

CHAPTER 3: FACILITY REQUIREMENTS

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3.1 INTRODUCTION

Facility requirements identify the scale and type of improvements the various airport facilities will need to safely and comfortably accommodate forecast growth in passengers and operations in future years. Facility requirements are developed through a 3-step process.

1. Facilities are inventoried to determine their existing condition and capacity.
2. Forecasts of aviation activity are prepared to determine future passenger and operations levels expected at the airport.
3. Requirements are determined for those facilities with inadequate capacity to accommodate future levels of passengers and operations.

Facility requirements are intended to be objective and to identify how much additional capacity should be provided. Facility requirements do not, however, evaluate how or where additional capacity should be provided. The details of how future requirements are met are addressed during the development of concepts.

For the purposes of the Minneapolis-St. Paul International Airport (MSP) Long Term Comprehensive Plan Update (LTCP), the airport's existing facilities were broadly described in Chapter 1. The facility requirements analysis presented in this chapter includes a more detailed evaluation of the conditions of the existing facilities including their current capacity.

The forecast of aviation activity presented in Chapter 2 estimates future operations and passenger levels. The airfield facilities will be impacted by the total number of operations at MSP while the terminal and landside facilities will be impacted by the number of passengers. Most airport support facilities can be evaluated based on the total number of operations.

Fifteen key focus areas were identified for the LTCP Update to evaluate. Each of these focus issues recognized existing facilities that are operating inefficiently today or are expected to operate efficiently with moderate increases in passenger numbers. The 15 focus areas are:

1. Balancing passenger demand between the two terminals
2. Reallocation of airlines between the two terminals
3. Arrival curbside capacity (Lindbergh Terminal)
4. Public parking (Both Terminals)
5. Way-finding / Signage for the airport roadways
6. Baggage claim facilities (Lindbergh Terminal)
7. Security Screening Check Points (Lindbergh Terminal)
8. International arrivals (Customs and Border Protection) facilities (Lindbergh Terminal)
9. Regional carrier aircraft gates (Lindbergh Terminal)
10. Refurbishing Concourses E and F (Lindbergh Terminal)
11. Rental car facilities (Both Terminals)
12. Airfield capacity and taxiways
13. The United States Post Office facility (Lindbergh Terminal)
14. Potential development of an airport hotel
15. Air Traffic Control Tower (ATCT) improvements

Though the LTCP will focus on these facility issues, an evaluation of all facilities has been included in the study to identify any other potential facility issues.

3.1.1 GATE ALLOCATION AND THE TWO-TERMINAL SYSTEM

As described in Chapter 1, MSP has two terminals: the Lindbergh Terminal and the Humphrey Terminal. Today, the Lindbergh Terminal is substantially larger than the Humphrey Terminal and accommodates the majority of passenger activity at MSP. However, even today, the terminal landside facilities, notably the arrivals curb and parking facilities are congested at the Lindbergh Terminal. Future expansion of terminal facilities is probably more feasible at the Humphrey Terminal where there is more available land and the supporting landside facilities have available capacity to serve more passengers. This theme – the expansion of the Humphrey Terminal – is a central element of the LTCP Update and is critical to the evaluation of facility requirements within the LTCP Update.

Each airline that serves MSP utilizes one or more gates on a consistent basis. Passengers can expect to find Delta Air Lines operating from the Lindbergh Terminal and Sun Country Airlines operating from the Humphrey Terminal. However, as passenger boardings increase at MSP, both terminals will require improvements and expansion. Further, Delta Air Lines operates a major hub at MSP. This is an important fact because approximately 60% of Delta Air Lines' passengers at MSP do not begin or end their trips at MSP, they simply fly through on their way between two other airports. These connecting passengers do not rely on MSP's bag claim facilities, ticketing facilities, roadways, or parking. However, most passengers on other airlines are beginning and ending their trips at MSP and do rely on the ticketing, bag-claim, roadways and parking facilities.

Today, in addition to Delta Air Lines, the Lindbergh Terminal accommodates eight other airlines: American Airlines, United Airlines, US Airways, Alaska Airlines, Midwest Airlines, Continental Airlines, Air Canada, and Frontier Airlines. The forecast of aviation activity identifies that the 117 gates at the Lindbergh Terminal will not be able to accommodate the forecast growth of these carriers at MSP beyond 2015. More critically, the landside facilities at the Lindbergh Terminal, including the curbs and parking areas, are unable to accommodate the arriving and departing passengers. The Humphrey Terminal, however, has expansion capability sufficient to expand passenger processing and landside facilities to accommodate passenger growth and additional boarding gates.

The existing capacities and constraints of the terminal and landside facilities will be discussed in greater detail within this chapter. However, it is essential to note that for the purposes of the LTCP Update facility requirements analysis, it was assumed that by 2015 all non-SkyTeam airlines (all airlines except Delta Air Lines and its alliance partners) will relocate to an expanded Humphrey Terminal.

Reallocating airline passengers between the two terminals by 2015 will relieve some capacity constraints at the Lindbergh Terminal. However, improvements and expansion of the Humphrey Terminal will be required to accommodate these airlines. The details of required improvements are presented in this chapter of the LTCP Update report.

After the initial reallocation of airlines between the two terminals, ongoing expansions and improvements will be required at both facilities throughout the 20-year LTCP Update planning period.

The aviation activity forecast presented in Chapter 2 includes a forecast of required aircraft gates. Delta and its SkyTeam partners are forecasted to require 119 gates by 2030 while all non-SkyTeam airlines combined are forecasted to require 36 gates by 2030. In addition to the

increased number of gates, the types of aircraft that each gate can accommodate will also change as the fleet of aircraft evolves with more modern planes. This will impact the size and layout of each required gate.

The reallocation of airlines between the two terminals will impact terminal and landside facility requirements. This reallocation was an assumption utilized in developing all facility requirements for the terminal and landside facilities at MSP as part of the LTCP Update.

The reallocation of airlines between the Lindbergh Terminal and Humphrey Terminal accomplishes three key goals:

1. Each terminal will accommodate originating (i.e., passengers beginning or ending their trips at MSP) passenger volumes commensurate with its capacity.
2. Passengers will be able to find their way to the appropriate terminal relatively easily because the Lindbergh Terminal would exclusively serve Delta and its SkyTeam partners while the Humphrey Terminal would serve all other airlines. This would organize all MSP airlines into two distinct and easily identified groups.
3. Expansion of the Humphrey Terminal is more easily accomplished in the near term and will allow the airport to continue a program of carefully phased improvements to both terminal facilities.

The facility requirements for the LTCP Update required that the reallocation of airlines between the two terminals be considered and evaluated early in the process. Therefore, each of the terminal and landside facility requirements discussions addresses the impacts the airline reallocation will have on the respective facilities at each terminal.

3.2 AIRFIELD CAPACITY ANALYSES

3.2.1 AIRFIELD CAPACITY AND DELAY

For the purposes of the LTCP Update, annual airfield capacity was evaluated to determine whether the runway system at MSP could likely accommodate the forecast annual number of takeoffs and landings.

There have been three capacity analyses completed for MSP in recent years that were reviewed to establish an approximate annual airfield capacity:

- The Dual-Track Airport Planning process completed in the mid 1990s
- The Draft Environmental Assessment for the 2015 terminal expansion
- The SIMMOD computer analysis of the proposed cross-field taxiway

As presented in Chapter 2, MSP is projected to have approximately 630,000 annual operations (takeoffs and landings) by 2030. Based on a review of the previous airfield capacity studies for MSP, at 630,000 annual operations MSP is expected to experience average annual delay of approximately ten minutes per operation. Some flights would experience no delays while others, during poor weather in most cases, would experience longer delays. This level of

average annual delay compares to other busy hub airports in the United States and is considered acceptable for airports of this size and number of operations.

The topic of capacity and delay is multi-faceted and can, at times, be heavily impacted by the interaction of other airports within the National Airspace System (NAS). The FAA conducts systematic evaluations of the major airports within the NAS and attempts to identify how impacts at one facility affects other facilities. To better understand MSP facilities and infrastructure, the MAC will initiate a capacity study two years in advance of when MSP is expected to reach 540,000 annual operations and incorporate the results of this study into the following LTCP Update.

3.3 AIRSIDE REQUIREMENTS

3.3.1 RUNWAYS

The LTCP Update does not recommend the development of any additional runways at MSP. The existing runways are expected to accommodate the forecast growth at MSP through 2030, the duration of the planning period.

3.3.2 TAXIWAYS AND CIRCULATION

The taxiway system allows aircraft to move between the runways and other airport facilities (e.g., terminals) in an efficient and safe manner. As the airfield becomes increasingly congested, improvements may be required to help reduce taxi time and delays. The existing MSP taxiway system works efficiently and does not require any immediate significant improvements. However, as the number of operations grows, improvements to the taxiway system will need to be evaluated.

A pair of crossover taxiways located east of the Lindbergh Terminal complex that would connect the approach ends of runways 30L and 30R were recommended in the previous master plan, which was prepared for the airport as part of the Dual-Track Airport Planning process conducted in the 1990s. A crossover taxiway in the same location was also considered in the 2020 Vision Plan proposed by Northwest Airlines in 2004.

The LTCP Update recommends further study of the crossover taxiways at this location and will make a preliminary recommendation that they be accommodated in all facility planning at MSP.

The taxiways will be planned to airplane design Group IV (wingspan less than 171 feet) criteria. Air Traffic Control Tower (ATCT) line-of-sight, though restricted, is not considered to be a constraint to implementing the crossover taxiways. It is assumed that ASDE-X (enhanced ground control RADAR), local area control by the airport, or other means will be used to compensate for limited line of sight from the existing ATCT.

An extension of Taxiway C on the south side of the airport is recommended to alleviate localized congestion in and out of the Humphrey remote apron.

3.4 GATE REQUIREMENTS

The forecast of aviation activity, presented in Chapter 2, includes a forecast of required gates for all airlines for the forecast period through 2030. MSP is characterized by an exclusive use

agreement whereby most airlines lease gates for their exclusive use and do not share their facilities with other airlines. Calculating the number of required airline gates in future years requires consideration of several factors including:

- How frequently a given airline uses its gates
- What size aircraft a given airline flies (larger aircraft require larger gates)
- Access to international passenger processing facilities

MSP airlines were split into three broad categories for calculation of future gate requirements:

- Delta Air Lines and its SkyTeam alliance partners
- Southwest Airlines
- All other passenger airlines

Delta Air Lines and its SkyTeam alliance partners were segregated because of the large hub operation Delta has at MSP. The characteristics of a hub airline differ from those of other airlines operating at MSP. Southwest Airlines was segregated because the airline has a history of significantly higher gate utilization than other airlines. For example, Delta Air Lines and its SkyTeam partners are assumed to operate, on average, 4.7 flights per day from each of their gates. However, Southwest is assumed to operate, on average, 8.5 flights per day from each of its gates. Finally, all other airlines were grouped after SkyTeam and Southwest were segregated.

Though the requirements call for 155 total gates, additional analysis has been provided to identify the characteristics of the gates. First, as presented in the introduction to this chapter, Delta and its SkyTeam partners are assumed to operate out of the Lindbergh Terminal by 2030 while all other airlines are assumed to operate out of the Humphrey Terminal, possibly as soon as 2015.

Lindbergh Terminal – Delta Air Lines/SkyTeam Airlines Requirements

- 119 total gates are required in 2030
- 13 gates must accommodate wide-body aircraft
- 63 gates must accommodate medium and large regional aircraft
- 20 gates must have access to international arrivals facilities

Though there are a total of 117 gates at the Lindbergh Terminal today, the 2030 requirements are far more demanding because, on average, aircraft in 2030 are anticipated to have larger wingspans and thus each gate position would be larger. Therefore, building two additional gates at the Lindbergh Terminal would not meet the 2030 gate requirements. Further, today only 10 gates provide access to international arrivals facilities. By 2030, 20 gate positions would require access to international arrivals facilities.

Humphrey Terminal – All non-SkyTeam Airlines Requirements

- 36 total gates are required in 2030
- 2 gates must accommodate wide-body aircraft
- 30 gates must accommodate narrow-body jet aircraft
- 5 gates must have access to international arrivals facilities

The 36 gates required at the Humphrey Terminal in 2030 will serve predominantly narrow-body aircraft operated by airlines with hubs elsewhere. Most air service to MSP on these airlines is anticipated to be operated by common narrow-body aircraft such as the Boeing 737 or Airbus A320. However, some international service is expected to be accommodated at the Humphrey Terminal and some airlines may like to operate smaller regional jets to MSP for some domestic service.

Though the timing of relocating all non-SkyTeam airlines to the Humphrey Terminal from the Lindbergh Terminal is predicated upon the increasing congestion at the curb and in the parking facilities at the Lindbergh Terminal, the need for additional gates is an essential component. In 2015, when the relocation is recommended to occur, the Humphrey Terminal would require an additional 17 gates to accommodate the associated demand of all non-SkyTeam airlines. In spite of the fact that this relocation would free all 15 gates on Concourse F in the Lindbergh Terminal, growing passenger numbers combined with the evolving fleet of aircraft at Delta Air Lines and its SkyTeam partners would require the Concourse F gates by 2020. This means that between 2015 and 2020 there is a window of approximately five years during which the Lindbergh Terminal may have excess gate capacity and some terminal improvements may be more easily phased due to the ability to relocate operations among gates.

3.5 TERMINAL REQUIREMENTS

3.5.1 OVERVIEW

The functional performance of the terminal facilities is measured by their ability to accommodate passengers during busy periods. Though it is possible to evaluate a terminal based upon annual passenger numbers, a more accurate assessment of the facility can be achieved by evaluating how it operates during peak hours of activity. Flight schedules can vary dramatically throughout the day and the airport must continue to operate efficiently and safely, even during these busy periods.

The terminal facility program was developed by quantifying the peak hour passenger numbers and analyzing the capacity of various terminal components (e.g., ticketing) at a desired level of service. A pragmatic approach to developing facility requirements will describe the desired characteristics of the terminal components in terms of passenger processing rates and spatial requirements.

- Process rates quantify the performance capability of a facility measured in terms of a unit of demand in relation to time - for example, passengers or bags per minute.
- Space templates have been developed for these facilities to illustrate the preferred arrangement of equipment and operational clearances around them as typically representing the industry's "best practices".
- Level of Service (LOS), as established by the International Air Transport Association, generally indicates the level of performance at which a facility operates under given demand levels (**Table 3.1**). It 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.

TABLE 3.1: IATA SERVICE LEVELS

LOS A	Excellent level of service; condition of free flow; no delays; excellent level of comfort
LOS B	High level of service; condition of stable flow; very few delays; high level of comfort
LOS C	Good level of service; condition of stable flow; acceptable delays; good level of comfort
LOS D	Adequate level of service; condition of unstable flow; acceptable delays for short period of time; adequate level of comfort
LOS E	Inadequate level of service; condition of unstable flows; unacceptable delays; inadequate level of comfort
LOS 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.

Pragmatic requirements in themselves are not a facility program since they do not fully address other program considerations such as functional arrangement, site constraints, or quality of service goals. Instead, they provide the basis to assess needs and begin the reciprocal process of defining a comprehensive facility program.

The following terminal functional areas of the LTCP Update were developed using this process:

- Ticket Counter/Passenger Check-in Area
- Security Screening Checkpoint Area
- Baggage Claim Area
- US Customs and Border Protection Area

Please note that for the purposes of the terminal facility requirements, the Lindbergh Terminal is assumed to accommodate only Delta Air Lines and its SkyTeam Alliance partner airlines. The Humphrey Terminal is assumed to accommodate all other airlines serving MSP.

The planning level of arrivals for Lindbergh Terminal domestic passengers is forecast to be 3,958 in the peak hour by year 2030. The forecast peak hour departure by year 2030 at the Lindbergh Terminal is 3,909 passengers.

3.5.2 PASSENGER CHECK-IN AREA

Currently, there are four different check-in options for departing passengers:

1. Off-Site (Internet) Check-In
2. Self-Service Units - positions where passengers acquire boarding passes
3. Bag Drop Positions - locations where airline staff tag and accept bags after passengers complete their self-service check-in transactions
4. Full-Service (Agent) Counter Check-in – locations where an agent may assist the passengers to acquire boarding passes and accepts their check-in bags

Market penetration of each check-in method is based on various surveys conducted on passenger travel and behavior, such as whether the passenger is checking bags. It assumes that, in the future, an increasing proportion of passengers will use self-service units and Internet check-in. This reflects the growing preference of passengers — coincidentally encouraged by airline staffing practices — for moving away from traditional agent check-in towards self-serve check-in.

Based on the peak hour passenger forecast for 2030, the Lindbergh Terminal is projected to require 85 ticketing positions. The conceptual plans of the ticket counter positions are based on a modular width of 7'-0" plus a 2'-6" baggage scale unit. To provide space for circulation and queuing, the reconfigured plan depth of the ticketing area is approximately 55 ft., which is an additional depth of 10 feet within the existing terminal.

3.5.3 SECURITY SCREENING CHECKPOINT

While the Transportation Security Administration (TSA) has direct responsibility for determining the size and configuration of the passenger screening checkpoints, it is typical for the TSA to collaborate with airports on those aspects along with the checkpoint location.

The "Checkpoint Design Guide" (CDG) Revision 1 - Transportation Security Administration (TSA), February 11, 2009, has been used as the basis for planning. The Security Screening Checkpoint (SSCP) template module includes:

Minimum clearance ahead of the divestiture tables that would typically accommodate:

- Minimum depth for queuing
- Document check podiums
- Private screening
- Post document queues and internal circulation

Main Screening Area, including:

- Divestiture tables
- Metal detectors
- X-Ray equipment
- Secondary search/ examination

Compose Area, including:

- Compose benches
- Supervisor and Local Enforcement Official stations

The following operational criteria have been used to assess security checkpoint facility needs:

- Document Check Throughput Rates: 5 passengers per minute per agent
- Screening Lane Throughput: 180 passengers per hour per lane

The numbers of document checkers and screening lanes necessary to accommodate the peak hour demand has been determined using the following criteria: 95% of passengers require no more than 10 minutes to reach the screening divestiture tables.

The basis for determining the amount of space that should be allocated for passengers queuing for document check has been based on having sufficient capacity to contain the peak hour demand at the checkpoint under the following parameters and level of comfort:

- The number of passengers standing in queue should be calculated on the basis of containing a 20-minute build-up of total checkpoint throughput. This would allow capacity for any throughput changes at the checkpoint – e.g., a shift change of TSA personnel.
- Sufficient area to provide each passenger 10.8 square feet of space while in queue, which conforms to IATA LOS C recommendations for this function.

Based on the SSCP peak hour of 3,909 passengers, 22 security lanes are required at the Lindbergh Terminal in 2030. While each SSCP lane is planned at 1,200 square feet, (for a total of 26,400 square feet for all 22 lanes), the combined total area that is required for the SSCP and passenger queuing is 40,656 square feet. Due to the minimal depth and constraint of the existing terminal lobby, the passenger queuing area of the preferred SSCP conceptual plan is deficient by approximately 2,750 square feet. However, as a means of off-setting this queuing deficiency, two additional checkpoint lanes could potentially be accommodated bringing the total number of lanes to 24. The required TSA support space would be approximately 7,200 square feet, generally based on 75 square feet per agent position with each line supporting four agents. This area would be identified and planned as the LTCP Update is further developed.

It should be noted that the SSCP requirement of 22 lanes and associated queuing space is all for Lindbergh Terminal originations including both domestic and international. There are alternatives for redistributing international originations at the Lindbergh Terminal which would reduce the required facilities within the existing ticketing lobby area.

3.5.4 BAGGAGE CLAIM AREA

The inbound baggage system consists of in-feed conveyors and claim devices. Typically, bags from arriving flights are delivered via baggage carts to the terminal and manually unloaded onto a loading conveyor with a direct feed to a sloped-plate claim device. The baggage claim area in the Lindbergh Terminal currently has twelve sloped-plate claim devices with a total of 1,249 linear feet. Two of the devices are sloped-plated carousels configured as ovals with 145 and 204 linear feet of claim frontage, and the remaining 10 are configured as circles, each having a diameter of approximately 29 feet with 90 linear feet of claim frontage. Due to the size of the circular-shaped claim devices and the minimal circulation around the claim units, the passenger waiting area becomes overcrowded during peak periods resulting in a reduced level of service.

The 2030 peak hour baggage claim requirement of 1,312 linear feet of claim frontage for the Lindbergh Terminal was calculated based on the following:

Domestic Peak Hour Terminating Passengers	3,958 passengers
Assumed Passengers Claiming Bags: 65% of 3,958	2,573 passengers
Assumption: ½ of total passengers (i.e., 1,286) will spend 30 minutes in the claim area	
Requirement Metric: 10.2 square feet (sf) per passenger x 1,286 passengers	13,121 square feet
Minimum Waiting Depth of Passenger Circulation Area	10 feet
Claim Frontage Required: 13,121 sf/10 feet	1,312 linear feet

The 2030 peak hour baggage claim requirement of 27,274 square feet of claim area (excluding the claim devices) for the Lindbergh Terminal was calculated based on the International Air Transport Association (IATA) Level of Service (LOS) C which recommends 21.2 square feet per passenger.

- 1,286 passengers x 21.2 square feet per passenger = 27,274 square feet

An analysis based on the existing number of 956 peak hour passengers claiming bags (26,550 square feet / 956 passengers) yields 27.8 square feet per passenger. While the total area of 26,550 square feet is adequate under the existing peak hour passenger activity, it is the configuration of the area (inadequate frontage of the small circular claim devices that limits passenger access to retrieving their bags) that causes overcrowding circulation conditions, thereby reducing the level service.

3.5.5 US CUSTOMS AND BORDER PROTECTION FACILITIES

The existing international arrivals facility at the Lindbergh Terminal has limited throughput for processing passengers arriving from foreign countries. There are 10 gates, all located on Concourse G, which provide access to the international arrivals facility. However, not all can be used simultaneously.

Customs and Border Protection (CBP) Programming

The Lindbergh Terminal international arrivals facility requirements were developed based on the latest US Customs and Border Protection Airport Technical Design Standards for Passenger Processing Facilities, dated August 2006. Based on the CBP space program categories, the Lindbergh Terminal's forecast international gate operation falls under the Large Airport category, which is between 2,000 and 5,000 passengers per hour operation. There are four sub-categories within the Large Airport program, which are listed as 2,000 passengers per hour (PPH), 3,000 PPH, 4,000 PPH, and 5,000 PPH. Based on the 2030 forecast of 2,855 passengers, the CBP space program category of 3,000 PPH was used in developing facility requirements.

The following areas shown on **Table 3.2** are based on the CBP Design Guidelines to meet the Large Airport category projections:

TABLE 3.2: CBP DESIGN GUIDELINES FOR LARGE AIRPORTS

Description	Area (SF)
Secure Area	
Sterile Corridor System	73,565
Primary Processing and Support	44,485
International Baggage Claim Area	60,935
Secondary Processing and Support	14,028
CBP Officer/Staff Area	6,270
Restrooms	1,495
Subtotal	200,778
Non-secure Area	
Public	33,086
Restrooms	1,908
Concessions – Meeter/Greeter Area	3,013
Subtotal	38,007
Total	238,785

The optimum international arrivals facility primary processing and baggage claim requirements were calculated based on the following:

Primary Processing Requirement	30 Primary Booths (3000 Passenger Category; 2,855 actual peak hour forecast)
Baggage Claim Requirement	The year 2030 peak hour baggage claim requirement is 1,383 linear feet
International Peak Hour Terminating Passengers	2,855 Passengers
Passengers Claiming Bags (95% of total International Peak Hour Terminating Passengers)	2,712 Passengers
Assumption: $\frac{3}{4}$ of total passengers (i.e., 2,034) will spend 45 minutes in the claim area	
Area Requirement: 10.2 square feet per passenger x 2,034 passengers	20,747 square feet
Minimum Waiting Depth of Passenger Area	15 feet
20,747 square feet/15 feet	1,383 linear feet of Claim Device
Total Passenger Claim area required (excluding claim devices): 41,252 square feet /2,034	20.28 square feet per passenger for IATA LOS C

The 238,785 square feet listed above is the total required international arrivals facility area for the Lindbergh Terminal in 2030. The existing international arrivals facility has a total area of 79,300 square feet.

3.6 LANDSIDE REQUIREMENTS

3.6.1 OVERVIEW

This section documents the existing landside conditions and traffic volumes on Glumack Drive at MSP's Lindbergh Terminal. Based on the forecasts of passenger activity, this section also documents the facility requirements for the following landside functions: terminal curb roadways, public parking, rental car ready and return spaces, and commercial vehicle spaces.

3.6.2 ROADWAY ACCESS AND CURB REQUIREMENTS

Traffic Volumes on Glumack Drive

Average Daily Traffic (ADT) and peak hour volumes on Glumack Drive were calculated based on counts available for Glumack Drive from the *Ground Transportation Vehicle Classification Study* performed in 2004. The 2008 and 2030 volumes were calculated by factoring the 2004 volumes in proportion to the growth of originating passengers to 2008 and 2030. **Table 3.3** summarizes the peak hour and ADT volumes on Glumack Drive.

TABLE 3.3: TRAFFIC VOLUMES ON GLUMACK DRIVE

Type of Traffic Volumes	Glumack Drive Volumes Approaching the Lindbergh Terminal	
	Existing (2008)	Future (2030)
Peak Hour	5,900	8,000
Average Daily Traffic	82,000	112,000

Terminal Curb Roadways

At the Lindbergh Terminal there is a two-level curb roadway system, with multiple parallel curbs on both the ticketing (departures) and baggage claim (arrivals) levels. At the Humphrey Terminal, there is a single-level terminal curb roadway which serves in sequence drop-off for departures and pick-up of arrivals.

Lindbergh Terminal Departures Curb Roadway

The departures curb roadway is designated for drop-offs of all departing passengers. The inner departures curb is the primary curb for drop-offs. It is 815 feet long with four striped lanes of traffic. The outer departures curb is currently used as a "backup" curb for peak periods and for public transit. It is 40 feet wide with two full (12-foot wide) lanes and three 16-foot wide left lane curb pockets, totaling 630 feet of curbside. This configuration allows two through lanes of traffic with opposite-side unloading in the curb pockets.

The inner (terminal-side) departures curb roadway provides access to six doorways, which are signed according to the associated airline ticket counters. Patrons using the outer (garage-side) curbs must use vertical circulation to either cross over or under the roadways before entering the terminal. The outer curb is designated for certain classes of commercial ground transportation. Patrons are not permitted to cross roadways at grade on either level.

Lindbergh Terminal Arrivals Curb Roadway

The arrivals roadway is designated for pick-ups of all arriving passengers. It is 60 feet wide and has five striped lanes of traffic. This roadway is generally operated with at least two through lanes of traffic, while the remaining three are used either for loading, standing, or through traffic, depending on the airport's level of activity.

The outer arrivals curb roadway is designated for use only by commercial vehicles. The outer curb is segregated by a barrier that prevents pedestrians from crossing. The outer roadway is on the west side of the Lindbergh Terminal Ground Transportation Center (GTC). The curb on the west side of the GTC has approximately 45 pull-through spaces for taxicabs and hotel shuttle services. The climate-controlled GTC also has pull-through stalls located on the east side which serve special taxis, limousines, scheduled shuttles, and off-airport parking shuttles.

Humphrey Terminal Curb Roadway

The Humphrey Terminal curb is a 670-foot long, single-level roadway, half of which is utilized for passenger drop-off at ticketing/check-in, and half of which is used for passenger pick up at baggage claim. The curb roadway is four lanes wide. The left lane is signed to bring rental car return traffic to the rental car area located in the Purple Ramp located on the other side of the curb roadway from the terminal.

Analysis of Curb Roadways and Estimate of Future Requirements

The capacity of a curb roadway is a balance between its ability to move vehicles (through capacity) and its ability to load and unload passengers (service capacity). The through capacity and service capacity depend upon the number of lanes in the roadway and how those lanes are utilized: for loading/unloading, through movement, or a combination of the two. Service capacity is also a function of the effective curb length and the characteristics of the vehicles using the curb, e.g., how long they dwell (dwell time) and their length. There is a point at which increasing the length of a curb (to add service capacity) is pointless unless an additional lane is added (adding through capacity), as the length cannot be utilized if there are not enough lanes to bring the traffic to or take the traffic away from the new length of curb.

The measure of effectiveness of a curb is its volume/capacity (v/c) ratio. The v/c ratio reflects the level of congestion on the curb, and gives an indication of the unused or spare capacity of the curb roadways. A curb would be at capacity when the volume using the curb equals the equilibrium capacity of the curb, i.e., when $v/c = 1$. This would represent a highly congested condition. 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, for planning purposes, the target $v/c = 0.70$ is desirable for the typical peak hour condition (the peak hour of the average day of the peak month). This implies that for the several hundred additional hours of the year when heavier curb traffic volume is present, conditions will be worse, but the investment in the curb roadway will not be so great as to overbuild its capacity.

Future requirements for curb length were calculated based on standard planning factors for the airport to achieve a v/c ratio of 0.70. These assumptions included average dwell times and average vehicle length. Additional assumptions were made regarding future number of lanes, which were set to balance against the curb length requirement. The 2030 forecast for passenger activity was used to generate a growth rate in landside activity, which was used to factor existing curb traffic volume counts. The number of vehicles by class on each of the curbs was obtained from the *Ground Transportation Vehicle Classification Study* performed in 2004 by URS Corporation. **Table 3.4** summarizes the estimates of curb requirements at both the Lindbergh and Humphrey Terminals for 2030.

TABLE 3.4: CURRENT CURB CONDITIONS AND FUTURE REQUIREMENTS

Curb Summary	Lindbergh Terminal		Humphrey Terminal	
	Existing Conditions and v/c	2030 Conditions at v/c=0.7	Existing Conditions and v/c	2030 Conditions at v/c=0.7
Departures Curb (feet)	4 lanes @ 815 feet (inner curb) v/c = 0.74	4 Lanes @ 1,600 feet (inner curb)	4 lanes @ 335 feet v/c = 0.33	4 lanes @ 760 feet or 5 lanes @ 460 feet
	3 Lanes @ 815 feet (outer curb) v/c = 0.13	3 Lanes @ 815 feet (outer curb)	No outer curb	No outer curb
Arrivals Curb (Feet)	5 lanes @ 815 feet v/c = 0.98	5 lanes @ 2,000 feet	4 lanes @ 335 feet v/c = 0.37	4 lanes @ 1,000 feet or 5 lanes @ 620 feet
Departures Curb Peak Hour Volumes	914 (inner curb)	1,114 (inner curb)	228	807
	75 (outer curb)	417 (outer curb includes some POV)	228	807
Arrivals Curb Peak Hour Volumes	922	1,576	184	766

3.6.3 PARKING REQUIREMENTS

On-Airport Public Parking Facilities

There are currently 14,400 public parking spaces provided at the Lindbergh Terminal, chiefly in the Green, Gold, Red, and Blue parking ramps. These include short-term, general, and valet spaces (which are located in the basement of the terminal) as per the data in **Table 3.5**.

There are currently 9,200 public parking spaces provided at the Humphrey Terminal, including short-term and general spaces as per the data in **Table 3.5**. The Orange ramp includes the newest parking product, MSP Value Parking, which is intended to attract patrons who otherwise might seek parking in the busier Lindbergh Terminal ramps. During busy periods, the public parking at the Lindbergh Terminal reaches capacity, and patrons are directed to the Humphrey Terminal parking ramps, from which they can ride the public Light Rail Transit (LRT) back to the Lindbergh Terminal to board their flight. However, even with this additional demand, the Humphrey Terminal's Purple and Orange ramps do not reach capacity. Approximately 2,500 parking spaces within the Purple and Orange ramps have been reserved for employee parking on a temporary basis.

The following methodology was used in estimating the 2030 parking requirements:

- The capacity for the public parking was defined as:
 - 85% of available spaces for short-term
 - 90% of available spaces for general parking

- 100% of available spaces for valet parking

Note: By using these percentages, vehicles arriving in the peak periods can still find enough spaces available that they can fill efficiently without an endless search for the very last space.

- Existing demand for parking at the Lindbergh Terminal was calculated based on information obtained from Metropolitan Airports Commission (MAC) staff. The demand in 2009 was down from 2008, so 2008 data were used to define the busy “existing” condition.
- Absent better data, the existing general parking demand at the Humphrey Terminal was assumed to be 40% of existing general parking capacity; for short-term parking, the assumption was that demand was 50% of existing short-term capacity.
- With the peak demand defined, the ratio of required spaces to meet that demand was compared with the annual originating passenger volumes. The ratio was rounded off to 2,000 spaces per Million Annual Originating Passengers.
- The 2030 future requirements were calculated by multiplying this ratio by the forecast number of annual originations.
- The estimates also included consideration of the anticipated migration of some off-airport parking demand onto the airport. That methodology is described below.

Table 3.5 summarizes the findings of parking requirements at both the Lindbergh and Humphrey Terminals in 2030.

TABLE 3.5: FUTURE PARKING REQUIREMENTS

Parking Summary	Lindbergh Terminal				Humphrey Terminal			
	Existing Spaces (2009)	Capacity (2008)	Existing Demand	Future Reqts (2030)	Existing Spaces (2009)	Capacity (2008)	Existing Demand	Future Reqts (2030)
Short Term Parking Spaces	900	820	490	900	500	460	230	600
General Parking Spaces	13,110	10,100	12,000	21,200	8,700	8,140	3,300	13,000
Valet Parking Spaces	390	380	430	700	-	-	-	500
Future Off-Airport Parking	-	-	-	1,700	-	-	-	1,000
Total Parking Spaces	14,400	11,300	12,920	24,500	9,200	8,600	3,530	15,100

Private Parking Facilities

There are currently four off-airport parking providers near MSP. All four off-airport parking providers are located within six miles of the airport. The following methodology was used in estimating the future off-airport parking:

- In the existing conditions there are 5,200 off-airport parking spaces which are assumed to be 60% full during the Average Day Peak Month.
- In the future, the demand will grow proportionately with originations and the supply will decrease down to 3,200 spaces due to development pressures and restrictions by the City of Bloomington.
- Any surplus demand that the future off-airport parking supply cannot handle will translate into spaces required at the airport. But 25% of the surplus demand is assumed to divert to an alternative mode or behavior, e.g., passengers will get dropped off at the curb or use the LRT or taxi, etc.
- The remaining 75% of the surplus demand will be distributed between the Lindbergh and the Humphrey Terminals pro rata with originations.

Table 3.6 summarizes the findings of future off-airport parking to be accommodated at both the Lindbergh and Humphrey Terminals in 2030.

TABLE 3.6: OFF-AIRPORT PARKING

Parking Summary	Spaces
Total Existing (2008) Spaces	5,200
Existing (2008) Demand (60 % full and 90 % efficiency)	3,400
Future (2030) Demand	6,800
Future (2030) Supply at Off-Airport	3,200
Future (2030) Surplus Demand	3,600
Future (2030) Surplus Demand (Assuming 25 % will use Alternative Modes)	2,700
Future (2030) Surplus to be accommodated at Lindbergh Terminal	1,700
Future (2030) Surplus to be accommodated at Humphrey Terminal	1,000

3.6.4 RENTAL CAR REQUIREMENTS

Rental car operations exist at both the Lindbergh and Humphrey Terminals. Currently, there is a Quick-Turn Around (QTA) facility (where rental vehicles are washed and fueled before being re-rented) at the Lindbergh Terminal only. Existing rental car information on number of spaces and transaction counts was obtained from MAC staff. The following approach was used in determining the future requirement:

- Peak month for total number of transactions was determined to be August
- Based on number of transactions in peak month, average daily transactions were determined
- Peak daily transactions were then calculated as twice the number of average daily transactions
- The turnover ratio was calculated by dividing peak transactions by the total number of ready/return spaces. Turnover ratio is an index of how labor-intensive the facility is, with labor costs increasing with turnover ratio, and thereby decreasing profitability. Turnover

ratios below 3.0 indicate an under-used facility; turnover ratios higher than 4.0 indicate a very busy facility, and ratios higher than 5.0 indicate an undersized facility.

- Finally, the calculated turnover ratio of 3.8 was used to determine the number of rental spaces required in the future. This turnover ratio is desirable for future Rental Auto Companies operations as current operations at MSP are in the efficient range.
- The size of future QTAs was estimated by determining the ratio of square feet of QTA in the Red/Blue ramps to the number of ready/return spaces it serves. This ratio was then applied to the number of spaces proposed at the Humphrey Terminal to estimate the future square feet which would be required to serve the rental cars at that terminal.

Table 3.7 summarizes the total number of space requirements in the future.

TABLE 3.7: RENTAL CAR REQUIREMENTS

RAC Summary	Lindbergh Terminal		Humphrey Terminal	
	Existing Spaces (2008)	Future Requirements (2030)	Existing Spaces (2008)	Future Requirements (2030)
Total Spaces	3,500	2,235	274	1,385
2030 Additional Requirements	-	-	-	819
2030 QTA Requirement	549 sf	350 sf	No QTA	215 sf

3.6.5 GROUND TRANSPORTATION CENTER REQUIREMENTS

The requirements for the Ground Transportation Center were calculated based on the number of commercial vehicles arriving during the peak hour. Commercial vehicles include taxis, limousines, and shuttles (hotel/parking/courtesy). A dwell time of 3.0 minutes was used for taxis and limos, and 5.0 minutes was assumed for shuttles. The total number of spaces required was calculated based on a desirable volume/capacity (v/c) ratio of 0.55. With a lower target v/c ratio for commercial vehicle stalls, the risk of a vehicle not finding an empty stall upon arrival is minimized.

Table 3.8 summarizes the space requirement for the Ground Transportation Center.

TABLE 3.8: GROUND TRANSPORTATION CENTER (GTC) REQUIREMENTS

GTC Requirements Summary	Lindbergh Terminal		Humphrey Terminal	
	Existing Spaces (2008)	Future Requirements (2030)	Existing Spaces (2008)	Future Requirements (2030)
Total Spaces	46	63	25	32

3.7 LIGHTING AND NAVIGATION REQUIREMENTS

The LTCP Update does not recommend the addition of any runways to the MSP airfield during the 20-year planning period. Commensurate with this recommendation, no substantial improvements to navigational aids and/or lighting of the existing runway approaches is recommended.

However, it is recommended that during the planning period, emerging technologies for navigational aids be monitored and evaluated to determine the potential benefit of implementation at MSP.

3.8 SECURITY REQUIREMENTS

The Metropolitan Airports Commission (MAC) has recently completed an upgrade to the entire airport perimeter security fence. Gate improvements have also recently been completed, with new technologies being studied in some locations. The MAC will continue to evaluate the perimeter security fence and upgrade as necessary. The Transportation Security Administration may also enforce changes from time to time that the MAC will coordinate and comply with as necessary.

Aside from the security checkpoint improvements discussed in Section 3.5.3, there are no specific security requirements that need to be met at this time.

3.9 UTILITY REQUIREMENTS

The MAC continues to coordinate airport projects with the primary utility companies. The proposed projects will impact existing utilities on the field. Any necessary re-locations are completed as a part of impacting projects. If the utility companies have specific upgrades that are required to their systems, the MAC will coordinate with them to have the work completed at the utility company's cost.

3.10 OBSTRUCTION-RELATED REQUIREMENTS

Mitigation of obstructions to critical surfaces for navigation to MSP runways should be monitored and evaluated.

3.11 OTHER AIRPORT SERVICES REQUIREMENTS

The two existing Aircraft Rescue & Fire Fighting (ARFF) facilities are adequate to provide services for all proposed projects in the Long Term Comprehensive Plan Update.

The MAC maintains its own police force. The police department operates from a couple of scattered locations within the Lindbergh Terminal. Ultimately, the MAC may choose to consolidate the department in one new building location on the airfield. The department's existing areas within the terminal could then be remodeled, occupied and leased by tenants. The MAC will continue to review this option and weigh the justifications against estimated costs before making a final decision.