CHAPTER FOUR
DEMAND/CAPACITY AND FACILITY REQUIREMENTS

INTRODUCTION

One of the first steps in the master planning process is gathering an inventory of all airside and landside airport facilities. The next step is to calculate the future requirements of these facilities to determine which facilities are currently adequate, which are currently inadequate, and those that will be unable to meet the future projected demand, based on the Master Plan Update forecast.

The facilities previously analyzed include the airfield facilities such as runways, taxiways, NAVAIDs, and lighting; as well as the terminal facilities including gates and passenger processing facilities. This working paper is focused on the other facilities to be considered, including curbfronts, parking, air cargo, general aviation, and airport support facilities including fueling, aircraft and airfield maintenance, and security. This analysis will serve as the basis of the next step in the planning process: the definition and evaluation of development alternatives.

Results of the facility requirements analysis indicate that the Lambert-St. Louis International Airport (STL or Lambert Airport) is generally well positioned to accommodate the forecast passenger and aircraft demand through the study period. There are some specific areas, such as the terminal, parking, and field maintenance, which will need to be expanded and/or reconfigured over time. These and the other facilities are discussed in the following sections.

4.1 AIRSPACE CAPACITY

The existing airspace system uses a "four-corner post" design for arriving aircraft bound for airports within the STL Terminal Radar Approach Control (TRACON). The arrival gates into the STL TRACON are generally located at the north, south, east and west corners of the TRACON. The arrival gates are defined by a series of very high frequency omni-directional range (VOR) radial points or fixes. The choice of arrival gates depends on aircraft type, runways in use, and aircraft altitude and speed. Similarly, aircraft depart the STL TRACON airspace in the existing airspace system through six departure gates. **Exhibit 4.1-1, *East Flow Map***, and **Exhibit 4.1-2, *West Flow Map***, show the arrival flow and departure flow for aircraft operations in the STL TRACON airspace in the two predominant airfield use configurations. Fixes used by arriving aircraft include RIVERS (RIVRS), VANDALIA (VAL), QBALL, and TRAKE. The six departure gates include CARDS, LINDBERGH, GATEWAY, OZARK, BLUES, and PRESS.

4.1.1 ARRIVAL TRAFFIC

The enroute system uses a network of airways and Standard Terminal Arrival Routes (STARs) to merge traffic entering the TRACON over the four-cornerposts. The procedures for handling arrival traffic include the use of unique altitude tiers over each cornerpost. In general, turbojet aircraft landing Runways 6, 11, 12L or 12R enter the airspace at 15,000 feet mean sea level (MSL). Turbojet aircraft when arriving to Runways 24, 29, 30L or 30R enter the airspace at 11,000 feet MSL.

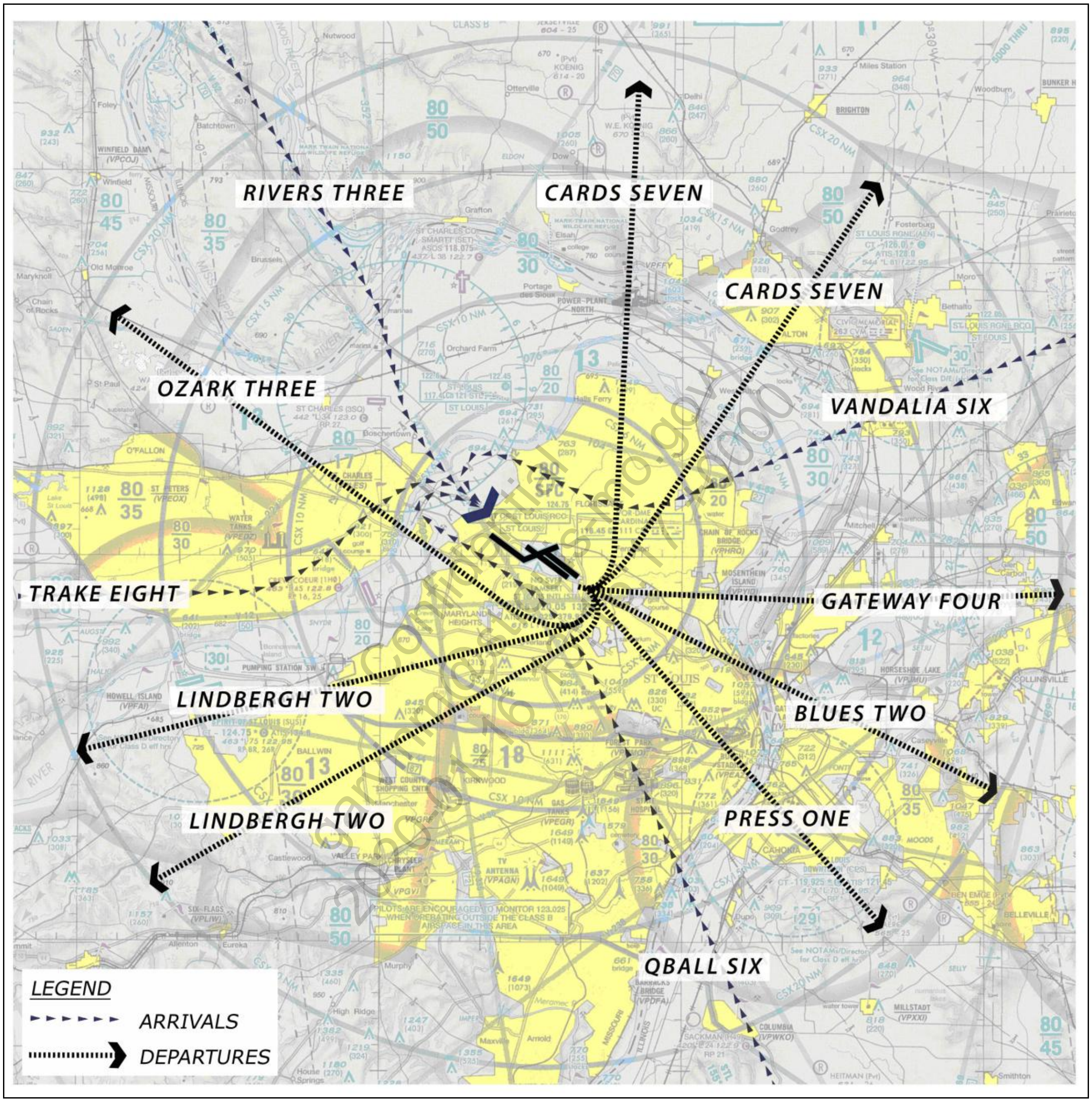
In general, arrival flows over the west (TRAKE) and south (QBALL) cornerposts are sequenced and merged together into one arrival stream to either end of the south parallel runways, Runway 12R/30L or Runway 11/29. Likewise, arrivals from the north (RIVRS) and east (VLA) typically use Runway 12L/30R. There are provisions in the arrival flows to cross over either the east traffic flow or west traffic flow to balance the traffic flows and accommodate heavy aircraft that may require the additional landing length that is available on the center parallel runway, Runway 12R/30L.

Each cornerpost has a capacity of approximately 45 to 55 arrivals per hour depending on the weather and mix of aircraft. Peak hour arrival flows into the TRACON are projected to increase from 34 in 2008 to 43 by 2028. The maximum hourly airspace arrival capacity for the TRACON would be 64 arrivals provided the weather is clear and visibility is unrestricted. The number of operations available goes down with decreased visibility and/or lower ceilings. To the degree that air traffic control (ATC) can segregate traffic flows into STL from the traffic flows into the satellite airports, the existing arrival airspace system has adequate capacity to accommodate the peak hour arrival flows into STL, and no significant modifications to the existing airspace system are anticipated within the master planning period.

4.1.2 DEPARTURE TRAFFIC

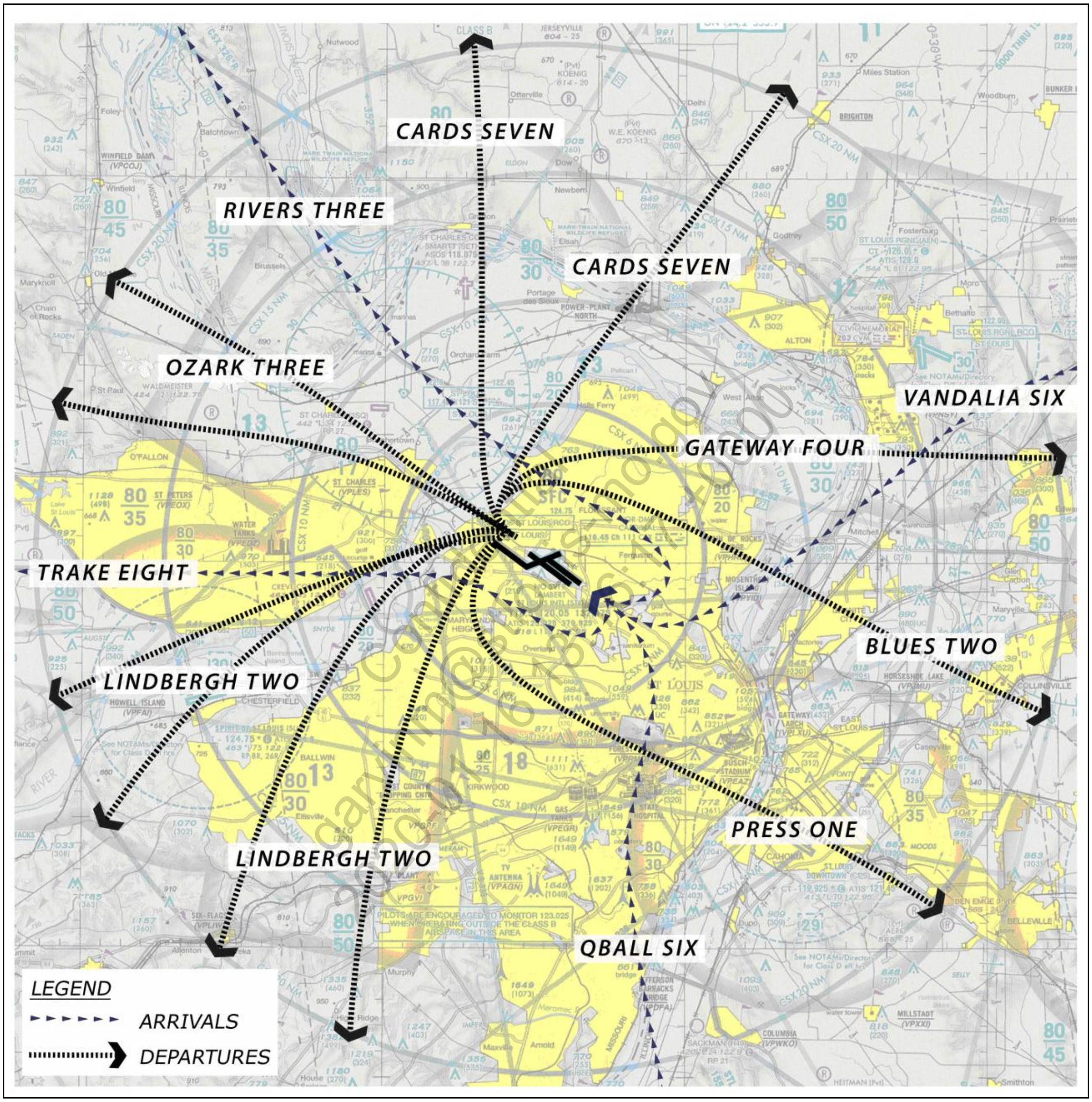
Aircraft depart the STL TRACON airspace in the existing airspace system through six departure gates. The departure gates, located on the sides of the TRACON boundary, are CARDS to the north, LINDBERGH to the south and southwest, OZARK to the west, and GATEWAY, BLUES and PRESS to the east. There are a total of 11 departure routes through the six departure gates. Each route has a capacity of between 50 and 60 departures per hour depending on weather and aircraft mix. The maximum hourly airspace departure capacity for the TRACON from STL would be 64 arrivals provided the weather is clear and visibility is unrestricted. The number of operations available goes down with decreased visibility and/or lower ceilings. The existing departure airspace system has adequate capacity throughout the planning period, and no modifications to the existing system are required.

Exhibit 4.1-1
EAST FLOW MAP
Lambert-St. Louis International Airport



Source: Lambert-St. Louis Air Traffic Control Tower (ATCT)

Exhibit 4.1-2
WEST FLOW MAP
Lambert-St. Louis International Airport



Source: Lambert ATCT

4.2 EXISTING AIRFIELD CAPACITY AND DELAY

The demand/capacity analysis examines the capability of the airfield system at STL to address existing levels of activity, as well as determine the capability of the airfield to meet the projected future levels of demand without incurring adverse levels of aircraft delay stemming from an airfield-related deficiency. The demand/capacity analysis was prepared based on both the existing and forecast aviation demand, as compared to the capacity of the current airfield layout and operational procedures.

A number of factors influence the capacity of an airfield to meet demand, both existing and as projected over the course of a 20-year planning horizon. This analysis utilizes predictions of annual operations by the specified fleet mix as projected in the Chapter Two, *Forecast of Aviation Demand*, while considering a variety of other factors central to the efficient operation of the current airfield. These additional factors are inherent in all of the methodologies used for the capacity calculations and are briefly described in the following sections.

4.2.1 AIRFIELD CHARACTERISTICS

In addition to the updated aviation activity forecasts, a number of the STL airfield characteristics and operational conditions must be considered to conduct the FAA capacity analyses. Elements that affect airfield capacity are listed below:

- Runway Configuration
- Aircraft Fleet Mix
- Taxiway Configuration
- Meteorological Conditions

When analyzed collectively, the above elements provide the basis for establishing the generalized operational capacity of an airport. The following sections will briefly overview each of these capacity related factors with respect to STL.

4.2.1.1 Runway Configuration

The runway system layout at an airport is a central component in the assessment of airfield capacity. Airports that utilize a single runway or intersecting runway systems to accommodate their demand generally have lower operational capacity than airports, like STL, that employ parallel runways. The STL airfield configuration consists of four paved runways as shown on **Exhibit 4.2-1, *Existing STL Airfield Layout***. Three runways are oriented in a general northwest/southeast parallel alignment (11/29 and 12/30). The fourth runway is a northeast/southwest (6/24) crosswind runway that lies almost perpendicular to the three parallel runways. Runway 11/29 and Runway 12L/30R maintain a centerline-to-centerline separation of less than 4,100 feet, which is below the separation required to permit simultaneous independent operations. A precision runway monitoring system, which permits simultaneous independent operations on runways not meeting the minimum runway separation requirement, is installed at the STL. However given the reduced traffic demand the Air Traffic Controllers are not trained on the equipment, the additional controller positions are not staffed, and the operations to parallel runways are dependent. The crosswind Runway 6/24 intersects with Runway 12R/30L and Runway 12L/30R. Runway 6/24 does not physically intersect with Runway 11/29, although the extended centerlines of both runways intersect a short distance west of the Runway 6 threshold and south of the Runway 29 threshold. The majority of the current aircraft operations are conducted on the parallel runways. The crosswind runway is mainly used when wind or weather conditions dictate, or as requested by pilots for operational convenience.

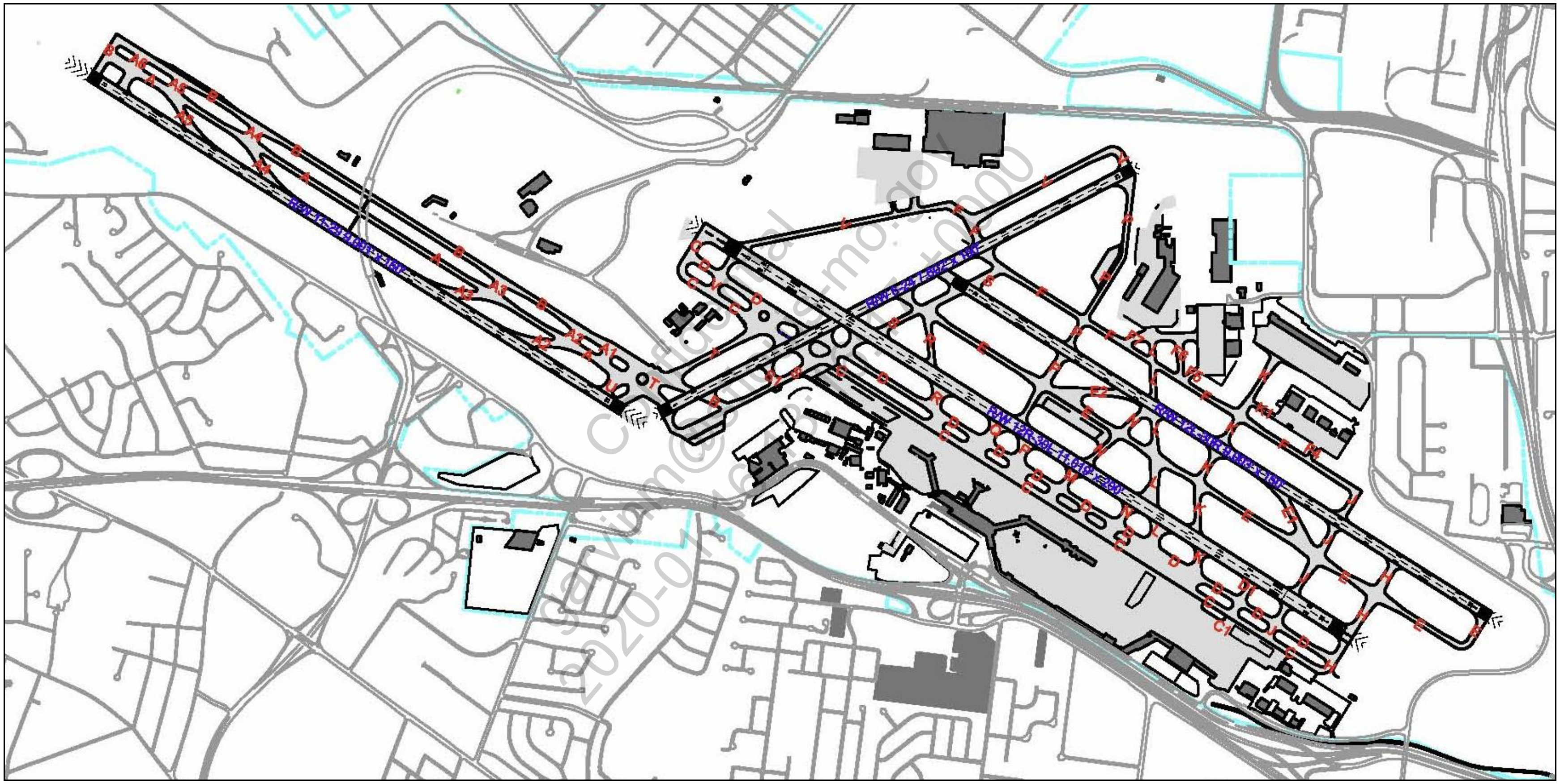
4.2.1.2 Aircraft Fleet Mix

Understanding the mix of aircraft operating into and out of an airport is critical to determining airfield capacity. The current and projected aircraft fleet mix for STL is defined in Chapter Two, *Forecast of Aviation Demand*.

This projection of annual fleet mix was refined into a Peak Month Average Day (PMAD) schedule for all airport users, including commercial passenger, air cargo, and general aviation (GA).

The mix of small, large, and heavy aircraft at an airport will influence its operational capacity, both on the airfield and in the surrounding airspace. Combining faster jet aircraft with slower aircraft results in a need for greater spacing between arrivals and departures. This corresponds to an increase in the time between arrivals and departures, which reduces the availability of the runway for operational use, or overall capacity.

Exhibit 4.2-1
EXISTING STL AIRFIELD LAYOUT
Lambert-St. Louis International Airport



Source: Lambert–St. Louis International Airport Layout Plan, 2010

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Wake turbulence considerations are dependent on the size and, in some cases, the type of aircraft operating at an airport and the runway separation distance. These can limit runway use and capacity by affecting the spacing of arriving and departing aircraft. For example, while the B757 is certainly not one of the largest aircraft flying today, the flight characteristics of its wing design has been found to create a greater potential for wake vortices, a phenomena that creates tornadic-like vortices that can remain in the air for several minutes. As a result, the FAA issued guidance to increase the horizontal separation between B757 aircraft and other generally smaller aircraft that follow, thereby resulting in a corresponding increase in time between arrivals and a resultant reduction in arrival capacity. The wake turbulence separation minima are applied to aircraft operating directly behind, or directly behind and less than 1,000 feet below, or following an aircraft conducting an instrument approach as follows:[1]

- Heavy behind heavy (four miles)
- Large/heavy behind B757 (four miles)
- Small behind B757 (five miles)
- Small/large behind heavy (five miles)

Additionally, parallel runways less than 2,500 feet apart are, for the purposes of wake turbulence separation minima, considered a single runway because of the possible effects of wake turbulence.

4.2.1.3 Taxiway Configuration

The ease and efficiency with which aircraft move to and from the runways via the taxiway system is another central element influencing the operational capacity of the airfield. To enhance runway capacity, it is important to provide multiple exit taxiways that are properly located along the runway and that lead to a parallel taxiway system, which further connects into the various airport development areas.

A properly designed taxiway system allows landing aircraft to decelerate and quickly exit the runway, making it available for additional landings or departures. Further, the efficiency of arriving aircraft movements from the runway to the parallel taxiway system can be further enhanced through the development of acute-angle (30-degree) "high-speed" exit taxiways. These high-speed exits allow aircraft to leave the runway at higher rates of speed than is possible on taxiways that intersect the runway at a 90-degree angle. The goal is to achieve an average runway occupancy time (ROT) of 50 seconds or less. This might allow for a reduction in separation (2.5 nautical miles) between aircraft established on the final approach course within 10 nautical miles of the landing runway. The following conditions must be in place for this to occur:

- The leading aircraft's weight class is the same or less than the trailing aircraft
- Heavy aircraft and the B757 are permitted to participate in the separation reduction as the trailing aircraft only

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[1] FAA Order 7110.65R, Air Traffic Control, Section 5-5-4, 16 February 2006

- An average runway occupancy time of 50 seconds or less is documented
- Control tower radar displays are operational and used for quick glance references
- Turnoff points are visible from the control tower

The runway system is served by a system of parallel taxiways and numerous high-speed and acute-angled exit taxiways. **Table 4.2-1, *Runway Exist Data***, provides a list of exits for each runway end that can be used for aircraft landing operations and the average ROT for each runway based on the 2008 aircraft fleet mix. The FAA Runway Exit Design Interactive Model (REDIM) was used to determine the ROT based on the existing aircraft fleet mix, runway exit locations, and geometry.

Table 4.2-1
RUNWAY EXIT DATA
Lambert-St. Louis International Airport

RW END	EXIT DISTANCE (FT.)			AVG. ROT (IN SECONDS)
	90° Exit	45° Exit	30° Exit	
6	3,670 (TWY E) 4,999 (TWY F) 7,217(TWY P/V)			62.5
24	3,510 (TWY E) 4,795 (TWY D) 5,183 (TWY C) 5,770 (TWY S1) 6,721 (TWY B) 7,402 (TWY S)			55.9
11	8,475 (TWY U *)		4,883 (TWY A3) 6,183 (TWY A2)	48.1
29	8,372 (TWY A6) 8,813 (TWY B)		4,991 (TWY A4) 6,183 (TWY A5)	47.9
12L	4,210 (TWY K) 6,322 (TWY J) 8,817 (TWY H)		4,821 (TWY E1)	51.8
30R	4,410 (TWY K) 5,490 (TWY N/L) 7,042 (TWY P)		5,490 (TWY E2)	50.9
12R	5,287 (TWY M) 7,117 (TWY N) 8,354 (TWY K) 9,188 (TWY D1) 9,105 (TWY J) 10,818 (TWY H)	7,126 (TWY L)		58.0
30L	5,148 (TWY P) 5,657 (TWY Q) 6,657 (TWY R) 10,232 (TWY V) 10,832 (TWY C)	8,052 (TWY S)		56.6

Sources: FAA Runway Exit Design Interactive Model (REDIM) and Landrum & Brown

The REDIM results indicate that the average ROT for the 2008 fleet varies from 48 to 62 seconds. Runway 11/29, the most recently completed runway, achieves the lowest runway occupancy time of the three parallel runways due to the availability of two acute 30° high-speed exits in each landing direction. Runway 12L/30R, which has one acute 30° high-speed exit in each direction, achieves slightly longer runway occupancy times. Occupancy times on Runway 12R/30L are the highest of the three parallel runways; however, this runway has historically been utilized as the primary departure runway during peak demand periods, and the need for additional acute angled exits has not been identified. Similarly, Runway 6/24, which is generally used only during periods with strong crosswinds, does not have acutely angled high-speed exits. Given the limited use and utility of the runway, the expense the need for high-speed exits is not justified.

4.2.1.4 Meteorological Conditions

Meteorological conditions, such as wind or inclement weather, will influence pilot decisions about which runway to use during a landing or takeoff. Accordingly, meteorological conditions will affect overall airfield capacity. Runway utilization is determined by prevailing wind conditions, cloud ceiling height, and visibility.

A wind and weather analysis for STL was prepared using the Landrum & Brown (L&B) WIND36 wind analysis computer program and the application of 20 consecutive years of National Weather Service weather data for the period 1986 through 2005.

The purpose of this analysis is to determine how often wind and weather conditions at STL favor the use of Runways 11/29, 12/30 and 6/24 given several categories of weather conditions, which are:

- *<u>All Weather</u>*: Any and all weather conditions are included in the "all weather" category regardless of cloud ceiling height or surface horizontal visibility.
- *<u>Visual Flight Rules (VFR)</u>*: Occurs when the cloud ceiling is 3,000 feet or higher and the surface horizontal visibility is five statute miles or greater.
- *<u>Marginal Visual Flight Rules (MVFR)</u>*: Occurs when the cloud ceiling is 1,000 feet or higher and less than 3,000 feet and the surface horizontal visibility is three statute miles or greater and less than five statute miles.
- *<u>Instrument Flight Rules (IFR)</u>*: Occurs when the cloud ceiling is below 1,000 feet or when surface horizontal visibility is reported to be below three statute miles. Total IFR hours would be equal to the sum of IFR Category I, IFR Category II, and IFR Category III hours , described below:
    - *<u>Category I Conditions Under IFR</u>*: Occurs when the cloud ceiling is 200 feet to 900 feet above the surface or when the surface horizontal visibility is ½-mile to 2½ miles, or not less than 2,400 feet runway visual range (RVR). For a runway with touchdown zone and centerline lighting, the RVR may be reduced to not less than 1,800 feet (3/8 mile) under Category I conditions.

- *Category II Conditions Under IFR*: Occurs when the cloud ceiling is 100 feet, or the surface horizontal visibility is 1/4 mile to 3/8 mile (not less than 1,200 feet RVR) for runways without touchdown zone and centerline lighting. Otherwise, the visibility range is 1/4 mile to 5/16 mile.
- *Category III Conditions Under IFR*: Occurs when the cloud ceiling is zero or the surface horizontal visibility is zero to 3/16 mile (zero to 700 feet RVR). This visibility range would be valid for runways with or without touchdown zone and centerline lighting.

A summary of the data included in the analysis is given in **Table 4.2-2, *Wind and Weather analysis Data Summary***.

The analysis restricted the use of each runway end to a maximum tailwind of five knots, and calm winds were defined as five knots. The computer analysis was repeated to allow for maximum crosswind components of 10.5 knots, 13 knots, 16 knots, and 20 knots on each runway end. In accordance with FAA Advisory Circular (AC) 150/5300--13, *Airport Design*, the crosswind should not exceed the following velocities for the specific aircraft design groups:

- 10.5 knots for A-I and B-I
- 13 knots for A-II and B-II
- 16 knots for A-III, B-III and C-I through D-III
- 20 knots for A-IV through D-VI

Table 4.2-2
WIND AND WEATHER ANALYSIS DATA SUMMARY
Lambert-St. Louis International Airport

ANALYSIS PARAMETERS	WEATHER CATEGORY						
	ALL WEATHER	VFR	MVFR	IFR			
				CAT I	CAT II	CAT III	TOTAL IFR
Average Number of Annual Observations	8,766	7,121	997	599	22	27	648
Percent of Annual Occurrence	100.00	81.23	11.38	6.83	0.26	0.30	7.39
Percent Calm Wind Occurrence (≤ 5 knots)	26.99	28.21	19.76	22.61	33.92	64.03	24.69
Period of Analysis	1986 - 2005, 20 years						
Total Observations	175,320 over the 20-year period						

Sources: National Climatic Data Center (NCDC), Asheville, North Carolina, station WBAN 13994, data recorded at Lambert-St. Louis International Airport (STL) for the period 1986-2005 based on National Weather Service (NWS) Synoptic and Aviation Reports (SA), and Automated Surface Observation System (ASOS) data. WBAN is Weather Bureau Army-Navy, reference http://lwf.ncdc.noaa.gov/oa/climate/stationlocator.html#STNHIST and Landrum & Brown analysis, 2010.

The results of the analysis showed the percent of time wind conditions would be favorable for arrival and departure operations on each runway end, for each weather category, given the established crosswind and tailwind restrictions. The results are summarized in **Table 4.2-3, *Runway Use Based on Historical Wind and Weather Conditions***.

The analysis shows that, overall ("all weather" category) weather conditions at STL are most favorable for Runway 24 arrivals and departures for all crosswind allowance conditions. When considering just VFR weather conditions and wind direction, the preferable runway would be Runway 24. Runway 6 is the preferable runway in all IFR conditions. For all weather, VFR and IFR CAT I conditions, Runway 30 provides the second-highest percentage of coverage.

The wind and weather analysis results presented above did not take into consideration the actual capability of each runway end to accommodate aircraft operations during these specific conditions. The preferred operation is on the parallel runways, which provide wind coverage above 76 percent of the time for all four crosswind tolerances evaluated. Actual runway end usage is dependent on the runway and aircraft instrumentation, aircraft fleet mix, and flight destination.

In analyzing the airfield capacity and delay, the following steps were conducted:

1. Defined the characteristics of the runway and taxiway system along with the manner in which the airfield is used by the Air Traffic Control Tower (ATCT) to move aircraft to and from the runway system;
2. Utilized the Aviation Activity Forecasts to define the anticipated level of existing and future aviation demand and fleet mix characteristics;
3. Developed operational schedules for the peak month average day (PMAD) level of activity in the base year (2008) and the 2028 projected activity based on the forecast of aviation activity;
4. Determined the average capacity of the existing airfield; and
5. Conducted a demand/capacity analysis and determined the extent of resulting delay or excess capacity, if any.

The following sections describe the assumptions and results of the analysis performed for each of the above steps.

Table 4.2-3
RUNWAY USE BASED ON HISTORICAL WIND AND WEATHER CONDITIONS
Lambert-St. Louis International Airport

RUNWAY	**CROSSWIND ALLOWANCE 10.5 KNOTS**					
	PERCENT USE, BY RUNWAY END, BY WEATHER CATEGORY					
	ALL WEATHER	**VFR**	**IFR**	**CAT I**	**CAT II**	**CAT III**
Runway 12	70.60%	70.77%	5.06%	4.58%	0.20%	0.27%
Runway 30	71.90%	71.85%	5.36%	4.94%	0.18%	0.25%
Runway 06	66.21%	65.26%	**5.78%**	**5.26%**	**0.23%**	**0.29%**
Runway 24	**75.74%**	**76.64%**	4.76%	4.32%	0.18%	0.26%

RUNWAY	**CROSSWIND ALLOWANCE 13 KNOTS**					
	PERCENT USE, BY RUNWAY END, BY WEATHER CATEGORY					
	ALL WEATHER	**VFR**	**IFR**	**CAT I**	**CAT II**	**CAT III**
Runway 12	73.99%	74.23%	5.24%	4.76%	0.21%	0.27%
Runway 30	75.31%	75.30%	5.57%	5.14%	0.18%	0.25%
Runway 06	71.66%	70.60%	**6.28%**	**5.75%**	**0.24%**	**0.29%**
Runway 24	**82.82%**	**83.73%**	5.27%	4.81%	0.19%	0.27%

RUNWAY	**CROSSWIND ALLOWANCE 16 KNOTS**					
	PERCENT USE, BY RUNWAY END, BY WEATHER CATEGORY					
	ALL WEATHER	**VFR**	**IFR**	**CAT I**	**CAT II**	**CAT III**
Runway 12	75.13%	75.42%	5.29%	4.81%	0.21%	0.27%
Runway 30	76.44%	76.45%	5.64%	5.20%	0.18%	0.25%
Runway 06	73.74%	72.67%	**6.44%**	**5.91%**	**0.24%**	**0.29%**
Runway 24	**85.82%**	**86.79%**	5.45%	4.98%	0.19%	0.27%

RUNWAY	**CROSSWIND ALLOWANCE 20 KNOTS**					
	PERCENT USE, BY RUNWAY END, BY WEATHER CATEGORY					
	ALL WEATHER	**VFR**	**IFR**	**CAT I**	**CAT II**	**CAT III**
Runway 12	75.36%	75.65%	5.30%	4.82%	0.21%	0.27%
Runway 30	76.71%	76.73%	5.65%	5.22%	0.18%	0.25%
Runway 06	74.33%	73.25%	**6.49%**	**5.95%**	**0.24%**	**0.29%**
Runway 24	**86.85%**	**87.84%**	5.50%	5.03%	0.19%	0.27%

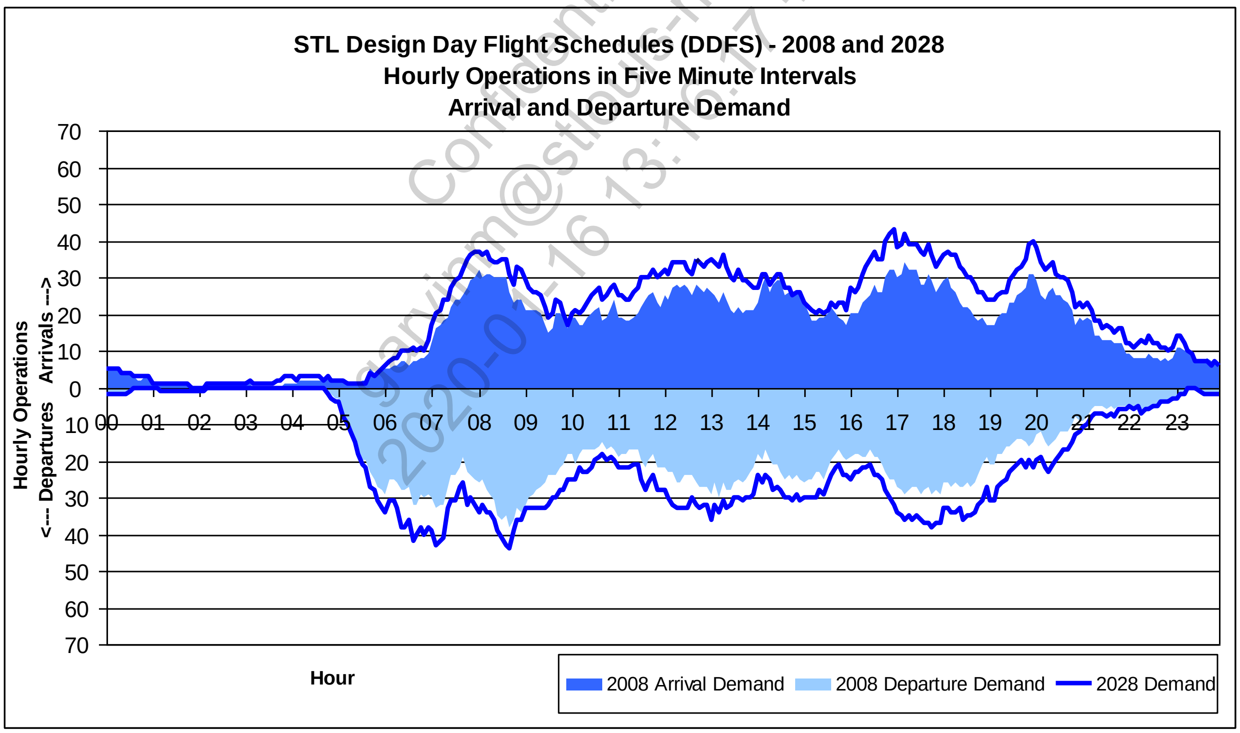
Note: The percent sums for Category I, II, and III equal the total IFR percentage.
Bold print emphasizes the runway end with maximum usage for each crosswind allowance.
Each percentage includes all the calm winds associated with the weather category.

Source: National Climatic Data Center (NCDC), Asheville, North Carolina, data recorded at Lambert–St. Louis International Airport for the period 1986-2005 based on National Weather Service (NWS) Synoptic and Aviation Reports (SA), and Automated Surface Observation System (ASOS) data. WBAN is Weather Bureau Army-Navy and WMO is the World Meteorological Organization, reference

4.2.2 AIRFIELD DEMAND

The current airfield system was evaluated based on a STL flight schedule for 2008 and a forecasted schedule for 2028. The aircraft arrival and departure flight schedule as shown on **Exhibit 4.2-2, *2008 and 2028 STL Flight Schedules***, was developed from FAA radar data associated with actual flight operations in August 2008. August was chosen because it is representative of the activity level that is associated with the Peak Month Average Day (PMAD) demand at STL. The PMAD represents a busy day, but not the busiest day, and is the industry standard for analyzing airfield capacity and delay. The flight schedule was broken down to show hourly demand in five-minute increments; for example, the demand shown at 1:05 a.m. represents hourly demand for the period from 1:05 a.m. to 2:05 a.m. The annual and PMAD demand is summarized in **Table 4.2-4, *STL Annual and Peak Month Average Day Aircraft Operations***.

Exhibit 4.2-2
2008 AND 2028 STL FLIGHT SCHEDULES
(ARRIVALS AND DEPARTURES)
Lambert-St. Louis International Airport



Source: STL Radar Data August 2008, FAA TAF FAA ASPM Database, and Landrum & Brown Analysis, 2011

Table 4.2-4
STL ANNUAL AND PEAK MONTH AVERAGE DAY AIRCRAFT OPERATIONS
Lambert-St. Louis International Airport

YEAR	ANNUAL OPERATIONS	PMAD OPERATIONS	PEAK HOUR OPERATIONS DEMAND
2008	248,397	756	66
2028	318,310	948	78

Source: STL Radar Data August 2008, FAA TAF and Landrum & Brown analysis

4.2.3 AIRFIELD CAPACITY

The existing airfield capacities indicated in **Table 4.2-5, *Existing STL Hourly Airfield Capacity***, are from the FAA Aviation System Performance Metrics (ASPM) database. The FAA uses this database to publish information about weather, capacities, delays, and runway use at all major airports in the U.S.

The FAA records the capacities in the ASPM database using the arrival and departure rates per each quarter hour at any airport, along with the runway configuration during each time period.

The STL capacities used for this analysis are an average of the capacities reported for 2008. It is assumed that the hourly airfield capacities will remain basically unchanged between 2008 and 2028 because neither the airfield layout instrumentation nor aircraft fleet mix is expected to vary greatly by 2028.

Table 4.2-5
EXISTING STL HOURLY AIRFIELD CAPACITY
Lambert-St. Louis International Airport

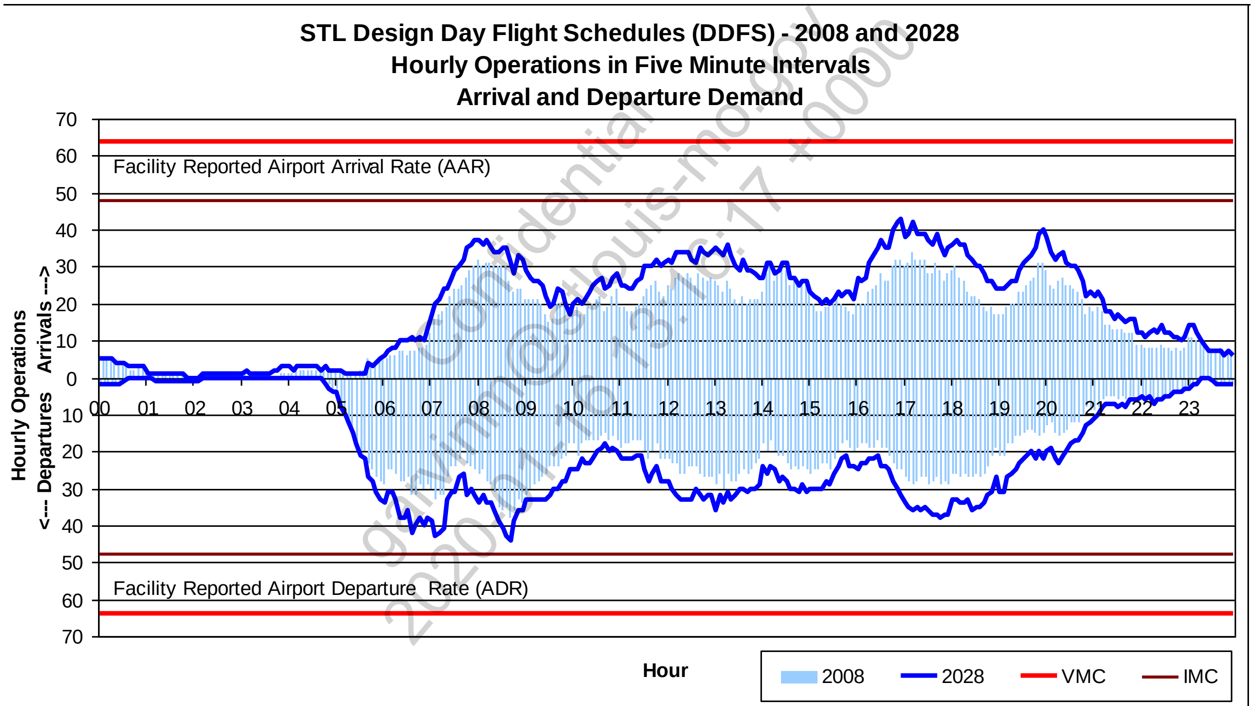
AIRFIELD CAPACITY TYPE	VFR CONDITIONS	MARGINAL VFR CONDITIONS	IFR CONDITIONS
Arrivals	64	48	48
Departures	64	48	48
Total Operations	**128**	**96**	**96**

Source: FAA ASPM Database (2008)

4.2.4 AIRFIELD DELAY

There was no actual delay/queuing model analysis conducted for the 2008 and 2028 demand levels because there are no points in the design day schedules during which the demand is projected to surpass VFR or IFR capacity. **Exhibit 4.2-3, *STL Demand vs. Capacity (Arrivals and Departures)***, shows the forecast arrival and departure demand for both 2008 and 2028 as compared to the VMC and IMC airfield capacities for the existing airfield. As shown, the airfield capacity exceeds operational demand during all times of day. At all of these times, there is sufficient overall capacity to meet the arrival or departure surges simply by altering how one or both runways are used.

Exhibit 4.2-3
STL DEMAND VS CAPACITY (ARRIVALS AND DEPARTURES)
Lambert-St. Louis International Airport



Source: STL Radar Data, FAA TAF (FY 2006), FAA ASPM Database (2006), and Landrum & Brown analysis

4.2.5 AIRFIELD DEMAND/CAPACITY CONCLUSIONS

The level of analysis undertaken for this project yields a conservative assessment of airfield capacity and assumes properly queued aircraft with no ground delays. Operational variables resulting from pilot actions, mechanicals, taxi delays, runway crossings, airborne crossings, etc. were not and cannot be fully accounted for in this study.

The capacity of the STL airfield facilities are defined as the number of aircraft operations that can be served without exceeding acceptable levels of delay. A standard definition of acceptable delay is not used in the industry because numerous operational factors and airport characteristics influence the acceptable amount of delay. Previous analysis of airport capacity and delay conducted by L&B at other major U.S. airports has shown that delay levels of six to 10 minutes indicated the need for additional facilities. As average aircraft delay increases above six minutes, passengers tend to perceive service reliability problems while airlines experience increased aircraft operating costs. As delay approaches 10 minutes per operation, further increases in demand are limited.

Average delays of six to seven minutes per aircraft at Miami, Philadelphia, and Detroit were indicative of peak delays, which resulted in significant disruption during certain periods of the day and year. While these airports were not operating at maximum capability, they would have benefited from airfield expansion as evidenced by the new runways built in Miami, Detroit, and Philadelphia. Based on historical evidence from these airports, a range of acceptable annual average delay between 6 and 10 minutes per operation was used for determining annual operations capacity. For any physical or operational improvement to be considered, the cost of the delay should exceed the cost of the improvement.

Evaluation of projected demand and expected capacity at STL over the forecast period, which ends in 2028, shows that the existing runway system should be fully capable of meeting demand during this time period. Based on the above analysis, there is no need for additional runways within the planning period to meet future demand.

4.3 AIRFIELD REQUIREMENTS

As noted in Chapter One, *Inventory of Existing Conditions*, the existing airfield layout consists of three parallel northwest/southeast runways and one northeast/ southwest crosswind runway. There are a number of airfield requirements to be considered for future planning purposes. This section will analyze the following:

- Runway length and width requirements
- Runway exit locations and geometry
- Taxiway requirements
- Airfield safety areas
- Airfield capital, technological, and operational improvements

Airside facilities needed at Lambert to accommodate the projected levels of aviation demand were determined using applicable FAA planning design standards and requirements. The planning and design of an airport are based on an airport's role, the number and type of aircraft operations, and the "critical" aircraft.

4.3.1 RUNWAY LENGTH REQUIREMENTS

All of the runways at STL can accommodate air carrier operations. The existing runway system provides the following runway lengths by runway alignment:

- Runway 12R/30L 11,019 feet
- Runway 12L/30R 9,003 feet
- Runway 11/29 9,000 feet
- Runway 6/24 7,602 feet

STL has served as a major domestic and international hub with non-stop 747-100/200 service between St. Louis and several European destinations during the period that TWA operated in St. Louis. This service, along with relatively long-haul activity using the Lockheed L1011 and Boeing 767-200/300 aircraft, provided the basis for the current runway lengths, and notably the length of Runway 12R/30L, which served then as now as the primary departure runway at the time.

Runway length requirements were calculated for a selection of aircraft from the fleet of passenger and cargo aircraft that were using STL in 2008, as well as those forecast to use STL in the year 2028. Passenger aircraft were chosen from the five longest routes to the top 20 market destinations from STL in 2008, which are Punta Arenas, CL South America; Rome, Italy; Cairo, Egypt; Frankfurt, Germany; and Anchorage, Alaska. Air cargo aircraft were chosen by the four most frequent air cargo aircraft forecast to be in operation at STL in 2028, which are the MD-11, B757, B727, and A300. The B767 was also analyzed as a cargo aircraft due to its number of operations at STL in 2008. Recognizing the Airport's role in facilitating economic growth, the runway length requirements of the Boeing 747-400 freighter aircraft were included to align the analysis with ongoing discussions between civic leaders in the Greater St. Louis area and business leaders and freight operators from the People's Republic of China. **Table 4.3-1, *Aircraft Characteristics for Runway Length Analysis***, presents the specific aircraft types and their key characteristics considered in the analysis.

The runway length requirements were calculated using charts published in the *Aircraft Characteristics for Airport Planning* manuals for each individual aircraft. Requirements were calculated by taking into consideration the airport elevation above mean sea level (MSL), hot day temperature, and the performance characteristics and operating weight of aircraft forecasted to be serving the airport. The operating weight of an aircraft is dependent on the amount of fuel needed to reach the destination, the amount of payload (passengers, baggage, and cargo) and operating empty weight (OEW).

Both the amount of fuel required to complete the flight, and the payload are variable quantities that can fluctuate depending on destination and season, among other factors. Where necessary, the requirements published in the individual aircraft planning manuals were adjusted to account for the actual mean maximum daily temperature in St. Louis by applying the methodology defined by the International Civil Aviation Organization (ICAO) in Chapter Three of the *Aerodrome Design Manual*.

Table 4.3-1
AIRCRAFT CHARACTERISTICS FOR RUNWAY LENGTH ANALYSIS
Lambert-St. Louis International Airport

Aircraft Type	Engine Type	Maximum Takeoff Weight (MTOW)	Maximum Landing Weight (MLW)	Maximum Payload	Maximum Fuel (In Pounds)
Boeing					
737-500	CFM56-3B1	133,500	110,000	33,470	38,880
737-700	CFM56-7B24	154,500	129,200	38,700	46,063
737-800	CFM56-7B27	174,200	146,300	47,000	46,063
737-900	CFM56-7B27	174,200	146,300	45,270	46,063
747-400	CF6-80C2B1	875,000	630,000	148,412	382,336
757-200	RB211-535E4B	255,000	210,000	47,060	75,550
767-300	CF6-80C2B7F	412,000	320,000	96,560	161,740
777-200LR	GE90-115BL	766,000	575,000	228,700	320,863
Airbus					
A300-600	CF6-80C2A5F	363,760	304,230	75,452	74,620
A319	CFM56-5A5	141,096	134,481	37,116	41,555
A320-200	CFM56-5A5	166,446	142,196	45,573	41,554
A330-200	CF6-80E1A4	507,055	396,825	108,139	243,077
McDonnell-Douglas					
MD-82	PW JT8D-217A	149,500	130,000	44,024	39,168
MD-83	PW JT8D-219	160,000	139,500	42,314	46,773
DC-10-30F	GE CF6-50C2	580,000	436,000	177,500	245,569
MD-11F	PW 4460	605,500	471,500	202,733	258,721
Embraer					
EMB 135	AE3007-A3	44,092	40,785	9,919	11,435
EMB 145	AE3007-A1E	48,502	42,549	12,755	11,435
EMB 170	GE CF34-8E5-A1	79,344	72,311	20,062	20,785
EMB 190	GE CF34-10E7	110,892	89,949	28,440	28,660
Bombardier					
CRJ-200	GE CF34-3B1	51,000	47,000	13,500	13,707
CRJ-700	GE CF34-8C1	75,000	67,000	18,750	19,450
CRJ-900	GE CF34-8C5	84,500	73,500	23,500	19,450

Source: *Aircraft Characteristics for Airport Planning Manuals*

4.3.1.1 Takeoff Length Requirements

All aircraft takeoff requirements are based on maximum takeoff weight (MTOW) at an airport elevation of 618 feet. The MTOW was used for this analysis to determine the maximum runway length needed for takeoff with no operational restrictions. One of the major planning parameters is air temperature. Takeoff runway length requirements can be determined for "standard day" (59 degrees Fahrenheit) or "hot day" conditions. For planning purposes, a hot day temperature was used for the takeoff runway length calculations. A hot day reference temperature is the safest option to choose when determining runway length since it accounts for days when longer-than-usual take off distances would be necessary. According to the National Oceanic and Atmospheric Administration (NOAA), the mean-maximum temperature at STL in July is 89.6 degrees Fahrenheit (F).[2]

The results of the runway takeoff length based on MTOW are shown on **Table 4.3-2, *Runway Takeoff Length at MTOW***. Typically, general aviation aircraft require substantially less runway length than air carrier aircraft. Therefore, general aviation aircraft are not incorporated in the runway length analysis. For the air carrier aircraft, the B777-200LR requires the longest runway length of 10,302 feet, and the B767-300 and Airbus A320-200 each requiring 9,180 feet of runway. The DC-10 cargo aircraft requires the longest takeoff length of 12,610 feet, followed by the 747-400F with 11,600 feet of runway. The DC-10 cargo aircraft is typically assigned to domestic cargo operations and is not suitable for long-haul cargo operations; therefore, it is not appropriate to plan future runway requirements for this equipment type.

4.3.1.2 Landing Length Requirements

Landing length calculations were based on the maximum landing weight (MLW) provided by the manufacturer in the *Aircraft Characteristics for Airport Planning* manuals using an airport elevation of 618 feet. Wet and dry runway lengths were calculated for all aircraft. The *Airbus Aircraft Characteristics* manuals do not provide information on landing length requirements for wet runways. Current FAA planning criteria[3] specifies that if the aircraft planning manual only provides dry landing conditions, this number should be increased by 15 percent to achieve wet landing conditions, but not more than 5,500 feet, whichever is less. The results of the landing length analysis are shown on **Table 4.3-3, *Runway Landing Length***.

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[2] National Oceanic and Atmospheric Administration (NOAA), *Climatology in the United States No. 81, Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971-2000 – 23 Missouri*, February 2002.

[3] FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, 7/1/05.

Table 4.3-2
RUNWAY TAKEOFF LENGTH AT MTOW
Lambert-St. Louis International Airport

AIRCRAFT TYPE	ENGINE TYPE	HOT DAY PER PLANNING MANUALS	TAKEOFF PER HOT DAY IN MANUALS	ICAO ADJUSTMENT IN FEET	ICAO ADJUSTED 89.6° F
BOEING					
737-500	CFM56-3B1	86F/30C	8,800	176	8,976
737-700	CFM56-7B24	86F/30C	6,900	138	7,038
737-800	CFM56-7B26	86F/30C	8,200	164	8,364
737-900	CFM56-7B27	86F/30C	8,200	164	8,364
747-400	CF6-80C2B1	90F/32.2C	11,600	-0-	11,600
757-200	RB211-535E4B	84F/29C	7,200	216	7,416
767-300ER	CF6-80C2B7F	86F/30C	9,000	180	9,180
777-200LR	GE90-115BL	86F/30C	10,100	202	10,302
AIRBUS					
A300-600	CF6-80C2A5F	86F/30C	8,500	170	8,670
A319	CFM56-5A5	86F/30C	6,050	121	6,171
A320-200	CFM56-5A5	86F/30C	9,000	180	9,180
A330-200	CF6-80E1A4	86F/30C	10,500	210	10,710
MCDONNELL-DOUGLAS					
MD-82	PW JT8D-217A	86F/30C	8,500	170	8,670
MD-83	PW JT8D-219	86F/30C	8,900	178	9,078
DC-10-30F	GE CF6-50C2	95F/35C	13,000	-390	12,610
MD-11F	PW 4460	86F/30C	10,900	218	11,118
EMBRAER					
EMB 135	AE3007-A3	86F/30C	6,890	138	7,028
EMB 145	AE3007-A1E	86F/30C	5,900	118	6,018
EMB 170	GE CF34-8E5-A1	86F/30C	5,000	100	5,100
EMB 190	GE CF34-10E7	86F/25C	5,800	406	6,206
BOMBADIER					
CRJ-200	GE CF34-3B1	86F/30C	6,800	136	6,936
CRJ-700	GE CF34-8C1	86F/30C	6,100	122	6,222
CRJ-900	GE CF34-8C5	86F/30C	7,100	142	7,242

Source: *Aircraft Characteristics for Airport Planning Manuals*, Annex 14, ICAO *Aerodrome Design Manual*, Chapter Three, Landrum & Brown Analysis

Table 4.3-3
RUNWAY LANDING LENGTH
Lambert-St. Louis International Airport

AIRCRAFT TYPE	DRY RUNWAY LANDING LENGTH	WET RUNWAY LANDING LENGTH
BOEING		
737-500	4,700	5,450
737-700	4,900	5,700
737-800	5,850	6,800
737-900	6,050	6,950
747-400	6,400	7,400
757-200	5,000	5,750
767-300	5,600	6,400
777-200LR	5,250	6,100
787-800	No data	No data
AIRBUS		
A300-600	5,100	5,865*
A319	4,400	5,060*
A320-200	4,950	5,693*
A330-200	6,600	7,590*
A340-500	6,567	7,545*
A340-600	6,890	7,925*
MCDONNELL-DOUGLAS		
MD-82	5,400	6,100
MD-83	5,400	6,100
DC-10-30F	6,000	6,900*
MD-11F	8,400	9,500
EMBRAER		
EMB 135	4,500	5,175*
EMB 145	5,800	6,670*
EMB-170	4,400	5,060*
EMB 190	4,100	4,715*
BOMBARDIER		
CRJ-200	4,800	5,520*
CRJ-700	4,900	5,635*
CRJ-900	6,600	7,590*

Source: Aircraft Characteristics for Airport Planning Manuals, ICAO Aerodrome Design, Chapter Three, Landrum & Brown analysis, 2011

4.3.1.3 Runway Length Summary

The preceding analysis has identified the potential need, should long haul cargo service established at some point in the future, for a runway providing 11,600 feet of takeoff length to accommodate hot day, maximum takeoff weight operations by the B747-400. At the time such service is announced, a review of the specific operational characteristics should be conducted to determine if the operations would truly trigger the need to provide additional runway length.

Preliminary load planning analysis using the aircraft planning manual indicates that the B747-400 would incur a 45,000-pound payload penalty if operating off the existing runway with sufficient fuel to travel 6,000 nautical miles with temperatures at departure time of 89.6 Fahrenheit.

Actual payload requirement, time of operation, and stage length could negate the need for a runway extension. For planning purposes, the identified 11,600-foot requirement is further analyzed in the evaluation of alternatives to ensure that if this need would arise, the issue will have addressed and STL would be equipped to move forward with the best option to meet the need.

As it relates to landing lengths, the existing runway system is fully adequate to meet the needs of the current and potential aircraft fleet. No extension to any runway is deemed needed to address a landing-length deficiency.

4.3.1.4 Airfield Design Requirements

As noted in Chapter Two, *Inventory of Existing Conditions*, all of the runways and taxiways were designed to accommodate at least Airport Reference Code (ARC) D-IV aircraft. Runways 6/24, 11/29 and 12L/30R are 150 feet wide, Runway 12R/30L is 200 feet wide, and all taxiways are a minimum of 75 feet wide.

For long-term planning purposes, it is recommended that meeting Group D-V requirements be considered for future runways, taxiways, and apron areas and when feasible design to the more demanding standard to minimize future expense associated with reconfiguring the airfield from Group D-IV to the more demanding Group D-V standard, should future demand require the added separation.

4.3.2 TAXIWAY REQUIREMENTS

Taxiways are defined as paved areas established to move aircraft from one part of the airport to another. This section evaluates the existing taxiway system and summarizes the taxiway requirements at STL. Refer back to Exhibit 4.2-1 for the existing taxiway layout and runway exit locations.

4.3.2.1 Parallel Taxiways

Runways 11-29 has full-length dual parallel taxiways, and Runway 12R-30L has full-length dual parallel taxiways/taxilane on the south side of the runway and a length single parallel taxiway to the north, which extends form the Runway 30L approach end to Taxiway S. Runway 12L-30R is served by a single full-length parallel taxiway to the south and a second parallel taxiway to the north that ends at Taxiway J, well short of the 30R approach end of the runway. Runway 6/24 has a parallel taxiway east of the runway extending from the Runway 6 Approach end to Taxiway F and section of parallel taxiway extending from the Runway 6 Approach end to Taxiway D. The Runway 24 Approach end is served by Taxiway V to the West and Taxiway P to the East; Taxiway V has been realigned to run parallel to the runway to the intersection with Taxiway F. For maximum flexibility and operational efficiency, dual taxiway capability should be considered for future airfield expansions.

4.3.2.2 Runway Exits

Entrance/exit taxiways (also referred to as runway exits) connect runways to parallel taxiways. These taxiways provide paths for aircraft to enter the runway for departure or leave the runway after landing.

The type of runway exits and the location and number of exits depend on many factors including the location of parallel taxiways and the type of aircraft using the runway. The time it takes an aircraft to decelerate to a speed that is slow enough to exit the runway varies depending on the size and performance characteristics of the aircraft and condition of the runway.

If exits are not placed at the point(s) where the majority of aircraft using the runway reach their exit speed, the aircraft must continue down the runway at a relatively low rate of speed until it gets to an exit. Runways with adequate and properly spaced runway exits allow capacity to be optimized by minimizing the runway occupancy times of arriving aircraft.

Generally, a greater number of runway exits are needed for a diverse fleet mix to allow all aircraft to exit the runway at their optimal speed. In addition, acute-angled exits provide lower runway occupancy times compared to 90-degree exits. This is because aircraft can exit the runway at higher speeds with acute-angled exits, thereby allowing the aircraft to exit the runway sooner.

Runway 12R-30L has 13exits on the terminal side of the runway, of which eight are 90-degree, three widened 90-degree, and two are acute-angled exits. Runway 12L-30R has 10 exits, of which six are 90-degree, and four are acute-angled exits. Runway 6-24 has eight exits, of which five are 90-degree, and three are widened 90-degree-angled exits. Runway 11- 29 has seven exits, of which two are 90-degree, one is a widened 90-degree, and four are acute-angled exits.

The FAA's REDIM program was used to analyze both the existing fleet mix 2008 and the forecast 2028 fleet mix at STL on each runway. The resulting average ROTs for each runway end are shown on **Table 4.3-4, *Average Runway Occupancy Time by Runway End***. It is recommended that the average ROT be 50 seconds or less for optimal arrival spacing of aircraft. Therefore, with ROTs of more than 50 seconds for all runways except Runway 11/29, it is recommended that additional exits or reconfigured exits be considered for these runways. Reconfiguration of the Runway 12L/30R, 12R/30L, and 6/24 exits is discussed in more detail in Chapter 5, *Airport Concept Development and Evaluation*.

Table 4.3-4
AVERAGE RUNWAY OCCUPANCY TIME BY RUNWAY END
EXISTING 2008 FLEET MIX COMPARED TO PROJECTED 2028 FLEET MIX
Lambert-St. Louis International Airport

RUNWAY END	2008 AVERAGE ROT (IN SECONDS)	2028 AVERAGE ROT (IN SECONDS)
11	48.1	48.1
29	48.1	47.9
12L	52.7	51.8
30R	50.8	50.9
12R	58.5	58.0
30L	57.4	56.6
6	63.6	62.5
24	56.4	55.9

Source: FAA Runway Exit Design Interactive Model (REDIM) and Landrum & Brown.

In addition to runway occupancy times, the location of runway exits can have an impact on the ability of the pilot to navigate an aircraft safely across the airfield. Areas where multiple taxiways intersect the runway within close proximity to one another have the potential to cause pilot confusion.

Taxiway L, at the intersection with Runway 12L/30R, is an example of an area where multiple exit points may result in pilot confusion. A REDIM run was conducted for operations on Runway 12L/30R to determine the impact to the operation should the Airport choose to remove the taxiway from the airfield. The analysis suggests that the impact to 12L arrivals is less than 1 second while the impact to 30R arrivals is negligible.

A similar REDIM analysis was conducted to identify the impact of removing the pavement on Taxiway E between Taxiway S and Runway 6/24. STL and the FAA have identified this portion of pavement as a possible source of confusion for pilots taxiing westbound on Taxiway E. In the unlikely event the turn onto Taxiway S is missed, pilots would taxi onto to Runway 6/24. Removing this pavement increases the occupancy time on Runway 6 arrivals by approximately one second; operations on Runway 24 are not affected.

As stated previously, runways that have a proven average ROT of 50 seconds or less may be allowed closer spaced arrivals by the FAA. Should an unforeseen change in demand above and beyond the forecast put pressure on the arrival capacity at the Airport, additional high-speed runway exits should be considered for Runway 12L/30R to reduce the ROT to less than 50 seconds.

4.3.2.3 Terminal Area Taxiways

The airside of the terminal complex has single taxiway to the north between Terminal 1 and Taxiway D, the full-length taxiway parallel to Runway 12R/30L. This configuration is not optimal for efficient flow of aircraft in the terminal complex area as aircraft pushing back from the gate impede the movement of other aircraft. Terminal 2 aircraft are able to pushback onto the two taxilanes between the terminal and Taxiway D permitting aircraft to maneuver without impeding free movement. The southwest side of Concourse A is served by a single taxilane, which does not permit aircraft to pass during a gate pushback. The area between Concourses C and D is served by dual taxilanes permitting bypass capability during aircraft pushback from gates on these two terminals. The terminal area also includes the LIMA pad located between Terminals 1 and 2 for remain over night (RON) aircraft parking. This capability frees up gate space and allows carriers to keep aircraft near the terminal complex when RONs are required.

4.3.2.4 Bypass Taxiways

Bypass areas or run-up pads are areas used to position aircraft prior to takeoff. These are placed adjacent to the ends of runways and are designed so that aircraft can pass by one another when necessary. A bypass area allows the trailing aircraft to pass the leading aircraft if the takeoff clearance of the leading aircraft is delayed or a malfunction is experienced. In addition, bypass areas provide space for instrumentation and engine operation to be checked on piston-engine aircraft prior to takeoff. It is important for air carrier airports to have sufficiently sized bypass areas to accommodate existing and future aircraft.

The airfield taxiway configuration provides bypass capability on the ends of two of the four runways by providing dual parallel taxiways and/or bypass taxiways at each runway end. Runways 11/29 and 12R/30L have a bypass taxiway at each runway end.

4.3.2.5 Taxiway Summary

The taxiway analysis identified the following taxiway parameters for determining future needs:

- Provide full-length parallel taxiways for all air carrier runways, including new runways constructed in the future
- Provide additional or reconfigured runway exits and acute-angled exits where necessary
- Provide bypass areas for all air carrier runways

4.3.3 FAR PART 77 SURFACES AND OBSTRUCTIONS

Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*, establishes standards for determining which structures pose potential obstructions to air navigation. This is accomplished by defining specific airspace areas around an airport that cannot contain any protruding objects. These airspace areas are referred to as imaginary surfaces. These imaginary surfaces include the primary, transitional, horizontal, conical, and approach surfaces. Data from the latest aeronautical survey for the approach, primary and missed approach surfaces of each runway is listed in **Table 4.3-5, *FAR Part 77 Obstructions***. (Please note - These obstructions will be verified through additional analysis during completion of the ALP and updated based on current physical conditions.) Any modifications to this data will be reported to the FAA for their reporting purposes.

Table 4.3-5
FAR PART 77 OBSTRUCTIONS (To be reviewed and updated with finalized ALP SET)
Lambert-St. Louis International Airport

RUNWAY END	OBSTRUCTION
6	Lighted Windsock Obstruction Light on Glide Slope Obstruction Light Transmissometers
24	Lighted Windsock Obstruction Light on Glide Slope ROD on Obstruction Light Glide Slope Obstruction Light Transmissometers
11	Lighted Windsock Obstruction Light on Glide Slope Obstruction Light Transmissometers ROD on Obstruction Light Glide Slope
29	Lighted Windsock Obstruction Light on Glide Slope Obstruction Light Transmissometers ROD on Obstruction Light Glide Slope
12L	Obstruction Light on Glide Slope Obstruction Light Transmissometers ROD on Obstruction Light Glide Slope
30R	Lighted Windsock Obstruction Light on Glide Slope Obstruction Light Transmissometers ROD on Obstruction Light Glide Slope
12R	Lighted Windsock Obstruction Light on Glide Slope Obstruction Light Transmissometers ROD on Obstruction Light Glide Slope
30L	Lighted Windsock Obstruction Light on Glide Slope Obstruction Light Transmissometers ROD on Obstruction Light Glide Slope

Sources: Airnav.com, November 24, 2008, and ALP Update, Dated Feb. 2 2007 prepared by Parsons Brinckerhoff (Runway Threshold Elevation)

4.3.4 AIRFIELD SAFETY AREAS

As stated in Chapter One, *Inventory of Existing Conditions*, the typical airport Safety Areas include the following, which are presented in more detail below:

- Runway Protection Zone (RPZ)
- Runway Safety Area (RSA)
- Object Free Zone (OFZ)
- Object Free Area (OFA)

4.3.4.1 Runway Protection Zone (RPZ)

The RPZ is trapezoidal in shape and is centered on the extended runway centerline. Each of the RPZ's at STL, for the most part, lies within the existing Airport property boundary. All the RPZ's, with the exception of the Runway 12L RPZ, overlay main thoroughfares that surround the Airport and in some cases parts of adjacent properties. Although specifically discouraged, parking facilities within the RPZ are permitted provided the parking facilities and any associated appurtenances are located outside the central portion of the RPZ.

As currently configured, the following facilities are located within some of the Airport's RPZs:

- The Super Park (D) parking area is located in the central portion of the Runway 6 RPZ; it is a legacy facility that is essential to the Airport's financial health. The lot is credit card only facility and there are no workstations or staffed revenue control booths. The lot is on the extended centerline to Runway 6 and the majority of parking spaces are within the Runway 6 RPZ. The RPZ size has been dictated by the Runway 6 RNAV approach, which has lower minima than the precision ILS approach. However, the RNAV approach like the ILS receives limited, if any, use. The Super Park D lot pre-dates the Runway 6 RNAV approach. Prior to implementing the RNAV approach, the lot would have been outside the RPZ. Over flight of the parking lot is nominal. Runway 6-24 is a crosswind runway with low use. Runway 6 experienced less than 200 arrivals in CY2011 and Runway 24 had 400 departures. Over flight by Runway 24 departures is rare. Runway 24 departures are routinely turned to a 300 heading as rapidly as feasible to prevent over flight of populated areas and to control the departure noise footprint. At the time the parking lot was constructed, in the 1980s, it was in accord with guidance that was applicable at the time of construction.
- The Super Park (C) is located on the extreme south edge of the Runway 6 RPZ away from the extended runway centerline; it is a legacy facility that is essential to the Airport's financial health. All workstations, the revenue control plaza, and surface parking are outside the RPZ. Covered parking is located within the RPZ, but outside both the inner approach OFZ and the inner transitional OFZ, and none of the covered parking structures penetrate the approach or departure surfaces. The RPZ size is dictated by the Runway 6 RNAV approach, which has lower minima than the precision ILS

approach. However, the RNAV approach like the ILS receives limited, if any, use. The Super Park C lot pre-dates the Runway 6 RNAV approach. Prior to implementing the RNAV approach, the lot would have been outside the RPZ. Over flight of the parking lot is nominal. Runway 6-24 is a crosswind runway with low use. Runway 6 experienced less than 200 arrivals in CY2011 and Runway 24 had 400 departures. Over flight by Runway 24 departures is rare. Runway 24 departures are routinely turned to a 300 heading as rapidly as feasible to prevent over flight of populated areas and to control the departure noise footprint. At the time the parking lot was constructed, in the 1980s, it was in accord with guidance that was applicable at the time of construction.

- The Hunter Engineering Buildings are located on the north edge of the Runway 6 RPZ. Unfortunately, the Hunter Engineering campus is located off-airport on private property and is outside the span of Airport control.
- An aircraft parking apron is located within the Runway 12L RPZ. The aircraft parking apron should be marked and or/signed to ensure that neither the airline nor the FBO park aircraft in the 12L RPZ.
- The Terminal 1 Cell Phone Lot is located within the Runway 29 RPZ and is under the inner transitional OFZ to Runway 29. The lot is located outside the Runway 29 inner approach OFZ. The lot provides a valuable customer service amenity and is essential to relieve terminal roadway congestion. The lot is buffered from potential Runway 11 overruns and potential Runway 24 overruns by Coldwater Creek. The airport should explore the possibility of relocating the cell phone lot.

All future runways or runway extensions should try to maintain the RPZ within the existing airport property. If this is not possible, it is recommended that STL purchase the land encompassed by the RPZ to maintain control of potential future development.

4.3.4.2 Runway Safety Area (RSA)

The RSA serves as a safety area if an aircraft overruns the paved surface. The RSA standard for STL's runways measures 500 feet wide and extends 1,000 feet beyond the runway end, centered on the centerline of the runway. The RSAs for Runways 11-29 and 12R-30L, and the approach ends to Runways 6 and 30R meet the requirement. The proximity of the localizer to the runway end is the limiting factor for Runway ends 12L and 24; Runway 24 is also limited by the proximity of the fence line along Banshee Road. In all cases where the full length RSA is not achieved, the Airport has implemented the appropriate declared distances to provide the necessary protection afforded by the RSA. The Airport should continue to make improvements to the airfield to meet the RSA requirements where practicable.

4.3.4.3 Obstacle Free Zone (OFZ)

The OFZ is a defined volume of airspace centered above the runway centerline. The OFZ clearing standard precludes taxiing and parked airplanes and object penetrations, except for frangible visual Navigational Aids (NAVAIDS) that need to be located in the OFZ because of their function. The OFZ is composed of the runway OFZ (ROFZ), and, when applicable, the precision OFZ (POFZ), the inner-approach OFZ, and the inner-transitional OFZ. The ROFZs extend 200 feet beyond each end of the runway, and are 400 feet in width. The POFZ is in effect only when certain operational conditions are met. Currently, no objects have been found to violate the OFZ for any of the runways. Therefore, there are no limits to capacity deriving from OFZ violations.

4.3.4.4 Runway Object Free Area (OFA)

Runways 6/24, 11/29, 12L/30R and 12R/30L should have OFAs that extend 1,000 feet from each runway end and measure 800 feet in width. The current OFAs for each of the runways are clear and free of obstructions (other than navigational aids that are fixed by their function), with the exception of the approach ends of Runway 12L and 24. All future runway OFAs will be compliant with FAA design standards.

4.3.5 AIRFIELD IMPROVEMENTS

In terms of capacity and capability, the STL airfield is sufficient to serve the needs of the forecast operations through the planning period. Improvements necessary moving forward are not required to meet operational demands, rather the improvements are necessary to improve the usability, efficiency and safety of the airfield. The Runway 11-29 complex represents the most modern design of an airfield complex for a commercial airport; exit geometries, pavement design and navigation aids are located with efficiency and safety in mind. The Runway 12R-30L and 12L-30R runway complexes represent an airfield that has undergone significant growth and many of the pavement areas and navigational aids are not in locations currently recommended by latest state of the art practices. Moving forward in the alternatives development of the Master Plan the following items will be evaluated; runway and taxiway geometries, including exit location, in the Runway 12R-30L and Runway 12L-30R complex, runway safety areas, locations of navigational aids and the need for any potential runway extensions.

4.4 PASSENGER TERMINAL

4.4.1 INTRODUCTION

This section of the chapter is devoted to the passenger terminal building facility requirements. The following sections describe the methodology and rationale for developing the aircraft gate and building area requirements.

4.4.2 METHODOLOGY

The approach used to develop the passenger terminal facility requirements for STL involved analyzing the current capacities of the existing terminal building, site observations, factors from comparable airports around the U.S., interviews with existing tenants and Airport staff, and the application of industry accepted planning standard guidelines. Current demand/capacity ratios were determined using the existing terminal 2008 facilities space allocations with updated 2010 terminal utilization values, the completed and planned *Airport Experience Program* list of projects and the August 11, 2010, demand day Official Airline Guide (OAG) flight schedule which serves to establish a baseline condition of demand to current facility capacities.

Airport terminal facilities are sized to accommodate the future forecast of passengers and aircraft operations. For the internal passenger processing functions of the terminal this typically involves using the demands associated with future projections of Annual and Peak Month Average Day Peak Hour (PMADPH) passenger volumes. Although annual enplanements are an indicator of overall airport size, Peak Hour volumes more accurately reflect the demand for specific functions within the terminal facilities.

Peak Hour volumes are often referred to as Design Hour passengers and are identified from a typical Busy Day or Design Day. The Peak Hour, or Design Hour, measures the enplaned (departing) and deplaned (arriving) passengers on aircraft in an elapsed hour of the Design Day. The Peak Hour generally does not correspond to a static hour or "clock hour" such as 6:00-6:59, but rather refers to a "rolling hour" which overlaps two "clock hours," e.g. 6:15-7:14, which better reflects airline scheduling patterns.

Design Hour passengers represent the number of persons in the terminal during peak periods. To capture the true anticipated demand on certain terminal functions, this Design Hour number may also include meeters and greeters, well-wishers (more commonly referred to as visitors), and employees. The Design Hour does not represent the absolute peak level of activity but instead is equal to the number of people occupying the space at any given point in time. The Design Hour is the approach that the industry has traditionally used as the level of activity by which most new terminal facilities are sized. These peaking characteristics are unique to each airport terminal due to the differences in operational factors that include variations in the airlines serving the airport and their respective flight schedules; the mix between mainline and regional aircraft types; varying activity levels of origin/destination (O&D) and connecting passengers; international and domestic passengers; and, business and leisure passengers.

4.4.3 AIRCRAFT GATES

4.4.3.1 Existing Gate Utilization

Initially the August 13, 2008 base schedule was "paired" (matching of arriving flights to departing flights) for each airline. This analysis produced such planning factors as turns or departures per gate, average time on gate, Domestic and International operations, Remain Overnight Night (RON) positions, and the total number of gates required. To reflect the current operating characteristics at STL the published schedule of August 11, 2010 was analyzed for the same planning factors as noted above. **Table 4.4-1, *Terminal 1 Gate Utilization – August 11, 2010 Schedule***, and **Table 4.4-2, *Terminal 2 Gate Utilization – August 11, 2010 Schedule***, summarize the utilization of gates by each airline and terminal from this schedule analysis. (To review the August 13, 2008 analysis, *see* Appendix B, *Terminal Demand/Capacity and Facility Requirements*.) A terminal "gate" is defined as a location where an aircraft is parked at the terminal for loading and unloading of passengers. Passengers using a gate can access an aircraft directly from the apron level via a stairway integrated into the aircraft, by a portable stairway or, more typically, though a passenger loading bridge, referred to as a "contact" gate.

At full operational capacity, STL has a total of 88 gates with 72 at Terminal 1 and 16 at Terminal 2. With the current closures of Concourse B and Concourse D, the total operating terminal capacity yields 61 gates (when including all Concourse C gates), 45 gates at Terminal 1 and 16 gates at Terminal 2. Gate E2 in Terminal 2 does not have a jet bridge and given the gate configuration of Southwest Airlines, it is unlikely that future operations will take place from this gate. This yields a total operational capacity of 60 gates between the two terminals. Of the 60 potential operational gates in 2010, 23 gates at Terminal 1 and 13 gates at Terminal 2 are leased by the airlines. When an airline had more RON aircraft than leased parking positions it required an "Extra RON" position as noted in Table 2.4-1 and Table 2.4-2.

To develop realistic estimates of gate requirements and RON parking requirements, assumptions need to be made regarding aircraft inter-gate time and which flights in the schedule are most likely to remain overnight prior to departure the next day. Inter-gate time refers to the additional time airlines typically reserve to prepare aircraft, enplane and deplane passengers, and preserve for off-schedule operations. The inter-gate time assumption explicitly removes a gate from potential use above and beyond an airlines scheduled departure and arrival time. A common practice when analyzing published airline flight schedules is to allow for an inter-gate time of 25 minutes, or 10 minutes before actual arrival time, and 15 minutes after scheduled departure time. This can have an effect on total gate need throughout the day by carrier. Another common assumption is the time in which RON flights are "towed" on or off the gate when an arrival/departure flight is not scheduled during the same 24-hour period. This can also affect total gate needs throughout the day and the actual operating schedules by carrier may differ from the results of the schedule analyses.

Table 4.4-1
TERMINAL 1 GATE UTILIZATION – AUGUST 11, 2010 SCHEDULE[1]
Lambert-St. Louis International Airport

Concourse	Airline	Gate #	Existing PBB	2010 PMAWD Operations	2010 Dep/Gate	Max AC Gauge	Active AC Gauge Utilization	2010 Extra RON	2010 Avg. Gate Time
Concourse A	Delta	A2	Y	60		B737-5,6,7,8,9w	CRJ/ERJ/CR7,9/ D94,95,9S/M88/ A319,320	3	0:42
		A3	Y			B737-5,6,7,8,9w			
		A4	Y			B737-5,6,7,8,9w			
		A6	Y			B727			
		A8	Y			B737-3,4			
		A10	Y			B737-5,6,7,8,9W			
	Total	**6**	**6**	**60**	**5.0**				**0:42**
	Unassigned	A12	Y			A321			
	Continental	A9	Y	26		B757-2,3	ERJ	1	0:39
		A14	Y			EMBRAER(E170,175)			
	Total	**2**	**2**	**26**	**6.5**				**0:39**
	US Airways	A15	Y	32		B737-5,6,7,8,9w	CRJ/ERJ/CR9/E70,75/ B733,734/A319,320	2	0:44
		A16	Y			B737-5,6,7,8,9w			
		A17	Y			B737-5,6,7,8,9w			
	Total	**3**	**3**	**32**	**5.3**				**0:44**
	United/Air Canada	A18	Y	46		B757	ER4/CR7/A320	3	0:43
		A19	Y			B737-7w			
		A21	Y			F70/F100			
	Total	**3**	**3**	**46**	**7.7**				**0:43**
Concourse B	Decommissioned/Closed	B2				MD80			
	Decommissioned/Closed	B3				COMMUTER			
	Decommissioned/Closed	B4				MD80			
	Decommissioned/Closed	B6				MD80			
	Decommissioned/Closed	B7				COMMUTER			
	Decommissioned/Closed	B8				CR2			
	Decommissioned/Closed	B14				COMMUTER			
	Decommissioned/Closed	B16				COMMUTER			
	Decommissioned/Closed	B10				B737			
	Decommissioned/Closed	B12				B737-5,6,7,8,9w			
Concourse C	American	C2	Y	68		B737-5,6,7,8,9,w	ER3/ERD/M80,83/ B757	3	0:46
		C6	Y			B757-200			
		C8	Y			A321			
		C10	Y			B757-200			
		C12	Y			B737-5,6,7,8,9,w			
	Total	**5**	**5**	**68**	**6.8**				**0:46**
	Cape Air[3]	C7	Y	32		F28	CNA402		0:58
	Total	**1**	**1**	**32**	**16.0**				**0:58**
	Midwest/AirTran[2,4]	C21	Y	18		Saab 340	ER3,4/B717,737		0:30
		C24	Y			B757-200			
	Total	**2**	**2**	**18**	**4.5**				**0:30**
	Frontier[2]	C23	Y	10		CRJ-7,9	A319		0:44
	Total	**1**	**1**	**10**	**5.0**				**0:44**
	Unoccupied/ AA Vacate	C1				RJ-70,85,100,115			
	Unoccupied/ AA Vacate	C3				RJ-70,85,100,115			
	Unoccupied/ AA Vacate	C5				Saab 340			
	Unoccupied/ AA Vacate	C9				EMBRAER(E170,175)			
	Unoccupied/ AA Vacate	C15				EMBRAER(E170,175)			
	Unoccupied/ AA Vacate[5]	C16				B737-5,6,7,8,9,w			
	Unoccupied/ AA Vacate	C17				B737-3,4			
	Unoccupied/ AA Vacate	C18				B707			
	Unoccupied/ AA Vacate[5]	C19				EMBRAER(E170,175)			
	Unoccupied/ AA Vacate	C25				B757			
	Unassigned	C27				B737-5,6,7,8,9,w			
	Unoccupied/ AA Vacate	C28				B767			
	Unassigned	C29				B737-5,6,7,8,9,w			
	Unoccupied/ AA Vacate - Intl	C30				B767			
	Unassigned	C31				B737-5,6,7,8,9,w			
	Unoccupied/ AA Vacate - Intl	C32				B767			
	Unoccupied/ AA Vacate	C33				B757			
	Unoccupied/ AA Vacate - Intl	C34				B767			
	Unoccupied/ AA Vacate - Intl	C35				MD80			
	Unoccupied/ AA Vacate - Intl	C36				B747-400			
	Unoccupied/ AA Vacate - Intl	C38				A330			
Concourse D/E[6]	Decommissioned/Closed	D2				B737-100,200			
	Decommissioned/Closed	D6				A318,319			
	Decommissioned/Closed	D4				B737-100,200			
	Decommissioned/Closed	D8[3]				EMBRAER			
	Decommissioned/Closed	D10[3]				EMBRAER			
	Decommissioned/Closed	D12				B757			
	Decommissioned/Closed	D14				MD80			
	Decommissioned/Closed	D16				MD80			
	Decommissioned/Closed	D18				B757			
	Decommissioned/Closed	D20				B757			
	Decommissioned/Closed	D22				MD80			
	Decommissioned/Closed	D24				B763			
	Decommissioned/Closed	D26				B727/MD80			
	Decommissioned/Closed	E34				DC9/B717			
	Decommissioned/Closed	E36				B757			
	Decommissioned/Closed	E38				EMBRAER			
	Decommissioned/Closed	E40				EMBRAER			

Totals

	Total Gates	PMAWD Operations	Dep/Gate	Total Extra RON	Total Avg. Time on Gate
Full Capacity	72	**292**	**6.3**	**12**	**0:44**
2010 Operational Capacity	45				
Assigned (2010)	**23**				
Unassigned	22				
Decommissioned/Closed	27				

Max AC Gauge Gate Mix	Full Capacity	% of Total	Active Max AC Gauge Utilized	2010	% of Total
Md Regional (Group II)	13	*18%*	Md Regional (Group II)	5	*22%*
Lrg Regional (Group III)	7	*10%*	Lrg Regional (Group III)	-	*0%*
Narrowbody (Group III)	33	*46%*	Narrowbody (Group III)	16	*70%*
B757w (Group IIIa)	10	*14%*	B757w (Group IIIa)	2	*9%*
Widebody (Group IV)	7	*10%*	Widebody (Group IV)	-	*0%*
Jumbo (Group V)	2	*3%*	Jumbo (Group V)	-	*0%*
Total	72	*100%*	Total	23	*100%*

Notes: AC =Aircraft
Dep/Gate = Aircraft Departures per Gate
PBB = Passenger Boarding Bridge
PMAWD = Peak Month Average Weekday
RON = Remain Overnight

1 The existing gate numbers, loading bridge, and aircraft gauge are based on field observations/assumptions, aerial data, and information received from Lambert Airport.
2 Frontier Airline Gates C21 and C23 operate from one hold room door with split jetways.
3 Cape Air will relocate from Gates D8 and D10.
4 Air Tran was relocated to Concourse C following the closure of Concourse B in June 2010.
5 Potential future gate for Alaska Airlines.
6 In December 2008, with the relocation of Cape Air, Lambert Airport closed a 12-gate section of Concourse D along with the entire concourse.

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Table 4.4-2
TERMINAL 2 GATE UTILIZATION – AUGUST 11, 2010 SCHEDULE[1]
Lambert-St. Louis International Airport

	Airline	Gate #	Existing PBB	2010 PMAD Operations	2010 Dep/Gate	Max AC Gauge	Active AC Gauge Utilization	2010 Extra RON	2010 Avg. Gate Time
Terminal 2/Concourse E		E4	Y			B737			
		E6	Y			B737			
		E8	Y			B737			
		E10	Y			B737			
		E12	Y			B737			
	Southwest	E14	Y	166		B737	B733,735,73G	0	0:29
		E16	Y			B737			
		E18	Y			B737			
		E20	Y			B737			
		E22	Y			B737			
	Total	**10**	**10**	**166**	**8.3**				**0:29**
	Unassigned	E2				B737			
	Unassigned	E24				B737			
	Unassigned	E25				B737			
		E29				B737			
	AirChoice One/USA 3000/Charter (International)	E31	Y	2		B737	A320	N/A	
		E33	Y			B737			
	Total	**3**	**2**	**2**	**0.3**				**0:00**

Totals						
Total Gates 2010	16					
Assigned	**13**	**168**	**6.5**		**0**	**0:29**
Unassigned	3					

Max Gate Mix	Full Capacity	% of Total	Active Max AC Gauge Utilized	2010	% of Total
Md Regional (Group II)	-	*0%*	Md Regional (Group II)	-	*0%*
Lrg Regional (Group III)	-	*0%*	Lrg Regional (Group III)	-	*0%*
Narrowbody (Group III)	16	*100%*	Narrowbody (Group III)	13	*100%*
B757w (Group IIIa)	-	*0%*	B757w (Group IIIa)	-	*0%*
Widebody (Group IV)	-	*0%*	Widebody (Group IV)	-	*0%*
Jumbo (Group V)	-	*0%*	Jumbo (Group V)	-	*0%*
Total	16	*100%*	Total	13	*100%*

Notes: AC =Aircraft
Dep/Gate = Aircraft Departures per Gate
PBB = Passenger Boarding Bridge
PMAWD = Peak Month Average Weekday
RON = Remain Overnight

1 The existing gate numbers, loading bridge, and aircraft gauge are based on field observations/assumptions, aerial data, and information received from Lambert Airport.

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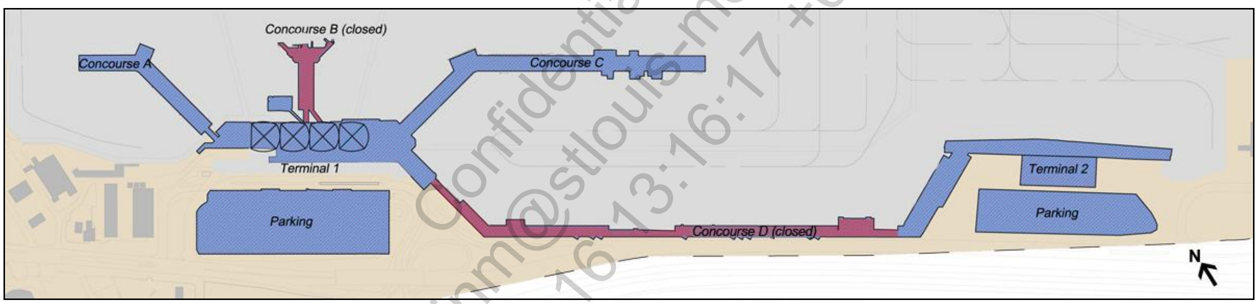
STL flights operate from two terminals that serve different carriers (*see* **Exhibit 4.4-1, *Existing Terminal Layout***):

- Terminal 1 – (formally the Main Terminal), includes both Domestic and International arrival operation capabilities
  - Preferential Use domestic flights operating from Concourses A & C
  - International "swing[4]" capable gates at the end of Concourse C[5]
- Terminal 2 – (formally the East Terminal), includes both Domestic and International arrival operation capabilities
  - Preferential Use domestic flights (Southwest Airlines)
  - International "swing" capable gates
  - Non-scheduled charter flights

Exhibit 4.4-1
EXISTING TERMINAL LAYOUT
Lambert-St. Louis International Airport



Source: Landrum & Brown, 2011

The following paragraphs describe existing gate utilization by terminal.

TERMINAL 1

Based on the STL August 11, 2010 Peak Month Average Week Day (PMAWD) schedule analysis the non-RON time on gate for the Domestic gates ranged from 30 minutes to just under an hour. On average, most flights had turn times of less than 45 minutes. Gate utilization, not including RON positions, varied from 4.5 to as much as 16 departures per gate. The lowest utilization was for the gates utilized by Midwest Connect and AirTran with 4.5 departures from its two available gates. The "Extra RON" aircraft as noted in Table 2.4.1 and 2.4.2 above, are either double-parked based on the gauge of the parking position, moved to "borrowed" or unassigned gates, or moved to designated hardstand positions adjacent to the terminals.

4 The term "swing" gate refers to a gate that is capable of accommodating both Domestic and outbound International traffic as well as international arriving traffic.

5 Currently no International arrival flight activity exists at Terminal 1 that requires facilities to process arriving international passengers who have not already been pre-cleared in the country of origin.

TERMINAL 2

Based on the same PMAWD schedule analysis, non-RON time ranged equated to just under 30 minutes. Gate utilization averaged slightly over eight departures per gate for domestic flights, less than one departure per gate for international flights.

4.4.3.2 Gate Forecast Requirements

GATE USE POLICIES

When assessing existing gate utilization and future demand, gate use policies should be taken into consideration. There are three standard gate use allocation categories: Exclusive, Preferential, and Common with each having different gate utilization rates. STL currently operates on a preferential gate and hold room use policy at both terminals. Discussions with the St. Louis Aviation Authority indicate that the present gate lease policy is anticipated to continue as part of the future master lease negotiations.

Generally, airports are moving away from exclusive use agreements that tend to result in a lower turn per gate utilization in favor of short-term (five-year) preferential leased gates. These agreements tend to have higher utilization rates and more operational flexibility. Preferential Use agreements typically have utilization criteria such as a minimum standard of operations or seats that allow the airport to reclaim the gates from the signatory airline if those gates are being underutilized. It also offers the Airport the operational flexibility given the contractual language to assign the gates to other airlines when not in use by the signatory airline.

Common Use gates tend to have the highest utilization rates of the three methods resulting from multiple airlines sharing a single gate, which typically increases the utilization of the gate.

The STL gates should be leased on a Preferential Use basis as required to maximize the utilization of the gates and provide the most flexibility for future demand. Depending on the airport and airlines involved, it is recommended that international gates be used on a common use basis and designed to handle both domestic and international departing and arriving passengers. Although Terminal 1 does not require the need to process international arriving passengers it, along with Terminal 2, have international "swing" capable gates. This allows for the sterile separation of arriving international passengers from both departing domestic and international passengers. Swing gates are another means to increase gate utilization.

GATE REQUIREMENT METHODOLOGIES

Various methods are used to forecast future gate requirements. Typically, these four methods are used to create a range of gate requirements:

- Annual Enplanements per Gate Method,
- Annual Departures per Gate Method,
- Peak Month Average Day (PMAD) Departure per Gate Method, and
- Future Design Day Flight Schedules (DDFS)

Four Design Day flight schedules were developed from the FAA-approved baseline forecast as described in the "*Aviation Activity Forecast*" to analyze the future gate demands. Based on the August 2008 airline schedules, three additional schedules were developed for years 2013, 2018, and 2028. Gate requirements are presented in five-year milestones from the base year; the horizon year 2023 gate requirements were interpolated from the 2018 and 2028 schedule analyses. Two additional gate demand scenarios were developed based on the "High" and "Low" forecasts to predict a potential future gate range that responds to the economic scenarios described in "*Aviation Activity Forecast.*"

Prior to American Airline's hub draw down announcement, the four Design Day schedules were run through Landrum & Brown's (L&B's) proprietary Gate Program. Output results include:

- Total gate need by airline (Domestic & International);
- Total Peak Hour gate need (exclusive of individual airline peak needs);
- Total operations by airline;
- Departures or "Turns" per gate by airline;
- Linear gate frontage need by airline;
- Airline total gate and linear frontage need by FAA Aircraft Design Group (ADG) as shown in **Table 4.4-3, *FAA Aircraft Design Group (ADG) Summary*.**

Table 4.4-3
FAA AIRCRAFT DESIGN GROUP (ADG) SUMMARY
Lambert-St. Louis International Airport

AIRCRAFT DESIGN GROUP		WINGSPAN	TYPICAL AIRCRAFT
I	Small Regional	< 49 Feet	Cessna/Learjet
II	Medium Regional	< 79 Feet	SF370/CRJ
III	Narrowbody/Large Regional	< 118 Feet	A320/B737/DCH8/E175
IV	B757 Specific	< 125 Feet	B757
IV	Widebody	< 171 Feet	MD11,B767
V	Jumbo	< 213 Feet	B747,777,787,A330,340
VI	Super Jumbo	< 262 Feet	A380

Source: FAA AC 150/5300-13, *Airport Design*

Because the gate need by airline by aircraft type peaks at varying times throughout the day, there is the potential for high levels of gate sharing by different size aircraft. For example, a gate that can accommodate a B757 could also be used by a B737 and regional jet aircraft. This would result in narrowbody and regional jet aircraft utilizing B757 capable parking positions. For this reason, potential aircraft gate sharing analyses were taken into account when determining final ADG gate requirements. For initial gate requirements and additional analyses prior to American Airline's capacity reduction see Appendix B, *Terminal Demand/Capacity and Facility Requirements*.

The following sections describe the potential range of gate requirements:

- Revised Gate Demand based on forecast sensitivity analyses resulting from American Airline's capacity cuts.
- High forecast scenario gate demand based on accelerated economical growth and new Low Cost Carrier entrant with STL as a mini-focus city.
- Low forecast scenario gate demand based on protracted economic recession and lower economic growth over the long-term.

FORECAST SENSITIVITY ANALYSIS

In September 2009, American Airline's announced a significant reduction in its 2010 flight schedule to 36 daily flights and nine destinations. Recently this has been further reduced to 34 daily flights and eight destinations. The schedule cuts primarily reflected a strategic de-emphasis of STL as a connecting hub in American Airline's domestic network. To determine the potential impact of the American Airline's service cuts on the baseline Master Plan Update forecast, a sensitivity analysis was conducted in October/November 2009 to evaluate the proposed facility requirements.

Based on the sensitivity analysis, the total enplaned passenger forecast was reduced by 9.2 percent or 916,300 enplanements at the 20-year planning level. The origin and destination passenger forecast was assumed to remain unchanged as Southwest Airlines, in particular, and other airlines operating at STL would likely backfill much of the demand for travel to and from the St. Louis area. The reduction in enplanements is assumed to primarily affect connecting activity at STL over the long-term. As a result, the sensitivity analysis projects connecting activity at STL will account for 14 percent of total enplanements at the 20-year planning level versus 22 percent in the baseline master plan forecast.

The passenger operations forecast was reduced to a greater degree than the enplanement forecast based on American Airline's decision to reduce service levels at STL. This is largely due to an assumed reallocation of O&D traffic among the carriers at STL and in particular Southwest Airlines, which has historically operated larger aircraft on average than American and the reduction of regional jet activity associated with American Connection at STL. Moving forward, American has announced it will shift its activity to predominantly narrowbody MD80 and 737-800 aircraft at STL in 2010 and this assumption was adopted under the sensitivity scenario. With the average size of aircraft assumed to be larger under the sensitivity scenario, fewer operations would be needed to meet the projected 20-year demand level. As a result, passenger operations were reduced 18.9 percent in the sensitivity scenario versus the baseline master plan forecast at the 20-year planning level. Additional information can also be found in the "*Aviation Activity Forecast.*"

The conclusions from this sensitivity analysis include:

- Lower enplanement volumes and commercial passenger operations versus the Master Plan Base Case
- Results should not impact alternatives developed for Master Plan Update and Part 150 study as the this analysis has been taken into account when developing the future terminal gate and space requirements
- Cargo, general aviation, and military forecasts remain unchanged from the Master Plan Forecasts
- No impact to Airport Reference Code outlined in Master Plan Update
- The Future (2015) Baseline developed for the Part 150 Study remains valid

The results of this sensitivity analysis are presented in the following tables:

- **Table 4.4-4, *Baseline Master Plan Forecast Passenger Enplanements***
- **Table 4.4-5, *Forecast Sensitivity Analysis Passenger Enplanements***
- **Table 4.4-6, *Baseline Master Plan Forecast Operations***
- **Table 4.4-7, *Forecast Sensitivity Analysis Operations***
- **Table 4.4-8, *Baseline Master Plan Forecast Design Day Flights***
- **Table 4.4-9, *Forecast Sensitivity Analysis Design Day Flights***
- **Table 4.4-10, *American Airlines 2010 Summer Flight Schedule***
- **Table 4.4-11, *American Airlines 2010 Summer Flight Schedule Fleet Mix***

REVISED GATE REQUIREMENTS

Using the existing DDFS, which recognize gate utilization changes due to shifts in airline forecast activity, and the results from the sensitivity analysis, a revised gate requirements analysis was performed. The original daily departures per gate utilization factors (Preferential Use) calculated from the DDFS (pre American Airline's capacity reduction) were assumed to remain relatively unchanged (*see* Appendix B, *Terminal Demand/Capacity and Facility Requirements*). The required number of gates for each year was then determined by dividing the revised annual departures by the annual departures per gate values. This method results in a requirement of 35 gates and 15 gates by the year 2028 for Terminal 1 and Terminal 2 respectively. This information is summarized in **Table 4.4-12, *Terminal 1 Projected Gate Demand – Preferential Use Scenario***, and **Table 4.4-13, *Terminal 2 Projected Gate Demand – Preferential Use Scenario***.

Table 4.4-4
BASELINE MASTER PLAN FORECAST PASSENGER ENPLANEMENTS
Lambert-St. Louis International Airport

	2008	2013	2018	2023	2028	AAG[2]
ORIGINATING ENPLANEMENTS						
AA	2,068,143	1,939,400	2,082,200	2,263,900	2,471,100	1.6%
WN	1,746,374	2,030,100	2,241,500	2,454,100	2,699,300	1.9%
OAL[1]	1,849,149	1,922,000	2,139,500	2,356,100	2,572,400	2.0%
Total	5,663,666	5,891,500	6,463,200	7,074,100	7,742,800	1.8%
CONNECTING ENPLANEMENTS						
AA	1,085,379	1,039,600	1,256,400	1,388,000	1,534,000	2.6%
WN	357,998	406,400	469,800	495,000	520,000	1.7%
OAL[1]	100,847	110,900	115,500	120,700	125,900	0.8%
Total	1,544,224	1,556,900	1,841,700	2,003,700	2,179,900	2.3%
TOTAL ENPLANEMENTS						
AA	3,153,522	2,979,000	3,338,600	3,651,900	4,005,100	2.0%
WN	2,104,372	2,436,500	2,711,300	2,949,100	3,219,300	1.9%
OAL[1]	1,949,996	2,032,900	2,255,000	2,476,800	2,698,300	1.9%
Total	7,207,890	7,448,400	8,304,900	9,077,800	9,922,700	1.9%

Notes: 1 OAL = All Other Airlines.
2 AAG = 2013 to 2028 Average Annual Growth Rate.

Source: Landrum & Brown analysis, 2011

Table 4.4-5
FORECAST SENSITIVITY ANALYSIS PASSENGER ENPLANEMENTS
Lambert-St. Louis International Airport

	2008	2013	2018	2023	2028	AAG[2]
ORIGINATING ENPLANEMENTS						
AA	2,068,143	1,120,036	1,202,505	1,307,440	1,427,101	1.6%
WN	1,746,374	2,624,305	2,870,556	3,134,547	3,441,947	1.8%
OAL[1]	1,849,149	2,147,159	2,390,139	2,632,113	2,873,752	2.0%
Total	5,663,666	5,891,500	6,463,200	7,074,100	7,742,800	1.8%
CONNECTING ENPLANEMENTS						
AA	1,085,379	197,653	212,207	230,725	251,841	1.6%
WN	357,998	656,076	717,639	783,637	860,487	1.8%
OAL[1]	100,847	113,008	125,797	138,532	151,250	2.0%
Total	1,544,224	966,738	1,055,643	1,152,894	1,263,578	1.8%
TOTAL ENPLANEMENTS						
AA	3,153,522	1,317,689	1,414,712	1,538,164	1,678,943	1.6%
WN	2,104,372	3,280,382	3,588,195	3,918,184	4,302,433	1.8%
OAL[1]	1,949,996	2,260,167	2,515,935	2,770,645	3,025,002	2.0%
Total	7,207,890	6,858,238	7,518,843	8,226,994	9,006,378	1.8%

Notes: 1 OAL = All Other Airlines.
2 AAG = 2013 to 2028 Average Annual Growth Rate.

Source: Landrum & Brown analysis, 2011

Table 4.4-6
BASELINE MASTER PLAN FORECAST OPERATIONS
Lambert-St. Louis International Airport

FLIGHT DEPARTURES						
	2008	**2013**	**2018**	**2023**	**2028**	**AAG[2]**
AA	47,713	45,700	51,200	55,600	60,500	1.9%
WN	26,278	29,200	32,000	34,400	37,000	1.6%
OAL[1]	36,714	37,070	39,270	41,820	44,040	1.2%
Total	110,705	111,970	122,470	131,820	141,540	1.6%
SEATS						
AA	4,021,389	3,852,600	4,280,600	4,641,100	5,046,200	1.8%
WN	3,565,004	3,994,100	4,388,800	4,707,000	5,062,800	1.6%
OAL[1]	2,707,187	2,723,500	3,001,800	3,286,400	3,570,300	1.8%
Total	10,293,580	10,570,200	11,671,200	12,634,500	13,679,300	1.7%
GAUGE						
AA	84	84	84	83	83	
WN	136	137	137	137	137	
OAL[1]	74	73	76	79	81	
Total	93	94	95	96	97	

Notes: 1 OAL = All Other Airlines.
2 AAG = 2013 to 2028 Average Annual Growth Rate.

Source: Landrum & Brown analysis, 2011

Table 4.4-7
FORECAST SENSITIVITY ANALYSIS OPERATIONS
Lambert-St. Louis International Airport

FLIGHT DEPARTURES						
	2008	**2013**	**2018**	**2023**	**2028**	**AAG[2]**
AA	47,713	12,070	13,397	14,566	15,899	1.9%
WN	26,278	39,313	42,350	45,634	49,449	1.5%
OAL[1]	36,714	41,214	43,814	46,711	49,372	1.2%
Total	110,705	92,598	99,561	106,911	114,720	1.4%
SEATS						
AA	4,021,389	1,593,260	1,768,390	1,922,706	2,098,678	1.9%
WN	3,565,004	5,377,456	5,808,237	6,251,491	6,766,179	1.5%
OAL[1]	2,707,187	3,027,973	3,349,151	3,677,103	4,002,582	1.9%
Total	10,293,580	9,998,689	10,925,777	11,851,299	12,867,438	1.7%
GAUGE						
AA	84.3	132.0	132.0	132.0	132.0	
WN	135.7	136.8	137.2	137.0	136.8	
OAL[1]	73.7	73.5	76.4	78.7	81.1	
Total	93.0	108.0	109.7	110.9	112.2	

Notes: 1 OAL = All Other Airlines.
2 AAG = 2013 to 2028 Average Annual Growth Rate.

Source: Landrum & Brown analysis, 2011

Table 4.4-8
BASELINE MASTER PLAN FORECAST DESIGN DAY FLIGHTS
Lambert-St. Louis International Airport

DESIGN DAY FLIGHTS (IN+OUT)[1]						
	2008	**2013**	**2018**	**2023**	**2028**	**AAG[3]**
AA	278	262	292	318	346	1.9%
WN	158	172	190	204	220	1.7%
OAL[2]	230	224	238	251	264	1.1%
Total	666	658	720	773	830	1.6%
PEAK HOUR FLIGHT DEPARTURES						
AA	20	19	21	23	25	1.8%
WN	9	10	11	11	12	1.2%
OAL[2]	14	14	15	15	16	0.9%
Total[4]	32	32	36	38	41	1.7%

Notes: AA = American Airlines
WN = Southwest Airlines

1 Design Day departures equals Design Day flights divided by two.
2 OAL = All Other Airlines.
3 AAG = 2013 to 2028 Average Annual Growth Rate.
4 Total Peak Hour departures is not the sum of the individual components as each may occur in separate hours.

Source: Landrum & Brown analysis, 2011

Table 4.4-9
FORECAST SENSITIVITY ANALYSIS DESIGN DAY FLIGHTS
Lambert-St. Louis International Airport

DESIGN DAY FLIGHTS (IN+OUT)[1]						
	2008	**2013**	**2018**	**2023**	**2028**	**AAG[3]**
AA	278	69	76	83	91	1.8%
WN	158	232	251	271	294	1.6%
OAL[2]	230	249	266	280	296	1.2%
Total	666	550	593	634	681	1.4%
PEAK HOUR FLIGHT DEPARTURES						
AA	20	5	5	6	7	1.8%
WN	9	13	15	15	16	1.2%
OAL[2]	14	16	17	17	18	1.0%
Total[4]	32	27	30	32	34	1.5%

Notes: AA = American Airlines
WN = Southwest Airlines

1 Design Day departures equals Design Day flights divided by two.
2 OAL = All Other Airlines.
3 AAG = 2013 to 2028 Average Annual Growth Rate.
4 Total Peak Hour departures is not the sum of the individual components as each may occur in separate hours.

Source: Landrum & Brown analysis, 2011

Table 4.4-10
AMERICAN AIRLINES 2010 SUMMER FLIGHT SCHEDULE
Lambert-St. Louis International Airport

	DESTINATION	GAUGE	SEATS	DAILY DEP	DAILY SEATS	ANNUAL DEP[1]	ANNUAL SEATS[1]
AA	DFW	M80	140	9	1,260	3,015	422,100
AA	ORD	M80	140	9	1,260	3,015	422,100
AA	LGA	M80	140	4	560	1,340	187,600
AA	DCA	M80	140	4	560	1,340	187,600
AA	AA LAX	AA M80	140	3	420	1,005	140,700
AA	MIA	757	190	2	380	670	127,300
AA	SEA	M80	140	1	140	335	46,900
AE	JFK	ERD	44	2	88	670	29,480
TOTAL				**34**	**4,668**	**11,390**	**1,563,780**

Notes: AA = American Airlines
AE = American Eagle

1 PMAD Daily factors were annualized by multiplying by 335 days

Sources: *St. Louis Post-Dispatch,* 9/17/09, Landrum & Brown analysis, 2011

Table 4.4-11
AMERICAN AIRLINES 2010 SUMMER FLIGHT SCHEDULE FLEET MIX
Lambert-St. Louis International Airport

AIRCRAFT DESIGN GROUP (ADG)		DAILY DEPARTURES	PERCENTAGE OF TOTAL DEPARTURES
I	Small Regional	-	-
II	Medium Regional	2	6%
III	Narrowbody/Large Regional	30	88%
IV	B757 Specific	2	6%
IV	Widebody	-	-
V	Jumbo	-	-

Sources: AA 2010 Summer Flight Schedule per the *St. Louis Post-Dispatch,* 9/17/09.

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Table 4.4-12
TERMINAL 1 PROJECTED GATE DEMAND – PREFERENTIAL USE SCENARIO
PEAK MONTH AVERAGE DAY DEPARTURES PER GATE SUMMARY
Lambert-St. Louis International Airport

	Existing Facilities 2010 Base Year Activity			**RECOMMENDED FACILITIES Forecast Year Activity**			
				2013	**2018**	**2023**	**2028**
Total Enplanements				3,577,856	3,930,647	4,308,810	4,703,945
Annual Passengers				7,155,712	7,861,294	8,617,620	9,407,890
PMAD Departures	146			159	171	182	194
Aircraft Design Group (ADG)	**Max AC Gauge Full Capacity[1]**	**Max AC Gauge Operational Capacity[2]**	**Active AC Gauge Utilized**	**RECOMMENDED GATES[3]**			
Small Regional (Group I)	-	-	-	-	-	-	-
Medium Regional (Group II)	13	4	5	11	12	13	13
Large Regional (Group II)	17	7	-	2	2	2	2
Narrowbody (Group III)	33(1)	20(1)	16	16(2)	17(2)	18(2)	19(2)
B757(Group IV)	10	6	2	-	-	-	-
Widebody (Group IV)	7(3)	6(3)	-	-	-	-	1(1)
Jumbo (Group V)	2(2)	2(2)	-	-	-	-	-
Total Gates[4]	72(6)	45(6)	23(0)	29(2)	31(2)	33(2)	35(3)
Departures per Gate			6.3	5.5	5.5	5.5	5.5
Total NBEG[5]	73.5	48.4	21.7	25.7	27.4	29.1	31.5
Total Linear Frontage[6]	10,520	6,900	3,130	3,720	3,960	4,200	4,550
Annual Enplanements per NBEG				139,200	143,500	148,100	149,300

Notes:
1 Represents the largest aircraft gauge in each Design Group, not necessarily the aircraft gauge currently being utilized
2 Total gates exclude Concourses B and D.
3 Existing and future international gate demand in parenthesis.
4 Existing Gates C21 and C23 operate from one hold room door with split jetways.
5 Narrowbody Equivalent Gate (NBEG): Used to normalize the apron frontage demand and capacity to that of a typical narrowbody aircraft gate.
6 Total Linear Frontage equals aircraft wingspan plus standard planning practice of 25-foot wingtip separation excluding any potential adjacency wingtip conflicts.

Source: Landrum & Brown analysis, 2011

Table 4.4-13
TERMINAL 2 PROJECTED GATE DEMAND – PREFERENTIAL USE SCENARIO
PEAK MONTH AVERAGE DAY DEPARTURES PER GATE SUMMARY
Lambert-St. Louis International Airport

	Existing Facilities 2010 Base Year Activity			**RECOMMENDED FACILITIES**			
				Forecast Year Activity			
				2013	**2018**	**2023**	**2028**
Total Enplanements				3,280,382	3,588,195	3,918,184	4,302,433
Annual Passengers				6,560,764	7,716,390	7,836,368	8,604,866
PMAD Departures	84			116	126	136	147
Aircraft Design Group (ADG)	**Max AC Gauge Full Capacity[1]**	**Max AC Gauge Operational Capacity[2]**	**Active AC Gauge Utilized**	**RECOMMENDED GATES[3]**			
Small Regional (Group I)	-	-	-	-	-	-	-
Medium Regional (Group II)	-	-	-	-	-	-	-
Large Regional (Group II)	-	-	-	-	-	-	-
Narrowbody (Group III)	16(3)	15(3)	13(3)	12	13	14	15
B757(Group IV)	-	-	-	-	-	-	-
Widebody (Group IV)	-	-	-	-	-	-	-
Jumbo (Group V)	-	-	-	-	-	-	-
Total Gates	16(3)	15(3)	13(3)	12	13	14	15
Departures per Gate			6.5	9.7	9.7	9.7	9.8
Total NBEG[4]	16.0	15.0	13.0	12.0	13.0	14.0	15.0
Total Linear Frontage[5]	2,288	2,145	1,860	1,720	1,860	2,000	2,145
Annual Enplanements per NBEG				273,400	276,000	279,900	286,800

Notes:
1 Represents the largest aircraft gauge in each Design Group, not necessarily the aircraft gauge currently being utilized
2 Total gates exclude Concourses B and D.
3 Existing and future international gate demand in parenthesis.
4 Existing Gates C21 and C23 operate from one hold room door with split jetways.
5 Narrowbody Equivalent Gate (NBEG): Used to normalize the apron frontage demand and capacity to that of a typical narrowbody aircraft gate.
6 Total Linear Frontage equals aircraft wingspan plus standard planning practice of 25-foot wingtip separation excluding any potential adjacency wingtip conflicts.

Source: Landrum & Brown analysis, 2011

To forecast the revised fleet mix by planning year, the DDFS were reutilized using the original calculated departures per gate factors combined with the forecast sensitivity analysis enplanements and operations factors as shown in Tables 4.4-4 to 4.4-9. The results from the analyses assumed that Southwest Airlines and the other carriers would backfill American's capacity reduction for O&D passengers (*see* Table 4.4-5). Table 4.4-6 and Table 4.4-7 indicate a shift from a dominant regional jet mix in the base year to narrowbody type aircraft by 2013 for American's operations. The gauge of all other carriers (WN and OAL) remains relatively unchanged. Daily and Peak Hour flight departures tabulated in Table 4.4-8 and Table 4.4-9 indicate a substantial reduction in American Airline's operations from the baseline by 255 daily and 18 Peak Hour flight departures by 2028. The 2028 daily flights of Southwest Airlines increased by 74 operations from the baseline while four Peak Hour flight departures were added. All other carriers increased by 32 daily flights and 2 Peak Hour flight departures by 2028.

American's new gate demand was calculated by dividing the revised Design Day departure operations shown in Table 4.4-9 by the original departures per gate factor. The future ADG fleet mix was then determined from the 2010 summer flight schedule shown in Table 4.4-10. Table 4.4-11 indicates the percentage of departures by aircraft fleet mix. These factors were then assumed for the future planning horizons when forecasting American's future fleet mix gate requirements. It should be noted that the M80 and B757 equipment types are being phased out with the assumption they will be replaced by the B737-800. Similar analyses were conducted for Southwest and all other airlines on a Preferential Use basis using the sensitivity analyses and the DDFS. The results for both gate scenarios by terminal are summarized in Table 4.4-12 thru 4.4-13.

RECOMMENDED GATES SUMMARY

The 2028 planning activity level of 35 and 15 Preferential Use aircraft gates for Terminal 1 and Terminal 2 respectively have been recommended as the planning benchmark for development of terminal concepts in Chapter Five, *Airport Concept Development and Evaluation*. These aircraft gate requirements represent a reasonable future Master Plan estimate for sizing the terminal building requirements in 2028 and preparation of level of magnitude capital improvement costs.

With the two existing terminals providing an overall current operational capacity of 45 gates and 15 gates, there is not a need within the Master Plan 2028 forecast to provide additional gate capacity. Strictly from a gate capacity perspective, there is no need for new additional aircraft gates, however there are opportunities for improved operational efficiencies, passenger convenience, and revenue generation through the renovation and redevelopment of an improved gate complex layout in Terminal 1. Terminal 2 will essentially service Southwest Airlines from its 15 available gates that include the three international swing capable gates. These additional terminal facility needs are addressed in Section 4.4.4, *Recommended Terminal Facilities*. While there is not a gate capacity shortfall relative to future demand, there is a need to renovate and/or reconfigure the terminal gate complex and terminal buildings to achieve operational savings and functional efficiencies.

ALTERNATE FORECAST GATE SCENARIOS

Two additional gate requirements were developed from the alternative forecast scenarios described in the "*Aviation Activity Forecast.*" These analyses attempt to create a range of potential gate requirements based on airline and economic assumptions. As previously stated the two alternative forecasts include:

- High forecast scenario gate demand based on accelerated economical growth and new Low Cost Carrier entrant with STL as a mini-focus city.
- Low forecast scenario gate demand based on protracted economic recession and lower economic growth over the long-term.

The gate methodologies used to forecast each scenario include the Annual Enplanements per Gate and the Annual Departures per Gate approach. When averaging both gate methodologies for both the high and low scenarios a potential range of 55 to 69 gates is established with a high of 71 gates (see Appendix B for tables by gate methodology). From an overall Master Plan and land use perspective the higher number of potential aircraft gates of 71 (*see* **Table 4.4-14, *2028 Alternative Forecast Scenario Gate Summary***) from the high forecast scenario Annual Departure per Gate method, is recommended as the appropriate requirements to use to *preserve* a land envelope for future terminal development.

Table 4.4-14
2028 ALTERNATIVE FORECAST SCENARIO GATE SUMMARY
Lambert-St. Louis International Airport

DEMAND FORECAST SCENARIO	SCENARIO APPROACH		AVERAGE GATES
	ENPLANED PASSENGERS PER GATE	DEPARTURES PER GATE	
High	66	71	69
Low	53	57	55
Average	60	64	62

Source: Landrum & Brown analysis, 2011

To determine gate requirements by terminal the percentage splits resulting from the 2028 DDFS gate analysis (based on the forecast sensitivity analysis) was used. The gate demand at Terminal 1 resulted in 70 percent of the overall total of 50 gates by 2028. Therefore, 70 percent of the 71 forecasted gates (High Scenario) resulted in the potential need for 50 gates at Terminal 1 and 21 gates at Terminal 2 by the 2028 planning horizon.

4.4.4 RECOMMENDED TERMINAL FACILITIES

4.4.4.1 Methodology

Major data inputs into the space program include annual enplanements and Peak Hour enplaning and deplaning passengers which can be found in **Table 4.4-15, *Terminal 1 Peak Hour Activity Forecast***, and **Table 4.4-16, *Terminal 2 Peak Hour Activity Forecast***. This analysis used two types of peak passenger levels based on Preferential Use and common use scenarios for airline usage.

Preferential Use passenger levels refer to the peak activity for each carrier that occurs over a 60-minute period based on that airline's flight schedule. These Preferential Use peaks typically happen at slightly different times of the day and therefore do not typically coincide in the same clock hour. The assumption is that this Peak Demand is appropriate to use when determining the facility requirements for individual airlines that are operating under a Preferential Use agreement with the Airport. Preferential Use peak passenger activity levels are typically used for calculating requirements for functions like each individual airline's ticket counters gates/holdrooms and, in some instances, baggage claim facilities depending on the operating use agreement with the Airport.

Common use Peak Passenger levels refer to the cumulative Peak Passenger volume in a given "rolling" hour for all airlines at STL. Essentially, the common use activity peak assumes that all airlines will share in the use of the facilities under a common use operating agreement with STL. These common use Peak Demand levels are typically used for calculating non-airline specific functions such as passenger security screening, Explosive Detection Systems (EDS), and public areas including general seating and meeter/greeter lobbies.

Other functional area projections are typically determined by their relationship to the number and type of aircraft or the number of gates/seats serving the terminal area. The relationship of area projections per aircraft operations, or by gates/seats is also a typical way to compare airport building component requirements. These areas of the terminal can include airline operations space, inbound/outbound baggage operations, and secure public restrooms.

The complexities involved in understanding the aircraft capacity implications of the term "gate" has led to a methodology to standardize the capacity definition of a "gate." This standardization methodology is referred to as the Narrowbody Equivalent Gate (NBEG) index. This index converts the gate requirements of diverse aircraft, from commuters to new large aircraft, so that they are equivalent to the apron capacity of a narrowbody aircraft gate. The amount of space or linear frontage each aircraft requires is based on the maximum wingspan of the aircraft in its respective aircraft group. Aircraft are classified according to FAA Taxiway Design Groups as shown in **Table 4.4-17, *Narrowbody Equivalent Gate (NBEG) Index***.

Table 4.4-15
TERMINAL 1 PEAK HOUR ACTIVITY FORECAST
Lambert-St. Louis International Airport

	FORECAST PLANNING YEARS			
	2013	**2018**	**2023**	**2028**
Annual Enplanements	3,577,856	3,930,647	4,308,810	4,703,945
Peak Month Enplanements	313,296	344,342	374,492	408,795
Percent of Annual Enplanements	8.8%	8.8%	8.7%	8.7%
Peak Month Average Day Enplanements	10,684	11,747	12,771	13,941
Peak Hour Passengers[1]				
Enplaned	1,261	1,427	1,524	1,630
Deplaned	1,174	1,246	1,398	1,573
Total[2]	2,136	2,274	2,520	2,797
Percent Daily Activity in Peak Hour				
Enplaned	11.8%	12.1%	11.9%	11.7%
Deplaned	11.0%	10.6%	10.9%	11.3%
Total	20.0%	19.4%	19.7%	20.1%

Notes 1 Peak Hour Passenger values were derived from the forecast sensitivity analysis results.
2 The Total Peak Hour does not reflect the sum of the Enplaned/Deplaned Peak Hour components as each can occur in different hours.

Source: Landrum & Brown analysis, 2011

Table 4.4-16
TERMINAL 2 PEAK HOUR ACTIVITY FORECAST
Lambert-St. Louis International Airport

	FORECAST PLANNING YEARS			
	2013	**2018**	**2023**	**2028**
Annual Enplanements	3,280,382	3,588,195	3,918,184	4,302,433
Peak Month Enplanements	283,300	312,360	341,422	375,069
Percent of Annual Enplanements	8.6%	8.7%	8.7%	8.7%
Peak Month Average Day Enplanements	9,661	10,652	11,644	12,791
Peak Hour Passengers[1]				
Enplaned	1,568	1,695	1,777	1,868
Deplaned	1,254	1,387	1,467	1,556
Total[2]	2,195	2,620	2,705	2,801
Percent Daily Activity in Peak Hour				
Enplaned	16.2%	15.9%	15.3%	14.6%
Deplaned	13.0%	13.0%	12.6%	12.2%
Total	22.7%	24.6%	23.2%	21.9%

Notes: 1 Peak Hour Passenger values were derived from the forecast sensitivity analysis results.
2 The Total Peak Hour does not reflect the sum of the Enplaned/Deplaned Peak Hour components as each can occur in different hours.

Source: Landrum & Brown analysis, 2011

Table 4.4-17
NARROWBODY EQUIVALENT GATE (NBEG) INDEX
Lambert-St. Louis International Airport

FAA TAXIWAY DESIGN GROUP		WINGSPAN	TYPICAL AIRCRAFT	NBEG INDEX
I	Small Regional	< 49 Feet	Cessna/Learjet	0.4
II	Medium Regional	< 79 Feet	SF370/CRJ	0.7
III	**Narrowbody/Large Regional**	**< 118 Feet**	**A320/B737/DCH8/E175**	**1.0**
IV	B757 Specific	< 125 Feet	B757	1.1
IV	Widebody	< 171 Feet	MD11,B767	1.4
V	Jumbo	< 213 Feet	B747,777,787,A330,340	1.8
VI	Super Jumbo	< 262 Feet	A380	2.2

Source: FAA AC 150/5300-13, *Airport Design* and Hirsh & Associates, 2011

Another methodology used for terminal facility program comparisons, similar to that of NBEG, is the Equivalent Aircraft (EQA) Index. This methodology looks at the Passenger Demand associated with gate usage. With EQA, each gate is converted based on the seating capacity of the aircraft that can be accommodated. Originally developed in the 1970's, EQA was a technique for sizing terminal facilities when the majority of the aircraft in service had 80-110 seats with some larger narrow-bodied aircraft up to 150 seats. With new larger fleet mixes of regional and jet aircraft the basis for EQA has been revised. The base Equivalent Aircraft is still that of a Group III narrowbody; however, this group now typically has total seats in the range of 145-150. The new EQA of 1.0 has been established using 145 seats as the base. Smaller aircraft may use the gate but the EQA capacity should be based on the largest aircraft/seating typically in use. One example of where this methodology is used is ramp equipment (bag carts/containers) required for aircraft arrivals and departures at the gate. **Table 4.4-18,** ***Equivalent Aircraft (EQA) Index***, summarizes the EQA of each aircraft group.

Airport Planners will often use the International Air Transport Association (IATA) Level of Service (LOS) standards to qualitatively or quantitatively provide a LOS standard at various processing functions within a terminal building and its associated concourse(s). This standard was originally developed by Transport Canada in the mid to late 1970s and later adopted and modified by IATA in 1990. The LOS standards are defined as follows:

- Excellent LOS; condition of free flow; no delays; excellent level of comfort
- High LOS; condition of stable flow very few delays; high level of comfort
- Good LOS; condition of stable flow; acceptable brief delays; good level of comfort
- Adequate LOS; condition of unstable flow; acceptable delays for short periods of time; adequate level of comfort
- Inadequate LOS; condition of unstable flow; unacceptable levels of delay; inadequate level of comfort
- Unacceptable LOS; condition of cross flows; system breakdown and unacceptable delays; unacceptable level of comfort

The programs developed for the study generally assumed a LOS C as the minimum standard when developing and validating the functional spaces within the terminal and concourses. In some instances, higher LOS standards were used based on emerging operational trends seen in U.S. airport terminals today and insights from the St. Louis Airport Authority (STLAA) about STL operations.

The programmatic approach to sizing facility areas is commonly used as the first step during the planning and preliminary design of any terminal expansion project. As a terminal project proceeds through the design process functions such as hold rooms, circulation areas, concessions, and other space-based requirements will often change because of the physical configuration of the design and cost considerations. The programmatic information contained in this Master Plan Update is considered a minimum generic facilities requirement program that is recommended to support the Peak Hour passenger activity levels and, as such, does not represent any specific terminal concept or gate configuration. The uniqueness of a specific site or terminal concept may increase the requirement for additional space especially for public circulation and other support areas.

Table 4.4-18
EQUIVALENT AIRCRAFT (EQA) INDEX
Lambert-St. Louis International Airport

FAA TAXIWAY DESIGN GROUP		TYPICAL SEATS	TYPICAL AIRCRAFT	EQA INDEX
I	Small Regional	25	Cessna/Learjet	0.2
II	Medium Regional	50	SF370/CRJ	0.4
III	Large Regional	75	Dash 8, E175, CRJ-700,900	0.5
III	**Narrowbody**	**145**	**A320/B737/DCH8/E175**	**1.0**
IV	B757	185	B757	1.3
IV	Widebody	280	MD11,B767	1.9
V	Jumbo	400	B747,777,787,A330,340	2.8
VI	Super Jumbo	525	A380	3.6

Source: *The Apron & Terminal Building Planning Manual* for US DOT, FAA by The Ralph M. Parsons Company: July 1975 and updated values based on Hirsh & Associates data, 2011.

For STL the terminal space program requirements were broken out and tabulated for each of the two terminals at the Airport. Terminal 1 and Terminal 2 are organized into general categories of space with various sub components depending on the terminals functional layouts:

- General
  - Overall Airport Statistics (Annual Passenger Statistics, Peak Hour Passenger Statistics)
  - Gates (Aircraft Parking Positions – International)
- Airline Functions
  - Domestic Airline Functions (Ticketing, Baggage Claim, etc.)
  - International Airline Functions (Ticketing, etc. for Terminal 1 only)
  - Other Airline Functions (Operations, Checked Bag Screening, etc.)
  - Departure Lounges
- Other Terminal Functions
  - Security
  - Circulation (Secure, Non-Secure, General)
  - Restrooms
  - Non-Airline Tennant Space (Airport Admin, Other Tenants)
  - Terminal Functions (Maintenance/Janitorial/Storage, Mechanical/Electrical , Structure/Non-Net)
- International Arrivals Functions (for Terminal 1 only)
  - Primary Inspection
  - Baggage Claim
  - Secondary Inspection
  - Support Functions
  - Other Space (Sterile Circulation, Greeter Lobby, Baggage Recheck)
- Concessions Space
  - Non-Secure Concessions Space
  - Secure Concessions Space
- Overall Summary

The program areas were developed based on the overall space allocation of each terminal and the actual utilization of those terminals. It should be noted that the 2008 space allocations with updated 2010 values included the planned and completed *Airport Experience Program* list of projects such as ticket lobby renovations, bag claim device upgrades, non-secure concession renovations and expansions, security screening consolidation and expansion, and the in-line EDS system. The proposed programs are summarized by terminal in the tables that follow. Preferential Use (based on gates) programs were developed for each terminal to generate a range of potential future terminal space needs. Additional program scenarios and results which attempt to provide a range of potential space needs and can be found in Appendix B.

The proposed Terminal 1 and Terminal 2 programs are summarized in **Table 4.4-19, *Existing Facility Inventory and Future Terminal 1 Requirements–Preferential Use***, and **Table 4.4-20, *Existing Facility Inventory and Future Terminal 2 Requirements–Preferential Use***. The table data compares existing terminal areas tabulated from recent CAD files obtained from the client, the recommended facility areas required to meet the existing demand, and the future forecasted annual enplanement levels and their associated recommended terminal area requirements. For analysis purpose the full capacity for Terminal 1 (including Concourse C and D) was used to gauge whether the closed or "moth balled" portions of the terminal will potentially need to be re-opened in order to meet future programmed demand. From this data, the existing and future efficiencies and deficiencies can be compared.

Table 4.4-19
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 1 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

	Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
General						
General [1]						
Overall Airport Statistics						
Annual Passengers		**9,975,382**	**7,155,712**	**7,861,294**	**8,617,620**	**9,407,890**
Annual Enplanements		4,987,691	3,577,856	3,930,647	4,308,810	4,703,945
Annual Domestic Enplanements		4,967,151	-	-	-	-
Annual International Enplanements		20,540	-	-	-	-
O&D Passengers		-	3,267,195	3,592,644	3,939,553	4,300,853
Connecting Passengers		-	310,662	338,004	369,257	403,092
Peak Hour Passenger Statistics						
Peak Hour Enplaned - Domestic		1,741	1,261	1,427	1,524	1,630
Peak Hour Enplaned - International		287	286	286	313	341
Total Peak Hour Enplaned [2]		**1,741**	**1,261**	**1,427**	**1,524**	**1,630**
Peak Hour Deplaned - Domestic		1,745	1,174	1,246	1,398	1,573
Peak Hour Deplaned - International		-	-	-	-	-
Total Peak Hour Deplaned [2]		**1,745**	**1,174**	**1,246**	**1,398**	**1,573**
Total Peak Hour[2]		**3,737**	**2,136**	**2,274**	**2,520**	**2,797**
Aircraft Gates/Positions (International in parenthesis)						
Small Commuter (Cessna)		-	-	-	-	-
Medium Commuter (CRJ/ERJ/BE1)		13	9	11	12	12
Large Commuter (CR7/E70)		7	-	-	-	-
Narrowbody (B737/A320)		33 (1)	11 (2)	11 (2)	11 (2)	11 (2)
B-757		10	-	-	-	-
Widebody (B767)		7 (3)	-	-	-	1 (1)
Jumbo (B777/A340/B747)		2 (2)	-	-	-	-
NLA (A380)		-	-	-	-	-
Total Gates:		**72**	**20**	**22**	**23**	**24**
Total EQA[3]:		**73.6**	**14.6**	**15.4**	**15.8**	**17.7**
Total NBEG[4]:		**73.5**	**17.3**	**18.7**	**19.4**	**20.8**
Total Positions:		72	20	22	23	24

Notes:
1. Forecasted Annual Passenger numbers based on forecast sensitivity analysis section.
2. The total Peak Hour numbers represent the total enplanement/deplanements Peak Hour, not the sum of the components (i.e. the enplaned/deplaned and total Peak Hours do not necessarily occur in the same hour). Domestic and International Peak Hour may differ.
3. EQA normalizes gate based on seating capacity of accommodated aircraft.
4. NBEG: Used to normalize the apron frontage demand and capacity to that of a typical narrowbody aircraft gate.

Source: Landrum & Brown analysis, 2011

Table 4.4-19 *(continued)*
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 1 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

	Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
Airline Space						
Domestic Airline Space						
Ticket Counter						
Linear Counter Check-in Positions (Kiosk)	pos	137 (49)	45(23)	50(25)	51(28)	55(32)
Total Check-in Locations (Kiosk)	pos	159 (55)	45(28)	50(30)	51(33)	55(38)
Total Linear Position Length	lf	570	190	220	210	220
Number of Unassigned Check-in Positions	pos	16	-	-	-	-
Total Unassigned Position Length	lf	82	-	-	-	-
Counter Area (Includes any curb check)	sf	8,298	2,100	2,400	2,300	2,400
Ticketing Queue (including any free standing kiosks)	sf	8,247	4,600	5,200	5,100	5,200
Curbcheck Positions	pos	16	6	6	6	6
Airline Ticket Offices	sf	11,779	5,700	6,500	6,300	6,500
Baggage Claim						
Claim Devices	units	6	3	3	4	4
Linear Frontage Required	lf	954	430	460	520	590
Linear Frontage Programmed	lf	-	480	480	640	640
Baggage Claim Hall (Includes Device, Queues & Circulation)	sf	31,926	16,800	16,800	22,400	22,400
Baggage Services	sf	5,447	2,000	2,100	2,300	2,600
Airline Clubs/VIP Lounges	sf	15,533	2,000	2,000	2,000	2,000
SubTotal:		**81,230**	**33,200**	**35,000**	**40,400**	**41,100**
International Airline Space						
Ticket Counter						
Linear Counter Check-in Positions (Kiosk)	pos	included above	8(0)	8(0)	8(0)	12(0)
Total Check-in Locations (Kiosk)	pos	included above	8(0)	8(0)	8(0)	12(0)
Total Linear Position Length	lf	included above	40	40	40	60
Counter Area (Includes any curb check)	sf	included above	400	400	400	600
Ticketing Queue (including any free standing kiosks)	sf	included above	1,000	1,000	1,000	1,500
Curbcheck Positions	pos	included above	0	0	0	0
Airline Ticket Offices	sf	included above	1,200	1,200	1,200	1,800
Airline Clubs/VIP Lounges	sf	included above	-	-	-	-
SubTotal:		**-**	**2,600**	**2,600**	**2,600**	**3,900**
Other Airline Space						
Outbound Bag Make-Up[4]	sf	64,962	44,900	47,900	50,800	56,900
Inbound Bag Delivery	sf	14,530	6,000	6,000	8,000	8,000
Baggage Train Circulation	sf	39,985	7,600	8,100	8,800	9,700
Checked Baggage Screening (TSA Space)[5]	sf	7,799	8,500	8,500	8,500	8,500
Level 1 Inspection Units (EDS)[6]	no	-	2	2	2	2
Airline Operations	sf	138,294	57,800	61,600	65,300	73,200
Other Airline Offices/Systems and Support	sf	27,504	8,700	9,200	9,800	11,000
SubTotal:		**293,074**	**133,500**	**141,300**	**151,200**	**167,300**
Departure Lounges						
Gates/Positions						
Small Regional (Cessna/Metro)	sf	-	-	-	-	-
Medium Regional (BE1/CRJ,CR7,9/ERJ/SF340)	sf	-	8,900	9,800	10,600	10,600
Large Regional (Q400/E170,175,190)	sf	-	2,200	2,200	2,200	2,200
Narrowbody (A320/B737w)	sf	-	31,400	33,400	35,400	37,300
B-757(winglets)	sf	-	-	-	-	-
Widebody (B767/MD11)	sf	-	-	-	-	3,000
Jumbo (B747,787,777/A330,340)	sf	-	-	-	-	-
Super Jumbo (A380)	sf	-	-	-	-	-
SubTotal:		**107,778**	**42,500**	**45,400**	**48,200**	**53,100**

Table 4.4-19 *(continued)*
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 1 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

		Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
Concessions Space	**Non-Secure Concessions Space**						
	Rental Car						
	Number of Counters	pos	6	6	6	6	7
	Counter Area/Offices	sf	2,197	2,400	2,400	2,400	2,800
	Queue	sf	1,613	1,800	1,800	1,800	2,100
	Non-Secure Concessions	sf	19,099	10,400	11,000	11,900	13,100
	Non-Secure Storage	sf	27,574	2,600	2,700	3,000	3,300
	SubTotal:		**50,483**	**17,200**	**17,900**	**19,100**	**21,300**
	Secure Concessions Space						
	Secure Concessions	sf	52,237	33,000	34,700	37,800	41,500
	Secure Storage	sf	9,753	8,300	8,700	9,400	10,400
	SubTotal:		**61,990**	**41,300**	**43,400**	**47,200**	**51,900**

Table 4.4-19 *(continued)*
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 1 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

		Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
US Customs & Border Protection Services (CBP)	**Primary Processing**	Units					
	Primary Inspection Booths (Double Counters)	units	4	5	5	6	7
	Area Primary Inspection Booths	sf	760	1,900	1,900	2,300	2,700
	Primary Inspection Queue	sf	3,962	4,700	4,700	5,600	6,600
	Primary Inspection Support	sf	11,566	700	700	700	700
	SubTotal:		**16,288**	**7,300**	**7,300**	**8,600**	**10,000**
	Baggage Claim						
	Claim Devices Required	units	2	3	3	3	4
	Linear Frontage Required	lf	266	470	470	520	590
	Linear Frontage Programmed	lf	-	510	510	510	680
	Baggage Claim Hall	sf	9,388	17,900	17,900	17,900	23,800
	SubTotal:		**9,388**	**17,900**	**17,900**	**17,900**	**23,800**
	Secondary Processing						
	Passport Control Check Positions	pos	0	1	1	1	1
	Area Passport Control Check	sf	-	200	200	200	200
	Area Secondary Waiting	sf	-	800	800	800	1,100
	Exam Podiums and Baggage Belts (2 belts per unit)	units	0	0	0	0	0
	Area Secondary Inspection	sf	8,384	-	-	-	-
	Baggage X-Ray Processing (1 X-Ray per unit)	units	0	1	1	1	1
	Area X-Ray Inspection	sf	-	1,500	1,500	1,500	1,500
	Secondary Inspection Support	sf	5,058	1,100	1,100	1,100	1,100
	SubTotal:		**13,442**	**3,600**	**3,600**	**3,600**	**3,900**
	Support Space						
	CBP Administration	sf	-	800	800	800	900
	CBP Administration Support	sf	-	600	600	600	700
	SubTotal:		**-**	**1,400**	**1,400**	**1,400**	**1,600**
	Other Space						
	Sterile Corridor Circulation	sf	3,141	4,300	4,300	4,300	7,200
	In-Transit/Sterile Holding Areas	sf	-	-	-	-	-
	Public Sterile Restrooms	sf	623	1,000	1,000	1,000	1,000
	General Circulation	sf	645	3,700	3,700	3,800	4,900
	Greeter Lobby						
	Greeter Waiting Area	sf	-	700	700	900	1,100
	Other	sf	-	-	-	-	-
	Baggage Recheck						
	Number Recheck Positions	pos	0	0	0	0	0
	Area Recheck Positions	sf	2,560	-	-	-	-
	Queue Baggage Recheck	sf	-	-	-	-	-
	SubTotal:		**6,969**	**9,700**	**9,700**	**10,000**	**14,200**

Table 4.4-19 *(continued)*
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 1 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

		Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
Public Space	**Security Screening Checkpoint (SSCP)**						
	Number of Lanes	pos	15	7	8	8	8
	Queuing Area	sf	8,534	4,100	4,700	5,000	5,400
	Checkpoint Screening Area	sf	16,992	8,600	9,600	10,600	10,600
	TSA Offices	sf	6,276	1,300	1,400	1,600	1,600
	SubTotal:		**31,802**	**14,000**	**15,700**	**17,200**	**17,600**
	Circulation						
	Ticket Lobby Circulation	sf	11,258	4,200	4,700	4,600	4,700
	Baggage Claim Circulation	sf	17,871	4,800	4,800	6,000	6,000
	Secure Circulation (Incl. Fire/Service Stairs to Apron)	sf	180,721	69,400	74,000	78,600	85,100
	General Public Circulation (Includes Vestibules, Vert Circ, Corridors)	sf	77,438	38,900	41,100	45,400	48,600
	Public Seating	sf	-	6,000	6,600	7,200	7,900
	Domestic Meeter/Greeter Lobby	sf	770	5,100	5,400	6,100	6,900
	Transportation (Shuttle Service) & Hotel Courtesy Phones	sf	100	200	200	200	200
	SubTotal:		**288,158**	**128,600**	**136,800**	**148,100**	**159,400**
	Restrooms						
	Public Restrooms - Secure	sf	10,821	4,800	4,800	6,400	6,400
	Public Restrooms - Non-Secure	sf	5,333	5,600	5,900	6,600	7,300
	SubTotal:		**16,154**	**10,400**	**10,700**	**13,000**	**13,700**
	Other Space						
	Misc Tenant						
	American Credit Union (AAFCU), Central Carts, Chapel, USO, USPS	sf	8,877	8,900	8,900	8,900	8,900
	Smoking Lounge	sf	1,458	1,500	1,500	1,500	1,500
	Other (Displays, Information Counters, Visitors Commission etc)	sf	677	700	700	700	700
	SubTotal:		**11,012**	**11,100**	**11,100**	**11,100**	**11,100**
Non-Public Space	**Non-Airline Tenant Space**						
	Airport Administration						
	Offices/Support (City)	sf	63,944	64,800	64,800	64,800	64,800
	Airport Police (Includes Locker Facilities)	sf	1,853	2,000	2,000	2,000	2,000
	Other Tenants						
	Misc Tenant	sf	4,870	6,500	6,500	6,500	6,500
	SubTotal:		**70,667**	**73,300**	**73,300**	**73,300**	**73,300**
	Other Space						
	Non-Public Restrooms	sf	4,073	2,200	2,300	2,400	2,600
	Non-Public Circulation	sf	19,480	22,300	23,200	24,300	26,100
	Other	sf	-	-	-	-	-
	SubTotal:		**23,553**	**24,500**	**25,500**	**26,700**	**28,700**
	Terminal Function						
	Maintenance/Janitorial/Storage/Shops	sf	4,075	5,700	6,000	6,400	7,000
	Mechanical/Electrical/Telephone/Plumbing	sf	131,890	69,200	72,400	77,400	84,200
	Building Systems (Structure/Non-net/Void)	sf	36,124	16,600	17,400	18,500	20,200
	Exterior - Other (ie Public Gardens, etc)	sf	-	-	-	-	-
	SubTotal:		**172,089**	**91,500**	**95,800**	**102,300**	**111,400**

Table 4.4-19 *(continued)*
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 1 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

Summary	Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
General						
2008-2028						
Annual Enplanements		4,987,691	3,577,856	3,930,647	4,308,810	4,703,945
Annual O&D Enplanements (%)		3,917,292 (76.2%)	3,267,195 (91.3%)	3,592,644 (91.4%)	3,939,553 (91.4%)	4,300,853 (91.4%)
Annual Connecting Enplanements (%)		1,186,226 (23.8%)	310,662 (8.7%)	338,004 (8.6%)	369,257 (8.6%)	403,092 (8.6%)
Peak Hour Enplaned Domestic		1,741	1,261	1,427	1,524	1,630
Peak Hour Enplaned International		287	286	286	313	341
Peak Hour Deplaned Domestic		1,745	1,174	1,246	1,398	1,573
Peak Hour Deplaned International		-	-	-	-	-
Gates/Positions		72	29	31	33	35
Airline Space						
Domestic Airline Space	sf	81,230	33,200	35,000	40,400	41,100
International Airline Space	sf	-	2,600	2,600	2,600	3,900
Other Airline Space	sf	293,074	133,500	141,300	151,200	167,300
Departure Lounges	sf	107,778	42,500	45,400	48,200	53,100
SubTotal:		482,082	211,800	224,300	242,400	265,400
Concessions						
Non-Secure Concessions Space	sf	50,483	17,200	17,900	19,100	21,300
Secure Concessions Space	sf	61,990	41,300	43,400	47,200	51,900
SubTotal:		112,473	58,500	61,300	66,300	73,200
US Customs & Border Protection Services[7]						
Design Hour Passengers	pax	400	286	286	372	484
Primary Processing	sf	16,288	7,300	7,300	8,600	10,000
Baggage Claim	sf	9,388	17,900	17,900	17,900	23,800
Secondary Processing	sf	13,442	3,600	3,600	3,600	3,900
Support Space	sf	-	1,400	1,400	1,400	1,600
Other Space	sf	6,969	9,700	9,700	10,000	14,200
SubTotal:		46,087	39,900	39,900	41,500	53,500
Public Space						
Security	sf	31,802	14,000	15,700	17,200	17,600
Circulation	sf	288,158	128,600	136,800	148,100	159,400
Restrooms	sf	16,154	10,400	10,700	13,000	13,700
Other Space	sf	11,012	11,100	11,100	11,100	11,100
SubTotal:		347,126	164,100	174,300	189,400	201,800
Non-Public Space						
Non-Airline Tenant Space	sf	70,667	73,300	73,300	73,300	73,300
Other Space	sf	23,553	24,500	25,500	26,700	28,700
Terminal Functions	sf	172,089	91,500	95,800	102,300	111,400
SubTotal:		266,309	189,300	194,600	202,300	213,400
Total						
Total Functional Terminal Area:		**1,082,000** [8]	**572,100**	**598,600**	**639,600**	**695,900**
Total Gross Terminal Area:		**1,254,100** [8]	**663,600**	**694,400**	**741,900**	**807,300**

Notes:
4 Outbound Baggage Make-up based on Preferential Use
5 EDS area represents Airport Experience planned In-Line EDS inspection area. Existing area shown represents current in-lobby standalone airline baggage screening excluding American Airline's In-Line space (no info available), approximately 21,350 square feet will be reconfigured within the existing building drip line (per STL planning staff).
6 Existing recommended EDS units are based on existing standalone in lobby devices and existing AA In-Line baggage system.
7 These are minimum facility standards set by the Customs and Boarder Protection "Airport Technical Design Standards August 2006." The CBP may evaluate the airports traffic projections on a case-by-case basis and update any requirements as needed.
8 Represents the total current available functional and gross terminal square footage (leased, non-leased, airport owned, and closed areas) and totals may not sum due to rounding.

Source: Landrum & Brown analysis, 2011

Table 4.4-20
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 2 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

		Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
General	**General [1]**						
	Overall Airport Statistics						
	Annual Passengers		**4,440,398**	**6,560,764**	**7,176,390**	**7,836,368**	**8,604,866**
	Annual Enplanements		2,220,199	3,280,382	3,588,195	3,918,184	4,302,433
	Annual Domestic Enplanements		2,144,794	-	-	-	-
	Annual International Enplanements		75,405	-	-	-	-
	O&D Passengers		-	2,624,305	2,870,556	3,134,547	3,441,947
	Connecting Passengers		-	656,076	717,639	783,637	860,487
	Peak Hour Passenger Statistics						
	Peak Hour Enplaned - Domestic		1,048	1,568	1,695	1,777	1,868
	Peak Hour Enplaned - International		-	-	-	-	-
	Total Peak Hour Enplaned [2]		**1,048**	**1,568**	**1,695**	**1,777**	**1,868**
	Peak Hour Deplaned - Domestic		932	1,254	1,387	1,467	1,556
	Peak Hour Deplaned - International		-	-	-	-	-
	Total Peak Hour Deplaned [2]		**932**	**1,254**	**1,387**	**1,467**	**1,556**
	Total Peak Hour[2]		**1,630**	**2,195**	**2,620**	**2,705**	**2,801**
	Aircraft Gates/Positions (International in parenthesis)						
	Small Commuter (Cessna)		-	-	-	-	-
	Medium Commuter (CRJ/ERJ/BE1)		-	-	-	-	-
	Large Commuter (CR7/E70)		-	-	-	-	-
	Narrowbody (B737/A320)		16 (3)	12	13	14	15
	B-757		-	-	-	-	-
	Widebody (B767)		-	-	-	-	-
	Jumbo (B777/A340/B747)		-	-	-	-	-
	NLA (A380)		-	-	-	-	-
	Total Gates:		**16**	**12**	**13**	**14**	**15**
	Total EQA[3]:		**16.0**	**12.0**	**13.0**	**14.0**	**15.0**
	Total NBEG[4]:		**16.0**	**12.0**	**13.0**	**14.0**	**15.0**
	Total Positions:		16	12	13	14	15

Notes:
1. Forecasted annual passenger numbers based on forecast sensitivity analysis section.
2. The total Peak Hour numbers represent the total enplanement/deplanements Peak Hour, not the sum of the components (i.e. the enplaned/deplaned and total Peak Hours do not necessarily occur in the same hour). Domestic and International Peak Hour may differ.
3. EQA normalizes gate based on seating capacity of accommodated aircraft.
4. NBEG: Used to normalize the apron frontage demand and capacity to that of a typical narrowbody aircraft gate.

Source: Landrum & Brown analysis, 2011

Table 4.4-20 ***(continued)***
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 2 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

Airline Space

	Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
Domestic Airline Space						
Ticket Counter						
Linear Counter Check-in Positions (Kiosk)	pos	38 (8)	21(6)	23(7)	24(8)	25(8)
Total Check-in Locations (Kiosk)	pos	38 (8)	21(6)	23(7)	24(8)	25(8)
Total Linear Position Length	lf	196	100	110	110	110
Number of Unassigned Check-in Positions	pos	12	-	-	-	-
Total Unassigned Position Length	lf	0	-	-	-	-
Counter Area (Includes any curb check)	sf	2,845	1,000	1,100	1,100	1,100
Ticketing Queue (including any free standing kiosks)	sf	1,826	2,200	2,400	2,400	2,500
Curbcheck Positions	pos	0	0	0	0	0
Airline Ticket Offices	sf	5,607	2,900	3,200	3,200	3,300
Baggage Claim						
Claim Devices	units	2	3	3	4	4
Linear Frontage Required	lf	360	500	560	590	630
Linear Frontage Programmed	lf	0	540	540	720	720
Baggage Claim Hall (Includes Device, Queues & Circulation)	sf	10,264	18,900	18,900	25,200	25,200
Baggage Services	sf	363	1,800	2,100	2,200	2,200
Airline Clubs/VIP Lounges	sf	-	-	-	-	-
SubTotal:		**20,905**	**26,800**	**27,700**	**34,100**	**34,300**
International Airline Space						
Ticket Counter						
Linear Counter Check-in Positions (Kiosk)	pos	included above	0(0)	0(0)	0(0)	0(0)
Total Check-in Locations (Kiosk)	pos	included above	0(0)	0(0)	0(0)	0(0)
Total Linear Position Length	lf	included above	0	0	0	0
Counter Area (Includes any curb check)	sf	included above	-	-	-	-
Ticketing Queue (including any free standing kiosks)	sf	included above	-	-	-	-
Curbcheck Positions	pos	included above	0	0	0	0
Airline Ticket Offices	sf	included above	-	-	-	-
Airline Clubs/VIP Lounges	sf	included above	-	-	-	-
SubTotal:		**-**	**-**	**-**	**-**	**-**
Other Airline Space						
Outbound Bag Make-Up[5]	sf	25,120	25,200	27,300	29,400	31,500
Inbound Bag Delivery	sf	5,632	5,400	5,400	7,200	7,200
Baggage Train Circulation	sf	included above	4,600	4,900	5,500	5,800
Checked Baggage Screening (TSA Space)[6]	sf	2,609	7,900	7,900	7,900	7,900
Level 1 Inspection Units (EDS)[7]		4	2	2	2	2
Airline Operations	sf	17,937	18,000	19,500	21,000	22,500
Other Airline Offices/Systems and Support	sf	1,591	1,800	2,000	2,100	2,300
SubTotal:		**52,889**	**62,900**	**67,000**	**73,100**	**77,200**
Departure Lounges						
Gates/Positions						
Small Regional (Cessna/Metro)	sf	-	-	-	-	-
Medium Regional (BE1/CRJ,CR7,9/ERJ/SF340)	sf	-	-	-	-	-
Large Regional (Q400/E170,175,190)	sf	-	-	-	-	-
Narrowbody (A320/B737w)	sf	47,670	30,200	32,700	35,200	37,700
B-757(winglets)	sf	-	-	-	-	-
Widebody (B767/MD11)	sf	-	-	-	-	-
Jumbo (B747,787,777/A330,340)	sf	-	-	-	-	-
Super Jumbo (A380)	sf	-	-	-	-	-
SubTotal:		**47,670**	**30,200**	**32,700**	**35,200**	**37,700**

Table 4.4-20 *(continued)*
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 2 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

		Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
Concessions Space	**Non-Secure Concessions Space**						
	Rental Car						
	Number of Counters	pos	0	0	0	0	0
	Counter Area/Offices	sf	-	-	-	-	-
	Queue	sf	-	-	-	-	-
	Non-Secure Concessions	sf	629	700	700	800	900
	Non-Secure Storage	sf	213	200	200	200	200
	SubTotal:		**842**	**900**	**900**	**1,000**	**1,100**
	Secure Concessions Space						
	Secure Concessions	sf	16,927	16,700	17,900	19,700	20,600
	Secure Storage	sf	5,834	4,200	4,500	4,900	5,100
	SubTotal:		**22,761**	**20,900**	**22,400**	**24,600**	**25,700**

Table 4.4-20 *(continued)*
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 2 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

		Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
Public Space	**Security Screening Checkpoint (SSCP)**						
	Number of Lanes	pos	6	7	8	8	8
	Queuing Area[8]	sf	1,180	4,500	4,900	5,100	5,300
	Checkpoint Screening Area[8]	sf	4,160	7,900	8,800	8,800	8,800
	TSA Offices[8]	sf	2,353	1,200	1,400	1,400	1,400
	SubTotal:		**7,693**	**13,600**	**15,100**	**15,300**	**15,500**
	Circulation						
	Ticket Lobby Circulation	sf	12,275	3,000	3,400	3,400	3,500
	Baggage Claim Circulation	sf	6,993	4,800	4,800	6,000	6,000
	Secure Circulation (Incl. Fire/Service Stairs to Apron)	sf	50,445	28,800	31,200	33,600	36,000
	General Public Circulation (Includes Vestibules, Vert Circ, Corridors)	sf	12,882	16,800	18,000	20,000	20,700
	Public Seating	sf	-	6,000	6,600	7,000	7,400
	Domestic Meeter/Greeter Lobby	sf	-	4,800	5,300	5,600	6,000
	Transportation (Shuttle Service) & Hotel Courtesy Phones	sf	150	200	200	200	200
	SubTotal:		**82,745**	**64,400**	**69,500**	**75,800**	**79,800**
	Restrooms						
	Public Restrooms - Secure	sf	3,811	3,200	3,200	3,200	3,200
	Public Restrooms - Non-Secure	sf	2,793	5,000	6,000	6,200	6,400
	SubTotal:		**6,604**	**8,200**	**9,200**	**9,400**	**9,600**
	Other Space						
	Misc Tenant						
	American Credit Union (AAFCU), Central Carts, Chapel, USO, USPS	sf	1,141	1,100	1,100	1,100	1,100
	Smoking Lounge	sf	1,150	1,200	1,200	1,200	1,200
	Other (Displays, Information Counters, Visitors Commission etc)	sf	107	100	100	100	100
	SubTotal:		**2,398**	**2,400**	**2,400**	**2,400**	**2,400**
Non-Public Space	**Non-Airline Tenant Space**						
	Airport Administration						
	Offices/Support (City)	sf	4,307	4,400	4,400	4,400	4,400
	Airport Police (Includes Locker Facilities)	sf	-	-	-	-	-
	Other Tenants						
	Misc Tenant	sf	4,513	6,600	7,200	7,800	8,600
	SubTotal:		**8,820**	**11,000**	**11,600**	**12,200**	**13,000**
	Other Space						
	Non-Public Restrooms	sf	1,434	1,500	1,600	1,700	1,800
	Non-Public Circulation	sf	5,109	7,600	8,100	8,700	9,200
	Other	sf	-	-	-	-	-
	SubTotal:		**6,543**	**9,100**	**9,700**	**10,400**	**11,000**
	Terminal Function						
	Maintenance/Janitorial/Storage/Shops	sf	2,420	2,500	2,700	2,900	3,100
	Mechanical/Electrical/Telephone/Plumbing	sf	36,881	30,500	32,700	35,800	37,500
	Building Systems (Structure/Non-net/Void)	sf	6,181	4,500	4,800	5,300	5,500
	Exterior - Other (ie Public Gardens, etc)	sf	-	-	-	-	-
	SubTotal:		**45,482**	**37,500**	**40,200**	**44,000**	**46,100**

Table 4.4-20 *(continued)*
EXISTING FACILITY INVENTORY AND FUTURE TERMINAL 2 REQUIREMENTS – PREFERENTIAL USE
Lambert-St. Louis International Airport

Summary		Units	Existing Terminal Space (sf) Full Capacity	2013 Recommended Facilities	2018 Recommended Facilities	2023 Recommended Facilities	2028 Recommended Facilities
	General						
2008-2028	Annual Enplanements		2,220,199	3,280,382	3,588,195	3,918,184	4,302,433
2008-2028	Annual O&D Enplanements (%)		1,862,201 (83.9%)	2,624,305 (80.%)	2,870,556 (80.%)	3,134,547 (80.%)	3,441,947 (80.%)
2008-2028	Annual Connecting Enplanements (%)		357,998 (16.1%)	656,076 (20.%)	717,639 (20.%)	783,637 (20.%)	860,487 (20.%)
2008-2028	Peak Hour Enplaned Domestic		1,048	1,568	1,695	1,777	1,868
2008-2028	Peak Hour Enplaned International		-	-	-	-	-
2008-2028	Peak Hour Deplaned Domestic		932	1,254	1,387	1,467	1,556
2008-2028	Peak Hour Deplaned International		-	-	-	-	-
	Gates/Positions (Unassigned in parenthesis)		16 (3)	12	13	14	15
	% of Unassigned Gates @ Terminal 2		19%	-	-	-	-
	Airline Space						
	Domestic Airline Space	sf	20,905	26,800	27,700	34,100	34,300
	International Airline Space	sf	-	-	-	-	-
	Other Airline Space	sf	52,889	62,900	67,000	73,100	77,200
	Departure Lounges	sf	47,670	30,200	32,700	35,200	37,700
	SubTotal:		121,464	119,900	127,400	142,400	149,200
	Concessions						
	Non-Secure Concessions Space	sf	842	900	900	1,000	1,100
	Secure Concessions Space	sf	22,761	20,900	22,400	24,600	25,700
	SubTotal:		23,603	21,800	23,300	25,600	26,800
	US Customs & Border Protection Services[9]						
	Design Hour Passengers	pax	400	-	-	-	-
	Primary Processing	sf	10,098	-	-	-	-
	Baggage Claim	sf	6,690	-	-	-	-
	Secondary Processing	sf	8,323	-	-	-	-
	Support Space	sf	1,185	-	-	-	-
	Other Space	sf	16,784	-	-	-	-
	SubTotal:		43,080	-	-	-	-
	Public Space						
	Security[8]	sf	7,693	13,600	15,100	15,300	15,500
	Circulation	sf	82,745	64,400	69,500	75,800	79,800
	Restrooms	sf	6,604	8,200	9,200	9,400	9,600
	Other Space	sf	2,398	2,400	2,400	2,400	2,400
	SubTotal:		99,440	88,600	96,200	102,900	107,300
	Non-Public Space						
	Non-Airline Tenant Space	sf	8,820	11,000	11,600	12,200	13,000
	Other Space	sf	6,543	9,100	9,700	10,400	11,000
	Terminal Functions	sf	45,482	37,500	40,200	44,000	46,100
	SubTotal:		60,845	57,600	61,500	66,600	70,100
	Total						
	Total Functional Terminal Area:		**303,000** [10]	**250,400**	**268,200**	**293,500**	**307,300**
	Total Gross Terminal Area:		**348,500** [10]	**287,900**	**308,400**	**337,500**	**353,400**

Notes:
5 Outbound Baggage Make-up based on Preferential Use.
6 Existing area shown represents current in lobby standalone airline screening area with future programmed area based on in-line system.
7 Existing recommended EDS units are based on existing standalone in lobby devices.
8 Existing area does not include new west expansion SSCP screening area.
9 These are minimum facility standards set by the Customs and Boarder Protection "Airport Technical Design Standards August 2006." The CBP may evaluate the airports traffic projections on a case-by-case basis and update any requirements as needed.
10 Represents the total current available functional and gross terminal square footage (leased, non-leased, airport owned, and closed areas) and totals may not sum due to rounding.

Source: Landrum & Brown analysis, 2011

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4.4.4.2 Terminal Area Requirements

The following sections describe the programmatic findings for Terminal 1 and Terminal 2 for the future 2028 planning level horizon. They are based on the *Airport Experience Program* completed and planned list of projects as well as the methodologies previously outlined. These sections are also organized by the major categories of space.

AIRLINE SPACE

This category of the terminal space program represents a major portion of the passenger processing functions of the terminal. It contains all the preferential areas typically required and leased by the airline tenants to support their operations. These functions include ticketing, baggage claim, airline operations and support, and departure lounges (hold rooms).

Initial airport tenant interviews were held with various station managers at the beginning of the study. These discussions along with on-site observations were used to determine the adequacy of the various airline functions. The airline requirements are presented in the following paragraphs:

<u>Domestic/International Airline Space</u>

<u>Ticket Counter & Queue</u> – This term refers to the area occupied by the ticket counter, ticket agents, and the ticket counter baggage belt. It is typically assumed as an exclusive use or Preferential Use operation for most U.S. airlines. In the case of STL, these areas are preferential per current lease agreements. This airline function is based on the Peak Hour originating passengers, their associated early arrival profiles, acceptable service times associated with the check-in process, and the percentage of the originating passengers that actually check-in at the terminal verses going directly to the gate or checking in at any offsite location. Data obtained from discussions with the airline tenants combined with industry accepted planning factors were used in determining the ticket counter requirements. The typical airline ticket counter has evolved over recent years to include both standard agent positions and the self-service electronic kiosks. These kiosks can either be converted from in-line counter positions, be freestanding in the ticketing queue area or a combination of both. Each airline, typically have their own arrangement within the ticketing area. This has ultimately reduced the need for some in-line counter positions but has increased the amount of queue space needed in the ticket lobby. The freestanding kiosk is typically referred to as a "Two-Step" process where the passenger checks in at the kiosk and the traditional in-line counter position accommodates the bag drop function while also serving as the location for additional airline assistance.

Based on a review of the lease drawings, on-site observations, the *Airport Experience Program* ticketing drawings and discussions with the airlines and the Airport, Terminal 1 had a total of 159 possible check-in locations for passengers made up of 104 traditional staffed agent positions, and 55 self-service kiosks of various arrangements depending on the airlines' ticket counter configuration.

Terminal 2 had a total of 38 check-in locations consisting of 30 agent positions and eight self-service kiosks set in-line with the ticket counter. However, with the Transportation Security Administration's (TSA) 100 percent baggage screening requirements this number is slightly less than what is potentially available with some EDS machines occupying the space of potential counter positions and queue area.

Currently both Terminals operate in a standard linear ticket counter arrangement with self-service kiosks either integrated within the standard in-line counter position or freestanding in the ticketing queue area; the exception being Delta, which uses a "two-step," kiosk/bag drop process. The existing ticket counters at STL vary in length and configuration based on terminal and individual airline preferences. Terminals 1 and 2 consist of an overall average of 4.2 feet and 5.2 feet per standard ticket agent position respectively compared to a domestic carrier average of 4.25 feet per agent and 5.5 feet to six feet for international carriers. A planning factor of five feet has been assumed for future requirements that also accounts for counter breaks for agent access.

The existing traditional linear counter areas measure between 10 feet to 13.5 feet from ticket counter and face to the back wall and are dependent on each airlines operational setup and terminal they occupy. For the program, a typical 10-foot depth has been assumed for each terminal.

The ticketing queue is a function of the counter frontage and the acceptable planning depth for passenger queuing in front of the counter positions. The existing depth by terminal varies based on each airline's ticketing configuration and the physical setup of the terminal check-in hall itself. A future depth of 20 to 25 feet has been used to account for required queue space needed for the area taken up by any freestanding kiosks and their passengers as well as an IATA LOS C typical planning factor of 15.1 square-feet per queued passenger. This area also includes the "Active Check-in Zone" or the space in front of the counters for passenger processing and cross circulation.

<u>Airline Ticket Offices (ATO)</u> - This category refers to the office area leased to the airlines and is generally located directly behind or adjacent to the ticket counter to provide support functions for the ticket agents and other airline administrative space. However, this space can be located in other terminal areas as necessary. Typically, the ATO space is 25 feet to 30 feet deep along the full-length of the ticket counters. However, this area ranges from approximately 10 to 23 feet for Terminal 1 and 27 feet for Terminal 2 for the space directly behind the linear check-in counters.

<u>Baggage Claim (Domestic)</u> - This category represents the area occupied by the baggage claim devices and the queuing area for active claiming. Baggage claim requirements are primarily based on the percentage of deplaned terminating passengers in a peak 20 minute period, the percentage of those passengers checking bags, and to a lesser extent, the number of bags checked. Because most passengers arrive at the claim area before their baggage arrives, sufficient claim frontage should be available to accommodate the concentration of these Peak

Passengers. A typical industry planning standard is to assume all passengers will be no more than one person deep to be able to reach in/around to the claim device when his/her baggage is presented. This results in an IATA LOS C planning ratio of 1.5-linear feet per claiming passenger. This analysis focused on using the existing Preferential Use claim areas for future requirements.

The existing claim devices range in size from 160-linear feet of frontage (Terminal 1) to 180 feet (Terminal 2). It is recommended that the future claim devices be sized at 160-linear feet for Terminal 1 and 180-linear feet for Terminal 2 to adequately handle a typical narrowbody aircraft with multiple flights by smaller regional aircraft. The recommendation for the baggage claim area is 35-square feet per linear feet of claim to provide adequate queuing and circulation space within the claim area.

Baggage Claim (International) - This category represents the area occupied by the baggage claim devices and the queuing area for active claiming within the international arrival processing functions. The approach for sizing the area and devices themselves is similar to that of the domestic baggage claim area. However, international claim devices are typical sized for greater baggage capacity because passengers must first clear U.S. Customs & Border Protection (CBP) primary processing before entering the baggage claim area as well as higher checked baggage per passenger ratios. Therefore, these devices are sized more for storage than for active claim frontage. An IATA LOS C planning ratio of 1.5-linear feet per claiming passenger was used.

The existing two claim devices average 140-linear feet of frontage. The future claim devices are recommended to be sized at 170-linear feet to adequately handle the 2028 DDFS average aircraft gauge. The future 2028 demand results in a need for approximately 590-linear feet of claim. The total provided claim length of 680-linear feet resulted in four claim devices or approximately 0.7-linear feet per Peak Hour terminating passenger.

The baggage claim hall area is recommended to be sized at 35-square feet per linear feet of claim to provide adequate queuing and circulation space within the claim area. The future demand results in a need of 23,800-square feet of claim hall by 2028

Baggage Services (Domestic) - This category includes the area of baggage service offices which are leased to the airlines. Typically, these offices are only required by airlines with sufficient activity to warrant staffing. A typical one-square foot per Peak Hour terminating passenger was used in the analysis.

Other Airline Space

Outbound Bag Make-Up - This category represents the area used for the accumulation, storage, and make-up of outbound baggage from the ticket counter and curbside check-in areas. This space typically consists of the make-up units, baggage train circulation and maneuvering lanes, the tug/cart staging areas and in some cases the TSA baggage screening EDS devices. A method for providing a consistent basis for baggage system planning involves using the EQA as previously described in Table 4.4-18. A planning ratio of 2,100-square feet per EQA for both Terminal 1 and 2 was used in the analysis. Airlines interviewed indicated as having sufficient space for their operational needs.

Inbound Bag Delivery - The inbound bag category represents the area that is used to feed bags to the baggage claim devices. This area includes a portion of the flat plate device where the bags are off-loaded or the remote conveyor that feeds the sloped bed unit, work aisles, and bypass lanes. Most airlines when interviewed voiced concerns of short input belt lengths and overcrowding when multiple inbound flights were utilizing the off-load area at the same time. A planning ratio of 2,000-square feet and 1,800-square feet per off-load area for Terminal 1 and Terminal 2 respectively was used in the analysis.

Checked Baggage Screening - Currently checked baggage screening for possible explosives is being done via five standalone EDS units in the Terminal 1 ticket lobby along with an integrated in-line system for American Airlines. Terminal 2 utilizes four standalone units in the ticketing area as well as an in-line system. Future program requirements assumed a fully integrated in-line system within the make-up area of both Terminals. (Note: STL is to receive a $42 million federal grant to move these standalone EDS units off the ticketing level in both terminals to a fully integrated in-line system.[6]) A planning ratio was used of 500 bags per hour with 65 percent of originating domestic passengers checking bags and 100 percent of international passengers checking bags. A domestic 0.8 bags per passenger and an international 1.5 bags per passenger ratios were used for Terminal 1 with 80 percent check bags and 0.7 bags per passenger for Terminal 2. A planning ratio of approximately 4,300-square feet per EDS unit was based on the *Airport Experience Program* plan for in-line EDS for Terminal 1 and 4,000-square feet per unit for Terminal 2.

Airline Operations - This category represents all of the area used by the airlines for their everyday operations which includes the apron level support spaces for aircraft crew, aircraft servicing, and other related support facilities. A program area is typically based on the number of gates expressed in EQA. The demand for operations space is a function of the size and number of aircraft being served based on individual airline or common use operating policies. A leased square-foot ratio of 2,700-square feet and 1,500-square feet per EQA for both Terminal 1 and 2 was used in the analysis. The airlines interviewed reported these areas as adequate to handle their current activity levels at STL.

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[6] *See* Internet website: http://www.stltoday.com/news/traffic/along-for-the-ride/article_812fd82a-c29e-11df-862e-00127992bc8b.html?mode=comments

Departure Lounges (Hold Rooms)

In evaluating the capacity of the hold rooms, physical location, and proximity to the gate are important factors to consider. The available hold room space needs to be in relatively close proximity to the gate. Multiple gates with adjacent hold rooms typically have additional hold room capacity resulting from sharing hold room seating between the gates. These factors were taken into consideration when evaluating the future requirements.

Hold rooms are based on the mix of gates and the average seating capacity of each aircraft design category. These areas generally consist of the passenger seating area, the airlines podium and associated queue space, the loading bridge egress corridor, circulation, and any additional square footage allowances for areas such as telephone banks, child play areas, etc.

When sizing these areas the amount of seating area is typically based on an industry standard of 80 percent of the aircraft seating capacity. Of this percentage, a range from 50 percent to 80 percent is allocated to the number of passengers seated with the remaining 20 percent to 50 percent standing. At STL, a typical IATA LOS B planning ratio of 80 percent seated and 20 percent standing has been applied. For these areas, a typical planning standard of 15-square feet and 10-square feet per sitting and standing passenger respectively has been used.

The physical layout of the preferred hold room consists of a 180-square foot (six-foot wide minimum) loading bridge egress corridor with an assumed average 30-foot deep hold room. The existing hold rooms in Terminal 1 vary in depth from 21 to 25 feet; in Terminal 2 the hold rooms are 28 feet in depth. The typical two-position podium range in size from 8 to 10 feet in length at Terminal 1 and 8 feet at Terminal 2 and are oriented towards the rear of the hold room with their queue space extending out towards the general circulation area. For this analysis an average podium position length of five feet as been assumed with a queue area equal to approximately 15 feet in depth. Existing hold rooms where available are paired as mentioned earlier and this has been assumed for future planning. This grouping has made it possible to reduce the physical amount of hold room seating area needed. For STL a five percent reduction in the seating/standing areas for each gate in a common group has been assumed. Additionally, to reflect the specific operating characteristics of airlines with frequent flights and short ground times, like Southwest's operation, a heavy utilization factor of 15 percent per gate has been used. This factor takes into account the additional passengers from more than one flight at the gate at the same time.

The average seating capacities and recommended hold room sizes for paired gates with shared utilization and those with high utilization are summarized in **Table 4.4-21, *Passenger Holdroom Typical Areas***.

Table 4.4-21
PASSENGER HOLDROOM TYPICAL AREAS
Lambert-St. Louis International Airport

AIRCRAFT DESIGN GROUP		TYPICAL SEATS	TYPICAL AIRCRAFT	SHARE AREA (SF)	HIGH UTILIZATION AREA (SF)
I	Small Regional	25	Cessna/Learjet	550	620
II	Medium Regional	50	SF370/CRJ	810	960
III	Large Regional	75	Dash 8, E175, CRJ-700,900	1,180	1,300
III	Narrowbody	145	A320/B737/DCH8/E175	1,970	2,400
IV	B757	185	B757	2,510	3,050
IV[1]	Widebody	233	MD11,B767	3,515	4,340

Note: 1 Seating capacity is based on the design day flight schedules.

Sources: FAA AC 150/5300-13, *Airport Design*, Hirsh & Associates, and Landrum & Brown analysis, 2011

CONCESSIONS SPACE

This category of the terminal space program represents all of the areas devoted to commercial concessions that generate revenue for the Airport. In general, these include food/beverage, news/gift/sundry (business centers, shoeshine, barbershops, specialty stores, etc.), rental car, duty-free shops, and other revenue-generating functions. These amenities provide the passenger with necessary services during the processing function and provide vital revenue to the airport.

A general planning rule suggests approximately eight to 12 percent of the public serving space be allocated to concessions. These areas typically include any space that the public has unrestricted access to. It is recommended that 80-90 percent of the total concessions area be allocated to the secured portion the terminal defined as airside and beyond the passenger security checkpoint. The remaining 10 to 20 percent would be allocated to the non-secure or landside portion of the terminal.

The revenue generating effectiveness of an airport's concession program is significantly affected by an airport's operating policies and the physical configuration of the terminals. Due to the financial importance of the concession program, it is suggested that the Airport staff seek a concessions planning specialist prior to determining a final airside/landside split. These specialists help to plan the physical configuration of concession areas and the identification of specific location in the terminal and concourses for retail and food/beverage concessions. For master planning purposes another accepted industry-planning standard uses a ratio of square feet of total concessions space per 100,000 annual enplanements.

A preliminary meeting was held with concessionaire HMS Host. The observations and concerns expressed by the HMS Host included:

- 32 total concessions areas ranging from as small as 400-square feet to as much as 3,000-square feet
- Overall "total" space is adequate but areas are dispersed
- Goods are delivered to the commissary building (18,000 to 19,000-square feet, approximately 40-50 years old) then HMS delivers to designated areas at the terminal and concourses
- Concessionaire passengers surveys indicate a 45-minute to one-hour and 30 minute dwell time
- A 85/15 to 90/10 percent split between concessions public space and storage areas
- Quick service concessions storage is adequate
- Would prefer to see storage directly below concessions
- Sit-down concessions need double the storage capacity
- More staging areas

The main goals of a concessions program are to achieve a high level of customer satisfaction while simultaneously optimizing the airport's revenue production. Planning considerations that support these goals include:

- Consolidate passenger flows through centralized and/or clustered commercial areas to provide enhanced visibility.
- Integrate passenger convenience facilities (restrooms, airline lounges, etc.) as well as primary passenger circulation routes and vertical access points (direct access to APM stations) within concession areas.
- Provide clear lines-of-sight for passengers between gate holding areas and centralized concession or cluster areas maximizes passenger dwell times, reduces passenger anxiety, and increases overall sales.
- Minimize walking distances post-security to gate holding areas from the centralized and/or clustered concessions areas.
- Terminal layouts that maximize the number of gates in close proximity to centralized or clustered concession areas will generate higher overall sales than those with decentralized layouts.
- Financially assess the implications of phasing operator income. In particular, the need to sometimes accelerate the development of revenue generating concessions in advance of the passenger-driven demand to allow revenues to assist in paying for the capital costs of providing the facilities.
- The concessions plan should provide for future flexibility for accommodating changes in passenger flows, customer demand, and phased development while minimizing impacts on current operations, achieving high levels of customer satisfaction, and maintaining satisfactory financial results for the Airport and concessionaires.

- Purpose-built areas for future concessions space could be used in the near-term for storage or other temporary passenger services.

Terminal 1 has approximately 12 percent of the public area allocated to concessions space, which is within the typical 8-12 percent planning standard. The revenue generating area in the secure area of the terminal accounts for 73 percent of the total public concessions space. The current terminal has a total of approximately 71,300-square feet of public concessions of which only 50,100 was utilized. This resulted in a ratio of approximately 1,000-square feet per 100,000 annual enplanements. For master planning purposes, the future concessions space requirements were based on a higher ratio of approximately 1,200-square feet per 100,000 annual enplanements. Using this higher concessions area to annual enplanements assumption resulted in a ratio of about 14 percent concession space to public areas in the terminal with approximately 76 percent of this concessions space located on the secured airside of the terminal. This is slighter higher than the existing 73 percent ratio to account for more centralized concessions space in the secure area of the terminal.

Terminal 2 has approximately nine percent of the public area allocated to concessions space with approximately 96 percent of the revenue generating area in the secure area of the terminal. The terminal currently has a total of approximately 17,500-square feet of public concessions resulting in a ratio of about 800-square feet per 100,000 annual enplanements. For future terminal area space requirements, a slightly higher ratio of 11 percent of the public serving areas with 96 percent of the space in the secure area of the terminal has been used.

In addition to the passenger service, side a portion of the overall concessions program is allocated to the "back-of-house" areas that are essential in supporting the concessions program. The types of concessions, as well as the number of concessionaires, determine the support space that needs to be located adjacent to the customer serving spaces. Larger operators with multiple locations may be served from a central storage/preparation area(s). The additional area typically reserved for storage and service areas is equal to 25-35 percent of the public concessions space program. These areas typically include storage areas, preparation kitchens, employee lockers, loading docks, trash compactors, and concessionaires' administrative offices.

For Terminal 1, a review of the Airport CAD drawings suggests there is an existing support area of approximately 34 percent of the total concessions area. It should be noted that these areas are a matter of interpretation from the CAD drawings as not all areas are specifically designated as support space. Additionally, with the closure of Concourses B and D, as well as the unutilized areas at the end of Concourse C, the concessionaires have less support areas to operate from. A more typical 25 percent has been used for future space requirements. Although this ratio is lower than what exists today it represents a more typical centralized concessions program rather than multiple dispersed locations. For Terminal 2, the existing 26 percent ratio has been used for future planning requirements.

When adding the public concessions space together with the support areas a total ratio of slightly less than 1,500 square feet per 100,000 annual enplanements or 18 percent of the total public areas results for Terminal 1. This is comparable to newer terminal concessions programs that have more centralized concession areas with smaller concourse nodes.

UNITED STATES CUSTOMS & BORDER PROTECTIONS SERVICES (CBP) - INTERNATIONAL ARRIVAL FACILITIES

The CBP services, formerly known as Federal Inspection Services, are required by law for the processing of international passengers into the U.S. with the exception of pre-cleared flights from most Canadian airports and a limited number of other airports with U.S. pre-cleared facilities. With its priority mission of homeland security, it consists of U.S. government agencies, which include U.S. Immigration and Naturalization Services (INS), U.S. Customs Services, Animal and Plant Health Inspection Services, and Public Health Services. CBP facilities consist of passenger processing areas for each agency as well as required support space for offices, maintenance, and other areas.

The future program's facility requirements and processing functions are assumed to reflect that of a two-step process adopted nationally. In this procedure, all international arriving passengers are subject to primary inspection by the INS and a secondary more selective inspection in the secondary processing function by U.S. Customs. Although this is a national policy, implementation may vary at each airport based on local conditions and annual activity levels. No interviews were conducted with CBP during the course of the study. As noted in the "*Aviation Activity Forecast*" activity levels in 2008 indicated approximately 95,945 passengers boarded flights to international destinations with 99 percent originating from STL. Destinations for the O&D enplanements included Mexico (60 percent) the Caribbean (20 percent) and Canada (17 percent). International O&D passenger enplanements are forecasted to grow at an annual average growth rate of 4.3 percent per year to approximately 228,000 by 2028. Future service includes destinations to Latin American using narrowbody 150 seat aircraft as well as seasonal service to Europe using B767 230 seat aircraft. Future 2028 DDFS indicated a need for three international capable arrival gates with nearly 500 Peak Hour arriving passengers.

The future CBP agency inspection and support area requirements are based on the U.S. Customs and Border Protection, <u>Airport Technical Design Standards Passenger Processing Facilities, March 2005 draft</u> document. CBP space requirements are sized for a capacity stated in terms of passengers per hour and the type of facility its planned for such as small (under 800 pax/hour), medium (800 to 2,000 pax/hour), and large (greater than 2,000 pax/hour) airports. STL under these scenarios would fall under the small airport category processing under 800 passengers per hour. The recommended future layout, space permitting, would have Primary Inspection, baggage claim, and Secondary Inspection on one level with other offices and support space on different levels as needed. At a minimum the Secondary Inspection and Support needs to be on the passenger processing level for direct access.

Currently the international arrivals facility on Concourse C at Terminal 1 has a two-level processing facility equal to an area of approximately 46,100-square feet. The disadvantages for an airside international arrivals facility include the need for terminating passengers to re-check their baggage to domestic claim devices on the non-secured side of the terminal and then process through a Security Screening checkpoint (SSCP) before entering the secured concourse. This location also limits direct access to meter/greeter areas for terminating passengers as well as direct access to check-in facilities for passengers connecting to domestic flights. This international arrivals area has been closed due to a newer facility located at Terminal 2. This slightly smaller 43,100-square foot, two-level landside processing facility is located at the west end of Terminal 2.

For alternative planning scenarios, it is assumed a future landside location at the airport for international arrivals processing will be located in a new or redeveloped Terminal 1 facility. Future CBP functions have been sized to handle a single widebody and two narrowbody aircraft processing through three international capable arrivals gates. The future 2028 demand forecasts a level of 484 passengers per hour resulting in a facility of approximately 53,500-square feet. Some of the future area requirements not directly tied to passenger processing functions are based on a Design Hour of 600 passengers per hour. Therefore, the CBP may evaluate the airports traffic projections on a case-by-case basis and update requirements as needed resulting in certain agency functions being combined or left out of the program all together.

PUBLIC SPACE

<u>Security Screening Checkpoint (SSCP)</u>

This area of the program is dedicated to the TSA space for screening departing passengers. Future planning requirements are based on the *Recommended Security Guidelines for Airport Planning, Design and Construction, June 2006* document published by the TSA and updated for Advanced Imaging Technology (AIT) published January 2010.

These areas generally include two types of screening configurations with multiple layouts based on equipment type. The "2 to 2" module includes two lanes with two x-rays per two magnetometers (WTMD) with footprints ranging from 28 feet by 59 feet to 30 feet by 62 feet. An additional 10 feet of depth has been added downstream for reconciliation of passenger baggage and personal belongings. Overall, this area requires an average of 1,050-square feet of space per lane.

The second module type is the "2 to 1" or two lanes consisting of two x-rays per one WTMD with footprints ranging from 25.5 feet by 58 feet to 25 feet by 68 feet with an additional 10 feet of depth downstream. The average for this module totals 1,020-square feet of space per lane. The "2 to 1" module type is becoming more prevalent according to TSA in that it provides greater flexibility for staffers to work among different checkpoint lanes. These modules generally consist of the primary screening areas and their equipment, and a secondary search area (holding or wanding area). Additional area needs to be added for passenger queuing and exits, and space permitting, area for TSA offices.

An additional "2 to 1" module type has been introduced for TSA's AIT or whole body imaging devices that are being distributed to specific airports around the country. Currently TSA is placing these devices either in the primary lane in parallel with the WTMD or in the secondary screening area downstream from the WTMD. The area required for these lanes ranges from 806-square feet per lane to as much as 856-square feet. Adding an additional 10 feet for passenger baggage reconciliation increases the total area to an average of 980-square feet.

For this analysis, an average of 1,020-square feet per lane (two x-rays per one WTMD) and an approximate queue depth of 50 feet have been used for both terminals.

Site observations of the TSA security screening checkpoint areas were conducted (interviews were not conducted with TSA staff). From these observations conducted in 2008 STL had four security checkpoints between the terminals consisting of a 1:1 module or one lane per one magnetometer. Terminal 1 has three checkpoint areas with 14 lanes; Concourse A has five lanes, Concourse B has two lanes), and Concourse C has seven lanes. Terminal 2 has one checkpoint area with four lanes.

With the closure of Concourse B at Terminal 1 in conjunction with the planned *Airport Experience Program* SSCP project, 15 lanes were used as the basis for the analysis at Terminal 1 using a 2:1 module configuration with five lanes at Concourse A and eight lanes at Concourse C. Terminal 2 added an additional two lanes for a total of six lanes.

The processing rates vary by airport and have been observed to range from approximately 100 passengers/lane/hour to over 200 passengers/lane/hour. Based on these numbers, an industry planning standard throughput of 180 passengers/lane/hour was used for future planning requirements. This is typical of what is being surveyed in the industry but STL should periodically review these as activity levels change.

Security screening lanes and area requirements are a function of the peak 10 minute throughput per number of required check-in positions. However, a number of dynamic factors can affect this known throughput from check-in such as use of self-service kiosks at ticketing, and passenger discretionary time after check-in (use of concessions, amount of time before flight departure, experience using the terminal, queue length, etc.). Based on this information, 50 percent of originating passengers in a peak 30 minute period of the Peak Hour factor was used. A 10-minute wait time along with a 20-minute queue capacity using a 15.1 square foot per passenger LOS C was also used for this analysis. Additional information about the LOS A analysis and results is provided in Appendix B, *Terminal Demand/Capacity and Facility Requirements*.

Circulation

The following categories represent the public circulation areas within the terminal and concourse areas that include the ticket lobby, baggage claim, secure circulation, general circulation, public seating areas, a domestic meeter/greeter lobby for arriving passengers, and non-public circulation. Each of these categories is described below. See Appendix B for further detailed analysis and results.

- Ticket Lobby Circulation - This category represents the unobstructed clear path within the ticket lobby extending from any seating and vestibules leading up to the ticket counter queue. It is generally used for cross-circulation from the ticket counter to the security checkpoint areas. Calculations are generally based on total linear counter length multiplied by an acceptable cross-circulation depth. Existing cross circulation depths for each terminal have been used in the analysis.

- Baggage Claim Circulation - This category represents the main circulation area adjacent to the claim area; a depth of 25 feet for the terminals was used for cross circulation along the full length of the claim area.

- Secure Circulation - This category represents all the area beyond the security checkpoint areas and consists primarily of the central corridor of the concourses and any adjacent egress stairs on the holdroom level. For future planning, 45-foot double loaded corridors (i.e. gate holdrooms on both sides of the concourse) were assumed; this is more or less a typical planning standard for longer concourses requiring moving walks. For areas not requiring assisted passenger movement a single loaded corridor of 20 feet is standard.

  The future calculated area is based on NBEG or an area per equivalent concourse length determined by gates. However, the actual amount of secure circulation will depend on the proposed concourse configurations and whether gates are located on one or both sides of the corridor. For Terminal 1 an existing calculated square feet per NBEG ratio of 1,800 (30 foot corridor with no moving walks) was used. For Terminal 2 an existing calculated square feet per NBEG ratio of 2,400 (20 foot corridor with no moving walks) was utilized.

- General Circulation - This area of the program includes all the other areas of circulation (secure and non-secure) that make up the public functions of the terminals and include areas such as vertical circulation elements, corridors, and any other architectural spaces that tie the functional public elements of the terminals together. Typical planning ratios range from 15 to 30 percent of the public serving spaces. Existing ratios of 23 percent and 15 percent were used for Terminal 1 and Terminal 2 respectively.

- Public Seating - This category includes the general waiting areas near the ticket lobby, baggage claim area, and concessions. The typical planning standard is to provide seating for approximately 15 percent of the Peak Hour departing passengers and their well-wishers along with the meeters/greeters for the Peak Hour arriving passengers. Because survey data was not available, a typical ratio of 0.10 visitor/passenger was used along with a LOS C standard of 15-square feet per seated passenger/visitor.
- Domestic Meeters/Greeters Lobby - This category includes the functional space required to accommodate the arriving passenger's meters/greeters in and around the baggage claim area of the terminal. The calculations include factors such as Peak Hour arriving passengers, visitor to passenger ratios, square feet/visitor, and average dwell time per arriving passenger and their visitors. For this analysis a typical 0.15 visitor to passenger ratio has been assumed along with a LOS C standard of 20.5-square feet per passenger+visitor factor. Dwell times for arriving passengers and visitors used were IATA standards of five minutes and 30 minutes respectively.
- Transportation (Shuttle Service) & Hotel Courtesy Phones – According to the building plans is appears Terminal 1 has approximately 100-square feet and Terminal 2 with 150-square feet of area allocated to this functional area which is located in each of the baggage claim areas. A typical planning standard of 90- to 110-square feet per 1,000,000 annual enplanements is used. For this analysis, a factor of 100-square feet has been used.

Restrooms

This category represents the area of public space allocated to passenger restroom facilities. The program has been divided between the non-secure (ticketing, baggage claim, and concessions areas) and secure (concourse areas beyond security) portions of the terminal and related concourses.

Restrooms by code should have as many toilets for women as toilets and or urinals for men. Based on the airport's lease drawings the majority of the restrooms have more fixtures for women than men with the exception of Concourse A at Terminal 1 where it appears to be equal. A typical planning standard of 50/50 is appropriate when the gender split is unknown; however, a 25 percent increase for women's fixtures has been assumed for the purposes of this analysis. Planning factors are based on a typical 2 to 2.5-square feet per Peak Hour total O&D passenger and their visitors for non-secure areas and providing a restroom module in the secure concourse areas for every eight EQA. The typical module for concourses serving O&D activity is 1,600-square feet which includes both men's and women's facilities

Other Space

This category accounts for miscellaneous and other tenant space which includes areas such as business centers, American Credit Union, Central Carts, Chapel, United Service Organizations, U.S. Postal Service, smoking lounges, etc. Other areas which are accounted for include display areas, information counters, Visitors Commission, etc.

For Terminal 1 an existing planning factor of 180-square feet per 100,000 annual enplanements has been assumed for the miscellaneous tenants and 30-square feet for the smoking lounges. An existing ratio 140 square feet per 1,000,000 annual enplanements has been assumed for the information counters and display areas.

For Terminal 2 an existing planning factor of 50-square feet per 100,000 annual enplanements has been assumed for the miscellaneous tenants and 50-square feet for the smoking lounges. An existing ratio of 50 square feet per 1,000,000 annual enplanements has been assumed for the information counters and display areas.

NON-PUBLIC SPACE

<u>Non-Airline Tennant Space</u>

This category includes the "back of house" area that is not accessible to the public and generally consists of areas such as airport administration (if not in a remote location), airport police, and any airport related offices and support space.

- <u>Airport Administration</u> - This category represents the total area devoted to airport administration/city space functions. It generally consists of reception areas, offices, conference rooms, storage areas, work areas, communication and incident control centers, rooms for special events such as VIP press conferences, and other airport related operations-related space such as paramedics and airport police. The requirements for airport administration are a function of staffing generated by the airport. This area is principally located in an office complex adjacent to the terminal however; some space can be allocated within the terminal area.
- <u>Other Tenants</u> - This category accounts for any other miscellaneous tenant space within the terminal area. A planning factor of square feet per 100,000 annual enplanements has been used for the analysis. A ratio of 130-square feet for Terminal 1 has been used which is a slight increase in the existing ratio and accounts for any future potential tenant additions. For Terminal 2 an existing 200-square feet ratio has been used. Future space requirements should be reviewed by the Airport.

<u>Other Space</u>

This category accounts for the non-public restroom facilities and circulation areas typically found in airline operations and airport administrative space. The majority of the non-public restroom facilities, which in some areas include locker space, are accounted for on the apron level of both terminal buildings and their concourses. The existing ratio of non-public space to non-public restrooms has been used for future planning requirements for both terminals.

The Non-Public Circulation area provides access to the airline operations, airport administration areas, concessions, support, and other areas typically not used by the traveling public. Typical planning standards base this on 10 to 15 percent of the non-public functional areas. Based on the STL CAD[7] drawings, the current ratios fall below this range for each of the two terminals. For the purpose of this analysis, a ratio of 10 percent of the non-public terminal space has been used. It should also be noted that this area of the program is often a matter of interpretation by the consultant as to whether or not to include this space in the public or non-public category.

Terminal Functions

This category accounts for all the mechanical, electrical, utility, janitorial, storage, and shop areas as well as the structure and non-net areas of the building. These areas combined with the other functional areas of the terminal and concourse locations create the total gross footprint of the building.

Maintenance/Janitorial/Storage/Shops – This category accounts for the building maintenance facilities and consists of shops, storage, office space, circulation, and janitorial closets. Typical planning standards require one to two percent of the total functional areas. For this analysis one percent has been used which in an increase over the existing ratio range of 0.4 percent to 0.8 percent for Terminals 1 and 2 respectively.

Mechanical/Electrical/Telephone/Plumbing – This category of the program includes all the utility support areas for the terminal and is generally a percentage of the enclosed functional areas of the terminal, typically 10 to 12 percent. Recent trends in computer systems, telecommunications, and other building related systems have increased the demand for these areas within the terminal building. Some of these areas can be accommodated in the airline operations area whereas common use systems need to be located in the airport controlled areas. The existing ratio of 12 percent was used in the analysis.

Building Systems (Structural/Non-Net/Void) – This category ties together the previous functional elements of the program to provide an estimate of the total gross building area. Unusable space or special structures often make up this category of the program. Depending on how the gross areas are determined, a factor of two to five percent is typically added for this category. The existing terminal gross area was taken from the airport terminal CAD drawings. All functional elements were then added together and subtracted from the overall gross area footprint per terminal to calculate the non-net areas of the two buildings. The existing ratios of three percent and two percent for Terminal 1 and Terminal 2 respectively were used for the analysis.

[7] CAD is Computer-Aided Design.

4.4.4.3 Summary of Terminal Building Requirements

Analysis of these programs reveals when future demand levels may potentially exceed current terminal capacities and when additional terminal infrastructure would need to be in place. This however is linked to the actual realization of passenger and operations activity when demand volume exceeds capacity thresholds or "trigger points." Crossing a capacity threshold triggers the need to begin planning, design, and the construction process to replace facilities in time to meet the growing passenger demand levels. Replacement can also be triggered by the need to supplant the aging infrastructure and their growing functional obsolescence such as those found in certain portions of Terminal 1.

The future program may assume greater efficiencies by consolidating any of the functions that may be replicated by the current operational layouts of the two terminals. Although each analysis shows no additional capacity-driven space there may be a need for re-allocated space for demand as described below. **Table 4.4-22, *Summary of Recommended Facilities***, summarizes the gate and space needs by terminal.

Table 4.4-22
SUMMARY OF RECOMMENDED FACILITIES
Lambert-St. Louis International Airport

	BASE YEAR ACTIVITY			RECOMMENDED FACILITIES			
	2010			2013	2018	2023	2028
	Full Capacity	Operational Capacity	Utilized Capacity				
Terminal 1 Gates							
Building Program (square feet)	**72**	**45**	**23**	**29**	**31**	**33**	**35**
	1,254,100	984,400	823,600	663,600	694,400	741,900	807,300
Terminal 2 Gates							
Building Program (square feet)	**16**	**15**	**13**	**12**	**13**	**14**	**15**
	348,400	348,400	338,000	287,900	308,400	337,500	353,400

Source: Landrum & Brown analysis, 2011

Terminal 1 currently has a gross terminal area of approximately 1,254,100 square feet. With the closure of Concourses B and D, the operational capacity has decreased to approximately 984,400-square feet of which approximately 823,600 is currently utilized. By the 2028 demand year a total gross Preferential Use terminal area of 807,300-square feet is required which although below current available capacity, the age of the existing terminal infrastructure will need to be considered in the evaluation of potential expansion or redevelopment alternatives. Specific areas of the existing terminal however are undersized to meet future demand activity such as secure concessions storage, non-secure public seating, domestic meter/greeter area, non-secure restroom areas and circulation space, and maintenance/janitorial/storage shops.

Terminal 2 currently has a gross terminal area of approximately 348,400 square feet of which approximately 338,000 is currently utilized. By the 2028 demand year, a total gross Preferential Use terminal area of 353,400-square feet is required which is slightly above the current available capacity. Some areas of the existing terminal are undersized to meet the future demand activity such as domestic airline passenger (baggage claim) and operational support space, security screening functions, restrooms, and non-airline tenant space.

In some cases, the deficiencies can be converted from excess space within the terminal program. Some of the types of conversions include:

- Converting excess operations space to airline offices (station managers, accounting, etc.)
- Expanded baggage claim into circulation space provided adequate clearances and corridor widths are maintained
- Concessions support space may be accommodated by moving some of the Airport maintenance functions which are not directly required in the terminal area to another on-airport location
- Baggage make-up and or EDS screening can sometimes be converted from operations space, which in turn may require the relocation of existing operation functions and lease changes

The re-use of space within the terminal must always be studied and evaluated before making a simple subtraction of existing from future programmed gross terminal areas.

A typical method for comparing airport terminal programs with similar characteristics is Gross Terminal Area per NBEG. However, this should be done with careful thought and consideration as the terminal configuration can greatly affect the area per gate calculation. Such factors include extensive basements associated with baggage handling, Automated People Mover systems, and multiple unit terminals that generate a higher area per NBEG ratio than airports with fewer terminals and similar gate capacity. A typical range for new individual terminal programs can be anywhere from 15,000-square feet per NBEG for smaller domestic terminals to more than 24,000-square feet per NBEG for larger domestic terminals. International terminals can have well over 35,000-square feet per NBEG. Mixed domestic/international terminals will typically fall within the large domestic terminal range. These ratios however are increasing given the larger area requirements for certain processing functions for passengers and baggage and should be used for comparative purposes only. Terminal 1's 2028 Preferential Use demand level equated to an area of 25,500-square feet per NBEG. Terminal 2's 2028 demand level resulted in a 23,800-square feet per NBEG ratio resulting from an increase in Southwest's future passenger and aircraft operations forecasted to fill the capacity left by American's de-hubbing operation.

4.5 AIR CARGO

Cargo operations at STL have changed significantly over the last two decades as the amount of belly cargo and overall cargo has steadily declined. The current fleet at STL includes two express carriers, Federal Express (FedEx) and United Parcel Service (UPS), and an all-cargo carrier, Capitol Cargo International Airlines operating as a subsidiary to ABX Air. In addition, the passenger airlines offer belly cargo; these include American Airlines, United Airlines, Delta Airlines, US Airways, Southwest Airlines, and the various airlines operating under code-share and marketing agreements with the network carriers. There are also multiple freight forwarding operations at STL, including JetStar Aviation, Brendan Airways, Burlington Air Express (BAX), Integrated Airline Services (IAS), and Forward Air.

Sources such as the FAA and International Air Transport Association (IATA) produce guidelines to help airport planners to right-size cargo facilities. STL's existing cargo facilities, especially those developed after the advent of express carriers, reflect some of these planning models. Given the variety of business models (and operational needs therein) entailed in the air cargo industry, however, there is no "one size fits all" approach to cargo facilities planning. Principally, the operational differences are between carriers using airport cargo terminals as pipelines from airside to landside versus those using on-airport spaces for actual sorting. For example, the FedEx network has traditionally been oriented toward on-airport sort centers. Having only later developed its trucking resources, ground hubs were developed independently off-airport. In contrast, UPS, which operated solely as a ground delivery company for decades, has typically minimized its on-airport building requirements while utilizing as much ramp as possible.

The designated air cargo facilities at STL are located in two primary areas; North Cargo Area located in the northeast portion of the Airport, and Cargo City Area located in the southeast portion of STL along Air Cargo Road. Combined, these facilities have a total of 269,210 square feet of building space and 675,180 square feet (15.5 acres) of ramp space as shown in **Table 4.5-1, *Existing Cargo Space***.

In the North Cargo Area, Fedex operates in a multi-tenant building occupying 57,400 square feet of warehouse and 465,870 square feet of the contiguous ramp. Approximately 42,200 square feet of the building are occupied by other cargo tenants, predominately freight forwarders. UPS occupies its own facility with 17,480 square feet of warehouse and 209,310 square feet of ramp. In total, between the two cargo facilities there are 117,080 square feet of building space and 675,180 square feet (15.5 acres) of ramp space.

In the Cargo City Area, there is a combined 152,130 square feet of building space between six facilities with no dedicated airside cargo apron area. The lack of dedicated ramp space is a function of the different handling process for belly haul cargo. Carriers such as ABX use the Juliet pad to off-load and load containerized cargo that is transferred from truck to plane.

Table 4.5-1
EXISTING CARGO SPACE
Lambert-St. Louis International Airport

CARGO FACILITY	WAREHOUSE/SORT SPACE (SQUARE FEET)	RAMP SPACE (SQUARE FEET)	RAMP TO WAREHOUSE RATIO
Haith cargo building (FED EX and freight forwarding companies	99,600	465,780	4.67 : 1 total 8.1:1 Fed Ex only
UPS Cargo Facility	17,480	209,310	12 : 1
Cargo City	152,130	-	No dedicated ramp space

Sources: 2008 STL ALP and Landrum & Brown analysis, 2011

Multiple indicators run contrary to aggressive expansion at STL. Most obviously, cargo volumes at STL have been on an almost continuous downward trend since 1999 and forecasted cargo volumes (see **Table 4.5-2, *Historical and Forecast Air Cargo Volumes (Metric Tonnes)***) show future volumes not surpassing STL's historical peak year (2002) during which 134,000 metric tonnes were handled. The total volume projected by year 2028 is little less than the amount STL accommodated with its existing facilities; however, the change in distribution between all-cargo and belly cargo over time is significant.

Table 4.5-2
HISTORICAL AND FORECAST AIR CARGO VOLUMES (METRIC TONNES)
Lambert-St. Louis International Airport

CALENDAR YEAR	ALL-CARGO TONNAGE	BELLY TONNAGE	TOTAL AIR CARGO TONNAGE
1999	85,596	45,461	131,057
2000	87,122	43,045	130,167
2001	87,794	33,666	121,460
2002	82,925	51,942	134,868
2003	85,843	32,657	118,500
2004	87,669	17,289	104,958
2005	88,793	12,400	101,192
2006	78,190	10,692	88,883
2007	74,491	8,760	83,251
2008	71,924	9,155	81,080
2009	66,495	7,675	74,170
2013	74,360	8,480	82,840
2018	86,290	8,720	95,010
2023	97,830	8,630	106,460
2028	110,900	8,370	119,270

Source: Landrum & Brown analysis, 2011

The IATA *Airport Development Reference Manual*, 9th edition, includes planning ratios, for cargo terminal buildings that are useful for long-term planning purposes. The three categories presented in the manual identify cargo-processing capacity per square meter for three levels of automation. Low automation yields 5 tonnes power square meter (0.46 tonnes per square foot), low automation yields 10 tonnes per meter (0.98 tonnes per square foot) and high automation yields 17 tonnes per square meter (1.58 tonnes per square foot). As previously indicated, STL presently has 269,210 square feet of total cargo terminal building space. While the level of automation varies from tenant to tenant, applying the function associated with "low automation" in IATA's model was used to produce a conservative estimate of capacity. STL's total current cargo terminal capacity between the North Cargo Area and Cargo City Area should accommodate approximately 123,835 metric tonnes of cargo, slightly above the forecast total cargo tonnage.

According to IATA's cargo planning model, "the apron size for all cargo facilities lies in the range of 4 to 5 times that of the cargo terminal building area." This includes aircraft stands, internal taxilanes, airside roads, ground service equipment parking, and processing zones on the apron. With 675,180 square feet of ramp in the North Cargo Area, STL currently has a ratio of 5.7 to 1, slightly higher than the recommendation and indicative of the fact that the facilities were built to meet the needs of the express package carriers.

Analysis suggests that STL does not require a significant amount of additional ramp space for the period covered in the cargo forecasts. As with projecting cargo terminal area requirements, however, significant variables exist for ramp utilization. Most obviously, the same ramp may be used for multiple "turns" each day. At a non-hub spoke like STL, a carrier may park an aircraft all day until it departs after the evening cut-off, or it may continue to another spoke market after being unloaded at STL. As with "dwell-times" for cargo, the number of "turns" for ramp space is critical.

STL's cargo carriers have options in responding to growth in demand. As previously explored, the integrated carriers that accounted for much of the cargo growth at STL in recent decades have maximized their utilization of trucks to accommodate as much growth as possible in the relatively slow-growth US market. Moreover, rather than dedicating additional aircraft to STL, carriers might allocate a larger aircraft - possibly shared with another city, requiring a quicker turn. While a larger aircraft consumes more ramp space, it still may be considerably less than two smaller aircraft. Again, much depends on how long the carrier elects to leave the aircraft on the ground.

Although the forecast does not project a significant need for additional cargo facilities, it should be noted that the current cargo operators on the airfield occupy the facilities suitable for a true cargo operation. Space is available in Cargo City; however, the lack of directly adjacent ramp space will preclude many cargo operators from considering the facility as a viable alternative. Although the ultimate plan for the Aeroterm development at the site of the former Boeing manufacturing facility is not known, the Airport must consider the need for potential cargo expansion in the long term if demand beyond the levels identified in the forecast materializes. The ongoing discussions between representatives of the Greater St. Louis business community and representatives from the People's Republic of China underscore the need to look beyond the forecast models. Although no formal agreements have been announced, there appears to be significant movement toward attracting an Asian cargo operation to STL. The existing cargo facilities are not appropriately configured to handle such an operation, and accommodating such an endeavor will require at a minimum, improvement to the taxilanes in the North Cargo area to accommodate Design Group V aircraft. If a larger international cargo presence materializes the Aeroterm site as well as the Brownleigh area, east of the existing North Cargo facilities, are appropriate candidate sites for cargo expansion. At a minimum, the international cargo facilities would include ramp area, building for sorting and short term warehousing with truck docks, sufficient area for truck movement, inspection facilities, GSE vehicle maintenance and support and associated office and support facilities.

4.6 GENERAL AVIATION (GA)

Two Fixed Base Operators (FBO) at STL serve the general aviation community. Signature Flight Support provides a full array of services including ground support, fueling, tie-downs, hangar space, shuttle service, rental cars, lounging areas for flight crews and light maintenance. ATS JetCenter provides similar services, though is not able to provide light maintenance or hangar facilities given its current facility.

The Signature Flight Support facility is located in the Northeast Airfield off John S. McDonnell Boulevard, just south of North Cargo Area and southeast of the Boeing facilities. The GA apron includes only one distinct area for based aircraft parking. The GA terminal area consists of one terminal building that is 5,638 square feet in area, and four hangars totaling 106,223 square feet. Signature Flight Support staff indicate 12 aircraft were based in the four hangars, which is approximately 75 percent of the available total capacity.

The ATS JetCenter facility is located in the Northwest Airfield, immediately adjacent to Trans States maintenance facility and former Boeing low/high bay hangar. The GA area consists of a 1,929-square-foot office building, a 38,871-square-foot parking area, and 50,000-square-foot ramp area. The total space for the two facilities is used as the basis for the determination of space requirements over the planning period. As shown on **Table 4.6-1, *General Aviation Facility Requirements***, due to the slight increase in projected GA operations over the planning period, there is no forecast need for expansion of the land area dedicated to FBO facilities. Although ramp space and parking space are sufficient for the long term-needs, there is a need for additional hangar space.

For long-term planning considerations, planning space for additional facilities is recommended. The need for GA space is difficult to forecast, and needs generally arise based on changes for a small population of users. With only one facility on the airfield providing hangar space to General Aviation and Corporate Aviation users it is difficult to estimate the true demand for these facilities as users have no option at STL and are left with little room to negotiate. Although these users require premium on-airport locations with good access to the airfield, the inability, or perceived inability, to negotiate may drive them to other airports in the region.

Further, the reduction in operations has the potential to increase the attractiveness of STL to General Aviators and Corporate Aviation Departments. During the peak of the TWA/American Airlines hub operations, the increased block time associated with delays due to the high level of commercial airline operations would certainly factor into the decision to use one of the surrounding airports rather than STL. While the General Aviation operations at STL dropped during the period from 1995 to 2000, the activity at surrounding airports increased. In the past few years the trend has turned to the positive and GA operations at STL have increased, a trend that would certainly be stimulated with the addition of expanded choices for corporate and general aviation users.

Table 4.6-1
GENERAL AVIATION FACILITY REQUIREMENTS
Lambert-St. Louis International Airport

	GA/ MILITARY	AREA REQUIRED PER			Hangar				GA Apron				AUTO PARKING[2]			
	PMAD[1]	PMAD OPERATION (SQ FT)			AREA REQUIRED		SURPLUS (DEFICIT)		AREA REQUIRED		SURPLUS (DEFICIT)		AREA REQUIRED		SURPLUS (DEFICIT)	
YEAR	OPERATIONS	GA TERMINAL	APRON	PARKING	SQUARE FEET	ACRES	SQUARE FEET	ACRES	SQUARE FEET	ACRES	SQUARE FEET	ACRES	SQUARE FEET	ACRES	SQUARE FEET	ACRES
Actual																
2008	70	1,300	2,400	1,280	91,032	2.09	22,758	0.5	168,000	3.8	171,071	3.9	89,600	2.1	137,795	3.2
Forecast																
2013	80	1,300	2,400	1,280	104,037	2.38	9,753	0.2	192,000	4.4	147,071	3.4	102,400	2.3	124,995	2.9
2018	92	1,300	2,400	1,280	119,642	2.74	(5,852)	(0.1)	220,800	5.1	118,271	2.7	117,760	2.7	109,635	2.5
2023	96	1,300	2,400	1,280	124,844	2.86	(11,054)	(0.3)	230,400	5.3	108,671	2.5	122,880	2.8	104,515	2.4
2028	102	1,300	2,400	1,280	132,647	3.04	(18,857)	(0.4)	244,800	5.6	94,271	2.2	130,560	3.0	96,835	2.2

	Square Feet	**Acres**
2008 Hangar Area Available:	113,790	2.6
2008 Parking Available:	227,395	5.2
2008 Apron Space Available:	339,071	7.8

Notes: 1 PMAD - Peak Month Average Day
2 Parking requirements include circulation area.

Source: 2008 Airport Layout Plan Update and Landrum & Brown analysis, 2011

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4.7 AIRPORT AND AIRLINE SUPPORT FACILITIES

4.7.1 AIRCRAFT FUEL STORAGE

The commercial passenger aircraft fuel storage facility is located in the southeast quadrant of airport property, at the intersection of Airport Exit Road and Lambert International Boulevard. It consists of twelve 60,000-gallon tanks and twenty-nine 30,000-gallon tanks of Jet-A fuel. Assuming a 15 percent reduction of total tank capacity to account for expansion, fuel quality and safety the total capacity for all 41 tanks is 1.35 million gallons

The Jet-A fuel arrives at the facility via two separate underground supply lines, which are able to directly fill the 30,000-gallon tanks. To protect the quality of the fuel in the hydrant system, the 60,000-gallon tanks are not directly connected to the underground supply lines, and the fuel must be pumped from the 30,000-gallon tanks to the 60,000-gallon tanks that supply the hydrant fueling system. Once the fuel reaches the fuel hydrants, fueling trucks distribute the fuel to the aircraft. Allied Aviation regularly maintains a four-day supply of Jet-A fuel. Future commercial fuel farm requirements are shown on **Table 4.7-1, *Commercial Fuel Storage Requirements***. To maintain a four-day supply of fuel as operations increase in the future, further expansion beyond the 2.4-million-gallon capacity will be needed by 2013. Given the redundant supply lines to the facility and the fact that tanker trucks are not incorporated into the system, however, it is reasonable to assume that a three-day supply of JET-A is sufficient to serve the needs of the commercial passenger aircraft.

TABLE 4.7-1
COMMERCIAL FUEL STORAGE REQUIREMENTS
Lambert-St. Louis International Airport

Year	Gallons Per PMAD[1] Departures (gallons)	Commercial PMAD Departures[2]	PMAD Demand (gallons)	Storage Requirements 4 Day Supply (gallons)	Storage Requirements 3 Day Supply (gallons)	Surplus/ (Deficit) 3 Day Supply (gallons)
Actual						
2008	1,194	333	338,500	1,352,000	1,014,000	-
Forecast						
2013	1,360	275	316,250	1,265,000	948,800	403,200
2018	1,390	297	346,905	1,387,600	1,040,700	311,300
2023	1,420	321	381,990	1,528,000	1,146,000	206,000
2028	1,450	341	412,005	1,648,000	1,236,000	116,000
	2008 Storage Available (gallons): [3]		1,352,000			

Notes: 1 PMAD – Peak Month Average Day
2 Commercial PMAD departures do not include cargo, non-commercial air taxi, general aviation, or military departures.
3 Fuel storage capacity includes central fuel farm, but does not include general aviation fuel tanks or North Cargo area fuel storage. The stated tank capacity has been reduced by 15 percent to accommodate reductions necessary for safety, fuel expansion and product quality.

Sources: Lambert Airport, Airport Terminal Service, and Landrum & Brown analysis, 2011

4.7.2 FUELING SERVICES MAINTENANCE

The STL Airport fueling service operations are located west of Terminal 1 and consist of two buildings. Building 308 is 7,092 square feet in size and is used for the maintenance of fuel service vehicles. Building 309 houses the offices for the administrative support of the operations and occupies 3,239 square feet of floor space. Immediately adjacent to Buildings 308 and 309 there is an approximate combined area of 75,350 square feet allocated for parking. This area includes 60 standard-size parking spaces and six oversized parking spaces for large trucks. Landside accessibility to these buildings is provided via Airfield Service Road via Lambert International Boulevard. Airport airside accessibility to the maintenance facilities is provided by an airport service road that connects to the terminal apron located west of Concourse A at Terminal 1. Discussions with staff indicate that the facilities are sufficiently sized to accommodate the fuel service vehicle maintenance and administration for the demand levels forecast through the planning period.

4.7.3 GROUND SERVICE EQUIPMENT

Ground service equipment (GSE) is stationed at and around the terminal gates for the servicing of passenger aircraft. For cargo aircraft, they are stationed in designated GSE areas on each operator's aircraft ramp. For FBOs, GSE maintenance is accommodated within their existing maintenance building or on the adjacent aircraft apron. Commercial airline GSE maintenance occurs within the maintenance facility in Cargo City, Cargo Building 1 and at the airline ground service vehicle maintenance facility, which is situated directly west of the main power plant and cooling towers. Discussions with airline staff indicate that the existing facilities are sufficient to service current and future needs through the planning horizon.

4.7.4 AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)

Currently, there are two ARFF facilities at STL that house personnel and equipment. First, the North ARFF station, a 10,075 square-foot facility, is situated north of Runway 12L/30R and southeast of the Runway End 24. The facility has 10 vehicle bays. The West ARFF station, a 10,792 square-foot facility, is located on the north side of Runway 11/29. A third ARFF station, known as the South ARFF station, was closed in August of 2010. That facility had 9,580 square-feet of floor space and six vehicle bays. In total, there is approximately 20,800 square feet of active ARFF facility space at STL.

During the Master Planning process, a separate analysis conducted by the City of St. Louis determined the South ARFF station was unnecessary because the North and West ARFF stations together have the ability to respond to any emergency on any part of the airfield within the required 2-3 minute time frame. With the current equipment and staffing the ARFF facilities are suitable for Group V operations. Follow up discussion with the Fire Chief indicated that the size of the existing facilities is adequate, but minor cosmetic improvements will be needed over the planning period.

4.7.5 AIRFIELD MAINTENANCE

Airport maintenance facilities are concentrated in a centrally located area of the airfield, between the extended centerline of Runway 12L/30R and Runway 11/29 along Old Natural Bridge Road (now NAVAID Road). The maintenance campus includes five buildings. Building 401 is composed of three large structures that total 65,390 square feet in size and is used for the landscape equipment storage and warehousing/central stores. Immediately adjacent, along the west side of Building 401, is a 52,800-square-foot employee parking area. Building 402 has 6,642 square feet of floor space and contains office space and rooms suitable for employee training. Building 403 is used for vehicle maintenance, and has 16,455 square feet of floor space. Building 404 is a 17,323-square-foot facility that is also used for vehicle maintenance. Building 405 is used for asphalt and sand storage, and has 8,288 square feet of floor space. In total, this maintenance area encompasses a combined facility area space of 114,098 square feet on approximately 15 acres of land.

As currently configured, the facilities are not well designed for the equipment in the STL fleet. The do not include suitable storage facilities for the snow and ice removal equipment. The FAA recommends that all snow and ice removal equipment be stored indoors to extend the life of the equipment. Airport staff indicated that the existing maintenance facilities are not designed to accommodate the size of modern airport equipment, requiring some maintenance activity to be performed outside. Additionally, the maintenance facilities do not include a dedicated wash facility, which results in potential wastewater runoff. Finally, the office space for field maintenance personnel is housed in a separate building from the repair and storage facility, which reduces communication abilities and impacts efficiency. Given the age, poor layout, and condition of the buildings, opportunities should be explored to modify or replace these structures in the near- to mid-term. A plan to replace the facilities with a more modern facility should be considered to provide the space required to repair vehicles inside the building and provide suitable covered and heated storage for the equipment.

4.7.6 AVIATION FACILITIES MAINTENANCE

The primary aviation facilities maintenance support facilities are located in a 13,000-square-foot building south of Concourse A. From this facility, Airport employees service the terminal complex including heating, ventilation, and air conditioning (HVAC), elevators, baggage conveyors, and other mechanical systems. Discussions with Airport employees indicated that the location of central stores on the opposite side of the airfield causes a significant amount of lost time while employees drive to and from the terminal area to central stores. Employees estimate that the round trip can take up to an hour. A plan is being developed by Airport staff to relocate some of the central stores inventory to the vacant space located within Cargo City.

4.7.7 AIRCRAFT MAINTENANCE

Aircraft maintenance at STL is performed in six aircraft maintenance buildings with a combined building area of 292,971 square feet and land area of 586,513 square feet. American Airlines occupies five of the buildings located at the east of the Runway 29 approach. Conversations with airline representatives indicate that the future use of the American hangar is closely tied to the fleet operated by the airline. As the airline phases out its fleet of older narrow-body aircraft, the need for the maintenance facility at STL will diminish. While it is possible that the Airline will repurpose the facility for another aircraft type, the reduction in overall service at STL significantly affects the likelihood of any future redevelopment. The Trans States facility is located on the north side of the airfield adjacent to the former Boeing McDonnell Douglas facility. Trans States indicated that the existing facility would adequately serve their needs through the planning period.

4.7.8 AIRPORT POLICE, SECURITY, AND SAFETY

The STL Police Department is located on the Terminal 1 Level near door MT 18. This 1,850-square-foot facility supports the police and security functions including housing prisoner holding cells, storage for Segways, and a Threat Containment Unit. The majority of the police officers and administrative staff are located at the Terminal 1 office. The investigative unit of the Airport Police and a training facility are currently housed in the former Trademart retail building located north of Runway 11/29. The former Bridgeton City Hall building was in the process of being remodeled to accommodate the Airport Police during the completion of the Master Plan Update. It is anticipated that all functions of the Airport Police will be housed in the newly remodeled facility, vacating all existing space except the space in Terminal 1, which will remain as a satellite post of the Airport Police. It is anticipated that no additional space would be needed through the planning period.

4.7.9 FLIGHT KITCHENS

Although flight kitchens were once a staple on an airfield, particularly airfields with hub airlines, changes in the industry have significantly changed, and the separate flight kitchen facility is fading away at many airports. Whereas the airlines once provided a free meal or substantial snack consisting of a sandwich, fresh fruit and desert on most flights, the common practice now is to provide a small-prepackaged snack and choice of beverage. True meals are reserved for long haul flights and the demand for kitchen space is minimal. Discussions with Gate Gourmet indicated that their current 85,640 square-foot facility on Scudder Road is more than adequate to provide the estimated 900 meals they prepare each day and any growth that may come in the planning period. The other provider on the airfield, HMSHost, has recently vacated their on-airport flight kitchen and is utilizing their other restaurant facilities within the terminal building to prepare meals for flights. As with Gate Gourmet, the management of HMSHost indicated that their existing space would adequately serve their needs throughout the planning horizon.

4.8 TERMINAL CURB FRONT

Curb front demand is a product of passenger enplanements, mode share, passenger occupancy per vehicle, average dwell time, and vehicle. The curb fronts at the two passenger terminals at STL are segregated by the primary passenger type being served and the terminal function located closest to the curb. Each of the terminals is served by a ticketing curb (departing passengers) and baggage curb (arriving passengers). As currently configured, the two curbs are completely separate and exist at different physical elevations.

Upon entering the terminal area of Terminal 1, vehicles have the opportunity to choose to continue to the Departures Curb or the Arrivals Curb. Departing passengers in private vehicles, taxis, limousines, Airport Terminal Shuttles, or Superpark Shuttles proceed to the departures curb, which consists of two movement lanes with diagonal parking located to the driver's right with an additional movement lane adjacent to the building to permit pull through operations in the diagonal parking. As configured, this layout permits an easy flow of traffic and support double parking in the right hand movement lane during peak demand periods. The effective curb length on the ticketing level is actually 150 percent of the linear curb length, which is approximately 990 feet.

The arrivals curb for Terminal 1, located to the drivers left upon entering the terminal area, is lower than the departures curb and consists of five lanes with a pedestrian median located between lanes 3 and 4, where lane 1 is the unloading lane closest to the terminal building. In addition to private vehicles picking up arriving passengers, the arrivals curb serves rental car, hotel and off-airport courtesy shuttles serving both arriving and departing passengers. Taxis are not permitted to utilize the arrivals curb and are located in the parking garage on the yellow level. With two movement lanes (lane 2 and 3) supporting the curb closest to the terminal the effective length of that portion of the curb is increased. The outer curb, serving the rental car and off-airport parking providers, has a single movement lane and therefore, double-parking to load or unload passengers is not possible. The total effective curb length for the Terminal 1 arrivals curb is approximately 1,668 feet.

Passengers entering the Terminal 2 area encounter a similar curb front operation. Departing passengers in private vehicles, taxis, limousines, Airport Terminal Shuttles, or Superpark Shuttles proceed to the departures curb, which consists of two movement lanes with diagonal parking located to the driver's right with an additional movement lane adjacent to the building to permit pull through operations in the diagonal parking. Similar in configuration to the Terminal 1 departures curb the layout permits double parking in the right hand movement lane during peak demand periods. The effective curb length on the ticketing level is actually 150 percent of the linear curb length, which is approximately 915 feet.

The arrival curb for Terminal 2, located to the drivers left upon entering the terminal area, is located directly below the departures curb and consists of four lanes with a pedestrian median located between lanes 2 and 3, where lane 1 is the unloading lane closest to the terminal building. In addition to private vehicles picking up arriving passengers, the arrivals curb serves rental car, hotel and off-airport courtesy shuttles serving both arriving and departing passengers. The total effective curb length for the Terminal 1 arrivals curb is approximately 1,200 feet.

4.8.1 AIRPORT ARRIVALS

Table 4.8-1, *Curbfront Demand Capacity Analysis Terminal 1 – Ticketing Curb*, shows the 2008 curb front demand during a peak hour for the Ticketing level of Terminal 1. **Table 4.8-2, *Curbfront Demand Capacity Analysis Terminal 1 – Arrivals Curb***, shows the 2008 demand for the Arrivals level at Terminal 1. **Tables 4.8-3, *Curbfront Demand Capacity Analysis Terminal 2 – Ticketing Curb***, and **Table 4.8-4, *Curbfront Demand Capacity Analysis Terminal 2 – Arrivals Curb***, provide the same information for Terminal 2 Ticketing and Arrivals levels.

The curb front demand was determined using the methodology described in ACRP Report 25, *Airport Passenger Terminal Planning and Design,*[8] with slight modifications to account for the specific layout and curb front usage requirements at STL. Modal share and passenger occupancy assumptions used in the calculation is based on the results of the Customer Survey conducted during the *Airport Experience Program* (AEP) in 2006. Vehicle length and dwell times are based on analysis conducted for the AEP with slight modifications based on airport observations and FAA guidelines.

The peak 15-minute demand is compared to the existing capacity and assigned a Level of Service rank between A and E. The recommended planning level is Level C, which represents a curb front utilization of 55 percent to 65 percent of the available length in the peak 15-minute period. As shown in Tables 1.4-1 through 1.4-4, the Terminal 1 arrival curb and Terminal 2 Departure curb provided sufficient capacity to support the peak 2008 demand. However, the Terminal 1 departure curb and Terminal 2 arrivals curb did not provide sufficient curb length to serve 2008 demand at a suitable level of service.

The same calculations were applied to passenger enplanements for forecast demand to project future demand and capacity at the terminal curb front. The results of these calculations are shown in the following four tables: **Table 4.8-5, *Projected Curbfront Demand Capacity Terminal 1 – Ticketing Curb*, Table 4.8-6, *Projected Curbfront Demand Capacity Terminal 1 – Arrivals Curb*, Table 4.8-7, *Projected Curbfront Demand Capacity Terminal 2 – Ticketing Curb*,** and **Table 4.8-8, *Projected Curbfront Demand Capacity Terminal 2–Arrivals Curb***. These calculations show that existing arrival curb at Terminal 1 is sufficient for future passenger demand. However, the length available for departing passengers at both terminals and the arrival curb at Terminal 2 will need to be addressed through additional length or other potential alternatives to mitigate and or accommodate the excess demand.

[8] Airport Cooperative Research Program, ACRP Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook,* Transportation Research Board of the National Academies, Sponsored by the Federal Aviation Administration, Washington, DC, 2010.

Table 4.8-1
CURBFRONT DEMAND CAPACITY ANALYSIS TERMINAL 1 – TICKETING CURB
Lambert-St. Louis International Airport

Vehicle Type	Design Hour Demand in Vehicles	Peak 15 Minutes as % of Demand	Vehicle Dwell Time (min.)	Multiple Stop Factor	Peak 15 Min. Demand in Minutes	Vehicle Length (ft)	Peak 15 Min. Demand (ft* min.)	Peak 15 Min. Demand (ft)
Private Auto	257	**77**	2.0	1.0	**154**	20	**3,089**	**206**
Rental Car Shuttle*	0	**0**	2.7	1.0	**0**	35	**0**	**0**
Taxis	51	**15**	3.0	1.0	**46**	20	**913**	**61**
Limousines	30	**9**	3.0	1.0	**27**	30	**822**	**55**
Hotel Shuttles*	0	**0**	2.6	1.0	**0**	35	**0**	**0**
Airport Shuttles*	48	**14**	2.6	1.0	**37**	35	**1,310**	**87**
Off Airport Parking	54	**16**	2.8	1.0	**45**	35	**1,588**	**106**
Paid Shuttle	11	**3**	2.7	1.0	**9**	35	**303**	**20**
Total	**451**	**135**	n/a	n/a	n/a	n/a	n/a	**535**

Existing Curbfront Length	660	ft	Existing Capacity Ratio	**0.54**	
Effective Parking Capacity**	**990**	ft	Existing Level of Service (LOS)	**B**	
			Required LOS 'C' Curbfront Range = from	**549**	ft
			to	**649**	ft

* Demand based on shuttle frequency of 1 every 5 minutes per operator for rental car and parking shuttles and 1 every 20 minutes for hotel operators
** Assumes diagonal parking configuration with ability to double park behind diagonally parked vehicles during peak periods

Source: Landrum & Brown analysis, 2011

Table 4.8-2
CURBFRONT DEMAND CAPACITY ANALYSIS TERMINAL 1 – ARRIVALS CURB
Lambert-St. Louis International Airport

Vehicle Type	Design Hour Demand in Vehicles	Peak 15 Minutes as % of Demand	Vehicle Dwell Time (min.)	Multiple Stop Factor	Peak 15 Min. Demand in Minutes	Vehicle Length (ft)	Peak 15 Min. Demand (ft* min.)	Peak 15 Min. Demand (ft)
Private Auto	258	**77**	2.0	1.0	**155**	20	**3,096**	**206**
Rental Car Shuttle*	84	**25**	2.7	1.0	**68**	35	**2,381**	**159**
Taxis	0	**0**	3.0	1.0	**0**	20	**0**	**0**
Limousines	31	**9**	3.0	1.0	**27**	30	**824**	**55**
Hotel Shuttles*	120	**36**	2.6	1.0	**94**	35	**3,276**	**218**
Airport Shuttles*	48	**14**	2.6	1.0	**37**	35	**1,310**	**87**
Off Airport Parking	54	**16**	2.8	1.0	**45**	35	**1,588**	**106**
Paid Shuttle	11	**3**	2.7	1.0	**9**	35	**304**	**20**
Total	**605**	**182**	n/a	n/a	n/a	n/a	n/a	**852**

Existing Curbfront Length	1,305	ft	Existing Capacity Ratio	**0.65**	
Effective Parking Capacity**	**1,305**	ft	Existing Level of Service (LOS)	**D**	
			Required LOS 'C' Curbfront Range = from	**1311**	ft
			to	**1549**	ft

* Demand based on shuttle frequency of 1 every 5 minutes per operator for rental car and parking shuttles and 1 every 20 minutes for hotel operators
** Double parking not permited on baggage claim level

Source: Landrum & Brown analysis, 2011

Table 4.8-3
CURBFRONT DEMAND CAPACITY ANALYSIS TERMINAL 2 – TICKETING CURB
Lambert-St. Louis International Airport

Curbfront Demand Capacity Analysis

Vehicle Type	Design Hour Demand in Vehicles	Peak 15 Minutes as % of Demand	Vehicle Dwell Time (min.)	Multiple Stop Factor	Peak 15 Min. Demand in Minutes	Vehicle Length (ft)	Peak 15 Min. Demand (ft* min.)	Peak 15 Min. Demand (ft)
Private Auto	155	**46**	2.0	1.0	**93**	20	**1,859**	**124**
Rental Car Shuttle*	0	**0**	2.7	1.0	**0**	35	**0**	**0**
Taxis	31	**9**	3.0	1.0	**27**	20	**550**	**37**
Limousines	18	**5**	3.0	1.0	**16**	30	**495**	**33**
Hotel Shuttles*	0	**0**	2.6	1.0	**0**	35	**0**	**0**
Airport Shuttles*	72	**22**	2.6	3.0	**168**	35	**5,897**	**393**
Off Airport Parking	0	**0**	2.8	1.0	**0**	35	**0**	**0**
Paid Shuttle	6	**2**	2.7	1.0	**5**	35	**183**	**12**
Total	**282**	**85**	n/a	n/a	n/a	n/a	n/a	**599**

Existing Curbfront Length	610	ft	Existing Capacity Ratio	**0.65**	
Effective Parking Capacity**	**915**	ft	Existing Level of Service (LOS)	**C**	
			Required LOS 'C' Curbfront Range = from	**921**	ft
			to	**1089**	ft

* Demand based on shuttle frequency of 1 every 5 minutes per operator for rental car and parking shuttles and 1 every 30 minutes for hotel operators
** Assumes diagonal parking configuration with ability to double park behind diagonally parked vehicles during peak periods

Source: Landrum & Brown analysis, 2011

Table 4.8-4
CURBFRONT DEMAND CAPACITY ANALYSIS TERMINAL 2 – ARRIVALS CURB
Lambert-St. Louis International Airport

Vehicle Type	Design Hour Demand in Vehicles	Peak 15 Minutes as % of Demand	Vehicle Dwell Time (min.)	Multiple Stop Factor	Peak 15 Min. Demand in Minutes	Vehicle Length (ft)	Peak 15 Min. Demand (ft* min.)	Peak 15 Min. Demand (ft)
Private Auto	138	**41**	2.0	1.0	**83**	20	**1,654**	**110**
Rental Car Shuttle*	42	**13**	2.7	1.0	**34**	35	**1,191**	**79**
Taxis	27	**8**	3.0	1.0	**24**	20	**489**	**33**
Limousines	16	**5**	3.0	1.0	**15**	30	**440**	**29**
Hotel Shuttles*	120	**36**	2.6	1.0	**94**	35	**3,276**	**218**
Airport Shuttles*	48	**14**	2.6	1.0	**37**	35	**1,310**	**87**
Off Airport Parking	54	**16**	2.8	1.0	**45**	35	**1,588**	**106**
Paid Shuttle	6	**2**	2.7	1.0	**5**	35	**162**	**11**
Total	**451**	**135**	n/a	n/a	n/a	n/a	n/a	**674**

Existing Curbfront Length	1,120	ft	Existing Capacity Ratio	**0.60**	
Effective Parking Capacity**	**1,120**	ft	Existing Level of Service (LOS)	**C**	
			Required LOS 'C' Curbfront Range = from	**1037**	ft
			to	**1225**	ft

* Demand based on shuttle frequency of 1 every 5 minutes per operator for rental car and parking shuttles and 1 every 20 minutes for hotel operators
** Double parking not permited on baggage claim level

Source: Landrum & Brown analysis, 2011

Table 4.8-5
PROJECTED CURBFRONT DEMAND CAPACITY TERMINAL 1 – TICKETING CURB
Lambert-St. Louis International Airport

	Peak 15 Minute Curbfront Demand (feet)				
Vehicle Type	**2008**	**2013**	**2018**	**2023**	**2028**
Private Auto	206	149	169	180	193
Rental Car Shuttle*	0	0	0	0	0
Taxis	61	44	50	53	57
Limousines	55	40	45	48	51
Hotel Shuttles*	0	0	0	0	0
Airport Shuttles*	393	393	393	393	393
Off Airport Parking	0	0	0	0	0
Paid Shuttle	20	15	17	18	19
Total	**735**	**641**	**673**	**692**	**713**
Level of Service	D	C	D	D	D
Curbfront range (feet) for LOS "C" from	1131	986	1036	1065	1097
to	1336	1165	1224	1259	1297

Source: Landrum & Brown analysis, 2011

Table 4.8-6
PROJECTED CURBFRONT DEMAND CAPACITY TERMINAL 1 – ARRIVALS CURB
Lambert-St. Louis International Airport

	Peak 15 Minute Curbfront Demand (feet)				
Vehicle Type	**2008**	**2013**	**2018**	**2023**	**2028**
Private Auto	206	139	147	165	186
Rental Car Shuttle*	113	113	113	113	113
Taxis	0	0	0	0	0
Limousines	55	37	39	44	50
Hotel Shuttles*	146	146	146	146	146
Airport Shuttles*	262	262	262	262	262
Off Airport Parking	82	82	82	82	82
Paid Shuttle	20	0	0	0	0
Total	**885**	**779**	**790**	**813**	**839**
Level of Service	C	B	B	B	B
Curbfront range (feet) for LOS "C" from	1361.5	1198.8	1215.4	1250.4	1290.7
to	1609	1417	1436	1478	1525

Source: Landrum & Brown analysis, 2011

Table 4.8-7
PROJECTED CURBFRONT DEMAND CAPACITY TERMINAL 2 – TICKETING CURB
Lambert-St. Louis International Airport

	Peak 15 Minute Curbfront Demand (feet)				
Vehicle Type	**2008**	**2013**	**2018**	**2023**	**2028**
Private Auto	124	185	200	210	221
Rental Car Shuttle*	0	0	0	0	0
Taxis	37	55	59	62	65
Limousines	33	49	53	56	59
Hotel Shuttles*	0	0	0	0	0
Airport Shuttles*	393	393	393	393	393
Off Airport Parking	0	0	0	0	0
Paid Shuttle	12	18	20	21	22
Total	**599**	**701**	**726**	**742**	**760**
Level of Service	C	D	D	D	D
Curbfront range (feet) for LOS "C" from	921	1078	1117	1142	1169
to	1089	1275	1320	1349	1382

Source: Landrum & Brown analysis, 2011

Table 4.8-8
PROJECTED CURBFRONT DEMAND CAPACITY TERMINAL 2 – ARRIVALS CURB
Lambert-St. Louis International Airport

	Peak 15 Minute Curbfront Demand (feet)				
Vehicle Type	**2008**	**2013**	**2018**	**2023**	**2028**
Private Auto	110	148	164	174	184
Rental Car Shuttle*	79	79	79	79	79
Taxis	33	44	48	51	54
Limousines	29	39	44	46	49
Hotel Shuttles*	218	218	218	218	218
Airport Shuttles*	87	87	87	87	87
Off Airport Parking	106	106	106	106	106
Paid Shuttle	11	15	16	17	18
Total	**674**	**737**	**763**	**779**	**796**
Level of Service	C	C	C	C	C
Curbfront range (feet) for LOS "C" from	1040	1130	1170	1200	1230
to	1230	1340	1390	1420	1450

Source: Landrum & Brown analysis, 2011

4.9 PUBLIC PARKING REQUIREMENTS

Currently there are 8,873 public parking spaces available on-airport. As evidenced by the presence of numerous off-airport parking providers, a portion of STL passengers are not served by the value proposition presented by the existing Super Park facilities.

Future parking demand is based on the number of projected originating passenger enplanements (passenger trips beginning or ending at STL) as well as peak parking demand. According to Central Parking staff, the month of March is typically considered peak seasons in terms of the number of originating passenger enplanements. The number of originating passenger enplanements is also high during the months of November and December.

To determine the projected airport parking demand, current peak parking utilization rates per 1,000 originating passenger enplanements were calculated for each parking facility. This ratio indicates the number of spaces needed at each facility to satisfy parking requirements during periods of high parking demand. The peak parking utilization ratio can then be applied to each parking facility for the years 2013, 2018, 2023 and 2028 to illustrate projected parking demand. **Table 4.9-1, *2008 Peak Parking Utilization Ratio***, shows the peak parking utilization ratio for each parking facility assuming the current size and utilization of each facility.

Table 4.9-1
2008 PEAK PARKING UTILIZATION RATIO
Lambert-St. Louis International Airport

PARKING FACILITY	ACTUAL # OF SPACES	PEAK UTILIZATION (%)	PEAK UTILIZATION (# OF SPACES)	PARKING UTILIZATION RATIO[1]
Lot D	1,223	88%	1,071	0.19
Lot B	486	98%	474	0.08
Lot C	3,174	90%	2,841	0.50
Lot A	993	75%	745	0.13
Terminal 1 Garage	2,017	90%	1,815	0.32
Terminal 2 Garage	980	100%	980	0.17
Total	**8,873**	**N/A**	**7,545**	**N/A**

Note: 1 The parking utilization ratio is calculated as (Peak Utilization / # of Originating Passenger Enplanements) x 1,000. In 2008, the estimated number of originating passenger enplanements was 5,663,666.

Source: Central Parking statistics and Landrum & Brown analysis, 2011

As shown, the demand for garage parking and lots B and C was quite high during the peak period in 2008. This high level of utilization combined with the fact that many off-airport paring providers have entered the market providing in excess of 14,000 additional spaces, suggests that the current parking utilization ratio is somewhat understated, particularly for Terminal 2 garage parking and Lot B. It is reasonable to assume that the utilization ratio of the Terminal 2 garage would more closely resemble the Terminal 1 garage utilization if sufficient space were available.

Further, given the similar pricing strategies and relative proximity to Terminal 1, it is reasonable to assume that the Lot B utilization would more closely resemble Lot C. **Table 4.9-2, *Projected Parking Demand***, shows the total projected peak parking demand for the years 2013, 2018, 2023 and 2028. This was calculated by multiplying the adjusted peak parking utilization ratio of each facility by the projected number of originating passenger enplanements for each specific year. The product was divided by 1,000 to estimate the peak parking demand in each facility for each of the planning years.

Table 4.9-2
PROJECTED PARKING DEMAND
Lambert-St. Louis International Airport

Parking Facility	Current Peak Demand	Parking Utilization Ratio[1]	Projected Peak Parking Demand (# of Spaces)[1]			
			2013	2018	2023	2028
Lot D	1,071	0.19	1,119	1,228	1,350	1,471
Lot B	474	0.10	589	646	710	774
Lot C	2,841	0.50	2,946	3,232	3,552	3,871
Lot A	745	0.13	766	840	923	1,007
Terminal 1 Garage	1,815	0.32	1,885	2,068	2,273	2,478
Terminal 2 Garage	980	0.26	1,532	1,680	1,847	2,013
Total Demand	**7,545**	**N/A**	**8,837**	**9,695**	**10,655**	**11,614**
Originating Enplanements	N/A	N/A	5,891,500	6,463,200	7,103,000	7,742,800

Note: 1 The projected parking demand is calculated as: (# of Originating Passenger Enplanements for each Specific Year x Parking Utilization Ratio) / 1,000.

Source: Landrum & Brown analysis, 2011

According to these calculations, the projected peak parking demand in 2013 is 8,837; an increase of 1,292 vehicles. By 2028, the projected peak parking demand is 11,614; an increase of 4,069 vehicles. It is anticipated, based on these calculations, that there would be a shortage of on-airport parking spaces before 2013 during peak seasons. Regarding specific parking facilities, there would be a shortage of spaces during peak seasons in the Terminal 2 Garage before 2013. Presently, parking at Terminal 1 Garage is also near capacity. Furthermore, the Terminal 2 Garage is at capacity three days a week during peak seasons from 7 a.m. to 3 p.m. When Garage 2 is full, passengers tend to park in Lot A, the Terminal 1 Garage, or select an off-site parking provider.

It is important to provide enough parking spaces to serve those with longer-term parking needs. By 2018, the peak demand at Lot C and Lot D is anticipated to be greater than the existing supply; the peak demand at Lot B will be greater than the existing supply shortly after 2013; and the demand at Lot A will exceed supply between 2023 and 2028. Therefore, to meet the projected peak parking demand, additional parking spaces would be needed before 2013.

4.10 TAXI AND LIMOUSINE STAGING AREA

Taxis presently park in the two separate staging areas along Airport Cargo Road and Pear Tree Drive. Currently, the taxi staging areas are considered adequate to meet current passenger demands however; the location of the Terminal 2 taxi staging is less than adequate. In terms of surface area required the taxi staging areas are not sufficient for future passenger demands in 2013, 2018, 2023, and 2028. The increase in staging areas required will need to be located within close proximity to the Terminal 2 area to support the growth in operations at that terminal. The taxi and limousine staging area requirements are shown on **Table 4.10-1, *Taxi/Limo Staging Area Requirements***.

Table 4.10-1
TAXI/LIMO STAGING AREA REQUIREMENTS
Lambert-St. Louis International Airport

	SQUARE FEET PER ORIGINATED PASSENGER	ORIGINATING PASSENGERS	AREA REQUIRED		SURPLUS/ (DEFICIT)	
YEAR			SQUARE FEET	ACRES	SQUARE FEET	ACRES
Actual						
2008	0.01	5,663,666	67,534	1.6	-	-
Forecast						
2013	0.01	5,891,500	70,300	1.6	(2,800)	(0.1)
2018	0.01	6,463,200	77,100	1.8	(9,600)	(0.2)
2023	0.01	7,103,000	84,700	1.9	(17,200)	(0.4)
2028	0.01	7,742,800	92,300	2.1	(24,800)	(0.6)
		<u>Square Feet</u>	<u>Acres</u>			
2008 Area Available:		67,534	1.6			

Sources: 2008 Airport Layout Plan Update, "STL Forecast Sensitivity_AA Cuts," and Landrum & Brown analysis, 2011.

4.11 PUBLIC TRANSPORTATION/LIGHT RAIL

The Metro Transit-St. Louis Agency (Metro) operates three public bus services to STL via Routes 45, 49, and 66. Route 45 runs eight stops, various times per day, from 4:21 a.m. to 10:52 p.m. Monday through Friday. There is a wide range of how many times Route 45 stops at its destinations. Route 45 runs only two times per day at the Valley Industries stop, and up to 24 times to the Village Square Shopping Center stop. It operates in a loop between stops in Ferguson, Florissant, and Hazelwood with intermediate stops. The bus route stops at STL at the bus stop located at Airport Road/North Hanley Road. This route is designed to serve Airport employees and not the general air traveler market. Therefore, it is anticipated that public transportation will not have a significant impact on the future transportation network capacity at STL. Similarly, it is not anticipated that bus Routes 49 and 66 will have a significant impact on the STL transportation network.

Metro also operates a light rail service, MetroLink, from both Terminal 1 and 2 to Shiloh-Scott Station in St. Clair County, Illinois. MetroLink runs from 4:00 a.m. to 12:30 a.m. daily, and conducts six train operations per hour. Passenger pickup for MetroLink is located in Terminal 1 at exit door MT1, on the upper level east of the American Airlines Credit Union. In Terminal 2, the MetroLink passenger pickup is located south of the terminal accessible through the parking garage on all levels. The average daily boarding's at the Terminal 1 MetroLink Station is 3,978 people, and is 1,095 people at the Terminal 2 MetroLink Station. According to the passenger survey conducted in 2006, approximately three percent of all STL passengers use the MetroLink station. Without major changes to the MetroLink network planned, this percentage is expected to remain constant over the planning period.

4.12 SUMMARY

The support facility requirements analysis identified a few facilities that need to be considered in the alternatives phase of the master planning process. Air cargo facilities and general aviation facilities are well positioned to provide for the short- and mid-term needs of the existing tenants; however, consideration for long-term needs must be incorporated into any discussion of on-airport lands that afford direct access to the taxiway network including those currently under consideration for collateral development opportunities. Discussions of terminal alternatives need to consider the constraints and limitations associated with the arrival level curbfronts at Terminal 1 and to a lesser degree Terminal 2. The number of off-airport parking providers and hotels providing shuttle service places a significant demand on the existing facilities. Finally, the airfield maintenance facilities do not function at the level required for efficient operation nor do they provide the necessary facilities to house the snow removal equipment; alternatives for rehabilitation or replacement of these facilities will be addressed in the alternatives evaluations.

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