CHAPTER 4: FACILITY REQUIREMENTS

Introduction

This chapter of the Airport Master Plan analyzes the existing and anticipated future facility needs at the Warren Municipal Airport (D37). The report is divided into sections that assess the needs of primary airport elements including airside, general aviation, support and landside facilities.

Airside requirements are those necessary for the operation of aircraft. Landside requirements are those necessary to support airport, aircraft and passenger operations. Proposed airport needs are based on a review of existing conditions, capacity levels, activity demand forecasts and airport design standards using FAA guidance and industry standards. This chapter identifies existing facility deficiencies along with facility needs to meet demand through the planning period. The level of review completed is sufficient to identify major elements that should be addressed in this comprehensive airport plan.

This chapter provides a review of the facility needs for the following airport infrastructure categories:

- Airside Facilities
- General Aviation
- Support Facilities
- Landside Facilities

Specific alternatives that propose solutions to address facility needs are evaluated in **Chapter 5: Alternatives Analysis**.

Planning Activity Levels (PALs)

There are various airport activity measures used to determine airport facility requirements including annual operations, peak hour activity, and based aircraft. Airport activity can be sensitive to industry changes, national and local economic conditions. This results in difficulty in identifying a specific calendar year for associated demand-driven improvements.

For this study, PALs are used to identify demand thresholds for many recommended facility improvements. If an activity level is approaching a PAL, then the airport should prepare to implement the improvements. Alternatively, activity levels that are not approaching a PAL can allow improvements to be deferred. The demand forecasts developed in this study correspond to an anticipated planning level calendar year to each PAL (2026, 2031, 2036, 2041) from the preferred aviation forecasts as seen in **Table 4-1**.

Table 4-1 – Planning Activity Levels (PALs)

Key Activity Metrics	Base	PAL 1	PAL 2	PAL 3	PAL 4
Forecast Year	**2021**	**2026**	**2031**	**2036**	**2041**
Operations	9,061	9,594	10,159	10,756	11,389
Based Aircraft	8	8	8	9	9

Source: KLJ Analysis

Airside Facilities

Airfield Design Standards

Airport design standards provide basic guidelines for a safe, efficient, and economic airport system. FAA guidance is found in FAA AC 150/5300-13B, *Airport Design*. Careful selection of basic aircraft characteristics for which the airport will be designed is important. Airport designs based only on existing aircraft can severely limit the ability to expand the airport to meet future requirements for larger, more demanding aircraft. Airport designs that are based on large aircraft unlikely to operate at the airport are not economical.

Key FAA airport design standards are listed below. More information on this topic can be found in **Appendix B: General Aviation Airports 101.**

- Critical Design Aircraft
- Airfield Design Classifications
    - Aircraft Approach Category (AAC)
    - Airplane Design Group (ADG)
    - Approach Visibility Minimums
- Airport Reference Code (ARC)
- Runway Design Code (RDC)
- Runway Reference Code (RRC)
- Taxiway Design Group (TDG)
- Other Design Considerations
    - Meteorological Considerations
    - Taxiway Configuration
    - Airspace Zoning Protection
    - Airfield Line of Sight
    - Environmental Factors

Critical Design Aircraft

The critical design aircraft types must be identified to determine the appropriate airport design standards to incorporate into airport planning. The existing and future critical design aircraft characteristics at Warren Municipal Airport (D37) are summarized in the following sections.

The overall design aircraft fleet mix is currently an ARC B-II, TDG 1-B airplane. The heaviest aircraft to regularly use the airport is approximately up to 16,000 pounds maximum takeoff weight (single wheel). As stated in the Forecast Chapter 3, the Air Tractor 802 was decided as the critical aircraft for those types of aircraft are based at the airport currently and make up a large number of the VFR operations. There are some King Air B200 aircraft operations that stop in for medical flights, this aircraft is a B-I (small). **Figure 4-1** depicts a variety of aircraft separated by ARC that currently operate in and out of the Warren Municipal Airport.

Figure 4-1 – Example ARC Aircraft

ARC A-I/Small Aircraft		ARC A-II/Small Aircraft	
Piper Archer		Pilatus PC-12	
ARC B-II/Small Aircraft		**ARC B-II Aircraft**	
Beech Baron 58		Air Tractor 802	
Cessna 421		Beech King Air 200	

Source: KLJ Analysis, Wikipedia.org, Airliners.net & UND Fleet

SUMMARY

The existing and ultimate design airplane characteristics for each runway is described in **Table 4-2**. Based on current trends, the future fleet mix for D37 is not expected to change appreciably. The forecast fleet mix is based on regional and local trends and does show a slight increase in operations for all aircraft but with the same constant type of aircraft. The critical design aircraft will remain the Air Tractor 802.

Table 4-2 – Existing & Ultimate Airfield Design Aircraft Summary

Design Characteristics	Runway 12-30	Runway 4-22
Aircraft Make/Model	Air Tractor 802	A/B-I Grouping
Airplane Approach Category	B	A/B
Airplane Design Group	II	I (Small)
Taxiway Design Group	1-B	1-A
Wingspan	59’ 3”	<49’ 0”
Length	37’ 6”	N/A
Height	11’ 2”	<20’ 0”
Cockpit to Main Gear	8’ 4”	N/A
Main Gear Width	10’ 0”	N/A
Approach Speed (1.3 x Stall)	103 knots	Less than 91 knots
Maximum Takeoff Weight	16,000 pounds	12,500 pounds
Landing Gear Configuration	Single Wheel	Single Wheel

Source: Air Tractor, KLJ Analysis

Meteorological Considerations

Meteorological conditions that affect the facility requirements of an airport include but are not limited to wind direction, wind speed, cloud ceiling, visibility, and temperature. Hourly metrological data was reviewed data from the Crookston Municipal Airport (CKN) Automated Weather Observation System III (AWOS-III) facility available from the National Climatic Data Center (NCDC). Periodic "special" weather observations within each hour were removed. This method considers the true average weather trends at an airport without skewing conditions toward IFR where multiple observations may be taken each hour due to changing conditions.

Wind coverage and weather conditions are evaluated based on the two different flight rules, VFR and IFR. Visual Meteorological Conditions (VMC) are encountered when the visibility is 3 nautical miles or greater, and the cloud ceiling height is 1,000 feet or greater. Conditions less than these weather minimums are considered Instrument Meteorological Conditions (IMC) requiring all flights to be operated under IFR.

WEATHER REPORTING

As stated in the inventory chapter, there is currently no weather reporting system for D37. Both AWOS and an Automated Surface Observing System (ASOS) are types of weather observation stations and report conditions in the immediate vicinity of the airport. The medical flights that operate under the Code of Federal Regulations (CFR) Title 14 Part 135: Operating Requirements states

> *"no pilot may begin an instrument approach procedure to and airport unless 1) that airport has a weather reporting facility operated by the U.S. National Weather Service... and 2) the latest weather report issued by that weather reporting facility indicates that weather conditions are at or above the authorized IFR landing minimums for that airport."*

If medical centers in the area are planning to expand or medical aircraft operations are planning to increase it would be in the interest of the Warren Municipal Airport to add a weather reporting system. **It is recommended an AWOS-III be installed.** This will provide altimeter setting, density altitude, dew point, temperature, wind data and visibility.

WIND COVERAGE

Wind coverage is important to airfield configuration and utilization. Aircraft ideally takeoff and land into a headwind aligned with the runway orientation. Aircraft are designed and pilots are trained to land aircraft during limited crosswind conditions. Small, light aircraft are most affected by crosswinds. To mitigate the effect of crosswinds, FAA recommends runways be aligned so that excessive crosswind conditions are encountered at most 5 percent of the time. This is known as a "95 percent wind coverage" standard. Each aircraft's AAC-ADG combination corresponds to a maximum crosswind wind speed component.

Small Aircraft Crosswind Landing Diagram (faasafety.gov)

Even when the 95 percent wind coverage standard is achieved for the design airplane or airplane design group, cases arise where certain airplanes with lower crosswind capabilities are unable to utilize the primary runway. The maximum crosswind component for different aircraft sizes and speeds are shown in **Table 4-3**.

Table 4-3 – FAA Wind Coverage Standards

AAC-ADG	Maximum Crosswind Component
A-I & B-I	10.5 knots
A-II & B-II	13.0 knots

Source: FAA AC 150/5300-13B – Airport Design

Wind coverage for the airport is separated into all-weather and IMC periods. All-weather analysis helps determine runway orientation and use. Local weather patterns commonly change in IMC. An IMC review helps determine the runway configuration for establishing instrument approach procedures.

As shown earlier from **Table 2-7** in **Chapter 2: Airport Inventory**, **the current runway configuration does not meet FAA standards for 95 percent overall all-weather wind coverage.** The prevailing winds are still from the North-Northwest but to meet FAA standards, a runway in the alignment of 14-32, 15-33, or 16-34 would get around 97.44% all weather wind coverage with a crosswind runway.

Table 2-9 reviewed the IMC wind coverage for the airfield. Runway 12-30 is currently the only runway capable of accommodating operations in IMC. Wind coverage to this runway however does not meet recommended levels for the design aircraft during IMC. When analyzed by runway end, the Runway 30 End was favorable during IMC but only by a marginal amount when compared to the Runway 12 end. The Runway 30 End currently has a published instrument approach procedure. It has been mentioned an instrument approach to the Runway 12 End would be favorable for medical operations. During this study improving IFR coverage was determined to not be a priority.

WEATHER CONDITIONS

Cloud Ceiling & Visibility

When IMC weather conditions occur, aircraft must operate under IFR and utilize instrument approach procedures to the runway. These IMC conditions drive the need to accommodate instrument approach procedures with sufficient weather minimums to enhance airport utilization.

Current GPS instrument approach weather minimums are 592-foot cloud celling and 1-mile flight visibility for Runway 30. Weather conditions are broken down into occurrence percentages based on current instrument approach minimums in the following table.

Table 4-4 – Meteorological Analysis

Weather Condition	Cloud Ceiling Minimum	Visibility Minimum	Total Observation Percentage	Hours Per Year (avg.)
VMC	1,000 feet	3 miles	91.84%	8,045
Usable IMC	592 feet	1 mile	2.91%	255
Additional Capture	300 feet	3/4 mile	1.08%	941
Closed (Below Minimums)	< 300 feet	< 3/4 mile	4.17%	365

Source: National Climatic Data Center data from CKN AWOS (2012-2021; hourly), KLJ Analysis
**Additional capture assumes IFR minimums lowered to 300-foot cloud ceiling and 3/4-mile flight visibility.*

If increased airport utilization is desired by D37, it is recommended the airport take steps to lower the cloud ceiling then flight visibility approach minimums to as low 300 feet ceiling and ¾ mile visibility on Runway 30 End. Options for implementing improvements will be evaluated in **Chapter 5: Alternatives Analysis**.

Infrastructure and navigational aid standards for improvements are outlined further in this chapter. Options for improvements will be evaluated in **Chapter 5: Alternatives Analysis**.

Temperature

Average high temperature data for the hottest month was reviewed from climate data available from the NCDC for D37. Using locally available data, the average high temperature in the hottest month from 2006-2020 was 82.0 degrees Fahrenheit. This NCDC data from 1991-2020 indicates the average high temperature in July to be 80.6 degrees Fahrenheit. Temperature affects recommended runway lengths.

Runway 12 End

After talking to local pilots, it was brought to our attention that on final approach for the 12 End, the aircraft encounter a sudden change in airspeed near the threshold. It is unclear why this is happening constantly but have heard from numerous users a couple of factors they believe is attributing to this issue. These could be the trees around the Runway 12 threshold, surrounding swamp and wetlands, thermal properties of nearby land, and possibly terrain. This is a safety concern because aircraft are already at a lower altitude and slower airspeed for landing so there is little response time for correction or altitude to recover. **There does not seem to be a clear answer at this time, and it is recommended a separate study evaluating the possible causes and recommendations to mitigate the problem be carried out. The work could likely be done by University of North Dakota Aerospace students.**

Runways

Runway 12-30: This runway is 3,199 feet long and 75 feet wide. The runway is currently designed to accommodate non-precision 1-mile instrument approaches on the 30 End and visual approaches with a displaced threshold on the 12 End. Aircraft weights not exceeding 26,000 pounds for single wheel aircraft. The runway's pavement is in good condition. Last major reconstruction/rehabilitation took place in 2012. This runway is equipped with Medium Intensity Runway Lighting (MIRL) and has non-precision pavement markings. For this planning study there are no recommendations for Runway 12-30.

Runway 4-22: This is the crosswind turf runway that is 2,578 feet long and 200 feet wide. The surface is in good condition and marked with yellow cones for visual approaches. There are no recommendations for improvements for Runway 4-22.

CONFIGURATION

Runway 12-30 and Runway 4-22 intersect near their midpoints. **There is currently no parallel taxiway for Runway 12-30, but it is recommended a full parallel taxiway be constructed for this paved runway.**

RUNWAY DESIGN CODE

The design aircraft and instrument approach minimums drive the RDC designation for each runway. For Runway 12-30 the current RDC is B-II-5000 (Not lower than 1 mile), and Runway 4-22 has an RDC of an A/B-I(Small)-Visual. Both RDC's will continue to be the same for this planning period.

RUNWAY REFERENCE CODES

Runway Reference Codes (RRCs) indicate current operational capabilities where no special operations procedures are necessary, and without consideration of the actual runway length. The existing operational capabilities of the runway is identified based on a taxiway separation distance. Because there is no parallel taxiway currently there are no approach or departure reference codes (APRC/DPRC). **For the future parallel taxiway for Runway 12-30 the APRC will be B-II-Visual for the 12 End and B-II-5000 (not lower than 1 mile) for the 30 End. Future DPRC codes for both runway ends will be B-II.**

DESIGN STANDARDS

Basic Safety Standards

One primary purpose of this master plan is to review and achieve compliance with all FAA safety and design standards. The design standards vary based on the RDC and RRC as established by the design aircraft. Some of the safety standards include:

- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)

Other basic design standards include runway width, runway surface gradient, runway shoulder width, blast pad, and required separation distances to markings, objects, and other infrastructure for safety. Critical areas associated with navigational aids as well as airspace requirements are described further in this chapter.

The current runway end turnarounds are within the existing RSA, ROFA and ROFZ standards. **It is recommended that the turnarounds be moved out of the safety surfaces.** No further improvements will need to be made to meet future standards.

Other Design Standards

The Runway 12 End has a displaced threshold 190 feet from the pavement threshold that is suitable for landing but not takeoff of aircraft. These are usually put in place to accommodate safety surfaces, to mitigate incompatible land use for the RPZ, or obstacle clearance. If the 12-30 Runway where to be extended a displaced threshold should be reevaluated.

Because D37 has intersecting runways a Runway Visibility Zone (RVZ) exists to prevent obstructions from blocking a pilots view and keep a clear Line of Sight (LOS). There are currently no obstructions to the RVZ. Any future updates to the apron area needs to keep structures and aircraft parking outside of the RVZ. Any lengthening or shortening of a runway will adjust the RVZ.

LAND USE CONTROL

Runway Protection Zone

The Runway Protection Zone (RPZ) is a trapezoidal land use area at ground level prior to the landing threshold or beyond the runway end. The RPZ's function is to enhance the protection of people and property on the ground. The RPZ size varies based on the runway's RDC.

Airport owners should, at a minimum, maintain the RPZ clear of any incompatible activities, such as residential structures or areas of public assembly. Protection of the RPZ is achieved through airport control over RPZs including fee title ownership or clear zone easement.

Minnesota State Highway 1 runs 900 feet through the Runway 12 End RPZ and about 540 feet through the Runway 22 End RPZ west and east. About 800 feet from the Runway 12 End Highway 1 intersects with 310th Avenue NW which runs about 830 feet through the RPZ and about 470 feet through the Runway 4 End RPZ running north and south.

The land uses in the existing RPZs appear to be acceptable now. Further review is required if new land uses, runway end locations or a change in the size of the RPZ is proposed and a land use requiring FAA coordination is in the RPZ.

D37 should consider acquiring land to control all existing, future, and ultimate RPZs in fee simple or land use easement.

MnDOT Clear Zone

As discussed in **Chapter 2: Airport Inventory**, MnDOT Aeronautics encourages airport sponsors to acquire and maintain each CZ for the ultimate development of the airport. The policy states that State participation in improvement projects may be limited to those airports that have adequate CZs.

D37 should plan to acquire land to control all future and ultimate CZs to meet MnDOT expectations. If D37 cannot purchase the necessary land, then a clear zone acquisition plan (CZAP) will need to be submitted. A CZAP will not be a part of this planning study and will be discussed further in Chapter 6: Implementation along with the timing.

The state also requires the clear zone *"must be maintained free of airspace obstructions and in a manner that prevents congregations of people"* and must be controlled and maintained. There is currently Minnesota Highway 1 in the Runway 12 and 22 Clear Zones and 310th Avenue NW in the Runway 12 and 4 Clear Zones. There are currently no recommendations to move the roadways out of the clear zones.

MnDOT Safety Zones

The state of Minnesota requires safety zones as described previously in **Chapter 2** and these safety zones for D37 can be found in **Figure 2-7**. The safety zones at the airport currently exceeds the needed minimums the state requires and means that certain restrictions are set into place within each zone.

The airport should continue to meet the minimum requirements by the state while considering the influence of these safety zones on the surrounding community. Any changes to the runway thresholds will also require updating the zoning.

Land Acquisition

Land acquisition allows the airport to protect airspace and land use areas from possible intrusions. FAA encourages the airport sponsor to own the following land for existing and planned airport facility:

- Airport Infrastructure
- Runway and Taxiway Object Free Areas
- Runway Protection Zones
- Building Restriction Line
- Navigational Aid Critical Areas
- Airspace Protection

Identified land acquisition areas to help meet current standards include acquiring 2.10 acres for the Runway Object Free Area (ROFA) and another 2.10 acres for the planned parallel taxiway. As stated above, the City needs to control all land in fee or easement for the RPZs and CZs. Land required for future development will be identified in **Chapter 5: Alternatives Analysis**.

RUNWAY LENGTH

Runway 12-30 is the longest runway at D37 with a length if 3,199 feet. As of the date this Master Plan study was initiated, FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design* was the current guidance for determining runway lengths at airports. A detailed analysis using these two methods including FAA runway length charts and aircraft performance data is in **Appendix D: Runway Length Evaluation**.

Small Airplanes Up to 12,500 Pounds

The FAA design approach to determine recommended runway length in small aircraft is identified in Chapter 2 of FAA AC 150/5325-4B. The method requires several steps to be performed including identifying percentage of fleet and using airport data to calculate runway length based on curves. Calculations for D37 are identified in **Table 4-5**.

Table 4-5 – FAA AC 150/5345-4B Runway Length Requirements (≤ 12,500 lbs.)

Airport and Runway Data	
Airport Elevation	888 feet
Mean Daily Maximum Temperature of Hottest Month	80.6°F
Current Length (Runway 12-30)	3,199 feet
Aircraft Classification	**Recommended Runway Length**
Small Airplanes 12,500 Pounds or less	
10 or more passenger seats	4,140 feet
Less than 10 passenger seats at 100 percent of fleet	3,800 feet
Less than 10 passenger seats at 95 percent of fleet	**3,190 feet**

Source: FAA AC 150/5325-4B, KLJ Analysis
Note: Runway length requirements estimated based on charts for airport planning purposes only.

For small general aviation flight training aircraft, the FAA runway length requirements of 95 percent of fleet would apply at D37. **The recommended runway length for small general aviation aircraft is 3,190 feet.** This matches the existing runway length for Runway 12-30 and should maintain this length through the planning period. This length also meets the FAA recommended minimum runway length of 3,200 feet exists for runways accommodating circling and non-precision instrument approaches with visibility minimums as low as ¾ mile.

RUNWAY PAVEMENT CONDITION

Airfield pavements should be adequately maintained, rehabilitated, and reconstructed to meet the operational needs of the airport. The published pavement strength is based on the construction materials, thickness, aircraft weight, gear configuration and operational frequency for the pavement to perform over its useful life.

The typical useful life of a bituminous pavement ranges from 20 to 30 years if properly maintained. The useful life for a concrete pavement can extend to 40 years and beyond. In 2021 the Minnesota Department of Transportation Office of Aeronautics completed a pavement condition report for D37. A summary of the existing runway pavement condition with recommendations is contained in **Table 4-6**:

Table 4-6 – Runway Pavement Condition & Recommendations

Runway ID	Pavement Condition Index (PCI)	Action Plan (Lowest PCI)		
		0-5 Years	6-10 Years	11-20 Years
Runway 12-30	80	Maintain	Maintain	Rehab

Source: Minnesota Department of Transportation Office of Aeronautics Pavement Condition Report (2021), KLJ Analysis

The runway is asphalt and is sufficient to accommodate the design aircraft of 26,000 pounds or less. The last major construction for the runway was August 2012 and is in Very Good condition. **It is recommended to continue to maintain Runway 12-30 and plan for rehabilitation toward the end of this master planning period.**

RUNWAY WIDTH

Runway width is driven by the RDC and approach visibility minimums for each runway as identified in FAA AC 150/5300-13B. Based on the existing and recommended future design standards, no changes are recommended to the existing runway widths.

DEFICIENCIES TO DESIGN STANDARDS

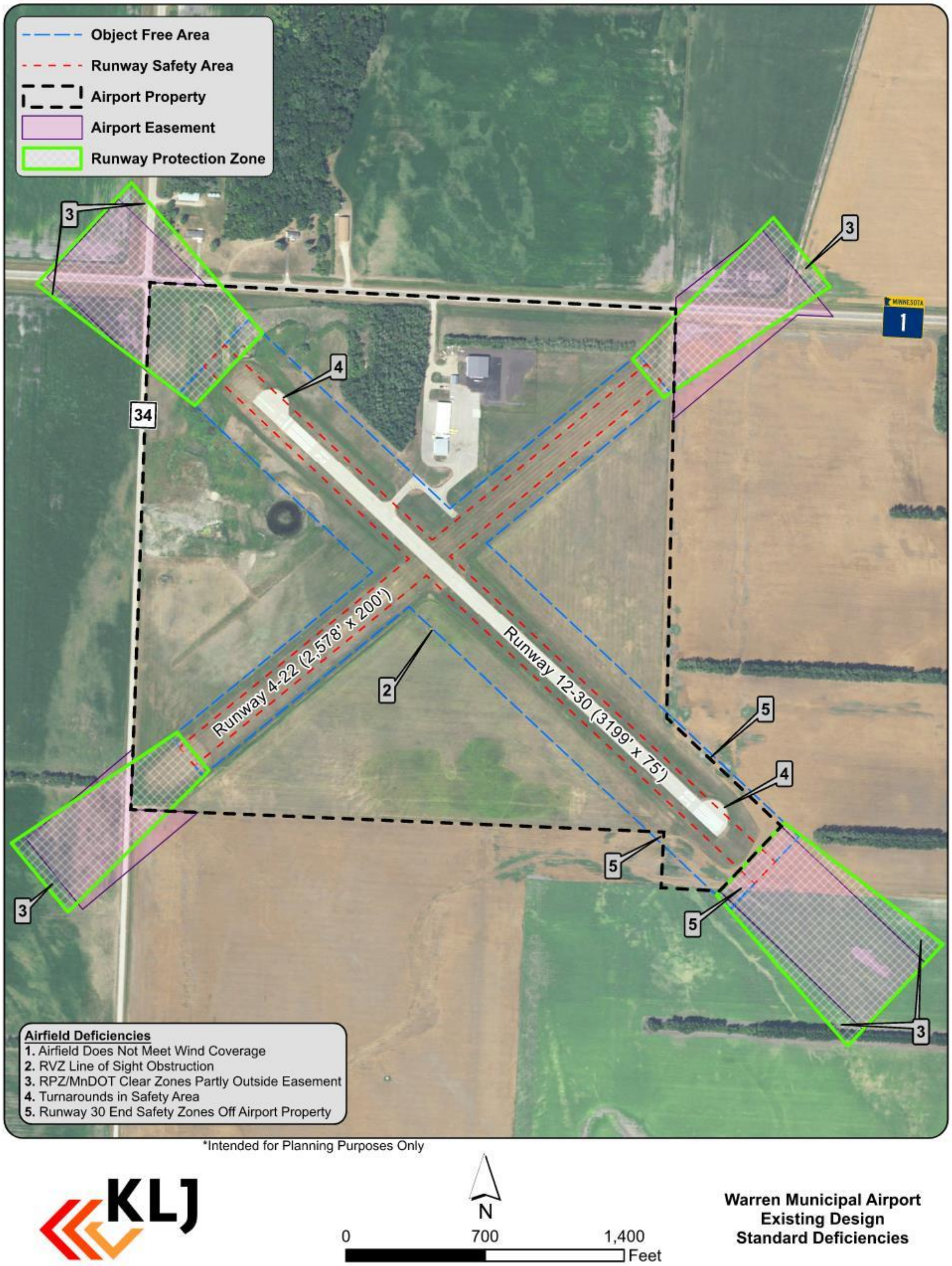
Known deficiencies to the existing runway design standards at D37 include:

- **95 Percent Recommended Wind Coverage**
  - Deficiency: The current runway configuration and runway ends do not meet the recommended FAA overall all-weather wind coverage.
  - Action Plan: No action during this planning period.
- **Runway 12-30 End Turnarounds within the Safety Zones**
  - Deficiency: Both runway end turnarounds are within the existing RSA, ROFA and ROFZ.
  - Action Plan: When the parallel taxiway is constructed the turnarounds will be removed.
- **Land Acquisition and Control**
  - Deficiency: The airport should control roughly 21 acres of land off the runway ends for the RPZs and MnDOT Clear Zones. An additional 2.10 acres of land needs to be purchased for the Runway 30 end ROFZ. Then, another 2.10 acres needs to be purchased for the future parallel taxiway on the Runway 30 end. In total the airport needs to acquire/control 25 acres of land.
  - Action Plan: The airport needs to begin planning for land acquisition or possible land trades to protect the airfield and airspace.

Any existing deficiencies to airport design standards will be noted in the ALP.

Figure 4-2 depicts the existing airfield design standards, deficiencies and key facility needs.

Figure 4-2 – Airfield Design Deficiencies



Airspace Protection

Airspace is an important resource around airports that is essential for safe flight operations. As of the time of this report, an obstruction analysis was completed to identify obstructions to Part 77 and other airspace surfaces utilizing Aeronautical Survey data collected in October 2022. **There is a road penetrating the Runway 12 End and trees penetrating the Runway 30 and Runway 4 End to the existing FAA airport design runway approach (threshold siting) surfaces. The trees are recommended to be removed.** The full results of this analysis will be identified in the ALP drawing set.

AREA AIRSPACE

The existing Class G airspace with Class E airspace beginning at 700 feet AGL is considered sufficient to support any enhancement to instrument approach procedures. Approach and departure services are provided by Minneapolis ARTCC.

PART 77 CIVIL AIRPORT IMAGINARY SURFACES

Title 14 CFR (Code of Federal Regulations) Part 77 *Safe, Efficient Use, and Preservation of the Navigable Airspace* is used to determine whether man-made or natural objects penetrate "imaginary" three-dimensional airspace surfaces and are obstructions. There are no changes recommended for approach surfaces during this planning study. Please reference **Table 2-13** in **Chapter 2: Airport Inventory** to review the current Part 77 approach airspace standards.

Any existing, future, or ultimate Part 77 obstructions located around D37 will be identified on the ALP for further action.

RUNWAY APPROACH/DEPARTURE SURFACES

FAA identifies sloping approach surfaces that must be cleared at an absolute minimum for safety for landing aircraft. These surfaces are identified in Table 3-2 of FAA AC 150/5300-13B.

The departure surface applies to runways with instrument departures available. It begins at the end of the takeoff distance available and extends upward and outward at a 40:1 slope. No new penetrations are allowed unless an FAA study has been completed and a determination of no hazard has been issued.

The applicable approach/departure surface standards are identified in **Table 4-7**:

Table 4-7 – Approach/Departure Surface Requirements

Runway End(s)	Surface Type Paragraph 3.6	Description	Slope
Existing			
12	3	Approach ends of runway serving large airplanes (>12,500 lbs.)	20:1
30	4	Approach ends of runway that support IFR circling procedures and procedures only providing lateral guidance greater than or equal to ¾ statute mile	20:1
4 & 22	2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more.	20:1
Future & Ultimate			
No recommended changes			

Source: FAA AC 150/5300-13B, KLJ Analysis

There are penetrations to the existing Runway 12 and 30 instrument departure surfaces that are noted in FAA publications (see adjacent figure). All existing FAA approach surfaces are clear of obstructions.

Airspace surface obstructions and mitigation options for future runway configurations will be evaluated in **Chapter 5: Alternatives Analysis**. Mitigation options generally include obstruction removal, lighting/marking, declared distances and/or adjustment of the visual guidance slope indicator angle. Other long-term options include reconfiguring the runway or modifying design standards. New development should be clear of airspace surfaces.

WARREN, MN

WARREN MUNI (D37)

TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES

ORIG-A 08JAN15 (15008) (FAA)

TAKEOFF MINIMUMS:

Rwys 4, 22, NA-Environmental.

DEPARTURE PROCEDURE:

Rwy 30, climb runway heading to 1400 before turning on course.

TAKEOFF OBSTACLE NOTES:

Rwy 12, trees beginning 379' from DER, 306' left of centerline, up to 86' AGL/973' MSL.
Light support structure 3' from DER, 17' right of centerline, 2' AGL/888' MSL.
Trees beginning 926' from DER, left and right of centerline, up to 71' AGL/955' MSL.
Rwy 30, trees beginning 30' from DER, 86' right of centerline, up to 15' AGL/904' MSL.
Trees, poles and antenna beginning 331' from DER, 373' right of centerline, up to 62' AGL/948' MSL.
Trees and bush beginning 51' from DER, 36' left of centerline, up to 68' AGL/954' MSL.
Vehicles on road beginning 233' from DER, 179' right of centerline, up to 15' AGL/906' MSL.

FAA AERONAUTICAL SURVEYS

The FAA has implemented Aeronautical Survey requirements per FAA AC 150/5300-18B: *General Guidance and Specifications for Submission of Aeronautical Data to NGS: Field Data Collection and Geographic Information System (GIS) Standards*. FAA airport survey requirements require obstruction data to be collected using assembled aerial imagery for the airport. This data is used in aeronautical publications and to develop instrument approach procedures.

An aeronautical survey and imagery acquisition took place at the beginning of this planning study in October 2022. When safety-critical areas are affected at the airport because of construction or removal, an update to the new aeronautical survey is typically required.

Navigational Aids (NAVAIDs)

Airfield NAVAIDs are any ground or satellite based electronic or visual device to assist pilots with airport operations. They provide for the safe and efficient operations of aircraft on an airport or within the vicinity of an airport. The type of NAVAIDS required are determined by FAA guidance based on an airport's location, activity and usage type.

AREA NAVIGATION

For area navigation (RNAV), satellite-based NAVAIDs will primarily be used for air navigation with ground-based NAVAIDs used for secondary purposes. Wide Area Augmentation System (WAAS) provides the framework for satellite–based navigation and approach procedures.

RUNWAY APPROACH

Other NAVAIDs are developed specifically to provide "approach" navigation guidance, which assists aircraft in landing at a specific airport or runway. These NAVAIDs are electronic or visual in type. FAA Order 6750.16D, *Siting Criteria for Instrument Landing Systems* and FAA Order 6850.2B, *Visual Guidance Lighting Systems* defines the standards for establishing these systems.

Visual Guidance Slope Indicator (VGSI)

A VGSI system provides visual descent guidance to aircraft on approach to landing. A Precision Approach Path Indicator (PAPI) system is a typical VGSI system installed on runway ends to enhance visual vertical guidance to the runway end. The 2-light system is for non-jet runways and the 4-light system is for jet-capable runways. **D37 does not currently have a VGSI system though it is recommended to add PAPIs on both ends of Runway 12-30 in the future.**

AIRFIELD VISUAL

Visual NAVAIDs provide airport users with visual references within the airport environment. They consist of lighting, signage, and pavement markings on an airport. Visual NAVAIDS are necessary airport facility components on the airfield, promoting enhancing situational awareness, operational capability, and safety. FAA AC 150/5340-30, *Design and Installation of Airport Visual Aids* defines the standards for these systems.

Airport Beacon

The airport beacon serves as the airport identification light so approaching pilots can identify the airport location from sunset to sunrise. The airport beacon's location at D37 adequately serves the airport without known obstructions to its line of sight. The minimum light beam angle is 2 degrees.

Runway Lighting

Runway edge lights are placed off the edge of the runway surface to help pilots define the edges and end of the runway during night and low visibility conditions. Runway 12-30 is equipped with medium intensity runway lighting (MIRL), and this should be maintained through the planning period.

Taxiway Lighting

Taxiway edge lighting delineates the taxiway and apron edges. There are currently only reflectors for the connecting taxiway to the apron. **Medium Intensity Taxiway Lighting (MITL) should be installed for any parallel taxiway system to Runway 12-30.**

Lighting Activation

Currently, runway lighting is active from sunrise to sunset. **It is recommended to install pilot-controlled lighting (PCL) which would use the Common Traffic Advisory Frequency (CTAF).**

Airfield Signage

D37 has mandatory, location, and directional signage on the airfield. All types of signage are lighted and marked in accordance with FAA AC 150/5340-18F, Standards for Airport Sign Systems. Upgraded signs are recommended when lighting is replaced.

Pavement Markings

Pavement markings help airport users visually identify important features on the airfield. FAA has defined numerous different pavement markings to promote safety and situational awareness as defined by FAA AC 150/5340-1, *Standards for Airport Markings*.

The minimum required runway markings for a standard runway are as follows:

- Visual (landing designator, centerline)
- Non-Precision (landing designator, centerline, threshold)
- Precision (landing designator, centerline, threshold, aiming point, touchdown zone, edge)

Warren currently has non-precision runway markings, standard displaced threshold markings on the Runway 12 End, and the current hold lines meet the minimum standards for a B-II design category of 200 feet from runway centerline. All pavement marking should be maintained and repainted when needed.

METEOROLOGICAL

Aircraft operating to and from an airport require meteorological aids to provide current weather data. Airports have various aids installed providing local weather information.

Surface Weather Observation

There is no weather observation system at D37. **An Automated Weather Observation System (AWOS) is recommended to be installed south of the runway intersection.**

Wind Cone(s)

Wind cones allow pilots to instantly obtain real-time wind direction and speed information. It is recommended the airport maintain their current lighted wind cone in the same location.

COMMUNICATIONS & ATC

The ability for pilots to communicate with other pilots and air traffic control (ATC) is critical for the safety and efficiency of the overall air transportation system. D37 will continue to be an uncontrolled airport. Communications with ATC are made possible through an on-site transmitter allowing communications at lower altitudes. Radar coverage is available starting at approximately 5,000 feet MSL. Coverage with ATC is expected to be enhanced at lower altitudes with the establishment of satellite-based ADS-B infrastructure over time. No airport action is necessary now.

Taxiways

Taxiways provide for the safe and efficient movement of aircraft between the runway and other operational areas of the airport. The taxiway system should provide critical links to airside infrastructure, increase capacity and reduce the risk of an incursion with traffic on the runway. The taxiway system should meet the standards design requirements identified in FAA AC 150/5300-13B.

DESIGN STANDARDS

FAA identifies the design requirements for taxiways. The design standards vary based on individual aircraft geometric and landing gear characteristics. The Taxiway Design Group (TDG) and Airplane Design Group (ADG) identified for the design aircraft using a particular taxiway. Some of the safety standards include:

- Taxiway Width
- Taxiway/Taxilane Safety Area (TSA)
- Taxiway Edge Safety Margin (TESM)
- Taxiway/Taxilane Object Free Area (TOFA)

Other design standards include taxiway shoulder width to prevent jet blast soil erosion or debris ingestion for jet engines and required separation distances to other taxiways/taxilanes. More information can be found in **Appendix B: General Aviation Airports 101 (Airport Design Standards)**.

The existing taxiways and taxilanes meet design standards. **Table 4-8** and **Table 4-9** describes the specific FAA taxiway design standards for various ADG and TDG design aircraft, respectively.

Table 4-8 – FAA Taxiway Design Standards Matrix (ADG)

Design Standard	Airplane Design Group (ADG)	
	ADG-I	ADG-II
Taxiway Safety Area	49 feet	79 feet
Taxiway Object Free Area	89 feet	124 feet

Taxilane Object Free Area	79 feet	110 feet
Taxiway Centerline to Fixed or Movable Object	44.5 feet	62 feet
Taxilane Centerline to Fixed or Movable Object	39.5 feet	55 feet
Taxiway Wingtip Clearance	20 feet	22.5 feet
Taxilane Wingtip Clearance	15 feet	15.5 feet
Design Standard	**ADG-I**	**ADG-II**
Connector Taxiway		X
Apron Taxilanes	X	X

Source: FAA AC 150/5300-13B, KLJ Analysis. NOTE: Green cell indicates planned change in future design standard

Table 4-9 – FAA Taxiway Design Standards Matrix (TDG)

Design Standard	Airplane Design Group (TDG)	
	TDG-1B	TDG-2A
Taxiway Width	25 feet	35 feet
Taxiway Edge Safety Margin (TESM)	5 feet	7.5 feet
Taxiway Shoulder Width	10 feet	15 feet
Design Standard	**TDG-1B**	**TDG-2A**
Taxiways		X
Apron Taxilanes	X	X

Source: FAA AC 150/5300-13AB, KLJ Analysis. NOTE: Green cell indicates planned change in future design standard

The recommended parallel taxiway will meet the design standards of TDG-2A as shown above.

TURN-AROUNDS

Turn-arounds provide the space at the end of a runway for an aircraft to turn-around to taxi back on the runway to the next connector taxiway. The current turn-arounds on both runway ends do not meet design standards. When the parallel taxiway is constructed the turn-arounds will be built into the connector taxiways and be eliminated. It is recommended that the connector taxiways meet the design standards with a hold line 200 feet away from runway centerline.

PAVEMENT STRENGTH & CONDITION

Taxiways should generally be designed to accommodate the design aircraft to serve that area. Reconstructed taxiways should be built to accommodate regular use of the future design aircraft. Currently the design aircraft is 12,500 pounds (SW) which is also the future design aircraft. A summary of the taxiway pavement condition with recommendations is in **Table 4-10**:

Table 4-10 – Taxiway Pavement Condition & Recommendations

Taxiway ID	Pavement Condition Index (PCI) Current Condition	Action Plan (Lowest PCI)		
		0-5 Years	6-10 Years	11-20 Years
Connector Taxiway	98	Maintain	Maintain	Rehab.
Taxilane West	100	Maintain	Maintain	Maintain
Taxilane East	76	Maintain	Maintain	Rehab.

Source: Minnesota Department of Transportation (2021), KLJ Analysis

It is recommended the connector taxiway and taxilane east be rehabilitated by the end of this planning period, but all other pavement is good to satisfactory and should be maintained.

Airside Data Summary

Please reference **Chapter 7: Airport Layout Plan** for a detailed summary table of Runway 12-30, Runway 4-22 and airfield data.

Terminal Area

Background

D37 only receives General Aviation (GA) activity which includes all civil aviation activities except for commercial service. Providing necessary facilities and access for general aviation users at D37 will continue to be important for the vitality of the Warren community. Based aircraft are projected to grow a total of 0.53 percent with operations growing by 1.15 percent through PAL 4. General aviation facilities evaluated in this section include aircraft storage hangars, aircraft parking apron, a fuel farm, and a snow removal equipment storage building.

Aircraft Storage

Aircraft storage requirements are driven by operational requirements, aircraft size, local climate, and owner preferences. For based aircraft, the harsh winters in the upper Midwest drive all owners to seek aircraft storage facilities rather than outdoor parking on an aircraft parking apron. Owners prefer to have covered, secure storage for their aircraft with space for other aeronautical facilities including an office or maintenance/storage areas. All based aircraft at D37 are stored in aircraft storage hangars. Transient aircraft travel to airports for several hours up to a few days at a time. These aircraft typically park on the aircraft apron or seek temporary indoor aircraft storage, especially during adverse weather conditions.

BASED AIRCRAFT

All 7 based single-engine piston aircraft and 1 multi-engine aircraft are currently stored in approximately 24,950 square feet of available aircraft storage space. The following assumptions were made about aircraft storage space requirements:

- Single-Engine Piston/Other/Ultralight: 45’ x 35’ storage area (1,575 SF)
- Multi-Engine/Turboprop: 55’ x 45’ storage area (2,475 SF)
- Additional 20 percent for general aeronautical storage and supplies

Using these assumptions with based aircraft forecasts, a projected need for based aircraft storage space is determined. It is important to understand that this projection provides a broad estimate of needed space into the future for facility planning. Actual space needs are demand-driven.

Table 4-11 – Based Aircraft Storage Requirements

Category	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Based Aircraft Storage Space (SF)						
Aircraft Storage Space	*24,950*	16,200	16,664	17,079	17,537	18,007
Capacity/Deficiency	**-**	**8,750**	**8,316**	**7,871**	**7,413**	**6,944**

Source: KLJ Analysis. Note: RED indicates a deficiency to existing capacity.

The recommended hangar types to accommodate aircraft storage depend on airport and aircraft owner preferences and financial position. There are two main hangar types:

- T-Hangar: Nested small aircraft storage units within a rectangular building.

- Conventional Hangar: Commonly known as "box" hangars are square/rectangular.

Hangars are constructed with public or private funds as demand warrants. This facility requirement analysis shows the current based hangar space is sufficient during this planning study. The current T-hangar and south box hangar are aging and should be replaced in a different location to continue to meet based hangar needs.

TRANSIENT AIRCRAFT

Transient aircraft storage is utilized on an as-needed basis as aircraft require temporary storage. Aircraft types that require this type of storage are typically larger and more expensive airplanes such as turboprop and turbojet aircraft. Storage timeframes vary but can be for a few hours to several days.

Transient aircraft storage should plan to accommodate one single-engine in the short term. This planning period will not reflect storage space for a multiengine/turboprop though one multi-engine/turboprop airplane should be considered in the long term if the fleet mix changes, and a new large hangar would be needed to accommodate transient aircraft.

Table 4-12 – Transient Aircraft Storage Requirements

Category	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Transient Aircraft Storage Space (SF)						
Corporate Hangar	*0*	2,475	2,621	2,775	2,938	3,111
Capacity/Deficiency	**-**	**2,475**	**146**	**300**	**463**	**636**

Source: KLJ Analysis. Note: RED indicates a deficiency to existing capacity.

Aircraft Parking Apron

General aviation (GA) aircraft parking is utilized by transient and based aircraft. All based aircraft at D37 are stored in hangars. Transient aircraft require parking for a period ranging from a few minutes to a few days. Itinerant aircraft will require either covered aircraft storage (based or transient) or apron parking space.

The apron size is driven by the number and size of maneuvering and parked aircraft. The purpose of this analysis is to determine the triggering point for additional GA apron space using the aviation activity demand forecasts.

A general rule of thumb identified in the Minnesota State Aviation System Plan states "*tiedowns for at least three more aircraft than are normally parked at the airport*".

Another method is to calculate transient aircraft parking space needs using the methodology contained in Appendix C of ACRP Report 113, *Guidebook on General Aviation Facility Planning.* Modifications to the ACRP equation were made to improve accuracy for this airport. The equation utilized for this analysis is below:

*Number of Transient Parking Positions = (X / 2) * T * B * S*
X = Number of fleet mix operations
T = Percent of transient operations
B = Busy day factor
S = Aircraft size factor

The assumptions below are based on forecast calculations and locally observed conditions at D37.

- Number of Fleet Mix Operations (10,000)

  - Reference **Table 3-6** from the **Aviation Activity Forecasts** chapter.
- Percent of Transient Operations (T)
  - 52.6% of operations are transient.
- Busy day factor (B)
  - 1.15% of total annual operations occur on the busy day; reference **Table 3-10** from the previous chapter.
- Aircraft Size factor (S) – *See discussion below.*

Apron size is driven by the number of airplanes during the peak period, as well as the size of the aircraft utilizing parking positions. A standard tie-down position accommodates one small multi-engine aircraft. Larger aircraft occupy additional space and can be accommodated with a nested tie-down configuration. The following aircraft size factors are used per ACRP Report 113:

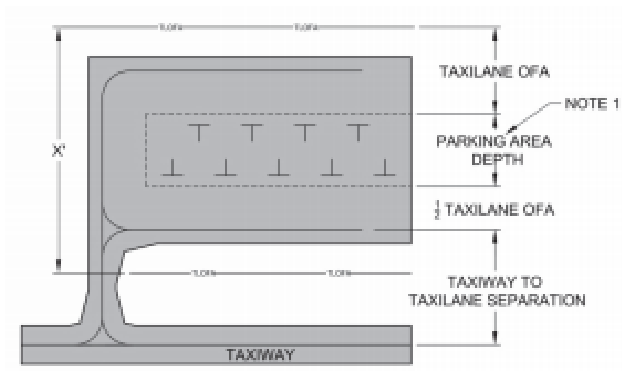
- Single-Engine/Multi-Engine/Other: 1.00
- Large Piston/Turboprop: 2.50

The number of total and equivalent aircraft parking positions required at D37 is calculated below for PAL 1:

- Single Engine: (10,000/ 2) * 0.526 * 0.0115 * 1.0 = 3.02
- Large Piston/Turboprop: (10,000 / 2) * 0.526 * 0.0115 * 2.5 = 7.56

Apron size must accommodate both the required aircraft parking positions and maneuvering standards. Aircraft maneuvering at D37 is required to accommodate safety setbacks for FAA Airplane Design Group (ADG) I wingspans. The current apron configuration does not meet maneuvering standards nor does it meet parking standards for the design aircraft.

The preferred apron design for Design Group I aircraft is a dual-taxilane configuration to support taxi-in and taxi-out operations.



Dual-Taxilane Apron Configuration (ACRP Report 96)

Based on this assessment, the existing apron is not sufficient to accommodate the existing and projected need. The apron space will require reconfigured tie-downs, additional parking spaces and additional maneuvering space to meet ADG-II needs.

Table 4-13 – Transient Apron Size Requirements

Category	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Apron Area (SY)						
Equivalent Tie-Downs	*4*	4	4	4	7	7
Size Per Aircraft	*190*	190	190	190	190	190
Tie-Down Area	*750*	750	750	750	1,330	1,330
Capacity/Deficiency	-	-	-	-	**580**	**580**

Source: KLJ Analysis. Note: RED indicates a deficiency to existing capacity.

Once the current T-hangar row and current south box hangar are removed and relocated, that will offer space that could be used for the apron.

PAVEMENT CONDITION & STRENGTH

According to the 2021 state PCI summary the apron with tiedowns located on it is in excellent condition, even the concrete tiedown spot. The newer north apron expansion was constructed in 2019 and is expected to be in excellent condition when the new state PCI summary is released. A summary of the general aviation apron pavement condition with recommendations is in **Table 4-81**. It is recommended the airport maintains the apron pavement.

Table 4-14 – GA Apron Pavement Condition & Recommendations

Apron ID	Pavement Condition Index (PCI)	Action Plan (Lowest PCI)		
	Current Condition	0-5 Years	6-10 Years	11-20 Years
Tiedown Apron	95	Maintain	Maintain	Maintain
North Apron Expansion	100	Maintain	Maintain	Maintain

Source:2021, MnDOT Pavement Condition Report, Warren Municipal Airport (D37).

GA Terminal Building

The size of the GA terminal building is based on the number of passengers and types of services. Although additional facilities can be provided, at a minimum the terminal building serving general aviation needs should include the following services:

- Passenger Waiting Area
- Restrooms
- Vending
- Pilots Lounge/Flight Planning
- Mechanical/Storage Room

The terminal building should be located adjacent to the transient aircraft parking apron with good visibility to the airfield, and be in close approximately to the automobile parking and waiting area. In most cases the terminal building is located within or near the Fixed Base Operator (FBO) providing aeronautical services. The terminal building at D37 is provided by the airport and is located on the north edge of the tiedown apron and west of the north apron expansion. There is 1,500 SF of terminal space usable for passengers and flight crews.

The estimated planning-level size of the terminal building is based on peak hour total airport operations, 2.5 passengers per peak hour operation and 100 square feet of space per passenger as identified in ACRP Report 113. These figures provide an estimate of the number of passengers to arrive, depart and generally flow through the GA terminal. Calculations are summarized in **Table 4-15**.

Table 4-15 – GA Terminal Building Size Requirements

Category	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
GA Terminal Building Size (SF)						
Peak Hour GA Operations	-	6.8	7.2	7.7	8.1	8.6
Number of Passengers	-	17	18	19.25	20.25	21.5
Total Building Size	*1,500*	**1,700**	**1,800**	**1,925**	**2,025**	**2,150**
Capacity/Deficiency	-	***200***	***300***	***425***	***525***	***650***

Source: KLJ Analysis

From speaking with the airport manager, the existing GA terminal is not utilized as often as expected after it was constructed in 2019, it meets the existing and projected future GA itinerant passenger needs.

Passenger Convenience

Passenger convenience elements for the general aviation pilots and passengers were reviewed. The proximity of the aircraft apron to the terminal building is ideal to minimize outdoor exposure time but it is not ideal for those on the southern tiedown locations. The terminal building itself however does adequately meet the space or comfort needs for both D37 pilots and passengers. The automobile parking location adjacent to the terminal building is ideal to minimize outdoor exposure time. An on-site airport courtesy car is available for passengers during the summer months. The airport does not offer aeronautical services such as fuel or hangar storage, but the airport manager is available to help whenever possible.

Support Facilities

Support facilities are necessary to support a safe and efficiently run airport supporting airport operations and the travelling public.

Airport Administration, Maintenance & Snow Removal

The large north private hangar houses airport maintenance such as smaller mowing and snow removal equipment (SRE). Larger SRE is stored in the city shop in town.

The city does not have dedicated airport SRE, it is recommended that the airport acquire this equipment. Snow and ice control equipment typically required includes a carrier vehicle (i.e. dump truck or tractor), snow plows, spreaders, sweepers, and blowers. For non-winter operations, grass cutting is accomplished with a carrier vehicle (i.e. tractor) and mower attachment. Smaller equipment is also used to facilitate snow removal or grass cutting. Equipment should be stored in a dedicated heated building for timely access and protection from the weather. North facing building doors should be avoided if possible to minimize prolonged snow and ice accumulation.

Total general maintenance equipment storage (MES) and SRE storage space needs are determined by type of equipment planned to be stored. Per ACRP Report 113, *Guidebook on General Aviation Facility Planning*, the following space assumptions are made to estimate the size of an MES and/or SRE building:

- 3 equipment bays (dump truck, tractor w/ mower, equipment/material storage)
- 1 support bay for general storage at a medium airport (250 to 500 acres in size)
- 600 SF for each equipment storage bay
- 600 SF for each support equipment bay

With three equipment bays at 600 SF each, that comes to 1,800 SF plus one support bay at another 600 SF equals 2,400 total storage space needed. **When equipment is purchased for the airport, it is recommended a 2,400 SF or 40’ x 60’ storage building be constructed to house the equipment from outside elements.**

Fueling Facilities

There is no fuel for sale at D37. Fuel storage needs are driven by having sufficient supply to meet demand and by the size of the fuel delivery truck. An ideal fuel farm should provide a tank capacity of 10,000 gallons to accommodate a full tanker truck (8,000 gallons) to minimize the cost of deliveries. A split tanker with a half-delivery (4,000 gallons) for a 6,000-gallon tank is also acceptable. Fuel tank capacity should meet peak 6-month fuel consumption demands at lower activity airports. Overall airport operations in airplanes needing AVGAS and JET-A are forecast to increase by up to over 50 percent.

The fuel consumption rate should also be considered but since there is no historical fuel consumption information at D37, industry standards should be used to determine future fueling needs. Actual fuel consumption is based on many factors including local fuel price and operator preferences. The aviation industry trend is for growth in turbine-powered aircraft requiring JET-A fuel and in light-sport aircraft that require typical automobile gasoline (MOGAS). If self-fueling is allowed, individuals may bring their own fuel to the airport provided they follow operational requirements set forth by the airport. The industry is also exploring the use of alternative fuels that may replace AVGAS or unleaded AVGAS may be a requirement.

During the planning period **it is recommended that a 6,000-gallon AVGAS tank with a 24-hour card reader be installed** that meets State minimum system objectives in a location compatible with any configuration changes to the apron. No fuel trucks are expected to be needed for an airport of this size.

Fencing, Security & Wildlife

SECURITY & FENCING

Security is an important consideration when operating a safe airport. Transportation Security Administration (TSA) published version 2 of the *Security Guidelines for General Aviation Airports* in 2017 providing recommended airport design guidelines.

The first line of security protection infrastructure is a perimeter fence. Perimeter fencing is not a requirement for non-certificated airports such as D37. Its installation would help prevent unauthorized persons from entering the airfield. A minimum 6-foot high fence with added barbed wire is generally recommended at a minimum for security. Airfield access points should be minimized, however those that are needed should be controlled. Ideally, automated controlled access gates would be installed at the apron, hangar area and east access entry points. Locked field gates would be installed at other airfield access points. It is not recommended to install a security fence during this planning study.

WILDLIFE CONTROL & MITIGATION

Controlling wildlife on or near the airport helps mitigate existing and prevent the creation of potential new hazards to aircraft. The airport can take steps to help increase safety of the airfield as identified in the Wildlife Hazard Management Plan (WHMP). The WHMP recommends the airport take step to construct a minimum 10-foot high wildlife fence to control entry by mammals. No wildlife has been reported therefore it is not recommended to install a 10-foot wildlife fence during this planning study.

Utilities

As stated in **Chapter 2: Airport Inventory**, the City provides power for the airport while the north hangar owner pays for water and propane to heat the hangar. It is recommended the city continue to provide power and when a storage building is constructed heat should also be provided by the City.

Landside Facilities

Ground Access, Circulation & Parking

The overall design objective is to provide ground vehicles with access to and from the terminal building and hangar facilities using a primary access road. To achieve this, access points should be secured to the apron, hangar area and any field access points to reduce undesired automobile access. The number of hangar access points should be limited to reduce the possibility of vehicle/aircraft incidents which improves safety. Fuel delivery trucks should have access to tanks without entering airside operations areas. Access roads should be paved to reduce the likelihood of foreign object debris (FOD) on the airside areas where it may become a hazard to aircraft.

Automobile parking at general aviation airports should accommodate landside access needed to serve aeronautical facilities. Facilities requiring automobile parking include the arrival/departure terminal building, aircraft storage hangars, administration, maintenance equipment storage buildings and FBOs. Vehicles should be discouraged from parking in airside areas. Automobile parking lots should be sized for the demand and have appropriate number of handicapped accessible spaces.

Apron access is provided at the end of the access road that leads to the west taxilane, south of the terminal area, and to the east of the northern large hangar. Ideally access points should require a turn from the end of a roadway to discourage inadvertent airfield access. Vehicles at D37 are parked north of the terminal building and north of the north apron expansion area. **Both access roads and vehicle parking areas are loosely defined with gravel and it is recommended that they be paved to minimize the likelihood of FOD.**

Summary

This chapter identifies safety, capacity and development needs for the Roseau Municipal Airport based on forecasted activity levels. These recommendations provide the basis for formulating development alternatives in **Chapter 5: Alternatives Analysis** to adequate address recommended improvements. The following summarizes the facility recommendations:

Airside Facilities

- Install a certified AWOS-III.
- Install pilot-controlled lighting using the Common Traffic Advisory Frequency (CTAF).
- Construct a 35’ wide full parallel taxiway with medium intensity taxiway lighting and remove the current turnarounds on both runway ends.
- Acquire land in fee simple for the future parallel taxiway, runway safety areas, and MnDOT Clear Zones.
- Acquire easements for existing runway protection zone surfaces.
- Remove south most hangar within the runway visibility zone at the end of its useful life.
- Proceed with a study of the airspeed loss on the Runway 12 End final approach.

General Aviation Facilities

- Accommodate additional aircraft hangar storage.
- Expand the aircraft apron to accommodate maneuvering and parking in Design Group II aircraft with additional aircraft tie-downs.

Support Facilities

- Plan to construct a 60’ x 40’ mechanical/snow removal equipment storage building with heat once snow removal equipment has been acquired.
- Construct a 6,000-gallon above-ground AVGAS storage tank for a 24-hour credit card reader fueling facility.

Landside Facilities

- Construct paved access road and parking areas.