APPENDIX O

Purpose and Need Technical Report

This page is left intentionally blank.

Purpose and Need Technical Report

Prepared by:

HNTB Corporation

February 2012

Minneapolis-St. Paul International Airport 2020 Improvements Environmental Assessment/ Environmental Assessment Worksheet

This page is left intentionally blank.

TABLE OF CONTENTS **Page**

LIST OF FIGURES **Page**

LIST OF TABLES **Page**

This page is left intentionally blank.

APPENDIX O
Purpose and Need Technical Report

INTRODUCTION

The Metropolitan Airports Commission (MAC/Sponsor) is proposing development at the Minneapolis-St. Paul International Airport (MSP). In order to comply with both the National Environmental Policy Act (NEPA) and the Minnesota Environmental Policy Act (MEPA), environmental review of the proposed development in the form of an Environmental Assessment (EA) was conducted.

An EA must include a discussion of the purpose and need for the proposed development. The purpose and need are identified by describing the problems being addressed and the proposed solutions. Defining the purpose and need is essential in providing a sound justification for the proposed development. In addition, the purpose and need is used as the primary foundation to develop reasonable alternatives to the proposed development as required by NEPA.

The purpose and need discussion within the EA should be brief. Therefore, this Technical Report was developed to document the detailed supporting information not provided within the body of the EA.

1 Statement of Purpose and Need

The need for the Sponsor's Proposed Action is evident in the existing and projected unacceptable levels of service at Minneapolis-St. Paul International Airport's (MSP's) facilities. MSP is experiencing unacceptable levels of service within Terminal 1-Lindbergh at both landside and terminal facilities: the arrivals curb, parking and international arrivals facility are currently congested. Additionally, the demand for gates at Terminal 2-Humphrey exceeds capacity during the winter period from the end of December to the beginning of April. As passenger activity grows, the levels of service for landside facilities, including access roads, are expected to deteriorate further. Similarly, the levels of service within the terminal environment at gates, ticket counters, passenger check-in areas, security screening checkpoints and baggage claim areas are projected to deteriorate to unacceptable levels based on standard airport planning practices.

The Metropolitan Airports Commission (MAC) is proposing to address the identified needs through 2020 by implementing the Proposed Action. Thus the purpose of the Proposed Action is to accommodate the expected demand such that the level of service is acceptable throughout MSP's facilities under both existing and 2020 conditions.

Need:

Unacceptable levels of service at MSP terminal and landside facilities under current and 2020 conditions

Purpose:

Accommodate expected demand at MSP such that the level of service is acceptable through the 2020 planning timeframe

2 Supporting Information

This section presents information, including data and analysis, which supports the statement of Purpose and Need. Sub-section 2.1 discusses the 2030 MSP Long Term Comprehensive Plan (LTCP) Update, as it was the initial basis for determining that certain components of the landside and terminal facilities did not and would not provide an acceptable level of service. The aviation activity forecast, the basis for determining future needs, is briefly described in Sub-section 2.2. Finally, Sub-section 2.3 identifies the specific current and future needs based on the aviation activity forecast.

2.1 MSP LTCP Update

The LTCP Update showed that airport improvements would be needed to accommodate the substantial changes that have occurred in the aviation industry and at MSP. Airline mergers, shifts in the aircraft fleet, new technologies and evolving security protocols stemming from the September 11, 2001 terrorist attacks resulted in many changes to airport operations. These changes affected airline service patterns, as well as passenger processing and behavior.

The LTCP Update stated that, "Airports work best when the capacities of their various elements are balanced and work in harmony to provide a safe, efficient system of facilities with a high level of customer service. Over time, some of MSP's facilities have become less efficient and some have not been improved to meet the dynamic needs of today's travelers. While MSP's airfield was dramatically improved with the addition of a fourth runway in 2005, portions of the terminal and landside facilities have become outdated and need improvement."[1]

The LTCP Update concluded that, "the existing passenger terminal complexes and their landside facilities are not able to accommodate planned forecast growth without expansion. Growth in passenger boardings will prompt additional aircraft gates, parking, roadway improvements and terminal space to allow passengers to enjoy a safe and comfortable airport environment."

The conclusion that airport improvements were needed was driven by the LTCP Update forecast of aviation activity. Forecasts of aviation activity are prepared to determine future passenger and operation levels expected at an airport. Aviation planning is then conducted using these forecasts to determine if existing facilities are in need of improvement.

In the LTCP Update, the MAC identified specific needs based on forecasts of aviation activity through 2030. The LTCP Update forecast was based on both economic trends and airline industry factors. The economic trends included regional and national income projections, as well as adjustments for both the 2008-2009 recession and fuel price increases. Airline factors included trends in air fares, anticipated aircraft fleet, connecting passenger routing patterns, the Delta/Northwest merger and the entry of Southwest Airlines into the market.

2.2 EA Aviation Activity Forecast

The LTCP Update forecast was considered for use in this EA. The LTCP Update forecast was prepared in 2009. Since then several significant factors have resulted in changes to aviation activity. These factors include the lagging economic recovery, the merger of Southwest Airlines and AirTran Airways, and changes in airline fleet plans. Additionally, more detailed forecast information was needed for various studies. Therefore, the LTCP Update forecast was updated and refined for this EA. A detailed discussion of the updated aviation activity forecast can be found in Appendix A of the EA, *Aviation Activity Forecast Technical Report*.

2.3 Current and Future Needs

Actual 2010 data and the updated aviation activity forecast, were used to verify the needs originally identified in the LTCP Update. While the LTCP Update identified needs through 2030, for the purposes of this EA, the 2020 planning timeframe is considered reasonably foreseeable. Therefore, detailed planning was conducted to identify aircraft gate requirements, as well as terminal and landside needs for current (2010) and future (2020) conditions. The future needs are based on the assumption that MSP would operate as it currently does with respect to terminal use; the respective airlines use the same terminal in the future as they do today. The following sub-sections summarize the identified needs for aircraft gates (Section 2.3.1), components of the terminal (Section 2.3.2) and landside facilities (Section 2.3.3) at the airport.

2.3.1 Gates

Two parameters were considered in identifying needs related to aircraft gates: the number of gates and the size of the gates. Gate size refers to the needed terminal frontage and depth for an aircraft to park at the terminal.

By considering these parameters it was determined that under current conditions additional gates are needed at Terminal 2-Humphrey and changes to gate size/ frontage is needed at Terminal 1-Lindbergh. The following paragraphs describe the reasons these improvements are needed.

Additional gates are currently needed at Terminal 2-Humphrey in order to maintain adequate capacity during the winter period from late December through early April. Operations have grown considerably at Terminal 2-Humphrey. While Terminal 2-Humphrey may have the capacity to accommodate this growth for the year-round carriers, it cannot accommodate additional operations in the form of seasonal charters or new entrants.

Charter carriers submit requests for gate use on a specific day(s) at specific times. During the winter period, the MAC is often unable to accommodate the requested times and must offer alternative times to the charter carriers. The charter carriers are usually unable to accept the alternative times because their schedules and planned use of their aircraft fleet cannot be adjusted and they are forced to go elsewhere. As a result the airport suffers a loss of revenue and the traveling public loses travel options and potentially pays more for travel because of the loss of competition. Likewise, the inability to accommodate a new entrant at Terminal 2-Humphrey would cause similar losses.

Changes to the gate sizes at Terminal 1-Lindbergh are needed to accommodate changes in the aviation industry. Two ongoing trends are already impacting the size of aircraft in the operating fleet and thus the terminal gate frontage requirements:

- The increased use of larger aircraft by predominantly regional carriers; and
- The practice of adding winglets to aircraft to reduce drag.

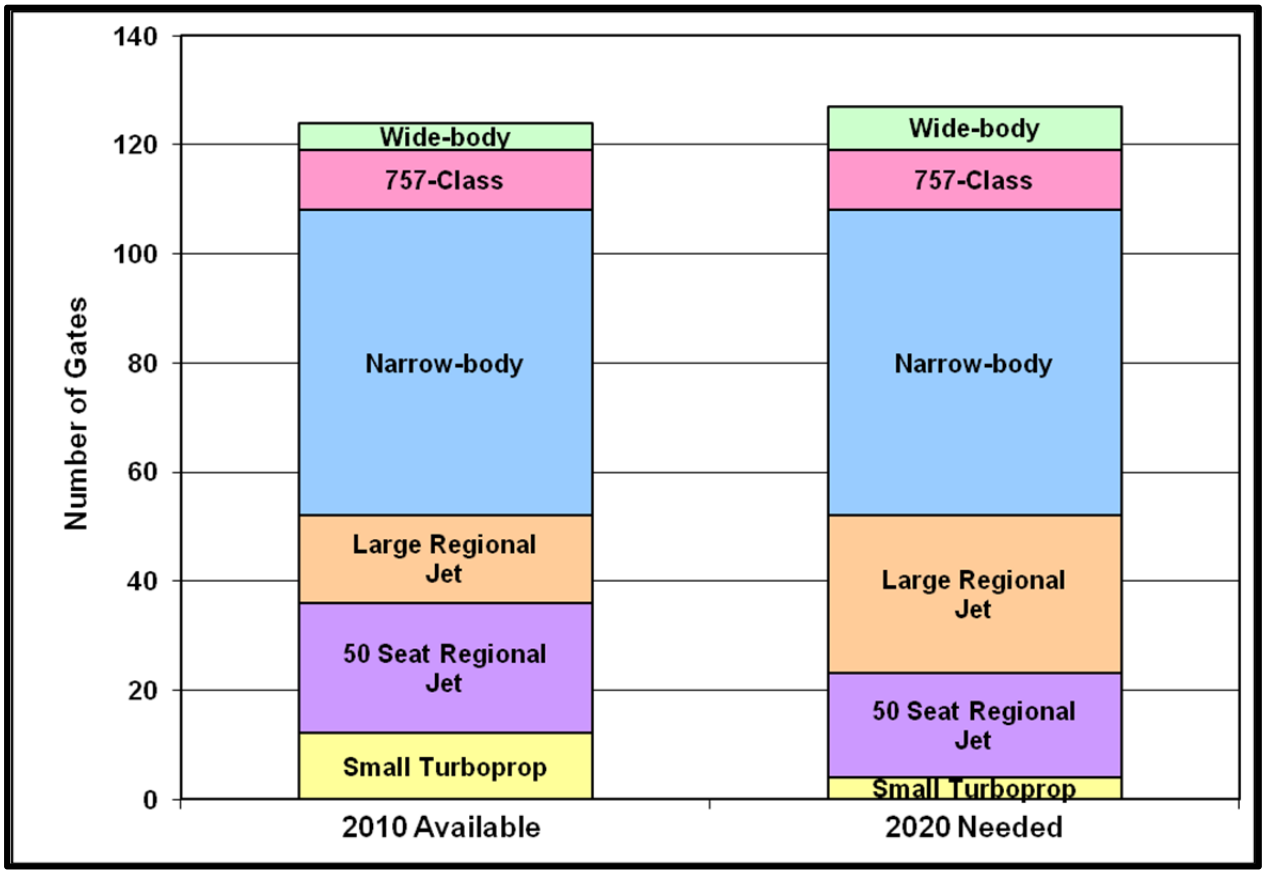
In order to accommodate these changes in the operating aircraft fleet, the MAC and Delta Air Lines are in the process of re-positioning the gate locations along the Terminal 1-Lindbergh frontage. This process adjusts the aircraft parking locations to accommodate increased aircraft size and results in fewer total gates at Terminal 1-Lindbergh. Also, in some cases adjusting the gate location is not possible because, while increasing the gate frontage to accommodate a larger aircraft at a particular position is possible, the necessary gate depth for the larger aircraft may not be available. For instance, at Concourse A the available gate depth limits the size of the aircraft that can access the gates. As a result these gates may become unusable for the projected fleet.

For future conditions, the needs relative to the aircraft gates were determined for the airport. To determine the needs, future schedules were created to show how the forecasted aircraft fleet would be accommodated at the gates. These schedules, referred to as gated flight schedules, include the time that an aircraft would be at a specific gate and the size of that aircraft.

The gated flight schedules developed for 2020 were used to define the needed number of gates and the aircraft types these gates would serve. The total number of gates needed in 2020 for MSP is 128. **Figure O.2-1** shows the existing number of gates for each group of aircraft type compared to the needed number of gates for each group of aircraft type according to the 2020 gated flight schedules. While the number of gates needed in 2020 is about the same as the total number of existing gates, it is the size of the gates needed that differs. From Figure O.2-1 it can be seen that in 2020, fewer turboprop and 50-seat regional jet gates, and a greater number of large regional jet gates, are needed than are currently available. These differences are important because large regional jets require more terminal frontage and depth than the turboprops and 50-seat regional jets.

Figure O.2-1

Gates Available in 2010 vs. Gates Needed in 2020



Note: There are a total of 127 gates currently available. However, when wide-body aircraft are parked at their assigned gates some of the adjacent gates cannot be used. Under this condition only 124 gates are currently available. The ongoing re-positioning will result in two fewer gates at Terminal 1-Lindbergh and thus reduce the total gates available to 125. Even with the re-positioning, adjacent gates will be unusable when wide-body aircraft are parked at the terminal and as a result only 122 gates may be available.

Source: HNTB analysis, 2011.

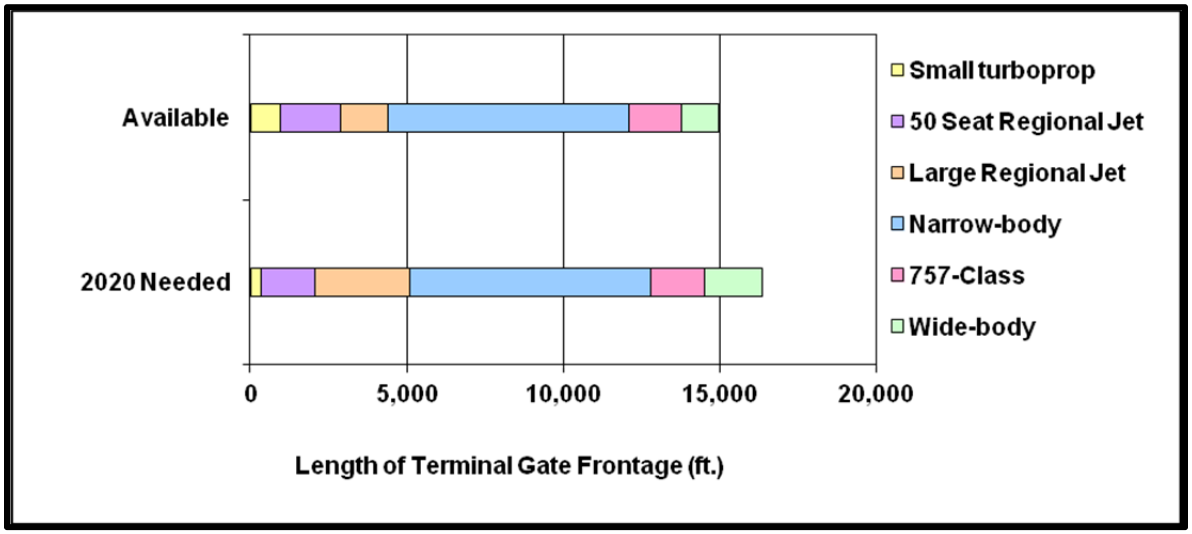
The length of terminal gate frontage needed was determined by summing up the representative wingspans of the aircraft groups at each gate and adding 20-foot buffers between the aircraft wing-tips parked at adjacent gates. Twenty-foot buffers are used for planning purposes because that is the buffer size generally accepted by the airlines. **Figure O.2-2** illustrates the approximate existing terminal gate frontage and the needed terminal gate frontage in 2020. The total calculated terminal gate frontage required for 2020 is approximately 16,400 feet. Given that the existing length of terminal gate frontage measures approximately 15,000 feet, an additional 1,400 feet of terminal frontage is needed to accommodate the forecasted 2020 aircraft fleet.

Anticipated changes in the MSP fleet as a result of recent developments in the EAS Program are not expected to impact the needed gates at MSP. In late 2011 Great lakes Airlines was

selected to provide service to several communities including Thief River Falls and Brainerd in Minnesota, Fort Dodge and Mason City in Iowa, Iron Mountain in Michigan, Watertown in South Dakota and Devils Lake in North Dakota. It is anticipated that Great Lakes Airlines will provide this service using Beech 1900 twin-engine turboprops. Beech 1900 turboprops are not included in the 2020 gated flight schedules. However, a larger turboprop, the Saab 340, is included in the gated forecast. Therefore, the future use of the Beech 1900 turboprops would not impact the future gate needs at MSP.

Figure O.2-2

Gate Frontage Available in 2010 vs. Gate Frontage Needed in 2020



Source: HNTB analysis, 2011.

2.3.2 Terminals

The functional performance of terminal facilities is measured by their ability to accommodate passengers during busy periods. Terminal facility performance was identified by quantifying the peak hour passenger numbers and comparing them to the capacity of various terminal components (e.g., ticketing) at the desired level of service.

Level of Service (LOS), as established for terminals by the International Air Transport Association (IATA), generally indicates the level of performance at which a facility operates under given demand levels (see **Table O.2.1**) and primarily uses passenger comfort (space) and convenience (time) as indicators of service quality. Conforming to industry standard best practices for planning terminal facilities, LOS C is the preferred design day performance level as it typically represents good service quality at a reasonable cost. Level D is considered tolerable during peak periods.

In addition to LOS, standard planning factors may be used to evaluate terminal needs. Standard planning factors are used by facility planners to identify general space requirements for a particular type of facility.

The need for improvements to the functional components of the terminals - passenger check-in area, security screening checkpoint, baggage claim area and the International Arrivals Facility - was determined based on industry standards, levels of service and terminal planning factors. The results of this analysis showed that improvements at Terminal 1-Lindbergh are needed for both current and future conditions.

Table O.2.1

Terminal Service Levels

LOS	Description
A	Excellent level of service; condition of free flow; no delays; excellent level of comfort
B	High level of service; condition of stable flow; very few delays; high level of comfort
C	Good level of service; condition of stable flow; acceptable delays; good level of comfort
D	Adequate level of service; condition of unstable flow; acceptable delays for short period of time; adequate level of comfort
E	Inadequate level of service; condition of unstable flows; unacceptable delays; inadequate level of comfort
F	Unacceptable level of service; condition of cross-flows, system breakdown and unacceptable delays; unacceptable level of comfort

Source: International Air Transport Association (IATA), *Airport Development Manual*.

Concourses

Concourse E in Terminal 1-Lindbergh is in need of refurbishment because it has not been updated in decades. Significant updates including space reallocation and mechanical and technological upgrades are needed. Space reallocation within the Concourse is needed to accommodate restroom upgrades and additions, concessions relocations and hold room modifications. Mechanical and technological upgrades, as well as exterior modifications, are needed in order to reduce energy use.

Passenger Check-In Area

The passenger check-in area at Terminal 1-Lindbergh currently experiences congestion during peak periods. Based on this observation, two aspects of the passenger check-in area were evaluated. The ticket counter area was evaluated to determine if it is adequate to meet

passenger demand while maintaining acceptable wait times. In addition, the ticket counter queuing area (area adjacent to the ticket counters for passenger queuing and circulation) was evaluated to determine if the area is adequate to accommodate waiting passengers during peak periods.

Standard planning factors were applied to the current and future demand to determine the approximate needs for the ticket counter area and the ticket counter queuing area. **Table O.2.2** shows the results of this analysis.

Table O.2.2

Terminal 1-Lindbergh Facilities Analysis

	Existing Facility Size	Planning Factor	2010 Existing Conditions			2020 Forecast Conditions		
			Demand	Required	Surplus (Deficit)	Demand	Required	Surplus (Deficit)
Passenger Check-In								
Ticket Counter Area	5,780 sf	1.64 sf/PHOP[(1)]	2,382 PHOP	3,906 sf	1,874 sf	3,008 PHOP	4,933 sf	847sf
Ticket Counter Queuing Area	17,900 sf	14.5 sf/PHOP[(2)]		34,539 sf	(16,639) sf		43,616 sf	(25,716) sf
Security Screening Checkpoint								
Lanes	20	1 lane/180 PHOP [(3)]	2,382 PHOP	13	7	3,008 PHOP	17	3
Area	27,530 sf	2,000 sf/lane[(4)]		26,000 sf	1,530 sf		34,000 sf	(6,470) sf
Baggage Claim								
Domestic Device Frontage	1,230 lf	0.6 lf/PHTP[(5)]	2,438 PHTP	1,462 lf	(232) lf	2,747 PHTP	1,648 lf	(418) lf
Domestic Device Queue	32,440 sf	16,000 sf /500 lf of frontage[(6)]		46,784 sf	(14,344) sf		52,736 sf	(20,296) sf

Notes:

(1) 1.64 square feet per peak hour originating passenger (PHOP).

(2) 14.5 square feet per peak hour originating passenger.

(3) 1 lane per 180 peak hour originating passenger.

(4) 2,000 square feet per lane.

(5) 0.6 linear feet per peak hour terminating passenger (PHTP).

(6) 16,000 square feet per 500 linear feet of device frontage.

Source: FAA Advisory Circular No. 150/5360 Planning and Design Guidelines for Airport Terminal Figure 5-29 and Architectural Alliance analysis, 2011.

As shown in Table O.2.2, the existing ticket counter area is sufficient for both existing and 2020 conditions. However, the ticket counter queuing area is, and would continue to be, deficient.

Not only is the ticket counter queuing area deficient based on planning factors, it is also deficient based on the MAC's LOS goals. According to the *Airport Development Manual*, 9th ed., IATA 2004, the minimum area required to achieve a "C" LOS is 14 square feet / peak hour originating passenger (SF/PHOP).[2] In 2010 and 2020, the existing area of 17,900 SF is equivalent to 7.5 SF/PHOP and 5.95 SF/PHOP; both considered a rating of LOS "F." This is likely the result of encroaching adjacent elements including security checkpoints and Transportation Security Administration (TSA) screening equipment. The Terminal 1-Lindbergh passenger check-in area is also relatively narrow and thus lacks the depth needed to provide adequate circulation space between the queuing area and adjacent obstructions including vertical circulation, mezzanine columns and miscellaneous amenities. When a surge in passengers at the queuing area is experienced, the overflow has a significant impact on circulation throughout the space.

Industry trends related to the layout of passenger check-in areas are evolving. Additionally, technology continues to emerge and evolve, impacting remote check-in devices and other approaches that relieve the passenger demand in the check-in area. Even with these evolving trends and emerging technologies, it is likely that improvements will be necessary to provide an acceptable LOS in the future.

Security Screening Checkpoint

Two aspects of security screening checkpoints, lanes and area, were evaluated to determine whether improvements are needed or would be needed at Terminal 1-Lindbergh. Standard planning factors were applied to the current and future demand to determine the approximate needs for the security screening checkpoint(s).

The required number of lanes was determined based on a planning factor of one lane per 180 peak hour originating passengers. As shown in Table O.2.2, no deficiencies were identified based on this planning factor and therefore, the 20 existing security screening checkpoint lanes at Terminal 1-Lindbergh appear to be sufficient for current and 2020 conditions.

While the analysis of the quantity of security screening checkpoint lanes is one factor, the area in square feet associated with those lanes is equally relevant as an indicator of the ability to process passengers efficiently and without excessive delay. There are 20 existing security screening checkpoint lanes with an associated area of 27,530 square feet. As indicated in Table O.2.2, this area is sufficient for the demand in 2010. However, the existing security screening checkpoint area is insufficient to address the forecasted 2020 passenger demand.

At Terminal 1-Lindbergh the existing quantity of 20 lanes take up a total area of 27,530 square feet. Therefore, the actual average area associated with each lane is 1,376 square feet. This is 69% of the recommended planning factor of 2,000 square feet per lane, indicating that while the number of lanes meets the projected demand, the area associated with those lanes is inadequate. This results in passenger processing inefficiencies today and further delays in the future.

Baggage Claim

The baggage claim area at Terminal 1-Lindbergh currently experiences congestion during peak periods resulting in an LOS that does not meet the MAC's vision. Based on these observations, two aspects of the baggage claim area, bag claim device frontage and queue area, were evaluated for deficiencies. The bag claim device frontage and queue area are aspects of the space that directly impact the passenger experience and are used to evaluate existing and projected LOS.

As shown in Table O.2.2, the existing baggage claim device frontage is insufficient for both existing and 2020 conditions. The existing lack of device frontage results in limited access to bags, causing delays and congestion adjacent to the devices and an unacceptable LOS. Looking ahead to 2020, the projected shortfall indicates not only an unacceptable LOS at peak times, but also that delays and congestion are likely to be experienced at unacceptable levels during non-peak times as well.

Table O.2.2 also shows that, based on standard planning factors, the existing baggage claim device queue area (including circulation, queue and Bag Service Office) is insufficient for both 2010 and 2020 conditions. Since the planning factor for the baggage claim device queue area is directly related to baggage claim device frontage, it is clear that deficiency in one aspect directly impacts delays, congestion and the overall LOS associated with the baggage claim device queue area.

Not only is the bag claim device queue area deficient based on standard planning factors, it is also deficient given LOS goals. According to the *Airport Development Manual*, 9th ed., IATA 2004, the minimum baggage claim device queue area (without claim device) required to achieve the goal of a "C" LOS is 18.3 square feet per peak hour terminating passenger (SF/PHTP)[3]. In 2010 the existing area of 32,440 square feet is equivalent to 13.3 SF/PHTP and a rating of LOS "E." Looking ahead to 2020, there would be a further decline to 11.8 SF/PHTP and a continued rating of LOS "E" while approaching the minimum of 10.8 SF/PHTP to stay above the threshold for LOS "F."

International Facilities

In 2010, the Terminal 1-Lindbergh US Customs and Border Protection primary processing and baggage claim facilities were routinely overstressed at daily peak demand, and were generally considered inadequate. Numerous airline and contracted staff were required to manually unload baggage carousels on a daily basis to prevent equipment failure and damage to passenger bags. Further, two separate carousels are used for certain flights, resulting in passenger confusion as to which carousel their bags will arrive on. This increases passenger inconvenience and delays their movement through the system.

Analysis shows that the current processing facilities are also expected to be inadequate in 2020. The US Customs and Border Protection Airport Technical Design Standards (BPATDS) was used to estimate the appropriate size of the primary processing facilities and the number of processing stations based on the rolling peak international deplanements. For MSP, the rolling

peak international deplanements in 2020 are forecasted at 1,641 Peak Hour Terminating Passengers (PHTP). According to the BPATDS, the recommended area for equivalent facilities is 24,500 square feet, nearly twice as much as the existing area of 13,600 square feet. The same referenced standards call for 32 processing stations.[4] With the existing 16 stations processing 50 passengers per hour per station, only 800 passengers are processed per hour. This results in wait times of up to two hours, which is unacceptable per BPATDS.

2.3.3 Landside Facilities

The need for improvements to the existing landside facilities was also evaluated based on industry standards and/or LOS. The following paragraphs describe the evaluation of each of the landside components: terminal curb roadways; ground transportation, parking and rental car facilities; and access roads.

Terminal Curb Roadways

Terminal curb roadway capacity is considered a function of the through capacity, or number of lanes, the service capacity, or length of curb available to load and unload passengers and the ideal capacity balance of those activities. The measure of effectiveness is represented by the volume to capacity (v/c) ratio which determines the level of congestion on the curb as measured against the through capacity and service capacity. A v/c ratio of 1.0 represents the capacity of the roadway in a gridlock situation. A v/c ratio of 0.70 during peak periods represents an adequate LOS where conditions are busy but have not reached a gridlock scenario and is the level to which facilities should be planned to operate. Congestion on a curb roadway increases disproportionately at v/c ratios above approximately 0.70, and curb conditions deteriorate very quickly under such circumstances. Thus, a v/c ratio over 0.70 is considered an inadequate LOS while a v/c ratio below 0.70 represents an acceptable LOS.

In 2010, the Terminal 2-Humphrey departure and arrival curb roadways operated with a v/c ratio of 0.70 or less representing an adequate LOS. Likewise, the Terminal 1-Lindbergh departures curb roadway operated with a v/c ratio of 0.70 or less. However, the Terminal 1-Lindbergh arrivals curb roadway operated with a v/c ratio of 0.80 in 2010 and will operate with a projected v/c ratio of 1.0 in 2020, representing an inadequate LOS. As shown in **Table O.2.3**, an additional 100 and 400 feet of curb are required to operate with a sufficient v/c ratio of 0.70 in 2010 and 2020, respectively.

Table O.2.3

Curb Roadway Analysis

	Existing Length (ft)	Existing Number of Lanes	2010 Existing Conditions			2020 Forecast Conditions		
			v/c ratio	0.70 v/c Requirement[(1)]	Surplus (Deficit) (ft)	v/c ratio	0.70 v/c Requirement (1)	Surplus (Deficit) (ft)
Terminal 1-Lindbergh								
Departures								
Inner	830	4	0.70	4 lanes @ 830’	0’	0.70	4 lanes @ 830’	0
Outer	630	3	0.15	3 lanes @ 240’	390’	0.35	3 lanes @ 330’	300’
Arrivals								
Inner	700	5	0.80	5 lanes @ 800’	(100’)	1.00	5 lanes @ 1,100’	(400’)
Outer[(2)]	700	4	N/A	N/A	N/A	N/A	N/A	N/A
Terminal 2-Humphrey								
Departures	350	4	0.60	4 lanes @ 155’	195’	0.70	4 lanes @ 350’	0’
Arrivals	350	4	0.60	4 lanes @ 210’	140’	0.60	4 lanes @ 290’	60’

Notes:

(1) A v/c ratio of 0.7 or below is considered an acceptable LOS.

(2) Terminal 1-Lindbergh outer arrivals curb is currently used as part of the ground transportation center (GTC).

Source: MAC As-Built CAD Files and HNTB analysis, 2011.

Commercial Ground Transportation Centers

The capacities and demands for the Terminal 1-Lindbergh and Terminal 2-Humphrey commercial ground transportation centers (GTC) are provided in **Table O.2.4**. The capacity is equal to the number of existing parking spaces. The estimated demand for spaces was calculated based on the existing peak hour volume and measured mean dwell time for each type of vehicle operating at the commercial GTCs.

Table O.2.4

Commercial Ground Transportation Center Analysis

	Existing Capacity	2010 Existing Conditions		2020 Forecast Conditions	
		Requirement	Surplus (Deficit)	Requirement	Surplus (Deficit)
Terminal 1-Lindbergh					
GTC Vehicle Loading Spaces	48	47	1	61	(13)
Terminal 2-Humphrey					
GTC Vehicle Loading Spaces	15	12	3	16	(1)

Source: MAC As-Built CAD Files and HNTB analysis, 2011.

As shown in Table O.2.4 the Terminal 1-Lindbergh commercial GTC had a net surplus of one space. In 2020, it is projected that 13 additional spaces will be needed at the Terminal 1-Lindbergh commercial GTC and only one additional space will be needed at the Terminal 2-Humphrey commercial GTC.

Parking

Parking requirements are calculated based on providing an adequate level of customer ease in finding an available parking space. To calculate the required number of spaces, the total passenger demand for each type of parking is divided by an efficiency or search factor, which represents the point at which the lot is deemed essentially full and a new entrant would have difficulty finding an available space. This factor is assumed to be 0.90 for general parking and 0.85 for short-term parking. This equates to a 90% and 85% maximum occupancy, respectively, which allows vehicles to search for an open space.

Analysis of existing conditions at Terminal 1-Lindbergh show a slight surplus of 483 general parking stalls during the average day of the peak month. However, MAC parking revenue data show that from January through May of 2010 passengers were directed to overflow parking at Terminal 2-Humphrey on eight Wednesdays and one Tuesday which will continue to increase as facilities become more constrained. As shown in **Table O.2.5**, by 2020, Terminal 1-Lindbergh will have a deficit of approximately 8,545 parking spaces while Terminal 2-Humphrey will have a surplus of approximately 310 spaces, assuming employees continue to use Terminal 2-Humphrey parking facilities.

Table O.2.5
Parking Facility Analysis

	Existing Capacity	2010 Existing Conditions		2020 Forecast Conditions	
		Requirement	Surplus (Deficit)	Requirement	Surplus (Deficit)
Terminal 1-Lindbergh					
General Parking Stalls	11,903	11,420	483	20,630	(8,727)
Short Term Parking Stalls	967	620	347	785	182
Total	12,870	12,040	830	21,415	(8,545)
Terminal 2-Humphrey					
General Parking Stalls	8,195	3,450	4,745	5,980	2,215
Employee Parking Stalls(1)	410	2,100	(1,690)	2,700	(2,290)
Sub Total	8,605	5,550	3,055	8,680	(75)
Short Term Parking Stalls	505	75	430	120	385
Total	9,110	5,625	3,485	8,800	310

Notes:
(1) In addition to the 410 employee spaces provided on the mezzanine level of the Purple ramp at Terminal 2-Humphry, Terminal 1-Lindbergh airport employees currently utilize Terminal 2-Humphrey General Parking.

Source: MAC As-Built CAD Files and HNTB analysis, 2011.

Rental Cars

Rental car ready-return facilities, where customers pick up and return rental cars, are provided at both Terminal 1-Lindbergh and Terminal 2-Humphrey; however the quick-turn-around (QTA) facility, where rental vehicles are fueled and washed between rentals, is provided only at Terminal 1-Lindbergh. Terminal 2-Humphrey rental cars are shuttled between Terminal 2-Humphrey rental spaces and the QTA facility at Terminal 1-Lindbergh between rentals.

The results of the rental car facility analysis are shown in **Table O.2.6**. Based on observation, rental car facilities are currently operating at capacity with an acceptable LOS. Future deficiencies were estimated by projecting the requirements relative to the forecasted growth in rental car activity. As shown in Table O.2.6, approximately 150 and 350 new spaces are required at Terminal 1-Lindbergh and Terminal 2-Humphrey, respectively, in 2020. In addition, a total of approximately 81,900 square feet of new QTA area will be required with 79,800 square feet of that area required to accommodate Terminal 2-Humphrey rental vehicles.

Table O.2.6
Rental Car Facility Analysis

	Existing Capacity	2010 Existing Conditions		2020 Forecast Conditions	
		Requirement	Surplus (Deficit)	Requirement	Surplus (Deficit)
Terminal 1-Lindbergh					
Rental Car Spaces	1,725	1,691	34	1,880	(155)
Quick-Turn-Around Area (sf)[(1)]	302,050	278,940	23,110	304,100	(2,050)
Terminal 2-Humphrey					
Rental Car Spaces	145	142	3	495	(350)
Quick-Turn-Around Area (sf)[(1)]	0	23,110	(23,110)	79,800	(79,800)

Note:
(1) Currently all quick-turn-around facilities for both Terminal 1-Lindbergh and Terminal 2-Humphrey rental cars are provided at Terminal 1-Lindbergh. The portion of the quick-turn-around area requirement for Terminal 2-Humphrey is 23,110 square feet in 2010 and 79,800 square feet in 2020.

Source: MAC As-Built CAD Files and HNTB analysis, 2011.

Roadways

Roads to and from Terminal 1-Lindbergh and Terminal 2-Humphrey were evaluated to determine whether improvements are or will be needed. Typically the operational conditions of roadways are expressed in LOS. "Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each LOS represents a range of operating conditions and the driver's perspective of those conditions."[5] For planning purposes LOS D or better (LOS A-D) is typically recognized by transportation agencies as satisfactory operations.

At intersections, LOS is based on the average control delay per vehicle. **Table O.2.7** and **Table O.2.8** list the LOS thresholds for signalized intersections and unsignalized intersections, respectively.

Table O.2.7

LOS Criteria for Signalized Intersections

LOS	Control Delay per Vehicle (sec/veh)[1]
A	≤ 10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

Notes:
(1) sec/veh = seconds per vehicle

Source: *Highway Capacity Manual*, Chapter 16.

Table O.2.8

LOS Criteria for Unsignalized Intersections

LOS	Control Delay per Vehicle (sec/veh)[1]
A	≤ 10
B	> 10-15
C	> 15-25
D	> 25-35
E	> 35-50
F	> 50

Notes:
(1) sec/veh = seconds per vehicle

Source: *Highway Capacity Manual*, Chapter 17.

As part of establishing the Purpose and Need, intersections operating at unacceptable levels of service, LOS E and F, were identified. For 2010, only one intersection operates at an LOS E or F. The intersection of Post Road and the SuperAmerica East Driveway operates at an LOS F during the PM peak. In 2020, several intersections are projected to operate at an LOS E or F. **Table O.2.9** shows the intersections projected to have an unacceptable LOS in 2020.

Table O.2.9

Intersections at LOS E or F in 2020

Intersection	Control	AM Peak		PM Peak		Midday Peak	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
34th Ave S & WB I-494 Ramps	Signal	91	F	40	D	21	C
Post Rd & Taxi Staging Middle Exit	Side Street Stop	37	E	2	A	25	C
Post Rd & Taxi Staging East Exit	Side Street Stop	9	A	9	A	35	E
Post Rd & SA West Driveway	Side Street Stop	14	B	11	B	39	E
Post Rd & SA East Driveway	Side Street Stop	11	B	29	D	37	E
Post Rd & NB TH 5 Ramps	Side Street Stop	15	B	61	F	65	F

Source: Kimley-Horn and Associates, Inc. analysis, 2011.

ENDNOTES

[1] MAC, MSP Long Term Comprehensive Plan Update, 7/26/10 p.E.1.

[2] IATA. *Airport Development Reference Manual*. p.180. 9th Edition. January 2004

[3] IATA. *Airport Development Reference Manual*. p.187. 9th Edition. January 2004

[4] U.S. Department of Homeland Security U.S. Customs and Border Protection, *Airport Technical Design Standards Passenger Processing Facilities*, August 2006, p. 3-2

[5] TRB, *Highway Capacity Manual*, 2000, p.2-3.