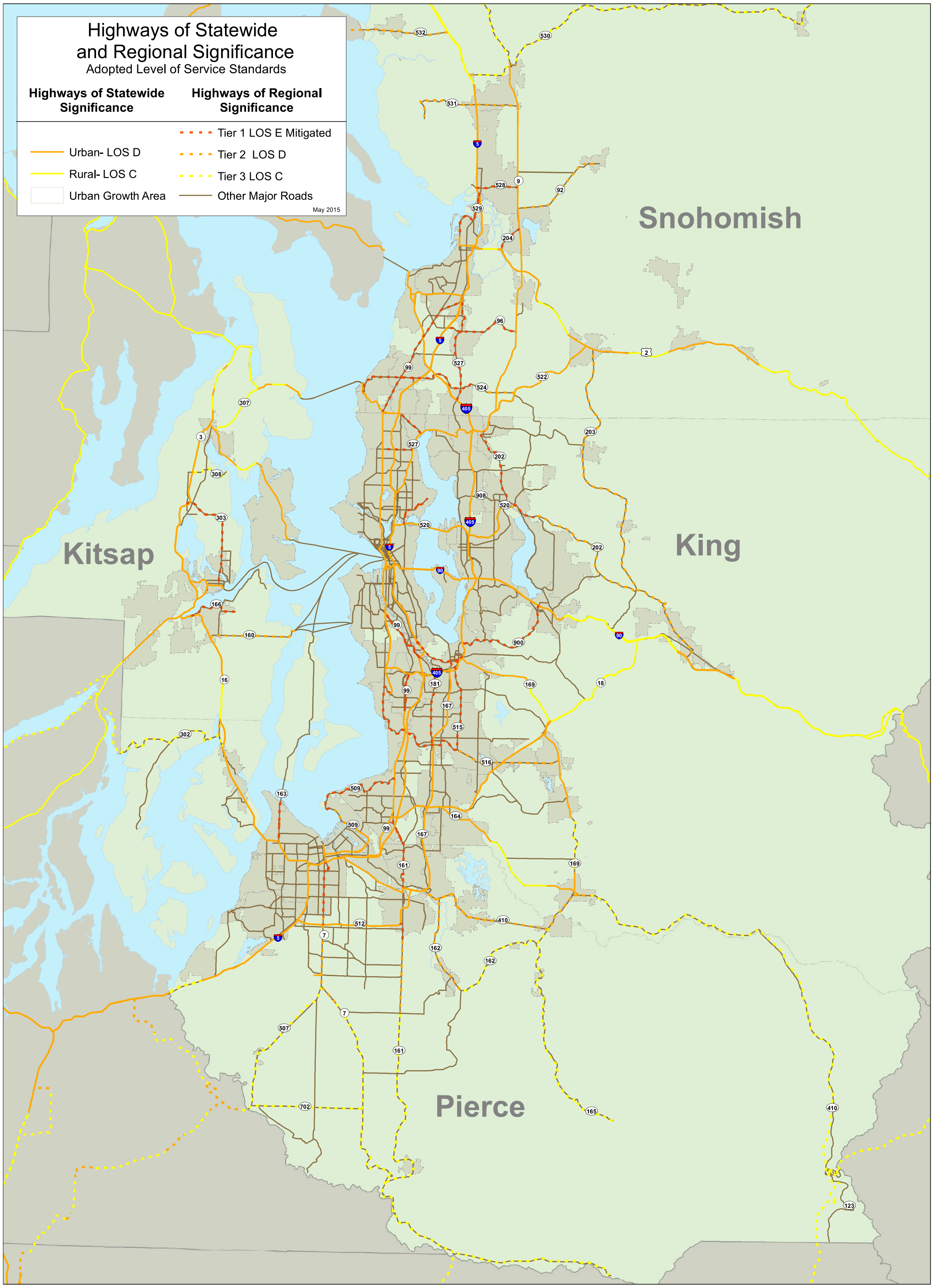
Note: Central Puget Sound includes King and Snohomish counties.
Source: Washington State Department of Transportation Multimodal Planning Division.

Exhibit 3-13 depicts the defined Level of Service (LOS) for the major highways and roadways in the region. As shown, many of the Interstate highways are defined as LOS D, while many of the area's state routes are defined as LOS E. LOS D indicates where speed begins to decline with increasing volume, freedom to maneuver is reduced, and the traffic stream has little space to absorb disruptions. LOS E indicates areas where unstable flow with volume are at or near capacity, freedom to maneuver is extremely limited, and level of comfort afforded to the driver is poor.

Exhibit 3-14 illustrates that route congestion increased in the Puget Sound region between 2013 and 2017. As shown, the areas north of Seattle experienced worsening traffic congestion between 2013 and 2017. Of the 91-mile I-5 corridor between the city of Federal Way (just north of Tacoma) and Everett, the segments leading to and from downtown Seattle experienced significant routine congestion in both directions. Overall, the length of highways where routine congestion occurred increased by 2.5 miles between 2013 (64 miles total) and 2017 (66.5 miles total), while the amount of routine congestion time increased by 8%. Similarly, vehicle delays along the I-405 corridor were higher at most locations in 2017 over 2013 levels.

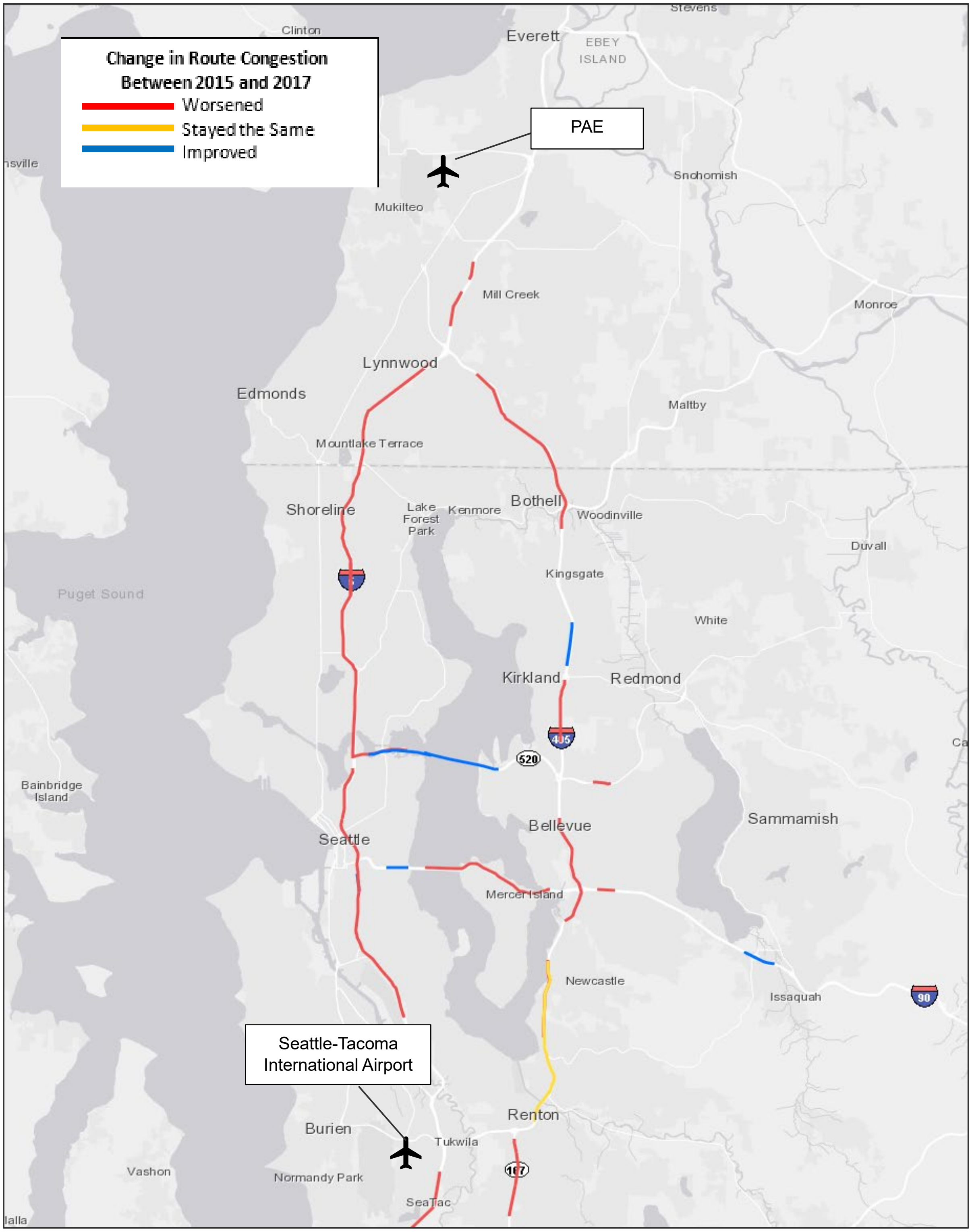
PAE is located approximately 23 miles north of downtown Seattle and 37 miles north of SEA. With no traffic, SEA is roughly a 45-minute drive from PAE but can take over 70 minutes in heavy traffic. By comparison, SEA is approximately 15 miles from downtown Seattle, and without traffic can take approximately 20 minutes to reach on I-5.[22] During heavy traffic periods, this commute can take more than 45 minutes. Given the growing traffic congestion in the region, particularly along the north/south Interstates I-5 and I-405, travel to and from SEA, will continue to become increasingly inconvenient for air passengers during peak travel periods. As such, PAE, north of downtown Seattle, is a much more convenient alternative for travelers from the northern half of the Seattle metropolitan area. This relative convenience will result in increasing air travel demand to/from PAE going forward.

Exhibit 3-13 Seattle Area Level of Service Categories



Source: Washington State Department of Transportation (WDOT). Prepared by Landrum & Brown

Exhibit 3-14 Seattle Traffic Congestion



Source: Washington State Department of Transportation, 2018 Corridor Capacity Study. Prepared by Landrum & Brown.

3.4 Review of Other Multi-Airport Cities

This section examines other major metropolitan areas that are currently served by more than one commercial passenger airport, including their key economic and passenger metrics. These metrics will assist in assessing the potential of the Seattle metropolitan area to support passenger service at a second airport such as PAE.

As shown in **Table 3-17,** Seattle is the 13th largest metropolitan area (MSA) in the U.S. and 12th largest in terms of total domestic O&D passengers for CY 2019. Most of the cities ranked ahead of Seattle have multiple airports. Of those that are only served by one airport, secondary airports have been proposed in the past for both Las Vegas and Atlanta. Denver International Airport (DEN) was rebuilt/re-located on a new greenfield site in 1995 and has ample real estate available for future growth.

On average, the top 30 O&D market areas in the U.S. generate 6.2 domestic O&D passengers per capita. However, several of the airports generate higher per capita demand, such as Orlando (15.6), Denver (13.2), Salt Lake City (11.6), San Francisco Bay area (11.4), Raleigh-Durham (8.4), Honolulu (12.6), and Seattle (7.6). Several factors contribute to the higher per capita demand for these airports, including: (1) they serve high-density markets with a higher per capita income; (2) they are popular tourist destination markets; and/or (3) they are a longer distance to other competing airports. Note: These are round-trip passenger counts (enplaned *2).

What differentiates the Seattle metropolitan area from other multi-airport metropolitan areas is that Seattle's primary airport SEA will not be able to supply adequate capacity to meet passenger demand at some point, most likely in the next 20 years. There is no doubt that at some point that this will be a major issue in Seattle.

Table 3-17 U.S. Airport O&D Passenger Rankings (Top 30) (Calendar Year 2019)

Rank	City	Airports	Domestic O&D Passengers	MSA Population	Domestic O&D Per Capita
1	New York City	JFK, EWR, LGA	72,842,142	19,216,182	3.8
2	Los Angeles	LAX, SNA, BUR, ONT,	70,042,776	13,214,799	5.4
3	SF Bay Area	SFO, OAK, SJC	54,135,776	4,731,803	11.4
4	Chicago	ORD, MDW	49,022,112	9,458,539	5.2
5	S. Florida	FLL, MIA, PBI	43,605,076	6,166,488	7.0
6	Orlando	MCO, SFB	40,828,366	2,608,147	15.6
7	Denver	DEN	39,345,632	2,967,239	13.2
8	Dallas-Fort Worth	DFW, DAL	37,166,356	7,573,136	5.0
9	Las Vegas	LAS	37,137,742	2,266,715	16.4
10	Boston	MHT, PVD, PSM, BOS	35,395,344	4,873,019	7.2
11	Atlanta	ATL	35,039,564	6,020,364	5.8
12	**Seattle**	**SEA**	**29,995,184**	**3,979,845**	**7.6**
13	Phoenix	PHX, AZA	29,151,488	4,948,203	5.8
14	Washington, D.C.	DCA, IAD	27,777,124	6,280,487	4.4
15	Houston	IAH, HOU	25,370,928	7,066,141	3.6
16	San Diego	SAN	21,776,006	3,338,330	6.6
17	Tampa	TPA, PIE	21,050,178	3,194,831	6.6
18	Minneapolis	MSP	20,668,772	3,654,908	5.6
19	Philadelphia	PHL	19,198,044	6,102,434	3.2
20	Detroit	DTW	18,372,588	4,319,629	4.2
21	Baltimore	BWI	17,636,984	2,800,053	6.2
22	Portland	PDX	15,704,534	2,492,412	6.4
23	Austin	AUS	14,517,106	2,227,083	6.6
24	Salt Lake City	SLC	14,198,256	1,232,696	11.6
25	Nashville	BNA	13,867,884	1,934,317	7.2
26	Charlotte	CLT	13,093,068	2,636,883	5.0
27	Honolulu	HNL	12,250,126	974,563	12.6
28	New Orleans	MSY	11,982,182	1,270,530	9.4
29	Raleigh-Durham	RDU	11,654,538	1,390,785	8.4
30	Sacramento	SMF	11,420,540	2,363,730	4.8
Weighted Average					**6.2**

Source: Diio Mi. Compiled by Landrum & Brown

Table 3-18 illustrates secondary and primary airports within multi-airport cities.

Table 3-18 Multi-Airport Cities Overview

City	Primary Airport	Secondary Airport(s)
Chicago	Chicago O'Hare International (ORD)	Chicago Midway International (MDW)
New York City	LaGuardia (LGA)	John F. Kennedy International (JFK)
		Newark Liberty International (EWR)
South Florida	Miami International (MIA)	Fort Lauderdale-Hollywood International (FLL)
Los Angeles	Los Angeles International (LAX)	John Wayne-Orange County (SNA)
		Hollywood Burbank (BUR)
		Long Beach (LGB)
		Ontario International (ONT)
San Francisco	San Francisco International (SFO)	Oakland International (OAK)
Dallas-Fort Worth	Dallas-Fort Worth International (DFW)	Dallas Love (DAL)
Washington, D.C.	Reagan National (DCA)	Dulles International (IAD)
Houston	Houston International (IAH)	Houston Hobby (HOU)
Phoenix-Mesa	Phoenix Sky Harbor (PHX)	Phoenix-Mesa Gateway (AZA)
Tampa-St. Pete	Tampa International (TPA)	St. Pete-Clearwater International (PIE)
Orlando	Orlando International (MCO)	Orlando-Sanford International (SFB)

Source: Compiled by Landrum & Brown

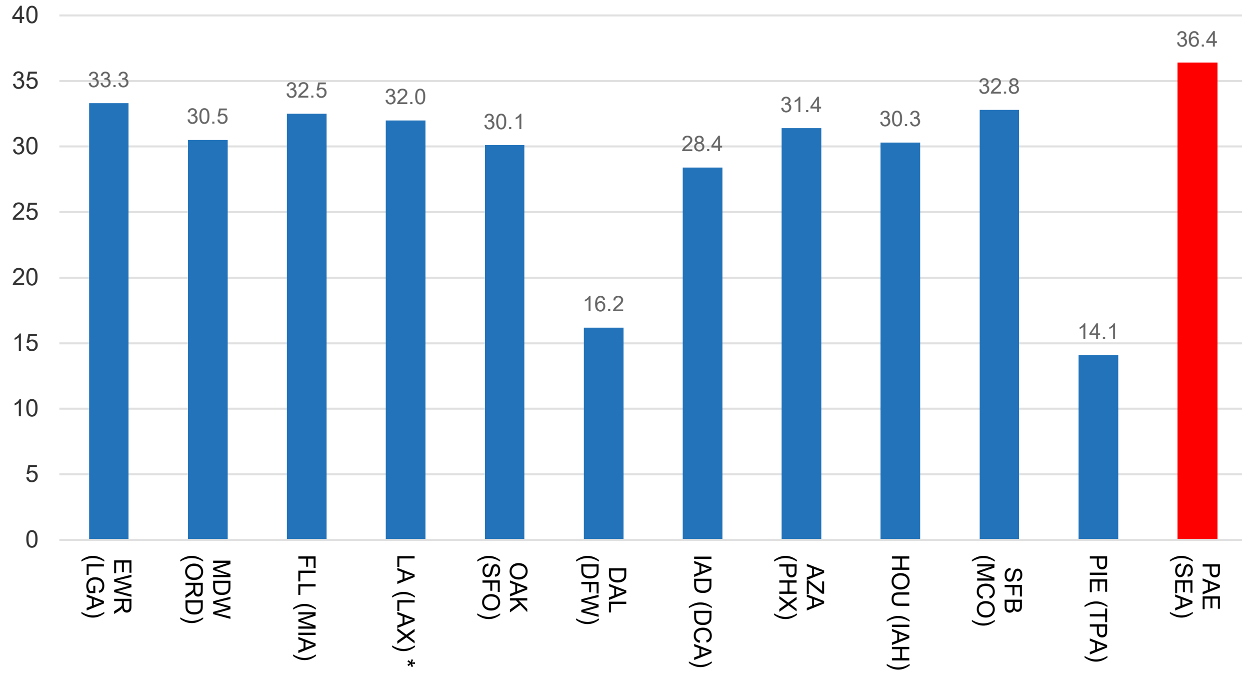
Primary airports are typically the largest, historically best known (or preferred) airport within a city. These primary airports are typically home to the largest, network airline and offers nonstop service to many domestic and international markets. They are also typically the major connecting airport within a city.

A secondary airport is typically much smaller than the primary airport, is much more reliant on point-to-point traffic and seldom offers international service. It also typically is faster growing over the past 10-20 years and is home to mostly ultra-low cost or low-cost carriers. While primary and secondary airports obviously overlap with traffic in similar catchment areas, the secondary airport typically will cater to a specific geographic area. Consistently, airports within multi-airport cities are typically around 30 miles from each other. It is expected that PAE will follow the typical path of development as compared to other secondary airports in the U.S.

3.4.1 Multi- Airport Cities: Mileage between Primary and Secondary Airports

Most secondary airports are roughly 30 miles from the primary airport, as shown in **Exhibit 3-15**. Even the St. Pete-Clearwater International Airport (PIE) beach area is closer to 30 miles from the Tampa International Airport (TPA). The lone exception to this rule is Dallas' Love Field (DAL) proximity to DFW. While Newark Liberty International Airport (EWR) is shown as a secondary airport, New York City (NYC) does not really have a dominant airport, although historically slot restricted LaGuardia Airport (LGA) is probably the preferred NYC airport.

Exhibit 3-15 Mileage between Primary and Secondary Airports



* Average of SNA, BUR and ONT

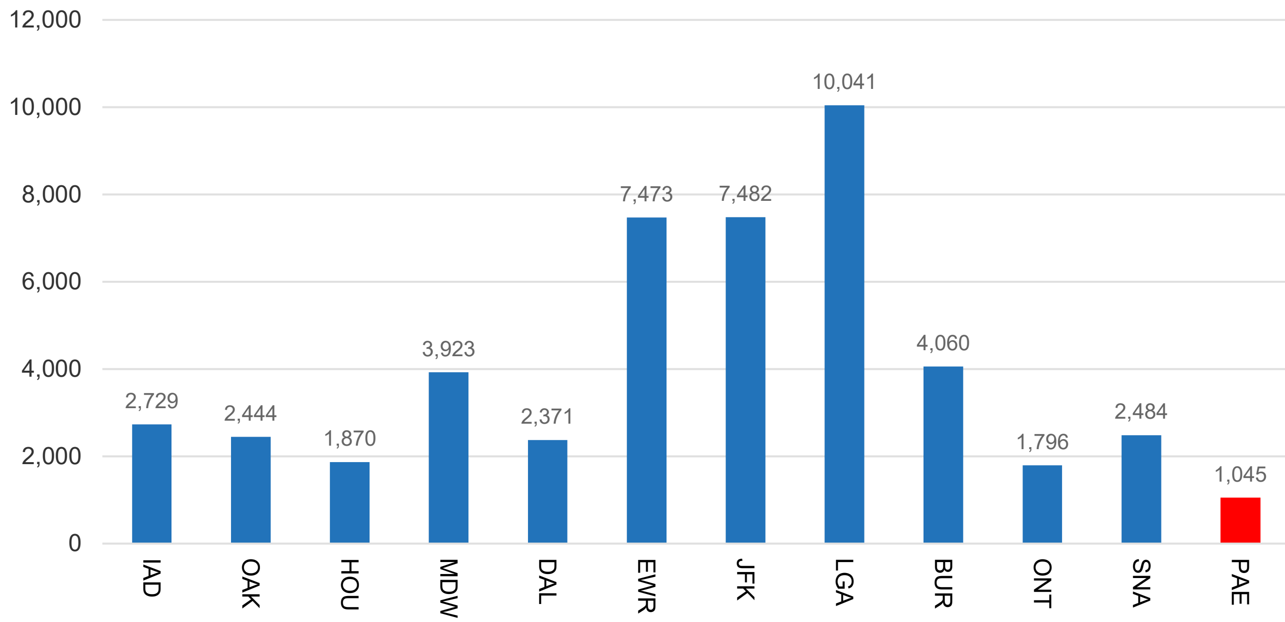
Source: Google. Compiled by Landrum & Brown

There are likely numerous reasons for the relative positioning of airports, including operational considerations, available real estate, timing of when cities grew/matured and airline demand considerations. PAE is ideally situated to the north of SEA, positioned to serve Snohomish County, northern King County, and most of the northern Seattle metropolitan area. This is consistent with how other secondary airports have served their metro areas.

3.4.2 Population Bases within 15 Miles of Secondary Airports

As noted earlier, while there is obvious overlap among airports in terms of population bases being served, there is still a core catchment area from which secondary airports primarily cater to. Given the proximity between airports, the point of where the secondary airport is the closest commercial airport is a good proxy. Given that airports are roughly 30 miles apart, 15 miles was chosen as the secondary airport's catchment area. Arguably, particularly as it pertains to PAE this could be conservative. **Exhibit 3-16** shows the population base within each secondary airport's catchment area (all major NYC airports are shown for comparative purposes).

Exhibit 3-16 Secondary Airport Population (000): Within 15 Miles of Airport



Source: U.S. Census Bureau using Diio Catchment Area Mapper. Compiled by Landrum & Brown

Phoenix-Mesa Gateway Airport (AZA), Orlando-Sanford International Airport (SFB) and PIE were not included as these airports cater almost exclusively to inbound, leisure traffic being served by Allegiant Airlines. This will not be the model followed by PAE. PAE will likely be served primarily by network airlines.

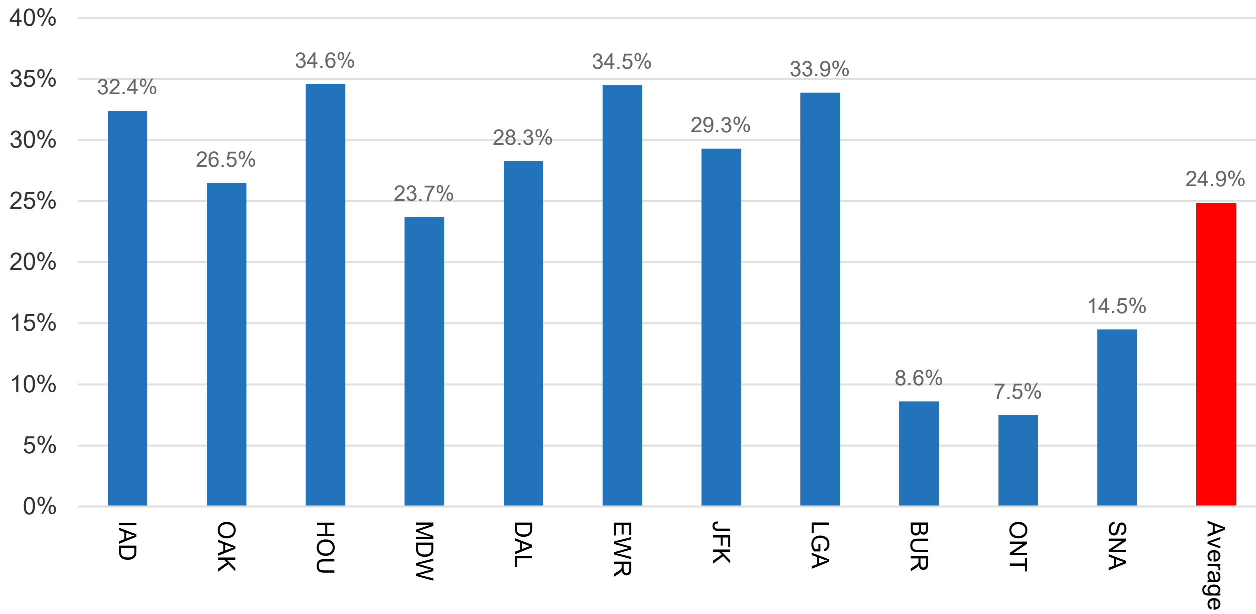
The population bases served by secondary airports differs dependent upon the city. Given the limited real estate in NYC, there is a fair amount of overlap, although EWR does serve parts of New Jersey in addition to Manhattan. This differs from the areas served by LGA and JFK. Outside of NYC, the population bases served by other secondary airports is somewhat consistent, particularly cities with one secondary airport such as Washington, D.C., San Francisco Bay, Houston and Dallas/Fort Worth. PAE would cater to a smaller population base as compared to other secondary airports.

3.4.3 Secondary Airport Domestic Passenger O&D Share of City Total

Exhibit 3-17 illustrates a secondary airport's share of domestic O&D passengers relative to the city total. This means, for example, that Chicago Midway International Airport (MDW) gets a 23.7% share of total Chicago domestic O&D passengers while O'Hare International Airport (ORD) gets 76.3%.

Domestic O&D passengers were benchmarked because this is the traffic segment that PAE will cater. PAE will likely not carry any connecting or international traffic, at least in the foreseeable future.

Exhibit 3-17 **Secondary Airport Domestic O&D Passenger Share (As part of Metro Airport Total)**



Source: Diio Mi. Compiled by Landrum & Brown

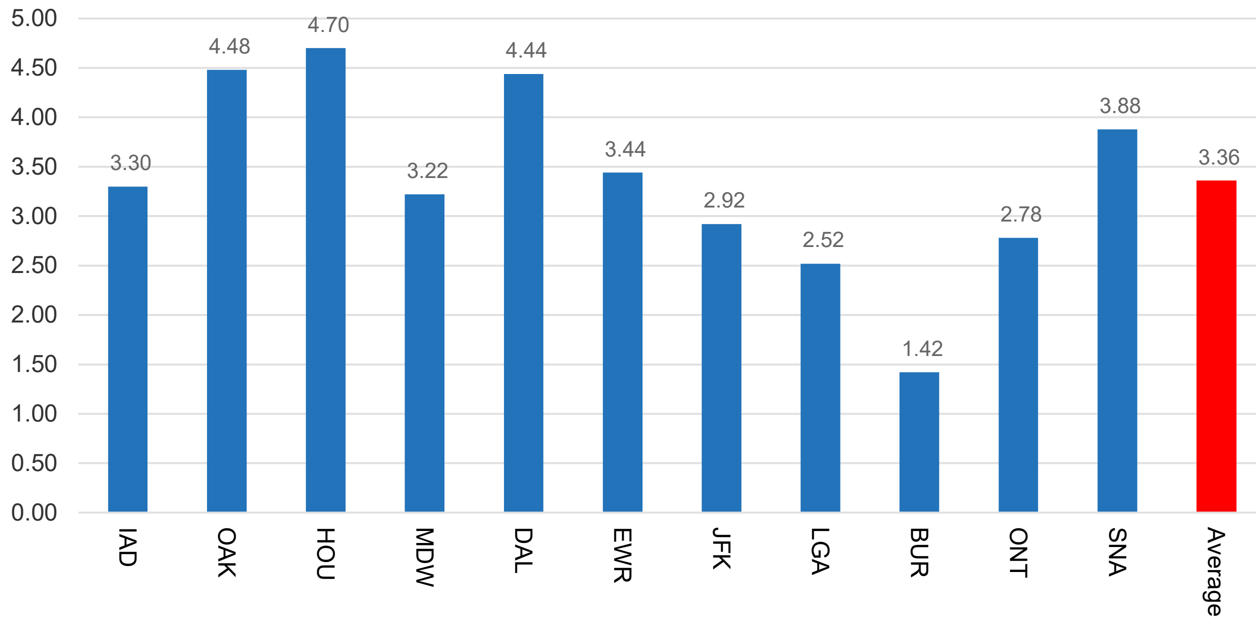
Secondary airports have typically garnered shares of domestic metro traffic in the range of 25%-35%. The exception to this is the Los Angeles (LA) area airports, which is home to two slot-restricted airport (John Wayne international Airport (SNA) and Long Beach/Daugherty Field Airport (LGB), an airport that lies to the extreme west of the primary population base (Ontario International Airport (ONT)) and the downtown airport Hollywood Burbank Airport (BUR) which is to-date primarily a niche airport serving the west coast and has historically had severe noise restrictions. Still, in aggregate these secondary LA airports garner 30.6% of the total LA market.

Secondary airports will naturally have limits on the share of traffic that they can carry. Secondary airports primarily will cater to segments of the population base, meaning that they will likely be focused upon flying to relatively larger markets where smaller shares of traffic are profitably sufficient. This will not be the case to smaller cities where larger shares of metro traffic and/or connecting traffic are required. Likewise, primary airports are home to large network airlines with brand awareness and loyalty (frequent flyer) programs that particularly cater to business traffic. Secondary airports and low-cost carriers are driven more by price-sensitive traffic. Still, it needs to be noted that over time, secondary airports and the low-cost carriers that frequent them have been growing at much higher rates of growth than experienced by primary airports and the network airlines that serve them.

3.4.4 Secondary Airport Domestic O&D Passengers Per Capita

In the prior section, it was shown that most secondary airport's generate market shares of a city's domestic air traffic in the 25%-35% range. In part this was because these airports generally cater to similar population bases. **Exhibit 3-18** shows another metric, domestic O&D passengers per capita, using each airport's catchment area for the population base.

Exhibit 3-18 Domestic O&D Passengers Per Capita (population within 15 miles)



Source: Diio Mi. Compiled by Landrum & Brown

The average of the eleven markets studied was 3.36. Airports such as New York LaGuardia (LGA) and Orange County (SNA), where slot-restrictions are in place, the results are artificially depressed relative to market-driven results. At the same time, a market like Washington Dulles (IAD) benefits from slot restrictions at Washington National Airport (DCA). Still, when factoring out BUR and capacity restricted NYC airports, there is a fairly tight range between 3.2-4.4.

While not shown, these per capita demand levels are roughly half of the city totals presented in **Table 3-17**. This is because of the relative service levels at secondary airports compared to the primary airports discussed earlier. In many cases, flying to smaller cities from the secondary airport is not possible. In addition, when service levels are comparable, network airline loyalty programs will drive a segment of passengers to the primary airport. It should be noted that PAE could benefit from this, due to Alaska Air Group's presence at PAE today and likely position in the future.

3.4.5 Secondary Airports: Potential Growth

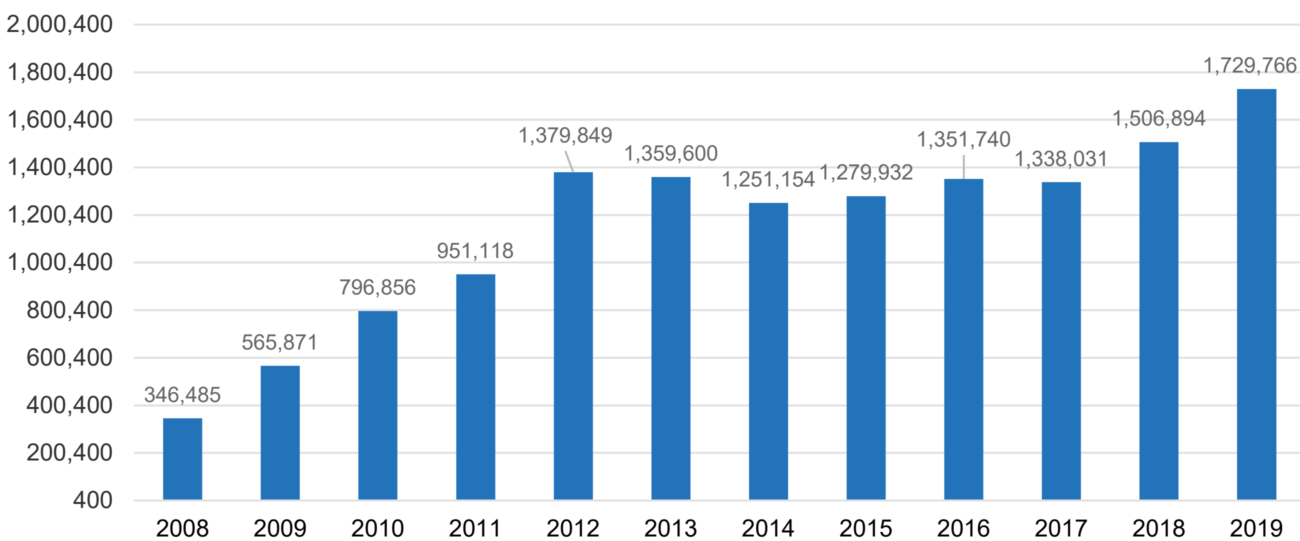
The following sections provided an analysis on secondary airports and their relative positions within multi-airport cities, detailing typical shares of traffic and per capita travel demand. This section will examine how secondary airports experienced traffic growth over time, particularly early in their existence. Below are examples of recent new airports start-ups (AZA and PIE), which is followed by overviews of older, secondary airport (MDW & IAD) growth phases in the 1980s and 1990s. These are examples of how fast these new, secondary airports can grow.

Phoenix-Mesa Gateway Airport (AZA)

AZA is located in Mesa, Arizona. The airport is located roughly 30 miles from Phoenix Sky Harbor International Airport (PHX) in the southeast portion of the Phoenix Metropolitan Area. While it primarily caters to inbound traffic, it also serves the local population base in southeast Phoenix.

Commercial airline service at AZA commenced in the 1st Quarter of 2008, with service provided by ultra-low cost carrier (ULCC) Allegiant Airlines. Since 2008, AZA has experienced significant growth, almost exclusively from Allegiant Airlines (although both Frontier and Spirit Airlines served AZA temporarily). As shown in **Exhibit 3-19**, within five years AZA's passenger volume increased from 346,485 in 2008, to 1,379,849 in 2012, representing an annual compounded growth rate of 41.27%. Following the departure of both Frontier and Spirit in 2013, AZA's passenger volumes declined from 2012 to 2014. Subsequent to an expansion of AZA's terminal building in 2015 and additional service by Allegiant, AZA's passenger volume once again increased moderately thereafter. AZA's passenger CAGR was 15.74% from 2008 through 2019.

Exhibit 3-19 Phoenix-Mesa Gateway Airport Passenger Trends



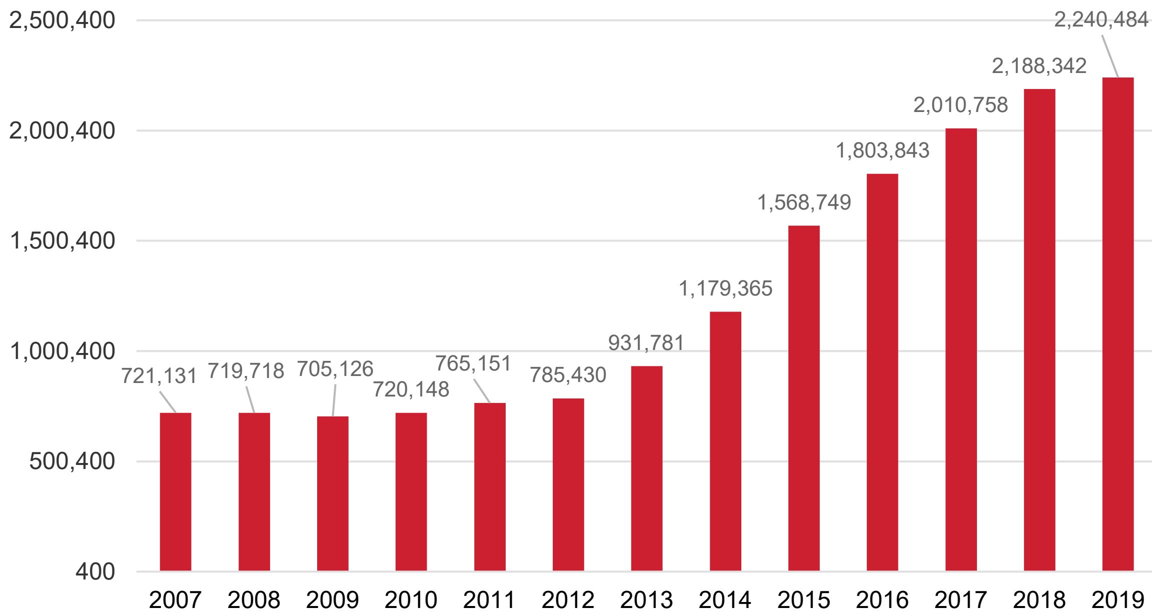
Source: Diio Mi. Compiled by Landrum & Brown

St. Pete – Clearwater International Airport (PIE)

PIE primarily caters to the St. Petersburg-Clearwater Beach area as a part of the greater Tampa-St. Petersburg Metropolitan Area. PIE is located approximately 15 miles from Tampa International Airport (TPA), although the majority of the population base and tourist activity is closer to 30 miles away.

Following a stoppage of commercial air service by American Trans Air in the early 2000s, PIE had little commercial air service until Allegiant Airlines initiated service in December 2006. As shown in **Exhibit 3-20**, PIE experienced limited growth over the first six years, following by explosive growth over the following six years. Much of this was dictated by Allegiant's strategic plans initially in the western half of the U.S., following a more eastern region focused growth phase. During the 12-year period, PIE passenger volume grew at a 9.91% CAGR (2007-2019).

Exhibit 3-20 **St. Pete – Clearwater International Airport Passenger Trends (2007-2019)**



Source: Diio Mi. Compiled by Landrum & Brown

In addition to the AZA and PIE examples, Chicago Midway (MDW) experienced significant growth starting in 1992 after the demise of Midway Airlines. From 1992 through 2002, passenger volumes increased from 2.18 million to 8.2 million, a 14.17% CAGR. While growth slowed during the subsequent years, MDWs 20-year CAGR was 7.36% (2021 vs 1992). Another secondary airport, Washington Dulles (IAD) saw passenger traffic grow from 4.69 million in 1994 to 11.0 million in 2004, an 8.90% CAGR over the 10-year period. Other secondary airports have also seen explosive growth over long periods of time until reaching a general equilibrium point relative to the larger, primary airport, when the secondary airport typically reaches a 25%-35% market share of that city's domestic traffic base.

The prior section (3.4) illustrated traffic shares, catchment areas and per capita travel at other secondary airports (within multi-airport cities) in the U.S. As illustrated, it was clear that there were generally consistent traffic levels generated at these secondary airports (either in total traffic or per capita demand).

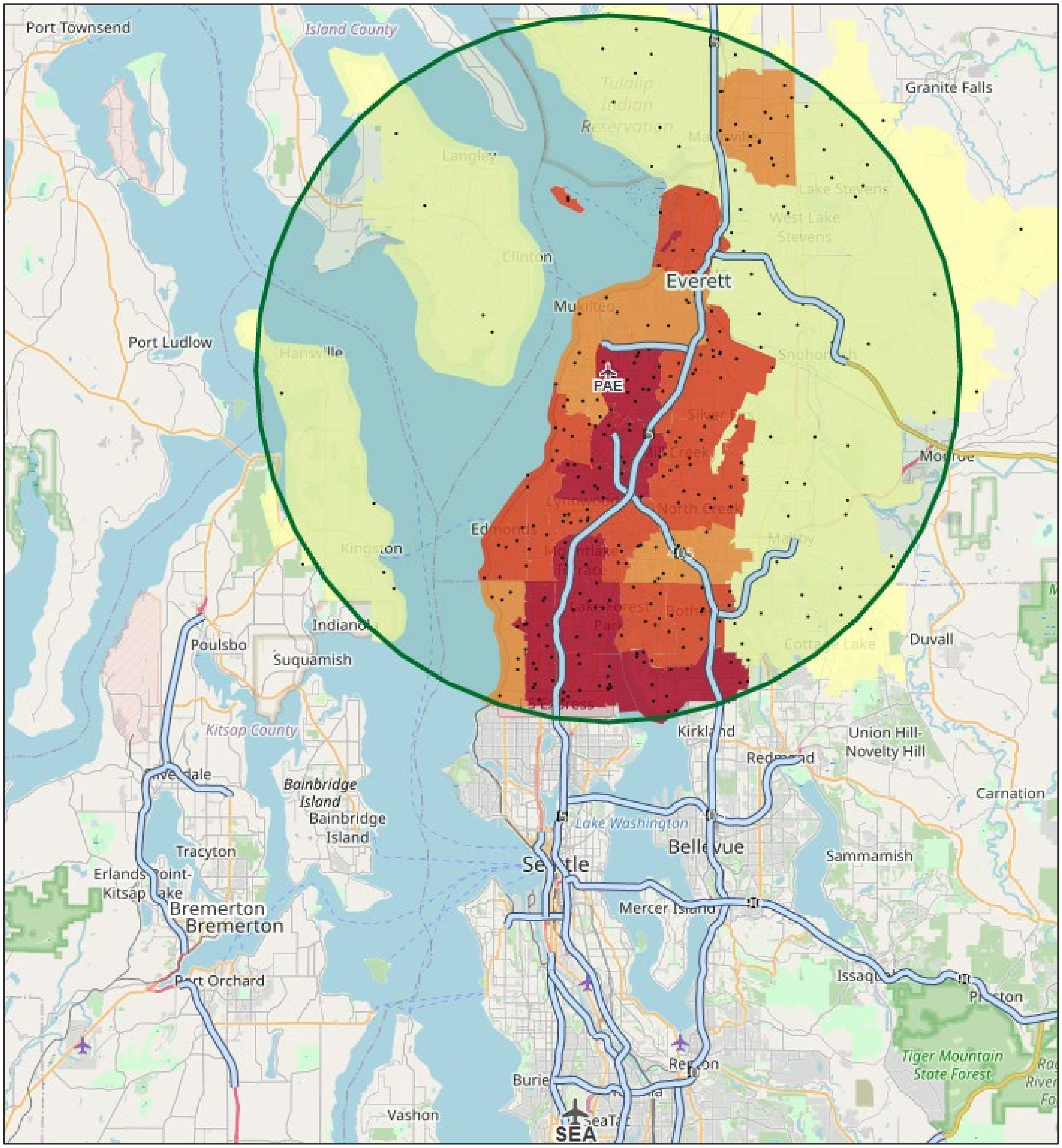
The section immediately above (3.4.5) illustrated examples how secondary airports will typically exhibit high rates of traffic growth during their relatively early years of existence. As shown, CAGRs of 7% to almost 16% were consistently generated over 10 and 20-year periods – regardless of the type of traffic that these airports catered to (PIE & AZA: Vacation/destination traffic; IAD: O&D and connecting traffic for both domestic & international; and MDW: Primarily point-point domestic traffic (PAE will likely most resemble MDW).

The prior section (3.4) will be the basis for the key assumptions that will drive the PAE passenger forecasts.

3.5 PAE Catchment Area

The primary catchment area for PAE is illustrated on **Exhibit 3-21** within the circle, which corresponds to a 15-mile radius of PAE. This radius is consistent with other studied secondary airports and is roughly half-way from SEA or the area where PAE is the closest commercial airport. The darker colors correspond to more heavily populated areas, as the dot density also illustrates.

Exhibit 3-21 PAE 15-Mile Catchment Area



Source: Diio Catchment Mapper, U.S. Census Bureau

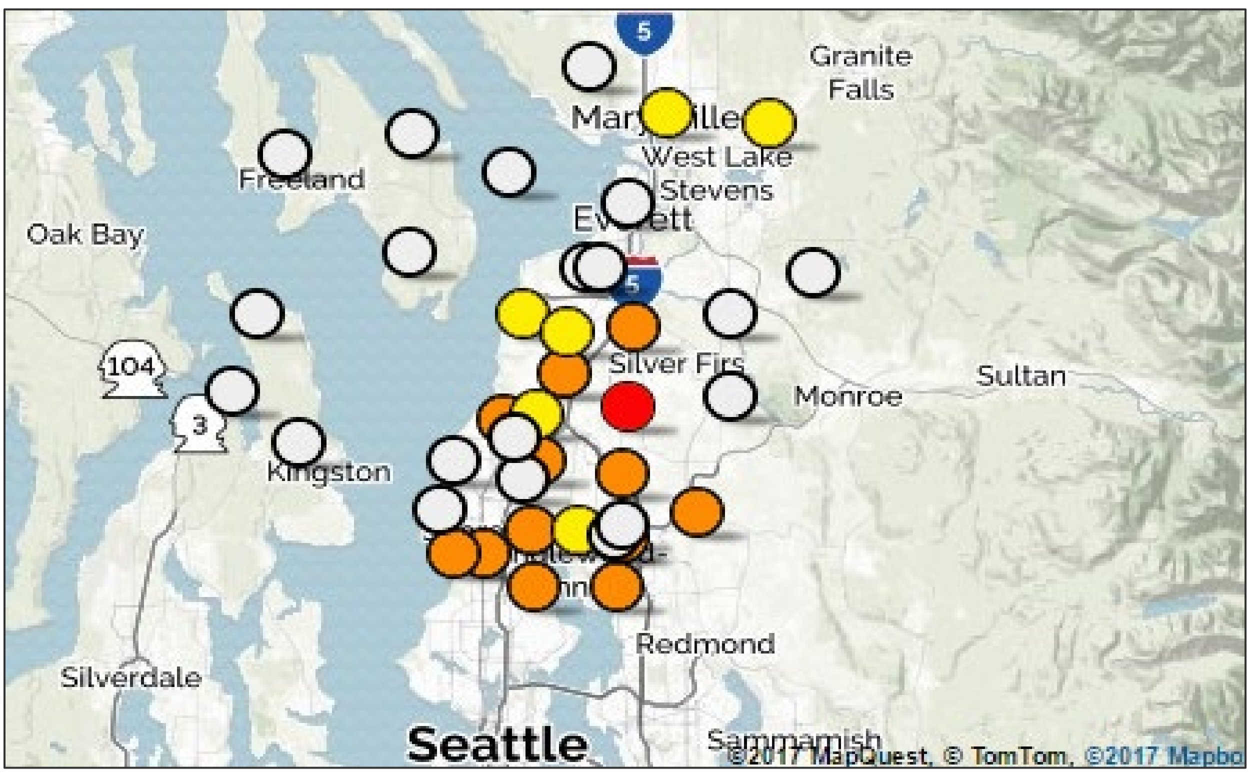
The 15-mile catchment area encompasses an estimated 1.045 million people in 2021. This is up from 924,000 taken during the 2010 census. Over the 10-year period, this is a 1.12% CAGR. Snohomish County makes up 68% of the catchment area population, while (northern) King County comprises 28%. The remaining 8% is comprised of Kitsap and Island counties. As noted earlier, this is a high-income area where almost one third of the households have incomes in excess of $100,000 annually. This is the segment of the U.S. population that travels by air frequently.

As shown on Table 3-17 earlier, the top 30 airports in the U.S. generated domestic O&D passengers per capita of 6.2 while SEA generated 7.6 (note: the focus is upon domestic O&D passengers, as this is the segment that will fly exclusively out of PAE). Based upon the catchment area's estimated 1.045 million population base, this translates to an estimated 6.48 million to 7.94 million passengers (round-trip) from the catchment area. These estimates are passengers that (mostly) use SEA today. These are not an estimate of PAE traffic, as their share would be much lower as was briefly referenced earlier and is also discussed in the next section.

3.5.1 Flight Booking Activity from the PAE Catchment Area

It is also important to examine flight booking activity from the PAE catchment area as it pertains to the total Seattle MSA. Estimates of flight bookings are based upon Agency Reporting Corporation (ARC) data obtained from online and corporate travel agencies. This booking sample represents an approximate 10% sample of all Seattle region bookings. **Exhibit 3-22** illustrates bookings from the 15-mile primary catchment area of PAE. In total, bookings within 15 miles of PAE represent 22.4% of all Seattle metropolitan area bookings. The 15-mile primary catchment area would mainly capture traffic from the northern suburbs of the Seattle MSA.

Exhibit 3-22 Seattle MSA Percentage of Bookings by City – 15-Mile Primary Catchment Area



Source: Agency Reporting Corporation (ARC) for CY 2019. Compiled by Landrum & Brown

3.5.2 Estimated Catchment Area Demand Summary

The potential number of passengers located within PAE's 15-mile primary catchment area can be estimated through one of two different methodologies:

- **Population-Based Methodology I** – Assumes that the total population within a 15-mile radius of PAE is applied to the trips per capita currently being generated by SEA.
- **Population-Based Methodology II** – Assumes that the total population within a 15-mile radius of PAE is applied to the trips per capita currently being generated by the average of the top 30 cities in the U.S.
- **Ticket Bookings Methodology** – Assumes that the percentage of trips booked within a 15-radius of PAE is applied to Seattle's total domestic O&D passengers for CY 2019.

As shown in **Table 3-19**, based on these methodologies, a theoretical total of between 6.48 and 7.94 million total passengers are estimated to be located within the 15-mile catchment area from PAE. It is likely that the overall 7.94 million is relatively high, as this estimate includes all of the Seattle area, but driven by downtown Seattle, which would be expected to have a relatively higher propensity to travel. It is likely that the booked passenger demand estimate (which is relatively close to the U.S. based per capita booking estimate) is likely the best estimate of demand from the 15-mile catchment area near PAE.

It is important to note that these passenger estimates do not reflect what is being forecast for PAE; rather they only serve to give an indication of PAE's longer-term traffic potential. These figures represent a theoretical level of passenger volume that is located within the 15-mile primary catchment area. Given the much higher volume and choice of air service that is currently provided at SEA relative to that expected at PAE, PAE will undoubtely capture only a share of passengers from its total catchment area.

Table 3-19 Summary of Estimated Passenger Demand Within PAE's 15-Mile Catchment Area

Methodology	Assumption	Applied Metric	Estimated PAE Catchment Area Total Passengers
Population-Based	7.6 trips per capita	1.045 million people	7.94 million
Population-Based	6.2 trips per capita	1.045 million people	6.48 million
Ticket Bookings	22.4% of total Seattle	29.995 million domestic	6.72 million

Source: Landrum and Brown analysis, February 2021

3.6 Industry Recovery Scenarios: Returning to 2019 Levels of Demand

Several industry sources have made predictions as to the length of recovery of air traffic to levels prior to the COVID-19 pandemic. **Table 3-20** presents summaries of various scenarios. As shown, the general consensus is that air traffic will not recover to 2019 levels until 2024. It should be noted that these are for U.S. airline passenger travel in total and are not market specific. Throughout the pandemic, specific markets such as those in Florida, the general mountain region of the U.S. and the South Carolina coastline have experienced much higher traffic demand as compared to large cities on the west and particularly the east coast. The Midwest in general also did relatively well. Much of this is tied to the level of lockdowns and subsequently economic activity.

Another near-term factor that will likely impact U.S. travel demand through 2022 are pilot and in some cases aircraft shortages at DL, UA and AA. Carriers are indicating that they are hoping that they can fly 2019 capacity levels by year-end 2022. Alaska Airlines is not expected to be as impacted.

Table 3-20 Summary of Industry Estimates of Return to 2019 Passenger Traffic Levels

Source Company/ Agency	Expected Recovery Period	Citation	Source
International Air Transport Association (IATA)	CY 2024	*"We assume a vaccine(s) is deployed in the second half of 2021, but it looks likely that there will be production and distribution challenges that mean it will only be in late 2021 and in 2022 when air travel rises back substantially. On this basis we don't expect 2019 levels to be regained until around 2024.*	*"Deep Losses Continue Into 2021"*, November 24, 2020. https://www.iata.org/en/pressroom/pr/2020-11-24-01/
Fitch Ratings	CY 2024	*"Unlike past disruptive events in aviation where recoveries were speedy, the coronavirus pandemic illustrates that a long trough in air travel is possible. Scenarios for recovery remain wide given the unknowns about future treatments and vaccines. Air traffic in 2021 will likely remain depressed but 2021 volumes are expected to rise above the nadir of 2020. Multiple uncertainties ranging from airline scheduling to government-imposed restrictions could lead to rapid shifts in passenger traffic over the next 12 months. Fitch's rating and severe downside case scenarios, at 35% and 60%, respectively, below 2019 levels, highlight the forecasting uncertainty for airports. Full recoveries are not expected until 2024..."*	*"Fitch Ratings 2021 Outlook: U.S. Transportation Infrastructure",* December 2, 2020 https://www.fitchratings.com/research/us-public-finance/fitch-ratings-2021-outlook-us-transportation-infrastructure-02-12-2020
Moody's Investor Service	CY 2024	*"Enplanement levels have divorced from traditional GDP correlations because of unpredictable consumer behavior and local and international restrictions on travel or onerous quarantine requirements. Enplanement levels depend on the perceived spread of the virus, but we expect enplanements to be 25% to 45% of 2019 volumes in the first half of 2021 before recovering with warmer weather and expected adoption of a vaccine."*	*"2021 outlook negative with high degree of traffic uncertainty, airline financial health"*, December 1, 2020. https://www.moodys.com/research/Moodys-2021-outlook-for-US-airports-remains-negative-amid-ongoing--PBC_1255600?cid=7QFRKQSZE021
Standard & Poor's (S&P)	CY 2024	*"We have updated our global air passenger traffic forecasts and now expect traffic to fall by as much as 60%-70% in 2020 versus 2019. This is weaker than the 50%-55% drop we forecast at the end of May. We now expect 2021 air passenger traffic to decline 30%-40% compared with the 2019 base and foresee a more gradual recovery to pre-COVID-19 levels by 2024."*	"From Bad to Worse: Global Air Traffic to Drop 60%-70% in 2020". August 12, 2020. https://www.spglobal.com/ratings/en/research/articles/200812-from-bad-to-worse-global-air-traffic-to-drop-60-70-in-2020-11610389

In summary as noted in Table 3-20, industry estimates are for a return to 2019 traffic levels in 2024. In discussions with SEA, they are also estimating a return to 2019 levels in 2024. Alaska Airlines has been more optimistic, indicating that they expect a return to normalcy (system-wide) sometime in 2022. UA, DL and AA are more pessimistic, as due to pilot shortages currently, they won't even be able to fly their 2019 scheduled capacity until year-end 2022. These carriers have been somewhat vague in their estimates of the return to normalcy, with most indicating a 2023-2024 expectation.

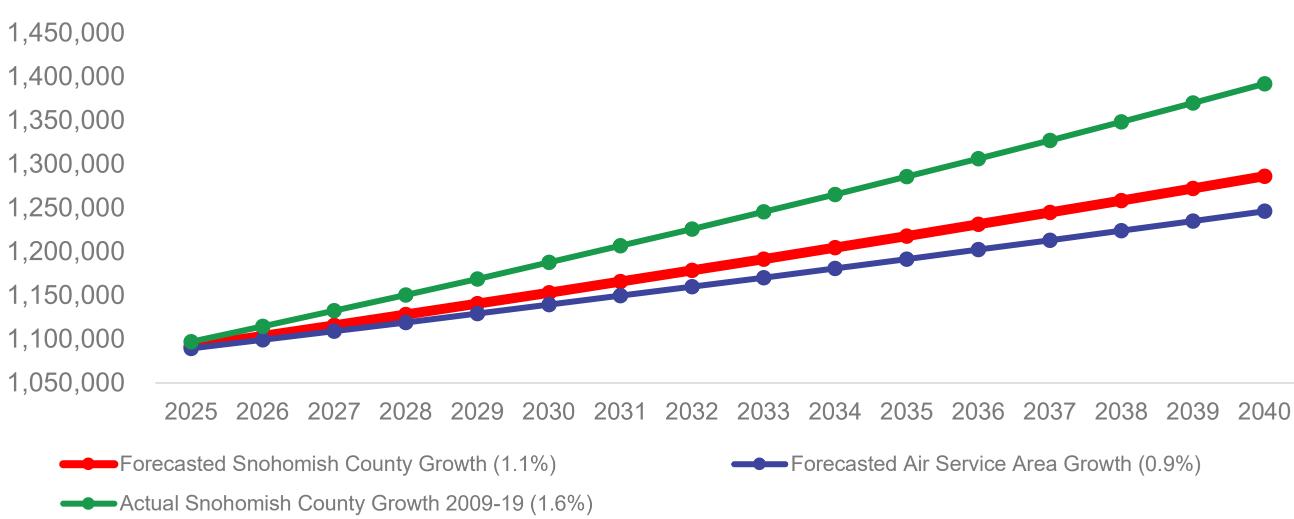
3.7 PAE Commercial Passenger Activity Forecast (2021-40)

The passenger forecasts in this section assume that PAE primarily relies on traffic from its core catchment area of 15 miles. The key assumptions include:

- PAE will recover back to 2019 passenger levels in 2025. This is likely conservative, although currently PAE's scheduled seat capacity for August is 75% below 2019 levels. Still, Alaska is indicating that PAE capacity will return to 2019 levels sometime in 2022, although UA just announced their exit from PAE.
- Over the subsequent fifteen years, PAE will capture shares of air travel demand from its catchment area consistent with the experience of other secondary U.S. airports. This assumes that air travel will gravitate to the airport that is more convenient and that offers air service at an equitable air fare relative to SEA.
- Underlying economic conditions and primarily population growth of the catchment area will drive demand in the future.
- SEA will begin to experience unmet passenger demand in 2037. This will be studied more in next section and differs from the Puget Sound Business Council (PSBC) study illustrated earlier (Exhibit 3-11). This is largely due to the PSBC study not considering any impact from COVID-19.

Because the forecast assumes air travel demand from the region will return to 2019 levels in 2025, the baseline year is 2025 and growth rates start after that year. The catchment area population was assumed to be 1.045 million in 2021 and booked demand from the catchment area is 6.72 million passengers in 2019. As shown in **Exhibit 3-23**, there are three population growth sensitivities, using a population of 1.045 million in 2021 as the starting point. Growth was applied to these starting points at three CAGRs: 0.9% (forecasted population growth of the air service area), 1.1% (forecasted Snohomish County population growth), and 1.6% (Snohomish Country population growth, 2009 to 2019). Given that most of traffic demand will come from Snohomish County, the forecasted population growth for Snohomish County over the next 20 years was determined to be the baseline estimate. The baseline forecast of a 1.1% CAGR resulted in a catchment area (15-miles) population of 1.286 million by 2040.

Exhibit 3-23 PAE Catchment Area Population Forecast



Source: U.S. Census Bureau, Diio Mi, Landrum and Brown analysis, March 2021

The baseline booked passenger forecast from the catchment area is forecast to increase from 6.72 million in 2024 to 8.0 million by 2040 – also growing at a 1.1% CAGR. This is not forecasted traffic at PAE but rather an estimate of forecasted booked air travel from the PAE catchment area. It will also be useful when compared against the PAE traffic forecast, allowing for calculating the share of catchment area booked travel that would utilize PAE. This would work as a forecast "check" or as a test of reasonableness.

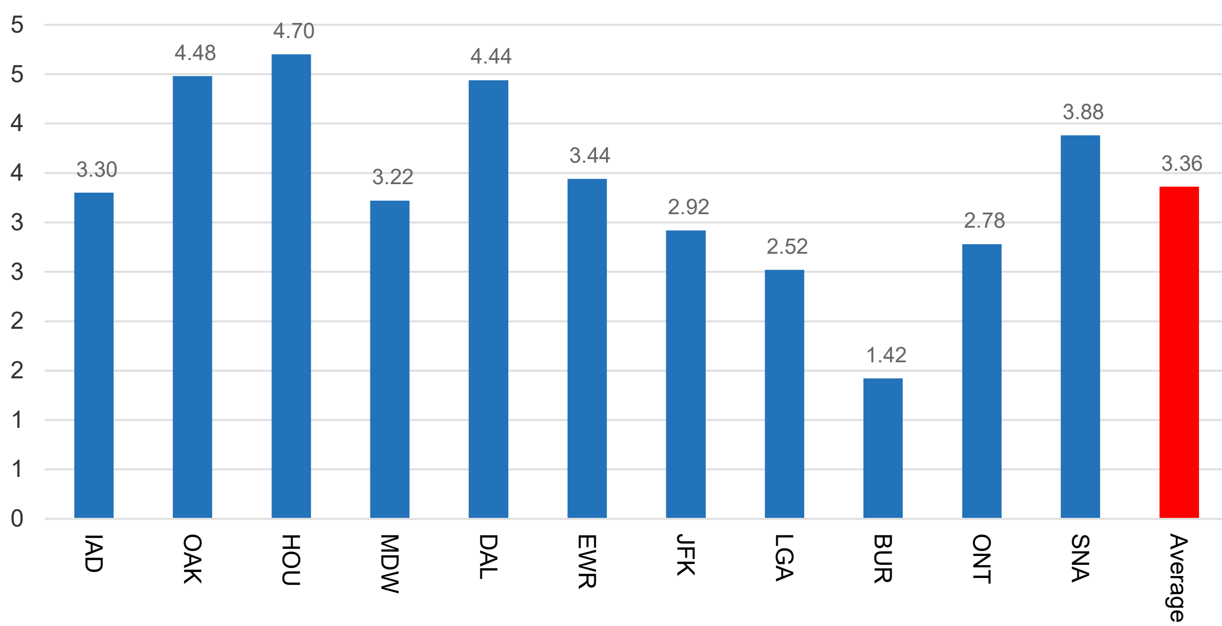
When considering population and booked demand growth rates, the following were considered:

- SEA's Domestic O&D Passengers CAGR
  - 20-year: 2.55%
  - 15-year: 3.29%
  - 10-year: 4.39%
  - 5-year: 3.11%
- Snohomish County 20-year forecast population CAGR: 1.1%
- Air service area's 20-year forecast population CAGR: 0.9%
- Air service area's forecast GMP CAGR: 2.2%
- Air service area's population growth (2009-19) CAGR: 1.6%

As noted earlier, given the high correlation between population near (15 miles) secondary airports and traffic demand, it was determined that the forecasted population growth for nearby Snohomish County (1.1%) would be the best estimator of air travel demand.

To determine a passenger volume forecast for PAE, domestic O&D passengers per capita at other secondary airports across the U.S. were considered to be a strong indicator of potential PAE passenger traffic. As shown in **Exhibit 3-24,** the average domestic O&D passengers per capita for all U.S. secondary airports is 3.36 (the red column). This factor was used as the baseline passenger demand scenario for PAE. The low scenario was based upon 2.36 trips per capita and the high case was based on 4.36 trips per capita.

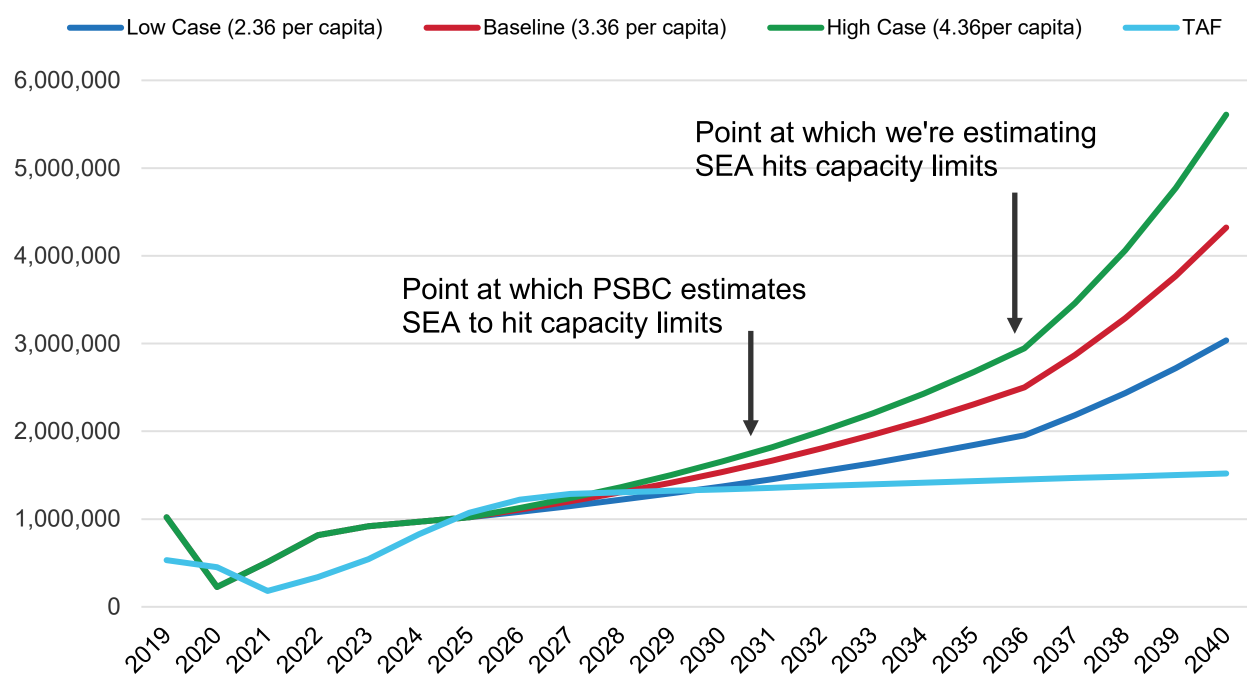
Exhibit 3-24 Domestic O&D Passengers Per Capita (population within 15 miles)



Source: Diio Mi, U.S. Census Bureau. Compiled by Landrum & Brown

The forecasted passenger results are presented in **Exhibit 3-25**. All forecasts assumed the same ramp up from 2021 to 2024, where passenger traffic would be at 50% of 2019 levels in 2021, 80% in 2022, 90% in 2023 and 95% in 2024 before getting back to 2019 levels in 2025. The forecasts are also presented in **Table 3-22**.

Exhibit 3-25 Domestic O&D Passengers Per Capita (population within 15 miles)



Source: Landrum & Brown analysis

Traffic growth is a function of both per capita demand growth in conjunction with population growth. The growth rates to reach the forecasted per capita demand rates were grown at CAGRs of 6.0% (low), 8.4% (baseline) and 10.0% (high) from 2026 to 2036. These growth rate assumptions were driven by the experience of other secondary U.S. airports (AZA, PIE, MDW and IAD) that were studied earlier.

These same scenarios were then grown at CAGRs of 11.5% (low), 14.5% (baseline) and 17.3% (high) from 2037 to 2040. These elevated growth rates are being driven by the estimated time period at which SEA will likely hit a capacity ceiling and unmet passenger demand will take place, hence potentially "spilling" demand to PAE. This issue was illustrated in section 3.3.1 and will be looked at more closely in the next section (3.7.1), including estimates of potential unmet passenger demand due to SEA capacity limitations.

The baseline forecast is 4.3 million total passengers by 2040. This translates to 54% of the forecast catchment area bookings, which is consistent with the experience at other secondary airports. This forecast assumes total passengers per capita reaches 3.36 by 2040. This compares to the average of secondary airports in the U.S. shown earlier. Over the 15-year period (2040 vs 2025), passenger volume will grow at a CAGR of 10.1%. The CAGR is 7.1% when comparing 2040 to 2019. As compared to the CAGR of secondary airports shown previously, these growth rates are similar.

The high case forecast assumed passengers per capita reaches 4.36 by 2040. This generally compares to results generated at Oakland (OAK), Dallas Love (DAL) and Houston Hobby (HOU). The 15-year CAGR is 11.23% which is comparable to recent secondary airport results at AZA and PIE.

The low case forecast assumed passengers per capita would be 2.36, which is near the low end of secondary airports and is somewhat comparable to New York LaGuardia (LGA) and Ontario, CA (ONT). Only Burbank (BUR) has generated fewer passengers per capita than this scenario. The 15-year CAGR is 7.5%, which is below other studied secondary airports.

The 3 passenger forecast scenarios are illustrated below in **Table 3-21**.

Table 3-21 PAE Total Passenger Forecast Summary

	Low Case	Baseline	High Case
2019	1,022,046	1,022,046	1,022,046
2020	226,304	226,304	226,304
2021	511,023	511,023	511,023
2022	817,637	817,637	817,637
2023	919,841	919,841	919,841
2024	970,944	970,944	970,944
2025	1,022,046	1,022,046	1,022,046
2026	1,084,126	1,108,719	1,125,251
2027	1,149,977	1,202,741	1,238,878
2028	1,219,828	1,304,737	1,363,979
2029	1,293,922	1,415,383	1,501,712
2030	1,372,517	1,535,412	1,653,353
2031	1,455,885	1,665,619	1,820,307
2032	1,544,317	1,806,869	2,004,120
2033	1,638,121	1,960,097	2,206,494
2034	1,737,622	2,126,319	2,429,303
2035	1,843,168	2,306,637	2,674,612
2036	1,955,124	2,502,247	2,944,692
2037	2,182,990	2,868,761	3,459,073
2038	2,437,414	3,288,959	4,063,307
2039	2,721,491	3,770,706	4,773,089
2040	3,035,989	4,322,426	5,608,862
2040 vs 2019	5.3%	7.1%	8.5%
2040 vs 2025	7.5%	10.1%	12.0%

Source: Landrum & Brown Estimate

PAE traffic growth rates are being driven by PAE being more convenient for travelers within PAE's catchment area. Longer-term, these growth rates are also impacted by capacity ceilings at SEA. (which is studied in the next section). It should be noted that no other secondary U.S. airport benefited from capacity ceilings at their primary airport in a way that PAE will benefit from a capacity ceiling at SEA.

As a "check" of the baseline passenger forecast, an estimate of PAE's forecasted passenger share of the total Seattle domestic O&D passenger market in 2040 was conducted. For 2024 (2019), the total Seattle domestic O&D passenger market was/is 16.5 million passengers. SEA's 20-year CAGR (2019 vs 1999) for domestic O&D passengers is 2.5%. Assuming a 2.5% CAGR over 16 years (from 2024 until 2040) results in an estimated 24.5 million domestic O&D passengers at Seattle in 2040. PAE's 4.3 million forecasted passengers results in a 17.6% (4.3/24.5) share of Seattle's domestic passenger traffic in 2040. This is less than for most other secondary U.S. airports shown on Exhibit 3-17 on page 42, which would appear to indicate that the PAE forecast is possibly conservative. But this can be explained by the fact that the PAE catchment area population is less than other secondary airport catchment areas shown on Exhibit 3-16 on page 41.

The total passenger forecast of 1.022 million in 2025 is 4.5% less than the FAA's TAF forecast of 1.07 million passengers in 2025, which is within FAA guidelines of 10%. The total passenger forecast of 1.53 million in 2030 is 14.6% greater than the FAA's TAF forecast of 1.33 million in 2030, which is within FAA guidelines of 15%.

There are no FAA guidelines for forecasts beyond 10 years. The FAA forecasts PAE passenger volume from 2028 until 2040 to grow at a 1.3% CAGR – this growth rate is half of SEA's 20-year O&D passenger growth rate and less than half (3.0%) SEA's 20-year total passenger growth rate (both 2019 vs 1999). It is also less than half Seattle's forecasted economic growth studied earlier in this chapter. It is also far less than King County's forecasted CAGR for hotel stays of 5.12% between 2023 and 2030 that was illustrated earlier on pages 21-22. Finally, it appears that the FAA TAF did not factor in any SEA capacity limitations that will likely take place in the mid-to-late 2030s. These SEA capacity ceilings could have a material impact upon passenger volumes at PAE.

3.7.1 Potential Sea-Tac Capacity Ceiling & Potential Unmet Passenger Demand

SEA will at some point have difficulty in accommodating needed capacity. SEA's SAMP plans more than 30 near-term projects that will improve SEA's efficiency, safety, access to the airport, and support facilities for airlines and the airport. Highlights include a new terminal with 19 gates, and an automated people mover with three stations to connect the rental car facility, new terminal, and main terminal. These near-term projects will allow SEA to accommodate 66 million total passengers. Keep in mind that SEA generated 51.8 million passengers in 2019.

3.7.1.1 Estimates of SEA Unmet Passenger Demand: Traffic that would utilize PAE

The Puget Sound Regional Council has prepared a preliminary study of potential unmet passenger demand at SEA. The results of that study are summarized in Exhibit 3-11 on page 33. As shown on Exhibit 3-11, this study assumed that the projects noted in the prior paragraph would be completed in phases through approximately 2025. Even with these projects completed, the study estimated that SEA's passenger demand could be impacted by capacity ceilings as early as the mid-2020s.

As illustrated in Exhibit 3-11, based upon completion of projects noted above, SEA would experience unmet passenger demand of 5 million passengers in 2027 (2.5 million enplaned as shown on Exhibit 3-11) and 12 million in 2032 (6 million enplaned). Based only upon the projects noted above, by 2037 unmet passenger demand was estimated at 16 million passengers (8 million enplaned as shown on Exhibit 3-11) and roughly 24 million (12 million enplaned). By 2050 the study estimated unmet passenger demand of 44 million passengers (22 million enplaned) based upon completion of the projects above.

Additionally, this study also assumed yet to-be-determined longer-term projects would also be undertaken that would allow SEA to accommodate up to 74 million annual passengers (MAP). As shown on Exhibit 3-11, this would extend the timeline until SEA would experience unmet passenger demand to the early-to-mid 2030s.

L&B conducted an estimate of when SEA could experience unmet passenger demand and the degree of that unmet demand. The results are shown in **Exhibit 3-26** below. A sensitivity analysis of passenger growth rates was done, ranging from CAGRs of 1.5% to 3.5%. The total passenger growth at SEA over the past 20 years (2019 vs 1999) was 3.0%, which is highlighted in yellow in section A. Based upon this assumed growth, SEA would begin to hit a capacity ceiling of 66 MAP as soon as 2033 if only near-term projects are completed. As shown in column B, unmet passenger demand would begin in 2033 at 1.6 MAP and grow to 17.1 MAP by 2040.

If longer-term projects are assumed to be completed, SEA's traffic ceiling is increased to 74 MAP. As shown in column C, unmet passenger demand would begin in 2037 at 2.0 million and grow to 9.1 million by 2040.

As PAE would only carry domestic O&D passengers, estimates were conducted of unmet domestic O&D passenger demand. If longer-term projects are assumed to be completed, unmet SEA domestic O&D passengers would begin in 2037 at 1.1 million passengers as shown in column E and grow to 5.2 million in 2040. This assumes that the percentage of domestic O&D passengers at SEA would decline from 64.8% in 2019 to 57.2% in 2040. This percentage decline is the same as has occurred between 1999 and 2019, where the percentage of domestic O&D passengers declined from 73.3% to 64.8%. These relative declines are being driven by relatively faster growth in international traffic, in addition to DL's buildup at SEA which drove relatively faster growth in connecting traffic over the past few years.

Exhibit 3-26 Estimated SEA Passenger Demand & Unmet Demand Sensitivities

	(A) SEA Total Passengers: CAGR Sensitivity				(B)=(A-66MAP) Passenger "Spill" (3%)	(C)=(A-74 MAP)	(D)=(.527*B) Domestic Pax "Spill" (57%)	(E)=(.572*C)
	2.0%	2.5%	3.0%	3.5%	66 MAP Cap	74 MAP Cap	66 MAP Cap	74 MAP Cap
2024	51,800,000	51,800,000	51,800,000	51,800,000				
2025	52,836,000	53,095,000	53,354,000	53,613,000				
2026	53,892,720	54,422,375	54,954,620	55,489,455				
2027	54,970,574	55,782,934	56,603,259	57,431,586				
2028	56,069,986	57,177,508	58,301,356	59,441,691				
2029	57,191,386	58,606,945	60,050,397	61,522,151				
2030	58,335,213	60,072,119	61,851,909	63,675,426				
2031	59,501,918	61,573,922	63,707,466	65,904,066				
2032	60,691,956	63,113,270	65,618,690	68,210,708				
2033	61,905,795	64,691,102	67,587,251	70,598,083	1,587,251		907,908	
2034	63,143,911	66,308,379	69,614,868	73,069,016	3,614,868		2,067,705	
2035	64,406,789	67,966,089	71,703,315	75,626,431	5,703,315		3,262,296	
2036	65,694,925	69,665,241	73,854,414	78,273,356	7,854,414		4,492,725	
2037	67,008,823	71,406,872	76,070,046	81,012,924	10,070,046	2,070,046	5,760,067	1,184,067
2038	68,349,000	73,192,044	78,352,148	83,848,376	12,352,148	4,352,148	7,065,429	2,489,429
2039	69,715,980	75,021,845	80,702,712	86,783,069	14,702,712	6,702,712	8,409,951	3,833,951
2040	71,110,300	76,897,391	83,123,794	89,820,477	17,123,794	9,123,794	9,794,810	5,218,810

Source: Landrum and Brown Estimate

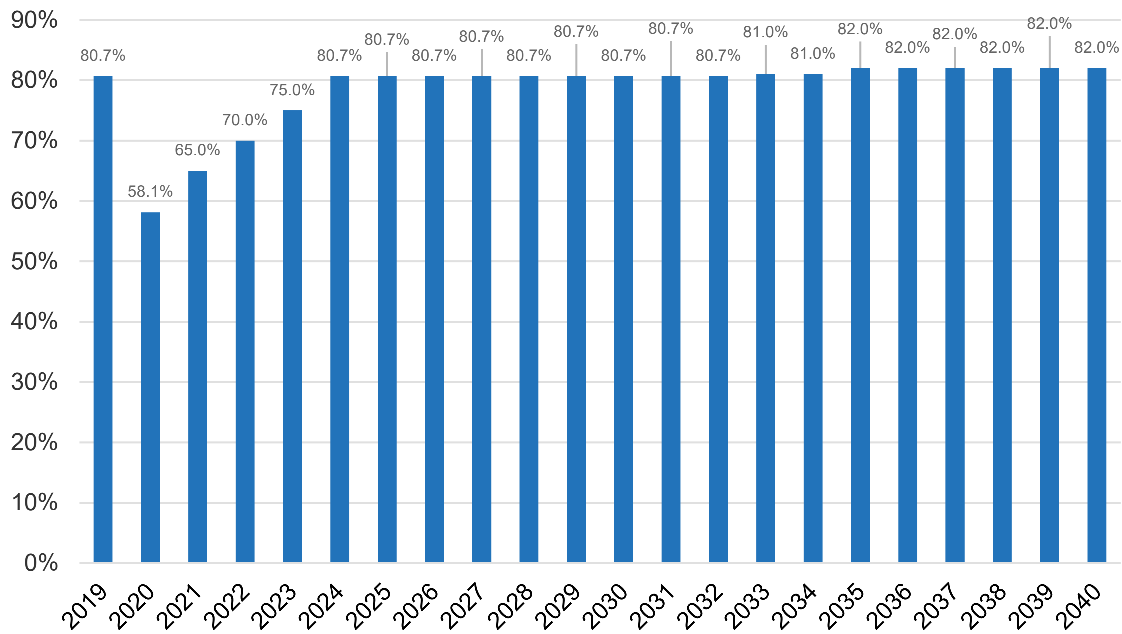
The earlier baseline passenger forecast of 4.3 million passengers by 2040 was derived by estimating passenger demand from the PAE catchment area that was consistent with other secondary U.S. airports. These are passengers that would utilize PAE (as at other secondary U.S. airports) primarily for convenience. The estimate of unmet SEA passenger demand in this section illustrates that it is likely that there will be significant unmet passenger demand at SEA by the late 2030s. This isn't traffic that would utilize PAE for convenience. As SEA reaches maximum capacity, it is likely that SEA would cater more to international and connecting traffic which would result in more domestic O&D passenger traffic shifting to PAE.

The estimate of 5.2 million unmet domestic O&D passengers at SEA by 2040 appears to indicate that passenger volumes in a range between the baseline forecast (4.3 MAP) and the high case (5.6 MAP) is warranted. Even if SEA passenger demand grows at a 2.5% CAGR as shown in Exhibit 3-26, which is well below historical rates, SEA would have 2.9 MAP in unmet demand by 2040, which is consistent with the low case forecast.

3.8 Commercial Passenger Operations Forecast (2021-40)

To estimate passenger aircraft operations, load factor assumptions were developed over the twenty-year time period. An overview of historical load factors is provided in **Exhibit 3-27**.

Exhibit 3-27 PAE Load Factor Assumptions: 2019-2040



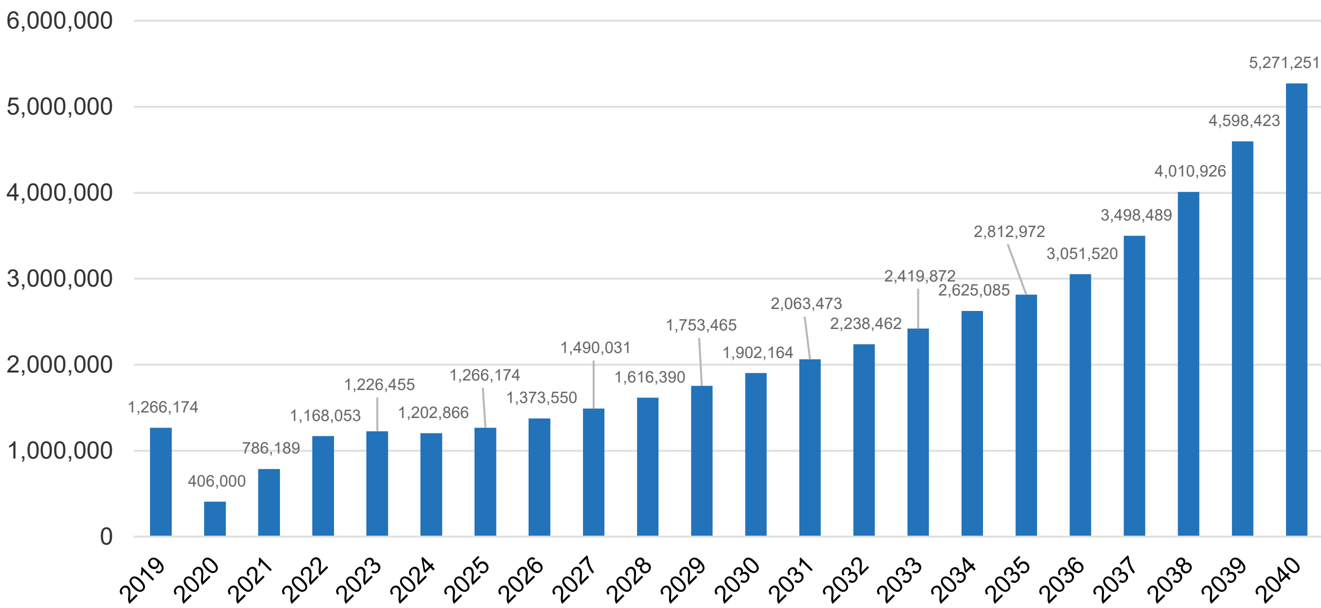
Source: Landrum & Brown Estimate

According to PAE activity reports, the PAE load factor for the year-ending March 3, 2020 time period was 80.7%. The load factor slowly improved after the start up in March of 2019. The 2020 load factor is based upon actual results through November with an estimate for December. It was then assumed that load factors will improve moderately until getting back to 2019 levels in 2024. At that point load factors are assumed to remain at those levels through 2031, then improving marginally to 81% through 2034, before increasing to 82% in 2034 where they remain through 2040.

PAE load factors are expected to be moderately less than domestic U.S. load factors, which operated at 85.2% for 2019. This is because it is expected that PAE will be primarily utilized to fly point to point markets along the west coast and to some degree mountain region markets. As a result, load factors are expected to be lower compared to longer haul markets, particularly in markets that will generate connecting plus O&D traffic.

Additionally, U.S. load factors increased by about 2%-3% points during the last decade. This is comparable to the assumed PAE load factor increase from 2025 through 2040. Combined with the passenger forecast completed earlier, an operating seat forecast was calculated. The results are shown in **Exhibit 3-28**.

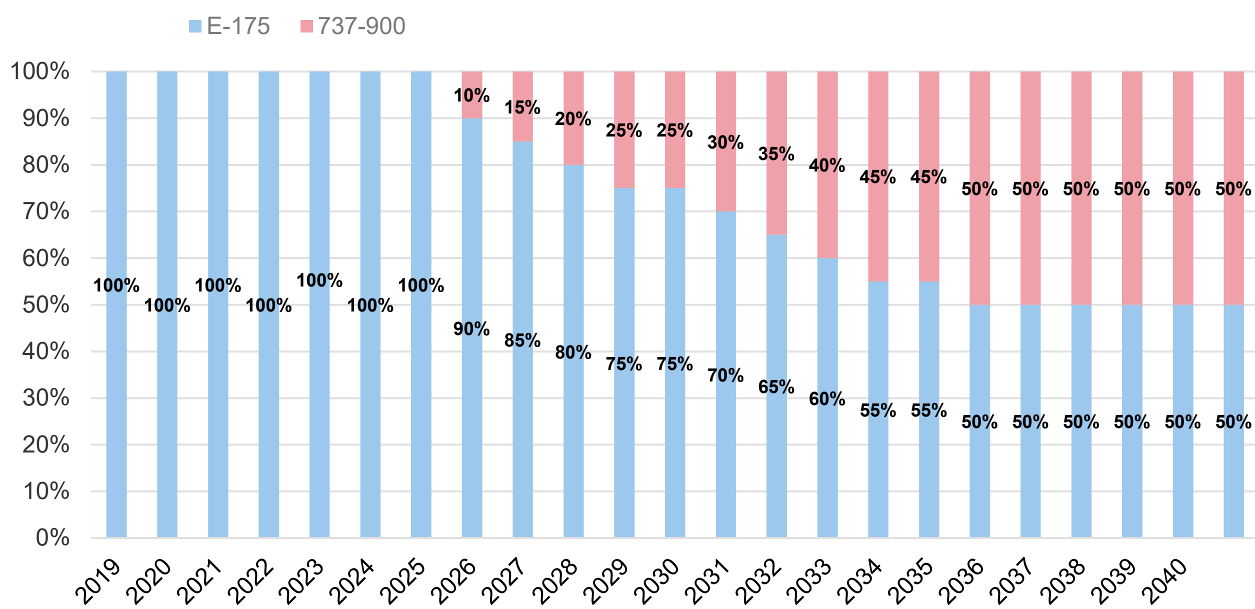
Exhibit 3-28 PAE Total Passenger Operating Seats: 2019-2040



Source: Landrum & Brown Estimate

With operating seats (departing seats x 2) forecast, the next step is to determine the aircraft fleets most likely to be used over the next twenty years. The assumed fleet mix by year is shown in **Exhibit 3-29**.

Exhibit 3-29 PAE Percentage of Passenger Operations by Aircraft Type: 2019-2040



Source: Landrum & Brown Estimate

For the year-ending March 3, 2020, which corresponds to the first 12 months of passenger operations at PAE, there were 16,660 passenger aircraft operations at PAE. During this time, PAE commercial passenger service was exclusively operated by the 76-seat E-175 aircraft. It was assumed that this will continue through 2025. Beginning in 2026, it was assumed that the 178-seat 737-900 aircraft will be introduced to PAE. The 737-900's used at PAE are expected to gradually increase over time, increasing to 50% of PAE passenger aircraft activity during the later years of the forecast period.

Alaska Air Group was assumed to continue being the dominant airline in the Seattle area and at PAE. The 737-900 aircraft was assumed to be the aircraft utilized at PAE, as well as the continued use of the E-175 aircraft. These two aircraft are currently the workhorses of the Alaska Air Group's fleet. Even as more fuel-efficient Airbus aircraft are added to the fleet, it was assumed that both the 737-900 and E-175 aircraft will comprise major parts of the AS fleet going forward.

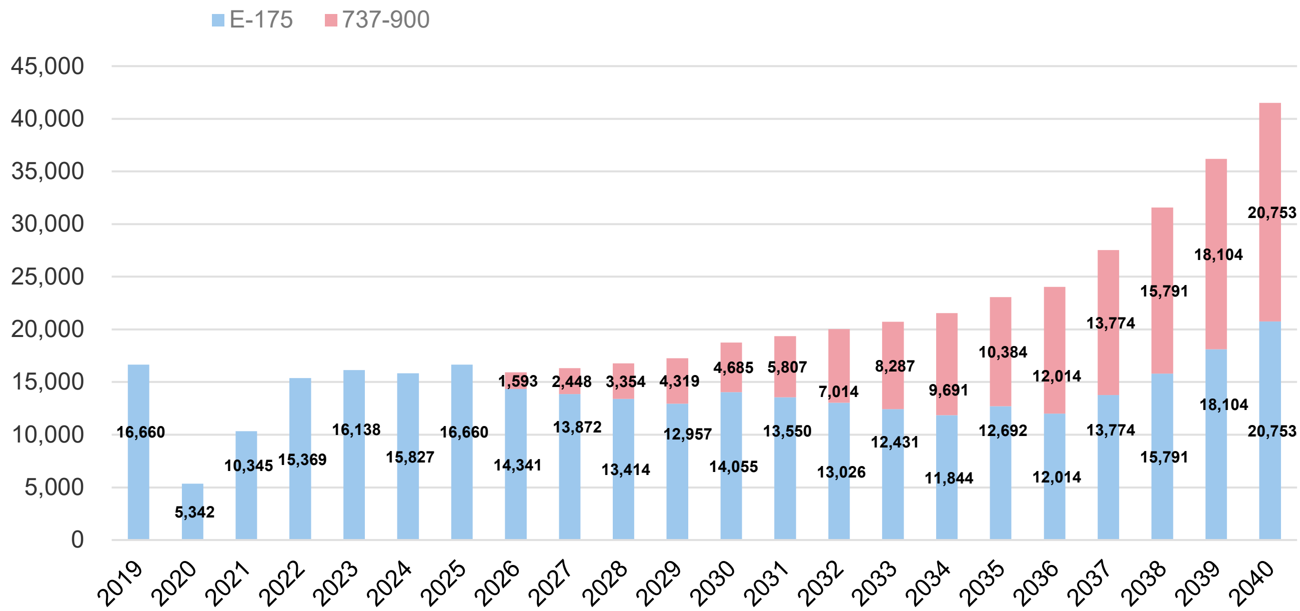
Alaska Airlines Scheduled Flying: March 2021

Aircraft Type	Flights	% of Flights	Seats	Seats/Depart
A320	2,059	7%	308,850	150
A321 Sharklets	710	2%	134,900	190
B737-700 Passenger	1,354	5%	167,896	124
B737-800 Winglets Pax/BBJ2	3,311	11%	526,449	159
B737-900 Passenger	502	2%	89,356	178
B737-900 Winglets Pax/BBJ3	7,498	25%	1,334,644	178
B737-Max 9 Passenger	180	1%	32,040	178
DHC-8-400	5,122	17%	389,272	76
E-175	9,058	30%	688,408	76

Source: Diio Mi.

The commercial passenger operations forecast is shown in **Exhibit 3-30** and also on **Table 3-22**. With the assumed increase in gauge (aircraft size), the CAGR in operations will be a little over half of the increase in passenger volumes. Larger gauge will likely become necessary as the Seattle area will be capacity constrained in the 2030s and beyond.

Exhibit 3-30 PAE Passenger Aircraft Operations by Aircraft Type Forecast: 2019-2040



Source: Landrum and Brown Estimate

3.9 Other Commercial Operations Forecast (2021- 40)

This section presents the following operations forecasts: other air carrier operations (primarily aircraft flown for maintenance and Boeing aircraft flown out for delivery), air taxi operations that have historically been primarily cargo/mail operations, and all-cargo operations.

3.9.1 Other Air Carrier Operations

Within the other air carrier operations category, the two major players are Boeing and ATS. Prior to 2019, almost all air carrier operations were tied to these two companies. Air cargo operations have been accounted for separately and are not included in this category.

ATS has contracts to conduct maintenance on aircraft for most of the largest airlines in the U.S. In addition, ATS also conducts maintenance on smaller aircraft, including business jets. As ATS is a private company, publicly available information is somewhat limited. Based upon discussions with ATS, while they took a hit from COVID, their business has been generally stable over time and this is expected to be the case going forward.

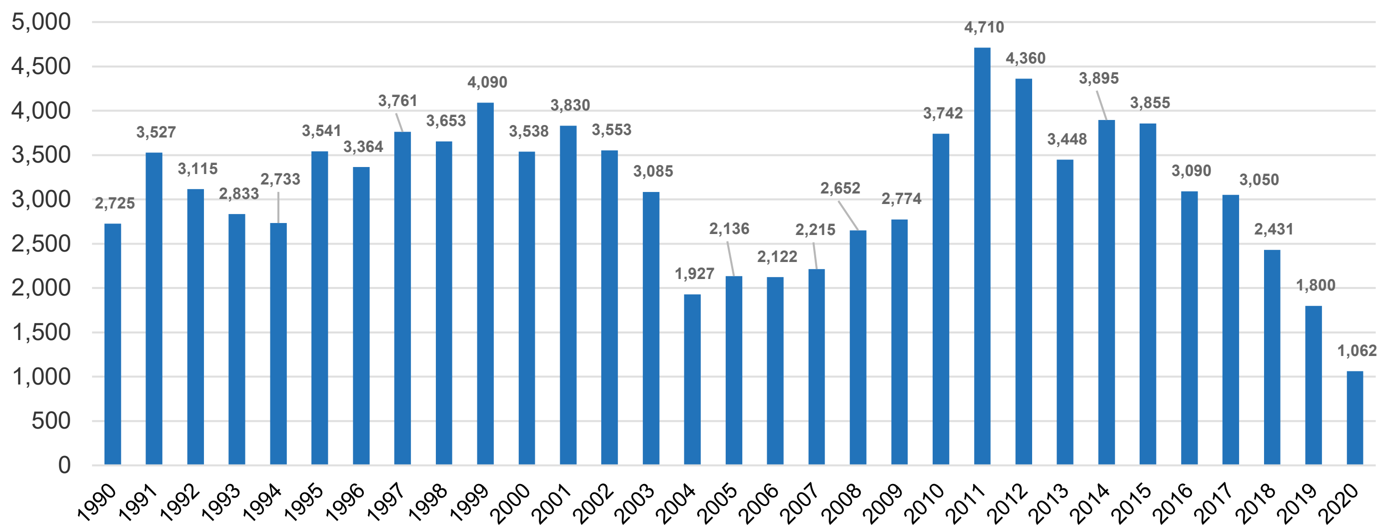
Boeing's business can be less stable over shorter periods of time, fluctuating as economic growth/contraction takes place, in addition to when new commercial aircraft are developed and come to market. But over the long-term, as the continued growth in worldwide air travel demand takes place, the continued growth in demand for commercial aircraft will follow. A significant portion of this growth will come from faster growing economies in Asia and the Middle East. Currently, 80% of Boeing's aircraft orders are from non-U.S. airlines. Boeing currently projects a 4% CAGR in worldwide air traffic over the next 20 years based upon 2.5% annual GDP growth. Boeing is estimating a 3.2% CAGR in commercial aircraft over the next 20 years. Passenger growth is expected to somewhat outpace aircraft growth due to larger aircraft gauge, in addition to longer aircraft lives.

Boeing experienced aforementioned declines in activity during the late 2000s as the worldwide economic recession took place and particularly during the 2018-2020 time period. This also impacted PAE operations as shown in **Exhibit 3-31** below.

Declines in activity during the 2018-2020 time period took place for the following reasons: First, Boeing was impacted by the 737 MAX tragedies and subsequent impact upon aircraft deliveries/orders. Second, as Boeing shifted manufacturing capacity to their South Carolina plant, activity for 787 production slowed at the Everett plant, impacting PAE operations. Third, Boeing was severely hampered by the COVID pandemic and its impact upon the aviation industry. Because of these factors, the recent declines in other air carrier aircraft operations were heavily impacted.

Based upon discussions with PAE stakeholders, it was determined that these recent declines were likely a low point and not reflective of longer-term expectations. The stakeholders indicated that the 2016-17 time period was a more representative period for longer-term Boeing activity at the airport. During these years, other air carrier operations were 3,050 and 3,090. The 737-800 generated 697 of these operations in 2017, with the 787-900 Dreamliner next at 456, with the 777-300ER accounting for 446 operations and the 737-700 at 374 operations. These 4 aircraft types accounted for 63% of aircraft operations in this category in 2017. This should not be a surprise as the 737-800 and 737-700 were the most flown Boeing aircrafts worldwide in 2019, with the 737-800 ranking only behind the A320 worldwide. These aircraft types are the preferred aircraft for fast growing ULCCs around the world.

Exhibit 3-31 All other Air Carrier Operations



Source: PAE Airport Records and FAA Report TFMSC. Compiled by Landrum and Brown
Note: Air cargo operations were taken out of this category. Example: 2017 air carrier operations were 3,722. Taking out air cargo operations of 672 (source: Snohomish County/Boeing) results in 3,050 operations.

Looking forward, there is an expectation of more normalized operations from Boeing/ATS activity, particularly as Boeing ramps up 777X production in a few years. The following factors were considered as it pertains to future forecasts:

- Boeing's 737 MAX received FAA approval to resume commercial service in November 2020 and deliveries of the 737 MAX resumed in December 2020. In addition, United just ordered 200 737 MAX aircraft, the majority which will arrive in 2023 and 2024. It appears that a "normalization" of 737 MAX deliveries is starting to take place.
- Boeing's 777X program. This program is based in Everett and expected to continue there. The first flight of the 777X was completed in the first quarter of 2020. The production rate expectation for the combined 777/777X program has been and is expected to remain at 2 per month throughout 2021. The FAA has indicated that the 777X is not yet ready for significant certification and has also indicated that realistically that it will not certify the airplane until mid-to-late 2023. Tied to this, Boeing has also indicated that the first 777X delivery will not occur until late 2023 at the earliest.
- The 777X program should generate significant activity at the Everett facility and subsequently PAE once certification takes place. As an example, pre-COVID, Boeing was producing 14 787s per month (although final assembly largely took place in South Carolina). This ties to higher PAE activity in 2016-17 and going back farther into the 1990s as other commercial aircraft came to market. Based upon FAA/Boeing indications, it is likely that this growth in production should start around 2024.

Going forward, it is forecast that operations in this category will shift back to 2017 levels by 2024, which is consistent with industry forecasts. Thereafter it is assumed that all other air carrier operations will grow at a 1.6% CAGR. This is a function of Boeing forecasting 3.2% commercial aircraft growth over the next 20 years, in conjunction with ATS indicating limited growth.

The resulting forecast is shown in **Table 3-22**.

3.9.2 Air Taxi & Air Cargo Activity

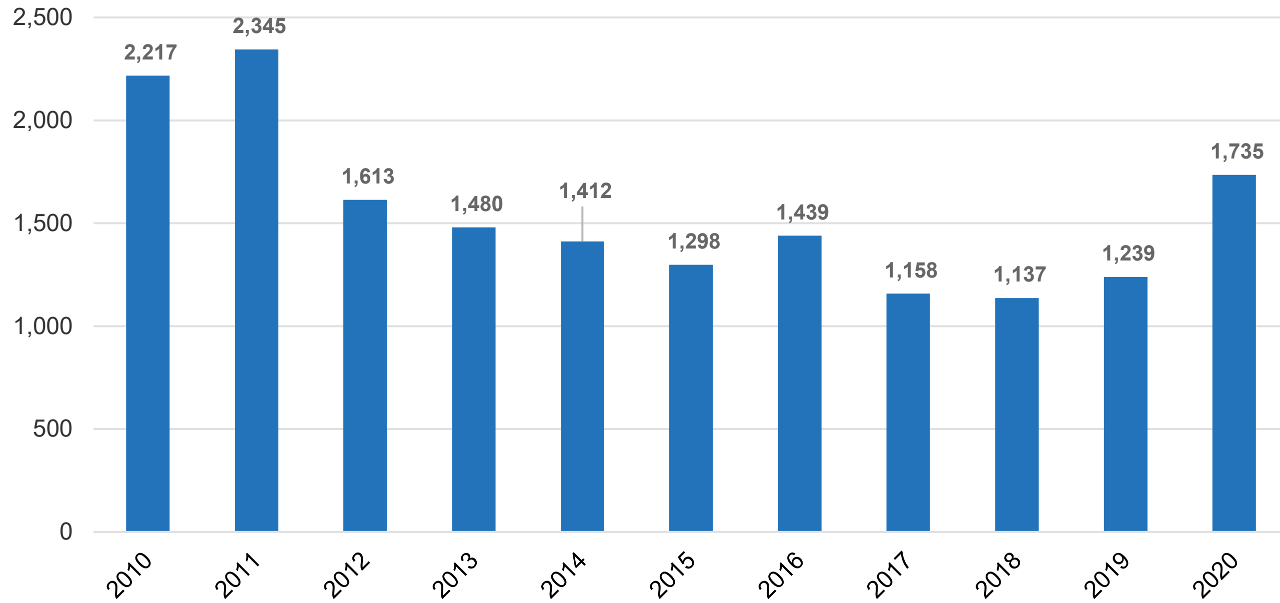
Operations related to air cargo/mail activity at the airport have been counted under the Air Taxi category of operations in Airport Traffic Control Tower data. Historically (excluding Boeing-related operations), limited air mail and air freight activity has occurred at PAE. These air cargo operations have been conducted with small air taxi type aircraft. This includes a scheduled mail route, which transports mail from the regional postal facility in Everett to the San Juan Islands and aircraft hauling checks (Ameriflight).

In 2018, there were 1,135 air taxi operations, which was primarily air freight carriers (mostly Ameriflight). Operations have been declining consistently over the past fifteen years, at roughly half 2011 levels in 2018. This is largely driven by the digital economy resulting in less need for mail and paper. This trend will likely continue into the foreseeable future.

As shown in **Exhibit 3-32**, in 2019, there was an increase to 1,239 air taxi operations, or an increase of almost 9%. This was driven by San Juan Airlines, who started service in April 2019 to Friday Harbor on San Juan island. The airline operates three- and five-passenger airplanes (Cessna 172, 206 and 207 aircraft).

In 2020, air taxi operations increased another 40% to 1,735 operations. Much of this increase was due to COVID-19 related flights. Most of these flights were transporting personal protective equipment (PPE) and pharmaceutical cargo flights. In late 2020 and into 2021, these operations are supporting the transportation of vaccine. While 2021 will likely see another year similar to 2020, it is likely that thereafter 2019 will be a more representative of air taxi operations going forward.

Exhibit 3-32 Air Taxi Operations



Source: PAE TAF (through 2019) and Air Traffic Activity System (ATADS) for 2020

Air Cargo

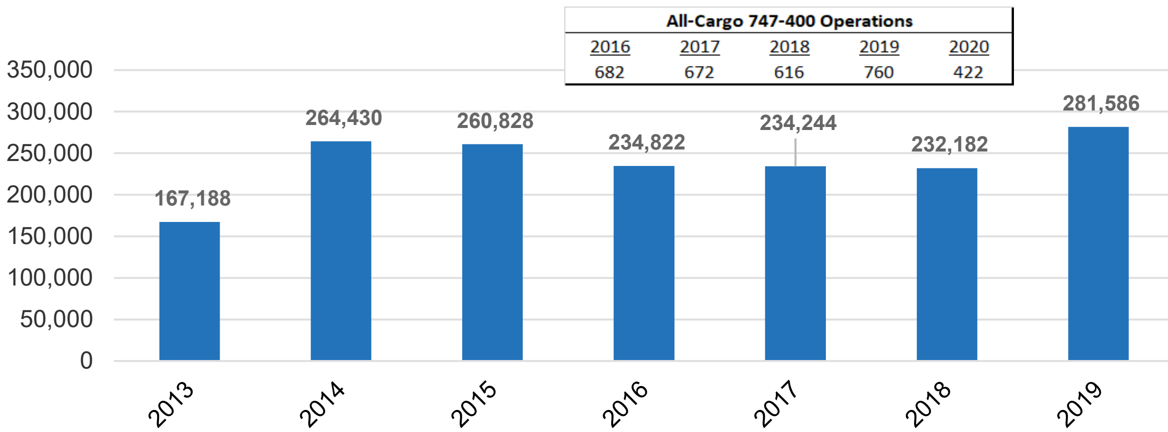
Air cargo at PAE has been mostly generated by special modified wide-body 747 freighters as a part of the Boeing Company's 787 airplane manufacturing and assembly program. Origin and destination cities for cargo generated at PAE include Anchorage (a trans-Pacific transload point), Charleston, Nagoya and Wichita. The aircraft are operated by Atlas Air Cargo. Until 2020, these operations took place on a nearly daily basis. Paine Field generated approximately 19,300 metric tons of air cargo in 2017.

As shown in **Exhibit 3-33**, PAE generated 281 million pounds of all-cargo landed weight in 2019, making PAE the 87th largest all-cargo airport in the U.S. PAE ranks as the third largest all-cargo airport in the state of Washington, ranking behind SEA (2.5 billion pounds of landed all-cargo weight) and Boeing Field (754 million pounds). PAE generated all-cargo landed weights in the 260 to 265 million pounds range in 2014-15, before declining to the mid-230 million pounds range during the 2015-18 period. In 2019 all-cargo landed weight increased approximately 22% to 281 million pounds. These changes were driven by production trends of the 787 aircraft. In 2020 as the pandemic impacted the aviation industry, Boeing's manufacturing operations fell sharply resulting in sharply lower air freight needs.

With the last Everett-built 787 rolling off the assembly line in March 2021 and given that all future 787 production will take place in Charleston, South Carolina, it is highly questionable whether Boeing's all-cargo freighter activity will be warranted at PAE. Tied to this, it is assumed that freighter activity tied to Boeing will end in 2022.

According to the recently completed Washington State Air Cargo Goods Movement Study, fresh cherries and seafood together represented over one-quarter of the region's air cargo exports, by metric tons, in 2016. Sea-Tac is a significant gateway to East Asia for footwear parts, electronic integrated circuits, and machines and apparatus for manufacturing semiconductors. Most of the growth in air cargo within the region is driven by the increase in international wide-body aircraft air service at Sea-Tac and the growth of e-commerce.

Exhibit 3-33 PAE All-Cargo Landed Weight (in 000s of Lbs.) and Operations: 2013 – 2019



Source: FAA, PAE Airport records

Given the size of the local economy near PAE and proximity to I-5, there is little doubt that there is significant demand for air cargo operations in the area. But airlines and freight forwarders already have significant infrastructure in place at both Sea-Tac and Boeing Field. Furthermore, they are more centrally located within the metro area. Hence, assuming SEA and Boeing Field can accommodate air freight demand growth going forward, they will likely be the first choice.

Sea-Tac and Boeing Field combined have enough airside ramp space to accommodate long-term demand (aircraft parking and GSE/container storage). Currently, at Boeing Field, UPS does not use on-airport warehousing but instead trucks the freight for sorting to an off-airport distribution center. But longer-term, the space available for warehouses (and their landside component) with direct access to the airfield is a scarce resource at both Sea-Tac and Boeing Field. It is these constraints that have likely resulted in an Air Cargo company reaching out to Paine Field and Boeing about leasing space at PAE.

It is estimated/assumed that an Air Cargo company would initiate service at PAE in 2022, coinciding with the exit of Boeing's all-cargo operation. It is assumed that Air Cargo would start with 5 weekly departures (10 operations) to Memphis (MEM) and 5 weekly departures (10 operations) to Oakland (OAK). This service would most likely be served with a 757-freighter aircraft, operating Monday-Friday on a year-round basis.

By 2025, it is assumed that this service increases to 6x weekly service (adding Saturday service) to each destination, where it will remain through the remainder of the forecast period. Tied to this, we're assuming that metric tons of air freight will grow from 16,000 metric tons in 2025 to a peak of 24,000 metric tons in 2040, increasing at a 2.7% CAGR.

3.9.4 Commercial Aircraft Operations Forecast Summary

Table 3-22 Commercial Aircraft Operations Forecast: 2010 - 2040

	Air Carrier						Air Taxi	Total
	Passenger Aircraft			All-Cargo	All Other	Total		
	E-175	737-900	Total					
2010	0	0	0	0	3,742	3,742	2,217	5,959
2011	0	0	0	0	4,710	4,710	2,345	7,055
2012	0	0	0	0	4,360	4,360	1,613	5,973
2013	0	0	0	457	3,448	3,905	1,480	5,385
2014	0	0	0	675	3,895	4,570	1,412	5,982
2015	0	0	0	680	3,855	4,535	1,298	5,833
2016	0	0	0	682	3,090	3,772	1,439	5,211
2017	0	0	0	672	3,050	3,722	1,158	4,880
2018	0	0	0	616	2,431	3,047	1,137	4,184
2019	16,660	0	16,660	760	1,800	19,220	1,239	20,459
2020	5,342	0	5,342	422	1,062	6,826	1,735	8,561
2021	10,345	0	10,345	380	1,800	12,525	1,735	14,260
2022	15,369	0	15,369	520	2,100	17,989	1,239	19,228
2023	16,138	0	16,138	1,040	2,431	19,609	1,239	20,848
2024	15,827	0	15,827	1,040	3,050	19,917	1,239	21,156
2025	16,660	0	16,660	1,248	3,099	21,007	1,239	22,246
2026	14,341	1,593	15,934	1,248	3,148	20,331	1,239	21,570
2027	13,872	2,448	16,320	1,248	3,199	20,767	1,239	22,006
2028	13,414	3,354	16,768	1,248	3,250	21,265	1,239	22,504
2029	12,957	4,319	17,276	1,248	3,302	21,825	1,239	23,064
2030	14,055	4,685	18,741	1,248	3,355	23,343	1,239	24,582
2031	13,550	5,807	19,357	1,248	3,408	24,014	1,239	25,253
2032	13,026	7,014	20,040	1,248	3,463	24,751	1,239	25,990
2033	12,431	8,287	20,718	1,248	3,518	25,484	1,239	26,723
2034	11,844	9,691	21,535	1,248	3,575	26,357	1,239	27,596
2035	12,692	10,384	23,076	1,248	3,632	27,956	1,239	29,195
2036	12,014	12,014	24,028	1,248	3,690	28,966	1,239	30,205
2037	13,774	13,774	27,547	1,248	3,749	32,544	1,239	33,783
2038	15,791	15,791	31,582	1,248	3,809	36,639	1,239	37,878
2039	18,104	18,104	36,208	1,248	3,870	41,326	1,239	42,565
2040	20,753	20,753	41,506	1,248	3,932	46,686	1,239	47,925
CAGR								
2040 vs 2019	1.5%	N/A	4.4%	2.4%	3.8%	4.3%	0.0%	4.1%
2040 vs 2024	1.7%	N/A	6.2%	1.1%	1.6%	5.5%	0.0%	5.2%

Source: Compiled by Landrum and Brown

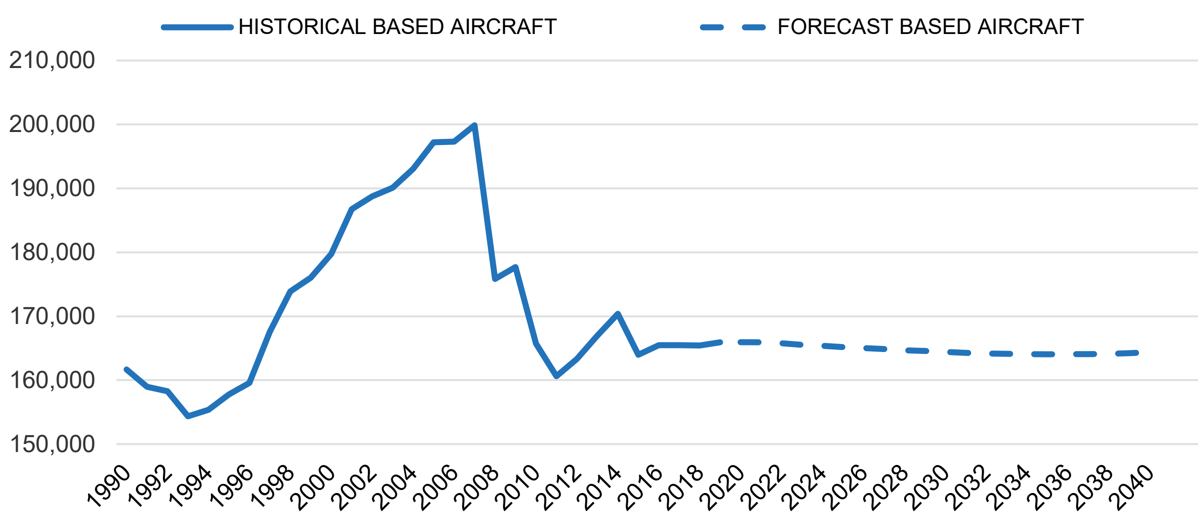
3.10 Based Aircraft Forecast

3.10.1 Based Aircraft at the National Level

On the national level, the *FAA Aerospace Forecast* provides an overview of aviation industry trends and expected growth rates for commercial passenger carrier, cargo carrier, and GA activity segments. National growth rates in passenger activity, operations, fleet growth and mix for commercial fleets and the GA fleet are provided over a 20-year forecast period. Using the published report for fiscal years 2020-2040 to align with PAE's baseline year of 2019, the *FAA Aerospace Forecast* indicates based aircraft at U.S. airports hit a 15-year low in 2011 after highs were achieved in 2007.

The economic recession from 2007 to 2009 has been attributed with the decline in the number of based aircraft, which fell nearly 20 percent between 2007 and 2011. Since the economic recovery from that time period, the general aviation community has not participated in that recovery. The number of general aviation aircraft in the U.S. has declined marginally, dropping at a CAGR of 0.6% since 2010, with higher-end business jets not quite growing as fast as the declines in smaller, piston aircraft. National forecasts over the next 20 years basically assumes no change in the total number of general aviation aircraft as shown in **Exhibit 3-34**.

Exhibit 3-34 U.S. Based Aircraft



Source: FAA Aerospace Forecast: Fiscal Years 2020-2040

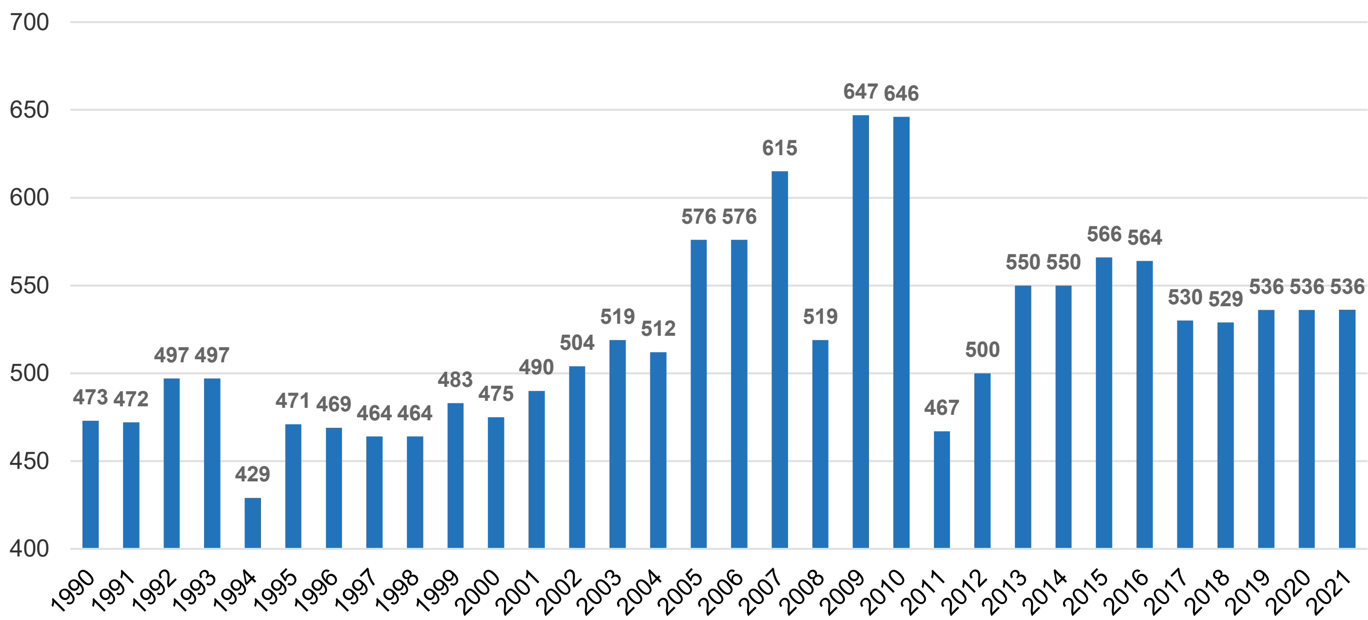
3.10.2 Based Aircraft at PAE

Prior to determining the forecast for based aircraft at PAE within the 20-year planning horizon, a review of historical and existing based aircraft data was necessary. Evaluating historical trends at an airport can be useful when projecting future aviation activity levels by providing insight as to what may be expected. Sources examined for the historical and existing based aircraft figures included the FAA *Terminal Area Forecast* (TAF) and the FAA Form 5010-1, *Airport Master Record* (5010).

The TAF is considered the official forecast of aviation activity for U.S. airports, and is often used for planning and budgeting for the implementation of capital projects. It also is a reference for historical data, as it is updated on an annual basis. Based aircraft at PAE for the past thirty years according to the most current TAF are depicted in **Exhibit 3-35**.

The TAF indicates 476 total based aircraft at PAE in 2019. This is 53 aircraft less than for the prior TAF or about 10%. Periods of steady growth followed by periods of decline seem to somewhat follow the historical trends of based aircraft at the national level. Declines since the financial crisis in 2010 are particularly evident.

Exhibit 3-35 PAE Historical Based Aircraft



Source: FAA TAF (2019-2018), Airport Records for 2019, 2020 and 2021.

But based upon stakeholder and airport feedback, there were discrepancies between different based aircraft counts. While the FAA TAF showed 476 for 2019, Washington DOT showed 658, while PAE's own records showed a total of 536 in 2021. As specific aircraft tail numbers were provided for each of these 536 aircraft, this appears to be the most realistic count. For forecast purposes, 536 aircraft will be used as the baseline. This assumes that based aircraft were 536 in 2019 (baseline year), 2020 and 2021.

3.10.3 PAE Based Aircraft Forecast

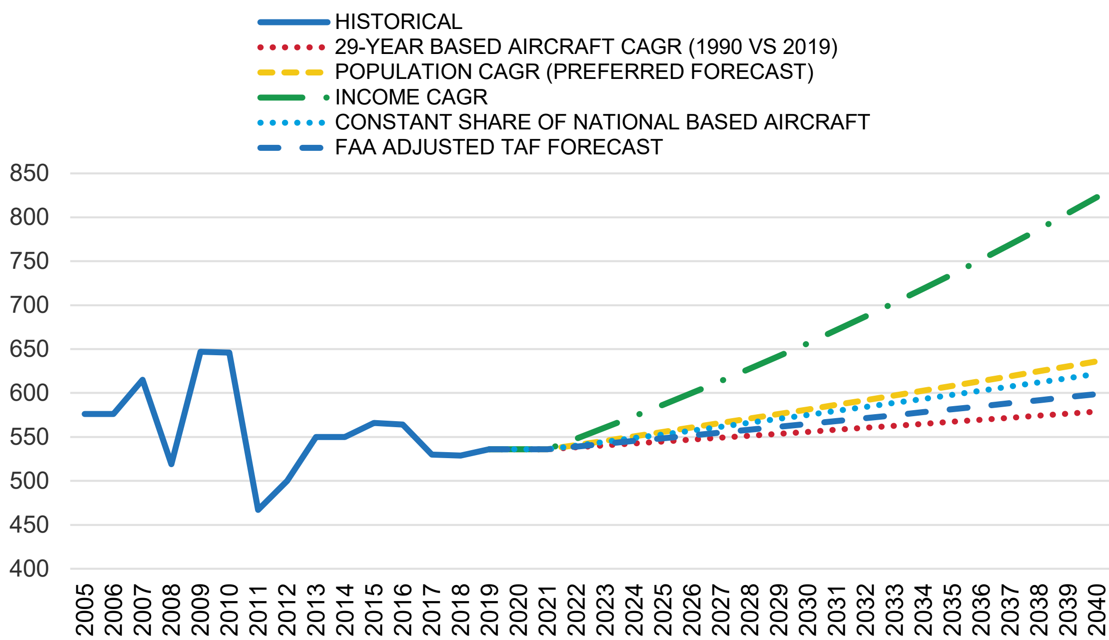
Typical forecast methodologies used to predict based aircraft at airports include time series (trend), regression, and market share analyses. These methods incorporate data from the FAA TAF, more timely airport records, Aerospace Forecasts, as well as other demographic and socioeconomic data. The specific forecasting methods applied to estimate based aircraft at PAE for the next 20 years included the following:

- 29-year PAE Based Aircraft CAGR (1990 vs 2019)
- Forecast Population CAGR (Air Service Area)
- Forecast Income CAGR (Air Service Area)

- PAE's Constant Share of the National Based Aircraft Forecast

The outcomes produced by the forecasting methodologies are illustrated in **Exhibit 3-36.** For comparative purposes, the historical and FAA Adjusted TAF based aircraft are also included. While the TAF forecast used 476 based aircraft as the baseline in 2019, based upon more timely and accurate data, the 2019 baseline should be 536 aircraft. Using 536 as the PAE based aircraft in 2019 and growing this at the FAA TAF CAGR of 0.58% results in an FAA TAF forecast of 605 based aircraft by 2040.

Exhibit 3-36 PAE Based Aircraft Forecast Methods



Source: Landrum and Brown Analysis; FAA TAF, PAE Airport Records

The forecasted population growth model for the air service area was chosen as the preferred based aircraft forecast. As previously mentioned, airports are often influenced by fluctuations in demographic and socioeconomic factors within their surrounding communities. Although modest, increases in population for the air service area, combined with steady increases in employment and per capita have the potential to increase PAE's aviation activity. The logic being that with these increases, there will be an increase in the population that may use general aviation aircraft for recreational or business purposes and, therefore, be inclined to either base an aircraft or fly to/from the airport (or both) on a regular basis.

The selected population growth model forecast projects based aircraft to increase from 536 in 2019 to 654 by 2040, growing at a CAGR of approximately 0.9%. Again, this compares to the adjusted TAF (within approximately 7.5%), which estimates Based Aircraft at 605 units by 2040 or at a 0.58% CAGR. The based aircraft forecast is summarized below in **Table 3-23**.

Table 3-23 Based Aircraft Forecast

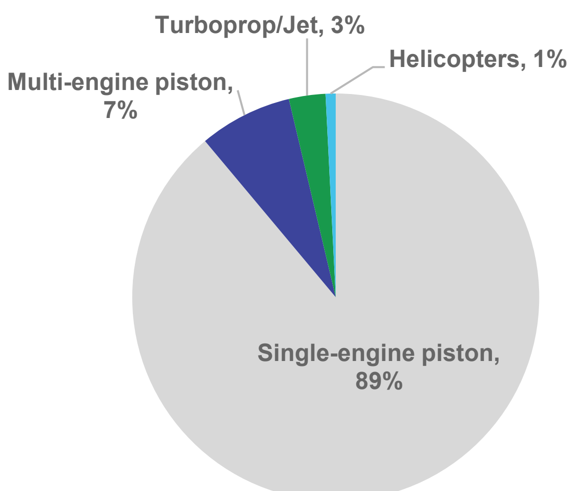
Metric	2019	2020	2025	2030	2040	CAGR
Total Based Aircraft	536	536	563	592	654	0.9%

Notes: Existing based aircraft baseline data taken from PAE Airport Records
Source: Landrum and Brown analysis, July 2021

3.10.4 PAE Based Aircraft Fleet Mix

The estimate of based aircraft over the 20-year planning horizon at an airport can be further broken down into an aircraft fleet mix, or the types of aircraft expected to be based at the airport during this time period. The existing breakdown of the types of aircraft based at the airport is reviewed, and then typically the preferred based aircraft forecast growth rate is applied to the forecast based aircraft within each planning period, which in turn determines the forecast fleet mix of based aircraft at the airport. The existing fleet mix data per airport records (July 2021) is the basis for the future fleet mix. **Exhibit 3-37** displays the breakdown of the existing aircraft fleet mix as a percentage of total based aircraft found at PAE in 2021.

Exhibit 3-37 PAE Based Aircraft Mix: July 2021



Source: Airport Records (July 2021)

For context, the FAA Aerospace Forecast, Fiscal Years (FY) 2020-2040, includes the following fleet mix projections at the national level:

- Fixed-wing piston powered aircraft are projected to decline at a CAGR of 1.0% during the next twenty years (2020 to 2040).
- Turbine-powered piston (turboprop) aircraft are assumed to grow at a 2.0% CAGR over the next twenty years, while turbine-powered jet aircraft are forecast to grow at a 3.0% CAGR.

Presently, single-engine piston aircraft comprise the majority of the based aircraft fleet mix at PAE. Multi-engine piston aircraft, rotorcraft and helicopters round out the mix. Although the national forecast predicts a decline in single- and multi-engine piston aircraft, it is anticipated that these aircraft types could increase by modest amounts based on historical flight training and recreational activities at PAE. This is in large part due to four flight schools operating at or near PAE: Regal Air, Northway Aviation, Chinook Flight Simulations and Everett helicopters. Recent growth in operations from these sectors supports this thesis.

Nationally, business jet usage has outpaced other types of GA aircraft for some time and this is expected to continue. The demand for business jets increased during COVID and appears to be increasing currently. Pre-owned business jets for sale were just 4.5% of the total fleet in early June 2021, the lowest on record, according to Cowen data (source: Barron's). Manufacturers are also in short supply. Demand increase appears to originate from first-time buyers, while at the same time large corporations and foreign buyer interest is currently lagging.

PAE has also experienced good growth in business jet activity over the past decade. Business jet activity has increased from 1,422 operations in 2010 to 2,040 in 2020, representing a 3.67% CAGR, which is about 20% faster than that of the U.S. Business jet activity grew marginally between 2019 and 2020, even during the height of the COVID-19 pandemic.

Table 3-24 presents the based aircraft fleet mix for PAE over the next 20-year planning horizon.

Table 3-24 Based Aircraft Fleet Mix Forecast

Year	Single-engine Piston	Multi-engine Piston	Turboprop/Jet	Helicopters	Total
2019	477	38	16	5	536
2020	477	38	16	5	536
2025	501	39	17	6	563
2030	527	41	18	6	592
2040	582	46	20	7	654

Notes: Existing based aircraft baseline data taken from Airport records.
Source: Compiled by Landrum & Brown, July 2021

3.11 General Aviation Annual Operations Forecasts

3.11.1 Introduction

General aviation annual operations were developed for the 20-year planning period. General aviation operations include all aircraft operations other than the commercial passenger, cargo transport, or military operations. These operations can be broken down further into either itinerant or local operations. Itinerant operations are for takeoff or landing operations going from one airport to another airport on trips of at least 20 miles. Local operations are in many cases touch-and-go and other training operations that stay near PAE.

General aviation operations forecasts provide airports with information that can be useful for future development planning. These forecasts for PAE includes the review of historical, existing, and forecast data from the FAA and airport management records. For context, a brief discussion on general aviation operational trends at the national level is also provided.

3.11.2 General Aviation Operations at the National Level

The general aviation industry recorded a modest increase of 1.4% in deliveries of U.S. manufactured aircraft in 2019, with pistons up by 6.5% and turbines, due to a decline in turboprop segment, down by 3.2%. As the higher priced turbojet deliveries improved by 6.3%, U.S. billings increased by 20.5% to a record $14.0 billion. General aviation activity at FAA and contract tower airports had a 3.3% increase in 2019 as local activity rose 6.1% and itinerant operations went up by 0.8%. For local GA activity, this was the highest increase recorded in more than twenty years.

Pre-COVID, the FAA forecast that the long-term outlook for general aviation was relatively stable, as growth at the high-end offset continuing retirements at the traditional low end of the segment. The active general aviation fleet was forecast to decline slightly by 0.9% between 2020 and 2040. While steady growth in both GDP and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed wing piston aircraft continues to shrink over the forecast period. Against this marginally declining fleet, the number of general aviation hours flown is projected to increase by 16% (an average of 0.7% per year) during the same period, as growth in turbine, rotorcraft, and experimental hours more than offset a decline in fixed wing piston hours.

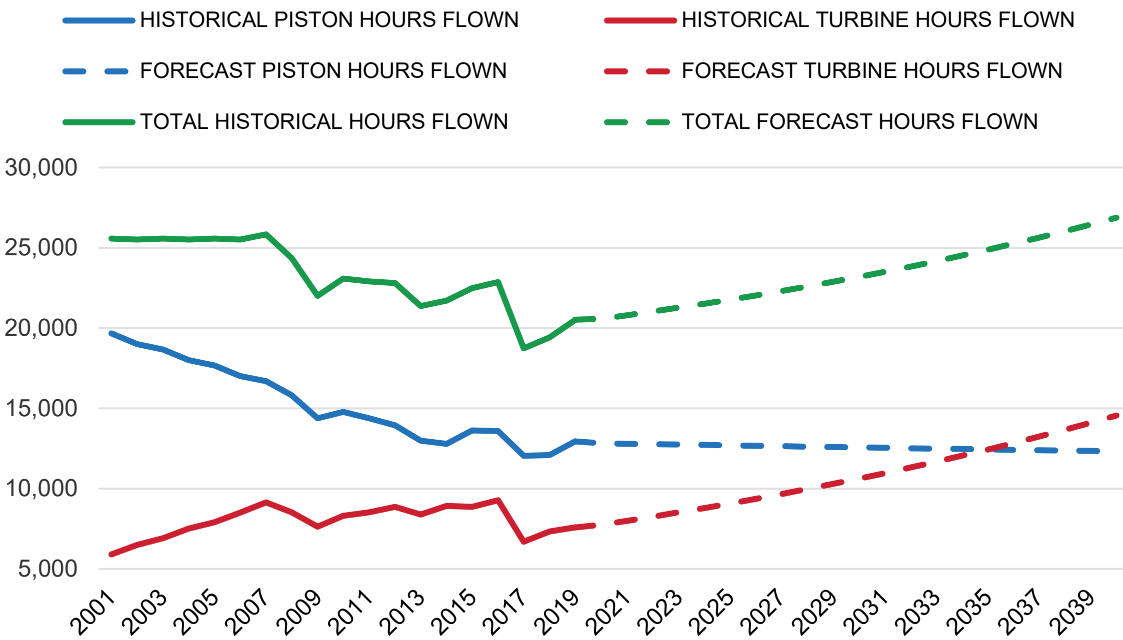
The number of turbine aircraft hours flown has increased an average of 3.2% annually between 2010 and 2019. Helicopters, which are also used by corporations, have also seen steady increases in hours flown. Conversely, the number of piston-powered aircraft hours flown has decreased steadily since 2010 and this is expected to continue. Although these types of aircraft still comprise the majority of general aviation aircraft in the U.S., they are used primarily for recreational and flight training purposes. According to the *Aerospace Forecast*, decreases can be attributed to higher ownership costs, increased fuel prices, and a decreasing pilot population. Multi-engine piston aircraft have seen the largest declines. These aircraft types are being replaced by newer, more efficient turboprop or jet aircraft for business travel.

Strong growth in corporate aircraft, and steady or decreased use of piston aircraft, is expected to continue over the planning period. This forecast may fluctuate with new unleaded fuel engines potentially reducing the cost of flying. The number of turbine aircraft hours flown (including rotorcraft) is expected to increase 2.2% annually during the forecast period.

Post-COVID, preliminary results (source: FAA OPSNET) indicate that GA Itinerant operations declined from 14.38 million in 2020 to 12.33 million in 2019, for a decline of 14.3%. GA local civil operations declined from 13.3 million in 2019 to 12.4 million in 2020, for a decline of 7.1%. Total general aviation operations declined 10.8%. Most of the declines took place during the 2nd quarter of 2020, during the depths of the pandemic.

As expected, in 2020, COVID-19 negatively impacted general aviation airplane orders and shipments, although they were more muted than with operations. Airplane shipments in 2020 saw piston airplane deliveries decline 0.9%, while turboprop airplane deliveries declined 15.6% and business jet deliveries declined approximately 16.9%. Total airplane shipments were down 9.7% in 2020 versus 2019. **Exhibit 3-38** and **Table 3-25** provide a summary of the FAA forecast for 2020-2040.

Exhibit 3-38 U.S. General Aviation Hours Flown



Source: FAA Aerospace Forecast: Fiscal Years 2020-2040

Table 3-25 U.S. General Aviation and Air Taxi Hours Flown

Year	Piston	Turbine	Total
Historical*			
2010	13,979	5,700	19,679
2015	12,825	6,375	19,200
2016	13,548	6,554	20,102
2017	13,583	6,690	20,273
2018	13,785	7,328	21,113
2019	13,700	7,584	21,284
Forecast			
2020	13,497	7,827	21,324
2025	12,479	8,901	21,380
2030	11,776	9,953	21,729
2035	11,321	10,936	22,257
2040	11,177	11,983	23,160
CAGR			
2010-19	-0.2%	3.2%	0.9%
2019-20	-1.5%	3.2%	0.2%
2020-30	-1.4%	2.4%	0.2%
2030-40	-0.9%	2.2%	0.4%

Source: FAA Aerospace Forecast: Fiscal Years 2020-2040; Landrum and Brown analysis, February 2021

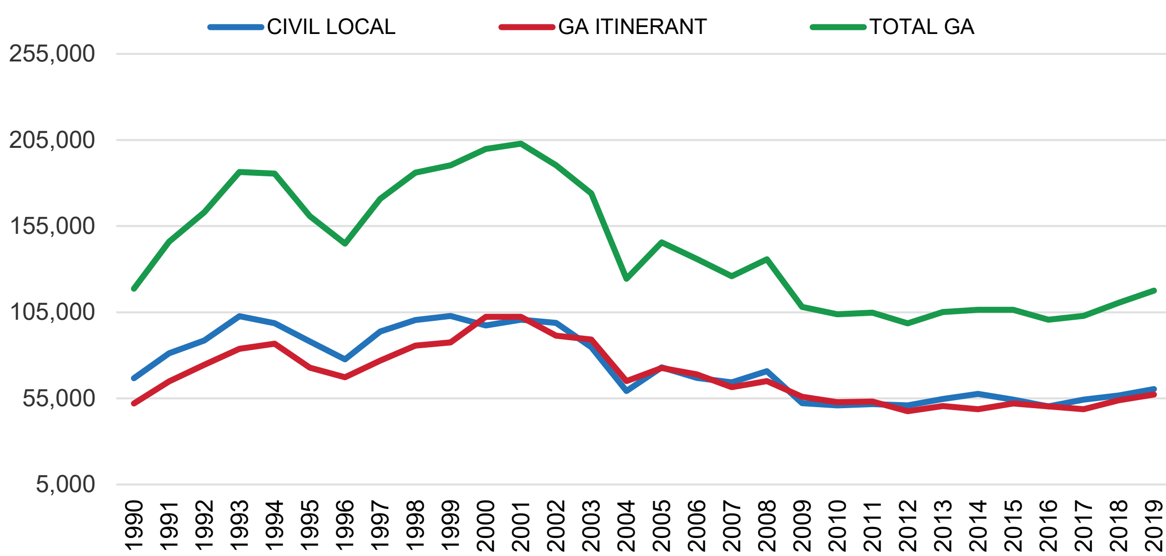
3.11.3 General Aviation Annual Operations at PAE

Many factors affect general aviation activity at airports, most notably those related to local and regional socioeconomic and demographic factors. Furthermore, GA activities at an airport vary depending on its pilot base, geographic location, and services offered. PAE is no exception as it has experienced fluctuations in its overall GA operations, with the result that PAE's general aviation activity is relatively unchanged versus levels of almost thirty years ago (see **Exhibit 3-29**). In line with general U.S. trends, PAE's GA operations have fallen acutely since 2001, with most of the decline occurring through 2003 and then again during the financial crisis in the late 2000s, finally bottoming in 2012. The decline was almost equally split between civil local and itinerant operations. Since 2012, general aviation operations at PAE have stabilized and have grown over 19% through 2020 or at a 2.2% CAGR.

PAE is a relatively large general aviation airport, ranking as the 52nd largest GA airport in the U.S. based upon operations and 2nd largest within the state of Washington to Boeing Field (based upon itinerant and local civil operations per the FAA's Operation Network Database). This established PAE in the 90th percentile of U.S. airports.

Much of PAE's success as a GA airport is in part driven by the number of flight schools located nearby, including Regal Air, Northway Aviation, Chinook Flight Simulators and Everett Helicopter. This has likely been the case over the past few years as the commercial pilot shortage became more prevalent.

Exhibit 3-39 PAE Historical General Aviation Operations (1990-2019)



Source: FAA PAE TAF for years 1990-2019

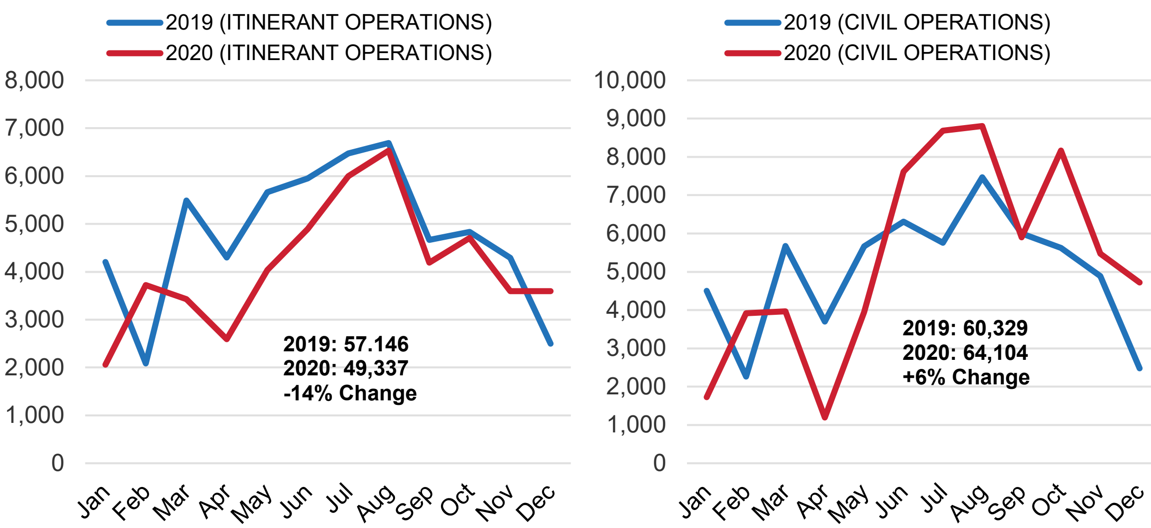
Exhibit 3-40 illustrates PAE's general aviation activity by month for both itinerant and civil local operations for the years 2019 and 2020. PAE's GA operations fell sharply starting in March when COVID-19 started to hit the state of Washington.

These year over year declines continued until mid-summer when operations started to increase. Since then, itinerant operations continued to approximate 2019 levels until exceeding 2019 levels in December. For the full year, itinerant operations were “only” down 14%, with most of the declines taking place from March through June.

PAE’s general aviation local operations saw declines from March through May, but since then have exceeded, in some months by significant amounts, 2019 levels. Even with the March through May declines, PAE’s GA local operations were up 6% as compared to 2019. The strength of PAE’s local operations were largely driven by the nearby flight schools.

Total PAE general aviation operations were only down 3.7% in 2020 as compared to 2019. Furthermore, after initial shocks from March through May, GA activity was generally up in 2020 as compared to 2019. This is indicative of the relative strength of the PAE GA market.

Exhibit 3-40 PAE Monthly General Aviation Operations: 2019 - 2020



Source: FAA Air Traffic Activity System (ATADS)

For the purposes of generating general aviation operations forecasts for PAE within the 20-year planning horizon, the local operations data reported on the FAA Traffic Activity System (ATADS) for CY 2020 was used as the baseline year, and ATADS for CY for 2019 was used for GA itinerant operations.

These time periods were used, given the severe short-term hit that itinerant operations took in the spring/early summer of 2020 and the subsequent recovery during the second half of 2020. This indicates that for itinerant operations the reduction in operations was a temporary shock. CY 2020 was used for local operations given the short-term nature of the drop in operations and the strength of the recovery later in 2020.

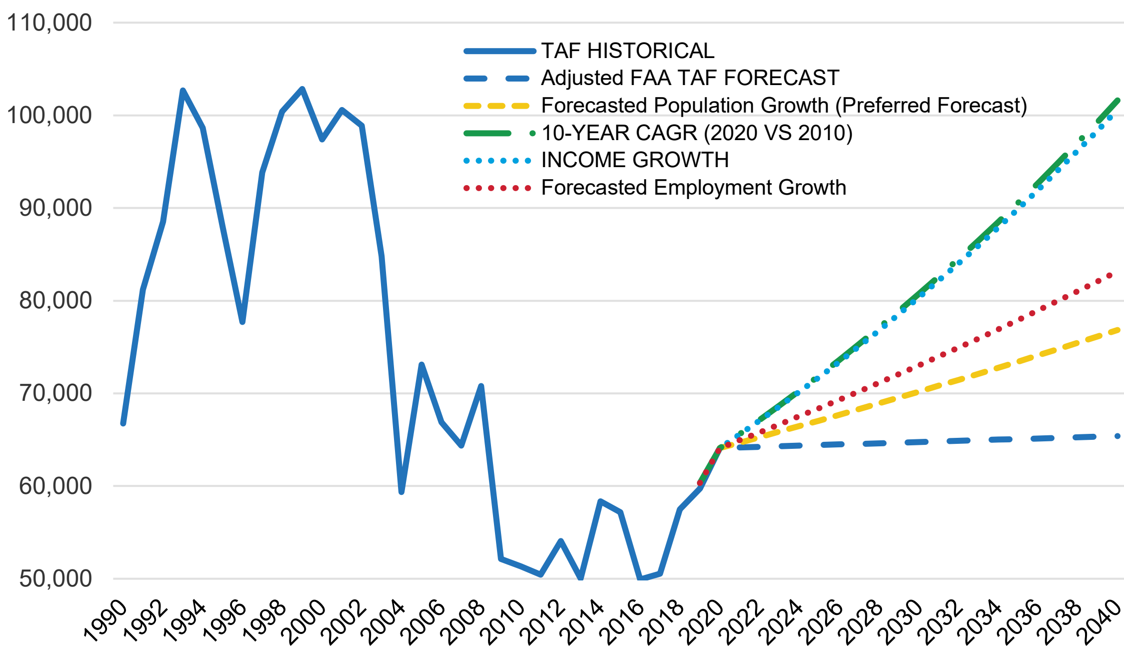
3.11.3.1 Local (Civil) Operations Forecast

The FAA defines local operations as those performed by aircraft that 1) operate in the local traffic pattern or within sight of an airport; 2) are known to be departing for, or arriving from, flight in local practice areas within a 20 nautical mile radius of the airport; and 3) are executing practice instrument approaches. Local operations are tracked by the FAA as either civil, i.e. civilian, or military local operations. As such, the general aviation local forecasts only include operations within the civilian category.

According to the January 2021 FAA TAF and ATDS, local operations at PAE have climbed consistently since 2010. During the ten-year period from 2010 through 2020, PAE local operations have increased from 50,930 to 64,104. This represents a 25.9% increase over the 10-year period or a 2.33% CAGR.

Much of this relative strength has been from the nearby flight schools. PAE's 2020 local operations were 4.4% greater than the TAF 2020 forecast. The forecast will incorporate the actual 2020 result as the baseline year.

Exhibit 3-41 PAE GA Local Operations Forecast Summary



Source: FAA PAE TAF (2020-2040) for years 1993-2015; FAA Form 5010-1, Airport Master Record, 2020; Landrum and Brown analysis, February 2021

As shown in in **Exhibit 3-41** above, several different forecasting methods were applied to estimate local operations at PAE for the next 20 years. Each of these methodologies considered a longer-term perspective that reflected different economic scenarios.

Based on the analysis of these methodologies, the preferred forecast method is identified as the population growth forecast method. Over longer-term periods, it is typically population and economic growth that are the best predictors of general aviation demand. Since the end of the financial crisis, PAE has generated good, consistent GA local demand.

Consequently, this forecast projects that local civil operations will increase at a CAGR of 0.9% per year. This ultimately results in a forecast of 76,837 local civil operations by 2040. The historical and forecast FAA TAF local operations, as well as the various forecast method projections, are illustrated on **Exhibit 3-41.**

3.11.3.2 Itinerant Operations Forecast

The FAA defines itinerant operations as operations performed by aircraft that land at an airport, arriving from outside the airport area, or departing an airport and leaving the airport area, beyond a 20 nautical mile radius in either instance.

Again, there are several categories of itinerant operations that the FAA records; itinerant operations by air carrier, air taxi, and commuter aircraft were captured within the commercial service forecast section, and itinerant military operations are included in a subsequent section. The forecast presented here only reflects itinerant operations projections for GA aircraft at PAE.

According to the January 2021 FAA TAF, GA itinerant operations at PAE have followed similar trends as PAE GA local operations. After peaking in CY 2000, PAE itinerant operations continued to fall steadily, until bottoming in 2012 – similar to PAE GA local operations and broader U.S. trends. From 2012 until 2019, PAE itinerant operations increased from 47,541 to 56,966, or 19.8%. This works out to a 2.62% CAGR which is comparable to economic growth from the region during this same period.

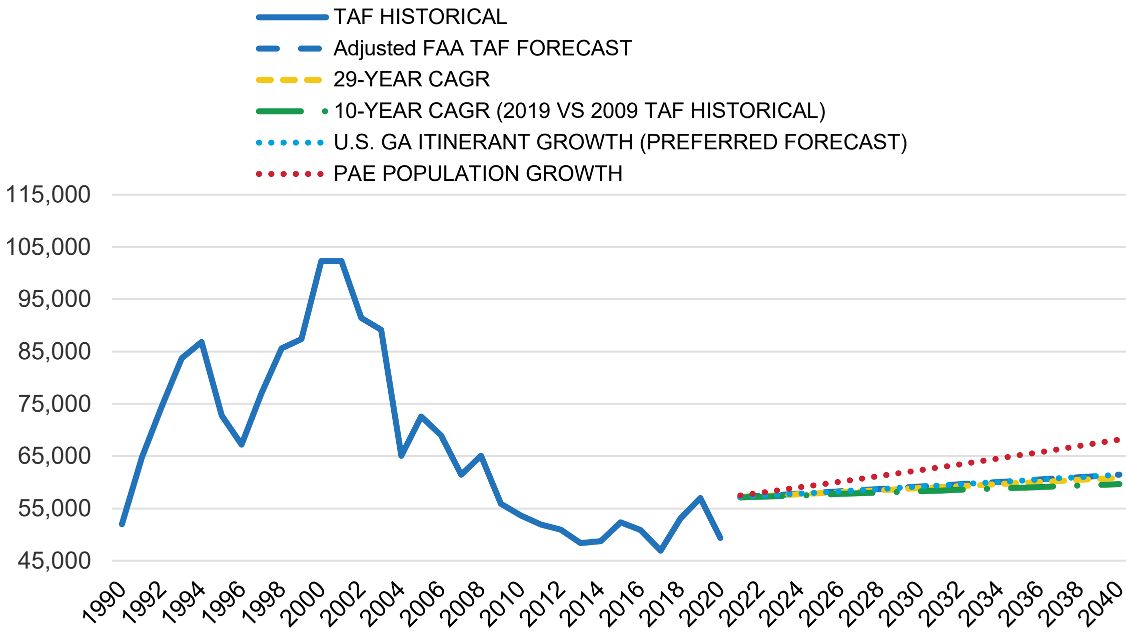
But in 2020, with the outbreak of COVID-19, PAE's GA itinerant operations declined 149%. Still, most of the decline took place during the late spring/early summer. By mid-summer and into the fall time period, PAE's GA itinerant operations approximated 2019 levels and in December 2020 rose well above December 2019 levels.

The specific forecasting methods applied to estimate itinerant operations at PAE for the next 20 years included the following:

- PAE Itinerant Operations 29-year CAGR (1990 vs 2019)
- PAE Itinerant Operations 10-year CAGR (2009 vs 2019)
- Forecast U.S. GA Itinerant Growth
- Forecast Population Growth (Air Service Area)
- FAA Adjusted PAE TAF (accounting for 2019-20 actuals)

Based on the analysis of these methodologies, the preferred forecast method was identified as the forecast U.S. GA Itinerant growth rate of 0.38%, using PAE's GA itinerant operations for 2019 as the baseline. This forecast method ultimately results in a forecast of 61,849 GA itinerant operations by 2040. It should be noted that all forecast methodologies resulted in similar results. The historical and forecast FAA TAF itinerant operations, as well as the various forecast method projections are illustrated on **Exhibit 3-42**.

Exhibit 3-42 PAE GA Itinerant Operations Forecast Summary



Source: FAA PAE TAF (2020-2040); Landrum and Brown analysis, February 2021

3.11.4 General Aviation Operations Summary

General aviation operations at PAE are forecast to grow to 138,282 by 2040, a 0.80% CAGR compared to 2019. Itinerant operations are forecast to grow at a 0.36% CAGR (versus 2019) over the forecast period, resulting in 61,445 operations by 2040, or comparable to levels generated in 2008 during the depths of the financial crisis. PAE GA local operations are forecast to grow at a 0.91% CAGR (versus 2020), which results in 76,837 local operations by 2040, comparable to levels generated in 2004. Part of the rationale for increased local operations is the expected increase in flight school enrollment in the coming years, due to the rash of pilot retirements in 2020 and into 2021. This will likely result in pilot shortages that were already an issue prior to COVID-19. A summary of the local civil and itinerant GA operations forecasts for PAE are shown in **Table 3-26**.

Table 3-26 General Aviation Operations Forecast Summary

Metric	2019	2020	2025	2030	2040	CAGR*
Local Operations	59,728	64,104	67,074	70,182	76,837	0.91%
Itinerant Operations	56,966	49,337	58,057	59,168	61,445	0.36%
Total Operations	116,694	113,441	125,131	129,350	138,282	0.80%
Local Share	51%	57%	54%	54%	56%	-
Itinerant Share	49%	43%	46%	46%	44%	-

Source: Landrum and Brown analysis, February 2021
* Local Operations CAGR (2040 vs 2020), Itinerant Operations (2040 vs 2019)

3.12 Military Operations Forecast

The number of military operations at PAE has declined since the early 1990s. Military itinerant operations peaked at 3,893 in 1992, dropping to 546 during the trough of the financial crisis in 2009, then improving to 823, before descending again to 379 in 2018 before improving to 428 in 2019 and to 649 in 2020. In 2020, the month of December more than doubled year over year, which would possibly indicate that this was tied to COVID vaccine-related efforts. Note that 2019-20 results were supplied from the Air Traffic Activity System (ATADS), while the result through 2018 came from the FAA TAF.

Local military civil operations, after declining in the early 1990s, has generally been consistently in the range of 200-400 annually, although local military operations also saw a significant increase in 2020.

Table 3-27 provides the military operations forecast for both local and itinerant operations. The forecast used for military operations ties to the TAF.

Table 3-27 Military Operations Forecast Summary

Metric	2019	2020	2025	2030	2040	CAGR*
Local Operations	437	733	561	561	561	1.20%
Itinerant Operations	428	649	535	535	535	1.07%

Source: Landrum and Brown analysis, FAA TAF; CAGR based upon 2040 vs 2019

3.13 Annual Instrument Approaches

Annual instrument approaches (AIAs) are defined as an approach to an airport conducted in actual instrument meteorological conditions. For purposes of this definition, an approach initiated when the observed visibility is less than three miles, or the cloud ceiling is less than the decision altitude over the final approach fix is considered an instrument approach. To determine AIAs, the number of itinerant operations were totaled from earlier estimates and compared to annual operations. Approximately 73% of all itinerant flight operations are conducted under instrument flight rules (IFR) according to FAA records. A review of local weather conditions found that 15% of these operations are conducted in actual instrument conditions for an instrument approach as shown in **Table 3-28**.

Table 3-28 Annual Instrument Approach Forecast

	2019	2020	2025	2030	2040	CAGR
Annual Operations	137,995	123,384	148,473	155,028	187,303	1.5%
Itinerant Operations	77,820	58,547	80,838	84,286	109,905	1.7%
% IFR Itinerant	36.20%	36.20%	36.20%	36.20%	36.20%	n/a
IFR Itinerant	28,171	21,194	29,263	30,512	39,786	1.7%
IFR Approaches	14,085	10,597	14,632	15,256	19,893	1.7%
Instrument Approach	15.00%	15.00%	15.00%	15.00%	15.00%	n/a
Annual Instrument	2,113	1,590	2,195	2,288	2,984	1.7%
AIA as a % of Itinerant	2.7%	2.7%	2.7%	2.7%	2.7%	n/a

Source: Landrum and Brown analysis

3.14 Peak Period Forecasts

The traffic demand patterns imposed upon an airport are subject to seasonal, monthly, daily, and hourly variations. Peaking characteristics are critical in the assessment of existing facilities and airfield components to determine their ability to accommodate forecast increases in passenger and operational activity throughout the forecast period.

The annual passenger and aircraft operations forecasts for PAE were converted into monthly, daily, and peak hour equivalents. The peak period aircraft operations forecasts were developed for passenger, all-cargo, other air carrier, air taxi, GA, military, and total operations.

3.15 Monthly Seasonality

The monthly passenger data from the Airport was used to determine the peak month for passengers. In 2019, August was the peak month for passengers. The month of August accounted for 11.5% of the annual passengers. Airport tower counts were used to determine the peak period for aircraft operations. August was also the peak period for aircraft operations, accounting for 11.8% of total operations.

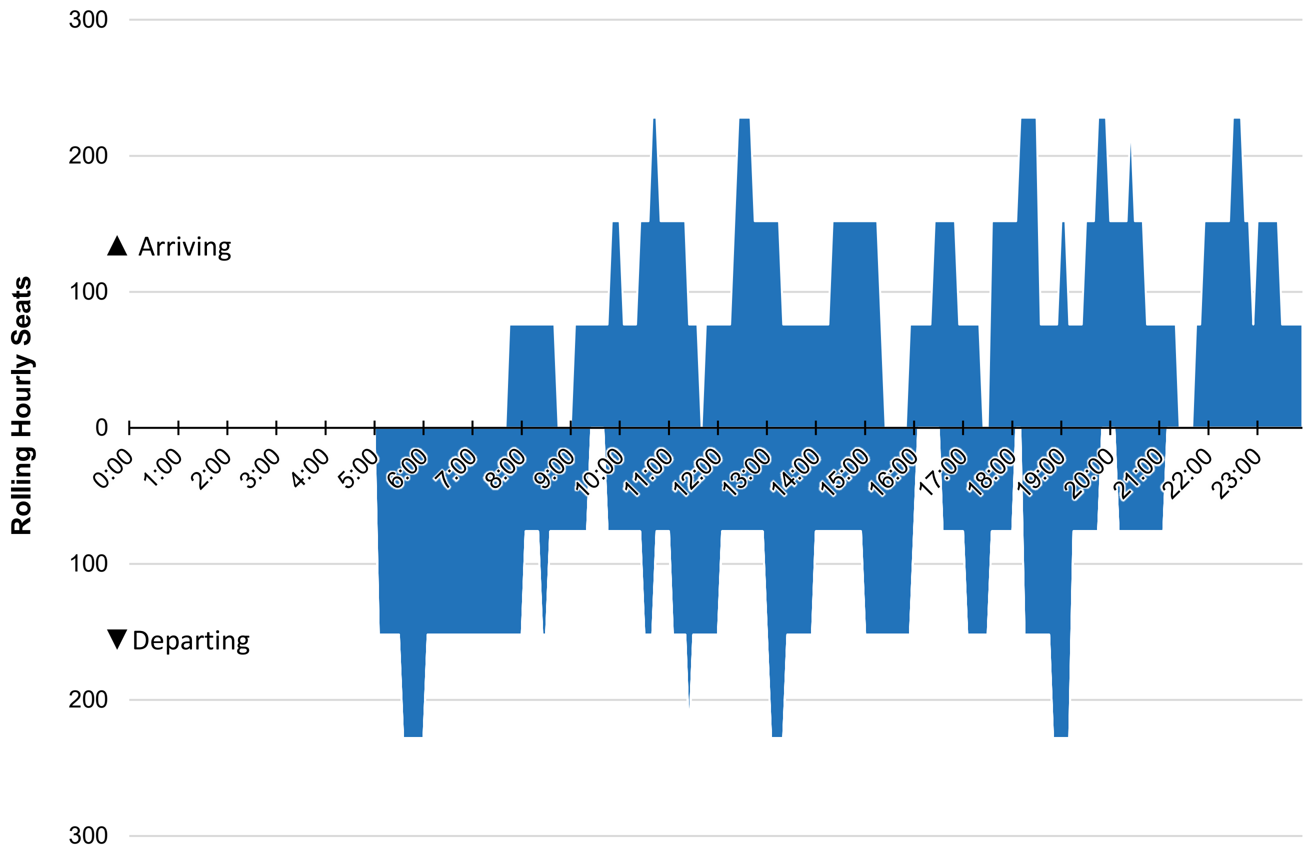
3.16 Daily Variation

The FAA recommends the use of the average day of the peak month, typically referred to as the peak month average day (PMAD), for purposes of physical planning such as developing gate requirements. There is currently no difference in passenger operations across the month. In August of 2019, there were 48 scheduled aircraft operations every day utilizing the same 76-seat aircraft. However, there were some differences in load factors from day to day. Based on the Airport's daily passenger counts, August 20, 2019 was selected as the design day as it most closely resembles the average day for the month.

3.17 Hourly Profiles

The published flight schedules for the design day for 2019 were analyzed to determine the hourly profile at the Airport to identify the periods of time where traffic was most concentrated. Using a clock hour as the basis for peak periods does not allow for peak periods of traffic that occur across clock hours to be identified, i.e. traffic occurring late in the first hour combined with the traffic at the beginning of the next hour. Therefore, a rolling 60-minute hour approach was used to determine the design day profile. In this case, aircraft operations were categorized into one of 288 five-minute buckets, or bins, that occur during the given day. The sum of twelve sequential buckets represents a rolling 60-minute hour. **Exhibit 3-43** graphically presents the rolling 60-minute hour profile for scheduled passenger seats in the design day for 2019.

Exhibit 3-43 Rolling 60-Minute Seating Profile (August 20, 2019)



Sources: Diio Mi, Schedule – Dynamic Table. Landrum & Brown.

3.18 Peak Period Forecast Summary

Information regarding peak month, average day, and peak hour from the design day was used to formulate factors to determine the peak period forecast. These factors include the peak month as a percent of the annual, the design day as a percent of the peak month, and the peak hour as a percent of the design day.

3.18.1 Aircraft Operations Forecast

Annual aircraft operations were divided by the peak month aircraft operations, peak month aircraft operations were divided by the design day aircraft operations, and the design day aircraft operations were divided by the peak hour aircraft operations to determine the peak period factors. Peak period factors were expressed for each of the segments (scheduled passenger, cargo, GA and air taxi, and military).

It was assumed that the peak month factors would remain relatively unchanged through the forecast period. However, the expansion of service at the Airport to meet future demand would result in an increase in design day factors but a more evenly distributed profile across the day. As a result, the design day and peak hour factors were adjusted to account for these changes. The annual, monthly, daily, and peak hour aircraft operations forecasts are presented in **Table 3-29**.

The total of annual, monthly, and design day aircraft operations is the aggregation of the individual segments. However, each of the individual segments peak at different periods of the day. As a result, peak hour total aircraft operations are not equal to the sum of the categories.

Table 3-29 Peak Period Aircraft Operations Forecast

Segment	Time Frame	2019	2025	2030	2040
Passenger	Annual	16,660	16,660	18,741	41,506
	Peak Month	1,485	1,485	1,670	3,700
	Design Day	48	48	55	126
	PH Arrivals	3	3	3	7
	PH Departures	3	3	3	7
	PH Total	5	5	5	11
All-Cargo	Annual	760	1,248	1,248	1,248
	Peak Month	80	131	131	131
	Design Day	2	4	4	4
	PH Arrivals	1	2	2	2
	PH Departures	1	2	2	2
	PH Total	1	2	2	2
Other Air Carrier	Annual	1,800	3,099	3,355	3,932
	Peak Month	189	325	352	413
	Design Day	6	10	11	13
	PH Arrivals	1	2	2	2
	PH Departures	1	2	2	2
	PH Total	2	3	4	4

Table 3-30 Peak Period Aircraft Operations Forecast (continued)

Segment	Time Frame	2019	2025	2030	2040
Air Taxi	Annual	1,239	1,239	1,239	1,239
	Peak Month	134	134	134	134
	Design Day	5	5	5	5
	PH Arrivals	1	1	1	1
	PH Departures	1	1	1	1
	PH Total	1	1	1	1
General Aviation	Annual	116,694	125,131	129,350	138,282
	Peak Month	13,861	14,863	15,364	16,425
	Design Day	648	695	718	768
	PH Arrivals	38	41	41	42
	PH Departures	47	51	51	52
	PH Total	74	79	79	81
Military	Annual	842	1,096	1,096	1,096
	Peak Month	44	57	57	57
	Design Day	2	2	2	2
	PH Arrivals	1	1	1	1
	PH Departures	1	1	1	1
	PH Total	1	1	1	1
Grand Total	Annual	137,995	148,473	155,028	187,303
	Peak Month	15,793	17,020	17,735	20,882
	Design Day	711	769	800	924
	PH Arrivals	40	50	50	55
	PH Departures	49	54	54	59
	PH Total	78	84	85	93

Sources: Diio Mi, Schedule – Dynamic Table. Landrum & Brown.

3.18.2 Passenger Forecast

Peak hour passengers were calculated using a similar methodology as peak hour aircraft operations. The annual and monthly passengers were determined from the Airport's records for 2019. The design day passengers are based on the scheduled seats for the design day as a share of the scheduled seats for the month.

Peak hour passengers were calculated from the aircraft seating configurations in the design day and assumed load factors from the annual passenger aircraft operations forecast. **Table 3-31** presents the peak period passenger forecasts for PAE.

Table 3-31 Peak Period Passenger Forecast

Segment	Time Frame	2019	2025	2030	2040
Passengers	Annual	1,022,046	1,022,046	1,535,412	4,322,426
	Peak Month	98,068	98,068	147,284	414,786
	Design Day	3,168	3,170	4,850	14,125
	PH Arrivals	198	198	375	920
	PH Departures	198	198	375	920
	PH Total	330	330	596	1,368

Sources: Paine Field, Activity Statistics. Diio Mi, Schedule – Dynamic Table. Landrum & Brown.

3.19 Forecast Summary

Table 3-32 below summarizes the key aspects of this forecast. The CAGRs to the right are all relative to CY 2019. Below the table is a short write-up that refers to the key points of this forecast.

Forecast Summary

- Paine Field (PAE) is forecasted to generate 4.3 million total passengers by 2040
  - 7.1% CAGR from 2019 to 2040
  - Traffic will primarily come from Snohomish & northern King Counties
  - PAE's share of Seattle's traffic is below other secondary airports in the U.S. due to PAE's catchment area having a relatively smaller population base as compared to others

- PAE will experience more rapid growth in the late 2030s as estimates of unmet passenger demand at SEA due to facility constraints ramp up
  - Estimated SEA unmet passenger demand ranges from 2.9 MAP to 5.2 MAP in 2040
  - Ties relatively closely to low case and high case passenger forecasts, with baseline forecast in the middle of this range

- PAE is forecasted to generate 41,506 passenger aircraft operations by 2040
  - 4.4% CAGR from 2019 to 2040
  - 50% of passenger aircraft operations forecasted to be on 737-900 aircraft by 2040
  - Most of PAE's passenger activity will be driven by Alaska Airlines

- Total operations at PAE forecasted to be 187,303 by 2040 (1.5% CAGR versus 2019)
  - PAE GA activity is relatively strong due to the number of flight schools nearby
  - Given that Boeing is shifting 787 Dreamliner manufacturing to Boeing's South Carolina facility, it is assumed that PAE's 787-related cargo activity ends by 2025
  - It is assumed that an air cargo service at PAE begins in 2023; by 2025 it is assumed that air cargo offers 24 operations per week, split between MEM & OAK

Table 3-32 Forecast Summary

	2019*	2020	2025	2030	2040	CAGR vs 2019		
						2025	2030	2040
Commercial Passengers (000s)	1,022	226	1,022	1,535	4,322	0.0%	3.8%	7.1%
Operations								
Itinerant								
Passenger Air Carrier	16,660	5,342	16,660	18,741	41,506	0.0%	1.1%	4.4%
All Other Air Carrier	1,800	1,062	3,099	3,355	3,932	9.5%	5.8%	3.8%
Commuter	-	-	-	-	-	-	-	-
Air Cargo	760	422	1,248	1,248	1,248	8.6%	4.6%	2.4%
Air Taxi	1,239	1,735	1,239	1,239	1,239	0.0%	0.0%	0.0%
Total Commercial Operations	**20,459**	**8,561**	**22,246**	**24,538**	**47,925**	**1.4%**	**1.7%**	**4.1%**
General Aviation	56,966	49,337	58,057	59,168	61,445	0.3%	0.3%	0.4%
Military	395	649	535	535	535	5.2%	2.8%	1.5%
Total Itinerant Operations	**77,820**	**58,547**	**80,838**	**84,286**	**109,905**	**0.6%**	**0.7%**	**1.7%**
Local								
General Aviation	59,728	64,104	67,074	70,182	76,837	2.0%	1.5%	1.2%
Military	447	733	561	561	561	3.9%	2.1%	1.1%
Total Local Operations	**60,175**	**64,837**	**67,635**	**70,743**	**77,398**	**2.0%**	**1.5%**	**1.2%**
Total Operations	**137,995**	**123,384**	**148,473**	**155,028**	**187,303**	**1.2%**	**1.1%**	**1.5%**
Annual Instrument Approaches	2,113	1,590	2,195	2,288	2,984	0.6%	0.7%	1.7%
Peak Hour Operations	78	n/a	84	85	93	1.4%	0.8%	0.8%
Air Freight (Metric Tons)	n/a	n/a	16,000	18,280	23,860	n/a	2.7%	2.7%
Based Aircraft	536	536	563	592	654	0.9%	0.9%	0.9%
Average Aircraft Size	76	76	76	102	127	0.0%	2.7%	2.5%
Load Factor	80.7%	80.7%	80.7%	80.7%	82.0%	0.0%	0.0%	0.1%

Source: Compiled by Landrum and Brown
* Sources for 2019: May 2021 TAF for: Air Taxi, All General Aviation and Military Operations. CY 2019 FAA Traffic Flow Management System for All Other Air Carrier Operations. CY 2019 Snohomish County Airport Statistics for Air Cargo Operations. Year-ending March 3, 2020 Snohomish County Airport Statistics for Commercial Passengers and Passenger Air Carrier operations.

3.19.1 Critical Aircraft Determination

In June 2017, FAA published Advisory Circular (AC) 150-5000-17, Critical Aircraft and Regular Use Determination, to provide guidance on the use of the design aircraft or critical aircraft in facility planning and design studies, and related FAA decision making for federally obligated airports. This AC establishes a common, uniform threshold for the number of annual aircraft operations required to identify the critical aircraft for all deliberations of the FAA Office of Airports, inclusive of planning and environmental, design and engineering, and financial decision making regarding airport development. Section 1.2.1 of the AC states the following in regard to critical aircraft determination:

> "The critical aircraft is the most demanding aircraft type, or group of aircraft with similar characteristics, that make use of the airport. Regular use is 500 annual operations, including both itinerant and local operations but excluding touch-and-go operations. An operation is either a takeoff or landing."

AC 150/5300-13A, Airport Design, provides a definition for an aircraft's airport reference code (ARC). ARC has two components; the aircraft approach category (AAC) and the airplane design group (ADG). The AAC is depicted by a letter and is determined by the reference landing speed or approach speed of the aircraft. The ADG is depicted by a Roman numeral and is based on the physical characteristics of the aircraft, i.e. wingspan and tail height of the aircraft, whichever is more restrictive. ***The Boeing 777-300ER represents the critical aircraft projected to have regular annual operations greater than 500.*** The Boeing 777-300ER has an approach speed of 149 knots which categorizes the aircraft as an AAC-D. The Boeing 777-300ER has a length of 242 feet and 6 inches; a wingspan of 212 feet and 7 inches; and a tail height of 61 feet and 10 inches. Based on these dimensions the Boeing 777-300ER is categorized as ADG-V. No other aircraft with more than 500 annual operations, either existing or forecasted, is more restrictive in terms of runway requirements or for airport design purposes. Therefore, the Boeing 777-300ER is the critical aircraft or design aircraft for PAE.

3.20 Forecast vs FAA TAF

Forecast vs TAF Summary

- Baseline passenger traffic through 2025 is in-line with FAA TAF
  - Assumes that industry returns to 2019 levels in 2024
  - Assumes that PAE experiences a bit slower recovery period, with return to 2019 levels in 2025

- 2030 Passenger forecast is 14.6% above FAA TAF
  - Within FAA guidelines
  - FAA TAF only assumes 1.3% CAGR from 2026 to 2030 (and through remainder of forecast period)

- Aircraft operations are generally in-line with FAA TAF forecasts
  - In-part this is due to TAF forecast apparently assuming continued E-175 passenger aircraft while this forecast assumes a transition to the larger 737-900 aircraft

Table 3-33 Forecast Summary vs FAA TAF

	Year	Airport Forecast	FAA Terminal Area Forecast (TAF)	AF/TAF % Difference
Total Passengers				
Base Yr.	2019*	1,022,046	531,314	N/M
Base Yr. + 5 Years	2025	1,022,046	1,070,798	-4.6%
Base Yr. + 10 Years	2030	1,535,412	1,339,446	14.6%
Total Operations				
Base Yr.	2019*	137,995	129,496	6.6%
Base Yr. + 5 Years	2025	148,473	146,465	1.4%
Base Yr. + 10 Years	2030	155,028	153,357	1.1%
Based Aircraft				
Base Yr.	2019*	536	536	0.0%
Base Yr. + 5 Years	2025	563	555	1.4%
Base Yr. + 10 Years	2030	592	571	3.6%

Notes: *Passenger volume for 2019 is for the time-period year-ending March 3, 2020; this is due to Airport opening for commercial service on March 4, 2019. Source: PAE Airport records. FAA TAF Baseline year was only for 7 months of operations at PAE.
*Passenger aircraft operations were conducted the same way (year-ending March 3, 2020); again, FAA TAF for 2019 only included only 7 months of passenger aircraft operations
*2019 figures for General Aviation, Air Taxi and Military Operations came from the May 2021 TAF. 2020 figures for these sectors were sourced from the Air Traffic Activity System (ATADS)
*Based Aircraft for 2019 taken from PAE Airport records (July 2021); TAF forecast used the current TAF CAGR of 0.58% and then applied against 536 Based Aircraft for 2019 (TAF for 2019 showed 476 Based Aircraft).

Endnotes

[1] Boeing Company website. http://www.boeing.com/company/about-bca/everett-production-facility.page.
[2] *Who's Buying for Travel*, 11th Edition, 2015, New Strategist Publications. Data in *Who's Buying for Travel* are based on the U.S. Bureau of Labor Statistics' Consumer Expenditure Survey, a nationwide survey of household spending.
[3] *Who's Buying for Travel*, 11th Edition, 2015, New Strategist Publications.
[4] In 2016 dollars
[5] Monthly civilian labor force data published for the Air Service Area are not seasonally adjusted.
[6] Seattle and King County: Where Big Ideas Take Flight, Economic Development Council of Seattle & King County, January 2016, www.EDC-SeaKing.org; Trade Development Alliance of Greater Seattle, http://www.seattletradealliance.com/uploads/pdf/aerospace-brochure-final.pdf; Aerospace, Puget Sound Regional Council, http://www.psrc.org/econdev/industries/aerospace, accessed March 2017.
[7] Economic Alliance, Snohomish County.
[8] Information Communication Technology, Trade Development Alliance of Greater Seattle, ict-brochure-2016-final.pdf; Regional Economic Strategy for the Central Puget Sound Region, Puget Sound Regional Council, RegionalEconomicStrategy.pdf, accessed March 2017.
[9] New Discoveries Revolutionary Cures, Life Science & Global Health, Choose Washington State, www.choose washingtonstate.com/wp-content/uploads/2012/10/sector-sub-lifesciences1.jpg; 2015 PSRC Regional Jobs Report, Puget Sound Regional Council, PSRC_2015_Regional_Jobs_Report.pdf; Regional Economic Strategy for the Central Puget Sound Region, Puget Sound Regional Council, RegionalEconomicStrategy.pdf, accessed March 2017.
[10] Snohomish County Visitor Guide 2016-2017, SnoVG_Fall_Winter_2016-17_0902_MY.pdf, accessed March 2017.
[11] Whidbey Camano Islands, http://www.whidbeycamanoislands.com/things-to-do, accessed March 2017.
[12] Kingston Chamber of Commerce, http://www.kingstonchamber.com, accessed March 2017.
[13] Olympic Peninsula Visitor Bureau, http://www.olympicpeninsula.org/destinations/olympic-peninsula-visitor-bureau; Visit Kitsap, http://www.visitkitsap.com, accessed March 2017.
[14] Visit Seattle, Accolades, http://www.visitseattle.org/press/press-kit/seattle-accolades, accessed March 2017.
[15] Jeffrey M. Caneen, "Cultural Determinants of Tourist Intention to Return," published in *Consumer Psychology of Tourism*, Hospitality and Leisure, CABI Publishing, 2004.
[16] National Association for Business Economics, NABE Outlook, December 2020.
[17] As of the end of Calendar Year 2019, SEA ranked as the 8th largest airport in the U.S.
[18] Port of Seattle Commission Agenda Staff Briefing memo dated September 15, 2014
[19] http://www.tomtom.com/en_gb/trafficindex/city/SEA. Accessed February 3, 2017.
[20] http://inrix.com/press-releases/scorecard-de/. Accessed February 2, 2017.
[21] Washington State Department of Transportation, 2016 Corridor Capacity Study. November 2016.
[22] Ibid.