CHAPTER 3

FACILITY REQUIREMENTS

Proper airport planning requires the translation of forecasted aviation demand into the specific types and quantities of facilities that can adequately serve the identified demand. This chapter analyzes the existing capacities of Paso Robles Municipal Airport (PRB) facilities. The existing capacities will then be compared to the forecasted activity levels prepared in Chapter Two to determine the adequacy of existing facilities and identify whether deficiencies currently exist or may be expected to materialize in the future. The chapter presents the following elements:

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

The objective of this effort is to identify (in general terms) the adequacy of existing airport facilities, outline what new facilities may be needed, and determine when these may be needed to accommodate forecasted demands. Once these facility requirements are established, alternatives for providing the facilities will be evaluated to determine the most practical, cost-effective, and efficient means for implementation.

The facility requirements for PRB were evaluated using guidance contained in several Federal Aviation Administration (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*
- Federal Aviation Regulation (FAR) Part 77, *Objects Affecting Navigable Airspace*
- FAA Order 5090.5, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS) and the Airports Capital Improvement Plan (ACIP)*

DEMAND-BASED PLANNING HORIZONS

An updated set of aviation demand forecasts for PRB has been established and was detailed in Chapter Two. These activity forecasts include annual aircraft operations, based aircraft, aircraft fleet mix, and peaking characteristics. With this information, specific components of the airfield and landside system 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 has been established that takes into consideration the reasonable range of aviation demand projections. **The planning horizons are the short term (years 1-5), the intermediate term (years 6-10), and the long term (years 11-20).**

It is important to consider that the 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 by allowing airport management the flexibility to make decisions and develop facilities based on need 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** presents the short-, intermediate-, and long-term planning horizon milestones for each aircraft activity level forecasted in Chapter Two.

TABLE 3A | Aviation Demand Planning Horizons

	Base Year (2024)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
BASED AIRCRAFT				
Single-Engine	181	195	203	235
Multi-Engine	1	1	1	1
Turboprop	4	6	9	15
Jet	2	5	10	20
Helicopter	9	11	15	23
Other	0	1	1	2
Total Based Aircraft	**197**	**219**	**239**	**296**
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	0	0	0	0
Air Taxi	3,015	3,800	4,700	6,700
General Aviation	28,878	31,700	34,800	42,400
Military	499	2,500	2,500	2,500
Subtotal Itinerant	*32,392*	*38,000*	*42,000*	*51,600*
Local				
General Aviation	15,710	16,600	17,300	22,100
Military	134	0	0	0
Subtotal Local	*15,844*	*16,600*	*17,300*	*22,100*
Total Operations	**48,236**	**54,600**	**59,300**	**73,700**

Source: Coffman Associates analysis

AIRFIELD CAPACITY

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

FACTORS AFFECTING ANNUAL SERVICE VOLUME

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

- **Runway Configuration |** The existing airfield configuration consists of two runways in a crosswind configuration. Primary Runway 1-19 is 6,008 feet long and 150 feet wide. Secondary Runway 13-31 is 4,701 feet long and 100 feet wide. Runway 19 has published instrument approach visibility minimums down to ¾-mile while all other runways are published at one mile or greater visibility minimums.

- **Runway Use |** Runway use in capacity conditions is controlled by wind and/or airspace conditions. For PRB, the direction of takeoffs and landings is typically determined by the speed and direction of the wind or as directed by the airport traffic controller. It is generally safest for aircraft to take off and land into the wind, avoiding crosswind (wind blowing perpendicular to the travel of the aircraft) or tailwind components during these operations. Runway usage data sourced from the airport's 1200.aero ADS-B data is summarized in **Table 3B**. The runway usage data show that most arrivals and departures utilize Runway 19, followed by Runway 31.

TABLE 3B | Runway Usage Data

	Runway				Unknown
	1	19	13	31	
Departures	6.2%	69.1%	2.8%	16.1%	5.8%
Arrivals	9.0%	66.4%	5.0%	12.3%	7.2%

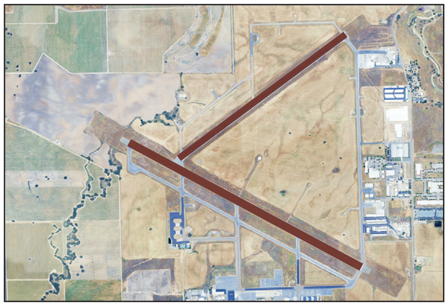
Source: 1200.aero, data available between August 19, 2022, and April 22, 2025

- **Exit Taxiways |** Exit taxiways have a significant impact on airfield capacity because the number and locations of exits directly determine the occupancy time of an aircraft on the runway. The airfield capacity analysis gives credit to taxiway exits located within the prescribed range from a runway's threshold. This range is based on the mix index of the aircraft that use the runways. Based on mix, only exit taxiways between 2,000 feet and 4,000 feet from the landing threshold count in the exit rating at PRB. The exits must be at least 750 feet apart to count as separate exit taxiways. Utilizing these criteria, Runway 1-19 is credited with one exit taxiway and Runway 13-31 has none.

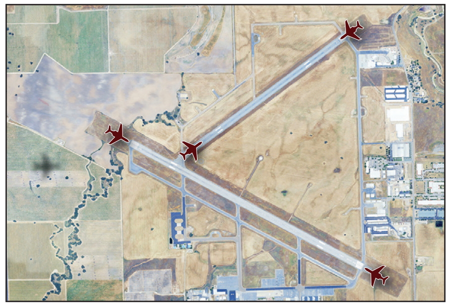
- **Weather Conditions |** Weather conditions can have a significant impact on airfield capacity. Airport capacity is usually highest in clear weather when flight visibility is at its best. Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are

AIRFIELD LAYOUT

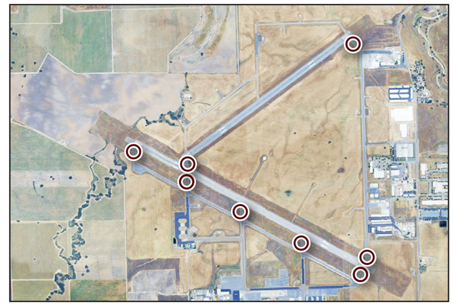
Runway Configuration



Runway Use



Number of Exits

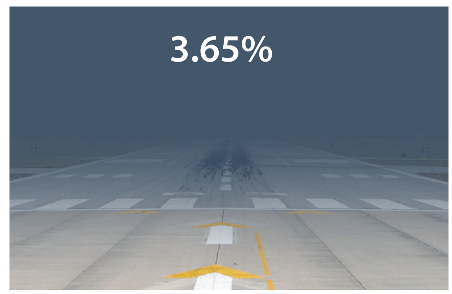


WEATHER CONDITIONS

VMC (VFR)
Visual Meteorological Conditions

IMC (IFR)
Instrument Meteorological Conditions

PVC
Poor Visibility Conditions



AIRCRAFT MIX

Category A & B Aircraft

Single Engine

Twin Piston

Small Turboprop

Category C Aircraft

Business Jet

Commuter

Regional Jet

Commercial Jet

Category D Aircraft

Wide Body Jets

OPERATIONS

Arrivals

Departures

Total Annual Operations

Touch-and-Go Operations

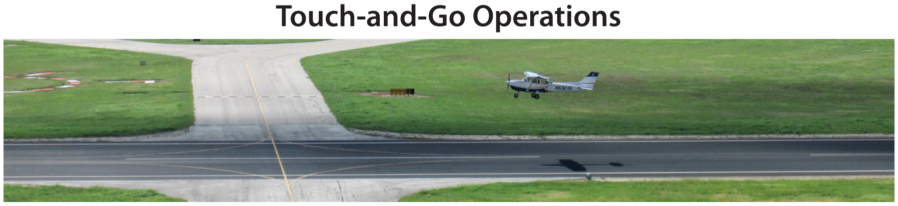


EXHIBIT 3A
AIRFIELD CAPACITY FACTORS

reduced. As weather conditions deteriorate, the spacing of aircraft must increase to provide allowable margins of safety and air traffic vectoring. The increased distance between aircraft reduces the number of aircraft that can operate at the airport during any given period, thus reducing overall airfield capacity.

According to local meteorological data, the airport operates under visual meteorological conditions (VMC) approximately 93.55 percent of the time. VMC exist whenever the cloud ceiling is greater than 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument meteorological conditions (IMC) are defined when cloud ceilings are between 500 and 1,000 feet AGL or visibility is between one and three miles. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. **Table 3C** summarizes the weather conditions experienced at the airport over a 10-year period.

TABLE 3C | Weather Conditions

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	≥ 1,000' AGL	> 3 statute miles	93.55%
IMC	≥ 500' AGL to < 1,000' AGL	1-3 statute miles	2.80%
PVC	< 500' AGL	< 1 statute mile	3.65%

VMC = visual meteorological conditions
IMC = instrument meteorological conditions
PVC = poor visibility conditions
AGL = above ground level

Source: Paso Robles Municipal Airport, 2014 through 2023

- **Aircraft Mix |** The aircraft mix for the capacity analysis is defined in terms of four aircraft classifications. Classes A and B consist of small- and medium-sized propeller aircraft and some jet aircraft, all of which weigh 12,500 pounds or less. These aircraft are primarily associated with general aviation activity but include some air taxi, air cargo, and commuter aircraft. Class C consists of aircraft that weigh between 12,500 pounds and 300,000 pounds. These aircraft include most business jets and some turboprop aircraft that utilize the airport on a regular basis. Class D consists of aircraft that weigh more than 300,000 pounds.

  Most operations at PRB are by aircraft in Classes A, B, and C. According to 1200.aero ADS-B data, in 2024, there were approximately 3,779 total operations by Class C aircraft at PRB, which represents approximately 7.8 percent of all operations. Class D aircraft do not operate at PRB; therefore, remaining operations are within Classes A and B, which represent 92.2 percent of total operations. It is anticipated that operations by Class C aircraft will represent approximately 12.1 percent of total operations by 2044.

- **Percent Arrivals |** The percentage of arrivals as they relate to total operations of the airport is important in determining airfield capacity. Under most circumstances, the lower the percentage of arrivals, the higher the hourly capacity will be. The aircraft arrival/departure percentage split at general aviation airports is typically 50/50, which is the case at PRB.

- **Touch-and-Go Activity |** A touch-and-go operation involves an aircraft making a landing and then an immediate takeoff without coming to a full stop or exiting the runway. As previously discussed in Chapter Two, these operations are normally associated with general aviation training activity and are classified as local operations. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and takeoff occurs within a shorter period than individual operations. Touch-and-go operations at PRB accounted for approximately 33 percent of total operations in 2024. This percentage is anticipated to drop slightly to 30 percent, as itinerant operations are expected to grow at a slightly faster pace over the planning period.

- **Peak Period Operations |** Average daily operations and average peak hour operations during the peak month are utilized for the airfield capacity analysis and are based on operational data collected from 1200.aero. Operations activity is important in the calculation of an airport's ASV, as peak demand levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times throughout the year. The forecasts for this master plan identified current average daily operations at 173 operations and current peak hour operations at 24 operations. By the long term, average daily operations are projected to grow to 249 and peak hour operations are projected to increase to 34. This results in an annual operations to average daily demand ratios of 279 in 2024 and 296 by 2044. The ratio of average daily operations to peak hour operations is 7.3 through the planning period.

CALCULATION OF ANNUAL SERVICE VOLUME

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

Hourly Runway Capacity

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

As the operational mix of aircraft at the airport changes to include a higher percentage of Class C aircraft that weigh over 12,500 pounds, the hourly capacity of the system slightly declines. This is a result of the additional spacing and time required by larger aircraft in the traffic pattern and on the runway.

The current and future weighted hourly capacities are presented in **Table 3D**. Weighted hourly capacity is the measure of the maximum number of aircraft operations that can be accommodated on the airfield in a typical hour. It is a composite of estimated hourly capacities for different airfield operating configurations adjusted to reflect the percentage of time in an average year that the airfield operates under each specific configuration. The current weighted hourly capacity on the airfield is 172 operations; the capacity is expected to decline slightly to 156 operations by the long-term horizon.

TABLE 3D | Airfield Capacity Summary

	Base Year (2024)	Short Term (1-5 Years)	Intermediate Term (6-10 Years)	Long Term (11-20 Years)
Operational Demand				
Annual	48,236	54,600	59,300	73,700
Capacity				
Annual Service Volume	350,000	346,000	345,000	336,000
Percent Capacity	13.8%	15.8%	17.2%	21.9%
Weighted Hourly Capacity	172	161	160	156

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

Annual Service Volume

The ASV is determined by the following equation:

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

The current ASV for the airfield has been estimated at 350,000 operations. **The increasing percentage of larger Class C aircraft over the planning period will contribute to a decline in ASV**, lowering it to a level of approximately 336,000 operations by the end of the planning period. With 2024 operations at 48,236, the airport is currently at 13.8 percent of its ASV. Long-range annual operations are forecasted to reach 73,700, which would equate to 21.9 percent of the airport's ASV.

Table 3D compares the airport's ASV and projected annual operations over the short-, intermediate-, and long-range planning horizons.

AIRCRAFT DELAY

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

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

Table 3E summarizes the potential aircraft delay for PRB. Estimates of delay provide insight into the impacts steady increases in aircraft operations have on the airfield and signify the airport's ability to accommodate projected annual aircraft operations. The delay per operation represents an average delay per aircraft. It should be noted that delays of five to 10 times the average could be experienced by individual aircraft during peak periods. As an airport's percent capacity increases toward the ASV, delay increases exponentially. Furthermore, complexities in the airspace system that surrounds an airport can also factor into additional delay experienced at the facility.

TABLE 3E | Airfield Delay Summary

	Base Year (2024)	Short Term (1-5 years)	Intermediate Term (6-10 years)	Long Term (11-20 years)
Percent Capacity	13.8%	15.8%	17.2%	21.9%
Delay				
Per Operation (Seconds)	6	6	7	10
Total Annual (Hours)	80	91	115	205

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

Current annual delay is estimated at six seconds per aircraft operation, or 80 total annual hours. Analysis of delay factors for the long-term planning horizon indicates that annual delays can be expected to reach 10 seconds per aircraft operation, or 205 annual hours.

CAPACITY ANALYSIS CONCLUSION

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, indicates that improvements for airfield capacity purposes should be considered when operations reach 60 to 75 percent of the ASV. This is an approximate level to begin the detailed planning of capacity improvements. When 80 percent of the ASV is reached, capacity improvement projects should become higher-priority capital improvements. According to this analysis, PRB's weighted hourly capacity, which will range between 172 and 156 operations over the planning period, is well above projected peak hour operations, which are expected to range between 24 and 34 operations. By the long term, projected operations will represent less than 22 percent of the airport's calculated ASV. As such, significant capacity enhancements at PRB are not warranted. However, options to improve airfield efficiency (such as additional exit taxiways) will still be considered as part of this master plan.

AIRSIDE FACILITY REQUIREMENTS

Airside facilities include those facilities related to the arrival, departure, and ground movement of aircraft. Airside facility requirements are based primarily on the runway design code (RDC) for each runway. Analysis in Chapter Two identified the existing RDCs as C-III-4000 for Runway 1-19 and C-III-5000 for Runway 13-31. **Ultimately, Runway 1-19 is planned to meet RDC C-IV-4000 design standards, while Runway 13-31 will remain at C-III-5000 design standards**.

RUNWAYS

Runway conditions, such as orientation, length, width, and pavement strength, were analyzed at PRB. From this information, requirements for runway improvements were determined for the airport.

Runway Designations

A runway's designation is based on its magnetic headings, which are determined by the magnetic declination for the area. The magnetic declination at PRB is 12.20° E ± 0.35°, changing by 0.08° W per year.[1] Runway 1-19 has a true heading of 29°/209° and Runway 13-31 has a true heading of 144°/324°. Adjusting for the magnetic declination, the current magnetic heading of Runway 1-19 is 16.8°/196.8° and 131.8°/311.8° for Runway 13-31. Runway designations are set to a whole number nearest one-tenth of the magnetic heading. Based on this information, Runway 1-19 should be redesignated as Runway 2-20, while the Runway 13-31 designation remains appropriate for the planning period. The redesignation of Runway 1-19 to 2-20 should be coordinated with the FAA in advance and is typically accomplished during a runway pavement maintenance project, which would require painting new markings. Runway signage will also need to be updated once the redesignation occurs.

Runway Length

There are three methodologies for determining runway length requirements, which are based on the maximum takeoff weight (MTOW) of the critical aircraft or the airplane group for each runway. The airplane group consists of multiple aircraft with similar design characteristics. The three weight classifications are those airplanes with a MTOW of 12,500 pounds or less, those that weigh over 12,500 pounds but less than 60,000 pounds, and those that weigh 60,000 pounds or more. **Table 3F** shows these classifications and the appropriate methodology to use in runway length determination.

TABLE 3F | Airplane Weight Classification for Runway Length Requirements

Airplane Weight Category (MTOW)		Design Approach	Methodology
12,500 pounds or less	Approach speeds of less than 30 knots	Family grouping of small airplanes	Chapter 2: para. 203
	Approach speeds of at least 30 knots but less than 50 knots	Family grouping of small airplanes	Chapter 2: para. 204
	Approach speeds of 50 knots or more with fewer than 10 passenger seats	Family grouping of small airplanes	Chapter 2: para. 205, Figure 2-1
	Approach speeds of 50 knots or more with 10 or more passenger seats	Family grouping of small airplanes	Chapter 2: para. 205, Figure 2-2
Over 12,500 pounds but less than 60,000 pounds		Family grouping of large airplanes	Chapter 3: Figures 3-1 or 3-2 and Tables 3-1 or 3-2
60,000 pounds or more, or regional jets		Individual large airplanes	Chapter 4: *Airplane Performance Manuals*

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

The determination of runway length requirements for the airport is based on five primary factors:

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

[1] National Oceanic and Atmospheric Administration (NOAA)

The mean maximum daily temperature of the hottest month for PRB is 94.0 degrees Fahrenheit (°F), which occurs in August. The airport elevation is 838.7 feet mean sea level (MSL). The primary runway (1-19) has a gradient of 0.18 percent.

Small General Aviation Aircraft (≤12,500 pounds)

This category applies to operations occurring at PRB conducted using smaller general aviation (GA) aircraft that weigh less than 12,500 pounds. Following guidance from AC 150/5325-4B, to accommodate 95 percent of these small aircraft with fewer than 10 passenger seats, a runway length of 3,400 feet is recommended. For 100 percent of these small aircraft, a runway length of 4,000 feet is recommended. For small aircraft with 10 or more passenger seats, 4,400 feet of runway length is recommended.

Small and Mid-Size Turbine Aircraft (12,500–60,000 pounds)

Runway length requirements for this classification of aircraft also utilize charts from AC 150/5325-4B and take into consideration the runway gradient and landing length requirements for contaminated (wet) runways. Business jets tend to need greater runway length when landing on wet surfaces because of their increased approach speeds. AC 150/5325-4B stipulates that runway length determination for business jets should consider a grouping of airplanes with similar operating characteristics. The AC provides two separate family groupings of airplanes, each of which is based on its representative percentage of aircraft in the national fleet. The first grouping is those business jets that comprise 75 percent of the national fleet, and the second group is those that comprise 100 percent of the national fleet. **Table 3G** shows example aircraft for both groups.

TABLE 3G | Aircraft Categories for Runway Length Determination

0-75 Percent of the National Fleet	MTOW (pounds)	75-100 Percent of the National Fleet	MTOW (pounds)
Challenger 300	38,850	Lear 55	21,500
Lear 40/45	20,500	Lear 60	23,500
Cessna 550 Citation II	14,100	Hawker 800XP	28,000
Cessna 560XL Excel	20,000	Hawker 1000	31,000
Cessna 650 VII	22,000	Cessna 650 III/IV	22,000
Cessna 680 Sovereign	30,775	Cessna 750X	35,700
Beechjet 400	15,800	Challenger 604	47,600
Falcon 50	18,500	Falcon 2000	42,800
MTOW = maximum takeoff weight			

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

The following is the five-step process for determining the recommended runway length for aircraft with MTOWs between 12,500 pounds and 60,000 pounds.

Step #1: Identify the critical airplane or airplane group.

This runway length analysis assumes mid-sized business jets that weigh less than 60,000 pounds MTOW operate at the airport on a regular basis. According to the 1200.aero ADS-B data, in 2024, more than 3,200 operations were conducted by aircraft within the B-II and C-II categories, which includes mid-sized business jets. In this case, the appropriate runway length methodology is to examine the general runway length tables from Chapter 3 of AC 150/5325-4B for aircraft that weigh between 12,500 pounds and 60,000 pounds.

Step #2: Identify the airplanes or airplane group that will require the longest runway length at MTOW.

Business jets typically require the longest runway lengths; therefore, the runway length curves in Chapter 3 of AC 150/5325-4B will be examined for future conditions.

Step #3: Determine which of the three methods described in the AC will be used for establishing the runway length.

In consideration of the growing number of business jets, it is necessary to select the specific methodology to use for the business jets. Chapter 3 of the AC groups business jets that weigh over 12,500 pounds but less than 60,000 pounds into the following two categories:

- 75 percent of the fleet
- 100 percent of the fleet

The AC states that airplanes in the 75 percent of the fleet category generally need 5,000 feet or less of runway at MSL and standard day temperature (59°F), while those in the 100 percent of the fleet category need more than 5,000 feet of runway under the same conditions.

The AC indicates that the airport designer must determine which category to use for runway length determination. PRB experiences significant levels of business jet activity from the full range of the business jet fleet.

Two runway length curves are presented in the AC under the 75-100 percent category:

- 60 percent useful load
- 90 percent useful load

The useful load is the difference between the maximum allowable structural weight and the operating empty weight (OEW). The useful load consists of passengers, cargo, and usable fuel. The determination of which useful load category to use will have a significant impact on the recommended runway length; however, it is inherently difficult to determine because of the variable needs of each aircraft operator. For shorter flights, pilots may take on less fuel; however, pilots may choose to ferry fuel so that they do not have to refuel frequently. Because of the variability in aircraft weights and haul lengths, the 60 percent useful load category is typically considered the default, unless there are specific known operations that would suggest using the 90 percent useful load category. For PRB, there are occasional long-haul operations that would suggest consideration of the 90 percent useful load classification. The FAA's Traffic Flow Management System Count (TFMSC) flight plan data documents city pairs by departing aircraft. An examination of the destinations shows there were 122 departures from PRB in 2024 to destination airports that are 1,000 miles or more away. Most flights departing PRB are to destinations less than 1,000 miles away, but due to the occasional long-haul flight, both the 60 and 90 percent useful load categories are included when calculating runway length requirements for business jets that weigh between 12,500 and 60,000 pounds.

Step #4: Select the recommended runway length from the appropriate methodology.

The next step is to examine the performance charts. These charts require the following inputs:

- The mean maximum daily temperature of the hottest month: August at 94.0°F
- The airport elevation: 838.7 feet above MSL

Step #5: Apply any necessary adjustments to the obtained runway length.

The raw runway lengths calculated in Step #4 are based on no wind, a dry runway surface, and zero effective runway gradient; therefore, the following criteria are applied:

- Wet runway surface (applies to landing operations only)
- 0.18 percent effective runway gradient, 11.1 feet of elevation difference for Runway 1-19 (applies to takeoff operations only)

To account for a wet/contaminated surface, the runway length obtained from the load performance chart used in Step #4 is increased by 15 percent, or up to 5,000 feet for the 60 percent category and 7,000 feet for the 90 percent category (whichever is less).

The runway length obtained from Step #4 is also increased at the rate of 10 feet for each foot of elevation difference between the high and low points of the runway centerline. At PRB, this equates to an additional 111 feet of runway length.

Table 3H presents the results of the runway length analysis for business jets that weigh between 12,500 and 60,000 pounds, developed following the guidance outlined in the steps above. This analysis shows the existing length of primary Runway 1-19 (6,008 feet) meets the recommended length for 100 percent of the business jet fleet at 60 percent useful load.

TABLE 3H | Runway Length Requirements – Aircraft Between 12,500 and 60,000 Pounds

Airport Elevation	838.7' feet above mean sea level			
Average High Monthly Temp.	94.0°F (August)			
Runway Gradient	0.18% Runway 1-19 (11.1' grade change)			
Fleet Mix Category	**Raw Runway Length from FAA AC**	**Runway Length with Gradient Adjustment**	**Wet Surface Landing Length for Jets (+15%)[1]**	**Final Runway Length[2]**
75% of fleet at 60% useful load	4,848'	4,959'	5,500'	5,500'
100% of fleet at 60% useful load	5,855'	5,966'	5,500'	6,000'
75% of fleet at 90% useful load	7,026'	7,137'	7,000'	7,200'
100% of fleet at 90% useful load	9,176'	9,287'	7,000'	9,300'

[1]Max 5,500' for 60% useful load and max 7,000' for 90% useful load in wet conditions
[2]Longest runway need rounded up to nearest hundred

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

Supplemental Analysis Undertaken for Typical Business Jets Operating with Local Conditions

Another method to determine runway length requirements for aircraft at PRB is to examine aircraft flight planning manuals under conditions specific to the airport. **Table 3J** provides a detailed runway length analysis for several of the most common airplane design group (ADG) C and D turbine aircraft in the national fleet. These data were obtained from UltraNav software, which computes operational parameters for specific aircraft based on flight manual data. The analysis includes the MTOW allowable and the percent useful load from 60 percent to 100 percent.

TABLE 3J | Supplemental Business Aircraft Takeoff Length Requirements

		Takeoff Length Requirements (feet)				
		Useful Load				
Aircraft	**MTOW**	**100%**	**90%**	**80%**	**70%**	**60%**
Challenger 300	38,850	**6,401**	5,911	5,439	4,991	4,556
Citation X	35,700	**6,774**	**6,195**	5,649	5,150	4,733
Falcon 2000	35,800	**7,220**	**6,353**	5,836	5,372	4,895
Gulfstream G450	74,600	**6,722**	**6,129**	5,577	5,057	4,595
Gulfstream G550	91,000	**7,654**	**6,866**	**6,110**	5,413	4,732
Gulfstream G650	99,600	**7,489**	**6,731**	**6,073**	5,499	4,999
Global 5000	92,500	**6,525**	5,961	5,422	4,906	4,414
Global Express	98,000	**7,339**	**6,668**	**6,030**	5,420	4,841
Hawker 800XP	28,000	**6,027**	5,977	5,448	4,954	4,532
Hawker 1000	31,000	**C/L**	**7,060**	**6,740**	**6,110**	5,470
Hawker 4000	39,500	**6,135**	5,577	5,141	4,742	4,368
Lear 40XR	21,000	5,368	5,028	4,666	4,325	4,069
Lear 60	23,500	**7,643**	**6,939**	**6,383**	5,821	5,275

Red figures are greater than 6,008 feet (length of the primary runway at PRB).
Runway length calculation assumptions: 838.7' MSL field elevation; 94.0°F ambient temperature; 0.18% runway grade
C/L = climb limited: aircraft cannot maintain required climb gradient
MTOW = maximum takeoff weight

Source: UltraNav software

The analysis shows that each jet examined can operate at PRB during the hottest periods of the summer at useful loads up to 60 percent, and all but one (Hawker 1000) can operate at 70 percent useful load.

CAL FIRE Runway Length Requirements

In addition to general aviation, PRB hosts CAL FIRE aerial firefighting aircraft, which include the Grumman S-2, American OV-10 Bronco, Lockheed C-130, BAe 146, and Boeing 737 aircraft. The Grumman S-2 and American OV-10 Bronco both have short runway length requirements of less than 2,000 feet in most operating conditions. The C-130 is designed to operate on short runways, requiring between 3,300 and 3,700 feet for takeoff at its MTOW. The BAe 146 typically needs between 3,300 and 5,000 feet to takeoff at MTOW depending on the variant. Factoring PRB's elevation and summer temperatures, these lengths will be slightly higher but still within the available runway length of 6,008 feet. CAL FIRE has also indicated that the Boeing 737-300 firefighting aircraft, which typically requires between 7,000 and 8,000 feet of takeoff length at its MTOW, are capable of operating on the available runway at PRB with no restrictions.

Runway Length Summary

Many factors are considered when determining appropriate runway length for safe and efficient operations of aircraft at PRB. It is essential to consider the diverse mix of aircraft that regularly operate at the airport. The airport should strive to accommodate all users, including the most physically demanding aircraft such as business jets, to the greatest extent possible as demand dictates.

Runway 1-19 is currently 6,008 feet long. At this length, the primary runway exceeds the FAA's recommended length for runways accommodating 100 percent of the business jet fleet that weigh between 12,500 and 60,000 pounds when operating at 60 percent useful load (recommended length is 6,000 feet). The existing length is 1,200 feet short of the FAA-recommended length of 7,200 feet for accommodating 75 percent of the business jet fleet at 90 percent useful load and 3,300 feet short of the recommended length for 100 percent of the fleet at 90 percent useful load. The supplemental runway length analysis shows that the available length accommodates larger business jet aircraft up to 60 and 70 percent useful loads but is limited at higher useful loads. Firefighting aircraft that currently use the airport and are planned to in the future are capable of operating at PRB without restriction.

Previous planning for PRB included extending Runway 1-19 to 7,200 feet so that it could accommodate larger/heavier business jets. This runway length analysis confirms the length of Runway 1-19 is sufficient to accommodate the needs of the existing and ultimate critical aircraft (BAe 146 and Lockheed C-130). However, additional length is needed to support larger and faster business jets that are projected to operate with greater frequency at PRB in the future. **Therefore, extension alternatives for Runway 1-19 should be considered to a minimum of 7,200 feet.**

Runway 13-31 is currently 4,701 feet long. As a crosswind runway, its length needs to be capable of accommodating primarily smaller aircraft and firefighting aircraft during high crosswind conditions. The available length meets the FAA-recommended length for small aircraft with 10 or more passenger seats (recommended length is 4,400 feet) but is 800 feet short of accommodating 75 percent of business jets at 60 percent useful loads. Previous planning for PRB included an extension of Runway 13-31 to 6,400 feet. Due to its regular use by turbine aerial firefighting aircraft and occasional business jets and turboprops, it is appropriate to consider alternatives to extend the crosswind runway to ensure safe operations in higher crosswind conditions. **Therefore, the alternatives chapter will consider extension options for Runway 13-31 to a minimum length of 5,500 feet.**

Runway Width

For Runway 1-19, existing RDC C-III-4000 design criteria stipulate a runway width of 100 feet while the ultimate C-IV-4000 standards stipulate a width of 150 feet. At 150 feet wide, the existing Runway 1-19 width meets the ultimate design standard and should be maintained through the planning period.

For Runway 13-31, RDC C-III-5000 standards stipulate a runway width of 100 feet. At 100 feet wide, Runway 13-31 meets the design standard. No runway width changes are planned for the crosswind runway.

Runway Shoulders

Runway shoulders provide resistance to soil erosion, decrease the likelihood of engine ingestion of foreign objects, and accommodate the passage of maintenance and emergency equipment, as well as the occasional passage of aircraft deviating from the runway. Like design standards for runway width, runway shoulder width is determined by the RDC. Paved shoulders are required for ADG IV and higher runways and are recommended for ADG III runways. The ADG III shoulder width standard is 20 feet; the ADG IV width standard is 25 feet.

Runway 13-31 has 20-foot-wide paved shoulders, while Runway 1-19 maintains unpaved shoulders. The Runway 13-31 shoulders should be maintained, and 25-foot-wide paved shoulders should be planned for Runway 1-19.

Blast Pads

Blast pads are paved surfaces adjacent to the ends of runways that provide erosion protection from jet blast and propeller wash. According to the FAA, blast pads must always be paved, must extend across the full width of the runway plus the shoulders, and must be able to support the occasional passage of the most demanding aircraft, as well as maintenance and emergency response vehicles. Blast pad dimensions are detailed in FAA AC 150/5300-13B and are determined by the RDC of the critical design aircraft ARC. Under existing C-III design standards for both runways, stabilized turf/soil blast pads are adequate with standard measurements of 140 feet wide and 200 feet long. For ultimate C-IV design, blast pads should be paved and measure 200 feet wide and 200 feet long.

Runway 19 has a paved blast pad measuring 100 feet wide and 200 feet long, and Runway 13 has a blast pad measuring 100 feet wide and extending to the angled intersection with Runway 1-19 that measures 187 feet at the longest point. Runways 1 and 31 do not have blast pads, currently. Runway 1-19 should be planned for paved blast pads on both ends measuring 200 feet by 200 feet. Runway 31 should be planned for a blast pad measuring 140 feet by 200 feet.

Pavement Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. For Runway 1-19, the pavement should be designed to handle the heaviest aircraft that routinely operate at PRB, including the CAL FIRE aircraft and business jets. The heaviest CAL FIRE aircraft expected to use the airport on a regular basis is the Lockheed C-130, which has a MTOW of 155,000 pounds and single tandem wheel main landing gear configuration. This MTOW exceeds the current strength rating for Runway 1-19; however, CAL FIRE has indicated the existing runway pavement strength is adequate for its C-130 variant and the operational weight of its aircraft. Additionally, the existing pavement strength is adequate for the heaviest business jets in the national fleet, including the Gulfstream G650, which has a MTOW of 99,600 pounds on dual wheel main landing gear.

Crosswind Runway 13-31 should have adequate pavement strength to accommodate routine operations by the BAe-146 CAL FIRE aircraft and smaller general aviation aircraft. The BAe-146-200, which is the variant used by CAL FIRE, has a MTOW of 93,000 pounds on dual wheel main landing gear. Again, CAL FIRE has indicated the available pavement strengths are adequate for its aircraft. The existing strength of Runway 13-31 is also adequate for most small and mid-sized general aviation aircraft.

As shown in **Table 3K**, the existing pavement strengths are adequate to accommodate the designated future critical aircraft for each runway. No additional strength is recommended for either runway.

TABLE 3K | Pavement Strength Requirements

Runway	Single Wheel Loading (SWL) Rating	Dual Wheel Loading (DWL) Rating	Double Tandem Wheel Loading (DTWL) Rating	Future Critical Aircraft MTOW	Additional Strength Needed?
Runway 1-19	60,000 pounds	106,000 pounds	150,000 pounds	155,000 pounds STWL (C-130)	No – CAL FIRE confirms existing strength is adequate
Runway 13-31	30,000 pounds	50,000 pounds	90,000 pounds	93,000 pounds DWL (BAe-146)	No – CAL FIRE confirms existing strength is adequate

Notes: STWL = Single Tandem Wheel Loading
Source: Coffman Associates analysis

It should be noted that strength ratings do not preclude aircraft that weigh more than the published strength rating from using the runway. All federally obligated airports must remain open to the public, and it is typically up to the pilot of an aircraft to determine if a runway can safely support their aircraft. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published strength rating. On the other hand, the airport sponsor has an obligation to properly maintain the runway and protect the useful life of the runway (typically 20 years).

The strength rating of a runway can change over time. Regular usage by heavier aircraft can decrease the strength rating, while periodic runway resurfacing can increase the strength rating.

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions. These include the runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), and runway protection zone (RPZ).

The entire RSA, ROFA, and ROFZ must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. RPZs should also be under airport ownership. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in place that ensure the RPZ remains free of incompatible development. The various existing airport safety areas and their dimensions are presented on **Exhibit 3B**.

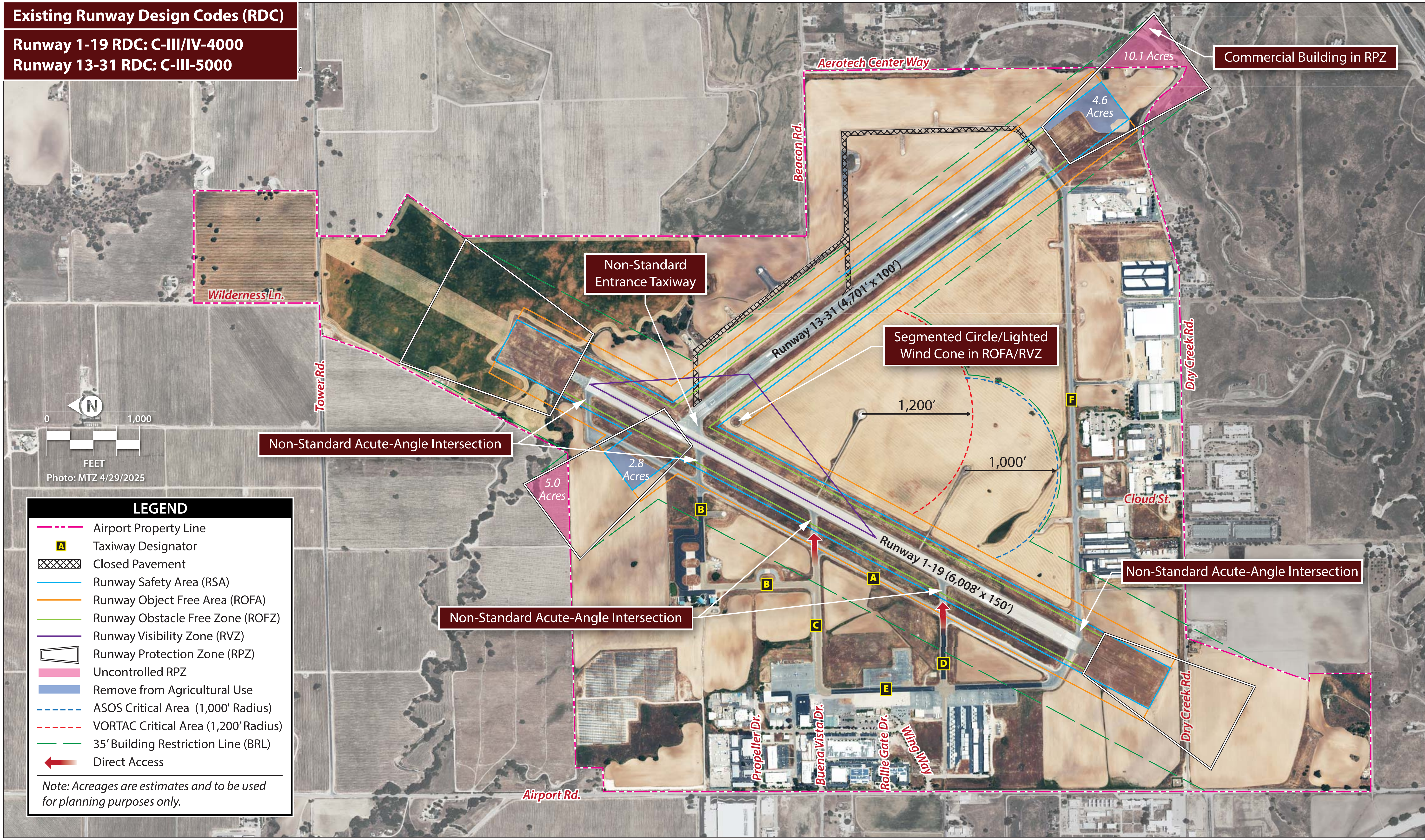


Exhibit 3B
EXISTING SAFETY AREAS

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Runway Safety Area

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.

For existing C-III design on both runways and ultimate C-IV design standards on Runway 1-19, the FAA calls for the RSA to be 500 feet wide and extend 1,000 feet beyond the runway ends and 600 feet prior to the landing threshold. There are currently no known object penetrations of the RSA on Runway 1-19 and it appears to meet grading and drainage requirements. For Runway 13-31, portions of the RSA are currently used for agricultural purposes but otherwise meet standards. It is recommended that the airport adjust the agricultural use areas to remove them from the RSA.

Runway Object Free Area

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

For C-III and C-IV design standards, the FAA calls for the ROFA to be 800 feet wide and extend 1,000 feet beyond each runway end. The only identified incompatibility within the ROFA is the segmented circle and lighted wind cone, which is located within the ROFA for both runways. The alternatives analysis will consider relocation sites for this equipment.

Runway Obstacle Free Zone

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

For all runways serving aircraft over 12,500 pounds, the ROFZ is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway ends. This standard applies to both runways at PRB. Under current evaluation with available data, there are no ROFZ obstructions at the airport.

Runway Protection Zone

An RPZ is a trapezoidal area centered on the extended runway centerline beginning 200 feet from the end of the runway. This safety area is established to protect the end of the runway from airspace penetrations and incompatible land uses. The RPZ dimensions are based on the established RDC and the approach visibility minimums serving the runway. While the RPZ is intended to be clear of incompatible objects or land uses, some land uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13B, Change 1, the following land uses are permissible within the RPZ:

- Farming that meets the minimum buffer requirements
- Irrigation channels, as long as they do not attract birds
- Airport service roads, as long as they are not public roads and are directly controlled by the airport operator
- Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable
- Unstaffed navigational aids (NAVAIDs) and facilities, such as those required for airport facilities that are fixed by function regarding the RPZ
- Aboveground fuel tanks associated with backup generators for unstaffed NAVAIDS

In September 2022, the FAA published AC 150/5190-4B, *Airport Land Use Compatibility Planning*, which states that airport owner control over RPZs is preferred. Airport owner control over RPZs may be achieved through the following methods:

- Ownership of the RPZ property in fee simple
- Possessing sufficient interest in the RPZ property through easements, deed restrictions, etc.
- Possessing sufficient land use control authority to regulate land use in the jurisdiction that contains the RPZ
- Possessing and exercising the power of eminent domain over the property
- Possessing and exercising permitting authority over proponents of development within the RPZ (e.g., where the sponsor is a state)

AC 150/5190-4B further states that “control is preferably exercised through acquisition of sufficient property interest and includes clearing RPZ areas (and keeping them clear) of objects and activities that would impact the safety of people and property on the ground.” The FAA recognizes that land ownership, environmental, geographical, and other considerations can complicate land use compatibility within RPZs; regardless, airport sponsors must comply with FAA grant assurances, including (but not limited to) Grant Assurance 21, *Compatible Land Use*. Sponsors are expected to take appropriate measures to “protect against, remove, or mitigate land uses that introduce incompatible development within RPZs.”

For a proposed project that would shift an RPZ into an area with existing incompatible land uses, such as a runway extension or the construction of a new runway, the sponsor is expected to have or secure sufficient control of the RPZ, ideally through fee simple ownership. Where existing incompatible land uses are present, the FAA expects sponsors to "seek all possible opportunities to eliminate, reduce, or mitigate existing incompatible land uses" through acquisition, land exchanges, right-of-first refusal to purchase, agreement with property owners on land uses, easements, or other such measures. These efforts should be revisited during master plan or ALP updates, and periodically thereafter, and should be documented to demonstrate compliance with FAA grant assurances. If a new or proposed incompatible land use impacts an RPZ, the FAA expects the airport to take the above actions to control the property within the RPZ and adopt a strong public stance opposing the incompatible land use.

For a new incompatible land use that results from a sponsor-proposed action (e.g., an airfield project like a runway extension, a change in the critical aircraft that increases the RPZ dimension, or lower minimums that increase the RPZ dimension), the airport sponsor is expected to conduct an alternatives evaluation. The intent of the alternatives evaluation is to "proactively identify a full range of alternatives and prepare a sufficient evaluation to be able to draw a conclusion about what is 'appropriate and reasonable'." For incompatible development off-airport, the sponsor should coordinate with the FAA ADO as soon as the sponsor learns of the development, and the alternatives evaluation should be conducted within 30 days of the sponsor's first awareness of the development within the RPZ. The following items are typically necessary in an alternatives evaluation:

- Sponsor's statement of the purpose and need of the proposed action (airport project, land use change, or development)
- Identification of any other interested parties and proponents
- Identification of any federal, state, and/or local transportation agencies involved
- Analysis of sponsor control of the land within the RPZ
- Summary of all alternatives considered, including the following:
    - Alternatives that preclude introducing the incompatible land use within the RPZ (e.g., zoning action, purchase, and design alternatives, such as implementation of declared distances or displaced thresholds, runway shift or shortening, raising minimums, etc.)
    - Alternatives that minimize the impact of the land use in the RPZ (e.g., rerouting a new roadway through less of the RPZ, etc.)
    - Alternatives that mitigate risk to people and property on the ground (e.g., tunnelling, depressing, and/or protecting a roadway through the RPZ, implementing operational measures to mitigate any risks, etc.)
- Narrative discussion and exhibits or figures depicting the alternative
- Rough order of magnitude cost estimates associated with each alternative, regardless of potential funding sources
- Practicability assessment based on the feasibility of the alternative in terms of constructability, cost, operational impacts, and other factors

Once the alternatives evaluation has been submitted to the ADO, the FAA will determine whether the sponsor has made an adequate effort to pursue and consider appropriate and reasonable alternatives.

The FAA will not approve or disapprove the airport sponsor's preferred alternative; rather, the FAA will evaluate whether an acceptable level of alternatives analysis has been completed before the sponsor makes the decision to allow or disallow the proposed land use within the RPZ.

In summary, the RPZ guidance published in September 2022 shifts the responsibility of protecting the RPZ to the airport sponsor. The airport sponsor is expected to take action to control the RPZ or demonstrate that appropriate actions have been taken. The decision to permit or disallow existing or new incompatible land uses within an RPZ is ultimately up to the airport sponsor, with the understanding that the sponsor still has grant assurance obligations, and the FAA retains the authority to review and approve or disapprove portions of the ALP that would adversely impact the safety of people and property within the RPZ.

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

Since Runways 19, 13, and 31 each have published instrument approach minimums of not lower than one mile, the approach RPZs for each have an inner width of 500 feet, an outer width of 1,010 feet, and a length of 1,700 feet. Runway 1 has instrument approach minimums of not lower than ¾-mile, which results in a larger RPZ with an inner width of 1,000 feet, an outer width of 1,510 feet, and a length of 1,700 feet. The departure RPZs for each runway end have an inner width of 500 feet, and outer width of 1,010 feet, and a length of 1,700 feet. Since there are no threshold displacements at PRB, all departure RPZs are contained within the approach RPZ. For this reason, only approach RPZs are depicted in **Exhibit 3B**.

The entirety of the Runway 1 and 19 RPZs are contained on airport property, although Dry Creek Road, a public roadway, passes through the Runway 19 RPZ. Public roadways are generally considered incompatible land uses within RPZs, but since this is an existing condition, it can remain. The RPZs associated with Runway 13-31 extend beyond airport property, encompassing approximately 15.1 acres of non-airport-controlled property. In addition, Dry Creek Road and Aerotech Center Way, both public roadways, extend through the Runway 31 RPZ, and a commercial building is located within the RPZ. The portion of the Runway 13 RPZ that extends beyond airport property is primarily farmland and includes no incompatible land uses.

The alternatives analysis will consider options to mitigate RPZ incompatibilities and allow the airport to establish control over those RPZs that extend beyond airport property.

RUNWAY SEPARATION STANDARDS

There are several other standards related to separation distances from runways. Each of these is designed to enhance the safety of the airfield.

Runway/Taxiway Separation

The design standard for the separation between runways and parallel taxiways is a function of the critical design aircraft and the instrument approach visibility minimums. The separation standard for Runway 1-19, which is equipped with ¾-mile instrument approach visibility minimums, is 400 feet from the runway centerline to the parallel taxiway centerline. Parallel Taxiway A is 400 feet west of the Runway 1-19 centerline, meeting the FAA design standard.

Runway 13-31 does not have a full-length parallel taxiway. The design standard for a C-III-5000 runway is also 400 feet of separation between the runway and taxiway centerlines. The alternatives in the next chapter may consider options for adding a parallel taxiway to Runway 13-31 and meeting the minimum separation standard.

Holding Position Separation

Holding position markings are placed on taxiways leading to runways. When instructed, pilots are to stop short of the holding position marking line. For C-III-4000/5000 design standards, which are applied to both runways in the existing condition, holding position markings should be situated 250 feet from the runway centerline. Holding position markings associated with Runway 1-19 meet the separation standard. The holding position marking on Taxiway F where it enters Runway 13-31 is located 200 feet from the runway centerline. This separation meets B-III design, which had previously been the design for this runway. It is recommended that the holding position markings associated with Runway 13-31 be located 250 feet from the runway centerline.

Ultimate C-IV-4000 design standards applied to Runway 1-19 dictate a separation distance of 250 feet plus one foot for every 100 feet above sea level the airport is elevated. PRB is situated at 838.7 feet MSL, so the holding position marking separation standard is increased by eight feet to 258 feet.

Runway Visibility Zone (RVZ)

The RVZ is an area formed by imaginary lines connecting the line-of-sight points of intersecting runways or converging but non-intersecting runways at airports without an airport traffic control tower (ATCT) or with a part-time ATCT. Since PRB is not equipped with an ATCT, an RVZ is in effect. The purpose of the RVZ is to facilitate coordination among aircraft and between aircraft and vehicles that are operating on active runways. Having a clear line of sight allows departing and arriving aircraft to verify the locations and actions of other aircraft and vehicles on the ground that could create a conflict. Within the RVZ, any point five feet above the runway centerline must be mutually visible with any other point five feet above the centerline of the converging runway. The RVZ at PRB is depicted on **Exhibit 3B**. Currently, the segmented circle/lighted wind cone are located within the RVZ and should be relocated outside the RVZ. As construction and rehabilitation projects occur, consideration should be given to maintaining a positive sight picture within the RVZ.

Aircraft Parking Area Separation

According to FAA AC 150/5300-13B, Change 1, aircraft parking positions should be located to ensure aircraft components (wings, tail, and fuselage) do not:

1. Conflict with the object free areas for the adjacent runway or taxiways:
    a. Runway object free area (ROFA)
    b. Taxiway object free area (TOFA)
    c. Taxilane object free area (TLOFA)

or

2. Violate any of the following aeronautical surfaces and areas:
    a. Runway approach or departure surface
    b. Runway visibility zone (RVZ)
    c. Runway obstacle free zone (ROFZ)
    d. Navigational aid equipment critical areas

There are no existing conflicts between the aircraft parking areas at PRB and the safety areas or aeronautical surfaces listed above.

TAXIWAYS

The design standards associated with taxiways are determined by the taxiway design group (TDG) or airplane design group (ADG) of the airport's critical aircraft. As previously determined, ADG III standards apply to both runways in the existing condition. ADG IV standards apply to Runway 1-19 in the ultimate condition, while Runway 13-31 should continue to meet ADG III standards. However, those standards apply to the taxiways used regularly by CAL FIRE aircraft, which dictate the ADG III and IV standards. In this case, Taxiways A, B, and F should meet ADG III standards in the existing condition. In the ultimate condition, Taxiways A and B should meet ADG IV standards while Taxiway F should continue to meet ADG III standards. Taxiways that are utilized primarily by general aviation aircraft, which would include portions of Taxiway C, D, and E, should meet ADG II standards, which are applicable to most business jets and smaller aircraft operating at PRB. **Table 3N** presents the various taxiway design standards related to ADG II, III and IV. The table also shows the taxiway design standards related to TDG. The TDG standards are based on the main gear width (MGW) and cockpit to main gear (CMG) distance of the critical aircraft expected to use those taxiways. As is the case with applicable ADGs, different taxiway and taxilane pavements can and should be planned to the most appropriate TDG design standards, based on usage. The current design standard for all taxiways is TDG 2A, which dictates a width of 35 feet. In the ultimate condition, TDG 2B standards should be applied to Taxiways A and B, as those would be used most frequently by CAL FIRE C-130 aerial firefighting aircraft. All other taxiways are planned to TDG 2A standards in the ultimate condition.

TABLE 3N | Taxiway Dimensions and Standards

STANDARDS BASED ON WINGSPAN	ADG II	ADG III	ADG IV
Taxiway and Taxilane Protection			
Taxiway Safety Area Width (TSA)	79’	118’	171’
Taxiway Object Free Area Width (TOFA)	124’	171’	243’
Taxilane Object Free Area Width (TLOFA)	110’	158’	224’
Taxiway and Taxilane Separation			
Taxiway Centerline to Parallel Taxiway Centerline	101.5’	144.5’	207’
Taxiway Centerline to Fixed or Moveable Object	62’	85.5’	121.5’
Taxilane Centerline to Parallel Taxilane Centerline	94.5’	138’	197.5’
Taxilane Centerline to Fixed or Moveable Object	55’	79’	112’
Wingtip Clearance			
Taxiway Wingtip Clearance	22.5’	26.5’	36’
Taxilane Wingtip Clearance	15.5’	20’	26.5’
STANDARDS BASED ON TDG	**TDG 2A/2B**		
Taxiway Width Standard	35'		
Taxiway Edge Safety Margin	7.5'		
Taxiway Shoulder Width	15’		

All dimensions are in feet.
ADG = airplane design group
TDG = taxiway design group

Source: FAA AC 150/5300-13B, Airport Design, Change 1

Existing and ultimate taxiway safety areas (TSAs) and taxiway object free areas (TOFAs) are depicted on **Exhibit 3C**. There are no observed obstructions to the existing TOFA. In the ultimate condition when applying ADG IV standards to the taxiways regularly utilized by the C-130 aircraft, the CAL FIRE hangar and an oak tree in the same area obstruct the TOFA. Further, most of the holding apron near the Runway 19 threshold is within the TOFA, which would not allow for the safe passage of aircraft on the taxiway while an aircraft is holding within the apron. The alternatives chapter will present options for mitigating TOFA/TSA obstructions.

A *Pavement Management Program* report developed for PRB in 2024 identified taxiway pavement maintenance, rehabilitation, and reconstruction priorities to ensure the system can accommodate the general aviation and heavier CAL FIRE branded and contract aircraft that routinely operate at the airport. Recommendations included reconstructing and strengthening a portion of Taxiway A (from Taxiway B to the Runway 19 threshold including the holding apron) so that it could handle routine CAL FIRE C-130 aircraft, which have a maximum takeoff weight of 155,000 pounds. Consideration should also be given to enhancing the pavement strength of Taxiway B and a portion of Taxiway C to accommodate C-130 aircraft as they taxi to/from the CAL FIRE base. Portions of Taxiways C and D may also need to be strengthened to accommodate heavier business jet aircraft. Currently, Taxiway C and D have pavement condition ratings (PCR) of 160, which can accommodate most general aviation aircraft, but larger business jets, such as the Gulfstream G500, typically require PCR ratings of between 253 and 297 for routine operations. PRB staff should continue to monitor taxiway pavements and prioritize rehabilitation and strengthening projects based on where heavier aircraft are operating at the airport.

Taxiway and Taxilane Design Considerations

FAA AC 150/5300-13B, *Airport Design*, Change 1, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as "any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft." The following is a list of the FAA's taxiway design guidelines and the basic rationale behind each recommendation included in the current AC, as well as previous FAA safety and design recommendations.

1. *Taxiing Method*: Taxiways are designed for cockpit-over-centerline taxiing with pavement that is wide enough 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. *Curve Design*: Taxiways should be designed so the nose gear steering angle is no more than 50 degrees, which is the generally accepted value to prevent excessive tire scrubbing.

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

4. *Channelized Taxiing*: To support visibility of airfield signage, taxiway intersections should be designed to meet standard taxiway width and fillet geometry.

5. *Designated Hot Spots and Runway Incursion Mitigation (RIM) Locations*: A hot spot is a location on the airfield with elevated risk of collisions or runway incursions. Mitigation measures should be prioritized for areas the FAA designates as hot spots or RIM locations. **PRB does not have any FAA-designated taxiway hot spots or RIM locations.**

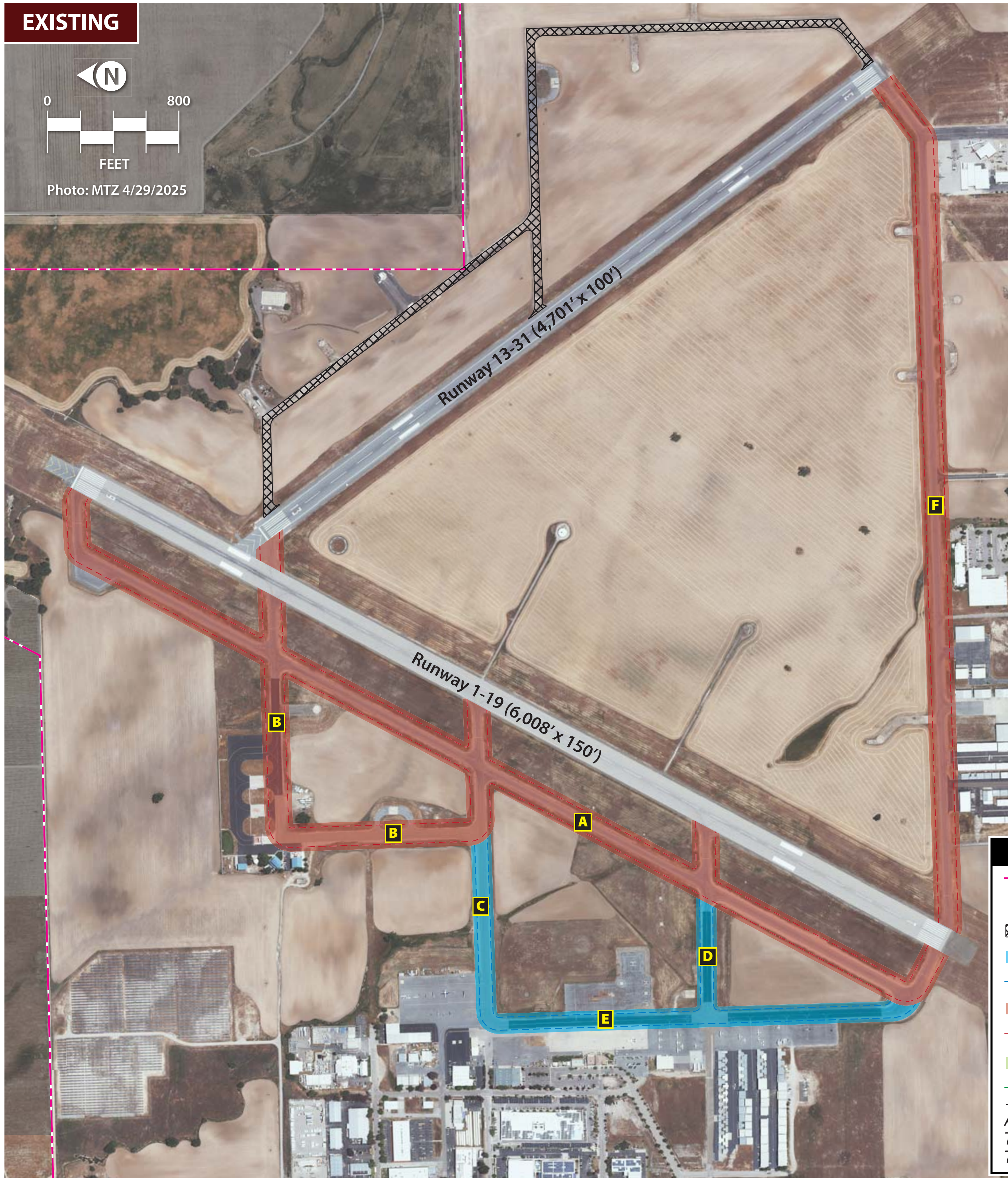
6. *Intersection Angles*: Turns should be designed to be 90 degrees, wherever possible. For acute-angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.

7. *Runway Incursions*: Taxiways should be designed to reduce the probability of runway incursions.

    - *Increase Pilot Situational Awareness*: Pilots who know where they are on the airport are less likely to enter a runway improperly. Complexity leads to confusion. Taxiway systems should be kept simple by using the three-path 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, direct access to a runway should be avoided.

    - *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 a reduction in air traffic controller workload.



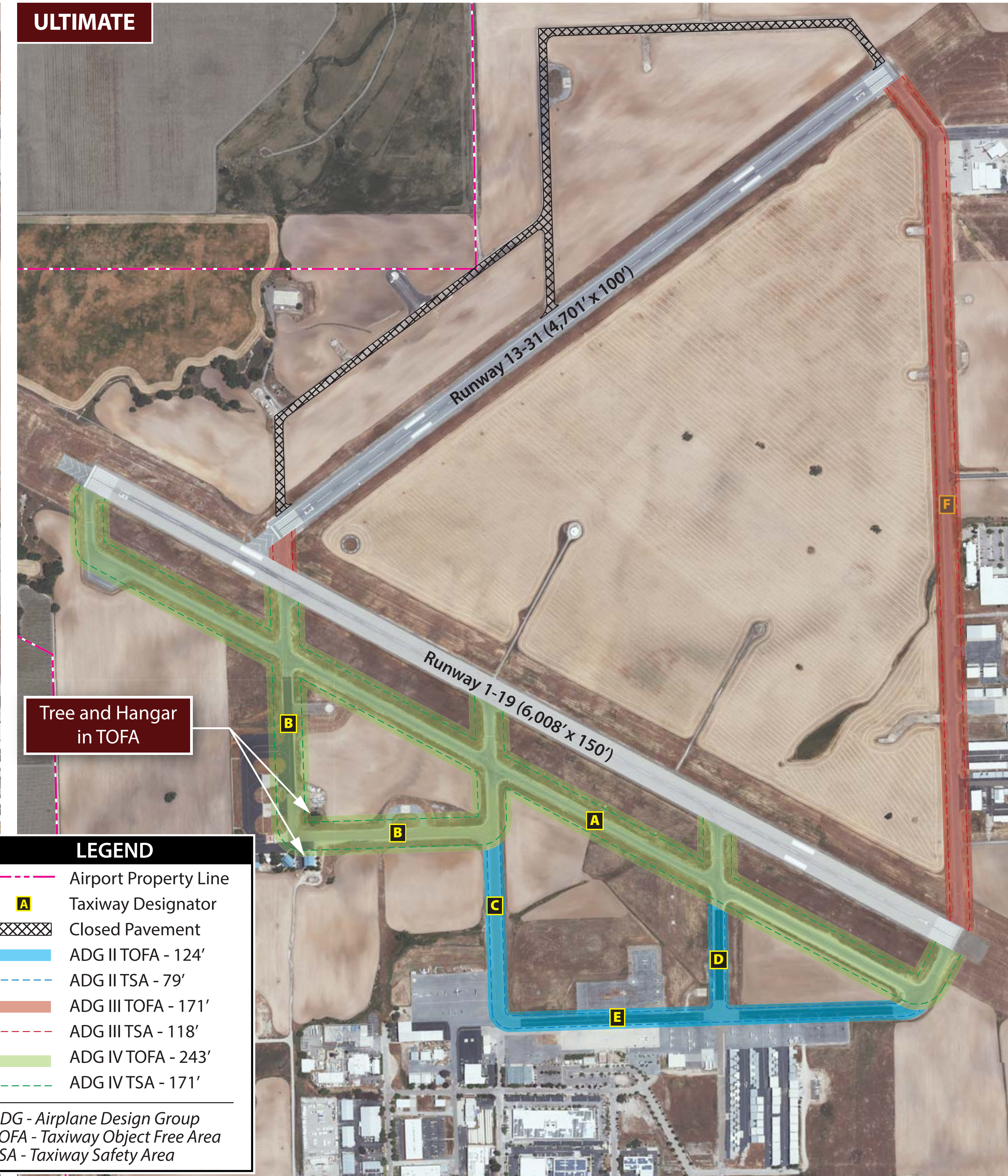


Exhibit 3C
TAXIWAY SAFETY DESIGN STANDARDS

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- *Avoid High-Energy Intersections*: These are intersections in the middle thirds of runways. By limiting runway crossings to the first and last thirds of a 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 provide greater efficiency in runway usage but should not be used as runway entrance or crossing points. A right-angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.

- *Avoid Dual-Purpose Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway, and only a runway.

- *Avoid Direct Access*: Taxiways should not be designed 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.

- *Mitigate Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

8. *Runway/Taxiway Intersections*:

   - *Right Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for an acute-angled 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 signage is visible to pilots.

   - *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high-speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage. The construction of high-speed exits is typically only justified for runways that experience regular use by jet aircraft in approach categories C and above.

   - *Large Expanses of Pavement*: A taxiway 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, which make it difficult to provide proper signage, marking, and lighting.

9. *Taxiway/Runway/Apron Incursion Prevention*: Apron locations that allow direct access to a runway should be avoided. Taxiways should be designed in a manner that increases pilot situational awareness by forcing pilots to consciously make turns. Taxiways that originate from aprons and form straight lines across runways at mid-span should be avoided.

- *Wide Throat Taxiways*: Wide throat taxiway entrances should be avoided because such large expanses of pavement may cause pilot confusion and can make lighting and marking more difficult.

- *Direct Access from Apron to Runway*: Taxiway connectors that cross over a parallel taxiway and directly onto a runway should be avoided. A staggered taxiway layout or a no-taxi island that forces pilots to make a conscious decision to turn should be considered.

- *Apron to Parallel Taxiway End*: Direct connection from an apron to a parallel taxiway at the end of a runway should be avoided.

The taxiway system at PRB generally provides for the efficient movement of aircraft, and there are no FAA-designated hot spots or RIM locations. Identified non-standard taxiway geometry conditions include:

- Taxiways C and D provide direct access from the main terminal area apron to the runway.

- Taxiways A (Runway 19 entrance), B, C, D, and F intersect with Runway 1-19 at acute angles of approximately 60 degrees, exceeding the design standard of 45 degrees. The FAA prefers runway/taxiway intersections at general aviation airports to be at 90 degrees.

- Taxiway B, serving as an entrance/exit from Runway 13-31 is non-standard design, intersecting at an acute angle (55 degrees) with the runway and the proximity of the intersection with Runway 1-19 does not allow for a holding position marking between the two runways.

The alternatives in the next chapter will explore options to mitigate these non-standard taxiway designs to minimize the potential for runway incursions and improve efficiency.

Taxilane Design Considerations | Taxilanes are distinguished from taxiways in that they do not provide direct access to or from the runway system. Taxilanes typically provide access to hangar areas and can be planned to varying design standards, depending on the type(s) of aircraft that utilize the taxilane, as previously described.

Helipad

The helipad at PRB is located near the terminal apron and measures 100 feet by 100 feet. It is equipped with standard helipad markings and perimeter edge lighting. Six individual helicopter parking spaces are located adjacent to the helipad. The helipad is used extensively by civilian and military aircraft and should be maintained through the planning period.

Consideration will be given to enhancing the helipad and parking spaces to accommodate emerging electric vertical takeoff and landing (eVTOL) aircraft and firefighting ships. This includes the potential installation of electric charging stations and other support equipment. Draft FAA Engineering Brief 105A, *Vertiport Design*, does not provide specific charging station requirements but does acknowledge that current standards for light electric aircraft charging require up to 350 kilowatts per charger. However, larger eVTOL aircraft manufacturers are reporting a need for a capacity up to 1 megawatt or more to support consistent operations. Alternative charging methods include mobile charging systems, fixed battery storage, cable and/or on-board battery cooling, battery swapping, or other concepts. The FAA has not yet established electric charging or connection standards, which will ultimately be dependent on the type of aircraft, duty cycles, charging speeds, battery chemistry, charging and cooling systems, etc.

NAVIGATIONAL AND APPROACH AIDS

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

Instrument Approach Aids

PRB has four published instrument approach procedures. Runway 19 is equipped with a global positioning system (GPS)-based localizer performance with vertical guidance (LPV) approach that provide visibility minimums down to ¾-mile. Runway 31 also has a GPS-based approach but with lateral navigation (LNAV) capabilities with visibility minimums down to one mile. Runway 19 has a published VOR-based (non-precision) straight-in approach with visibility minimums down to one mile, and an additional VOR-based approach provides circling approach capabilities to each runway end at PRB with visibility minimums down to 1 mile. Runways 19 and 31 are used for over 78 percent of arrival operations, so the published approaches to these runways are adequate. Consideration should be given to establishing straight-in GPS-based approach procedures to Runways 1 and 13 with visibility minimums of one mile or greater. Having straight-in procedures to each runway end at PRB would make the airport more accessible during lower visibility weather conditions.

Visual Approach Aids

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, electronic visual approach aids are commonly provided at airports. Currently, Runways 19 and 31 are equipped with a four-box precision approach path indicator (PAPI-4). These approach aids are adequate and should be maintained for the duration of the planning period. Runways 1 and 13 were previously equipped with PAPI systems, but they were removed as part of a 2019 lighting upgrade project. PAPI-4s should be planned for Runways 1 and 13.

Runway end identification lights (REILs) are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from the other lighting on the airport and in the approach areas. REILs should be considered for all lighted runway ends not planned for more sophisticated approach lighting systems. Runway 19 is equipped with a REIL system. Consideration should be given to adding REILs to Runways 1, 13, and 31.

Weather Reporting Aids

PRB has a lighted wind cone and segmented circle located south of the Runway 13 threshold near the intersection of the two runways. The wind cone provides information to pilots regarding wind speed and direction. Typically, the wind cone is centralized on the airfield system and is often co-located within a segmented circle, which is the case at PRB. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots. The segmented circle and lighted wind cone are located within the ROFA of both runways and is an obstruction to the runway visibility zone (RVZ). The alternatives analysis will include options for relocating this equipment outside of the ROFA and RVZ.

PRB is equipped with an automated surface observing system (ASOS) located in the midfield area, approximately 1,150 feet north of Taxiway F. The ASOS provides weather observations 24 hours per day and updates weather observations every minute, continuously reporting significant weather changes as they occur in real time. This information is then transmitted via a designated radio frequency at regular intervals. A 1,000-foot radius critical area surrounds the ASOS equipment. Within the ASOS critical area, the following standards apply:

- The maximum vegetation height allowed within 100 feet of the visibility sensor is 10 inches.
- The wind sensor must be 15 feet above any obstruction within 500 feet.
- The wind sensor must be 10 feet above any obstruction within 1,000 feet.
- An object is an obstruction if it covers 10 degrees or more of the angle from the wind sensor.

There are no known obstructions to the ASOS equipment. This system should be maintained through the duration of the planning period.

AIRFIELD LIGHTING, MARKING, AND SIGNAGE

Several lighting and pavement marking aids serve pilots using the airport. These aids assist pilots in locating an airport and runway at night or in poor visibility conditions. They also serve aircraft navigating the airport environment on the ground when transitioning to/from aircraft parking areas to the runway.

Airport Identification Lighting | PRB's rotating beacon is located in the terminal area. The beacon is in good working order and should be maintained for the duration of the planning period.

Runway and Taxiway Lighting | Runway 1-19 is equipped with incandescent high intensity runway lighting (HIRL) and Runway 13-31 is equipped with LED medium intensity runway lighting (MIRL) systems. Most of the taxiway system is equipped with LED medium intensity taxiway lighting (MITL). Taxiway F is equipped with edge reflectors while Taxiway B west of Taxiway A is not equipped with MITL or reflectors. MITL should be planned for these unlit taxiways. Planning should consider expansion of the MIRL and MITL systems when/if new pavements are constructed.

Pavement Markings | Runway markings are typically designed to the type of instrument approach available on the runway. FAA AC 150/5340-1K, *Standards for Airport Markings*, provides guidance necessary to design airport markings. Both runways at PRB are equipped with non-precision markings. These markings are adequate and should be maintained for the duration of the planning period.

Airfield Signs | Airfield identification signs assist pilots in identifying their locations on the airfield and directing them to their desired locations. Lighted signs are installed on the runway and taxiway systems on the airfield. The signage system includes runway and taxiway designation signage, holding position signage, routing/directional signage, and mandatory instruction signs. Runway 1-19 is also equipped with distance remaining signage. All signs should be maintained through the planning period.

A summary of the airside facilities at PRB is presented on **Exhibit 3D**.

ADVANCED AIR MOBILITY (AAM)

Since the turn of the decade, private companies have been developing and testing AAM technologies. AAM, which may also be called urban air mobility (UAM), is an emerging concept of air transportation using electric vertical takeoff and landing (eVTOL) aircraft to move people and cargo between places that are not easily or currently served by surface or air modes. A common example is the air taxi, in which a person or small group of people could travel within or between metropolitan areas, including airports, using small eVTOL aircraft. Development of infrastructure in support of AAM is currently underway in test cities across the country, and AAM is projected to become a key component of the nation's air transportation network. The following images show several different AAM/eVTOL aircraft currently in development that would use a vertiport like the one proposed in some alternatives.

eVTOL Aircraft in Development (Courtesy of Archer and Joby)

DESIGN STANDARDS FOR VERTIPORTS

Design dimensions for a vertiport are established by a reference aircraft. A vertiport may consist of several facilities, including aircraft charging and storage, a passenger terminal, and takeoff and landing areas. The landside facilities of a vertiport will be specific to and determined by the unique AAM company that chooses to establish a presence in the study area. The airside facilities are the focus of FAA Draft Engineering Brief (EB) 105A, *Vertiport Design*, which was published in September 2024. The takeoff and landing area design and geometry contained in *Vertiport Design* include the TLOF, the FATO, and the safety area, which are defined in detail as follows.

- **Final Approach and Takeoff Area (FATO) |** The FATO is a defined load-bearing area over which an aircraft completes the final phase of its approach to a hover or landing, and from which the aircraft initiates takeoff. The FATO is similar to the total surface of a helipad.

- **Touchdown and Liftoff Area (TLOF) |** The TLOF is a load-bearing, generally paved area centered in a FATO on which the aircraft performs a touchdown or liftoff. The TLOF is analogous to the center “H” of a helipad.

- **Safety Area |** The safety area is a defined area surrounding the FATO that is intended to reduce the risk of damage to aircraft accidentally diverging from the FATO. The vertiport safety area is identical in purpose to a runway or taxiway safety area.

The calculations for these areas are presented in **Table 3P** and are based on the controlling dimension (designated “D”) or propulsion dimension (designated “D-p”) of the design eVTOL aircraft as defined for the vertiport facility (see **Figure 3A**). D is the diameter of the smallest circle enclosing the aircraft on a horizontal plane while the aircraft is in the takeoff or landing configuration with rotors/propellers turning (if applicable). D-p is the smallest circle enclosing all the propulsion units (including propellers, rotors, fans, etc.) on a horizontal plane while the aircraft is in the vertical takeoff or landing configuration with rotors turning (if applicable).

TABLE 3P | Takeoff and Landing Area Minimum Dimensions

	DIMENSION (length and width or diameter)	
Element	**Non-Powered Lift**	**Powered Lift**
TLOF	1.88 D-p	1 D-p
FATO	1.88 D-p	2 D-p
Safety Area	2.5 D	2.5 D

FATO = final approach and takeoff area
TLOF = touchdown and liftoff area

Source: FAA, Draft EB 105A, Vertiport Design, Table 2-1

Each element is centered within the subsequent element: the TLOF is located in the center of the FATO, which is centered within the safety area, as shown in **Figure 3B**. The “broken wheel” symbol should be used and located in the center of the TLOF to identify the site as a vertiport, as opposed to a heliport. Both the TLOF and FATO are expected to be located on level terrain or a structure, be clear of penetrations and obstructions, and support the weight of the design eVTOL aircraft. The TLOF may be circular, square, or rectangular in shape.

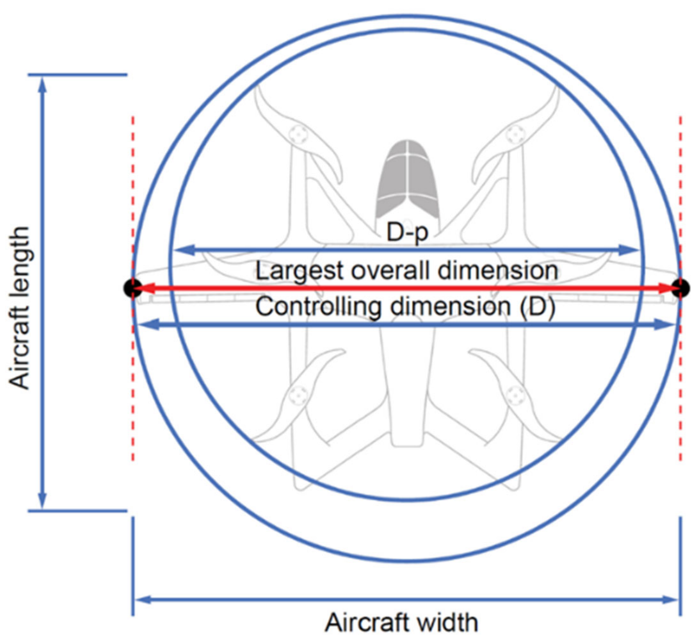

Figure 3A – eVTOL Controlling Dimensions

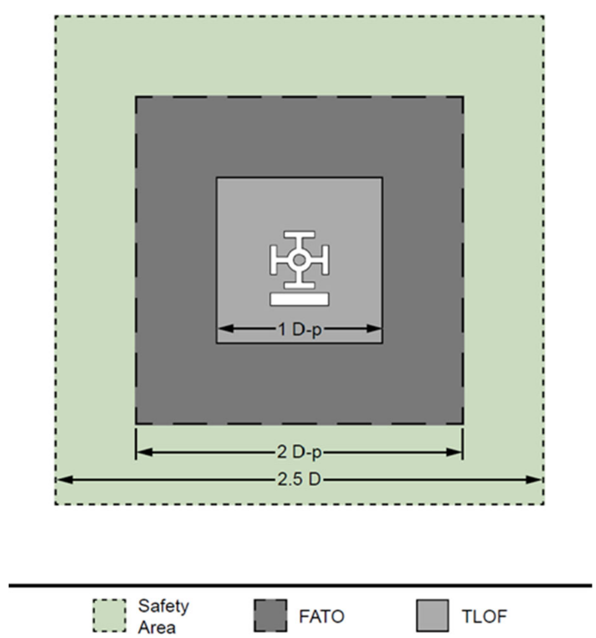

Figure 3B – Relationship and Dimensions

	RUNWAY 1-19		RUNWAY 13-31	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
RUNWAYS				
Runway Design Code (RDC)	C-III-4000	C-IV-4000	C-III-5000	Maintain
Dimensions	6,008' x 150'	Consider Extension to Minimum Length of 7,200'	4,701' x 100'	Consider Extension to Minimum Length of 5,500'
Pavement Strength	60,000 SWL; 106,000 DWL; 150,000 DTWL	Maintain	30,000 SWL; 50,000 DWL; 90,000 DTWL	Maintain
Blast Pads	200'x100' (Rwy 19)	200' x 200'	100'x187' (Rwy 13)	140' x 200'
Runway Safety Area (RSA)	Standard RSA	Maintain	Standard RSA	Maintain
Runway Object Free Area (ROFA)	Standard ROFA; Segmented Circle/ Lighted Windcone Obstructs	Relocate Segmented Circle/Lighted Windcone	Standard ROFA; Segmented Circle/ Lighted Windcone Obstructs	Relocate Segmented Circle/Lighted Windcone
Runway Obstacle Free Zone (ROFZ)	Standard ROFZ	Maintain	Standard ROFZ	Maintain
Runway Protection Zone (RPZ)	Standard RPZs	Maintain	Approximately 15.1 Acres of Uncontrolled RPZ Property; Commercial Building Obstruction (Rwy 31)	Establish Control Over Full RPZs
TAXIWAYS				
Design Group	TDG 2A	TDG 2B (A & B); TDG 2A (all others)	TDG 2A	Maintain
Parallel Taxiway	Taxiway A	Maintain	NA	Consider Full-Length Parallel Taxiway
Parallel Taxiway Separation from Runway	400′ (Taxiway A)	Maintain	NA	Minimum 400' Separation for Ultimate Parallel
Widths	50′	Maintain	50′	Maintain
Holding Position Separation	250′	258′	200′	250′
Notable Conditions	Non-standard Taxiway Conditions: Direct-Access Points, Acute-Angle Intersections	Consider Corrective Measures	Non-standard Taxiway Conditions: Acute-Angle Intersections	Consider Corrective Measures
NAVIGATIONAL AND WEATHER AIDS				
Instrument Approaches	LPV GPS (19), VOR (19), VOR (Circling)	Consider GPS-based Approaches (1)	LNAV GPS (13), VOR (Circling)	Consider GPS-based Approaches (31)
Weather Aids	ASOS, Wind Cone, Rotating Beacon, Segmented Circle	Relocate Segmented Circle/ Lighted Windcone Outside ROFA/RVZ	ASOS, Wind Cone, Rotating Beacon, Segmented Circle	Relocate Segmented Circle/ Lighted Windcone Outside ROFA/RVZ
Approach Aids	PAPI-4s (19); REILs (19)	Add PAPI-4s (1); Add REILs (1)	None	Add PAPI-4s (13 & 31); Add REILs (13 & 31)
LIGHTING AND MARKING				
Runway Lighting	HIRL	Maintain	MIRL	Maintain
Runway Marking	Non-Precision	Maintain	Non-Precision	Maintain
Taxiway Lighting	MITL (All Taxiways Except B West of Taxiway A, and Taxiway F)	Expand MITL to All of Taxiway B and F	MITL (Taxiway B)	Add MITL to Taxway F
Airfield Signage	Standard Runway/Taxiway Identification, Holding Position, and Routing Signage	Maintain	Standard Runway/Taxiway Identification, Holding Position, and Routing Signage	Maintain

KEY

ASOS - Automated Surface Observation Station
DTWL - Dual Tandum Wheel Loading
DWL - Dual Wheel Loading
GPS - Global Positioning System
HIRL - High Intensity Runway Edge Lighting
LNAV - Lateral Navigation
LPV - Localizer Performance with Vertical Guidance
MIRL - Medium Intensity Runway Edge Lighting
MITL - Medium Intensity Taxiway Edge Lighting
PAPI - Precision Approach Path Indicator
REIL - Runway End Identification Lighting
RVZ - Runway Visibility Zone
SWL - Single Wheel Loading
TDG - Taxiway Design Group
VOR - Very High Frequency Omni-directional Range

Exhibit 3D
AIRFIELD SUMMARY

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APPROACH PROFILES – IMAGINARY SURFACES

The imaginary surfaces defined for heliports in Title 14 Code of Federal Regulations (CFR) Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, are applicable to vertiports and include the primary surface, approach, and transitional surfaces. Section 77.23 defines these surfaces for heliports, and they have been adopted for use and presented in *Vertiport Design*.

- **Primary Surface |** The primary surface is the same size and shape as the FATO. This surface is a horizontal plane at the established vertiport elevation.

- **Approach Surface |** This surface begins at each end of the vertiport's primary surface, has the same width as the primary surface, and extends outward and upward for a horizontal distance of 4,000 feet, at which point its width is 500 feet. The slope of this surface is 8:1 and it doubles as the departure surface.

- **Transitional Surface |** The transitional surface extends outward and upward from the lateral boundaries of the primary and approach surfaces at a slope of 2:1 for 250 feet horizontally from the centerline of the primary and approach surfaces.

The primary, approach, and transitional surfaces should remain clear of penetrations whenever possible, unless an FAA analysis determines the penetrations to any Part 77 surface not to be hazardous. **Figure 3C** is a visual representation of the imaginary surfaces as they apply to vertiports.

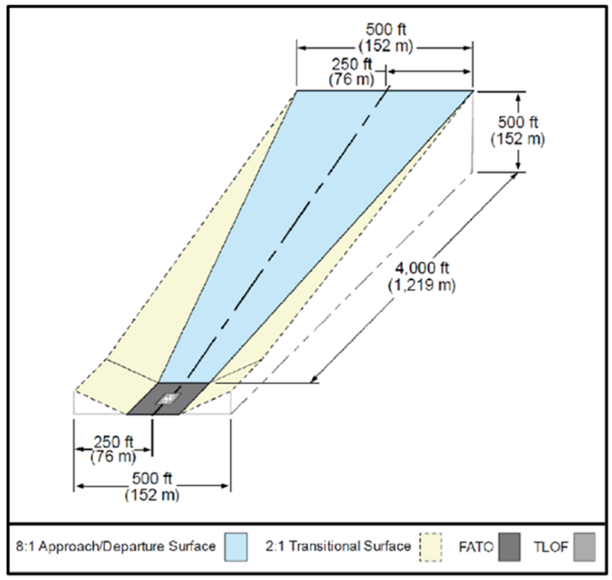

Figure 3C – Vertiport Imaginary Surfaces

VERTIPORT SUMMARY

eVTOLs and AAM/UAM represent an emerging (yet unproven) aviation market. Testing and initial adoption are likely to occur in large metropolitan areas and then expand to mid-sized and smaller markets. Full integration of eVTOL into the national airspace system may not occur for many years; however, it is prudent for this planning study to consider the potential for such activity at PRB. For this reason, the alternatives analysis includes options for a potential future vertiport on airport property, including enhancing the existing heliport to vertiport standards. The vertiport dimensions depicted are conceptual and are not based on a specific reference aircraft.

LANDSIDE FACILITY REQUIREMENTS

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

As a reminder, the yearly forecasts from Chapter Two have been converted to planning horizon levels to provide flexibility to the demand-based plan. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests, rather than on specific dates in the future. The short term roughly corresponds to a five-year period, the intermediate term is approximately 10 years, and the long term is 20 years.

GENERAL AVIATION FACILITIES

General aviation facilities are those necessary for handling general aviation aircraft, passengers, and cargo while on the ground. This section is devoted to identifying future general aviation facility needs during the planning period for the following types of facilities normally associated with general aviation terminal areas:

- General aviation terminal services
- Aircraft hangars
- Aircraft parking aprons

General Aviation Terminal Services

The general aviation terminal facilities at an airport are often the first impression of the community that corporate officials and other visitors will encounter. General aviation terminal facilities at an airport provide space for passenger waiting, a pilots' lounge, flight planning, concessions, management, storage, and many other various needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by fixed base operators (FBOs) and other specialty operators for these functions and services. At PRB, general aviation terminal services are primarily provided from the 8,000-square-foot (sf) terminal building which serves as the base for the airport's FBO, Loyd's Aviation. The terminal building includes various functional areas unrelated to core general aviation terminal services, including a restaurant, mezzanine, patio, and administrative offices, which total approximately 3,500 sf. Excluding those areas, the total area of general aviation services provided in the terminal is approximately 4,500 sf.

The methodology used in estimating general aviation terminal facility needs was based on the number of airport users expected to utilize general aviation facilities during the design hour. Space requirements for terminal facilities were based on providing 125 square feet per design hour itinerant passenger. A multiplier of 2.5 in the short term, increasing to 3.5 in the long term, was also applied to terminal facility needs to better determine the number of passengers associated with design hour operations. This increasing multiplier indicates an expected increase in larger aircraft operations through the long term. These operations typically support larger turboprop and jet aircraft, which can accommodate an increasing passenger load factor. Such is the case at PRB, where an increasing number of turbine operations are anticipated.

Table 3Q outlines the space requirements for general aviation terminal services at PRB through the long-term planning period. The general aviation services space currently available in the terminal is approximately 4,500 sf. Other specialty aviation service operators (SASOs) on the airfield also typically provide some level of general aviation services; however, the terminal building is the focus point for most operators. As shown in the table, the space currently provided needs to be expanded over the course of the planning period. By the long-term, approximately 9,250 sf of general aviation terminal service space is needed. The airport is currently in the process of designing a 5,200-sf expansion of the terminal building, which will expand passenger and crew facilities to support FBO operations. Once completed, the terminal building will have adequate capacity to meet the projected long-term need for general aviation terminal services.

TABLE 3Q | General Aviation Terminal Area Facilities

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need
Input Data				
Design Hour Operations	–	15	17	21
Passenger Multiplier	–	2.5	3.0	3.5
Design Hour Passengers	–	38	51	74
Terminal Service Space Requirements				
Space per Design Hour Passenger (sf)	–	125	125	125
Terminal Building (sf)[1]	4,500	4,750	6,375	9,250
Terminal Vehicle Parking Requirements				
Terminal Vehicle Spaces	94	53	69	99

Red indicates a projected need that exceeds current capacity.
Notes: [1] The total terminal building area is 8,000 sf; however, portions not associated with typical general aviation services (restaurants, mezzanine, patio, and administrative offices) are excluded, resulting in 4,500 sf currently available.
Source: Coffman Associates analysis

General aviation terminal service vehicle parking demands have also been determined for PRB. Space determinations for passengers were based on an evaluation of existing airport use, as well as standards set forth to help calculate projected terminal facility needs. There are currently 94 individual parking spaces available at the terminal building. As shown in the table, existing vehicle parking is adequate through the intermediate period; however, additional capacity may be needed by the long-term. It should be noted that the planned expansion of the terminal building will displace some existing vehicle parking spaces. The displaced parking capacity should be replaced by a new lot near the expanded terminal.

The airport has additional vehicle parking spaces located throughout the landside areas associated with the various SASOs and hangar facilities. The alternatives analysis in the next chapter will consider additional parking capacity along with any new hangar development to accommodate both transient users and based tenants.

Aircraft Hangars

Utilization of hangar space varies as a function of local climate, security, and owner preference. The trend in general aviation aircraft is toward more sophisticated (and, consequently, more expensive) aircraft; therefore, many aircraft owners prefer enclosed hangar space over outside tiedowns.

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

While most aircraft owners prefer enclosed aircraft storage, some will still use outdoor tiedown spaces, usually due to lack of available hangar space, high hangar rental rates, or operational needs; therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft.

Hangar types vary greatly in size and function. T-hangars and box hangars are popular with aircraft owners who need to store individual or multiple small aircraft. These hangars typically provide individual spaces within a larger structure or in portable standalone buildings. Individual T-hangar units vary in size from 650 to 1,500 sf while box hangars range from 1,500 and 2,500 sf to nearly 10,000 sf. There is approximately 233,662 sf of total T-hangar and box hangar storage space at PRB. For determining future aircraft storage needs, it is assumed that owners of new single-engine and other smaller aircraft (e.g., ultralights, gliders, etc.) will prefer T-hangar or box hangar storage space. A planning standard of 1,200 sf per single-engine piston and other aircraft is utilized for this hangar type.

Conventional hangars are larger open-space facilities typically able to house single-engine, multi-engine, turboprop, and jet aircraft, as well as helicopters. Conventional hangars provide for bulk aircraft storage and are often utilized by airport businesses, such as FBOs or SASOs. Conventional hangars are generally larger than box hangars and can range in size from 10,000 sf to more than 20,000 sf. There is approximately 154,600 sf of space for conventional hangars at PRB. For future planning, standards of 3,000 sf per turboprop, 5,000 sf per jet, and 1,500 sf per helicopter are utilized for conventional hangars.

Future hangar requirements for the airport are summarized in **Table 3R**.

TABLE 3R | Aircraft Hangar Requirements

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need	Difference
Total Based Aircraft	197	219	239	296	+99
Hangar Area Requirements					
T-Hangar/Box Hangar Area (sf)	233,662	251,700	261,300	300,900	+67,238
Conventional Hangar Area (sf)	154,600	178,600	218,600	298,600	+144,000
Total Hangar Area (sf)	**388,262**	**430,300**	**479,900**	**599,500**	**+211,238**
Red indicates a projected need that exceeds current capacity.					

Source: Coffman Associates analysis

Because most based aircraft owners prefer enclosed hangar space, it is assumed that all based aircraft will occupy hangar spaces, as opposed to tying down on the apron. The analysis shows that future hangar requirements indicate a potential need for 211,238 sf of new hangar storage capacity through the long-term planning period. Due to the projected increase in based aircraft, the existing demand for hangar space, annual general aviation operations, and hangar storage needs, facility planning will consider additional hangars at the airport. It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types.

The airport is in the planning stage for a new hangar development that will add approximately 18 new box hangars, ranging in size from 1,600 sf to 4,200 sf, for a total gain of 54,800 sf in total capacity, which would exceed the projected need for the short-term period.

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

Aircraft Parking Aprons

The aircraft parking apron is an expanse of paved area intended for aircraft parking and circulation. Typically, a main apron is centrally located near the airside entry point, such as the terminal building or FBO facility. Ideally, the main apron is large enough to accommodate transient airport users, as well as a portion of locally based aircraft. Smaller aprons are often available adjacent to SASO hangars and at other locations around the airport. The apron layout at PRB generally follows this pattern; the main terminal apron, which totals 291,700 sf, is adjacent to the terminal and FBO facilities and primarily caters to itinerant aircraft. Additional aprons located throughout the west landside areas total approximately 315,300 sf of capacity, primarily used by the various FBOs/SASOs and locally-based aircraft. Combined, PRB has a total apron capacity of 607,000 sf.

To determine future apron needs, the FAA-recommended planning criterion[2] of 3,240 sf was used for ADG I aircraft (single-engine and multi-engine piston aircraft), while a planning criterion of 4,410 sf was used for larger ADG II aircraft (turboprops and jets). A parking apron should also provide space for locally based aircraft that require temporary tiedown storage. Locally-based tiedowns are typically utilized by smaller single-engine aircraft; thus, a planning standard of 3,240 sf per position was utilized in the analysis.

The total apron parking requirements are presented in **Table 3S**. Using the planning standards described above and factoring in assumptions regarding operational and based aircraft growth, the available apron capacity as a whole meets the long-term need; however, the transient-specific apron areas may need to be expanded to accommodate projected needs for the intermediate and long-term periods.

TABLE 3S | Aircraft Parking Apron Requirements

	Currently Available	Short-Term Need	Intermediate-Term Need	Long-Term Need	Difference
Aircraft Parking Area (square feet)					
Based/Local Aircraft	315,300	93,600	103,400	128,300	-187,000
Transient Small Aircraft	291,700	272,200	294,800	366,100	+100,900
Transient Jet Aircraft		8,800	13,200	26,500	
Total Apron Area	**607,000**	**374,600**	**411,400**	**520,900**	**-86,100**

Red indicates a projected need that exceeds current capacity.

Source: Coffman Associates analysis

[2] Per the FAA Apron Size Calculation Tool

The 2024 *Pavement Management Program* identified the terminal apron as having insufficient strength for larger aircraft. Most of the terminal apron is planned for reconstruction/rehabilitation to add strength for heavier business jets.

SUPPORT FACILITIES

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

- Aviation fuel storage
- Perimeter fencing and gates

Aviation Fuel Storage

Loyd's Aviation is the airport's public fuel service provider and leases all fuel storage facilities at the airport. There are two aboveground fuel storage tanks, consisting of 20,000 gallons for Jet A storage and 12,000 gallons for 100LL (Avgas) fuel.

Fuel flowage records for 2024 show the airport dispensed 887,279 gallons of Jet A fuel and 158,398 gallons of Avgas fuel. Utilizing operations reported by 1200.aero, the number of turbine operations in 2024 totaled approximately 9,852 (fixed-wing and helicopter aircraft including those operated by CAL FIRE). Dividing the total fuel flowage by the total number of operations provides a ratio of fuel flowage per operation. In 2024, the airport dispensed approximately 90 gallons of Jet A fuel per turbine operation and 4.1 gallons of Avgas fuel per piston operation.

Maintaining a 14-day fuel supply would allow the airport to limit the impact of a disruption of fuel delivery. Currently, the airport has enough static fuel storage to meet the 14-day supply criteria for Avgas fuel through the long-term horizon; however, the analysis shows there is a need to expand Jet A fuel storage capacity. The forecasted fuel storage requirements are summarized in **Table 3T**.

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

TABLE 3T | Fuel Storage Requirements

	Capacity	2024 Flowage Summary	Planning Horizon		
			Short-Term	Intermediate-Term	Long-Term
Jet A					
Daily Usage (gal.)	**20,000**	2,431	2,467	2,724	3,398
14-Day Supply (gal.)		34,126	34,544	38,134	47,573
Annual Usage (gal.)		887,279	900,600	994,200	1,240,300
Avgas (100LL)					
Daily Usage (gal.)	**12,000**	434	545	582	698
14-Day Supply (gal.)		6,092	7,629	8,151	9,765
Annual Usage (gal.)		158,398	198,900	212,500	254,600
Red indicates a projected need that exceeds current capacity.					

Sources: Historical fuel flowage data provided by airport staff; fuel supply projections prepared by Coffman Associates

Perimeter Fencing, Gates, and Security

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

- Gives notice of legal boundary of the outermost limits of the 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 the aircraft operations areas on the airport
- Creates a psychological deterrent
- Demonstrates a corporate concern for facilities
- Limits inadvertent access to the aircraft operations area by wildlife

PRB operations areas are mostly enclosed by fencing, including a combination of six-foot security fencing and wrought iron and concrete walls. A series of automated controlled access gates are available for access to areas throughout the airport.

In cooperation with the GA community, the Transportation Security Administration (TSA) has developed guidelines to enhance security at GA airports. *Security Guidelines for General Aviation Airport Operators and Users* was released in June 2021. The guidance places a large emphasis on risk-based security by evaluating hazards/threats, vulnerabilities, and consequences. Risk-based security helps ensure resources and requirements are focused on the areas where the greatest risks are present. TSA security recommendations for various types of airport infrastructure are included in **Table 3U**.

TABLE 3U | TSA Airport Infrastructure Security Recommendations

Infrastructure	Recommendation
Hangars	• Hangars should be properly marked and numbered for ease of emergency response. • Install security and informational signs. • Avoid keyed hangar locks. If keyed, locks should be rekeyed with every new tenant. • Ensure proper lighting around hangar areas. • Equip hangars with electric bypass switches and/or alarm and intrusion detection systems for enhanced security.
Locks	• Combination locks – may not be suitable for outdoor use if they are exposed to precipitation or freezing temperatures. Change lock combinations frequently. • Cipher (push button) locks – limit use to controlling access in manned areas because lock codes can be given to unauthorized users and the presence of other personnel could deter the unauthorized use of the code. Change lock codes frequently. • Keyed locks – best for outdoor use. Locks should be rekeyed, replaced, or discarded when a tenant moves out. • Advanced electronic key technologies – provide airport management with the ability to immediately disable access on keys that are lost or stolen. Also provide a record of users' movements throughout the airport area. • Deadbolt locks, built-in door handle locks, or padlocks and metallic keys should be considered to secure an access point, particularly those that are perceived or presumed to be low-risk, low throughput, or significantly distant from the main areas of concern.
Key Control	• Where key-cutting codes and equipment are used, measures should be taken to protect them against loss or misuse. • Limit key issuance authority to as few personnel as possible to minimize improper distribution. • Issue keys to personnel based on operational need and not as a convenience. • Retrieve keys when personnel leave the airport by transfer, dismissal, resignation, or lease expiration. • Lost keys should be reported promptly to the appropriate airport personnel. • Unissued locks and keys should be properly safeguarded. • Keys should be stamped or engraved with "Do Not Duplicate." • The key issuance system should be periodically (at least annually) audited to ensure accountability for all keys.
Perimeter Security	• Physical barriers (fencing, walls, electronic boundaries) can be used to deter and delay access of unauthorized persons into sensitive areas.
CCTV (Closed Circuit Television)	• Monitored CCTV systems are an effective method of perimeter security and – in conjunction with security fencing – can deter security breaches. • Consider outdoor security lighting and cameras to improve security of aircraft parking and hangar areas, fuel storage areas and fuel trucks, airport access control points, vehicle parking lots, fences, or obstructed areas.
IDS (Intrusion Detection Systems)	• Can replace the need for physical security personnel to patrol an entire facility or perimeter. • Monitored by a contracted company that notifies police, fire, and/or airport management in the event of an intrusion.
Fencing	• Most common means of securing a perimeter. • Low maintenance; provides clear visibility for patrols; deters animals from the airfield; and can be installed in almost any environment. • For best value, fencing should be used in conjunction with a "challenge" system or airport watch program.
Access Points	• The number of access points on perimeter controls should be minimized and their use and conditions should be regularly monitored. • Should control/prevent access, but also differentiate between an authorized and unauthorized user. • If an access point is not user-friendly, it may be abused, disregarded, or subverted and thus pose a security risk.

Continues on next page

TABLE 3U | TSA Airport Infrastructure Security Recommendations

Infrastructure	Recommendation
Gates	• Should have self-closures and be equipped so they can be secured, should enhanced security conditions require it. • All gates should be sufficiently lighted. • Should have no more than 4-6 inches of ground clearance beneath the gate and minimal gaps on both sides.
Vehicle Gates	• The chief concern with vehicle gates is tailgating. It is the responsibility of each authorized person to prevent tailgating in a safe and non-confrontational manner. Where prevention is not practical or safe, suspected unauthorized access should be reported. • Include signage to remind vehicle operators to confirm gate closure.
Lighting	• Security lighting should be connected to an emergency power source, if available. • Ensure lighting does not interfere with aircraft operations.
Signage	• Wording may include, but is not limited to, warnings against trespassing, unauthorized use of aircraft and tampering with aircraft, and reporting of suspicious activity. • Use concise language and include phone numbers of the nearest responding law enforcement agency, 9-1-1, or TSA's 1-866-GA-SECUR, as appropriate.

Source: Security Guidelines for General Aviation Airport Operators and Users, June 2021

LANDSIDE FACILITY REQUIREMENTS SUMMARY

A summary of the overall general aviation landside facility requirements is presented in **Table 3V**.

TABLE 3V | General Aviation Landside Facility Requirements Summary

	Current Capacity	Projected Needs		
		Short-Term	Intermediate-Term	Long-Term
General Aviation Terminal Facilities and Parking				
Terminal Service Space (sf)	4,500	4,750	6,375	9,250
Total Terminal Public Vehicle Parking	94	53	69	99
Aircraft Storage Hangar Requirements				
T-Hangar/Box Hangar (sf)	233,662	251,700	261,300	300,900
Conventional Hangar (sf)	154,600	178,600	218,600	298,600
Total Hangar Storage Area (sf)	388,262	430,300	479,900	599,500
Aircraft Parking Apron				
Based/Local Aircraft Parking (sf)	315,300	93,600	103,400	128,300
Transient Parking (sf)	291,700	281,000	308,000	392,600
Total Apron Area (sf)	607,000	374,600	411,400	520,900
Fuel Storage				
100LL (14-Day Fuel Storage)	12,000	7,058	7,641	9,485
Jet A (14-Day Fuel Storage)	20,000	34,544	38,134	47,573
Red indicates a projected need that exceeds current capacity.				

Source: Coffman Associates analysis

SUMMARY

This chapter outlines the safety design standards and facilities required to meet the potential aviation demand projected at PRB for the next 20 years. To provide a more flexible master plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a five-year period, the intermediate term is approximately 10 years, and the long term is

20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests, rather than on specific dates in the future.

In Chapter Four, potential improvements to the airside and landside systems will be examined through a series of airport development alternatives. Most of the alternatives discussion will focus on capital improvements that would be eligible for federal and state grant funds. Ultimately, an overall airport development plan that presents a vision beyond the 20-year scope of this master plan will be developed.