TECHNICAL MEMORANDUM

To: Eric Gilles
Metropolitan Airports Commission

From: William J. Schmitz, P.E.
Kimley-Horn and Associates, Inc.

Date: June 30th, 2022

Subject: ***MSP Airport 2040 LTP***
Future Landside Facility Requirements – Parking, Rental Cars, and Commercial Ground Transportation

CONTENT

1 OVERVIEW

This memorandum describes future landside parking, rental car, and commercial ground transportation (GT) facility requirements for the Minneapolis-St. Paul International Airport (MSP). This work is being completed as part of the MSP 2040 Long Term Plan (LTP). Kimley-Horn determined the future facility requirements using a data driven approach that incorporated parking and commercial vehicle data provided by the Metropolitan Airports Commission (MAC) and a rental car company survey.

Future landside facility requirements established in this technical memorandum will inform landside development alternatives.

2 PLANNING ASSUMPTIONS

2.1 Planning Activity Levels

Planning Activity Levels (PALs) based on projections of future annual enplanement activity were determined by Ricondo and Associates, Inc. as part of the MSP 2040 Long Term Plan Forecast Technical Memorandum dated November 2021. The PALs established in the MSP 2040 LTP forecast were used for the future requirements. The forecast enplanement values used for the landside requirements assume an aggressive recovery from the COVID-19 pandemic. Each PAL, estimated year, and corresponding activity are presented in **Table 1.**

Since landside facilities are only used by originating and departing (O&D) passengers, the projected enplanements were split between O&D enplanements and connecting enplanements. The *Forecast Technical Memorandum,* prepared by Ricondo & Associates, Inc., identifies that O&D passengers will vary to consist of between 59% and 63% of enplanements over the planning horizon.

Table 1. PAL Activity Summary

	Forecast			
	2019	**PAL 1 (2025)**	**PAL 2 (2030)**	**PAL 3 (2040)**
Passenger Aircraft Operations (000)	372.1	382.1	407.1	465.0
Enplaned Passengers (mil)	19.8	22.3	24.1	28.1
O&D Enplaned Passengers (mil)	12.1	13.6	14.6	16.7

Source: Ricondo & Associates, Inc., Forecast Technical Memo, Section 10 – Revised Baseline Forecast and DDFS Tables.

2.2 Design Day Flight Schedules

Design Day Flight Schedules (DDFSs), prepared by Ricondo & Associates, Inc., were used to determine peak hour activity through the planning horizon. The number of terminating passengers for the peak hour was determined using the summer design day flight schedule. The DDFS activity was adjusted using an early arrival curve and a late departure curve. Refer to the *Curbfront and Access Roadway Requirements Technical Memorandum* for curve description. The summer design day was used because passenger and flight peaking activity impacts commercial vehicle forecasts, which typically peaks during the summer. The number of arriving and departing flights in the peak hour were obtained directly from the Ricondo DDFS forecast. Since departing and arriving air traffic activity peak at different times throughout the day, the total number of peak hour flights indicates the peak of the combined originating and departing activity. **Table 2** presents projected peak hour activity at MSP, inclusive of activity at Terminal 1 and Terminal 2.

Table 2. Summer Design Day Peak Hour Activity

	2019 (1)	PAL 1	PAL 2	PAL 3
Terminating Passengers	4,668	3,724	4,470	5,767
Total Flights	99	102	103	124

(1) *Flight schedule from August 8th, 2019.*

Sources: Kimley-Horn and Associates, Inc.; Ricondo & Associates, Inc., Forecast Technical Memo, Section 10 – Revised Baseline Forecast and DDFS Tables.

2.3 Existing Landside Facility Requirements

The *Existing Landside Facility Requirements Technical Memorandum,* prepared by Kimley-Horn and Associates, Inc., served as the basis for the future landside facility requirements. For further details regarding methodologies utilized for existing requirements, refer to the *Existing Landside Facility Requirements Technical Memorandum* dated October 8, 2021.

2.4 Electric Vehicle (EV) Considerations – Public and Employee Parking

EV use has grown substantially over the past several years. The current EV fleet has driven an increasing demand for EV charging infrastructure. Kimley-Horn researched the goals for EVs set by the federal government, the State of Minnesota, and vehicle manufacturers to inform future EV utilization and potential infrastructure requirements.

2.4.1 Public Policy Research

2.4.1.1 US Government

Support for increased EV infrastructure is greatly supported by the Biden Administration, which has stated their intentions to invest $15 billion by 2030 to fund a nationwide network of over 500,000 EV charging stations[1]. In support of this goal, the FHWA launched its 5th round of "Alternative Fuel Corridors" to help install infrastructure that supports electric vehicle operations along the interstate system as well as state and local roadways. The Biden Administration has indicated that the national goal is for 50 percent of all new vehicles sales to be EV by 2030.

2.4.1.2 Minnesota State

In the 2019 *Pathways to Decarbonizing Transportation in Minnesota*[2] report, three EV sales growth scenarios were identified. The 80x50 scenario combines several strategies to achieve an 80% reduction in emissions by 2050 to meet the Next Generation Energy Act goal. The 100x50 scenario hopes to achieve a 100% reduction in emissions below 2005 levels by 2050. This scenario was explored to account for other sectors not reaching emission targets and to prevent catastrophic climate change. Given the current trajectory of emission reduction in Minnesota, the 80x50 scenario seems more realistic to achieve than the 100x50 goal. The 80x50 scenario would require 40% of new vehicles sales to be EV by 2030, and 80% by 2050.

[1] The White House, *Fact Sheet: Biden Administration Advances Electric Vehicle Charging Infrastructure*, 2021.

[2] Minnesota Department of Transportation, *Pathways to Decarbonizing Transportation*, August 2019.

2.4.1.3 Automotive Manufacturing

Many vehicle manufacturers have developed plans for EV market expansion in the next 5 to 15 years. Several auto manufacturers, including Hyundai, Jaguar, Lexus, Mercedes-Benz, and Volvo, have committed to have 100 percent EV sales by 2030. Others, such as BMW, Ford, Honda, Nissan, and Volkswagen, have stated that 40 or 50 percent of all their vehicle sales will be EV by 2030. All manufacturers with stated commitments to advancing EV sales anticipate 100 percent of their new vehicle sales to be EVs by 2040.

2.4.2 EV Fleet Projections

EVs currently represent a small percentage of total passenger vehicles on the road. In 2021, EVs represented only 1.33% of total registered vehicles in Minnesota. To estimate the number of EVs in the fleet through the planning horizon, three sales scenarios were explored. The scenarios were developed based on professional judgement and available research data. The assumptions of each scenario are described in **Table 3** and take into consideration national goals, auto manufacturer plans, and MN-specific goals.

Table 3. EV Sales Scenarios and Descriptions

Sales Scenario	Description	Assumptions
Scenario 1	National Goals	2030: EV sales account for 50% of all new vehicle sales. 2050: EV sales account for 100% of all new vehicle sales.
Scenario 2	Auto Manufacturer Plans	2030: EV sales account for 40% of all new vehicle sales. 2035: EV sales account for 80% of all new vehicle sales. 2040: EV sales account for 100% of all new vehicle sales.
Scenario 3	MN 80 x 50 Goal	2030: EV sales account for 40% of all new vehicle sales. 2050: EV sales account for 80% of all new vehicle sales.

Annual light-duty vehicle sales forecasts through 2050 were obtained from the U.S. Energy Information Administration[3] for the West North Central region. State motor vehicle registrations for 2020 were used to estimate the percent of vehicle sales in the West North Central region attributed to Minnesota residents[4]. This percent was assumed to stay constant through the planning horizon. Using these scenarios, historical data, and the projected vehicle sales information, the number of EVs on the road and the total number of registered vehicles was estimated. Vehicles were assumed to reach their end of life based on a normal distribution with a mean of 15 years and a variance of 5 years. The total number of registered vehicles in Minnesota is anticipated to decrease for the next 10 to 15 years, as consistent with historical trends, to approximately 1.5 million registered vehicles in 2040.

Kimley-Horn recommends planning for Scenario 2 for EV adoption and fleet percentages through 2030. The auto manufacturers will be a driving force in the adoption of EVs as they control the types and quantity of EVs and conventional internal combustion engine vehicles that are available. Kimley-Horn recommends planning for Scenario 3 after 2030 since this reflects the stated goals for Minnesota and is supported by

[3] U.S. Energy Information Administration, *AEO2022 National Energy Modeling System* (accessed April 2022).
[4] U.S. Department of Transportation, Federal Highway Administration, *State Motor-Vehicle Registrations – 2020*.

current policy. **Table 4** presents the details of each sales scenario and the Kimley-Horn recommendation. The recommended values will be used later in this document for EV charger planning recommendations.

Table 4. EV Fleet Percentage in Minnesota

Year	Total Projected Vehicle Fleet [(1)]	EV Fleet (Percent Total Fleet)			
		Scenario 1	Scenario 2	Scenario 3	Recommendation
2019		0.44%			
2020		0.57%			
2021		0.84%			
2025 (PAL 1)	1,900,384	3.5%	3.1%	3.1%	3.1%
2030 (PAL 2)	1,652,872	14.9%	12.3%	12.3%	12.3%
2040 (PAL 3)	1,563,340	52.3%	60.4%	42.0%	42.0%

[(1)] *Total vehicle fleet only includes light-duty vehicles. The electrification of trucks was not analyzed as part of this study.*

2.5 EV Considerations – Rental Car Agencies

Similar to public and employee parking, rental car fleets will transition from internal combustion engine (ICE) vehicles to primarily EVs. The percent EVs in the rental car fleet will differ from the public and employee parking fleet because of a shorter rental car fleet vehicle lifespan. Rental car agencies operating at MSP are contractually obligated to replace vehicles every three years. This will increase the percent EVs in the rental car fleet faster than the public.

Rental car agencies have stated a business desire to convert their fleets to EVs, including one large national brand planning to convert their entire fleet by 2025. Aggressive corporate goals may not immediately manifest in greater rates of EVs within the fleet, but the trend towards fleet electrification should not be diminished due to the significant electrical loads associated with maintaining an all-EV fleet.

Kimley-Horn recommends planning for aggressive EV fleet growth at MSP, consistent with Scenario 1 identified in Section 2.4.2 above. **Table 5** presents the Kimley-Horn recommended rental car EV fleet projection. The recommended values will be used later in this document for EV charger planning recommendations.

Table 5. Rental Car EV Fleet Percentage

	EV Fleet (Percent Total Fleet)
2025 (PAL 1)	19%
2030 (PAL 2)	53%
2040 (PAL 3)	96%

2.6 Autonomous Vehicles (AVs)

Autonomous vehicles (AVs) have been a topic of great discussion in the transportation industry for the last couple of years. However, the discussion surrounding AVs has since subdued. While the technology for some levels of autonomy is available, legal and liability issues are currently being discussed. The regulatory

environment for how AVs would operate within the general fleet is also undefined. Currently, vehicles with autonomy Levels 1 and 2 are commercially available. Vehicles with Level 1 automation require the human to drive the vehicle but the vehicle may support the driver with features such as lane centering or adaptive cruise control[5]. Experts predict that it will take at least 20 years or more until Level 4 and Level 5 vehicles are available to consumers. Level 5 vehicles are fully autonomous vehicles that can drive everywhere in all conditions without human assistance or supervision[5]. Since cars can have a life span of up to 30 years, the ubiquitous adoption of AVs can lag significantly behind when these vehicles are first introduced so the widespread implementation of fully autonomous vehicles is likely to occur much after 2040. Airport roadway networks are also particularly complex for wayfinding and navigating. As such, this study assumes that AVs will not have a significant impact on future facility requirements through 2040. MAC should continue to monitor the trends in the AV industry to be able to prepare for facility improvements to accommodate AVs when/if the time comes.

3 PARKING REQUIREMENTS

The MSP public parking ramps accommodate both public parkers and a subset of airline, tenant, and concessionaire employees. Additional public and employee parking supply is currently provided in off-airport, private facilities and surface parking lots distributed across the MSP campus serving specific tenants.

Kimley-Horn performed a baseline parking requirements analysis (see Section 3.1) assuming no change in passenger and employee behavior over the planning horizon. Changes in customer behavior over time could result in changing parking requirements at a given PAL. Kimley-Horn assessed potential changes in customer behavior through PAL 1 (see Section 3.2) to test the resiliency of the existing parking system and inform potential near-term development requirements.

3.1 Baseline Requirements

3.1.1 Employee Parking

The employee parking stall requirement includes airline staff, based flight crews, tenant staff, and concessionaire staff, and MAC staff authorized to park in the airport operated parking ramps. Some Delta Airlines employees currently parking in privately operated lots accessible from 34th Avenue. Delta Airlines employee parking requirements are estimated separately from other parking requirements since MAC does not currently provide parking for these users but may as part of the alternatives development process. Parking requirements related to tenants and MAC staff parking in surface lots distributed across the MSP campus are not included in this analysis.

The existing employee parking stall requirement was grown at the same rate as annual passenger aircraft operations through the planning horizon to determine future requirements. Aircraft operations, rather than passenger enplanements, was used because there is not a direct, linear relationship between employees and passengers. More employees are generally required to accommodate additional flight operations and the passengers aboard these flights. As discussed in the *Existing Landside Facilities Requirements Technical*

[5] SAE International, *SAE J3016 Levels of Driving Automation* (accessed April 2022).

Memorandum, the parking requirement accounts for a 10% service factor to account for inefficiencies in parking operations and enhanced demand during shift changes. The resulting employee parking stall requirements for PAL 1, PAL 2, and PAL 3 are presented in **Table 6.**

Table 6. Employee Parking Requirement

	Requirement [1]			
	2019	**PAL 1**	**PAL 2**	**PAL 3**
On-Airport Employees	1,900	1,950	2,080	2,380
Delta Airlines Off-Airport Employees [2][3]	1,660	1,700	1,810	2,070
Total	3,560	3,650	2,890	4,450

[1] Rounded to the nearest 10 stalls.

[2] Requirement estimated from observed traffic activity in March 2021 and employee parking occupancy in Silver Ramp in January 2021. Future studies should verify Delta employee parking requirement.

[3] Growth based on Delta flight operation growth.

3.1.2 Public Parking

The existing public parking stall requirement was grown at the same rate as the annual O&D enplanements through the planning horizon to determine future requirements. The parking requirement includes an assessment of both on-airport and off-airport parking requirements, consistent with existing conditions. As discussed in the *Existing Landside Facilities Requirements Technical Memorandum*, the parking requirement accounts for a 5% service factor to account for parking inefficiencies. The resulting public parking stall requirements for PAL 1, PAL 2, and PAL 3 are presented in **Table 7**.

Table 7. Public Parking Requirement - Baseline

	Requirement [1]			
	2019	**PAL 1**	**PAL 2**	**PAL 3**
On-Airport	18,800	21,090	22,640	25,900
Off-Airport	5,700	6,370	6,840	7,820
Total	24,500	27,460	29,480	33,720

[1] Rounded to the nearest 10 stalls.

3.1.3 Airport Requirements

The baseline forecast, presented in **Table 8**, provides the parking requirements for the airport as a whole; terminal specific parking requirements will be explored in more detail as part of the Alternatives chapter. Mode choices and customer behavior are also difficult to anticipate with emerging technology.

Table 8. Baseline Parking Requirement

	Requirement [1]		
	PAL 1	PAL 2	PAL 3
Public Parking [2]	27,460	29,480	33,720
Employee Parking [3]	1,950	2,080	2,380
Total Requirement	**29,410**	**31,560**	**36,100**

[1] *Rounded to the nearest 10 stalls.*

[2] *Includes on- and off-airport public parking*

[3] *Excludes Delta employee parking*

Anticipated changes to on-airport and off-airport parking supply will result in significant parking supply changes at the airport. Various parking supply scenarios were analyzed to estimate the future surplus or deficits. The supply scenarios analyzed include:

- **Supply Stage 1: Existing –** Assumes all existing MAC parking facilities are open and no developments have impacted the supply of off-airport operators. **Table 9** provides the estimated surplus/deficit for Stage 1.
- **Supply Stage 2: Off-Airport Development and Red/Blue Ramps CIP –** Assumes off-airport developments have reduced the private operator parking supply with the loss of the Park 'N Fly surface lot, approximately 1,000 stalls. This stage also assumes the Red and Blue Ramps Levels 2 and 3 are converted to public parking, adding an additional 1,700 public parking stalls. **Table 10** provides the estimated surplus/deficit for Stage 2.
- **Supply Stage 3: Green/Gold Ramps Demolition –** In addition to the impacts to the parking supply from Supply Stage 2, Supply Stage 3 accounts for the loss of on-airport parking with the demotion of the Green and Gold Ramps. It also includes the additional reduction of off-airport parking supply with the loss of the Park 'N Go surface lot and the Park 'N Fly parking ramp, approximately 2,100 stalls. **Table 11** provides the estimated surplus/deficit for Stage 3.

Table 9. Parking Surplus/Deficit – Stage 1

	Number of Stalls [1]		
	PAL 1	PAL 2	PAL 3
Total Requirement	29,410	31,560	36,100
Total Parking Supply		33,220	
Surplus/(Deficit)	3,810	1,660	(2,880)

[1] *Rounded to the nearest 10 stalls.*

Table 10. Parking Surplus/Deficit – Stage 2

	Number of Stalls [1]		
	PAL 1	PAL 2	PAL 3
Total Requirement	29,410	31,560	36,100
Total Parking Supply		33,920	
Surplus/(Deficit)	4,510	2,360	(2,180)

[1] *Rounded to the nearest 10 stalls.*

Table 11. Parking Surplus/Deficit – Stage 3

	Number of Stalls (1)		
	PAL 1	PAL 2	PAL 3
Total Requirement	29,410	31,560	36,100
Total Parking Supply	23,870		
Surplus/(Deficit)	(5,540)	(7,690)	(12,230)

(1) *Rounded to the nearest 10 stalls.*

3.2 PAL 1 Parking Gap Analysis

Parking scenarios were evaluated at PAL 1 as part of the gap analysis to assess campus wide and terminal specific parking requirements and near-term development priorities.

3.2.1 Considerations

Elements that were analyzed as part of the PAL 1 scenarios include:

- Propensity to Park
- Requirements by Terminal
- Employee Allocations
- Existing On-Airport Parking Supply
- Off-Airport Parking Developments

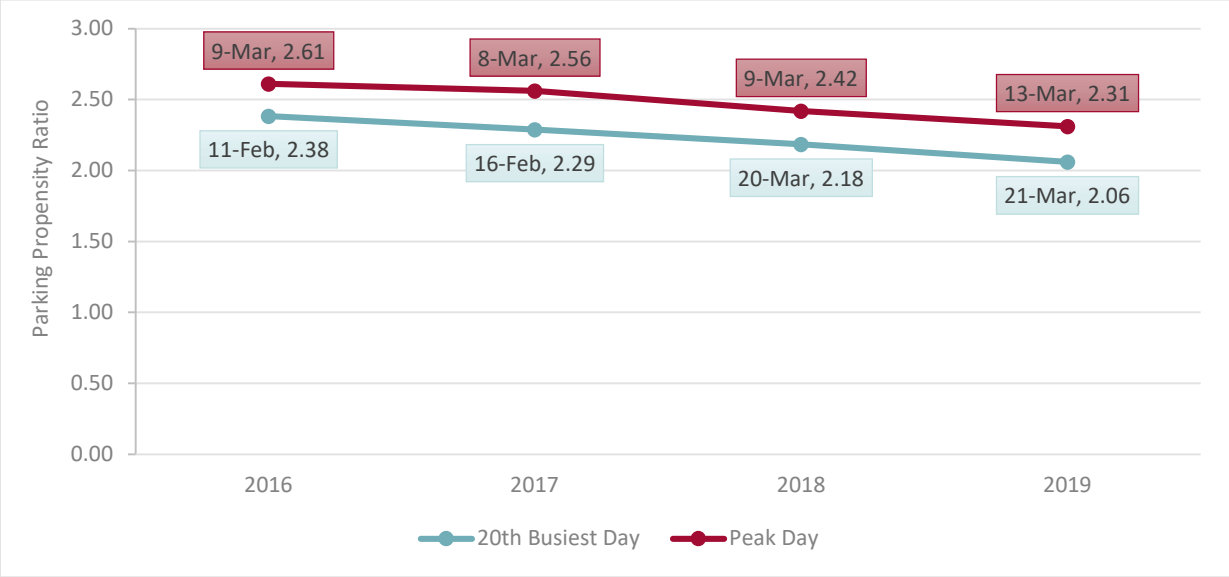
While off-airport parking is operated by private entities, the loss of off-airport parking availability due to private developments will impact the on-airport parking stall requirement.

3.2.1.1 Propensity to Park

The propensity to park is a metric that correlates parking occupancy with O&D passenger activity, which provides insight into passenger preference over time. For this study, propensity to park was calculated as the parking occupancy per 1,000 annual O&D enplanements. The propensity to park was calculated as a function of the observed on-airport and estimated off-airport parking occupancy to comprehensively understand airport parking demand.

The propensity to park at MSP has been steadily decreasing since 2016. The design day propensity to park has fallen approximately 16% between 2016 and 2019, as shown in **Figure 1**. The peak day propensity to park followed a parallel trajectory, suggesting that parking behavior is relatively consistent between the peak day and the design day.

Figure 1. Historical Propensity (2016 to 2019)

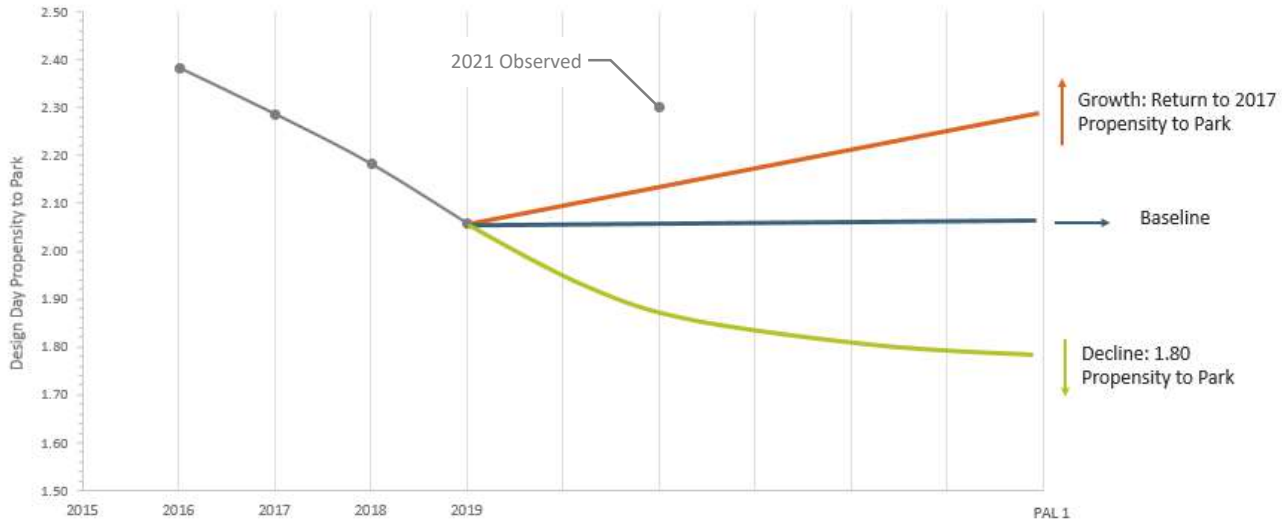


The COVID-19 pandemic had dramatic impacts on the propensity to park. In 2020, passenger activity was low and parking activity was high, resulting in a spike in the propensity to park. In 2021, the propensity to park normalized, but did see an increase from 2019. The design day propensity to park in 2021 was 2.31 vehicles per 1,000 enplanements, similar to 2017 levels.

A range of propensity to park values were evaluated for the PAL 1 gap analysis, as described below and illustrated in **Figure 2**:

- **Decline** – Assumes the design day propensity to park declines to 1.80 vehicles per 1,000 annual enplanements at PAL 1. This situation would indicate that historical trends continue, with an equilibrium point reached in the mode share market at a propensity to park of approximately 1.80. A continued decline in propensity to park would suggest that changes in passenger behavior observed during the pandemic will not be sustained in the long term.
- **Baseline** – Assumes the design day propensity to park through PAL 1 remains at 2.06 vehicles per 1,000 annual enplanements, consistent with the propensity observed in 2019. The baseline propensity to park indicates that customer behavior does not substantially change between 2019 and PAL 1.
- **Growth** – Assumes a design day propensity to park increase to 2.29 vehicles per 1,000 annual enplanements, consistent with the propensity observed in 2017 and again in 2021. A growth in propensity to park would reflect a lasting change in passenger behavior. In addition, the parking supply increase associated with the opening of the Silver Ramp may stimulate a natural increase in propensity to park, as passengers feel more confident that they will be able to find a parking spot at Terminal 1.

Figure 2. PAL 1 Propensity to Park Scenarios



3.2.1.2 Activity By Terminal

To assess the impacts of future parking requirements on each terminal's facilities, the terminal specific parking stall requirement was estimated for employee and public parking, assuming unconstrained facilities. Product-specific parking stall requirement is an important metric for planning because overbuilding certain products, regardless of the total airport parking demand, can result in underutilized parking facilities and investments that do not align with the Airport's goals.

Terminal specific employee parking stall requirements for PAL 1 were based on the existing percent of gates located at each terminal. The number of gates serves as a proxy for the number of ticket counters, gate agents, concessions staff, ground service, etc. needed at each terminal. The parking scenarios evaluate employee parking at both terminals to determine if operational changes are feasible to enhance the employee parking experience.

For public parking facilities at PAL 1, the demand was refined based on the split between passengers at Terminal 1 and Terminal 2. Monthly passenger data by airline for 2019 was obtained from the Bureau of Transportation Statistics (BTS). The airline operational conditions for 2019 determined which airlines operated at each terminal and are assumed to remain the same through PAL 1. The split of passenger activity for March, the peak month for public parking, was used throughout the future public parking requirements analysis. It was assumed that the total number of passengers at each terminal is proportional to the number of O&D passengers at each terminal. **Table 12** presents the assumed percent of passenger and employee activity at each terminal.

Table 12. Terminal Specific Activity

Activity Type	Terminal	
	Terminal 1	Terminal 2
Employee	88.1%	11.9%
Public Parking	79.6%	20.4%

Sources: Bureau of Transportation Statistics (BTS); MSP Airport Website.

3.2.1.3 On-Airport Parking Supply

This assessment assumes that the Quick Ride Ramp reopens to Terminal 1 public parking customers and that all other existing MSP parking ramps remain open for public or employee use through PAL 1. Refer to **Table 13** and **Table 14** for the assumed PAL 1 On-Airport parking supply.

Table 13. PAL 1 On-Airport Parking Supply – Terminal 1

	Stalls
Valet Ramp	389
Brown/Gold Ramp	3,721
Pink/Green Ramp	3,835
Red Ramp	2,806
Blue Ramp	2,650
Silver Ramp	3,394
Quick Ride Ramp	1,704
Total	18,499

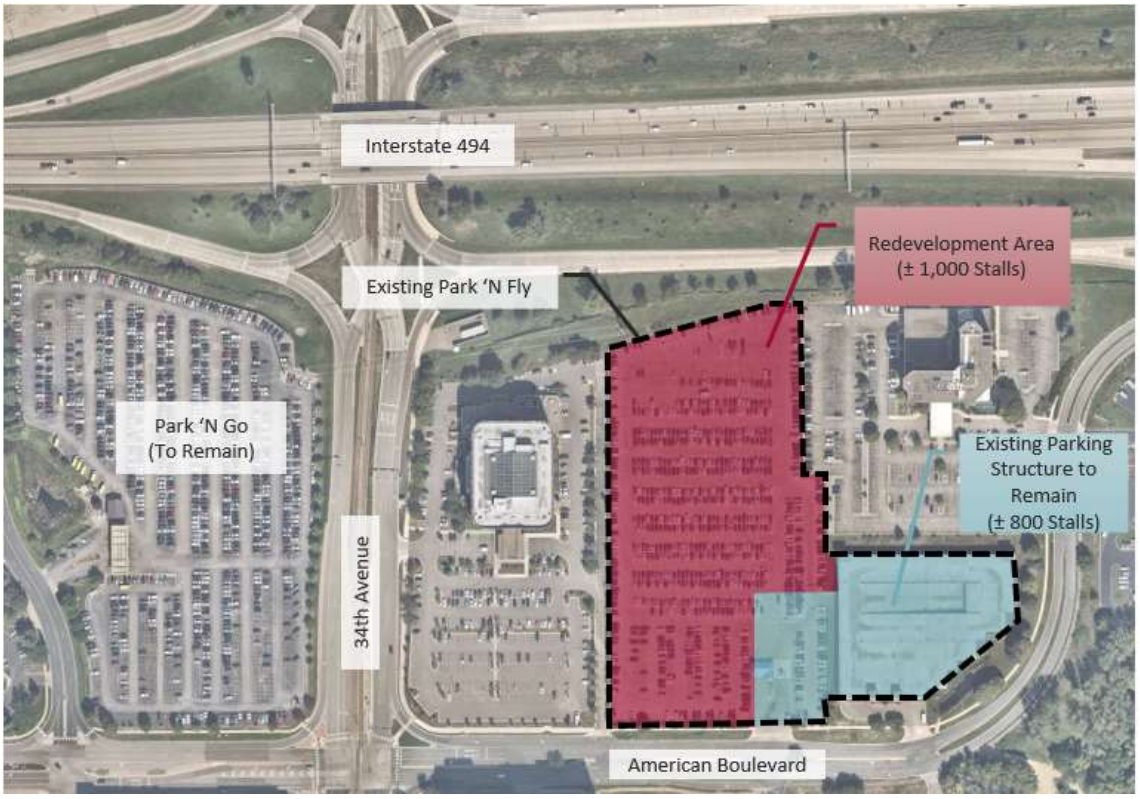
Table 14. PAL 1 On-Airport Parking Supply – Terminal 2

	Stalls
Purple Ramp	4,002
Orange Ramp	4,668
Total	8,716

3.2.1.4 Off-Airport Public Parking Re-Development

Off-airport parking options provide an alternative parking product for passengers. A new development, occupying part of the existing Park 'N Fly facility has been approved by the City of Bloomington, with construction anticipated to begin in 2022. **Figure 3** illustrates the anticipated impacts to available off-airport parking supply, reducing the estimated available supply from 6,000 stalls in 2019 to 5,000 available stalls by PAL 1.

Figure 3. Off-Airport Parking Redevelopment Footprint



A decrease in off-airport parking stall supply will increase on-airport parking stall requirements. This study assumed that off-airport parking customers would utilize on-airport parking when the off-airport parking demand exceeds available supply. Off-airport parkers re-assigned to on-airport parking are assumed to park at each Terminal consistent with the assumptions in Section 3.2.1.2.

3.2.1.5 Delta Airlines Off-Airport Employee Parking

This study assumes the existing Delta Airlines employee parking lots accessed from 34th Avenue are not impacted and remain available for employee parking through PAL 1.

3.2.2 PAL 1 Scenarios

The analyzed parking scenarios are outlined in **Table 15** and described in detail in the sections below.

Table 15. Parking Scenarios Assumptions

	Propensity to Park	Off-Airport Development	Employee Parking at Terminal 1
Scenario 1.1	Decline	Yes	Yes
Scenario 1.2	Baseline	Yes	Yes
Scenario 1.3	Growth	Yes	No

3.2.2.1 Scenario 1.1

Public parking Scenario 1.1 evaluates a future scenario with a reduced propensity to park and off-airport development impacts. To analyze holistic parking demand at each terminal, Scenario 1.1 would operationally allow all employees to park at the terminal of their choice. Public parking demand is also calculated by terminal, based on the specifications outlined in **Section 3.2.1.2**.

Scenario 1.1 public parking requirements were calculated by reducing the baseline requirement to account for a change in design day propensity to park from 2.06 to 1.80 vehicles per 1,000 annual originating enplanements. Future off-airport parking requirements were calculated using the same methodology. Due to the reduction in available off-airport parking supply, the off-airport parking requirement that cannot be met with the off-airport parking supply was added to the on-airport parking requirement. The parking requirements for Scenario 1.1 are presented in **Table 16**.

Table 16. Design Day Parking Requirements – PAL 1 Scenario 1.1

	Supply [1]	Requirement [1]				
		Public Parking	Employee Parking [2]	Excess Off-Airport Parking	Total	Surplus/ (Deficit) [1]
On-Airport: Terminal 1	18,500	14,680	1,720	450	16,850	**1,650**
On-Airport: Terminal 2	8,720	3,760	230	120	4,110	**4,610**
Off-Airport	5,000	5,570	--	(570)	5,000	**0**
Total	**32,220**	**24,010**	**1,950**	**0**	**25,960**	**6,260**

[1] Rounded to the nearest 10 stalls.

[2] Excludes Delta Employee Parking

With Scenario 1.1, the results presented in **Table 16** show that:

- The projected total parking supply can meet the design day requirement with an excess of parking stalls at each terminal.
- Terminal 2 is underutilized with a design day requirement of only approximately 47% of the available capacity.
- Employees would be able to park at either terminal without compromising public parking revenue.

3.2.2.2 Scenario 1.2

Scenario 1.2 evaluates a future situation where the propensity to park remains consistent with observed 2019 levels. Park 'N Fly development will decrease off-airport parking supply and employees can park at the terminal of their choice. The parking requirements for Scenario 1.2 are presented in **Table 17**.

Table 17. Design Day Parking Requirements – PAL 1 Scenario 1.2

	Supply [1]	Requirement [1]				
		Public Parking	Employee Parking [2]	Excess Off-Airport Parking	Total	Surplus/ (Deficit) [1]
On-Airport: Terminal 1	18,500	16,800	1,720	1,090	19,610	**(1,110)**
On-Airport: Terminal 2	8,720	4,300	230	280	4,810	**3,910**
Off-Airport	5,000	6,370	--	(1,370)	5,000	**0**
Total	**32,220**	**27,470**	**1,950**	**0**	**29,420**	**2,800**

[1] Rounded to the nearest 10 stalls.

[3] Excludes Delta Employee Parking

With Scenario 1.2, the results presented in **Table 17** show that:

- The projected total parking supply can meet the design day requirement with an excess of parking stalls at Terminal 2.
- The projected total parking supply cannot meet the Terminal 1 design day requirement with an excess of parking stalls. Additional parking development at Terminal 1 is required to accommodate Scenario 1.2.
- Terminal 2 is underutilized with a design day requirement of only approximately 55% of the available capacity.
- Off-airport parking supply is required to meet the total parking requirement on the design day. This suggests that the continued loss of additional off-airport parking supply could trigger the need for on-airport parking development by PAL 1.

3.2.2.3 Scenario 1.3

Scenario 1.3 stress tests the existing facilities by increasing the propensity to park to 2.29 vehicles per 1,000 enplanements, in addition to the loss of off-airport parking supply. Employees are not provided the option of parking at their preferred terminal and must utilize the Terminal 2 parking ramps. Only employees parking at Terminal 1 before the pandemic were assumed to remain. The parking requirements for Scenario 1.3 are presented in **Table 18**.

Table 18. Design Day Parking Requirements – PAL 1 Scenario 1.3

	Supply [1]	Requirement [1]				
		Public Parking	Employee Parking [2]	Excess Off-Airport Parking	Total	Surplus/ (Deficit) [1]
On-Airport: Terminal 1	18,500	18,670	250	1,660	20,580	**(2,080)**
On-Airport: Terminal 2	8,720	4,780	1,700	420	6,900	**1,820**
Off-Airport	5,000	7,080	--	(2,080)	5,000	**0**
Total	**32,220**	**30,530**	**1,950**	**0**	**32,480**	**(260)**

[1] *Rounded to the nearest 10 stalls.*

[4] *Excludes Delta Employee Parking*

With Scenario 1.3, the results presented in **Table 18** show that:

- The projected total parking supply cannot meet the Terminal 1 design day requirement. Additional parking development at Terminal 1 is required to accommodate Scenario 1.3.
- Terminal 2 is better utilized with 79% occupancy on the design day.
- The projected total parking supply cannot meet the design day requirement.

3.2.4 PAL 1 Gap Analysis Summary and Recommendations

A summary of the PAL 1 scenario results for total airport parking, Terminal 1 and Terminal 2 are presented in **Figure 4**, **Figure 5**, and **Figure 6,** respectively. Based on these results, Kimley-Horn recommends:

- *Employee parking should remain at Terminal 2.* Employees parking at Terminal 2 prior to the COVID-19 pandemic should return to Terminal 2. Only employees previously parking in the nested Terminal 1 area should remain at Terminal 1. This will help minimize the number of public parking diversions needed throughout the year. If employees remain at Terminal 1, only Scenario 1.1 can be accommodated with the existing facilities (see **Figure 5**). Additionally, moving employees back to Terminal 2 will not impact the ability for Terminal 2 ramps to meet the projected demand.
- *Near-term Terminal 1 parking development.* MAC should move forward with the proposed CIP project to convert Red and Blue Ramps Levels 2 and 3 to public parking at Terminal 1. The additional public parking will help meet Terminal 1 design day parking requirements for Scenario 1.2 and will almost cover the demand in Scenario 1.3. This is the lowest cost parking MSP can develop as all other locations, such as the Purple Ramp, Orange Ramp, or Silver Ramp expansions, require new structures.

Figure 4. PAL 1 Parking Gap Analysis – Total Airport

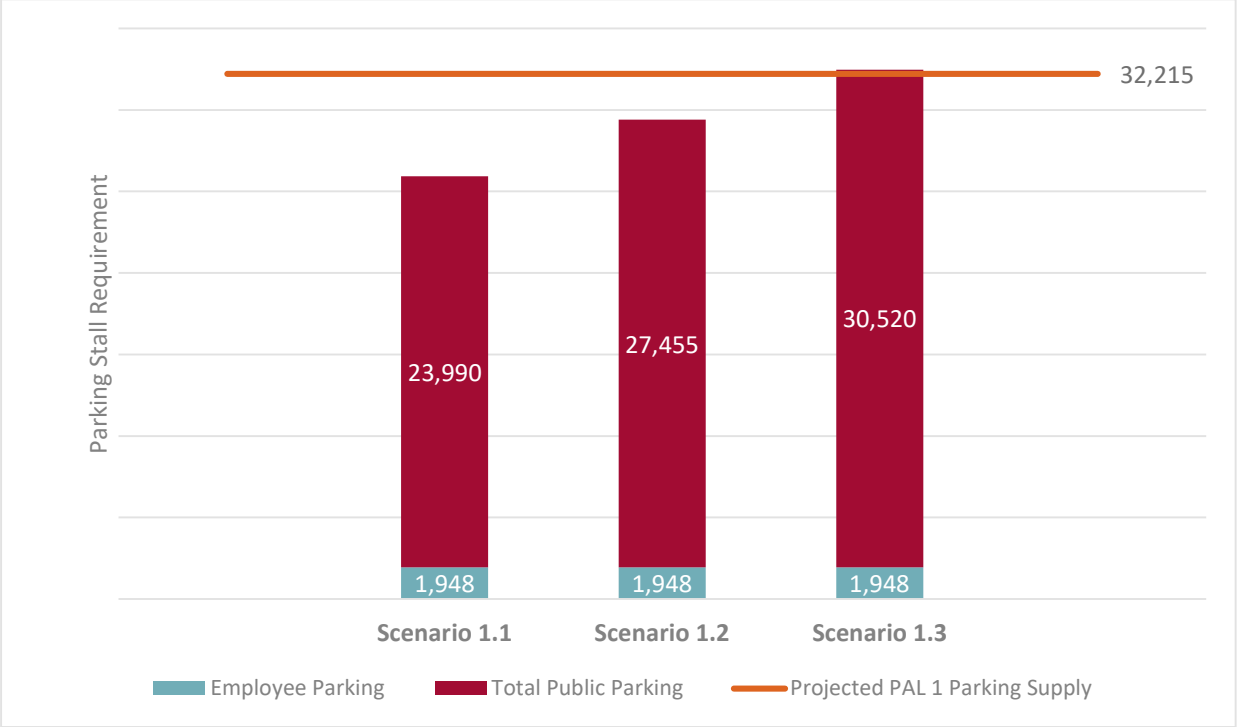


Figure 5. PAL 1 Parking Gap Analysis – Terminal 1

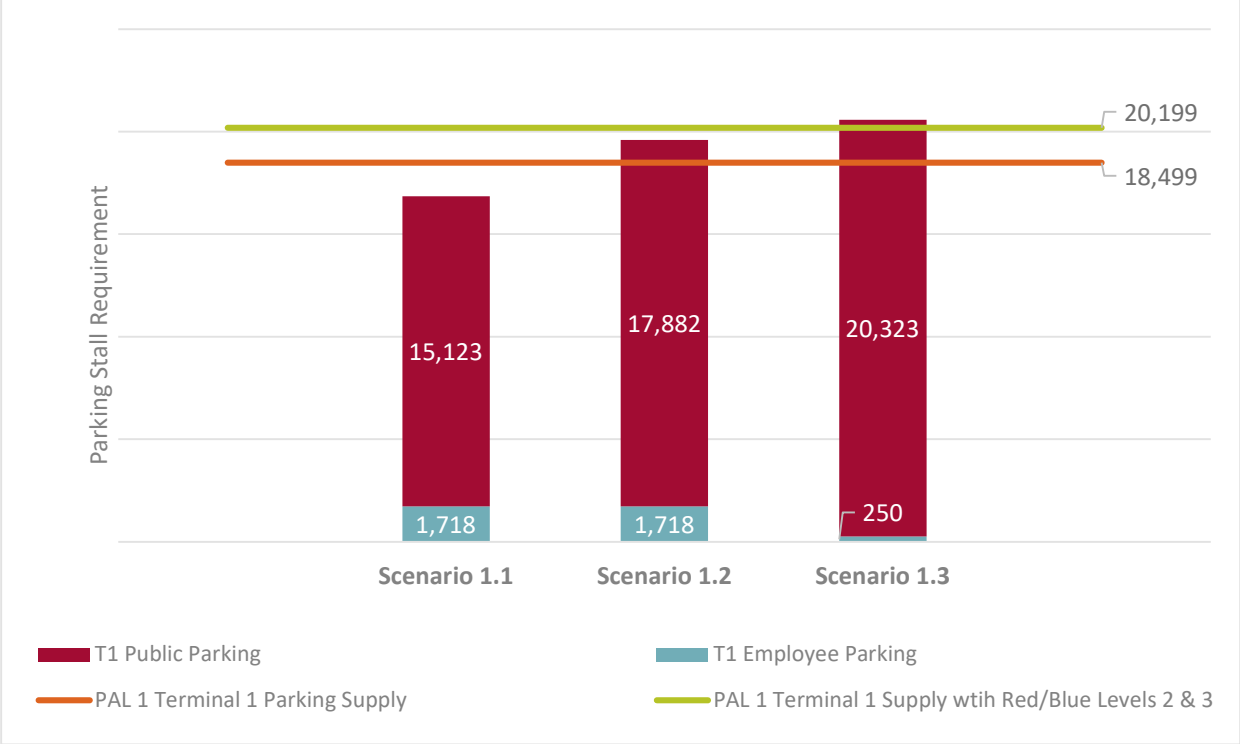
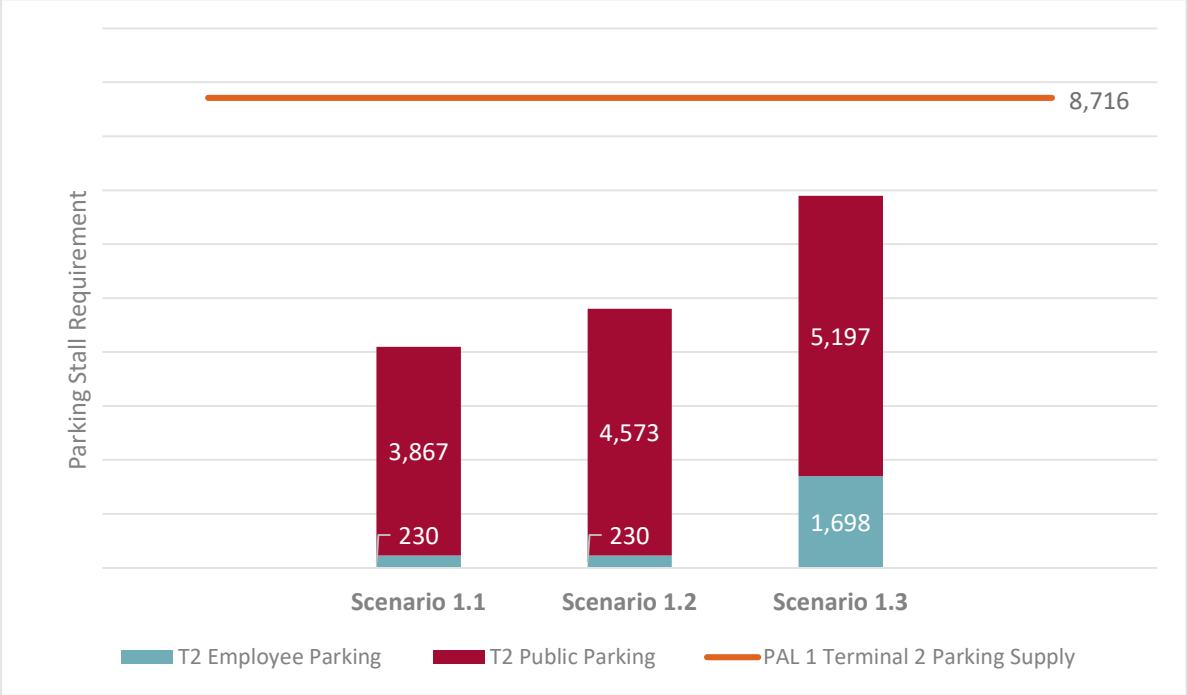


Figure 6. PAL 1 Parking Gap Analysis – Terminal 2



3.3 EV Parking Stall Requirements

The number of EV chargers provided by MAC will depend on the number of EV vehicles on the road, the driving range of customers, and the level of customer experience that MAC would like to provide. Not all EV drivers parking at the Airport will need to charge. The recommended number of EV parking stalls will vary based on:

- Projected EV percent of total vehicles fleet on the road
- Demand of on-airport parking stalls at MSP (public and employees)
- Percent of EV drivers requiring a charge at the Airport
    - Drive Electric Minnesota estimates that approximately 80% of charging occurs at home, overnight[6].
    - In 2021, only approximately 17 percent of the EVs in Minnesota were registered outside the Twin Cities metro region[7]. This indicates that the majority of EVs are located within 50 miles of MSP.

[6] Drive Electric Minnesota, Electric Vehicle Fast Facts.

[7] Minnesota Department of Transportation, 2021 Minnesota Electric Vehicle Assessment Chapter 3: Electric Vehicles in Minnesota.

This study assumes that 25% of EVs parked at the Airport at a given time will want or need access to an EV charger at the Airport. Changes in driver habits, battery technology, charging technology, and available off-airport charging options may alter the number of EVs needing access to an EV charger at the Airport over the planning horizon. Also, vehicles may require different charging intensity based on the stay duration. Future study work exploring EV chargers should explore the number of chargers at different levels (i.e. Level 1, Level 2, and DC Fast Charge) to provide a range of services that align with customer demand, while balancing electrical demands to the power grid. Industry trends suggest that long duration and employee parking facilities are typically equipped with Level 1 or Level 2 chargers and short duration parking facilities have DC Fast Chargers installed.

Table 19 provides a summary of the recommended number of EV stalls for public parking facilities at each PAL. Evaluating the type and level of EV charger is outside the scope of this study and can be evaluated as part of a future study.

Table 19. Recommended Number of EV Stalls in Public Parking Facilities

	On -Airport Parking Requirement [1] [2]	Percent EV Fleet	EV Stall Requirement
PAL 1	24,410	3.1%	**191**
PAL 2	28,660	12.3%	**884**
PAL 3	33,200	42%	**3,485**

[1] Rounded to the nearest 10 stalls.

[2] Includes on-airport public parking requirement, excess off-airport parking, and employee parking. Excludes Delta employee requirement.

4 RENTAL CAR OPERATIONAL FACILITIES REQUIREMENTS

There were four rental car agency (RAC or RACs) families operating on-airport at MSP in 2019. The four families consisted of Enterprise Holding Inc. (Alamo, Enterprise, and National), Dollar Thrifty Automotive Group (Dollar, Hertz, and Thrifty), Avis Budget Group (Avis, Budget, and Payless), and SIXT Rental Car. The on-airport RACs utilize MAC constructed, and tenant financed, facilities to rent and service customer vehicles. The current rental car fleet at MSP consists of approximately 12,400 vehicles. Rental car agencies are contractually obligated to replace vehicles every three years at MSP.

Kimley-Horn performed a baseline requirements analysis (see Section 4.1) assuming no change in passenger behavior over the planning horizon. Changes in customer behavior over time could result in changing rental car facility requirements at a given PAL. Kimley-Horn assessed PAL 1 (see Section 4.2) to test the resiliency of terminal specific existing rental car facilities and inform potential near-term development requirements.

To determine future rental car facility requirements, the 2019 peak hour returns and peak hour rentals were grown at the same rate as annual O&D enplanement growth at each PAL. Using updated peak hour rentals and returns for each PAL, the same methodology used for to determine existing rental car requirements was utilized to determine future requirements. The methodology is based on industry-standard formulas and accounts for surges in activity.

4.1 Baseline Requirements

Requirements within this section are determined for the airport as a whole. Terminal specific allocations depend on the airlines assigned to each terminal and RAC preferences for serving customers at a single or multiple facilities. Terminal specific requirements will be further explored during the alternatives phase of the 2040 LTP.

4.1.1 Customer Service Building (CSB)

Table 20 provides CSB requirements at each PAL. Based on the evaluation, the airport currently has adequate CSB positions to meet customer demand. Airline terminal allocations may impact the terminal specific CSB adequacy. Future requirements could also be impacted by RAC operational considerations and continually changing needs for customers to visit a counter before renting a vehicle.

Table 20. CSB Counter Requirements

	2019	PAL 1	PAL 2	PAL 3
CSB Counter Requirement (1)	55	61	66	75
Existing Supply	77			
Surplus/(Deficit)	22	16	9	2

(1) Includes 1.25x surge factor.

4.1.2 Ready Return (RR)

Table 21 provides RR requirements at each PAL. Based on the evaluation, the airport currently has adequate RR stalls to meet customer demand. Airline terminal allocations may impact the terminal specific RR adequacy.

Table 21. RR Stall Requirements

	2019	PAL 1	PAL 2	PAL 3
RR Stall Requirement (1)	1,650	1,855	1,990	2,275
Existing Supply	2,715			
Surplus/(Deficit)	1,065	860	725	440

(1) Includes 1.25x surge factor.

4.1.3 Quick Turnaround (QTA)

Table 22 and **Table 23** provide QTA requirements at each PAL for functions that are not impacted by EV fleet conversion. Fueling position requirements are highly dependent upon the RAC fleet conversion to EVs and the location/procedure RAC's use to charge EVs. **Table 24** provides QTA requirements at each PAL assuming an internal combustion engine (ICE) fleet continues operating at MSP through the planning horizon. This is unlikely, but it provides a conservative estimate of the number of fueling positions and vehicle storage positions based on the existing fleet characteristics. Refer to **Section 4.3** for additional context regarding EV charger requirements.

Table 22. Car Wash Bay Requirements

	2019	PAL 1	PAL 2	PAL 3
Car Wash Bay Requirement (1)	24	26	27	32
Existing Supply	20			
Surplus/(Deficit)	(4)	(6)	(7)	(12)

(1) Includes 1.25x surge factor.

Table 23. Vehicle Storage Requirements

	2019	PAL 1	PAL 2	PAL 3
Vehicle Storage Requirement	1,160	1,310	1,400	1,610
Existing Supply	1,260			
Surplus/(Deficit)	100	(50)	(140)	(350)

(1) Includes 1.25x surge factor.

Table 24. Fueling Position Requirement (No EV Fleet Conversion)

	2019	PAL 1	PAL 2	PAL 3
ICE Fueling Position Requirement	92	102	109	125
Existing Supply	100			
Surplus/(Deficit)	8	(2)	(9)	(25)

(1) Includes 1.25x surge factor.

The airport currently has a fueling position deficit. Given the anticipated fleet conversion to EVs, adding more ICE fueling positions is not recommended. Kimley-Horn recommends coordinating with RACs to add EV chargers to existing facilities to support fleet conversion from ICE to EV. **Section 4.3** provides more insight into the projected EV charger demand. The airport has projected car wash bay and vehicle storage deficits that should be addressed as part of the alternatives evaluation.

4.2 PAL 1 Rental Car Gap Analysis

Table 25 and Table 26 provides terminal specific rental car requirements for PAL 1 at Terminal 1 and Terminal 2, respectively. It was assumed that 90% of the total demand occurred at Terminal 1 and 20% occurred at Terminal 2, which accounts for peaking at different times. Through PAL 1, the QTA rental car facilities at Terminal 1 will experience deficiencies.

Table 25. Terminal 1 Rental Car Facility Requirements (PAL 1)

Facility	Requirement [1]	Existing Supply	Surplus/(Deficit)
CSB Counter Positions [2]	50	48	(2)
RR Stalls	1,515	2,050	535
ICE Fueling Positions [2]	68	76	8
Wash Bays [2]	21	12	(9)
QTA Storage (On-Site Vehicles)	1,070	575	(495)

[1] Terminal Split: 90% Terminal 1, 20% Terminal 2.

[2] Includes 1.25x surge factor.

Table 26. Terminal 2 Rental Car Facility Requirements (PAL 1)

Facility	Requirement [1]	Existing Supply	Surplus/(Deficit)
CSB Counter Positions [2]	11	29	18
RR Stalls	340	665	325
ICE Fueling Positions [2]	16	24	8
Wash Bays [2]	5	8	3
QTA Storage (On-Site Vehicles)	240	685	445

[1] Terminal Split: 90% Terminal 1, 20% Terminal 2.

[2] Includes 1.25x surge factor.

[3] *Assumes DC Fast Chargers in the QTA. Refer to* ***Section 4.3****.*

The Silver Ramp CSB and RR stalls at Terminal 1 were sized to accommodate rental car demand through 2030 (PAL 2). The Silver Ramp CSB was constructed to add counter positions if needed through the planning horizon. The fueling positions, wash bays, and QTA storage facilities had deficits when evaluated in 2015. **Table 25** confirms that the Terminal 1 CSB and RR stalls are adequate, while the QTA is inadequate. The Terminal 2 CSB, RR, and QTA are all adequate through PAL 1.

4.3 Rental Car EV Charger Demand

The shift in the rental car fleet towards EVs could change the turnaround process, as vehicles require electric fueling rather than gasoline fueling. The demand for EV chargers will be dependent on the rental car agency's operational model. Three operational scenarios are feasible, as described in the sections below:

- Ready/Return (RR) Charging
- Quick Turnaround (QTA) Charging
- RR and QTA Charging

4.3.1 Ready/Return (RR) Charging

A Ready/Return charging scenario assumes all EVs are charged in the RR area using either Level 2 chargers or a variety of Level 2 and DC Fast Chargers. The same percentage of EV within the fleet should be applied to

the RR stalls to determine how many stalls need an EV charger. The ICE fueling position requirement also decreases by the percentage of EV in the fleet.

4.3.2 Quick Turnaround (QTA) Charging

A QTA electric fueling operation would parallel the existing operation, using DC Fast chargers for power. The number of DC Fast chargers needed at the QTA will depend on the vehicle fleet battery size and the charging load of the QTA chargers. As charging load increases, the number of QTA EV fueling positions may decrease.

4.3.3 RR and QTA Charging

Vehicles can charge in both the RR area and the QTA area. Vehicles would be charged for a fixed time of 15 minutes in the QTA area using a DC fast charger, while undergoing other servicing functions, such as vacuuming. Vehicles requiring additional charging will be charged in the RR area using a Level 2 charger. This scenario would not impact the total requirement for number of fueling positions in the QTA since QTA ICE requirements assume a servicing time of 15 minutes. The split between ICE fueling positions and EV fueling positions in the QTA is based on the percent of the rental car fleet that is electric. The number of EV chargers needed in the RR area will be a function of the fleet vehicle battery sizes, the charging load of the QTA chargers, the percent of the fleet that is electric, and the rental car agencies service requirements (e.g., acceptable return and rental battery level).

Rental car agencies have expressed the desire to operate with DC Fast Charging in the QTA and additional charging within the RR. Additional coordination with the rental car agencies and studies will be needed to determine the power demand for the electrified rental car operation.

5 COMMERCIAL GROUND TRANSPORTATION REQUIREMENTS

Numerous commercial ground transportation modes serve MSP at both Terminal 1 and Terminal 2. Commercial ground transportation operators include:

- Limo
- Taxi
- Transportation Network Company (TNC)
- Charter Bus
- Metro Transit
- Hotel Courtesy Shuttle
- Off-Airport Parking Shuttle
- Off-Airport Rental Car Shuttle
- Out State Shuttle
- Shared Ride

In this study, on-demand ground transportation modes include TNCs, taxis, and limo services, whereas scheduled services accounts for the other commercial modes. Kimley-Horn performed a baseline GT requirements analysis (see **Section 5.1**) assuming no change in passenger behavior over the planning horizon. Changes in customer behavior over time could result in different GT requirements at a given PAL. Kimley-Horn assessed potential changes in customer mode choice through PAL 1 (see **Section 5.2**) to inform near-term development requirements.

5.1 Baseline Requirements

The existing on-demand commercial vehicle requirements were grown by the peak hour terminating passengers between the flight schedule for August 8th, 2019, and the 2025, 2030, and 2040 DDFS, provided by Ricondo, to determine future requirements. Only pick-up transactions occur on the commercial curb, so the on-demand requirements only accounted for terminating passenger activity.

The existing scheduled service requirements were grown at the same rate as the number of peak hour total flights. Peak hour arriving and departing flights were used for scheduled service requirements because scheduled service drop-off and pick-up transactions occur on the commercial curb. The peak hour for flights does not correlate directly to the peak hour for terminating passengers.

The baseline requirements for the number of on-demand and scheduled service positions are presented in **Table 27.** A reduction in terminating peak hour passengers at PAL 1 and PAL 2 suggest that on-demand commercial vehicle requirements will not change until PAL 3.

Table 27. Commercial Vehicle Position Requirements by Service Type

	Existing (2019)	PAL 2 (2030)	PAL 3 (2040)
On-Demand	106	106	133
Scheduled	51	63	71
Total Positions	157	169	204

5.1.1 PAL 3 Requirements

The baseline forecast, presented in **Table 28**, provides the PAL 3 on-demand commercial vehicle requirements by operator type. **Table 29** presents the PAL 3 scheduled service requirements by operator type. Many external factors can influence a GT customer's choice of operator, so this study assumes that the operator splits remain consistent with those observed in 2019. Tables 30 and 31 present GT requirements for the airport as a whole; terminal specific GT requirements will be explored in more detail as part of the Alternatives chapter.

Table 28. On-Demand Commercial Vehicle Requirements – PAL 3

Mode Type	Requirement	Existing Supply	Surplus/(Deficit)
Limo	43	32	(11)
Taxi	34	56	22
TNC	56	38	(18)
Total	**133**	**126**	**(7)**

Table 29. Scheduled Commercial Vehicle Requirements – PAL 3

Mode Type	Requirement
Bus	17
Metro Transit	2
Hotel Courtesy Shuttle	17
Off-Airport Parking Shuttle	14
Off-Airport Rental Shuttle	6
Out State Shuttle	11
Shared Ride	6
Total	**73**
Existing Airport Supply	*63*
Surplus/(Deficit)	*(10)*

By PAL 3, on-demand services and scheduled services are anticipated to have a deficit of loading positions.

5.2 PAL 1 GT Gap Analysis

GT scenarios were evaluated at PAL 1 as part of the gap analysis to assess campus wide and terminal specific GT requirements and near-term development priorities.

5.2.1 Considerations

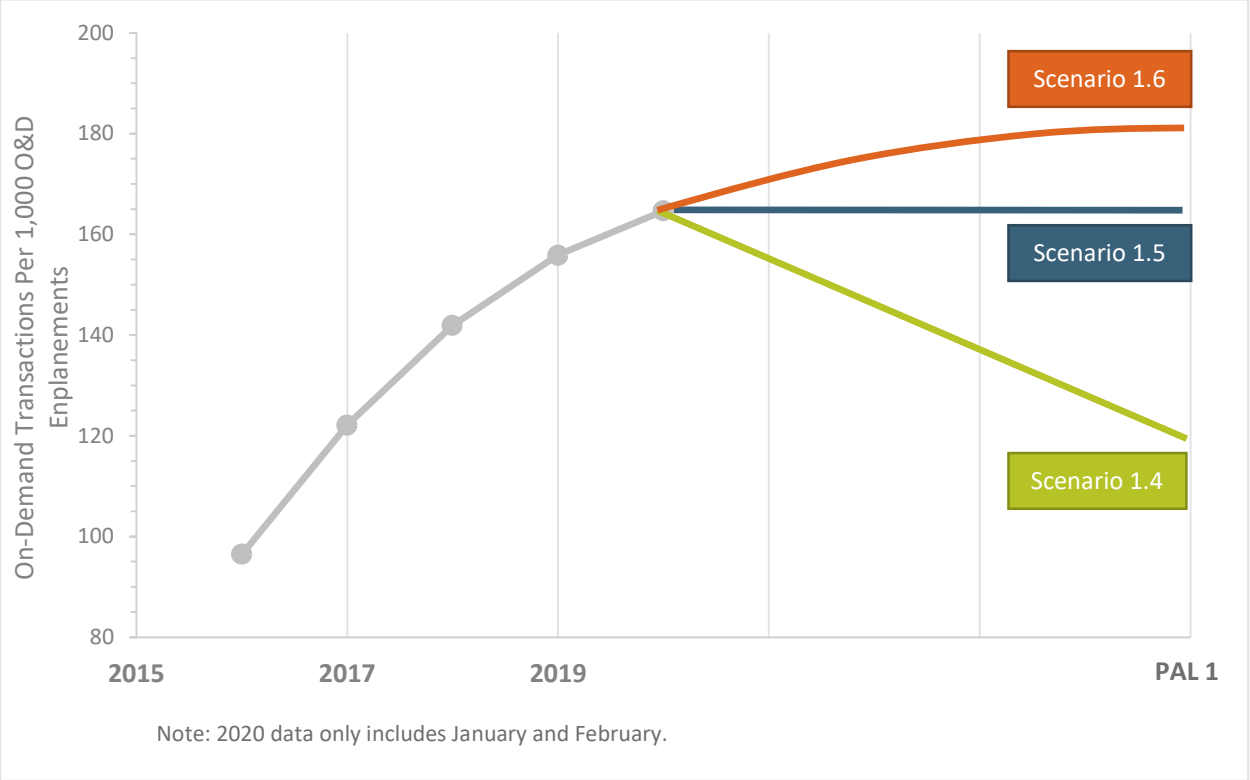
A variety of factors may impact the need or desire for on-demand services, such as:

- **Recovery of On-Demand Activity from the COVID-19 Pandemic:** Demand may fluctuate depending on concerns regarding vehicle cleanliness and driver health status.
- **Driver Supply:** Driver shortages for TNC and taxi companies have resulted in increased wait times and higher fares.
- **External Factors**: Mode choice is dependent on external factors, such as parking availability and price, leisure vs. business travelers, weather, etc.

5.2.2 PAL 1 On-Demand Service Scenarios

The proposed PAL 1 scenarios for GT requirements are independent of the scenarios presented for parking in **Section 3.2**. The analyzed parking scenarios are differentiated by the number of transactions per 1,000 enplanements, as shown in **Figure 7**, and described in more detail in the sections below.

Figure 7. PAL 1 On-Demand Transactions Per 1,000 O&D Enplanements Scenarios



5.2.2.1 PAL 1 Scenario 1.4

Scenario 1.4 explores a decline in on-demand services between 2019 and 2025. This scenario represents a future where on-demand services do not recover from the dip in activity that occurred during the COVID-19 pandemic. Increased fares and waiting times may encourage passengers to use alternative modes of transportation. On-demand mode choice was estimated to return to levels of activity seen historically at the beginning of the introduction of TNCs in 2017, with about 125 transactions per 1,000 O&D enplanements. The requirements for loading positions are presented in **Table 30** for Terminal 1 and in **Table 31** for Terminal 2.

Table 30. Terminal 1 On-Demand Commercial Vehicle Requirements – PAL 1 Scenario 1.4

Mode Type	Requirement	Existing Supply	Surplus/(Deficit)
Limo	22	23	1
Taxi	17	44	27
TNC	31	30	(1)
Total	**70**	**97**	**27**

Table 31. Terminal 2 On-Demand Commercial Vehicle Requirements – PAL 1 Scenario 1.4

Mode Type	Requirement	Existing Supply	Surplus/(Deficit)
Limo	5	9	4
Taxi	4	12	8
TNC	7	8	1
Total	**16**	**29**	**13**

The results presented in **Tables 30 and 31** suggest that in Scenario 1.4:

- Terminal 1 and Terminal 2 have an excess number of on-demand loading positions for PAL 1.
- A reduction in the propensity to use on-demand services may provide the Airport an opportunity to reduce the size of the commercial vehicle areas at both terminals to open the space for alternative uses.

5.2.2.2 PAL 1 Scenario 1.5

Scenario 1.5 serves as a baseline scenario. This scenario assumes that passenger mode choice remains constant, and passengers use the ground transportation services at the same rate as in 2019, at approximately 156 transactions per 1,000 O&D enplanements. The requirements for loading positions are presented in **Table 32** for Terminal 1 and in **Table 33** for Terminal 2.

Table 32. Terminal 1 On-Demand Commercial Vehicle Requirements – PAL 1 Scenario 1.5

Mode Type	Requirement	Existing Supply	Surplus/(Deficit)
Limo	28	23	(5)
Taxi	21	44	23
TNC	38	30	(8)
Total	**87**	**97**	**10**

Table 33. Terminal 2 On-Demand Commercial Vehicle Requirements – PAL 1 Scenario 1.5

Mode Type	Requirement	Existing Supply	Surplus/(Deficit)
Limo	6	9	3
Taxi	6	12	6
TNC	7	8	1
Total	**19**	**29**	**10**

The results presented in **Tables 32 and 33** suggest that in Scenario 1.5:

- Both Terminal 1 and Terminal 2 have an adequate number of loading positions for PAL 1.
- At Terminal 1, the taxi loading positions are underutilized, while there is a projected deficit for TNC and Limo positions. Reallocation of positions between operator types would improve operational efficiency.

5.2.2.3 PAL 1 Scenario 1.6

Scenario 1.6 explores the continued growth of on-demand services. The historical trends of the on-demand services suggests that an equilibrium will be reached for passenger mode choice. In 2019, approximately 15.6% of terminating passengers chose to utilize on-demand services as their mode choice from the Airport. Scenario 1.6 predicts that growth will continue to occur through PAL 1 before stabilizing. At PAL 1, a rate of 180 transactions per 1,000 O&D enplanements is estimated. **Table 34** presents the on-demand requirements based on a growth of passenger tendency to choose an on-demand mode for Terminal 1. Terminal 2 requirements are included in **Table 35**.

Table 34. Terminal 1 On-Demand Commercial Vehicle Requirements – PAL 1 Scenario 1.6

Mode Type	Requirement	Existing Supply	Surplus/(Deficit)
Limo	33	23	(10)
Taxi	24	44	20
TNC	44	30	(14)
Total	**101**	**97**	**(4)**

Table 35. Terminal 2 On-Demand Commercial Vehicle Requirements – PAL 1 Scenario 1.6

Mode Type	Requirement	Existing Supply	Surplus/(Deficit)
Limo	7	9	2
Taxi	5	12	7
TNC	10	8	(2)
Total	**22**	**29**	**7**

The results presented in **Tables 34 and 35** suggest that in Scenario 1.6:

- An increase in the desire to use on-demand services will result in a slight deficit of loading positions at Terminal 1. Like Scenario 1.5, reallocation of positions between operator types would result in better utilization of the existing space.
- Terminal 2 has an adequate number of on-demand positions to meet PAL 1 requirements.

5.2.3 PAL 1 Scheduled Services

Due to their operational model, scheduled service requirements do not vary by the PAL 1 scenarios presented for on-demand services. The scheduled service requirements for both terminals at PAL 1 are presented in **Table 36**. At PAL 1, a slight deficit of shuttle positions will exist at Terminal 1.

Table 36. Scheduled Commercial Vehicle Requirements – PAL 1 Scheduled Vehicles

Mode Type	Required Loading Positions		
	Terminal 1	Terminal 2	Airport Total
Bus	9	5	14
Metro Transit	2	-	2
Hotel Courtesy Shuttle	11	4	15
Off-Airport Parking Shuttle	6	6	12
Off-Airport Rental Shuttle	3	3	6
Out State Shuttle	7	3	10
Shared Ride	3	3	6
Total	**41**	**24**	**65**
Existing Airport Supply	*36*	*26*	*62*

The results presented in **Table 36** suggest that Terminal 1 will experience a deficit of 5 shuttle positions at PAL 1. Terminal 2 has an adequate number of positions through PAL 1.

6 SUMMARY

Future landside facility requirements established in this technical memorandum will inform landside development alternatives. **Table 37**, **Table 38**, and **Table 39** summarize the baseline facility requirements analyzed in this memorandum. The requirements include parking stalls, rental car facilities, and commercial ground transportation positions.

Table 37. Parking Requirements - Baseline

	Requirement [1]			
	2019	**PAL 1**	**PAL 2**	**PAL 3**
On-Airport	18,800	21,090	22,640	25,900
Off-Airport	5,700	6,370	6,840	7,820
Employee	1,900	1,950	2,080	2,380
Total	26,400	29,410	31,560	36,100

Table 38. Rental Car Facility Requirements

	2019	**PAL 1**	**PAL 2**	**PAL 3**
CSB Counter Requirement	55	61	66	75
RR Stall Requirement [1]	1,650	1,855	1,990	2,275
Car Wash Bay Requirement [1]	24	26	27	32
Vehicle Storage Requirement	1,160	1,310	1,400	1,610
ICE Fueling Position Requirement [1]	92	102	109	125

[1] *ICE fueling position requirement assumes there is no EV fleet conversion. Refer to* ***Section 4.3*** *for requirements assuming EV conversion.*

Table 39. Commercial Vehicle Position Requirements

	Existing (2019)	**PAL 1 (2025)**	**PAL 2 (2030)**	**PAL 3 (2040)**
On-Demand [1]	106	106	106	133
Scheduled [2]	51	63	63	71
Total Positions	157	169	169	204

[1] *On-demand services include TNCs, Taxis, and Limos.*

[2] *Scheduled services include shuttles and buses.*