Appendix D:
Air Quality and Climate Assessment

Air Quality and Climate Assessment Appendix

The National Ambient Air Quality Standards (NAAQS) and their averaging periods are provided in Table D-1.

Table D-1: NAAQS

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
CO	primary	8 hours	9 ppm	Not to be exceeded more than once per year
CO	primary	1 hour	35 ppm	Not to be exceeded more than once per year
Pb	primary and secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
NO_2	primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
NO_2	primary and secondary	1 year	53 ppb	Annual Mean
O_3	primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
PM	$PM_{2.5}$ primary	1 year	9.0 µg/m^3	annual mean, averaged over 3 years
	$PM_{2.5}$ secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
PM	PM_{10} primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
PM	PM_{10} primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
SO_2	primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
SO_2)	secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Notes : CO = Carbon Monoxide, Pb = Lead, NO_2 = Nitrogen Dioxide, O_3 = Ozone, PM = Particle Pollution, and SO_2 = Sulfur Dioxide.

Source: EPA NAAQS Table, https://www.epa.gov/criteria-air-pollutants/naaqs-table.

Emission factors for off-road construction equipment and on-road vehicles were developed using MOVES, version 4. The model input data were developed based on specific information (e.g., vehicle/fuel mix, fuel specifications, inspection maintenance program, meteorology data, etc.) related to the Proposed Action. Table D-2 summarizes the inputs to MOVES used to estimate worst-case emission rates for the emission sources associated with the Proposed Action.

Table D-2: MOVES Inputs – Off-road Equipment and On-road Vehicles

Parameter	Input Data
Evaluation Year(s):	2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, and 2037
Location:	St. Louis County, Missouri
Evaluation Month(s):	December (Winter) and July (Summer)
Days:	Weekdays
Evaluation Hour(s):	7:00-8:00 AM (Hour 8) – January 3:00-4:00 PM (Hour 16) – July
Level of Analysis:	Nonroad Model/Default Scale/Inventory Onroad Model/ Default Scale (National Level MOVES Defaults for Vehicle Age Distribution, I/M Programs, etc.)/Inventory
Source Type:	Off-road Equipment: Agriculture, Construction, and Industrial Sectors (Diesel Fuel) On-road Vehicles: 21 – Passenger Car (Gasoline Fuel) 31- Passenger Truck (Diesel Fuel) 52 - Single Unit Short-haul Truck (Diesel Fuel) 61 - Combine Short-haul Truck (Diesel Fuel)
Roadway Type:	Rural Unrestricted
Temperature:	Winter – 22.7°F (AM) Summer – 88.5°F (PM)
Relative Humidity:	Winter – 79.1% Summer – 52.7%
Criteria/Precursor Pollutants:	CO, VOC, NO_x, SO_2, PM_{10}, and $PM_{2.5}$
GHGs:	CO_2, N_2O, and CH_4

Source: EPA MOVES, Version 4.

Table D-3 lists the construction projects needed to implement the Proposed Action and the schedule. Construction is assumed to begin in the spring of 2025 and be completed by the fall of 2027.

Table D-3: Construction Schedule and Projects

Demolition/ Construction	Project Type	Project Description	Start Date	End Date
Demolition	Building/Structure	MoANG Buildings (All)	Feb -26	Oct -26
Demolition	Building/Structure	Credit Union	Feb -26	Oct -26
Demolition	Building/Structure	South Firehouse Medical Storage	Feb -26	Oct -26
Demolition	Building/Structure	Landside and Parking Garage Demolition (Phase 1) (Buildings/Structures)	Jan-27	Apr-27
Demolition	Building/Structure	Jet Linx Building	Jan-27	Dec-27
Demolition	Building/Structure	West Tritorator	Jun-29	Dec-29
Demolition	Building/Structure	Fuel Consortiums	Jun-29	Dec-29
Demolition	Building/Structure	HMS Host Facilities	Jun-29	Dec-29
Demolition	Building/Structure	Building Maintenance Facility	Jun-29	Dec-29
Demolition	Building/Structure	West Lambert Substation	Jun-29	Dec-29
Demolition	Building/Structure	Airfield General Building	Jun-29	Dec-29
Demolition	Building/Structure	Airline Service Facility	Jun-29	Dec-29
Demolition	Building/Structure	Central Utility Plant	Jun-29	Dec-29
Demolition	Building/Structure	Concourse A	Jan-27	Apr-27
Demolition	Building/Structure	Concourse B	Jan-27	Apr-27
Demolition	Building/Structure	Landside Demolition - Phase 3 (Structures)	Jul 27	Oct-27
Demolition	Building/Structure	Concourse C	Jan-29	Apr-29
Demolition	Building/Structure	Concourse D	Jan-29	Apr-29
Demolition	Road/Surface	Phase 1 Demolition (Roads/Surfaces)	Jul-26	Feb-27
Demolition	Road/Surface	Phase 3 Demolition (Roads/Surfaces)	Jul-27	Dec-28
Demolition	Road/Surface	Phase 4 Demolition (Roads/Surfaces)	Jan-29	Dec-29
Demolition	Airfield/Surface	West Concourse Apron	Jan-27	Jul-27
Demolition	Airfield/Surface	East Concourse Apron	Jan-29	Jul-29
Construction	Building/Structure	Central Utility Plant	Jul-26	Apr-27
Construction	Building/Structure	West Lambert Substation	Jul-26	Apr-27
Construction	Building/Structure	Fuel Consortium Services	Aug-26	Feb-28
Construction	Building/Structure	Airline Service Facility and Extension	Aug-26	Feb-28
Construction	Building/Structure	Landside Phase 1 Construction (Buildings/Structures)	Apr-27	Dec-27
Construction	Building/Structure	West Tritorator	Jul-27	Dec-27
Construction	Building/Structure	Security Screening Checkpoint	July-27	Dec-28
Construction	Building/Structure	West Concourse	Jan-27	Dec-28

Demolition/ Construction	Project Type	Project Description	Start Date	End Date
Construction	Building/Structure	Phase 3 Construction (Roadway Structures)	Oct-27	Dec-28
Construction	Building/Structure	FIS	Jan-27	Dec-28
Construction	Building/Structure	West Baggage Claim	July-27	Dec-28
Construction	Building/Structure	Center Ticketing Reconfiguration	Jan-27	Dec-28
Construction	Building/Structure	Airport Police Building	July 29	Dec-30
Construction	Building/Structure	Airport Administration Space	July 29	Dec-30
Construction	Building/Structure	Building Maintenance Space	July 29	Dec-30
Construction	Building/Structure	East Concourse	Jan-29	Dec-30
Construction	Building/Structure	Phase 4 Construction (Buildings/Structures)	Jan-29	Dec-29
Construction	Building/Structure	East Bagage Claim	Jan-29	Dec-30
Construction	Building/Structure	CRDF	Jul-30	Dec-31
Construction	Road/Surface	Phase 1 Construction (Roads/Surfaces)	Jul-26	Mar-27
Construction	Road/Surface	Phase 2 Construction (Roads/Surfaces)	Apr-27	Sep-27
Construction	Road/Surface	Phase 3 Construction (Roads/Surfaces)	Oct-27	Dec-28
Construction	Road/Surface	Phase 4 Construction (Roads/Surfaces)	Jan-29	Dec-29
Construction	Road/Surface	Phase 2 Construction (Parking Surfaces)	Feb-27	Jul-27
Construction	Road/Surface	Phase 3 Construction (Parking Surfaces)	Jul-27	Dec-28
Construction	Road/Surface	Phase 4 Construction (Parking Surfaces)	Jan-29	Dec-29
Construction	Road/Surface	Phase 4 (Parking Garage Structure)	Jan-29	Dec-31
Construction	Road/Surface	Phase 4 (Parking Garage Structure)	Jan-29	Dec-31
Construction	Airfield/Surface	West Concourse Apron	Jul-27	Dec-28
Construction	Airfield/Surface	East Concourse Apron	Jul-29	Dec-30

Source: CMT, April 2024.

Table D-4 presents the types of off-road construction equipment and on-road construction vehicles as well as monthly activity levels associated with the projects needed to implement the Proposed Action.

Table D-4: Construction Equipment/Vehicles and Activity Levels

Construction Equipment/Vehicles	Off-Road/On-Road	Fuel Type	Activity Levels	Units
40 Ton Crane	Off-Road	Diesel	2,351	hours/month
40 Ton Rough Terrain Crane	Off-Road	Diesel	163	hours/month
90 Ton Crane	Off-Road	Diesel	89	hours/month
Air Compressor	Off-Road	Diesel	154	hours/month
Asphalt 18-Wheeler	On-Road	Diesel	6,058	miles/month
Asphalt Paver	Off-Road	Diesel	103	hours/month
Auger Drill	Off-Road	Diesel	140	hours/month
Backhoe	Off-Road	Diesel	3,547	hours/month
Bob Cat	Off-Road	Diesel	12,451	hours/month
Bulldozer	Off-Road	Diesel	328	hours/month
Cement Mixer	On-Road	Diesel	153,384	miles/month
Chain Saw	Off-Road	Diesel	127	hours/month
Chain Saws	Off-Road	Diesel	140	hours/month
Chipper/Stump Grinder	Off-Road	Diesel	127	hours/month
Compacting Equipment	Off-Road	Diesel	94	hours/month
Concrete Pump	Off-Road	Diesel	206	hours/month
Concrete Ready-Mix Trucks	Off-Road	Diesel	862	hours/month
Concrete Saws	Off-Road	Diesel	154	hours/month
Concrete Truck	Off-Road	Diesel	849	hours/month
Curb/Gutter Paver	Off-Road	Diesel	49	hours/month
Distributing Tanker	On-Road	Diesel	2,638	miles/month
Dozer	Off-Road	Diesel	889	hours/month
Dump Truck	On-Road	Diesel	857,446	miles/month
Dump Truck - Asphalt	On-Road	Diesel	9,791	miles/month
Dump Truck (12 cy)	On-Road	Diesel	36,479	miles/month
Dump Truck Subbase Material	On-Road	Diesel	81,795	miles/month
Excavator	Off-Road	Diesel	350	hours/month
Excavator with Bucket	Off-Road	Diesel	7,243	hours/month
Excavator with Hoe Ram	Off-Road	Diesel	1,087	hours/month
Flat Bed or Dump Trucks	On-Road	Diesel	5,853	miles/month
Flatbed Truck	On-Road	Diesel	23,861	miles/month
Fork Truck	Off-Road	Diesel	16,629	hours/month

Construction Equipment/Vehicles	Off-Road/On-Road	Fuel Type	Activity Levels	Units
Forklift	Off-Road	Diesel	134	hours/month
Front Loader	Off-Road	Diesel	368	hours/month
Front Loader for Subgrade Materials	Off-Road	Diesel	45	hours/month
Generator Sets	Off-Road	Diesel	6,155	hours/month
Grader	Off-Road	Diesel	50	hours/month
Grout Mixer	Off-Road	Diesel	67	hours/month
High Lift	Off-Road	Diesel	4,627	hours/month
Hydroseeder	Off-Road	Diesel	45	hours/month
Line Painting Truck and Sprayer	On-Road	Diesel	1,171	miles/month
Loader	Off-Road	Diesel	178	hours/month
Log Chipper	Off-Road	Diesel	140	hours/month
Man Lift	Off-Road	Diesel	11,823	hours/month
Man Lift (Fascia Construction)	Off-Road	Diesel	1,176	hours/month
Material Deliveries	On-Road	Diesel	5,471	miles/month
Mulcher	Off-Road	Diesel	140	hours/month
Off-Road Truck	Off-Road	Diesel	45	hours/month
Other General Equipment	Off-Road	Diesel	1,856	hours/month
Passenger Car	On-Road	Gasoline	762,511	miles/month
Paving Machine	Off-Road	Diesel	187	hours/month
Pickup Truck	On-Road	Diesel	307,537	miles/month
Pumps	Off-Road	Diesel	42	hours/month
Roller	Off-Road	Diesel	645	hours/month
Rubber Tired Loader	Off-Road	Diesel	154	hours/month
Scraper	Off-Road	Diesel	193	hours/month
Skid Steer Loader	Off-Road	Diesel	222	hours/month
Slip Form Paver	Off-Road	Diesel	154	hours/month
Small Dozer	Off-Road	Diesel	94	hours/month
Surfacing Equipment (Grooving)	Off-Road	Diesel	229	hours/month
Survey Crew Trucks	On-Road	Diesel	3,174	miles/month
Ten Wheelers	On-Road	Diesel	2,341	miles/month
Ten Wheelers- Material Delivery	On-Road	Diesel	5,797	miles/month
Tool Truck	On-Road	Diesel	106,608	miles/month
Tractor	Off-Road	Diesel	234	hours/month
Tractor Trailer	On-Road	Diesel	3,162	miles/month
Tractor Trailer- Material Delivery	On-Road	Diesel	54,501	miles/month
Tractor Trailer- Steel Deliveries	On-Road	Diesel	5,034	miles/month
Tractor Trailer- Stone Delivery	On-Road	Diesel	2,230	miles/month

Construction Equipment/Vehicles	Off-Road/On-Road	Fuel Type	Activity Levels	Units
Tractor Trailer- Topsoil & Seed	On-Road	Diesel	1,115	miles/month
Tractor Trailer with Boom Hoist- Curbs Del & Place	On-Road	Diesel	1,115	miles/month
Tractor Trailer with Boom Hoist- Delivery	On-Road	Diesel	3,512	miles/month
Tractor Trailers Temp Fac.	On-Road	Diesel	1,621	miles/month
Tractors/Loader/Backhoe	Off-Road	Diesel	345	hours/month
Trencher	Off-Road	Diesel	134	hours/month
Trencher for U/G Piping	Off-Road	Diesel	89	hours/month
Trowel Machines (2) machines	Off-Road	Diesel	18	hours/month
Vibratory Compactor	Off-Road	Diesel	98	hours/month
Water Truck	On-Road	Diesel	323,642	miles/month

Source: CMT, April 2024.

The type and number of aircraft operations directly affects emissions. Table D-5 provides the aircraft fleet mix and operations modelled in AEDT for the future years 2032 and 2037 for both the No Action Alternative and Proposed Action. Notably, the number of aircraft operations and fleet mix does not change between the No Action Alternative and Proposed Action.

Table D-5: Aircraft Fleet Mix and Operations

Aircraft Category	AEDT Equip ID	AEDT Aircraft Airframe	AEDT Aircraft Engine	2032 Operations	2037 Operations
Passenger Carrier	6662	Boeing 737-7	LEAP-1B27	47,277	64,123
Passenger Carrier	6472	Boeing 737-8	LEAP-1B28/28B1/28B2/28B3	30,302	45,907
Passenger Carrier	3815	Embraer ERJ175	CF34-8E5A1	27,411	31,068
Passenger Carrier	178	Boeing 737-700 Series	CFM56-7B24	15,757	--
Passenger Carrier	2106	Cessna 208 Caravan	PT6A-114	11,089	11,642
Passenger Carrier	3998	Bombardier CRJ-900	CF34-8C5A2	7,562	8,161
Passenger Carrier	6585	Boeing 737-800 Series	CFM56-7B26E	7,289	--
Passenger Carrier	6532	Tecnam P2012 Traveller	TIO-540-J2B2	6,427	6,798
Passenger Carrier	6400	Airbus A319-NEO	LEAP-1A26CJ	5,099	5,572
Passenger Carrier	967	Airbus A319-100 Series	CFM56-5B6/P	3,457	3,777
Passenger Carrier	5301	Airbus A220-100	PW1524G	2,590	2,832
Passenger Carrier	2456	Airbus A321-200 Series	CFM56-5B3/3	2,219	2,404
Passenger Carrier	5976	Airbus A321-NEO	LEAP-	2,219	2,404

Aircraft Category	AEDT Equip ID	AEDT Aircraft Airframe	AEDT Aircraft Engine	2032 Operations	2037 Operations
			1A35A/33/33B2/32/30		
Cargo	457	Boeing 767-300 ER	CF6-80C2B6F	2,132	2,194
Passenger Carrier	6406	Boeing 737-9	LEAP-1B28/28B1/28B2/28B3	1,604	2,338
Passenger Carrier	6398	Airbus A320-NEO	LEAP-1A29	1,041	1,128
Cargo	704	Airbus A300F4-600 Series	PW4158	834	819
Passenger Carrier	2546	Bombardier CRJ-700	CF34-8C5B1	828	--
Passenger Carrier	1095	Airbus A330-300 Series	Trent 772	520	520
Passenger Carrier	2560	Embraer ERJ170	CF34-8E5A1	485	530
Passenger Carrier	3049	Bombardier CRJ-200	CF34-8C5B1	374	--
Passenger Carrier	2412	Boeing 737-900-ER	CFM56-7B27	360	--
Passenger Carrier	997	Airbus A320-200 Series	CFM56-5B4/2P	347	376
Passenger Carrier	6440	Boeing 787-9 Dreamliner	Trent 1000-N3	--	208
Air Taxi / General Aviation	1239	Bombardier Challenger 600	ALF 502L-2	3,082	3,253
Air Taxi / General Aviation	6070	Cessna 560 Citation XLS	PW530	2,870	3,029
Air Taxi / General Aviation	3047	Cessna 680 Citation Sovereign	PW306B	2,262	2,387
Air Taxi / General Aviation	6552	Embraer Legacy 450 (EMB-545)	AS907-3-1E-A1 (HTF7500E)	1,913	2,019
Air Taxi / General Aviation	2028	Bombardier Learjet 35	TFE731-2-2B	1,485	1,567
Air Taxi / General Aviation	1927	Gulfstream G-5 Gulfstream 5 / G-5SP Gulfstream G500	BR700-715C1-30	1,347	1,422
Air Taxi / General Aviation	1292	Cessna 550 Citation II	JT15D-4 series	1,344	1,418
Air Taxi / General Aviation	1976	Gulfstream G150	TFE731-3	1,313	1,385
Air Taxi / General Aviation	1309	Cessna 750 Citation X	AE3007C1	784	828
Air Taxi / General Aviation	1603	Raytheon King Air 100	TPE331-6	585	617
Air Taxi / General Aviation	5189	Gulfstream G400	PW812GA	551	582
Air Taxi / General Aviation	1489	Pilatus PC-12	PT6A-67B	421	442
Air Taxi / General	1323	Dassault Falcon 900-	TFE731-3	355	374

Aircraft Category	AEDT Equip ID	AEDT Aircraft Airframe	AEDT Aircraft Engine	2032 Operations	2037 Operations
Aviation		EX			
Air Taxi / General Aviation	31	Raytheon Beech 1900-C	PT6A-67B	318	336
Air Taxi / General Aviation	1776	Bombardier Global Express	BR700-715C1-30	303	320
Air Taxi / General Aviation	1196	Raytheon Beech Baron 58	TIO-540-J2B2	184	194
Air Taxi / General Aviation	6286	Diamond DA40	IO-360-B	173	182
Air Taxi / General Aviation	1265	Cessna 172 Skyhawk	TSIO-360C	107	113
Air Taxi / General Aviation	1324	Cirrus SR20	IO-360-B	78	82
Military(L)	1807	Boeing F-15 Eagle	F100-PW-100	1,369	1,369
Military(L)	4236	Boeing F/A-18 Hornet	F404-GE-400	931	--
Military(L)	1862	T-38 Talon	J85-GE-5H (w/AB)	219	876
Military(I)	1532	Pilatus Turbo Trainer PC-9	PT6A-68	85	85
Military(I)	1403	Boeing C-17A	F117-PW-100	11	11
Military(I)	3170	Lockheed C-130 Hercules	R-1820	11	11

Source: CMT, April 2024.

Table D-6 lists the social cost of greenhouse gases (GHGs) per one metric ton. These values were used in the GHG analysis. These costs are based on year 2020 dollars and an assumed discount rate of 2 percent.

Table D-6: Social Cost of Greenhouse Gases per One Metric Ton

Year of Emissions	CO_2	CH_4	N_2O
2020	$190	$1,600	$54,000
2030	$230	$2,400	$66,000
2040	$270	$3,300	$79,000
2050	$310	$4,200	$93,000
2060	$350	$5,100	$110,000
2070	$380	$5,900	$120,000
2080	$410	$6,800	$130,000

Notes : CO_2 = Carbon Dioxide, CH_4 = Methane, and N_2O = Nitrogen Oxides.

Source: EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific, November 2023, [EPA-HQ-OAR-2021-0317], available at https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf.

APPENDIX D

MEMO

TO: Jerry Beckmann, Dana Ryan, STLAA

FROM: John van Woensel

SUBJECT: **STL Master Plan Aviation Demand Forecast Review and Proposed Interim Adjustments**

DATE: **September 30, 2022**

EXECUTIVE SUMMARY

This memo presents findings of a review of the August 2020 FAA-accepted forecast for the St. Louis Lambert International Airport (STL) Airport Layout Plan Update and Master Plan (ALPU/MP), and provides a recommendation of proposed adjustments to the forecast elements to be used during advanced planning and environmental studies for the terminal program. The review was conducted to determine if industry trends and the actual recovery of aviation demand at STL from the impacts of the COVID-19 pandemic warrant adjustments to the demand forecast elements. After reviewing actual STL fiscal year (FY) 2022 passenger enplanements, aircraft operations, aircraft fleet, and the FAA Terminal Area Forecast (TAF) for STL, as well as national FAA forecasts and other industry outlooks, we propose the following:

- Passenger Enplanements: STL is recovering very closely to the FAA-accepted forecast, with passenger enplanements tracking approximately 4.1% above the forecast for FY 2022[1]. While STL is recovering slightly faster than anticipated, we expect that in several years, growth is expected to track with the accepted forecast. There is no indication that the long-term growth projections are invalid or should be changed. However, international service to Europe materialized in 2022 instead of the forecast 2036. While the numbers are relatively low, because international passengers have a greater facility impact, these projected enplanements should be added to the totals for FY 2032 and FY 2037.
- Passenger Aircraft Fleet Mix: only minor adjustments to the commercial aircraft fleet mix are proposed, as a result of accelerated airline fleet modernization, including:
  - Replacing older aircraft models with newer versions of the same models (e.g., A319 to A319neo)
  - Reflecting the earlier-than-planned retirement of some aircraft (e.g., B717-200)

[1] STLAA's fiscal year ends each year on June 30th. Unless otherwise indicated, the information presented in this memo is based on STLAA's fiscal year.

  - Accelerating the elimination of smaller (50-seat) regional jets (RJ) (e.g., CRJ-200, CRJ-700, E135/140/145)

- Passenger Aircraft Operations: updating the fleet by swapping similarly-sized aircraft has no impact on seats and total aircraft operations; however, the elimination of small RJs does. Approximately 2,500 fewer aircraft operations are anticipated in FY 2037, reflecting the replacement of smaller regional jets with larger regional jets. It is assumed that this replacement does not, on average, increase regional seats or enplanements.
- Flight schedule: current airline schedules do not contain notable changes in peak hour activity and day-night split.
- Documentation: we recommend that this memo be shared with the FAA for their comment and concurrence; it would then become part of the official forecast record in the form of an amendment or appendix to the ALPU/MP forecast chapter. Detailed adjusted spreadsheets would be attached to the final version of this memo.

EXISTING CONDITIONS/BACKGROUND

The St. Louis Airport Authority (STLAA) is initiating advanced planning and preNEPA efforts for the proposed consolidated terminal at STL, which resulted from the 2022 ALPU/MP, also referred to as "the master plan". The current planning forecast (FAA term) for STL is the master plan forecast, which was accepted by the FAA in August 2020. Since the forecast was prepared and accepted in the early days of the COVID-19 global pandemic, the aviation industry has continued to see dramatic change: there was limited growth in FY 2021, then significant growth in FY 2022, partially recovering to FY 2019 activity.

This memo documents a review of recent aviation industry and local trends and data, and a recommendation of whether any adjustments to the forecast (or a new planning forecast) are warranted. The purpose of this analysis is to ensure that a valid and current forecast is used in the advanced planning and preNEPA efforts. While the master plan forecast focuses on five-year intervals through 2040, this analysis uses FY 2032/2033 and FY 2037/2038, because of the planned late-2031 (calendar year [CY]) full opening date of the new consolidated terminal.

ACTIVITY COMPARISON

Planning forecast projections of aviation demand for FY 2022 were compared with actual passenger enplanements, fleet mix data, and aircraft operations. Actual aircraft operations and enplanements were obtained from the *STLAA Activity Statistics Reports*; fleet mix data was obtained from STL's ANOMS database (actual), Airline Data, Inc (airline schedules), and industry news reports.

PASSENGER ENPLANEMENTS

STL and many other U.S. airports are strongly recovering from COVID-19. Given the high rates of growth being experienced during this recovery, a variation of 4.1% in actual enplanements represents a close tracking to the projected recovery enplanements. Passenger enplanements were forecast at 6,048,202 in FY 2022, compared to actual FY 2022 enplanements of 6,293,730.

Based on review and comparison with the following industry outlooks, there is no indication that the long-term outlook reflected in the planning forecast should change:

- Boeing Outlook: in its *2022 Commercial Market Outlook*, Boeing projects that global aviation activity will return to 2019 levels in the 2023 to 2024 timeframe, at which time long-term growth rates will return to pre-2019 levels. According to this forecast, passengers in North America are projected to increase at a compound annual growth rate (CAGR) of 2.6% for the next 20 years.
- FAA National Forecast: The FAA *Aerospace Forecast Federal FY (FFY) 2022 through FFY 2042* shows enplanements recovering in the U.S. to FFY 2019 levels by FFY 2024. Enplanements are projected to increase at a CAGR of 2.5% from FFY 2024 through FFY 2042, which is similar to long-term growth rates historically and projected prior to the COVID-19 pandemic.
- STL FAA TAF: The STL TAF projects that STL will reach FFY 2019 enplanement levels by FFY 2024. The TAF long-term growth rate for STL is a CAGR of 1.9% from FFY 2025 through FFY 2040. This rate is slightly higher than the long-term growth rate of 1.6% for the FAA-accepted forecast for the master plan.
- Southwest Airlines: As the air carrier with the highest passenger share at STL, the outlook for this carrier is important. Southwest Airlines is financially among the strongest airlines, and its national and STL recovery have been stronger than most. In the second quarter of CY 2022, Southwest Airlines posted record quarterly revenues that were 13% higher than those of the same quarter in CY 2019, as well as net income that was 2.6% higher than the same quarter of CY 2022, despite a 57.7% increase in fuel costs per gallon in the same quarter of FY 2019.

However, international service to Europe materialized in 2022 instead of the forecast 2036, with thrice weekly flights to Frankfurt, Germany, starting in June 2022. Although the associated enplanement numbers are relatively low, international passengers have a greater impact on facilities, and as such, these enplanements should be added to the projections for FY 2032 and FY 2037. It is estimated that approximately 60% of the Frankfurt enplanements is new traffic. The remaining 40% of Frankfurt enplanements are diverted from connecting flights to Europe (i.e. 40% of the Frankfurt enplanements would have occured at STL without the Frankfurt flight).

Currently, the Lufthansa flight to Frankfurt operates three times a week; with an assumed annual average 75% load factor and an average A330-300 seating capacity of 255, this represents approximately 30,000 enplanements per year, or 18,000 new enplanements (60% of 30,000). In 2032 and 2037, assuming five weekly flights, this represents approximately 50,000 annual enplanements, or 30,000 new enplanements.

Table 1 summarizes proposed enplanement adjustments to the master plan forecast.

Table 1: Passenger Enplanements Adjustments

	PASSENGER ENPLANEMENTS		
	FY 2022 (ACTUAL)	FY 2032	FY 2037
Master Plan Forecast		9,162,376	10,039,620
Lufthansa Service to Frankfurt (Estimated New Traffic)		30,000	30,000
Adjusted Forecast	**6,296,168**	**9,192,376**	**10,069,620**

Source: WSP USA, 2022.

PASSENGER AIRCRAFT FLEET MIX

Fleet mix projections were reviewed against the latest aircraft fleet changes. Only minor adjustments to the commercial aircraft fleet mix are proposed due to accelerated airline fleet modernization, including:

- Replacing older aircraft models with newer versions of the same models (e.g., A319 to A319neo)
- Reflecting the earlier-than-planned retirement of some aircraft (e.g., B717-200)
- Accelerating the elimination of smaller (50-seat) regional jets (RJ) (e.g., CRJ-200, CRJ-700, E135/140/145)

For example, Delta Air Lines announced in September 2020 that the B717-200 would be completely retired from its fleet by December 2025. This aircraft was assumed to still be operating in the 2037 forecast. In this forecast adjustment effort, the B717 will be replaced with the A220, for which Delta has placed a large order, and which was not included in the original FY 2022 fleet mix forecast. Likewise, some aircraft models were replaced with their more recent equivalent (e.g A319 with A319neo).

Table 2 summarizes the proposed aircraft substitutions and additions.

Table 2: Proposed Aircraft Model Replacements

AIRCRAFT TYPE	PROPOSED ACTION
A220	Add in 2032
A319	2032 & 2037: 50% become A319neo
A320	2032: 75% become A320neo & 25% become A320S
A320neo	Add in 2032
A321	2032: 50% of A321 become A321S, 50% become A321neo
A321neo	Add in 2032
A330-300	2032 & 2037: add to reflect new Frankfurt service by Lufthansa (5 flights/week)
B717-200	2032 & 2037: 100% become A220
B737MAX 7	Add in 2032
B737-700	2032: 75% become B737MAX 7; 2037: 100% become B737MAX 7
B737-800	2032: 75% become B737MAX 8; 2037: 100% become B737MAX 8
B737-900	2032: 75% become B737MAX 9; 2037: 100% become B737MAX 9
Canadair Regional Jet 200	2032: 90% become E175; 2037: 100% become E175
Canadair Regional Jet 700 (50 seats)	2032: 90% become E175; 2037: 100% become E175
Canadair Regional Jet 700	2032: 90% become E175; 2037: 100% become E175
E135/140/145	2032 & 2037: 100% become E175

Note:
A320S/A321S = with sharklets

Sources: WSP USA, 2022; CMT, 2022.

Table 3 compares average seats for the proposed aircraft fleet changes and indicates whether an adjustment in aircraft operations is required to keep the number of seats relatively the same.

Aircraft seats and operations for the CRJ-200, CRJ-700 (50 seats) and E135/140/145 were reassigned to the E175. Since the E175 has a larger seating capacity, the resulting number of total aircraft operations decreased to keep the total number of seats the same. This adjustment is consistent with carriers reducing service frequency to some smaller makets. It should also be noted that aircraft operations were added for the new flight from STL to Frankfurt, Germany, introducing the Airbus A330-300 to the fleet mix.

Table 3: Comparison of Average Aircraft Seats

MASTER PLAN FORECAST		FORECAST ADJUSTMENTS		AIRCRAFT OPERATIONS ADJUSTMENT?
Original Aircraft	Average Seats	Replacement Aircraft	Average Seats	
B717-200	110	A220	120	No
CRJ-200	50	E175	70	Yes
CRJ-700 (50 seats)	50	E175	70	Yes
CRJ-700	69	E175	70	No
E135/140/145	50	E175	70	Yes
B737-700/-700W	143	B737MAX 7	150	No
B737-800/-800W	175	B737MAX 8	175	No
B737-900/-900W	180	B737MAX 9	180	No

Sources: WSP USA, 2022; CMT, 2022.

AIRCRAFT OPERATIONS

A comparison of actual to forecast aircraft operations shows a 5.4% decrease (163,554 forecast versus 154,940 actual). This change is also in line with industry trends, as carriers continue to upgauge and reduce frequencies to smaller makets. **Table 4** summarizes the adjusted fleet mix for FY 2032 and FY 2037, as well as the corresponding aircraft operations numbers.

As shown in Table 4, as a result of fleet mix changes (larger aircraft replacing smaller aircraft and addition of the Lufthansa flight), a net small reduction in aircraft operations is anticipated for both FY 2032 (approximately 1,900 fewer aircraft operations) and FY 2037 (approximately 2,300 fewer aircraft operations).

Table 4: Proposed Adjustments to STL's 2020 Aviation Activity Forecast

	AIRCRAFT OPERATIONS			
AIRCRAFT TYPE	FY 2032 FORECAST	FY 2032 ADJUSTED	FY 2037 FORECAST	FY 2037 ADJUSTED
A220-100		2,590	-	2,832
A319	6,915	3,457	7,554	3,777
A319 neo	1,642	5,099	1,795	5,572
A320	1,387	-	1,503	-
A320S	-	347	-	376
A320 neo	-	1,041	-	1,128
A321	4,437	-	4,808	-
A321S	-	2,219	-	2,404
A321 neo	-	2,219	-	2,404
A300-600	556	556	546	546
A330-300	-	520	-	520
B717-200	2,590	-	2,832	-
B737-700W	63,026	15,757	64,113	-
B737-700	9	2	10	-
B737-800W	15,154	3,789	18,972	-
B737-800	14,002	3,500	15,310	-
B737-900W	699	175	765	-
B737-900	1,439	360	1,573	-
B737MAX 7	-	47,277	-	64,123
B737MAX 8	8,434	30,302	11,624	45,907
B737MAX 9	-	1,604	-	2,338
B 757-200	28	28	-	-
B767-300	1,422	1,422	1,463	1,463
CRJ 200	3,736	374	4,018	-
CRJ 700 (50 seats)	1,151	115	1,259	
CRJ 700	7,130	713	7,779	-
CRJ 900	7,562	7,562	8,161	8,161
Cessna Single	11,089	11,089	11,642	11,642

Single TP	6,427	6,427	6,798	6,798
E170	485	485	530	530
E175	7,601	20,065	8,311	23,036
E175W	7,346	7,346	8,032	8,032
E190	-	-	-	-
E135/140/145	4,068	-	4,448	-
MD-11	4	4	-	-
Tecnam P2012	421	421	442	442
B787-800	-	-	208	208
Other	2,246	2,246	2,283	2,283
Total Passenger/Cargo Aircraft Operations	**181,007**	**179,108**	**196,783**	**194,525**

Source: WSP USA, 2022.