3

MAX WESTHEIMER AIRPORT
The UNIVERSITY of OKLAHOMA
Master Plan Update

# Facility Requirements

# 03 FACILITY REQUIREMENTS

## 3.1 OVERVIEW

A key step in the planning process is developing requirements of airport facilities, which will allow for airside and landside evolution over the term of the planning period. By comparing the existing conditions of the Airport to forecast aviation activity based upon both existing and future aircraft usage, the requirements for runways, taxiways, aprons, terminal, and other related facilities to accommodate growth over the short, intermediate, and long-term planning periods can be determined. Demand-capacity analyses aid in the identification of airport deficiencies, surpluses, and opportunities for future development.

This chapter of the Airport Layout Plan (ALP) Update narrative will analyze the ability of the current facilities at Max Westheimer Airport (OUN) to meet the forecast planning activity shown in Chapter 2, *Forecast of Aviation Demand*. Using Federal Aviation Administration (FAA) methodologies and typical sizing factors, the aviation projections are converted into facility requirements over the 20-year planning period.

An essential step in the process of estimating airport needs is the determination of an airport's current capacity to accommodate anticipated demand. Demand-capacity analyses yield information that is ultimately used to design the airport layout plan and state facility development. This chapter will examine the ability of OUN to accommodate anticipated aviation demand and outline specific facility requirements necessary to address any deficiencies in the existing airport system. Specifically, this analysis will extend into the following areas:

- Airfield Capacity, Runway Orientation, Design Standards including Runway and Taxiway System
- Approach and Navigational Aids
- Airfield Lighting, Signage, and Pavement Markings
- Aircraft Parking Aprons
- Aircraft Storage Hangars
- Aircraft Fuel Storage
- Public Automobile Parking
- Ground Access
- Airport Security and Fencing

## 3.2 AIRFIELD DEMAND AND CAPACITY

The major components of the airfield system to be considered when determining capacity include runway orientation and configuration, runway length, and runway exit locations. Additionally, the capacity of a given system is affected by operational characteristics such as fleet mix, climatology, and air traffic control (ATC) procedures. Runway orientation and the degree to which it meets wind coverage requirements influence how the runway system is utilized. Design standards established by the FAA set geometric clearance guidelines for airfield components. Upon completion of analysis of these elements, a review of existing facilities is performed and any additional requirements necessary to meet the forecasted demand are identified.

### *3.2.1 AIRFIELD CAPACITY*

The FAA methodology and guidance for airfield capacity is contained in AC 150/5060-5, *Airport Capacity and Delay* and is generally defined "as the number of aircraft operations that can be safely accommodated on both the runway and taxiway system at a given point in time before an unacceptable level of delay is experienced". Measurement of airfield capacity as described in the FAA Advisory Circular relates to:

- Hourly Capacity – the maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period, and the
- Annual Service Volume (ASV) – the estimate of an airport's annual capacity in terms of annual aircraft operations that will result in an average annual aircraft delay, which is the total delay incurred by aircraft using the airfield during a given time.

The capacity of an airport is determined by several factors and the relationship of these factors have a cumulative impact on airfield capacity. The factors as they pertain to OUN are assessed and detailed in the following paragraphs.

### *3.2.2 METEOROLOGICAL CONDITIONS*

Climatological conditions of an airport not only influence the layout of the airfield, but also affect the runway system. Runways should be oriented to take full advantage of prevailing and surface winds. Taking-off and landing into the wind provides the safest operating environment for aircraft and helps to avoid the need to operate in excessive crosswind or tailwind conditions.

#### CEILING AND VISIBILITY

FAA classifies ceiling and visibility conditions within three (3) broad categories:

- Visual Flight Rules (VFR) – occurs whenever the cloud ceiling is at least 1,000 feet above ground level and the visibility is at least three (3) statute miles;
- Instrument Flight Rules (IFR) – occurs whenever the reported cloud ceiling is at least 500 feet, but less than 1,000 feet and/or visibility is at least one (1) statute mile but less than three (3) statute miles;
- Poor Visibility and Ceiling (PVC) – occurs whenever the cloud ceiling is less than 500 feet and/or the visibility is less than one (1) statute mile.

#### WIND COVERAGE

Surface wind conditions have a direct effect and impact on airport functionality. Runways that are not oriented to take the fullest advantage of prevailing winds will restrict the capacity of the airport to varying degrees. When landing and taking off, aircraft are able to operate on a runway properly and safely as long as the wind velocity perpendicular to the direction of flight (i.e., crosswind) is not excessive. The wind coverage analysis translates the crosswind velocity and direction into a "crosswind component". Smaller aircraft are more easily affected by crosswinds than larger aircraft, and therefore, have a more restrictive crosswind component.

The determination of the appropriate crosswind component is dependent upon the RDC, which is C/D-II for Runway 18/36 and B-II for Runway 3/21. According to AC 150/5300-13B, *Airport Design*, the maximum crosswind component used for RDC's A-I and B-I is 10.5 knots, a 13-knot crosswind component is used for RDC A-II and B-II, a 16-knot crosswind component is used for A-III and B-III, C-I through C-III and D-I through D-III. A maximum crosswind component of 20 knots is used for A-IV, B-IV, C-IV, C-VI, D-IV and D-VI.

The desirable wind coverage for an airport is 95%, meaning the runway system should be oriented so that the maximum crosswind component is not exceeded more than 5% of the time annually. Weather data specific to the airport was obtained from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC). This data was collected from the ground based AWOS weather reporting station for the 10-year period January 2013 – December 2022. A total number of 210,104 observations were observed, with 16,777 of those being made under IFR conditions. Based on the all-weather wind analysis for OUN, the existing runway system provides 97.14% for the 10-knot crosswind component, 98.88% for the 13-knot crosswind component, and 99.70% for the 16-knot crosswind component. The following table, **Table 3.1**, quantifies the wind coverage provided by the individual runways and the combined runway ends during all weather conditions.

### OPERATIONAL WEIGHTING OF WIND DATA

According to Advisory Circular 150/5300-13B's Appendix B, it is permissible to "operationally weight the wind data to reflect the shift in use periods at airports where operations are predominantly seasonal, or if operations decline substantively after dark". With a large percentage of OUN's operations conducted by OU Aviation during their regularly scheduled flight blocks ranging from 8:00 AM to 5:00 PM, it was expected that operational data would show significantly more operations during this period than other times of day.

This analysis used AWOS data from January 1, 2014 through December 31, 2023, capturing the most recent full ten years of wind data. The crosswind coverage percentages for Runway 18/36 during each hour of the day were calculated first. To find the percentage of operations taking place during each hour of the day, OUN's ATCT records for the 2023 calendar year were compiled. As expected, operations at OUN are highest between the hours of 9:00 AM and 5:00 PM, with spikes between 10:00 AM and 11:00 AM and between 1:00 PM and 2:00 PM.

The crosswind coverage percentages were weighted by multiplying them by the corresponding percentage of operations within that hour. Taking the sum of these results yielded a weighted crosswind coverage for Runway 18/36 at 10.5 knots of 94.95%, while the unweighted coverage for the same time period was 96.68%. This is likely attributable to the windiest conditions occurring during afternoon hours when the most operations are taking place. When hourly wind coverages are weighted by the percentage of operations taking places during the respective hours, Runway 3/21 is necessary for the Airport to achieve 95% crosswind coverage for a 10.5-knot crosswind component. Additional supplemental wind data can be found in **Appendix D**.

*THIS SECTION INTENTIONALLY LEFT BLANK*

*TABLE 3.1 – ALL-WEATHER WIND COVERAGE*

| | 10.5-Knot | 13-Knot | 16-Knot |
|---|---|---|---|
| Runway 18 | 88.18% | 89.78% | 90.72% |
| Runway 36 | 78.06% | 79.70% | 80.78% |
| Runway 18 / 36 | 96.18% | 98.33% | 99.55% |
| Runway 3 | 77.73% | 83.85% | 88.73% |
| Runway 21 | 79.52% | 86.69% | 92.07% |
| Runway 3 / 21 | 83.49% | 91.36% | 97.25% |
| All Runways | 97.14% | 98.88% | 99.70% |

Source: National Climate Data Center, Station 723570, Max Westheimer Airport, Period 2013-2022

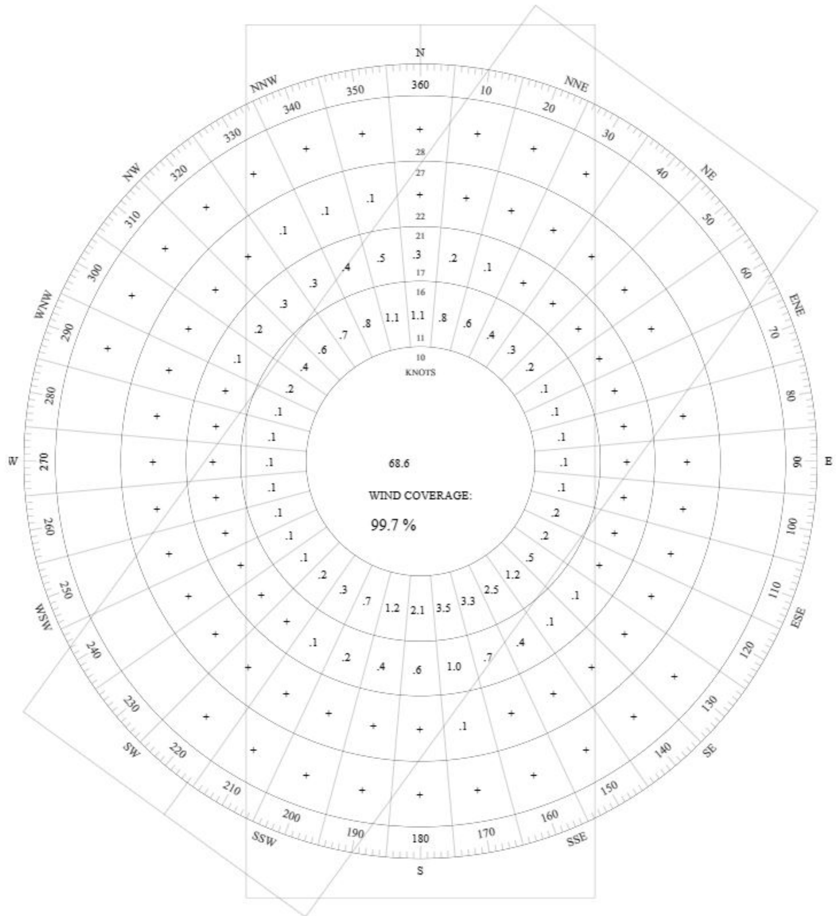
*TABLE 3.1A – ALL-WEATHER WIND COVERAGE - WEIGHTED*

| | 10.5-Knot | 13-Knot | 16-Knot |
|---|---|---|---|
| Runway 18 / 36 | 94.95% | 97.90% | 99.27% |
| Runway 3 / 21 | 80.22% | 91.04% | 96.55% |
| All Runways | 96.36% | 98.53% | 99.48% |

Source: National Climate Data Center, Station 723570, Max Westheimer Airport, Period 2014-2023

*THIS SECTION INTENTIONALLY LEFT BLANK*

*EXHIBIT 3.1 – ALL-WEATHER WIND ROSE*




Source: National Climate Data Center, Station 723570, 210,104 Observations; Max Westheimer Airport, Period 2013-2022

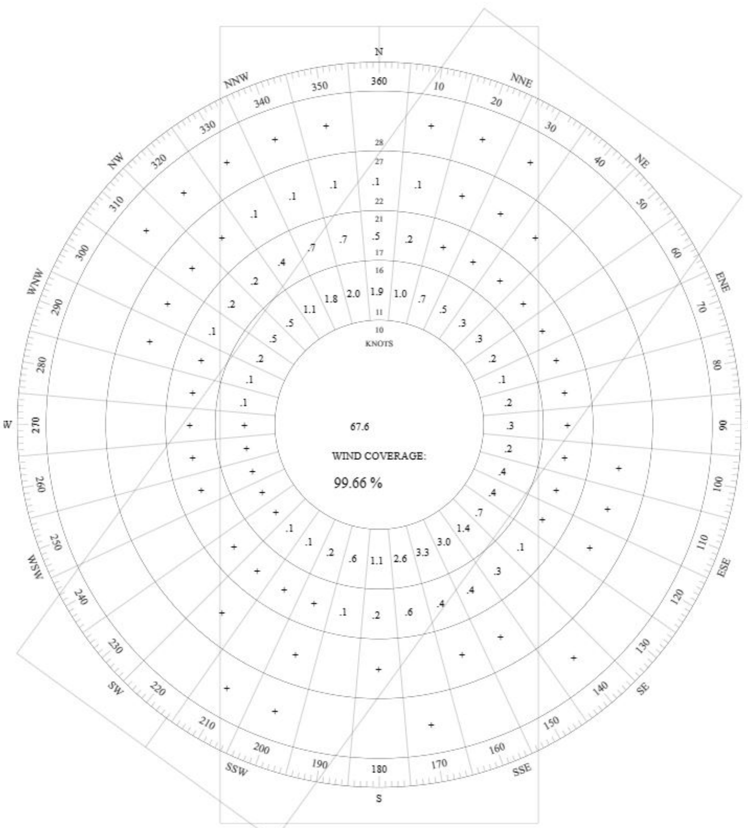
The airport is also served by an ILS ½-mile precision approach to Runway 18, along with not lower than ¾-mile RNAV GPS and LOC approaches Runway 03 and 7/8-mile RNAV GPS approach to Runway 36. Runway 21 does not offer instrument approach capabilities. To evaluate the effectiveness of these approaches and the potential benefits of implementing lower approach visibility minimums, an Instrument Flight Rules (IFR) wind rose has been generated. The following table, Table 3.2, quantifies the wind coverage offered by each runway end in consideration of typical Category I precision approach minimums. (i.e., weather conditions having a ceiling less than 1,000 feet, but equal to or greater than 200 feet and/or visibility less than 3-miles, but equal to or greater than 1/2-mile.) The table quantifies the wind coverage provided by the individual runway ends and the combined runway system. From this analysis, it can be concluded that both Runway 18 and Runway 3 provide the best wind coverage for all crosswind components, which coincides with the location of the existing approach lighting systems.

*TABLE 3.2 – IFR WIND COVERAGE*

| | 10.5-Knot | 13-Knot | 16-Knot |
|---|---|---|---|
| Runway 18 | 82.79% | 84.76% | 85.99% |
| Runway 36 | 82.15% | 84.16% | 85.54% |
| **Runway 18 / 36** | **95.39%** | **97.96%** | **99.52%** |
| Runway 3 | 78.90% | 86.85% | 93.05% |
| Runway 21 | 75.62% | 83.42% | 89.39% |
| **Runway 3 / 21** | **81.28%** | **90.28%** | **97.06%** |
| All Runways | 96.41% | 98.63% | 99.66% |

Source: National Climatic Data Center, Station 723570, Max Westheimer Airport, Period of Record 2013-2022

*EXHIBIT 3.2 – IFR WIND ROSE*




Source: National Climatic Data Center, Station 723570, 16,777 Observations; Max Westheimer Airport. Period of Record 2013-2022.

### *3.2.3 AIRFIELD LAYOUT*

The arrangement and interaction of airfield components (runways and taxiways) refers to the layout or design of the airfield. The existing runway configuration consists of two (2) runways – Runway 18/36 (primary), and Runway 3/21 (crosswind). These runways are supported with various parallel and exit taxiways.

### *3.2.4 RUNWAY USE*

Runway use is dictated by wind and airspace conditions. The direction of take-offs and landings are typically determined by wind direction. Taking-off and landing into the wind provides the safest operating environment for aircraft and helps to avoid the need to operate in an excessive crosswind or tailwind condition. Virtower is a system that uses ADS-B signals broadcasted from aircraft to automatically track operations at the Airport, even when the ATCT is closed. According to preliminary Virtower data, the primary runway, approximately 47 percent of operations occur on Runway 18, followed by Runway 36 at 23 percent, Runway 3 at 15%, and Runway 21 at 14%. It is important to note that this is based on six months of collected data which do not capture a spring or early summer, when wind conditions more frequently favor Runway 3 and 21.

### *3.2.5 IMPORTANCE OF RUNWAY 3/21*

Wind data indicates that wind conditions favored Runway 3/21 almost a quarter of the time over the last ten years. This is not including approximately 10% of the time when the wind is calm, and Runway 3/21 is favored due to its proximity to the terminal and apron. Analyzed on a monthly basis, there have been several months in the past ten years when wind conditions favored Runway 3/21 over one third of the time.

The availability of both runways also makes it possible for itinerant aircraft, including jets, to land or depart on one of the runways with minimal disruption to a full traffic pattern of flight school students practicing touch-and-go landings on the other runway. Many aircraft prefer to utilize Runway 3/21 when wind conditions are calm because of its proximity to the ramp, eliminating a relatively long taxi to the end of Runway 18.

### *3.2.6 AIRCRAFT MIX*

The capacity of a runway is dependent upon the type and size of the aircraft that utilize the facility. FAA AC 150/5060-5, *Airport Capacity and Delay*, categorizes aircraft into four (4) classes dictated by certificated maximum take-off weight, which differs from the previously discussed RDC/ARC that classifies aircraft based on approach category of wing-span. For aircraft weight class mix, Classes A and B consist of small single- and twin-engine aircraft weighing 12,500 pounds or less, Class C consists of jet and propeller aircraft weighing between 12,500 and 300,000 pounds (business jets and commuter / narrow-body air carrier aircraft), and Class D aircraft are those weighing greater than 300,000 pounds (air cargo, wide-body air carrier, and military aircraft). Aircraft mix is defined as the relative percentage of operations conducted by each of these aircraft classes.

### *3.2.7 EXIT TAXIWAYS*

The capacity of a runway is influenced by the ability of an aircraft to adequately exit the runway as quickly and safely as possible. Thus, the quantity and design of the exit taxiways can directly affect aircraft runway occupancy time and the capacity of the runway system. Exit taxiways should permit free flow to the parallel taxiway or at least to a point where the aircraft is completely clear of the hold line and be constructed in a “right angle” or “acute angle” fashion. Right angled taxiways provide bi-directional use and better pilot visibility than acute angled taxiways. Acute angled taxiways are commonly considered or classified as high-speed exit taxiways and allow aircraft to exit runways at a faster speed or pace than right angled taxiways.

FAA AC 150/5300-13B *Airport Design*, provides guidance on the effect of exit taxiway locations from runway end thresholds. Dependent on the category of aircraft (small single-engine, small multi-engine, large $\geq$ 12,500 pounds, and heavy $\geq$ 300,000 pounds) exit taxiways should be spaced between 2,000' and 4,000' from the runway threshold end, no less than 750' apart. Generally, each 100-foot reduction of the distance from the threshold to the exit taxiway reduces the runway occupancy time by approximately 0.75 seconds for each aircraft using the exit. Under these guidelines, Runways 18 / 36 and 3 / 21 would each be credited with two exit taxiways.

### *3.2.8 PERCENT ARRIVALS*

Runway capacity is also significantly influenced by the percentage of arrival operations. Because those aircraft on final approach are slated for priority over departing aircraft, higher percentage of arrivals during peak periods of operations impact the Annual Service Volume. At OUN, the percentage of arrivals is generally balanced against that of arrivals, therefore, a 50/50 split was assumed for capacity calculations during the peak period.

### *3.2.9 TOUCH-AND-GO ACTIVITY*

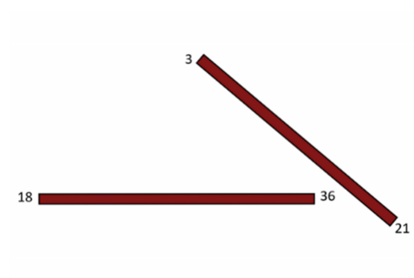
Touch-and-go operations refer to an aircraft performing a normal landing touchdown followed by an immediate take-off without stopping or clearing of the runway. Typically, these operations are affiliated with flight training and calculated as a local operation. As previously reflected in the *Aviation Demand Forecasts* Chapter, local operations account for approximately 48 percent of the total and are anticipated to remain throughout the planning period.

### 3.2.10 *CAPACITY ANALYSIS*

Applying the use of the ASV measure, it is easy to compare current and projected annual operations numbers and analyze capacity. Although not always viable for hourly capacity or delay peak periods, this guideline is helpful for long-range, 20-year planning horizons, and planning for when capacity enhancements should begin. According to FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, improvements for airfield capacity should begin to be considered once operations reach 60 to 75 percent of ASV and at 80 percent capacity, construction for those improvements should begin. If 100 percent capacity is reached, serious impacts to airport operations may occur resulting in increased delay. Analysis shows that the airport will adequately support the forecast demand in the planning period for all runway configurations, with the highest demand capacity being 22.6% in 204. For the base year 2021, the recorded operations at OUN were calculated at 48,284 with a forecast of 66,325 by 2041

<u>Dual Runway (Primary and Crosswind) – Runway 18 / 36 and Runway 3 / 21</u>

- Annual Service Volume – 225,000 operations
- Hourly Capacity – 108 (VFR) / 57 (IFR)
- Current Capacity – 21.4%
- Forecast Capacity – 29.4%



## 3.3 AIRFIELD REQUIREMENTS

This section addresses the actual physical facilities and / or improvement to existing facilities needed to safely and efficiently accommodate the projected demand that will be placed on the airport. The analysis of airfield requirements will be broken into two elements – *airside* and *landside*. The analysis of airfield requirements focuses on the determination of needed facilities and spatial considerations related to the actual operation of aircraft operating at the airport. This evaluation will highlight and detail airfield dimensional (design standards) criteria, design parameters of the runway and taxiway system, and lighting and NAVAIDS.

### 3.3.1 *RUNWAY DESIGN CODE*

The RDC is a coding system developed by the FAA to relate airport design criteria to the operational and physical characteristics of the airplane types that will operate at a particular airport. The RDC has three components relating to the airport design aircraft. The first component, depicted by a letter, is the aircraft approach category and relates to airplane wingspan. The second component relates to the designated, or planned, visibility minimums expressed by runway visual range (RVR) values in feet.

Generally, aircraft approach speed applies to runways and runway length-related features. Airplane wingspan primarily relates to separation criteria and width-related features. Airports expected to accommodate single-engine airplanes normally fall into Airport Reference Code A-I or B-I. Airports serving larger general aviation and commuter-type planes are usually Airport Reference Code B-II or B-III. Small to medium-sized airports serving air carriers are usually Airport Reference Code C-III, while larger air carrier airports are usually Airport Reference Code D-VI or D-V. As previously established, the RDC at OUN is C/D-II-2400 for Runway 18 / 36 and B-II-4000 for Runway 3 / 21. Based on existing and ultimate operations at the Airport and the existing and ultimate critical aircraft, the current C/D-II ARC designation for Runway 18/36 and B-II Designation for Runway 3/21 is deemed appropriate for the 20-year planning period. Exhibit 3.3 graphically depicts representative aircraft by Runway Design Code while Table 3.3 present the FAA design standards as they apply to each runway at the airport.

### 3.3.2 *TAXIWAY DESIGN GROUP (TDG)*

Similar to runways, taxiways are also required to be designed to certain limitations and offer a set of criteria referred to as Taxiway Design Group (TDG). TDG is based on guidance that established requirements based on overall Main Gear Width (MGW) and the Cockpit to Main Gear Distance (CMG) for all aircraft operating at the Airport. This criterion helps establish design standards for fillets and edge safety margins to help limit pilot error and use a consistent taxi method throughout the Airport. FAA Advisory Circular 150/5300-13B, *Airport Design*, Table 3.4, provides the essential requirements for taxiway design and the associated groups.

*THIS SECTION INTENTIONALLY LEFT BLANK*

*TABLE 3.3 – RUNWAY DESIGN CODE*

| Aircraft Approach Category (AAC) | | |
|---|---|---|
| AAC | Approach Speed | |
| A | Less than 91 knots | |
| B | 91 knots or more but less than 121 knots | |
| C | 121 knots or more but less than 141 knots | |
| D | 141 knots or more but less than 166 knots | |
| E | 166 knots or more | |
| **Airplane Design Group (ADG)** | | |
| Group | Tail Height (ft) | Wingspan (ft) |
| I | < 20’ | < 49’ |
| II | 20’ - < 30’ | 49 ‘ - < 79’ |
| III | 30’ - < 45’ | 79’ - < 118’ |
| IV | 45’ - < 60’ | 118’ - < 171’ |
| V | 60’ - < 66’ | 171’ - < 214’ |
| VI | 66’ - < 80’ | 214’ - < 262’ |
| **Approach Visibility Minimums** | | |
| RVR (ft) | Flight Visibility Category (statute mile) | |
| 5000 | Not lower than 1-mile | |
| 4000 | Lower than 1-mile but not lower than ¾-mile | |
| 2400 | Lower than ¾-mile but not lower than ½-mile (CAT-I) | |
| 1600 | Lower than ½-mile but not lower than ¼-mile CAT-II) | |
| 1200 | Lower than ¼-mile (CAT-III) | |

RVR – Runway Visual Range. The approximate visibility (in feet).
Source: FAA A/C 150/5300-13B, *Airport Design*

*THIS SECTION INTENTIONALLY LEFT BLANK*

## EXHIBIT 3.3 – *AIRCRAFT CHARACTERISTICS*

**AIRPLANE DESIGN GROUP (ADG)**

**A-I**


CESSNA 182 - SINGLE ENGINE AIRCRAFT (2 - 6 SEATS)

Maximum Take-off Weight (MTOW): 3,100 lbs. Length: 29’ Wingspan: 36’

Similar Aircraft: Beechcraft Bonanza, Cessna 172, Cirrus SR-22

**B-I**


BEECH KING AIR C90 - SMALL CABIN AIRCRAFT (4 - 10 SEATS)

Maximum Take-off Weight (MTOW): 10,100 lbs. Length: 35’ 6” Wingspan: 50’ 3” Tail Height: 14’ 3”

Similar Aircraft: Citation Mustang, Eclipse 500, HondaJet

**B-II**


CITATION XLS - SMALL CABIN AIRCRAFT (6 -12 SEATS)

Maximum Take-off Weight (MTOW): 20,200 lbs. Length: 52’ 6” Wingspan: 56’ 4” Tail Height: 17’ 2”

Similar Aircraft: Citation II/III/VII, Citation M2, Phenom 300

**C-II / D-II**


GULFSTREAM G-IV - COMMERCIAL/BUSINESS JET (14 -70 SEATS)

Maximum Take-off Weight (MTOW): 73,200 lbs. Length: 88’ 4” Wingspan: 77’ 10” Tail Height: 24’ 5”

Similar Aircraft: Bombardier Challenger 600, Embraer E-175

**C-III / D-III**


BOEING 737-800 - LARGE COMMERCIAL/BUSINESS JET (14 TO 160 SEATS)

Maximum Take-off Weight (MTOW): 174,200 lbs. Length: 129’ 6” Wingspan: 112’ 7” Tail Height: 41’2”

Similar Aircraft: Bombardier BD-700 Global Express, Boeing 757, Airbus A320

*TABLE 3.4 – TAXIWAY DESIGN GROUP (TDG) CRITERIA*

| Item | Taxiway Design Group | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1A | 1B | 2A | 2B | 3 | 4 | 5 | 6 |
| Taxiway Width | 25' | 25' | 35' | 35' | 50' | 50' | 75' | 75' |
| Taxiway Edge Safety Margin | 5' | 5' | 7.5' | 7.5' | 10' | 10' | 14' | 14' |
| Taxiway Shoulder Width | 10' | 10' | 15' | 15' | 20' | 20' | 30' | 30' |

Source: FAA Advisory Circular 150/5300-13B, *Airport Design*

### 3.3.3 *RUNWAY LENGTH*

As outlined in FAA AC 150/5325-4B, *Runway Length Requirement for Airport Design*, the runway length necessary for an airport is dependent on several factors including; airport elevation, temperature, wind velocity, aircraft operating weight and configurations, runway surface condition (wet or dry), obstructions present in the vicinity of the airport, and departure/arrival procedures.

Max Westheimer Airport's primary runway, Runway 18 / 36, is 5,199 feet in length and the secondary runway, Runway 3 / 21, is 4,748 feet in length. The current runway infrastructure at OUN is well positioned to serve a wide variety of general aviation and business aircraft.

The method for determining the recommended runway length is based on examining the design aircraft (ARC C/D-II) and the characteristics of aircraft included in that design category. In order to determine the ultimate required length of a runway, several issues must be considered, including the characteristics of the design aircraft type that will use the runway, the typical stage length being flown by the design aircraft, as well as common atmospheric conditions at the Airport. In general, longer stage lengths require aircraft to carry more fuel thereby increasing the aircraft's weight at takeoff and increasing the runway length required for takeoff. Similarly, warmer air temperatures (and its corresponding impacts on air density) result in increased runway takeoff length requirements for most aircraft.

FAA runway length requirements are based on small aircraft with weights of 12,500 pounds or less, large aircraft between 12,500 and 60,000 pounds, and large aircraft weighing greater than 60,000 pounds.

The results of the runway length analysis conducted for OUN indicate that the current runway length is more than sufficient to accommodate operations by all small airplanes. Runway length requirements for large aircraft between 12,500 and 60,000 pounds are calculated based on the percentage of aircraft in that category that can be accommodated as well as the useful load of those aircraft. As shown in Table 3.5, the runway length analysis indicates that an approximate runway length of 4,900 feet is required to accommodate 75% of large airplanes (less than 60,000 pounds) when operating at 60% of their average useful load and an approximate length of 5,900 feet is required to accommodate 100% of these same aircraft at 60% useful load. When evaluating the same fleet percentages at 90% useful load, the approximate runway length needs increase to 6,900' for 75% of the fleet and 9,000' for 100% of the fleet.

It is important to note that aircraft greater than 60,000 pounds can safely operate at the Airport with its current runway length; however, some aircraft may have to fly at less than 100 percent of their useful load and may not be able to fly the maximum range of their aircraft when temperatures are high. Again, aircraft performance characteristics determine the required runway length.

Table 3.5 presents the recommended FAA design standard lengths for runways using various categories of aircraft at standard useful loads.

*TABLE 3.5 – RUNWAY LENGTH ANALYSIS SUMMARY*

| Airport and Runway Data | |
|---|---|
| Airport Elevation (MSL) | 1,181.7’ |
| Mean daily maximum temperature of the hottest month | 92° |
| Maximum difference in runway centerline elevation | 4.4’ |
| Existing Runway Condition<br>Runway 18 / 36<br>Runway 3 / 21 | <br>5,199’<br>4,748’ |
| **Small aircraft ≤ 12,500 pounds with less than 10 seats** | |
| 95% of the fleet | 3,500’ |
| 100% of the fleet | 4,100’ |
| Small aircraft with more than 10 seats | 4,450’ |
| **Aircraft between 12,500 pounds and 60,000 pounds** | |
| 75% of Fleet – 60% useful load | 4,900’ |
| 75% of Fleet – 90% useful load | 6,900’ |
| 100% of Fleet – 60% useful load | 5,900’ |
| 100% of Fleet – 90% useful load | 9,000’ |
| **Large Aircraft > 60,000 pounds** | Refer to individual aircraft manufacturer’s planning manual |

Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design.* Lengths based on 1,181.7’ MSL, 92 degrees F Mean Max Temperature, 500 NM stage length, and maximum difference in runway centerline elevation of 4.4’.

As the runway length analysis indicates, the existing runway length at OUN is sufficient to accommodate a significant portion of the active general aviation fleet. While even the largest business jets can safely operate on the existing runway system, they are weight limited at certain times of the year and may have to take weight and range penalties. As the number of corporate general aviation jets in the national fleet increases and the number of operations conducted by these aircraft at the Airport increases, a runway extension should be considered and will be evaluated during the *Alternatives* portion of this planning effort. Additional factors that will be considered in this evaluation is university athletics transitioning to the Southeastern Conference (SEC), which exhibit prolific traveling fanbases, as well as larger charter aircraft for both the University’s teams and those traveling for competition purposes.

### 3.3.4 *BALANCED FIELD LENGTH*

While the FAA runway analysis provides an overview for categories of aircraft, balanced field length is a more precise calculation to determine the runway length needs for a certain aircraft. Specific to each aircraft and determined by the aircraft manufacturer, balanced field length is defined as "*distance required to stop an accelerating aircraft in exactly the same distance as that required to reach take-off speed*". As with those distances presented in the table above, balanced field length requirements are based on airport elevation, temperature, MTOW, and stage length.

Table 3.6 includes aircraft performance data for two groups of jet aircraft: those that averaged at least two operations per month over the last year at OUN, and those that are expected to utilize the Airport most frequently for SEC football games (italicized rows). It is notable that in the last year, over 600 operations took place at OUN by aircraft that require more than 5,199 feet of runway to operate at their maximum capacity on a standard temperature day, much less during the mean max temperature. It is also evident that many of the aircraft expected to arrive at OUN once the University transitions to the SEC in 2024 exceed the current pavement rating of 50,000 lbs. for dual-wheel configurations.

*THIS SECTION INTENTIONALLY LEFT BLANK*

*TABLE 3.6 – BALANCED FIELD LENGTH ANALYSIS SUMMARY*

| Aircraft | Annual Operations | MTOW (lbs) | Gear Configuration | Approximate Length | |
|---|---|---|---|---|---|
| | | | | Standard Day (59°) | Mean Max Temp (92°) |
| C56X - Cessna Excel/XLS | 288 | 20,200 | S | 4,079 | 4,731 |
| E55P - Embraer Phenom 300 | 164 | 17,968 | S | 3,592 | 4,165 |
| C25M - Cessna Citation M2 | 137 | 10,700 | S | 3,593 | 4,166 |
| C680 - Cessna Citation Sovereign | 120 | 30,775 | D | 3,947 | 4,577 |
| CL60 - Bombardier Challenger 600/601/604 | 99 | 47,600 | D | **6,279** | **7,287** |
| CL30 - Bombardier (Canadair) Challenger 300 | 98 | 38,850 | D | **5,362** | **6,221** |
| C25C - Cessna Citation CJ4 | 92 | 17,110 | S | 3,814 | 4,423 |
| C510 - Cessna Citation Mustang | 87 | 8,645 | S | 3,482 | 4,038 |
| H25B - BAe HS 125/700-800/Hawker 800 | 82 | 28,000 | D | **6,257** | **7,261** |
| CL35 - Bombardier Challenger 300 | 73 | 40,600 | D | **5,389** | **6,253** |
| SF50 - Cirrus Vision SF50 | 73 | 6,000 | S | 2,295 | 2,659 |
| C525 - Cessna CitationJet/CJ1 | 64 | 10,700 | S | 3,593 | 4,166 |
| C68A - Cessna Citation Latitude | 63 | 30,800 | D | 4,002 | 4,641 |
| C25B - Cessna Citation CJ3 | 54 | 13,870 | S | 3,560 | 4,128 |
| BE40 - Raytheon/Beech Beechjet 400/T-1 | 52 | 16,100 | S | **5,240** | **6,080** |
| LJ45 - Bombardier Learjet 45 | 49 | 21,500 | D | **5,616** | **6,516** |
| C560 - Cessna Citation V/Ultra/Encore | 42 | 16,300 | S | 3,935 | 4,564 |
| F900 - Dassault Falcon 900 | 37 | 49,000 | D | **5,970** | **6,927** |
| E135 - Embraer ERJ 135/140/Legacy | 36 | 44,533 | D | **6,391** | **7,416** |
| C550 - Cessna Citation II/Bravo | 35 | 15,100 | S | 3,853 | 4,468 |
| E545 - Embraer EMB-545 Legacy 450 | 34 | 35,759 | D | 4,363 | 5,061 |
| C25A - Cessna Citation CJ2 | 30 | 12,500 | S | 3,759 | 4,359 |
| C750 - Cessna Citation X | 27 | 36,100 | D | **5,726** | **6,645** |
| C700 - Cessna Citation Longitude | 26 | 39,500 | D | **5,461** | **6,336** |
| HDJT - HONDA HA-420 HondaJet | 24 | 9,039 | S | 4,466 | 5,181 |
| LJ60 - Bombardier Learjet 60 | 24 | 22,750 | D | **6,070** | **7,043** |
| *GLF5 - Gulfstream V/G500* | *22* | ***90,500*** | *D* | ***6,799*** | ***7,890*** |
| *C55B - Cessna Citation Bravo* | *12* | *14,800* | *S* | *4,024* | *4,667* |
| *GLEX - Bombardier BD-700 Global Express* | *2* | ***99,500*** | *D* | ***6,478*** | ***7,518*** |
| *GA6C - G-7 Gulfstream G600* | *2* | ***94,600*** | *D* | ***6,346*** | ***7,364*** |
| *GL5T - Bombardier BD-700 Global 5000* | *2* | ***92,500*** | *D* | ***6,169*** | ***7,158*** |
| *GLF6 - Gulfstream G650* | *0* | ***99,600*** | *D* | ***6,520*** | ***7,567*** |

Source: Flight Planning Guides, Airport Planning Manuals, Manufacturer websites, **Bold** = aircraft needing greater than existing length

These lengths provide a general overview of the appropriate requirements for larger corporate and commercial service aircraft to operate at the field. Justification for any potential runway extension to meet the needs of commercial or business jet aircraft requires regular use, which is defined as 500 itinerant operations annually and the minimum threshold necessary to obtain FAA grant funding assistance.

### 3.3.5 *RUNWAY WIDTH*

The required width of a runway is determined by the critical aircraft and the instrumentation available for the airport. Based on FAA design criteria and existing instrument procedures, the existing width of 100' for both runways at Max Westheimer Airport is adequate for meeting the existing and proposed operational levels during the 20-year planning period.

### 3.3.6 *RUNWAY VISIBILITY ZONE (RVZ)*

The RVZ is an area formed by imaginary lines connecting the line-of-sight points of intersecting runways. Its purpose is to facilitate coordination among aircraft and between aircraft and vehicles that are operating on active runways. Having a clear line-of-sight allows departing and arriving aircraft to verify the location and actions of other aircraft and vehicles on the ground that could create a conflict. Within the RVZ, any point five (5) feet above the runway centerline must be mutually visible with any other point (5) feet above the centerline of the crossing runway. Currently, no known obstructions affect the line-of-sight within the RVZ.

### 3.3.7 *RUNWAY PAVEMENT STRENGTH*

Runway pavement strength is typically expressed by common landing gear configurations. Example aircraft for each type of gear configuration are as follows:

- Single Wheel: each landing gear unit has a single tire; example aircraft include light aircraft and some business jet aircraft.
- Dual Wheel: each landing gear unit has two tires; example aircraft are the King Air 350, Citation Longitude, and Gulfstream 500.
- Dual-Tandem: main landing gear unit has four tires arranged in the shape of a square; i.e., Boeing 757.

The aircraft gear type and configuration dictate how aircraft weight is distributed to the pavement and determines the pavement response to loading. As previously mentioned in the *Inventory of Existing Conditions*, the current runway pavement strength is 30,000 pounds for single-wheel loaded aircraft (SW), 50,000 pounds for dual-wheel loaded aircraft (DW), and 100,000 pounds for dual-tandem wheeled aircraft (DTW).

The strength rating of a runway does not preclude aircraft weighting more than the published strength rating from utilizing the airfield, it simply provides the ability to support a high volume of aircraft at or below the published weight. While aircraft weighing more than the published weight could potentially damage the runway in severe conditions, it more commonly reduces the life cycle of the pavement over time. Should the airport accommodate aircraft weighing more than the design weight limitations, it is recommended the airport undertake a Pavement Management Program study to determine the exact requirements to accommodate such aircraft.

### 3.3.8 *TAXIWAYS*

As previously mentioned, the FAA updated taxiway design requirements to aid in the appropriate design for spacing and size of taxiways. It is important to note that the FAA lists seven conditions which should be addressed to reduce the potential for runway incursions.

- Increase Pilot Situational Awareness. Keep taxiways simple – "three-node" concept.
- Avoid wide expanses of pavement. Requires signage placed away from line of sight.
- Limit runway crossings. Reduces the number of occurrences and ATC workload.
- Avoid "high-energy" intersections. Intersections in the middle third of the runways create the potential for a high speed/energy collision.
- Increase visibility. Using right angle intersections, both between taxiways and between taxiways and runway, provides the best visibility for pilots.
- Avoid "dual purpose" pavements. Dual purpose runways/taxiways can lead to confusion.
- Indirect Access. Taxiways leading directly from an apron to a runway without requiring a turn increase the possibility for incursions.

Per AC 150/5300-13B, *Airport Design,* the FAA requires a full-length parallel taxiway for runways configured with instrument approach procedures with visibility minimums below one-mile and recommended for all other conditions. The airport meets or exceeds the mandated design criteria for taxiways. As discussed in the *Inventory of Existing Conditions*, there are designated "HOT SPOTS" defined by the FAA on the field. These areas will be reviewed and potential remedies reflected in the *Alternatives* chapter. Table 3.7 presents the various taxiway design standards.

*THIS SECTION INTENTIONALLY LEFT BLANK*

*TABLE 3.7 – TAXIWAY DESIGN STANDARDS*

| Airplane Design Group (ADG) | II | III | IV |
|---|---|---|---|
| Taxiway Protection: | | | |
| Taxiway Safety Area Width | 79' | 118' | 171' |
| Taxiway Object Free Area Width | 124' | 171' | 243' |
| Taxilane Object Free Area Width | 110' | 158' | 224' |
| Taxiway Separation: | | | |
| Taxiway Centerline to:<br>Parallel taxiway / taxilane centerline<br>Fixed or movable object | <br>101.5'<br>62' | <br>144.5'<br>85.5' | <br>207'<br>121.5' |
| Taxilane Centerline to:<br>Parallel taxilane centerline<br>Fixed or movable object | <br>94.5'<br>55' | <br>138'<br>79' | <br>197.5'<br>112' |
| Wingtip Clearance: | | | |
| Taxiway wingtip clearance | 22.5' | 26.5' | 36' |
| Taxilane wingtip clearance | 15.5' | 20' | 26.5' |
| Taxiway Design Group (TDG) | 2A/2B | 3 | 4 |
| Taxiway Width | 35' | 50' | 50' |
| Taxiway Edge Safety Margin | 7.5' | 10' | 10' |
| Taxiway Shoulder Width | 15' | 20' | 20' |

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

## 3.4 DIMENSIONAL CRITERIA

The type of aircraft currently operating and projected to operate at the airport have an impact on the planning and design of airport facilities. The FAA, in their Advisory Circular 150/5300-13B, *Airport Design*, provides the requirements for dimensional design criteria pertaining to the Critical or Design Aircraft that currently utilize the airport, or is projected to utilize the airport in the future. Table 3.8 details dimensional criteria based upon the Runway Design Code (RDC) for each runway. The ultimate RDC, referring to aircraft wingspan and approach speed, for each runway was identified in the previous chapter, *Aviation Demand Forecasts:*

- Runway 18-36: C/D-II-2400
- Runway 3-21: B-II-4000

*TABLE 3.8 – FAA DESIGN CRITERIA SUMMARY*

| Design Item | Runway 18/36 (C/D-II); Not lower than ½ - mile vis. minimums | Runway 3/21 (B-II); Not lower than ¾ - mile vis. minimums |
|---|---|---|
| **Runway** | | |
| Width | 100' | 75' |
| **Safety Areas (SA)** | | |
| Width | 500' | 300' |
| Length Beyond Departure End | 1,000' / 1,000' | 300' / 300' |
| Length Prior to Threshold | 600' / 600' | 300' / 300' |
| **Object Free Areas (OFA)** | | |
| Width | 800' | 500' |
| Length Beyond Departure End | 1,000' / 1,000' | 300' / 300' |
| Length Prior to Threshold | 600' / 600' | 300' / 300' |
| **Obstacle Free Zone (OFZ)** | | |
| Width | 400' | 400' |
| Length Beyond Departure End | 200' / 200' | 200' / 200' |
| **Taxiway** | | |
| Width | 35' | 35' |
| Safety Area | 79' | 79' |
| Object Free Area | 124' | 124' |
| Centerline to Fixed or Movable Object | 62' | 62' |
| **Runway Centerline to:** | | |
| Holdline | 250' | 200' |
| Taxiway Centerline | 400' | 240' |
| A/C Parking Area | 500' | 400' |

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

### 3.4.1 *RUNWAY SAFETY AREA*

The Runway Safety Area (RSA) is a defined 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. According to the FAA's definition and dimensional standards, the RSA should be cleared, graded, and have no potentially hazardous ruts or surface variations.

For both Runway 18 / 36, design standards (ARC C/D-II) dictate the RSA is required to be 500 feet wide and extend 1,000 feet beyond the departure end of the runway. For Runway 3/21, design standards (ARC B-II) dictate the RSA is required to be 300 feet wide and extend 300 feet beyond the departure end. Both runways meet associated criteria and should be maintained through the planning period. An inventory of all objects located within the RSAs is included in the appendix.

### 3.4.2 *RUNWAY OBJECT FREE AREA*

The Runway Object Free Area (OFA) is a two-dimensional ground area centered on a runway, taxiway, or taxilane centerline 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. The OFA prohibits parked aircraft and other objects, except NAVAIDs and objects with locations fixed by function. According to FAA guidelines, OFA for ARC C/D-II runways should extend 1,000 feet beyond each end of the runway and have a width of 800 feet, and for ARC B-II, the OFA should be 500 feet wide and extend 300 feet beyond the runway end. Similar to the RSA, both runways meet the requisite OFA requirements.

### 3.4.3 *OBSTACLE FREE ZONES*

The Obstacle Free Zone (OFZ) is a three-dimensional volume of airspace that surrounds the transition of ground-to-airborne operations (or vice versa). The OFZ clearing standards prohibit taxiing, parked aircraft, and other objects with the exception of frangible NAVAIDs or fixed-function objects, from penetrating this zone. The OFZ consists of a volume of airspace below 150 feet above the established airport elevation and is centered on the extended runway centerline. The OFZ extends 200 feet beyond each end of the runway and has a width that varies with approach visibility minimums and the size of aircraft using the runway, in the case of OUN, 400'.

### 3.4.4 *RUNWAY PROTECTION ZONES*

A Runway Protection Zone (RPZ) is an area off the runway end intended to enhance the protection of people and property on the ground. This is achieved through airport control of the RPZ areas. The RPZ is trapezoidal in shape, centered on the extended runway centerline, and begins 200 feet beyond the end of the area usable for take-off or landing. RPZ dimensions are a function of the RDC, aircraft size, and the lowest visibility minimums associated with a runway's end.

Because RPZ's often extend beyond airport property and overlap with property specifically owned and operated by the airport, the FAA has produced a memorandum to provide policy guidance on compatible land uses within an RPZ, entitled, *Interim Guidance on Land Uses within a Runway Protection Zone* (September 2012). While "it is desirable to clear all objects from the RPZ, some uses are permitted with conditions and other land uses prohibited". Airport owner control over the RPZ land is emphasized to achieve the desired protection of people and property on the ground. Although the FAA recognizes that in certain situations the airport sponsor may not fully control land within the RPZ, the FAA expects airport sponsors to take all possible measures to protect against and remove or mitigate incompatible land uses.

While the following land uses are permissible within an RPZ without further scrutiny or evaluation:

- Farming that meets airport design standards,

- Irrigation channels that do not attract wildlife, or birds in general,
- Airport service roads, as long as they are not public roads or directly controlled by the airport operator,
- Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable, and
- Unstaffed NAVAIDs and facilities, such as equipment for airport facilities that are considered fixed-by-function in regard to RPZ,

There are certain trigger points or actions that could alter incompatibility land uses within an RPZ as a result of:

- An airfield project (e.g., runway extension, runway shift),
- change in the critical design aircraft that increases the RPZ dimension,
- A new or revised instrument approach procedure that increases the RPZ dimensions, and
- A local development proposal in the RPZ (either new or reconfigured).

Should such trigger points revise the limits of an RPZ that include the following land uses, then additional evaluation and approval from the FAA would be necessary and mandatory.

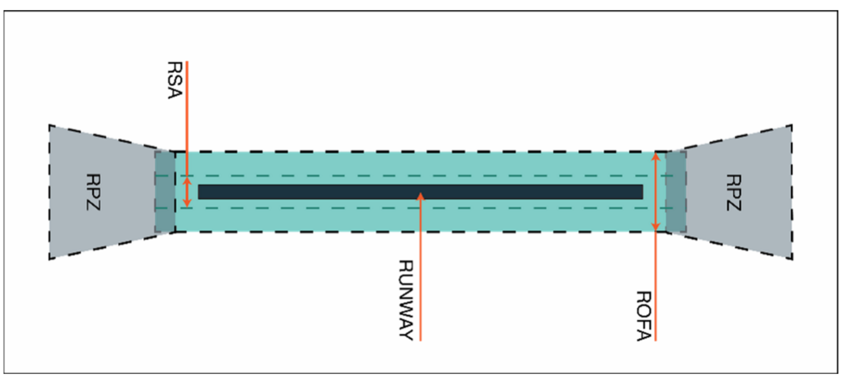
- Buildings and structures (Examples include, but are not limited to: residences, schools, churches, hospitals, or other medical care facilities, commercial / industrial buildings, etc.),
- Recreational land use (Examples include, but are not limited to: golf courses, sports fields, amusement parks, other places of public assembly, etc.),
- Transportation facilities. Examples include, but are not limited to:
  - Rail facilities – light or heavy, passenger, or freight
  - Public roads / highways
  - Vehicular parking facilities
- Fuel storage facilities (above and below ground),
- Hazardous material storage (above and below ground),
- Wastewater treatment facilities, and
- Above-ground utility infrastructure (i.e. electrical substations), including any type of solar panel installations.

It should be noted, these new criteria do not apply to existing RPZ's, only those which are new or modified. While it is till incumbent of the airport sponsor to take all reasonable action to meet RPZ design standards, FAA funding priority for certain actions will be addressed and determined on a case-by-case basis. Table 3.9 presents the RPZ dimensions for each runway end and whether the Airport owns and controls the entire area contained within the RPZ.

*TABLE 3.9 – RUNWAY PROTECTION ZONE (RPZ) DIMENSIONS*

| Item | Width at Inner Edge | Length | Width at Outer Edge | Airport Control |
|---|---|---|---|---|
| Existing RPZ Dimension | | | | |
| Runway 18 | 1,000’ | 2,500’ | 1,750’ | No |
| Runway 36 | 500’ | 1,700’ | 1,010’ | Yes |
| Runway 3 | 500’ | 1,700’ | 1,010’ | Yes |
| Runway 21 | 1,000’ | 1,700’ | 1,510’ | No |
| Required RPZ Dimension | | | | |
| Visual and not lower than 1-mile, small aircraft only | 250’ | 1,000’ | 450’ | |
| Visual and not lower than 1-mile, approach categories A & B | 500’ | 1,000’ | 700’ | |
| Visual and not lower than 1-mile, approach categories C & D | 500’ | 1,700’ | 1,010’ | |
| Not lower than ¾-mile, all aircraft | 1,000’ | 1,700’ | 1,510’ | |
| Lower than ¾-mile, all aircraft | 1,000’ | 2,500’ | 1,750’ | |

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



### 3.4.5 *BUILDING RESTRICTION LINE (BRL)*

The BRL is a line that identifies suitable building area locations on airports based on visibility and imaginary airspace surfaces. It considers such things as runway protection zones, the appropriate OFAs and OFZs, NAVAID critical areas, areas required for TERPS, and air traffic control (ATCT) line of sight (at airports where ATCTs exist). Typically, the closer development is to the Aircraft Operations Area (AOA), the more impact it will have on future expansion capabilities of the Airport. The BRL setback for both runways should be 675 feet for a 25-feet high structure and 745 feet for a 35-feet high structure. It is anticipated the airport will safely retain these distances for any future and / or proposed development.

## 3.5 NAVIGATIONAL AIDS

Navigations aids (NAVAIDs) are any visual or electronic devices, airborne or on the ground, that provide point-to-point guidance information or position data to aircraft in flight. Airport NAVAIDs provide guidance to a specific runway end or to an airport. An airport is equipped with precision, non-precision, or visual capabilities in accordance with design standards that are based on safety considerations and airport operational needs. The type, mission, and volume of activity used in association with meteorological, airspace, and capacity considerations determine an airports eligibility and need for various NAVAIDs.

### 3.5.1 *INSTRUMENT NAVIGATIONAL AIDS*

This category of NAVAID provides assistance to aircraft performing instrument approach procedures to an airport. An instrument approach procedure is defined as a series of predetermined maneuvers for guiding an aircraft under instrument flight conditions from the beginning of the initial approach to a landing, or to a point from which a landing be made visually.

The current instrument approaches outlined in Chapter 1, *Inventory of Existing Conditions*, are sufficient to meet the current and forecast demand at OUN. Should new lower visibility instrument approaches be considered in the future, a review of the equipment components necessary to accommodate these upgrades will be evaluated.

### 3.5.2 *AUTOMATED WEATHER*

Max Westheimer Airport is served by an on-site Automated Weather Observation System (AWOS-3) which can be tuned to frequency 119.55 or by phone at (405) 325-7302. An AWOS provides pilots with a computer-generated voice message which is broadcast via radio frequency in the vicinity of an airport. The message contains pertinent weather information including wind speed and direction, visibility, temperature, dew point, and cloud ceiling heights. FAA Order JO 6560.20C, *Siting Criteria for Automated Weather Observing Systems* (AWOS) outlines the siting criteria for airports equipped with a Precision Instrument Runway with RVR instrumentation. "*The cloud height, visibility, and wind sensors must be located adjacent to the primary instrument runway 1,000 feet to 3,000 feet down runway from the threshold. The minimum distance perpendicular from runway centerline must be 750 feet. The maximum distance perpendicular from runway centerline must not exceed 1,000 feet. The minimum distance of 750 feet assumes flat terrain.* The current location of the AWOS is adequate; however, due to horizontal distance requirements from runway centerline, the *Alternatives* section will analyze the opportunity to increase the setback from Runway 18 / 36 based on siting criteria.

### 3.5.3 *AIRFIELD MARKING*

FAA AC 150/5340-1M, *Standards for Airport Markings*, provides guidance for establishing uniform airfield markings for runways, taxiways and aprons. Runway markings typically coincide with the level of instrument capability provided by the runway. Runways 18 should continue to maintain the precision approach markings and the remaining three runway ends should maintain non-precision markings until such time approaches to any of these ends is adjusted. It is recommended that all runway markings be maintained in accordance with FAA AC 150/5340-1M.

### 3.5.4 *AIRFIELD LIGHTING AND SIGNS*

All runways are recommended to retain their equipped Medium Intensity Runway Lights (MIRL). Additionally, the MALSR to Runway 18 and MALS to Runway 3 should remain. It is recommended all lighting be upgraded or consistent with LED type. Additionally, those areas along the taxiways without MITL or proper airfield directional signs should be programmed for install when financially feasible. These features enhance safety along maneuvering areas, maintain a consistency across the airfield, and increase or enhance pilot awareness.

## 3.6 LANDSIDE REQUIREMENTS

This section describes the landside requirements needed to accommodate OUN's general aviation activity throughout the planning period. Areas of particular focus include the hangars, aprons, tie-down areas, automobile parking, as well as various associated support facilities.

### *3.6.1. GENERAL AVIATION TERMINAL BUILDING*

General aviation terminal facilities range in size from a very basic waiting room, restrooms, and telephones to multi-story buildings with amenities such as pilot lounge and briefing room, restaurants, conference and training rooms, and administration offices. The specific layout of a general aviation terminal is often driven by whether or not it is an airport-owned and operated facility or a private FBO building.

For most airports, the general aviation terminal will be the focal point of the airport; thus, the building should be easy to locate. The view should not be obstructed by other buildings and other buildings should not obstruct the view of the airfield from the terminal. At OUN, general aviation terminal services are provided by Cruise Aviation.

Rule of thumb methodology used in estimating general aviation terminal facility needs is based on the number of airport users anticipated to utilize the general aviation facilities during the design hour. A general planning guideline calculation of 125 square feet of space per person and 2.5 automobile parking spaces is recommended to determine overall general aviation terminal needs. **Table 3.10** outlines the proposed space requirements through the planning period. Based on the calculations, the anticipated terminal space requirement need by the end of the planning period is approximately 8,600 square feet, with an associated auto parking need of 170 spaces.

*TABLE 3.10 – SUMMARY OF GENERAL AVIATION TERMINAL REQUIREMENTS*

| | 2021 | 2026 | 2031 | 2036 | 2041 |
|---|---|---|---|---|---|
| Peak Hour Passengers | -- | 34 | 44 | 56 | 69 |
| GA Terminal Requirement (sq. ft.) | -- | 4,200 | 5,500 | 6,900 | 8,600 |
| Auto Parking Spaces | 100 | 85 | 110 | 139 | 170 |

Source: KSA

### 3.6.2 GENERAL AVIATION AIRCRAFT PARKING APRONS

Aircraft aprons are typically the largest facility on an airport. Currently, approximately 93,500 square yards of apron space in various locations across the airfield are used for aircraft parking. Aircraft parking requirements were developed using FAA Advisory Circular 150/5300-13B *Airport Design*, Appendix 5 and ACRP Report 113, *Guidebook on General Aviation Facility Planning*. Two types of aircraft apron parking are available – based aircraft and itinerant aircraft.

#### BASED AIRCRAFT APRON

Based aircraft tie-downs are usually provided for those aircraft owners and operators that do not require or desire to pay the cost for long-term hangar storage or have space available at an airport due to facility shortages. According to ACRP Report 113, *Guidelines for General Aviation Facility Planning*, space calculations for these areas range in size between 400 and 800 square yards depending on aircraft category. For planning purposes, a size of 500 square yards will be utilized to determine based aircraft size requirements. This space allotment provides for aircraft parking and circulation between the rows of tie-downs. Trends indicate that as more aircraft are based at an airport, hangar storage capacity is surpassed before additional hangar space is supplied.

#### ITINERANT AIRCRAFT APRON

Itinerant apron storage is provided for transient aircraft owners and operators requiring short-term or temporary storage and to provide higher levels of activity. Typically, these aprons provide easy access to the FBO and fueling facilities and are configured to allow for safe and efficient taxiing movements between parking positions and the airfield. Similar to the based aircraft apron, calculations of this storage requirement are based on ACRP Report 113 – 500 square yards for ADG-I aircraft (single-engine and smaller multi-engine aircraft), 1,000 square yards for ADG-II aircraft (turbo-prop and small / medium business jet aircraft), and 2,000 square yards for ADG-III aircraft (large business jet aircraft). This additional space allotment over that of based aircraft is due to the typical itinerant pilot not being conditioned or familiar with the airport and its maneuvering or circulation patterns and the overall increase in aircraft size.

### 3.6.3 AIRCRAFT HANGAR STORAGE

Understanding aircraft storage demand is an important element when considering facility requirements for general aviation based aircraft. The quantity and type of hangar space is driven by many variables including: total number of based aircraft, fleet mix, local weather conditions, and user preference. This section outlines requirements for T-hangars and corporate / executive hangars.

#### T-HANGARS

T-hangars come in two types: standard and nested. Standard T-hangar configurations produce a longer and narrower building and work well where existing infrastructure or available property is not wide enough for nested T-hangars while nested T-hangar configurations produce a shorter and wider building than the standard T-hangar. Nested T-hangars optimize the developable space and reduce the required taxi-lane pavements and allow for the construction of a larger rectangular unit or "pod" on the ends of the building for larger aircraft. Nested T-hangars are the most common hangars types. T-hangars are typically constructed for single-engine and smaller twin-engine aircraft or those aircraft with a wingspan up to 79 feet. Standard planning assumptions for T-hangars are based on 1,200 square feet of storage space for single-engine aircraft and 1,500 square feet of storage space for multi-engine aircraft.

#### CORPORATE / EXECUTIVE HANGARS

A corporate hangar is usually a standard box hangar with the addition of dedicated space such as an office, restroom, conference room, break room, and lobby area. These types of hangars work well when there is a local FBO present of aircraft manager that oversees the hangar. Aircraft stored in corporate hangars typically reflects those aircraft within the medium to large turbine category.

Executive hangars are hangars constructed when a conventional hangar is too large and T-hangar is too small and are typically a single structure divided into as little as two and up to six storage units. These hangars most often accommodate small to medium piston / turbo-prop and smaller jet type aircraft. Executive hangars provide flexibility for an airport that does not need hangar space to accommodate large aircraft but needs to house aircraft too large for a standard T-hangar. These hangars are usually custom sizes and offer expansion capabilities.

Calculations for corporate / executive hangars are based on 2,500 square feet of storage needs for turbo-prop aircraft, 10,000 square feet of storage needs for business jets, and 1,500 square feet of storage needs for helicopters.

Table 3.11 presents the type of facilities and the number of units or area needed in order to meet the forecast demand for each development phase. It is expected that most of the owners and operators of newly-based aircraft at the airport will desire hangar storage facilities. It should be noted that the actual number, size, type, and location of future hangars will depend on user needs, market conditions, and financial feasibility at the time demand occurs. While the table calculates adequate storage and space needs over the planning period, during times of game days and other large scheduled events, aircraft parking apron space becomes limited or is non-existent. Locations to help support expansion areas will be addressed in the *Alternatives* chapter.

*TABLE 3.11 – SUMMARY OF APRON AND HANGAR REQUIREMENTS*

| | 2021 | 2026 | 2031 | 2036 | 2041 |
|---|---|---|---|---|---|
| Itinerant (sq. yds.) | | | | | |
| ADG-I | -- | 2,500 | 2,700 | 2,900 | 3,100 |
| ADG-II | -- | 8,300 | 8,900 | 9,700 | 10,500 |
| ADG-III | -- | 6,600 | 7,200 | 7,800 | 8,400 |
| Based Aircraft | | | | | |
| Apron (sq. yds.) | -- | 3,300 | 3,600 | 3,900 | 4,200 |
| Tie-Down parking spots | 177 | 7 | 7 | 8 | 8 |
| **TOTAL APRON (sq. yds.)** | **93,500** [1] | **20,700** | **22,400** | **24,300** | **26,200** |
| Hangar Area Requirements | | | | | |
| T-Hangars (sq. ft.) | 45,400 | 60,805 | 65,000 | 69,000 | 73,800 |
| Corporate / Executive Hangar Area (sq. ft.) | 100,240 | 171,500 | 189,800 | 211,500 | 231,300 |
| Total Hangar Need (sq. ft.) | 145,640 | 232,305 | 254,800 | 280,500 | 305,100 |
| ADDITIONAL HANGAR REQUIREMENT (sq. ft.) | -- | 86,665 | 22,495 | 25,700 | 24,600 |
| Number Aircraft in T-Hangars | -- | 50 | 53 | 56 | 60 |
| Number of Aircraft in Corp. / Exec. Hangars | -- | 75 | 82 | 91 | 99 |

Source: KSA

[1] Existing apron does not differentiate between itinerant and based. Does not include the dedication OU School of Aviation Apron of 34,200 sq. yds.

### 3.6.4 *SUPPORT FACILITIES REQUIREMENTS*

In addition to the aviation and airport access facilities, there are other airport support facilities, which have quantifiable requirements, and which are vital to the efficient and safe operation of the airport. The support facilities at OUN that require further evaluation include the fuel storage facility, and the Airport Traffic Control Tower (ATCT), and perimeter fencing.

### 3.6.5 *FUEL STORAGE FACILITY*

Fuel storage and sales are provided by the on-field FBO (Cruise Aviation). Available fuel storage includes one Jet-A fuel tank providing 15,000 gallons and one 100LL fuel tank providing 15,000 gallons. In addition, the FBO has two full-time mobile fuelers – one 3,000 gallon Jet-A and one 1,500 gallon 100LL. The fuel storage tanks are located on the southeast corner of the dedicated OU flight school apron.

According to fuel sales provided by the airport, fuel flowage for 2021 at the airport equated to 107,783 gallons of 100LL and 251,417 gallons of Jet-A. Based on the total average operations for the baseline year of 2021, this equates to approximately 4.4 gallons per operation for piston aircraft and 10 gallons for turbine-engine aircraft. Typically, as operations increase, fuel storage requirements can be expected to increase proportionately. By increasing the ratio of gallons sold per operation, an estimate of future fuel storage needs can be calculated as a 14-day supply during the peak month of operation. As reflected in **Table 3.12**, the airport's fuel storage capacity for the planning period of 100LL is adequate but undersized for the anticipated Jet-A needs. Additional Jet-A fuel storage capacity is recommended over the span of the planning period.

*TABLE 3.12 – SUMMARY OF AIRCRAFT FUEL REQUIREMENTS*

| Operational Activity | 2021 | 2026 | 2031 | 2036 | 2041 |
|---|---|---|---|---|---|
| 100LL | | | | | |
| Average Day of Peak Month Ops | 78 | 84 | 91 | 98 | 106 |
| 14-days of Operations | 1094 | 1171 | 1268 | 1372 | 1486 |
| Gallons per operation | 4.4 | 4.8 | 5.3 | 5.9 | 6.4 |
| Fuel Storage (gallons) | 4,812 | 5,667 | 6,749 | 8,037 | 9,571 |
| Jet-A | | | | | |
| Average Day of Peak Month Ops | 85 | 91 | 98 | 106 | 115 |
| 14-days of Operations | 1185 | 1268 | 1373 | 1487 | 1609 |
| Gallons per operation | 10 | 11.0 | 12.1 | 13.3 | 14.6 |
| Fuel Storage (gallons) | 11,848 | 13,953 | 16,616 | 19,788 | 23,564 |

Source: Airport Records; KSA

### 3.6.6 *AIRPORT TRAFFIC CONTROL TOWER (ATCT)*

At towered airfields, the ATCT is the facility that supervises, directs, and monitors aircraft operations surrounding the immediate airspace of the airport (i.e., within 5-miles). The existing tower is located atop the terminal building just southeast of Runway 18 / 36 and east of Runway 3 / 21. Currently, the airport is in contract negotiations to perform an official FAA siting study to assess and determine the optimal location for a new fully equipped tower. Until that project is complete, this planning study will evaluate a new ATCT in general locations based on sound planning practices as part of the alternatives process. Standard criteria for new ATCT new locations will consider FAR Part 77 airspace criteria, sight distances and shadowing effects, and other factors such as topography, infrastructure development, access, and costs. Should the siting study conclude before completion of the Master Plan, details will be included as an Appendix to this document.

### 3.6.7 *SECURITY (FENCING)*

Airport security and fencing is an important part of airfield infrastructure. Tenants, users, and businesses count on airport management to provide secure and safe facilities to help protect their investments. Various types of fencing are used for wildlife and security and vary in height and type, depending on local security needs. These fences are low-maintenance and provide clear visibility for security sweeps and may include chain link, barbed wire, razor wire, or other elements to increase intrusion difficulty. The airport currently provides sufficient fencing and controlled access at various points across the airfield. No new fencing requirements are recommended over the planning period; however, it is important to ensure any future development areas at the airport should include security measures of fencing and / or controlled access gates.

## 3.7 SUMMARY

The information provided in this chapter provides the basis for understanding what facility improvements at the airport might help in the effort to accommodate future demands in an efficient and safe manner. Airport staff has done an excellent job keeping the airport deficient free in terms of mandated FAA design standards criteria. Following are development issues and improvement considerations from the narrative above:

- Maximize runway length in support of anticipated fleet mix, athletic charters, and additional traffic associated with transition to the Southeastern Conference (SEC)
- Future location and siting of the Air Traffic Control Tower (ATCT)
- Correction of FAA designated runway / taxiway "HOT SPOTS"
- Proper siting for weather reporting equipment (AWOS-3) dependent on recommended runway layout
- Landside development areas programmed for small / large general aviation facilities and operators
- Areas programmed for terminal parking and terminal building expansion
- The following chapter, *Alternatives Analysis*, will examine the proposed needs assessment from this chapter with a focus on airside and landside layouts and concepts for consideration of a final airfield footprint and vision for the planning period.