CHAPTER 4: FACILITY REQUIREMENTS

Introduction

This chapter of the Airport Master Plan analyzes the existing and anticipated future facility needs at Minot International Airport (MOT). This chapter is divided into sections that assess the needs of primary airport elements including airside facilities, landside facilities, passenger terminal, air cargo, general aviation, and support facilities.

Airside requirements are those necessary for the operation of aircraft. Landside requirements are those necessary to support airport, aircraft, and passenger operations. Proposed requirements 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 projected facility needs through the planning period. The level of review completed is sufficient to identify major airport elements that should be addressed in this comprehensive airport plan.

In recent years, demands on Minot facilities and infrastructure have increased as a result of growth in energy, retail, military, and financial sectors, as well as an increase in area population. Since the last Master Plan update, the airport has completed various improvements, including constructing a new terminal.

Potential solutions to address the facility needs through the planning period are discussed in this chapter. Specific alternatives that implement the recommendations are evaluated in **Chapter 5: Alternatives**.

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

- Airside Facilities
- Passenger Terminal
- Air Cargo
- General Aviation
- Landside Facilities
- Support Facilities

Planning Activity Levels

There are various airport activity measures used to determine facility requirements including passenger enplanements, airport operations, based aircraft, and peak period activity. Airport activity can be sensitive to industry changes, and national or local economic conditions. This makes forecasting difficult to tie to a specific calendar year. For this Master Plan, Planning Activity Levels (PALs), which are forecast to occur within the planning period, are used to identify demand thresholds for 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 allow recommended improvements to be deferred. The forecasts developed in the last chapter are now correlated with each PAL 1, 2, 3, and 4 which are 5, 10, 15 and 20 years (5 years), (10 years), (15 years), (20 years) respectively.

Table 4-1 identifies the PAL metrics for the Minot International Airport.

Table 4-1 – Planning Activity Levels (PALs)

Metric	Base	PAL 1 *(5 Year)*	PAL 2 *(10 year)*	PAL 3 *(15 Year)*	PAL 4 *(20 Year)*
Forecast Year	2014	2019	2024	2029	2034
Passengers					
Annual Enplanements	220,522	192,253	201,574	241,643	289,769
Peak Month Enplanements	20,486	17,860	18,726	22,449	26,920
Design Day Enplanements	898	783	821	984	1,180
Design Hour Enplanements	310	271	284	340	408
Design Hour Deplanements	379	330	346	415	498
Design Hour Total Passengers	450	391	398	485	571
Passenger Airline Operations					
Airline Operations	7,655	5,804	4,820	6,060	7,300
Design Hour	8.9	6.7	5.6	7.0	8.5
Total Operations					
Annual Operations	30,826	27,065	26,293	27,697	29,694
Peak Month	2,857	2,509	2,437	2,595	2,753
Design Day	117	103	100	107	113
Design Hour	20	17	17	18	19

Source: KLJ & Trillion Aviation Analysis

Airside Facilities

Airfield Design Standards

Guidance on airport design standards is found in FAA Advisory Circular 150/5300-13A, *Airport Design* (Change 1). Airport design standards provide basic guidelines for a safe, efficient, and economic airport system. Careful selection of basic aircraft characteristics to 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. In the same respect, airport designs based on larger aircraft unlikely to operate at the airport are not economical. **Appendix H** provides detailed information on design standards.

DESIGN AIRCRAFT

Aircraft characteristics relate directly to the design components of an airport. FAA design standards for an airport are determined by a coding system that relates the physical and operational characteristics of an aircraft to the design and safety separation distances of the airfield facility. The design aircraft is the most demanding aircraft operating or forecast to operate at the airport on a regular basis, which by FAA standards is considered 500 annual operations. The design aircraft may be a single aircraft, or a grouping of aircraft. The FAA typically only provides funding for the airport to be designed to existing and forecasted critical aircraft. See **Appendix H** for more information on the MOT design aircraft.

AIRPORT AND RUNWAY CLASSIFICATIONS

The FAA has established aircraft classification systems that group aircraft types based on their performance and geometric characteristics. These classification systems, described below and in **Appendix H**, are used to determine the appropriate airport design standards for specific runway, taxiway, apron, or other facilities, as described in FAA AC 150/5300-13A *Airport Design*.

- Aircraft Approach Category (AAC) - a grouping of aircraft based on approach speed. Approach speed drives the dimensions and size of runway safety and object free areas.
- Airplane Design Group (ADG) - a classification of aircraft based on wingspan and tail height. When the aircraft wingspan and tail height fall in different groups, the higher group is used. Wingspan drives the dimensions of taxiway and apron object free areas, as well as apron and parking configurations.
- Approach Visibility Minimums - relates to the visibility minimums expressed by Runway Visual Range (RVR) values in feet. These distances relate to the minimum distance at which pilots must be able to see the runway or lighting from the runway. Visibility categories include visual (V), non-precision approach (NPA), approach procedure with vertical guidance (APV) and precision approach (PA). Lower visibility minimums require more complex airfield infrastructure and enhanced protection areas including safety and object free areas as well as runway-to-taxiway separation distances.
- Taxiway Design Group (TDG) - a classification of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. TDG relates directly to taxiway/taxilane pavement width and fillet design at intersections.

DESIGN CODES

Design codes recognize existing conditions or identify planned capabilities for specific runways and for the airport as a whole. In summary these codes are:

- Airport Reference Code (ARC) - an airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC.
- Runway Design Code (RDC) - a code signifying the design standards to which the runway is to be built.
- Approach Reference Code (APRC) - a code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to landing operations.
- Departure Reference Code (DPRC) - a code signifying the current operational capabilities of a runway with regard to takeoff operations.

OTHER DESIGN CONSIDERATIONS

Other airport design principles considered important for a safe and efficient airport design include:

- Runway/Taxiway Configuration
- Approach and Departure Airspace & Land Use
- Meteorological Conditions
- Controller Line of Sight
- Navigation Aids & Critical Areas
- Airfield Line of Sight
- Interface with Landside
- Environmental Factors

Design Aircraft

As detailed in **Chapter 3**, the critical design aircraft is identified as the most demanding aircraft or family of aircraft to regularly use the airport (500 annual operations).

SCHEDULED PASSENGER SERVICE

Existing airport operations at MOT were analyzed with consideration to potential changes to the design aircraft identified in the aviation forecasts based on local and national aviation trends. **Table 4-2** summarizes the existing MOT scheduled passenger service design aircraft. These represent the most demanding or "critical" aircraft types based on FAA design standards overall at MOT. The most demanding scheduled passenger aircraft is a grouping of AAC-D, ADG-III, TDG-4 aircraft.

Table 4-2 – Critical Scheduled Passenger Service Operations

Aircraft Type	IFR Operations		AAC	ADG	TDG	MTOW
	CY 2014	CY 2015				
Boeing MD-83/88	545	532	D	III	4	166,000
Boeing 737-700/-800	31	38	D	III	3	174,200
CRJ-200	4,105	3,989	D	II	3	53,000
Airbus A319/A320	446	180	C	III	3	166,400
CRJ-900	352	996	C	III	3	84,500
Embraer E-170	1,820	1,009	C	III	3	79,300
E-135/-145/-145EX	764	930	C	II	2	53,100
Total AAC-D	**4,681**	**4,559**				
Total ADG-III	**3,218**	**2,767**				
Total TDG-4	**545**	**532**				
Design MTOW	**166,000 lbs.**					

Source: FAA Traffic Flow Management System Counts, KLJ Analysis
MTOW = Maximum Takeoff Weight (pounds), AAC = FAA Aircraft Approach Category, ADG = FAA Airplane Design Group, TDG = FAA Taxiway Design Group. Aircraft operations exceeding 500 operations are shown in Green.

AIR CARGO

The existing critical aircraft design codes for air cargo operations is ARC B-II, TDG-2. This includes aircraft such as the Swearingen Metroliner III with a maximum weight of 16,000 pounds. It should be noted the ATR-42 aircraft (FAA ARC B-III, TDG-2, 36,800 pounds) now has regular service to MOT and conducted 417 operations at MOT in 2015.

As noted above, the existing critical aircraft design codes for air cargo operations is a FAA ARC B-II, TDG-2 but the future critical design aircraft is expected to evolve to the ATR-42 turboprop aircraft. The ATR-42 is an ARC B-III, TDG-2 aircraft with a MTOW of 36,800 pounds. This aircraft is expected to exceed 500 annual operations within the next 5 years.

GENERAL AVIATION / OTHER COMMERCIAL

The existing critical aircraft design codes for "other commercial" and general aviation aircraft is a FAA ARC B-II, TDG-2 turbojet airplane with a MTOW up to 60,000 pounds. These aircraft are turboprop or business jet aircraft types. A common example of the fleet design aircraft is a Cessna Citation 680 Sovereign business jet. In 2015 there were 1,284 aircraft operations at MOT classified by FAA as business jet aircraft according to TFMSC data. Of those, approximately 650 operations were in specific aircraft classified by FAA as 75 percent of the general aviation business jet fleet. There were approximately 300 annual operations in larger business jet aircraft that would generally identify in the 100 percent of fleet category. Other aircraft were not classified.

OVERALL

The most demanding design components are summarized in **Table 4-3.** This determination is adequate for the current classification of the airport as an ARC D-III, TDG-4 facility.

Table 4-3 - Design Aircraft Operations

Design Component	2015 Operations
AAC-D	4,559
ADG-III	2,755
TDG-4	532

Source: FAA TFMS, KLJ Analysis

FORECAST TRENDS

Within the next 10 years, the overall MOT design aircraft is expected to transition as Allegiant Airlines intends to replace or phase out the MD-83/-88 aircraft with the Airbus A320. This aircraft has an Airport Reference Code (ARC) of C-III with a TDG-3 classification and 171,961 lbs. maximum takeoff weight. Other Approach Category D aircraft expected to utilize MOT include the CRJ-200 through the mid-term with at least 500 annual operations. Other large business jets occasionally using MOT also have an AAC-D classification. The CRJ-200 is expected to be retired within the next ten years, resulting in an ultimate design aircraft ARC of C-III.

The future critical design fleet for general aviation is expected to continue to be a FAA ARC B-II, TDG-2 turbojet aircraft through the next 5 years. Common examples include the Cessna Citation II, Cessna Citation CJ3 and Cessna Citation Sovereign. Occasionally, larger ADG-III or AAC-C/D aircraft may still utilize MOT. At this time no change to the general aviation fleet mix is expected.

Based upon analysis developed in **Chapter 3**, the future critical design aircraft fleet mix for MOT is presented in **Table 4-4**. It is forecast the future design aircraft at MOT will evolve to an ARC C-III, TDG-3 aircraft in the long-term (10+ years). A representative airplane is the Airbus A-320 with a maximum takeoff weight of 166,400 pounds.

Table 4-4 - Future Critical Design Aircraft

Aircraft Type	Design	2014	2019	2024	2034
Boeing MD-83/88	ARC D-III, TDG-4	545	718	0	0
Boeing 737-700/-800	ARC D-III, TDG-3	31	40	50	80
CRJ-200	ARC D-II, TDG-3	4,105	1,500	0	0
Airbus A319/A320	ARC C-III, TDG-3	446	85	1,120	1,400
CRJ-700/-900	ARC C-III, TDG-3	352	800	1,200	1,800
Embraer E-170/-175	ARC C-III, TDG-3	1,820	2,700	2,400	4,100
E-135/-145/-145EX	ARC C-II, TDG-2	764	0	0	0
	Total AAC-D	**4,681**	**2,258**	**0**	**0**
	Total AAC-C	3,382	3,585	**4,720**	**7,300**
	Total ADG-III	**3,218**	**4,343**	**4,770**	**7,380**
	Total TDG-4	**545**	**718**	**0**	**0**
	Total TDG-3	6,754	5,125	**4,770**	**7,380**

Source: Trillion Aviation, KLJ Analysis
MTOW = Maximum Takeoff Weight (pounds), AAC = FAA Aircraft Approach Category, ADG = FAA Airplane Design Group, TDG = FAA Taxiway Design Group. Aircraft operations exceeding FAA regular use threshold are shown in Green.

Airfield Capacity

The total capacity of the airfield is the measure of the maximum number of aircraft arrivals and departures capable of being accommodated for a runway and taxiway configuration. Delay occurs when operations exceed the available capacity at an airport. Airports should plan to provide capacity enhancements well in advance to avoid undue operational delays. A master planning-level analysis was completed using the methods outlined in FAA Advisory Circular AC 150/5060-5, *Airport Capacity and Delay*.

Capacity is measured using various metrics:

- Hourly Capacity – The maximum throughput of arrivals and departures an airfield can safely accommodate in a one-hour period.
- Annual Service Volume (ASV) – The maximum throughput of annual operations an airfield can safely accommodate in one-year with an acceptable level of delay.
- Aircraft Delay – The difference in time between a constrained and an unconstrained aircraft operation, measured in minutes.

INPUT FACTORS

Measuring airfield capacity is driven by many factors including aircraft fleet mix, runway use configuration, meteorological flight conditions, and runway operational procedures. Each is calculated to cumulatively determine the hourly capacity and annual service volume for an airport.

Aircraft Fleet Mix

Different types of aircraft operating on an airport impact airport capacity. In addition to required arrival and departure flow separation requirements between similar aircraft types, aircraft with different speeds create the need for additional spacing requirements to maintain minimum separation standards. The airport's fleet mix index is established using FAA guidelines. These classifications are provided in **Table 4-5**.

Table 4-5 – Aircraft Fleet Mix Classifications

Aircraft Fleet Mix Classification for Capacity/Delay	Maximum Takeoff Weight (MTOW)	Number of Engines	Wake Turbulence
A	<12,500 lbs.	Single	Small (S)
B		Multi	Small (S)
C	12,500 – 300,000 lbs.	Multi	Large (L)
D	>300,000	Multi	Heavy (H)

Source: FAA AC 150/5060-5, Airport Capacity and Delay

The aircraft fleet mix percentage for capacity calculations is determined by the FAA's formula (C + 3D) using aircraft fleet mix classifications. For purposes of this analysis, the Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC) fleet mix percentage was considered roughly equivalent for this high-level capacity review. The Fleet Mix Index incorporating the FAA's formula is also provided below in **Table 4-6**.

Table 4-6 – Aircraft Fleet Mix Index

Metric	Base	PAL 4 (2034)
A & B Classification	48.04%	48.65%
C Classification	51.96%	51.35%
D Classification	0.00%	0.00%
Aircraft Mix Index	***24.83%***	***24.58%***

Source: FAA AC 150/5060-5, Airport Capacity and Delay, KLJ Analysis

Runway Use

The runway use configuration affects the operational efficiency and capacity of an airfield. A dependent runway is directly affected by the operations of another runway. Operations from another runway must be clear so operations on the other runway can safely occur. Runway 13/31 and 8/26 at MOT are dependent runways as they intersect near the middle of each runway. Both of these runways can handle VMC and IMC arrivals and departures. Runway 13/31 is the primary IMC and VMC runway. The estimated runway end utilization (pilot usage of runway ends for landing and taking off) is identified in **Table 4-7** table below.

Table 4-7 - Runway Utilization

Runway End	End Utilization	Runway Utilization
13	26%	65.0%
31	39%	
8	5%	35.0%
26	30%	

Source: ATCT Estimate Provided June 2016

Other Considerations

Meteorological conditions are a consideration for capacity calculations. An analysis of the weather observations over the past 10 years show IMC conditions are experienced 90.34 percent of the time at MOT, IMC conditions within the capability of current approach minimums are experienced 8.45 percent, and IMC conditions below current instrument approach minimums occur 1.21 percent of the time.

Touch-and-go operations consist of a landing followed immediately by a takeoff on the same runway without exiting the runway. These typically occur with small training aircraft and count for two operations, a landing and takeoff, thus increasing airfield capacity.

The number and location of exit taxiways at MOT were considered to be adequate to minimize runway occupancy time. Arrivals are assumed to be 50 percent of total operations. Additional weighting factors are not used. The taxiway system is considered adequate from a capacity perspective. According to AC 150/5300-13A, if design peak hour traffic reaches 30 or more operations per hour on a single runway then “high-speed” exit taxiways may be appropriate to maximize capacity. Please see the taxiway section for additional recommendations.

HOURLY CAPACITY

Hourly capacity is calculated during VMC and IMC conditions using an FAA recommended equation based on runway configuration, touch-and-go operations, and taxiway exit factors. Weighted hourly capacity is determined based on runway utilization, weather conditions and an FAA weighting factor. The results for the base and PAL 4 scenarios are identified in **Table 4-8**. Assuming no change to the airfield configuration, the results are similar for the base through PAL 4 due to a minimal change in fleet mix.

Table 4-8 - Hourly Capacity

Factors	Base, PAL 1-4 Fleet Mix
VMC Hourly Capacity	75
IMC Hourly Capacity	53

Source: ACRP Report 79, FAA AC 150/5060-5, Airport Capacity and Delay, KLJ Analysis

ANNUAL SERVICE VOLUME

Annual Service Volume (ASV) is an estimate of the total annual aircraft operations on an airfield annually. ASV is calculated based on the weighted hourly capacity multiplied by hourly and daily demand ratios. The ratio of the total operations to an airport’s ASV determines if and when an airport should plan for capacity improvements to increase overall capacity. For MOT, the weighted Annual Service Volume is 191,576 operations. **Table 4-9** summarizes the overall MOT capacity calculations.

Table 4-9 - Capacity Calculations

Metric	Base	PAL 1	PAL 2	PAL 3	PAL 4
Annual Operations	30,826	27,065	26,293	27,697	29,694
Average Design Hour	20	17	17	18	19
ASV Capacity	191,576	191,576	191,576	191,576	191,576
Capacity Level	**16.1%**	**14.1%**	**13.7%**	**14.5%**	**15.5%**

Source: ACRP Report 79, FAA AC 150/5060-5, Airport Capacity and Delay, KLJ Analysis

FAA recommends airports take action on capacity enhancement projects when an airport has reached 60 percent of its annual capacity. MOT is not projected to be near this value in the planning period.

AIRCRAFT DELAY

Aircraft delay exists because of local weather and operational conditions and cannot be entirely eliminated. Delay is measured in minutes per aircraft and hours per year. The FAA's assumptions identified in *FAA AC 150/5060-5, Airport Capacity and Delay* are used to identify delay measures and estimated cost. A four-to-six minute delay per aircraft is considered acceptable for normal airport operations. Delay at MOT on average does not exceed these thresholds. Delay is considered acceptable for operations into the planning period.

Meteorological Considerations

Meteorological conditions that affect the facility requirements of an airport include wind coverage and weather condition encountered. Meteorological data for MOT was reviewed using that past 10 years of data from the Minot International Airport ASOS facility from 2005 through 2014. This provides a comprehensive look into the average weather trends at an airport.

Wind coverage and weather conditions are evaluated based on the two different conditions, VMC and IMC. 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 which allows these flights to be operated under Visual Flight Rules (VFR). Conditions less than this are considered Instrument Meteorological Conditions (IMC) requiring flights to be operated under Instrument Flight Rules (IFR).

WIND COVERAGE

Wind coverage is important to airfield configuration and utilization. Aircraft ideally takeoff and land into headwinds alighted with the runway orientation. Aircraft are also designed and pilots are trained to land aircraft during crosswind conditions but there are limitations. Small, light aircraft are most affected by crosswinds. To mitigate the effect of crosswinds, runways on an airport are aligned so that they meet a minimum of 95 percent wind coverage where crosswind conditions are encountered 5 percent of the time or less. Each aircraft's AAC-ADG combination corresponds to a maximum crosswind wind speed component.

Table 4-10 - Wind Coverage Requirements

AAC-ADG	Maximum Crosswind Component
A-I & B-I	10.5 knots
A-II & B-II	13.0 knots
A-III, B-III, C-I through D-III	16.0 knots
A-IV through D-VI	20.0 knots

Source: FAA AC 150/5300-13A, Airport Design

Wind coverage for the airport is separated into all-weather (VMC and IMC) and IMC alone. 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 approaches.

Table 4-11 - All-Weather Wind Analysis

Runway	AAC-ADG	Crosswind Component (Wind Speed)		
		10.5 knots	13.0 knots	16.0 knots
Runway 13/31	D-III	87.03%	93.13%	97.85%
Runway 8/26	B-II	85.81%	92.09%	97.09%
Combined*	-	96.21%	98.62%	99.65%

**Combined assumes up to maximum design aircraft crosswind component for each runway*
Source: Minot International Airport ASOS (2005-2014)

The MOT design aircraft (ARC D-III aircraft; 16.0 knot crosswind component) is accommodated on Runway 13/31 during all-weather conditions with airfield wind coverage exceeding 95 percent. Aircraft that require a 10.5 and 13 knot crosswind need Runway 8/26 runway to achieve 95 percent wind coverage (see **Table 4-11**).

Table 4-12 - IFR Wind Analysis

Runway	AAC-ADG	Crosswind Component (Wind Speed)		
		10.5 knots	13.0 knots	16.0 knots
Runway 13/31	D-III	87.84%	93.67%	97.97%
Runway 8/26	B-II	79.81%	87.03%	93.63%
Combined*	-	94.90%	97.86%	99.34%

**Combined assumes up to maximum design aircraft crosswind component for each runway*
Source: Minot International Airport ASOS (2005-2014)

The design aircraft is accommodated on Runway 13/31 during IFR with airfield wind coverage exceeding 95 percent. Aircraft that require a 10.5 and 13 knot crosswind need Runway 8/26 runway to achieve 95 percent wind coverage when operating under IFR (see **Table 4-12**).

When analyzed by runway end as shown in **Table 4-13**, Runway 31 and Runway 26 are the preferred runway ends by typical wind direction, followed by 13 then 8. The lowest published instrument approach minimums are available on Runway 31. It is recommended to take steps to lower approach minimums to other runway ends to maximize airfield utilization.

Table 4-13 -Wind Analysis by Runway End

Runway End	AAC-ADG	Crosswind Component (Wind Speed)		
		10.5 knots	13.0 knots	16.0 knots
Runway 13	C-III	43.39%	45.47%	47.20%
Runway 31	C-III	50.16%	54.07%	57.11%
Runway 8	B-II	36.90%	38.83%	40.53%
Runway 26	B-II	56.94%	60.86%	63.73%

Source: National Climatic Data Center hourly data from Minot International Airport ASOS (2004-2014)

WEATHER CONDITIONS

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

Weather conditions are broken down into occurrence percentages based on instrument approach minimums in **Table 4-14**.

Table 4-14 – Meteorological Analysis

Weather Condition	Cloud Ceiling Minimum	Visibility Minimum	Observation Percentage
Visual Flight Rules (VFR)	3,000 feet	5 miles	78.99%
Marginal Visual Flight Rules (MVFR)	1,000 feet	3 miles	11.35%
Instrument Flight Rules (IFR) Category I	200 feet	½ mile	8.45%
Instrument Flight Rules IFR Category II	100 feet	¼ mile	1.08%
IFR Category III & Below	0 feet	$^{1}/_{8}$ mile	0.13%

Source: National Climatic Data Center hourly data from Minot International Airport ASOS (2004-2014)

Average high temperature data for the hottest month was reviewed from climate summaries available from the National Weather Service for MOT. The average high temperature in the hottest month was 81.5 degrees Fahrenheit.

Runways

Minot has two runways. Runway 13/31, the primary runway, is the longest runway at 7,700 feet long and 150 feet wide. The runway is concrete and has a grooved surface. Runway 31 currently accommodates precision approaches with visibility minimums of ½ mile. Runway 13 has a non-precision instrument approach with 1 mile visibility minimums.

Crosswind Runway 8/26 is 6,347 feet long and 100 feet wide. The runway is asphalt and has a grooved surface. Although Runway 13/31 is predominantly used by air carrier aircraft, Runway 8/26 is capable of supporting the majority of air carrier aircraft currently utilizing the airport. Runway 8/26 has non-precision instrument approaches with visibility minimums as low as 1 mile.

RUNWAY DESIGN CODES

The overall critical design aircraft type for MOT is an ARC D-III aircraft with TDG-4 (see **Table 4-3**).

Runway 13-31 and the parallel taxiway is currently built to accommodate up to ARC D-III aircraft and TDG-5, exceeding the current design aircraft (MD-83/88 operated by Allegiant Airlines). The basic runway and taxiway separation distance of 400 feet meets standards to accommodate aircraft up to ARC D-IV assuming approach minimums lower than ½ mile.

As previously mentioned, within the next 10 years, the overall MOT design aircraft is expected to transition as the ARC D-III MD-83/-88 aircraft will be replaced with the ARC C-III Airbus A320 operated by Allegiant Airlines. Other Approach Category D aircraft expected to utilize MOT include the CRJ-200 through the mid-term with at least 500 annual operations. When the CRJ-200 is retired ultimately the design aircraft ARC may change so this should be monitored closely. An ultimate ARC of C-III is used for this Master Plan.

Runway 8-26 is currently intended by the airport sponsor to accommodate up to ARC C-III aircraft. The associated taxiway to Runway 8-26 varies from TDG-2 to TDG-3. This runway is used frequently by the airlines because of its close proximity to the airline terminal. While federal funding eligibility for Runway 8-26 is limited to B-II standards, the City has historically elected to maintain Runway 8-26 according to C-III design standards for the flexibility to accommodate larger aircraft. The basic runway and taxiway separation distances meets standards to accommodate aircraft up to ARC D-IV assuming approach minimums no lower than ½ mile.

Runway 8-26 however is only 100 feet wide which limits Approach Category C aircraft to no more than 150,000 pounds. Runway 8-26 is only required for the airport to achieve 95 percent wind coverage for up to ARC B-II aircraft which is considered the existing design code. FAA funding is limited to ARC B-II standards as well.

Runway 8-26 is planned to be classified as an ARC B-II runway to reflect the existing design aircraft and wind coverage capabilities of the runways. This reduces the size of the RPZ. The future Runway 8 runway end is proposed to shift to the east which will place the entire Runway 8 approach and departure RPZ within airport property. The Runway 26 RPZ would also reduce in size and remain within airport property. On March 13, 2016 a presentation on Runway 8-26 illustrated benefits of designating Runway 8-26 as a B-II runway. The presentation is located in **Appendix C**.

In accordance with FAA AC 150/5300-13A, based on the current critical aircraft and airfield configuration, the information in **Table 4-15** describes the runways and airfield at MOT.

Table 4-15 - Airport Design Codes

Runway End	RDC	APRC	DPRC	TDG
13	D-III-5000	D-IV-2400	D-IV	5*
31	D-III-2400	D-IV-2400	D-IV	5*
8	B-II-5000	C-II-5000	C-II	2 to 4
26	B-II-5000	C-II-5000	C-II	2 to 4

Overall RDC	Existing	Future	Ultimate
	D-III-2400	C-III-2400	C-III-2400

*Source: KLJ Analysis *Based on existing infrastructure*

DESIGN 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 TDG as established by the design aircraft. In addition to the runway pavement width, some of the safety standards include:

- Runway Safety Area (RSA) – A defined graded surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot or excursion from the runway. The RSA must be free of objects, except those required to be located in the RSA to serve their function. The RSA should also be capable of supporting airport equipment and the occasional passage of aircraft.

- Runway Object Free Area (ROFA) – An area centered on the ground on a runway provided to enhance the safety of aircraft operations by remaining clear of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

- Runway Obstacle Free Zone (ROFZ) – The OFZ is the three-dimensional volume of airspace along the runway and extended runway centerline that is required to be clear of taxiing or parked aircraft as well as other obstacles that do not need to be within the OFZ to function. The purpose of the OFZ is for protection of aircraft landing or taking off from the runway and for missed approaches.

Other design standards include runway shoulder width to prevent soil erosion or debris ingestion for jet engines, blast pad to prevent soil erosion from jet blast, and required separation distances from objects and other infrastructure for safety. Critical areas associated with navigational aids as well as airspace requirements are described further in this chapter.

Please see the design standard matrices located in **Appendix H** for a full list of design standards applicable to both runways. **Exhibit 4-1** provides a graphical display of design standards and deficiencies to those design standards.

RUNWAY PROTECTION ZONE

The Runway Protection Zone (RPZ) is a trapezoidal land use area at ground level prior to the threshold or beyond the runway end to enhance the safety and protection of people and property on the ground. The land within the RPZ should be under airport control and cleared of incompatible land uses. FAA issued an interim policy on activities within an RPZ on September 27, 2012. Please see **Appendix H** for more background information on Runway Protection Zones.

New development discouraged within the RPZ includes new roads, structures, and places of public assembly. New development within an RPZ or new RPZ size/location of an RPZ is subject to FAA review on a case-by-case basis to reduce risk to people on the ground. Mitigation tactics for new or existing land uses may include removal/relocation of the object or modifying usable runway length (declared distances) to relocate the RPZ outside of the land use.

Existing RPZ Conditions

The RPZ standards for the existing runway configurations at MOT are identified in **Table 4-16**. The existing RPZs were evaluated to determine existing land uses and airport control. The location of RPZs are provided in **Exhibit 4-1**. Details on property within the RPZs is provided below:

- Runway 8 - The approach and departure RPZs near the Runway 8 end extend off-airport property and contain residential and commercial structures. A total of approximately 17 acres of property is located outside of Airport control.
- Runway 26 - This RPZ is entirely within Airport property.
- Runway 13 - The airport owns all but approximately 0.1 acres of land under the Runway 13 RPZ. This land is within the public roadway right-of-way for U.S. Highway 83.
- Runway 31 - There is approximately 4.0 acres of open space within the Runway 31 RPZ that is not currently owned or controlled by the Airport.

Incompatible land uses exist near the Runway 8 end for RPZs required to achieve RDC C-III runway design standards. The Runway 8 end is proposed to be shifted to the east and Runway 8-26 reclassified to B-II to remove incompatible land uses. Because a clear RPZ is desired, all existing land uses shall be addressed in other RPZs with any future airfield design modification.

Future/Ultimate RPZ Conditions

The standards future and ultimate runway configurations at MOT are also identified in **Table 4-16**.

The future RPZs were evaluated to determine existing land uses and airport control. The size of the approach RPZ is proposed to increase for Runway 13 in the long-term future. When approach visibility minimums reduce from 1 mile to ¾ mile, the inner width increases by 500 feet to a total inner width of 1,000 feet. As a result of this size increase, a 250-foot long portion of U.S. Highway 83 would be located within the future Runway 13 RPZ. Approximately 1.3 acres of the future RPZ would be located within roadway right-of-way.

Runway 8-26 is planned to be classified as an ARC B-II runway to reflect the existing design aircraft, wind coverage capabilities of the runways, and potential available FAA funding. This reduces the size of the RPZ. Please see the Alternatives Chapter for additional discussion regarding the Runway 8-26 RPZs and exhibits depicting RPZ footprints.

Table 4-16 - FAA RPZ Dimensional Standards

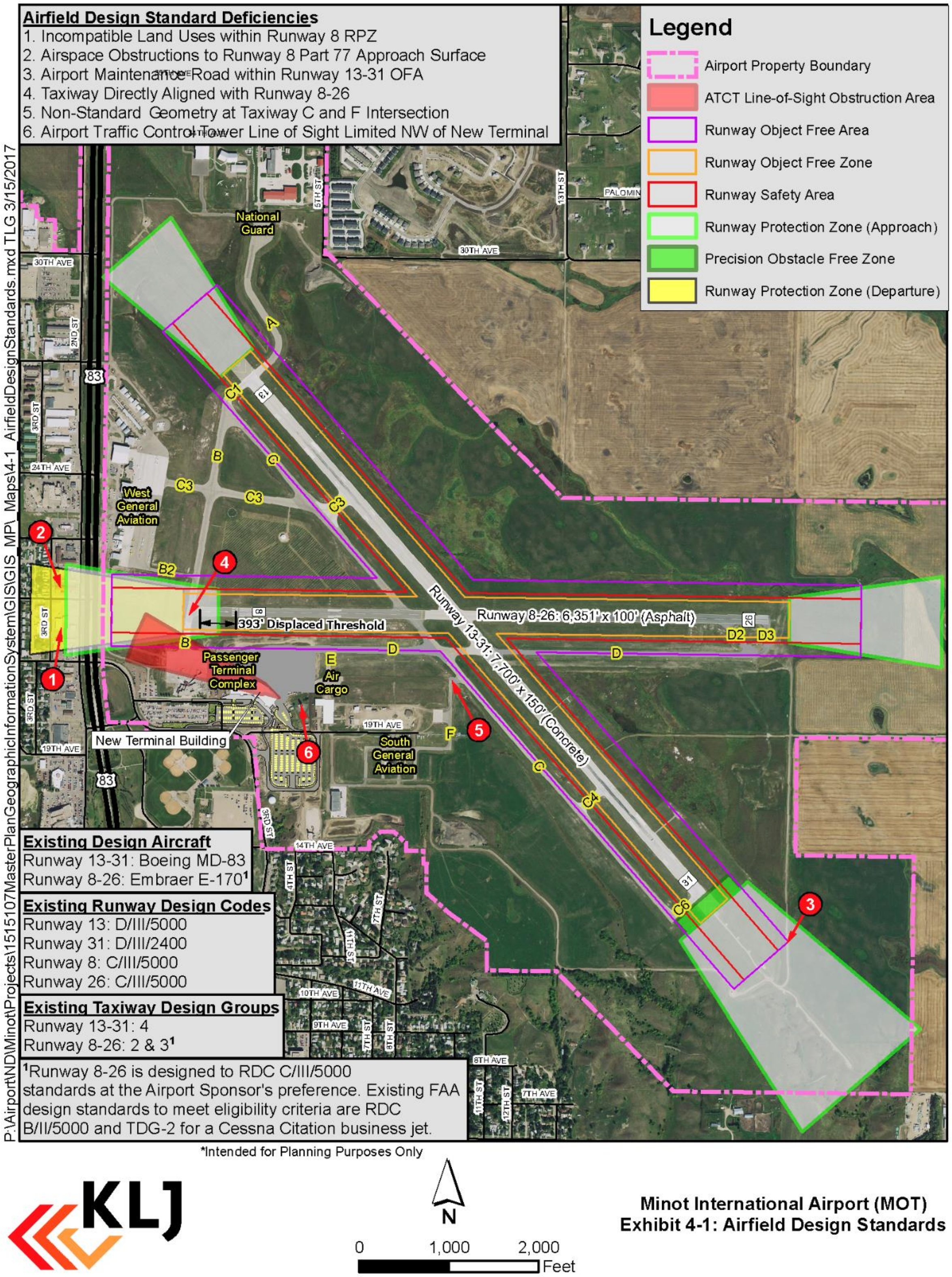
Runway	Operation	RDC	Inner Width	Outer Width	Length	Acres
EXISTING						
13	Approach	D-III-5000	500’	1,010’	1,700’	29.465
31	Approach	D-III-2400	1,000’	1,750’	2,500’	78.914
13-31	Departure	D-III	500’	1,010’	1,700’	29.465
8	Approach	C-III-5000*	500’	1,010’	1,700’	29.465
26	Approach	C-III-5000*	500’	1,010’	1,700’	29.465
8-26	Departure	C-III	500’	1,010’	1,700’	29.465
FUTURE/ULTIMATE						
13	**Approach**	**D-III-4000**	**1,000’**	**1,510’**	**1,700’**	**48.978**
8	**Approach**	**B-II-5000**	**500’**	**700’**	**1,000’**	**13.770**
26	**Approach**	**B-II-5000**	**500’**	**700’**	**1,000’**	**13.770**
8-26	**Departure**	**B-II**	**500’**	**700’**	**1,000’**	**13.770**

Source: FAA AC 150/5300-13A, Airport Design, KLJ Analysis
*Note: *Runway 8-26 to be classified as B-II-5000 as existing. Changes from previous phase shown in Blue.*

FUTURE/ULTIMATE RUNWAY 8/26 RECOMMENDATION

Even though the analysis for Runway 8/26 provides justification for a B-II configuration, the runway will continue to see airline operations with aircraft as large as C-III because of the airfield layout and location of the airline terminal. **For this reason, the alternatives will include an RDC of C-III for the ultimate configuration for Runway 8/26.** For Runway 8/26 this will include all safety surfaces, design standards, and runway protection zones for C-III with as low as 1 mile visibility approaches.

Exhibit 4-1 Airfield Design Standards



RUNWAY LENGTH

The recommended runway length for an airport facility varies widely based on runway usage (number of operations per year), specific aircraft operational demands (aircraft type, weight/load) and local meteorological conditions (elevation, temperatures). Runway length should be suitable for the forecasted critical design aircraft. Restrictions on runway length may lead to reduced weight on a flight, which then translates into reduced fuel, passenger, and/or cargo loads. The design approach identified in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design* was used to determine runway length calculations for MOT.

It is very important to adequately plan for a future runway configuration as these projects tend to affect the community beyond the property line. Projects of this magnitude require many resources and long lead times for planning, environmental review and funding allocation.

Aircraft Greater Than 60,000 Pounds

For aircraft greater than 60,000 pounds, the existing design aircraft with more than 500 annual operations is an MD-83 aircraft operated by Allegiant Airlines. This aircraft alone exceeds the FAA's regular use threshold. On a typical flight to Las Vegas or Phoenix/Mesa, the MD-83 requires 7,700 feet accounting for an 81.5° F (27.5° C) degree day and the actual Runway 13-31 runway slope gradient. This meets the existing runway length for Runway 13-31. Runway length requirements increase during individual peak hot days. On average, MOT experiences 3.7 days per year where the high temperature meets or exceeds 95° F (35° C). During these situations the payload is reduced.

Allegiant Airlines MD-83 (Airliners.net)

The summary of the existing runway length requirements using aircraft performance data is identified in **Table 4-17**. These lengths would apply to primary Runway 13/31. See **Appendix H** for airplane performance charts for each applicable airplane operating from MOT.

Table 4-17 - Existing Aircraft Fleet Runway Length Analysis

Airline	Destination(s)	Aircraft	2014 Operations	Runway Length
United/Delta	Denver (DEN), Minneapolis/St. Paul (MSP)	CRJ-200	4,107	6,700 feet
Delta	Minneapolis/St. Paul (MSP)	E-170	1,821	5,500 feet
United, Other	Denver (DEN), Houston (IAH)	ERJ-135/145XR	764	6,400 feet[1]
Allegiant	Phoenix/Mesa (IWA), Las Vegas (LAS)	MD-83	545	**7,700 feet**[2]
Delta, Allegiant, United	Minneapolis/St. Paul (MSP), Phoenix/Mesa (IWA), Denver (DEN)	A319	438	5,000 feet
Delta/United	Minneapolis/St. Paul (MSP), Denver (DEN)	CRJ-700/900	352	7,100 feet
Other	Various	E-190	24	5,900 feet
Other	Laughlin, NV (IFP)/Various	Boeing 737-800	40	7,700 feet

Source: FAA Traffic Flow Management System, Boeing, Embraer, Airbus, Bombardier, KLJ Analysis
Note: Includes 450-foot increase in takeoff distance from 45-foot runway gradient on Runway 13-31
Green = Exceeds FAA regular use threshold of 500 annual operations

[1] Runway length assumes flights to Denver. Flights to Houston (charter; 105 departures in 2014) require 7,200 feet.
[2] MD-83 runway length increases to approximately 7,900 feet during a peak hot day of the year (95° F/35° C).

The future design aircraft with more than 500 annual operations is expected to evolve to an Airbus A320 as Allegiant airlines begins to phase out the MD-83 aircraft and emphasize the Airbus A320. Expected future service includes a nearly 1,500 nautical mile route to Orlando-Sanford. On this flight the A320 requires 7,700 feet accounting for an 81.5° F (27.5° C) degree day and the actual Runway 13-31 runway slope gradient. Warmer conditions may require additional runway length. If the MD-83 were to fly this route it would require upwards of 9,000 feet of runway length.

Ultimate runway length planning includes considering potential new routes and aircraft types that require longer runway lengths. Examples include a longer-haul flight to Atlanta, for example, in a CRJ-900 regional jet may require as long as 8,500 feet during an 81.5° F degree day. A Boeing 737-800 may require the same length for a 1,800-mile stage length route to Cancun, Mexico.

The summary of the forecasted future/ultimate runway length requirements using aircraft performance data is identified in **Table 4-18**. These lengths would apply to primary Runway 13/31.

Table 4-18 – Future/Ultimate Design Aircraft Fleet Runway Length Analysis

Airline	Destination(s)	Aircraft	Runway Length	Phase
Allegiant	Las Vegas, Los Angeles, Phoenix	Airbus A320	7,400 feet	Future
Allegiant	Orlando/Sanford (SFB)	Airbus A320	**7,700 feet**[3]	Future
United	Houston/Intercontinental (IAH)	EMB-145XR	7,200 feet	Ultimate
Delta	Atlanta/Hartsfield (ATL)	CRJ-900	**8,500 feet**	Ultimate
Other	Cancun, Mexico (CUN)	Boeing 737-800	**8,500 feet**	Ultimate

Source: Trillion Aviation, Boeing, Embraer, Airbus, Bombardier, KLJ Analysis
Note: Includes 450-foot increase in takeoff distance from 45-foot runway gradient on Runway 13-31

Aircraft Less Than and Equal to 60,000 Pounds

The overall MOT design aircraft is a regional jet and other commercial aircraft greater than 60,000 pounds. However, the runway length needs of smaller aircraft that utilize MOT have also been evaluated. A summary of these results is in **Table 4-19 and 4-20** using FAA recommended runway lengths.

Table 4-19 – FAA Recommended Runway Lengths ($\leq$ 60,000 lbs.)

Standard	Runway Length
Small Aircraft (12,500 lbs. or less)	
Small Aircraft Less Than 10 Passengers	4,200 feet
Small Aircraft 10 or More Passengers	4,400 feet
Large Aircraft (Greater than 12,500 lbs. but less than 60,000 lbs.)	
75% of Aircraft Fleet @ 60% Useful Load	5,500 feet
75% of Aircraft Fleet @ 90% Useful Load	7,000 feet
100% of Aircraft Fleet @ 60% Useful Load	6,100 feet
100% of Aircraft Fleet @ 90% Useful Load	8,700 feet

Source: FAA AC 150/5325-4B, KLJ Analysis
NOTES: 75 percent of fleet aircraft are adjusted for Runway 8-26 slope gradient, 100 percent of fleet adjusted for Runway 13-31 slope gradient

The table above identifies FAA recommended runway lengths for general aviation aircraft flown for private and commercial purposes. Private and fractional ownership flights are subject to rules under Federal Aviation Regulation (FAR) Part 91 and commercial on-demand flights are subject to another

[3] A320 runway length increases to approximately 7,800 feet during a peak hot day of the year (95° F/35° C).

more stringent set of rules under FAR Part 135. The recommended runway length is based on the type of aircraft, takeoff weight, runway condition, and operating rules.

In 2014, there were 1,545 documented aircraft operations in business jet aircraft at MOT according to FAA Traffic Flow Management System Count (TFMSC) data. A total of 1,062 operations were in specific aircraft classified by FAA as 75 percent of the general aviation business jet fleet. Most of these aircraft are ARC B-II classification. The useful load was assumed to be 90 percent because common destinations are more than 1,000 nautical miles away from MOT including airports in Alaska, Arizona, California, and Texas. **Under the current FAA guidance, the existing recommended runway length for up to 60,000 pound aircraft is 7,000 feet. This standard would apply to Runway 8-26.**

There were 594 documented IFR operations in 2014 in ARC B-I or B-II turbojet aircraft that require the use of Runway 8-26 to meet 13-knot all-weather wind coverage requirements. A typical design aircraft is a Cessna Citation 680 Sovereign business jet with a B-II ARC. This aircraft's performance requires up to 5,500 feet when operating under Part 91K/135 operating rules on a wet runway.

In 2014 there were 358 annual operations in larger business jet aircraft that generally identify in the 100 percent of fleet category. This fleet mix is forecast to grow to ultimately exceed 500 annual operations and utilize Runway 13-31 due to wind coverage. The FAA runway length required by 100 percent of fleet aircraft less than 60,000 pounds is 6,100 feet based on 60 percent useful load and 8,700 feet based on a 90 percent useful load. These aircraft will utilize Runway 13-31 for length needs rather than 8-26 due to wind coverage.

Under proposed FAA guidance in draft FAA AC 150/5325-4C, each individual design aircraft would have to be evaluated to determine the actual required runway length. As an example, the Cessna Citation 680 Sovereign (ARC B-II) would require 5,500 feet as shown in **Table 4-20**.

Table 4-20 – Selected Aircraft Performance (≤ 60,000 lbs.)

Aircraft	ARC	Runway	Runway Length
Cessna Citation 680	B-II	Runway 8-26	5,500 feet

Source: Cessna Aircraft, KLJ Analysis

Table 4-21 summarizes the recommended runway lengths for MOT.

Table 4-21 - Recommended Runway Lengths

	Existing Needs	Future	Ultimate
Primary Runway 13-31			
Runway Length	7,700 feet	7,700 feet	8,500 feet
Aircraft Type(s)	MD-83	Airbus A320	Boeing 737-800
Secondary Runway 8-26			
Runway Length	7,000 feet	7,000 feet	7,000 feet
Basis / Aircraft Type(s)	75% of Fleet, 90% Useful Load*	75% of Fleet, 90% Useful Load*	75% of Fleet, 90% Useful Load*

Source: FAA AC 150/5325-4B, Aircraft Performance Manuals, KLJ Analysis
**Aircraft greater than 12,500 pounds and up to 60,000 pounds.*

PAVEMENT STRENGTH

Airfield pavements should be adequately maintained, rehabilitated, and reconstructed to meet the operational needs of the airport. Typical airport pavements have a 20-year design life. 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. Larger aircraft could exceed the pavement strength but not on a regular basis.

The FAA standard for measuring the reporting pavement strength is defined in FAA AC 150/5335-5B, *Standard Method of Reporting Airport Pavement Strength*. The Aircraft Classification Number – Pavement Classification Number (ACN-PCN) method is defined within this guidance. The PCN value must equal or exceed the ACN value assigned for the design aircraft.

Despite the requirement to publish PCN values for runways at certificated airports, many runways including those at MOT still publish a weight bearing capacity rating based on single-wheel (SW), dual-wheel (DW), dual-tandem (DTW) and/or dual double-tandem (DDTW). **Table 4-22** identifies the current published MOT weight bearing capacity on runways.

Table 4-22 – Published PCN/Weight Bearing Capacity for MOT Runways

Runway	PCN	Weight Bearing Capacity		
		SW	DW	DTW
Runway 13-31	43/R/C/W/T	120,000 lbs.	150,000 lbs.	240,000 lbs.
Runway 8-26	34/F/D/W/T	120,000 lbs.	150,000 lbs.	240,000 lbs.

Source: FAA Airport Master Record

Utilizing the technical ACN-PCN method for evaluating pavements and updated aircraft fleet mix data from this master plan study, the following PCN values and weight bearing capacities identified in **Table 4-23** are recommended to be published in the MOT Airport Master Record.

Table 4-23 – Calculated Existing PCN/Pavement Strength for MOT Runways

Runway	PCN	Weight Bearing Capacity		
		SW	DW	DTW
Runway 13-31	43/R/C/W/T	110,000 lbs.	148,000 lbs.	234,000 lbs.
Runway 8-26	27/F/D/W/T	69,000 lbs.	88,000 lbs.	-

Source: KLJ Analysis

The calculated PCN values resulted in no change to Runway 13-31. Runway 8-26 calculations resulted in a lower PCN based on the current fleet mix of regional jets. Both runways should have calculated weight bearing capacity figures adjusted accordingly.

For Runway 13-31, a fully-loaded Airbus A320-200 (ACN: 48) and MD-83 (ACN: 52) on rigid concrete pavement would exceed the calculated PCN value. These aircraft will operate at MOT frequently through the planning period. This will accelerate pavement damage and wear for regular aircraft operations. Runway 8-26 can accommodate regular use of aircraft as large as a CRJ-900 and Embraer E-175 jet without accelerated pavement damage. Recognizing any effort to improve the PCN will only be possible through major rehabilitation or reconstruction, it is recommended that any changes be incorporated into pavement design using justified aircraft types at the time. Please see **Appendix G** for more details, including the most recent North Dakota Aeronautics Commission Pavement Condition Index (PCI) study for MOT.

Instrument Procedures

Instrument approach procedures to a runway end are used by landing aircraft to navigate to the airport during low visibility weather when cloud ceiling is 1,000 feet or less and/or visibility is 3 miles or less. Establishing approaches with the lowest possible weather minimums allows the airport to maximize its operational capability. Each approach type requires differing infrastructure and navigational aids. Approaches with lower visibility minimums typically have additional infrastructure and navigational aids requirements. Types of approach procedures include non-precision approach (NPA), approach with vertical guidance (APV), and precision approach (PA).

EXISTING

The lowest weather minimums that an aircraft can operate at MOT are 200 foot ceiling and ½ mile visibility when wind conditions are appropriate for Runway 31. When the winds are appropriate for Runway 13, the lowest weather minimums are a 319 foot ceiling and 1 mile visibility available through an APV procedure. The airport also has approaches for Runway 8 and 26 through an APV procedure. The lowest weather minimums are 250-foot ceiling and 1 mile visibility for Runway 26. See **Appendix L** for a full summary of the existing procedures.

RECOMMENDATIONS

Southern or easterly winds during IFR conditions favor approaches for Runway 13 and therefore it is **recommended that lower minimums be pursued**. Very few new ILS systems are being installed nationwide. It is recommended the airport pursue lower approach minimums through GPS technology and possibly the establishment of an approach lighting system. GPS currently can provide minimums nearly equivalent to Category I precision approaches. Further coordination with FAA is required to conduct a feasibility study for the lowest weather minimums to Runway 13.

Upgrading approaches to capture lower visibility minimums (¾-mile) requires additional airport design standards to be met (see **Appendix H – Airfield Design Requirements**), including maintaining a compatible FAA Runway Protection Zone beyond the end of the runway. While there would be further improvement to go as low as a ½ mile visibility, the RPZ required for this approach would be very large and would likely require the shortening of the runway, which is not recommended.

Each runway end was reviewed to quantify the benefit of lower approach minimums. Lower minimums on Runway 13 to ¾ mile would increase utility to this runway end by 16%. This improvement is recommended for future implementation.

Lowering approach minimums to a Category II ILS for Runway 31 would have a benefit of capturing nearly 50% additional utility to this runway end - a significant net benefit to airport users. This would require operational justification and new runway NAVAID infrastructure (runway centerline lighting, approach lighting system with sequence flashing lights, etc.). This improvement should be preserved for ultimate implementation.

If minimums to Runway 8 are lowered to 200 feet and ¾ mile, a net 39% benefit is realized to that runway end. However, due to land use compatibility constraints from a larger RPZ, upgrading this approach is not recommended. Many of the operations that would benefit from a Runway 8 approach upgrade would be captured with lower weather minimums to Runway 13.

Table 4-24 identifies the net benefit of lower weather minimums for proposed runway approaches.

Table 4-24 – Additional Capture Meteorological Analysis

Runway End	Approach Type	Proposed Minimums	Additional Capture	Additional Capture Wind Coverage*	Net Additional Capture	Net Additional Utility
13	APV	250 feet, ¾ mile	1.09%	46.85%	0.513%	15.6%
13	CAT-I ILS	200 feet, ½ mile	2.06%	47.58%	0.981%	29.8%
31	CAT-II ILS	100 feet, ¼ mile	1.09%	55.33%	0.605%	49.2%
8	APV	250 feet, ¾ mile	0.34%	41.92%	0.114%	5.7%
8	APV	200 feet, ¾ mile	0.99%	76.90%	0.763%	30.0%
26	APV	250 feet, ¾ mile	0.34%	31.79%	0.109%	4.3%
26	APV	200 feet, ¾ mile	0.99%	40.65%	0.403%	15.9%

Source: FAA Airports GIS Website Data for Minot International Airport (2005-2014), KLJ Analysis
RVR = Runway Visual Range, n.m. = statute miles (reported), ILS = Instrument Landing System
**Wind coverage by runway end only. 10.5 knot crosswind component for Runway 13-31, 13 knot crosswind for Runway 8-26*

Airspace Protection

Airspace is an important resource surrounding airports that is essential for safe flight operations. There are established standards to identify airspace obstructions around airports. FAA grant assurances (obligations) require the airport sponsor to take appropriate action to assure that airspace is adequately cleared to protect instrument and visual flight operations by removing, lowering, relocating, marking or lighting, or otherwise mitigating existing airport hazards and preventing the establishment or creating of future airport hazards. Sufficiently clear airspace near the approach and departure ends, and along extended centerlines, are vitally important for safe airport operations.

An obstruction analysis is currently underway to identify obstructions to Part 77 and other airspace surfaces. The results of this analysis will be identified in the Airport Layout Plan drawing set.

The City has airport-specific zoning, but the focus is on maintaining uses compatible with airport noise. In 2009, an airport land use compatibility plan[4] was developed for MOT that aides the City in evaluating development proposals. The plan's recommendations include the protection of Part 77 "imaginary surfaces" and include maps to aid in determining whether impacts to MOT airspace would occur.

AREA AIRSPACE

MOT is within Class D controlled airspace served by an Airport Traffic Control Tower (ATCT). Minot ATC controls traffic on the ground within airfield movement areas and in the air within a 5 nautical-mile radius of the Airport up to an elevation of 2,500 feet above ground level. ATCT normally operates from 7:00 a.m. to 10:00 p.m. daily. When the ATCT is not operating, the airspace becomes uncontrolled Class E. No changes are recommended.

No new recommendations are presented in this study for the Airport Traffic Control Tower (ATCT), Approach/Departure radar control, or other communications infrastructure. Please see **Appendix L** for additional information on existing conditions.

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 these

[4] Available at http://www.minotnd.org/DocumentCenter/Home/View/73

"imaginary" three-dimensional airspace surfaces and become obstructions. Please see **Appendix L** for graphical depictions of Part 77 imaginary surfaces.

Federal Aviation Regulation (FAR) Part 77 surfaces are the protective surfaces most often used to provide height restriction zoning protection around an airport. Sufficiently clear airspace is necessary for the safe and efficient use of aircraft arriving and departing an airport. Part 77 airspace standards are defined by the most demanding approach to a runway. These airspace surfaces include the primary, approach, transitional, horizontal, and conical surfaces each with different standards. The slope of an airspace surface is defined as the horizontal distance traveled for every one vertical foot (i.e. 50:1).

EXISTING

The combination of the approach type and the runway classification defines the dimensional criteria for each approach. The published Part 77 approach airspace dimensional criteria for MOT are identified in the table below. According to the established rules, airspace surfaces must clear public roads by 15 feet, interstate highways by 17 feet, railroads by 23 feet, and private roads by 10 feet or the height of the most critical vehicle. See **Table 4-25** for existing standards.

Table 4-25 - Existing Part 77 Approach Airspace Standards

Runway End	Approach Standards	Part 77 Code	Inner Width*	Outer Width	Length	Slope
Existing Airport Configuration						
13	Non-Precision Other than Utility (> 3/4 mile)	C	500'	3,500'	10,000'	34:1
31	Precision (≤ 1/2 mile)	PIR[5]	1,000'	16,000'	50,000'	50:1/40:1
8	Non-Precision Other than Utility (> 3/4 mile)	C	500'	3,500'	10,000'	34:1
26	Non-Precision Other than Utility (> 3/4 mile)	C	500'	3,500'	10,000'	34:1

**Inner width is also the Primary Surface width driven by the most demanding approach to a runway.*
Source: 14 CFR Part 77, FAA Form 5010-1 Airport Master Record for MOT

[5] "Precision Instrument Approach"

FUTURE & ULTIMATE

Each existing runway approach standard is sufficient for the design aircraft and usage forecast to occur within the planning period. While lowering the approach for Runway 13 to ¾ mile will not have an impact on airspace standards/obstructions, it will require additional analysis of the RPZ. See **Table 4-26** for future and ultimate standards.

Table 4-26 – Future/Ultimate Part 77 Approach Airspace Standards

Runway End	Approach Standards	Part 77 Code	Inner Width*	Outer Width	Length	Slope
Future and Ultimate Airport Configuration						
13	Non-Precision Other than Utility (> 1/2 mile)	**D**	**1,000'**	**4,000'**	10,000'	34:1
31	Precision (≤ 1/2 mile)	PIR	1,000'	16,000'	50,000'	50:1/40:1
8	Non-Precision Other than Utility (> 3/4 mile)	C	500'	3,500'	10,000'	34:1
26	Non-Precision Other than Utility (> 3/4 mile)	C	500'	3,500'	10,000'	34:1

**Inner width is also the Primary Surface width driven by the most demanding approach to a runway.*
Source: 14 CFR Part 77, FAA Form 5010-1 Airport Master Record for MOT, KLJ Analysis. BLUE text indicates change from existing configuration.

For existing obstructions that cannot easily be removed, an FAA obstruction evaluation through the filing of 7460 forms should be completed to determine the aeronautical effect and identify potential mitigation strategies (i.e. lighting, marking). Based on existing data, there are various Part 77 obstructions located around MOT that will be identified on the Airport Layout Plan (ALP) for evaluation. **At this time, a comprehensive obstruction analysis of Part 77 surfaces has not yet been completed. This will be completed during the Airport Layout Plan with an action plan documented on the Inner Approach sheets of the Airport Layout Plan.**

RUNWAY APPROACH/DEPARTURES SURFACES

FAA identifies sloping approach surfaces that must be cleared at an absolute minimum for the safety of landing aircraft. These surfaces are identified in Table 3-2 of FAA AC 150/5300-13A, *Airport Design*. All objects must clear the surface for the applicable runway operational design standard to meet minimum aviation safety standards for a given runway landing threshold location. Approach airspace penetrations require mitigation which may include the removal of the object or the runway landing threshold to be shifted or displaced down the runway.

The departure surface applies to instrument departures. It begins at the end of the takeoff distance available (TODA) and extends upward and outward at a 40:1 slope. Penetrations to the departure surface may simply require the obstacle to be published, or require mitigation including increasing the minimum aircraft climb rate or runway length operational restrictions.

A detailed obstruction identification and mitigation disposition is identified in the Airport Layout Plan developed at the end of this planning study and located in **Chapter 7: Airport Layout Plan**.

EXISTING

MOT currently meets the requirements for the existing approach surfaces for Runway 13, 31, and 26 ends. Runway 8 meets approach surface standards with the 393-foot displaced threshold.

All MOT runway ends have departure surfaces with obstructions to the 40:1 surface, which is not uncommon. Departure Surface obstacles require a minimum climb rate of 219 feet per nautical mile for departures off Runway 26 to the west in order to meet required obstacle clearance. Required weather minimums are 300-foot cloud ceiling height and 1.5 miles of flight visibility. Individual obstacles are also noted in the Runway 8 and 31 departure zones.

The existing, future and ultimate approach/departure surface standards are provided in **Table 4-27**.

FUTURE/ULTIMATE

At this time, a comprehensive obstruction analysis of future or ultimate design surfaces has not yet been completed. This will be completed during the Airport Layout Plan with an action plan documented in the Master Plan.

Table 4-27 – Approach/Departure Surface Requirements

Runway End(s)	Table 3-2 Row	Description	Slope
Existing			
8, 26, 13	5	Approaches supporting instrument night operations in greater than Category B aircraft	20:1
31	7	Approach end of runways expected to accommodate instrument approaches with minimums <3/4 mile	34:1
8, 26, 13, 31	8	Approach end of runways to accommodate approaches with vertical guidance	30:1
8, 26, 13, 31	9	Departure runway ends for all instrument operations	40:1
Future and Ultimate			
8, 26	5	Approaches supporting instrument night operations in greater than Category B aircraft	20:1
13	**6**	**Instrument approaches having visibility minimums ≥ ¾ but <1 statute mile, day or night**	**20:1**
31	7	Approach end of runways expected to accommodate instrument approaches with minimums <3/4 mile	34:1
8, 26, 13, 31	8	Approach end of runways to accommodate approaches with vertical guidance	30:1
8, 26, 13, 31	9	Departure runway ends for all instrument operations	40:1

Source: FAA Advisory Circular 150/5300-13A, Airport Design
*Note: Most critical row(s) shown. **BLUE** text indicates change from existing configuration.*

TERMINAL INSTRUMENT PROCEDURES (TERPS)

The FAA has established standards to develop instrument procedures in the United States. FAA Order 8260.3B, *U.S. Standards for Terminal Instrument Procedures (TERPS)* and related orders outlines these complex standards to develop departure, climb, en-route, approach, missed approach and holding standards for aircraft operating along a published route with different navigational equipment. Some critical obstruction clearance standards are integrated into the approach/departure surfaces identified in Airport Design including many final approach segments and the 40:1 sloped departure surface. Other important obstacle clearance surfaces within the inner airport environment identified in TERPS include the precision obstacle clearance surfaces and the missed approach surfaces. Some TERPS surfaces may even be more restrictive that Part 77 standards. Penetrations to TERPS surfaces results in higher weather minimums or operations restrictions.

OTHER DESIGN SURFACES

Other airport design airspace surfaces considered protect navigational aids and identify airport data to populate FAA databases.

Inner-Approach/Transitional Obstacle Free Zones

If an approach lighting system is installed, a clear inner-approach and inner-transitional Obstacle Free Zone (OFZ) is necessary. The inner-approach OFZ is a 50:1 sloped surface that begins 200 feet from the runway threshold and extends 200 feet beyond the last approach light. The inner-transitional OFZ airspace surface is along the sides of the ROFZ. No objects not necessary for airport operations, including aircraft tails, can penetrate this surface. For MOT, the inner-transitional OFZ begins at 44.8 feet for a Category I approach and extends upward and outward at a 6:1 slope. There are no current or projected issues which would create an obstruction to the inner-approach or inner-transitional OFZ.

Precision Obstacle Free Zone (POFZ)

If a precision instrument approach is in existence (visibility minimums <¾ mile) there exists a POFZ which begins at the runway threshold as a flat surface 800 feet wide centered on the runway centerline and extending 200 feet to connect to the inner-approach OFZ. As with the OFZ, no above-ground objects not necessary for airport operations including aircraft or vehicles on the ground can penetrate this surface. For MOT, there are no current or projected issues which would create an obstruction within the POFZ of Runway 31 or Runway 13.

VISUAL AIDS SURFACES

Visual aids at an airport require clear obstacle clearance surface (OCS) to provide sufficient guidance for pilots. These include approach lighting systems and visual guidance slope indicators. For a Precision Approach Path Indicator (PAPI) system, this surface begins 300 feet in front of the VGSI system and extends upward and outward at an angle 1 degree less than the lowest on-course aiming angle. This equates to a 32:1 slope for a standard 3-degree PAPI. The specific airspace standards for this and for approach lighting systems are defined in FAA Order 6850.2B. The PAPI OCS surfaces at MOT are clear of obstructions.

FAA AERONAUTICAL SURVEYS

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

This Master Plan triggered the requirement for an aeronautical survey which is being done with this project. In the future, when safety-critical data changes such as modification to runway ends or instrument approach procedures are proposed then a new aeronautical survey with an airspace analysis is required. Obstructions that have been removed can be deleted from the database by coordinating with FAA Flight Procedures Office.

Projects that change other airfield geometry require as-built data to be submitted to FAA to the standards outlined in the current version of FAA AC 150/5300-18.

Navigational Aids

Airfield navigational aids (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 and are based on an airport's location, activity, and usage type.

AREA NAVIGATION

The FAA is updating the nation's air transportation infrastructure through the Next Generation Air Transportation System (NextGen) program. New procedures and technology are to be implemented to improve the efficiency and safety of the national air transportation system. For area navigation, satellite-based NAVAIDs will primarily be used for air navigation with ground-based NAVAIDs used for secondary purposes. Other initiatives include implementing a new surveillance technology for tracking aircraft known as Automatic Dependent Surveillance-Broadcast (ADS-B) to improve position accuracy reporting and supplement ground radar data for air traffic control. An ADS-B station is located at MOT near the SRE building.

Satellite based RNAV approaches have been created for all four runway approaches at MOT. These approaches do not rely on ground-based NAVAIDs such as the existing Very-high Frequency Omni-directional Range (VOR). Even though the MOT VOR is planned to remain, many VORs around the country are being decommissioned by the FAA in the long-term future. It is also anticipated that the existing Airport Surveillance Radar will be replaced by ADS-B.

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 these lighting systems.

Instrument Landing System (ILS)

An ILS is a ground-based system that provides precision instrument guidance to aircraft approaching and landing on a runway. ILS approaches enable a safe landing in IMC with low cloud ceiling and/or visibility. Major components of ILS include the localizer antenna for horizontal guidance, glide slope antenna for vertical guidance, and an approach lighting system. The localizer and glide slope require critical areas that are sufficiently graded and do not contain certain objects.

There are three categories of ILS systems, each capable of supporting approaches in equipped aircraft with lower weather minimums (see **Table 4-28**). Each category also requires an increasing complexity of airport equipment. Currently, Runway 31 is equipped with a Category I ILS approach. A Category II ILS approach would provide additional benefit but would be difficult to justify for FAA funding but is still recommended as the ultimate objective. Ultimately, the ground-based localizer and glideslope systems may eventually be replaced by precision GPS systems.

Table 4-28 – Standard ILS Categories

ILS Category	Decision Height (ft.)	Runway Visual Range (ft.)
Category I	200	2,400/1,800
Category II	100	1200
Category IIIa	0-100	700
Category IIIb	0-50	150
Category IIIc	0	0

Source: FAA Aeronautical Information Manual

Visual Guidance Slope Indicator (VGSI)

A VGSI system provides visual descent guidance to aircraft on approach to landing. There are several types of VGSI systems available including a Precision Approach Path Indicator (PAPI) system and a Visual Approach Slope Indicator (VASI). These systems are typically installed on runway ends with instrument approaches and co-located with the glideslope antenna, but are also installed for visual runways.

At MOT, Runways 13, 8, and 26 are equipped with four-light PAPIs installed on the left side of the runway. Runway 31 does not have a PAPI system installed. The PAPIs are owned and maintained by the FAA. PAPI for Runway 8 and 26 have been in place since 2002. The PAPI system for Runway 13 has been its current location since the shift of the Runway 13 end in 2003.

Runway End Identifier Lights (REIL)

REILs consist of high-intensity flashing white strobe lights located on the approach ends of runways to assist the pilot in early identification of the runway threshold. REILs are installed on Runway 13, 8, and 26 at MOT. The Runway 13 REIL was installed in 2002 and is FAA-owned. The REIL for Runway 8 and Runway 26 were installed in 1999 and are owned by MOT. There is no need for a REIL system for Runway 31 as it has an approach lighting system installed. The REILs for Runway 13 should be maintained until such time as an approach lighting system is installed. If runway ends are relocated, REIL locations will need to be adjusted accordingly.

Approach Lighting System (ALS)

ALSs help pilots transition from instrument flight to visual flight for landing. An ALS is required as part of an ILS. An ALS installed on non-precision approach runways can help provide a ¼ mile visibility credit for instrument approach minimums. There are various configurations, lighting types and complexities to these systems. The requirement for an airport runway end is dependent upon the type of precision approach and visibility minimums of the approach.

At MOT, Runway 31 is currently served by a MALSR extending approximately 2,450 feet out from the runway end in conjunction with the ILS approach.

Recommendations

Runway 31 is recommended to have a 4-light PAPI system installed to aid in vertical guidance to the runway end. When Runway 13 approach is upgraded from 1-mile to ¾ mile flight visibility, the installation of at least a basic ALS may be needed to achieve lower weather minimums. Recommended ALS types for Runway 13 include ODALS (basic) or MALSF (intermediate).

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 enhanced situational awareness, operational capability and safety. FAA AC 150/5340-30E, *Design and Installation of Airport Visual Aids* defines the standards for these systems. Please see **Appendix K** for additional information.

Airport Beacon

The airport beacon serves as the airport identification light so approaching pilots can identify the airport location during night and low visibility conditions. The rotating beacon for MOT is a white-green beacon located approximately 1,600 feet northeast of the Runway 13 end. The beacon is owned by MOT and the beacon “head” was replaced in 2010.

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 lights are classified according to the intensity of light they produce including high intensity (HIRL), medium intensity (MIRL) and low intensity (LIRL). Runway 13-31 and Runway 8-26 are both equipped with pilot controlled HIRL systems which were installed in 2001.

Other runway lights are installed at airports to facilitate the safe and efficient operation of aircraft. These include runway centerline lighting (RCL) and touchdown zone lighting (TDZL). No runways at MOT are equipped with RCL or TDZL. An in-pavement RCL and TDZL lighting system would be required for landing operations below 2400 feet RVR, including an enhanced Category I approach with minimum as low as 1800 RVR.

Taxiway Lighting

Taxiway edge lighting delineates the taxiway and apron edges. Most taxiways in the movement areas at MOT, except for Taxiway B2, are equipped with high intensity edge lights (HITL). Other taxiway lights are installed at airports to promote safe operations. These include taxiway centerline lighting, runway guard lights (RGL), a runway stop bar, and a clearance bar. RGLs are installed at all taxiway-runway intersections. An economical alternative to taxiway lighting on general aviation portions of the airport is the use of retro-reflective markers. These markers are plastic and have blue reflective material designed to reflect light back toward its source.

Recommendations

In-pavement centerline and touchdown zone lights for Runway 31 are optional for RVR-based Category I ILS minimums as low as 1800 RVR. A Medium Intensity Runway Lighting (MIRL) system is needed at a minimum for Runway 8-26 given the planned approach type. **Runway Guard Lights (RGL) are recommended to be maintained at the north intersection of Taxiway C and Runway 26 to mitigate a “hot spot”.** Please see **Exhibit 4-2** below for a location of hot spots.

AIRFIELD SIGNAGE

Airfield signage is essential for the safe and efficient operation of aircraft and ground vehicles on the airport movement area. Common signs include mandatory instruction signs, location signs, boundary signs, direction/destination signs, information signs, and distance remaining signs. Airports certificated under 14 CFR Part 139 such as MOT must have a sign plan developed and implemented to identify taxi routes and holding positions. This plan must be consistent with FAA AC 150/5340-18F, *Standards for Airport Sign Systems*.

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 150/5340-1L, *Standards for Airport Markings*. Markings at MOT are in “good” condition, but regular maintenance will be required throughout the planning period.

Runway

Runway pavement markings are white in color. The type and complexity of the markings are determined by the approach threshold category to the runway end. The minimum required runway markings for a standard runway are as follows:

- Visual (designation, centerline)
- Non-Precision (designation, centerline, threshold, aiming point)
- Precision (designation, centerline, threshold, aiming point, touchdown zone, side stripes)

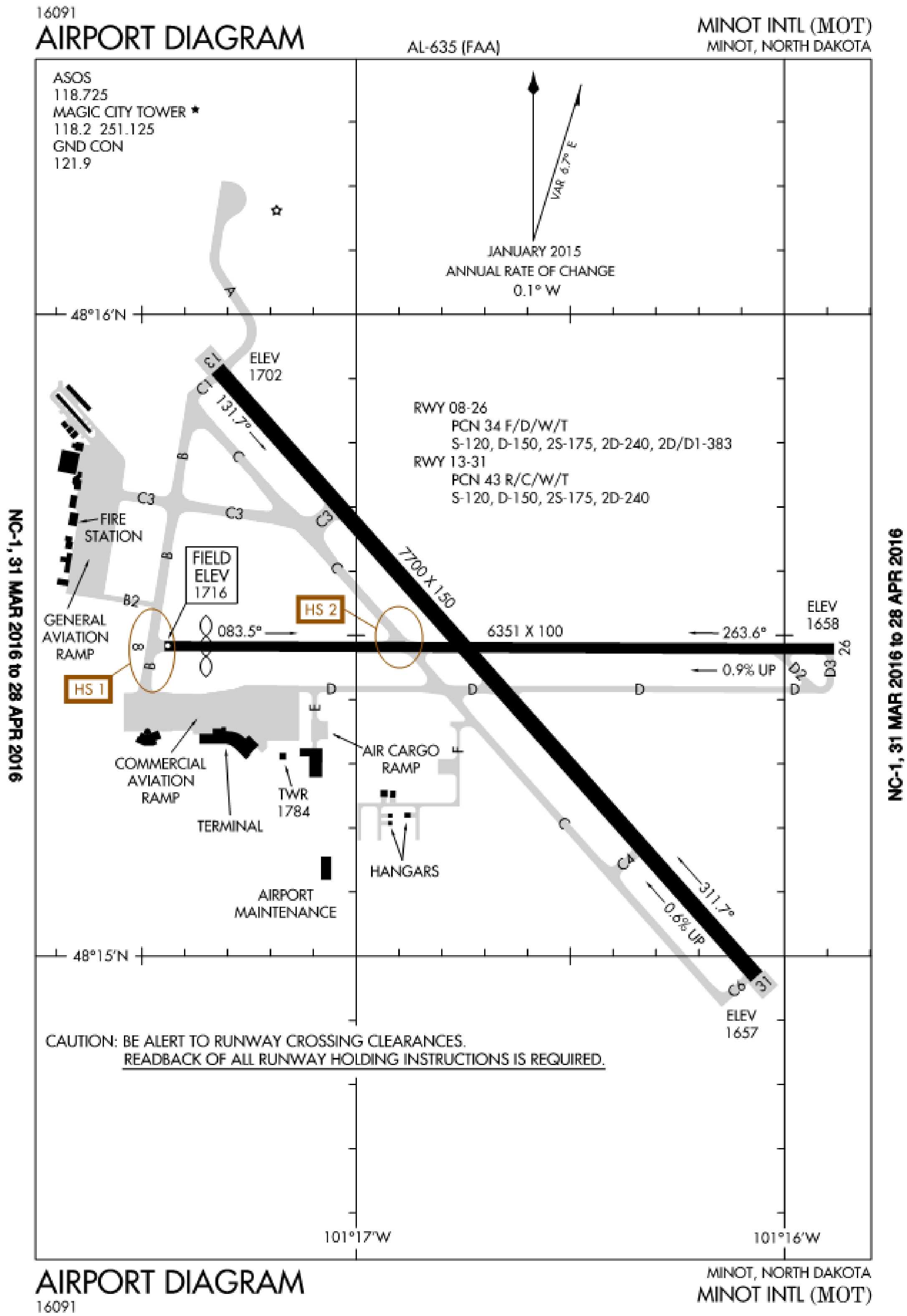
Additional runway markings for a displaced threshold, blast pad, stopway, or shoulders are required as needed for an airport. Cone markers may be used to identify the edges and ends of turf runways.

Runway 13-31 at MOT is equipped with precision runway markings identifying the runway designation, threshold, centerline, side stripes, aiming point, and touchdown zone. Runway 8-26 is equipped with non-precision runway markings identifying the runway designation, threshold, centerline, and aiming point. The runway markings are reported to be in good condition.

Taxiway/Taxilane

Taxiway and taxilane markings are important for directional guidance for taxiing aircraft and ground vehicles. Common taxiway and apron markings include taxiway/taxilane centerline, edge, and non-movement area boundary. Enhanced taxiway markings are required along taxiway centerlines that lead to runway entrances. Taxiway/taxilane centerline markings should be used throughout to define a safe centerline with object clearance. Taxiway/taxilane edge markings should be used to delineate the taxiway edge from the shoulder, apron, or some other contiguous paved surface. The non-movement area boundary should be marked appropriately per ATCT line of sight requirements.

Exhibit 4-2 - Minot Airport Diagram



Source: FAA Terminal Procedures

Holding Position

Holding position markings are a visual reference to prevent aircraft and vehicles from entering critical areas such as an active runway environment. These markings consist of yellow bars and dashes on a black background. In some locations they are located 250-257 feet from all runway centerlines where 267 feet is required for Runway 13-31. This is primarily due to recent changes in FAA AC 150/5300-13A, *Airport Design* resulting in holding position locations being dependent on elevation above mean sea level.

Recommendations

Runway and taxiway markings should be maintained to the same standard as today. Holding position locations should be reviewed and updated according to recent changes in FAA AC 150/5300-13A, *Airport Design*.

METEOROLOGICAL

Aircraft operating to and from an airport require meteorological aids to provide current weather data. Weather information helps pilots make informed decision about flight operations. Airports have various aids installed providing local weather information.

Surface Weather Observation

There are various types of surface weather observation stations. An Automated Surface Observation System (ASOS) is a federal weather reporting station at airports. It provides continuous 24-hour observations and reporting for the FAA, National Weather Service (NWS) and Department of Defense.

The ASOS at MOT was commissioned in 2002 and is co-located with the glideslope antenna near the Runway 31 landing threshold. The ASOS is owned and maintained by the NWS. This system is entirely automated and provides current wind direction and velocity, visibility, cloud clearances, sky condition, temperature, dew point, barometric pressure, precipitation measurements and lightning detection.

Weather observing systems are recommended to be kept clear of agricultural operations within 100 feet, clear of objects above the 30-foot sensor height within 500 feet, and clear of high objects within 1,000 feet.

Wind Cone

Wind cones visually indicate the current wind direction and velocity on an airfield. A primary wind cone is located in a central visible location on the airport and is usually lighted for night operations. A segmented circle is installed around the wind cone to aid pilots in its identification from the air. Supplemental wind cones are installed around the airfield to provide surface wind direction information to pilots where the primary wind cone is not visible. Wind cones must be lit for night air carrier operations.

MOT's primary wind cone and segmented circle is located east of the GA apron, approximately 340 feet southwest of the Taxiway C2 and B intersection, north of Runway 8 end. There are three (3) supplemental wind cones located on the airfield near the Runway 13, 31 and 26 ends.

Other

Runway Visual Range (RVR) visibility sensor systems provide instant reporting of the visibility at targeted locations on the airfield. These systems must be located at the touchdown zone, mid-point (if required for runway length) and rollout points to allow for Category II or lower operations.

MOT is equipped with RVR equipment at the touchdown point to Runway 31. This system allows RVR-based minimums to be published for the ILS approach to Runway 31. The system is co-located with the glideslope antenna, approximately 400 feet from Runway 13-31 centerline.

Recommendations

If Category II ILS minimums are planned for the ultimate configuration, then additional RVR sensors would need to be installed. Beyond that, there are no recommended changes to meteorological facilities beyond maintenance of existing facilities.

COMMUNICATIONS & ATC

The ability for pilots to communicate with other pilots and air traffic control is critical for the safety and efficiency of the overall air transportation system.

MOT ATCT provides air traffic control services for aircraft in the Minot area from 7:00 am to 10:00 pm at 118.20 MHz. This ATCT is in the FAA's contract tower program and is operated by Midwest Air Traffic Control. The tower was constructed in 1976. ATCT provides clearances, radar advisories, and safety alerts to Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) flights in the controlled Class D airspace.

ATCT is located adjacent to the new passenger terminal at MOT. ATCT requires a clear line of sight from the controller cab to the airport's movement areas which includes the runways, taxiways, aprons, and arrival/departure corridors. The existing ATCT cab height is 44.9 feet AGL which is 1754.9 feet AMSL. Structures on an airport need to consider this design standard, and in some cases require the completion of a shadow study to demonstrate no adverse impact. There may be impacts to visibility from ATCT to Taxiway D and B southwest of Runway 8 end.

When the ATCT is closed, pilots "see-and-avoid" other aircraft in the local area aided through the use of position reports using the Common Traffic Advisory Frequency (CTAF).

A Remote Communications Air-Ground (RCAG) station is located at MOT northeast of Runway 13 end, available on frequency 127.60 MHz. The local presence of this facility enables aircraft to communicate with Minneapolis ARTCC at a lower altitude in the local area.

A Remote Communications Outlet (RCO) provides a direct communication link with the Flight Service Station (FSS) for pilot briefings, flight plan processing, inflight radio communications, search and rescue (SAR) services, and assistance to lost aircraft and aircraft in emergency situations. A RCO ground station at MOT providing communications with the FSS is available on 122.20 MHz.

Recommendations

The existing ATCT has limited line-of-sight from the tower cab to Taxiway B south of the existing Runway 8 end. Please see **Exhibit 4-1**. The ATCT direct line-of-sight requirements also limits future building development in the south areas as development in this area can restrict the ability to see aircraft on Taxiway C. A camera is currently used to view the portion of apron and Taxiway B blocked by the terminal.

An alternate site for the ATCT should be explored. Within the planning period the structure may need to be replaced on the current site or at another location. FAA Order 6480.4A, *Airport Traffic Control Tower Siting Process* identifies the criteria used for considering a new tower location:

1. Visual performance
2. TERPS airspace surfaces
3. FAR Part 77 airspace
4. Sunlight/daylight
5. Airport/background lighting
6. Atmospheric Conditions
7. Industrial Municipal Discharge
8. Site Access

9. Interior Physical Barriers
10. Security

Preliminary ATCT siting alternatives will be reviewed in **Chapter 5: Alternatives Analysis**. The Airport Layout Plan will show a potential ATCT site location based on a preliminary analysis. Additional research and modeling will be required prior to actual site selection. An ATCT siting study would need to be initiated and conducted by the FAA.

SUMMARY

Table 4-29 below summarizes the NAVAID recommendations by runway end. Blue text indicates recommended additions.

Table 4-29 – Navigational Aid Summary

Component	Runway 13/31	Runway 8/26
Runway Dimensions (feet)	*7,700' x 150'*	*6,351' x 100'*
Pavement Markings	Precision	Non-Precision
Runway Lighting	HIRL, **CL, TDZ (31)**	HIRL - > MIRL
Taxiway Lighting	HITL	HITL -> **MITL**
Approach Lighting	MALSR (31), **ODALS/MALSF (13)** PAPI-4L (13, **31**) REIL (13)	PAPI-4L (8,26) REIL (8, 26)
Instrument Approach Procedures	ILS or LOC (31) RNAV (GPS) (13,31) VOR (13,31) LOC/DME (13)	RNAV (GPS) (8,26) RNAV (GPS) (8,26) VOR (8,26)
Navigational Aids	Rotating Beacon Air Traffic Control Tower (ATCT) **- Site Study/Analysis**	
Meteorological Facilities	Automated Surface Observation System (ASOS) Runway Visual Range (RVR) - 31 Lighted Wind Cone with Segmented Circle	

Source: Airnav.com, FAA Airport Master Record Form 5010 Report

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 design requirements identified in FAA AC 150/5300-13A, *Airport Design*.

SYSTEM DESIGN

FAA has placed a renewed emphasis on taxiway design in the updated airport design standards. In order to develop efficient systems that meet demands, reduce pilot confusion and enhance safety the following considerations were identified:

- Design taxiways to meet FAA design standards for existing and future users considering expandability of airport facilities.
- Design taxiway intersections so the cockpit is over the centerline with a sufficient taxiway edge safety margin.
- Simplify taxiway intersections to reduce pilot confusion using the three-node concept, where a pilot has no more than three choices at an intersection.
- Eliminate “hot spots” identified by the FAA Runway Safety Action Team where enhanced pilot awareness is encouraged.
- Minimize the number of runway crossings and avoid direct access from the apron to the runway.
- Eliminate aligned taxiways whose centerline coincides with a runway centerline.
- Other considerations include avoiding wide expanses of pavement and avoiding “high energy intersections” near the middle third of a runway.

MOT TAXIWAY DESIGN

The dimensions for each of the taxiway design standards vary according to the group of aircraft they currently or are intended to accommodate. The required MOT taxiway design standards are defined by the critical design aircraft. ADG-III aircraft is the current critical design airplane for the overall airport. The critical design airplane with the largest TDG is the MD-83 aircraft with a TDG-4 classification. The current taxiways serving Runway 13-31 accommodate aircraft up to TDG-5. The taxiways serving Runway 8-26 vary in width from 50 to 35 feet meeting TDG-4 to TDG-2 standards, respectively. The FAA identifies the design requirements for taxiways. The design standards vary based on the Taxiway Design Group (TDG) and Airplane Design Group (ADG) identified for the design aircraft using a particular taxiway. In addition to taxiway/taxilane pavement width, some of the safety standards include:

- Taxiway/Taxilane Safety Area (TSA) - A defined graded and drained surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft deviating from the taxiway. The surface should be suitable to support equipment during dry conditions

- Taxiway Edge Safety Margin (TESM) - The minimum acceptable distance between the outside of the airplane wheels and the pavement edge.

- Taxiway/Taxilane Object Free Area (TOFA) - An area centered on the centerline to provide enhanced the safety for taxiing aircraft by prohibiting parked aircraft and above ground objects except for those objects that need to be located in the OFA for aircraft ground maneuvering purposes.

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. The specific FAA taxiway design standards for various ADG and TDG design aircraft are identified in **Table 4-30** and **4-31**.

Table 4-30 – FAA Taxiway Design Standards Matrix (ADG)

Design Standard	Airplane Design Group (ADG)	
	ADG II*	ADG III*
Taxiway Safety Area	79 feet	118 feet
Taxiway Object Free Area	131 feet	186 feet
Taxilane Object Free Area	115 feet	162 feet
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	105 feet	152 feet
Taxiway Centerline to Fixed or Movable Object	65.5 feet	93 feet
Taxilane Centerline to Parallel Taxiway/Taxilane Centerline	97 feet	140 feet
Taxilane Centerline to Fixed or Movable Object	57.5 feet	81 feet
Taxiway Wingtip Clearance	26 feet	34 feet
Taxilane Wingtip Clearance	18 feet	27 feet

ADG II applies to general aviation, ADG III applies to some general aviation and existing and future commercial service aircraft.
Source: FAA AC 150/5300-13A Airport Design, KLJ Analysis

Table 4-31 – FAA Taxiway Design Standards Matrix (TDG)

Design Standard	Taxiway Design Group (TDG)		
	TDG 2*	TDG 3*	TDG 4*
Taxiway Width	35 feet	50 feet	50 feet
Taxiway Edge Safety Margin	7.5 feet	10 feet	10 feet
Taxiway Shoulder Width	10 feet	20 feet	20 feet
Taxiway Fillet Dimensions	See specific guidance in FAA AC 150/5300-13A		

Source: FAA AC 150/5300-13A Airport Design, KLJ Analysis

Exhibit 4-3 indicates the ability of existing taxiway infrastructure to accommodate taxiway design standards and requirements of the critical design aircraft (MD-83). **Exhibit 4-4** illustrates the proposed TDG standards.

A review for taxiway design standard compliance was completed. There are two “hot spots” as depicted by the FAA airport diagram shown above in **Exhibit 4-2**. These are locations with a history of a potential risk of collision or runway incursion, where heightened attention by pilots and drivers is necessary. Hot spots at MOT include:

1. Taxiway B crossing the approach end to Runway 8. Holding positions are identified by red and white 8 APCH signs.
2. Taxiway C crossing Runway 8-26 at an angle. Pilots sometimes miss the holding position signs and markings for Runway 8-26.

Configuration modifications will be considered in **Chapter 5: Alternatives** to mitigate Hot Spot #1 including completely removing Taxiway B under the Runway 8 approach.

Configuration modifications to mitigate Hot Spot #2 would create more of a non-standard condition. Parallel taxiways are essentially required for efficient operation of the airfield. Rather than reconfiguration, **it's recommended the existing flashing runway guard lights (wig-wags) be maintained to help mitigate Hot Spot #2.**

Taxiway C, the parallel taxiway serving Runway 13-31, is currently 75-feet in width. **The taxiway width exceeds the current required width of 50 feet to accommodate the current design aircraft (TDG-4).**

Taxiway B is aligned based on the alignment of an old north-south runway. Taxiway B currently results in an "aligned" taxiway where Taxiway B connects to the Runway 8 end. Taxiway B also crosses approach surfaces, including the threshold siting surface, in close proximity to the runway ends as shown in **Exhibit 4-5. This configuration should be analyzed to determine if reconfiguration is necessary. This taxiway also has limited line of sight from the Airport Traffic Control Tower with the new passenger terminal.**

Taxiway C3 is 75 feet wide which meets standards for up to TDG-5 aircraft. **Taxiway C3 would only require a 50-foot wide taxiway for TDG-3 for large general aviation aircraft and charters.**

Exhibit 4-3 – Existing Taxiway TDG

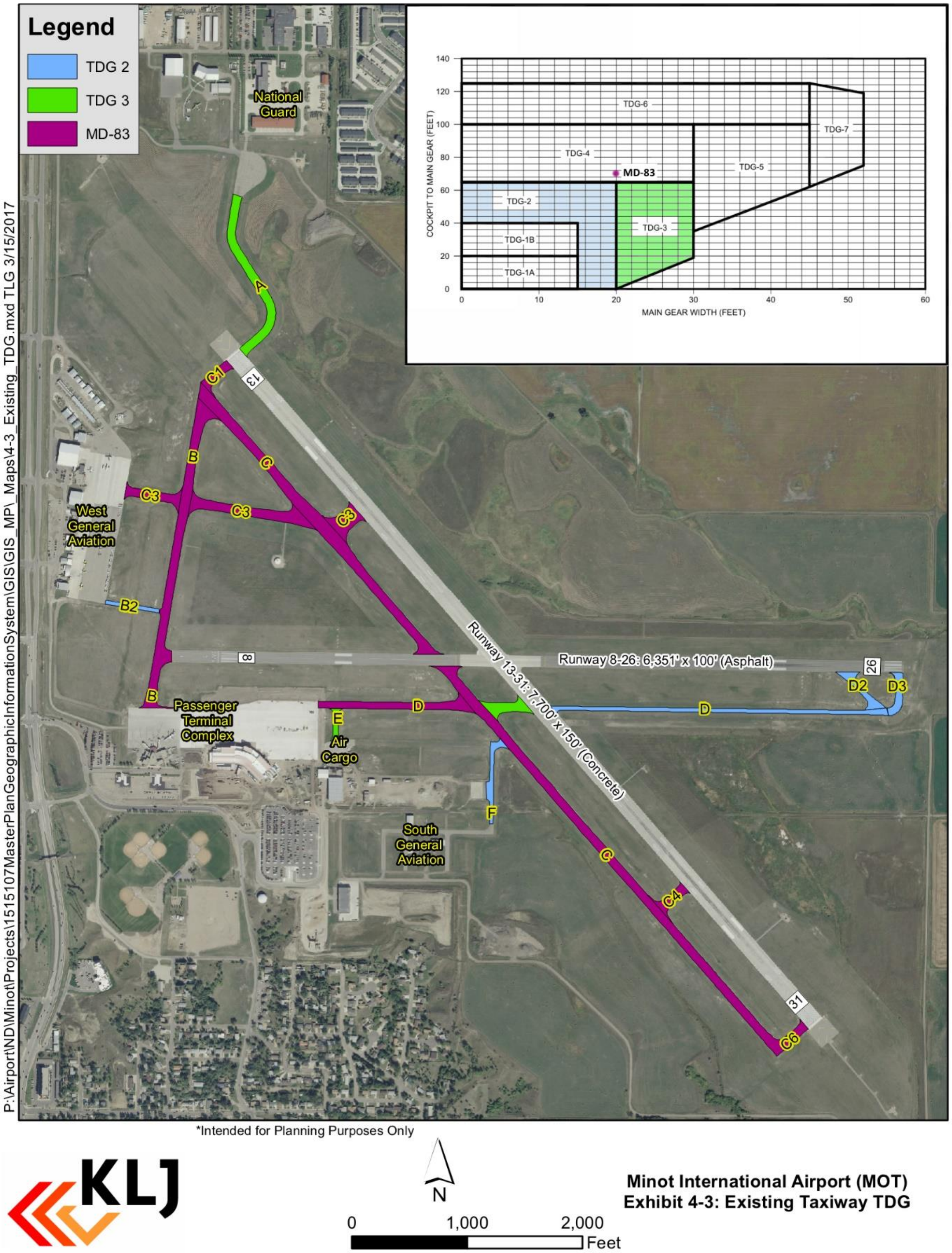
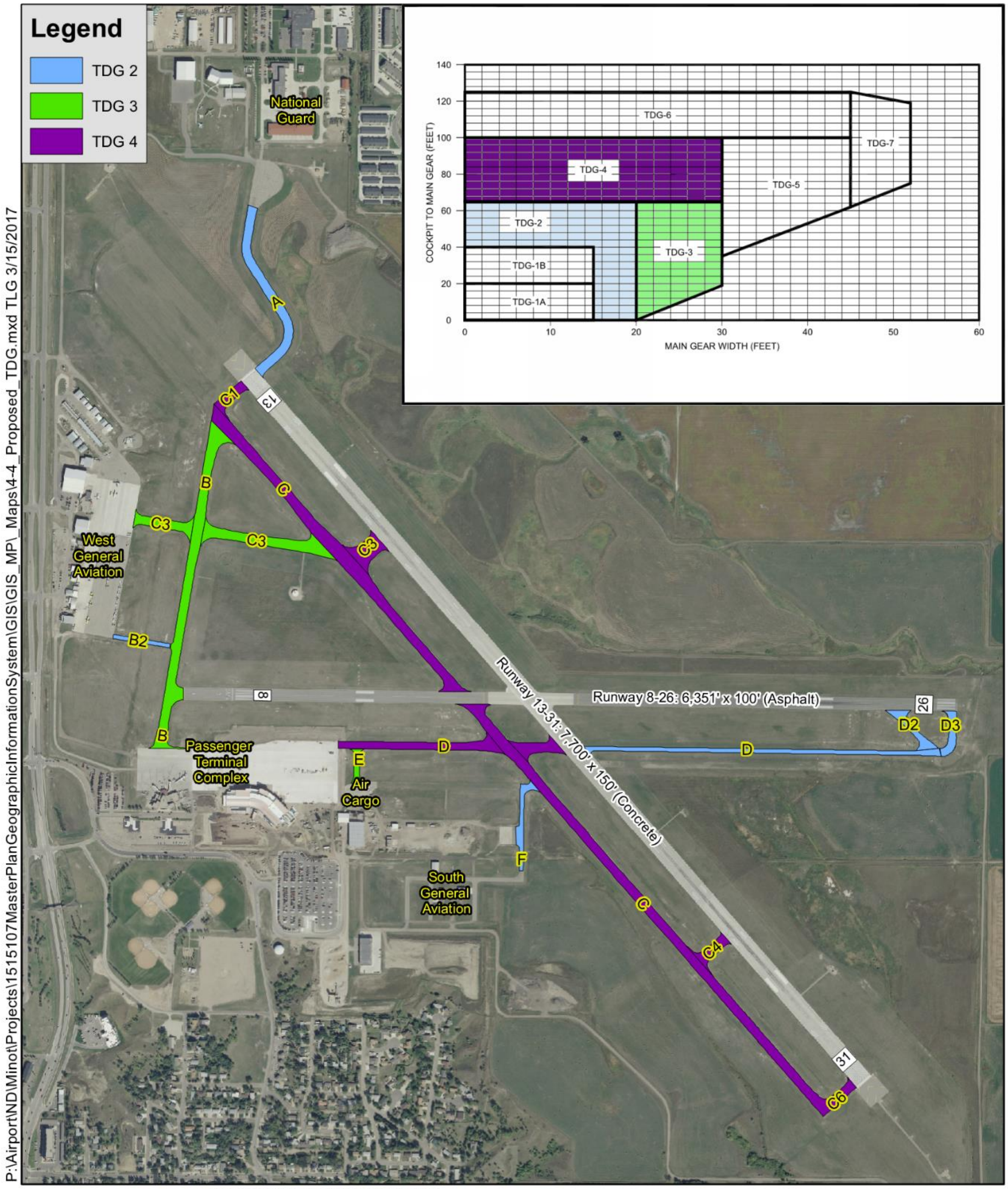


Exhibit 4-4 - Proposed Taxiway TDG



*Intended for Planning Purposes Only

N

0 1,000 2,000 Feet

Minot International Airport (MOT)
Exhibit 4-4: Proposed Taxiway TDG

The intersection of Taxiway F and Taxiway C to the south of the runway intersection is based on when Taxiway F was originally connected to the old alignment of Taxiway D. **The intersection is a non-standard configuration and should be corrected to meet current airfield design standards.**

Taxiway D east of Runway 8-26 is designed for smaller aircraft and is 35 feet wide. A meandering taxiway once connected the old Runway 26 end with the air cargo apron. This has since been realigned to be a parallel taxiway with Runway 8-26. Taxiway D west of Runway 8-26 is 60 feet wide and is adequate as it serves as the primary route to access the commercial apron.

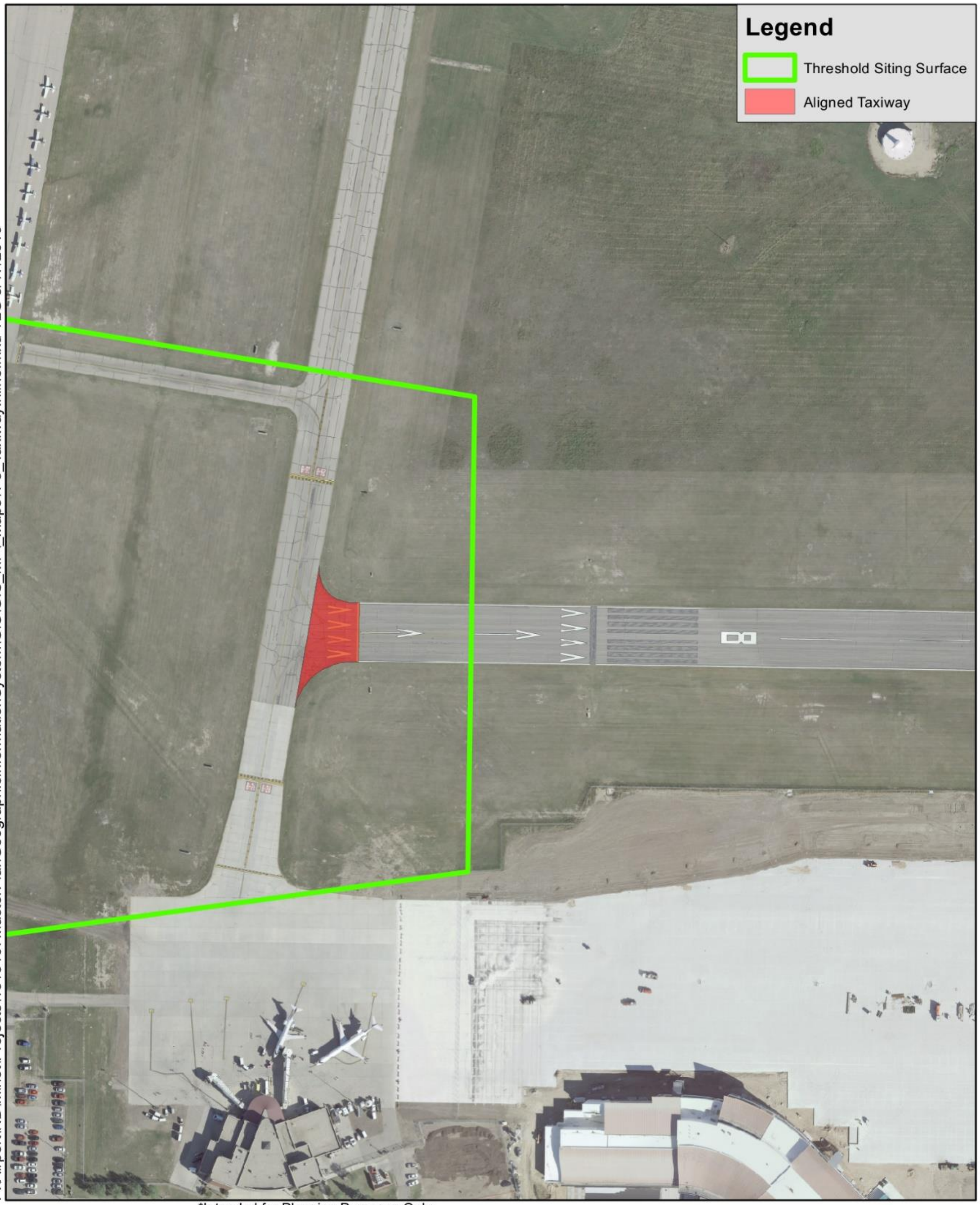
Runway departure delays can be caused by aircraft awaiting departure clearance or completing pre-flight checks. **There are currently no holding bays or bypass taxiways close to the runway ends. These should be considered near the Runway 13 and 31 ends** in particular to improve efficiency and overall flow when sequential departure operations are expected.

Runway 13-31 has five exit taxiway turnoffs. The configuration of the exit taxiways appears to be sufficient to accommodate efficient landing operations on either Runway 13 or 31 without causing substantial delays from aircraft occupying the runway.

Please see **Appendix H** for Runway 13-31 connector taxiway exhibits depicting the existing taxiway safety margin for an MD-83 aircraft along with TDG-4 fillet requirements per AC 150/5300-13. The exhibits indicate sufficient taxiway pavement to meet the needs of the critical design aircraft (MD-83). However, if TDG-4 fillet requirements are to be met in the future, reconfiguration of some taxiway segments would be necessary.

There are currently four exit taxiways for Runway 8-26 landing operations. The exit taxiways are currently available at the end of each runway and where the runway crosses Taxiway C. T**o help increase operational flow and efficiency, improved exit taxiways at each end with an additional mid-field exit east of the Runway 13-31 intersection for small aircraft should be considered.**

Exhibit 4-5 Taxiway B



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*Intended for Planning Purposes Only

KLJ

N

0 250 500 Feet

Minot International Airport (MOT)
Exhibit 4-5: Taxiway B

Passenger Terminal

The requirements identified for the passenger terminal are identified to accommodate the travelling public with a sufficient level of service based on existing and projected growth. The airport opened a new terminal building in February 2016 sufficient to meet the needs of the community through the planning period.

The passenger terminal building consists of approximately 125,000 total usable square feet, including offices, administration, ticketing, baggage, security, concessions, holdrooms/gates, storage and mechanical spaces. Public space open to everyone in non-secure areas is about 41,300 square feet (including counters for Airlines and Rental Cars), and sterile areas for passengers that require security clearance is about 20,300 square feet including the restaurant area. The security checkpoint and TSA offices are 9,400 square feet and TSA baggage screening is also 9,400 square feet. The terminal has six gates, four of which have passenger boarding bridges.

This section will identify key issues with the existing passenger terminal building and provide planning-level conceptual space requirements. Landside requirements for passenger loading/unloading and automobile parking are evaluated separately. Requirements identified are based on the following references to FAA, Transportation Security Administration (TSA), International Air Transport Association (IATA), and industry standards:

- FAA AC 150/5360-13A, *Planning and Design Guidelines for Airport Terminal Facilities* (2012)
- Airports Cooperative Research Program (ACRP), Report 25: *Airport Passenger Terminal Planning and Design Guidebook* (2010)
- ACRP Report 130: *Guidebook for Airport Terminal Restroom Planning and Design* (2015)

The first step is to identify the terminal space needs for MOT to provide a terminal building that meets passenger demands through the planning period. Once the space needs are identified, any long-term changes to the terminal building will be addressed in the next chapter. Broad recommendations will be made in this study; details on a specific interior layout and engineering and architectural review would be identified in a separate terminal master planning study.

Terminal Design

OVERALL CONSIDERATIONS

Terminals are designed to handle passenger volume and functions to interface between aircraft and ground transportation. Terminals must accommodate changes in the airline industry and passenger preferences. Factors that influence terminal design include:

- Total Passenger Volume – The annual number of passenger enplanements affects the total size and recommended configuration of a terminal building.
- Passenger Peaking Characteristics – Arriving or departing flights concentrated into a small timeframe require adequate space and throughput for surges in passenger ticketing, security, gates, baggage claim, and concessions.
- Passenger Preferences – Business travelers typically are more experienced with airports, demand shorter wait times and efficiency. Leisure passengers require more time, attract meters/greeters, and typically have more baggage to process. Airline fees also drive passenger preferences to check or carry-on baggage.
- Airline Station Characteristics – Spoke airports such as MOT accommodate origin & destination (O&D) passengers rather than using the airport to connect to another flight. Aircraft tend to

remain overnight for the first flight out to a hub airport. All passengers have a requirement for check-in, security, baggage, ground transportation, and parking.

- Aircraft Mix – The size and frequency of the aircraft activity affects the number and size of the gates, passenger waiting holdroom, and the terminal apron configuration.
- International Service – Airports with international service require aircraft to have longer gate occupancy times and additional space for Federal Inspection Services (FIS).
- Industry Trends – Industry changes are affecting terminal design. Examples include reduced airline flight frequency, higher load factors, aircraft types, use of check-in kiosks, TSA pre-check program and airline fees affecting baggage.

LEVEL OF SERVICE

Terminal improvements are evaluated in their ability to serve passengers and provide a comfortable experience through the airport. A Level Of Service (LOS) concept uses a set of standards to measure the quality of the passenger experience. LOS standards are used to evaluate the efficiency of passenger flow, space requirements and wait time. Each LOS has a defined space planning standard to determine facility requirements.

Table 4-32 – Level of Service (LOS) Standards

LOS		Service Level
A	Excellent	Conditions of free flow; no delays; direct routes; excellent level of comfort
B	High	Condition of stable flow; high level of comfort
C	Good	Condition of stable flow; provides acceptable throughput; related systems in balance
D	Adequate	Condition of unstable flow; delays for passengers; condition acceptable for short periods of time
E	Unacceptable	Condition of unstable flow; subsystems not in balance; represents limiting capacity in the system
F	System Breakdown	Unacceptable congestion and delays

Source: ACRP Report 25: Airport Passenger Terminal Planning and Design

The assumption for this master plan is to obtain LOS C which peak wait times are 10 minutes or below. Delays and space requirements are typically considered acceptable. LOS C is considered reasonable balance between ideal size and economic considerations.

MINOT CONSIDERATIONS

There are no specific space-planning considerations at MOT that need to be evaluated in this study considering the newly opened terminal building. The primary focus will be to assess the capacity of the terminal with the demand identified in the **Chapter 3: Aviation Forecasts**.

Demand Factors

The primary function of a terminal is to provide adequate space to serve passengers. An evaluation of the passenger and gate demand is first completed to provide overall terminal space planning metrics at Minot.

PASSENGER ACTIVITY LEVELS

The following planning activity levels (PAL) numbers are to be used for terminal building planning. These figures provide an estimate of the number of passengers to arrive, depart and generally flow through the terminal building. The figures depicted in **Table 4-33** are based on a percentage of total enplaned passengers distributed based on the existing airline schedule.

Table 4-33 – Terminal Passenger Activity Levels

Metric	Base	PAL 1 5 Year	PAL 2 10 Year	PAL 3 15 Year	PAL 4 20 Year
Terminal Passengers					
Annual Enplanements	220,522	192,253	201,574	241,643	289,769
Design Hour Departing	310	271	284	346	408
Design Hour Arriving	379	330	346	422	498
Design Hour Passengers	458	399	418	500	601

Source: KLJ Analysis

DESIGN HOUR & FLEET MIX

The aircraft fleet mix in the terminal area is determined using the total number of forecast departures as shown during the design hour. The design hour is the early morning block of flights where four flights depart MOT. Aircraft types are grouped in Airplane Design Group (ADG) and class. The design aircraft for MOT will remain a regional aircraft accommodating 61 to 99 passengers. The airlines serving MOT will be increasing the sizes of the smallest aircraft in the market which will increase enplanements but leave operations relatively flat. The aviation forecasts project the average number of seats per aircraft will increase. As a result, the total number of flights is projected to remain flat while the total number of passengers will increase nearly 31 percent through PAL 4 (see **Table 4-34**).

Table 4-34 – Design Hour Departures

Design Aircraft Type	Seats	Base	PAL 1	PAL 2	PAL 3	PAL 4
Regional Aircraft (ADG II)	50	2.6	0.9	-	-	-
Regional Aircraft (ADG III)	76	1.3	2.0	2.2	2.8	3.4
Narrowbody Aircraft (ADG III)	155	0.2	0.1	-	-	-
Narrowbody Aircraft (ADG III)	166-177	0.3	0.4	0.6	0.7	0.8
Boeing 757 (ADG IV)	215	-	-	-	-	-
Design Hour Departures	**-**	**4.4**	**3.4**	**2.8**	**3.5**	**4.2**

Source: KLJ Analysis

GATE REQUIREMENTS

Gates are necessary for aircraft to adequately serve arriving and departing aircraft. The minimum number of gates at an airport is a function of the peak hour activity. Additional contingency metrics are also used to determine the required gates. At MOT the peak gate utilization period is the early morning departure block which exceeds the demand of the late evening arrival period. One contingency gate is added to accommodate unscheduled charter flights or long-term delayed flights (see **Table 4-35**).

Table 4-35 - Gate Requirements

Design Aircraft	Base	PAL 1	PAL 2	PAL 3	PAL 4
Design Hour Departures	4.4	3.4	2.8	3.5	4.2
Contingency Gate	1.0	1.0	1.0	1.0	1.0
Total Gates	5.4	4.4	3.8	4.5	5.2
Total Required Gates	**6**	**5**	**4**	**5**	**6**

Source: KLJ Analysis

The total required gates is then split up into aircraft types using the fleet mix determinations to determine the total and equivalent number of gates for space planning. There are four gates at MOT able to accommodate regional and narrowbody aircraft simultaneously with a passenger boarding bridge (PBB). The existing gates are designed to meet the size of the design aircraft. Two parking stands with ground access are available at gates 1 and 6 for overnight parking. The contingency gates should accommodate the occasional use of up to Boeing 757 aircraft for nonscheduled operations.

Table 4-36 - Gate Space Requirements

Design Aircraft	Existing	Base	PAL 1	PAL 2	PAL 3	PAL 4
Medium Regional Aircraft (ADG-II)	*0*	3	1	0	0	0
Large Regional Aircraft (ADG-III)	*0*	1	2	2	3	3
Narrowbody Aircraft (ADG-III)	*4*	1	1	1	1	1
Boeing 757 (ADG-IV) - Contingency	*2*	1	1	1	1	1
Total Number of Gates	***6***	**6**	**5**	**4**	**5**	**5**
Narrowbody Equivalent Gate (NBEG)	*6.2*	5.2	4.8	5.1	5.1	6.1
Equivalent Aircraft (EQA)	*7.0*	4.0	4.0	4.0	4.0	5.0

Source: KLJ Analysis

Per **Table 4-36**, **MOT will not require any additional gates during the planning period**, however adding one PBB to the existing four will be needed during the planning period. The increased amount of large regional and narrowbody aircraft can be accommodated within the current gate positions and terminal structure. There is additional capacity to accommodate a Boeing 757 contingency gate.

One notable issue exists with Gate 4. On the airside of this gate, Taxiway D continues along the north edge of the commercial apron. With the taxiway object free area space required for aircraft to taxi on Taxiway D, Gate 4 is limited to only large regional aircraft.

Building Areas

Individual functional areas of the terminal building have been evaluated to determine planning-level space needs to accommodate current and future demand. Space requirements will be a major consideration when evaluating terminal building alternatives.

AIRLINE SPACE

There is currently 2,400 square feet of area behind the ticketing counters dedicated for airline offices. There are a total of six airline areas within this space with an average space per office of 400 square feet. According to ACRP Report 25 a planning factor of 10-25 square feet of office space per linear feet of counter space. With 119 linear feet of counter space this calculates to 1,190 to 2,975 square feet of office. There are three airlines serving MOT presently and two different companies currently provide ticketing and ground handling services for these airlines. One company, DGS, serves Delta and United and Trego-Dugan serves Allegiant. If a new airline enters into the MOT market then existing office space is available. **There is sufficient total space to accommodate up to six airlines at MOT.**

Other airline space considerations include airline ramp offices, baggage make-up and support facilities on the airside portion of the airport. These are used for airline ground servicing functions. There is currently 24,600 square feet for baggage make-up, ramp offices, and GSE storage. Using a planning space metric of 1,300 square feet per office, 2,500 square feet for ramp services and 8,100 square feet for baggage makeup, there is a need for 19,500 square feet of space. The airlines are able to adequately function with the existing space as some services are contracted to other providers. **The total airline ramp space needs are forecast to be fully met into the future.**

Baggage Service Offices (BSO) provide handling and storage for late or unclaimed bags. There is a BSO facility at MOT located on the eastern most end of the baggage claim area which is staffed by airline ticket counter and ramp staff. The BSO includes a secure area for baggage storage. This space is sufficient.

TICKETING & CHECK-IN

The passenger check-in process continues to change as new technologies and processes are implemented. These changes have reduced the space needed in the ticketing lobby space and staffed ticket counter positions. Waiting times are also reduced. Traditionally, all passengers checked in at the ticket counter to both receive boarding passes and check baggage. Now, remote self-service equipment allows individuals to obtain boarding passes online or at the airport without the need to use staffed ticket counters. Checked baggage is accommodated by a dedicated airline bag-drop representative at the counter. The use of self-service equipment continues to grow. Potential future trends include self-tagging stations and remote off-airport bag-drop facilities which would reduce the need for staffed positions at the airport.

The passenger check-in assumptions are important to evaluate space and facility needs. For planning purposes the following assumptions are made:

- Passengers Checking Baggage - Average is 50 percent with 70 percent for leisure flights
- Checked Baggage Location - 100 percent within the terminal, 0 percent curbside, 0 percent remote location
- Passenger Check-In Location - 30 percent remote, 30 percent in-terminal kiosk, 40 percent in-terminal counter

The ticketing lobby at MOT currently consists of 5,100 square feet for ticket counters and queuing with a total of 26 available check-in positions provided at the airport with 119 linear feet of counter space. The airlines lease 6 staffed counters and provide one to two positions per counter for a total of 11 positions.

Many airlines also provide self-service kiosks near their ticket counter area mostly within the ticket counter queue. There are several check-in kiosks located in the corridor, owned by Delta Air Lines and United Airlines. There are no curbside check-in facilities provided. The ticketing lobby has a 30 foot queue depth which is more than the FAA's minimum recommendation of 15 feet.

Table 4-37 – Ticketing Requirements

Metric	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Staffed Ticketing Positions		8	7	7	10	12
Number of Dedicated Kiosks		6	6	6	6	6
Staffed Bag Drops for Kiosks		3	3	3	3	3
Total Equivalent Positions		14	14	14	16	18
Total Queue/Kiosk Area (SF)	***3,400***	**2,700**	**2,700**	**2,700**	**2,700**	**2,700**

Source: KLJ Analysis

The total number of airport provided ticketing positions meets the needs through PAL 4 (see **Table 4-37**). Each individual airline is responsible for leasing space to allow customers adequate space and check-in options. Additional positions may be provided for frequent fliers and/or first class customers. Most airlines at Minot require customers to proceed to a check-in position where an agent and a kiosk are available. It is recommended additional self-service kiosks be installed in the ticketing areas with staffed bag drops. Kiosks reduce passenger waiting time and require minimal space.

A simple review shows there is sufficient total queuing space for passengers. There will be individual peak periods that may exceed leased space in front of each airline counter and queue area. The space is available from the airport but is it the responsibility of each airline to lease the space for passenger exclusive use.

Curbside check-in is provided to enhance the LOS and reduce congestion within the ticketing lobby. MOT does not offer curbside check-in. There is adequate space and a high LOS within the existing ticketing lobby. Curbside check-in would require a 30-foot wide curb, check-in podiums with a baggage cart.

BAGGAGE SCREENING & MAKE-UP

Baggage screening facilities are located behind the airline offices using an in-line baggage screening conveyor system connected directly to the airline ticket counters. The screening equipment is operated by the TSA to screen checked bags for explosives and other prohibited items. Bags are fed through one Explosive Detection System (EDS) machine or screened with one Explosive Trace Detection (ETD) station. Once bags are cleared they are sent by baggage belt to the airlines bag make-up area to be carted to the aircraft.

Oversized bags are delivered by hand to the TSA through an overhead door on the west end of the screening room. After these oversized bags are screened they are dropped back in the same area for the airlines to move to the baggage make-up area. The screening equipment is within a 6,700 square foot area dedicated to baggage screening. **The baggage screening space meets the needs through PAL 4 using TSA equipment assumptions** (see **Table 4-38**).

Baggage make-up facilities are connected in-line with the screening area by a baggage conveyor system. After the bags are screened they continue on a conveyor to one of two baggage make-up carousels. The baggage carousels each have 220 linear feet for handling bags and luggage cart access area for bag make-up exclusive to each airline connected to a driving corridor for baggage carts and tugs. This driving corridor is also used for the storage of ground support equipment. The area totals 10,500 square feet and includes the 7,100 square feet corridor for equipment maneuvering and 3,400 square feet for the baggage make-up carousels.

Table 4-38 – Baggage Screening & Make-Up Requirements

Metric	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Baggage Screening Area	***6,700***	**2,580**	**2,580**	**2,580**	**2,580**	**3,380**
Baggage Make-Up Area	***10,500***	6,800	6,800	6,800	6,800	6,800

Source: KLJ Analysis

Based on the volume of bags for MOT it is recognized that the airport currently needs 3,380 square feet of space for baggage screening and 6,800 square feet for baggage make-up by PAL 4 to accommodate total and peak periods (see **Table 4-38**). **The total dedicated space for baggage make-up will be sufficient through the planning period.**

SECURITY CHECKPOINT

The Security Screening Checkpoint (SSCP) area is used by TSA to screen passengers and property prior to entering the sterile area of the terminal concourse. MOT has a facility with space sufficient to meet the current and future demands. There are currently two lines for checking passengers with space for a third. One is configured for TSA Pre-Check and the other for all other passengers. There are currently two x-ray machines for property search, one walk-through metal detectors, and one Advanced Image Technology (AIT) scanner, all staged in a wide corridor. There is a 1,200 square foot queue area in front of the screening equipment. The total screening area is about 4,200 square feet in size. There is another 1,400 square feet of TSA office space. The calculated maximum current wait time in queue is 15.7 minutes during the peak hour and two lines according to calculations using metrics from ACRP's terminal planning spreadsheet.

SSCP space requirements are driven by equipment and queuing space from the number of passengers and estimated throughput rate. Actual throughput rates of 150 passengers per hour per lane are common nationally. Queue wait time does not exceed a maximum of 10 minutes through the planning period with both security lanes in service. **The existing SSCP space with three lanes is sufficient to meet the needs until design hour enplanements reaches 390 (see Table 4-39).**

Table 4-39 - Security Screening Checkpoint Requirements

Metric	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Design Hour Enplanements	-	310	271	284	340	408
Security Screening Lanes	*2*	3	3	3	3	4
Maximum Wait Time (min.)	*15.7*	3.8	0.7	1.8	6.1	3.5
Security Screening Area	***4,200***	**3,600**	**3,600**	**3,600**	**3,600**	**4,800**
Total Security Area	***5,400***	**4,500**	**4,500**	**4,500**	**4,500**	**6,000**

Source: KLJ Analysis

Technology and processes will continue to evolve. The TSA Pre-Check program will likely increase throughput which in the future may reduce the need for additional queuing areas. TSA staffing levels will also affect passenger wait times.

PASSENGER HOLDROOMS

Passenger holdrooms are designated areas in the sterile concourse area where passengers wait to board the aircraft at the gate. The size of the holdrooms are directly related to the aircraft size at each gate. The estimated fleet mix is used to determine holdroom sizing for each gate. Each holdroom is sized assuming 80 percent of the total number of passengers are seated and the remaining 20 percent are standing. Additional space requirement for the gate podium and podium queue are also taken into account.

There is a total of 10,600 square feet of net holdroom space for six gates. Holdroom seating capacity is often shared among several gates or in separate areas of the terminal. Cumulatively, total existing seating capacity is approximately 350 seats which provides seating for 100 percent of the peak hour departing passengers through PAL 3 and 85 percent of PAL 4 peak hour departing passengers.

The evaluation of holdroom requirements is based on the average number of passengers per aircraft per gate. Without a contingency gate, the peak hour departure block requires five gates for PAL 1 dropping to three gates for PAL 2 then rising again to five gates in PAL 4. The rise and fall in gate requirements is due to higher frequency small aircraft being used in PAL 1 and 2 changing to less frequent larger aircraft in PAL 3 and 4. This assumes a maximum of four of the six gates are in use at the same time for RON (Remain Over Night) flights. **The analysis concludes the existing holdroom space is sufficient for the planning period as shown in Table 4-40.**

Table 4-40 – Holdroom Requirements

Metric	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Design Aircraft Size						
50 Passengers (1,000 SF)	*0*	3	1	0	0	0
76 Passengers (1,400 SF)	*4*	1	2	2	3	3
155-177 Passengers (2,700 SF)	*2*	1	1	1	1	1
215 Passengers (3,200 SF)	*2*	0	0	0	0	0
Total Number of Gates In Use	***6***	**5**	**4**	**3**	**4**	**5**
Total Holdroom Area	***11,900***	**6,800**	**6,200**	**5,200**	**6,600**	**6,600**

Source: KLJ Analysis

CONCOURSE SIZE & CIRCULATION

The overall size of the terminal concourse was evaluated for future space planning as shown in **Table 4-41**. The exterior terminal frontage is based on the aircraft fleet mix parked at the gate with sufficient wingtip clearance between aircraft. The current concourse exterior frontage available to aircraft is 482 linear feet (LF) with approximately 780 feet available for aircraft parking. The width of the terminal varies based on whether the terminal has gates on one or both sides (single vs. double loaded) and the corridor width. The current MOT terminal is single loaded with gates only on one side. The current corridor width is 10-12 feet for a walkway. The suggested minimum width for a single-loaded terminal is 20 feet for a high LOS facility. **The concourse width is adequate considering the short length of the terminal and centralized location for entry and exit to ticketing and baggage claim.**

Table 4-41 – Concourse Size & Requirements

Metric	*Exist.*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Narrowbody Equivalent Gate (NBEG)*	6.2	4.1	3.7	4.0	4.0	5.0
Aircraft Frontage (LF)	*780*	598	533	429	572	715
Concourse Length** (LF)	*482*	598	533	429	572	715
Concourse Width (ft.)**	*12*	20	20	20	20	20

**Does not include Boeing 757 contingency gate beyond existing, **Assumes single-loaded concourse*
Source: KLJ Analysis

BAGGAGE CLAIM & HANDLING

Baggage claim devices are provided for arriving passengers to retrieve their checked bags from the aircraft. Bags are offloaded from the aircraft, placed on baggage carts, transported to a baggage handling area, and then offloaded onto the baggage belts in a secure area.

The baggage claim area at MOT has two flat-plate baggage claim devices. One is ‘U’ shaped with 290 LF of presentation frontage and the second is ‘T’ shaped with 168 LF of frontage for a total baggage claim frontage space of 458 LF. There is approximately 12,100 square feet of baggage claim area connected directly to entry/exit corridors to the front of the terminal and to the car rental area. An area for distributing oversized baggage is located adjacent to the Baggage Service Office. It is assumed 70 percent of passenger check bags.

There is space available for an additional 149 LF ‘L’ shaped baggage claim device if it is needed in the future. Peak single aircraft is assumed to be a Boeing 757 with 215 passengers. **The existing baggage handling infrastructure should be sufficient through the planning period (see Table 4-42).**

Table 4-42 – Baggage Claim & Handling Requirements

Metric	*Exist.*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Peak People at Claim	-	167	145	152	186	212
Baggage Claim Frontage	*458*	250	218	228	279	329
Peak Single Aircraft Frontage	*290*	189	189	189	189	189
Total Baggage Claim Area	***12,100***	**7,500**	**6,540**	**6,840**	**8,220**	**9,870**
Total Baggage Handling Area	***4,000***	**2,300**	**2,200**	**2,200**	**2,500**	**2,800**

Source: KLJ Analysis

The baggage handling area is approximately 4,000 square feet in size. The baggage handling area requires a baggage tug drive lane, offloading zone and bypass lane. Multiple flights arriving near the same time will also require additional space to drive around active unloading operations. The existing depth is 21 feet and is adequate for the planning period.

Total percentage of passengers checking bags dramatically changes the baggage claim requirements. Baggage trends should continue to be monitored by the airport with space needs updated. Over the past several years airline fee structures have charged for checked bags reducing demand. The trend is for airlines to charge for carry-on bags as well which may cause the number of checked bags to increase again.

CONCESSIONS

Concessions are areas within the airport terminal used for retail space located in the public and sterile portions of the terminal. Airport industry trends demand more concessions in the sterile portion of the terminal as passengers have increased dwell times after the security checkpoint. Additionally liquids, aerosols, and gels are heavily restricted through the checkpoint. Currently 15 percent of the concession area is located in the public area with 85 percent in the sterile concourse.

Concessions located in the public area is a 360 square foot coffee/newsstand area on the first level. Within the sterile concourse the primary concession is a 2,150 square foot cafe/bar area. In addition to the concessions on the first level, there is an eating area on the second level which can be served from the restaurant in the sterile area through a 'sally port'. The sally port is a secure controlled entry/exit point for badged cafe workers to take orders and deliver food to persons in the public area. Other amenities such as vending machines are included in the terminal in both the public area and sterile area. **The space available for concessions should be sufficient through the planning period.**

RENTAL CAR

Near baggage claim in the public area, there are five rental car counters at MOT totaling about 3,100 square feet. The size of the offices are sufficient. The queue area is not designated but extends 18 feet from the counters toward the baggage claim area. **Four of the five rental car counters and offices are occupied, so there is space available for one additional providers.** See **Table 4-43** for a space tabulation.

Table 4-43 - Rental Car Requirements

Metric	*Exist.*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Number of Providers	*5*	4	4	4	5	5
Rental Car Office Area (SF)	*960*	768	768	768	768	960
Rental Car Counter Area (SF)	*660*	528	528	528	528	660
Rental Car Area (SF)	***3,100***	**2,480**	**2,480**	**2,480**	**2,480**	**3,100**

Source: KLJ Analysis

AIRPORT ADMINISTRATION

The Airport Administration terminal areas include staff operations, offices and conference rooms. This includes 4,400 square feet of space, all on the second level adjacent to the concourse entry. **This space should provide sufficient space through the planning period.**

PUBLIC SPACES

Public spaces include non-revenue generating areas of the terminal building used for restrooms, circulation, seating and waiting areas. Including sterile and non-secure areas, 2,750 square feet is dedicated to public restrooms. The number of restrooms is based on the design hour passengers in the public area, and on the number of equivalent aircraft within the secure area. **Restrooms are located in adequate locations within the sterile and non-secure areas.**

Table 4-44 – Restroom Requirements

Metric	*Exist.*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Secure Area						
Male Restrooms	*10*	5	5	5	5	5
Female Restrooms	*10*	6	6	6	6	6
Family Restrooms	*1*	1	1	1	1	1
Total Fixtures	***21***	**12**	**12**	**12**	**12**	**12**
Non-Secure Area						
Male Restrooms	*6*	5	5	5	5	6
Female Restrooms	*6*	6	6	6	6	8
Family Restrooms	*1*	1	1	1	1	1
Total Fixtures	***13***	**12**	**12**	**12**	**12**	**15**

Source: KLJ Analysis, ACRP Report 130 Guidebook for Airport Terminal Restroom Planning and Design

The meet/greet areas are both on the second level and in the baggage claim area. The second level area is 1,000 square feet of space adjacent café/bar on the secure side which is considered to be sufficient space. The meet/greet area in baggage claim is not designated.

General circulation within the terminal is adequate on both the first and second levels. On the second level there is a total of 4,600 square feet of public circulation space which includes the checkpoint entry, secure area exit and entry to the airport administrative offices. On the first level there is 15,000 square feet of public circulation space, including the elevator and escalators.

Circulation efficiency is a product of good wayfinding signage. As deficiencies are noted and as changes take place in the terminal, signage must be adjusted to properly direct the public to terminal building services.

Recommendations

Table 4-45 below summarizes the identified space requirements for the passenger terminal building:

Table 4-45 - Passenger Terminal Building Space Requirements

Metric	*Exist.*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Demand						
Annual Enplanements	-	220,522	192,253	201,574	241,643	289,769
Building Areas						
Total Required Gates	*6*	6	5	4	5	6
Airline Ticket Office (SF)	*2,400*	1,200	1,200	1,200	1,600	1,600
Staffed Equivalent Positions	-	14	14	14	16	18
Dedicated Kiosks	*6*	6	6	6	6	6
Baggage Screening Area (SF)	*6,700*	2,580	2,580	2,580	2,580	3,380
Baggage Makeup Area (SF)	*10,500*	6,800	6,800	6,800	6,800	6,800
Security Screening Lanes	*2*	3	3	3	3	4
Total Security Area (SF)	*5,400*	4,500	4,500	4,500	4,500	6,000
Total Holdroom Area (SF)	*11,900*	6,800	6,200	5,200	6,600	6,600
Aircraft Frontage (LF)	*780*	598	533	429	572	715
Baggage Claim Frontage (LF)	*458*	250	218	228	279	329
Baggage Claim Area (SF)	*12,100*	7,500	6,540	6,840	8,220	9,870
Baggage Handling Area (SF)	*4,000*	2,300	2,200	2,200	2,500	2,800
Rental Car Area (SF)	*3,100*	2,480	2,480	2,480	2,480	3,100
Sterile Area Restroom Fixtures	*21*	12	12	12	12	12
Public Area Restroom Fixtures	*13*	12	12	12	12	**15**

Note: RED indicates a deficiency to existing facilities
Source: KLJ Analysis

Passenger terminal building facility recommendations include the following:

- **Remain apprised of any issues that arise associated with the new terminal and adjust space as possible.**
- **Monitor passenger peak hour activity and associated SSCP wait times to determine if/when additional security screening lanes are required.**

Apron

TERMINAL APRON

The primary purpose of the terminal apron is to provide parking for commercial passenger aircraft at the terminal gate and provide circulation space for aircraft and airline support functions. There are four passenger boarding bridges and six parking positions around the terminal.

The primary driver for the size of a terminal apron is the terminal building. The building layout and configuration drives the size and space needs for the apron. The terminal apron size and configuration is a function of the total number of gates, building configuration, aircraft type, airfield configuration, aircraft maneuvering, and FAA design standards including wingtip clearances.

The terminal apron is sized to accommodate regular use of larger aircraft as identified in the gate space requirements. Known existing considerations to the terminal apron size include deicing operations at the gates. The deepest portion of the apron is on the eastern portion and it narrows as it continues west. Also, as the apron continues west, the terminal narrows to provide the most apron space possible while limiting hold room space inside the terminal.

The terminal apron was constructed narrower to the west in anticipation of the Runway 8 threshold being relocated further east. Since there is no recommendation to relocate the Runway 8 threshold as determined in the previous ALP, it will be possible to expand the terminal apron to the north. The minimum depth of apron to the taxiway centerline can roughly be figured by adding the setback from the terminal, aircraft length plus safety margin, service road, and taxiway object free area.

$$100'(setback) + 175'(aircraft) + 25'\ (service\ road) + 93'\ (TOFA) = 393'$$

The narrowest portion of the terminal apron is currently 305 feet from the terminal to the taxiway centerline.

REMAIN OVERNIGHT PARKING (RON)

There is currently no designated RON parking apron at MOT, however commercial aircraft typically park overnight at the terminal gates. There are currently six aircraft parking stands surrounding the terminal building accommodating aircraft ranging from a CRJ-200 to a Boeing 757. Four aircraft can connect to a passenger boarding bridge depending on aircraft size. The December 2014 flight schedule shows there are five RON aircraft (1 CRJ-200, 2 Embraer E-170, 1 CRJ-900 and 1 A319 aircraft) during weekdays. **The existing gate configuration is considered to be sufficient to support RON operations.**

DEICING APRON

Aircraft deicing is necessary prior to departure in cold weather conditions. Deicing operations are currently accomplished on the existing aircraft apron in front of each gate. The apron for the terminal all drains to a centralized point for monitoring. **A dedicated apron area for aircraft de-icing is recommended to eliminate aircraft access blockages to the main terminal apron, taxiway, and gates.**

GROUND EQUIPMENT STORAGE

Airlines operate their own ground service equipment (GSE), including a variety of aircraft tugs, pushbacks, service vehicles, deicers, ground power units (GPUs), baggage belt-loaders, and other support vehicles. GSE is currently stored outdoors, inside the existing terminal and around the baggage make-up area. The deicing trucks are not able to park in this area. **Due to the cold winter temperatures a facility to store deicing trucks and deicing fluids inside should be planned.**

Air Cargo

MOT has air cargo flights conducted to serve FedEx, UPS, and to carry checks for banks. The FedEx service is to Grand Forks[6] with periodic service beyond to Williston or Bismarck. The UPS service is from Sioux Falls, SD with periodic service beyond to Williston. FedEx cargo is processed on the cargo apron adjacent to Taxiway D. UPS cargo is processed on the north end of the main general aviation apron. Please see **Exhibit 4-6** for cargo apron locations. The banking activity does not use a specific location on the apron.

[6] FedEx announced in February 2016 its plans to relocate air cargo from Grand Forks to Fargo which will become the new distribution point for Minot when the change occurs later in 2016.

Exhibit 4-6 – Cargo Aprons

Total enplaned and deplaned air cargo is forecasted to grow steadily by 5 percent through PAL 4. There is minimal belly cargo carried by the airlines.

The air cargo operations at MOT occur in the morning and early evening for FedEx and UPS and occur in the early morning for banking to meet delivery schedules. Cargo is loaded and unloaded on the apron areas.

FedEx recently expanded their building by adding a 36,000 square foot addition to the previous 6,400 square foot building. This addition was made because the facility is used as a ground cargo hub for FedEx packages to be distributed to western North Dakota.

The current cargo apron and taxiway used by FedEx are undersized for strength and small considering the larger FedEx aircraft currently serving Minot. A consolidated space can be created to accommodate both FedEx and UPS. There will need to be sufficient apron for FedEx to park through the day and the UPS carriers typically hangar their aircraft during the day to avoid deicing. The apron area for air cargo needs close access to roadways to minimize movement of cargo trucks on the airside and it needs to be conveniently located for services needed for the aircraft such as storage, fueling, and deicing.

The apron needs will be based on estimated fleet mix. Current fleet mix includes:

- One ADG-I air cargo aircraft (1 banking)
- One ADG-II air cargo aircraft (1 UPS)
- One ADG-III FedEx ATR-42 air cargo aircraft

It is estimated cargo aircraft will remain relatively stable with a slight increase through PAL 4. Size requirements were calculated for each design aircraft using calculated clearances from other aircraft, objects and an assumed taxilane. An additional 10 percent is added for Ground Support Equipment (GSE).

- Airplane Design Group I – 1,000 square yards per aircraft
- Airplane Design Group II – 2,400 square yards per aircraft
- Airplane Design Group III – 3,300 square yards per aircraft

The apron should be designed to FAA standards so that sufficient space for parking, circulation and ground operations. **Table 4-46** summarizes the air cargo apron space requirements. Expansion concepts will be developed in the following chapter.

Table 4-46 – Air Cargo Apron Requirements

Category	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Cargo Aircraft						
Design Group I	*1*	1	1	1	1	1
Design Group II	*1*	1	1	1	1	2
Design Group III	*1*	1	1	1	1	1
Total	***3***	**3**	**2**	**3**	**3**	**3**
Cargo Apron Space (SY)						
Design Group I	-	1,000	1,000	1,000	1,000	1,000
Design Group II	-	2,400	2,400	2,400	2,400	4,800
Design Group III	-	3,300	3,300	3,300	3,300	3,300
Total Space	***4,400***	**6,700**	**6,700**	**6,700**	**6,700**	**9,100**

**USPS aircraft is not added since it operates at a time when the other aircraft have already departed the airport.*
Source: KLJ Analysis

The most recent North Dakota Aeronautics Commission Pavement Condition Index (PCI) study for MOT shows the cargo apron, southern GA apron, and Taxiway B2 have a PCI index below 40, which typically indicates reconstruction is necessary. Please see **Appendix G** for more details.

Recommendations

The Air Cargo recommendations are as follows:

- **Establish an area of apron and associated buildings for air cargo with sufficient airside and landside access. The facility should be sized to meet the requirements in PAL 1 (6,700 SY) with expansion capability through PAL 4 (9,100 SY).**
- **Locate the cargo apron area so that there is flexibility to either store aircraft in hangars in the area or conveniently tow aircraft for storage in other hangars.**

General Aviation

General Aviation (GA) includes all civil aviation activities except for commercial service. GA includes corporate aviation and covers a much broader portion of the aviation community. GA activities found at Minot include corporate travel, medical transport, flight training, aerial application, as well as recreational flying. These types of aeronautical activates serve the public in a capacity that may be less noticeable to the average citizen. Providing facilities and access for GA users at MOT will continue to be vital for the community and region.

On-airport businesses providing aeronautical services known as Fixed-Base Operators (FBOs) and Specialized Aviation Service Operators (SASOs) provide aircraft maintenance, fueling and other pilot and passenger services.

Table 4-47 identifies the PAL metrics for General Aviation.

Table 4-47 – General Aviation Planning Activity Levels (PALs)

Metric	Base	PAL 1	PAL 2	PAL 3	PAL 4
Based Aircraft					
Single Engine	95	108	115	120	132
Multi-Engine	7	13	18	27	30
Jet	4	6	9	12	13
Helicopter	1	1	1	1	1
Other	0	0	0	0	0
Total Based Aircraft	107	128	143	160	176
General Aviation Operations					
Local Operations	6,790	6,627	7,034	7,466	7,925
Itinerant Operations	11,096	9,743	9,860	9,979	10,100
Total GA Operations	17,886	16,370	16,894	17,445	18,025

Source: KLJ Analysis

Aircraft Storage

Aircraft storage requirements are driven by the aircraft size, local climate, and owner preferences. MOT has 107[7] reported civil aircraft based at the airport. Aircraft storage facilities consists of large conventional hangars (typically 8,000 square feet or greater), small conventional hangars (typically less

[7] Please note of the 107 current aircraft based at Minot, there are 25 currently stored with the Dakota Territory Air Museum. These aircraft have been removed from the calculations for hangar and apron space.

than 8,000 square feet), and T-hangars. There are two areas used for aircraft storage at the airport. These are on the west side of the airport along North Broadway Road and on the south side with access from Airport Road and 3rd Street NE. **Appendix I** provides additional information on aircraft storage.

FBO/SASO HANGARS

All the existing FBO/SASO hangars are located in the west area on the general aviation apron opening to the east. The hangars on the north end are the newer ones which are around the GA terminal and north of the ARFF station. These are identified as hangars W1, W2 and W4 on **Exhibit 4-7**. The hangars south of the ARFF station are used by SASOs but are extremely old and small dating back to as early as 1928. These are identified as hangars W5 through W8.

NORTH T-HANGARS AND SMALL CONVENTIONAL HANGARS

There are two sets of T-Hangars at the airport which are north of the general aviation apron in between sets of small conventional hangars.

SOUTH STORAGE HANGARS

On the south side of the airport, south of Taxiway D and west of Taxiway C is an area established since early 2000's for hangar development. There are currently five conventional hangars in an area with thirty-two (32) developable lots. Three of these five hangars are sized only for ADG-I aircraft. All the 35-foot wide taxilanes and set-backs in this area are designed for up to ADG-II and TDG-2 aircraft with excess space for landside automobile parking at some hangars.

FINANCIAL ELEMENTS OF HANGAR CONSTRUCTION

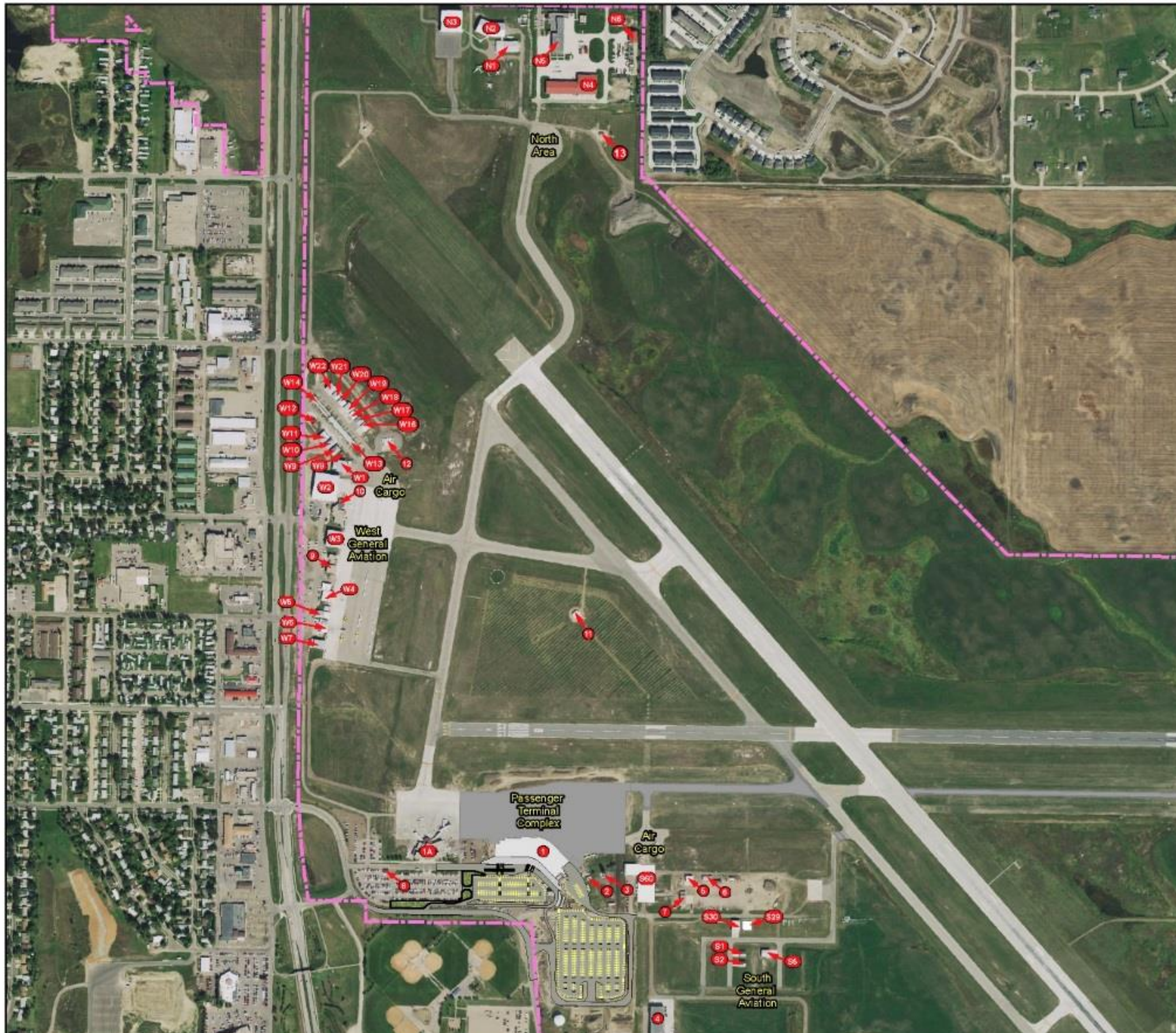
MOT has typically allowed hangar development based on long term land leases. The tenant pays for all the improvements in exchange for a long term (20 to 25 years) ground lease rate. This scenario can work for many larger traditional hangars but as hangar size requirements get smaller it is more difficult for owners to justify the expense. Traditional hangars and T-Hangars are occupied by individuals who are not necessarily interested in constructing their own hangar. Hangar construction options are to lease land to a developer to build and/or lease the units, or for the airport to construct the hangar and lease the units.

FUTURE/ULTIMATE REQUIREMENTS AND RECOMMENDATIONS

The following assumptions were made about aircraft storage space requirements based on two different scenarios. One with the same proportion of aircraft stored outside and a second with all aircraft being hangered.

If the proportion of aircraft stored outside remains then:

- If all aircraft stored outside remain outside then 52.6% of Single Engine aircraft and 42.9% of Multi-Engine aircraft will be stored in hangars; 100% of Turbojet aircraft and Helicopters will be stored in hangars
- Space Assumptions - Single Engine aircraft 1,575 square feet; Multi-Engine aircraft 2,475 square feet; Turbojet Aircraft 3,575 square feet; Helicopters 2,050 square feet
- An additional 20 percent of forecast aircraft storage needs have been added to total hangar square footage. This additional space is expected to be needed for other aeronautical purposes, including maintenance and transient aircraft storage.



Legend

Airport Property Boundary

Existing Buildings/Facilities

1. Airline Terminal
1A. Old Airline Terminal
2. Electrical Vault
3. ATCT
4. SRE Building
5. Storage
6. Storage
7. Storage
8. Parking Booth
9. ARFF
10. GA Terminal/CBP
11. VOR
12. Fuel Farm
13. FAA Radio Antenna Farm
N1. Air Museum
N2. Air Museum
N3. Air Museum
N4. Army National Guard
N5. Army National Guard
N6. Army National Guard
S1. Private Hangar
S2. Private Hangar
S5. Private Hangar
S29. Private Hangar
S30. Private Hangar
S60. FedEx Building
W1. SASO Hangar
W2. FBO Hangar
W3. FBO Hangar
W4. SASO Hangar
W5. SASO Hangar
W6. SASO Hangar
W7. SASO Hangar
W8. T-Hangar
W9. Private Hangar
W10. Private Hangar
W11. Private Hangar
W12. T-Hangar
W13. T-Hangar Unit
W14. T-Hangar Unit
W16. Private Hangar
W17. Private Hangar
W18. Private Hangar
W19. Private Hangar
W20. Private Hangar
W21. Private Hangar
W22. Private Hangar

N

0 500 1,000 2,000 Feet

*Intended for Planning Purposes Only

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Minot International Airport (MOT)
Exhibit 4-7:
Landside Facilities Map

If all aircraft based at the airport were to be hangared then:

- 100% of Single Engine, Multi-Engine, Turbojet aircraft and Helicopters will be stored in hangars
- Space Assumptions - Single Engine aircraft 1,575 square feet; Multi-Engine aircraft 2,475 square feet; Turbojet Aircraft 3,575 square feet; Helicopters 2,050 square feet
- An additional 15 percent of forecast aircraft storage needs added to total hangar square footage. This additional space is expected to be needed for other aeronautical purposes including maintenance and transient aircraft storage.

Using these assumptions along with based aircraft forecasts, a projected need for aircraft storage space was 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. The space requirements is first presented by aircraft size in **Table 4-48**. This table presents two scenarios, one where based aircraft currently utilizing the GA apron to store their aircraft continue to do so throughout the planning period, and one where based aircraft utilizing tie-downs relocate to hangars. These scenarios provide a range for which to plan.

Space requirements by type of hangar is then presented in **Table 4-49**. This carries forward current ratios of storage options (T-hangars, small conventional, and large conventional, etc.) throughout the planning period.

Future hangar space needs will be highly dependent on the number of based aircraft choosing to utilize the GA apron instead of a hangar to store their aircraft. Demolition of existing hangars in the future would also increase the amount of new hangar space requirements.

Table 4-48 - Aircraft Storage Requirements - By Aircraft Size

Category	Base	PAL 1	PAL 2	PAL 3	PAL 4
Hangar Size Needs - Not Including Aircraft Currently Utilizing Tie-Downs					
Single Engine (S.F.)	78,750	89,526	95,329	99,474	109,421
Multi Engine (S.F.)	7,425	13,789	19,093	28,639	31,821
Turbojet (S.F.)	14,300	21,450	32,175	42,900	46,475
Helicopter (S.F.)	2,050	2,050	2,050	2,050	2,050
Maintenance/Transient	20,505	25,363	29,729	34,613	37,953
Total S.F.	***123,030***	***152,179***	***178,376***	***207,676***	***227,721***
Capacity/(Deficiency)	*5,810*	*(23,339)*	*(49,534)*	*(78,836)*	*(98,881)*
Hangar Size Needs - Including Aircraft Currently Utilizing Tie-Downs					
Single Engine (S.F.)	111,825	127,127	135,367	141,253	155,378
Multi Engine (S.F.)	14,850	27,579	38,186	57,279	63,643
Turbojet (S.F.)	14,300	21,450	32,175	42,900	46,475
Helicopter (S.F.)	2,050	2,050	2,050	2,050	2,050
Maintenance/Transient	21,454	26,731	31,167	36,522	40,132
Total S.F.	***164,479***	***204,937***	***238,944***	***280,003***	***307,678***
Capacity/(Deficiency)	*(35,639)*	*(76,079)*	*(110,104)*	*(151,163)*	*(178,838)*

Note: RED indicates a deficiency to existing facilities which is currently 128,840 SF in total
Source: KLJ Analysis

Table 4-49 – Aircraft Storage Distribution – By Hangar Type

Category	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Hangar Space Needs - Not Including Current Tie-Downs						
T-Hangar	*15,900*	15,750	17,905	19,066	19,895	21,884
Small Conventional	*74,640*	60,473	73,720	83,885	95,943	105,530
Large Conventional	*38,300*	26,303	35,191	45,696	57,225	62,353
Maintenance/Transient		20,505	25,363	29,729	34,613	37,953
Total	*128,840*	***123,030***	***152,179***	***178,376***	***207,676***	***227,721***
Capacity/(Deficiency)	-	*5,810*	*(23,339)*	*(49,534)*	*(78,836)*	*(98,881)*
Hangar Space Needs - Including Current Tie-Downs						
T-Hangar	*15,900*	33,548	38,138	40,610	42,376	46,613
Small Conventional	*74,640*	75,986	95,100	109,738	129,021	142,139
Large Conventional	*38,300*	33,491	44,968	57,430	72,084	78,793
Maintenance/Transient		21,454	26,731	31,167	36,522	40,132
Total	*128,840*	***164,479***	***204,937***	***238,944***	***280,003***	***307,678***
Capacity/(Deficiency)	-	*(35,639)*	*(76,079)*	*(110,104)*	*(151,163)*	*(178,838)*

Source: KLJ Analysis

Aircraft Parking Apron

GA aircraft parking is used by both itinerant and based aircraft. Currently, there are 54 official aircraft parking positions. Projections of future apron parking needs is based on an "equivalent aircraft" that represents a typical GA aircraft operating at the airport. A Beechcraft 58 Baron was selected as this aircraft and would require approximately 1,100 SY of pavement after consideration of taxilane separation and wing tip clearances, etc. is included. The Beech 58 is a small multi-engine aircraft categorized as ADG-I. The space assumed for larger aircraft is as follows: 2,750 SY for turboprops; 3,300 SY for turbojets; and 2,200 SY for helicopters.

Actual space requirements varies depending on the number of based aircraft on the apron. Projections for transient aircraft are shown in **Table 4-50**. Projections show the need for 63 to 75 equivalent aircraft positions throughout the planning period assuming the ratio of based aircraft parking on the apron remains consistent. The size of aircraft based on the apron varies, but they have all typically been single-engine or small multi-engine aircraft.

Table 4-50 – GA Apron Aircraft Calculations

Category	Base	PAL 1	PAL 2	PAL 3	PAL 4
Itinerant Operations (Pro-Rated by Aircraft Type)					
Single Engine	1,437	951	738	552	366
Multi Engine	754	668	712	735	759
Turboprop	4,920	4,565	4,647	4,802	4,958
Turbojet	3,969	3,542	3,749	3,874	4,000
Equivalent Tie-Downs (Transient)[8]					
Single Engine	1	1	1	0	0
Multi Engine	2	2	2	2	2
Turboprop	16	14	15	15	16
Turbojet	19	17	18	18	19
Total Transient	**38**	**34**	**36**	**35**	**37**
Based Aircraft Needs					
Single Engine / Small Multi Engine	25	29	32	34	38
Total Aircraft Needs (Based + Transient)					
Total Aircraft Needs	**63**	**63**	**68**	**69**	**75**

Source: KLJ Analysis

A design day, based on the low end of the top twenty-five busiest general aviation days in FFY 2014, was used to determine apron space requirements. The existing apron is undersized for the number of based aircraft and transient aircraft currently utilizing the apron. **A 44% expansion of the existing 57,000 SY apron would be needed to meet PAL 4 needs. However, if based aircraft were not included in the analysis, the apron is sized appropriately for existing and forecast transient aircraft parking needs.** In fact, the apron is over-sized by about 30% (see **Table 4-51**).

Table 4-51 – GA Apron Space Requirements

Category	*Existing*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Apron Area Need (Transient Only)						
Equivalent Aircraft	*54*	38	34	36	35	37
Area Per Aircraft (SY)	*1,056*	1,100	1,100	1,100	1,100	1,100
Apron Area (SY)	***57,000***	**41,800**	**37,400**	**39,600**	**38,500**	**40,700**
Deficit/Surplus	-	*15,200*	*19,600*	*17,400*	*18,500*	*16,300*
Apron Area Need (Transient & Based Aircraft)						
Equivalent Aircraft	54	63	63	68	69	75
Area Per Aircraft (SY)	1,056	1,100	1,100	1,100	1,100	1,100
Apron Area (SY)	**57,000**	**69,300**	**69,520**	**74,470**	**76,120**	**82,060**
Deficit/Surplus	-	*(12,300)*	*(12,520)*	*(17,470)*	*(19,120)*	*(25,060)*

Source: KLJ Analysis

The most recent North Dakota Aeronautics Commission Pavement Condition Index (PCI) study for MOT shows the cargo apron, southern GA apron, and Taxiway B2 have a PCI index below 40, which typically indicates reconstruction is necessary. Please see **Appendix G** for more details.

[8] Based on applying size ratio to the equivalent based aircraft

Recommendations

The General Aviation needs are as follows:

- **Monitor hangar demand and identify development areas to accommodate forecast demand while providing flexibility to accommodate a variety of hangar sizes.**
- **Investigate feasibility of constructing airport-owned hangars to lease to transient and based aircraft.**
- **Identify development options to expand the GA apron.**

Landside Facilities

Terminal Curbside

There is approximately 430 linear feet of curbside frontage in front of the MOT terminal building for passenger pick-up and drop-off. Of this, 240 linear feet is in front of the ticketing area and 190 linear feet is in front of the baggage claim area. There are two dedicated lanes for loading and unloading, with a third lane for through traffic. In front of the baggage claim area, there is one separate bus/taxi/limo queuing lanes with approximately 150 linear feet of frontage, and another lane for through traffic.

Terminal curbside needs are evaluated using industry planning criteria to determine linear frontage for the curb to meet standards. It is assumed 25% of design hour passengers will use the inner curbside for vehicles. An estimate of commercial service vehicle usage of the outer curb is based on the assumption this usage is equivalent to 15% of design hour passenger vehicles. See **Table 4-52** for a space needs tabulation.

Table 4-52 - Curbside Requirements

Category	*Exist.*	Base	PAL 1	PAL 2	PAL 3	PAL 4
Design Hour Passengers	-	450	391	398	485	571
Lane 1 Inner Curbside						
Personal Occupancy Vehicles		113	98	100	121	143
Taxis/Limousines		0	0	0	0	0
Shuttles		0	0	0	0	0
Total Curbside Length	***456***	**290**	**252**	**257**	**311**	**367**
Lane 2 Outer Curbside						
Taxis/Limousines		12	11	11	13	15
Shuttles		3	3	3	4	4
Commercial/Other Vehicles		1	1	1	1	1
Total Curbside Length	***125***	**73**	**70**	**70**	**85**	**125**

Source: KLJ Analysis

As enplanements increase at the airport, so will the number of vehicles occupying the terminal curbside. The curbside length at MOT is projected to be adequate throughout the planning period. The length of time a vehicle remains stopped at the curbside area is referred to as “dwell time.” Dwell times assumed for MOT are high; however, if curbside congestion begins to occur it is recommended that dwell times be reviewed for different classes of vehicles

Automobile Parking

The automobile parking needs at a commercial service airport directly relates to the number of annual enplaned passengers. Automobile parking types include public, employee and rental car parking. Existing automobile parking supply consists of 1,459 public parking spaces, 52 employee spaces and 90 rental car Ready/Return spaces.

The number of "effective" parking spaces was determined by assuming 95 percent of the actual supply of spaces is available at any one time. This would be due to maintenance or snow removal or for circulating parkers to find an available stall. The effective space count will be used for planning purposes.

PUBLIC PARKING

Public parking includes short-term and long-term parking lots at MOT. This analysis combines all public parking needs into a cumulative review. The need for public parking spaces is driven by passenger enplanements in the peak day of the peak month.

Public parking demand is projected using 3.3 spaces per 1,000 annual enplanements projected through the planning period as shown in **Table 4-53**. This ratio was determined based on FAA standard guidance using available parking data from 2010 to 2012. An additional 15% factor was added to allow for sufficient supply for passengers to find spaces in a timely manner. It should be noted individual MOT absolute peak days may exceed indicated parking demand figures. **Total available public parking meets the needs at MOT through the planning period.**

Table 4-53 - Public Parking Requirements

Category	Base	PAL 1	PAL 2	PAL 3	PAL 4
Enplanements	220,522	192,253	201,574	241,643	289,769
Public Parking Demand*	837	730	765	917	1,100
Effective Public Parking Supply	1,386	1,386	1,386	1,386	1,386
Surplus/(Deficiency)	**549**	**656**	**621**	**469**	**286**
Percent	39.7%	47.3%	44.8%	33.8%	20.6%

**15% added for passenger convenience*
Source: KLJ Analysis

EMPLOYEE PARKING

Using future enplanements as a method to projecting existing demand into the future, demand is anticipated to exceed existing capacity (see **Table 4-54**). **Demand for additional parking should be monitored throughout the planning period.**

Table 4-54 - Employee Parking Requirements

Category	Base	PAL 1	PAL 2	PAL 3	PAL 4
Employee Parking Demand	54	47	49	59	71
Effective Employee Parking Supply	49	49	49	49	49
Surplus/(Deficiency)	**(5)**	**2**	**0**	**(10)**	**(22)**

Source: KLJ Analysis

RENTAL CAR PARKING & FACILITIES

Rental car parking needs include ready/return lots for customers near the terminal, and long-term storage lots where the rental car fleet can be stored. Facilities with the parking areas include a quick-turn-around (QTA) facility for rental car companies to clean and maintain vehicles. Each of the four car rental concessionaires at MOT will have different facility needs. Car rental facility requirements are evaluated cumulatively.

Ready/Return Parking

Ready/return parking needs correlates with the peak number of customer transactions rather than the total number of customers. Currently, there are 90 ready/return lot spaces. Conversations with rental car companies indicate a need for 150 ready/return lot spaces based on current airport conditions (enplanements, flight schedules, etc.). **Table 4-55** below indicates anticipated lot space demands if lot demand is tied to enplanements and carried forward throughout the planning period.

Table 4-55 – Rental Car Ready/Return Parking Requirements

Category	Base	PAL 1	PAL 2	PAL 3	PAL 4
Peak Hour Transactions/Demand	150	130	133	161	190
Effective Ready/Return Supply	90	90	90	90	90
Capacity/(Deficiency)	**(60)**	**(40)**	**(43)**	**(71)**	**(100)**

Source: KLJ Analysis

The calculation shows there is inadequate rental car ready/return parking lot spaces throughout the planning period.

Rental Car Storage

The size of the rental car storage lot is directly tied to the total rental car fleet. Total fleet is directly attributed to the total number of arriving passengers requiring rental cars. On-airport rental car storage is not available that this time. Rental car companies have had to store vehicles off-airport. The rental car companies expressed a need for 200 storage spaces given existing operational conditions. **Table 4-56** shows anticipated demand throughout the planning period if storage need is tied to forecast enplanements.

Table 4-56 – Rental Car Storage Parking Requirements

Category	Base	PAL 1	PAL 2	PAL 3	PAL 4
Typical Rental Car Storage Demand	200	174	183	219	263
Effective Rental Car Storage Supply	0	0	0	0	0
Capacity/(Deficiency)	**(200)**	**(174)**	**(183)**	**(219)**	**(263)**

Source: KLJ Analysis

The addition of on-airport rental car storage is recommended. The actual amount of spaces required depends on a number of factors, but planning for 200 to 300 spaces would be appropriate based on conversations with rental car companies.

Quick-Turn-Around Facility (QTA)

A facility to accommodate rental car operations is a maintenance or “quick-turn-around” facility. These facilities are located within the vicinity of rental car operations and parking. A typical rental car QTA consists of a car wash, maintenance bays, storage and fueling area. Currently, there is no QTA on the airport and rental car companies have to drive vehicles off-airport to wash and clean cars. This has been an issue from an efficiency standpoint and in certain conditions, vehicles become again on the drive back to the airport.

A QTA facility of approximately 7,800 square feet in size is recommended at MOT. A facility of this size should accommodate one automatic car wash bay, four auto-detailing bays, maintenance, equipment and storage space. Adjacent fueling and storage parking should also be provided.

RECOMMENDATIONS

Automobile parking facility recommendations for MOT include:

- **Develop ready/return lot with at least 150 parking spaces**
- **Develop or allocate at least 200 parking spaces for rental car storage near the QTA facility.**
- **Construct a consolidated rental car QTA facility with an estimated facility footprint of 7,800 square feet.**

Ground Access & Circulation

Roadway System

The airport provides the air accessibility for the community but once an aircraft arrives, its passengers and cargo rely upon the airport's connectivity to the local roadway network to get to their final destination. MOT is connected to Minot by U.S. Highway 83 (North Broadway). This provides north-south access from the airport and joins U.S. Highway 2 located 3 miles south for east-west connectivity. See **Appendix J** for a depiction of roads in the vicinity of the airport.

Public Transit

The City of Minot operates a City Transit System. The nearest stops to the airport include a stop at 20th Avenue NW and North Broadway and a stop at 20th Avenue NW and 3rd Street NW. From these existing Transit stop locations it is still a half mile walk to the airport terminal crossing U.S. 83 with at least half of the route without sidewalks. In addition, the schedules are only Monday through Friday during the day with some additional transit routes on school days. Most travelers and their flight schedules would not be accommodated by this current transit system route and schedule.

Local taxi providers serve MOT to provide passengers with connectivity to the community. Ride sharing services such as Lyft or Uber currently do not serve the Minot area.

On-Airport Public Roads

People conducting business at the airport often will need to go from one business to another at the airport and therefore need an efficient route to travel by vehicle without entering or crossing the airfield. This need is met currently for vehicles to travel around the landside of the airport by using North Broadway to access the west GA area. **While this access configuration is sufficient, options should be examined to improve access to and within the GA area and space available for parking**.

The most heavily used public road on the airport is the entry to the airport terminal. The entry is currently a one lane entry turn off of Airport Road which allows access to the paid parking lot and the front of the terminal. South/east bound drivers on Airport Road make a 45 degree turn to the left. North/west bound drivers on Airport Road make a 135 degree turn to the right. The current entry is not intuitive, and since it is limited to one lane it does not allow for problems on the roadway. **Redesign of this entry should be considered as a long-term option.**

On-Airport Non-Public (Interior) Roads

Inside of the airfield, there is a need for vehicles to move around without impeding aircraft movements. This includes ARFF, FBO, FAA NAVAID maintenance, airport maintenance, airport operations and others. Airport perimeter roads provide a means for vehicles to move around the airport in all weather conditions and not impede aircraft movement or landings and takeoffs. Depending upon the amount of use, these perimeter roads may be paved or unpaved and may be needed to support equipment such as large fuel trucks, ARFF and SRE equipment. When an unpaved surface is used, it is recommended a 'lead-in' portion of pavement be constructed within 300 feet of any taxiways, aprons, or runways to eliminate any debris from being tracked onto the aircraft movement areas. Some portions of the existing MOT interior road are in poor condition, particularly south of the west GA area.

Since the airport perimeter road is inside the airfield, it is imperative that appropriate security measures such as gates and limited access points be established to restrict access to only those persons with a need and sufficient training to be inside the airfield. **A full interior airport perimeter road would be maintained and secured.**

Support Facilities

Support facilities are an integral element of MOT. These facilities enable the airport to safely serve certain sizes of aircraft, types of service (e.g. passenger airlines), and do so in various weather conditions. These are not necessarily connected directly to the airfield, but must be located appropriately to meet the needs they are intended to fill. **Appendix J** provides additional information on support facilities.

Fueling Facilities

AIRCRAFT FUELING/STORAGE

MOT has three fuel tanks with a total storage capacity of 20,000 gallons of 100LL and 40,000 gallons of Jet-A. These airport-owned, above-ground fuel tanks are located in a common location known as a "fuel farm" which has a spill containment area. The fuel farm tanks are double-walled providing self-contained spill prevention. Should there be a need to relocate the fuel tanks, there is minimal permanent infrastructure in place that would impede relocation.

In addition to fuel storage tanks, fuel trucks with 1,500 gallon 100LL capacity and 18,000 gallon Jet-A capacity are used to dispense fuel around the airport where aircraft are parked.

Based on MOT 2015 records, there was over 3 million gallons of Jet-A fuel sold and nearly 900,000 gallons of 100LL. Future consumption is not anticipated to change dramatically. Using average consumption rates the current Jet-A supply is just over 5 days. **Additional Jet-A fuel farm capacity is recommended to help mitigate any fuel shortages.**

There are no self-fueling stations at the airport. Self-fueling stations are publicly or privately owned allowing individuals to fuel their own aircraft. Public-use facilities commonly can be used 24-hour a day with a credit card reader. **The implementation of self-fueling stations are recommended, particularly in areas not in close proximity to the FBO.**

GROUND VEHICLE/OTHER FUELING

MOT has two fuel tanks dedicated for ground vehicles. There is a total capacity of 2,000 gallons of diesel and 1,000 gallons of unleaded for use at the airport. These fuel farms include those used to support airport operations and others. Each of the above ground fuel tanks are double walled providing self-contained spill prevention. No recommendations are made. Should there be a need to relocate the above ground tanks, there is minimal permanent infrastructure in place to impede them from being relocated.

Aircraft Rescue and Fire Fighting (ARFF)

The Aircraft Rescue and Firefighting (ARFF) services at MOT are provided by the City of Minot Fire Department. Airports provide ARFF as required by the FAA based upon accommodating passenger service airlines with seating of at least 10 passengers. In accordance with Federal Aviation Regulation (FAR) Part 139 *Certification of Airports*, an acceptable ARFF response time requires the airport to have sufficient apparatus meeting the applicable index proceed to the mid-point of the furthest runway and begin delivering an extinguishing agent in no more than 3 minutes from the time of the call for the first responding vehicle, and 4 minutes for the second vehicle (if applicable).

The design aircraft will require ARFF Index B to be maintained. MOT regularly maintains an Index B level but is capable of Index C with prior notification for additional staffing with the existing equipment (see **Appendix J**).

The ARFF equipment is located in the City of Minot Fire Station Number 3 which houses structural and ARFF equipment in this joint use station. The station is situated in the west general aviation area on the aircraft apron with access to the airfield by Taxiways C3 and B2. The City of Minot operates three battalions with a total of 45 firefighters all training and rotated into ARFF duty. The airport pays for three dedicated personnel on this rotating shift who are also supported in the same station from other City of Minot Fire Department staff. In order to meet the requirements of the airline schedules, the ARFF staff is on duty 24 hours per day. **There are deficiencies with the facility related to functionality, end of useful life, and crew quarters.** A copy of the Building Assessment report, provided to KLJ in June 2016, is included in **Appendix J – Support Facilities**. A summary of the findings is as follows:

- Quarters and Office Areas occupy a narrow area between ARFF Apparatus Bays and Structural Apparatus Bays leaving little space for expansion (less than 2,000 sf currently and approximately 4,000 sf needed)
- Building was constructed close to existing grade and has several ongoing drainage issues with storm water and ground water
- Building is poorly insulated
- Building originally used an under-slab ventilation system that filled with ground water, was filled with concrete, but still presents air quality issues into the building
- Current Code requires automatic sprinklers
- Current Code requires egress windows from sleeping areas
- 8" steps between quarters/offices to apparatus bays does not meet ADA
- Doorways do not meet ADA
- Dormitory area is very small and does not provide gender equity with separation by plywood partitions and curtains
- The one bathroom for the crew quarters serves as toilet and shower room for all staff
- Mechanical and Electrical systems are inadequate

The airport is examining a major rehabilitation or replacement of the facility. Because the rehabilitation is currently estimated to be 64% of the cost of a new facility, the City of Minot is considering a replacement facility. Please see the Alternatives Chapter for potential facility locations.

Airport Maintenance & Snow Removal

MOT owns and operates six runway/taxiway plows, six tractor/apron plows and eight brooms/blowers/other snow removal equipment (SRE) to handle snow and ice control including the runways, taxiways and terminal apron. The parking operator, Republic Parking, provides snow removal for the revenue-generating parking area. The airport maintenance staff provides snow removal for all other parking and roads out to Airport Road. The City of Minot conducts snow removal on Airport Road and 3rd Street.

MOT stores and maintains the snow and ice control equipment and material in one building which is 21,500 square feet in size. The building is located on the south portion of the airfield near the south general aviation hangar area. All of the airport's SRE and maintenance equipment are stored and maintained in this building. **The building was constructed in 2013 and the size is sufficient to meet existing and projected needs.** This SRE building replaced the existing 6,400 square foot building located near where the new terminal was constructed.

Customs and Border Protection (CBP)

According to U.S. Air Commerce Regulations (19 CFR Part 112, Subpart B) there are three classifications of airports that handle international passengers/cargo. These are "International" airports, "Landing Rights" airports, and "User Fee" airports. Regardless of the type of designation there are also three categories of CBP facilities. The highest is the Federal Inspection Service (FIS) which is staffed at a minimum with 12 to 14 Federal employees, the second is the General Aviation Facility (GAF) with a minimum of two to four Federal employees. The third type is the User Fee facility which can function for general aviation or passenger airlines depending on location and configuration. The User Fee facility is staffed by Federal employees, but the cost of the service is paid by the airport, local government, and/or users.

MOT currently is a federally designated international airport with a Customs and Border Protection (CBP) facility in the General Aviation terminal. The current facility is classified as a general aviation facility (GAF). It has approximately 2,800 square feet of space for passenger processing, inspection and staff offices. Persons arriving by air from an international origination point may land directly at MOT. **This existing GAF facility appears to meet all CBP space needs. No enhanced FIS facility to accommodate larger scheduled/unscheduled service airplanes is required, nor is recommended due to the relative low demand.**

There are aircraft flying domestically to and from Alaska to the lower 48 contiguous states and for those aircraft, MOT is one of the first and last options to stop for fuel and remain a domestic flight while flying over Canada. These are accommodated by the existing facility.

Security & Access

Security is an important consideration when operating a safe airport. Transportation Security Administration (TSA) publishes recommended airport design guidelines. A minimum 6-foot high fence with added barbed wire is recommended by TSA.

FAA Advisory Circular 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*, states: "Security fencing can vary in design, height, and type, depending on local security needs. Generally, it is recommended that the fencing be, as a minimum, No. 10 gauge, galvanized steel, chain link fabric installed to a height of 8 feet and topped with a three strand (12 gauge) barbed wire overhang. The latter should have a minimum 6-inch separation between the strands and extend outward at a 45 degree angle from the horizontal."

A recently published Part 139 CertAlert (No. 16-03) provides FAA-recommended wildlife exclusion fencing. The CertAlert recommends a 10-foot fence with 3-strand barbed wire outriggers. It states that in some cases, an airport may be able to use an 8-foot fence with 3-strand barbed-wire outriggers, depending on the amount of deer activity in a local area. Also, the FAA states a 4-to 5-foot skirt of fencing material, attached to the bottom of the fence and buried at a 45-degree angle on the outside of the fence, is ideal to prevent animals from digging under the fence and reduce the chance of washouts.

The air operations area at MOT is encompassed by an eight-foot, chain-link security fence to prevent unauthorized access. There is approximately 43,000 linear feet of fencing around the airport providing wildlife control and a security perimeter. The fencing and gate access is maintained and operated by the airport staff in accordance with Transportation Security Administration (TSA) and FAA requirements.

It is recommended MOT make improvements to fencing in accordance with FAA Advisory Circular 150/5360-13 and other applicable standards. The CIP located in **Chapter 6 – Implementation**, will address replacement of perimeter fencing (and increasing fence height to 10 feet) planned for 2020.

FAA generally recommends airports have a full internal access road system that allows authorized vehicles to access various portions of the airfield, minimizing the need to navigate on taxiways, cross runways or leave the boundaries of airport property.

Airport Utilities

MOT has utility services provided from a number of entities. **Although localized service issues may exist, there are no known significant deficiencies to overall utility infrastructure at MOT.** The existing utility infrastructure is sufficient to meet current needs. Most improvements to utilities will occur at the expense of the utility provider unless there is a determination that it will be paid by the airport as a user. Utility easements will be provided on the Exhibit 'A' Airport Property Map.

Other

Other Aeronautical/Non-Aeronautical Development

Other aeronautical development includes aviation-related businesses. Examples include aircraft maintenance, repair and overhaul (MRO) facilities or other businesses that require direct access to the airfield. Considerations for developing property for these uses include adequate airfield access, parcel size, landside roadway access/parking and utilities. This type of development should be protected if sufficient available land exists.

Airport property should primarily be reserved for existing and planned aeronautical uses, however, non-aeronautical uses can enhance the customer experience and provide additional revenue-generation opportunities to the airport. If airport owned land does not have any aeronautical need for the safety, capacity or other airport development needs then it can be considered for a non-aeronautical use. Non-aeronautical development of airport property requires approval from the FAA.

MOT has expressed interest in utilizing airport property for non-aeronautical use. In particular, Airport property located on the west side of Highway 83 (Broadway) could be converted to non-aeronautical development. FAA release requirements would need to be satisfied and the released property would need to be used in a manner consistent with City of Minot zoning, specifically Chapter 18.1 – Airport Noise Buffer Area.

The airport should continue to explore and market opportunities in areas not needed for aeronautical use. Non-aeronautical development areas must be shown on the ALP and approved by FAA.

FOREIGN TRADE ZONE

MOT has expressed interest in establishing a Foreign Trade Zone (FTZ). An FTZ is a designated site under Customs and Border Protection (CBP) supervision that is considered outside of CBP. Foreign and domestic merchandise may be admitted into an FTZ duty-free without formal CBP entry procedures. Goods are considered international commerce and can be assembled, manufactured or processed and re-exported without paying duties. Common activities include warehousing/distribution and manufacturing. A potential location for an FTZ is provided in **Chapter 5: Alternatives**.

DAKOTA TERRITORY AIR MUSEUM

The Dakota Territory Air Museum is located approximately 2,000 feet north of the Runway 13 end. The museum was founded in 1986 and displays famous military and vintage aircraft. Education and preserving history are the primary goals of the museum. The museum leases approximately 17 acres from the airport. The president of the museum indicated there is sufficient space on the current leased land for any expansion needs the museum may have during the planning period.

Land Use Compatibility

As mentioned above, the City has airport-specific zoning, but the focus is on maintaining uses compatible with airport noise. In 2009, an airport land use compatibility plan was developed for MOT that aides the City in evaluating development proposals. The plan's recommendations include the protection of Part 77 "imaginary surfaces" and include maps to aid in determining whether impacts to MOT airspace would occur. An appendix to the 2009 plan included an example "Airport Overlay Zone" from Chapter 17 of the North Dakota Airport Managers' Manual. A 1995-1996 version of the manual can be found at the North Dakota Aeronautics Commission website[9].

The development and adoption of Part 77-based airspace zoning is recommended to further protect MOT airspace.

[9] https://aero.nd.gov/image/cache/AIRPORT_MANAGERS_MANUAL_COMPLETE.pdf

Summary

This chapter identifies safety, capacity and development needs for the Minot International Airport based on forecasted activity levels. These recommendations provide the basis for formulating development alternatives to adequate address recommended improvements. The following summarizes the facility recommendations:

Airside Facilities

- Runway 8/26 needed to meet FAA wind coverage for ARC C-III aircraft
- Runway 13/31: Existing runway length sufficient. Plan ultimate extension from 7,700’ to 8,500’
- Runway 13/31: Upgrade Runway 13 approach to achieve lower visibility minimums (3/4 mile)
- Runway 08/26: Maintain compatible land use on Runway 8 approach, ARC C-III Design Standards
- Runway 08/26: Plan for ultimate to remain at 6,347 x 100’
- Taxiway design standards change from TDG-4 to TDG-3: 50’ wide taxiways needed for largest airplanes

Passenger Terminal

- Peak activity drives terminal space needs
- Four gates needed for overnight aircraft schedule
- Five gates needed to accommodate total peak hour departures now and in PAL 4
- Security checkpoint may need 3rd lane in future and 4th lane for peak long-term activity
- Need additional space for rental car ready/return lot
- Rental car storage parking space
- Consider new consolidated rental car Quick Turnaround (QTA) facility

Air Cargo

- Look at consolidation of air cargo activities to one area
- Expand apron from 4,400 SY to 6,700 SY.
- Additional apron pavement strength needed for FedEx ATR-42

General Aviation

- FAA forecast is for 69 new based aircraft in next 20 years
- Require replacement of existing hangars which are beyond repair or functionally inadequate
- Potential need of up to 139% additional hangar space needed if all aircraft are in hangars
- Existing GA apron is undersized by 22% when including based aircraft parking on the apron
- Require additional 44% of apron space for long-term demand

Support Facilities

- Aircraft Rescue & Fire Fighting (ARFF) Building needs additional crew quarter space
- Maintain Airport Traffic Control Tower line-of-sight or relocate facility
- Relocate VOR if possible