2016 ANNUAL REPORT TO THE LEGISLATURE

PREPARED BY THE METROPOLITAN AIRPORTS COMMISSION

MARCH 2017

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1. METROPOLITAN AIRPORTS COMMISSION (MAC)

1.1 GENERAL INFORMATION

The Metropolitan Airports Commission (MAC) was created in 1943 by the Minnesota Legislature to promote air transportation in the seven-county metropolitan area. The MAC's 15-member board of commissioners, which sets the MAC's policies, consists of 13 appointments by Minnesota's Governor and one appointment each by the mayors of Minneapolis and St. Paul. The MAC's policies are implemented by the MAC's Executive Director/CEO and staff.

The MAC airport system is comprised of seven airports: Minneapolis-St. Paul International Airport (MSP) and six reliever airports. The reliever airports include Airlake, Anoka County-Blaine, Crystal, Flying Cloud, Lake Elmo and St. Paul Downtown. **Figure 1-1** shows each MAC airport location.

In 1989, the Minnesota Legislature adopted the Metropolitan Airport Planning Act which requires the MAC to prepare an Annual Report to the Legislature that describes recent MSP activity, current and anticipated capacity and delay for its airfield and terminals, and technological developments that could improve airport efficiency. Details about activity levels and development projects at the MAC's six Reliever Airports are also included in the report.

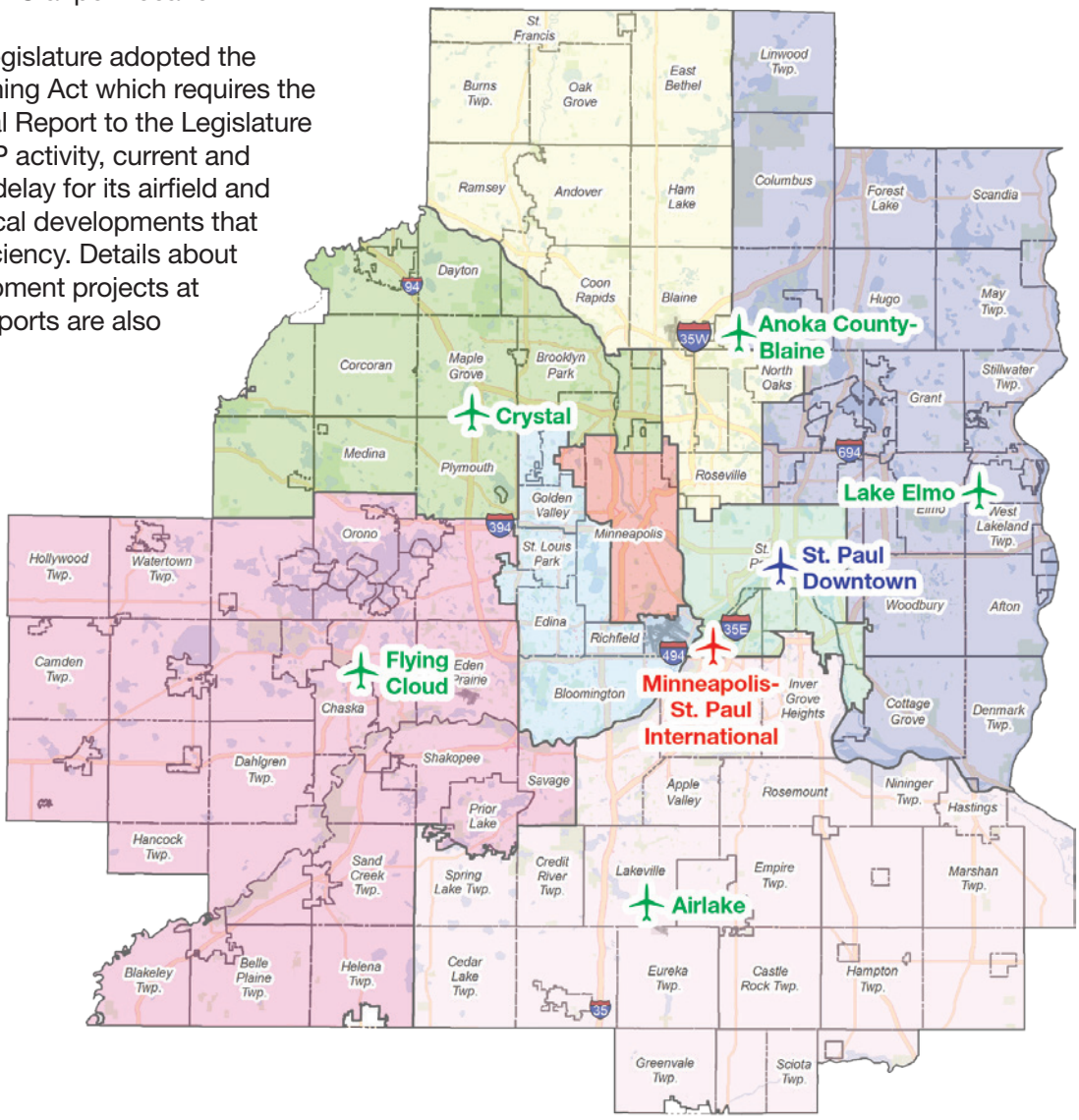
The 2016 Annual Report to the Legislature is divided into three sections:

1. Metropolitan Airports Commission (MAC)
2. Minneapolis-St. Paul International Airport (MSP)
3. Reliever Airports

These sections are further subdivided into sub-sections pertinent to the various facilities.

Metropolitan Airports Commission Airports System

Figure 1-1



1.2 2016 MAC OVERVIEW

1.2.1 New MAC Executive Director and Chief Executive Officer (CEO)

After a national search, the MAC Board selected Minnesota native Brian Ryks as the MAC's new Executive Director/CEO. In May 2016, Ryks replaced Jeff Hamiel, who had led the MAC for more than three decades.

A 30-year veteran of the airport industry, Mr. Ryks came to the MAC from Gerald R. Ford International Airport in Grand Rapids, MI, where he had served as executive director and CEO since 2012. Previously he had led the Duluth Airport Authority and St. Cloud Regional Airport in Minnesota and the Aberdeen Regional Airport in South Dakota. Mr. Ryks began his career as a noise and operations technician at the Metropolitan Airports Commission in 1986. He then became noise abatement manager at Stapleton and Denver International airports in Colorado before landing the top job at airports in South Dakota, Minnesota and Michigan.

Mr. Ryks holds a Bachelor of Arts degree from St. Cloud State University, is a licensed pilot with an instrument rating, and is an Accredited Airport Executive with the American Association of Airport Executives. He currently serves on the Airports Council International-North America (ACI-NA) Board of Directors. He also holds a professional affiliation with the Great Lakes Chapter of AAAE, of which he is a past president.

He was awarded a TSA Partnership Award in 2006, a Patriot Award in 2008 from the Employee Support of National Guard & Reserve, a 2009 Minnesota Council of Airport's Award of Excellence for Outstanding Promotion of Aviation, a 2012 Minnesota Council of Airports Distinguished Service Award and was named the 2015 Newsmaker of the year in Economic Development by the Grand Rapids Business Journal.

1.2.2 MAC Staff

The MAC consists of a 600-person staff that supports the ownership and operation of its system of airports. The MAC has a wide range of specialized employees, most of whom work to support the operations at the hub airport – MSP – which functions much like a city with its own police force, fire department, emergency 9-1-1 dispatch, building inspectors and maintenance workers.

1.2.3 MAC Finances

In 2016, the MAC's budgeted operating revenues equated to $330.4 million, which was made up of airline rates and charges (34%), rents and fees (14%), concessions revenue (47%), and other revenues (5%). The 2016 budgeted operating expenses equated to $173.7 million, including personnel (46%), maintenance (22%), operating services (14%), utilities (11%), professional services (4%), administrative (1%) and other expenses (2%).

The Capital Improvement Program (CIP) identifies and allocates funds for projects that enhance technological and passenger processing capabilities and maintain existing infrastructure at each MAC-owned airport. The CIP budget for 2016 was Board-approved at $309 million. The Board-approved CIP budget for 2016 was $309 million.

1.2.4 Awards and Accolades

MAC programs and airport facilities often are recognized and honored by a variety of local, national and international sources. Details about these awards and accolades are published each year in the MAC Budget Book; awards and accolades garnered in 2016 may be found in the MAC's 2017 Budget Book at: **metroairports.org/Airport-Authority/Metropolitan-Airports-Commission/Administration/Financials.aspx.**

1.2.5 MSP Annual Noise Contour Analysis

Assessments of MSP aircraft operations are conducted annually to evaluate aircraft noise exposure levels for residences surrounding MSP. In an effort to provide relief from aircraft noise for citizens, the MAC initiated an industry-leading Residential Noise Mitigation Program in the 1990s. Currently, mitigation eligibility is assessed on an annual basis. The 2016 MSP Annual Noise Contour Report is available here: **www.macnoise.com/noise-mitigation-program.**

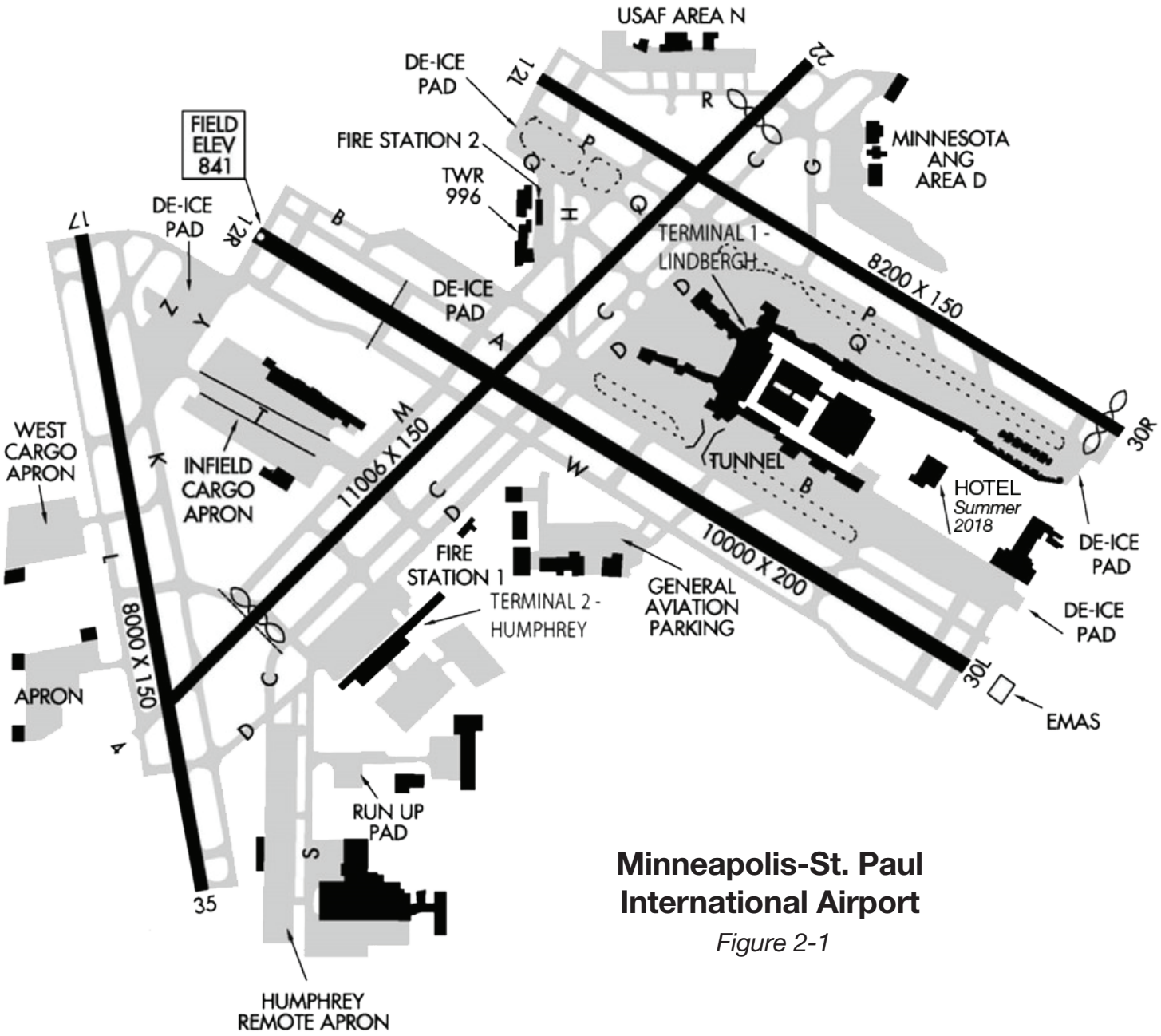
2. MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT (MSP)

The MSP airfield is approximately 3,400 acres in size and consists of two parallel runways, one north-south runway and one crosswind runway. Runway 4-22 is 11,006 feet long; Runway 12R-30L is 10,000 feet long; Runway 12L-30R is 8,200 feet long; and Runway 17-35 is 8,000 feet long. **Figure 2-1** shows MSP's current airfield layout.

The following sections describe MSP passenger levels, airlines, aircraft operations, airfield capacity and delay, and technological and capacity enhancements.

2.1 PASSENGER LEVELS AT MSP

In 2016, MSP saw near-record passenger levels. MSP's passenger total increased to 37,505,521 which is a 2.5 percent increase over the 2015 passenger total of 36,582,851. This represents the seventh consecutive year of growth for MSP's total passenger activity.



Minneapolis-St. Paul International Airport

Figure 2-1

2.1.1 Passenger Originations/Destinations and Connections

Figure 2-2 depicts the annual historical passenger originations/destinations (O&D) data for MSP for the years 1990 through 2016. O&D passengers are those who begin or end their trip at MSP. O&D passenger demand is driven primarily by local socioeconomic factors.

In 2016, MSP accommodated 7.3 percent more O&D passengers compared to 2015. There were 21,016,854 O&D passengers in 2016 and 19,582,778 O&D passengers in 2015. Between 1990 and 2016, O&D passengers at MSP rose from 9.5 million to over 21 million, which represents an annual compounded growth rate of 3.1 percent.

Connecting passengers are those who travel through the airport enroute to another destination. There were 3.5 percent fewer passengers connecting through MSP in 2016 compared to 2015. In 2016, there were 15,319,644 connecting passengers at MSP and 15,878,034 in 2015.

2.1.2 Annual Revenue Passengers

The revenue passenger level at MSP reported by the airlines in 2016 grew 2.4 percent from 2015 levels. There were 36,341,564 revenue passengers reported at MSP in 2016 and 35,489,192 in 2015.

Figure 2-3 shows the revenue passenger levels each year, which includes O&D and connecting passengers. Between 1990 and 2016, total revenue passengers grew from 19.2 million to nearly 36.4 million, which represents an annual compounded growth rate of 2.5 percent.

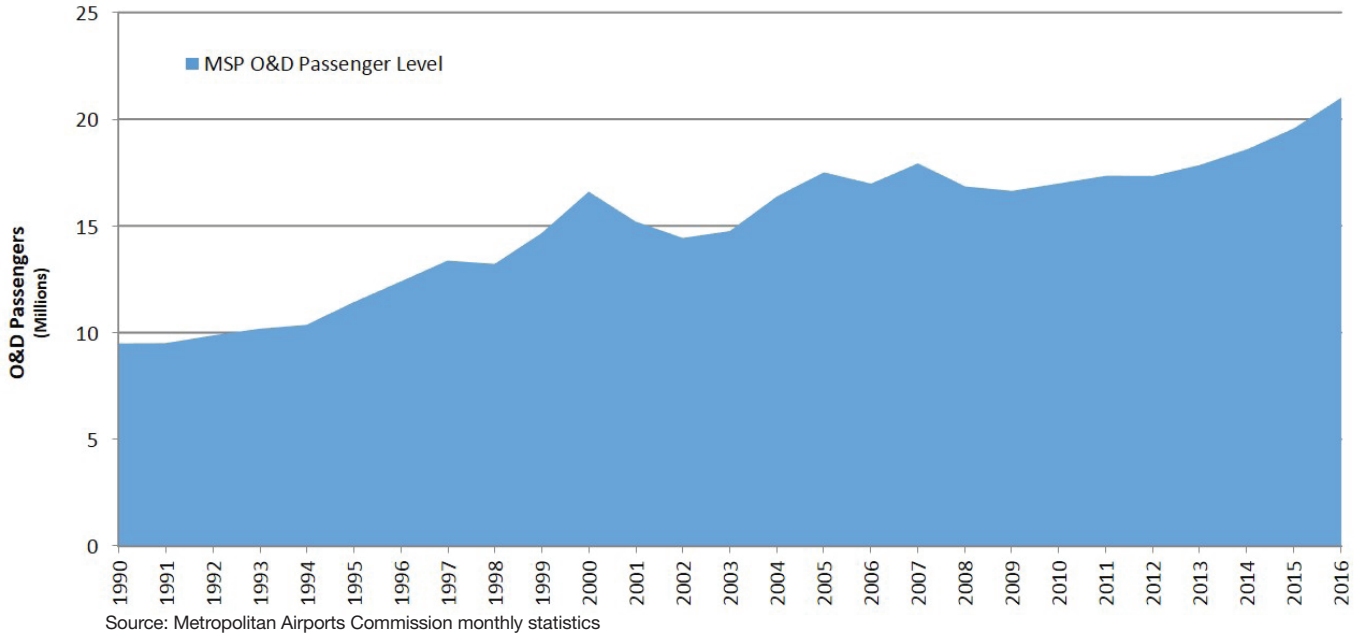
MSP's revenue passengers have grown by 2,227,193 passengers between 2014 and 2016. Delta Air Lines has accounted for 626,767 of these passengers, or 27.4 percent. The other airlines operating at MSP collectively have grown as well, serving a total of 1,648,426 more revenue passengers in 2016 compared to 2014.

2.2 AIRLINE ACTIVITIY AT MSP

MSP experienced a record year for the introduction of new service by airlines in 2016, with nine airlines introducing 22 routes. The following paragraphs will describe the additions by each airline.

Delta Air Lines is the largest service provider at MSP and operates out of Terminal 1-Lindbergh. Delta and its

MSP O&D Passengers 1990-2016 *Figure 2-2*



Source: Metropolitan Airports Commission monthly statistics

regional partners averaged approximately 380 flights per day from MSP to more than 130 destinations worldwide in 2016. Delta's market share of MSP passengers in 2016 was 71.1 percent; its market share in 2015 was 72.8 percent. Delta added service to four destinations in 2016: Rome, Italy (FCO); Reykjavik, Iceland (KEF); Pellston, MI (PLN); and West Palm Beach, FL (PBI). Service to Rome and Pellston is not resuming in 2017.

In 2016, the U.S. Department of Transportation allocated five new daytime slots for U.S. airlines to access Tokyo's Haneda Airport (HND), which is more centrally located near the city center of Tokyo than the Tokyo-Narita International Airport (NRT). Delta applied for three of the five daytime slots; they were ultimately awarded two slots that grant service from Los Angeles(LAX) and MSP. Effective October 29, 2016, Delta's MSP service to Tokyo shifted from Tokyo-Narita International Airport to Haneda Airport.

Sun Country Airlines added service to three destinations: Denver, CO (DEN); Portland, OR (PDX); and West Palm Beach, FL (PBI).

American Airlines added service to three destinations: New York-LaGuardia, NY (LGA); Washington-National, DC (DCA); and Los Angeles, CA (LAX).

Spirit Airlines added service to three destinations: Atlanta, GA (ATL); Boston, MA (BOS); and Philadelphia, PA (PHL).

Frontier Airlines added service to two destinations: Orlando, FL (MCO); and Chicago-O'Hare (ORD). Service to Chicago is not resuming in 2017.

Alaska Airlines added service to Portland, OR (PDX); and Southwest Airlines added service to Baltimore-Washington, MD (BWI).

In 2016, MSP introduced two new airlines providing Essential Air Service (EAS) to four small communities in Minnesota, Michigan, and Iowa:

Air Choice One operates the nine-passenger Cessna Grand Caravan, and began service to Ironwood, MI (IWD) on June 1, 2016. Service to Mason City, IA (MCW) and Fort Dodge, IA (FOD) commenced on November 7, 2016.

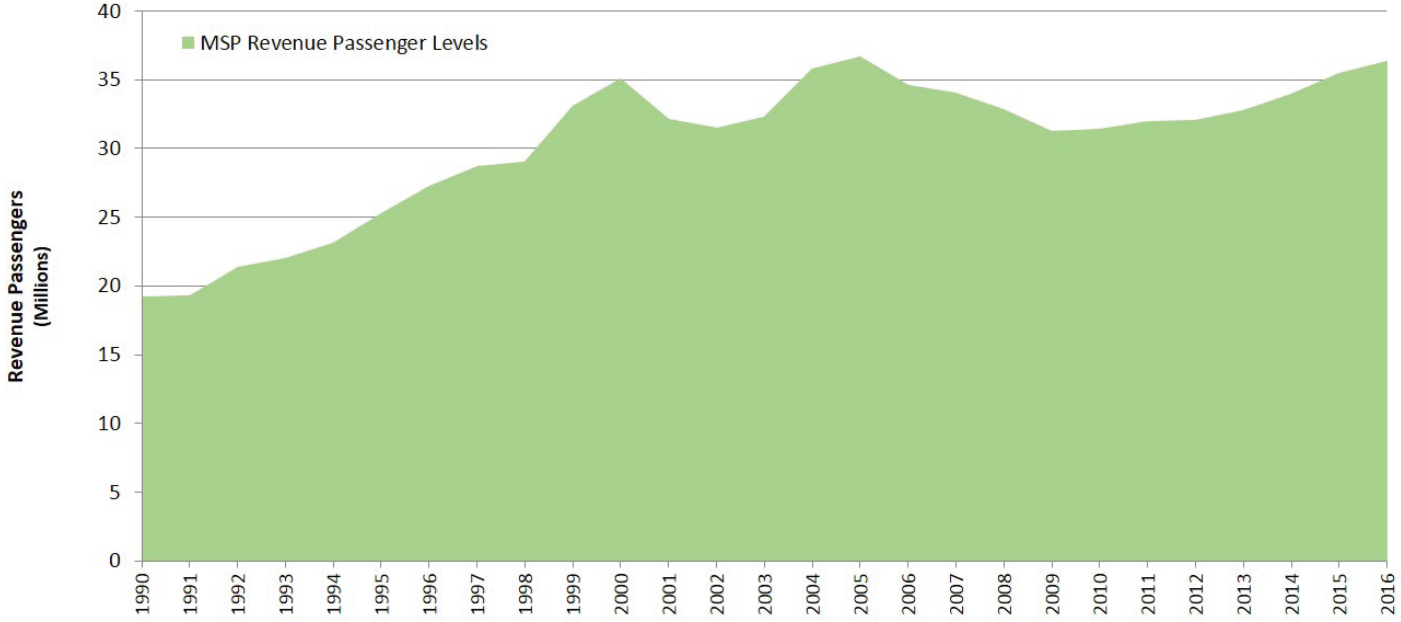
Boutique Air operates the nine-passenger Pilatus PC-12, and began service to Thief River Falls, MN (TVF) on June 27, 2016.

It is important to note that Great Lakes Airlines, the previous EAS operator for several of the aforementioned markets, terminated service at MSP on June 1, 2016.

The increasing service trend continues in 2017, with five airlines already announcing service to five destinations. This includes the return of international airline KLM Royal Dutch Airlines for the first time since 2004, with service to Amsterdam starting March 27, 2017.

Table 2-1 shows the ranking of airlines based on MSP Revenue Passengers gain/loss between 2014 and 2016. **Table 2-2** indicates the ranking of airlines based on their market share at MSP in 2016.

MSP Revenue Passengers 1990-2016 *Figure 2-3*



Source: Metropolitan Airports Commission monthly statistics

TABLE 2-1 MSP REVENUE PASSENGER SUMMARY

Rank	Airline	2014	2015	2016	Gain/Loss 2014-2016	% Change 2014-2016
1	Delta	25,216,478	25,844,791	25,843,245	626,767	2.49%
2	Sun Country	1,672,881	2,051,647	2,197,819	524,938	31.38%
3	United	1,297,274	1,567,854	1,736,055	438,781	33.82%
4	American/US Airways	2,188,969	2,244,409	2,403,295	214,326	9.79%
5	Southwest/AirTran	1,885,779	1,884,704	2,109,637	223,858	11.87%
6	Spirit	996,858	1,029,510	1,200,623	203,765	20.44%
7	Alaska Airlines	185,017	193,548	276,412	91,395	49.40%
8	Icelandair	40,263	56,795	74,564	34,301	85.19%
9	Air Canada	63,503	82,726	89,282	25,779	40.59%
10	Air France	41,957	60,100	52,845	10,888	25.95%
11	Condor	9,825	10,581	18,861	9,036	91.97%
12	Boutique Air	N/A	N/A	6,458	6,458	---
13	Air Choice One	N/A	N/A	3,113	3,113	---
14	Great Lakes	11,462	8,765	1,557	(9,905)	-86.42%
15	Frontier	456,105	453,762	327,798	(128,307)	-28.13%
	Total	**34,066,371**	**35,489,192**	**36,314,564**	**2,275,193**	**6.68%**

Source: MAC Operations Report-01-31-2017

TABLE 2-2 MSP REVENUE PASSENGER MARKET SHARE

Rank	Airline	2014	2015	2016	Gain/Loss 2014-2016	% Change 2014-2016
1	Delta	74.02%	72.82%	71.09%	-2.93%	-3.96%
2	American/US Airways	6.43%	6.32%	6.61%	0.19%	2.92%
3	Sun Country	4.91%	5.78%	6.05%	1.13%	23.11%
4	Southwest/AirTran	5.54%	5.31%	5.80%	0.27%	4.83%
5	United	3.81%	4.42%	4.78%	0.97%	25.40%
6	Spirit	2.93%	2.90%	3.30%	0.38%	12.86%
7	Frontier	1.34%	1.28%	0.90%	-0.44%	-32.65%
8	Alaska Airlines	0.54%	0.55%	0.76%	0.22%	40.00%
9	Air Canada	0.19%	0.23%	0.25%	0.06%	31.75%
10	Icelandair	0.12%	0.16%	0.21%	0.09%	73.54%
11	Air France	0.12%	0.17%	0.15%	0.02%	18.02%
12	Condor	0.03%	0.03%	0.05%	0.02%	79.89%
13	Boutique Air	N/A	N/A	0.02%	0.02%	---
14	Air Choice One	N/A	N/A	0.01%	0.01%	---
15	Great Lakes	0.15%	0.03%	0.00%	-0.15%	-97.14%

Source: MAC Operations Report-01-31-2017

2.3 AIRCRAFT OPERATIONS AT MSP

The Federal Aviation Administration (FAA) reported MSP air traffic counts reached 412,898 operations in 2016, up 2.1 percent from the level of 404,374 in 2015. Annual MSP aircraft operations 1990-2016 are presented in **Figure 2-4.**

Total annual aircraft operations at MSP generally increased between 1990 and 2001. Air traffic counts declined across the aviation industry following the terrorist attacks on September 11, 2001. The year 2001 ended with 501,252 total operations at MSP. In 2002 and 2003 operations rose approximately 1.2 percent over the level in 2001.

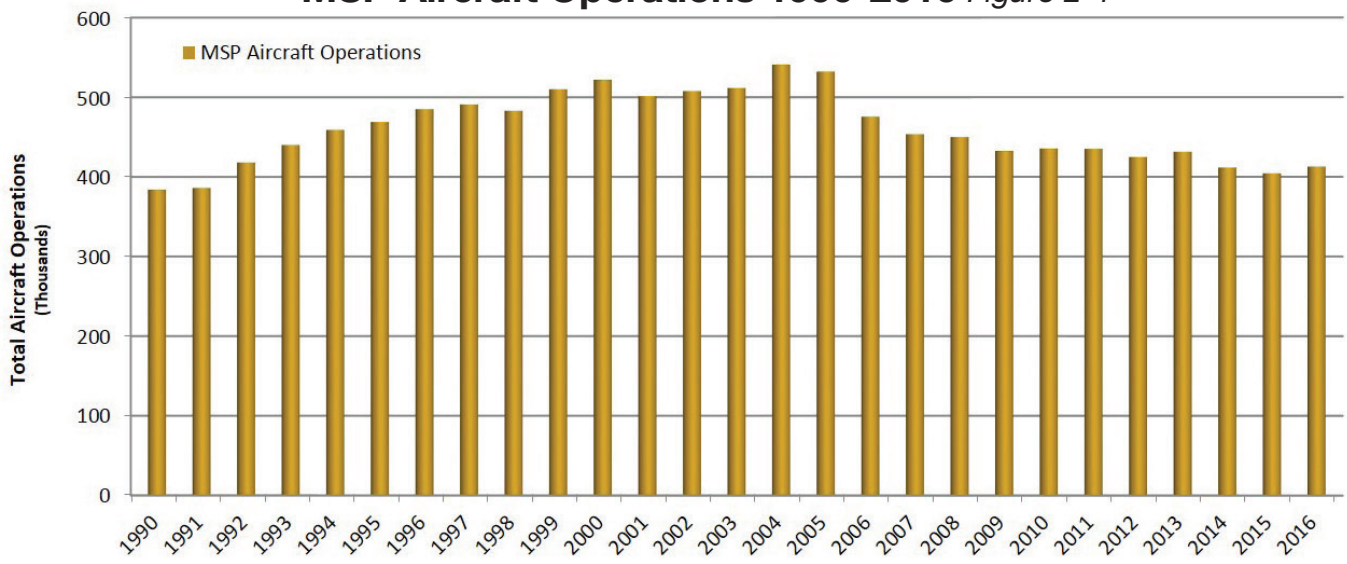
2.4 MSP AIRFIELD CAPACITY AND DELAY

This section describes the airfield capacity at MSP. Aircraft delay analysis is also provided.

2.4.1 Airfield Capacity

Airfield capacity is typically described in terms of hourly capacity and annual capacity under good and poor weather conditions. **Table 2-3** reflects the hourly capacity for MSP in optimum, marginal and poor weather conditions.

MSP Aircraft Operations 1990-2016 *Figure 2-4*



Source: Metropolitan Airports Commission monthly statistics

The peak year for aircraft operations at MSP was in 2004 with 540,727 total takeoffs and landings. Increasing fuel prices and struggling economic conditions contributed to decreasing aircraft activity levels at MSP from 2005 through 2009; MSP ended 2009 with a total of 432,604 operations. MSP activity rose slightly to 435,583 operations in 2010 before steadily declining again to 404,374 in 2015. It is important to note that from 2010 to 2015, while aircraft operations counts declined, the number of passengers steadily rose as described previously in this report **(see Section 2.1)**.

The MSP aircraft operations count for 2016 is approximately 23.7 percent lower than the peak activity year.

TABLE 2-3 MSP AIRFIELD CAPACITY

Hourly Airfield Capacity	Existing
Optimum Rate [1]	141
Marginal Rate [2]	135
IFR Rate [3]	114

Source: Federal Aviation Administration (FAA) Air Traffic Control Tower Analysis

[1] Ceiling and visibility above minima for visual approaches.
[2] Below visual approach minima but better than instrument conditions.
[3] Instrument conditions (cloud ceiling less than 1,000 feet or visibility less than 3 miles).

As a result of Converging Runway Operations (CRO) measures implemented in 2015 **(see Section 2.5.4),** MSP's current airfield capacity is about 141 aircraft operations in optimum conditions and 135 operations in marginal conditions. When instrument flight rules (IFR) are being used, typically during periods of low-level clouds and/or low visibility, the airfield capacity at MSP is about 114 operations per hour.

2.4.2 Airfield Delay

Delay can be measured in several ways. This section reviews delay measures and the number of delayed flights as they are reported by the FAA and apply to MSP.

The FAA Air Traffic Operations Network (OPSNET) database counts flights that were reported by Air Traffic Control (ATC) to be delayed for more than 15 minutes. **Figure 2-5** depicts the annual number of MSP flights delayed by ATC in 2007 through 2016.

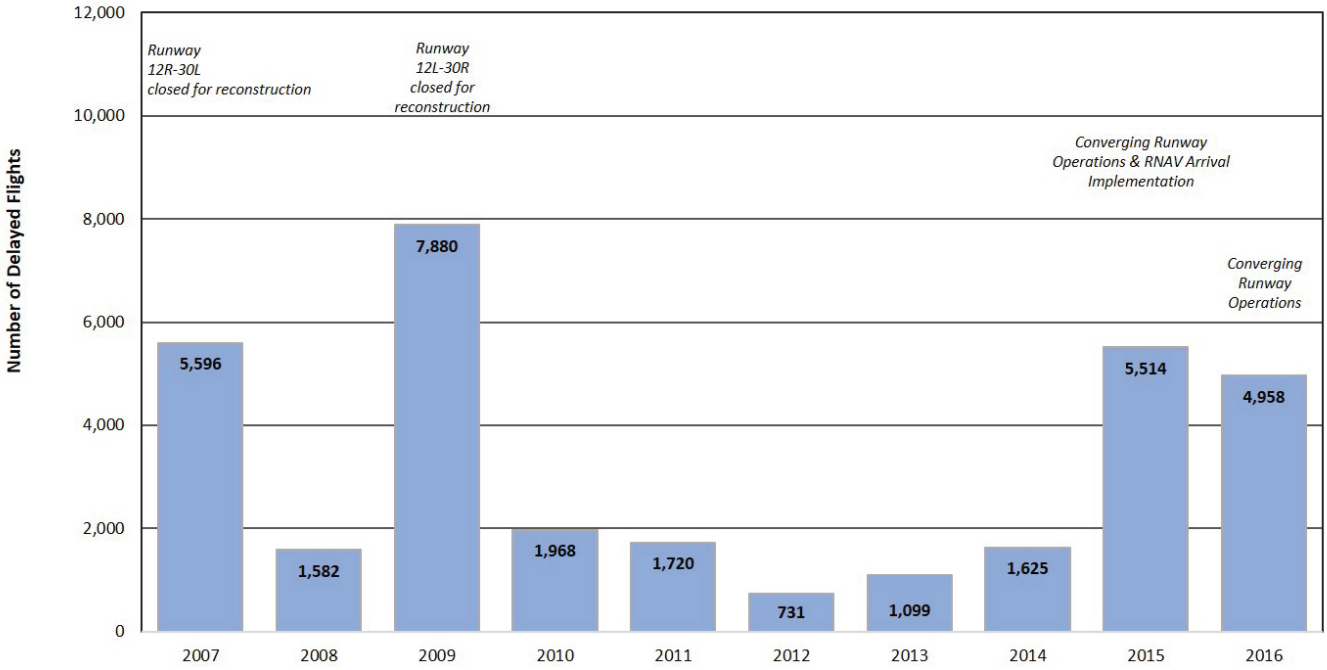
In 2008, the FAA made significant modifications to its reporting rules that affect historical data comparisons. The FAA now combines arrival and enroute delays into one category, and reports delays for aircraft that accumulate 15 minutes or more holding delay at each facility throughout the entire route of flight. Delays of fewer than 15 minutes are not counted, nor are delays not initiated by ATC. In addition, since delays are reported by each airport facility, a flight that was delayed by 13 minutes at one airport facility and 12 minutes by another airport facility (for a total delay of 25 minutes) was not included in the OPSNET database prior to October 1, 2008. These data limitations should be kept in mind when reviewing OPSNET delay.

In 2016, there were 4,958 delayed flights at MSP, which is a 10.1 percent decrease from the level of 5,514 delayed flights in 2015. In 2015 delays at MSP largely were attributed to new CRO requirements, which halted arrivals temporarily on Runway 35 from July 24 - August 28, 2015. The FAA worked on adjusting the CRO procedures to increase throughput and reduce delays throughout 2016 **(see Section 2.5.4)**.

2.4.2.1 Percentage of Flights Arriving On-time

The data series used to calculate on-time performance for arrivals is the FAA's Aviation System Performance Metrics (ASPM) database. Within this data set, aircraft must be airborne enroute to their scheduled destination in order for them to be considered delayed; therefore, cancelled and/or diverted flights are not considered late in this system.

MSP Flights Delayed by ATC* 2007-2016 *Figure 2-5*



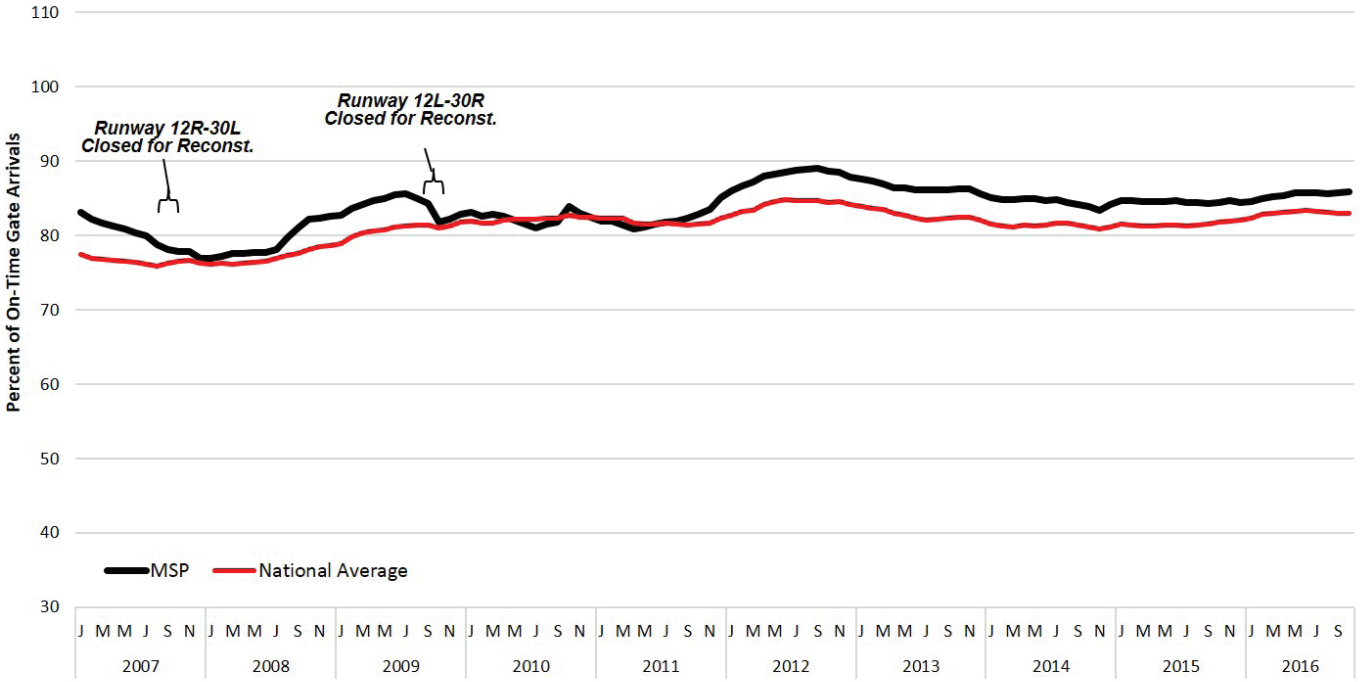
*This total is reported differently in 2008 due to FAA adjusting the way air traffic control calculates delays for arriving and departing flights.
Source: Federal Aviation Adminstration Opsnet.

Scheduled flight times typically include some cushion for delay, especially for arrivals operating during peak periods. Factors that can cause a flight to be delayed may be related to mechanical problems, lack of crew, weather or airfield capacity constraints.

MSP on-time performance in 2016 began at 85 percent in January and ended at 90 percent in December. MSP tracked about 3 percent higher than the national average in 2016. **Figure 2-6** shows average on-time gate arrival performance for domestic air carrier flights at MSP. Data used to calculate delay are extracted from the FAA ASPM database and compares MSP's moving 12-month average for on-time performance with the national average. **Figure 2-7** provides a comparison of monthly on-time gate arrivals and percent of good weather at MSP.

On-Time Gate Arrivals, MSP vs. National Average[1] (12-Month Moving Average) 2007-2016

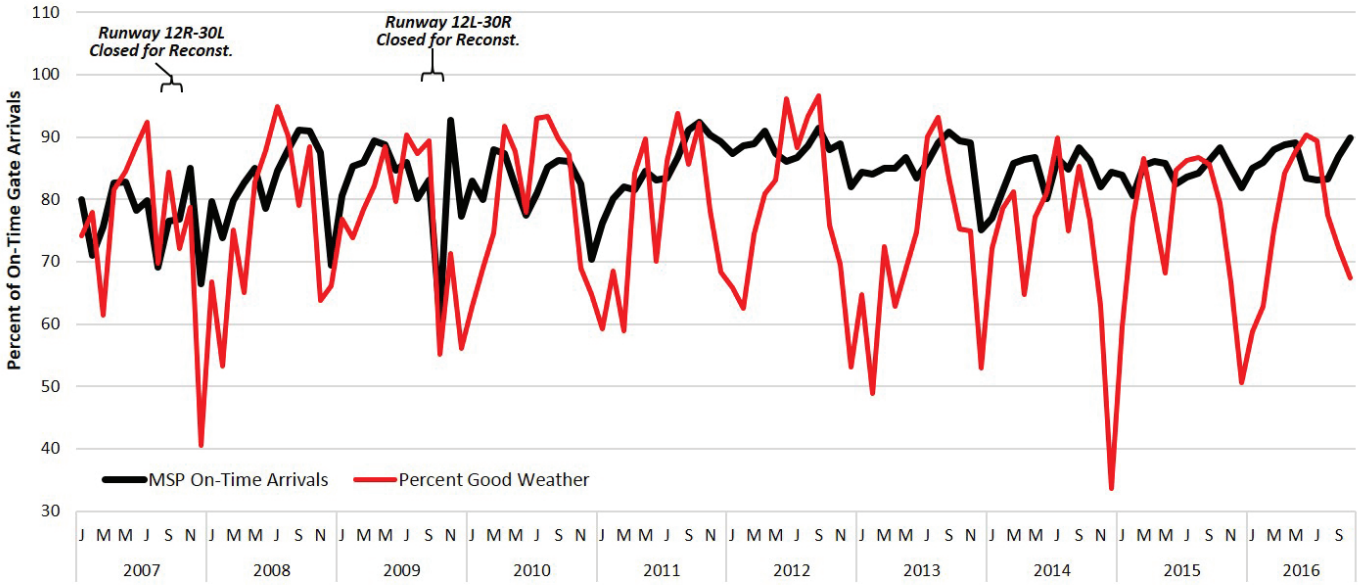
Figure 2-6



(1) National average consists of the top 77 airports.
Source: Federal Aviation Administration Aviation System Performance Metrics (ASPM)

Comparison of MSP Monthly on-time gate arrivals[1] and percent of good weather[2] 2007-2016

Figure 2-7



(1) Percentage of flights arriving within 15 minutes of scheduled arrival time.
(2) Good weather is defined as when conditions may allow visual approaches; actual separation standards used at time of observation are not available in ASPM database.
Source: Federal Aviation Administration Aviation System Performance Metrics (ASPM).

2.4.2.2 Average Delay per Aircraft Operation

When calculating the average delay per aircraft operation, airport-attributable delay is estimated by comparing a flight's actual air and taxi times with estimated unconstrained times. The total cumulative amount of delay experienced by all scheduled flights in the database is then divided by the total number of flights in the database for the same time period. The output is usually expressed in minutes of delay per operation.

The current industry standard for estimating delay relies on the FAA's ASPM data, which provide a comprehensive analysis of airport delay and capacity. The FAA uses ASPM results to create performance benchmarks for airports each year. Since 2005, use of ASPM data has been a well-supported methodology to calculate aircraft delays, accepted by both government and industry, as the most valid, accurate and reliable metric[1].

Figure 2-8 shows the average delay per operation for MSP compared to the national average. MSP activity was below the national average for delay per operation throughout 2016, averaging about 5.5 minutes of delay from January-October. Data for November and December were not available at the time of this analysis.

Figure 2-9 provides a comparison of MSP average delay per aircraft operation and percent of poor weather. The monthly comparison shows the percentage of time MSP operated in poor weather conditions[2] along with a 12-month moving average for MSP and 77 high-delay airports tracked by the FAA.

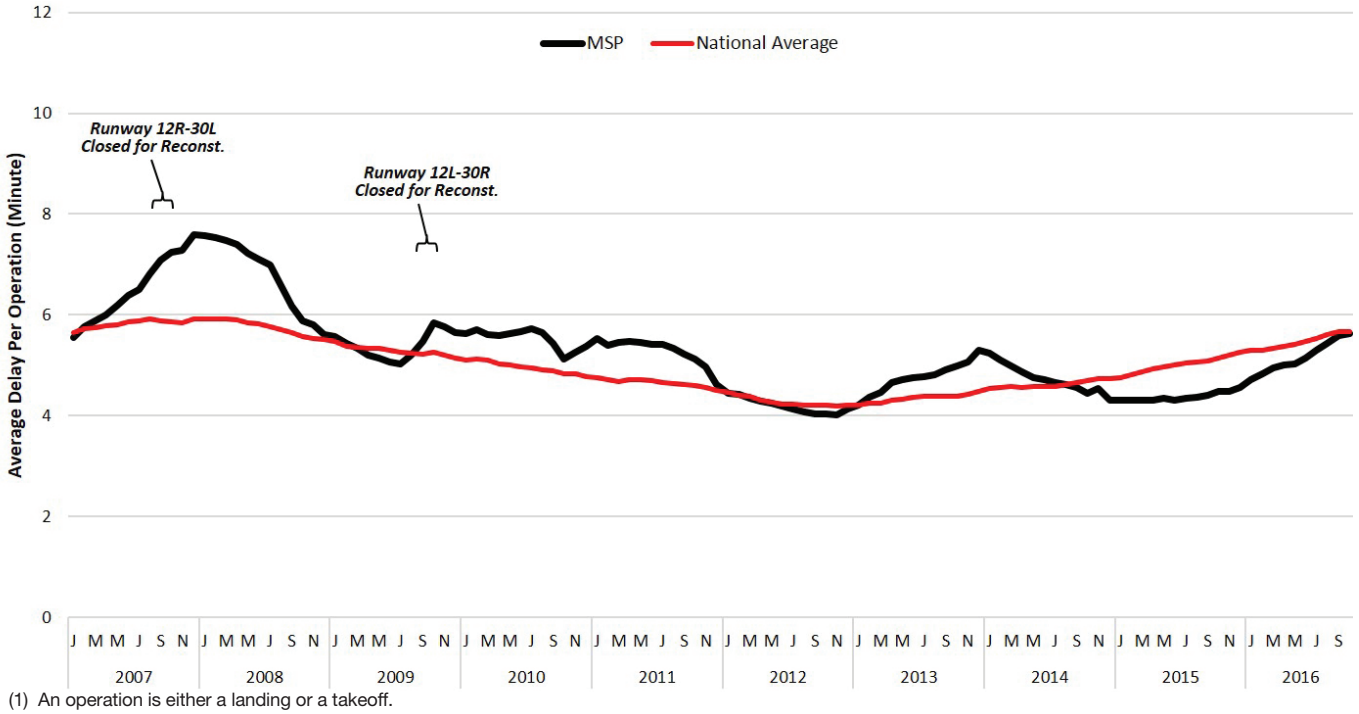
When compared to other large hub U.S. airports, as shown in **Table 2-4,** MSP ranked 15th overall in 2016 in terms of highest average delay per operation.

(1) Prior to 2005, the industry standard was the FAA's Consolidated Operations and Delay Analysis System (CODAS); the U.S. Department of Transportation (DOT) Airline Service Quality Performance (ASQP) data were used to compare optimal versus actual taxi and flight times for MSP.

(2) Historically, weather and wind - while not the only causes of delay - are one of the primary causes of delay at MSP.

MSP Average delay per aircraft operation[1] compared to national average[2] (12-Month Moving Average) 2007-2016

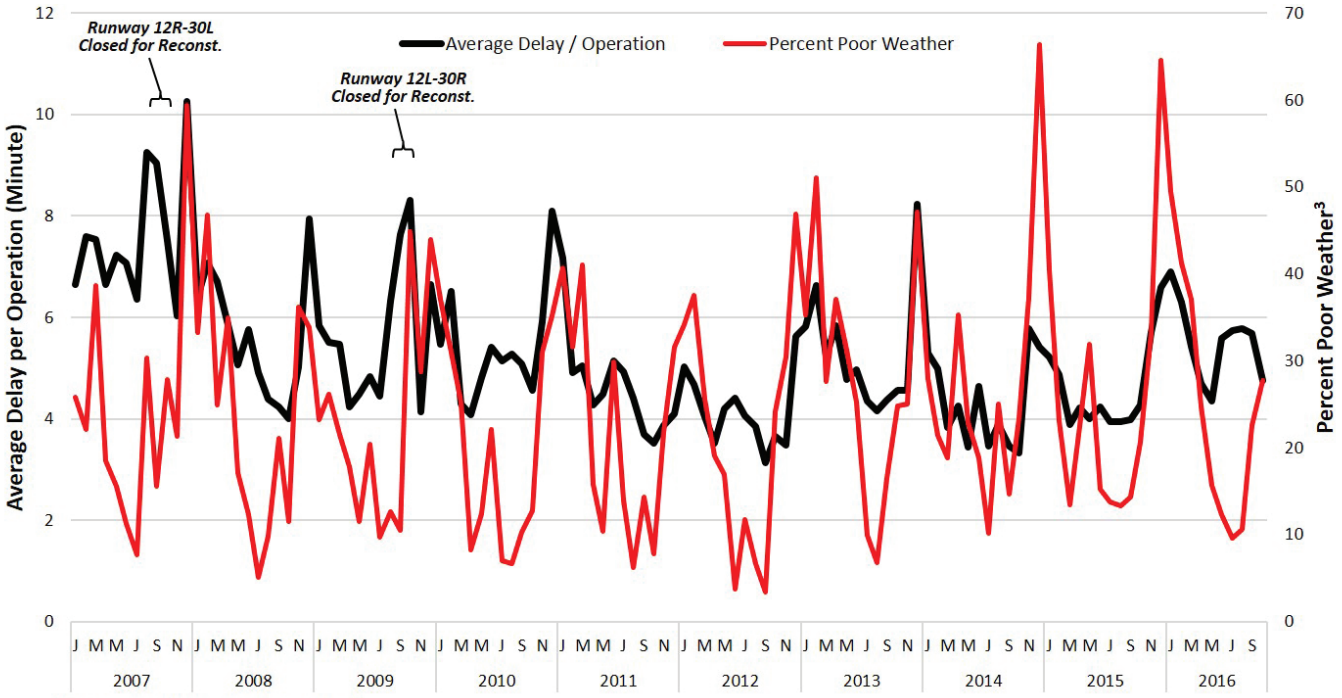
Figure 2-8



(1) An operation is either a landing or a takeoff.
(2) National average consists of top 77 airports in ASPM database.
Source: Federal Aviation Administration Aviation System Performance Metrics (ASPM)

Comparison of MSP Average delay per aircraft operations and percent poor weather[3] 2007-2016

Figure 2-9



(1) An operation is either a landing or a takeoff.
(2) National average consists of top 77 airports in ASPM database.
(3) Poor weather is defined as when aircraft must make instrument approaches; actual separation standards used at time of observation are not available in ASPM database.

TABLE 2-4
TOP 25 LARGE HUB AIRPORTS WITH HIGHEST AVERAGE TOTAL DELAY PER OPERATION

Rank	Airport	2016 Total Airport Operations	2016 Average Minutes of Delay per Operation	2015 Average Minutes of Delay per Operation	2015 Rank	Change from 2015 to 2016
1	LGA	374,487	11.9	10.5	1	1.4
2	CLT	545,742	9.1	7.7	4	1.5
3	ORD	867,635	9.0	8.7	2	0.3
4	JFK	458,707	8.9	8.0	3	0.9
5	DCA	299,670	7.8	5.9	10	1.9
6	LAX	696,890	7.8	6.4	8	1.4
7	EWR	431,214	7.7	7.2	6	0.6
8	DFW	672,748	7.6	7.2	5	0.4
9	PHL	394,022	7.4	6.8	7	0.6
10	MIA	414,234	6.6	5.5	12	1.1
11	SFO	450,391	6.5	5.3	15	1.2
12	IAH	470,780	6.2	6.3	9	-0.2
13	SEA	412,170	5.9	5.3	14	0.6
14	PHX	440,643	5.7	5.2	18	0.5
15	**MSP**	**412,898**	**5.5**	**4.5**	**22**	**1.0**
16	IAD	292,124	5.4	5.0	20	0.4
17	BOS	395,811	5.4	5.5	13	-0.1
18	DEN	572,520	5.3	5.1	19	0.2
19	RDU	193,453	5.2	3.9	29	1.3
20	MCO	323,914	5.1	4.4	25	0.7
21	DTW	393,427	5.1	4.8	21	0.3
22	ATL	898,356	4.8	5.3	16	-0.4
23	MDW	253,046	4.7	5.5	11	-0.8
24	DAL	224,193	4.6	4.5	23	0.1
25	BWI	248,585	4.5	5.2	17	-0.7

Source: FAA OPSNET for airport operations data, FAA Aviation Performance Metrics for average minutes of delay per operation (taxi-in, taxi-out, and airborne delay).

2.5 TECHNOLOGICAL DEVELOPMENTS AND CAPACITY ENHANCEMENTS AT MSP

The FAA continuously explores potential capacity-enhancing development/technology in an effort to increase airport efficiency and reduce delay. When advances are identified, efforts are made to implement the technology at the busiest airports. This section describes these efforts as they apply to MSP.

Installation of Airport Surface Detection Equipment, Model X (ASDE-X) at MSP was completed in 2009 and provides seamless coverage for complete aircraft identification information. This equipment also allows for future implementation and upgrade to the FAA's Next Generation (NextGen) navigation technology, Automatic Dependence Surveillance-Broadcast (ADS-B), which uses a Global Navigation Satellite System to broadcast critical information.

Federal policy requires aircraft operating in capacity-constrained airspace, at capacity-constrained airports or in any other airspace deemed appropriate by the FAA, to be equipped with ADS-B/Cockpit Display of Traffic Information (ADS-B/CDTI) technology by 2020. This includes MSP.

2.5.1 Performance-based Navigation/Area Navigation (PBN/RNAV)

As part of the FAA's NextGen initiative to modernize the national airspace system, in 2011 the agency began to pursue advanced aircraft navigation technology at MSP in the form of PBN flight procedures. By 2015 the FAA focused these efforts on implementing RNAV and Required Navigation Performance (RNP) arrival procedures at MSP. On November 19, 2012, after extensive public involvement led by the MSP Noise Oversight Committee (NOC), the MAC supported implementation of MSP RNAV arrival procedures and partial implementation of MSP RNAV departure procedures. The MAC withheld its support for RNAV departure procedures for MSP Runways 30L and 30R in response to a large volume of residents and elected officials expressing concern about concentrating departure flights over certain residential areas in Minneapolis and Edina. As a result, the FAA indicated it would need to conduct a safety risk management evaluation for partial implementation of RNAV at MSP.

On February 19, 2014, the results of the FAA's safety risk management evaluation concluded partial implementation of RNAV departures introduces unsafe risk factors. Specifically, moving forward with implementation of RNAV departure procedures for Runways 12L, 12R and 17 without implementation of RNAV departure procedures on Runways 30L and 30R was determined unsafe. Therefore, the FAA concluded that RNAV departure procedures would not be implemented at MSP at this time.

In response to the FAA's safety risk management findings, on March 6, 2014 the NOC passed a resolution that specified further consideration of the use of RNAV departure procedures at MSP. The resolution specified that further consideration of RNAV departure procedures at MSP must be structured in a way that takes into account proven successes at other similarly-situated airports and incorporates community outreach efforts. The resolution also specifically expressed support for the implementation of the RNAV and RNP arrival procedures at MSP. On March 17, 2014 the MAC Board of Commissioners took unanimous action supporting the NOC resolution and forwarded it to the FAA.

The FAA moved forward with the approved RNAV and RNP arrival procedures incorporating Optimized Profile Descents (OPD); publication of the RNAV and RNP arrival flight procedures and air traffic control implementation began in March 2015 and was fully implemented by April 2015.

2.5.2 Optimized Profile Descents (OPD) at MSP

With the incorporation of OPD, the new RNAV and RNP arrival procedures increase aircraft fuel efficiency compared to traditional arrival procedures. Instead of following a step-down approach to the airport, in which pilots would descend and level off at the direction of Air Traffic Control, OPDs allow for a smooth and continuous descent from cruise altitude (approximately 35,000 feet) down to approximately 8,000 feet.

Since implementation of the procedures, the MAC has been collaborating with the FAA, the airlines and an environmental consulting firm to quantify the environmental and economic benefits of implementing these procedures.

While these efforts are still on-going, the MAC estimates that 80 percent the arrivals to MSP are flying an OPD. This equates to the potential savings of millions of gallons of fuel and associated greenhouse gas emissions.

2.5.3 Ongoing Precision Instrument Approach Capabilities

In addition to runway separation and configuration, airfield capacity can be affected greatly by how the runways are equipped for inclement weather. A number of precision instrument approaches continue to be available at MSP as summarized in **Table 2-5.**

TABLE 2-5
PRECISION INSTRUMENT APPROACHES

MSP	CAT I	CAT II	CAT III
Runways:	30R	30L	12L
			12R
			35

Notes: The term decision height is defined as the height at which a decision must be made during a precision approach to either continue the landing maneuver or execute a missed approach.

Precision approaches are categorized based on decision height and the horizontal visibility that a pilot has along the runway. Visibility values are expressed in statute miles or in terms of runway visual range (RVR) if RVR measuring equipment is installed at an airport. The different classes of precision instrument approaches are:

i. Category I (CAT I) – provides approaches to a decision height down to 200 feet and a basic visibility of ¾ statute miles or as low as 1,800 feet runway visual range (RVR).
ii. Category II (CAT II) – provides approaches to a decision height down to 100 feet and an RVR down to 1,200 feet.
iii. Category IIIa (CAT IIIa) – provides approaches without a decision height (down to the ground) or a decision height below 100 feet and an RVR down to 700 feet.
iv. Category IIIb (CAT IIIb) – provides approaches without a decision height or a decision height below 50 feet and an RVR down to 150 feet.
v. Category IIIc (CAT IIIc) – provides approaches without a decision height and RVR. This will permit landings in "0/0 conditions," that is, weather conditions with no ceiling and visibility as during periods of heavy fog.

Source: MSP Airfield Operations, FAA

2.5.4 Converging Runway Operations

In 2013, the National Transportation Safety Board (NTSB) recommended modifications to arrival and departure procedures for airports with Converging Runway Operations (CRO). A converging runway operation exists when runways that do not physically intersect have flight paths that could intersect within one mile of the runway ends. At MSP, the extended centerline of Runway 35 intersects within one mile with the extended centerlines of both Runway 30L and Runway 30R. Since Runway 35 generally is used only for arrivals from the south, potential convergence in flight paths would occur only if an aircraft executed an aborted landing (go-around) on Runway 35. CRO procedures at MSP prevent an aircraft that aborts its landing on Runway 35 from conflicting with aircraft departing from Runways 30L or 30R, as shown in **Figure 2-10.**

The FAA used a phase-in approach to introduce new safety requirements at U.S. airports identified by the NTSB. Beginning in July 2015, the FAA initially suspended arrivals on Runway 35 at MSP for about one month while it focused on developing procedures that would comply with the NTSB requirements. This temporary suspension reduced MSP's capacity significantly when flights were landing and departing in a northerly direction to a maximum hourly arrival rate between 60 and 64 aircraft, down from a previous maximum of 90 aircraft.

This resulted in reduced departure rates, ground congestion, departure delays and added complexity for controllers when flights were landing and departing in a northerly direction. For this reason, coupled with increased southerly winds, MSP experienced notable changes in runway use.

In response, the MSP Noise Oversight Committee (NOC) unanimously passed a resolution requesting the FAA evaluate the current and future environmental and capacity impacts from the new CRO rules and to communicate the findings back to the NOC. The MAC Board of Commissioners took unanimous action supporting the NOC resolution and forwarded it to the FAA.

While the FAA's efforts related to CRO were taking place, the MAC was in the process of updating the Long Term Comprehensive Plan (LTCP) for MSP. The LTCP is a forward-looking document that acts as a road-map for possible facility improvements needed for the next 20 years to meet deficiencies identified through the LTCP update process. A component of the LTCP document is a 20-year forecast noise contour to provide an estimated depiction of the future noise impacts associated with MSP. At the request of elected officials and community members, the MAC deferred its LTCP efforts to ensure the FAA's CRO efforts and any resulting changes to ground and air operations be taken into account in the MAC's long-term planning efforts.

Throughout 2015 and 2016, the FAA continued its work to refine the CRO procedures at MSP to regain capacity and reduce environmental impacts as much as feasible. Regular updates on the FAA's activities related to CRO were given to the NOC, the MAC Board, surrounding city councils and neighborhood groups. In January 2017, the FAA reported that further procedure adjustments enabled use of two Arrival Departure Window (ADW) tools that allowed air traffic controllers to provide the needed separation requirements while improving airfield efficiency. Use of the new ADW tools have improved the northerly arrival rate at MSP to 78 aircraft per hour. The FAA continues its efforts to improve CRO procedures at MSP and estimates this effort will be complete by mid- to late-2017.

MSP Converging Runway Operations Diagram

Figure 2-10

2.6 MSP TERMINAL AND CAMPUS IMPROVEMENTS

This section describes some of the key construction improvements underway at MSP.

2.6.1 Terminal 1-Lindbergh Operational Improvements

The Terminal 1-Lindbergh Operational Improvements Program involves a complete overhaul of the ticket lobby (departures) area, the bag claim (arrivals) area and the ground transportation center. All of these areas are located on the public, non-secure side of the terminal. These areas are in the process of being completely remodeled, essentially providing entirely new facilities without the high cost associated with brand new construction.

The work includes construction of a new exterior glass façade creating additional walking space; replacement of end-of-life escalators and elevators; replacement of old, undersized bag claim carousels with more-efficient, higher-capacity carousels; improvements to the existing baggage handling system; new terrazzo floors, more daylighting for spaces; better sight lines; centralized meet and greet space in both the arrivals and departures levels; and new restrooms and security enhancements.

The work also will include improvements to the vertical circulation are designed to improve the way people move between upper levels and lower levels of Terminal 1. The program needs to be completed in phases so that adequate facilities are still available while others are taken out of service. Phase one began on the north end of Terminal 1 in 2016; once phase one work is complete, the next phase will begin on the south end of the terminal.

The entire program is expected to take six years to complete fully.

2.6.2 Terminal 1-Lindbergh Parking Ramp Program– Roadway and Site Prep

In 2016, the MAC proceeded with $150 million in projects that will clear the site for construction of a new parking ramp at Terminal 1. The 2016 projects include roadway improvements that will ultimately result in the relocation of the outbound roadway, construction of a new parking ramp exit plaza and construction of support facilities that house the parking revenue management system. At the time of publication, all projects are on schedule and under budget, and planned for completion in mid-2017 to allow for construction of the parking ramp to begin in 2017.

2.6.3 Terminal 1-Lindbergh Hotel and Skyway Development

Construction on an airport hotel began in 2016 and is expected to be completed in mid-2018. RSP Architects, Graves Hospitality's architect for the project, paid special attention to establishing a strong sense of place with local design elements. Warm woods and local materials like Kasota stone and Cold Spring granite, along with integrated architectural art (including an interesting partnership with Red Wing Shoe Co. for leather materials in the lobby), will create an inviting and unique environment.

Connecting the hotel to Terminal 1's Concourse C will be a new skyway. The skyway is being constructed as a MAC project, and is being built to accommodate a future extension to Concourse G. The project also includes improvements to the Concourse C/Concourse A rotunda space to provide enhanced passenger movements and interior access to the skyway.

2.6.4 MSP Concessions Program

The Metropolitan Airports Commission (MAC) is in the process of revamping MSP's retail and food and beverage offerings in Terminal 1-Lindbergh and Terminal 2-Humphrey. As of 2016 year-end, 50 new retail shops and dining establishments have opened or were in the process of completing their build out. The program expands the variety of products and price points available to consumers, including a broader selection of ethnic foods. There is also a mix of national brands, local brands and established airport-only brands.

The program continues into 2017 with a selection process for the remaining concessions, which are primarily food and beverage venues.

3. RELIEVER AIRPORTS

3.1 HISTORIC ACTIVITY LEVELS

3.1.1 Based Aircraft at MAC Reliever Airports

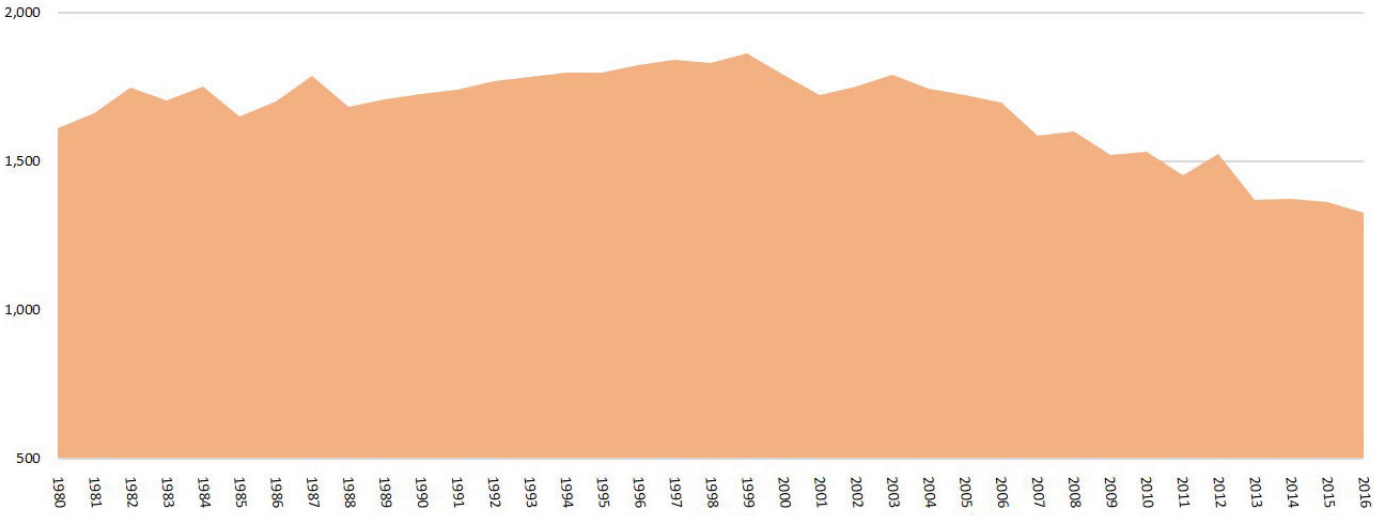
Aircraft operators must choose an airport at which to base their aircraft. Airports in Minnesota are required to submit to the State a report that identifies the aircraft based at their facilities for 180 days or more. **Figure 3-1** shows historical based aircraft trend for the MAC Reliever airports from 1980 through 2016. Total based aircraft peaked in 1999 with 1,864 based aircraft at MAC Reliever airports. While the general trend continues to decline, based aircraft totals fluctuate each year.

3.1.2 Aircraft Operations at MAC Reliever Airports

MAC Reliever airports are open for public use 24 hours per day. **Figure 3-2** shows the historical levels of aircraft operations that occurred in the MAC Reliever airport system from 1980 through 2016. These totals are obtained from the FAA for MAC Reliever airports with an air traffic control tower[3] and from other data sources for MAC airports that do not have an air traffic control tower[4].

Total Based Aircraft at MAC Reliever Airports 1980-2016

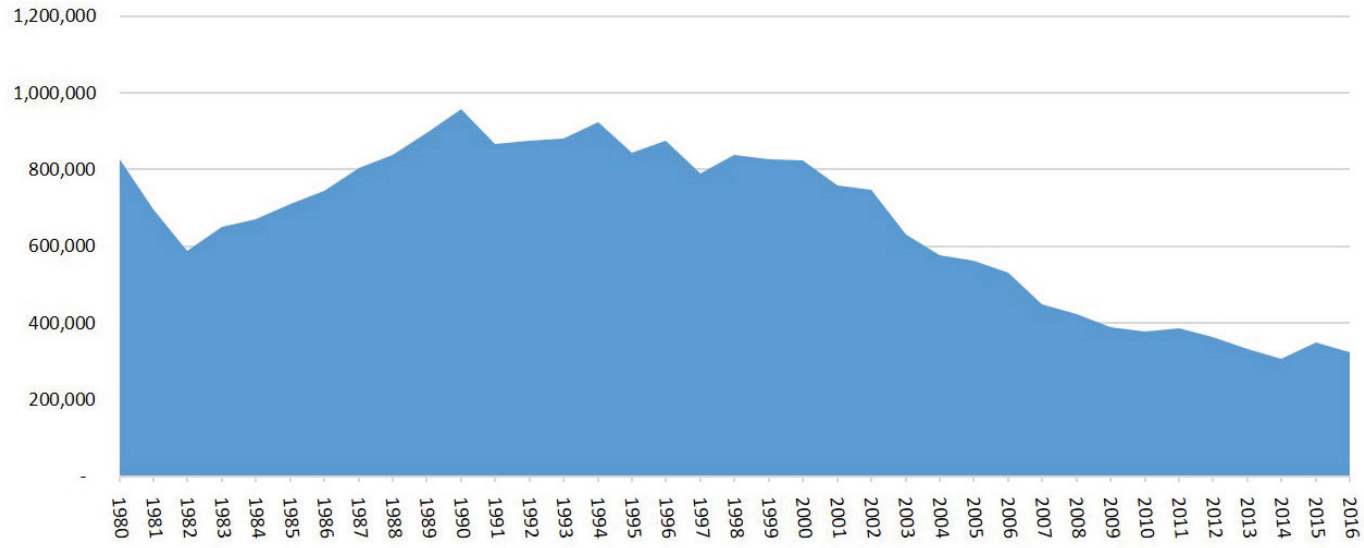
Figure 3-1



Source: Metropolitan Airports Commission

Total Aircraft Operations at MAC Reliever Airports 1980-2016

Figure 3-2



Source: MAC Reliever Airports and Federal Aviation Adminstration data.

3.2 PLANNING AND DEVELOPMENT AT MAC RELIEVER AIRPORTS

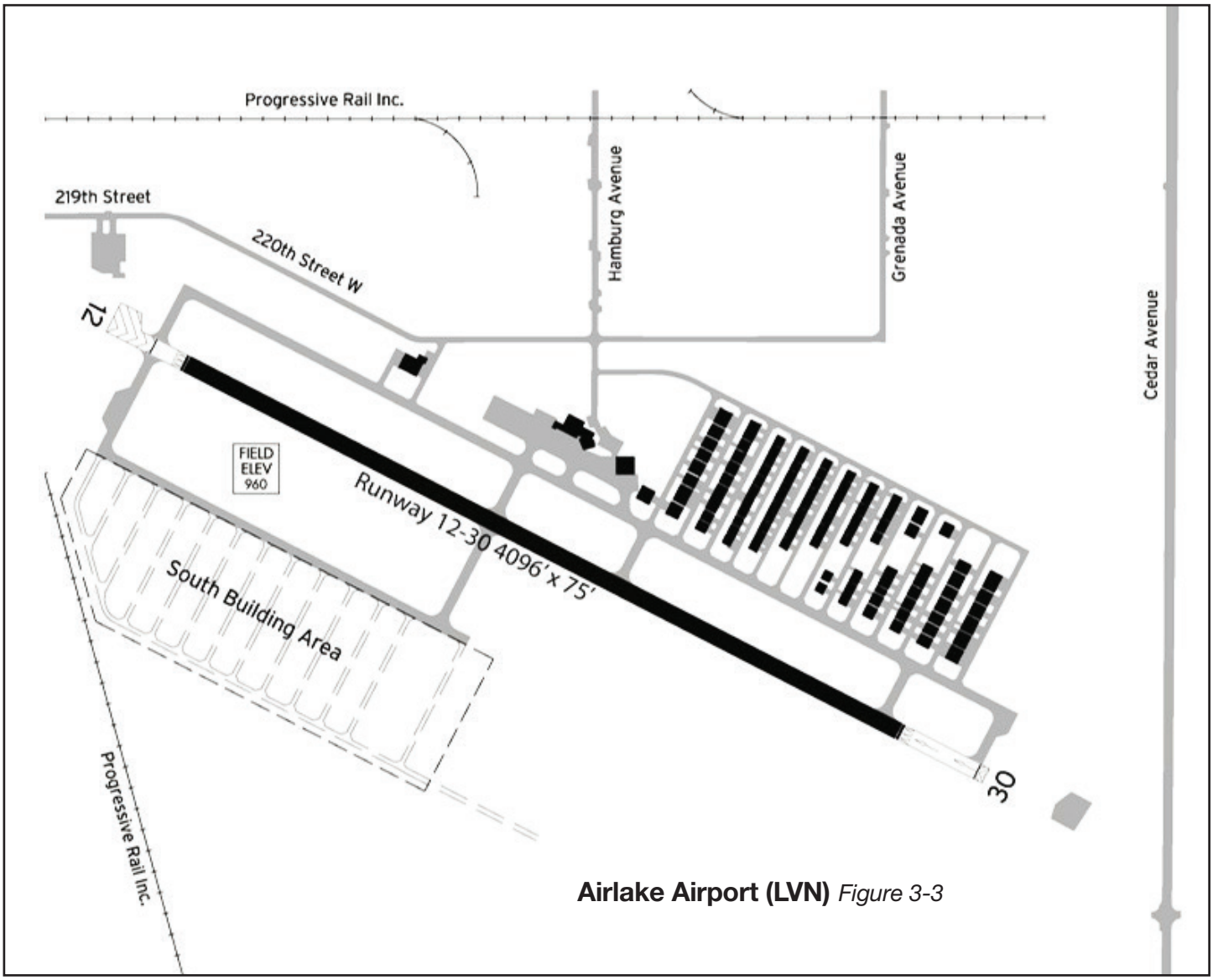
This section provides an overview of planning efforts and capital improvements at each MAC Reliever Airport. It is important to note that the MAC is investigating revenue-generating development at the Reliever Airports as a way to help make the Reliever Airport system as financially self-sustaining as possible.

The MAC has an ongoing program to rehabilitate aircraft operations areas (runways, taxiways, aprons) through bituminous overlays and seal coats; in some instances, reconstruction is necessary to restore the surfaces to a smooth, even condition for optimum operating conditions. Projects vary from year to year, depending on available funding and airport needs. In 2016, pavement rehabilitation was completed at Flying Cloud Airport (FCM), Lake Elmo Airport (21D), and St. Paul Downtown Airport (STP). Also, an Asset Management Report was completed for all MAC-owned buildings at the relievers. This assessment will help to prioritize funding for building maintenance and repair activities.

3.2.1 Airlake Airport (LVN)

Figure 3-3 shows LVN's current airfield layout. In 2016, the MAC completed a project to rehabilitate a portion of the parallel taxiway (Taxiway A) at LVN.

The LVN 2008 Long Term Comprehensive Plan (LTCP) update recommended that the airfield's only runway (Runway 12-30) be extended to 5,000 feet at some point in the future to coincide with industrial/commercial



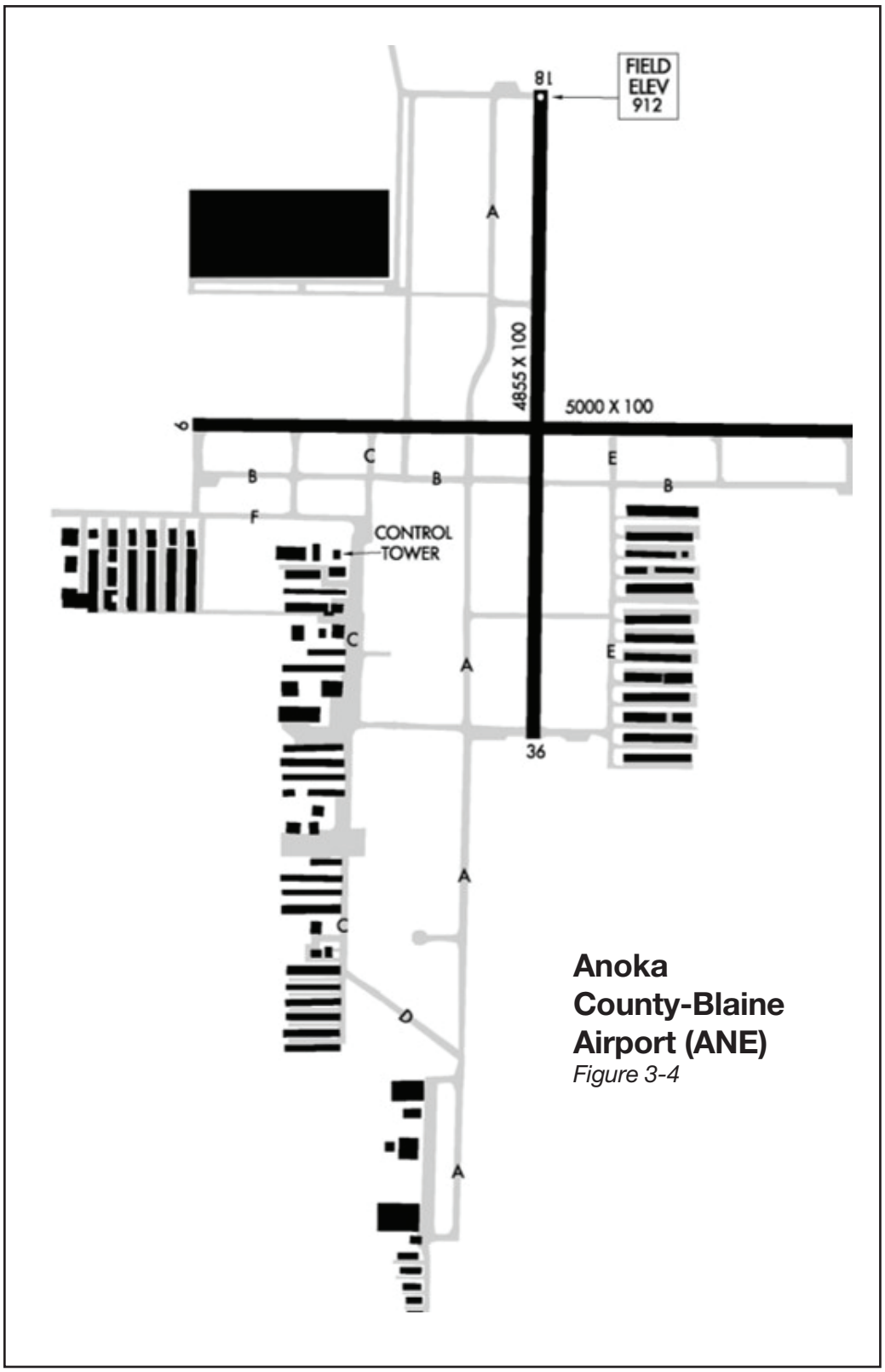
Airlake Airport (LVN) *Figure 3-3*

(3) MAC airports that have an air traffic control tower are as follows: Anoka County-Blaine Airport (ANE), Flying Cloud Airport (FCM) in Eden Prairie, Crystal Airport (MIC) and St. Paul Downtown Airport (STP). It should be noted that these airports are open 24 hours per day, but the control towers are closed during late night and early morning hours.

(4) MAC airports that do not have an air traffic control tower, such as Airlake Airport (LVN) in Lakeville and Eureka Township and Lake Elmo Airport (21D), the operations totals are estimated through various methods and available data. The operations totals presented for LVN and 21D are airport staff estimations calculated from aircraft operations counts completed in 2016.

development in Lakeville and potentially in Eureka Township. The runway extension recommended in the 2008 plan would require relocation of a portion of Cedar Avenue. In 2010 the MAC completed a Draft Scoping Decision Document and a Draft Environmental Assessment Worksheet (EAW) for the proposed development activity.

Preparation of the draft 2035 LTCP for LVN is underway and is expected to be completed in 2017. As a part of this effort, concepts are being evaluated to determine if it is feasible to provide additional useable runway pavement without having to relocate Cedar Avenue. Based on agency and user coordination completed to date, it appears that a feasible option exists to accomplish these objectives. It is anticipated that the 2035 LTCP for LVN will move forward with an alternative that provides additional runway length but does not require relocation of Cedar Avenue on the east side of the airport or the railroad track on the west side.



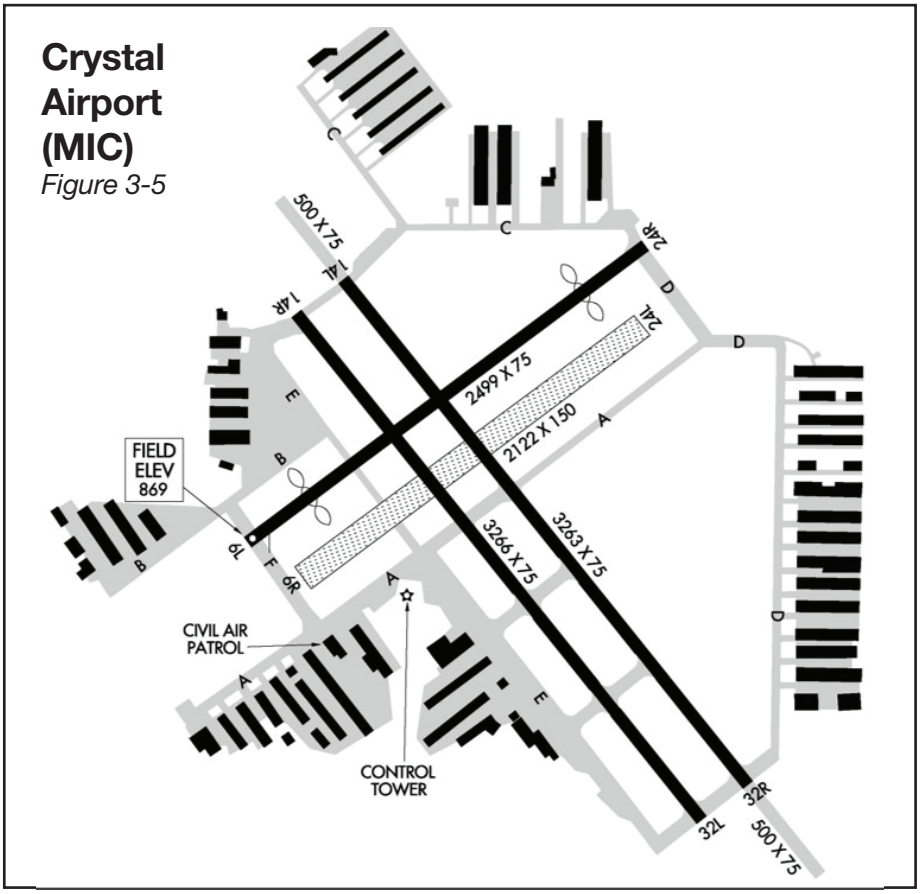
Anoka County-Blaine Airport (ANE)
Figure 3-4

3.2.2 Anoka County-Blaine Airport (ANE)

Figure 3-4 shows ANE's current airfield layout. In 2016, the MAC completed a project to repair and improve the exterior façade of the MAC Maintenance Building at ANE.

The Long Term Comprehensive Plan (LTCP) update was completed in 2010 for ANE. This plan analyzed existing facilities, forecasted future activity, and outlined development needed to meet the projected demand. Based upon the forecasts and existing airfield configuration, no airside or landside expansions are proposed in the LTCP. Currently, there is no demonstrated need for longer runway lengths, additional runways or additional hangar areas.

Preparation of the 2035 LTCP for ANE will be initiated in 2017.



Crystal Airport (MIC)
Figure 3-5

3.2.3 Crystal Airport (MIC)

Figure 3-5 shows MIC's current airfield layout. In 2016, the MAC completed a project to demolish the former Helicopter Flight, Inc. (HFI) hangar facility. Additionally, the MAC initiated a project to identify and remove obstructions to the runway approaches. These obstructions consist primarily of trees on privately-owned property which must be acquired via individual negotiations and compensation to homeowners.

The MAC completed a Long Term Comprehensive Plan (LTCP) update for MIC in 2008. The adopted LTCP recommends that two runways be closed to "right-size" the airport. The 2008 LTCP for MIC suggests keeping the original paved runway (Runway 14L-32R) and the paved crosswind runway (Runway 6L-24R) intact.

Preparation of the draft 2035 LTCP for MIC is underway and is expected to be completed in 2017. The current version of the draft 2035 LTCP includes several revisions from the 2008 plan, including a longer primary runway and preserving a portion of the existing turf runway.

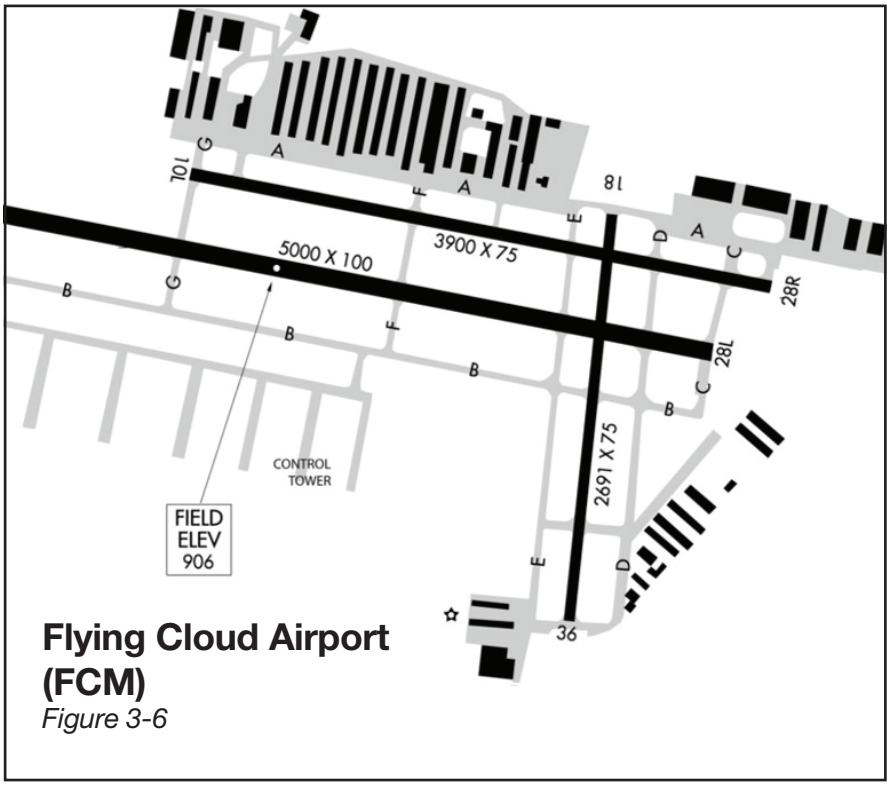
Further details about the draft 2035 LTCP for the Crystal Airport can be found on the MAC's website at: **http://metroairports.org/General-Aviation/Airports/Crystal.aspx.**

3.2.4 Flying Cloud Airport (FCM)

Figure 3-6 shows FCM's current airfield layout. In 2016, the MAC completed the second phase of a multi-year project to reconstruct Taxiway A at FCM. This phase included the full-depth reconstruction of the portion of the taxiway west of Runway 18-36.

The Long Term Comprehensive Plan (LTCP) update for FCM was completed in 2010. This plan analyzed existing facilities, forecasted future activity, and outlined development needed to meet projected demands. The primary project recommended in the plan involved shifting the crosswind runway at FCM (Runway 18-36) to the north. This project was completed in 2013 and provides a fully compliant runway safety area at FCM.

Preparation of the 2035 LTCP for FCM will be initiated in 2017.



Flying Cloud Airport (FCM)
Figure 3-6

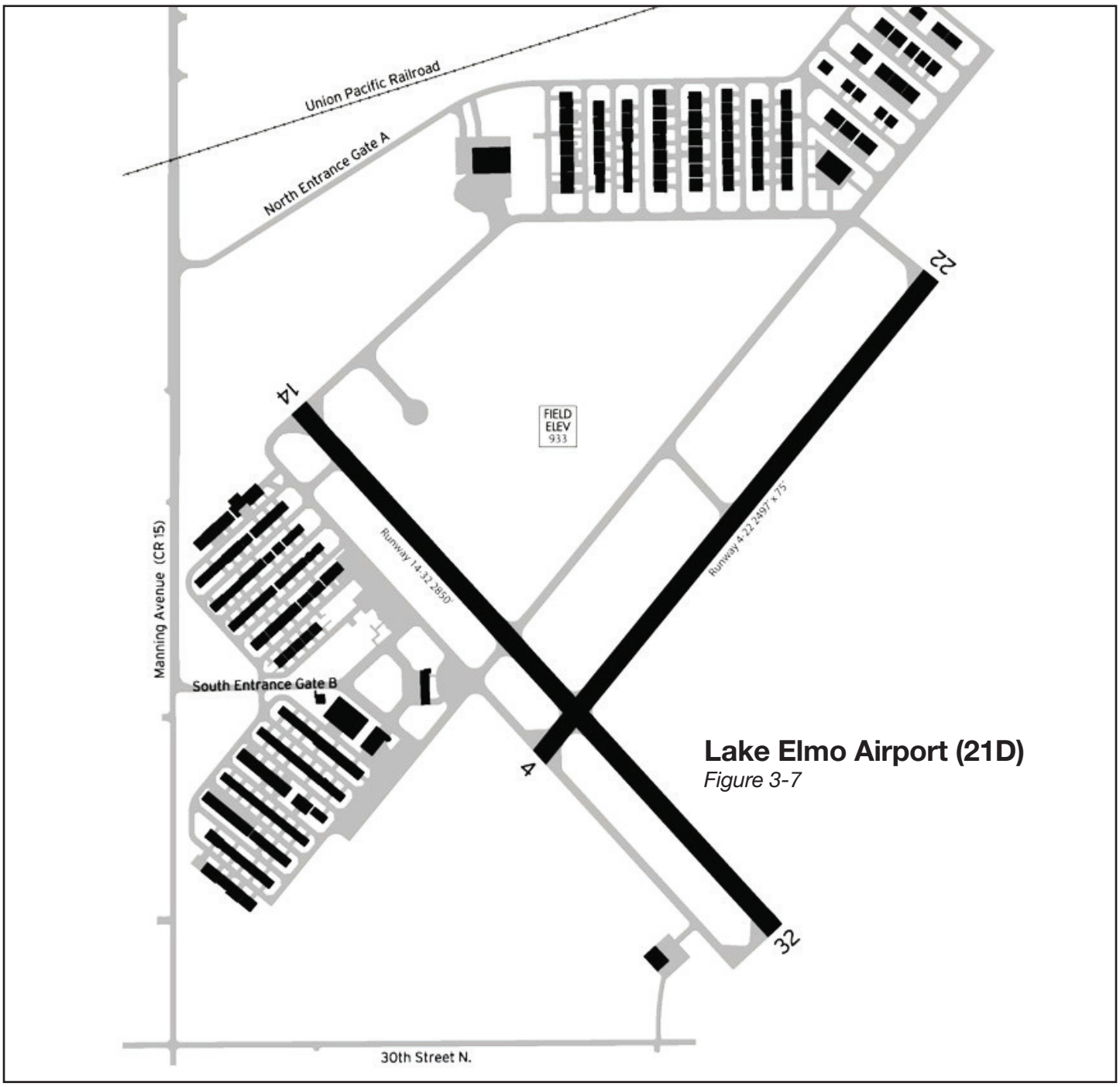
3.2.5 Lake Elmo Airport (21D)

Figure 3-7 shows 21D's current airfield layout. In 2016, the MAC completed a project to rehabilitate and widen a portion of the primary runway's parallel taxiway at 21D.

The 2035 LTCP for 21D was adopted by the MAC Board in September 2016.

The adopted 2035 LTCP recommends a relocated and lengthened primary runway (Runway 14-32), which necessitates a realignment of a public roadway (30th Street N) to remain clear of the Runway Protection Zone (RPZ). Further details about the adopted 2035 LTCP for the Lake Elmo Airport can be found on the MAC's website at: **http://metroairports.org/General-Aviation/Airports/Lake-Elmo.aspx.**

The State and federal environmental review process for the proposed developments at 21D is underway and is expected to be completed in mid-2018.



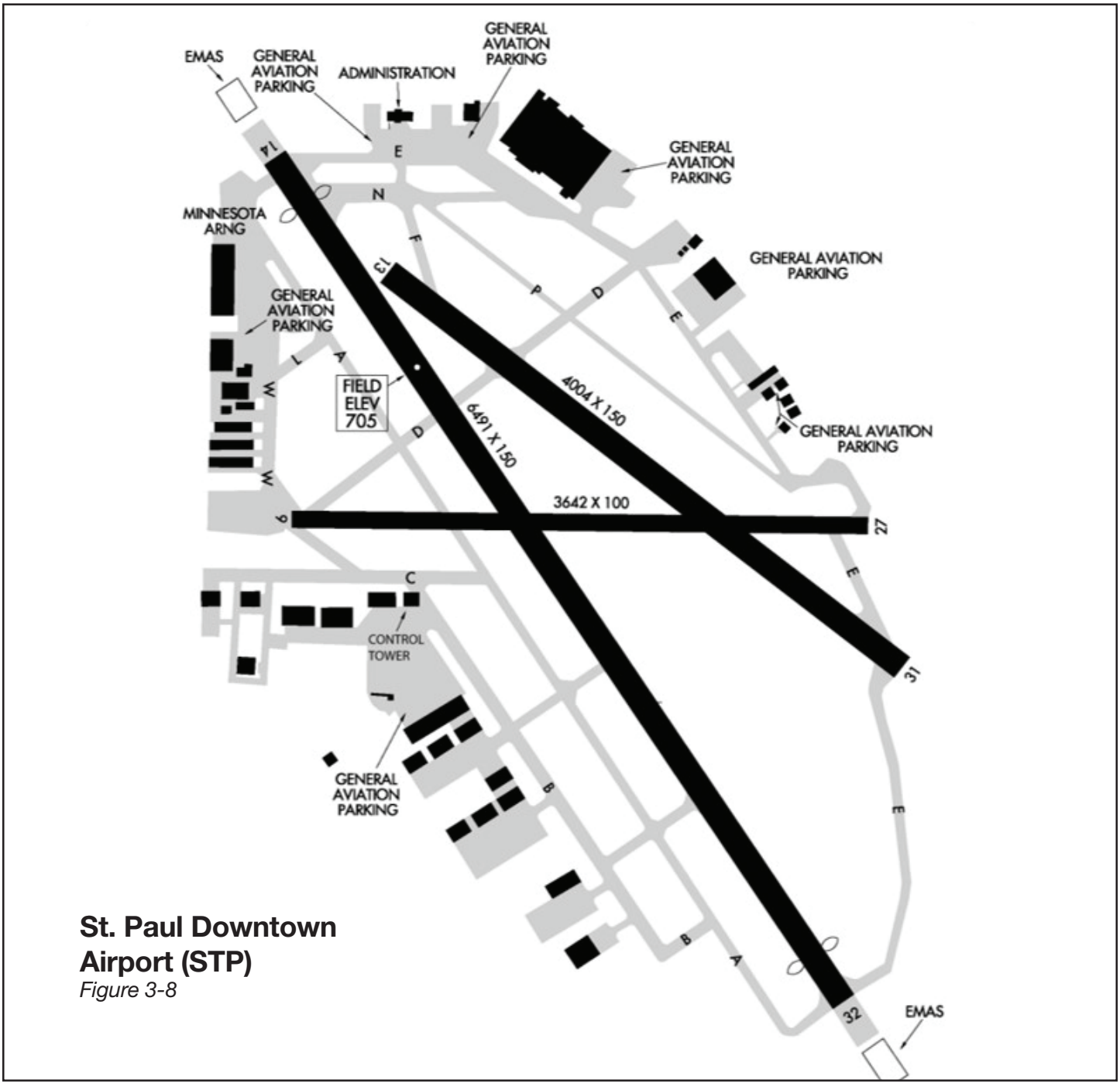
Lake Elmo Airport (21D)
Figure 3-7

3.2.6 St. Paul Downtown Airport (STP)

Figure 3-8 shows STP's current airfield layout. In 2016, the MAC completed a project to reconstruct the north end overlapping portions of Runway 14 and Runway 13, along with safety-related geometric modifications to Taxiways F and N to reduce risk associated with potential runway incursions and improve overall safety of taxiing aircraft from Runways 13 and 14.

The Long Term Comprehensive Plan (LTCP) update for STP was completed in 2010. This plan analyzed existing facilities, forecasted future activity and outlined development needs in order to meet projected demand. Based upon the forecasts and existing airfield configuration, no airside or landside expansions are proposed in the LTCP. There is currently no demonstrated need for longer runways, additional runways or additional hangar areas.

Preparation of the 2035 LTCP for STP will be initiated in 2017.



St. Paul Downtown Airport (STP)
Figure 3-8


MINNEAPOLIS SAINT PAUL
MAC
METROPOLITAN AIRPORTS COMMISSION