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
- Airport Physical Planning Criteria
- Airside and Landside Facility Requirements

As indicated 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. These 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. At Santa Fe Municipal Airport, this includes components for commercial service and general aviation needs such as:

- Terminal Facilities
- Aircraft Hangars
- Aircraft Parking Aprons
- Automobile Parking
- Airport Support Facilities

The objective of this effort is to identify, in general terms, the adequacy of existing airport facilities, outline what new facilities may be needed, and when these may be needed to accommodate forecast demands. Having established these facility requirements, 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 Santa Fe Municipal Airport was established. The activity forecasts include airline enplanements, 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 Santa Fe Municipal 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 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 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 the five, ten, and 20-year periods used in Chapter Two.

TABLE 3A
Planning Horizon Activity Summary
Santa Fe Municipal Airport

	Base Year (2014)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
ENPLANED PASSENGERS	**74,551**	**85,000**	**95,000**	**120,000**
BASED AIRCRAFT				
Single Engine Piston	129	136	141	153
Multi-Engine Piston	22	22	23	24
Turboprop	6	8	11	15
Jet	20	23	27	31
Helicopter	4	6	8	12
TOTAL BASED AIRCRAFT	**181**	**195**	**210**	**235**
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	3,858	4,000	3,800	4,200
General Aviation	23,100	24,200	25,800	28,800
Air Taxi	4,300	4,500	4,900	5,700
Military	2,500	2,500	2,500	2,500
Total Itinerant	**33,758**	**35,200**	**37,000**	**41,200**
Local				
General Aviation	30,900	32,500	34,300	37,600
Military	3,600	3,600	3,600	3,600
Total Local	**34,500**	**36,100**	**37,900**	**41,200**
TOTAL OPERATIONS*	**68,300**	**71,300**	**74,900**	**82,400**

*Includes ATCT after-hours adjustment rounded to the nearest 100

AIRFIELD CAPACITY

ASV is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors.

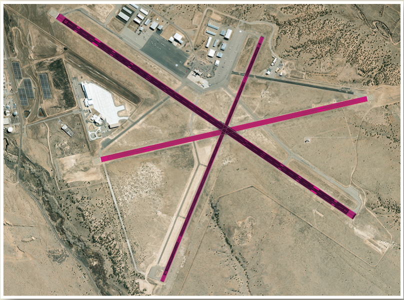
An airfield's capacity is expressed in terms of its annual service volume (ASV). ASV is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors. As aircraft operations near or surpass the ASV, delay factors increase exponentially. The airport's ASV was examined utilizing the Federal Aviation Administration's (FAA) Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

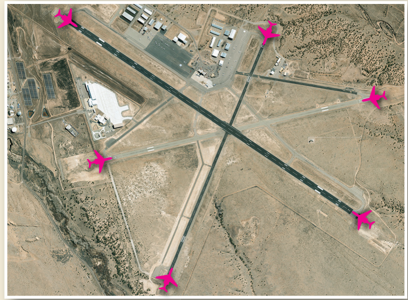
This analysis takes into account specific factors about the airfield in order to calculate the airport's ASV. These various factors are depicted in **Exhibit 3A**. The following describes the input factors as they relate to Santa Fe Municipal Airport and include airfield layout, weather conditions, aircraft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

AIRFIELD LAYOUT

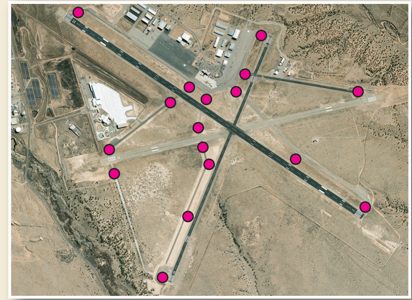
Runway Configuration



Runway Use



Number of Exits



WEATHER CONDITIONS

VMC
Visual Meteorological Conditions

IMC
Instrument Meteorological Conditions

PVC
Poor Visibility Conditions

AIRCRAFT MIX

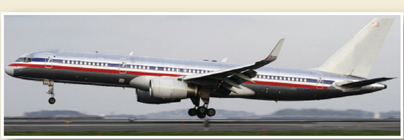
Category A & B Aircraft

Category C Aircraft

Category D Aircraft

OPERATIONS

Arrivals



Departures

Touch-and-Go Operations

Total Annual Operations

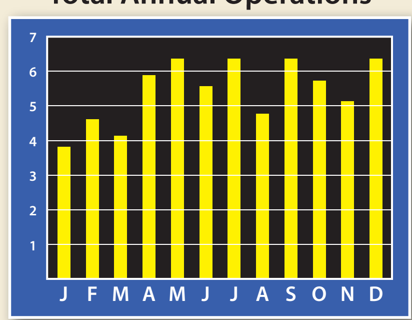


Exhibit 3A
AIRFIELD CAPACITY FACTORS

- **Runway Configuration –** Primary Runway 2-20 is 8,366 feet long and 150 feet wide. Runway 15-33, the primary crosswind runway, is 6,316 feet long and 100 feet wide. Runway 10-28 is the secondary crosswind runway and measures 6,301 feet long and 75 feet wide. All three runways intersect near the mid-point of each runway. The existing airfield configuration also consists of a series of taxiways serving the various runways.

- **Runway Use –** Runway use in capacity conditions will be controlled by wind and/or airspace conditions. For Santa Fe Municipal Airport, the direction of takeoffs and landings are generally determined by the speed and direction of the wind. It is generally safest for aircraft to takeoff and land into the wind, avoiding a crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components during these operations. Runway 2-20 is the primary runway and is capable of accommodating all types of aircraft operating at the airport, day and night. Runway 2 also provides the only precision instrument approaches at the airport. Runway 15-33 can also accommodate a large majority of aircraft utilizing the airport. Similar to primary Runway 2-20, this runway is capable of handling operations during daytime and nighttime conditions. Runway 10-28 generally serves smaller general aviation aircraft and can also be utilized during daytime and nighttime conditions.

  Based upon information received from airport traffic control tower (ATCT) personnel, Runway 2-20 is utilized most often, estimated at 60 percent of the time. Runway 15-33 is utilized approximately 35 percent of the time, and Runway 10-28 is estimated to be used the remaining five percent. It should be noted that wind conditions on the airfield tend to blow from the north in the morning and from the south in the afternoon and evening. Overall, wind conditions generally blow from the southwest the majority of the time.

- **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. Based upon mix, only exit taxiways between 2,000 feet and 4,000 feet from the landing threshold count in the exit rating at Santa Fe Municipal Airport. The exits must be at least 750 feet apart to count as separate exit taxiways. Utilizing these standards, the airport is generally provided two exit taxiways on each runway.

- **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 meteorological conditions (VMC) approximately 94 percent of the time. VMC exist whenever the cloud ceiling is greater than 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument meteorological conditions (IMC) 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, IMC prevailed approximately three percent of the time. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. PVC conditions occur approximately three percent of the year. **Table 3B** summarizes the weather conditions experienced at the airport over a 10-year period of time.

TABLE 3B
Weather Conditions
Santa Fe Municipal Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	> 1,000' AGL	> 3 statute miles	93.59%
IMC	≥ 500' AGL and ≤ 1,000' AGL	1-3 statute miles	3.45%
PVC	< 500' AGL	< 1 statute mile	2.96%

VMC - Visual Meteorological Conditions
IMC - Instrument Meteorological Conditions
PVC - Poor Visibility Conditions
AGL - Above Ground Level

Source: National Oceanic and Atmospheric Administration (NOAA) - National Climatic Data Center. Airport observations from 2005 - 2014.

- **Aircraft Mix -** 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 and some jet aircraft, all weighing 12,500 pounds or less. These aircraft are associated primarily with general aviation activity. A large majority of aircraft operations at Santa Fe Municipal Airport are those in Classes A and B. Class C consists of aircraft weighing between 12,500 pounds and 300,000 pounds. These aircraft include most business jets and some turboprop aircraft. The Embraer ERJ-140-series and Bombardier CRJ-200 regional jets being operated by American Eagle and United Express are also categorized in Class C. Class D aircraft consists of large aircraft weighing more than 300,000 pounds. The airport does not experience operations by Class D aircraft.

- **Percent Arrivals –** The percentage of arrivals as they relate to total operations of the airport is important in determining airfield capacity. Under most circumstances, the lower the percentage of arrivals, the higher the hourly capacity. The aircraft arrival-departure percentage split is typically 50/50, which is the case at Santa Fe Municipal Airport.

- **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 Santa Fe Municipal Airport account for approximately 50 percent of total annual operations. A similar ratio is expected in the future.

- **Peak Period Operations –** For the airfield capacity analysis, average daily operations and average peak hour operations during the peak month are utilized. 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.

CAPACITY ANALYSIS CONCLUSIONS

Given the factors outlined above, the airfield ASV will range between 150,000 and 200,000 annual operations. The ASV does not indicate a point of absolute gridlock for the airfield; however, it does represent the point at which operational delay for each aircraft operation will increase exponentially. The current operational level for the airport represents approximately 45 percent of the airfield's ASV, if the ASV is considered at the low end of the typical range of 150,000 annual operations. By the end of the planning period, total annual operations are expected to represent 55 percent of the airfield's ASV.

While no significant capacity improvements will be necessary, options to improve airfield efficiency will still be considered in the Master Plan.

FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. This is an approximate level to begin the detailed planning of capacity improvements. At the 80 percent level, the planned improvements should be made. While no significant capacity improvements will be necessary, options to improve airfield efficiency will still be considered in the Master Plan.

AIRSIDE FACILITY REQUIREMENTS

As indicated earlier, airport facilities include both airside and landside components. Airside facilities include those that are related to the arrival, departure, and ground movement of aircraft. These components include:

- Runway Configuration
- Safety Area Design Standards
- Runways
- Taxiways
- Navigational and Approach Aids
- Lighting, Marking, and Signage

RUNWAY CONFIGURATION

The airport is currently served by a three-runway system. Primary Runway 2-20 is orientated in a northeast-southwest manner. Crosswind Runway 15-33 is orientated in a northwest-southeast manner. Finally, Runway 10-28 is orientated in an east-west manner.

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 not exceeding a 10.5 knot (12 mph) component for RDC A-I and B-I, 13 knot (15 mph) component for RDC A-II and B-II, and 16 knot (18 mph) component for RDC A-III, B-III, C-I through C-III, and D-I through D-III.

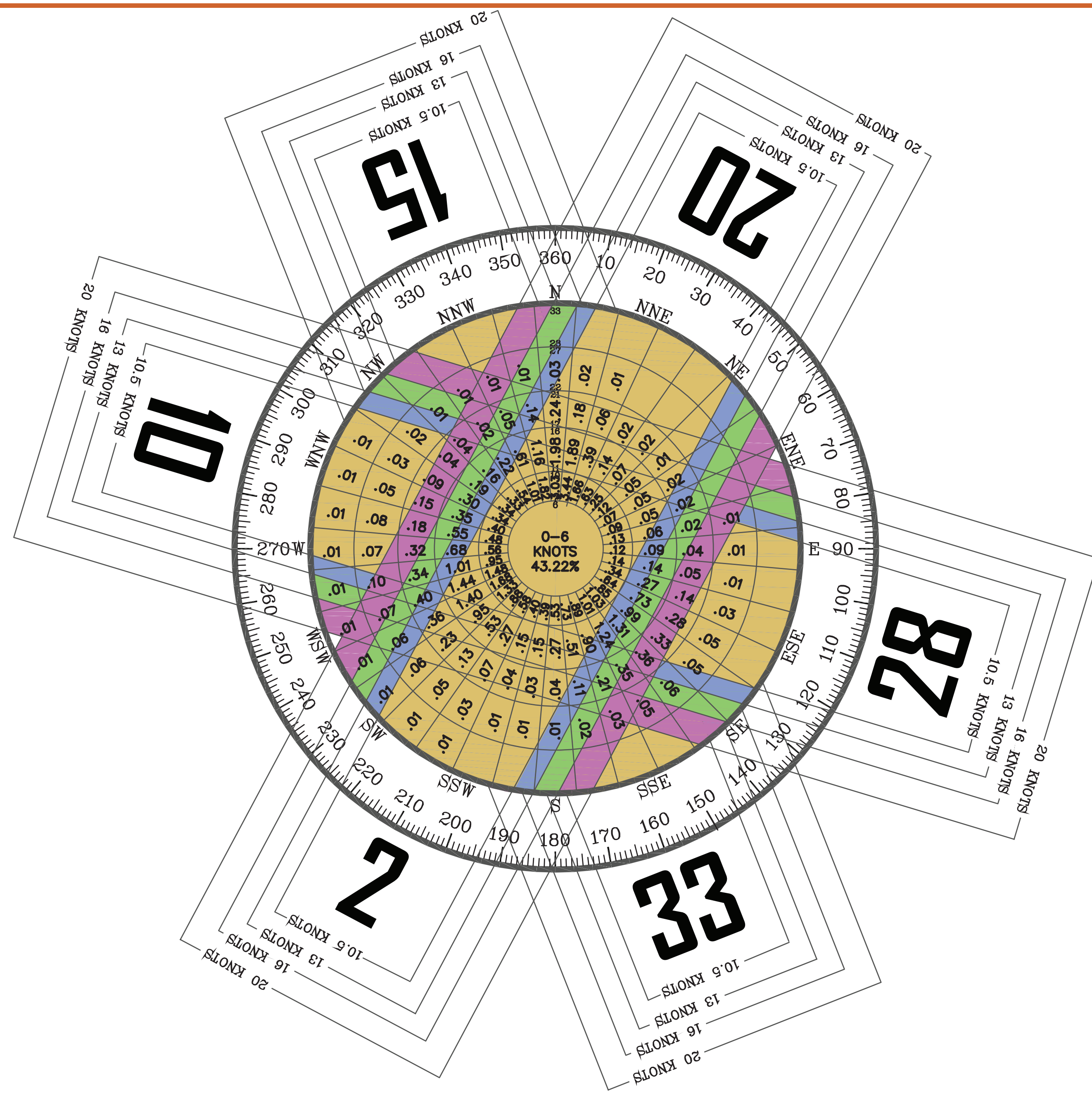
Weather data specific to the airport was obtained from the National Oceanic Atmospheric Administration (NOAA) National Climatic Data Center. This data was collected from the ASOS located on the airfield over a continuous 10-year period from January 2005 through December 2014. A total of 93,022 observations of wind direction and other data points were made. Of the total number of observations, 3,207 were made in instrument flight rules (IFR) conditions. IFR conditions exist when the visibility is below three miles or the cloud ceilings are below 1,000 feet.

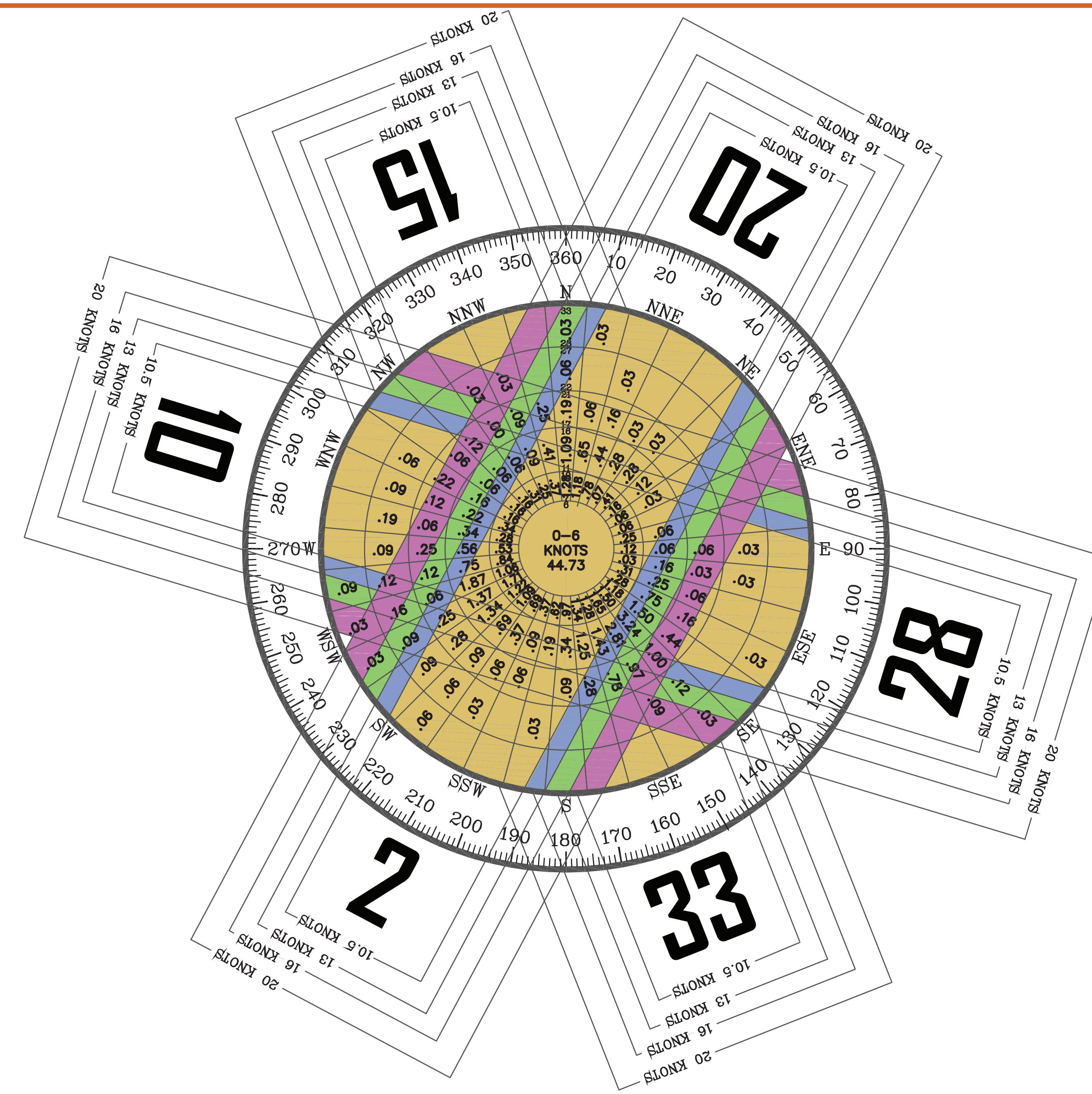
Exhibit 3B presents both an all-weather and IFR wind rose. A wind rose is a graphic tool that gives a succinct view of how wind speed and direction are historically distributed at a particular location. The table at the top of each wind rose indicates the percent of wind coverage for each runway and specific wind intensity.

No single runway can provide sufficient wind coverage at 13 knots or below. Therefore, a crosswind runway is justified by FAA standards.

As can be seen, no single runway can provide sufficient wind coverage at 13 knots or below. Therefore, a crosswind runway is justified by FAA standards. In all-weather conditions, Runway 2-20 provides 86.99 percent wind coverage for 10.5 knot crosswinds, 92.34 percent coverage at 13 knots, 96.85 percent at 16 knots, and 99.07 percent at 20 knots. Crosswind Runway 15-33 provides for 88.38 percent wind coverage at 10.5 knots, 92.63 percent at 13 knots, 96.86 percent at 16 knots, and 98.99 percent coverage at 20 knots. Runway 10-28 provides 87.10 percent wind coverage for 10.5 knot crosswinds, 93.30 percent coverage at 13 knots, 98.14 percent at 16 knots, and 99.52 percent coverage at 20 knots.

The combination of primary Runway 2-20 and crosswind Runway 15-33 provides 95 percent wind coverage for all wind categories except at 10.5 knots, while the combination of primary Runway 2-20 and





Source:
NOAA National Climatic Center
Asheville, North Carolina
Santa Fe Municipal Airport
Santa Fe, NM

Observations:
93,022 All Weather Observations
Jan. 1, 2005 - Dec. 31, 2014

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 2-20	86.99%	92.34%	96.85%	99.07%
Runway 10-28	87.10%	93.30%	98.14%	99.52%
Runway 15-33	88.38%	92.63%	96.86%	98.99%
Runway 2-20 and Runway 10-28	96.83%	99.23%	99.86%	99.99%
Runway 2-20 and Runway 15-33	94.78%	97.43%	98.99%	99.75%
All Runways	99.30%	99.84%	99.97%	100.00%

NORTH

Magnetic Declination
8° 36' East (July 2015)
Annual Rate of Change
00° 6.0' West (July 2015)

IFR WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 2-20	82.03%	88.39%	95.00%	98.53%
Runway 10-28	86.49%	92.79%	97.66%	99.32%
Runway 15-33	88.26%	92.96%	97.15%	98.56%
Runway 2-20 and Runway 10-28	95.15%	98.13%	99.68%	99.95%
Runway 2-20 and Runway 15-33	95.32%	97.53%	98.77%	99.41%
All Runways	99.24%	99.60%	99.85%	99.95%

Source:
NOAA National Climatic Center
Asheville, North Carolina
Santa Fe Municipal Airport
Santa Fe, NM

Observations:
3,207 IFR Observations
Jan. 1, 2005 - Dec. 31, 2014

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crosswind Runway 10-28 provides 95 percent wind coverage for all wind categories. The combined runway system all-weather wind coverage at 10.5 knots is 99.30 percent and increases to 100 percent at 20 knots.

Under IFR conditions, the crosswind component coverages for the runway system decrease. Runway 15-33 provides the best orientation for wind coverage of orientations at 10.5 knots and 13 knots, while Runway 10-28 provides the best orientation for 16 knots and 20 knots.

The airport should maintain, at a minimum, a two-runway system as no single runway orientation provides the full 95 percent wind coverage. The remainder of this study will consider the existing three-runway system to remain intact at the airport.

SAFETY AREA DESIGN 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).

The entire RSA, ROFA, and ROFZ must 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 purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in place which ensure the RPZ remains free of incompatible development. The various airport safety areas are presented on **Exhibit 3C**.

The entire RSA, ROFA, and ROFZ must 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.

Dimensional standards for the various safety areas associated with the runways are a function of the type of aircraft expected to use the runways as well as the instrument approach capability. **Table 3C** presents the FAA design standards as they apply to the runways at Santa Fe Municipal Airport per the detailed analysis conducted at the end of Chapter Two.

TABLE 3C
Runway Design Standards
Santa Fe Municipal Airport

	RUNWAY 2-20		RUNWAY 15-33		RUNWAY 10-28
	Existing	Ultimate	Existing	Ultimate	Existing/Ultimate
Runway Design Code	D-II	D-III	C-II	C-III	B-II
Visibility Minimums	3/4-mile - Rwy 2 ≥1 mile - Rwy 20	1/2-mile - Rwy 2 3/4-mile - Rwy 20	≥1 mile – Both Ends	3/4-mile – Both Ends	≥1 mile – Both Ends
Runway Design					
Runway Width	150	150	100	100	75
Blast Pad Length x Width	200 x 150 - Rwy 20	200 x 200	150 x 120	200 x 140	N/A / 150 x 95
Runway Protection					
Runway Safety Area					
Width	500	500	500	500	150
Length Beyond Departure End	1,000	1,000	1,000	1,000	300
Length Prior to Threshold	600	600	600	600	300
Runway Object Free Area					
Width	800	800	800	800	500
Length Beyond Departure End	1,000	1,000	1,000	1,000	300
Length Prior to Threshold	600	600	600	600	300
Runway Obstacle Free Zone					
Width	400	400	400	400	400
Length Beyond Runway End	200	200	200	200	200
Precision Obstacle Free Zone					
Width	800 (Rwy 2)	800 (Rwy 2)	N/A	N/A	N/A
Length Beyond Runway End	200 (Rwy 2)	200 (Rwy 2)	N/A	N/A	N/A
Approach Runway Protection Zone					
Inner Width	1,000 / 500	1,000 / 1,000	500	1,000	500
Outer Width	1,510 / 1,010	1,750 / 1,510	1,010	1,510	700
Length	1,700 / 1,700	2,500 / 1,700	1,700	1,700	1,000
Departure Runway Protection Zone					
Inner Width	500	500	500	500	500
Outer Width	1,010	1,010	1,010	1,010	700
Length	1,700	1,700	1,700	1,700	1,000
Runway Separation					
Runway Centerline to:					
Holding Position	250-300	314	250	314	130-180 / 200
Parallel Taxiway	400	400	N/A	400	240
Aircraft Parking Apron	500	500	500	500	250

Note: All dimensions in feet unless otherwise noted.
Source: FAA AC 150/5300-13A, Airport Design

Runway Safety Area

The RSA is defined in FAA AC 150/5300-13A, Change 1, *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 and dimensioned in accordance to the approach speed of the critical design aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design

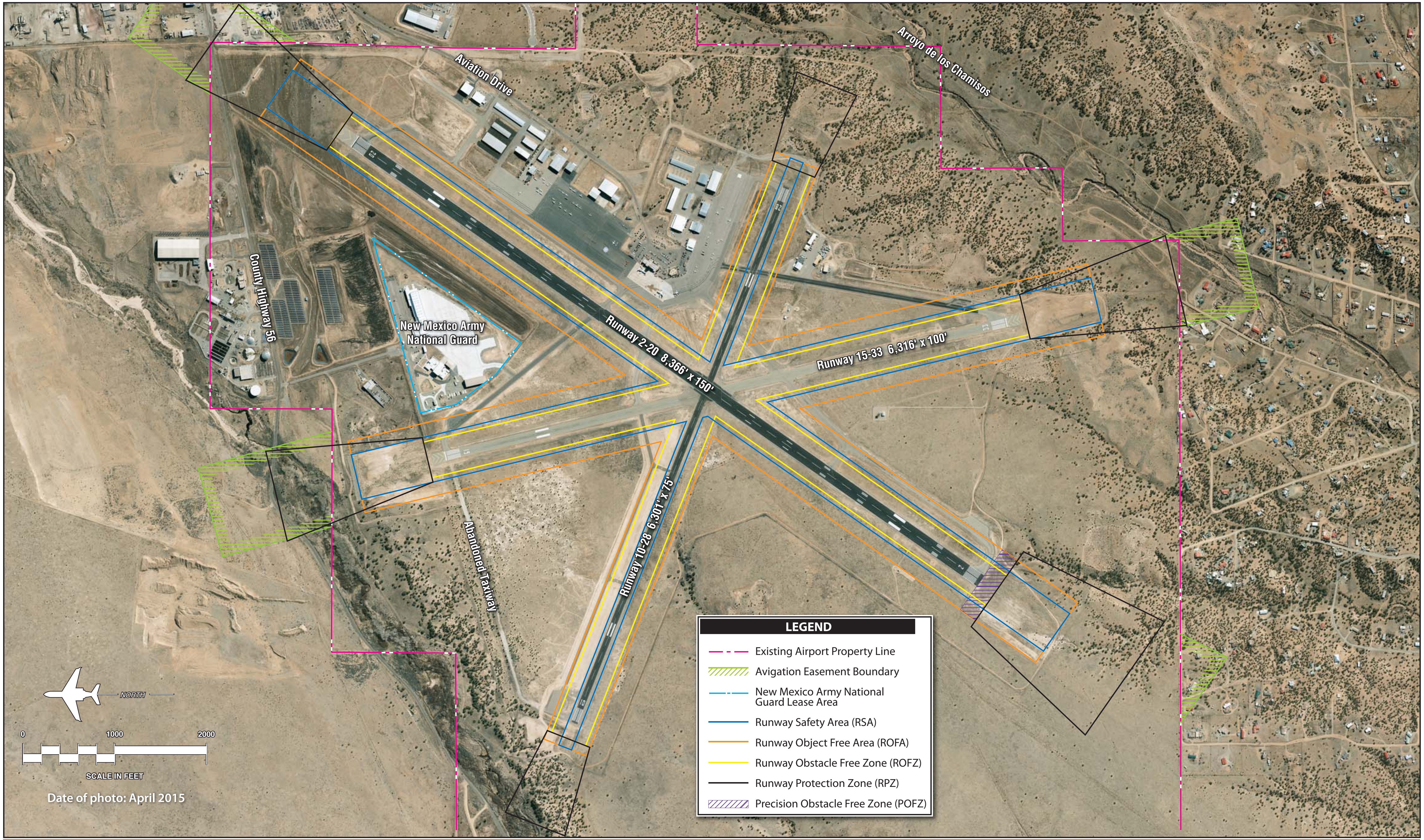

Exhibit 3C
EXISTING AIRFIELD SAFETY AREAS

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aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose such as runway edge lights or approach lights.

All RSAs at federally-obligated airports…shall conform to the standards contained in AC 150/5300-13, Change 1, Airport Design, to the extent practicable."

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 AC 150/5300-13, Change 1, *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 C/D-II design, the FAA calls for the RSA to be 500 feet wide and extend 1,000 feet beyond the runway ends. Analysis in Chapter Two indicated that Runways 2-20 and 15-33 should be planned to accommodate aircraft in RDC D-III and C-III, respectively. The RSA for these RDCs is also 500 feet wide and extends 1,000 feet beyond each runway end. It should be noted that only 600 feet of RSA is needed prior to the landing threshold on each runway end under RDC C/D-II and C/D-III standards.

Runway 10-28 is currently RDC B-II with visibility minimums not lower than one mile. The applicable RSA is 150 feet wide, extending 300 feet beyond each runway end. This standard should be maintained on this runway through the long term planning period.

As depicted on **Exhibit 3C**, the RSA extends to the southeast of Runway 15-33 and is penetrated by perimeter fencing and vegetation. All other RSAs associated with the runway system at the airport appear to comply with FAA standards.

While the standard for RSA width is 500 feet as previously discussed, AC 150/5300-13A, Change 1, *Airport Design*, allows for the application of a narrower RSA of 400 feet for RDC C/D-II. Under this scenario, the RSA associated with Runway 15-33 still extends over portions of the perimeter fencing and vegetation to the southeast of the runway.

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 C/D-II and C/D-III design, the FAA calls for the ROFA to be 800 feet wide, extending 1,000 feet beyond each runway end. Similar to the RSA, only 600 feet is needed prior to the landing threshold. The ROFA for RDC B-II is smaller, encompassing an area 500 feet wide and 300 feet beyond each runway end.

Exhibit 3C depicts the ROFA for all three runways at Santa Fe Municipal Airport. Similar to the RSA, the ROFA associated with Runway 15-33 extends to the southeast of the runway and is penetrated by perimeter fencing and vegetation. In addition, a portion of the ROFA extending beyond the east end of Runway 10-28 is obstructed by the roadway providing access to airport support facilities that include maintenance and aircraft rescue and firefighting (ARFF). It should be noted that this road is restricted to authorized airport personnel and is not open for public use.

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 runway utilized by aircraft weighing more than 12,500 pounds requires a clear ROFZ to extend 200 feet beyond the runway ends and 400 feet wide (200 feet on either side of the runway centerline). The ROFZ standards are met for all runways except the east portion of Runway 10-28, where the private road leading to the airport maintenance and ARFF facilities penetrate the ROFZ.

A precision obstacle free zone (POFZ) is further defined for runway ends with a precision approach, such as the instrument landing system (ILS) approach to Runway 2. The POFZ is 800 feet wide, centered on the runway, and extends from the runway threshold to a distance of 200 feet. The POFZ is in effect when the following conditions are met:

a) The runway supports a vertically guided approach.
b) Reported ceiling is below 250 feet and/or visibility is less than ¾-mile.
c) An aircraft is on final approach within two miles of the runway threshold.

When the POFZ is in effect, a wing of an aircraft holding on a taxiway may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ. POFZ standards are met for Runway 2 at Santa Fe Municipal Airport.

Runway Protection Zone

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 feet beyond the runway end. 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.

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, and/or
- A local development proposal in the RPZ (either new or reconfigured).

Since the interim guidance only addresses a new or modified RPZ, existing incompatibilities are generally (but not always) 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.

RPZs have been further designated as approach and departure RPZs. The approach RPZ is a function of the Aircraft Approach Category (AAC) and approach visibility minimums associated with the approach runway end. The departure RPZ is a function of the AAC and departure procedures associated with the runway. For a particular runway end, the more stringent RPZ requirements (usually associated with the approach RPZ) will govern the property interests and clearing requirements that the airport sponsor should pursue.

Currently, only the RPZs serving the Runways 2, 10, and 28 thresholds are fully contained on airport property, as depicted on **Exhibit 3C**. Whenever possible, the airport should maintain positive control over the RPZs through fee simple acquisition; however, avigation easements can be pursued if fee simple acquisition is not feasible. Portions of the RPZs associated with Runways 15, 20, and 33 that extend beyond airport property are contained within avigation easements. County Highway 56 falls within the RPZs serving the Runways 15 and 20 thresholds. Furthermore, the private road leading to the airport maintenance and ARFF facilities on the southeast side of the airport traverses the Runway 28 RPZ.

Whenever possible, the airport should maintain positive control over the RPZs through fee simple acquisition.

Further examination of the RPZs associated with each runway end will be undertaken later in this study. The potential for improved instrument approach procedures and their effects on RPZ dimensions will also be considered.

Runway/Taxiway Separation

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 runway to taxiway separation standard for RDC C/D-II with not lower than ¾-mile visibility minimums is 300 feet. This standard applies to quasi-parallel Taxiways A and D serving Runway 2-20. These taxiways currently exceed this standard, as they are located 400 feet from the runway (centerline to centerline). The separation standard for RDC C/D-III is 400 feet regardless of the instrument approach visibility minimums. As a result, Taxiways A and D adhere to ultimate planning on Runway 2-20. In the event that a parallel taxiway is constructed to serve portions of Runway 15-33, it should be separated at a distance of 400 feet from the runway centerline.

Taxiways A and F serve as quasi-parallel taxiways serving Runway 10-28. Taxiway A has a separation of 375 feet from the Runway 10-28 centerline, and Taxiway F has a separation of 240 feet from the runway centerline. The separation standard for RDC B-II design is 240 feet. As such, these taxiways meet the separation standard and should be maintained accordingly.

Hold Line Separation

Hold lines are markings on taxiways leading to runways. When instructed, pilots are to stop short of the hold line. For Runway 2-20, hold lines range from 250 to 300 feet from the runway centerline. The hold lines are at a separation distance of 250 feet from the Runway 15-33 centerline. As such, the hold lines associated with Runways 2-20 and 15-33 at least meet the 250-foot separation standard. The hold lines associated with Runway 10-28 are located 130 to 180 feet from the runway centerline.

According to FAA AC 150/5300-13A, Change 1, *Airport Design*, the hold line location must be increased based on an airport's elevation and the RDC of the runway. For RDC C/D-III, the hold line position should be increased one foot for every 100 feet above sea level. With Santa Fe Municipal Airport's elevation at 6,348 feet above mean sea level (MSL), the hold lines for Runways 2-20 and 15-33 should be increased above 250 feet by 64 feet or at 314 feet from the runway centerline in order to meet ultimate RDC C/D-III standards. For Runway 10-28, the hold lines should be relocated to 200 feet from the runway centerline to meet existing/ultimate RDC B-II standards.

Aircraft Parking Apron Separation

For Runways 2-20 and 15-33, aircraft parking areas should be at least 400 feet from the runway centerline for RDC D-II and C-II, respectively. For RDC C/D-III, parking aprons should be located 500 feet from the runway centerline. For Runway 10-28, aircraft parking areas should be at least 250 feet from the runway centerline. All aircraft parking aprons at least meet or exceed this standard.

RUNWAYS

The adequacy of the existing runway system at Santa Fe Municipal Airport has been analyzed from a number of perspectives, including runway orientation and adherence to safety area design standards. From this information, requirements for runway improvements were determined for the airport. Runway elements such as length, width, and strength are now presented.

Runway Length

AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. A draft revision to this AC is currently available (150/5325-4C) and the FAA is utilizing the draft revision in most cases when evaluating runway length needs for airports.

The determination of runway length requirements for Santa Fe Municipal Airport is based on five primary factors:

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

Aircraft performance declines as elevations, temperature, and runway gradient factors increase.

Aircraft performance declines as elevations, temperature, and runway gradient factors increase. For Santa Fe Municipal Airport, the mean maximum daily temperature of the hottest month is 86 degrees Fahrenheit (F), which occurs in July. The airport elevation is 6,348 feet MSL. The runway elevation difference is 74 feet for Runway 2-20, 44 feet for Runway 15-33, and 17 feet for Runway 10-28. The gradient of all runways conform to FAA design standards.

Airplanes operate on a wide variety of available runway lengths. Many factors will govern the suitability of those runway lengths for aircraft such as elevation, temperature, wind, aircraft weight, wing flap settings, runway condition (wet or dry), runway gradient, vicinity airspace obstructions, and any special operating procedures. Airport operators can pursue policies that can maximize the suitability of the runway length. Policies such as area zoning and height and hazard restricting can protect an airport's runway length. Airport ownership (fee simple or easement) of land leading to the runway ends can reduce the possibility of natural growth or man-made obstructions. Planning of runways should include an evaluation of aircraft types expected to use the airport, or a particular runway now and in the future. Future plans should be realistic and supported by the FAA approved forecasts and should be based on the critical design aircraft (or family of aircraft).

Commercial Service Aircraft

Runway length needs for commercial service aircraft must factor the local airport conditions described above and the load carried. The aircraft load is dependent upon the payload of passengers and/or cargo, plus the amount of fuel it has on board. For departures, the amount of fuel varies depending upon the length of non-stop flight or trip length.

Currently, scheduled air service from the airport is available to Dallas/Fort Worth International Airport, Los Angeles International Airport, and Denver International Airport. **Table 3D** shows the current destinations served from Santa Fe Municipal Airport and their haul length.

TABLE 3D
Non-Stop Trip Lengths
Santa Fe Municipal Airport

Existing Daily Non-Stops	Air Miles
Dallas/Fort Worth	549
Denver	303
Los Angeles	707

Note: Non-stop service to Los Angeles International Airport is ending in September 2015.
Source: http://www.landings.com

As previously detailed, commercial service aircraft operating at the airport include the Embraer ERJ-140-series and Bombardier CRJ-200 regional jets. These aircraft are configured to accommodate between 44 and 50 passenger seats. Forecasts anticipate the introduction of larger regional jets to the airport in the future, including the potential for the Embraer E-170 and E-175 as well as the Bombardier CRJ-700 and CRJ-900. These aircraft are capable of carrying approximately 70 to 90 passengers. **Table 3E** presents the takeoff weight limits for certain regional jets utilizing conditions specific to Santa Fe Municipal Airport.

TABLE 3E
Takeoff Weight Limits
Santa Fe Municipal Airport

Aircraft	Maximum Takeoff Weight (pounds)	Runway Length (feet)	Maximum Allowable Takeoff Weight (pounds)
CRJ-200	47,500	8,366 9,000 10,000	44,000 45,500 47,500
CRJ-700	72,750	8,366 9,000 10,000	66,000 66,500 67,800
CRJ-900	82,500	8,366 9,000 10,000	68,500 71,500 74,500
Boeing 737-800	172,500	8,366 9,000 10,000	146,000 150,000 155,000

Current Runway 2-20 Length - 8,366 feet
Design Criteria: Elevation - 6,348 feet MSL; Temperature - 86 degrees F
Source: Aircraft Operating Manuals; Coffman Associates analysis

While the current length of 8,366 feet on Runway 2-20 is capable of handling existing operations by the ERJ-140 series and CRJ-200 regional jets, these aircraft are often weight-restricted, especially during times when warm temperatures and high density altitudes prevail at the airport. Furthermore, additional runway length could be necessary to better accommodate larger regional jets, such as the CRJ-700 and CRJ-900 models. While runway length needs in order to accommodate full payloads for these regional jets may be difficult to attain given the cost and environmental impacts involved, prudent planning should analyze potential runway extensions in order to better accommodate existing and future commercial service aircraft that operate at Santa Fe Municipal Airport.

General Aviation Aircraft

The majority of operations at Santa Fe Municipal Airport are conducted using smaller single engine piston-powered aircraft weighing less than 12,500 pounds. Following guidance from AC 150/5325-4B, to accommodate 100 percent of these small aircraft, a runway length of 7,500 feet is recommended.

The airport is also utilized by aircraft weighing more than 12,500 pounds, including small to medium business jet aircraft. Runway length requirements for business jets weighing less than 60,000 pounds have also been calculated. These calculations take into consideration the runway gradient and landing length requirements for contaminated runways (wet). Business jets tend to need greater runway length when landing on a wet surface because of their increased approach speeds. AC 150/5325-4B stipulates that runway length determination for business jets consider a grouping of airplanes with similar operating characteristics. The AC provides two separate "family groupings of airplanes," each based upon their representative percentage of aircraft in the national fleet. The first grouping is those business jets that make up 75 percent of the national fleet, and the second group is those making up 100 percent of the national fleet. **Table 3F** presents a partial list of common aircraft in each aircraft grouping. A third group considers business jets weighing more than 60,000 pounds. Runway length determination for these aircraft must be based on the performance characteristics of the individual aircraft.

TABLE 3F
Business Jet Categories for Runway Length Determination

75 percent of the national fleet	MTOW	75-100 percent of the national fleet	MTOW	Greater than 60,000 pounds	MTOW
Lear 35	20,350	Lear 55	21,500	Gulfstream II	65,500
Lear 45	20,500	Lear 60	23,500	Gulfstream IV	73,200
Cessna 550	14,100	Hawker 800XP	28,000	Gulfstream V	90,500
Cessna 560XL	20,000	Hawker 1000	31,000	Global Express	98,000
Cessna 650 (VII)	22,000	Cessna 650 (III/IV)	22,000		
IAI Westwind	23,500	Cessna 750 (X)	36,100		
Beechjet 400	15,800	Challenger 604	47,600		
Falcon 50	18,500	IAI Astra	23,500		

MTOW: Maximum Take Off Weight
Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*

Table 3G presents the results of the runway length analysis for business jets developed following the guidance provided in AC 150/5325-4B. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 8,000 feet is recommended. This length is derived from a raw length of 7,200 feet that is adjusted, as recommended, for runway gradient and consideration of landing length needs on a contaminated runway (wet and slippery). To accommodate 100 percent of the business jet fleet at 60 percent useful load, a runway length of 11,800 feet is recommended.

TABLE 3G
Runway Length Requirements
Santa Fe Municipal Airport

Airport Elevation	6,348 feet above mean sea level			
Average High Monthly Temp.	86 degrees (July)			
Runway Gradient	74' Runway 2-20			
Fleet Mix Category	**Raw Runway Length from FAA AC**	**Runway Length With Gradient Adjustment (+740')**	**Wet Surface Landing Length for Jets (+15%)***	**Final Runway Length**
100% of small airplanes	7,500’	N/A	N/A	N/A
75% of fleet at 60% useful load	7,200’	7,940	5,500'	8,000’
100% of fleet at 60% useful load	11,000’	11,740’	5,500’	11,800’
75% of fleet at 90% useful load	9,000’	9,740’	7,000’	9,800’
100% of fleet at 90% useful load	11,000’	11,740’	7,000'	11,800’

*Max 5,500' for 60% useful load and max 7,000' for 90% useful load in wet conditions

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

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at the airport. This could be documented activity by a business jet operator that flies out frequently with heavy loads. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 9,800 feet is recommended. To accommodate 100 percent of business jets at 90 percent useful load, a runway length of 11,800 feet is recommended.

Runway Length Summary

Many factors are considered when determining appropriate runway length for safe and efficient operations of aircraft at Santa Fe Municipal Airport. The airport should strive to accommodate commercial service aircraft and business jets to the greatest extent possible.

Runway 2-20 is the primary runway and it is 8,366 feet long. This runway can accommodate a large majority of business jets on the market under moderate loading conditions, especially with shorter trip lengths and during cool to warm temperatures. Likewise, it accommodates the regularly scheduled commercial service regional jets that utilize the airport; however, these aircraft are often weight-restricted when combining operational factors such as temperature and density altitude. Larger commercial service aircraft, such as the E-170 and CRJ-700 could support an even longer runway, but would be dependent upon the specific make and model that the FAA agrees to consider as the critical design aircraft in the event that these regional jets would commence operations at the airport. The existing runway length presents loading limitations, as well as departure climb limitations. It is the hot days and longer trip lengths which will limit many jets at Santa Fe Municipal Airport.

The previous Master Plan analyzed runway extension alternatives for Runway 2-20 that provided an overall length of 9,600 feet, equating to an approximate 1,200-foot extension. While not recommended in the previous Master Plan, it noted that demand may change the need for additional length. At that time, commuter airlines were operating with 40 to 50 percent load factor, so off-loading of passengers was not as significant of a concern as it is now with airlines requiring load factors of 80 percent or higher to maintain service at an airport.

Commuter airlines were operating with 40 to 50 percent load factor, so off-loading of passengers was not as significant of a concern as it is now with airlines requiring load factors of 80 percent or higher to maintain service at an airport.

Although the current Airport Layout Plan (ALP) does not depict a potential runway extension, the alternatives analysis in the next chapter will consider the possibility of lengthening primary Runway 2-20 to at least 9,000 feet. This analysis will be subject to many factors, including economic, environmental and safety design parameters, before a recommendation is made as a result of this Master Plan.

Crosswind Runway 15-33 is currently 6,316 feet long. Due to terrain limitations on both ends of the runway, significant improvements would be required in order to extend the runway to better meet the needs of more demanding aircraft that utilize the airport. The existing length of the runway does place operational restrictions on most jet activity at the airport, but is sufficient for many small- to medium-sized aircraft. In addition, the length can support certain commercial service aircraft during times when the primary runway is closed for maintenance and emergencies or strong crosswinds dictate. As such, its current length should be maintained in the future.

Runway 10-28 is currently 6,301 feet long. This falls short of the length needed to satisfy the needs of small aircraft, as outlined previously (7,500 feet). This runway functions to primarily serve the needs of smaller aircraft for times when crosswinds prohibit the use of Runways 2-20 and 15-33. In this capacity, the existing length of Runway 10-28 should be adequate.

Runway Width

Runway width design standards are primarily based on the critical aircraft, but can also be influenced by the visibility minimums of published instrument approach procedures. For Runway 2-20, RDC D-II design criteria stipulate a runway width of 100 feet. Its current runway width of 150 feet exceeds this standard. For future planning, ARC D-III design criteria calls for a width of 150 feet if the runway is served by an instrument approach with visibility minimums lower than ¾-mile. In addition, the runway is utilized regularly by commercial service aircraft, and the 150 feet of width provides added safety enhancements for these operations. As such, the existing width of Runway 2-20 should be maintained in the future.

Runway 15-33 is 100 feet wide. This width meets the design standard for RDC C-II, which stipulates 100 feet. FAA design standards call for a runway width of 100 feet to serve aircraft up to RDC C-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, future planning will consider the existing width of Runway 15-33 to be maintained at 100 feet.

Runway 10-28 is 75 feet wide, which meets the design standard width for RDC B-II. The width should be maintained for this runway through the planning period.

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA reports the pavement strength for Runways 2-20 and 15-33 at 48,000 pounds single wheel loading (SWL), 65,000 pounds dual wheel loading (DWL), and 105,000 pounds dual tandem wheel loading (DTWL). These strength ratings refer to the configuration of the aircraft landing gear. For example, SWL indicates an aircraft with a single wheel on each landing gear.

The strength rating of a runway does not preclude aircraft weighing more than the published strength rating from using the runway. 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 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, typically for 20 years.

An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published 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, typically for 20 years.

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.

The strength rating of a runway can change over time. Regular usage by heavier aircraft can decrease the strength rating, while periodic runway resurfacing can increase the strength rating. The current runway strength rating is adequate to accommodate a large majority of aircraft that operate at Santa Fe Municipal Airport; however, in the event that large business jets, such as the Gulfstream V and Global Express, operate at the airport more regularly and larger commercial service aircraft, such as the Embraer E-170 or Bombardier CRJ-700, are introduced into the operational mix at the airport, the runway should be strengthened. As such, future consideration should be given to increasing the pavement strength on Runways 2-20 and 15-33 to approximately 100,000 pounds DWL.

Runway 10-28 is strength-rated at 30,000 pounds SWL. This weight capacity is capable of handling the mix of smaller general aviation aircraft that operate at the airport and should be maintained through the long term planning period.

TAXIWAYS

The design standards associated with taxiways are determined by the Taxiway Design Group (TDG) or the Airplane Design Group (ADG) of the critical design aircraft. As determined previously, the applicable ADG for primary Runway 2-20 and crosswind Runway 15-33 is currently ADG II. Ultimate planning considers ADG III for these runways. For Runway 10-28, the applicable design is ADG II both now and in the future. **Table 3H** presents the various taxiway design standards related to ADGs II and III.

TABLE 3H
Taxiway Dimensions and Standards
Santa Fe Municipal Airport

STANDARDS BASED ON WINGSPAN	***ADG II***	***ADG III***
Taxiway Protection		
Taxiway Safety Area width (feet)	79	118
Taxiway Object Free Area width (feet)	131	186
Taxilane Object Free Area width (feet)	115	162
Taxiway Separation		
Taxiway Centerline to:		
Fixed or Movable Object (feet)	65.5	93
Parallel Taxiway/Taxilane (feet)	105	152
Taxilane Centerline to:		
Fixed or Movable Object (feet)	57.5	81
Parallel Taxilane (feet)	97	140
Wingtip Clearance		
Taxiway Wingtip Clearance (feet)	26	34
Taxilane Wingtip Clearance (feet)	18	23
STANDARDS BASED ON TDG	***TDG 2***	***TDG 3***
Taxiway Width Standard (feet)	35	50
Taxiway Edge Safety Margin (feet)	7.5	10
Taxiway Shoulder Width (feet)	10	20

ADG: Airplane Design Group
TDG: Taxiway Design Group

Source: FAA AC 150/5300-13A, Change 1, *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 Cockpit to Main Gear (CMG) distance of the critical design aircraft expected to use those taxiways. Different taxiway and taxilane pavements can and should be planned to the most appropriate TDG design standards based on usage.

The current taxiway design for all runways should be TDG 2. As such, the taxiways on the airfield should be at least 35 feet wide. Ultimate planning accounts for TDG 3. Thus, the taxiways associated with Runways 2-20 and 15-33 should be at least 50 feet to meet this standard.

The current taxiway system is composed of varying taxiway widths. The taxiways associated with Runways 2-20 and 15-33 are currently 50 feet in width and meet the standards for ultimate TDG 3 design. Those portions of Taxiway F that relate directly with Runway 10-28 are constructed to 35 feet in width and meet TDG 2 standards. As such, the current taxiway widths are sufficient to meet existing and planned aircraft TDG design criteria at Santa Fe Municipal Airport.

Taxiway Design Considerations

FAA AC 150/5300-13A, Change 1, *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 Santa Fe Municipal Airport generally provides for the efficient movement of aircraft; however, recently published AC 150/5300-13A, Change 1, *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 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 Incursions**: 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.

Analysis in the next chapter will consider improvements which could be implemented on the airfield to minimize runway incursion potential, improve efficiency, and conform to FAA standards for taxiway design. Any future taxiways planned will also take into consideration the taxiway design standards.

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 planned 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 the T-hangar.

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 an 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. Santa Fe Municipal 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 global positioning system (GPS) technology, it is now used to provide both vertical and lateral navigation for pilots.

At Santa Fe Municipal Airport, there are eight published approaches. Runway 2 is served by ILS and area navigation (RNAV) GPS approaches. Runway 20 is served by an RNAV GPS approach. RNAV GPS approaches are also available on each end of Runway 15-33 and Runway 28. Runway 33 is also served by a very high frequency omnidirectional range (VOR) approach utilizing the Santa Fe VORTAC, which is combined with a military tactical air navigation aid (TACAN). The ILS approach to Runway 2 provides for the lowest minimums with ¾-mile visibility and 200-foot cloud ceilings.

Ultimately, it would be preferable to improve the straight-in instrument approach minimums on primary Runway 2-20 to include visibility minimums down to ½-mile on Runway 2 and ¾-mile on Runway 20, which would better serve commercial and general aviation aircraft that utilize this runway. In addition, it would be preferable to implement ¾-mile visibility minimums on Runway 15-33, especially since this runway is capable of accommodating commercial service aircraft.

Analysis in the next chapter will consider improvements necessary for enhancing instrument approaches to the runway system at Santa Fe Municipal Airport. It should be noted that a sophisticated approach lighting system in the form of a medium intensity approach lighting system with runway alignment indicator lights (MALSR) would need to be implemented on a runway end in order to achieve visibility minimums lower than ¾-mile.

Analysis in the next chapter will consider improvements necessary for enhancing instrument approaches to the runway system.

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. The most common visual approach aids at airports include the visual approach slope indicator (VASI) and precision approach path indicator (PAPI). Currently, each end of Runway 2-20 and Runway 33 are served by a four-box visual approach slope indicator (VASI-4). Another visual approach aid is the pulsating/steady burning visual approach slope indicator (PSIL) system. Runway 15 has historically been served by this PSIL system; however, this system is permanently out of service. Future planning should consider a more current four-box PAPI system on Runway 15. In addition, a two-box PAPI system could be recommended for each end of Runway 10-28.

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. There are currently REIL systems on each end of Runway 15-33, Runway 20, and Runway 10. It is recommended that REILs be implemented on the ends of Runways 2 and 28.

As mentioned earlier, a proposed MALSR in conjunction with the existing localizer antenna and glide slope antenna would provide ideal approach minimums to Runway 2. This approach lighting system would enhance the overall safety at the airport, especially during inclement weather activity. In the event a MALSR would be planned for Runway 2, the REIL system would not be needed on this runway end.

Weather Reporting Aids

Santa Fe Municipal Airport has a lighted windcone and segmented circle, as well as additional supplemental windcones in various locations on the airfield. The windcones provide information to pilots regarding wind speed and direction. These should be maintained throughout the planning period.

The airport is equipped with an 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 (usually once per hour) on the airport's automated terminal information service (ATIS) or via a local telephone number (505-474-3117). Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (128.55 MHz). This system should be maintained through the planning period.

Communication Facilities

Santa Fe Municipal Airport has an operational ATCT located atop the terminal building on the east side of the airfield. The ATCT is staffed from 7:00 a.m. to 9:00 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 an airport and runway at night or in poor visibility conditions. They also assist in the ground movement of aircraft.

Airport 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 on top of the ATCT should be maintained through the planning period.

Runway and Taxiway Lighting

Runway lighting provides the pilot with positive identification of the runway and its alignment. Runways 2-20, 15-33, and 10-28 are served by medium intensity runway lighting (MIRL). Runway lighting on these three runways should be maintained through the planning period.

Medium intensity taxiway lighting (MITL) is provided on all active taxiways serving the three-runway system. This system is vital for safe and efficient ground movements and should be maintained in the future. Taxiway J, which leads to landside facilities on the northeast side of the airport, is served by elevated edge reflectors. Planning should consider MITL on future taxiways that support the runway system at Santa Fe Municipal Airport.

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 typically designed 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 2-20 is served by precision markings. This aids in accommodating the ILS approach to Runway 2 and provides enhanced identification for both ends of the primary runway at the airport. Runways 15-33 and 10-28 currently have non-precision markings. All runway markings should be maintained through the long term planning period.

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, and runway exits. All of these signs should be maintained throughout the planning period, and it is recommended that runway distance remaining signs be installed on Runways 2-20 and 15-33.

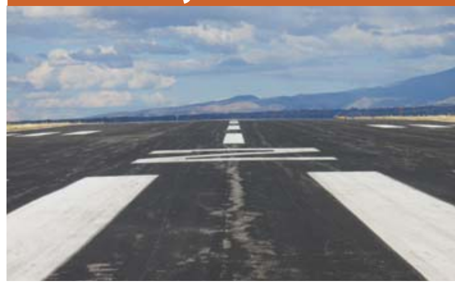
A summary of the airside facilities previously discussed at Santa Fe Municipal Airport is presented on **Exhibit 3D**.

LANDSIDE FACILITY REQUIREMENTS

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 element was examined in relation to projected demand to identify future landside facility needs. At Santa Fe Municipal Airport, this includes components for commercial service and general aviation needs such as:

RUNWAYS

Runway 2-20



AVAILABLE	FUTURE
RDC D-II-4000	RDC D-III-2400
8,366' x 150'	Examine potential to extend to at least 9,000'
48,000 lbs. SWL	Maintain
65,000 lbs. DWL	Increase to 100,000 lbs. DWL
105,000 DTWL	Maintain

Runway 15-33

AVAILABLE	FUTURE
RDC C-II-5000	RDC C-III-4000 - Improve RSA and ROFA
6,316' x 100'	Maintain
48,000 lbs. SWL	Maintain
65,000 lbs. DWL	Increase to 100,000 lbs. DWL
105,000 lbs. DTWL	Maintain

Runway 10-28

AVAILABLE	FUTURE
RDC B-II-5000	RDC B-II-5000 - Improve ROFZ and ROFA
6,301' x 75'	Maintain
30,000 lbs. SWL	Maintain

TAXIWAYS

AVAILABLE	FUTURE
All taxiways 35'-50' wide	Maintain
Parallel taxiways 400' from Runway 2-20	Maintain
Parallel taxiways at least 240' from Runway 10-28	Maintain
	Future taxiways serving Runways 2-20 and 15-33 constructed to 50' in width
	Future taxiways serving Runway 10-28 constructed to 35' in width
	Examine taxiway layout to enhance airfield safety, efficiency, and geometry

WEATHER AND COMMUNICATION AIDS

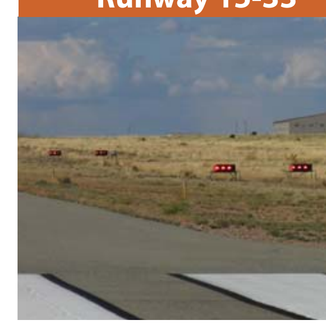
AVAILABLE	FUTURE
ILS - Runway 2	Maintain
RNAV (GPS) - Runway 21	Maintain
RNAV (GPS) - Runway 15	Maintain
RNAV (GPS) - Runway 20	Maintain
RNAV (GPS) - Runway 28	Maintain
RNAV (GPS) - Runway 33	Maintain
VOR - Runway 33	Maintain
VOR/DME-A	Maintain
	Consider improved approach visibility minimums on Runways 2-20 and 15-33
ASOS, Lighted Windcones, Segmented Circle, ATCT, CTAF, Remote Transmitter/Receiver	Maintain

LIGHTING, MARKING, AND NAVIGATIONAL AIDS

Runway 2-20

AVAILABLE	FUTURE
Precision markings	Maintain
VASI-4 - Both ends	Maintain
REILs - Runway 20	Maintain
MIRL	Maintain
Hold position markings 250'-300' from runway centerline	Hold position markings 314' from runway centerline
	Consider REILs/MALSR on Runway 2

Runway 15-33



AVAILABLE	FUTURE
Non-precision markings	Maintain
VASI-4 - Runway 33	Maintain
PSIL - Runway 15	Consider PAPI-4 on Runway 15
REILs - Both ends	Maintain
MIRL	Maintain
Hold position markings 250' from runway centerline	Hold position markings 314' from runway centerline

Runway 10-28

AVAILABLE	FUTURE
Non-precision markings	Maintain
REILs - Runway 10	Maintain
MIRL	Maintain
Hold position markings 130'-180' from runway centerline	Hold position markings 200' from runway centerline
	Consider PAPI-2 on both runway ends
	Consider REILs on Runway 28

Exhibit 3D
AIRSIDE FACILITIES SUMMARY

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- Passenger Terminal Complex
- General Aviation Terminal Facilities
- Aircraft Hangars
- Aircraft Parking Aprons
- Airport Support Facilities

PASSENGER TERMINAL COMPLEX

Components of the passenger terminal complex include the terminal building, gate positions, and apron area. This section identifies the facilities required to meet the airport's needs through the planning period.

The review of the capacity and requirements for various terminal complex functional areas was performed with guidance from FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*. Facility requirements were updated to reflect the short, intermediate, and long term planning horizons for enplanement milestones. This included the levels of 85,000, 95,000, and 120,000 annual enplaned passengers.

Airline terminal capacity and requirements were developed for the following functional areas:

- Airline ticketing and operations
- Departure facilities
- Baggage claim
- Terminal services
- Public use areas and security
- Administration/Support

Ticketing and Airline Operations

The first destination for enplaning passengers in the terminal building is usually the airline ticket counter. The ticketing area consists of the ticket counters, queuing area for passengers in line at the counters, and the ticket lobby which provides circulation.

The ticket lobby should be arranged so that the enplaning passenger has immediate access and clear visibility to the individual airline ticket counters upon entering the building. Circulation patterns should allow the option of bypassing the counters with minimum interference. Provisions for seating should be minimal to avoid congestion and to encourage passengers to proceed to the gate area. Airline ticket counter frontage, counter area, counter queuing area, ticketing lobby, and airline office and operations area requirements for each potential enplanement level have been calculated. The analysis of the airline ticketing spaces indicates that additional space should be considered both now and in the future in order to accommodate these types of activities, as shown on **Exhibit 3E**.

Departure Gates and Hold Rooms

Ground level loading and unloading of passengers is appropriate for Santa Fe Municipal Airport as regional jet aircraft are forecast to be the aircraft type serving the airport. Currently, there is a single

	Available	Current Need	Short Term	Intermediate Term	Long Term
Annual Enplanement Horizon		75,000	85,000	95,000	120,000
Airline Operations/Ticketing					
Counter Area (s.f.)	150	180	240	240	240
Ticket Queue (s.f.)	350	360	480	480	480
Airline Operations/Makeup (s.f.)	1,100	1,620	1,900	2,050	2,200
Subtotal (s.f.)	**1,600**	**2,160**	**2,620**	**2,770**	**2,920**
Counter Frontage (l.f.)	40	50	50	60	70
Security Spaces					
Checkpoint/Queue Area (s.f.)	600	1,000	1,500	1,800	2,500
Office Space (s.f.)	--	400	400	400	400
Subtotal (s.f.)	**600**	**1,400**	**1,900**	**2,200**	**2,900**
Departure Facilities					
Holdroom Area (s.f.)	**620**	**2,000**	**2,300**	**2,500**	**3,000**
Baggage Claim					
Makeup and Handling (s.f.)	--	500	600	700	900
Claim Lobby Area (s.f.)	350	1,700	2,000	2,200	2,600
Subtotal (s.f.)	**350**	**2,200**	**2,600**	**2,900**	**3,500**
Rental Car Counters					
Counter Office Area (s.f.)	510	600	640	680	720
Counter Queue Area (s.f.)	120	180	200	210	230
Subtotal (s.f.)	**630**	**780**	**840**	**890**	**950**
Food and Beverage Concessions					
Total Concessions (s.f.)	**2,200**	**2,600**	**3,100**	**3,400**	**3,900**
Public Waiting Lobby					
Lobby Area (s.f.)	**300**	**900**	**1,100**	**1,200**	**1,400**
Restrooms					
Men's/Women's Restrooms (s.f.)	**600**	**600**	**650**	**700**	**900**
Administration Offices					
Administration Space (s.f.)	**700**	**700**	**750**	**800**	**900**
Internal Facilities					
Circulation/Building Support (s.f.)	**2,100**	**5,300**	**6,400**	**6,800**	**7,700**
Total Terminal Building Space (s.f.)	**9,700**	**18,640**	**22,260**	**24,160**	**28,070**

Exhibit 3E: PASSENGER TERMINAL FACILITIES SUMMARY

departure gate in the terminal building. Achieving the forecast enplanement levels leads to the possibility of a need for a second departure gate. Without a second gate, airline schedules may need to be coordinated to avoid two arriving or departing aircraft at the same time.

Analysis indicates that overcrowding in the existing 600-square-foot hold room area is currently being realized.

The number of gates required to accommodate the combined peak hour activity and the aircraft seating capacities determine secure passenger hold room capacity requirements. Hold rooms should be sized to provide adequate space and area for the largest group of people that can use each gate. Analysis indicates that overcrowding in the existing 600-square-foot hold room area is currently being realized. The entrance of commercial aircraft capable of seating more than 50 passengers would likely trigger the need for even more hold room area.

The aircraft parking apron adjacent to the terminal is designed to accommodate two commercial service aircraft comfortably. This space should be adequate to accommodate existing and future demands.

Baggage Claim

The passenger arrival process consists primarily of those facilities and functions that reunite the arriving passengers with their checked baggage. The baggage claim facility needs for each planning horizon are included on **Exhibit 3E**. The existing baggage claim area is limited and forecasts call for a significant increase in the size of the current baggage claim handling and lobby/pick-up area through the long term. This projection is based on serving two flights at the same time.

Terminal Services

Similar to airline ticketing, rental car counter facilities include office, counter area, and queue areas. There is one identified counter for rental car services. Approximately 600 square feet of rental car area is available. The current space is likely undersized and additional space should be planned through the planning period to meet enplanement projections.

As shown on **Exhibit 3E**, there is approximately 2,200 square feet dedicated to food and beverage services in the terminal building that includes a restaurant and small vending area. Additional space for food and beverage should be planned through the long term that could accommodate an increase in passenger enplanements as well as the general public. Existing public restroom space should be adequate currently, but thought could be given to providing additional space for the general public, as well as bathroom space in the hold room area for departing passengers once they go through security.

Public-Use Area and Security Screening

The public lobby is where passengers or visitors may comfortably relax while waiting for arrivals or departures. In today's environment, visitors must remain out of the secure departure areas, so a public lobby is important. The terminal building provides a limited amount of space for this purpose. Additional space should be considered during the planning period to accommodate this activity.

Current security screening is positioned adjacent to the entrance to the departure passenger hold room in the terminal building. There is currently one security checkpoint, which should be adequate through the long term planning horizon. The space available in the existing security areas, however, is not fully sufficient to efficiently process passengers both currently as well as into the long term horizon milestone. Obviously, this analysis reflects the possibility of overlapping departures, which would generate a high traffic volume in a short period of time. If future operations are spaced out to where there are not simultaneous departures, the current space would still be undersized but more manageable.

The space available in the existing security areas, however, is not fully sufficient to efficiently process passengers both currently as well as into the long term horizon milestone.

Building Support and Administration

Building support facilities include all miscellaneous spaces at the airport, including mechanical, telephone, business centers, walls/structures, and general circulation. As other components of the airport increase in size, so will supporting spaces.

The administrative offices are separate from the passenger service areas in the terminal building. These offices include space for airport and airline management and operations personnel. Heating, ventilating, and air conditioning (HVAC) mechanical spaces are provided, but may be undersized to meet demands on the facility. As enplanement levels increase, stresses could be placed on the building, necessitating expansion of HVAC facilities.

Terminal Building Requirements Summary

As presented in **Exhibit 3E**, most all of the considerations for the terminal building appear to be undersized for existing and projected passenger service demand. The terminal building was constructed and sized to accommodate smaller commercial service aircraft, such as the 19-seat Beech 1900. With the introduction of 50-seat regional jet service at Santa Fe Municipal Airport, additional needs have been placed on the facility. Projected enplanement levels show a need for

The existing terminal provides approximately one-half the space needed to adequately serve the airport's current passenger enplanement levels.

additional terminal building space to better support several elements, such as airline operations, security, departure holding areas, baggage claim, and other support facilities, such as rental cars and concessions. In fact, it is estimated that the existing terminal provides approximately one-half the space needed to adequately serve the airport's current passenger enplanement levels. Analysis to be presented in the next chapter of this study will address possible solutions to these terminal building deficiencies.

Terminal Access Roadway

The capacity of the airport access and terminal area roadways is the maximum number of vehicles that can pass over a given section of a lane or roadway during a given time period. It is normally preferred that a roadway operate below capacity to provide reasonable flow and minimize delay to the vehicles using it. Access to the terminal building is provided by Aviation Drive which makes a loop road leading to the terminal building curb.

Terminal Curb Frontage and Vehicle Parking

The curb element is the interface between the terminal building and the ground transportation system. The length of curb required for the loading and unloading of passengers and baggage is determined by the type and volume of ground vehicles anticipated in the peak period on the design day.

A typical problem for terminal curb capacity is the length of dwell time for vehicles utilizing the curb. At airports where the curb front has not been strictly patrolled, vehicles have been known to be parked at the curb while the driver and/or riders are inside the terminal checking in, greeting arriving passengers, or awaiting baggage pick-up. Since most curbs are not designed for vehicles to remain curbside for more than two to three minutes, capacity problems can ensue. Since the events of September 11, 2001, most airports police the curb front much more strictly for security reasons. This alone has reduced the curb front capacity problems at most airports.

At Santa Fe Municipal Airport, the terminal roadway provides one lane for loading and unloading of passengers. The curb frontage totals approximately 100 feet in length, connected to the entrance road in a loop configuration, and is used by both enplaning and deplaning passengers. As presented in **Table 3J**, curb lengths should be increased through the planning period to better accommodate projected passenger demand.

Vehicle parking in the airline passenger terminal area of the airport includes those spaces utilized by passengers, visitors, and employees of the airline terminal facilities. Parking spaces are classified as public and rental car.

Public parking is located in surface lots in the terminal area. This parking area currently contains approximately 205 spaces for public parking and 30 marked spaces for rental cars. It should be noted that the public parking spaces can be utilized by general aviation activities associated with the fixed base operators (FBOs) in close proximity to the passenger terminal complex. This even further constrains the existing vehicle parking needs at the airport. It should be noted, however, that additional parking is available in unpaved areas east of the existing paved parking lots. Future consideration will be given to providing additional vehicle parking areas to support the passenger terminal area.

TABLE 3J
Airline Terminal Vehicle Requirements
Santa Fe Municipal Airport

	Existing	Short Term	Intermediate Term	Long Term
Terminal Curb				
Enplane Curb (ft)	--	111	122	143
Deplane Curb (ft)	--	127	139	163
Total Curb (ft)	100	239	261	300
Auto Parking				
Total Public Parking	205	347	387	476
Rental car	30	102	114	144
Total All Parking	**235**	**449**	**501**	**620**

Rental car parking needs depend upon the operational requirements of the rental car agencies. If available, the rental car companies will utilize extra spaces for storage. Analysis indicates that additional rental car parking spaces are needed through the planning period. As a result, this study will also consider rental car parking needs in the alternatives analysis.

GENERAL AVIATION TERMINAL FACILITIES

The general aviation facilities at the 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, pilots' lounge, pilot flight planning, concessions, management, storage, and various other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by FBOs and other specialty operators for these functions and services. At Santa Fe Municipal Airport, general aviation terminal services are primarily provided by the two FBOs located adjacent to the terminal area.

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 and recreational operations through the long term. These operations often support larger turboprop and jet aircraft which accommodate an increasing passenger load factor. Such is the case at Santa Fe Municipal Airport, as the facility experiences a significant amount of itinerant aircraft activity and is expected to do so through the planning period of this study.

Table 3K outlines the space requirements for general aviation terminal services at Santa Fe Municipal Airport through the long term planning period. As shown in the table, up to 6,700 square feet of space could be needed in the long term for general aviation passengers. The amount of space planned to be offered by the two FBOs on the airfield is approximately 9,000 square feet. This is pending completion of a new terminal facility to be constructed by Jet Center at Santa Fe, in addition to the existing terminal facility offered by Landmark Aviation. These spaces include designated areas for passenger waiting lobbies, flight planning, pilots' lounges, restroom facilities, and other amenities.

TABLE 3K
General Aviation Terminal Area Facilities
Santa Fe Municipal Airport

	Currently Available	Short Term Need	Intermediate Term	Long Term Need
General Aviation Services Facility Area (s.f.)	9,000*	5,100	5,800	6,700
Design Hour Passengers	38	41	46	54
Passenger Multiplier	2.5	2.6	2.8	3.0
Vehicle Parking Spaces	280**	149	166	196

*Includes approximate space to be offered by FBOs (Landmark Aviation and Jet Center at Santa Fe)
**Approximate number of marked vehicle parking spaces at the airport that accommodate commercial service and general aviation activities
Source: Coffman Associates analysis

General aviation vehicular parking demands have also been determined for Santa Fe Municipal 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 approximately 150 spaces in the short term, increasing to approximately 200 spaces in the long term planning horizon. It is estimated that there are 280 marked vehicle parking spaces at Santa Fe Municipal Airport currently serving various airport activities, including commercial passenger terminal services, the FBOs, rental car parking, and other aviation functions. Furthermore, additional unmarked parking serving the terminal area, as well as more remote locations adjacent to landside hangar facilities, is located on the airport. As previously detailed, future consideration in the Master Plan will be given to providing more vehicle parking in order to provide adequate space for commercial passenger service and general aviation activities.

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 an 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.

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 Santa Fe Municipal Airport, it is estimated that approximately 20 percent of 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. There is an estimated 144,700 square feet of storage space at the airport comprised of T-hangars and linear box hangars. 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 Santa Fe Municipal Airport is estimated at 30,600 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 173,500 square feet of space at Santa Fe Municipal Airport. For future planning needs, 2,500 square feet per aircraft is utilized for conventional hangars.

In total, there is approximately 348,800 square feet of hangar, maintenance, and office space provided on the airport for general aviation activities. It should be noted that the New Mexico Army National Guard provides a large amount of hangar space that is used specifically for its operational activities and, as a result, was not factored into this analysis.

Future hangar requirements for the airport are summarized in **Table 3L**. 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 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 3L
Aircraft Hangar Requirements
Santa Fe Municipal Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
Total Based Aircraft	181	195	210	235
Aircraft To Be Hangared	150	166	183	212
Hangar Area Requirements				
T-Hangar/Linear Box Hangar Area (s.f.)	144,700	148,500	161,500	183,000
Executive Hangar Area (s.f.)	30,600	48,000	65,000	85,000
Conventional Hangar Area (s.f.)	173,500	159,000	182,000	201,000
Maintenance Area (s.f.)		29,000	31,500	35,500
Total Hangar Area (s.f.)	**348,800***	**384,500**	**440,000**	**504,500**

Note: *Includes total hangar and maintenance area currently at the airport
Source: Coffman Associates analysis

The analysis shows that future hangar requirements indicate that there is a potential need for over 500,000 square feet of hangar storage space to be offered through the long term planning period. This includes a mixture of hangar and maintenance areas. 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. Furthermore, the advanced age of some storage hangars at Santa Fe Municipal Airport could further necessitate the need for additional hangar development through the long term planning horizon. It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types.

The advanced age of some storage hangars at Santa Fe Municipal Airport could further necessitate the need for additional hangar development through the long term planning horizon.

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 facilities. 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 Santa Fe Municipal Airport includes parking aprons adjacent to the FBO facilities, as well as additional apron space for the parking and circulation of aircraft. The parking apron located immediately adjacent to the passenger terminal building is utilized for commercial service aircraft operations.

The total aircraft parking apron area dedicated for general aviation activities at Santa Fe Municipal Airport is approximately 142,100 square yards and includes those spaces on the east side of the airfield. 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 25 spaces are identified for maintenance activities. Maintenance activities 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 3M**. Currently, there are approximately 167 marked positions available for based and itinerant aircraft at Santa Fe Municipal Airport on the east side of the airport. A large majority of these positions are for small single and multi-engine aircraft. As shown in the table, it appears that there are adequate marked tiedown positions and apron space available through the planning period of this study. It should be noted that the airport does experience higher volumes of traffic associated with area-wide special events that often requires additional parking apron space for these peak period activities. As a result, future facility planning will consider the potential for additional parking apron space to accommodate the mix of aviation activity that occurs at the airport.

In addition to fixed-wing aircraft parking, areas should also be dedicated for helicopter parking. Helicopters also operate on various apron areas shared by fixed-wing aircraft at Santa Fe Municipal 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 activity areas at the airport.

A summary of the general aviation landside facilities previously discussed at Santa Fe Municipal Airport is presented on **Exhibit 3F**.

GENERAL AVIATION TERMINAL SERVICES

	Available	Short Term	Intermediate Term	Long Term
General Aviation Services Facility Area (s.f.)	9,000*	5,100	5,800	6,700
Vehicle Parking Spaces	280**	149	166	196

AIRCRAFT STORAGE HANGAR REQUIREMENTS

	Available	Short Term	Intermediate Term	Long Term
Aircraft to be Hangared	150	166	183	212
T-Hangar/Linear Box Hangar (s.f.)	144,700***	148,500	161,500	183,000
Executive Hangar (s.f.)	30,600***	48,000	65,000	85,000
Conventional Hangar (s.f.)	173,500***	159,000	182,000	201,000
Maintenance Area (s.f.)	---	29,000	31,500	35,500
Total Hangar Area (s.f.)	**348,800*** **	**384,500**	**440,000**	**504,500**

AIRCRAFT PARKING APRON REQUIREMENTS

	Available	Short Term	Intermediate Term	Long Term
Transient Single and Multi-Engine Aircraft Positions	---	16	19	22
Apron Area (s.y.)	---	12,400	15,100	17,500
Transient Turboprop / Jet Positions	---	16	19	23
Apron Area (s.y.)	---	24,800	30,300	37,000
Locally-Based Aircraft Positions	---	54	52	48
Apron Area (s.y.)	---	19,400	18,700	17,300
Total Marked Positions	**167**	**85**	**90**	**93**
Total Apron Area (s.y.)	**142,100**	**56,600**	**64,100**	**71,800**

SUPPORT FACILITIES

	Available	Short Term	Intermediate Term	Long Term
Fuel Storage - 100LL Fuel Storage - JetA	28,250 gallons 68,000 gallons	Based on Fixed Base Operator aircraft demand.		
	ARFF - Index A	ARFF - Index B	ARFF - Index B	ARFF - Index B
	Security Fencing / Gates	Maintain	Maintain	Maintain
	Airport Maintenance Facilities	Consider adequate space for staging and storing equipment and supplies		

*Includes approximate space to be offered by FBOs (Landmark Aviation and Jet Center at Santa Fe)
**Estimated marked vehicle parking spaces at the airport that accommodate commercial service and general aviation activities
***Includes estimated hangar, maintenance, and office space at Santa Fe Municipal Airport

Exhibit 3F
LANDSIDE FACILITIES SUMMARY

TABLE 3M Aircraft Parking Apron Requirements Santa Fe Municipal Airport	Available	Short Term	Intermediate Term	Long Term
Single, Multi-engine				
Transient Aircraft Positions		16	19	22
Apron Area (s.y.)		12,400	15,100	17,500
Transient Business Jet Positions		16	19	23
Apron Area (s.y.)		24,800	30,300	37,000
Locally-Based Aircraft Positions		54*	52*	48*
Apron Area (s.y.)		19,400	18,700	17,300
Total Positions	167	85	90	93
Total Apron Area (s.y.)	142,100	56,600	64,100	71,800
*Factors an additional 25 positions for aircraft maintenance				
Source: Coffman Associates analysis				

AIRPORT SUPPORT FACILITIES

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

- Aircraft Rescue and Firefighting (ARFF)
- Aviation Fuel Storage
- Maintenance Facilities
- Perimeter Fencing and Gates

Aircraft Rescue and Firefighting

Requirements for aircraft rescue and firefighting (ARFF) services at an airport are established under Title 14 CFR Part 139, which applies to the certification and operation of airports served by any scheduled or unscheduled passenger operation of an air carrier using an aircraft with nine or more passenger seats. Paragraph 139.315 establishes ARFF Index ratings based on the length of the largest aircraft with an average of five or more daily departures.

The following indicates the requirements for each ARFF Index and the associated equipment requirements:

Index A - Includes aircraft less than 90 feet in length (Saab 340, Embraer ERJ-135).

Index B - Includes aircraft at least 90 feet but less than 126 feet in length (Embraer ERJ-145, Boeing 737).

Index C - Includes aircraft at least 126 feet but less than 159 feet in length (MD-83, Boeing 757).

Index D - Includes aircraft at least 159 feet but less than 200 feet in length (Boeing 767).

Index E - Includes aircraft at least 200 feet in length (Boeing 747).

The Santa Fe Municipal Airport ARFF facility must currently provide Index A for airline service according to the Airport Certification Manual. Based upon future commercial service forecasts, Index B should be applicable through the long term planning period as the airport is expected to accommodate daily departures with aircraft between 90 feet and 126 feet in length. **Table 3N** presents the vehicle requirements and capacities for each index level. The existing ARFF facility is located approximately 500 feet south of the intersection of Runway 10-28 and Taxiway C in the southeast area of the airport. This location provides good access to the airfield system.

TABLE 3N
ARFF Index Requirements

Index	Aircraft Length	Requirements
Index A	<90'	1. One ARFF vehicle with 500 lbs. of sodium-based dry chemical or 2. One vehicle with 450 lbs. of potassium-based dry chemical and 100 lbs. of water and AFFF for simultaneous water and foam application
Index B	90'-126'	1. One vehicle with 500 lbs. of sodium-based dry chemical and 1,500 gallons of water and AFFF or 2. Two vehicles, one with the requirements for Index A and the other with enough water and AFFF for a total quantity of 1,500 gallons
Index C	126'-159'	1. Three vehicles, one having Index A, and two with enough water and AFFF for all three vehicles to combine for at least 3,000 gallons of agent or 2. Two vehicles, one with Index B and one with enough water and AFFF for both vehicles to total 3,000 gallons
Index D	159'-200'	1. One vehicle carrying agents required for Index A and 2. Two vehicles carrying enough water and AFFF for a total quantity by the three vehicles of at least 4,000 gallons
Index E	>200'	1. One vehicle with Index A and 2. Two vehicles with enough water and AFFF for a total quantity of the three vehicles of 6,000 gallons

AFFF: Aqueous Film-Forming Foam
ARFF: Aircraft Rescue and Firefighting
Source: Title 14 Code of Federal Regulations Part 139

Aviation Fuel Storage

As previously discussed in Chapter One, there are currently four fuel farms located on airport property that store aviation fuel. One of these fuel farms is owned and operated by the airport's on-demand air ambulance operator and utilized for the sole purpose of providing fuel to the company's helicopter operations and is not associated with the re-sale of fuel for commercial aviation activities. Fuel trucks operated by the FBOs on the airfield are also capable of handling additional fuel storage.

As presented in **Table 3P**, there is 96,250 gallons of fuel storage capacity on airport property utilized for the re-sale of fuel for commercial aviation activities. Approximately 70 percent of the storage capacity is dedicated to Jet A fuel. It should be noted that an additional 20,000 gallons of Jet A fuel storage capacity is being planned for one of the FBOs at the airport.

TABLE 3P
On-Airport Fuel Storage Capacity
Santa Fe Municipal Airport

	Tank Storage Capacity (gallons)	Truck Storage Capacity (gallons)	Total Storage Capacity (gallons)
100LL	25,000	3,250	28,250
Jet A	48,000	20,000	68,000

Source: Airport records

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 fueling 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.

Maintenance Facilities

Airport maintenance facilities are located in two separate facilities that make up one larger complex in the southeast area of the airport, adjacent to the ARFF facility. A maintenance yard is also included adjacent to these facilities that provides for the outside storage of airport equipment. The airport owns and operates a significant amount of equipment, including snow removal equipment (SRE) and other support vehicles needed to maintain the airfield during winter weather conditions. Future planning will consider the expansion of airport maintenance facilities in the southeast area of the airport to provide for adequate staging and storing of airfield equipment and supplies.

Perimeter Fencing and 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.

Santa Fe Municipal Airport's perimeter is enclosed with six-foot tall chain-link fence topped by three-strand barbed-wire. Several controlled-access and manual gates associated with the fencing lead to different areas on the airfield.

SUMMARY

This chapter has outlined the safety design standards and facilities required to meet potential aviation demand projected at Santa Fe Municipal 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 five-year timeframe, the intermediate term is approximately ten 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 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.