REDDING REGIONAL AIRPORT

Chapter Three

Facility Requirements

To properly plan for the future of Redding Regional Airport (RDD), it is necessary to identify specific types and quantities of facilities required or desired to adequately serve the airport over the next 20 years. Facilities are broadly classified as airside (i.e., runways, taxiways, navigational aids, marking, and lighting) and landside (i.e., hangars, aircraft parking apron, and automobile parking). There are four primary sources from which to examine and determine facility requirements:

- **Aviation Demand Forecasts:** The forecasts of aviation demand developed in the previous chapter serve as data inputs to various models – which have been constructed following Federal Aviation Administration (FAA) guidance – in order to generate facility needs.
- **Design Standards Review:** Various design standards that apply to the airport are reviewed, as they can change based on modifications to FAA guidance or activity changes at the airport. Design standards primarily relate to the imaginary safety-related surfaces and separation distances.
- **Facility Maintenance:** Airports are required to maintain their pavement surfaces for the useful life of those pavements. The pavements require routine maintenance and occasionally must be rehabilitated or reconstructed. This category includes maintenance of airport structures and landside facilities.
- **Support Facilities:** This category includes all airport-related facilities that do not naturally fall into the airside and landside categories, including elements such as fuel facilities, access and circulation, and general on-airport land use.

The objective of this effort is to identify the adequacy of existing airport facilities and outline what new facilities may be needed, as well as when these may be needed to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated in the next chapter.

The facility requirements at Redding Regional Airport were evaluated using guidance contained in several FAA publications, including the following:

- Advisory Circular (AC) 150/5300-13B, *Airport Design*
- AC 150/5060-5, *Airport Capacity and Delay*
- AC 150/5325-4B, *Runway Length Requirements for Airport Design*
- AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*
- Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*
- FAA Order 5090.5, *Formulation of the National Plan of Integrated Airport Systems (NPIAS) and Airports Capital Improvement Plan (ACIP)*

PLANNING HORIZONS

An updated set of aviation demand forecasts for the airport has been established and a summary of the primary forecasting elements was presented previously on Exhibit 2J. These activity forecasts include annual operations, based aircraft, fleet mix, and enplanements. With this information, specific components of the airfield and landside systems can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, efficient, and orderly development of an airport should rely more on actual demand at an airport than on 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 have been established that take into consideration the reasonable range of aviation demand projections. The planning horizons presented in **Table 3A** are segmented as the short term (approximately years 1-5), the intermediate term (approximately years 6-10), and the long term (years 11-20 and possibly beyond).

It is important to consider that actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand. It is important for the plan to accommodate these changes so that airport officials can respond to unexpected changes in a timely fashion.

The most important reason for utilizing milestones is that doing so allows airport management the flexibility to make decisions and develop facilities according to needs generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program.

TABLE 3A | Planning Activity Levels

		PLANNING HORIZON		
	Base Year 2022	Short Term	Intermediate Term	Long Term
Enplanements	100,890	139,402	148,602	154,500
Itinerant Operations				
Air Carrier (>59 Seats)	1,860	2,748	3,190	2,728
Commuter (<60 Seats)	2,044	1,123	0	0
Air Cargo	2,235	2,841	3,430	4,850
Other Air Taxi	16,304	18,694	21,712	25,803
General Aviation	17,100	19,101	21,234	26,242
Military	548	549	549	549
Total Itinerant Operations	**40,091**	**45,056**	**50,115**	**60,172**
Local Operations				
General Aviation	21,951	24,311	27,026	33,400
Military	345	298	298	298
Total Local Operations	**22,296**	**24,609**	**27,324**	**33,698**
Total Annual Operations	**62,387**	**69,665**	**77,439**	**93,870**
Based Aircraft	**240**	**249**	**262**	**290**

Source: Coffman Associates analysis

AIRFIELD CAPACITY

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 operations near or surpass the ASV, delay factors increase exponentially. Guidance on calculating ASV is found in FAA AC 150/5060-5, *Airport Capacity and Delay*.

FACTORS AFFECTING ANNUAL SERVICE VOLUME (ASV)

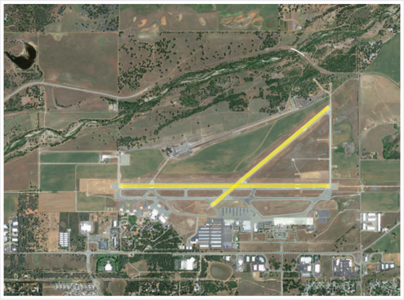
Many factors are considered in the calculation of an airport's ASV, including airfield characteristics, meteorological conditions, aircraft mix, and demand characteristics (aircraft operations). These factors are described below and in **Exhibit 3A**.

Airfield Characteristics

The layout of runways and taxiways directly affects an airfield's ASV. This includes the orientation of the runway and the percentage of time that the runway is in use. Additional airfield characteristics include the length, width, load-bearing strength, and instrument approach capability of each runway at an airport, all of which determine the type(s) of aircraft that may operate on the runway, as well as if operations can occur during poor weather conditions.

AIRFIELD LAYOUT

Runway Configuration



Runway Use

Number of Exits

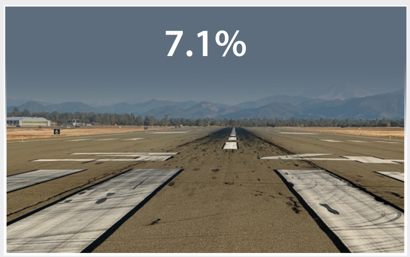
WEATHER CONDITIONS

VMC (VFR)

Visual Meteorological Conditions

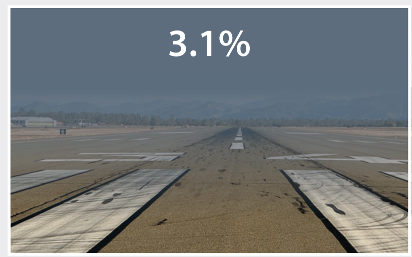
IMC (IFR)

Instrument Meteorological Conditions



PVC

Poor Visibility Conditions



AIRCRAFT MIX

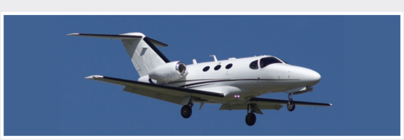
Category A & B Aircraft

Category C Aircraft

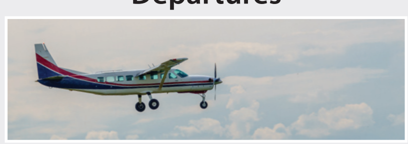
Category D Aircraft

OPERATIONS

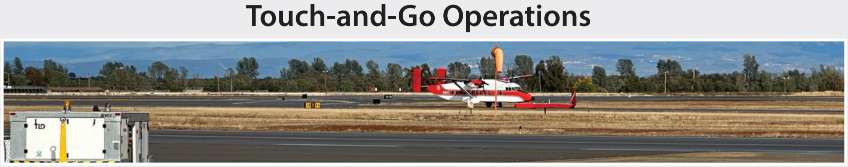
Arrivals



Departures



Touch-and-Go Operations



Total Annual Operations

Exhibit 3A
AIRFIELD CAPACITY FACTORS

- **Runway Configuration –** The existing runway configuration at RDD consists of primary Runway 16-34 and additional Runway 12-30, which is a crossing runway.

- **Meteorological Conditions –** Weather conditions have a significant effect on airfield capacity. Airfield 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. The increased distance between aircraft reduces the number of aircraft that can operate at the airport during any given period; consequently, this reduces overall airfield capacity.

  There are three categories of meteorological conditions, each defined by the reported cloud ceiling and flight visibility. Visual flight rule (VFR) conditions exist whenever the cloud ceiling is greater than 1,000 feet above ground level and visibility is greater than three statute miles. VFR flight conditions permit pilots to approach, land, or take off by visual reference, and to see and avoid other aircraft.

  Instrument flight rule (IFR) conditions exist when the reported cloud ceiling is less than 1,000 feet above ground level and/or visibility is less than three statute miles. Under IFR conditions, pilots must rely on instruments for navigation and guidance to the runway. Safe separations between aircraft must be ensured by following air traffic control rules and procedures. This leads to increased distances between aircraft, which diminishes airfield capacity.

  Poor visibility conditions (PVC) exist when cloud ceilings are less than 500 feet above ground level or visibility is less than one mile.

  RDD has an on-field automated surface observing system (ASOS). According to the last 10 years of data retrieved from the ASOS weather station, VFR conditions have been in effect 89.8 percent of the time, IFR conditions have been in effect 7.1 percent of the time, and PVC conditions have been in effect 3.1 percent of the time. **Table 3B** summarizes the annualized meteorological conditions at RDD.

TABLE 3B | Meteorological Conditions

Condition	CRITERIA		RDD ASOS			
	Cloud Ceiling	Visibility	Time (minutes)	Percent	Observations	Percent
VFR	1,000' and greater	3-miles and greater	4,168,906	95.84%	92,881	89.75%
IFR	<1,000' and >/= 500' or	<3-miles and >/= 1-mile	129,513	2.98%	7,380	7.13%
PVC	Less than 500' or	Less than 1-mile	51,426	1.18%	3,227	3.12%
Total			**4,349,845**	**100%**	**111,263**	**100%**

ASOS: automated surface observing system
VFR: visual flight rules
IFR: instrument flight rules
PVC: poor visibility conditions

Source: ASOS data from January 1, 2014 - December 31, 2023

- **Instrument Approach Procedures –** The instrument approach capabilities of a runway factor into the airfield capacity determination. The lower the cloud ceiling minimums and visibility minimums, the more capable a runway is, thus resulting in greater airfield capacity. Runway 34 has an instrument landing system (ILS) instrument approach with a 200-foot cloud ceiling height minimum. Runway 16 has a global positioning system (GPS) approach with a 250-foot cloud ceiling height minimum and ¾-mile visibility minimums. Runway 12-30 is available for visual approaches only.

- **Runway Use –** Runway use is normally dictated by wind conditions. The direction of takeoffs and landings is generally determined by the speed and direction of wind. It is generally safest for aircraft to depart and land into the wind, avoiding a crosswind or tailwind component during these operations. Prevailing winds favor the use of Runway 16-34 in all-weather conditions and account for an estimated 95 percent of total operations.

  When runways are not dimensioned equally, their use by aircraft operating at the facility may vary. Some runways may be able to accommodate the entire fleet mix operating at the facility and other runways may only be sufficient for smaller aircraft.

  Airfield capacity is directly affected by the runways in use. Ideally, maximum runway capacity would be achieved if both runways were able to accommodate the entire mix of aircraft. Since certain aircraft operations are restricted to specific runway configurations, the capacity of the existing runway system is lower than if there were no use restrictions. Runway 16-34 is designed to accommodate the entire fleet mix currently operating at the airport; however, Runway 12-30 is somewhat limited to medium and small general aviation (GA) aircraft due to its length.

  In general, airplanes will take off and land facing into the prevailing wind direction. If the wind is coming from the north, the airport will use north flow, and if the wind is from the south, the airport will use south flow. Runway 16-34 accounts for more than 95 percent of operations.

- **Exit Taxiways –** Exit taxiways have a significant impact on airfield capacity because the number and location of exits directly determine the occupancy time of an aircraft on the runway. Based on the aircraft mix using the airport, taxiways located between 2,000 and 4,000 feet from the landing threshold and separated by at least 750 feet are factored in the exit rating for the airfield. The greater the number of appropriately spaced taxiway exits, the lower the runway occupancy time is for an aircraft, which contributes to a higher overall capacity for the airfield. For capacity analysis, RDD qualifies for the maximum benefit for exit taxiways.

- **Aircraft Mix –** Aircraft mix refers to the speed, size, and flight characteristics of aircraft operating at the airport. As the mix of aircraft operating at an airport increases to include larger aircraft, airfield capacity begins to diminish. This is due to larger separation distances that must be maintained between aircraft of different speeds and sizes.

Aircraft mix for the capacity analysis is defined by the FAA in terms of four aircraft classes, only three of which are reflected in the mix at RDD. Classes A and B consist of single- and multi-engine aircraft weighing less than 12,500 pounds. Aircraft within these classifications are primarily associated with GA operations, but this classification also includes some air taxi aircraft. Class C consists of aircraft weighing over 12,500 pounds but not exceeding 300,000 pounds. Class D aircraft are those over 300,000 pounds, which do not operate at the airport and thus are not included in the aircraft mix calculation.

For the capacity analysis, the percentage of Class C aircraft operating at the airport impacts the ASV, as these classes include the larger and faster aircraft in the operational mix. The existing and projected operational fleet mix was previously shown in Table 2PP, which showed that more activity by larger business jets and turboprops is anticipated. By the long-term planning period, activity by aircraft weighing more than 12,500 pounds is estimated to represent 21.90 percent of overall operations. In the capacity model, capacity begins to be constrained when operations by aircraft in Class C exceed 20 percent. **Table 3C** summarizes the aircraft operational fleet mix, as classified for the capacity model.

TABLE 3C | Aircraft Operational Fleet Mix

Weather	Term	A & B[1]	C[2]
VFR (Visual)	Existing	85.40%	14.60%
	Short Term	82.60%	17.40%
	Intermediate Term	80.60%	19.40%
	Long Term	78.10%	21.90%
IFR (Instrument)	Existing / Future	30.00%	70.00%

[1] Aircraft 12,500 lbs. or less
[2] Aircraft greater than 12,500 lbs. and less than 300,000 lbs.

Source: Coffman Associates analysis using FAA AC 150/5060-5, Airport Capacity and Delay

Demand Characteristics

Operations – not only the total number of annual operations, but also the way in which they are conducted – have an influence on airfield capacity. Peak operational periods, touch-and-go operations, and the percentage of arrivals impact the number of annual operations that can be conducted at the airport.

- **Peak Period Operations –** For the airfield capacity analysis, average daily operations during the peak month are determined based on airport traffic control tower (ATCT) data**.** Typical operational 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. The design day of 239 operations is utilized for 2022. By 2042, the design day is estimated to be 359 operations.

- **Touch-and-Go Operations –** 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. Touch-and-go activity is counted as two operations because both an arrival and a departure are involved. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and one takeoff occur within a shorter time period than individual operations. These operations are normally associated with GA training operations and are included in local operations data. Touch-and-go operations at the airport have historically averaged approximately 36 percent of total annual operations.

- **Percent Arrivals –** Under most circumstances, a lower percentage of arrivals correlates to a higher capacity. Except in unique circumstances, the aircraft arrival/departure split is typically 50/50.

ESTIMATION OF ANNUAL SERVICE VOLUME

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

Table 3D shows the calculation of the ASV, which is C (x) D (x) H. Following this formula, the current airfield capacity is estimated at 210,000 annual operations. With the increase of operations projected over time and the increasing number of operations by larger aircraft (requiring greater separation distances on landing), the ultimate ASV is estimated at 208,000 annual operations.

TABLE 3D | Annual Service Volume Calculation

ASV Calculation Input	2022	Short Term	Intermediate Term	Long Term
C = Weighted hourly capacity	91	91	89	88
D = Ratio of annual demand to average daily demand during the peak month	62,387 annual operations/239 design day operations = 261	69,665 annual operations/267 design day operations = 261	77,439 annual operations/ 296 design day operations = 261	93,870 annual operations/359 design day operations = 261
H = Ratio of average daily demand to peak hour demand during the peak month	239 design day operations/51 design hour operations = 4.69	267 design day operations/57 design hour operations = 4.68	296 design day operations/63 design hour operations = 4.70	359 design day operations/77 design hour operations = 4.66
Annual Service Volume = C x D x H	**210,000**	**210,000**	**209,000**	**208,000**

Note: ASV is rounded to the nearest 1,000 and C/D/H ratios are fractions.

Delay

As the number of aircraft operations approaches the airfield's capacity, increasing amounts of delay begin to occur for arriving and departing aircraft in all-weather conditions. Arriving aircraft delays result in aircraft holding outside the airport traffic area, while departing aircraft delays result in aircraft holding at the runway end until they can safely take off.

Currently, total annual delay at the airport is estimated at 250 hours annually (0.24 minutes per aircraft) (reference Figure 2.2, FAA AC 150/5060-5). If no capacity improvements are made, total annual delay can be expected to reach 845 hours (0.54 minutes per aircraft) by the long-term planning horizon. At times, delays five to 10 times the average could be experienced by individual aircraft.

Conclusion

Table 3E provides a comparison of the ASV at the operational levels for each planning horizon. The current level of operations represents 30 percent of the ASV. In 20 years, the percentage is projected to reach 45 percent of the ASV.

TABLE 3E | Annual Service Volume Summary

	Annual Operations (rounded)	Weighted Hourly Capacity	Annual Service Volume (rounded)	Percent of Capacity
EXISTING CONFIGURATION				
Existing	62,400	91	210,000	30%
Short Term	69,700	91	210,000	33%
Intermediate Term	77,400	89	209,000	37%
Long Term	93,900	88	208,000	45%

Source: Coffman Associates analysis using FAA AC 150/5060-5, Airport Capacity and Delay

FAA Order 5090.5, *Formulation of the NPIAS and ACIP*, indicates that improvements for airfield capacity purposes should be considered when operations reach 60 percent of the ASV and should be implemented by the time operations reach 80 percent of the ASV. By the long-term planning period, the current runway configuration is adequate from a capacity perspective. **Exhibit 3B** summarizes the airfield capacity analysis.

AIRFIELD REQUIREMENTS

As indicated earlier, airport facilities include both airfield and landside components. Airfield facilities are those related to the arrival, departure, and ground movement of aircraft. The FAA has established various dimensional design standards related to the airfield to ensure the safe operation of aircraft.

The FAA design standards impact the design of each airfield component to be analyzed. The following airfield components are analyzed in detail for compliance with FAA design standards:

- Runway Configuration
- Runway Design Standards
- Runway Elements
- Taxiways
- Navigational and Weather Aids
- Instrument Approaches

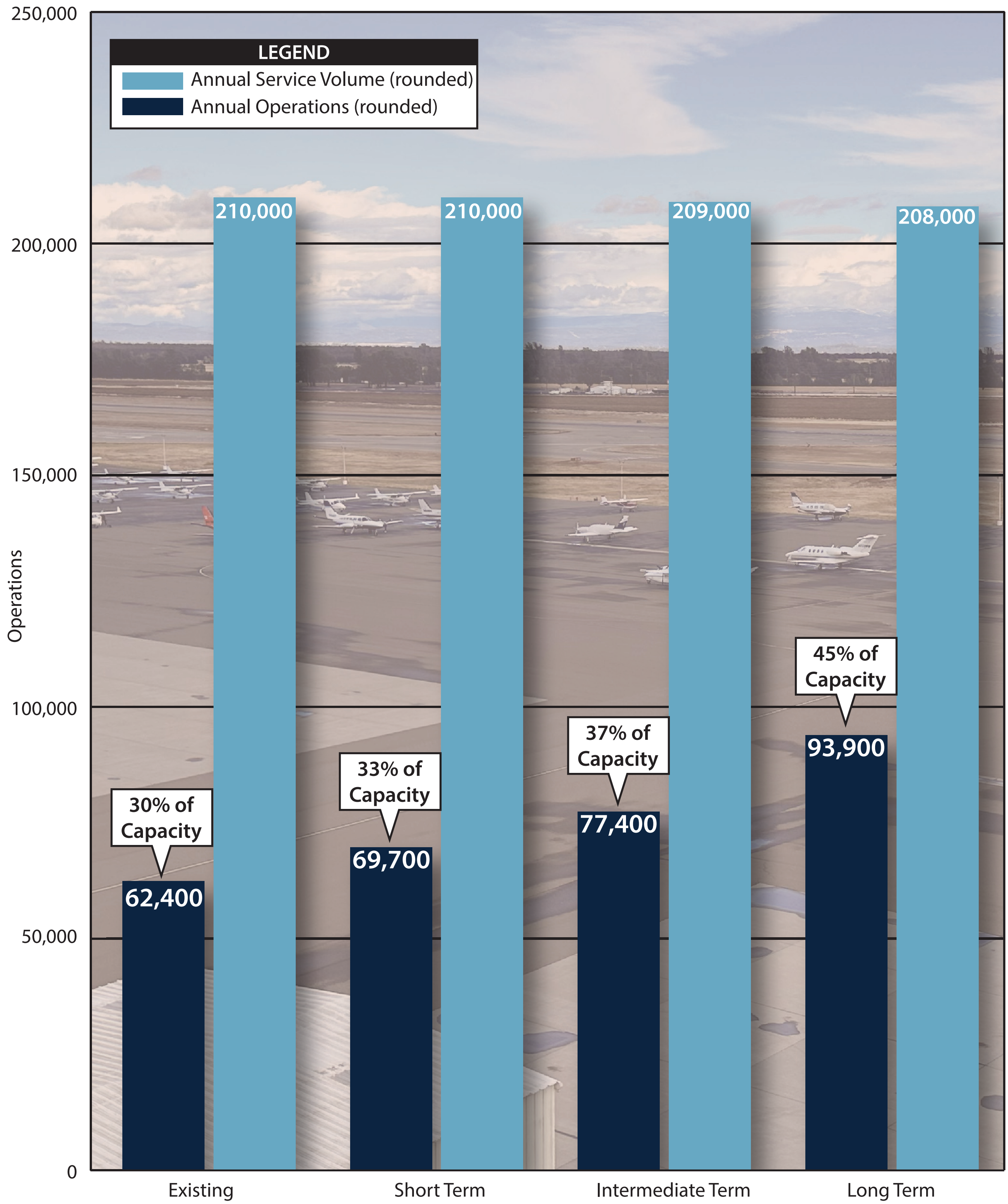


Exhibit 3B
AIRFIELD CAPACITY ANALYSIS

RUNWAY CONFIGURATION

Runway 16-34 is the primary runway and is oriented in a north/south 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 winds, which reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off. The prevailing winds at RDD are north to south.

According to FAA Order 5100.38D, *Airport Improvement Handbook*, only one runway at any NPIAS airport is eligible for ongoing maintenance and rehabilitation funding unless the FAA Airport District Office (ADO) has made a specific determination that a crosswind or secondary runway is justified. A runway that is not a primary runway, crosswind runway, or secondary runway, is an *additional* runway, which is not eligible for FAA funding. It is not unusual for a two-runway airport to have a primary runway and an additional runway, and no crosswind or secondary runway. **Table 3F** presents the eligibility requirements for runway types.

TABLE 3F | Runway Eligibility

For the following runway type…	Must meet all of the following criteria…	And is…
Primary Runway	1. A single runway at an airport is eligible for development, consistent with FAA design and engineering standards.	Eligible
Crosswind Runway	1. The wind coverage on the primary runway is less than 95%.	Eligible if justified
Secondary Runway	1. There is more than one runway at the airport. 2. The non-primary runway is not a crosswind runway. 3. Either of the following: a) The primary runway is operating at 60% or more of its annual capacity. b) FAA has made a specific determination that the runway is required.	Eligible if justified
Additional Runway	1. There is more than one runway at the airport. 2. The non-primary runway is not a crosswind runway. 3. The non-primary runway is not a secondary runway.	Ineligible

Source: FAA Order 5100.38D, AIP Handbook

FAA AC 150/5300-13B, *Airport Design,* recommends a crosswind runway when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is computed based on wind not exceeding a 10.5-knot (12 miles per hour [mph]) component for runway design code (RDC) A-I and B-I; 13-knot (15 mph) component for RDC A-II and B-II; 16-knot (18 mph) component for RDC A-III, B-III, C-I through C-III, and D-I through D-III; and 20 knots for wider wingspans.

It is preferable to analyze weather data that is local to the airport being studied. The ASOS weather sensor located at RDD is connected to the National Oceanic and Atmospheric Administration (NOAA); therefore, the data are available for analysis.

According to FAA guidelines, the most recent 10 years of wind data should be analyzed to determine various facility requirements, including the appropriate runway configuration. **Exhibit 3C** shows wind rose analysis of 10 years of wind data from RDD during all weather and IFR conditions. A wind rose is a graphic tool that gives a succinct view of how wind speed and direction are historically distributed at a location. The table at the top of the wind rose exhibit indicates the percent of wind coverage for the runway at specific wind intensities.

For all weather conditions, Runway 16-34 provides 99.5 percent wind coverage at 10.5 knots and 99.82 percent wind coverage at 13 knots. Runway 12-30 provides 95.39 and 97.83 percent wind coverage at 10.5 and 13 knots, respectively. Combined, both runways provide for greater than 95 percent wind coverage at 10.5 knots and above. Because the primary runway provides greater than 95 percent total wind coverage, a crosswind runway is not justified for FAA funding eligibility.

For Runway 12-30 to be eligible as a secondary runway, either current airfield capacity must exceed 60 percent of the annual service volume, or the FAA must make a specific determination that the runway is required. Currently airfield capacity is well below the 60 percent threshold and the FAA has not made a determination that Runway 12-30 is required; therefore, Runway 12-30 does not meet the criteria for a secondary runway and is not eligible for FAA funding.

The airport sponsor can maintain Runway 12-30 on its own, if it so chooses. The sponsor would have to ensure that the runway continues to meet FAA design standards and that it continues to be operated in a safe manner.

The current airport layout plan (ALP) – which will be updated based on the findings of this master plan – shows Runway 12-30 to ultimately be closed and replaced with a parallel training runway that is intended to serve operations by smaller general aviation aircraft.

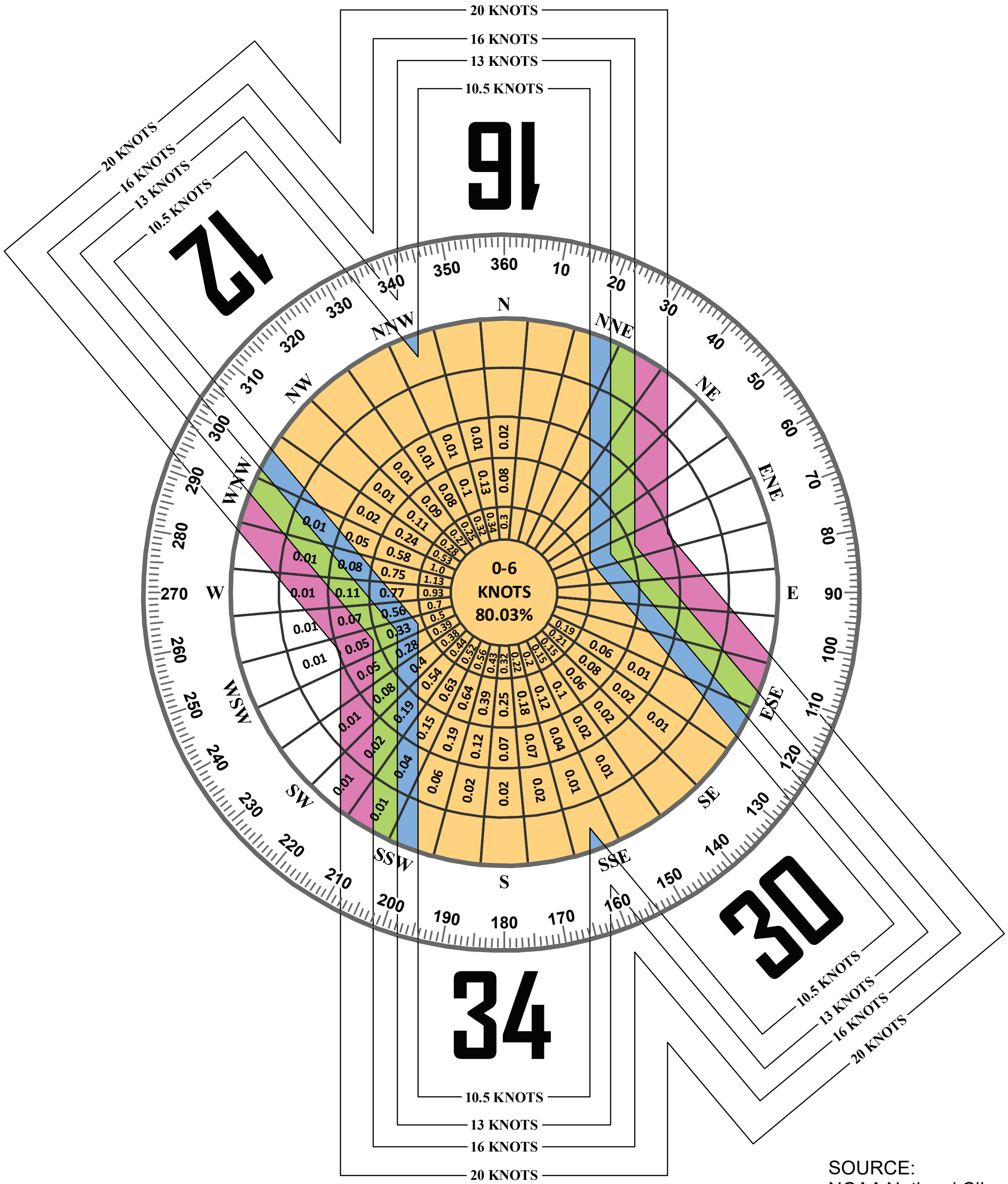
RUNWAY DESIGN STANDARDS

The FAA has established several design standards 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 (OFZ), and runway protection zone (RPZ).

The entire RSA and OFZ 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 ROFA should also be under the ownership of the airport sponsor but is not required, provided the clearance standards are met. The RPZ for each runway end should also be under airport ownership; however, 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 ensures the RPZ remains free of incompatible development.

As discussed in the previous chapter, the applicable design standards are primarily based on the critical aircraft and the instrument approach visibility minimums. The critical design aircraft is the aircraft or group of aircraft types with similar characteristics that accounts for 500 or more annual operations at

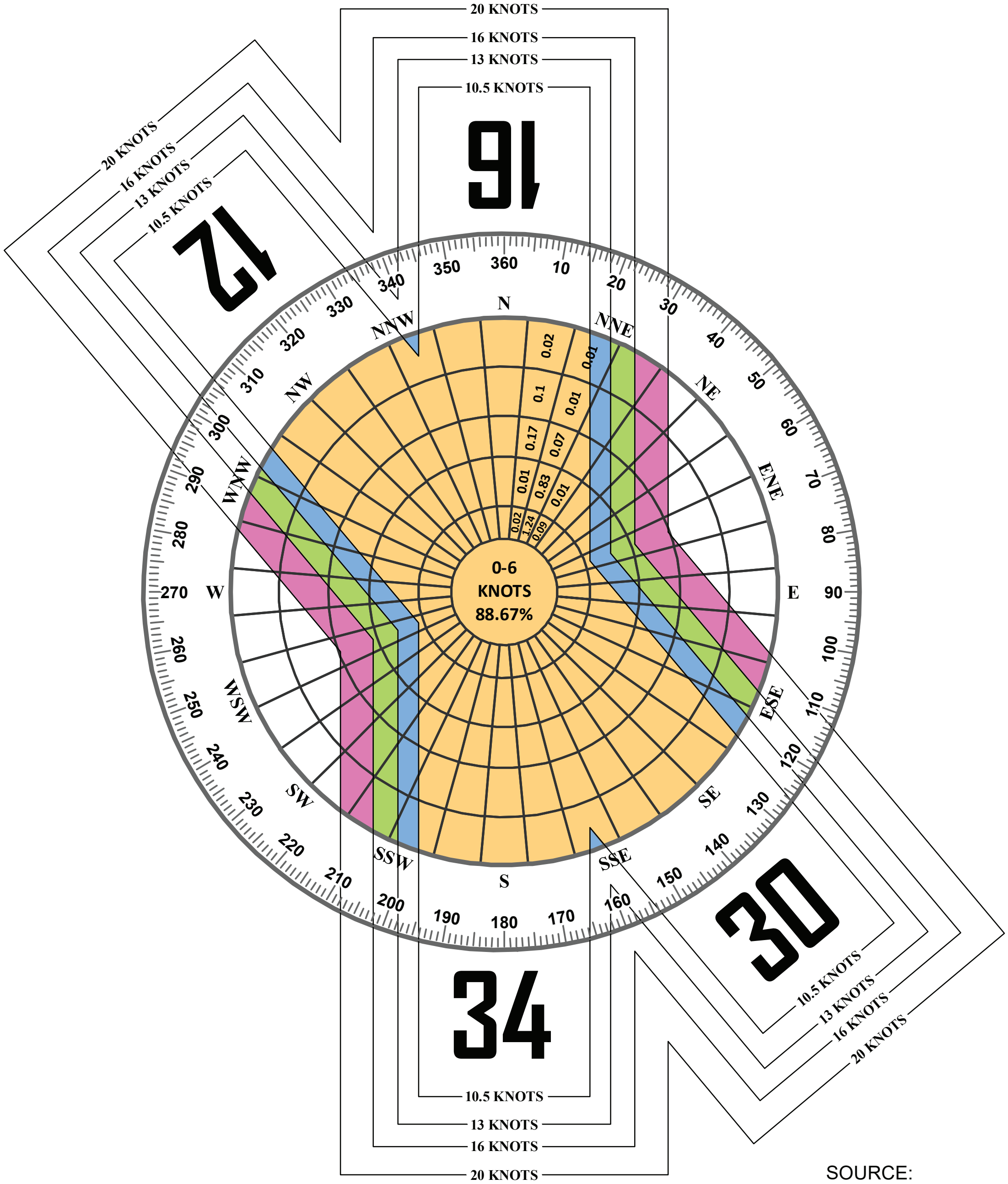
ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16-34	99.50%	99.82%	99.97%	100.00%
Runway 12-30	95.39%	97.83%	99.31%	99.88%
All Runways	99.70%	99.91%	99.99%	100.00%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Redding Regional Airport
Redding, California

OBSERVATIONS:
112,110 All Weather Observations
Jan. 1, 2014 - Dec, 31 2023

IFR WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 16-34	99.50%	99.79%	99.95%	99.98%
Runway 12-30	95.25%	97.76%	99.37%	99.91%
All Runways	99.59%	99.85%	99.96%	99.99%



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Redding Regional Airport
Redding, California

OBSERVATIONS:
11,039 IFR Observations
Jan. 1, 2014 - Dec, 31 2023

the airport. Currently, aircraft in Airport Reference Code (ARC) C-III exceed the threshold of 500 operations. Per FAA criteria, the airport should currently be designed to meet the standards associated with ARC C-III. **Exhibit 3D** presents the ARC C-III runway design standards overlaid on an aerial of the airport. The planned future design standards are those associated with D-III, which are the same as C-III.

The applicable design standards for an airport can and do change periodically. Often, this change is outside of the control of the airport sponsor, which cannot restrict aircraft operations. When a change occurs and is sustained (typically for at least three years), the airport sponsor should have a plan to meet the design standards to the greatest degree practicable.

Runway Safety Area (RSA)

The RSA is defined in FAA AC 150/5300-13B, *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 with 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 aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose, such as runway edge lights or approach lights.

The C-III RSA is 500 feet wide, centered on the runway, and it extends 1,000 feet beyond the runway end. For RDC C-III, 600 feet of RSA is needed prior to the landing threshold on each runway end. The grade of the RSA to the sides of the runway must not exceed 3.0 percent and must slope downward. The grade of the RSA beyond the runway end must be no greater than 3.0 percent for the first 200 feet and no more than 5.0 percent thereafter.

A portion of Taxiways M and C traverse the RSA beyond the Runway 12 threshold. This is not a standard condition, however, there are hold line markings on these taxiways where taxing pilots may be instructed to hold if Runway 12-30 is in use. These hold lines are a mitigating measure, and an ideal scenario would be to remove these taxiways from the RSA.

The RSAs for both runways meet the design standard and should be maintained.

Runway Object Free Area (ROFA)

The ROFA is a two-dimensional ground area surrounding runways that is clear of objects, except for objects with locations that are 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 nearest lateral elevation of the RSA. The ROFA is centered on the runway, extending out in accordance with the critical design aircraft utilizing the runway.

The C-III ROFA is 800 feet wide, centered on the runway, and extends 1,000 feet beyond the runway ends. For RDC C-III, 600 feet of ROFA is needed prior to the landing threshold on each runway end. The ROFAs for both runways meet design standards and should be maintained.

A portion of Taxiways M and C traverse the ROFA beyond the Runway 12 threshold. This is not a standard condition, however, there are hold line markings on these taxiways where taxing pilots are instructed to hold if Runway 12-30 is in use. These hold lines are a mitigating measure, and an ideal scenario would be to remove these taxiways from the RSA.

Obstacle Free Zone (OFZ)

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

The OFZ extends 200 feet beyond the runway ends and the width is established by approach characteristics of the critical design aircraft. For large aircraft, the OFZ width is 400 feet. The OFZs for both runways meet the OFZ design standard.

Precision Obstacle Free Zone

The POFZ is a volume of airspace above an area beginning at the threshold, at the threshold elevation. It extends along the extended runway centerline beyond the runway end for a distance of 200 feet at a width of 800 feet. The POFZ is an object clearing surface; however, it is only in effect when aircraft are on final approach utilizing a precision instrument approach, such as the ILS approach to Runway 34. The POFZ surface should be maintained as long as there is a precision instrument approach.

Runway Protection Zones (RPZ)

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 feet beyond the runway end. When an RPZ begins at a location other than 200 feet beyond the end of a runway, two RPZs are required (i.e., a departure RPZ and an approach RPZ). 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.

On September 16, 2022, the FAA published AC 150/5190-4B, *Airport Land Use Compatibility Planning*. This AC represented a significant effort to address RPZ land use compatibility. Airport-compatible land uses are those that can coexist with a nearby airport without constraining the safe and efficient operations of the airport. Ensuring compatible land uses within the RPZ is best achieved through:

1. Airport ownership of the RPZ property;
2. Possessing sufficient interest in the RPZ property through easements, deed restrictions, etc.;

Exhibit 3D
DESIGN STANDARDS

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3. Possessing sufficient land use control authority to regulate land use in the jurisdiction containing the RPZ;
4. Possessing and exercising the power of eminent domain over the RPZ property; or
5. Possessing and exercising permitting authority over proponents of development within the RPZ.

Expectations of Airport Sponsors

The FAA requires all federally obligated airport sponsors to comply with FAA grant assurances. These include (but are not limited to) Grant Assurance 21, *Compatible Land Use*. Sponsors should take appropriate measures to protect against, remove, or mitigate land uses that introduce incompatible development within RPZs. For projects proposed by the sponsor (such as runway extensions or new runways) that would result in moving the RPZ into an area that has incompatible land uses, the FAA expects the sponsor to have or secure sufficient control of the RPZ, ideally through fee simple ownership, including any off-airport property within the RPZ.

Existing Incompatible Land Uses

The FAA expects airport sponsors to seek all possible opportunities to eliminate, reduce, or mitigate existing incompatible land uses. Examples may include land acquisition, land exchanges, easements, right-of-first refusal to purchase, agreements with property owners on land uses, or other such measures. The FAA also expects sponsors to actively consider and evaluate available options any time there is an ALP update or master plan update, and to be vigilant for any other opportunities that may arise – especially opportunities to purchase land – to eliminate or minimize existing incompatibilities. The FAA expects airport sponsors to document their efforts to demonstrate that they are complying with relevant FAA Grant Assurances. **Table 3G** summarizes FAA expectations regarding existing incompatible land uses within an RPZ.

TABLE 3G | Expectations of Airport Sponsors – Existing Incompatible Land Uses

Type of Land Use Control	Expectations of Airport Sponsors
The airport sponsor owns the land.	Because the sponsor has total land use control, the FAA considers it a reasonable expectation that the sponsor will establish and enforce the necessary zoning controls or lease terms to enable it to address existing incompatible land uses when the opportunity arises.
The property is off airport, but the sponsor has land use authority, or the local jurisdiction and land use regulatory authority are owned by the same governing body.	Because the sponsor has at least some influence over land use control, the FAA considers it a reasonable expectation that the sponsor will seek to establish the necessary zoning controls to enable it to address existing incompatible land uses when the opportunity arises.
The sponsor has no land use control (i.e., RPZ land falls within another jurisdiction).	Even though the sponsor has no land use control, the FAA still considers it a reasonable expectation that the sponsor will actively seek opportunities to establish the necessary zoning controls to enable it to address existing incompatible land uses when the opportunity arises. The FAA will consider financial assistance to public-sector airport sponsors for land acquisition, even if the airport sponsor has no land use control, but only if the sponsor demonstrates that the airport sponsor is taking all appropriate steps available to enhance control and mitigate existing risks.

Source: FAA AC 150/5190-4B, Airport Land Use Compatibility Planning

Proposed Incompatible Land Uses

The FAA expects the airport sponsor to take active steps to prevent or mitigate proposed incompatible land uses. The FAA expects the airport sponsor to actively seek opportunities to prevent or mitigate risks associated with proposed incompatible land uses within the RPZ. The FAA expects the airport sponsor to secure control of land within the RPZ if a sponsor-initiated project results in incompatible land use within the newly defined RPZ. This is expected, regardless of the funding source(s) involved. Sponsors should actively monitor conditions, publicly object to proposed incompatible land uses, and make it a high priority (financially or otherwise) to acquire land or otherwise establish land use controls that prevent incompatible uses. The FAA expects airport sponsors to document their efforts so they can demonstrate that the airport is complying with its grant assurances. **Table 3H** summarizes FAA expectations regarding proposals for introducing new incompatible land uses within an RPZ.

Potential new incompatible land uses within an RPZ might be caused by one or more circumstances. Some of these circumstances may result from airport sponsor-proposed projects, including (but not limited to):

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

TABLE 3H | Expectations of Airport Sponsors – New Incompatible Land Uses

Type of Land Use Control	Expectations of Airport Sponsors
The airport sponsor owns the land.	Because the sponsor has total land use control, the FAA expects that the sponsor will establish all necessary protections to prevent new incompatible land uses.
The property is off airport, but the sponsor has land use authority, or the local jurisdiction and land use regulatory authority are owned by the same governing body.	The FAA expects the sponsor to take all appropriate steps available to establish and exercise zoning controls necessary to prevent any new incompatible land uses. The FAA recognizes that the standard of "appropriate action, to the extent reasonable" does not mean, in this case, that the sponsor can always prevail; rather, the FAA expects the sponsor to demonstrate and document a reasonable effort.
The sponsor has no land use control (i.e., RPZ land falls within another jurisdiction).	Even though the sponsor has no land use control, the FAA still expects the sponsor to actively pursue and consider all possible steps to secure land necessary to prevent any new incompatible land uses. The FAA recognizes that the standard of "appropriate action, to the extent reasonable" may not succeed; even so, the FAA expects the sponsor to demonstrate and document a reasonable effort. The FAA expects the airport sponsor to adopt a strong public stance to oppose incompatible land uses and to communicate the purpose of the RPZ and associated risks to the proponent, and to actively consider measures such as land acquisition, land exchanges, right-of-first refusal to purchase, agreements with property owners regarding land uses, or other such measures.

Source: FAA AC 150/5190-4B, Airport Land Use Compatibility Planning

The FAA has higher expectations for the airport sponsor to mitigate potential incompatible land uses within the RPZs when the introduction of the incompatible land use is the result of an airport sponsor-initiated project (regardless of funding source). The sponsor should submit an alternatives evaluation to the FAA, unless the land use is permissible. The following are the permissible land uses requiring no further evaluation:

- Farming that meets airport design clearance standards in FAA AC 150/5300-13 and guidance as outlined in AC 150/5200-33;
- Irrigation channels that meet the standards of AC 150/5200-33 and the FAA/U.S. Department of Agriculture (USDA) manual, *Wildlife Hazard Management at Airports*;
- 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 standards), as applicable;
- NAVAIDs and aviation facilities, such as equipment for airport facilities that is considered fixed by function in regard to the RPZ; and
- Aboveground fuel tanks associated with backup generators for unstaffed NAVAIDs.

The RPZs associated with Runway 16-34 provide compatible land uses and meet standard. These should be maintained clear of any future incompatible land uses. The RPZ associated with Runway 30 extends over Venture Parkway. The RPZ also extends over a small portion of privately owned property (1.4 acres). This portion of privately owned property is currently compatible with RPZ land use guidelines. The airport should make efforts for this portion of property to remain with RPZ compatible land uses.

Runway 12 has two on-airport buildings within its RPZ. Both buildings are used for the storage of airport maintenance equipment. Two storage buildings on the U.S. Forest Service parcel are also within this RPZ. A small corner of the RPZ extends over Airport Road, off airport property. In addition, taxilanes C and M traverse the Runway 12 RPZ. To mitigate this, special hold lines are marked on taxilanes C and M to alert pilots to hold if an aircraft is using Runway 12-30. **Figure 3-1** shows the details of these incompatible land uses within the Runway 12-30 RPZs.

Figure 3-1: RPZ Incompatible Land Uses

The future disposition of these incompatible land uses will be examined in the airport alternatives analysis. One option could be to remove those land uses, while another option may be to adjust the runway in a way that would change the RPZs. The adjustments may include implementing declared distances, shortening the runway, changing the RDC of the runway, or closing the runway.

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 minimum. Parallel Taxiway D is 400 feet from the runway, centerline to centerline, which meets the applicable design standard. The runway/taxiway separation meets standard and should be maintained. Runway 12-30 currently does not have a parallel taxiway; if it did, the separation standard would also be 400 feet.

Hold Line Separation

Hold line position markings are placed on taxiways leading to runways. When instructed, pilots must stop short of the holding position marking line. For Runway 16-34, hold line position markings are situated 250 feet from the runway centerline. The hold line location standard for ARC C-III is 250 feet from the runway centerline.

Based on the forecasts for this master plan, the critical aircraft may transition to D-III. The D-III hold line separation standard requires that the distance be increased one foot for every 100 feet above sea level. Because the airport elevation is 505 feet, the hold line would need to be 255 feet from the runway centerline. A planned 202r runway rehabilitation project includes relocating the hold lines to 255 feet from the runway centerline.

RUNWAY ELEMENTS

The adequacy of the existing runway system at Redding Regional Airport has been analyzed from several perspectives, including runway orientation and adherence to safety area standards. From this information, requirements for runway improvements were determined for the airport. Runway elements – such as configuration, length, width, and strength – are discussed in this section.

Runway Configuration

The airport has a two-runway configuration. Runway 16-34 is the primary runway and Runway 12-30 is an additional runway that crosses the primary runway. As noted previously, Runway 12-30 is not justified as a crosswind runway and is not eligible for FAA maintenance/rehabilitation funding. Runway 12-30 is shown on the current ALP as ultimately being closed and replaced with a shorter parallel runway, which would primarily serve smaller general aviation aircraft.

The future disposition of Runway 12-30 will be analyzed in the alternatives chapter of this master plan. A determination will be made to either maintain the runway with local funding, follow the current ALP to ultimately close the runway and plan for a shorter parallel training runway, or ultimately close the runway permanently.

Runway Length

AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. The determination of runway length requirements for RDD is based on four primary factors:

- Airport elevation – 504.7 feet mean sea level (MSL);
- Mean maximum temperature – 99.9 degrees Fahrenheit (°F);
- Critical aircraft expected to use runway;
- Runway gradient – 14 feet.

There is not a direct relationship between the classification of the critical aircraft and runway length, as airplanes operate on a wide variety of available runway lengths. The suitability of the runway length is governed by many factors, including elevation, temperature, wind, aircraft weight, wing flap settings, runway condition (wet or dry), runway gradient, vicinity airspace obstructions, useful load, and any special operating procedures.

Aircraft performance declines as elevation, temperature, and runway gradient factors increase. For RDD, the mean daily maximum temperature of the hottest month is 99.9°F, which occurs in July. The airport's elevation is 504.7 feet MSL. The runway elevation difference is approximately 14 feet for Runway 16-34, which equates to a 0.2 percent gradient change.

When the critical aircraft weighs more than 60,000 pounds, the FAA recommends that the aircraft manufacturer's Airport Planning Manuals (APM) are referenced to determine runway length requirements. Many business jets and most commercial aircraft weigh more than 60,000 pounds; therefore, the flight planning manuals were used for these aircraft.

Commercial Aircraft Runway Length Requirements

Using the previously described conditions at the airport, the approximate takeoff runway length under several useful load conditions was evaluated. **Table 3J** shows the runway length calculations. At 7,003 feet in length, the current runway is capable of accommodating the commercial aircraft that operate at RDD up to an 80 percent useful load.

TABLE 3J | Commercial Aircraft Takeoff Runway Length

Aircraft Type	MTOW (lbs.)	TAKEOFF LENGTH REQUIREMENTS (feet) Useful Load 60%	70%	80%	90%	100%
B737-700	***154,500***	***5,000***	***5,900***	***6,800***	***7,900***	***10,100***
B737-800	174,200	5,300	6,000	6,800	7,300	8,200
B767-300	350,000	7,700	8,300	8,900	9,200	10,000
CRJ-200	53,000	4,500	5,100	5,600	6,100	6,600
CRJ-700	75,000	4,400	4,800	5,200	5,500	5,900
CRJ-900	82,500	5,100	5,600	6,000	6,400	7,000
EMB 170	79,344	3,600	4,000	4,300	4,800	5,300
DC10-40	555,000	8,600	9,000	9,800	10,300	11,100

- Airfield elevation: 504.7' MSL
- Mean maximum temperature of the hottest month: 99.9°F
- MTOW: maximum takeoff weight
- ***Boldface*** is representative of the current critical aircraft.
- Length calculations above 30 are rounded up to the next 100.
- RED indicates the calculated length is greater than the existing 7,003' runway length.

Airport sponsors can pursue policies that can maximize the suitability of the runway length, such as area zoning and height and hazard restrictions, which 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 human-made obstructions. Planning for runways should include an evaluation of aircraft types expected to use the airport now and in the future. Future plans should be realistic, supported by the FAA-approved forecasts, and based on the critical design aircraft (or family of aircraft).

According to the aircraft planning manuals, there are times – very hot days under heavy operating conditions – when the critical aircraft (B-737-700 currently and B737-800 ultimately) would be weight-restricted; however, on those hot days, both of these aircraft can operate unrestricted to the farthest current destination (Denver International Airport [DEN]). These aircraft would only be weight-restricted, to some degree, if they have longer haul lengths with a full load of passengers and fuel. For this reason, an extension of Runway 16-34 of at least 1,000 feet may be justified within the 20-year planning horizon of this master plan and will be considered in the alternatives chapter.

Large Firefighting Aircraft Runway Length Consideration

Redding Regional Airport is home to an important Cal Fire/U.S. Forest Service (USFS) base. During fire season, it is common for some very large firefighting aircraft to use the airport, including the C-130 and the DC-10. These large aircraft are not currently based at RDD because of the current runway length, which limits the DC-10 aerial tanker to approximately 40 percent of its useful load. A runway length of 8,000 feet increases the capacity to 44 percent of its useful load and would allow up to approximately 56 percent useful load. Interviews with Cal Fire/USFS staff indicate that a 2,000-foot runway extension would provide enough flexibility to base the large aerial tankers at RDD. The feasibility of a runway extension of 2,000 feet will be evaluated in the alternatives chapter.

General Aviation Aircraft Runway Length

FAA AC 5325-4B, *Runway Length Requirements for Airport Design*, provides several methodologies for estimating runway length needs for general aviation aircraft. The first is a method for evaluating small aircraft, which are those under 12,500 pounds. The second is a method for evaluating runway length for business jets weighing between 12,500 and 60,000 pounds. The third uses airport planning manuals from the individual aircraft manufacturers to determine runway length needs. There is often overlap among these categories as there are business jets that weigh less than 12,500 pounds, and there are occasions to use the individual planning manuals for business jets that weigh less than 60,000 pounds. All three methods are examined in the following analysis.

Small Aircraft (<12,500 pounds)

The airport is utilized by small aircraft that weigh less than 12,500 pounds. These aircraft comprise most local operations and a portion of itinerant operations. Following the guidance from AC 150/5325-4B, to accommodate 95 percent of small aircraft, a runway length of 3,400 feet is recommended. To accommodate 100 percent of small aircraft, a runway length of 4,000 feet is recommended. For small aircraft with 10 or more passenger seats, a runway length of 4,400 feet is recommended. **Table 3K** presents the small aircraft runway lengths for RDD. If RDD is to support an additional runway, it should be 4,400 feet long, at a minimum, to accommodate the full range of small aircraft.

TABLE 3K | Small Aircraft Runway Length Calculations

Airport Elevation	504.7' MSL
Average High Monthly Temperature	99.9°F (July)
Runway Gradient	0.20%
Fleet Mix Category	**Runway Length**
95% of small aircraft	3,400'
100% of small aircraft	4,000'
Small aircraft with 10+ passenger seats	4,400'

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

Business Jets Between 12,500-60,000 Pounds

The airport is also utilized by aircraft weighing between 12,500 and 60,000 pounds, which includes small- to medium-size business jets. FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides a methodology for determining runway length for this class of aircraft. This class of aircraft is segmented into those groupings of airplanes that comprise zero to 75 percent of the national fleet, and those that comprise the remaining 100 percent of the national fleet. Runway lengths are further determined by the aircraft's useful load and the airport's conditions. The useful load of an aircraft consists of the passengers, cargo, and useable fuel.

To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 feet is recommended. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 7,600 feet is recommended. For 100 percent of the business jet fleet to take off at 60 percent useful load, a runway length of 6,200 feet is recommended. For 100 percent of the business jet fleet to take off at 90 percent useful load, a runway length of 10,200 feet is recommended. Unless specifically necessary, FAA plans runway length requirements at 60 percent useful load. **Table 3L** presents the business jet runway length requirements for RDD.

TABLE 3L | Business Jet Runway Length Requirements (FAA Method)

Airport Elevation	505' MSL
Average High Monthly Temperature	99.9°F (July)
Runway Gradient	0.20%

Fleet Mix Category	Raw Runway Length from FAA AC	Runway Length with Gradient Adjustment	Wet Surface Landing Length for Jets (+15%)*	Final Runway Length
75% of fleet at 60% useful load	4,891	4,971	5,500	5,500
100% of fleet at 60% useful load	6,105	6,185	5,500	6,200
75% of fleet at 90% useful load	7,493	7,573	7,000	7,600
100% of fleet at 90% useful load	10,127	10,207	7,000	10,200

*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

Business Jet Runway Length by Aircraft Planning Method

To add precision to business jet runway length calculations for RDD, the aircraft planning manuals for several common business jets were analyzed. The software program Ultranav utilized the individual aircraft planning manuals to provide runway length estimates under location-specific conditions. **Table 3M** summarizes the business jet runway length calculations based on the useful load of the aircraft.

TABLE 3M | Business Jet Takeoff Runway Length

Aircraft Type	MTOW (lbs.)	TAKEOFF LENGTH REQUIREMENTS (feet) Useful Load 60%	70%	80%	90%	100%
Citation Bravo	14,800	3,750	4,035	4,358	4,729	5,140
Citation Sovereign	30,300	3,425	3,555	3,760	4,030	4,333
Challenger 601	45,100	5,200	5,800	6,460	7,200	8,040
Falcon 900B	46,500	4,390	4,960	5,590	6,300	7,080
Falcon 900EX	49,200	4,430	5,030	5,720	6,400	7,020
Gulfstream 300	72,000	4,560	4,859	5,283	5,790	6,338
Gulfstream 550	91,000	4,815	5,492	6,212	6,989	7,813
Gulfstream 650	99,600	5,081	5,588	6,172	6,851	7,649
Gulfstream IV	74,600	4,753	5,056	5,649	6,215	CL
Hawker 1000	31,000	5,610	6,250	CL	CL	CL

- Airfield elevation: 504.7 feet MSL
- Mean maximum temperature of the hottest month: 99.9°F
- MTOW: maximum takeoff weight
- CL: climb limited
- RED indicates the calculated length is greater than the existing 7,003' runway length.

Most business jets can operate up to an 80 percent useful load condition without restriction on the current runway system. On very hot days and under heavier loading conditions, some business jets may be weight restricted. A weight restriction typically means the aircraft cannot take on a full load of fuel and/or passengers. This may result in the need for an intermediate stop for refueling.

Runway Length Conclusion

At 7,003 feet in length, the runway is capable of accommodating the runway length needs for the critical design aircraft (Boeing 737-700 and -800) for typical lengths from RDD, including to Denver, which is the longest planned destination. If more distant destinations were added, then under very hot conditions, additional runway length could be needed and justified. The alternatives analysis to following in the next chapter will analyze the impact of a 1,000-foot extension of Runway 16-34 that is meant to accommodate more distance destinations.

The alternatives chapter will also consider an extension of 2,000 feet, which would be intended to better accommodate large air tanker aircraft used in seasonal firefighting. The aircraft that would need this additional runway length (DC-10/C-130) operate occasionally at RDD, but they are weight restricted and cannot take full loads of retardant. With a 7,003-foot-long runway, operations by these large airtankers are unlikely to exceed the threshold of 500 annual operations to be classified as the critical aircraft. This situation is challenging because Cal Fire/USFS indicate the need for additional runway length (+2,000 feet); however, operationally, they cannot use the aircraft that would justify the extension to the level needed (500 annual operations). Cal Fire/USFS and airport management have been looking to alternate sources to fund an extension; therefore, it is prudent to examine the impact of a 2,000-foot extension of Runway 16-34 in the alternatives section of this master plan.

Runway 12-30 is not justified for FAA maintenance/rehabilitation funding. It is an additional runway that is maintained locally. The previous master plan envisioned this runway to be closed and replaced with a shorter parallel training runway. The previous master plan and airport layout plan included a 4,000-foot-long parallel runway located 2,500 feet to the east. Options related to Runway 12-30 will be considered in the alternatives analysis.

Runway Width

Runway width standards are based on the critical aircraft and the visibility minimums of published instrument approach procedures. Runway 34 has an instrument approach with ½-mile visibility minimums. Runway 12-30 is a visual runway with no instrument approaches. The runway width standard for C-III runways is 100 feet, unless the critical aircraft has a maximum takeoff weight greater than 150,000 pounds, in which case, the standard is 150 feet. The current critical aircraft is best represented by the Boeing 737-800, which has a maximum takeoff weight (MTOW) of 174,000 pounds; therefore, the runway width design standard is 150 feet. Both runways are 150 feet wide and meet the standard for the current critical design aircraft. The current runway width should be maintained.

Runway Shoulders

Runway shoulders provide resistance to blast erosion and allow the passage of maintenance and emergency equipment, as well as the occasional aircraft veering from the runway. Runway 16-34 has asphalt shoulders that are 25 feet wide. This width meets the FAA design standards for RDC C-III and should be maintained during the planning period. Runway 12-30 also has 25-foot paved shoulders, which should be maintained.

Runway Blast Pads

A runway blast pad provides erosion and foreign object debris (FOD) protection beyond the runway from propeller wash and jet blast. Blast pads are not required but are recommended for those runways serving critical aircraft in airplane design group (ADG) III and larger. The blast pad standard is 200 feet by 200 feet extending from the ends of the runway. The blast pads on each end of Runway 16-34 meet this standard and should be maintained.

Runway 12-30 has partial blast pads on each end of the runway to provide erosion and FOD protection. These partial blast pads should be maintained as long as the runway remains in service.

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA reports Runway 16-34 at 98,000 pounds single wheel loading (S), 128,000 pounds dual wheel loading (D), and 195,000 pounds dual tandem wheel loading (DT). These strength ratings refer to the aircraft landing gear configuration. The pavement strength of Runway 12-30 is 60,000 (S), 72,000 (D), and 110,000 (DT).

A second method of identifying pavement strength is to utilize the Pavement Classification Number (PCN). The PCN for Runway 16-34 is expressed as 60/F/C/X/T, which means the underlying pavement value has a load-carrying capacity of 60 (unitless), is flexible (asphalt), is low subgrade strength, has high allowable tire pressure capability, and was calculated through a technical evaluation. This is the appropriate pavement strength rating for the runway and should be maintained. The PCN for Runway 12-30 is also 60/F/C/X/T. When either runway is in need of reconstruction, the subgrade should be strengthened to better support repeated use by the critical aircraft.

The pavement strength of the runway does not prohibit aircraft weighing more than the published strength rating from using the runway. Federally obligated airports must remain open to the public. Pilots are responsible for determining if the runway will support the weight of their aircraft; however, the airport sponsor has an obligation to maintain the useful life of the runway.

Runway Markings

Runway markings are typically designed to the type of instrument approach available for the runway. FAA AC 150/5340-1M, *Standards for Airport Markings*, provides guidance necessary to design airport markings.

Runway 16-34 has precision markings that include the runway designation, threshold bars, threshold stripes, centerline stripes, edge lines, touchdown zone, and aiming point markings. These markings should be maintained. Runway 12-30 has non-precision markings that include threshold bars, threshold stripes, centerline and edge lines, and touchdown zone markings. These runway markings are appropriate for this runway and should be maintained.

Runway Lighting

Runway lighting provides pilots with identification of the runway and its alignment at night. Runway 16-34 is served by high intensity runway lighting (HIRL). HIRL is the appropriate edge lighting for any runway with a precision instrument landing system (ILS) approach, like Runway 34; the HIRL should be maintained. Runway 12-30 has medium intensity runway edge lighting (MIRL). This is appropriate for a visual runway and should be maintained.

TAXIWAYS AND TAXILANES

The design standards associated with taxiways/taxilanes are determined by the ADG of the critical design aircraft and the taxiway design group (TDG). **Table 3N** presents the taxiway design standards. Those standards based on ADG III and TDG 3 are applicable today.

TABLE 3N | Taxiway Dimensions and Standards

STANDARDS BASED ON WINGSPAN	ADG III
Taxiway Protection	
Taxiway Safety Area (TSA) Width	118'
Taxiway Object Free Area (TOFA) Width	171'
Taxilane Object Free Area Width	158'
Taxiway Separation	
Taxiway Centerline to:	
Fixed or Movable Object	85.5'
Parallel Taxiway/Taxilane	144.5'
Taxilane Centerline to:	
Fixed or Movable Object	79'
Parallel Taxilane	138'
Taxiway Centerline to:	
Runway 16-34 Centerline (½-mile visibility)	400'
Wingtip Clearance	
Taxiway Wingtip Clearance	26.5'
Taxilane Wingtip Clearance	20'
STANDARDS BASED ON TDG	**TDG 3**
Taxiway Width Standard	50'
Taxiway Edge Safety Margin	10'
Taxiway Shoulder Width	20'

ADG: airplane design group
TDG: taxiway design group
Source: FAA AC 150/5300-13A, Airport Design

Taxiway Protection and Separation

The parallel taxiway, the runway connecting taxiways, and the taxiways serving the commercial apron all meet or exceed the applicable design standards. Taxiways serving the general aviation areas are not required to meet the ADG III standards because these areas serve smaller aircraft; therefore, the taxiways providing access to the general aviation areas are of varying dimensions associated with smaller aircraft. All taxiways meet design standards for taxiway protection, separation, and wingtip clearance and should be maintained.

Taxiway Design Group

The applicable taxiway design group (TDG) is determined by the aircraft or group of aircraft with the same TDG that accounts for 500 or more annual operations at the airport. The TDG standards are based on the outer-to-outer main gear width (MGW) and cockpit to main gear (CMG) distance for the critical design aircraft expected to use the taxiways. The critical aircraft falls into C-III, as best represented by the Boeing 737 aircraft. This aircraft has a TDG of "3"; therefore, TDG 3 is the applicable design standard. Under TDG 3, the taxiway width standard is 50 feet, the taxiway edge safety margin is 10 feet, and the taxiway shoulder width standard is 20 feet. The taxiways at RDD meet these design standards and should be maintained.

Taxiway Design Considerations

FAA AC 150/5300-13B, *Airport Design*, and Engineering Brief 75 provide 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 the airport generally provides for the efficient movement of aircraft; however, the recently published AC 150/5300-13B, *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 that is 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, existing intersections should be upgraded to eliminate judgmental oversteering, which is when a pilot must intentionally steer the cockpit outside the marked centerline to ensure the aircraft remains on the taxiway pavement.
2. **Steering Angle**: Taxiways should be designed so that the nose gear steering angle is no more than 50 degrees, which is the generally accepted value to prevent excessive tire scrubbing.

3. **Three-Node Concept**: To maintain pilot situational awareness, taxiway intersections should provide a pilot with a maximum of three choices of travel. Ideally, these are right- and left-angle turns and a continuation straight ahead.
4. **Intersection Angles**: Design turns to be 90 degrees wherever possible. For acute-angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.
5. **Runway Incursions**: Design taxiways to reduce the probability of runway incursions.
   - *Increase Pilot Situational Awareness*: A pilot who knows where they are 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 a 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 between taxiways and runways provide the best visibility. Acute-angle runway exits should be avoided unless there is a capacity issue (RDD has no capacity issue). 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 practical.
6. **Runway/Taxiway Intersections**:
   - *Right Angles*: 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 the signs are visible to pilots.
   - *Acute Angles*: 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 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.
8. **Wide Throat Taxiways**: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and make lighting and marking more difficult.
9. **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 a pilot to make a conscious decision to turn.
10. **Apron to Parallel Taxiway End**: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.
11. **End-Around Taxiways (EAT)**: To improve efficiency and provide a safe means of movement from one side of a runway to the other, an EAT may be desired. EATs must be at least 1,500 feet from the runway end and clear of any runway imaginary surfaces.
12. **Taxiway Gradient**: The maximum longitudinal grade should not exceed 1.5 percent.

Taxiway Geometry Issues

The taxiway system at RDD meets the recommended design and geometry standards set forth by the FAA; however, there are a few taxiway geometry issues that the FAA recommends the airport address during the planning process.

Connecting Taxiways D1, M, B, and Taxiway D at the threshold to Runway 34 are all angled taxiways. According to FAA guidance, it is preferable for the connecting taxiways to be perpendicular to the runway to increase pilot peripheral views. In cases where airfield capacity is an issue, angled high-speed existing may be considered. Airfield capacity is not shown to be an issue at RDD. **Figure 3-2** highlights the subject taxiways.

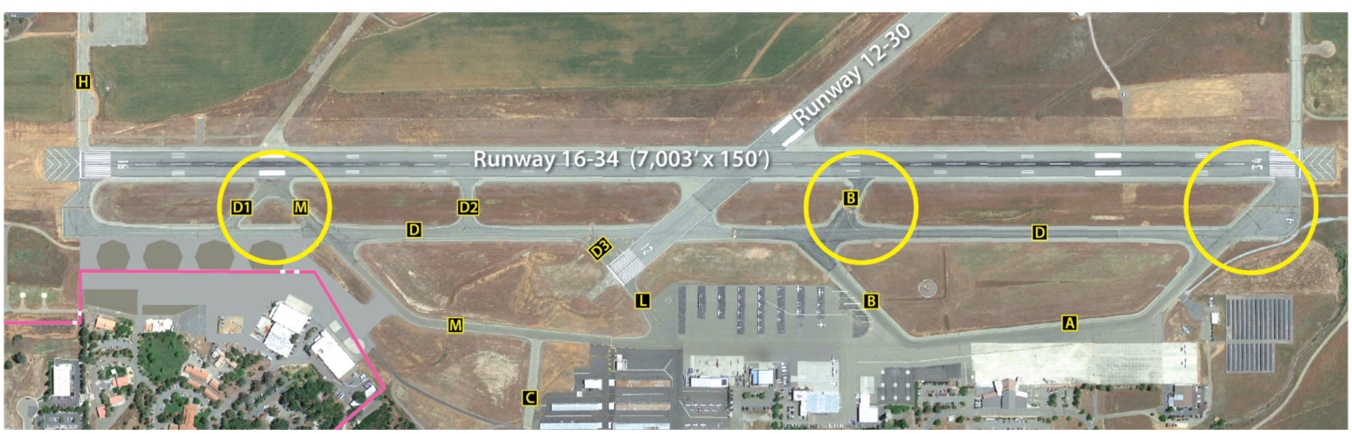

Figure 3.2 – Taxiway Considerations

Taxiway Lighting

Taxiway lights assist the pilot in maneuvering on the airfield in low visibility conditions. The taxiways at RDD are served by medium intensity taxiway lighting (MITL). Taxiway D and the runway connecting taxiways have MITL on both sides of the taxiways. Apron edge taxilanes have edge lighting on the non-apron side. Taxiway H does not have taxiway edge lighting. Future planning should consider high intensity taxiway lighting (HITL) for Taxiway D and the connectors.

Airfield Signs

Airfield signs assist pilots in identifying where they are on the airfield and directing them to desired locations. The signage system installed at the airport includes runway and taxiway designations, holding positions, routing/directional, runway end and exits, and runway distance remaining. All these signs should be maintained throughout the planning period.

Taxiway Nomenclature

In December 2022, FAA issued a memorandum entitled Engineering Brief No. 89A, *Taxiway Nomenclature Convention*, which is supplemental to guidance provided in FAA AC 150/5340-18G, *Standards for Airport Sign Systems*. The primary change to the taxiway nomenclature is use of an alphanumeric naming convention for shorter connecting or stub taxiways. For example, where there is a parallel taxiway designated Taxiway A, the short connecting taxiways between the two should be designated A1, A2, A3, etc. Parallel taxiways and other prominent, high-use taxiways should be assigned a single letter designation.

With the current configuration of the runway/taxiway system, connecting Taxiways M and B should have an alphanumeric designation. The threshold taxiways leading to both ends of Runway 16-34 should also have an alphanumeric designation.

Once a final airfield concept has been developed for this master plan, a new taxiway naming convention will be proposed.

VISUAL NAVIGATION AIDS

The airport beacon provides for rapid identification of the airport with a rotating light that is green on one side and white on the opposite side. The beacon is located on top of the airport traffic control tower and should be maintained.

Both ends of Runway 16-34 are equipped with a four-light precision approach path indicator (PAPI) system. These visual lighting systems indicate to pilots if they are on the correct glide path to the runway. Runway 30 has a two-light PAPI system. These systems should be maintained at the airport.

Runway end identification lights (REIL) are strobe lights set on either side of the runway. These lights provide rapid identification of the runway threshold to pilots at a distance of up to 20 miles. Runway 16 is equipped with REILs. This system should be maintained.

Runway 34 is equipped with a medium intensity approach lighting system with runway alignment indicator lights (MALSR), which provides a lighted, visual grid for pilots to identify and align to the runway end on final approach. The MALSR is a component of the ILS facilitating visibility minimums. This approach lighting system should be maintained. Consideration will be given to a supplemental approach lighting system for Runway 16. Approach lights are not necessary for Runway 12-30.

WEATHER AIDS

Redding Regional Airport has a lighted windsock inside a segmented circle located in the grassy area bounded by Taxiways D, B, and A. This is an appropriate location, as it is central to the airfield and easily identifiable from the airport. The windsock and the segmented circle should be maintained at the airport. There are supplemental windsocks located near Runway 16, 34, and 30. These provide wind indications in close proximity to the landing thresholds and should be maintained.

Redding Regional Airport is equipped with an automated surface observing system (ASOS), automatic terminal information service (ATIS), and Common Traffic Advisory Frequency (CTAF). These systems should be maintained through the planning period.

CONTROL TOWER FACILITIES

Redding Regional Airport is served by an operational airport traffic control tower (ATCT) located immediately north of the terminal building. The tower is staffed from 6:30 a.m. to 9:30 p.m. daily. The control tower was constructed in 1972 and is therefore more than 50 years old. It predates modern building codes and is near the end of its useful life. In the alternative's element of this master plan, consideration will be given to a replacement tower and the optimal location for a replacement tower.

INSTRUMENT NAVIGATIONAL AIDS

The airport has a good complement of instrument approaches for a regional commercial service airport. The ILS and GPS approaches to Runway 34 provide for visibility minimums down to ½-mile for all classes of aircraft. The area navigation (RNAV) localizer performance with vertical guidance (GPS-LPV) approach to Runway 16 has a visibility minimum of ¾-mile for Class A and B aircraft and ⅞-mile for Class C and D aircraft. Runway 12-30 is a visual runway and does not have instrument approach procedures.

As a primary commercial service airport, the lowest possible visibility minimums should be considered. Visibility minimums as low as ¾-mile or ½-mile are common. Some large hub commercial service airports may have even lower visibility minimums.

The ILS and GPS approaches should be maintained. Consideration will be given to the feasibility of providing ¾- or ½-mile minimums for Class C and D aircraft to Runway 16. This would provide more flexibility during low visibility conditions.

Instrument approach procedures are not considered necessary for the additional runway or for a potential parallel training runway.

FAR PART 77 AIRSPACE IMAGINARY SURFACES

Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*, was established for use by local authorities to analyze the impact of and control the height of objects near airports. The airport sponsors should do all in their power to ensure development stays below the FAR Part 77 surfaces to protect the role of the airport. The following discussion will describe those surfaces that make up the FAR Part 77 surfaces at Redding Regional Airport.

Penetrations to any of the FAR Part 77 surfaces are considered obstructions. If there are obstructions, additional evaluation criteria are examined by the FAA to determine if an obstruction is a hazard to air navigation. This determination is typically done during an airspace determination conducted by the FAA.

The FAR Part 77 criteria assign three-dimensional imaginary surfaces to the airport. These imaginary surfaces emanate from the runway centerline(s) and are dimensioned according to the visibility minimums associated with the approach to the runway end and the size of aircraft to operate on the runway. The FAR Part 77 imaginary surfaces include the primary surface, approach surface, transitional surface, horizontal surface, and conical surface. Each surface is described as follows.

Primary Surface: The primary surface is an imaginary surface longitudinally centered on the runway. The primary surface extends 200 feet beyond each runway end. The elevation of any point on the primary surface is the same as the elevation along the nearest associated point on the runway centerline. The primary surface for Runway 16-34 is 1,000 feet wide, centered on the runway. The primary surface for Runway 12-30 is 500 feet wide because it is a visual runway.

Approach Surface: An approach surface is established for each runway end. The approach surface begins at the end of the primary surface, extends upward and outward from the primary surface end, and is centered along an extended runway centerline. The approach surface leading to each runway is based on the type of approach (instrument or visual) available or planned.

The precision approach surface for Runway 34 extends outward and upward to an ultimate width of 16,000 feet. The slope is 50:1 for the first 10,000 feet and an additional 40,000 feet at a slope of 40:1. The non-precision approach surface for Runway 16 extends upward and outward to a width of 4,000 feet at a slope of 34:1 and a distance of 10,000 feet.

The approach surface for both ends of Runway 12-30 extends to a width of 1,500 feet at a slope of 20:1 and a distance of 5,000 feet.

Transitional Surface: The transitional surface begins at the outside edge of the primary surface at the same elevation as the runway. This surface rises at a slope of 7:1 up to a height 150 feet above the highest runway elevation. At that point, the transitional surface is replaced by the horizontal surface.

Horizontal Surface: The horizontal surface is established at 150 feet above the highest elevation of the runway surface. The horizontal surface has no slope and connects the transitional and approach surfaces to the conical surface.

Conical Surface: The conical surface begins at the outer edge of the horizontal surface. The conical surface continues for an additional 4,000 feet horizontally at a slope of 20:1; therefore, at 4,000 feet from the horizontal surface, the elevation of the conical surface is 350 feet above the highest airport elevation.

As part of this master plan project, a new FAR Part 77 airspace map will be included as a drawing within the ALP set. All penetrations to the FAR Part 77 surfaces will be identified. The FAA will review the ALP and conduct an airspace review of the plan. Additional mitigation for airspace penetrations may be required, based on the FAA airspace study. **Figure 3-3** shows the FAR Part 77 surfaces, which are based on the future planned condition from the previous master plan. Therefore, it includes the parallel runway that is on the current ALP.

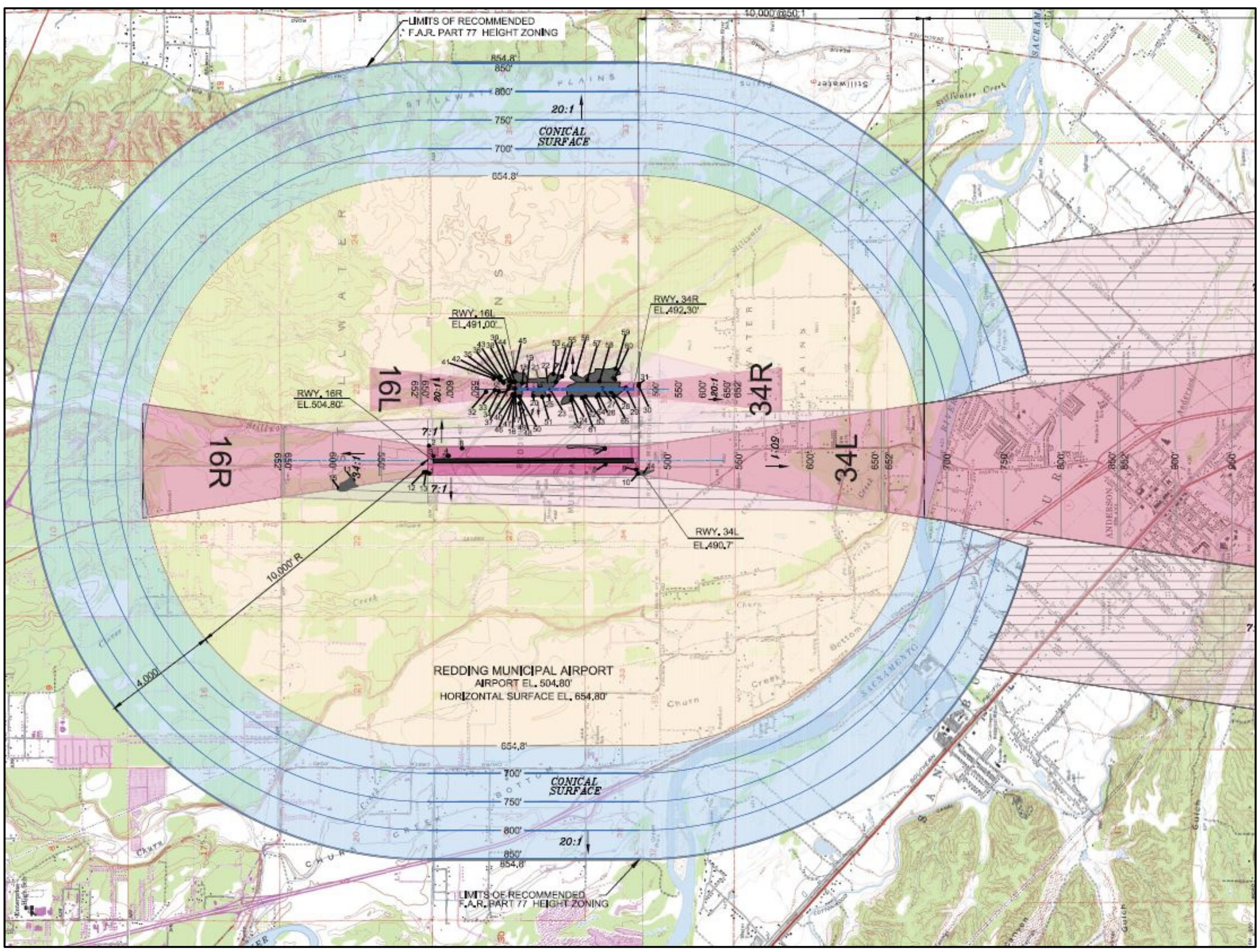

Figure 3-3: FAR Part 77 Surfaces Based on 2018 Master Plan

APPROACH AND DEPARTURE SURFACES

The approach surface – as defined in FAA AC 150/5300-13B, *Airport Design* (to be differentiated from the Part 77 approach surface) – is another imaginary surface applied to the approach to runway ends. The approach surface is typically a trapezoidal shape that extends along the runway centerline at a specific slope. The specific size and starting point of the approach surface is a function of the visibility minimums and the type of procedure associated with the runway end.

The applicable approach surface for both ends of Runway 16-34 is Surface 6, as designed in the AC. This approach surface begins at the landing threshold, where it is 350 feet wide. It extends for a distance of 10,200 feet at a slope of 30:1 to a width of 1,000 feet.

The approach slope for Runway 12-30 (Surface 3) begins at the landing threshold at a width of 400 feet. It extends upward and outward for a distance of 1,500 feet at a slope of 20:1 to a width of 1,000 feet. The surface then continues upward at a slope of 20:1 for an additional distance of 8,500 feet with the same width of 1,000 feet.

The approach surface should be clear of penetrations. When penetrations exist, certain mitigating actions may be taken by the FAA, including lighting of penetrations, adjusting vertical glide path slopes, increasing minimums, and/or displacing landing thresholds. The ALP associated with this master plan will include analysis of the current and planned approach surfaces for the airport.

AIRSIDE SUMMARY

Redding Regional Airport has a good complement of airside systems, including a runway that is 7,003 feet in length, a full parallel taxiway, full airfield edge lighting, instrument approach procedures, and visual approach aids.

Several elements of the airside will be reviewed and analyzed in the alternatives chapter to follow, including the future disposition of primary Runway 16-34. At 7,003 feet in length, Runway 16-34 can accommodate most commercial operations that currently occur at RDD; however, if there is a change in aircraft type or more distant destinations are added, the runway would be too short at certain times of the year. In addition, the U.S. Forest Service and Cal Fire have indicated a desire for a longer runway to accommodate their aircraft fleet, which includes the DC-10; therefore, the alternatives will consider a future extension of Runway 16-34.

The future disposition of the additional runway will also be revisited. It is not necessary as a crosswind or secondary runway, so the airport would have to fund any maintenance or rehabilitation, which can be expensive. The previous master plan and ALP indicated a future closure and ultimate replacement of Runway 12-30 by a parallel training runway.

Several of the existing connecting taxiways are at an angle to the runway, while the preferred geometry is for these taxiways to be at a 90-degree intersection with the runway. The alternatives will examine changes to the taxiway geometry.

A summary of the airside needs at Redding Regional Airport is presented on **Exhibit 3E**.

COMMERCIAL TERMINAL COMPLEX

Components of the terminal area complex include the terminal building, terminal curb, aircraft apron, and vehicle parking lots. This section identifies the facilities required to meet the airport's needs through the 20-year planning period. The current terminal building is approximately 37,500 square feet and has two stories. The second story houses a restaurant and administration offices. All passenger functions are on the first floor. There are no loading bridges (i.e., jetways) and ground loading is used.

The terminal building analysis is based on guidance provided in the following sources:

- FAA AC 150/5360-13A, *Airport Terminal Planning and Design Guidelines for Airport Terminal Facilities*
- Airport Cooperative Research Program (ACRP), Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook*
- ACRP, Project Number 07-04, *Spreadsheet Models for Terminal Planning and Design*
- International Air Transport Association (IATA), *Airport Development Reference Manual*

COMMERCIAL PASSENGER ACTIVITY LEVELS

Forecast annual enplanement levels comprise the most basic factor utilized when analyzing terminal complex requirements. The forecast enplanement levels of 139,402 (5-year), 148,602 (10-year), and 154,500 (20-year) for each planning horizon were utilized. Many terminal building elements are primarily a function of peak hour enplanements and aircraft utilization assumptions. **Table 3P** presents the baseline assumptions utilized to determine the terminal building requirements; these were calculated in the forecast chapter and are summarized here.

The 2022 peak month enplanement level is from October 2022, when there were 9,806 enplanements. The design day enplanement level is an average of the top four days in each week of the peak month. Each of the top four days had 624 available departing seats. Applying an 85 percent load factor results in a design day enplanement level of 530 enplanements. The enplanement design hour was determined by examining the flight schedule from the top four days of the peak month. The design hour averages 214 total departure seats, 85 percent of which is 182. During the design hour, there are 287 deplaning seats. Assuming an 85 percent load factor results in 244 deplanements during the peak hour. Combined, the design hour for enplanements and deplanements is 426, which means that during the peak hour, on average, 426 people will pass through the terminal to or from an airplane. Visitors will also utilize the terminal building when picking up or dropping off passengers. In total, the peak hour for terminal building use is 673 people.

		RUNWAY 16-34		RUNWAY 12-30		PARALLEL RUNWAY 16L-34R
	CATEGORY	EXISTING	ULTIMATE	EXISTING	ULTIMATE	ULTIMATE
RUNWAY						
	Runway Design Code	RDC C-III-2400	RDC D-III-2400	RDC C-III-VIS	Consider B-II-VIS or Close Runway	B-II(s)-VIS
	Length	7,003'	9,003'	5,067'	Maintain or Close Runway	4,400'
	Width	150'	150'	150'	75' or Close Runway	75'
	Pavement Strength (landing gear configuration)	98 (S); 128 (D); 195 (DD)	Maintain	60 (S); 72 (D); 110 (DD)	Maintain or Close Runway	12,500 (s)
	Pavement Strength (PCN)	60 F/C/X/T	Maintain	60 F/C/X/T	Maintain or Close Runway	NA
SAFETY AREAS						
	RSA	(500'x1,000') Meets standard	Maintain	Taxiways M and C in RSA	Maintain or Close Runway	150'x300'
	ROFA	(800'x1,000') Meets standard	Maintain	Hangars and Taxiways M and C in ROFA	Maintain or Close Runway	500'x300'
	OFZ	(400'x200') Meets standard	Maintain	Meets Standard	Maintain or Close Runway	200'x250'
	POFZ	(800'x200') Meets Standard (Rwy 34)	Maintain	NA	NA	NA
	RPZ	(Various) Meets standard	Remove incompatible land uses, including public roads from RPZs	Structures in Rwy 12 RPZ	Remove Structures or Close Runway	1,000'x250'x450'
TAXIWAYS						
	Taxiway Design Group	3	Maintain	3	3	2
	Width	50' (standard)	All Taxiways to be at least 50' wide	50' (standard)	All Taxiways to be at least 50' wide	35' for any taxiway serving this runway exclusively
	Parallel Taxiway Separation	400' (standard)	Maintain	NA	NA	240'
	Angled Taxiways	Twys D1, M, B, D (Runway 36 threshold)	Reconstruct at 90° Angle	NA	NA	90-degree intersections
NAVIGATIONAL AIDS						
	Instrument Approaches	½-mile (Runway 34)/¾-mile (Runway 16)	Maintain	VIS	Maintain or Close Runway	VIS
	Glideslope Antenna	Yes (Part of ILS)	Maintain	NA	NA	NA
	Localizer Antenna	Yes (Part of ILS)	Maintain	NA	NA	NA
	Weather Aids	ASOS Segmented Circle Wind Tee Windsocks	Maintain Maintain Maintain Maintain	Maintain Maintain Maintain Maintain	Maintain Maintain Maintain Maintain	Maintain Maintain Maintain Two additional windsocks
	Control Tower	Yes	Replace with modern facility	Yes	Replace with modern facility	Replace with modern facility
VISUAL APPROACH AIDS						
	Glide Path Indicator Lights	PAPI-4	Maintain	PAPI-2 (Rwy 30)	Maintain or Close Runway	NA
	Runway End Identification Lighting	REIL (Rwy 16)	Maintain	No REIL	Non required	NA
	Approach Lighting System	MALSR	Maintain	NA	NA	NA
LIGHTING, MARKING, SIGNAGE						
	Airport Identification	Rotating Beacon	Maintain	Maintain	Maintain	Maintain
	Runway Edge Lighting	HIRL	Maintain	Maintain	Maintain	MIRL
	Taxiway Edge Lighting	MITL	Maintain	Maintain	Maintain	MITL
	Hold Position Marking	250' from Rwy centerline	Maintain	Maintain	Maintain	125'
	Connecting Taxiways	Enhanced Centerline Markings	Maintain	Maintain	Maintain	Centerline markings
	Other Taxiways	Yellow Centerline Markings	Maintain	Maintain	Maintain	Centerline markings
	Lighted Airfield Signage	Yes	Maintain	Maintain	Maintain	Yes, as appropriate

KEY

ASOS - Automated Surface Observing System
ATCT - Airport Traffic Control Tower
MALSR - Medium Intensity Approach Light System with Runway Alignment Indicator Lights
MIRL/HIRL - Medium/High Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
PAPI - Precision Approach Path Indicator
PCN - Pavement Classification Number
POFZ - Precision Obstacle Free Zone
RDC - Runway Design Code
REIL - Runway End Identification Lights
ROFA - Runway Object Free Area
ROFZ - Runway Obstacle Free Zone
RPZ - Runway Protection Zone
RSA - Runway Safety Area
VIS - Visual

Exhibit 3E
AIRSIDE FACILITY REQUIREMENTS

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TABLE 3P | Airline Peaking Activity Levels

Enplanements	2022 – Current	Short Term	Intermediate Term	Long Term
Annual	100,890	139,402	148,602	154,500
Peak Month	9,806	13,549	14,443	15,017
Design Day	530	732	781	812
Design Hour	182	251	268	279
Deplanements				
Design Hour	244	337	359	374
Total Passengers				
Design Hour	426	588	627	653
Commercial Operations				
Annual	3,905	3,871	3,190	2,728
Peak Month	350	347	286	245
Design Day	12	12	10	8
Design Hour	4	4	3	3
Departures/Arrivals				
Design Day	6	6	5	4
Design Hour	2	2	2	2

Source: Coffman Associates analysis

AIRCRAFT GATES

Several methods were utilized to determine aircraft gate requirements for the airport. The first is the gate demand model from ACRP Report 25. This model utilizes two different approaches. The first approach uses the current ratio of annual passengers per gate, adjusted for forecast changes in fleet mix and annual load factors. This methodology assumes the pattern of gate utilization will remain relatively stable over the 20-year forecast period. The changes in passengers per gate are due to changes in enplanements per departure (due to forecast increases in seating capacity and load factors), as opposed to increasing or decreasing the number of departures per gate. The second ACRP method considers increases in the number of departures per gate.

The two methods are averaged to arrive at the aircraft gate forecast. There is currently one aircraft gate, and two gates are needed. Within the 20-year planning horizon, three gates are needed to meet demand.

FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*, was also consulted. The AC provides three methodologies: one is based on the peak hour utilization rate, the second utilizes the daily departure for a daily utilization rate, and the third considers an annual utilization rate. Each of these was found to be consistent with the ACRP methodology.

TERMINAL APRON

Four primary considerations govern efficient aircraft apron design:

- The movement and physical characteristics of the aircraft to be served;
- The maneuvering, staging, and location of ground servicing equipment and underground utilities;
- The dimensional relationships of parked aircraft; and
- The safety, security, and operational practices related to apron control.

The optimal apron design will depend on available space, aircraft mix, and terminal configuration.

The existing commercial terminal apron is 14,500 square yards (sy) in size and is marked with four parking positions. This apron is narrow in size, with only 150 feet from the terminal building to the east edge. As a result, the two parking positions closest to the terminal are sized for smaller regional jets. The two positions farther from the terminal building, where more apron depth is available, are sized for Boeing 737 aircraft. In addition, there is another apron farther south which encompasses approximately 7,000 square yards and is primarily used for remain-overnight (RON) aircraft and overflow parking. The air cargo apron, which encompasses approximately 5,200 square yards, is at the south end beyond the RON apron. Figure 3-1 shows the apron layout at RDD.

From a gross size perspective, the terminal apron is adequate in size when including the RON positions; however, its shape is restrictive. Currently, only smaller passenger aircraft can park next to the terminal building. Larger aircraft (e.g., Boeing 737) must park farther from the terminal. Passengers have to walk a distance of 400 feet from the fourth aircraft parking position to the terminal outside.

Options to expand the depth of the apron will be considered in the alternatives chapter.

TERMINAL BUILDING REQUIREMENTS

Determining the requirements for the passenger terminal building begins with a demand/capacity analysis of the existing facilities that identifies the current capacity of key processing areas for comparison to the passenger demand at the airport. The purpose of the analysis is to quantify and qualify the ability of the existing terminal facilities to satisfy the current demand of the traveling public.

A model based on industry standards and calibrated for RDD – based on observations of passenger activities and terminal operations and design – was used in this analysis. The model utilizes the standard queuing theory, which can be defined as: passengers arriving minus passengers processed equals passengers in queue. The evaluation of individual processing elements is based on industry standards and formulas.

The model considers the level of service standards established by the International Air Transport Association (IATA). Level of service (LOS) defines the comfort and quality of the passenger experience. Some LOS standards are related to crowding in queuing areas, while others define the amount of time a passenger must wait for processing. **Table 3Q** outlines the basic level of service standards, while **Exhibit 3F** outlines space requirements for each functional element of the passenger terminal building.

In general, LOS C is a typical design goal for most airports. LOS B would be a preferred goal if the budget allows. LOS A is generally too expensive to achieve and is therefore prohibitive to implement. For the purposes of this analysis, LOS C+ was used to represent a median between LOS B and C.

		Existing	Planning Activity Levels: Current Need 100,890	Short 139,402	Intermediate 148,602	Long 154,500
DEPARTURES PROCESSING						
Ticket Counters						
Utilization Factor	90%	0	164	226	241	251
Agent Positions	#	5	7	9	10	10
Frontage	LF	94	42	54	60	60
Area	SF	650	460	590	660	660
Ticket Lobby						
Queing Area	SF	1,650	920	1,270	1,360	1,410
TSA Baggage Check	SF	580	840	1,080	1,200	1,200
Outbound Baggage	SF	Outside	2,020	2,590	2,880	2,880
Airline Ticket Office/Baggage Screening	SF	2,240	1,720	2,210	2,460	2,460
Ticket Lobby Circulation	SF	1,750	480	620	690	690
Subtotal Airline Operations	**SF**	**6,220**	**5,980**	**7,770**	**8,590**	**8,640**
Public Area						
Circulation	SF	2,500	11,930	16,460	17,560	18,280
Lobby/Waiting Area	SF	3,180	Included in Circulation			
Security Stations						
Number	#	1	1	2	2	3
Queing Area	SF	1,050	590	810	860	900
Station Area	SF	2,360	360	720	720	1,080
TSA Administration/Operations	SF	0	700	1,400	1,400	2,100
CONCOURSE FACILITIES						
Passenger Holdrooms						
Gates	#	1	2	2	2	3
Gate Area	SF	1,760	Included in Holdroom Area			
Holdroom Area	SF	1,740	3,540	4,570	4,830	5,860
Airline Operations	SF	0	2,000	2,000	1,500	1,500
Concourse Circulation						
Circulation Area	SF	850	1,062	1,371	1,449	1,758
ARRIVALS PROCESSING						
Baggage Claim						
Passengers claiming bags	85%	207	207	286	305	318
Claim Display Frontage	LF	45	150	200	220	220
Claim Device Floor Area	SF	670	750	1,000	1,100	1,100
Inbound Baggage	SF	0	1,800	2,400	2,640	2,640
Baggage Service Office	SF	0	300	400	440	440
Claim Lobby						
Area Excl. Device Area	SF	600	4,930	6,810	7,260	7,560
Circulation Area	SF	600	2,970	4,100	4,360	4,550
PUBLIC SPACES						
Restrooms						
Area	SF	1,465	2,040	2,820	3,010	3,130
Concessions						
Food & Beverage	SF	5,365	1,210	1,670	1,780	1,850
Retail	SF	0	500	700	740	770
Support	SF	0	340	470	500	520
Rental Car						
Counter Frontage	LF	50	43	59	63	65
Counter and Office Area	SF	1,100	640	880	940	980
Counter Queuing Area	SF	690	340	470	500	520
Airport Administration						
Administration/Operations	SF	1,690	5,100	7,100	7,500	7,800
Business Center	SF	230	Included in Admin			
FUNCTIONAL AREA TOTAL						
Total Functional Area	**SF**	**32,720**	**46,702**	**63,431**	**67,139**	**71,438**
BUILDING SYSTEMS/SUPPORT						
Mechanical/HVAC	SF	2,450	1,870	2,540	2,690	2,860
Vertical Circulation/Structural Space	SF	1,290	1,900	2,500	2,700	2,900
General Storage	SF	1,090	3,270	4,440	4,700	5,000
TOTAL TERMINAL						
Gross Building Area	**SF**	**37,550**	**53,742**	**72,911**	**77,229**	**82,198**

Note: Level of Service C+ is applied

Exhibit 3F
TERMINAL SPACE REQUIREMENTS

TABLE 3Q | Level of Service Standards (IATA)

AREA PER OCCUPANT (feet^2)								
Level of Service Standards	**A**	**B**	**C+**	**C**	**C-**	**D**	**E**	**F**
Check-in Queue Area	19.4	17.2	16.1	15.1	14	12.9	10.8	–
Wait/Circulate	29.1	24.8	22.6	20.4	18.3	16.1	12.8	–
Holdroom	15.1	13.5	12.8	12	11.3	10.5	8	–
Bag Claim Area (excl. claim device)	21.5	19.4	18.3	17.2	16.1	15.1	12.9	–
Federal Inspection Services	15.1	12.9	11.8	10.8	9.7	8.6	6.5	–

A: Excellent levels of comfort and service; conditions of free flow
B: High levels of comfort and service; condition of stable flow; very few delays
C: Good levels of comfort and service; condition of stable flow; acceptable delay
D: Adequate levels of comfort and service; condition of unstable flow; acceptable delays for short periods
E: Inadequate levels of comfort and service; condition of unstable flow; unacceptable delays
F: Unacceptable levels of comfort and service; conditions of cross flows; system breakdown and unacceptable delays; applies to areas below LOS E

Departures Processing

The first destination for most enplaning passengers in the terminal building is the ticket counters/check in kiosks. The ticketing area includes the counters, queuing area and lobby, ticket offices, and bag screening and processing. Security screening is also included in the departures processing element.

Ticket Counters/Kiosks: The percentage of the departing passenger peak hour demand that checks in at the ticket lobby is estimated at 85 percent. The remaining percentage is assumed to check in prior to arriving at RDD and does not have checked baggage. The capacity at the ticket counters was calculated based on the passenger processing rate derived from observation and IATA averages. The ticket counter functions appear to be adequate through the long-term planning period. The ticket counter area is adequately sized through the 20-year planning horizon.

Ticket Lobby: The adequacy of the ticket lobby floor area is also evaluated to determine whether demand levels result in an acceptable level of service. Typically, the ticket lobby demand would include a percentage of well-wishers, in addition to the passengers. Well-wishers are estimated at 58 percent of passengers. The evaluation was based on a service goal of a 2.5-minute maximum wait in queue and an LOS C+ of 16.1 square feet per person in queue with baggage.

The ticket lobby queueing area calculation shows that the lobby will become constrained by the intermediate planning horizon. At peak periods, portions of the ticket lobby circulation area will accommodate counter queue persons.

Bag Screening and Processing: The Transportation Security Administration (TSA) must inspect every checked bag that is to be put on an aircraft. Bags are screened to the side of the ticket counters and then transported outside to carts. The bag screening area is currently too small and should be enclosed. The automated in-line bag screening system is up to date with current technology and should be maintained.

Passenger Security Screening: The required queuing area for the checkpoint was determined using an area of 16.1 square feet per person at an LOS C+. Across the country, the TSA is making efforts to help streamline the screening process, including providing staff during peak periods, installing new equipment, and opening pre-check lanes. The security screening at RDD consists of one x-ray machine for bags. Passengers pass through either a metal detector or an explosives detection system (EDS) automated body scanning machine.

The availability of one security station is adequate in the short term. By the intermediate term, an additional security station is recommended, and by the long term, three screening stations are recommended. Additional space for the security station passenger queue is recommended. By the intermediate term, additional space is recommended for the security station itself, which reflects the need for an additional x-ray machine.

The security queuing area is actually part of the public lobby, as there is not enough space for a separate security queuing area.

Arrivals Processing

The passenger arrivals process consists primarily of those facilities and functions that provide a means to reunite the arriving passenger with items that were checked at the origin of the flight.

Baggage Claim: It is estimated that 85 percent of arriving peak hour passengers claim checked baggage. The remaining passengers bypass the baggage claim areas and go directly to the curb or to other ground transportation-related facilities. An industry standard of 1.3 checked bags per passenger is utilized. The baggage claim capacity is based on the device frontage per person to a depth of five feet.

Claim Lobby: Claim lobby area is based on meeting LOS C+ and is calculated as 18.3 square feet per person. The existing baggage claim lobby is undersized. At peak periods, adjacent areas (such as the public lobby and the circulation areas) will be used by passengers waiting for bags.

Concourses

The concourse area for an airport is, essentially, those areas beyond the security screening stations, including the passenger holdrooms and general circulation areas. While holdrooms and circulation are calculated separately, it is common for actual usage to include both elements. For example, while passengers are waiting, they will typically disperse throughout the secure concourse. As their boarding time nears, passengers tend to gather in the gate area. As a result, it is common to consider holdroom and concourse capacity in aggregate.

Holdrooms: The holdroom capacity is based on available seats for the design aircraft for each gate, as well as average load factors. Podium space and queuing/exit space are also considered. The holdroom area is shown to be significantly undersized. This is evidenced by the fact that the peak hour exceeds the seating capacity of the holdroom. As a result, passengers are often standing or seated on the ground in the holdroom. In addition, the TSA will hold departing passengers outside screening until boarding time in order to avoid overcrowding the holdroom. This procedure often leads to delayed departures.

Circulation: The circulation element consists of hallways adjacent to the passenger seating areas. The circulation requirement is based on providing circulation at 22.6 square feet per occupant. The concourse circulation area is undersized currently and through the planning period.

Public Spaces

Public spaces include restrooms, concessions, and other public areas.

Restrooms: Restrooms are strategically located throughout the terminal building on both the public and secure sides. Restroom capacity is calculated based on square footage per peak hour passenger, as provided in FAA AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*. Total restroom facilities are currently undersized.

Concessions and Retail: While planning standards and demand are important considerations in the adequacy of concessions in a terminal, there are marketing considerations that determine the capacity and economic viability of airport food/beverage services and retail concessions. At RDD, there is a popular restaurant on the second floor before security. Past security, there is a small coffee shop and some vending machines in the holdroom.

Concessions are based on providing 15 square feet per 1,000 annually enplaned passengers. Retail space is estimated as eight square feet per 1,000 annual enplaned passengers. Both types of space are undersized if the restaurant space is excluded. Local economies will heavily influence the actual space needed for these functions.

Building Systems and Support

The systems and support functions include mechanical rooms, heating and air conditioning (HVAC), storage, and stairwells. These elements are necessary for the continued efficiency of the terminal building and are estimated at four percent of the total building size.

Administration Offices

It is common for administration offices to be located in the terminal building, which is the case at RDD, where the administration offices are on the second story of the building. Administration space is calculated as a function of the design hour passengers (426) multiplied by 12. The current administration space is well below what is recommended.

Terminal Building Requirements Summary

The main floor of the terminal building encompasses approximately 28,420 square feet of space and the second floor is 9,130 square feet. The total building size is 37,550 square feet. Based on the current level of annual enplanements, the ideal terminal building size is 53,742 square feet. The most pressing concern is the need for additional holdroom space. Several other functional areas are undersized, including bag processing (inbound and outbound), general circulation space, and restrooms.

According to industry standards for terminal building requirements, a building of approximately 50,000 square feet should be planned in the short-term planning horizon. By the long-term planning horizon, a slightly larger facility of 53,000 square feet is recommended.

The alternatives chapter of this master plan will consider the feasibility of adding to the existing terminal building and constructing a new building.

TERMINAL ROADWAY, CURB, AND PARKING

The capacity of the airport access road 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 for a roadway to operate below capacity in order to provide reasonable flow and minimize delay to the vehicles using it. The existing terminal roadway is of optimal design. It provides ready access to the parking lot and the front of the terminal building. The terminal roadway is a one-way road that leads up to the terminal's curbside entrances and circles around the passenger parking lot.

The terminal curb is used for loading/unloading, queuing, or vehicle staging for passengers. The curb length is currently 300 feet long. While the curb is one continuous length in front of the terminal building, for planning purposes, it is estimated that 180 feet is primarily for departing (enplaning) passengers and the remaining 120 feet is for arriving (deplaning) passengers. Curb length is determined by the type and volume of ground vehicles expected during the peak period of the design day. The curb length model indicates a need for a curb length of 240 feet currently and 370 feet in the long term. The curb length projections show an adequate current curb length.

Terminal vehicle parking is a function of peak hour visitors, peak hour passengers, and the average modal split at the airport. The terminal parking lot has approximately 328 spaces (98 short-term and 230 long-term spaces). There are 75 rental car parking spaces and the employee parking lot to the south of the terminal building has 34 spaces. By the short-term planning period, parking becomes constrained, and 56 additional vehicle parking spaces are ultimately needed. **Table 3R** presents the terminal curb and parking needs by planning horizon.

TABLE 3R | Terminal Curb and Parking

	Existing	Current Need	Short Term	Intermediate Term	Long Term
Terminal Curb					
Enplane Curb (ft)	120	100	100	110	110
Deplane Curb (ft)	180	140	240	250	260
Total Curb (ft)	***300***	***240***	***340***	***360***	***370***
Auto Parking					
Short Term	98	64	88	94	98
Long Term	230	143	198	211	219
Employee	34	30	42	45	46
Rental Car	75	85	117	125	130
Taxi/Shuttle Stand	1	1	1	1	1
Total All Parking	**438**	**323**	**446**	**476**	**494**

TERMINAL COMPLEX SUMMARY

The commercial terminal complex is currently undersized. Many of the sizing elements of a terminal building are a function of peak passenger levels. Most facility planning does not utilize the absolute peak period; instead, averages of peak periods are utilized as model inputs. Because of this, various terminal elements may feel congested at times; however, the planned facilities should be adequate most of the time.

The terminal building currently encompasses 37,550 square feet of space. The needs analysis indicates that a terminal building of approximately 53,742 square feet should be considered to meet current activity levels. To meet the long-term passenger forecasts, a terminal building of approximately 82,198 square feet should be planned. **Exhibit 3F** summarizes the terminal building needs by functional area.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for handling aircraft and passengers while on the ground. These facilities provide the essential interface between air and ground transportation modes. The capacities of the various components of each area were examined in relation to projected demand in order to identify future landside facility needs. This analysis covers facility needs to support general aviation activity and commercial passenger service. The general aviation landside components include the following:

- Aircraft Hangars
- Aircraft Parking Apron
- Auto Parking and Access
- General Aviation Terminal Building Services
- Support Facilities

AIRCRAFT HANGARS

Owning an aircraft represents a significant financial investment. Most aircraft owners prefer to store their aircraft in enclosed hangar space, as opposed to utilizing outside aircraft tiedown positions. This is especially true in climates with frequent precipitation. Enclosed hangar space provides protection from the elements and an increased level of security. At RDD, approximately 20 percent of the based aircraft utilize designated tiedown positions on one of the aircraft parking aprons.

There are three general types of aircraft storage hangars: T-hangars, box hangars, and conventional hangars. T-hangars are similar in size and will typically house a single-engine piston-powered aircraft. Some multi-engine aircraft owners may elect to utilize these facilities as well. Many T-hangar units are typically "nested" within a single structure. Box hangars are larger, and open space hangars are typically used to store somewhat larger personal/business aircraft and/or to house aviation businesses. Conventional hangars are large hangars with open floor plans that can store several aircraft.

Baseline hangar information was previously presented in Chapter One – Inventory (Table 1H). RDD currently has 122,000 square feet of T-hangar/Port-O-Port hangar space, which is 104 positions. Box hangar space is estimated at approximately 47,000 square feet and 19 units. There is approximately 82,100 square feet of conventional hangar space, providing an estimated 27 spaces.

Calculations of future hangar needs by hangar type have been developed. Future T-hangar space is estimated at 1,400 square feet. Future box hangar space is estimated at 2,500 per aircraft and conventional hangar space is estimated at 3,000 square feet per aircraft. This analysis assumes that – over time – more aircraft owners would utilize enclosed hangar space if it was available. While approximately 80 percent of based aircraft are currently stored in hangars, by the long-term planning period, this number increases to 86 percent.

Table 3S presents aircraft storage needs based on the demand forecasts. Estimates indicate a long-term need for a total of approximately 185,900 square feet of additional aircraft storage space to accommodate the forecast growth in based aircraft. An additional 20,235 square feet of space is estimated to be needed for non-storage aviation activities, such as aircraft maintenance.

TABLE 3S | Hangar Needs

	Currently Available	Short Term	Intermediate Term	Long Term	Total Need
Based Aircraft	240	249	262	290	–
Aircraft to be Hangared	192	204	220	249	58
Hangar Positions					
T-Hangar Positions	104	107	113	124	20
Box Hangar Positions	19	37	39	44	25
Conventional Hangar Positions	27	37	42	51	24
Hangar Area Requirements					
T-Hangar Area	122,000	149,000	158,000	173,000	51,000
Box Hangar Area	47,000	92,000	98,000	111,000	64,000
Conventional Hangar Area	82,100	112,000	126,000	153,000	70,900
Total Storage Area (sf)	**251,100**	**353,000**	**382,000**	**437,000**	**185,900**
Maintenance Area	19,365	30,600	33,600	39,600	20,235

Source: Coffman Associates analysis

Hangar space requirements are general in nature and are based on standard hangar size estimates and typical user preferences. If a private developer desires to construct or lease a large hangar to house one aircraft, any extra space in that hangar may not be available for other aircraft. The actual hangar area needs will be dependent on the usage within each hangar.

GENERAL AVIATION AIRCRAFT APRON

Aircraft apron area is a critical feature for any airport. Apron areas should be in proximity to airport services, a terminal building, or fixed base operator (FBO) services. Local aprons are designated for based aircraft owners who store their aircraft outside. Transient aprons are designated for aircraft operators who are making a short stay at the airport. As noted in the inventory chapter, there are three primary apron areas at RDD. The 12,500-square-yard apron east of Air Shasta is primarily for locally based aircraft and it provides 36 tiedown positions. The transient apron is to the east of the Air Shasta and Redding Jet Center FBOs. This apron encompasses approximately 30,000 square yards with 77 tiedown positions and eight positions for larger aircraft. The helicopter apron east of the control tower measures approximately 5,000 square yards and has nine marked positions. While this analysis will estimate future apron area needs as either local or transient, it is common for there to be crossover at various times; a local based aircraft owner may use a transient position, or vice versa, for short periods of time.

Local Apron Requirements

Local tiedown positions are assumed to be utilized by owners of small single-engine aircraft. Local tiedown positions tend to be more closely spaced because they may be tied down for long periods of time; therefore, a planning criterion of 400 square yards per aircraft is utilized. In addition, it is common for hangared aircraft to periodically use local tiedown positions on a temporary basis. To accommodate this typical usage pattern, an additional 10 local tiedown spaces are planned above the calculated need.

It is estimated that there is a current need for 55 local tiedown spaces, which is more than the current capacity of 36. By the long-term planning period, a total of 51 local tiedown spaces are forecast to be needed. In terms of apron area, there is a long-term need for 25,300 square feet of local apron. An additional 12,800 square yards of local apron space is needed over the next 20 years.

Transient Apron Requirements

FAA AC 150/5300-13B, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. Planning criteria of 400 square yards per small aircraft and 900 square yards per large aircraft were applied to determine current and future transient apron area requirements. These area estimates do not include circulation areas and access taxilanes. The current need for transient apron area is 24,800 square yards; therefore, the current transient apron is adequately sized. By the intermediate and long-term planning horizons, additional transient apron is calculated to be needed. There is a long-term need for 7,400 square yards of additional itinerant apron space.

General Aviation Aircraft Apron Summary

The local apron area is currently undersized at 12,500 square yards. By the long-term planning period, a total local apron size of 25,300 square yards is estimated to be needed. Currently, some locally based aircraft use transient aprons for overflow. Approximately 7,400 additional square yards of transient apron will be needed through the 20-year planning horizon. The current transient apron is adequately sized until years 10-20 of this study. The helicopter apron is adequately sized and should be maintained. **Table 3T** summarizes the aircraft apron needs at the airport.

TABLE 3T | Aircraft Apron Requirements

		FORECAST			
	Currently Available	Short Term	Intermediate Term	Long Term	Total Need
Local Apron Positions	36	55	52	51	15
Local Apron Area (sy)	12,500	27,400	26,000	25,300	12,800
Transient Apron Positions	77	43	47	58	-19
• *Piston Transient Positions*	*69*	*21*	*24*	*29*	*-40*
• *Turbine Transient Positions*	*8*	*21*	*24*	*29*	*21*
Transient Apron Area (sy)	30,000	27,700	30,900	37,400	7,400
Total Apron Area (sy)	**42,500**	**55,100**	**56,900**	**62,700**	**20,200**

Source: Coffman Associates analysis

GENERAL AVIATION VEHICLE ACCESS AND PARKING

General aviation parking needs are attributable to locally based users, transient airport users, and aviation businesses. Locally based users primarily include those attending to their based aircraft. As with many airports with a significant general aviation component, most based aircraft owners will park their vehicles in or adjacent to their hangars when attending to or flying their aircraft. Current planning standards suggest that dedicated vehicle parking lots and access roads should be made available to hangar owners/occupants, where feasible. This has the positive effect of removing vehicular traffic from aircraft movement areas.

Vehicle parking needs for locally based aircraft operators are estimated at half the total number of based aircraft. If dedicated vehicle parking were made available for local aircraft owners, there would be a need for 120 spaces currently and 145 spaces in the long term.

Transient users will require vehicle parking lots, as they are short-term (often same day) visitors. This space is typically provided by the airport businesses and FBOs.

Calculations of future transient vehicle parking needs are a function of the number of potential general aviation passengers during the design hour. The number of design hour itinerant passengers is multiplied by 2.0 (average vehicle occupants), which results in a total number of vehicle parking spaces needed. Calculations of vehicle parking are estimated at 16 spaces for the current need and 20 spaces for the long-term need. Calculations of the number of spaces needed for airport businesses are estimated at one space per 1,000 operations.

Table 3U summarizes the vehicle parking needs for transient and local airport users. It is estimated that there are 37 parking spaces currently available and there will be a need for 40 spaces by the long-term planning period. Total GA vehicle parking area is currently 19,000 square feet, with a long-term need for 19,800 square feet. Future hangar development should consider dedicated road access and parking lots to accommodate the needs of transient visitors and airport businesses.

TABLE 3U | GA Vehicle Parking Requirements

	Current Need	Short Term	Intermediate Term	Long Term
Design Hour GA Itinerant Passengers	65	73	81	99
GA VEHICLE PARKING SPACES				
GA Itinerant Spaces	131	146	161	197
GA Local Spaces	120	125	131	145
Total GA Spaces	**251**	**270**	**292**	**342**
GA VEHICLE PARKING AREA (sf)				
GA Itinerant Parking Area (sf)	65,300	73,000	80,600	98,600
GA Local Parking Area (sf)	60,000	62,250	65,500	72,500
Total Parking Area (sf)	**125,300**	**135,250**	**146,100**	**171,100**

GENERAL AVIATION TERMINAL SERVICES

Typically, certain services will be made available to general aviation users. These may include a pilot's lounge, flight planning station, line services, conference room, and restrooms. These facilities may be provided by a dedicated facility and/or shared with FBO facilities. At RDD, both FBOs provide these spaces for general aviation users.

General aviation terminal needs are a function of the average number of general aviation passengers that may use the facilities during the design hour. Assuming two people per design hour itinerant operation it is estimated that there is a need to accommodate up to 10 people within any single hour in the long term. Calculating 120 square feet of space per person results in the general aviation terminal building space requirements of 8,800 square feet in the short term and 11,800 square feet in the long-term planning horizon. **Table 3V** presents the calculation for general aviation terminal space needs at the airport.

TABLE 3V | General Aviation Terminal Area Facilities

	Currently Available	Short Term	Intermediate Term	Long Term
Design Hour GA Operations	51	57	63	77
Design Hour GA Itinerant Operations	33	36	40	49
Multiplier	2.0	2	2	2
Total Design Hour Itinerant Passengers	65	73	81	99
GA Terminal Building Public Space (sf)	7,800	8,800	9,700	11,800

*Estimated GA terminal building space

Source: Coffman Associates analysis

AIRPORT SUPPORT REQUIREMENTS

Various facilities that do not logically fall within the classifications of airside or landside facilities have also been analyzed for their adequacy through the long-term planning period. These other areas provide certain support functions related to the overall operation of the airport.

Maintenance Equipment Building

The airport has a small 1,500-square-foot maintenance equipment building located north of the T-hangar area. For this size of airport, the building is undersized. The current maintenance equipment building is in the RPZ for Runway 12 and should be removed for this purpose, as well. Consideration should be given to replacing the existing maintenance equipment building with a larger structure that is approximately 3,000 square feet in size.

Aircraft Rescue and Firefighting (ARFF)

Part 139 airports are required to have ARFF services during air carrier operations. Each certified airport maintains equipment and personnel, based on an ARFF index that is established according to the length of aircraft and the frequency of scheduled flights. An ARFF index is determined by the longest aircraft that conducts at least five or more daily departures. There are five indices based on aircraft length: A through E.

The current ARFF equipment and staffing available at Redding Regional Airport meet ARFF Index B, based on operations by large aircraft with lengths between 90 feet and 126 feet. The current ARFF index for RDD is anticipated to remain the same; therefore, no changes are needed to maintain adequate fire protection.

RDD maintains equipment and agents that meet ARFF Index C. ARFF Index C would not be required until the airport experiences five or more daily departures by a 737-800 or larger aircraft. That level of activity is not forecast for this master plan; nevertheless, it is the airport's prerogative to maintain an ARFF index level higher than what is required.

FAA design standards recommend for ARFF station facilities and equipment to be located so that equipment can respond to emergencies on the terminal apron without having to cross an active runway. The ARFF building is centrally located to the immediate west of the transient apron. This facility should be maintained.

Fuel Storage

The airport has a total storage capacity of 112,700 gallons for Jet A fuel and 40,700 gallons for Avgas.

Fuel sales records were provided by the airport. Over the past five years, the airport has sold 1.68 million gallons of Jet A fuel and 202,000 gallons of Avgas fuel per year, on average. The Avgas fuel consumption estimate is a function of the forecast of piston aircraft operations. The Jet A fuel consumption estimate is a function of the forecast of turbine aircraft operations. Additional fuel storage capacity should be planned when the airport is unable to maintain an adequate supply and reserve (commonly up to a 14-day reserve). Current capacities of Jet A and Avgas storage are adequate through the long-term planning period. **Table 3W** presents this analysis.

TABLE 3W | Fuel Storage Requirements

		Planning Horizon			
	Current Capacity	Baseline Consumption (5-year average)[1]	Short Term	Intermediate Term	Long Term
Jet A Fuel Requirements					
Annual Usage (gal.)	**112,700 gal.**	1,679,047	2,115,750	2,388,750	2,916,550
Daily Usage (gal.)		4,600	5,797	6,545	7,991
14-Day Storage (gal.)		64,402	81,152	91,623	111,868
Avgas Requirements					
Annual Usage (gal.)	**40,700 gal.**	201,667	232,075	255,950	309,105
Daily Usage (gal.)		553	636	701	847
14-Day Storage (gal.)		7,735	8,902	9,817	11,856

Source: [1]RDD fuel sales records

Perimeter Fencing

Perimeter fencing is used at airports primarily to secure the aircraft operational area and reduce wildlife incursions. The physical barrier of perimeter fencing:

- 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 facility security; and
- Limits inadvertent access to the aircraft operations area by wildlife.

The airport has full perimeter fencing, which serves as operational security and as a deterrent to wildlife accessing the airfield movement areas. There are more than 38,000 linear feet of fencing, which is regularly inspected. This fencing should be maintained.

GENERAL AVIATION LANDSIDE REQUIREMENTS SUMMARY

To meet the projected needs of general aviation activity, approximately 185,900 square feet of additional hangar area is anticipated to be needed as a mix of conventional, box hangar, and T-hangar space. These estimates are based on typical airport needs and pilot preference for hangar types. Specific operators may have needs that differ from what is typical; for example, a new tenant may prefer to store their aircraft in a large conventional hangar.

The general aviation apron areas are sized through the intermediate planning horizon. By the long-term planning horizon, approximately 20,200 square yards of additional apron area is projected to be needed. Additional apron area is often constructed in conjunction with new hangar development, and this may ultimately be adequate.

Most based aircraft owners with hangars will park their vehicles in their hangars when they are using their aircraft. Optimal planning will provide enough public parking for both based aircraft owners and transient users. The general aviation vehicle parking model indicated that additional parking will be needed in the short-term planning horizon.

Those landside facilities necessary to meet current and future demand should be maintained to a high standard. To this end, the airport should prioritize ongoing maintenance needs and pay attention to aesthetics, as the airport is an important entrance to the community.

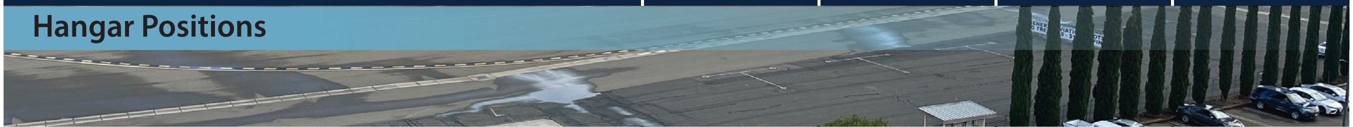
Exhibit 3G presents a summary of the landside requirements, as well as the support requirements that are discussed in the next section.

SUMMARY

This chapter has outlined the facilities required to meet potential aviation demands projected for the airport for the next 20 years. The next chapter, Chapter Four – Alternatives, examines potential improvements to the airfield system and the landside area. Most of the discussion focuses on those capital improvements that would be eligible for federal grant funds. Several facility layouts that meet the forecast demands over the next 20 years are presented and an overall ALP that presents a long-term vision will ultimately be developed.

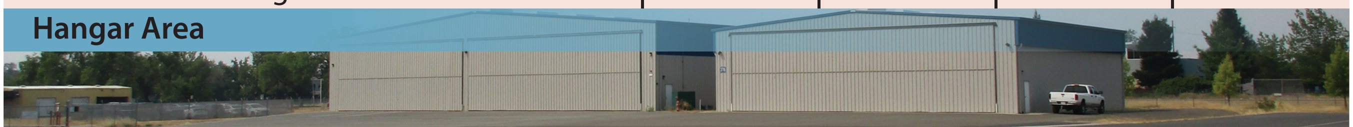
	Available	Short Term	Intermediate Term	Long Term
Based Aircraft	**240**	**249**	**262**	**290**

Hangar Positions



	Available	Short Term	Intermediate Term	Long Term
T-Hangars	104	107	113	124
Executive/Box Hangars	19	37	39	44
Conventional Hangar Positions	27	37	42	51

Hangar Area



	Available	Short Term	Intermediate Term	Long Term
T-Hangars	122,000	149,000	158,000	173,000
Executive/Box Hangars	82,100	112,000	126,000	153,000
Conventional Hangar (s.f.)	47,000	92,000	98,000	111,000
Total Hangar Area (s..f)	251,100	353,000	382,000	437,000
Maintenance Area (s.f.)	19,365	30,600	33,600	39,600

Aircraft Parking Positions

	Available	Short Term	Intermediate Term	Long Term
GA Local Positions	36	55	52	51
GA Transient Piston Positions	69	21	24	29
GA Transient Turboprop/Jet Positions	8	21	24	29

GA Aircraft Parking Apron

	Available	Short Term	Intermediate Term	Long Term
GA Local Apron Area (s.y.)	12,500	27,400	26,000	25,300
GA Transient Apron Area (s.y.)	30,000	27,700	30,900	37,400
GA Total Apron (s.y.)	42,500	55,100	56,900	62,700

GA Terminal Services

	Available	Short Term	Intermediate Term	Long Term
Area (s.f.)	7,800	8,800	9,700	11,800

Fuel Storage

	Available	Short Term	Intermediate Term	Long Term
AvGas Capacity (underground)	40,700 gal.	Maintain	Maintain	Maintain
Jet A Capacity	112,700 gal.	Maintain	Maintain	Maintain

Perimeter Fencing

	Available	Short Term	Intermediate Term	Long Term
Linear Feet	38,000	Maintain and Replace As Needed	Maintain and Replace As Needed	Maintain and Replace As Needed

Exhibit 3G
GA LANDSIDE AND SUPPORT REQUIREMENTS