Chapter Three

FACILITY REQUIREMENTS

This chapter will evaluate the existing capacities of the airport and outline any new facilities needed to accommodate projected forecast levels. The existing capacity is compared to the forecast activity levels prepared in Chapter Two to determine where deficiencies currently exist or may be expected to materialize in the future. The chapter will cover:

- Planning Horizon Activity Levels
- Airfield Capacity and Delay
- Airport Physical Planning Criteria
- Airside and Landside Facility Requirements

As indicated previously in Chapter One, airport facilities include both airside and landside components. Airside facilities include those that are related to the arrival, departure, and ground movement of aircraft. The components include:

- Runways
- Taxiways
- Navigational Approach Aids
- Airfield Lighting, Marking, and Signage

Landside facilities are needed for the interface between air and ground transportation modes. This includes components for general aviation needs such as:

- General Aviation Terminal Services
- Aircraft Hangars
- Aircraft Parking Aprons
- Airport Support Facilities

Once deficiencies in a component are identified, alternatives for providing these facilities will be evaluated in Chapter Four to determine the most practical, cost-effective, and efficient direction for future development.

PLANNING HORIZONS

In Chapter Two, an updated set of aviation demand forecasts for Scottsdale Airport was established. The activity forecasts include based aircraft, fleet mix, annual operations, peaking characteristics, and annual instrument approaches (AIAs). With this information, specific components of the airside and landside systems can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, safe, efficient, and orderly development of an airport should rely more upon actual demand at an airport than a time-based forecast figure. In order to develop a Master Plan that is "demand-based" rather than "time-based," a series of planning horizon milestones has been established for Scottsdale Airport that takes into consideration the reasonable range of aviation demand projections prepared in Chapter Two. It is important to consider that the actual activity at any given time at the airport may be higher or lower than projected activity levels. By planning according to activity milestones, the resulting plan can accommodate unexpected shifts or changes in the airport's aviation demand.

The most important reason for utilizing milestones is that they allow the airport to develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can either be slowed or expedited according to actual demand at any given time over the planning period. The resultant plan provides airport management with a financially responsible and needs-based program. **Table 3A** presents the planning horizon milestones of short, intermediate, and long term for each aircraft activity category for the airport. These milestones generally correlate to five, 10, and 20-year periods used in Chapter Two.

TABLE 3A
Planning Horizon Activity Summary
Scottsdale Airport

	Current (2012)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
BASED AIRCRAFT				
Single Engine Piston	191	195	200	210
Multi-Engine Piston	27	27	26	25
Turboprop	31	38	45	62
Jet	105	122	138	173
Helicopter	14	18	21	30
TOTAL BASED AIRCRAFT	**368**	**400**	**430**	**500**
ANNUAL OPERATIONS				
Itinerant	90,070	94,395	100,065	113,925
Local	63,327	66,780	70,455	78,855
TOTAL ANNUAL OPERATIONS*	**153,397**	**161,175**	**170,520**	**192,780**
ANNUAL INSTRUMENT APPROACHES	**N/A**	**945**	**1,002**	**1,140**

*Includes ATCT After-Hours Adjustment

AIRPORT PEAKING CHARACTERISTICS

Airport capacity and facility needs on the airfield typically relate to the levels of activity that are projected to occur during a peak or design period. The periods used in developing the capacity analyses and facility requirements in this chapter are presented in **Table 3B** and were detailed in Chapter Two. They include the following:

- Peak Month – The calendar month when peak volumes of aircraft operations occur.
- Design Day – The average day in the peak month. The indicator is easily derived by dividing the peak month operations by the number of days in a month.
- Busy Day – The busy day of a typical week in the peak month.
- Design Hour – The peak hour within the design day.

TABLE 3B
Peaking Characteristics
Scottsdale Airport

	Current (2012)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
Peak Month	14,300	15,634	16,540	18,700
Design Day	461	504	534	603
Busy Day	581	635	672	760
Design Hour	60	66	69	78

AIRFIELD CAPACITY AND DELAY

Airfield capacity is measured in a variety of different ways. The **hourly capacity** of a runway measures the maximum number of aircraft operations that can take place in an hour. The **annual service volume** (ASV) is an annual level of service that may be used to define airfield capacity needs. **Aircraft delay** is the total delay incurred by aircraft using the airfield during a given timeframe. The Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*, provides a methodology for examining the operational capacity of an airfield for planning purposes.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

This analysis takes into account specific factors about the airfield, such as airfield layout, weather conditions, aircraft mix, and operations in order to calculate the airport's ASV. These factors are depicted in **Exhibit 3A**. The following describes the input factors as they relate to Scottsdale Airport.

Runway Configuration

The existing runway configuration consists of a single runway supported by a full-length parallel taxiway on each side. Runway 3-21 is 8,249 feet long and 100 feet wide.

Runway Use

Runway use in capacity conditions will be controlled by wind and/or airspace conditions. The direction of takeoffs and landings are generally determined by the direction of the wind. It is generally safest for aircraft to take off and land into the wind, in order to avoid crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components. In addition, due to the congested airspace associated with the greater Phoenix metropolitan area that surrounds Scottsdale Airport, aircraft flow can be dictated by air traffic control when wind conditions are calm. Based upon information from previous airport studies, Runway 21 is utilized most often, estimated at 56 percent of the time. The availability of instrument approaches is also considered. Both ends of Runway 3-21 are served by straight-in and circling instrument approach procedures. According to airport traffic control tower (ATCT) personnel, the area navigation (RNAV) global positioning system (GPS)-D circling approach is the most utilized instrument approach procedure at Scottsdale Airport.

Exit Taxiways

Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determine the occupancy time of an aircraft on the runway. The airfield capacity analysis gives credit to taxiway exits located within the prescribed range from a runway's threshold. This range is based upon the mix index of the aircraft that use the runways. Only exit taxiways located between 2,000 and 4,000 feet from the landing threshold count in the capacity determination. The exits must be at least 750 feet apart to count as separate exits. Under these criteria, Runway 3 is credited with three exit taxiways and Runway 21 is credited with two exit taxiways in this analysis.

Weather Conditions

Weather conditions can have a significant impact on airfield capacity. Airport capacity is usually highest in clear weather, when flight visibility is at its best. Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are reduced. As weather conditions deteriorate, the spacing of aircraft must increase to provide allowable margins of safety and air traffic vectoring. The increased distance between aircraft reduces the number of aircraft which can operate at the airport during any given period, thus reducing overall airfield capacity.

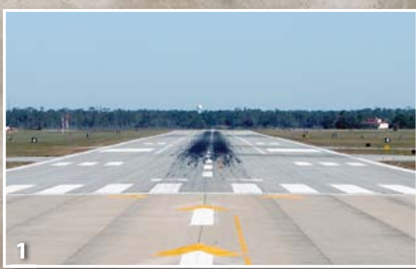
According to meteorological data collected from the on-airport automated surface observation system (ASOS), the airport operates under visual flight rule (VFR) conditions approximately 99 percent of the time. VFR conditions exist whenever the cloud ceiling is greater than 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument flight rule (IFR) conditions are defined when cloud ceilings are between 500 and 1,000 feet AGL or visibility is between one and three miles. According to the weather observations, IFR conditions prevailed only one percent of the time. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. PVC rarely occurs at Scottsdale Airport. **Table 3C** summarizes the weather conditions experienced at the airport over a 10-year period of time.

AIRFIELD LAYOUT

Runway Configuration / Runway Use / Number of Exits

WEATHER CONDITIONS

VMC
Visual Meteorological Conditions



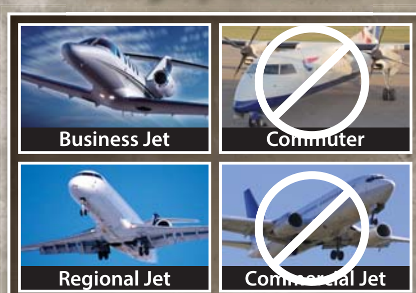
IMC
Instrument Meteorological Conditions

PVC
Poor Visibility Conditions

AIRCRAFT MIX

Category A & B Aircraft

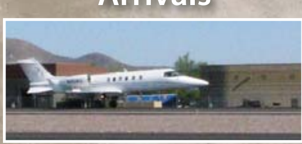
Category C Aircraft



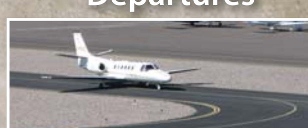
Category D Aircraft[2]

OPERATIONS

Arrivals

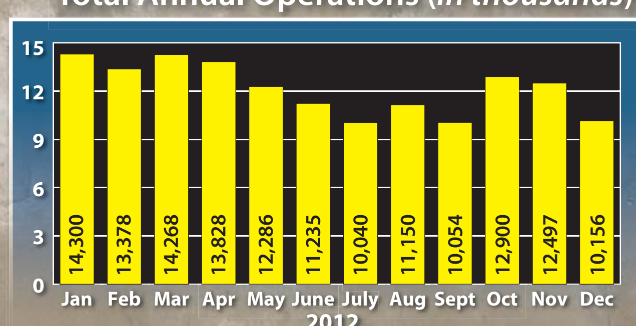


Departures



Touch-and-Go Operations

Total Annual Operations (*in thousands*)



[1] Photographs not Scottsdale Airport
[2] Category D aircraft not permitted at Scottsdale Airport

TABLE 3C Weather Conditions Scottsdale Airport				
Condition	**Cloud Ceiling**	**Visibility**	**Observations**	**Percent of Total**
VFR	> 1,000' AGL	> 3 statute miles	79,852	98.68%
IFR	≥ 500' AGL and ≤ 1000' AGL	1-3 statute miles	824	1.02%
PVC	< 500' AGL	< 1 statute mile	245	0.30%

VFR - Visual Flight Rules
IFR - Instrument Flight Rules
PVC - Poor Visibility Conditions
AGL - Above Ground Level

Source: National Oceanic and Atmospheric Administration (NOAA) - National Climatic Data Center. Airport observations from 2002-2012.

Aircraft Mix

The aircraft mix for the capacity analysis is defined in terms of four aircraft classes. Classes A and B consist of small and medium-sized propeller-driven aircraft and some smaller business jets, all weighing 12,500 pounds or less. These aircraft are associated primarily with general aviation activity, but do include some air taxi, air cargo, and commuter aircraft. Class C consists of aircraft weighing between 12,500 pounds and 300,000 pounds. These aircraft include most business jets and some turboprop aircraft. Class D consists of large aircraft weighing more than 300,000 pounds. These aircraft are associated with major airline and air cargo activities, and include the Boeing 747 and 777, among others. The airport does not experience operations by Class D aircraft. A description of the classifications and the percentage mix for each planning horizon is presented in **Table 3D**.

TABLE 3D Aircraft Operational Mix - Capacity Analysis Scottsdale Airport				
Aircraft Classification	**Current (2012)**	**Short Term (1-5 Years)**	**Intermediate Term (6-10 Years)**	**Long Term (11-20 Years)**
Classes A & B	86.2%	85.1%	84.2%	82.2%
Class C	13.8%	14.9%	15.8%	17.8%
Class D	0%	0%	0%	0%

Class A - Small single engine aircraft with gross weights of 12,500 pounds or less
Class B - Small multi-engine aircraft with gross weights of 12,500 pounds or less
Class C - Large aircraft with gross weights over 12,500 pounds up to 300,000 pounds
Class D - Large aircraft with gross weights over 300,000 pounds

Source: Coffman Associates analysis

For the capacity analysis, the percentage of Class C aircraft operating at Scottsdale Airport is critical in determining the ASV as this class includes the larger and faster aircraft in the operational mix. The percentage of Class C aircraft operations at the airport is expected to increase through the planning period as business and corporate use of jets increases.

Percent Arrivals vs. Departures

The aircraft arrival/departure split is typically 50/50 in the design hour. At Scottsdale Airport, traffic information indicated no major deviation from this pattern.

Touch-And-Go Activity

A touch-and-go operation involves an aircraft making a landing and then an immediate takeoff without coming to a full stop or exiting the runway. As previously discussed in Chapter Two, these operations are normally associated with general aviation training activity and classified as a local operation. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and one takeoff occurs within a shorter time period than individual operations. Touch-and-go operations at Scottsdale Airport account for approximately 40 percent of total annual operations. A similar ratio is expected in the future.

Peak Period Operations

Typical operations activity is important in the calculation of an airport's ASV as "peak demand" levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times throughout the year. For the airfield capacity analysis, average daily operations and average peak hour operations during the peak month, as calculated in the previous chapter and detailed earlier in this chapter, are utilized.

CALCULATION OF ANNUAL SERVICE VOLUME

The preceding information was used in conjunction with the airfield capacity methodology developed by the FAA to determine airfield capacity for Scottsdale Airport.

Hourly Runway Capacity

The first step in determining ASV involves the computation of the hourly capacity of the runway configuration. The percentage use of the runway, the amount of touch-and-go activity, and the number and locations of runway exits are the important factors in determining hourly capacity.

Based upon these factors, the current and future hourly capacities for Scottsdale Airport were determined. As the operational mix of aircraft at the airport changes to include a higher percentage of large aircraft weighing over 12,500 pounds, the hourly capacity of the system declines slightly. This is a result of the additional spacing and time required by larger aircraft in the traffic pattern and on the runway. As indicated in **Table 3D**, the percentage of Class C aircraft is projected to increase in each planning horizon activity milestone. Class C aircraft at the airport currently represents 13.8 percent of the operational mix. This upward progression is in line with corporate aircraft operations' likely increase at a greater rate than other general aviation operations involving smaller aircraft.

The current and future weighted hourly capacities are depicted in **Table 3E**. Weighted hourly capacity is the measure of the maximum number of aircraft operations that can be accommodated on the airfield in a typical hour. It is a composite of estimated hourly capacities for different airfield operating configurations adjusted to reflect the percentage of time in an average year that the airfield operates under each specific configuration. The current weighted hourly capacity on the airfield is 93 operations; likewise, the capacity is expected to decline slightly to 89 operations by the long term horizon.

TABLE 3E
Airfield Capacity Summary
Scottsdale Airport

	Current (2012)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
Operational Demand				
Annual	153,397	161,175	170,520	192,780
Capacity				
Annual Service Volume	220,000	216,000	212,000	206,000
Percent Capacity	69.7%	75.0%	80.4%	93.6%
Weighted Hourly Capacity	93	92	91	89

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

Annual Service Volume

The ASV is determined by the following equation:

Annual Service Volume = C x D x H
C = weighted hourly capacity
D = ratio of annual demand to the average daily demand during the peak month
H = ratio of average daily demand to the design hour demand during the peak month

The current ASV for the airfield has been estimated at 220,000 operations. The increasing percentage of larger Class C aircraft over the planning period will attribute to a decline in ASV, lowering it to a level of 206,000 operations by the end of the planning period. With operations in 2012 estimated at 153,397 (factoring a five percent adjustment for operations when the ATCT is closed), the airport is currently at 69.7 percent of its ASV. Long range annual operations are forecast to reach 192,780, which would be 93.6 percent of the airport's ASV. **Table 3E** and **Exhibit 3B** summarize and compare the airport's ASV and projected annual operations over the short, intermediate, and long range planning horizons.

AIRCRAFT DELAY

The affect that the anticipated ratio of demand to capacity will have on users of Scottsdale Airport can be measured in terms of delay. As the number of annual aircraft operations approaches the airfield's capacity, increasing operational delays begin to occur. Delays occur to arriving and departing aircraft in all weather conditions. Arriving aircraft delays result in aircraft holding outside the airport traffic pattern area. Departing aircraft delays result in aircraft holding at the runway end until they can safely takeoff.

Aircraft delay can vary depending on different operational activities at an airport. At airports where large air carrier aircraft dominate, delay can be greater given the amount of time these aircraft require in the traffic pattern and on approach to land. For airports that accommodate primarily small general aviation aircraft, experienced delay is typically less since these aircraft are more maneuverable and require less time in the airport traffic pattern.

Table 3F summarizes the potential aircraft delay for Scottsdale Airport. Estimates of delay provide insight into the impacts that steady increases in aircraft operations have on the airfield and also signify the airport's ability to accommodate projected annual aircraft operations. The delay per operation represents an average delay per aircraft. It should be noted that delays of five to ten times the average could be experienced by individual aircraft during peak periods. As an airport's percent capacity increases toward the ASV, delay increases exponentially. Furthermore, the complex airspace system that surrounds Scottsdale Airport can also factor into additional delay experienced at the airport.

TABLE 3F
Airfield Delay Summary
Scottsdale Airport

	Current (2012)	Short Term (1-5 years)	Intermediate Term (6-10 years)	Long Term (11-20 years)
Percent Capacity	69.7%	75.0%	80.4%	93.6%
Delay				
Per Operation (Minutes)	0.7	0.9	1.1	1.6
Total Annual (Hours)	1,790	2,418	3,126	5,141

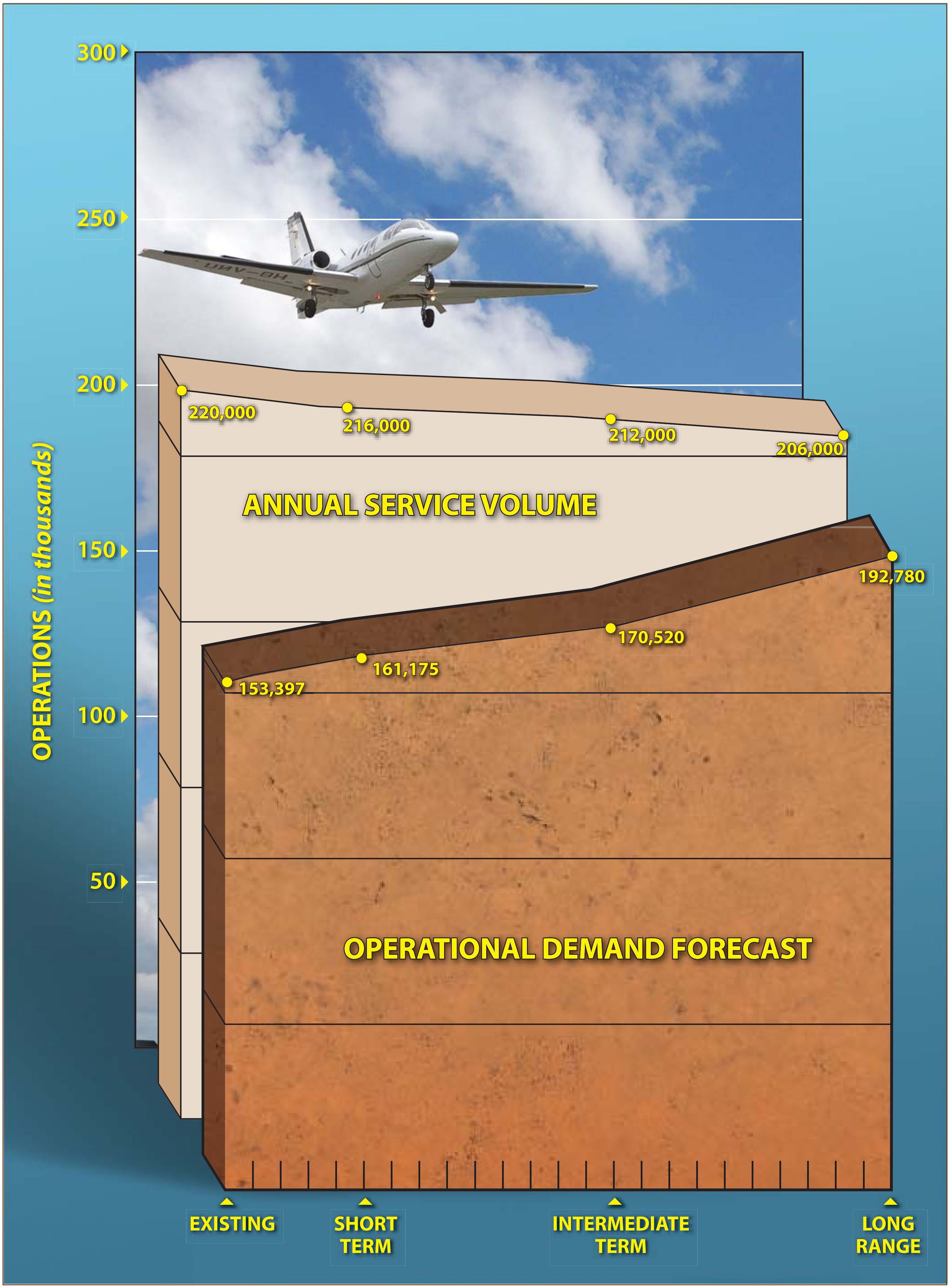
Source: FAA AC 150/5060-5, *Airport Capacity and Delay*

Currently, the total annual delay at the airport is estimated at 1,790 hours. If no capacity improvements are made, annual delay can be expected to reach 5,141 hours by the long range planning horizon. This calculates to a current average delay per aircraft of 0.7 minutes and a long term delay of 1.6 minutes per aircraft. The FAA threshold for significant delay is four minutes per aircraft. The current level of delay may not be noticeable by pilots and is not forecast to reach the FAA level of significance.

CAPACITY ANALYSIS CONCLUSION

Exhibit 3B compares ASV to existing and forecast operational levels at Scottsdale Airport. The 2012 operations level equated to 69.7 percent of the airfield's ASV. By the long term planning horizon, total annual operations are expected to represent 93.6 percent of ASV.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, indicates that improvements for airfield capacity purposes should be considered when operations reach 60 to 75


300
250
200
150
100
50
OPERATIONS (in thousands)
220,000
216,000
212,000
206,000
ANNUAL SERVICE VOLUME
192,780
170,520
161,175
153,397
OPERATIONAL DEMAND FORECAST
EXISTING
SHORT TERM
INTERMEDIATE TERM
LONG RANGE

percent of the ASV. Actual implementation may be deferred until such time that the improvement is considered timely and cost-beneficial. When 80 percent of the ASV is reached, capacity improvement projects should become higher priority capital improvements. Options to improve airfield efficiency and capacity, including their feasibility and practicability, will be evaluated in the next chapter.

SAFETY AREA DESIGN STANDARDS

The FAA publishes AC 150/5300-13A, *Airport Design*, to guide airport planning. The AC provides guidance on various design elements of an airport intended to maintain or improve safety at airports. The design standards include airport elements such as runways, taxiways, safety areas, and separation distances. According to the AC, *"airport planning should consider both the present and potential aviation needs and demand associated with the airport."* Consideration should be given to planning runway and taxiway locations that will meet future separation requirements even if the width, strength, and length must increase later. Such decisions should be supported by the aviation demand forecasts and coordinated with the FAA and shown on the Airport Layout Plan (ALP).

FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, was published on September 28, 2012. It is intended to replace AC 150/5300-13, *Airport Design*, which was dated September 29, 1989. The latter was subject to 18 published changes over 23 years.

The previous Airport Design AC established the design standards based primarily on the Airport Reference Code (ARC), which was defined as "*a coding system used to relate airport design criteria to the operational and physical characteristics of the airplanes intended to operate at the airport."*

In the current AC, the definition of the ARC is found in Paragraph 102.i. and reads, *"An airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning and design only and does not limit the aircraft that may be able to operate safely on the airport."*

RUNWAY DESIGN CODE

As presented in Chapter Two, the Runway Design Code (RDC) is defined as, *"A code signifying the design standards to which the runway is to be built."* Paragraph 105.c. indicates that the Aircraft Approach Category (AAC), the Airplane Design Group (ADG), and the approach visibility minimums combine to form the RDC of a particular runway. These provide the information needed to determine certain design standards that apply.

The FAA design standards are based upon the characteristics of the critical design aircraft expected to use the airport, as well as the instrument approach capability of the runway system. The critical design aircraft is defined as the most demanding category of aircraft, or family of aircraft, which conducts at least 500 itinerant operations per year at the airport. As detailed in Chapter Two, Runway 3-21 at Scottsdale Airport should be designed to meet standards for RDC D-III with not lower than one-mile visibility minimums based upon the aircraft fleet mix that utilizes the airport. The alternatives analysis in Chapter Four will evaluate the ability of the airfield to meet these standards.

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions that could affect their safe operation. These include the runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), and runway protection zone (RPZ). **Table 3G** presents the FAA design standards as they apply to RDC D-III for Runway 3-21 at Scottsdale Airport.

TABLE 3G
Runway Safety Area Design Standards
Scottsdale Airport

	Runway 3	Runway 21
RUNWAY DESIGN CODE	D-III	
VISIBILITY MINIMUMS	≥1-mile	≥1-mile
RUNWAY PROTECTION		
Runway Safety Area (RSA)		
Width (feet)	500	
Length Beyond Departure End (feet)	1,000	
Length Prior to Threshold (feet)	600	
Runway Object Free Area (ROFA)		
Width (feet)	800	
Length Beyond Departure End (feet)	1,000	
Length Prior to Threshold (feet)	600	
Runway Obstacle Free Zone (ROFZ)		
Width (feet)	400	
Length Beyond Runway End (feet)	200	
Approach Runway Protection Zone (RPZ)		
Inner Width (feet)	500	500
Outer Width (feet)	1,010	1,010
Length (feet)	1,700	1,700
Departure Runway Protection Zone (RPZ)		
Inner Width (feet)	500	500
Outer Width (feet)	1,010	1,010
Length (feet)	1,700	1,700

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

According to AC 150/5300-13A, *Airport Design*, the entire RSA, ROFA, and ROFZ should be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. The RPZ should also be under airport ownership. An alternative to outright ownership of the RPZ is the granting of avigation easements (acquiring control of designated airspace and land use within the RPZ) or having sufficient land use control measures in places which ensure the RPZ remains free of incompatible development. These safety areas will be further outlined in the sections to follow.

DECLARED DISTANCES

Declared distances are the maximum length of runway available and suitable for meeting takeoff, rejected takeoff, and landing distance performance requirements. These distances are based on aircraft characteristics, safety requirements, and the airport environment. They include:

- Takeoff run available (TORA) - Takeoff run available is the length of runway declared available and suitable for takeoff run requirements and must consider the start of takeoff, potential incompatibilities within the departure RPZ, and limitations resulting from a reduced takeoff distance available.
- Takeoff Distance Available (TODA) - Takeoff distance available is generally the TORA plus the length of any remaining runway or clearway beyond the departure end of the takeoff run available for satisfying takeoff distance requirements.
- Accelerate-Stop Distance Available (ASDA) - Accelerate-stop distance available applies to a rejected takeoff and is the runway plus stopway length (if any) declared available and suitable for the acceleration and deceleration of an aircraft aborting a takeoff. The RSA and ROFA beyond the start of takeoff are considered in determining the ASDA.
- Landing Distance Available (LDA) - Landing distance available is a function of landing and is the length of runway declared available and suitable for satisfying landing distance requirements. Threshold siting criteria, the approach RPZ, the RSA, and the ROFA prior to the threshold and beyond the LDA are considered in establishing this distance.

Declared distances may be used for the following purposes to:

- Obtain additional RSA and/or ROFA prior to the runway's threshold (the start of the LDA) and/or beyond the stop end of the ASDA and LDA.
- Mitigate unacceptable incompatible land uses in the RPZ.
- Meet runway approach and/or departure surface clearance requirements, in accordance with airport design standards.
- Mitigate environmental impacts.
- Act as an incremental improvement technique when it is not practical to fully meet certain safety requirements.

As detailed in Chapter One, declared distances currently apply to Runway 3-21 at Scottsdale Airport. These declared distances are published and currently included on the ALP that has been approved by the FAA. **Table 3H** presents the existing declared distances at Scottsdale Airport. The declared distances related to Runway 3-21 at Scottsdale Airport are depicted on **Exhibit 3C**.

TABLE 3H
Declared Distances
Scottsdale Airport

	Runway	
Existing Declared Distances (feet)	**3**	**21**
Takeoff Run Available (TORA)	8,249	8,249
Takeoff Distance Available (TODA)	8,249	8,249
Accelerate-Stop Distance Available (ASDA)	7,849	8,069
Landing Distance Available (LDA)	7,110	7,669

Source: Airport Layout Plan (May 2013)

RUNWAY SAFETY AREA

The RSA is defined in FAA AC 150/5300-13A, *Airport Design,* as a "surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway." The RSA is centered on the runway centerline and must be:

1) cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;
2) drained by grading or storm sewers to prevent water accumulation;
3) capable, under dry conditions, of supporting new removal equipment, aircraft rescue and firefighting (ARFF) equipment, and the occasional passage of aircraft without causing damage to the aircraft; and
4) free of objects, except for objects that need to be located in the RSA because of their function.

The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program.* The Order states, "The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports…shall conform to the standards contained in Advisory Circular 150/5300-13, *Airport Design*, to the extent practicable." Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

For RDC D-III aircraft, the FAA calls for the RSA to be 500 feet wide and extend 1,000 feet beyond the runway ends. In the case at Scottsdale Airport, the RSA extends 1,000 feet beyond the end of the ASDA and LDA for both runways.

As depicted on **Exhibit 3D**, the RSA width encompasses 250 feet on each side of Runway 3-21. As a result, portions of parallel Taxiways A and B serve as penetrations to the RSA. In addition, a small portion of the perimeter access road located on the north side of Runway 3-21 is located within the RSA. It should be noted that this access road is restricted to authorized airport personnel and is not open to the public.

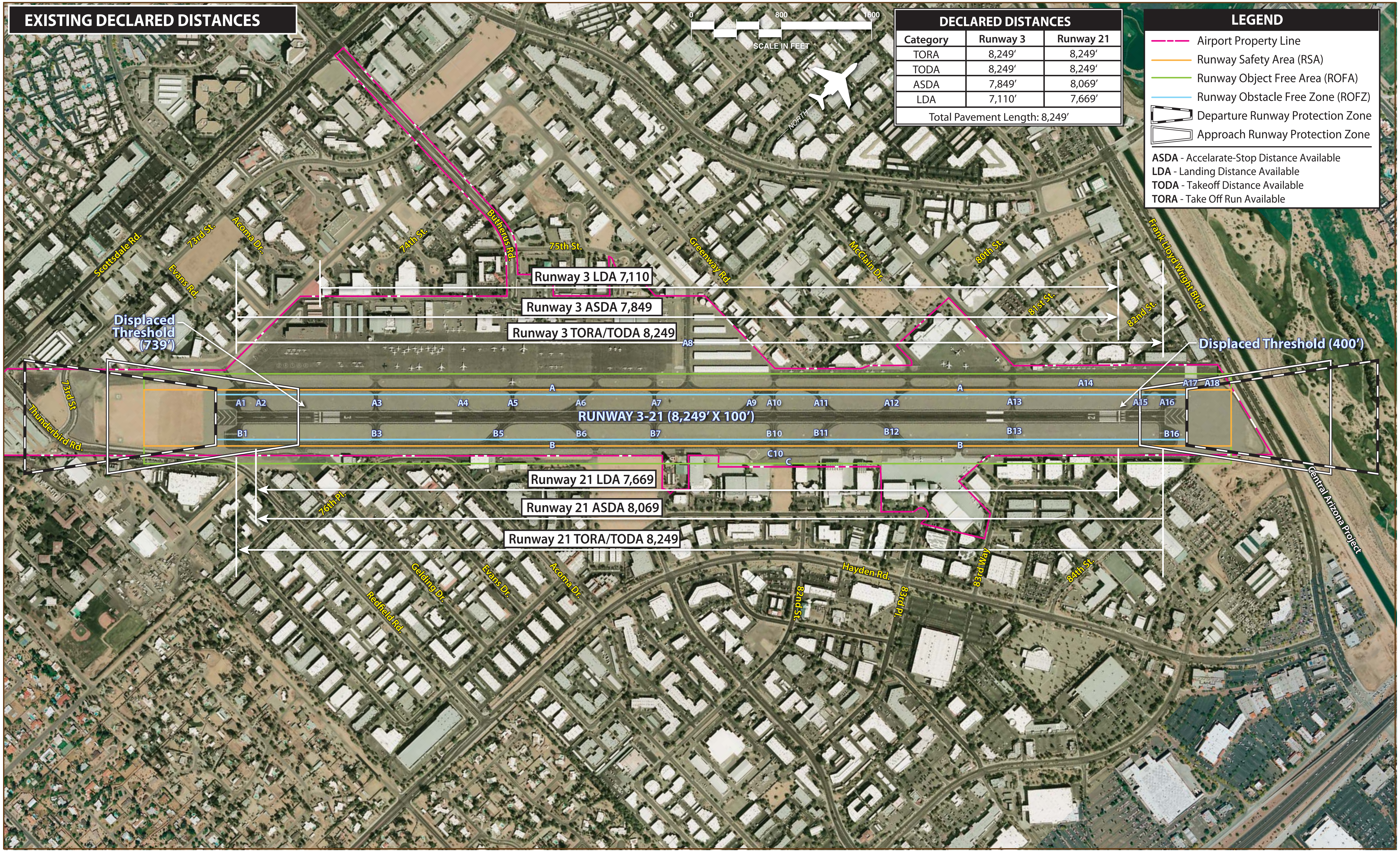
RUNWAY OBJECT FREE AREA

The ROFA is "a two-dimensional ground area, surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The ROFA does not have to be graded and level like the RSA; instead, the primary requirement for the ROFA is that no object in the ROFA penetrates the lateral elevation of the RSA. The ROFA is centered on the runway, extending out in accordance to the critical design aircraft utilizing the runway.

For RDC D-III aircraft, the FAA calls for the ROFA to be 800 feet wide, extending 1,000 feet beyond each runway end. Similar to the RSA, the ROFA associated with Runway 3-21 extends 1,000 feet beyond the end of the ASDA and LDA on each runway end.

Certain areas of the airport's ROFA do not conform to design standards on the airfield. As shown on **Exhibit 3D**, the northwestern edge of the ROFA extends beyond airport property on the north side of the airport and extends over a small portion of Frank Lloyd Wright Boulevard.

EXISTING DECLARED DISTANCES



DECLARED DISTANCES		
Category	Runway 3	Runway 21
TORA	8,249'	8,249'
TODA	8,249'	8,249'
ASDA	7,849'	8,069'
LDA	7,110'	7,669'
Total Pavement Length: 8,249'		

LEGEND

- Airport Property Line
- Runway Safety Area (RSA)
- Runway Object Free Area (ROFA)
- Runway Obstacle Free Zone (ROFZ)
- Departure Runway Protection Zone
- Approach Runway Protection Zone

ASDA - Accelarate-Stop Distance Available
LDA - Landing Distance Available
TODA - Takeoff Distance Available
TORA - Take Off Run Available

Aerial Source: Woolpert, 5-18-2013

Aerial Source: Woolpert, 5-18-2013

In addition, a blast fence located immediately south of this area also penetrates the ROFA. Furthermore, a large majority of the ROFA on the east side of the airport extends beyond airport property and encompasses roads, fencing, and building infrastructure.

RUNWAY OBSTACLE FREE ZONE

The ROFZ is an imaginary volume of airspace which precludes object penetrations, including taxiing and parked aircraft. The only allowance for ROFZ obstructions is navigational aids mounted on frangible bases which are fixed in their location by function, such as airfield signs. The ROFZ is established to ensure the safety of aircraft operations. If the ROFZ is obstructed, the airport's approaches could be removed or approach minimums could be increased.

The FAA's criterion for runways utilized by large airplanes (those weighing more than 12,500 pounds) requires a clear ROFZ to extend 200 feet beyond the runway ends and be 400 feet wide (200 feet on either side of the runway centerline). Currently, Scottsdale Airport's runway meets the 400-foot width needed to accommodate aircraft weighing more than 12,500 pounds.

RUNWAY PROTECTION ZONES

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 feet beyond the runway threshold. The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses, in order to enhance the protection of people and property on the ground. The RPZ is comprised of the central portion of the RPZ and the controlled activity area. The central portion of the RPZ extends from the beginning to the end of the RPZ, is centered on the runway, and is the width of the ROFA. The controlled activity area is any remaining portions of the RPZ.

The dimensions of the RPZ vary according to the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway. For the not lower than one mile visibility minimums and RDC D-III for Runway 3-21 at Scottsdale Airport, the approach and departure RPZs have an inner width of 500 feet, an outer width of 1,010 feet, and an overall length of 1,700 feet.

While the RPZ is intended to be clear of incompatible objects or land uses, some uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13A, the following land uses are permissible within the RPZ:

- Farming that meets the minimum buffer requirements;
- Irrigation channels as long as they do not attract birds;
- Airport service roads, as long as they are not public roads and are directly controlled by the airport operator;
- Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable; and
- Unstaffed navigational aids (NAVAIDs) and facilities, such as required for airport facilities that are fixed-by-function in regard to the RPZ.

Any other land uses considered within RPZ land owned by the airport sponsor must be evaluated and approved by the FAA Office of Airports. The FAA has published, *Interim Guidance on Land Uses within a Runway Protection Zone* (9.27.2012), which identifies several potential land uses that must be evaluated and approved prior to implementation.

The specific land uses requiring FAA evaluation and approval include:

- 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
- Above-ground utility infrastructure (i.e., electrical substations), including any type of solar panel installations.

The *Interim Guidance on Land within a Runway Protection Zone* states, "RPZ land use compatibility also is often complicated by ownership considerations. 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."

Currently, the RPZ review standards are applicable to any new or modified RPZ. The following actions or events could alter the size of an RPZ, potentially introducing an incompatibility:

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

Since the interim guidance only addresses new or modified RPZs, existing incompatibilities are essentially grandfathered under certain circumstances. While it is still necessary for the airport sponsor to take all reasonable actions to meet the RPZ design standard, FAA funding priority for certain actions, such as relocating existing roads in the RPZ, will be determined on a case by case basis.

As depicted on **Exhibit 3D**, the RPZs associated with each runway end have incompatibilities that should be pointed out. The approach and departure RPZs on the north side of Runway 3-21 extend over Frank Lloyd Wright Boulevard and portions of a golf course. On the south side of the runway, the approach and departure RPZs are traversed by portions of Thunderbird Road, Redfield Road, and 73rd Street as well as commercial development.

AIRSIDE FACILITIES

Airside facilities include those facilities related to the arrival, departure, and ground movement of aircraft. The adequacy of existing airfield facilities at Scottsdale Airport has been analyzed from a number of perspectives, including:

- Runways
- Taxiways
- Navigational and Approach Aids
- Airfield Lighting, Marking, and Signage

RUNWAYS

Runway conditions such as orientation, length, width, and pavement strength at Scottsdale Airport were analyzed. In addition, separation standards associated with Runway 3-21 have been evaluated. From this information, requirements for runway improvements were determined for the airport. **Table 3J** presents the various runway standards related to RDC D-III.

TABLE 3J
Runway Design and Separation Standards
Scottsdale Airport

	Runway 3	Runway 21
RUNWAY DESIGN CODE	D-III	
VISIBILITY MINIMUMS	≥1-mile	≥1-mile
RUNWAY DESIGN		
Runway Length (feet)	8,249	
Runway Width (feet)	100*	
Shoulder Width (feet)	20*	
Pavement Strength (pounds)	45,000 SWL & 75,000 DWL	
Blast Pad Width (feet)	140*	140*
Blast Pad Length (feet)	200	200
RUNWAY SEPARATION		
Runway Centerline to:		
Holding Position	266**	
Parallel Taxiway	400	
Aircraft Parking Apron	500	

SWL – Single Wheel Loading
DWL – Dual Wheel Loading

*For Airplane Design Group (ADG) III aircraft with maximum certificated takeoff weight of more than 150,000 pounds and approach visibility minimums lower than ¾-mile, the standard runway width is 150 feet, the shoulder width is 25 feet, and the runway blast pad width is 200 feet. Runway 3-21 is planned for aircraft with maximum certificated takeoff weights of 100,000 pounds or less, thus the existing runway and blast pad widths meet design standards.

**Design standard calls for 250 feet at sea level. For all ADGs that are aircraft approach categories D and E, the distance is increased 1 foot for each 100 feet above sea level. Scottsdale Airport is situated at 1,510 feet MSL.

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

Runway Orientation

For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off.

FAA AC 150/5300-13A, *Airport Design,* recommends that a crosswind runway be made available when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for RDC A-I and B-I, 13 knots (15 mph) for RDC A-II and B-II, and 16 knots (18 mph) for RDC A-III, B-III, C-I through C-III, and D-I through D-III.

Weather data specific to the airport was obtained from the National Oceanic Atmospheric Administration (NOAA) National Climatic Data Center. This data was collected from the on-field ASOS over a continuous time period from 2002 to 2012. A total of 80,921 observations of wind direction and other data points were made.

Runway 3-21 provides 99.22 percent wind coverage for 10.5 knot crosswinds, 99.63 percent coverage at 13 knots, and 99.91 percent at 16 knots. **Exhibit 3E** presents the all-weather wind rose for the airport.

Based upon historical wind data, Runway 3-21 exceeds 95 percent for all crosswind components. Therefore, based on this analysis, the runway system is properly orientated and a crosswind runway is not needed.

Runway Length

Runway length is the most important consideration when evaluating the airside facility requirements for future aircraft serving Scottsdale Airport. Runway length requirements are based upon five primary elements that include:

- Mean maximum temperature of the hottest month
- Airport elevation
- Runway gradient
- Critical aircraft type expected to use the airport
- Stage length of the longest nonstop destination (specific to larger aircraft)

Aircraft performance is a key factor in determining the runway length needed for takeoff and landing. The runway length requirement of an aircraft type can be affected by elevation, temperature, and runway gradient factors. For calculating runway length requirements, the airport is at an elevation of 1,510 feet mean sea level (MSL), and the mean daily maximum temperature of the hottest month is 105 degrees Fahrenheit (F). The maximum effective gradient for Runway 3-21 is 0.81 percent.

Aircraft Classification

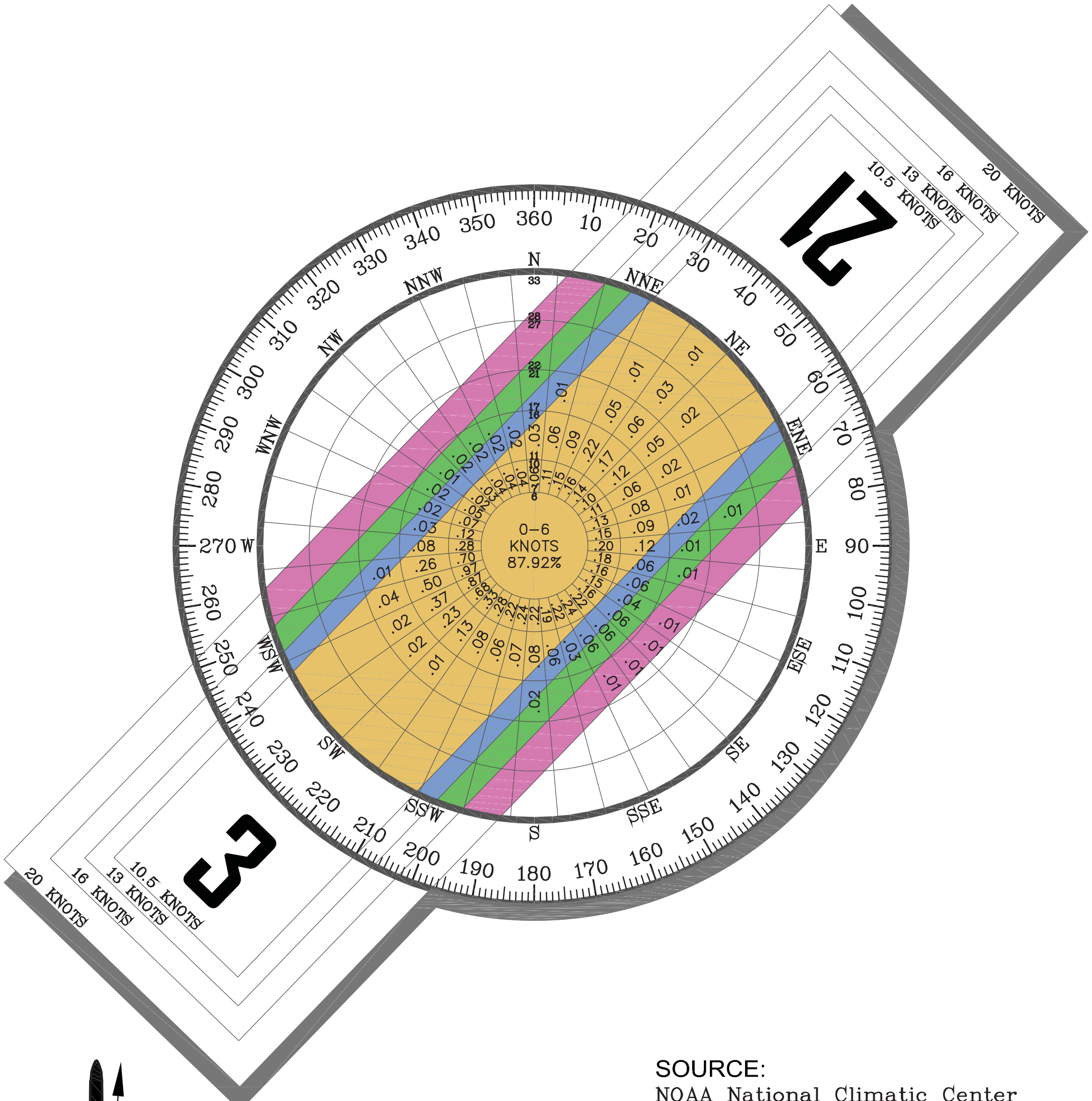
Table 3K outlines the runway length requirements for various classifications of aircraft that utilize Scottsdale Airport. These standards were derived using FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*.

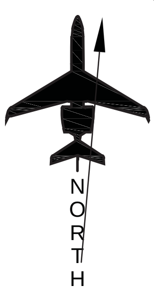
TABLE 3K
Runway Length Requirements
Scottsdale Airport

Airport and Runway Data	
Airport elevation	1,510 feet MSL
Mean daily maximum temperature of the hottest month	105 degrees F
Maximum difference in runway centerline elevation:	
Runway 3-21	66 feet
Runway Length Recommended for Airport Design	
Large airplanes of 60,000 pounds or less:	
75 percent of business jets at 60 percent useful load	5,900 feet
75 percent of business jets at 90 percent useful load	8,700 feet
100 percent of business jets at 60 percent useful load	7,600 feet
100 percent of business jets at 90 percent useful load	11,700 feet
Airplanes of more than 60,000 pounds	7,600 feet

Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*

ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	*99.22%*	*99.63%*	*99.91%*	*99.98%*





SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Scottsdale Airport
Scottsdale, Arizona

OBSERVATIONS:
80,921 All Weather Observations
2002-2012

Magnetic Declination
10° 44' 15" East (June 2013)
Annual Rate of Change
00° 06.3' West (June 2013)

NOTE:
Wind Rose Orientation Based on True North

The AC groups business jets weighing 60,000 pounds or less into two categories: aircraft that make up 75 percent of the national fleet and aircraft that make up 100 percent of the national fleet. For example, the "75 percent fleet at 60 percent useful load" provides a runway length sufficient to satisfy the operational requirements of approximately 75 percent of the fleet at 60 percent useful load. The FAA accepts planning for runway length at 60 percent useful load unless specific justification can be made for a need to plan for 90 percent useful load. Planning for jet aircraft at 90 percent useful load is not practicable because many aircraft are weight-restricted during the climb after takeoff. In other words, due to the need to maintain a certain positive climb rate after departure, the aircraft can rarely be fully loaded. According to the AC, in order to accommodate 75 percent of business jet aircraft at 60 percent useful load, the runway length should be at least 5,900 feet. To accommodate 100 percent of business jet aircraft at 60 percent useful load, the runway should be at least 7,600 feet long.

Paragraph 306 of the AC recognizes that general aviation airports are being used more frequently by business jets. It goes on to state that "General aviation airports that receive regular use by large airplanes over 12,500 pounds, in addition to business jets, should provide a runway length comparable to non-general aviation airports." That is, the extension of an existing runway can be justified at an existing general aviation airport that has a need to accommodate heavier airplanes on a "frequent basis." Scottsdale Airport has historically accounted for the frequent utilization of large business jets by providing a runway length of 8,249 feet. This was accomplished through a runway extension project that was completed in 1980.

The top half of **Table 3L** presents the list of those aircraft weighing 60,000 pounds or less which make up 75 percent of the active business jet fleet category that were used in calculating the lengths required in **Table 3K**. Aircraft listed in the bottom half of **Table 3L** represent those aircraft used for the 100 percent category. Since it is known that most of the aircraft listed in the 100 percent of the business jet category utilize Scottsdale Airport on a frequent basis, consideration should be given to providing adequate runway length for their safe and efficient operation.

Further analysis was conducted on runway lengths for general aviation aircraft weighing more than 60,000 pounds. This group includes long-range corporate jets, such as the Gulfstream G550 and G650. According to aircraft planning manuals, these aircraft typically require a runway length of 7,600 feet to operate at Scottsdale Airport given the existing conditions that dictate runway length requirements.

Runway 3-21 at Scottsdale Airport provides 8,249 feet of physical length, thus exceeding the runway requirement of 7,600 feet for the categories of aircraft previously mentioned. As noted earlier in this chapter, safety area deficiencies beyond both ends of Runway 3-21 do restrict declared usable runway length for Runways 3 and 21. The existing ASDA on Runway 21 and existing LDA on Runways 3 and 21 are published at 7,509 feet and 7,109 feet, respectively. The proposed declared distances would improve usable runway length to the point that only the LDA on Runway 3 would remain below 7,600 feet.

TABLE 3L Aircraft Type as a Percent of the Business Jet Fleet Weighing 60,000 Pounds or Less	
Manufacturer	**Models**
Airplanes that make up 75 percent of the fleet	
Beech Jet	400
Cessna	500, 525, 550, 560, 650 (Citation VII)
Dassault	Falcon 10, 20, 50, 900
Hawker	400, 600
Israel Aircraft Industries (IAI)	Westwind 1123/1124
Learjet	20, 31, 35, 36, 40, 45
Mitsubishi	300
Sabreliner	40, 60, 75/80, T-39
BAe	125-700
Raytheon	Premier 390
Aerospatiale	Sn-601 Corvette
Airplanes that make up 100 percent of the fleet	
Bombardier	Challenger 600, 604, BD-100
Cessna	650 (Citation III/VI), 750 (Citation X)
Dassault	Falcon 900EX, 2000
IAI	Astra 1125, Galaxy 1126
Learjet	45, 55, 60
Hawker	800, 800EX, 1000
Sabreliner	65, 75
Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*	

Aircraft Stage Length

Another important consideration when analyzing runway length requirements is the stage length, or flying distance, an aircraft will complete to or from the airport. Longer stage lengths will require aircraft to carry more fuel, thus making the aircraft heavy on takeoff. This results in the need for longer takeoff roll, especially on hot days.

The airport is utilized by a wide variety of corporate users with varying originations and destinations across the country. Since the airport is home to a U.S. Customs facility, it is capable of handling international flights on a frequent basis. It is important that the airport maintain a runway length that can satisfy the long-haul nature of many flights that originate at the facility.

Runway Length Summary

Many factors are considered when determining appropriate runway length for the safe and efficient operation of aircraft at Scottsdale Airport. The starting point for analysis begins with utilizing FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. The AC shows a number of different runway lengths based on aircraft characteristics such as useful load and percent of active business jets. The results show that, at a minimum, Runway 3-21 should be at least 7,600 feet long in order to accommodate 100 percent of the business jet fleet at 60 percent useful load.

The stage length of aircraft utilizing Scottsdale Airport was also considered in this analysis. As discussed, jet traffic originates from or departs to points across the country and even internationally. Under these long-haul conditions, the runway length up to 8,249 feet that is provided on Runway 3-21 allows them to increase their useful load to accommodate these cross-country and international flights.

It should be noted that corporate aviation departments and fractional ownership (air taxi) programs often restrict what airports they can use based on runway length. Often, these groups will restrict operations to those runways that have adequate runway length, plus a buffer. Obviously, the longer the runway, the more opportunity these aircraft operators will have to use the airport. According to Title 14 Code of Federal Regulations (CFR) Part 135 rules, fractional aircraft and charter operators must increase their landing runway length requirements under certain conditions. This increase can equate to requiring up to an additional 60 percent of runway length for landing operations. The 8,249 feet of runway length provided on Runway 3-21 can help provide the runway length required for many of these operators.

An additional consideration is for aircraft weighing over 60,000 pounds. For Scottsdale Airport, this includes business jets, such as the Gulfstream G550 and G650. According to the operating manuals for these aircraft, a runway length of approximately 7,600 feet is needed to satisfy most of these aircraft operating under the hot weather conditions prescribed in **Table 3K**.

Forecast future demand at Scottsdale Airport indicates that the airport should strive to accommodate all business jet operations with a maximum certified takeoff weight of 100,000 pounds or less. A runway length of 8,249 feet is needed to fully serve these business jets expected to operate at the airport. Therefore, the existing length on Runway 3-21 should be maintained through the long term planning period of this study.

Runway Width

The FAA design standard for runway width is based on the Aircraft Approach Category (AAC) and approach visibility minimums to the runway. Runway 3-21 at Scottsdale Airport is currently 100 feet wide. FAA design standards call for a runway width of 100 feet to serve aircraft up to RDC D-III with a maximum certificated takeoff weight of 150,000 pounds or less as long as the approach visibility minimums to the runway are not lower than ¾-mile. As such, Runway 3-21 meets the runway width standard and should be maintained through the long term planning period.

Runway Shoulders

Runway shoulders provide resistance to blast erosion and accommodate the passage of maintenance and emergency equipment and the occasional passage of an aircraft veering from the runway. Runway 3-21 currently has shoulders constructed of asphalt that are 12 feet wide. The FAA design for runway shoulders associated with Airplane Design Group (ADG) III aircraft is 20 feet. Future planning should consider providing a 20-foot shoulder on Runway 3-21.

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The strength ratings of a runway do not preclude operations by aircraft that weigh more; however, frequent activity by heavier aircraft can shorten the useful life of that pavement. The pavement strength rating for Runway 3-21 is 45,000 pounds single wheel loading (SWL) and 75,000 pounds dual wheel loading (DWL).

All federally obligated airports must remain open to the public, and it is typically up to the pilot of the aircraft to determine if a runway can support their aircraft safely. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published pavement strength rating. On the other hand, the airport sponsor has an obligation to properly maintain the runway and protect the useful life of the runway.

According to the FAA publication, *Airport/Facility Directory*, "Runway strength-rating is not intended as a maximum allowable weight or as an operating limitation. Many airport pavements are capable of supporting limited operations with gross weights in excess of the published figures." The directory goes on to say that those aircraft exceeding the pavement strength should contact the airport sponsor for permission to operate at the airport. This is the case at Scottsdale Airport, as the Airport/Facility Directory states that "Runway 3-21 is limited to 75,000 pounds DWL except with prior permission requested."

The strength rating of a runway can change over time. Regular usage by heavier aircraft can decrease the strength rating, while periodic runway resurfacing or reconstructing can increase the strength rating. Given the high volume of large business jets that utilize the airport, future planning should consider providing a pavement strength of 100,000 pounds. Note: An environmental assessment has been conducted at the airport for a proposed strength rating on Runway 3-21 to consistently accommodate aircraft up to 100,000 pounds. This potential strength rating has been analyzed by the FAA and City of Scottsdale Aviation Department and is further detailed in Chapter Four.

Runway Blast Pads

A runway blast pad provides blast erosion protection beyond the runway end during jet blast and propeller wash. Both ends of Runway 3-21 are currently equipped with a blast pad. The blast pads are 200 feet long by 140 feet wide, which meet ADG III aircraft standards with maximum certificated takeoff weights of 150,000 pounds or less.

Runway Separation Standards

FAA AC 150/5300-13A, *Airport Design*, discusses separation distances between aircraft and various areas on the airfield. The separation distances are primarily a function of the approaches provided for the airport and the runway's designated RDC.

Runway/Taxiway Separation

Scottsdale Airport has two taxiways that run parallel to the runway. The design standards for the separation between runways and parallel taxiways are a function of the critical design aircraft and the instrument approach visibility minimums.

The separation standard for RDC D-III with not lower than one-mile visibility minimums is 400 feet from the runway centerline to the parallel taxiway centerline. Currently, Taxiways A and B at Scottsdale Airport are situated 250 feet from the runway (centerline to centerline).

In order to increase the runway-to-parallel taxiway separation at Scottsdale Airport, significant improvements would be needed due to existing infrastructure located adjacent to the taxiways. Alternatives to enhance the runway-to-parallel taxiway separation standard will be evaluated in the next chapter, which will include their feasibility and practicability.

Runway Hold Line Separation

Runway hold lines consist of four yellow lines, two solid and two dashed, extending across the width of a taxiway. These markings indicate where an aircraft is supposed to stop when it does not have clearance to proceed onto the runway. The solid lines are always on the side where the aircraft is to hold. When approaching the runway, a pilot should not cross the runway hold line marking without ATCT clearance. An aircraft exiting the runway is not clear of the runway until all parts of the aircraft have crossed the applicable hold line.

The current hold line markings on all taxiways associated with Runway 3-21 are marked 152 feet from the runway centerline. The FAA standard for hold lines associated with runways in RDC D-III is 250 feet, plus one foot for each additional 100 feet above sea level, resulting in a separation distance of 266 feet from the runway centerline.

As previously discussed, the runway-to-parallel taxiway separation at Scottsdale Airport is 250 feet; therefore, relocating the hold lines to the FAA standard of 266 feet on Runway 3-21 is not possible with the airfield's current configuration. The airport worked with FAA Lines of Business by way of a Safety Risk Management Document (SRMD) to analyze the safety and operational impacts of relocating the runway hold lines farther away from the runway centerline. The final version of the SRMD was published on August 28, 2013.

The findings of the SRMD state that "Based on the safety analysis conducted by the Safety Risk Management Panel (SRMP), combined with the recorded results from the Tower Simulation System (TSS), some of the air traffic control (ATC) procedures that would be required in support of the hold line relocation change cannot currently be introduced into the National Airspace System (NAS) with an acceptable level of risk, as defined in the FAA Safety Management System (SMS) manual." The SRMD identified nine risk hazards associated with relocating hold lines. Four of the hazards were initially considered high-risk, and two of the four could not be sufficiently mitigated. All of the remaining seven identified risk hazards could be mitigated.

The final version of the SRMD is detailed in **Appendix B** of the Master Plan. The findings of the SRMD report, as well as further evaluation within this Master Plan, will better determine the ability of the airport to conform to the hold line separation standards.

Runway/Aircraft Parking Apron Separation

The FAA standard for runway-to-aircraft parking apron separation for RDC D-III is 500 feet. Existing aircraft parking areas on the airport begin between approximately 370 feet and 410 feet from the Runway 3-21 centerline. At Scottsdale Airport, the distance between the runway and various aircraft parking aprons is dictated by the separation distance between the runway and parallel taxiways, in addition to safety areas associated with the taxiways. As such, further analysis in this study related to the runway-to-parallel taxiway separation will also consider the impact on aircraft parking aprons on each side of the runway.

TAXIWAYS

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some taxiways are necessary to simply provide access between the aircraft parking aprons and runways, whereas other taxiways become necessary as activity increases at an airport to provide safe and efficient use of the airfield.

As discussed in Chapter One, the taxiway system at Scottsdale Airport consists of a full-length parallel taxiway serving each side of Runway 3-21. Parallel Taxiway A serves the west side of Runway 3-21 and is 40 feet wide. Taxiway B serves as the parallel taxiway on the east side of the runway and is also 40 feet wide.

The design standards associated with taxiways are determined by the Taxiway Design Group (TDG) or the ADG of the critical design aircraft. As determined previously, the applicable ADG for Runway 3-21 is ADG III. **Table 3M** presents the various taxiway design standards related to ADG III.

TABLE 3M
Taxiway Dimensions and Standards
Scottsdale Airport

STANDARDS BASED ON WINGSPAN	ADG III
Taxiway Protection	
Taxiway Safety Area (TSA) width	118'
Taxiway Object Free Area (TOFA) width	186'
Taxilane Object Free Area width	162'
Taxiway Separation	
Taxiway Centerline to:	
Fixed or Movable Object	93’
Parallel Taxiway/Taxilane	152'
Taxilane Centerline to:	
Fixed or Movable Object	81'
Parallel Taxilane	140'
Taxiway Centerline to:	
Runway 3-21 Centerline	400'
Wingtip Clearance	
Taxiway Wingtip Clearance	34'
Taxilane Wingtip Clearance	23'
STANDARDS BASED ON TDG	**TDG 3**
Taxiway Width Standard	50'
Taxiway Edge Safety Margin	10'
Taxiway Shoulder Width	20'

ADG: Airplane Design Group
TDG: Taxiway Design Group

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

The table also shows those taxiway design standards related to TDG. The TDG standards are based on the Main Gear Width (MGW) and the Cockpit to Main Gear (CMG) distance of the critical design aircraft expected to use those taxiways. Different taxiway/taxilane pavements can and should be designed to the most appropriate TDG design standards.

The taxiway standards for Runway 3-21 should utilize design standards for TDG 3. Therefore, these taxiways should be 50 feet wide. As previously detailed, parallel Taxiways A and B associated with Runway 3-21 at Scottsdale Airport are 40 feet wide. The entrance/exit taxiways associated with the runway system range from 40 to 50 feet in width. Many other taxiway standards on the airfield, including safety areas, separation, and shoulder width, are currently designed to ADG II and TDG 2 design standards. The alternatives analysis in the next chapter will evaluate options for meeting ADG III and TDG 3 standards.

Taxiway Design Considerations

FAA AC 150/5300-13A, *Airport Design*, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as, "any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft."

The taxiway system at Scottsdale Airport generally provides for the efficient movement of aircraft; however, recently published AC 150/5300-13A, *Airport Design*, provides recommendations for taxiway design. The following is a list of the taxiway design guidelines and the basic rationale behind each recommendation:

1. **Taxi Method**: Taxiways are designed for "cockpit over centerline" taxiing with pavement being sufficiently wide to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading existing intersections should be undertaken to eliminate "judgmental oversteering," which is where the pilot must intentionally steer the cockpit, outside the marked centerline, in order to assure the aircraft remains on the taxiway pavement.

2. **Steering Angle**: Taxiways should be designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing.

3. **Three-Node Concept**: To maintain pilot situational awareness, taxiway intersections should provide a pilot with a maximum of three choices of travel. Ideally, these are right and left angle turns and a continuation straight ahead.

4. **Intersection Angles**: Design turns to be 90 degrees wherever possible. For acute angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.

5. **Runway Incursion Prevention**: Design taxiways to reduce the probability of runway incursions.
    - *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiway systems simple using the "three node" concept.

- *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot's eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, avoid direct access to a runway.
- *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold – through simple reduction in the number of occurrences, and through a reduction in air traffic controller workload.
- *Avoid "high energy" Intersections*: These are intersections in the middle third of runways. By limiting runway crossings to the first and last thirds of the runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
- *Increase Visibility*: Right angle intersections, both between taxiways and runways, provide the best visibility. Acute angle runway exits provide for greater efficiency in runway usage, but should not be used as runway entrance or crossing points. A right angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.
- *Avoid "dual purpose" Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.
- *Indirect Access*: Do not design taxiways to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.
- *Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

6. **Runway/Taxiway Intersections**:
   - *Right Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for a high-speed exit. Right-angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs so they are visible to pilots.
   - *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage.
   - *Large Expanses of Pavement*: Taxiways must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a

single area create large expanses of pavement, making it difficult to provide proper signage, marking, and lighting.

7. **Taxiway/Runway/Apron Incursion Prevention**: Apron locations that allow direct access into a runway should be avoided. Increase pilot situational awareness by designing taxiways in such a manner that forces pilots to consciously make turns. Taxiways originating from aprons and forming a straight line across runways at mid-span should be avoided.
   - *Wide Throat Taxiways*: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and makes lighting and marking more difficult.
   - *Direct Access from Apron to a Runway*: Avoid taxiway connectors that cross over a parallel taxiway and directly onto a runway. Consider a staggered taxiway layout that forces pilots to make a conscious decision to turn.
   - *Apron to Parallel Taxiway End*: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.

The alternatives chapter of this Master Plan will consider the previous recommendations for improving taxiway layout on the airfield where applicable.

Taxilane Design Considerations

Taxilanes are distinguished from taxiways in that they do not provide access to or from the runway system directly. Taxilanes typically provide access to hangar areas. As a result, taxilanes can be designed to varying design standards depending on the type of aircraft utilizing the taxilane. For example, a taxilane leading to a T-hangar area only needs to be designed to accommodate those aircraft typically accessing a T-hangar.

There are numerous taxilanes at Scottsdale Airport leading to more remote areas on the airfield. Most of these taxilanes should be designed to at least ADG I standards, which call for the distance from the taxilane centerline to an object to be at least 39.5 feet. Evaluation of current taxilanes on the airfield indicates a distance of at least 40 feet between taxilanes and fixed or movable objects. The next chapter will further assess the safe movement of aircraft on the airfield's taxilanes.

NAVIGATIONAL AND APPROACH AIDS

Navigational aids are devices that provide pilots with guidance and position information when utilizing the runway system. Electronic and visual guidance to arriving aircraft enhance the safety and capacity of the airfield. Such facilities are vital to the success of the airport and provide additional safety to passengers using the air transportation system. While instrument approach aids are especially helpful during poor weather, they are often used by pilots conducting flight training and operating larger aircraft when visibility is good. The airport employs the following navigational and approach aids.

Instrument Approach Aids

Instrument approaches are categorized as either precision or non-precision. Precision instrument approach aids provide an exact course alignment and vertical descent path for an aircraft on final approach to a runway, while non-precision instrument approach aids provide only course alignment information. In the past, most existing precision instrument approaches in the United States have been the instrument landing system (ILS); however, with advances in GPS technology, it is now used to provide both vertical and lateral navigation for pilots.

At Scottsdale Airport, there are seven published instrument approaches, all which provide visibility minimums greater than or equal to one mile. Three of these approaches offer straight-in approach capabilities and include two RNAV approaches to Runway 3 and one RNAV approach to Runway 21. The required navigation performance (RNP) associated with these RNAV approaches provide for both vertical and horizontal guidance information to pilots; however, very few aircraft are equipped with the required instrumentation to fly these precision approaches. Furthermore, aircraft in approach category D are not authorized to conduct a straight-in instrument approach procedure to Runway 3-21.

Analysis in the next chapter will evaluate improvements necessary for enhanced instrument approaches to Runway 3-21 at Scottsdale Airport. Any improvements to approach visibility minimums would necessitate an increase in the size of the RPZ, potentially creating additional incompatibilities.

Visual Approach Aids

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, electronic visual approach aids are commonly provided at airports. Currently, Runway 3-21 is served by two-box precision approach path indicators (PAPIs). It is recommended that a four-box PAPI system ultimately be implemented on the runway as the PAPI-4s are better to serve business jets that regularly use the airport because they are more visible for these faster approaching aircraft.

Runway end identification lights (REILs) are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from other lighting on the airport and in the approach areas. The FAA indicates that REILs should be considered for all lighted runway ends not planned for a more sophisticated approach lighting system. Runway 3-21 is currently equipped with REILs, and this system should be maintained through the planning period.

Weather Reporting Aids

Scottsdale Airport has a lighted wind cone and segmented circle, as well as additional supplemental wind cones in various locations on the airfield. The wind cones provide information to pilots regarding wind direction and speed. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots. These should be maintained throughout the planning period.

The airport is equipped with an Automated Surface Observation System (ASOS) which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. This information is then transmitted at regular intervals on the automated terminal information service (ATIS), which is broadcast on radio frequency 118.6 MHz. These systems should be maintained through the planning period.

A Stand Alone Weather Station (SAWS) is also located on the airport adjacent to the ASOS. The SAWS measures critical parameters of wind speed and direction, wind gusts, altimeter setting, dew point, air temperature, and relative humidity. It can be used as a backup to the ASOS equipment and can be integrated into the ATIS.

Communication Facilities

Scottsdale Airport has an operational ATCT located on the east side of Runway 3-21. The ATCT is staffed with FAA personnel from 6 a.m. to 9 p.m. daily. The ATCT enhances safety at the airport and should be maintained through the planning period.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

There are a number of lighting and pavement marking aids serving pilots using the airport. These aids assist pilots in locating the airport and runway at night or in poor visibility conditions. They also assist in the ground movement of aircraft.

Identification Lighting

The location of the airport at night is universally indicated by a rotating beacon. For civil airports, a rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The existing beacon located on the west side of the airport should be maintained through the planning period.

Runway and Taxiway Lighting

Runway lighting provides the pilot with a rapid and positive identification of the runway and its alignment. Runway 3-21 is served with medium intensity runway lighting (MIRL). This system should be maintained through the planning period.

Medium intensity taxiway lighting (MITL) is provided on Taxiways A and B and all associated connector taxiways serving Runway 3-21. This system is vital for the safe and efficient ground movement of aircraft and should be maintained in the future. Any future taxiways constructed on the airfield that are associated with Runway 3-21 should also be provided with MITL.

Taxiway C is equipped with elevated taxiway reflectors. These should be maintained through the long term planning period.

As previously discussed in Chapter One, a runway safety lighting project is currently underway to meet FAA lighting standards for Runway 3-21. This project involves the installation of new runway threshold lighting and replacement of runway edge lighting globes on the final 2,000 feet of each runway end to meet the requirements for a non-precision runway.

Over time, the airport should consider removing the incandescent airfield signage and runway and taxiway edge lighting systems, and replacing them with light emitting diode (LED) technology. LEDs have many advantages, including lower energy consumption, longer lifetime, tougher construction, reduced size, greater reliability, and faster switching. While a substantial initial investment is required upfront, the energy savings and reduced maintenance costs will outweigh any additional costs in the long run.

Pavement Markings

Runway markings are designed according to the type of instrument approach available on the runway. FAA AC 150/5340-1K, *Standards for Airport Markings*, provides guidance necessary to design airport markings. Runway 3-21 has non-precision markings that include threshold, designation, centerline, edge, and aiming points. The thresholds on each end of the runway are displaced, with white arrows serving as the runway centerline leading to the displaced thresholds. The runway markings should be maintained through the long term planning period.

Taxiway and taxilane centerline markings are provided to assist pilots in maintaining proper clearance from pavement edges and objects near the taxiways. Taxiway markings also include the hold lines discussed earlier in this chapter which are located on the entrance/exit taxiways serving Runway 3-21. These taxiway markings should be maintained through the long term planning period. As previously discussed, the location of the hold line markings in relationship to the runway will be further evaluated in Chapter Four.

Airfield Signs

Airfield identification signs assist pilots in identifying their location on the airfield and directing them to their desired location. Lighted signs are installed on the runway and taxiway system on the airfield. The signage system includes runway and taxiway designations, holding positions, routing/directional, runway exits, and runway distance remaining. All of these signs should be maintained throughout the planning period.

A summary of the airfield facilities previously discussed at Scottsdale Airport is presented on **Exhibit 3F**.

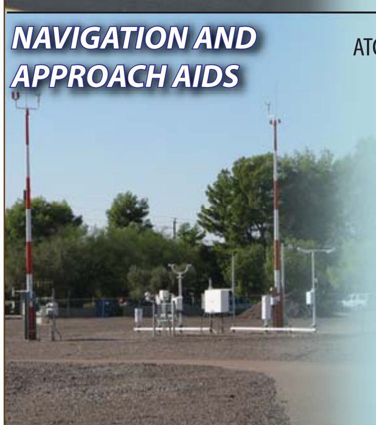
LANDSIDE FACILITIES

Landside facilities are those necessary for the handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacity of the various components of each area was examined in relation to projected demand to identify future landside facility needs. The purpose of this section is to identify future landside facility needs and includes components for general aviation, including:

- General Aviation Terminal Services
- Aircraft Hangars
- Aircraft Parking Aprons
- Airport Support Facilities

GENERAL AVIATION TERMINAL SERVICES

The terminal facilities at an airport are often the first impression of the community that corporate officials and other visitors will encounter. General aviation terminal facilities at an airport provide space for passenger waiting, pilot's lounge, pilot flight planning, concessions, management, storage, and other various needs. This space is not necessarily limited to a single, separate terminal build-

	EXISTING	SHORT TERM	LONG TERM
RUNWAY 3-21 	8,249' x 100'	Maintain	Maintain
	45,000 lbs. SWL / 75,000 lbs. DWL	Increase to 100,000 lbs. DWL	Maintain
	RDC D-III, NPI-1	RDC D-III, NPI-1; Improve RSA and ROFA deficiencies as practicable	RDC D-III, NPI-1; Improve RSA, ROFA, and RPZ deficiencies as practicable
	Shoulders - 12'	Increase Shoulders to 20'	Maintain
	Published Declared Distances for Runway 3-21	Increase Declared Distances for Runway 21 ASDA and LDA	Maximize Declared Distances
	Hold Lines - 152' from runway centerline	Evaluate Hold Line separation as practicable	Maintain
TAXIWAYS 	All taxiways 40' - 50' wide	Taxiways associated with Runway 3-21 50' wide / Others maintained at 40'	Maintain
	Full-length parallel Taxiways A and B with associated entrance/exit taxiways	Maintain	Examine potential for additional taxiway exits to improve airfield capacity
	Runway/Parallel Taxiway separation - 250'	Examine increased Runway/Parallel Taxiway separation	Implement separation improvements as practicable
	Four Hold Aprons serving runway ends	Maintain	Maintain
		Examine taxiway safety areas and efficiency	Implement safety improvements as practicable
NAVIGATION AND APPROACH AIDS 	ATCT, ASOS, ATIS, Lighted Wind Cone	Maintain	Maintain
	PAPI-2s - Runway 3-21	Upgrade to PAPI-4s	Maintain
	REILs - Runway 3-21	Maintain	Maintain
	RNAV (RNP) - Runway 3-21	Maintain	Maintain
	RNAV (GPS) circling	Maintain	Maintain
	VOR/DME circling	Maintain	Maintain
	VOR-C circling	Maintain	Maintain
		Examine GPS LPV straight-in approach to each runway	Maintain
LIGHTING, MARKING, AND SIGNAGE 	Rotating Beacon	Maintain	Maintain
	MIRL	Maintain	Upgrade to LED Lighting
	MITL	Maintain	Upgrade to LED Lighting
	Non-Precision Markings	Maintain	Maintain
	Lighted Airfield Signs	Maintain	Maintain
	Distance Remaining Signs	Maintain	Maintain

KEY

ASOS - Automated Surface Observation System
ATCT - Airport Traffic Control Tower
ATIS - Automated Terminal Information Service
DME - Distance Measuring Equipment
DWL - Dual Wheel Loading
GPS - Global Positioning System
LED - Light Emitting Diode
LPV - Localizer Performance with Vertical Guidance
MIRL - Medium Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
NPI-1 - Not lower than one-mile visibility (RVR)
PAPI - Precision Approach Path Indicator
RDC - Runway Design Code
RSA - Runway Safety Area
ROFA - Runway Object Free Area
RPZ - Runway Protection Zone
REIL - Runway End Identification Lights
RNAV - Area Navigation
RNP - Required Navigation Performance
SWL - Single Wheel Loading
VOR - Very High Frequency Omni-Directional Range

ing, but can include space offered by fixed base operators (FBOs) and other specialty operators for these functions and services. This is the case at Scottsdale Airport, as general aviation terminal space is currently provided by several separate facilities on the field, including the FBOs and a dedicated airport terminal building.

The methodology used in estimating general aviation terminal facility needs was based upon the number of airport users expected to utilize general aviation facilities during the design hour. Space requirements for terminal facilities were based on providing 125 square feet per design hour itinerant passenger. A multiplier of 2.6 in the short term, increasing to 3.0 in the long term, was also applied to terminal facility needs in order to better determine the number of passengers associated with each itinerant aircraft operation. This increasing multiplier indicates an expected increase in business operations through the long term. Business operations typically support larger turboprop and jet aircraft which accommodate an increasing passenger load factor. Such is the case at Scottsdale Airport, as the facility experiences a significant amount of business jet activity and is expected to do so through the planning period of this study.

Table 3N outlines the space requirements for general aviation terminal services at Scottsdale Airport through the long term planning period. As shown in the table, up to 17,600 square feet of space could be needed in the long term for general aviation passengers. As detailed in the table, the amount of space currently offered in the airport terminal building is nearly 18,000 square feet; however, not all of this space is dedicated for aircraft passengers. The space includes designated areas for a passenger waiting lobby, airport administration, restroom facilities, rental car counters, aviation-related businesses, and a restaurant.

TABLE 3N
General Aviation Terminal Area Facilities
Scottsdale Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
General Aviation Services Facility Area (s.f.)	17,970*	12,900	14,500	17,600
Design Hour Passengers	90	103	116	140
Passenger Multiplier	2.5	2.6	2.8	3.0
Auto Parking Spaces	820**	304	339	416

*Includes space offered in airport terminal building only
**Estimated number of marked auto parking spaces on airport property

Source: Coffman Associates analysis

The FBOs and other specialty aviation operators on the airfield also provide space for pilots and passengers. As detailed in Chapter One, these operators offer an array of terminal services including offices, conference rooms, flight planning, pilot's lounges, and other amenities. Although the amount of terminal area provided by these operators varies, it can be assumed that adequate services and space is provided to accommodate their customers.

General aviation vehicular parking demands have also been determined for

Scottsdale Airport. Space determinations for itinerant passengers were based on an evaluation of existing airport use, as well as standards set forth to help calculate projected terminal facility needs.

The parking requirements of based aircraft owners should also be considered. Although some owners prefer to park their vehicles in their hangar, safety can be compromised when automobile and aircraft movements are intermixed. For this reason, separate parking requirements, which consider one-half of based aircraft at the airport, were applied to general aviation automobile parking space requirements. Utilizing this methodology, parking requirements for general aviation activity call for 304 spaces in the short term, increasing to 416 spaces in the long term planning horizon. It is estimated that there are 820 marked automobile parking spaces at Scottsdale Airport currently serving various airport activities, including terminal services, FBOs, dedicated "Rental Car" parking, ATCT services, and other aviation and non-aviation functions. Furthermore, additional automobile parking serving some based aircraft and itinerant aircraft operation needs is provided in areas within the Scottsdale Airpark, which is located off airport property.

AIRCRAFT HANGARS

The demand for aircraft hangars typically depends on local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is toward more sophisticated aircraft (and, consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tiedowns.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the airport in the future. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity. However, hangar development should be based upon actual demand trends and financial investment conditions.

While the majority of aircraft owners prefer enclosed aircraft storage, a number of based aircraft will still use outdoor tiedown spaces (due to lack of hangar availability, hangar rental rates, and/or operational needs). Therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft. At Scottsdale Airport, approximately 63 aircraft are currently based on aircraft parking aprons with the remainder housed in hangar spaces.

Hangar types vary in size and function. T-hangars and linear box hangars are popular with aircraft owners having only one small aircraft. These hangars provide individual spaces within a larger structure. Aircraft owners are allowed privacy and individual access to their space. At Scottsdale Airport, covered tiedown hangars also provide storage space similar to T-hangars and linear box hangars. There is an estimated 188,100 square feet of storage space at the airport comprised of T-hangars, linear box hangars, and covered tiedowns. For determining future aircraft storage needs, a planning standard of 1,200 square feet per aircraft is utilized.

Executive hangars are open-space facilities with no interior supporting structure. These hangars can vary in size and typically house multi-engine, turboprop, or jet aircraft in addition to helicopters. Executive hangar space at the airport is estimated at 25,900 square feet. For future planning, a standard of 2,500 square feet per aircraft is utilized for executive hangars.

Conventional hangars are open space facilities with no supporting structure interference that can store several aircraft. Often, other airport services are offered from the conventional hangars, such as FBO activities. Conventional hangars are estimated to encompass 223,600 square feet of space at Scottsdale Airport. For future planning needs, 2,500 square feet per aircraft is utilized for conventional hangars.

In total, there is approximately 437,600 square feet of hangar, maintenance, and office space provided on airport property. Of the 368 aircraft currently based at the airport, 239 are located on airport property.

As detailed earlier in the Master Plan, the Scottsdale Airpark encompasses a wide array of aviation services and offers an estimated 837,800 square feet of space through various hangar types. According to airport records, 129 aircraft are currently stored in hangars at the Scottsdale Airpark and provided access to the Scottsdale Airport. Approximately one-half of the hangar space within the Airpark is thought to be utilized for aircraft storage and other aviation-related purposes.

Future hangar requirements for the airport are summarized in **Table 3P**. While some based aircraft will continue to utilize aircraft parking apron space instead of hangar facilities, the overall percentage of aircraft seeking hangar space is projected to increase during the long term planning period. Since portions of the hangars on airport property are known to be used for aircraft maintenance servicing, requirements for maintenance/ service hangar area was estimated using a planning standard of 150 square feet per based aircraft.

TABLE 3P
Aircraft Storage Hangar Requirements
Scottsdale Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
Total Based	368	400	430	500
Aircraft To Be Hangared	298	328	357	425
Hangar Area Requirements				
T-Hangar/Linear Box Hangar/Covered Tiedown (s.f.)	188,100*	190,600	194,500	197,300
Executive Hangar (s.f.)	25,900*	209,000	235,500	287,000
Conventional Hangar (s.f.)	223,600*	243,000	284,000	389,000
Total On-Airport Hangar Area (s.f.)	**437,600***			
Total Off-Airport Hangar Area (s.f.)	**837,800****			
Maintenance Area (s.f.)		60,000	64,500	75,000
Total Hangar Area Projected Need (s.f.)		**702,600**	**778,500**	**948,300**

*Includes estimated hangar, maintenance, and office space at Scottsdale Airport (on airport property)
**Includes estimated hangar area within Scottsdale Airpark (off airport property)

Source: Airport records; Coffman Associates analysis

The analysis shows that future hangar requirements indicate that there is a potential need for 948,300 square feet of hangar storage space to be offered through the long term planning period. This includes a mixture of hangar and maintenance areas. Executive and conventional hangar space constitute the largest needs, which can be attributed to projected growth in based turboprops, jets, and helicopters as outlined in the aviation demand forecasts. These aircraft typically require larger open-space hangars similar to what executive and conventional hangars offer.

Due to the projected increase in based aircraft, annual general aviation operations, and hangar storage needs, facility planning will consider additional hangars at the airport. It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types both on the airport and within the Scottsdale Airpark.

It should be noted that hangar requirements are general in nature and based on the aviation demand forecasts. The actual need for hangar space will further depend on the actual usage within hangars. For example, some hangars may be utilized entirely for non-aircraft storage such as maintenance, yet from a planning standpoint, they have an aircraft storage capacity. Therefore, the needs of an individual user may differ from the calculated space necessary.

AIRCRAFT PARKING APRONS

The aircraft parking apron is an expanse of paved area intended for aircraft parking and circulation. Typically, a main apron is centrally located near the airside entry point such as the terminal building or FBO facility. Ideally, the main apron is large enough to accommodate transient airport users as well as a portion of locally based aircraft. Often, smaller aprons are available adjacent to FBO hangars and at other locations around the airport. The apron layout at Scottsdale Airport follows this typical pattern.

The total aircraft parking apron area at Scottsdale Airport is approximately 200,000 square yards. FAA AC 150/5300-13A, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. At Scottsdale Airport, the number of itinerant spaces required was estimated at 20 percent of the busy-day itinerant operations. A planning criterion of 800 square yards was used for single and multi-engine itinerant aircraft, while a planning criterion of 1,600 square yards was used to determine the area for transient turboprop and jet aircraft.

A parking apron should also provide space for the number of locally based aircraft that are not stored in hangars. Locally based tiedowns typically will be utilized by smaller single engine aircraft; thus, a planning standard of 360 square yards per position is utilized. For local tiedown needs, an additional 20 spaces are identified for maintenance activities. Maintenance activity would include the movement of aircraft into and out of hangar facilities and temporary storage of aircraft on the apron.

The total apron parking requirements are presented in **Table 3Q**. Currently, there are approximately 162 marked positions available for based and itinerant aircraft at Scottsdale Airport. As shown in the table, it appears that there is adequate apron space available to accommodate aircraft parking through the planning period of this study; however, there will be a need for additional parking positions during the timeframe, especially in the form of large aircraft parking to accommodate jet aircraft. In order to satisfy the increased need for large aircraft parking, additional aircraft parking space should be considered for business jets through the long term planning period of this study.

TABLE 3Q
Aircraft Parking Apron Requirements
Scottsdale Airport

	Available	Short Term	Intermediate Term	Long Term
Transient Single/Multi-Engine Aircraft Positions		57	58	59
Apron Area (s.y.)	N/A	45,700	46,500	47,400
Transient Turboprop/Jet Positions		38	43	55
Apron Area (s.y.)	N/A	61,000	69,400	87,600
Locally-Based Aircraft Positions		92*	93*	95*
Apron Area (s.y.)	N/A	33,100	33,500	34,200
Total Marked Positions	162	187	194	209
Total Apron Area (s.y.)	200,000	139,800	149,400	169,200

*Factors an additional 20 positions for aircraft maintenance

Source: Coffman Associates analysis

In addition to fixed-wing aircraft parking, areas should also be dedicated for helicopter parking. Presently, there are marked helicopter parking positions located on the southwest side of the airfield. Helicopters also operate on various apron areas shared by fixed-wing aircraft at Scottsdale Airport. Helicopter operations should be segregated to the extent practicable to increase safety and efficiency of aircraft parking aprons. Long term facility planning will consider dedicated helicopter parking areas at Scottsdale Airport.

AIRPORT SUPPORT FACILITIES

Various other landside facilities that play a supporting role in overall airport operations have also been identified. These support facilities include:

- Aviation Fuel Storage
- Aircraft Wash Rack
- Aircraft Rescue and Firefighting
- U.S. Customs and Border Protection
- Security Fencing / Gates
- Utilities
- Security Recommendations

Aviation Fuel Storage

As previously discussed in Chapter One, there are currently five fuel farms located on airport property that currently store aviation fuel. Furthermore, fuel trucks operated by the FBOs on the airfield are capable of handling additional fuel storage. As presented in **Table 3R**, there is 238,100 gallons of fuel storage capacity on airport property, with approximately 75 percent being dedicated to Jet A fuel.

TABLE 3R
On-Airport Fuel Storage Capacity
Scottsdale Airport

	Tank Storage Capacity (gallons)	Truck Storage Capacity (gallons)	Total Storage Capacity (gallons)
100LL	55,000	3,100	58,100
Jet A	149,000	31,000	180,000

Source: Airport records

In addition to the fuel farms located on airport property, there are also 27 private fuel farms located within the Scottsdale Airpark that provide additional fuel storage capabilities. When combined, these fuel farms allow for 508,000 gallons of storage capacity in the form of 100LL and Jet A fuel.

Fuel storage requirements are typically based upon keeping a two-week supply of fuel during an average month; however, more frequent deliveries can reduce the fuel storage capacity requirements. Generally, fuel tanks should be of adequate capacity to accept a full refueling tanker, which is approximately 8,000 gallons, while maintaining a reasonable level of fuel in the storage tank. Future aircraft demand experienced by the FBOs on airport property will determine the need for additional fuel storage capacity. It is important that airport personnel work with the FBOs to plan for adequate levels of fuel storage capacity through the long term planning period of this study.

Aircraft Wash Rack/ Pad

There are two designated aircraft wash areas currently located on the west side of the airport. The aircraft wash rack is located approximately 800 feet southwest of the Runway 21 displaced threshold and the aircraft wash pad is located approximately 600 feet north-northeast of the Runway 21 displaced threshold. These facilities should be maintained through the planning period.

Aircraft Rescue and Firefighting

Scottsdale Airport is currently served by the City of Scottsdale Fire Station #609, which is located on the east side of the airport. The facility provides emergency and rescue services to the airport and the surrounding area through at least five full-time firefighters that are present at the facility 24 hours per day, seven days per week.

Fire Station #609 has the equipment and personnel necessary to handle aircraft-related emergency situations. Federal regulations do not require ARFF services to be provided at Scottsdale Airport since the airport is not certificated under Title 14 CFR Part 139 and does not accommodate scheduled air carrier service. Unless federal regulations change, there will not be a regulatory requirement for ARFF facilities on the airport; however, given the significant amount of aircraft operations, including a large number of jet aircraft on the airfield, it is desirable that ARFF services be provided to maintain the highest degree of safety.

U.S. Customs and Border Protection

The U.S. Customs and Border Protection (CBP) offices are located in the Aviation Business Center immediately north of the terminal building on the west side of the airport. The CBP program was originally established at Scottsdale Airport in 1999, and arrivals and departures were limited to certain countries. Since 2011, a new service called "US-VISIT" has been established which allows visitors from all over the world to land at Scottsdale Airport, provided they have proper visas. Normal hours of operation for CBP services are from 9 a.m. to 5 p.m., Thursday through Monday. The City of Scottsdale is currently working with the CBP to offer expanded customs service at the airport 10 hours per day, seven days per week.

Security Fencing / Gates

Perimeter fencing is used at airports primarily to secure the aircraft operational area. The physical barrier of perimeter fencing provides the following functions:

- Gives notice of the legal boundary of the outermost limits of a facility or security-sensitive area.
- Assists in controlling and screening authorized entries into a secured area by deterring entry elsewhere along the boundary.
- Supports surveillance, detection, assessment, and other security functions by providing a zone for installing intrusion-detection equipment and closed-circuit television (CCTV).
- Deters casual intruders from penetrating a secured area by presenting a barrier that requires an overt action to enter.
- Demonstrates the intent of an intruder by their overt action of gaining entry.
- Causes a delay to obtain access to a facility, thereby increasing the possibility of detection.
- Creates a psychological deterrent.
- Optimizes the use of security personnel, while enhancing the capabilities for detection and apprehension of unauthorized individuals.
- Demonstrates a corporate concern for facilities.
- Limits inadvertent access to the aircraft operations area by wildlife.

Scottsdale Airport's air operations areas are completely enclosed with six-foot tall chain link fence topped by three-strand barbed-wire, eight-foot tall chain link fence, or other walls that are eight feet tall. Several controlled-access and manual gates associated with the fencing lead to different areas on the airfield.

In addition, there are six controlled-access gates leading to and from private entities located within designated areas associated with the Scottsdale Airpark. Certain parcels on the east side of the airfield are also located within the Scottsdale Airpark but are granted direct access to the airfield without having to enter through a controlled-access gate. These direct-access properties are required to maintain a security plan that demonstrates the ability to meet the functions listed above in order to enhance safety and security at Scottsdale Airport.

Utilities

Electricity, water, sanitary sewer, solid waste disposal, and telecommunications services are available at the airport. The availability and capacity of the utilities serving the airport are factors in determining the development potential of the airport. Utility extensions to new development and/or redeveloped areas may be needed through the planning period.

Security Guidelines

In cooperation with representatives of the general aviation community, the Transportation Security Administration (TSA) published security guidelines for general aviation airports. These guidelines are contained in the publication entitled, *Security Guidelines for General Aviation Airports*, published in May 2004. Within this publication, the TSA recognized that general aviation is not a specific threat to national security. However, the TSA does believe that general aviation may be vulnerable to misuse by terrorists as security is enhanced in the commercial portions of aviation and at other transportation links.

To assist in defining which security methods are most appropriate for a general aviation airport, the TSA defined a series of airport characteristics that potentially affect an airport's security posture. These include:

1. **Airport Location –** An airport's proximity to areas with over 100,000 residents or sensitive sites that can affect its security posture. Greater security emphasis should be given to airports within 30 miles of mass population centers (areas with over 100,000 residents) or sensitive areas such as military installations, nuclear and chemical plants, centers of government, national monuments, and/or international ports.

2. **Based Aircraft** – A smaller number of based aircraft increases the likelihood that illegal activities will be identified more quickly. Airports with based aircraft weighing more than 12,500 pounds warrant greater security measures.

3. **Runways** – Airports with longer paved runways are able to serve larger aircraft. Shorter runways are less attractive as they cannot accommodate the larger aircraft which have more potential for damage.

4. **Operations –** The number and type of operations should be considered in the security assessment.

Table 3S summarizes the recommended airport characteristics and ranking criterion. The TSA suggests that an airport rank its security posture according to this scale to determine the types of security enhancements that may be appropriate. As shown in the table, the Scottsdale Airport's ranking on this scale is 42. Points are assessed for the airport being located in a mass population area and within 25 miles from Luke Air Force Base. Points are also assessed for a based aircraft count of 368, many of which are over 12,500 pounds, and having a runway greater than 5,001 feet in length made of asphalt. The ATCT reported well over 50,000 annual operations in 2012, and Title 14 CFR Part 135 charter operations, flight training operations, aircraft rental, and maintenance on larger aircraft are all offered at the airport, thus enhancing the need for adequate security.

TABLE 3S General Aviation Airport Security Measurement Tool Transportation Security Administration		
	Assessment Scale	
Security Characteristic	**Public Use Airport**	**Scottsdale Airport**
Airport Location		
Within 20nm of mass population areas[1]	5	5
Within 30nm of a sensitive site[2]	4	4
Falls within outer perimeter of Class B airspace	3	3
Falls within boundaries of restricted airspace	3	0
Based Aircraft		
Greater than 101 based aircraft	3	3
26-100 based aircraft	2	0
11-25 based aircraft	1	0
10 or fewer based aircraft	0	0
Based aircraft over 12,500 pounds	3	3
Runways		
Runway length greater than 5,001 feet	5	5
Runways less than 5,000 feet and greater than 2,001 feet	4	0
Runway length less than 2,000 feet	2	0
Asphalt or concrete runway	1	1
Operations		
Over 50,000 annual operations	4	4
Part 135 operations (Air taxi and fractionals)	3	3
Part 137 operations (Agricultural aircraft)	3	0
Part 125 operations (20 or more passenger seats)	3	0
Flight training	3	3
Flight training in aircraft over 12,500 pounds	4	0
Rental aircraft	4	4
Maintenance, repair, and overhaul facilities conducting long-term storage of aircraft over 12,500 pounds	4	4
Totals	**64**	**42**

[1] An area with a population over 100,000

[2] Sensitive sites include military installations, nuclear and chemical plants, centers of government, national monuments, and/or international ports

Source: *Security Guidelines for General Aviation Airports* (TSA 2004)

As shown in **Table 3T**, a rating of 42 points places Scottsdale Airport in the second tier ranking of security measures by the TSA. This rating clearly illustrates the importance of meeting security needs at Scottsdale Airport as the activity at the airport grows. In the event that large aircraft in excess of 12,500 pounds conduct flight training at the facility, the Scottsdale Airport ranking could move into the first tier. Based upon the results of the security assessment, the TSA recommends 13 potential security enhancements for Scottsdale Airport. These enhancements are discussed in detail as follows:

TABLE 3T **Recommended Security Enhancements**				
	Points Determined Through Airport Security Characteristics Assessment			
Security Enhancements	**Tier 1 > 45**	**Tier 2 25-44**	**Tier 3 15-24**	**Tier 4 0-14**
Fencing	■			
Hangars	■			
Closed-Circuit Television (CCTV)	■			
Intrusion Detection System	■			
Access Controls	■	■		
Lighting System	■	■		
Personal ID/Vehicle ID System	■	■		
Challenge Procedures	■	■		
Law Enforcement Support	■	■	■	
Security Committee	■	■	■	
Transient Pilot Sign-In/Sign-Out Procedures	■	■	■	
Signs	■	■	■	
Documented Security Procedures	■	■	■	■
Positive/Passenger/Cargo/Baggage ID	■	■	■	■
Aircraft Security	■	■	■	■
Community Watch Program	■	■	■	■
Contact List	■	■	■	■
Source: *Security Guidelines for General Aviation Airports*				

Access Controls: To delineate and adequately protect security areas from unauthorized access, it is important to consider boundary measures such as fencing, walls, or other physical barriers, electronic boundaries (e.g., sensor lines, alarms), and/or natural barriers. Physical barriers can be used to deter and delay the access of unauthorized persons onto sensitive areas of airports. Such structures are usually permanent and are designed to be a visual and psychological deterrent as well as a physical barrier. The airport provides perimeter fencing with access control gates for vehicles and pedestrians.

Lighting System: Protective lighting provides a means of continuing a degree of protection from theft, vandalism, or other illegal activity at night. Security lighting systems should be connected to an emergency power source, if available.

Personal ID System: This refers to a method of identifying airport employees or authorized tenants and allowing access to various areas of the airport through badges or biometric controls.

Vehicle ID System: This refers to an identification system which can assist airport personnel and law enforcement in identifying authorized vehicles. Vehicles can be identified through the use of decals, stickers, or hang tags.

Challenge Procedures: This involves an airport watch program which is implemented in cooperation with airport users and tenants to be on guard for unauthorized and potentially illegal activities at the airport.

Law Enforcement Support: This involves establishing and maintaining a liaison with appropriate law enforcement, including local, state, and federal agencies. These organizations can better serve the airport when they are familiar with airport operating procedures, facilities, and normal activities. Procedures may be developed to have local law enforcement personnel regularly or randomly patrol ramps and aircraft hangar areas, with increased patrols during periods of heightened security.

Security Committee: This committee should be composed of airport tenants and users drawn from all segments of the airport community. The main goal of this group is to involve airport stakeholders in developing effective and reasonable security measures and disseminating timely security information.

Transient Pilot Sign-In/Sign-Out Procedures: This involves establishing procedures to identify non-based pilots and aircraft using their facilities, and implementing sign-in/sign-out procedures for all transient operators and associating them with their parked aircraft. Having assigned spots for transient parking areas can help to easily identify transient aircraft on an apron.

Signs: The use of signs provides a deterrent by warning of facility boundaries, as well as notifying of the consequences for violation.

Documented Security Procedures: This refers to having a written security plan. This plan would include documenting the security initiatives already in place at Scottsdale Airport, as well as any new enhancements. This document should consist of airport and local law enforcement contact information, and include utilization of a program to increase airport user awareness of security precautions such as an airport watch program.

Positive/Passenger/Cargo/Baggage ID: A key point to remember regarding general aviation passengers is that the persons boarding these flights are generally better known to airport personnel and aircraft operators than the typical passenger on a commercial airliner. Recreational general aviation passengers are typically friends, family, or acquaintances of the pilot in command. Charter/ sightseeing passengers typically will meet with the pilot or other flight department personnel well in advance of any flights. Suspicious activities, such as use of cash for flights or probing or inappropriate questions, are more likely to be quickly noted and authorities could be alerted. For corporate operations, typically all parties onboard the aircraft are known to the pilots. Airport operators should develop methods by which individuals visiting the airport can be escorted into and out of aircraft movement and parking areas.

Aircraft Security: The main goal of this security enhancement is to prevent the intentional misuse of general aviation aircraft for criminal purposes. Proper securing of aircraft is the most basic method of enhancing general aviation airport security. Pilots should employ multiple methods of securing their aircraft to make it as difficult as possible for an unauthorized person to gain access to it. Some basic methods of securing a general aviation aircraft include: ensuring that door locks are consistently used to prevent unauthorized access or tampering with the aircraft; using keyed ignitions where appropriate; storing the aircraft in a hangar, if available; locking hangar doors, using an auxiliary lock to further protect aircraft from unauthorized use (i.e., propeller, throttle, and/or tie-down locks); and ensuring that aircraft ignition keys are not stored inside the aircraft.

Community Watch Program: The vigilance of airport users is one of the most prevalent methods of enhancing security at general aviation airports. Typically, the user population is familiar with those individuals who have a valid purpose for being on the airport property. Consequently, new faces are quickly noticed. A watch program should include elements similar to those listed below. These recommendations are not all-inclusive. Additional measures that are specific to each airport should be added as appropriate, including:

- Coordinate the program with all appropriate stakeholders, including airport officials, pilots, businesses, and/or other airport users.
- Hold periodic meetings with the airport community.
- Develop and circulate reporting procedures to all who have a regular presence on the airport.
- Encourage proactive participation in aircraft and facility security and heightened awareness measures. This should include encouraging airport and line staff to "query" unknowns on ramps, near aircraft, etc.
- Post signs promoting the program, warning that the airport is watched. Include appropriate emergency phone numbers on the sign.
- Install a bulletin board for posting security information and meeting notices.
- Provide training to all involved for recognizing suspicious activity and appropriate response tactics.

Contact List: This involves the development of a comprehensive list of responsible personnel/agencies to be contacted in the event of an emergency procedure. The list should be distributed to all appropriate individuals. Additionally, in the event of a security incident, it is essential that first responders and airport management have the capability to communicate. Where possible, coordinate radio communication and establish common frequencies and procedures to establish a radio communications network with local law enforcement.

Other security measures may be considered by the airport as the local need demands. The additional measures include full perimeter fencing, hangar availability, closed-circuit television, and intrusion detection systems.

A summary of landside needs is presented on **Exhibit 3G**.

SUMMARY

The intent of this chapter has been to outline the safety design standards and facilities required to meet potential aviation demand projected at Scottsdale Airport for the next 20 years. In an effort to provide a more flexible Master Plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a 5-year timeframe, the intermediate term is approximately 10 years, and the long term is 20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests rather than on specific dates in the future.

In Chapter Four, potential improvements to the airside and landside systems will be examined through a series of airport

GENERAL AVIATION TERMINAL SERVICES

	Available	Short Term	Intermediate Term	Long Term
General Aviation Services Facility Area (s.f.)	17,970[1]	12,900	14,500	17,600
Automobile Parking Spaces	820[2]	304	339	416

AIRCRAFT STORAGE HANGAR REQUIREMENTS

	Available	Short Term	Intermediate Term	Long Term
Aircraft to be Hangared	298	328	357	425
T-Hangar/Linear Box Hangar/Shade Hangar (s.f.)	188,100[3]	190,600	194,500	197,300
Executive Hangar (s.f.)	25,900[3]	209,000	235,500	287,000
Conventional Hangar (s.f.)	223,600[3]	243,000	284,000	389,000
Total On-Airport Hangar Area (s.f.)	437,600[3]			
Total Off-Airport Hangar Area (s.f.)	837,800[4]			
Maintenance Area (s.f.)		60,000	64,500	75,000
Total Hangar Area (s.f.)		**702,600**	**778,500**	**948,300**

AIRCRAFT PARKING APRON REQUIREMENTS

	Available	Short Term	Intermediate Term	Long Term
Transient Single and Multi-Engine Aircraft Positions		57	58	59
Apron Area (s.y.)		45,700	46,500	47,400
Transient Turboprop / Jet Positions		38	43	55
Apron Area (s.y.)		61,000	69,400	87,600
Locally-Based Aircraft Positions		92	93	95
Apron Area (s.y.)		33,100	33,500	34,200
Total Marked Positions	**162**	**187**	**194**	**209**
Total Apron Area (s.y.)	**200,000**	**139,800**	**149,400**	**169,200**

SUPPORT FACILITIES

	Available	Short Term	Intermediate Term	Long Term
Fuel Storage - 100LL	58,100 gal.[5]	Based on Fixed Base Operator aircraft demand.		
Fuel Storage - JetA	180,000 gal.[5]			

	Short Term	Intermediate Term	Long Term
Aircraft Wash Rack	Maintain	Maintain	Maintain
ARFF - Index A	Maintain	Maintain	Maintain
U.S. Customs and Border Protection	Maintain	Maintain	Maintain
Security Fencing/Gates	Maintain	Maintain	Maintain
Utilities	Maintain	Maintain	Maintain

[1] Includes space offered in airport terminal building only
[2] Estimated number of marked auto parking spaces on airport property
[3] Includes estimated hangar, maintenance, and office space at Scottsdale Airport (on airport property)
[4] Includes estimated hangar area within Scottsdale Airpark (off airport property)
[5] On-airport fuel storage (fuel tanks and fuel trucks). An additional 508,000 gallons of fuel storage capacity is provided within Scottsdale Airpark.

development alternatives. Most of the alternatives discussion will focus on those capital improvements that would be eligible for federal and state grant funds. Other projects of local concern will also be presented. Ultimately, an overall airport development plan that presents a vision beyond the 20-year scope of this Master Plan will be developed.