MinnesotaGO

A Collaborative Vision for Transportation

State Aviation System Plan

Minnesota Department of Transportation

LAST UPDATE JULY 2013

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Minnesota GO
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Chapter 6

PERFORMANCE REPORT

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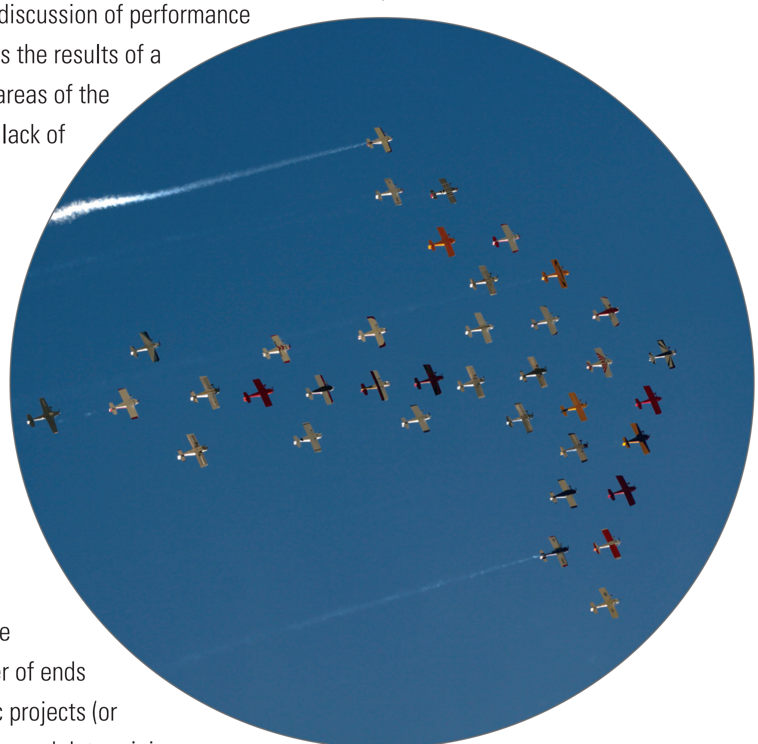
PERFORMANCE REPORT

This chapter outlines the eight performance measures and 15 system indicators developed to track progress toward meeting the goals presented in **Chapter 1: Introduction and System Goals**. Following the discussion of performance measures and indicators, the chapter also presents the results of a comprehensive "density analysis" through which areas of the state with specific performance deficiencies (e.g., lack of crosswind runways) are identified.



Performance Measures and Indicators

To analyze the performance measures and system indicators developed for this Plan, as well as for future iterations of the SASP, a GIS based tool was developed to produce up to the minute performance reports to be utilized as new projects are completed or as new GIS data become available and to run scenarios to achieve a number of ends including: evaluation of system impacts of specific projects (or events such as an airport closure), decision making, and determining individual airports' impacts on the system. This GIS tool will help MnDOT track how the measures and indicators change as new data becomes available and the system evolves over time.

It is important to note the difference between performance measures and system indicators. MnDOT has the ability, through investment, to directly impact system performance in a number of areas. For these areas, performance measures have been developed through which MnDOT will track progress toward meeting system goals. However, in some areas of performance analysis, MnDOT has limited or no ability to influence the outcome but expectations for transparency and information sharing still exist. These data sets are referred to as performance indicators, rather than measures. System indicators can be driven by market demand, local community growth, or other difficult to influence factors. They are designed to show trends and help describe how well the overall system is functioning. Over time indicators provide quantitative information for MnDOT authorities and decision makers.

The performance measures and system indicators are listed in **Figure 6-1**. Several of the measures and indicators have been used to track performance for a number of years and/or in previous system plans while others are newly established as part of this planning process. In some cases, an existing measure has been adjusted and in one case a previously abandoned measure has been brought back.

A 20-year historical perspective of SASP related performance measures is found in **Chapter 1: Introduction and System Goals**. The remainder of this chapter outlines each performance measure based on the following information:

Title: Name of each measure as referenced throughout this Plan

Measure: What is being measured

Relevance: Why the measure is relevant and important to the system

Target: Desired performance outcome

Performance: Review of each measure's current performance

Technical Description: Explains target development and its role in aviation

Source(s): Data used to develop targets or evaluate the measure

System indicators are outlined based on the following information:

Title: Name of each indicator as referenced throughout this Plan

Indicator: What is being tracked

Relevance: Why the indicator is relevant and important to the system

Trends: Description of current system trends in Minnesota

Source(s): Data used to develop targets or evaluate the measure

Individual airport performance measure report cards are included in **Appendix E: Airport Facility Needs Sheets and Report Cards** and will help airport communities understand if their airport meets individual measures and how their airport compares to the rest of the system. **Figure 6-1** presents a snapshot summary of the system's current performance measures and system indicators. The summary highlights that there are some areas where performance can be improved significantly and others where expectations are being met or exceeded. In some instances improvements can be made with little cost to the state while other improvements may require significant investments which are further outlined in **Chapter 7: Investment Plan and System Recommendations**.

Figure 6-1: Current Performance Measures and System Indicators Summary

Adequate Safety Zoning Ordinances
(pg. 90)
81% meet the target

Airport Surfaces Clear of Obstructions
(pg. 93)
Data collection in progress

Adequate Proximity to Weather Reporting
(pg. 96)
100% meet the target

Emergency Medical Response
(pg. 99)
77% of hospitals within 15 minutes

Aviation Accidents
(pg. 104)
26 accidents in 2011

Aviation Fatalities
(pg. 105)
2 fatalities in 2011

Adequate Approaches to Airport
(pg. 106)
32% meet the target

Adequate Proximity to Alternate Airport
(pg. 110)
87% meet the target

Airport Usability
(pg. 113)
MnDOT D1 airports usable 363 days per year

Population to a Key System Airport
(pg. 122)
99% of population within 90 minutes

Population to a Paved & Lighted Runway
(pg. 124)
71% of population within 30 minutes

Level 1 & 2 Regional Trade Center Proximity to Key Airports (pg. 126)
100% of Level 1 & 67% of Level 2 within 30 minutes

Level 3 Regional Trade Center Proximity to Key & Intermediate Airports (pg. 129)
100% of Level 3 within 30 minutes

Population to an Airline Service Airport
(pg.131)
72% of population within 60 minutes

Non-stop Airline Service Markets
(pg. 133)
138 nom-stop markets in 2011

Originating Passengers
(pg.136)
7.8 million passengers in 2010

Annual Delay at MSP
(pg. 138)
1720 flights delayed in 2011

Up-to-Date Planning Documents
(pg. 140)
10% meet the target

24/7 Fueling at Airports
(pg. 143)
100% of airports within 50 nautical miles

Maintenance & Repair at Airports
(pg. 145)
100% of airports within 50 nautical miles

Population to Scheduled Cargo Service
(pg. 148)
75% of population within 60 minutes

Up-to-Date Navigational Systems
(pg. 150)
Data collection in progress

Pavement Condition Index
(pg. 152)
77% meet the target

Performance Measures
System Indicators

ADEQUATE SAFETY ZONING ORDINANCES

Measure: Percent of system airports with an adequate State Safety Zoning Ordinance

Relevance: Airport safety zoning ordinances serve to protect people and property from aviation accidents by limiting land uses and population density around airports, particularly in aircraft approach areas beyond the ends of runways. Adopting an airport safety zoning ordinance also helps ensure that compatible land uses develop around an airport. Ideally the regulations adopted in the airport safety zoning ordinance are incorporated and enforced as a part of the community's comprehensive plan.

Target:

100% of system airports should have an adequate safety zoning ordinance adopted by a joint airport zoning board or equivalent authority

Performance:

81% of system airports meet the target

Airports with an adequate airport safety zoning ordinance are displayed in **Figure 6-2**. The 2006 SASP indicated that 88 percent of airports had an airport safety zoning ordinance adopted by a zoning authority. In addition, 8 percent of the airports indicated that a master plan or ALP review process was underway which would affect the area zoned or to be zoned. Only 4 percent of airports did not have an airport safety zoning ordinance.

This plan evaluated each ordinance to determine if: existing runways are protected by zoning, proposed improvements are protected by zoning, both, or neither. Some airports extended runways without a zoning authority concurrently updating the zoning ordinance, and although an ordinance was previously adopted, it did not protect for the additional infrastructure. The more detailed evaluation of this measure in this Plan led to a drop in performance percentage as compared to the 2006 Plan, even though a large majority of airports have some level of airport safety zoning protection in place.

Figure 6-2: Adequate Safety Zoning Ordinances

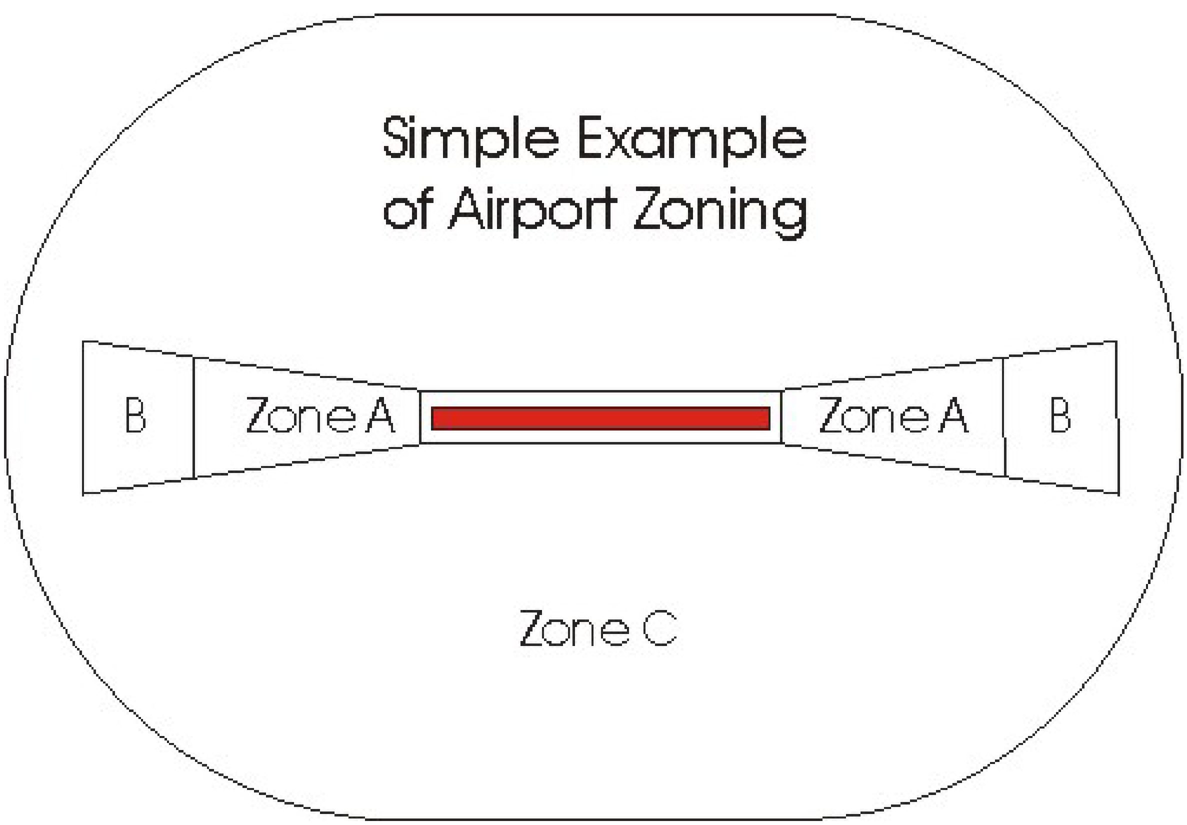
Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

Technical Description: Minnesota Statutes Chapter 360 and Minnesota Administrative Rules, Chapter 8800 define the process, procedures, and standards a joint airport zoning board or equivalent authority must use to develop and adopt an airport safety zoning ordinance. One notable difference between airport zoning and other municipal zoning processes is that the board is likely to include representation from multiple jurisdictions. Airport communities in Minnesota have been allowed by statute to enact airport safety zoning since 1945. But, it wasn't until 1973 that the legislature made airport safety zoning a condition for receiving federal and state funds for airport development and maintenance.

To assist local governments in the airport zoning process, MnDOT Aeronautics publishes a model zoning ordinance and provides related technical assistance to local zoning authorities. Minnesota's zoning rules require three distinct safety zones (Zone A, Zone B, and Zone C) which restrict specific uses in the areas surrounding airports (see **Figure 6-3**). These zones apply to both existing and ultimate airport conditions (i.e. a planned for but not yet constructed runway must also be zoned). Additional airport zoning information can be found on the MnDOT Office of Aeronautics Airport Zoning webpage.

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey, Airport Database, & MnDOT Analysis

Figure 6-3: Safety Zones



AIRPORT SURFACES CLEAR OF OBSTRUCTIONS

Measure: Percent of system airports that have no obstructions to protected airspace

Relevance: Obstructions in protected airspace are flight hazards and must be accounted for by the pilot during the two most critical phases of flight – take-off and landing. Obstructions raise the minimums of instrument approach procedures, when lower minimums are more desirable. This affects the amount of time an airport is accessible during inclement weather.

Target:

100% of system airports should be clear of obstructions to Federal Aviation Regulation (FAR) Part 77 approach and primary airspace surfaces

An airport meets the target if there are no obstructions to the FAR Part 77 primary or approach airspace surfaces or if the obstruction is already lighted with approved hazard lighting.

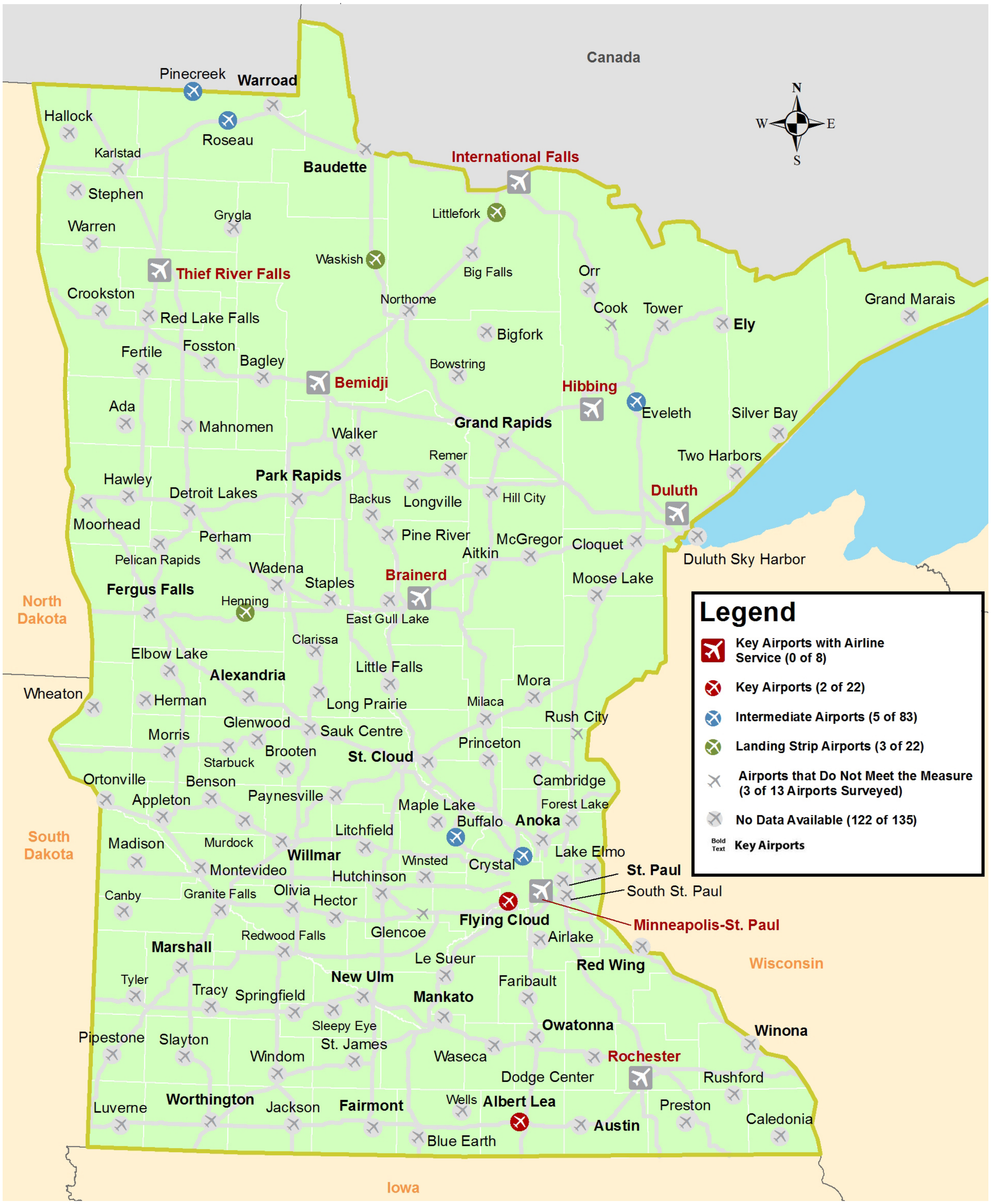
Obstructions to be mitigated or eliminated may include trees and vegetation, topography (such as the ground), buildings, roads and railroads. Methods for mitigating obstructions may include removal, alteration until no longer a hazard or addition of hazard lighting.

Performance:

Data collection in progress

All system airports are surveyed periodically. Since 2011, improvements in survey technology have allowed more detailed identification of obstructions. New detailed data exist for the 13 airports identified in **Figure 6-4**, of which three do not meet the measure (Cook, Glencoe, and Rush City). Surveying will continue with each airport surveyed on a three-year rotation basis. Obstructions identified are considered within the context of the airport to determine appropriate mitigation measures.

Figure 6-4: Airport Surfaces Clear of Obstructions



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

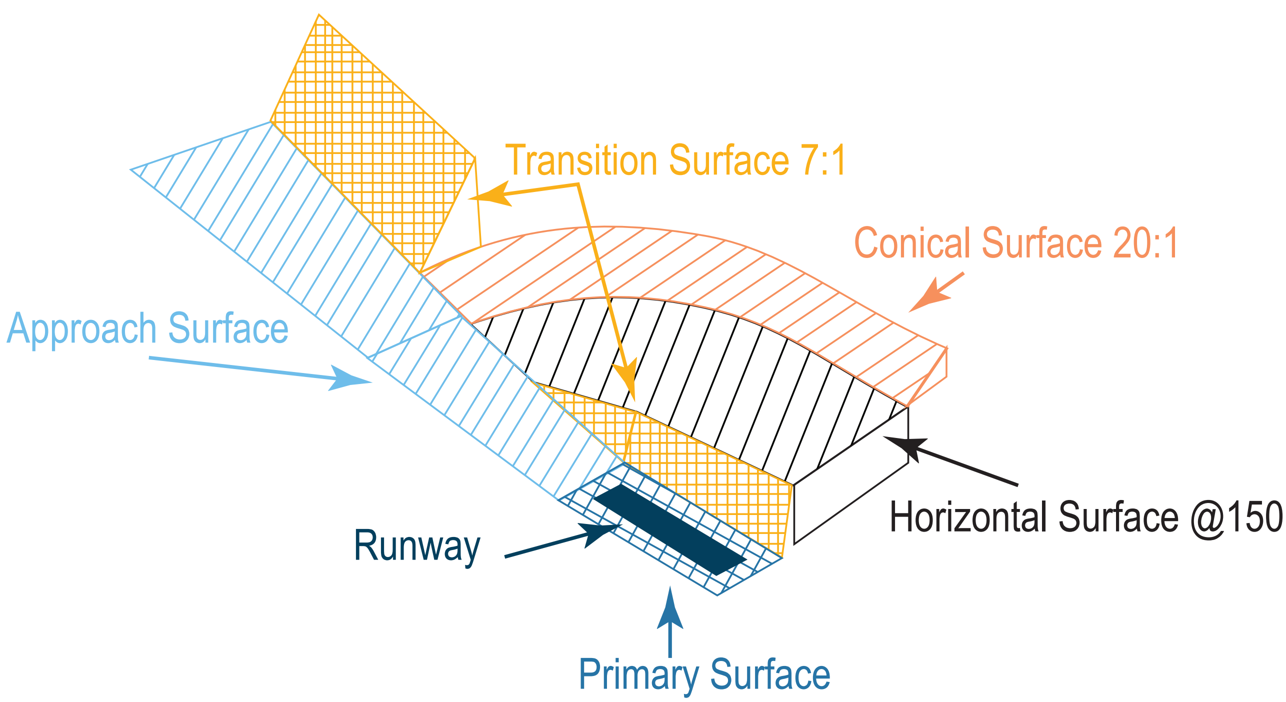
Technical Description: FAR Part 77 contains the obstruction standards for the National Airspace System (NAS). Part 77.19 is one of five criteria that defines height limits that if exceeded can adversely affect the safety and efficiency of the NAS. Part 77.19 defines numerous surfaces surrounding the airport that are used to evaluate the effect that obstacles can have on aircraft (see **Figure 6-5**). The two most relevant imaginary surfaces to this performance measure are the runways primary surface and the runway approach surface.

A runway's primary and approach surface dimensions are based on the type of approach to that runway. Visibility minimums are determined by visual approach requirements or instrument approach requirements by type (e.g., ILS, LPV, APV-2), the presence of approach lighting systems, and obstacles.

If there is an obstruction to a Part 77.19 surface, depending on the height and location, the obstruction can become a controlling obstacle in the development of an instrument approach procedure. The approach procedure will be designed with minimums set high enough to avoid the obstacle and an added margin of safety above it. If the obstruction did not exist, the aircraft could approach the runway closer to the ground, maximizing visibility in IFR conditions. Thus, a single obstruction can considerably degrade the usability of an airport if not mitigated.

Source(s): MnDOT Office of Aeronautics 2011 Airport Inspection Database

Figure 6-5: Airport Surfaces



ADEQUATE PROXIMITY TO WEATHER REPORTING

Measure: Percent of system airports that have a weather reporting station on-site or within 30 nautical miles

Relevance: Minnesota's continental climate provides a variety of quickly changing weather conditions from thunderstorms in Spring and Summer to ice storms in late Fall and Winter. Up-to-the-minute accurate weather reporting at airports helps pilots make good flight planning decisions.

One of the most common causes of aircraft accidents is continued flight into deteriorating weather conditions. A weather station at a local airport provides instant reporting of current conditions at that airport. Providing weather stations at several airports creates a reliable network of available weather information along any flight route and enhances the safety of the flight. However, not every airport needs a weather observation station. A distance of 30 nautical miles is considered adequate spacing.

Target:

100% of system airports should have weather reporting stations on-site or be within 30 nautical miles of an airport that has weather reporting on-site

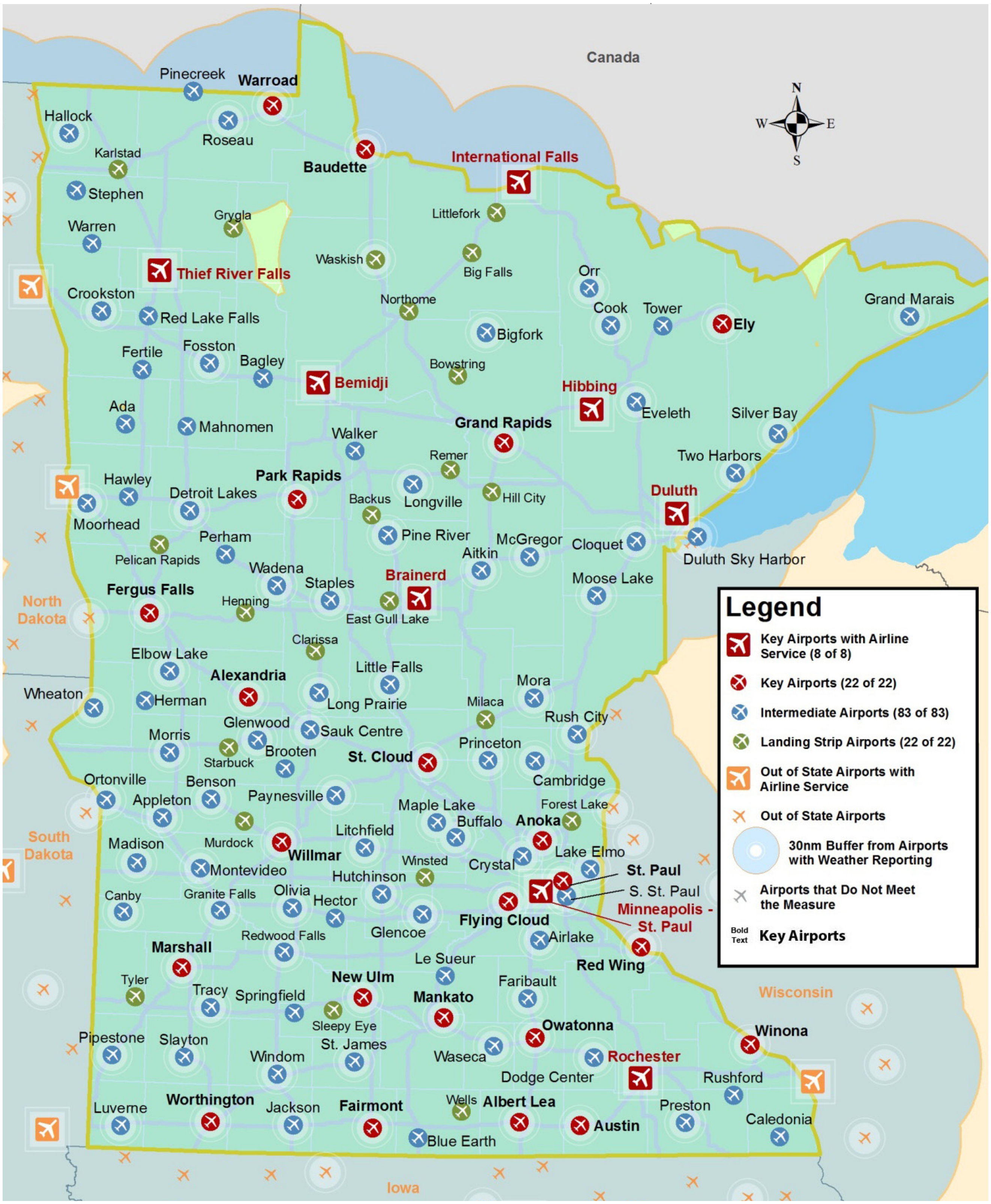
Performance:

100% of system airports meet the target

Every system airport either has weather reporting or is within 30 nautical miles of one that does. Only a very small area located near Upper and Lower Red Lake is not within 30 NM of weather reporting; however, there are no system airports in this area.

Figure 6-6 presents the results of the analysis for this measure.

Figure 6-6: Adequate Proximity to Weather Reporting



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

Technical Description: Pilots need accurate, up-to-date weather data during all phases of flight but especially for the critical phases of flight, takeoff and landing. In addition to obtaining the forecast weather for the destination airport and while en route, it is safety critical that accurate weather forecasts are also available for surrounding airports when planning for an IFR alternate airport for landing. Currently, there are two types of weather reporting systems in use in the state: ASOS (Automated Surface Observing System) and AWOS (Automated Weather Observing System). Data typically gathered by these systems are shown in **Table 6-1**.

Table 6-1: Data Collected for Weather Reporting

Cloud ceiling (Height above the ground)
Visibility (Distance a pilot can see without a weather obstruction)
Wind direction and speed
Temperature and dew point
The presence of lightning (Thunderstorms)
The presence of precipitation, type of precipitation and precipitation accumulation
Snow depth

Sensors detecting these weather characteristics are located adjacent to the reporting station which broadcasts data on an airport specific radio frequency.

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey, Airport Database, NOAA ASOS and AWOS Stations Lists, February 2012

EMERGENCY MEDICAL RESPONSE

Indicator: Percent of Hospitals with access to an instrument approach either on site or within 15 minutes drive time

Relevance: Emergency Medical Response within the state of Minnesota relies on air and ground transportation for moving accident victims to a hospital or for moving patients from a lower to a higher level trauma center hospital. In many cases, helicopters and fixed wing aircraft are used when it is determined that ground transportation may take too long due to the patient's condition or other factors. Moving of patients using helicopters or fixed wing aircraft may be negatively impacted by the following three aviation conditions.

Having only private approaches limits the flexibility to use multiple air ambulance providers during large scale emergency responses when the weather is poor. The percentage of hospital heliports with approved approaches is minimal within the state and private approaches are restricted to only certain service providers who have paid for development of the approach.

Ground travel time in excess of 15 minutes for an ambulance transferring a patient between a hospital and an airport with an instrument approach during inclement flying weather is undesirable. In many cases, transferring of patients between hospitals is accomplished by using a local airport when a heliport is not available at the hospital or the weather does not permit helicopter operations.

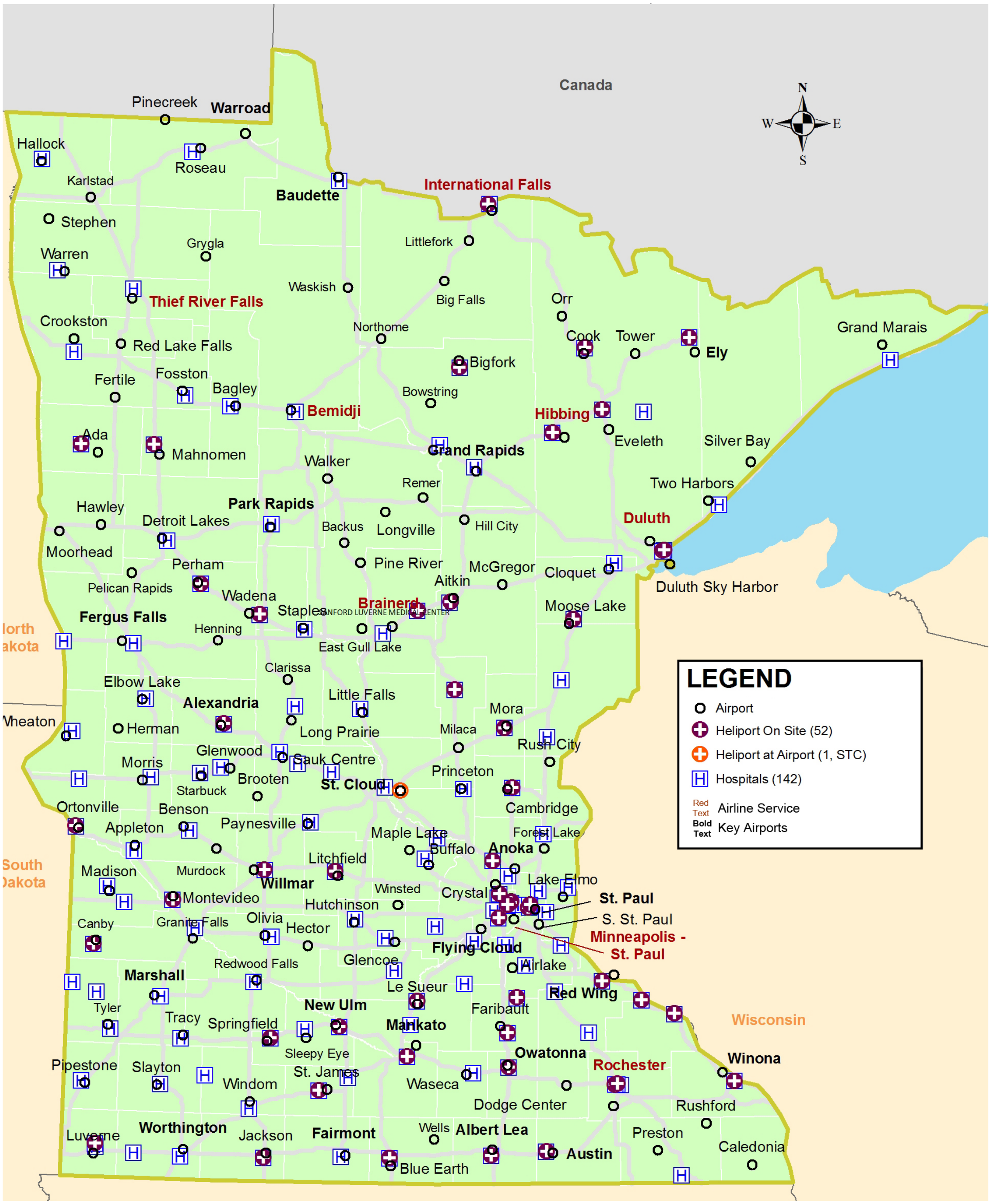
Access to hospitals north of MSP by aircraft flying across MSP airspace are hindered by current airspace restrictions.

Trends: Figure 6-7 shows those Hospitals in the state that have heliports. There are 142 hospitals in Minnesota and 53 of these have a heliport. All of the heliports in the state are private use, but some may grant users access if they request permission to do so prior to landing. Currently there are 15 hospitals with FAA-approved instrument approach procedures that allow special-use authorized helicopter operators to fly instrument approaches to and from medical facilities (see **Table 6-2**).

Table 6-2: Hospitals with FAA-Approved Private Instrument Procedures

Albert Lea Medical Center
Austin Medical Center
St. Mary's Hospital (Duluth)
District One Hospital
Lake City Medical Center
Immanuel - St. Joseph's Hospital (Mankato)
Abbot Northwestern Hospital (Minneapolis)
New Ulm Medical Center
Northfield Hospital
Fairview Red Wing Medical Center
St. Mary's Hospital (Rochester)
St. James Medical Center
St. Elizabeth Hospital (Wabasha)
Winona Community Memorial Hospital

Figure 6-7: Hospitals with Heliports



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

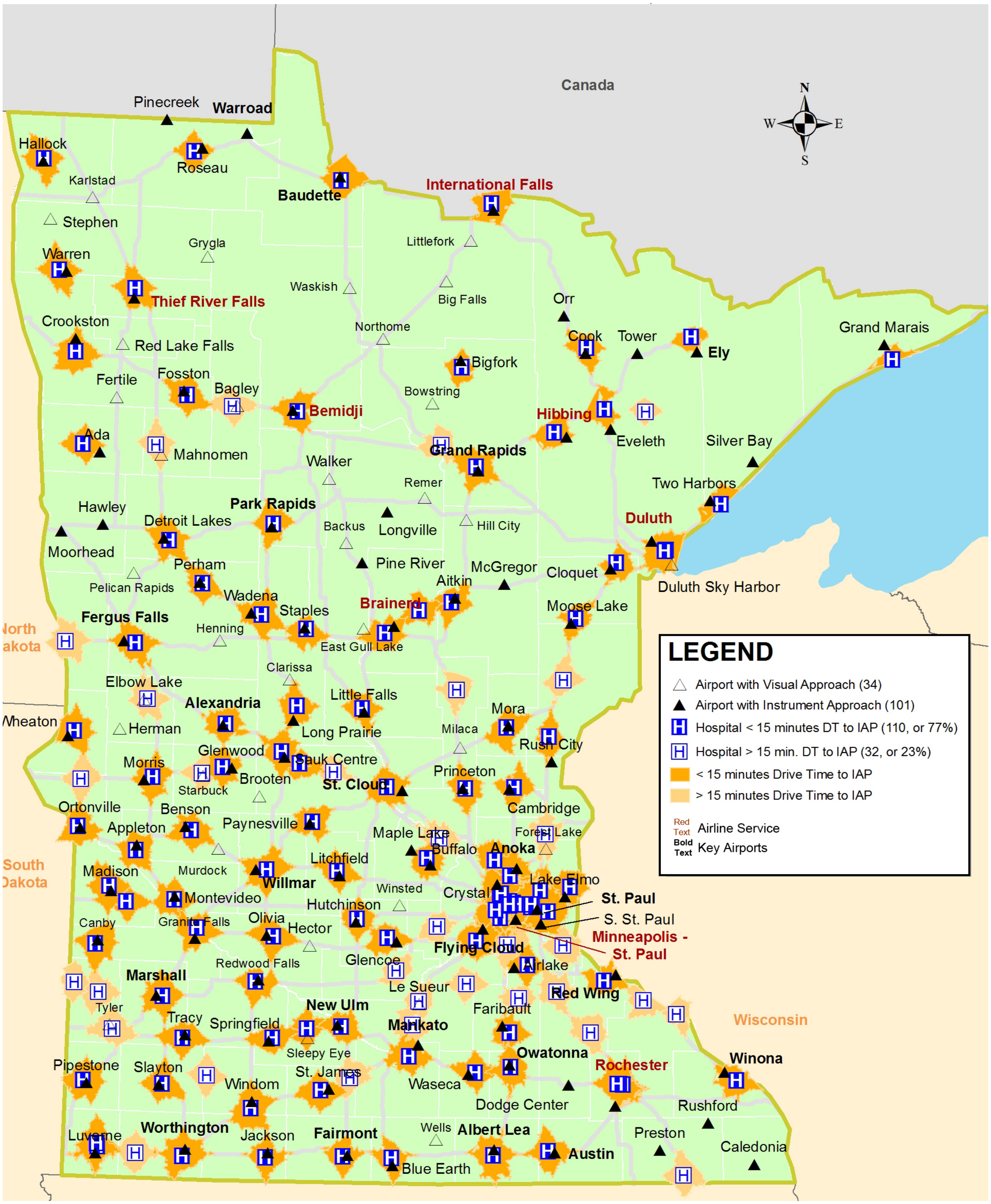
Hospitals within the state that need to transfer a patient to a higher level trauma center will use fixed wing aircraft at a local airport to either minimize total travel time between hospitals or avoid weather conditions such as icing that limit the use of a helicopter. Hospitals within 15 minutes of an airport with an instrument approach increase the reliability of using this method for transferring patients during both good and bad weather. An airport with an instrument approach will also allow a helicopter to land at that airport when weather is poor and the nearby hospital itself does not have a heliport with an instrument approach.

Figure 6-8 shows all of the hospitals in the state within 15 minutes drive times from the airports that also have at least one instrument approach procedure. Of the 142 hospitals in the state, 110 are 15 minutes drive time to an airport with an instrument approach. This equates to 77 percent of the hospitals in the state within 15 minutes drive time to an airport in the state with an instrument approach.

Crossing of MSP airspace takes more time and has become more difficult with the addition of runway 17-35. The increased time has a negative impact on the transferring of patients by helicopter from the southern Twin Cities area to hospitals north of MSP. Provision of a dedicated GPS route through the airspace would improve the ability to quickly transition through the airspace, reduce pilot and controller workload, and increase safety. It is recommended that this be further explored by MnDOT.

Source(s): Minnesota Department of Health (2003), Distributer Organization: State of MN Land Management Information Center (LMIC), Federal Aviation Administration (2012), Distributer Organization: AirNav

Figure 6-8: Hospitals Within 15 Minutes of an Airport with an Instrument Approach



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

AVIATION ACCIDENTS

Indicator: Total number of aviation related accidents in Minnesota

Relevance: Safety is a primary mission of MnDOT Aeronautics. Looking at trends in aviation accidents is one way to indicate how well the system is functioning relative to safety.

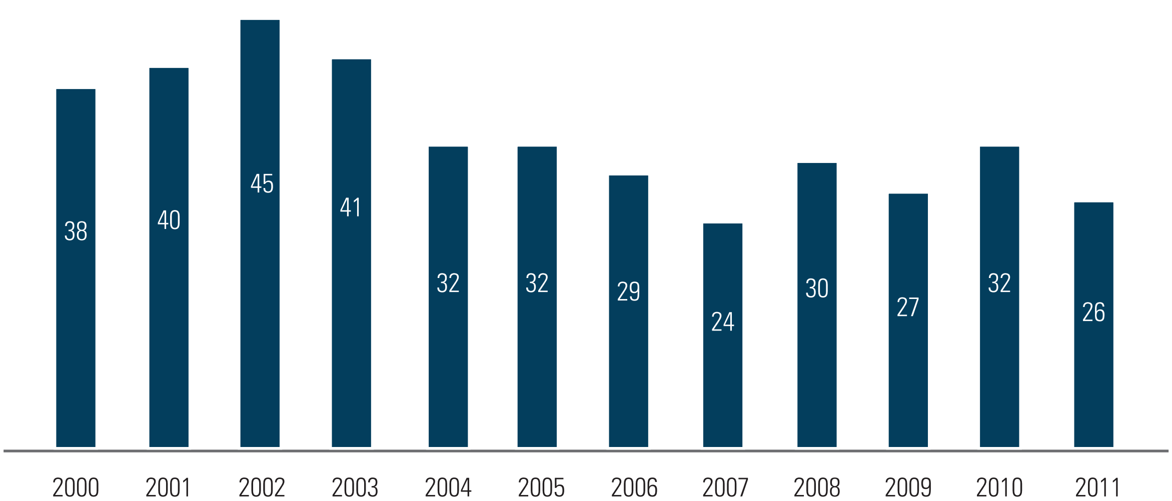
Trends: The MnDOT Office of Aeronautics strives to eliminate all accidents related to aviation. This is done through funding projects which enhance airport safety, restricting land use and construction near airports, and providing pilots and the public education on safe flying. MnDOT's website has links to safety seminars which are hosted at different system airports. These can be found at: http://www.dot.state.mn.us/aero/avoffice/events/fly-ins.html.

Accidents can be caused by a wide range of factors including aircraft equipment malfunctions, inattentive grounds crew members, and pilots attempting risky landings or flying in bad weather. Aviation accidents are investigated and reported first by the National Transportation Safety Board (NTSB) and then by MnDOT. These investigations allow MnDOT to track the location of accidents and also understand the reason for the crash. Using this data, MnDOT is able to identify common accident locations and look at means of mitigating potential problems.

Since 2000 there have been a total of 379 accidents related to aviation. The annual average for the first six years (2000-2005) was thirty-eight accidents. Within the last six years (2006-2011) the annual average has dropped to twenty-five. There were nine aviation accidents in 2011, which continues the decreasing trend in the number of aviation accidents from a high of 45 accidents in 2002. **Figure 6-9** shows historic aviation accident data.

Source(s): MnDOT Office of Aeronautics Aviation Accident Database

Figure 6-9: Annual Aviation Accidents



Source: MnDOT Office of Aeronautics Aviation Accident Database

AVIATION FATALITIES

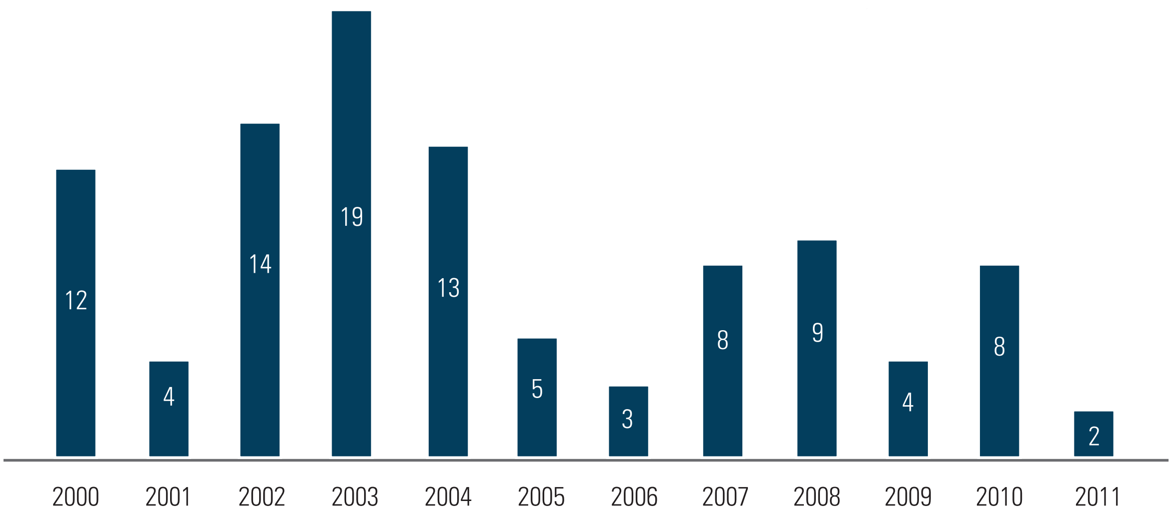
Indicator: The total number of aviation related fatalities in Minnesota

Relevance: This indicator also relates to the Minnesota Statewide Transportation Policy Plan regarding traveler safety. MnDOT strives to "create a culture for which…fatalities and serious injuries are no longer acceptable," and tracking fatalities will assist them in reaching this goal.[23]

Trends: Similar to other modes of transportation, fatalities in aviation are often the result of human error or equipment malfunction. Understanding trends in fatalities may assist in creating new policies or educating the public on problematic areas in the system. There were two aviation fatalities in 2011. The number of aviation fatalities has fluctuated over the past six years, ranging between two and nine fatalities per year from 2006 through 2011. Overall, there's been a slight trend of decrease since 2000. **Figure 6-10** shows historic aviation fatality data for the state.

Source(s): MnDOT Office of Aeronautics Aviation Accident Database

Figure 6-10: Annual Aviation Fatalities



Source: MnDOT Office of Aeronautics Aviation Accident Database

[23] http://www.minnesotatzd.org/index.html

ADEQUATE APPROACHES TO AIRPORTS

Measure: Percent of system airports with adequate approaches appropriate for their airport classification

Relevance: An approach is an invisible pathway in the sky guiding an aircraft from the air to the runway. There are three types of approaches: precision instrument, non-precision instrument and visual. The more precise the approach, the more information a pilot can use to get their aircraft to the runway. Weather is the number one factor that determines if an airport can be used at any given time. Instrument approaches allow airports to be more accessible under a variety of weather conditions thereby creating a safer system and improving accessibility across the state.

Target:

100% of system airports should have appropriate approaches

Key Airports: All have at least one precision instrument approach to the primary runway[24] AND a non-precision instrument approach[25] with vertical guidance on the opposite runway end.

Intermediate Airports: All have at least one runway end with a non-precision instrument approach with vertical guidance.

Landing Strips: Visual approaches are appropriate.

Performance:

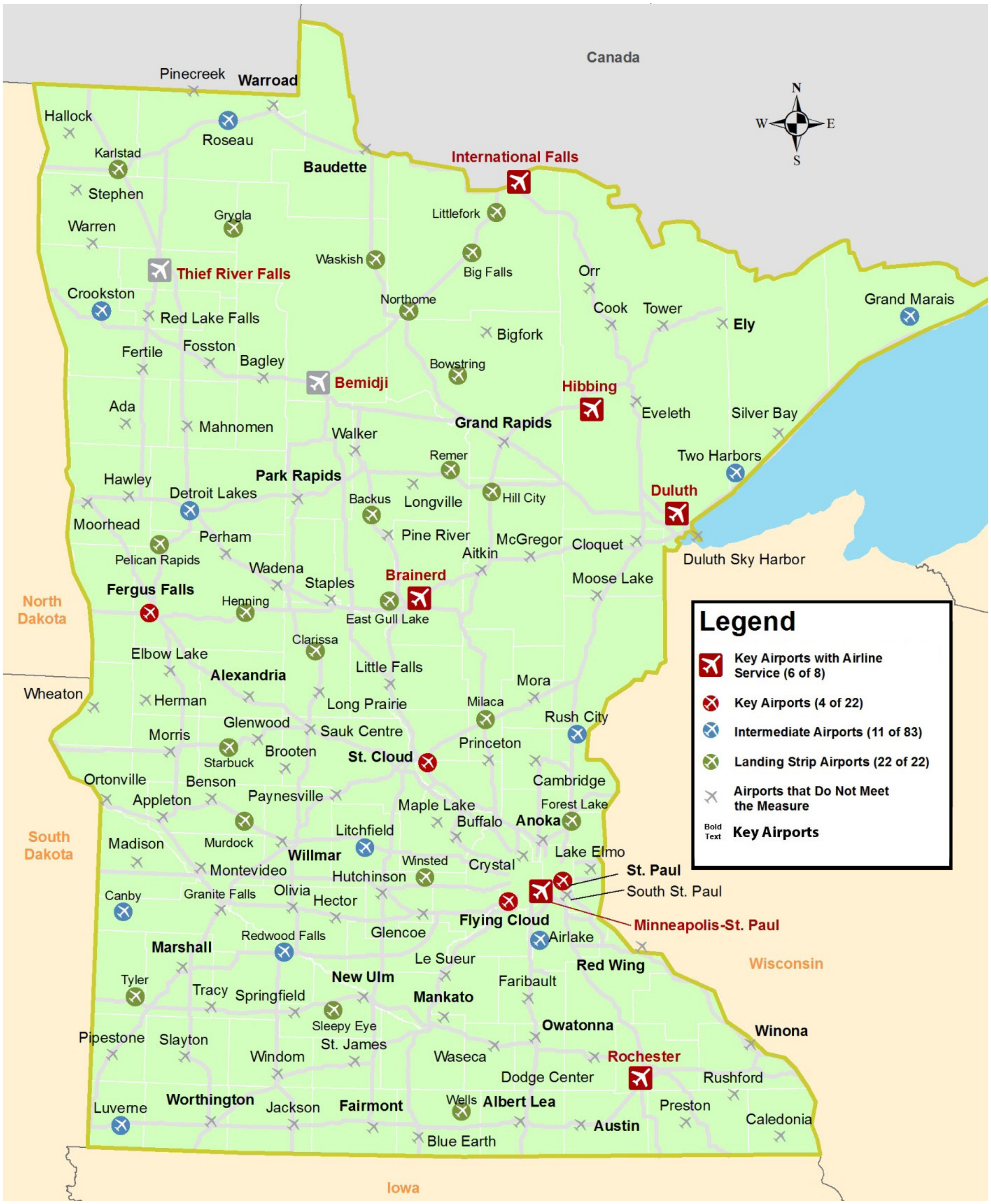
32% of system airports meet the target

Thirty-two percent of system airports have approaches appropriate for their airport classification. Further breakdown by classification shows that 33 percent of Key Airports, 13 percent of Intermediate Airports, and all Landing Strips meet the measure. The majority of airports that do not meet the measure have the necessary approaches, but have high cloud ceiling or visibility minimums which prevent them from being fully utilized. High minimums are due to obstructions in the approach area, either manmade (e.g., buildings or cell towers), or natural (e.g., trees or terrain). **Figure 6-11** identifies the system airports which meet or do not meet the target.

[24] An ILS approach, which is a precision approach developed using a ground based navigation system and requiring system-specific avionics installed in the aircraft, OR a LPV approach, which is an approach procedure with vertical guidance (performance level 1, or APV-1), developed using the global navigation satellite system (GNSS) along with the wide area augmentation system (WAAS), also requiring system-specific avionics installed in the aircraft.

[25] A performance level 2 lateral navigation/vertical navigation (LNAV/VNAV) approach. This is computed using either the aircraft's onboard WAAS avionics or through the aircraft's barometric vertical (Baro-VNAV) avionics.

Figure 6-11: Adequate Approaches to Airports



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

Technical Description: There are two major categories of flight rules which are dependent on weather conditions, visual flight rules (VFR) conditions and instrument flight rules (IFR) conditions. In VFR meteorological conditions, pilots fly by sight. In IFR conditions, pilots fly using instruments in the aircraft.

All licensed pilots are allowed to operate during VFR conditions. According to FAA rules, the cloud ceiling must be more than 1,000 feet above the ground, and visibility must be at least three miles. The aircraft must remain 500 feet below any overhead clouds, 1,000 feet above any underlying clouds, and 2,000 feet laterally from any adjacent clouds. Because approximately 90 percent of the weather in the state is VFR conditions, the system is open to all pilots most of the time, except where the winds are too strong.

The remaining ten percent of the time, when the weather is below the VFR conditions into IFR conditions, an airport is not usable unless; the pilot is instrument rated, the airport has an instrument approach procedure and there is adequate proximity to an airport that will qualify as an alternate airport that can be used for landing. Additionally, either an on-airport weather reporting station, or one nearby, will increase the accuracy of weather forecasting. With these procedures and equipment in place, the airport may be usable most of the time.

On a system-wide basis, a vertically guided instrument approach procedure has the greatest impact for improving access during IFR conditions. Vertically guided instrument approach procedures allow instrument-rated pilots equipped with the proper avionics to navigate by instruments both to and from the airport, except for the final segment of an instrument approach, which is done visually. While it is possible to navigate by lateral guidance (i.e., non-precision) alone, the incorporation of electronic or computed vertical guidance into an instrument approach procedure is needed to provide a constant glide path angle; stabilize the descent rate, and decrease landing minimums. Following vertical guidance helps to avoid obstacles within known tolerances and will allow pilots to descend to lower altitudes while relying only on instruments. Airports can remain open more often with vertically guided instrument flight procedures in place.

FAA studies have shown that vertically guided approaches enhance safety by decreasing the likelihood of undershooting or overshooting the landing threshold and controlled flight into terrain (CFIT) or into obstacles. Moreover, many airlines will not allow their aircraft to make an approach without vertical guidance even under clear weather conditions.

Finally, the importance of vertically guided instrument approach procedures led the International Civil Aviation Organization (ICAO) to pass a safety resolution encouraging its members to implement vertically-guided approaches to all runways by 2016. The FAA also was working to publish vertically-guided instrument approach procedures to most runways at NPIAS airports by the end of 2010.

Ideally, a runway with an ILS precision approach or LPV (APV-1) approach has an approach lighting system and an approach area clear of obstructions. When these conditions are met, the approaches will have the lowest possible minimums - the height at which a pilot either can see the runway or aborts the landing. When these conditions are not met, either due to the lack of an approach lighting system or due to the existence of controlling obstacles in the approach area, then the decision height and visibility for either the ILS or LPV (APV-1) will increase significantly.

Raising the instrument approach procedure minimums increases the percentage of time that the airport is unusable due to weather conditions (i.e., cloud ceiling and visibility).

Source(s): FAA Aeronautical Informational Manual (AIM), FAA ILS and Area Navigation (RNAV/GPS) Master Listings, U.S. Terminal Procedure Publications (TERPS),FAA's NextGen Implementation Plan (March, 2011), EUROCONTROL RNAV Approach Task Force (RATF) (2009).

ADEQUATE PROXIMITY TO ALTERNATE AIRPORT

Measure: Percent of system airports within 50 nautical miles of an airport that serves as an alternate for an Instrument Flight Rules (IFR) flight plan

Relevance: When the weather is forecast to be less than required for Visual Flight Rules (VFR) flight, a pilot must list an alternate airport on the flight plan. The type of instrument approach available at the alternate airport affects the minimum weather required for using the airport as an alternate. Since the weather often is similar at airports surrounding the destination airport, the best alternate airports are those with precision approaches (ILS) and Terminal Area Forecasts (TAF).[26] In planning the flight, the pilot must include enough fuel to fly from the destination to the alternate and have an additional number of minutes fuel use in reserve as specified by the regulations. The further the alternate is from the destination, the more fuel the aircraft must carry. At some point the aircraft weight or fuel capacity reaches an upper limit and the flight must be canceled.

Planning for an alternate airport improves the safety of the flight because the pilot is required to plan for the possibility of not being able to land at the destination. The act of choosing the alternate requires the pilot to check weather forecasts for the surrounding area and to ensure that they carry enough fuel to allow them to proceed to an alternate airport. Having airports within 50 nautical miles of the destination airport that have a precision approach (ILS) improves the safety of all flights since the weather will sometimes develop differently than forecast and other situations, such as a short notice closure of the destination airport may require flights to be diverted, even in the best of weather.

While most airports can be used as an alternate airport, airports with precision approaches give the lowest alternate minimums. When a TAF is not available within five miles of the airport the Area Forecast must be used to determine if the airport will meet the weather minimums. Since the Area Forecast covers a much broader area the forecast generally includes worse weather and is less reliable than a TAF. Airports with an ILS and a TAF make the best alternates.

Ensuring that system airports with instrument approaches have an alternate airport nearby is critical to providing a reliable system. Weather is difficult to predict, but providing airports that can be used as alternates in proximity to system airports allows for more reliable flight scheduling.

[26] A Terminal Area Forecast is a weather forecast specifically for the localized area around the airport for which the forecast is issued.

Target:

100% of system airports should have an IFR alternate airport within 50 nautical miles

Performance:

87% of system airports meet the target

The majority of system airports are within 50 nautical miles of an IFR authorized alternate airport. There are five Key Airports, ten Intermediate Airports, and two Landing Strips which are outside of the 50 nautical miles minimum. One important point of this performance measure is that an alternate airport cannot be an alternate for itself. One of the five Key Airports, Brainerd Lakes Regional Airport, is an authorized alternate but is not within 50 NM of an alternate for itself.

The full results of the analysis are presented in **Figure 6-12**.

Technical Description: An alternate airport must be designated in an IFR flight plan. An alternate airport for landing is used as a backup to the destination airport in the event that at the time of arrival the ceiling and visibility minimums have fallen below the published approach procedure minimums. In such a case, the aircraft will need to divert to the planned alternate. The pilot must have enough fuel to be able to fly to their intended destination, then to their alternate, and then still have 45 minutes of reserve fuel.

For an airport to be considered an alternate airport under this measure the airport must meet the three criteria listed in **Table 6-3**.

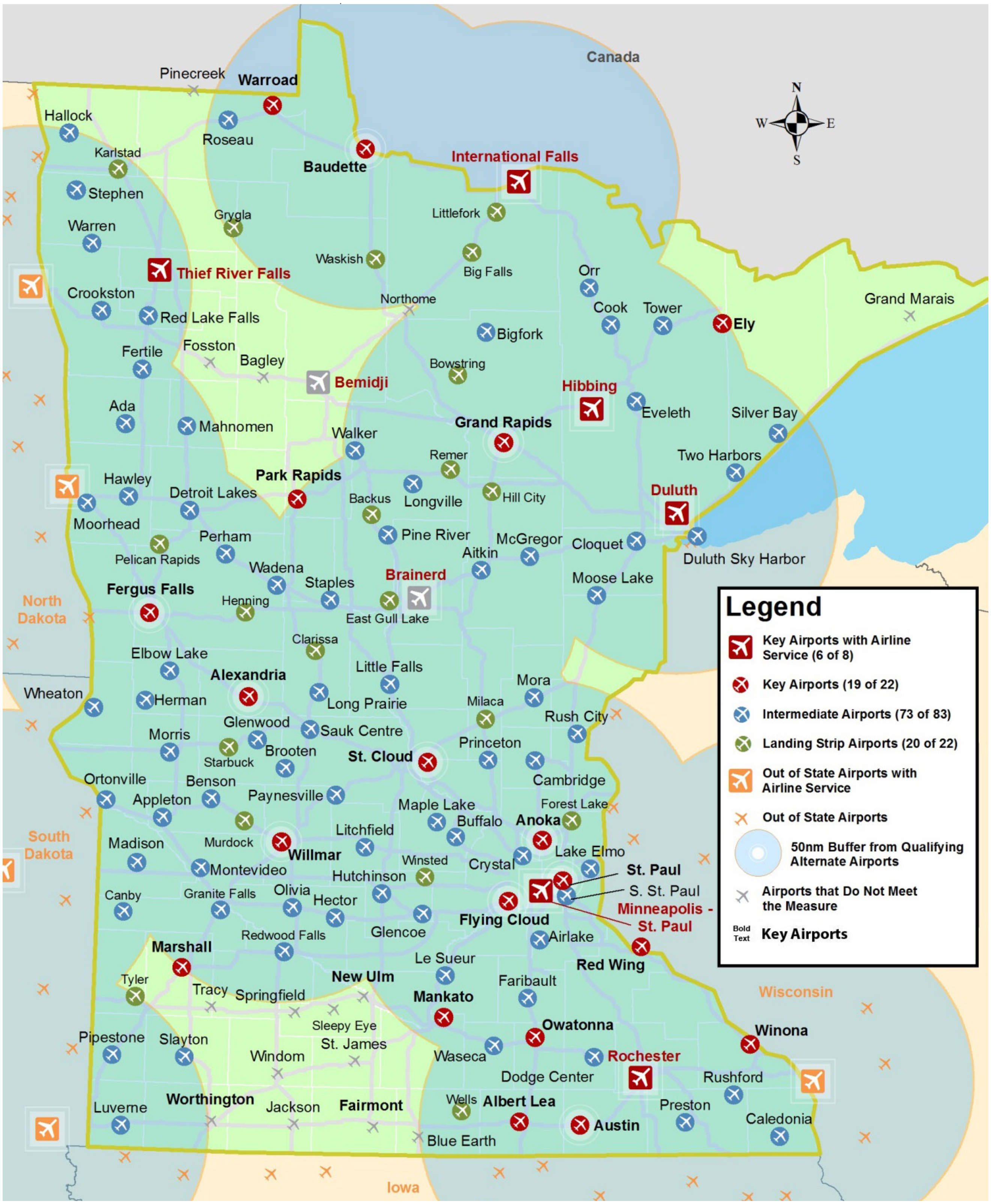
Table 6-3: Alternate Airport Criteria

Airport must have an ILS. An ILS consists of electronic equipment to guide an aircraft to the runway vertically (a glide slope) and laterally (localizer).
The airport's ILS must be monitored at all times. A dedicated ground telephone line continually monitors the ILS to ensure it is operating properly and notifies pilots if it goes offline.
The airport needs a weather reporting station on-site.

Other approaches (LPVs) are considered to be authorized alternates by the FAA, but because the equipment required to use these approaches is not standard or widely used at this time they are not considered in this analysis.

Source(s): FAA ILS RNAV/GPS Master Listing, FAA Terminal Procedures Publications, FAR Part 91.169 IFR flight plan; information required.

Figure 6-12: Adequate Proximity to Alternate Airport



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

AIRPORT USABILITY

Indicator: Percent of time that pilots can use an airport is primarily dependent upon weather conditions

Relevance: The purpose of this indicator is to show the annual percentages of time that Minnesota's airports are usable by pilots based upon the weather conditions that pilots are able to fly within. Not all pilots, nor aircraft, nor airports, are trained and/or equipped so as to be usable in every weather condition. What is shown here is an attempt to classify weather conditions according to four categories, three of which are based upon the type of approach a pilot uses at an airport, and the fourth of which is based upon the weather conditions for when airports are not usable due to weather conditions.

Trends: To determine airport usability, weather data for the most recent ten-year period was gathered from the National Climatic Data Center (NCDC) for one airport from each of the eight MnDOT Districts to represent the percentages of time weather falls into these three approach types: visual, non-precision instrument (NPI), and precision instrument (PI).

Visual approaches are made during visual meteorological conditions (VMC), which is when cloud ceilings are equal to greater than 1,000 feet above the ground and the visibility is at least three statute miles. Under VMC, pilots operate their aircraft according to the FAA Visual Flight Rules (VFR) and for the most part come and go freely from all public use airports by relying on visual references during all phases of flight. In this way, airports are usable most of the time because most of the time the weather is permitting VFR operations.

When either the cloud ceilings drop below 1,000 feet and/or the visibilities become less than three miles, the weather changes to instrument meteorological conditions, or IMC, and pilots must operate according to instrument flight rules (IFR). To operate in IMC according to IFR, a pilot must be instrument-rated by the FAA, which requires training, and the plane must be equipped with the necessary instrumentation to fly without any visual reference. Often, if the cloud ceilings and/or visibility are not too low the airport can be used with a NPI approach, which provides only lateral guidance. For the SASP, it was assumed that a typical NPI approach covers ceiling minimums as low 381 feet above the airport and visibility minimums of 1¼ mile, or 381-1¼.

Typically for very poor weather conditions, use of a PI approach is with ceiling and visibility minimums ranging from 380-1 down to 200-½ is needed to use the airport, as a PI allows for a precise, steady vertical navigation (e.g., clearing obstacles or terrain). The ceiling and visibility minimums, or 200-½, are the lowest that pilots can fly with visual reference to the runway (except for MSP and DLH). When the weather is below that, aircraft are grounded and airports are essentially closed.

Table 6-4 shows the annualized usage for each approach type broken out for each of the MnDOT Districts. **Figure 6-13** provides the information visually. **Table 6-5** through **Table 6-12** give a breakdown of each airport by District and the percent of time, in general, that airport is usable based on the best instrument approach at the airport. This data shows that District 3 has the greatest amount of time when the weather is below VFR minimums and airport usage in that district is the lowest.

The FAA continues to publish satellite-based PI flight procedures (i.e., with vertical guidance) that will increase the usability of Minnesota's airports during times of low ceilings and low visibilities.

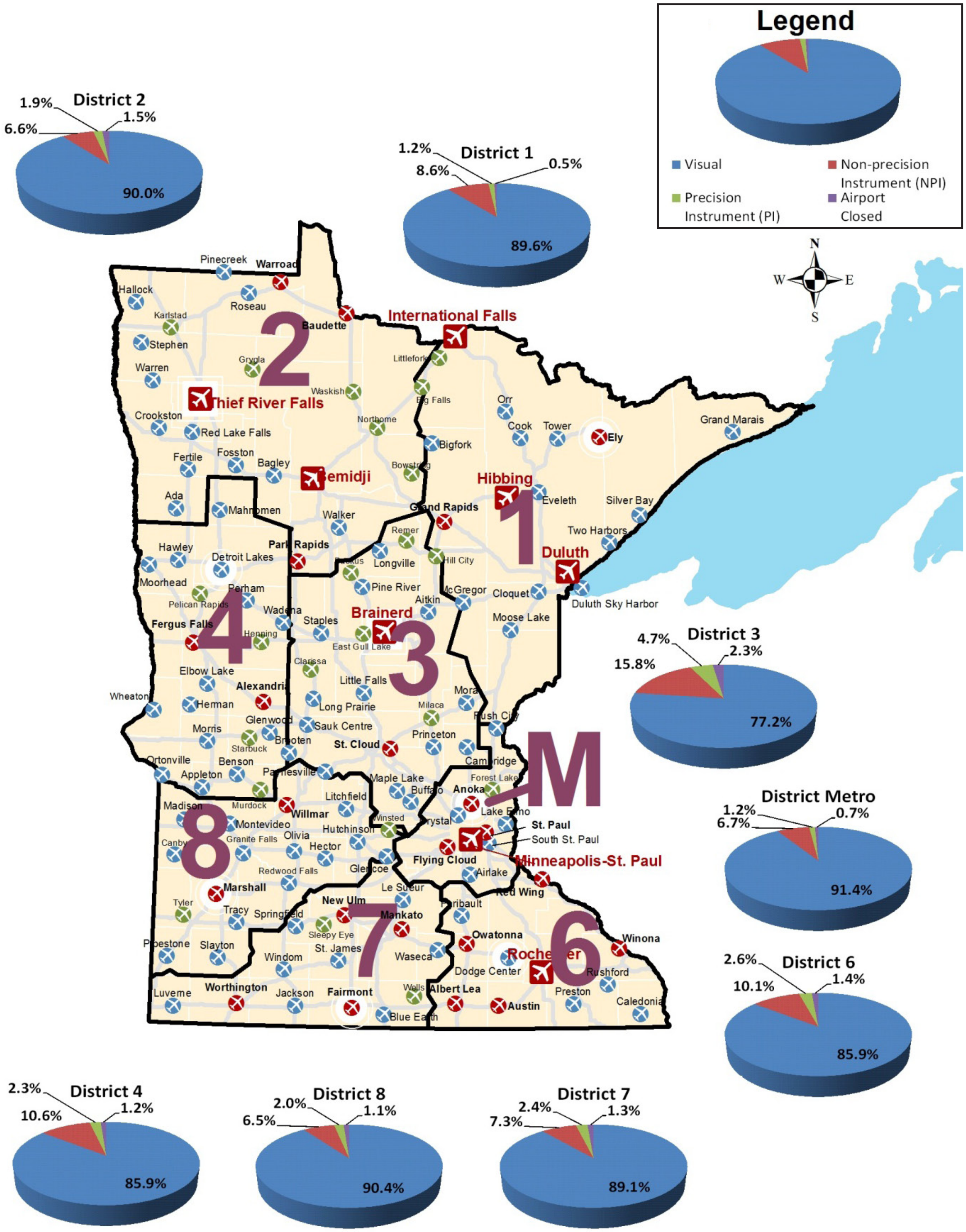
Source(s): The National Climatic Data Center (NCDC) S3505 Integrated Surface Data, Hourly Global, Station Summaries

Table 6-4: Annualized Usage for Each Approach Type by District[27]

MnDOT District	Approach Type: Visual		Basic Non-Precision Instrument (NPI)		Precision Instrument (PI)			Airport Below Weather Minimums		
	Days	%	Days	%	Days	Hours	%	Days	Hours	%
1	327.1	89.61%	31.5	8.63%	4.4	107	1.22%	2.0	48	0.54%
2	328.6	90.03%	24.2	6.62%	6.8	164	1.87%	5.4	129	1.48%
3	281.9	77.24%	57.6	15.78%	17.2	413	4.72%	8.2	198	2.26%
4	313.7	85.94%	38.8	10.63%	8.3	199	2.28%	4.2	101	1.15%
Metro	333.6	91.40%	24.5	6.71%	4.4	104	1.19%	2.6	61	0.70%
6	313.4	85.86%	37.0	10.14%	9.6	232	2.64%	5.0	119	1.36%
7	325.1	89.06%	26.6	7.28%	8.7	208	2.38%	4.7	112	1.28%
8	329.8	90.37%	23.8	6.51%	7.2	174	1.98%	4.2	100	1.14%

27 Sky Conditions Assumptions:
Visual = Cloud Ceilings > 1,000 feet and Visibility > 3 miles
Basic NPI = 381 feet < Cloud Ceilings < 1000 feet and/or 1 mile < Visibility < 3 miles
PI = 200 feet < Cloud Ceilings < 380 feet and/or 1/2 mile < Visibility < 1 mile
Airport Below Weather Minimums = Cloud Ceilings < 200 feet and Visibility < 1/2 mile

Figure 6-13: Annual Percentage of Airport Usability by Approach Type



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

Table 6-5: Best Approach Usability Summary - District 1

AIRPORT	IDENTIFIER	CLASS	BEST APPROACH	USABILITY
Duluth	DLH	Key	PI	99.46%
Grand Rapids	GPZ	Key	PI	
Hibbing	HIB	Key	PI	
International Falls	INL	Key	PI	
Ely	ELO	Key	PI	98.24%
Two Harbors	TWN	Key	NPI	
Tower	12D	Intermediate	NPI	
Silver Bay	BFW	Intermediate	NPI	
Orr	ORB	Intermediate	NPI	
Moose Lake	MZH	Intermediate	NPI	
McGregor	HZX	Intermediate	NPI	
Grand Marais	CKC	Intermediate	NPI	
Eveleth	EVM	Intermediate	NPI	
Cook	CQM	Intermediate	NPI	
Cloquet	COQ	Intermediate	NPI	
Bigfork	FOZ	Intermediate	NPI	
Duluth Sky Harbor	DYT	Intermediate	Visual	89.61%
Big Falls	7Y9	Landing Strip	Visual	
Littlefork	13Y	Landing Strip	Visual	

Source: Weather data from Ely Municipal Airport AWOS from 6/1/2002 to 6/1/2012

Table 6-6: Best Approach Usability Summary - District 2

AIRPORT	IDENTIFIER	CLASS	BEST APPROACH	USABILITY
Bemidji	BJI	Key	PI	98.52%
Park Rapids	PKD	Key	PI	
Thief River Falls	TVF	Key	PI	
Warroad	RRT	Key	PI	
Baudette	BDE	Key	NPI	96.65%
Crookston	CKN	Intermediate	NPI	
Fosston	FSE	Intermediate	NPI	
Hallock	HCO	Intermediate	NPI	
Pinecreek	48Y	Intermediate	NPI	
Roseau	ROX	Intermediate	NPI	
Twin Valley	D00	Intermediate	NPI	
Warren	D37	Intermediate	NPI	
Bagley	7Y4	Intermediate	Visual	90.03%
Fertile	D14	Intermediate	Visual	
Red Lake Falls	D81	Intermediate	Visual	
Stephen	D41	Intermediate	Visual	
Walker	Y49	Intermediate	Visual	
Bowstring	9Y0	Landing Strip	Visual	
Grygla	3G2	Landing Strip	Visual	
Karlstad	23D	Landing Strip	Visual	
Northome	43Y	Landing Strip	Visual	
Waskish	VWU	Landing Strip	Visual	

Source: Weather data from Thief River Falls Regional Airport AWOS from 6/1/2002 to 6/1/2012

Table 6-7: Best Approach Usability Summary - District 3

AIRPORT	IDENTIFIER	CLASS	BEST APPROACH	USABILITY
Brainerd	BRD	Key	PI	97.74%
St. Cloud	STC	Key	PI	
Aitkin	AIT	Intermediate	NPI	93.02%
Buffalo	CFE	Intermediate	NPI	
Cambridge	CBG	Intermediate	NPI	
Little Falls	LXL	Intermediate	NPI	
Long Prairie	14Y	Intermediate	NPI	
Longville	XVG	Intermediate	NPI	
Maple Lake	MGG	Intermediate	NPI	
Mora	JMR	Intermediate	NPI	
Pine River	PWC	Intermediate	NPI	
Princeton	PNM	Intermediate	NPI	
Sauk Centre	D39	Intermediate	NPI	
Staples	SAZ	Intermediate	NPI	
Brooten	6D1	Intermediate	Visual	77.24%
Backus	7Y3	Landing Strip	Visual	
Clarissa	8Y5	Landing Strip	Visual	
East Gull Lake	9Y2	Landing Strip	Visual	
Hill City	07Y	Landing Strip	Visual	
Milaca	18Y	Landing Strip	Visual	
Remer	52Y	Landing Strip	Visual	

Source: Weather data from FAA Airways AWOS Brainerd, MN from 6/1/2002 to 6/1/2012

Table 6-8: Best Approach Usability Summary - District 4

AIRPORT	IDENTIFIER	CLASS	BEST APPROACH	USABILITY
Alexandria	AXN	Key	PI	98.85%
Fergus Falls	FFM	Key	PI	
Appleton	AQP	Intermediate	NPI	96.57%
Benson	BBB	Intermediate	NPI	
Detroit Lakes	DTL	Intermediate	NPI	
Glenwood	GHW	Intermediate	NPI	
Hawley	04Y	Intermediate	NPI	
Moorhead	JKJ	Intermediate	NPI	
Morris	MOX	Intermediate	NPI	
Ortonville	VVV	Intermediate	NPI	
Perham	16D	Intermediate	NPI	
Wadena	ADC	Intermediate	NPI	
Wheaton	ETH	Intermediate	NPI	
Elbow Lake	Y63	Intermediate	Visual	85.94%
Herman	06Y	Intermediate	Visual	
Mahnomen	3N8	Intermediate	Visual	
Henning	05Y	Landing Strip	Visual	
Murdock	23Y	Landing Strip	Visual	
Pelican Rapids	47Y	Landing Strip	Visual	
Starbuck	D32	Landing Strip	Visual	

Source: Weather data from Detroit Lakes Minicipal Airport-Wething Field AWOS from 6/1/2002 to 6/1/2012

Table 6-9: Best Approach Usability Summary - Metro District

AIRPORT	IDENTIFIER	CLASS	BEST APPROACH	USABILITY
Anoka	ANE	Key	PI	99.30%
Flying Cloud	FCM	Key	PI	
St. Paul Downtown	STP	Key	PI	
Minneapolis-St. Paul	MSP	Key	PI	
Airlake	LVN	Intermediate	PI	
Crystal	MIC	Intermediate	NPI	98.11%
Lake Elmo	21D	Intermediate	NPI	
Rush City	ROS	Intermediate	NPI	
South St. Paul	SGS	Intermediate	NPI	
Forest Lake	25D	Landing Strip	Visual	91.40%

Source: Weather data from Minneapolis-Anoka County/Blaine Airport AWOS from 6/1/2002 to 6/1/2012

Table 6-10: Best Approach Usability Summary - District 6

AIRPORT	IDENTIFIER	CLASS	BEST APPROACH	USABILITY
Austin	AUM	Key	PI	98.64%
Owatonna	OWA	Key	PI	
Red Wing	RGK	Key	PI	
Rochester	RST	Key	PI	
Albert Lea	AEL	Key	NPI	96.00%
Winona	ONA	Key	NPI	
Dodge Center	TOB	Intermediate	NPI	
Faribault	FBL	Intermediate	NPI	
Houston	CHU	Intermediate	NPI	
Preston	FKA	Intermediate	NPI	
Rushford	55Y	Intermediate	NPI	

Source: Weather data from Dodge Center Municipal Airport AWOS from 6/1/2002 to 6/1/2012

Table 6-11: Best Approach Usability Summary - District 7

AIRPORT	IDENTIFIER	CLASS	BEST APPROACH	USABILITY
Fairmont	FRM	Key	PI	98.72%
Mankato	MKT	Key	PI	
Worthington	OTG	Key	PI	
New Ulm	ULM	Key	NPI	96.34%
Blue Earth	SBU	Intermediate	NPI	
Jackson	MJQ	Intermediate	NPI	
Luverne	LYV	Intermediate	NPI	
Springfield	D42	Intermediate	NPI	
St. James	JYG	Intermediate	NPI	
Waseca	ACQ	Intermediate	NPI	
Windom	MWM	Intermediate	NPI	
Le Sueur	12Y	Intermediate	Visual	89.06%
Sleepy Eye	Y58	Landing Strip	Visual	
Wells	68Y	Landing Strip	Visual	

Source: Weather data from Fairmont Municipal Airport AWOS from 6/1/2002 to 6/1/2012

Table 6-12: Best Approach Usability Summary - District 8

AIRPORT	IDENTIFIER	CLASS	BEST APPROACH	USABILITY
Marshall	MML	Key	PI	98.86%
Willmar	BDH	Key	PI	
Canby	CNB	Intermediate	NPI	96.88%
Glencoe	GYL	Intermediate	NPI	
Granite Falls	GDB	Intermediate	NPI	
Hutchinson	HCD	Intermediate	NPI	
Lac Qui Parle	DXX	Intermediate	NPI	
Litchfield	LJF	Intermediate	NPI	
Montevideo	MVE	Intermediate	NPI	
Olivia	OVL	Intermediate	NPI	
Paynesville	PEX	Intermediate	NPI	
Pipestone	PQN	Intermediate	NPI	
Redwood Falls	RWF	Intermediate	NPI	
Slayton	DVP	Intermediate	NPI	
Tracy	TKC	Intermediate	NPI	
Hector	1D6	Intermediate	Visual	90.37%
Tyler	63Y	Landing Strip	Visual	
Winsted	10D	Landing Strip	Visual	

Source: Weather data from Marshall-SW MN Regional Airport AWOS from 6/1/2002 to 6/1/2012

POPULATION TO A KEY AIRPORT

Indicator: Percent of population that is within 40, 60, and 90 minutes surface travel time to a Key Airport

Relevance: Access to Key airports is an important indicator in measuring system performance. Key airports, in general, provide the most and best services of all the airports in the state. Convenient and reasonable access to the state's primary airports is necessary to adequately serve the state's population. Accessibility can be measured by determining the percentage of the state's population that is within established drive times from Key Airports.

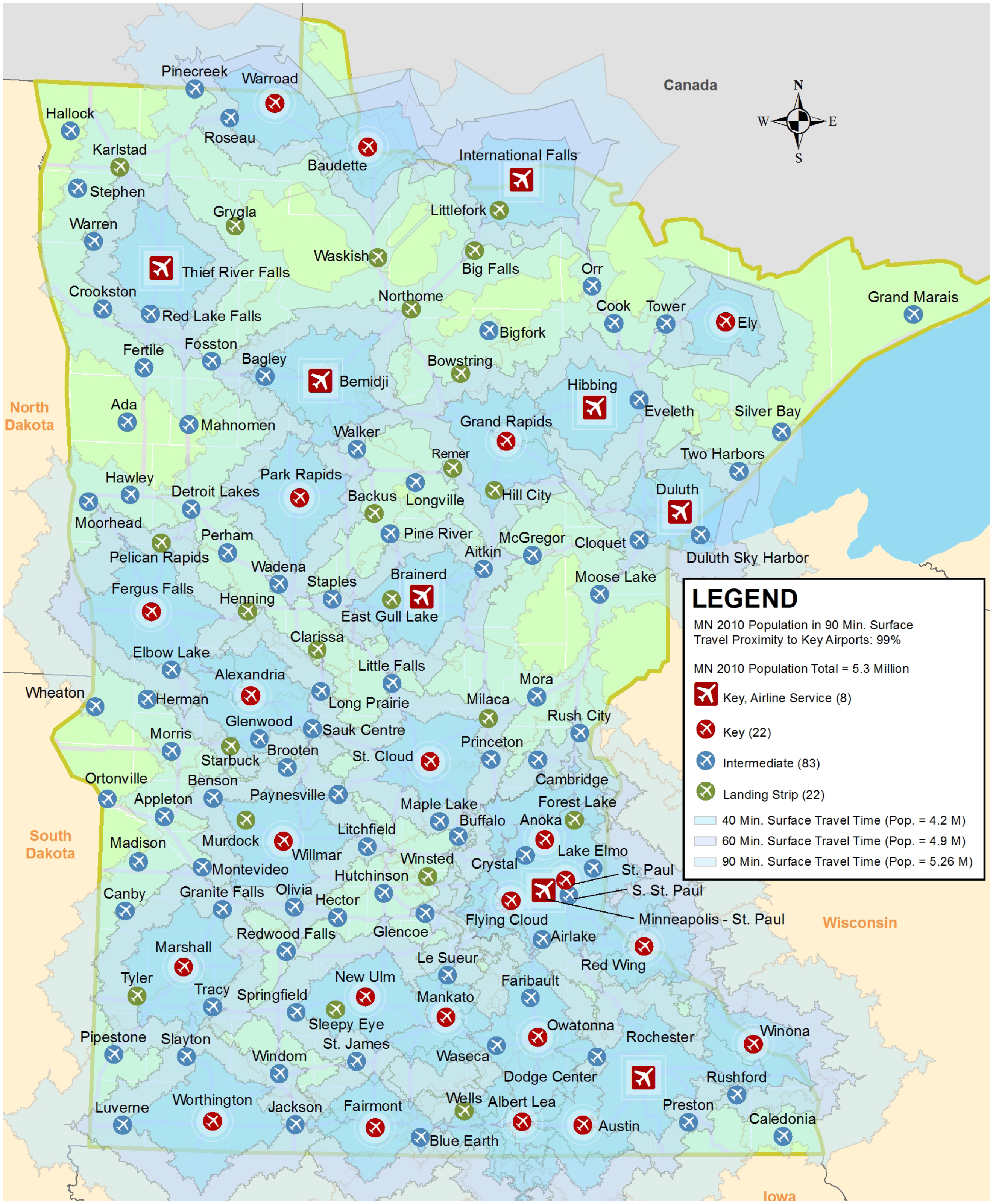
Trends: Population to a Key Airport shows a density analysis for three levels of service (LOS). The percentages of population that are within 40, 60, and 90 minutes surface travel time to a Key Airport are shown in **Table 6-13**. The geographic area of the state covered by 40, 60, and 90 minutes surface travel time to a Key Airport is shown in **Figure 6-14**.

Table 6-13: Percent of Population Within 40, 60, 90 Minutes Surface Travel Time to a Key Airport

SURFACE TRAVEL TIME	% POPULATION
40 Minutes	79.2%
60 Minutes	92.5%
90 Minutes	99.2%

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and Airport Database

Figure 6-14: Population to a Key Airport



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

POPULATION TO A PAVED AND LIGHTED RUNWAY

Indicator: Percent of the population that is within 30 minutes surface travel time to a paved and lighted runway

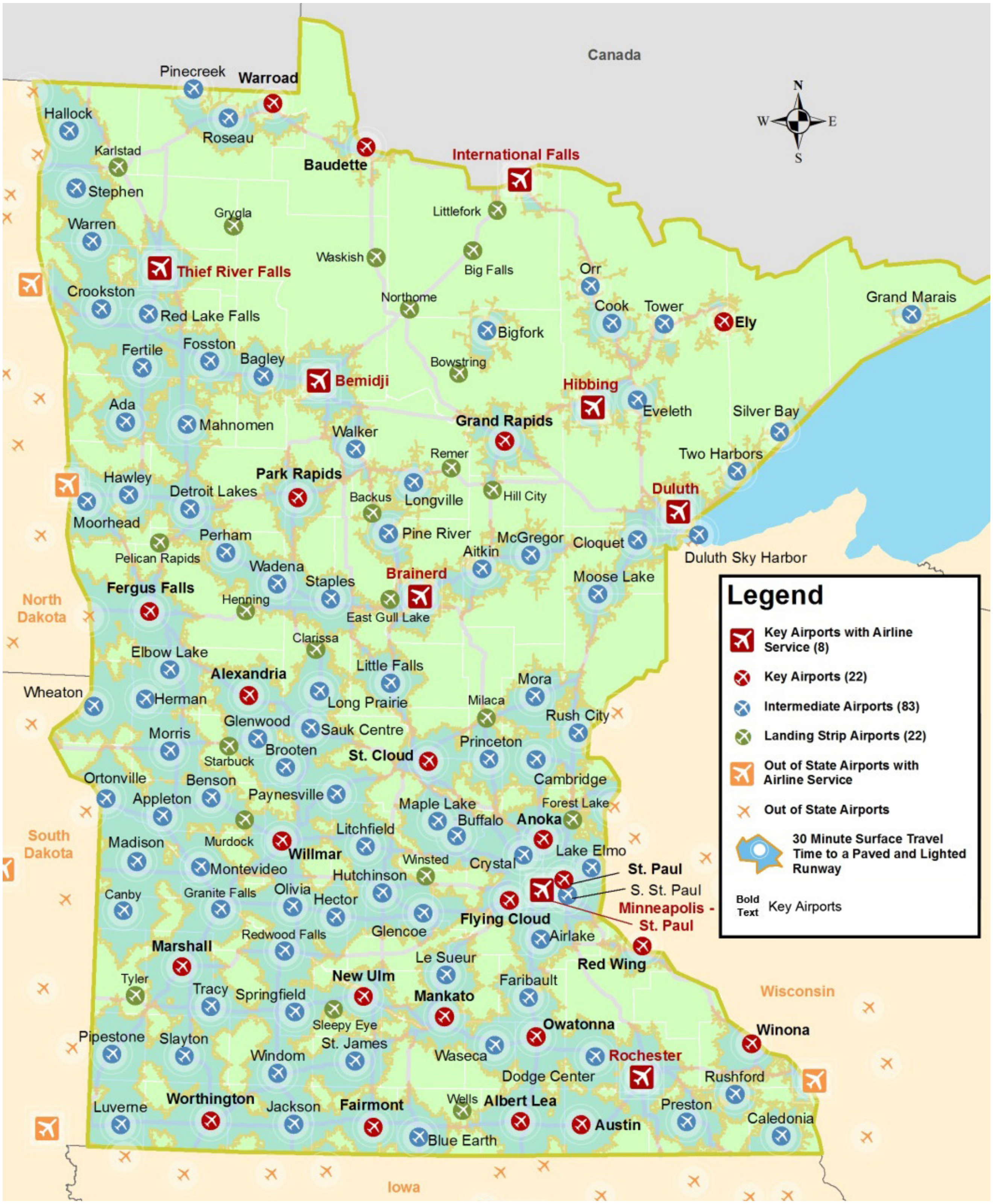
Relevance: Paved and lighted runways are one of the most important components of an airport system. A paved and lighted runway allows for a broader range of aircraft utilization, especially during periods of reduced visibility. An airport with a paved and lighted runway that is 3,200 feet or longer can support at least an LNAV/VNAV (APV-2) approach with visibility minimums less than one mile. Local businesses that have access to a paved and lighted runway with visibility minimums of less than one mile, along with access to aircraft equipped with APV-2-capable avionics, have both convenient and uninterrupted ability to transport goods and services into and out of such airports in nearly all weather conditions.

Trends: Many businesses and individuals in the state depend on the aviation industry for economic competitiveness. Convenient access to an airport which can accommodate basic transport aircraft indicates a level of convenience to pilots and local business.

Seventy-one percent of the state's population is within 30 minutes surface travel time to a paved and lighted runway. **Figure 6-15** shows 30 minute drive times around airports with paved and lighted runways in the state.

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and MnDOT Office of Capital Programs and Performance Measures Highway Classification GIS Files

Figure 6-15: Population to a Paved and Lighted Runway



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

LEVEL 1 AND 2 REGIONAL TRADE CENTER PROXIMITY TO KEY AIRPORTS

Indicator: Percent of Level 1 and 2 Regional Trade Centers (RTCs) that are within 30 minutes surface travel time to a Key Airport

Relevance: Regional Trade Center (RTC) Analysis was developed in 1963 at the Center for Urban and Regional Planning (CURA), University of Minnesota, by John R. Borchert and Russell B. Adams, to classify communities according to a hierarchy of trade center levels, which are based on community size and community economic diversity. Due to advancing technology, RTC analysis methodology has undergone two revisions by CURA, in 1990 and 1999, by expanding the scope economic activity and focusing on larger trade center levels. In 2003 MnDOT did their own update by making further adjustments in geographic aggregations and demographic and business data concluding in the RTC hierarchy levels used in this analysis.

The number of Primary (Level 1 – Primary Wholesale/Retail Center) and Secondary (Level 2 – Secondary Wholesale/Retail Center) Regional Trade Centers (RTCs) within 30 minutes surface travel time to a Key Airport indicates how convenient it is for large population and business centers to have accessible transportation for goods and services utilizing jet and turboprop aircraft.

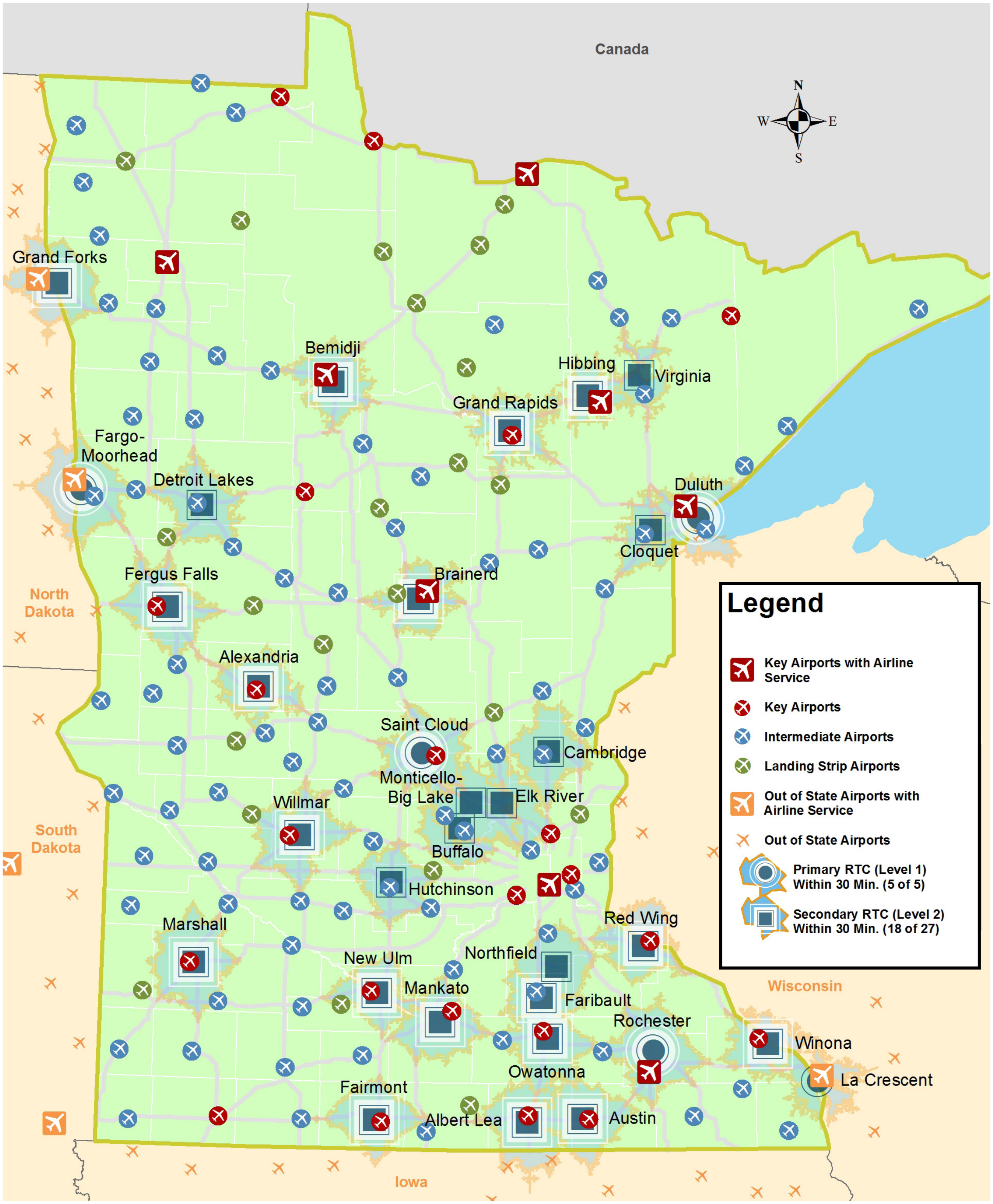
Trends: One hundred percent of the state's Primary RTCs and 67 percent (19 out of 27) Secondary RTCs are within 30 minutes surface travel time to a key airport. **Table 6-14** lists the Level 1 and 2 RTCs that are within 30 minutes drive time of a Key Airport. **Figure 6-16** shows the RTC proximity to Key Airports.

Source(s): Trade Centers of the Upper Midwest 2003 Update, SRF Consulting Group, Inc. and MnDOT. MnDOT Office of Aeronautics 2011 SASP Inventory Survey and MnDOT Office of Capital Programs and Performance Measures Highway Classification GIS Files

Table 6-14: Level 1 and 2 Regional Trade Center Proximity to Key Airports

WITHIN 30 MINUTES		OUTSIDE 30 MINUTES	
RTC	LEVEL	RTC	LEVEL
Duluth	1	Buffalo	2
La Crescent	1	Cambridge	2
Moorhead	1	Cloquet	2
Rochester	1	Detroit Lakes	2
St. Cloud	1	Elk River	2
Albert Lea	2	Hutchinson	2
Alexandria	2	Monticello	2
Austin	2	Northfield	2
Bemidji	2	Virginia	2
Brainerd	2		
East Grand Forks	2		
Fairmont	2		
Faribault	2		
Fergus Falls	2		
Grand Rapids	2		
Hibbing	2		
Mankato	2		
Marshall	2		
New Ulm	2		
Owatonna	2		
Red Wing	2		
Willmar	2		
Winona	2		

Figure 6-16: RTC Level 1 and 2 Proximity to Key Airports



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

LEVEL 3 REGIONAL TRADE CENTER PROXIMITY TO KEY & INTERMEDIATE AIRPORTS

Indicator: Percent of Level 3 RTCs that are within 30 minutes surface travel time to at least one Key or Intermediate Airport

Relevance: The number of Shopping (Level 3) RTCs within 30 minutes surface travel time to at least one Key or Intermediate Airport indicates how convenient it is for moderate sized population and business centers to have accessible transportation for goods and services using multiengine aircraft.

Trends: Level 3 RTCs require regular shipments, some of which are from air transports. This indicates the level of service these communities have to adequate airport facilities.

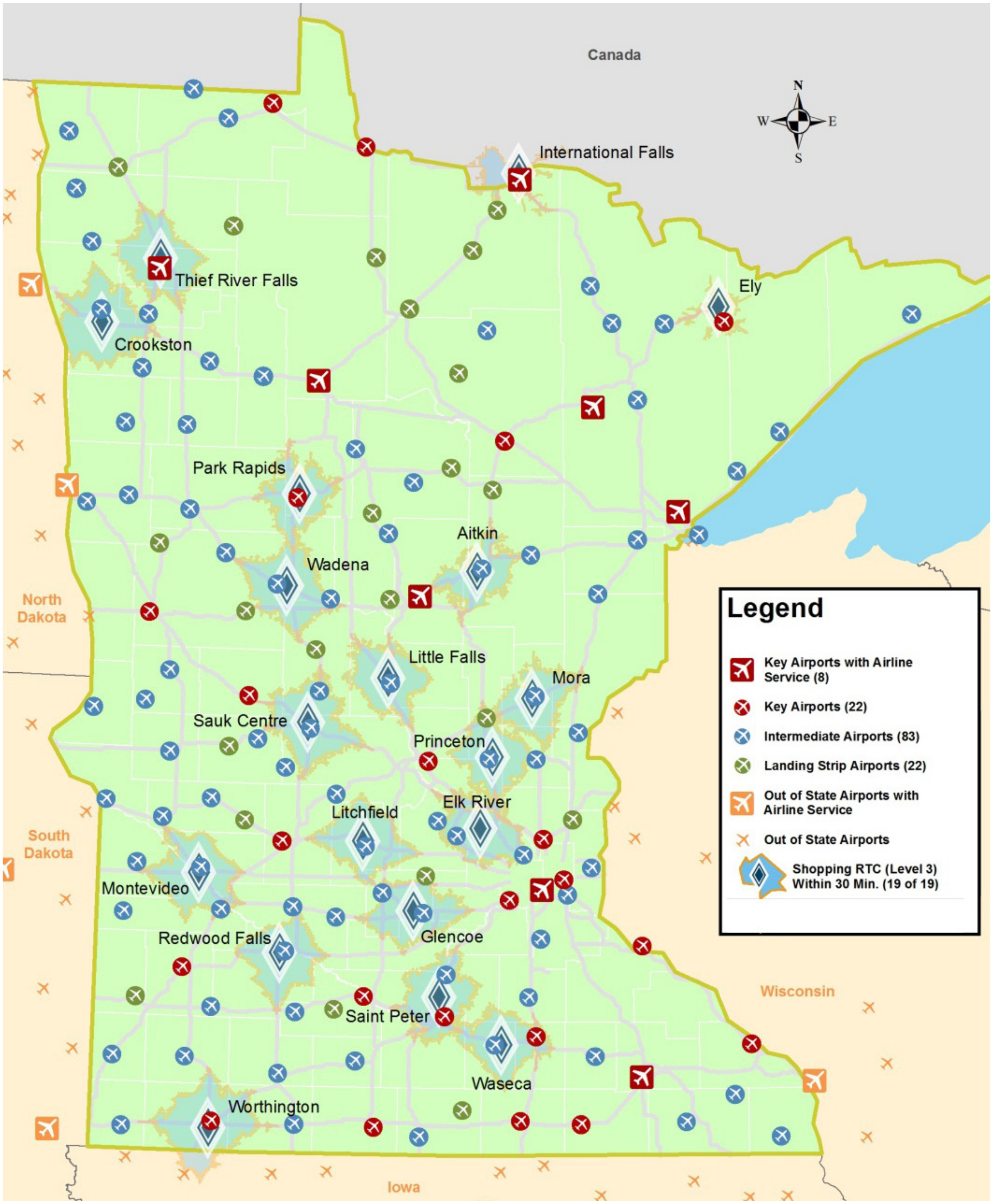
One hundred percent of Shopping RTCs are within 30 minutes surface travel time to at least one Key or Intermediate airport. **Table 6-15** lists the Level 3 RTCs that are within 30 minutes drive time of a Key or Intermediate Airport. **Figure 6-17** shows the RTC proximity to Key and Intermediate Airports.

Table 6-15: Level 3 Regional Trade Center Proximity to Key and Intermediate Airports

WITHIN 30 MINUTES		OUTSIDE 30 MINUTES	
RTC	LEVEL	RTC	LEVEL
Aitkin	3	NONE	
Crookston	3		
Elk River	3		
Ely	3		
Glencoe	3		
International Falls	3		
Litchfield	3		
Little Falls	3		
Montevideo	3		
Mora	3		
Park Rapids	3		
Princeton	3		
Redwood Falls	3		
St. Peter	3		
Sauk Centre	3		
Thief River Falls	3		
Wadena	3		
Waseca	3		
Worthington	3		

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and MnDOT Office of Capitol Programs and Performance Measures Highway Classification GIS Files

Figure 6-17: RTC Level 3 Proximity to Key and Intermediate Airports



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

POPULATION TO AN AIRLINE SERVICE AIRPORT

Indicator: Percent of the population that is within 60 minutes surface travel time to an airport with scheduled airline service

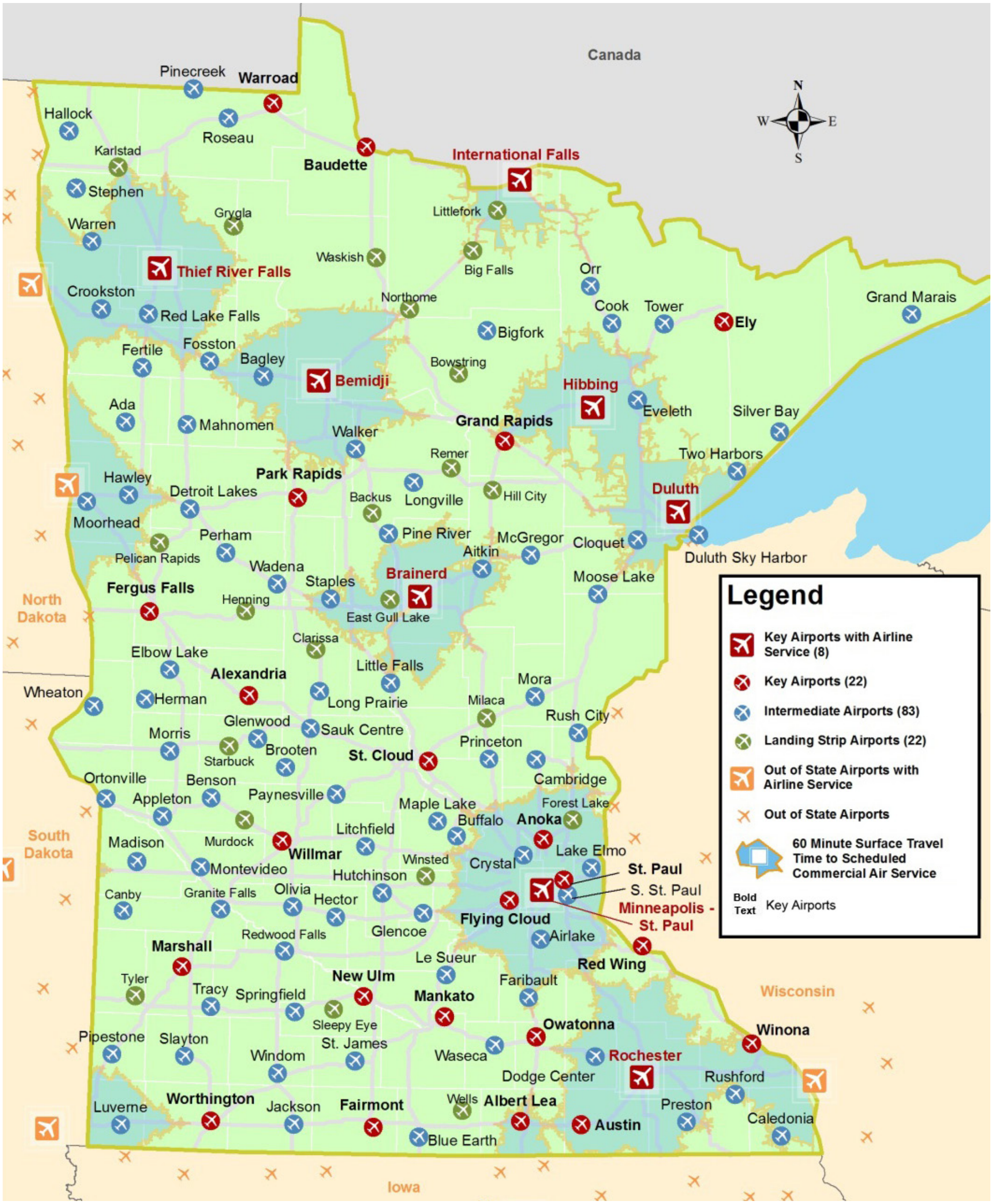
Relevance: It is important for residents of the state to have access to airports with scheduled airline service. The population that is within an hour's drive of an airport with airline service indicates how convenient it is for the general public to reach destinations outside of the state.

Trends: Airports with airline service are often near major population centers, so the density needs for this service are fairly well met.

GIS analysis indicates that 72 percent of the state's population is within 60 minutes surface travel time of an airport with airline service. **Figure 6-18** shows 60 minute drive times around the Scheduled Commercial Air Service Airports that serve the state. This drive time analysis assumes the user is able to travel to and from airports at posted speed limits.

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and MnDOT Office of Capital Programs and Performance Measures Highway Classification Graphic Information System (GIS) Files

Figure 6-18: Airline Service Airport Access



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

NON-STOP AIRLINE SERVICE MARKETS

Indicator: Total number of non-stop markets served from Minnesota

Relevance: Non-stop markets indicate both the level of convenience to the people of Minnesota and the market destination demand of other airports. In addition to domestic non-stop markets, Minnesota's airports offer access to international non-stop destinations from MSP. This indicator relates to the Mobility goal of the system plan.

Trends: Providing convenient access to other regions of the country as well as international destinations increases the quality of life of the people of Minnesota. Non-stop flights within the state allow out-state communities to connect to the rest of the country and the world via MSP. Non-stop flights also attract and retain businesses by providing easy access to the markets they serve. Direct flights help businesses in the state stay economically competitive.

According to the 2011 Annual Report to the Legislature prepared by the Metropolitan Airports Commission there were 138 non-stop markets served by MSP in 2011 - 118 domestic and 20 international. Non-stop markets have been relatively stable. Between 2004 and 2008 there were approximately 123 domestic and between 15 and 20 international. Since 2008 they have been slightly lower at approximately 113 domestic and 20 international. The 112 current domestic non-stop destinations are shown on **Figure 6-19**. International non-stop destinations in 2011 are shown in **Table 6-16.**

Table 6-16: International Non-Stop Destinations from MSP

Canada (Toronto, Winnipeg, Edmonton, Calgary, Vancouver, Saskatoon, Regina, Montreal)
Mexico (Cancun, Puerto Vallarta, Mexico City, San Jose del Cabo, Mazatlan, Cozumel)
Caribbean (Montego Bay)
Europe (Amsterdam, Paris, London, Reykjavik)
Asia (Tokyo)

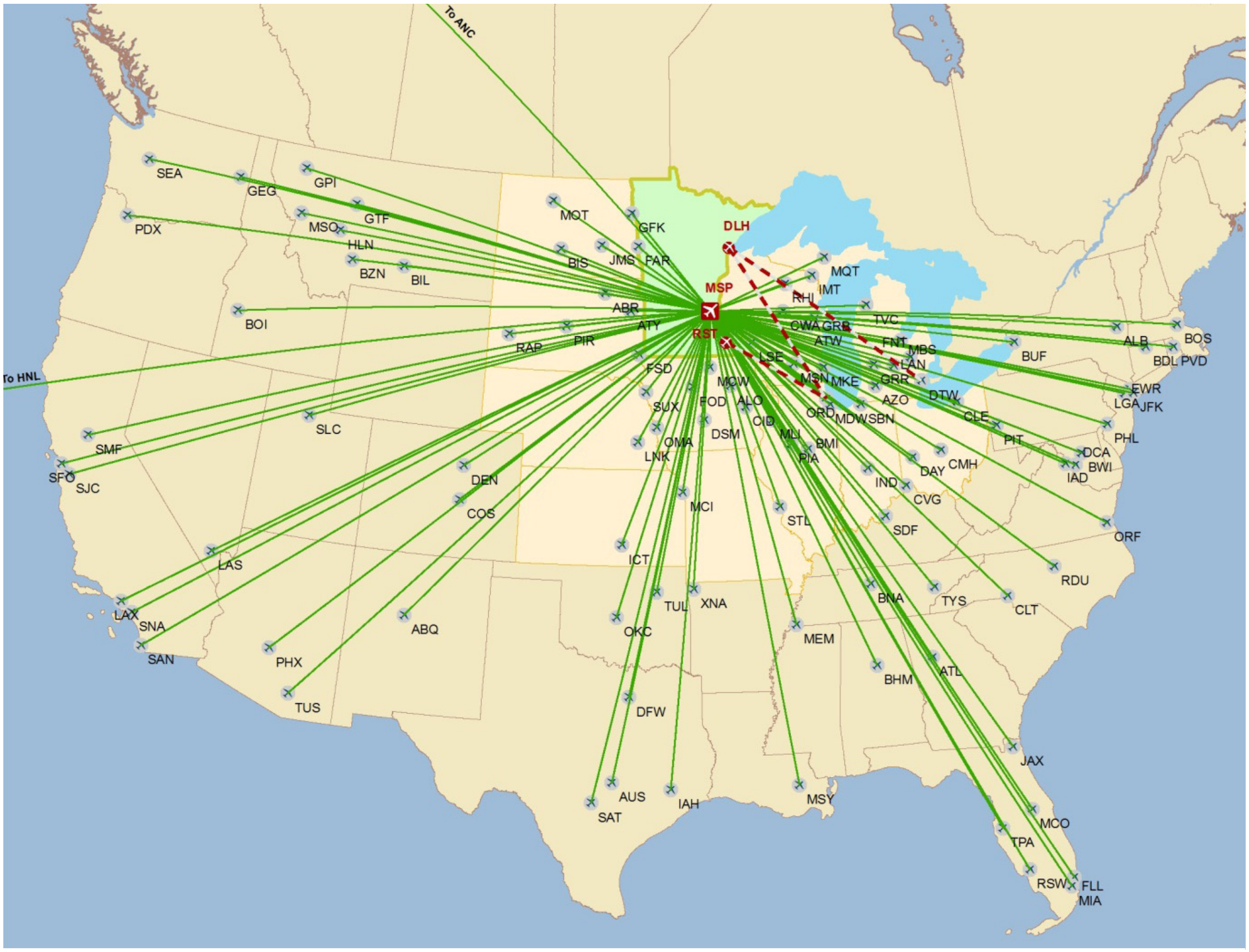
Although the number of non-stop markets has been relatively stable in recent years, there has been a shift in the types of markets served. The number of international and long-haul domestic markets has increased while the number of very short-haul non-stop markets has decreased. For example, during the past twenty years MSP has gained non-stop service to long-haul markets such as Albuquerque, Ft. Lauderdale, New Orleans, and Raleigh-Durham. It has lost service to short-haul markets such as St. Cloud, Fairmont, Mankato, and Worthington. Over time, the average range of mainline and regional aircraft has increased making long-haul markets more accessible. At the same time, the small aircraft that are most suitable for short-haul markets have become less cost-effective, as fuel prices and regulatory requirements increased.

Many of the remaining short-haul non-stop markets rely on Essential Air Service (EAS) program subsidies to remain viable. Therefore, any measures that the state and communities can take to boost traffic and maintain the EAS program will help retain short-haul non-stop service to MSP.

The Legislative Report also compares Minneapolis-St. Paul International Airport to other major metropolitan areas in terms of the number of non-stop markets served by each airport per population of the Metropolitan Statistical Area. Only residents of the Denver metropolitan area enjoy air service to more non-stop markets per capita than do people in the Twin Cities.

Source(s): Federal Research and Innovative Technology Administration (RITA) – Bureau of Transportation Statistics (BTS) T-100 data, Official Airline Guide

Figure 6-19: Domestic Non-Stop Airline Service Markets from Minnesota



Source: HNTB

ORIGINATING PASSENGERS

Indicator: Total number of originating passengers departing from Minneapolis-St. Paul International Airport (MSP)

Relevance: Originating passengers are those that begin the air portion of their trip at the airport. This measurement can indicate the demand for and health of passenger air travel in the state. Many factors determine the number of passenger originations. The overall strength of the economy determines the income available for business and leisure travel. The strength of the business and tourist industry helps determine the attractiveness of Minnesota to visiting passengers. The availability of convenient non-stop air service determines the accessibility of Minnesota for passenger travel to and from the state. Average air fares determine the affordability of air travel for leisure and business passengers. Airport amenities and security policies affect the convenience and comfort of air travel relative to other transportation modes.

Trends: The number of people travelling from and arriving into the state is important because those travelers impact several economic indicators. These indicators include, but are not limited to, the types and health of local businesses, the desirability of the state's leisure market, and population growth in the state.

There were approximately 7.2 million originating passengers at MSP in 2010. According to the MSP 2020 Improvements draft Environmental Assessment, between 1990 and 2010 the average annual growth rate for domestic originations was 2.5%. The period of record is shorter for international originations; they grew at a 2.9 percent annual rate between 2001 and 2010 (see **Table 6-17**).

Source(s): RITA-BTS T-100 data

Table 6-17: Historical Originating Passengers at MSP

YEAR	DOMESTIC ORIGINATORS	COMBINED INTERNATIONAL	TOTAL
1990	4,284,240	-	-
1991	4,288,090	-	-
1992	4,414,590	-	-
1993	4,511,050	-	-
1994	4,598,270	-	-
1995	5,021,830	-	-
1996	5,411,820	-	-
1997	5,750,780	-	-
1998	5,736,650	-	-
1999	6,365,610	-	-
2000	7,225,020	-	-
2001	6,603,320	544,189	7,147,509
2002	6,207,930	502,422	6,710,352
2003	6,390,140	499,471	6,889,611
2004	7,074,980	595,452	7,670,432
2005	7,609,360	618,977	8,228,337
2006	7,643,820	654,297	8,298,117
2007	7,703,380	709,046	8,412,426
2008	7,065,580	718,963	7,784,543
2009	6,987,990	644,281	7,632,271
2010	7,084,400	706,128	7,790,528
AVERAGE ANNUAL GROWTH RATE			
1990-2010	2.5%	-	-
2001-2010	0.8%	2.9%	1.0%

Source: USDOT, Origin-Destination Survvey and HNTB analysis

ANNUAL FLIGHT DELAY AT MSP

Indicator: Annual delay at the Minneapolis-St. Paul International Airport (MSP)

Relevance: Delays at airports impact the economy and cost airlines and passengers both time and money. Annual delay often results when demand exceeds capacity and is therefore an indicator of the adequacy of the facilities at MSP. Delays can also be caused by other factors such as weather and construction projects, among others. Delay can be reduced by airfield and capacity improvements such as the implementation of the NextGen Air Traffic Management System. All other things equal, an increase in traffic will increase delay and in that respect delay can be considered a positive indicator of increased demand for air service and a growing economy. Delay is an important indicator that needs to be monitored as it reveals major trends that may be occurring. Major changes in this indicator should call for an examination of what is happening, and if some sort of action needs to be taken.

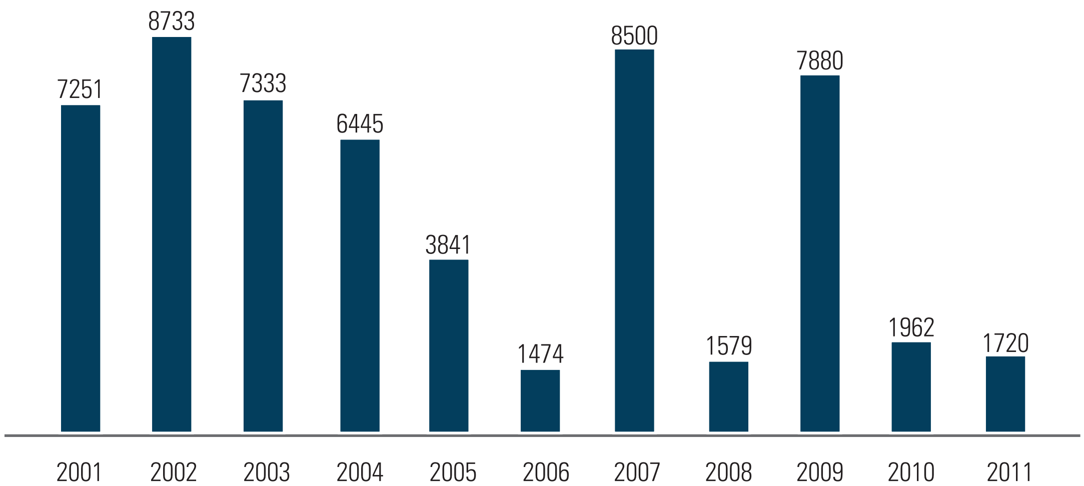
Trends: As the busiest airport in the state, MSP serves as a connecting hub for Delta Air Lines as well as the primary departure/arrival location for many Minnesotans. Average annual delay is an indicator of congestion. Keeping flights departing on time helps reduce overall costs of flying and maximizes operational efficiency at MSP and other airports.

The annual number of delayed flights at MSP appears to be following an overall decreasing trend over the last decade, owing in part to a precipitous drop in delays during the years 2004 through 2006 when the new runway became operational (see **Figure 6-20**). However, the past few years have shown a slow upturn in the number of delays. There were significant spikes in 2007 and 2009 as a result of runway closures for reconstruction. The number of aircraft delayed at MSP is expected to gradually increase in the future as the number of aircraft operations increases.

Compared to other large hub US airports, MSP ranked 14th overall in 2011 for highest average delay per operation. The average delay per operation was 4.6 minutes. In 2010 MSP ranked 11th.

Source(s): 2011 Metropolitan Airports Commission (MAC) annual report to the legislature

Figure 6-20: Annual MSP Flights Delayed



Source: 2011 MAC annual report to the legislature

UP-TO-DATE PLANNING DOCUMENTS

Measure: Percent of System Plan airports with Up-to-Date Planning Documents.

Relevance: Master Plans and Long Term Comprehensive Plans (LTCPs) document the anticipated needs of an airport over a specific planning period. They provide supporting documentation as to the purpose and appropriate timing of proposed development. Airport Layout Plans (ALPs) provide guidance, or a "blueprint", for future growth and illustrate the existing conditions. Keeping these planning documents current provides FAA, MnDOT and the airports the information needed to document and prepare for future growth.

Target:

100% of system airports have up-to-date federal and state approved planning documents that exhibit existing and future development

Up-to-date is defined for each airport classification below:

Key Airports: All should have an ALP and Master Plan/LTCP updated or revisited at least every seven years.

Intermediate Airports: All should have an ALP and Master Plan/LTCP updated or revisited at least every 15 years.

Landing Strips: All should have an ALP.

Performance:

10% of system airports meet the target

The majority of system airports have these planning documents, but many have not been updated within the targeted timeframe. **Figure 6-21** displays the state's current performance in this measure.

Technical Description: ALPs, Master Plans and Long Term Comprehensive Plans identify airport design standards as well as highlight airport improvements to meet forecasted needs. These plans are based on FAA standards and policies. While it is important that these planning documents are tailored to each individual airport, some common elements of each plan for Minnesota's airports are shown in **Table 6-18**.

Table 6-18: Common Plan Elements

MASTER PLANS/LTCPS	ALPS
Inventory of existing conditions	Existing airport layout
Aviation forecasts	Future airport layout
Facility requirements	Wind data (Wind rose)
Airport development alternatives	Terminal/Facility plan
Environmental considerations	Airport airspace maps
Recommended alternative	Airport land use
Capital improvement program	Airport property map
	Airport zoning map

NPIAS airports must keep ALPs current in order to be eligible for federal funding. Up-to-date planning documents allow the state to better assess project funding needs across the system.

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and Airport Database


MASTER PLAN UPDATE
ROCHESTER INTERNATIONAL AIRPORT

Final Report
Rochester, Minnesota

Prepared for:
The City of Rochester, Minnesota

November 2009

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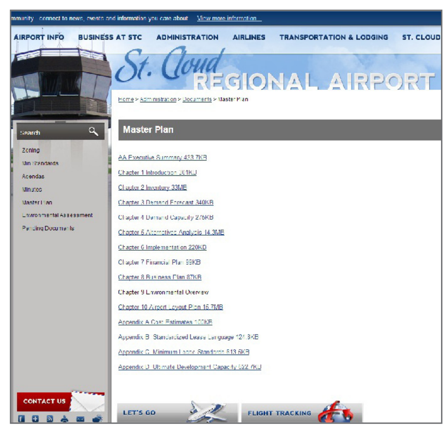


Figure 6-21: Up-to-date Planning Documents

Legend

- Key Airports with Airline Service (0 of 8)
- Key Airports (1 of 22)
- Intermediate Airports (11 of 83)
- Landing Strip Airports (1 of 22)
- Airports that Do Not Meet the Measure
- Bold Text: **Key Airports**

Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

24/7 FUELING AT AIRPORTS

Indicator: Percent of airports within 50 nautical miles (NM) of an airport with fueling available 24/7

Relevance: The percent of airports within 50 NM of an airport with around-the-clock fuel availability is a measure of convenience and safety. Having convenient access to fuel allows pilots to plan more efficient routes, carry less fuel, and succumb to fuel exhaustion less often. This results in less fuel consumption and increased safety margins.

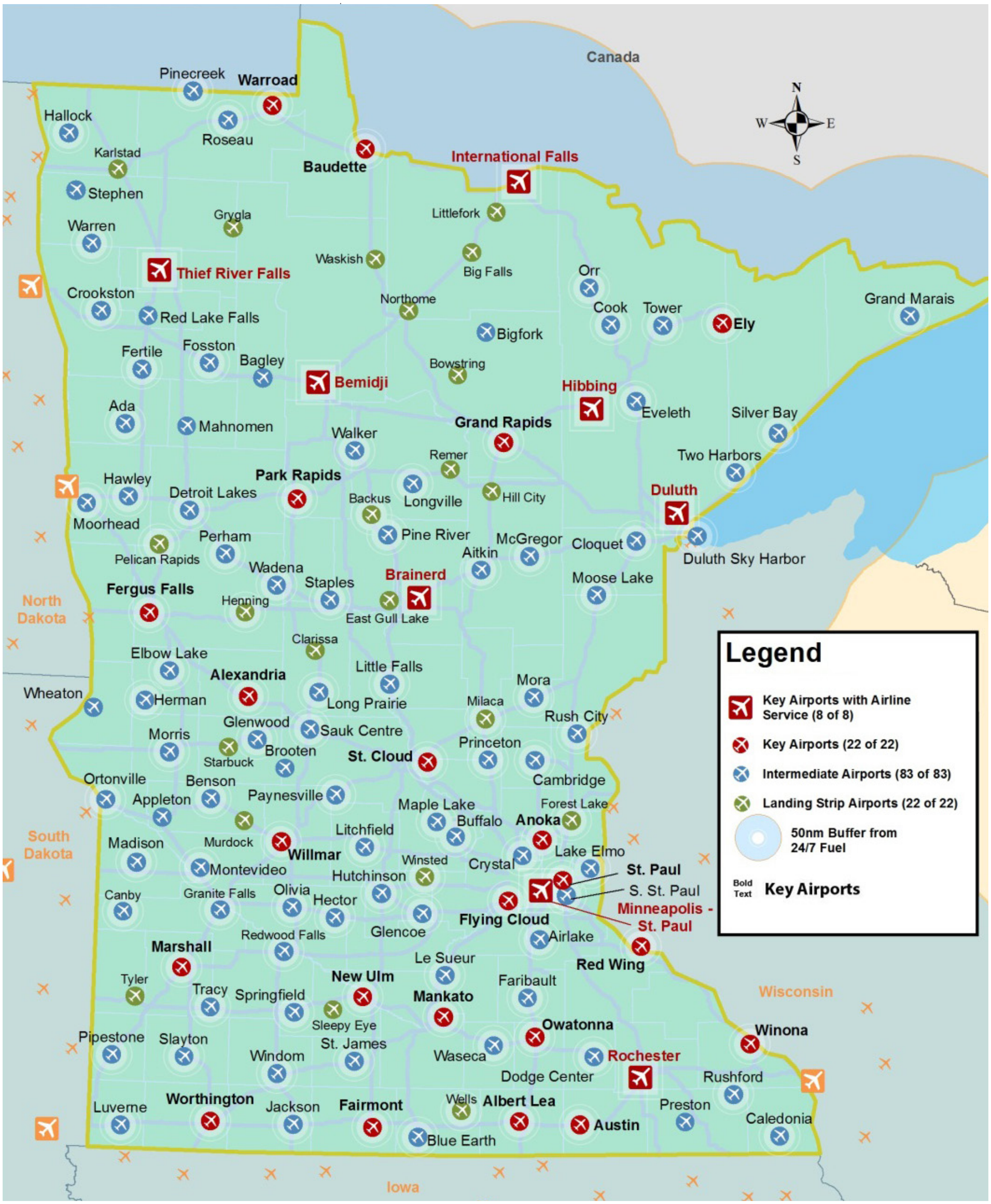
Trends: Access to fuel plays a role in activity levels at airports and also may influence the likelihood of a pilot basing their aircraft at a particular airport. There are 110 airports in the state that provide 24/7 fueling.

Figure 6-22 depicts those airports with 24/7 fuel service available (shown with a halo around the airport icon). It also shows 50 NM radius coverage around those airports. Any pilot located in or travelling to any system airport will be able to find a 24-hour fueling facility within 50 NM of their destination airport.

One hundred percent of the state's airports are within 50 NM of an airport that has fueling service available 24 hours a day seven days a week.

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and Airport Database

Figure 6-22: Airports with 24/7 Fuel and Buffer



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

MAINTENANCE & REPAIR AT AIRPORTS

Indicator: Percent of airports that are within 50 NM of an airport that has aircraft maintenance and repair facilities

Relevance: The number of airports within 50 NM of an airport with aircraft maintenance and repair facilities indicates the convenience aircraft owners have to repair and maintain their aircraft.

Trends: Access to maintenance facilities is a factor in activity levels at airports and also increases the likelihood of a pilot basing their aircraft at a particular airport. Easy access to aircraft or aviation repair facilities enables a higher quality of flying for pilots traveling to or from the state. If a maintenance facility is not located at an airport, it is important to have a facility close enough so a mechanic can drive to the airport without service and make emergency repairs so the aircraft can be quickly ferried to an airport where complete repairs can be made.

All pilots located at or destined to any of the system plan airports have access to maintenance and repair facilities within 50 NM miles of their base or destination airport. **Table 6-19** shows those airports that reported having maintenance and repair service.

All of the system plan airports are within 50 NM miles of an airport that has aircraft maintenance and repair facilities. **Figure 6-23** shows airports that have maintenance and repair services and a 50 NM radius around these airports.

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and Airport Database

Photo Credit: USAF photo, 2012-2013

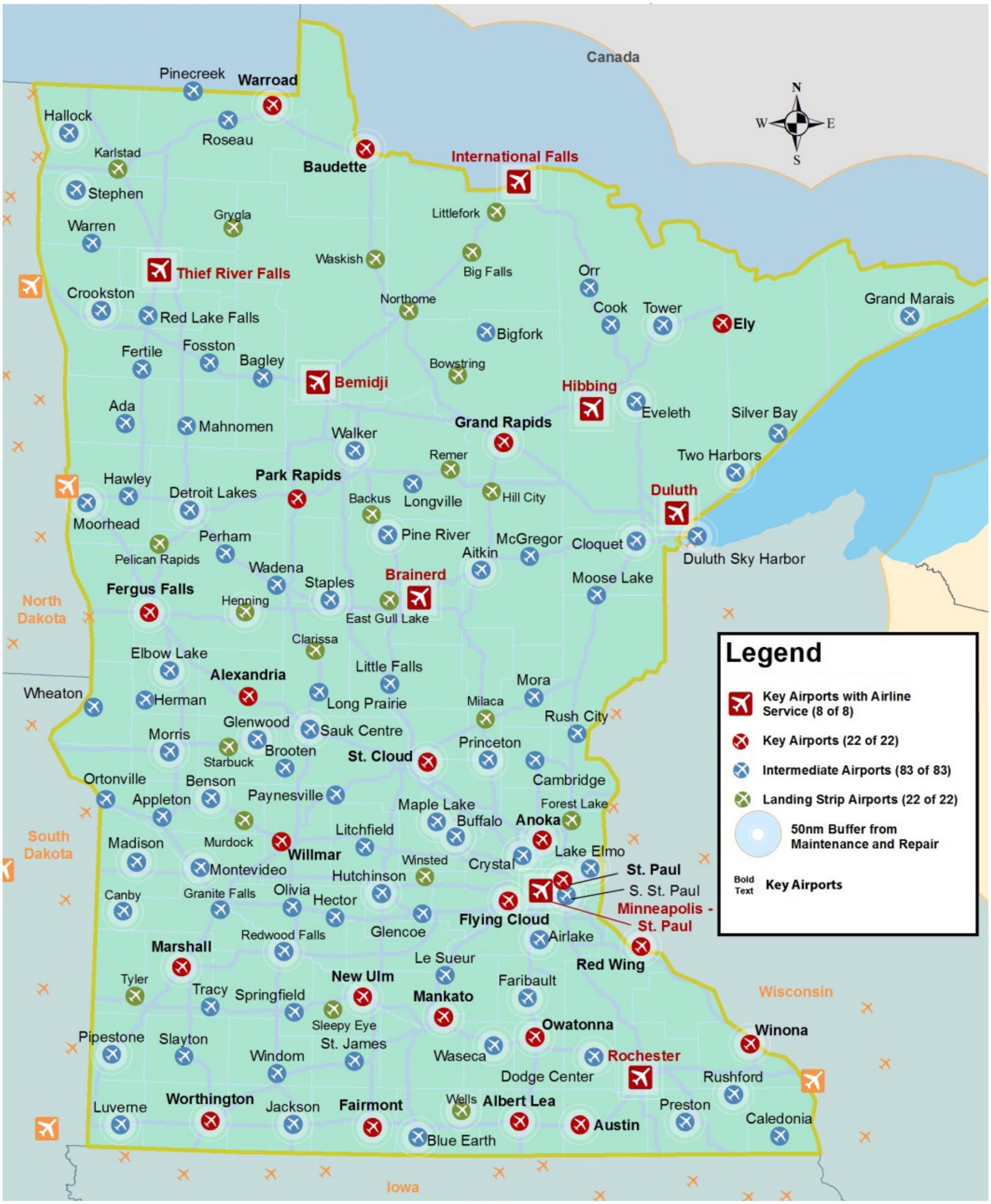
Photo Credit: USAF photo, 2012-2013

Photo Credit: USAF photo, 2012-2013

Table 6-19: Airports in Minnesota with Maintenance and Repair Service

Henning Municipal Airport	Chisholm-Hibbing Municipal - Range Regional Airport
Tower Municipal Airport	Falls International Airport
Lake Elmo Airport	Moorhead Municipal Airport
Rushford Municipal Airport	Airlake Airport
Wells Municipal Airport	Luverne Municipal Airport
Waseca Municipal Airport	Maple Lake Municipal Airport
Albert Lea Municipal Airport	Crystal Airport
Aitkin Municipal Airport - Steve Kurtz Field	Jackson Municipal Airport
Anoka County - Blaine Airport	Mankato Regional Airport - Sohler Field
Austin Municipal Airport	Southwest Minnesota Regional Airport - Marshall/Ryan Field
Benson Municipal Airport	Morris Municipal Airport
Baudette International Airport and Seaplane Base	Minneapolis-St. Paul International Airport
Bemidji Regional Airport	Montevideo/Chippewa County Airport
Brainerd Lakes Regional Airport	Winona Municipal Airport
Buffalo Municipal Airport	Worthington Airport
Grand Marais/Cook County Airport	Owatonna Degner Regional Airport
Crookston Municipal Airport - Kirkwood Field	Princeton Municipal Airport
Canby Municipal Airport - Myers Field	Pipestone Municipal Airport
Cloquet/Carlton County Airport	Pine River Regional Airport
Sauk Centre Municipal Airport	Red Wing Regional Airport
Stephen Municipal Airport	Warroad International Memorial Airport
Duluth International Airport	Rochester International Airport
Detroit Lakes Municipal Airport - Wething Field	Redwood Falls Municipal Airport
Lac Qui Parle County Airport	Staples Municipal Airport
Duluth - Sky Harbor Airport and Seaplane Base	Blue Earth Municipal Airport
Eveleth Virginia Airport	South St. Paul Municipal Airport - Richard E. Fleming Field
Faribault Municipal Aiport	St. Cloud Regional Airport
Flying Cloud Airport	St. Paul Downtown Airport
Fergus Falls Municipal Airport - Einar Mickelson Field	Dodge Center Municipal Airport
Preston/Fillmore County Airport	Thief River Falls Regional Airport
Fairmont Municipal Airport	Two Harbors Municipal - Richard B. Helgeson Airport
Glenwood Municipal Airport	New Ulm Municipal Airport
Grand Rapids/Itasca County Airport - Gordon Newstrom Field	Walker Municipal Airport
Hutchinson Municipal Airport	Elbow Lake Municipal - Pride of the Prairie Airport
Hallock Municipal Airport	

Figure 6-23: Airports with Maintenance and Repair and Buffer



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

POPULATION TO SCHEDULED CARGO SERVICE

Indicator: Percent of population that is within 60 minutes surface travel time to scheduled cargo service

Relevance: Airports that have air cargo activities provide economic support to the communities they serve. Fourteen airports in the state reported having cargo service. The percentage of population within an hour travel indicates the level of service provided to the citizens of Minnesota and local business who use cargo companies to ship goods.

Trends: The population within an hour of an airport with air cargo activity indicates how convenient it is for large shipping companies to get packages to and from their intended national and international destinations. The greater the convenience to the shipping companies the lower the cost to the consumers.

Table 6-20 lists the airports in Minnesota that reported having cargo service.

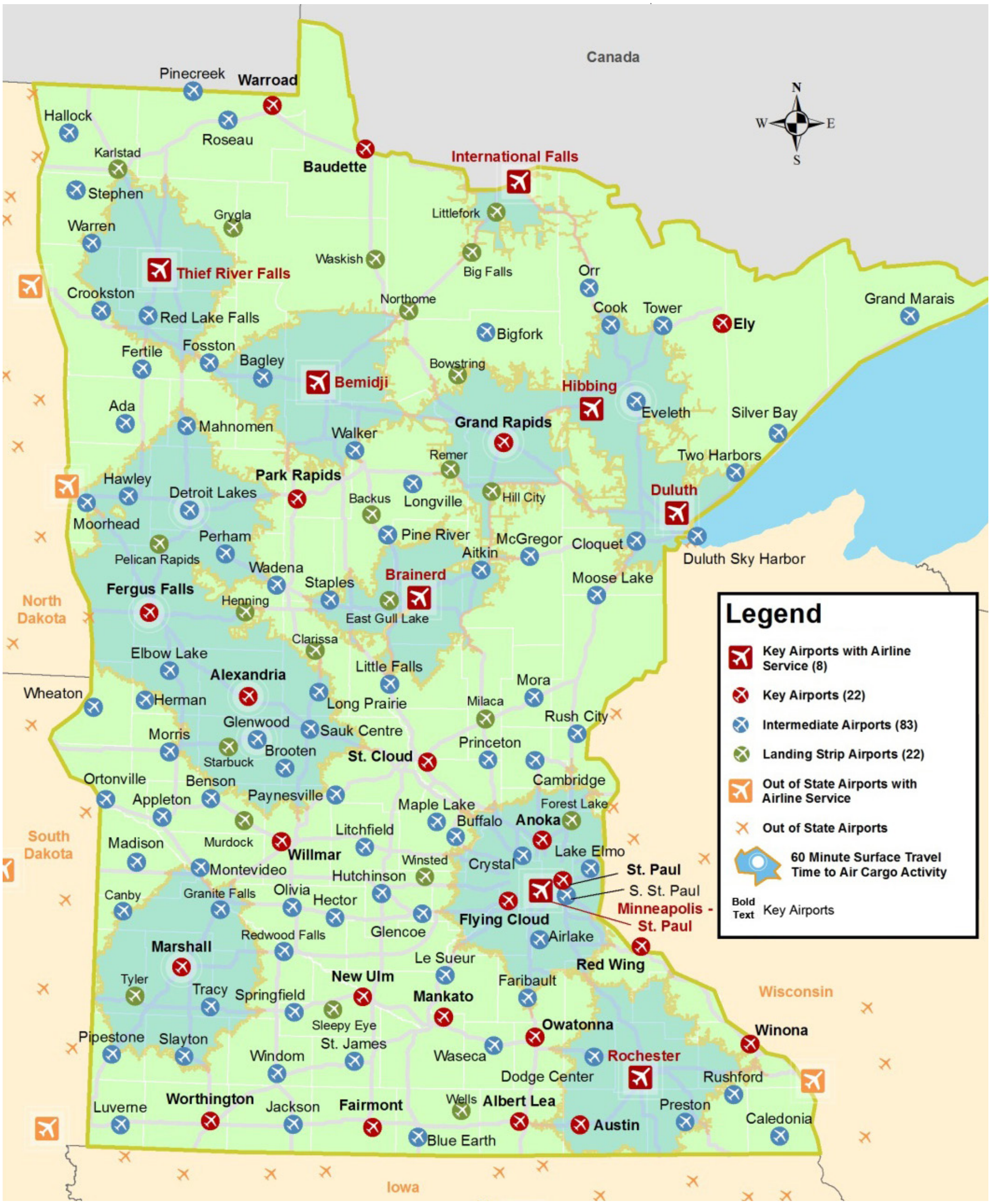
Table 6-20: Cargo Service Airports

Alexandria Municipal Airport
Bemidji Regional Airport
Brainerd Lakes Regional Airport
Duluth International Airport
Detroit Lakes Municipal Airport - Wething Field
Eveleth Virginia Airport
Fergus Falls Municipal Airport - Einar Mickelson Field
Glenwood Municipal Airport
Grand Rapids/Itasca County Airport - Gordon Newstrom Field
Falls International Airport
Southwest Minnesota Regional Airport - Marshall/Ryan Field
Minneapolis-St. Paul International Airport
Rochester International Airport
Thief River Falls Regional Airport

Seventy-five percent of the state's population is less than or equal to 60 minutes surface travel time to scheduled air cargo service. **Figure 6-24** shows 60 minute drive times around the Scheduled Cargo Service Airports within the state.

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and MnDOT Office of Capital Programs and Performance Measures Highway Classification GIS Files

Figure 6-24: Cargo Service Airports



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

UP-TO-DATE NAVIGATION SYSTEMS

Measure: Percent of system airports with navigation systems that are up to date.

Relevance: Navigation systems at or near airports provide guidance for pilots operating in the airspace system. As navigation systems age or become outdated, finding usable replacement parts may be difficult. As new sophisticated systems, like GPS, become available the old systems are used less frequently.

Through diligent documentation of the type and model of navigation systems across the state, replacement parts can be procured as necessary and replacement of outdated systems can be considered. Major repair or replacement can be planned as systems near the end of their usable life.

Target:

100% of system airports should have up-to-date navigation aids appropriate for its classification

Performance:

Data collection in progress

MnDOT is in the process of surveying system airports to determine the age and condition of existing navigation systems.

Technical Description: Navigation systems are ground based electronic systems or visual guidance lighting systems. The advent of GPS has made it possible to replace most ground based electronic systems. Ground based equipment will likely continue to serve as a necessary backup system for GPS, and is also important because some aircraft are not equipped with the avionics required to utilize GPS.

MnDOT is responsible for the functionality and repair of the electronic and visual navigation systems described below.

> ILS (Instrument Landing System): a ground based precision system (i.e. electronic vertical guidance) used during approach and landing. The ILS includes three primary components; a glide slope antenna for vertical guidance, a localizer antenna for lateral guidance, and an outer marker or low power distance measuring equipment to mark the beginning of the final descent.

VOR (Very High Frequency Omni-directional Range): a non-precision system providing azimuth information for low and high altitude routes and airport instrument approaches. Using two VORs, a location on a map can be determined where two radials, one from each VOR, intersect.

Approach Lighting Systems: lighting increases early identification of runway environment for landing purposes.

ALSF: High-intensity Approach Lighting System with Sequenced Flashers

MALSF: Medium-intensity Approach Lighting System with Sequenced Flashers

MALSR: Medium-intensity Approach Lighting System with Runway alignment indicator lights

ODALS: Omni-Directional Approach Lighting System

REIL: Runway End Identifier Lights

Approach Path Indicators: systems that provide a visual reference to the glide path.

PAPI: Precision Approach Path Indicator

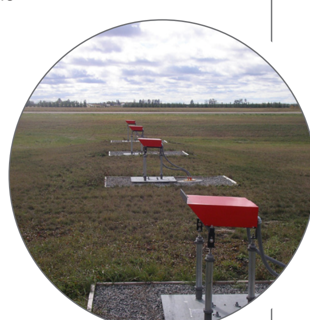
VASI: Visual Approach Slope Indicator

NDB (Non-Directional Beacon): radio transmitter at a known location

Wind Cone: tube used to indicate wind direction and speed

Rotating Beacon: used to identify the location of an airport at night

Source(s): MnDOT Office of Aeronautics 2011 SASP Inventory Survey and Airport Database, FAA Order 6850.2B, Visual Guidance Lighting Systems, FAA Order 6750.16D, Siting Criteria for Instrument Landing Systems



PAVEMENT CONDITION INDEX (PCI)

Measure: Runway and Parallel Taxiway Pavement Conditions within PCI Targets

Relevance: Maintaining good runway and taxiway pavement condition reduces the potential for damage to aircraft and also can minimize costs over the course of the pavement's usable life. Loose pavement can become dislodged during aircraft operations and taken into jet aircraft engines causing considerable damage. Pavement condition is monitored on a zero to100 rating scale known as a pavement condition index (PCI) with a score of zero indicating a runway or taxiway has the worst possible pavement and a score of 100 indicating the best possible pavement.

MnDOT currently collects PCI data for pavements at all system airports with paved runways with the exception of nine airports which prepare their own PCI reports. The nine airports include seven owned and operated by the Metropolitan Airports Commission (MAC), Duluth International Airport, and Rochester International Airports. These airports use different methodologies to evaluate pavements and are not included in this analysis.

Target:

The targets are outlined below:

Key Airports: Eighty-five percent of primary runway pavements (weighted by area) are in "very good" or "excellent" condition (PCI of 70 or greater).

All Paved Airports: Eighty-four percent of all runway and parallel taxiway pavements (weighted by area) are in at least "good" condition (PCI of 55 or greater) and no more than four percent of all runway and parallel taxiway pavements (weighted by area) are in "poor" condition (PCI of 40 or less).

Performance:

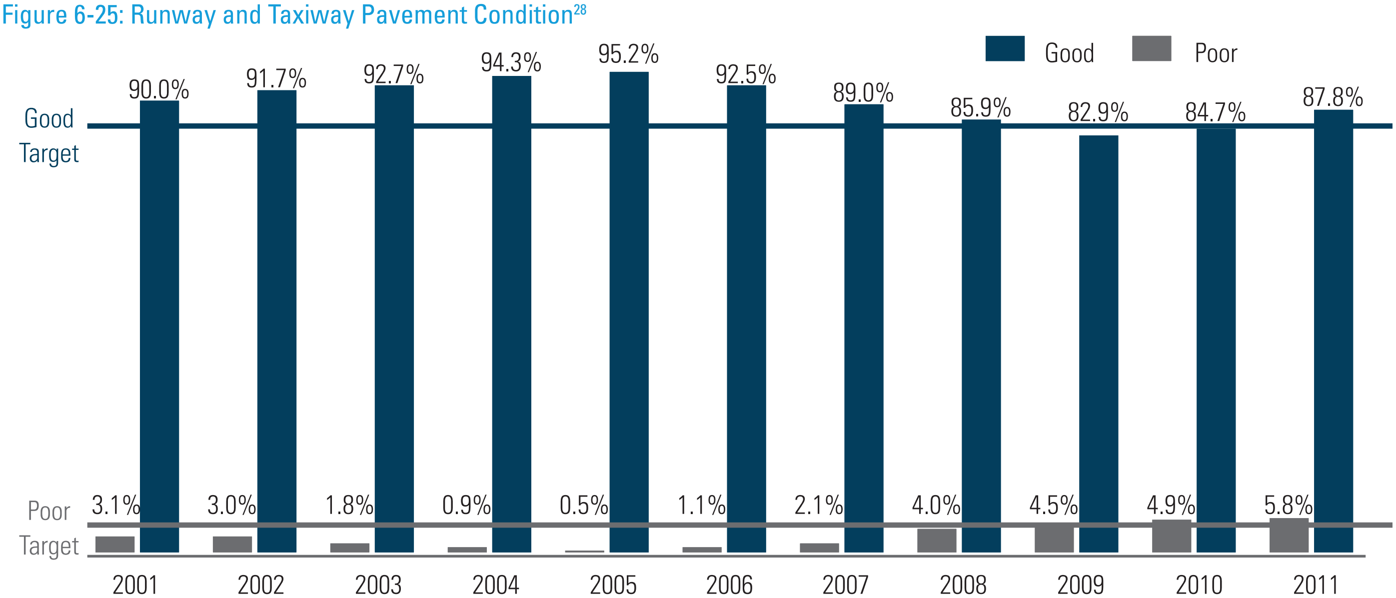
77% of Key Airport primary runways meet the target PCI value of 70 or greater;
87.8% of runways and parallel taxiways at all paved airports have a PCI value of 55 or greater;
5.8% of runways and parallel taxiways at all paved airports are rated at a PCI of 40 or less

Minnesota airports have met the target for the percentage of airport pavements in good or better condition for the past two years, following just one year where the target was not met. Since 2009, the target for the percentage of airport pavements in poor or worse condition has not been met. In 2011, the percent of all runway and parallel taxiways in poor condition exceeds the threshold by the largest margin since any time in the last ten years. The increase in poor pavement condition may be attributed to airports whose local units of government are not eligible to receive federal funding and have limited local funds available. The 2010 Legislature provided special bond funds for airport runway rehabilitation. As a result, 14 airport runways across the state will be rehabilitated over the next two years, likely resulting in a dramatic decrease in the number of runways in poor condition.

Current and historic data for this measure are displayed in **Figure 6-25**. It is important to note when comparing the data across years that two methodology changes have been adopted with the 2011 data. First, for all paved airports the threshold for pavements in "good" condition was moved from greater than or equal to 56 to greater than or equal to 55. This adjustment was made to increase consistency with the pavement reports completed every three years for each airport. Second, 2011 data do not include all taxiway pavements, but rather only those pavements considered parallel taxiways. This adjustment was made to better identify and measure the pavements with the greatest impact on safety.

Airport specific PCI information for runways and parallel taxiways are shown on the individual airport's data sheets included in **Appendix E: Airport Facility Needs Sheets and Report Cards**.

Figure 6-25: Runway and Taxiway Pavement Condition[28]



28 2011 data is for all runway but only parallel taxiway pavements. Pre-2011 good pavements were measured at >= 56 while 2011 is >= 55.

Technical Description: The FAA provides guidance for evaluation of airport pavements. PCI values are assigned based on a visual inspection of the conditioin of the pavement. These values assist engineers in determining the stage and rate at which pavements are degrading. New pavements are rated between a 95 and 100 on the PCI scale. Pavements which degrade beyond a certain PCI rating are unable to be effectively repaired through routine maintenance and must be rehabilitated, which can be costly. If pavements are allowed to degrade even more pavements must be completely reconstructed due to the behavior of the pavement and subgrade. As the pavement conditions deteriorate water and ice can cause damage beyond that of normal wear and tear. Each progression of degradation repair is significantly more burdensome on Federal and State funds.

With properly timed maintenance and repair, pavement rehabilitations and other costly repairs, though eventually unavoidable in the lifecycle of pavements, can be delayed and costs may be minimized. Occasionally pavement reconstructions are necessary, however, to modernize outdated facilities and lower overall life-cycle costs moving forward, which is less costly in the long-term compared to repeated rehabilitation of pavements designed decades ago. It is also worth noting that airport pavements constructed using Federal funds are required to be maintained through the FAA's grant assurance program.

Source(s): MnDOT Office of Aeronautics 2011 MnDOT PCI Report

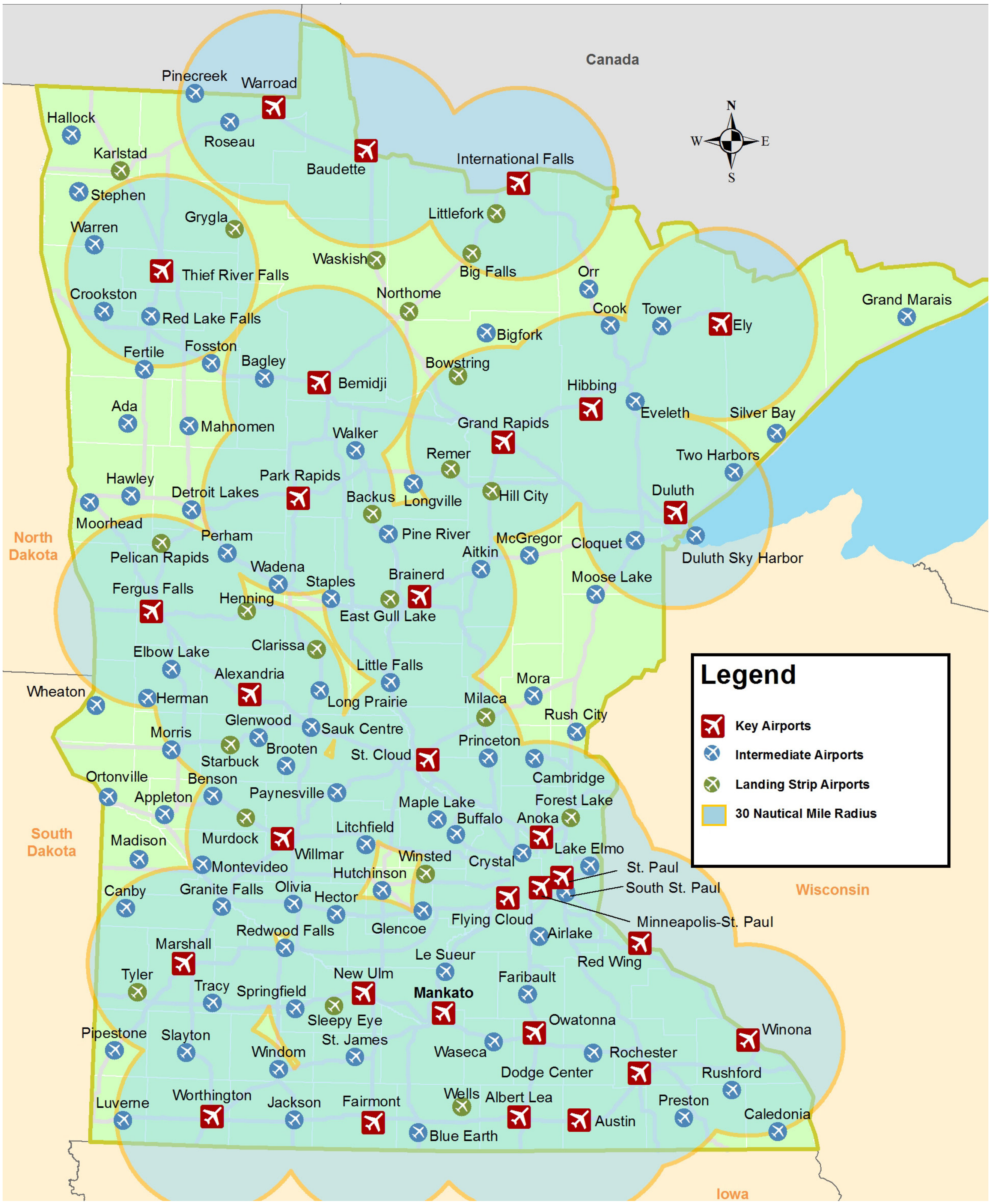
Density Analysis

As noted at the beginning of this chapter, in addition to the performance measures and indicators used to track performance, additional analyses were performed to assist in determining the statewide density of a few critical airport facilities. These analyses help measure access to the air transportation system and also could serve as tool for selecting certain facilities to receive for funding. Key Airport density, crosswind runway location density and available hangar density were analyzed and are presented below.

KEY AIRPORT DENSITY

This analysis determines the density of Key Airports and how much of the state is within 30 nautical miles (NM) of one of these airports. The 30 NM buffer represents less than 30 minutes flying time for even the slowest aircraft and generally represents less than an hour's vehicle drive time assuming a typical road network. **Figure 6-26** shows that these airports are fairly well dispersed across the state and that a large portion of the state and its population is within 30 NM of a Key Airports. From a system standpoint the state appears to have an adequate number of Key Airports with a higher density in the south. Establishment of a new Key Airport would require that a community provide a strong business case that it is needed and justified.

Figure 6-26: Airport Density Analysis



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

CROSSWIND RUNWAY DENSITY

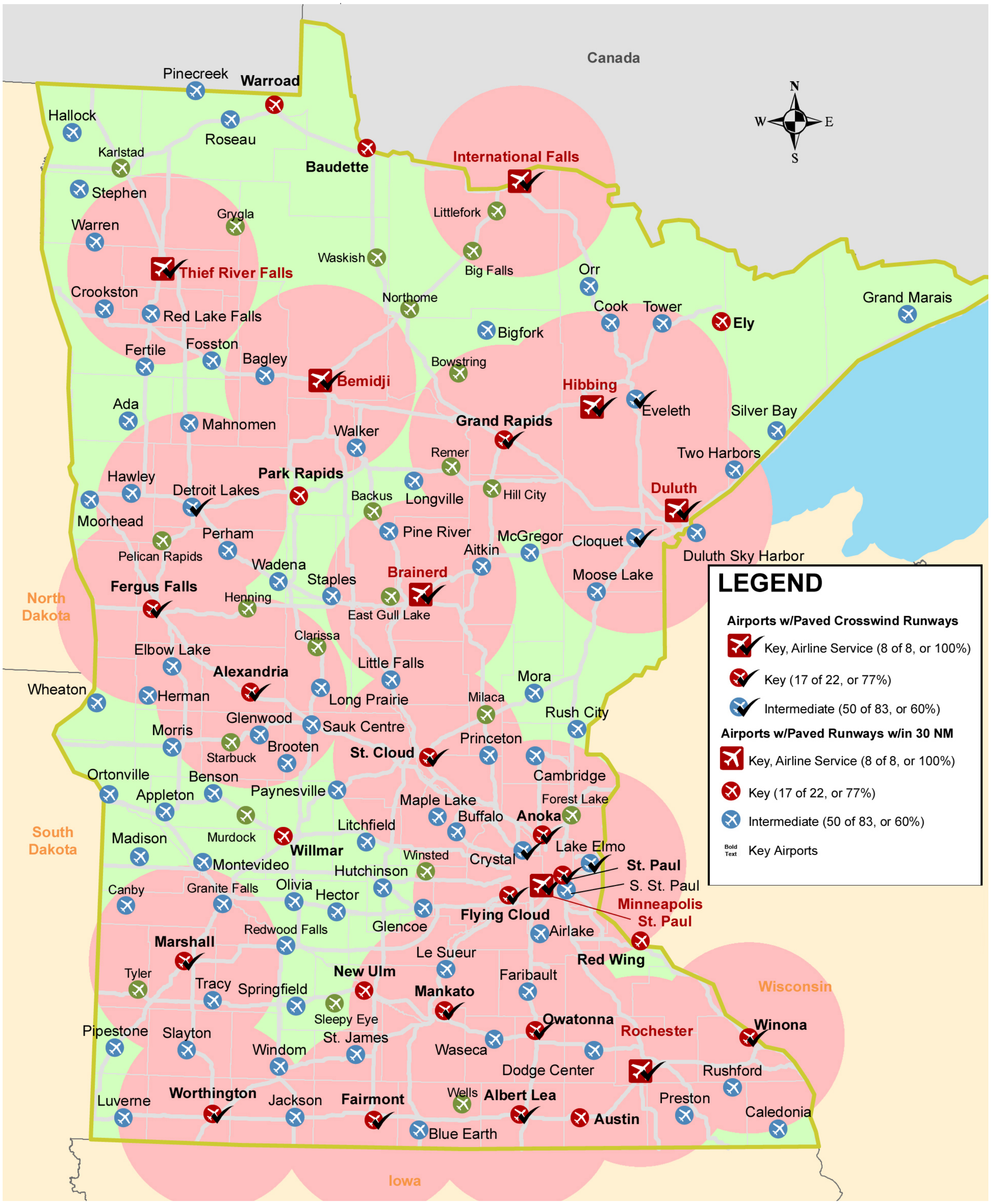
Crosswinds are often a contributing factor in small airplane accidents. Primary runways are generally aligned with the prevailing winds at the airport 's location but there are times when winds are not blowing from the direction of the primary runway and it is during those times that a crosswind runway is desired. Wind conditions affect all airplanes in varying degrees. Generally, the smaller the airplane, the more it is affected by wind, particularly crosswind.

The FAA standards for airport design recommend a crosswind runway be provided for large airplanes when the effective crosswind is more than 20 knots for 5 percent or more of the time. The standards for small airplanes are 10.5 knots. This illustrates the increased sensitivity that small airplanes have to crosswinds. Crosswind runways provide additional wind coverage when winds are not in the direction of the primary runway. A measure of providing a paved and lighted crosswind runway within 30 miles of any airport has been established for performing density analysis. Thirty nautical miles roughly equates to approximately 20 minutes of flying time for those aircraft that are most sensitive to crosswinds. This is 67 percent of the required daytime fuel reserve of 30 minutes and about 50 percent of the required nighttime fuel reserve of 45 minutes.

All eight Key Airports with airline service either have a paved crosswind runway or are within 30 NM of a paved crosswind runway. Seventeen of the 22 other Key Airports, 50 of the 83 Intermediate Airports and 17 of the 22 Landing Strip Airports have or are within 30 NM of a paved crosswind runway. As a result, 68 percent of the airports are within 30 NM of a paved crosswind runway.

Figure 6-27 identifies those airports with paved crosswind runways and a 30 NM buffer. As evidenced by the figure, the state is well covered in the Twin Cities Metropolitan Area as well as the southern part of the state. Adding a crosswind runway at an airport where gaps in coverage exist could improve safety and reduce accidents.

Figure 6-27: Crosswind Runway Density Analysis



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis

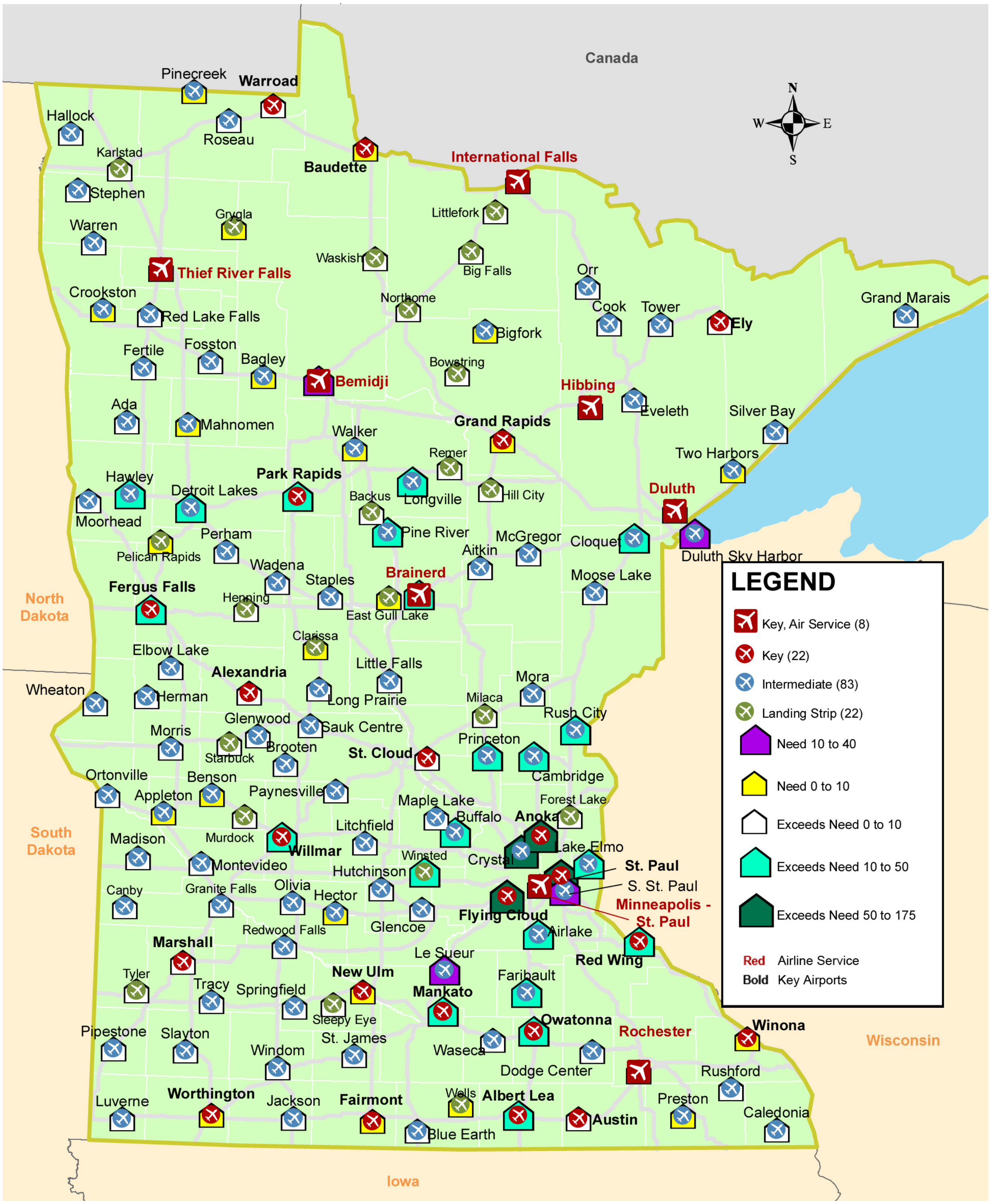
AVAILABLE HANGAR DENSITY

There are two primary types of airplane hangars, conventional and T-hangars. Conventional hangars typically can accommodate one or more aircraft whereas T-hangars are individual units designed to hold just one aircraft at a time.

A hangar density analysis was conducted to identify areas of the state where there exists an excess of hangars and where there may be a shortage. Hangar space was estimated based upon the number of T-Hangar units and conventional hangar square footage and is provided on the individual airport facility sheets contained in **Appendix E: Airport Facility Needs Sheets and Report Cards**.

Hangar needs for 2010 and 2030 were compared to the existing facilities as identified during the inventory stage of the planning process. **Figure 6-28** shows hangar needs and hangar excess in 2010 and 2030. One example of how this analysis can be applied considers two airport such as Albert Lea and Austin which both have been identified as having an excess of hangars. However, nearby Preston and Wells airports are both identified as needing additional hangars. One option for consideration would be having aircraft owners consider storing their aircraft at a nearby airport where there is available space, rather than making the large investments necessary to construct a new hangar. It is noted, however, that many factors are considered when aircraft owners choose where to store their aircraft.

Figure 6-28: Available Hangar Density Analysis



Source: MnDOT Office of Aeronautics 2011 Inventory Survey and Airport Database & HNTB Analysis