Chapter 5 – Airfield and Landside Facility Requirements

INTRODUCTION

In efforts to quantify future facility needs, it is necessary to translate the forecasted aviation activity into specific physical requirements for Palm Springs International Airport (PSP or the Airport). Therefore, this chapter analyzes the actual types and quantities of facilities and/or the required improvements to existing facilities needed to accommodate the projected demand safely and efficiently. For those components determined to be deficient, the type, size, or number of facilities required to meet the demand is identified. Two separate analyses are included: those requirements related to airside facilities, and those requirements related to landside facilities.

This analysis uses the forecasts presented in the **Aviation Activity Forecast** chapter for establishing future development at the Airport. This is not intended to dismiss the possibility that either accelerated growth or consistently higher or lower levels of activity may occur. Aviation activity levels should be monitored for consistency with the forecasts. In addition, an airport's runway and taxiway system should be designed in accordance with the specified Runway Design Code (RDC) based on the critical aircraft. The Federal Aviation Administration (FAA) defines critical aircraft as an aircraft or group of aircraft within a RDC that have a minimum of 500 annual operations at an airport. Based on the critical aircraft analysis conducted for this Master Plan, the existing and future critical aircraft for each runway facility at PSP is designated as follows:

Runway 13R/31L – RDC D-III-5000

- Boeing 737-900 (Existing)
- Boeing 737 MAX 9 (Future)

Runway 13L/31R – RDC B-II (Small)-VIS

- Beechcraft King Air (Existing)
- Beechcraft King Air and Cessna Citation CJ2 (Future)

AIRFIELD CAPACITY

Airfield capacity refers to the maximum number of aircraft operations (takeoffs and landings) that can be conducted in a given period of time without causing delays. The FAA Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*, provides the methodology used to measure airfield capacity, which can be defined as:

- **Hourly Capacity of Runways.** The maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period.
- **Annual Service Volume (ASV).** A reasonable estimate of an airport's annual capacity (i.e., level of annual aircraft operations that will result in an average annual aircraft delay of approximately one to four minutes).

The AC indicates that several factors can impact airfield capacity including, but not limited to:

- **Runway Use Configuration.** The number, location, and orientation of the active runway(s), the type and direction of operations, and the flight rules in effect at a particular time. PSP has two parallel runways that are spaced 700 feet apart allowing simultaneous Visual Flight Rules (VFR) operations.
- **Ceiling and Visibility.** Ceiling refers to the cloud height above ground level while visibility refers to the distance that can be seen ahead. Both depend on weather conditions that will dictate whether a pilot can fly under VFR or Instrument Flight Rules (IFR):
  - VFR – minimum ceiling of 1,000 feet and minimum visibility of three statute miles.
  - IFR – ceiling less than 1,000 feet and/or visibility less than three statute miles.
- **Mix Index.** Mix index is a mathematical expression that calculates the percentage of Class C aircraft plus three times the percentage of Class D aircraft that operate at the Airport. The mix index for PSP is 122, which was calculated using the latest FAA Traffic Flow Management System Counts (TFMSC) data.
  - *Class C aircraft* refers to large jet aircraft weighing more than 41,000 and up to 255,000 pounds.
  - *Class D aircraft* refers to large non-jet aircraft and small regional jets weighing more than 41,000 and up to 255,000 pounds.
- **Taxiways.** The parallel taxiways, entrance/exit taxiway, and crossing taxiways can impact capacity if an arriving or departing stream of aircraft must cross an active runway. Both runways at PSP have parallel taxiways on each side of the runway with several entrance, exit, and crossing taxiways along the length of the runway.

For the purposes of this Master Plan, airfield capacity was analyzed at a high level focusing on the airfield capacity range throughout the long-term planning horizon. AC 150/5060-5 provides a method to determine the long-term ASV based on the runway-use configuration. PSP has two parallel runways that are spaced 700 feet apart allowing simultaneous VFR operations. **Table 5-1** summarizes the ASV range for an airfield that has two parallel runways that are spaced between 700 and 2,499 feet apart.

Table 5-1: Airfield Capacity

Runway-Use Configuration Number	Mix Index (C+3D)	Hourly Capacity Operations per Hour		ASV
		VFR	IFR	
2	0 to 20	197	59	355,000
	21 to 50	145	57	275,000
	51 to 80	121	56	260,000
	81 to 120	105	59	285,000
	121 to 180	94	60	340,000

Sources: *Mead & Hunt, 2023; AC 150/5060-5 Figure 2-1 Capacity and ASV for long range planning.*

Airfield Capacity Conclusion

The ASV for PSP's airfield range is 340,000 operations per year. It is important that an airfield can meet forecasted operations to maintain a safe and efficient system. The **Aviation Activity Forecast** chapter forecasts PSP operations to increase to an estimated 88,687 operations which is approximately 26 percent of the ASV, by the end of the 20-year planning horizon. Therefore, the existing airfield is anticipated to be adequate for PSP's long-term needs and additional evaluation of capacity will not be explored further.

AIRFIELD FACILITY AND AIRSPACE FACILITY REQUIREMENTS

To identify facility needs, it is necessary to translate the forecast aviation activity into specific types and quantities. This section addresses the actual physical facilities and/or improvements to existing facilities needed to accommodate safely and efficiently the projected demand that will be placed on the Airport.

Airfield Design Standards

The types of aircraft that currently operate at PSP and those projected to use the facility in the future have an impact on the planning and design of airport facilities. This knowledge assists in the selection of FAA-specified design standards for the Airport, which include runway and taxiway dimensional requirements, runway length, and pavement strength. These standards are based on the critical aircraft that currently use the Airport or that are projected to use the Airport in the future. According to AC 150/5300-13B, *Airport Design*; the first step in defining a runway's design geometry is to determine the RDC. The critical aircraft can take the form of one aircraft or a composite aircraft representing a collection of aircraft classified by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). The critical aircraft for each of the runways at PSP are discussed further in the following subsections and are used to evaluate each runway's ability to meet current FAA design standards.

Runway 13R/31L Design Standards

Runway 13R/31L is the primary runway at PSP and the only runway that serves air carrier aircraft. The FAA approved Critical Aircraft Memo for this runway was prepared in May of 2023. The memo identified the Boeing 737 MAX 9 as the future critical aircraft. As documented in the **Inventory of Existing Conditions** chapter, Runway 13R/31L provides an instrument approach procedure (IAP) visibility minimum of 1 mile (i.e., a 5,000 foot runway visual range). Therefore, the RDC for Runway 13R/31L is designated D-III-5000. **Table 5-2** evaluates the existing runway's ability to meet the specified FAA design standards and **Figure 5-1** through **Figure 5-3** depict the existing runway design standards.

Table 5-2: Runway 13R/31L Design Standards Matrix – RDC D-III-5000

Item	Existing Dimension	FAA Criteria	Standard Met
Runway Design			
Runway Width	150’	100’	Yes
Shoulder Width	40’	20’	Yes
Blast Pad Width	230’	140’	Yes
Blast Pad Length	200’	200’	Yes
Crosswind Component	16 knots	16 knots	Yes
Runway Protection			
Runway Safety Area (RSA)			
Length beyond departure end (Runway 13R)	1,000’	1,000’	Yes[1]
Length beyond departure end (Runway 31L)	1,000’	1,000’	Yes
Length prior to threshold (Runway 13R)	600’	600’	Yes
Length prior to threshold (Runway 31L)	600’	600’	Yes
Width (both runways)	500’	500’	Yes
Runway Object Free Area (ROFA)			
Length beyond departure end (Runway 13R)	**503’**	1,000’	**No**[2]
Length beyond departure end (Runway 31L)	1,000’	1,000’	Yes
Length prior to threshold (Runway 13R)	600’	600’	Yes
Length prior to threshold (Runway 31L)	600’	600’	Yes
Width (both runways)	800’	800’	Yes
Runway Obstacle Free Zone (ROFZ) – Both Runway Ends			
Length	200’	200’	Yes
Width	400’	400’	Yes
Precision Obstacle Free Zone (POFZ) – Both Runway Ends			
Length	N/A	N/A	N/A
Width	N/A	N/A	N/A
Runway Separation			
Runway centerline to:			
Parallel runway centerline	700’	700’[3]	Yes
Holding position	250’	250’	Yes
Parallel taxiway/taxilane centerline (Taxiway W between A & G)	500’	400’	Yes
Parallel taxiway/taxilane centerline (Taxiway W between G & K)	525’	400’	Yes
Parallel taxiway/taxilane centerline (Taxiway W between K & J)	400’	400’	Yes
Parallel taxiway/taxilane centerline (Taxiway C)	400’	400’	Yes
Aircraft parking area (east)	N/A	N/A	N/A
Aircraft parking area (west)	>485.5’ – 664.5’[4]	485.5’ – 664.5’[4]	Yes

Sources: *Mead & Hunt, 2023; FAA Advisory Circular 150/5300-13B.*

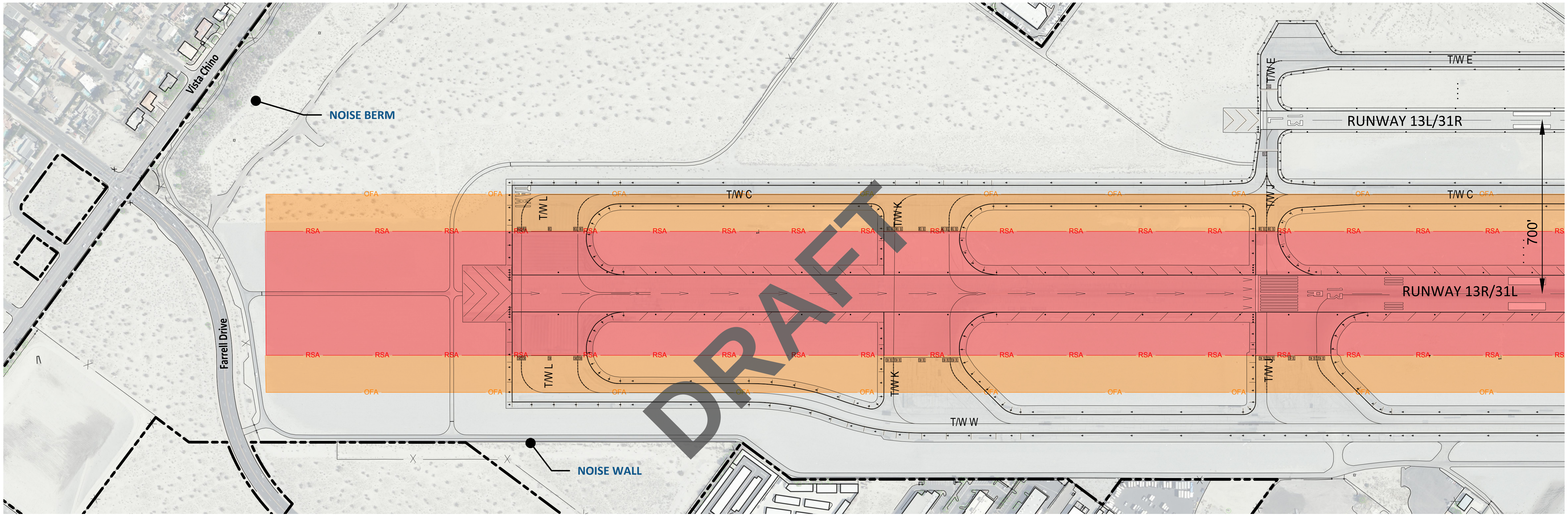
Notes: [1] *The Runway 13R RSA overrun length criteria is met with the application of declared distances standards (i.e., reduces both the ASDA and LDA lengths for Runway 13R).*

[2] *The length beyond runway end for Runway 13R’s ROFA does not meet standards because of the existing fence.*

[3] *Specified separation requirements for simultaneous takeoff and landings under VFR conditions.*

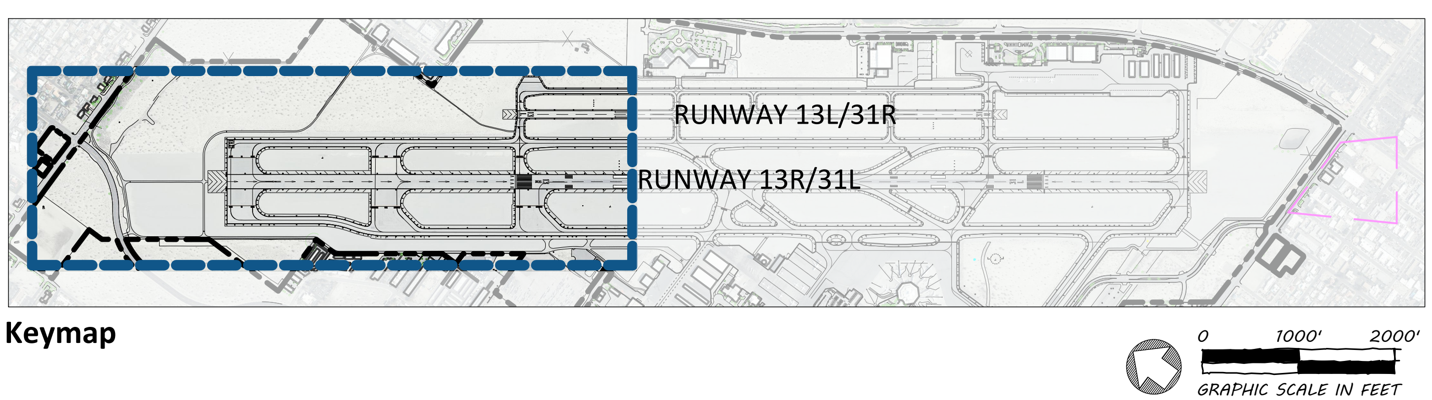
[4] *Aircraft parking west = runway/taxiway separation + TOFA/2 + TLOFA/2 = 500 + (400/2) + (171/2) = 664.5.*

Figure 5-1: Runway 13R/31L Design Standards D-III-5000 - North Detail



Legend

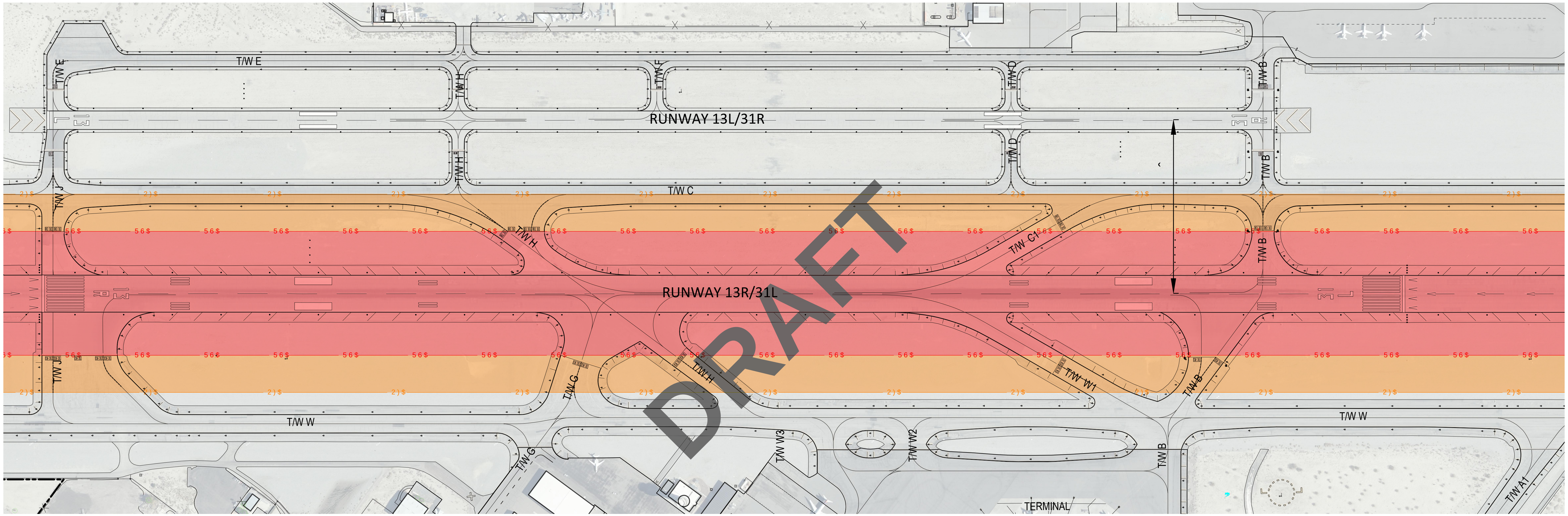
- Runway Safety Area
- Runway Object Free Area
- Airport Property Line



Keymap

CRITERIA MET/NO NON-STANDARD CONDITIONS

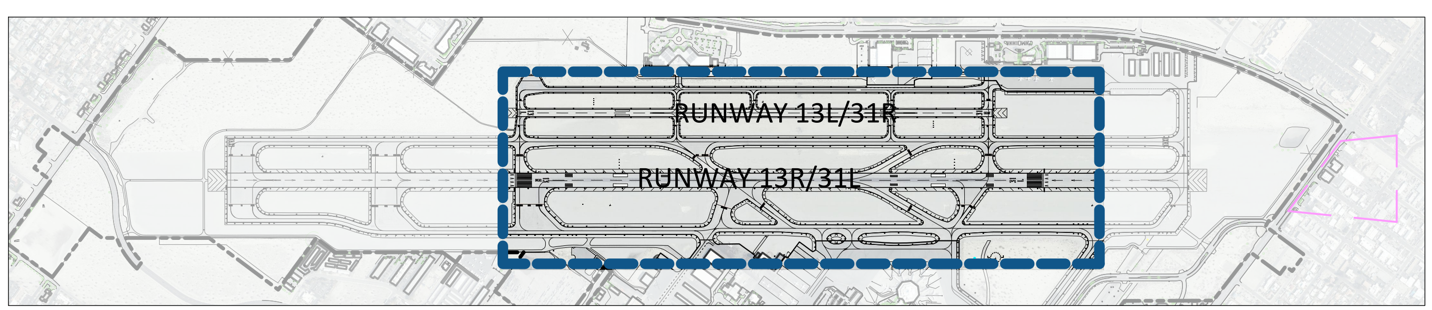
Figure 5-2: Runway 13R/31L Design Standards D-III-5000 - Central Detail



0 200' 400'
GRAPHIC SCALE IN FEET

Legend

- **Runway Safety Area**
- **Runway Object Free Area**
- **Airport Property Line**

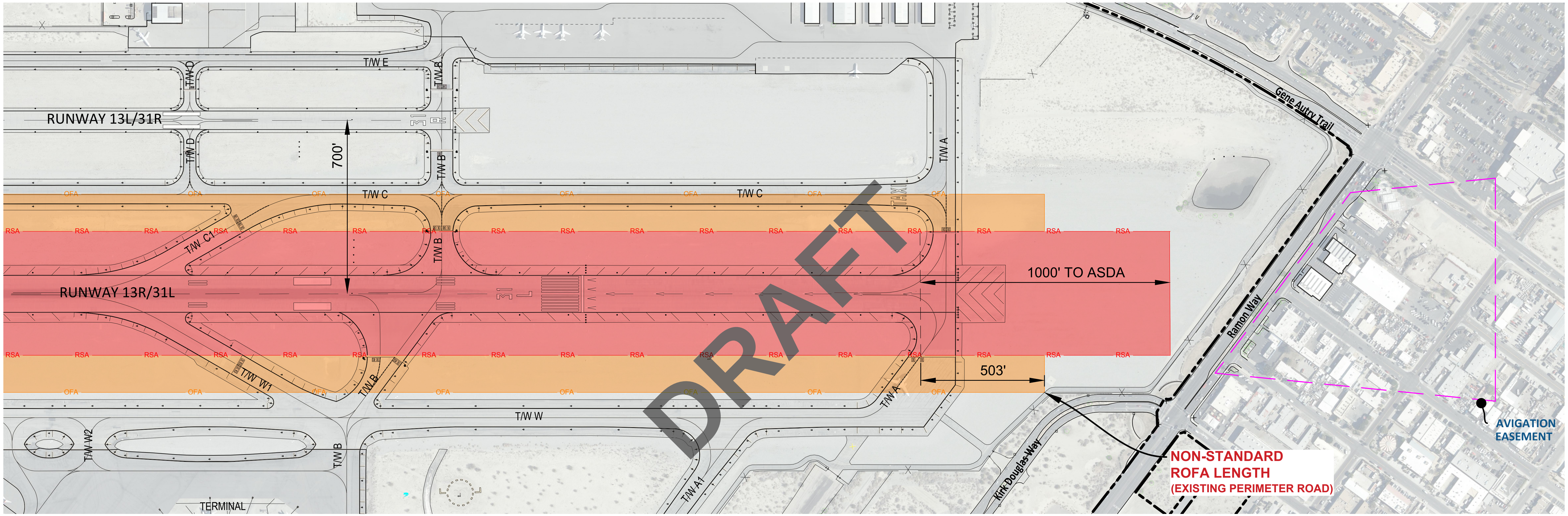


Keymap

0 1000' 2000'
GRAPHIC SCALE IN FEET

CRITERIA MET/NO NON-STANDARD CONDITIONS

Figure 5-3: Runway 13R/31L Design Standards D-III-5,000 - South Detail

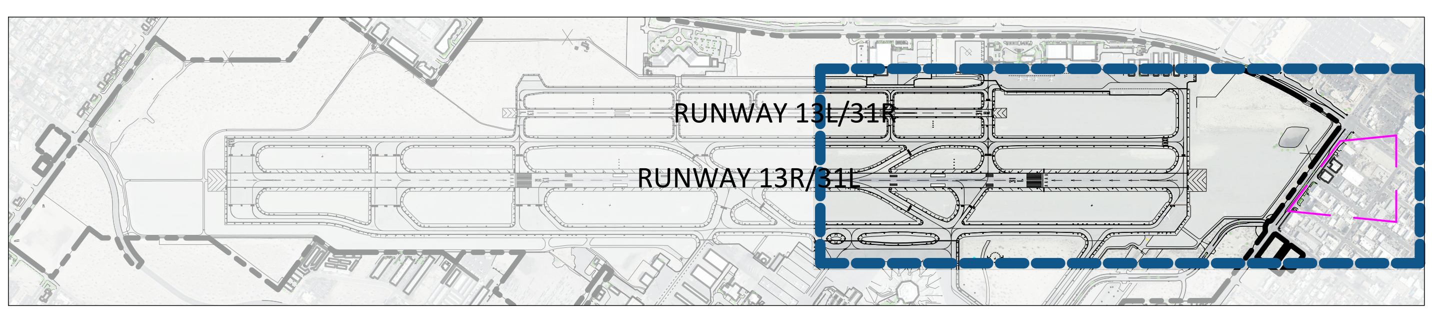


0 200' 400'
GRAPHIC SCALE IN FEET

Legend

- Runway Safety Area
- Runway Object Free Area
- Airport Property Line

NOTES:
1. ASDA- Accelerate Stop Distance Available
2. For this runway end, the length beyond departure end begins at the end of the ASDA rather than the physical end of runway



Keymap

0 1000' 2000'
GRAPHIC SCALE IN FEET

Runway 13R/31L Design Standards Conclusion

Runway 13R/31L meets the majority of FAA D-III-5000 design standards with the notable exception of the Runway 13R Runway Object Free Area (ROFA) length beyond runway end.

The 2010 FAA approved PSP Airport Layout Plan (ALP) listed both the Runway Safety Area (RSA) and ROFA as “Deviations From FAA Airport Design Standards.” However, as noted in Table 5-2 above, the Runway 13R overrun RSA is currently being mitigated with the application of declared distances criteria. Ultimately, the ALP identified the future relocation of the Runway 31L end to mitigate the existing non-standard ROFA. This previous recommendation for the mitigation of the non-standard ROFA will be reexamined in the context of a comprehensive review of the overall airfield layout configuration, as an element of the **Alternatives Analysis** chapter, in this update of the PSP Master Plan.

Runway 13L/31R Design Standards

Runway 13L/31R is the shorter parallel runway at PSP, providing only visual approaches, which is utilized by smaller general aviation aircraft. Based upon the existing and projected operational capacity of the Airport’s primary runway, Runway 13L/31R is classified by the FAA as an “Additional Runway,” which is not eligible for federal funding participation of future maintenance or development projects. Thus, the use of local Sponsor funding sources is required to maintain this facility.

Currently, the Beechcraft King Air is identified as the critical aircraft for this runway on the ALP. The latest FAA TFMSC data shows that a combination of the Beechcraft King Air and the Cessna Citation CJ2 is the appropriate critical aircraft for this runway. Based upon the specified wingspan and approach speed of these aircraft, along with the runway’s visual approaches, the RDC of the runway is designated at B-II (Small)-VIS. **Table 5-3** evaluates the runway’s ability to meet these FAA design standards and is depicted in **Figure 5-3**.

Table 5-3: Runway 13L/31R Design Standards Matrix – RDC B-II (Small)-VIS

Item	Existing Dimension	FAA Criteria	Standard Met
Runway Design			
Runway Width	75′	75′	Yes
Shoulder Width	10′	10′	Yes
Blast Pad Width	95′	95′	Yes
Blast Pad Length	150′	150′	Yes
Crosswind Component	13 knots	13 knots	Yes
Runway Protection			
Runway Safety Area (RSA) – Both Runway Ends			
Length beyond departure end	300′	300′	Yes
Length prior to threshold	300′	300′	Yes
Width	150′	150′	Yes
Runway Object Free Area (ROFA) – Both Runway Ends			
Length beyond departure end	300′	300′	Yes
Length prior to threshold	300′	300′	Yes
Width	500′	500′	Yes
Runway Obstacle Free Zone (ROFZ) – Both Runway Ends			
Length	200′	200′	Yes
Width	250′	250′	Yes
Precision Obstacle Free Zone (POFZ)			
Length	N/A	N/A	N/A
Width	N/A	N/A	N/A
Runway Separation			
Runway centerline to:			
Parallel runway centerline	700′	700′[1]	Yes
Holding position	125′	125′	Yes
Parallel taxiway/taxilane centerline (Taxiway C)	300′	240′	Yes
Parallel taxiway/taxilane centerline (Taxiway E)	240′	240′	Yes
Aircraft parking area (east)	>357′[2]	357′[2]	Yes
Aircraft parking area (west)	N/A	N/A	N/A

Sources: *Mead & Hunt, 2023; FAA Advisory Circular 150/5300-13B.*

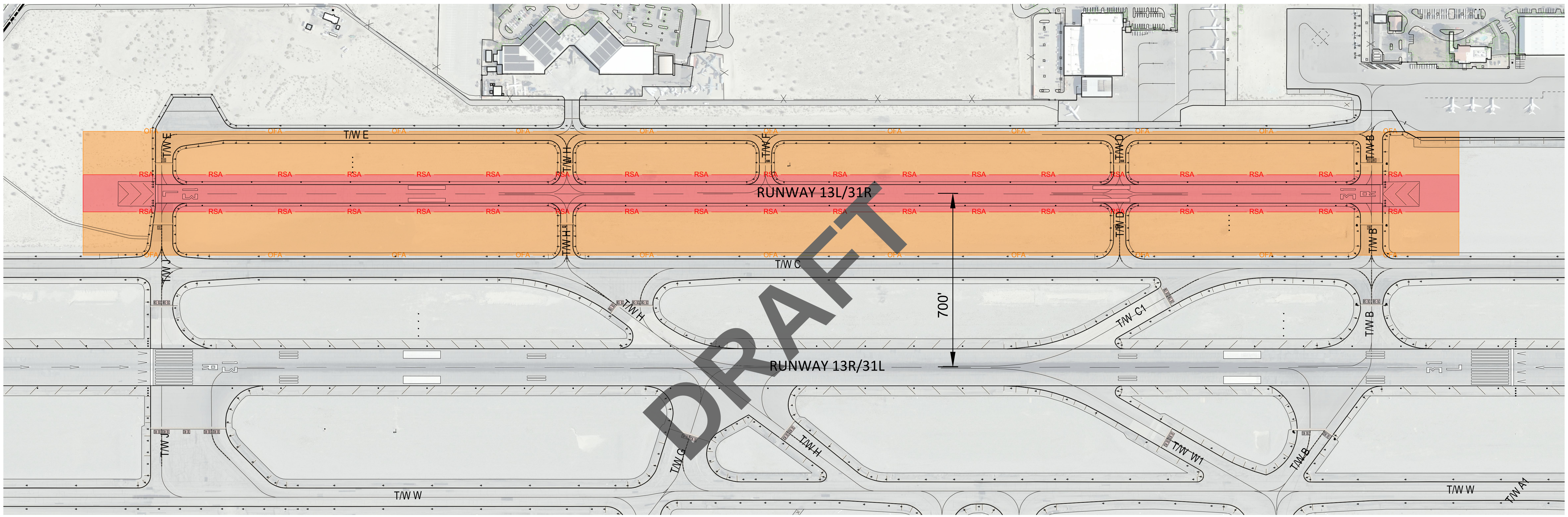
Notes: [1] *Specified separation requirements for simultaneous takeoff and landings under VFR conditions.*

[2] *Aircraft parking east = runway/taxiway separation + TOFA/2 + TLOFA/2 = 240 + (124/2) + (110/2) = 357.*

Runway 13L/31R Design Standards Conclusion

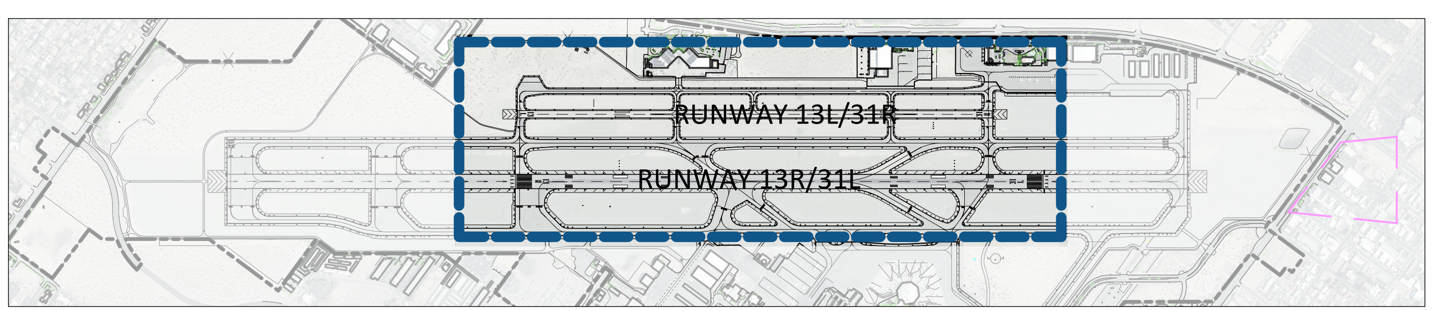
Runway 13L/31R meets the current FAA design standards for RDC B-II (Small)-VIS.

Figure 5-4: Runway 13L/31R Design Standards B-II (Small)-VIS - Detail



Legend

- Runway Safety Area
- Runway Object Free Area
- Airport Property Line



Keymap

CRITERIA MET/NO NON-STANDARD CONDITIONS

Runway Length Analysis

Adequate runway length is essential for the safety of aircraft takeoffs and landings. Following guidance provided in AC 150/5325-4B, *Runway Length Requirements for Airport Design*, individual Airport Planning Manuals (APMs) produced and published by aircraft manufacturers should be used to evaluate commercial service aircraft with Maximum Takeoff Weights (MTOWs) greater than 60,000 pounds. Therefore, the APMs for the most demanding commercial service passenger aircraft serving PSP will be used to identify a recommended length for Runway 13R/31L. In comparison, the evaluation of the recommended length for Runway 13L/31R will focus on the family grouping of smaller general aviation aircraft with maximum certificated takeoff weight of 12,500 pounds or less, and a percentage of the larger general aviation aircraft fleet with maximum certificated takeoff weights ranging from 12,500 pounds to 60,000 lbs.

The performance requirements of the identified critical aircraft for the runway length analysis determine the recommended runway length. Factors that affect aircraft performance capabilities include the airport elevation, air temperature, aircraft payload and fuel requirements, effective runway gradient, and weather conditions (e.g., wet pavement). The application of these factors for PSP are presented below.

Elevation

Aircraft performance declines at higher altitudes because the air is less dense. Higher elevations negatively impact thrust produced by the aircraft on takeoff and the aerodynamic performance of the aircraft. An elevation of 476 feet above mean sea level (AMSL) will be used for this analysis at PSP. In addition, for runways having non-zero effective runway gradients the recommended runway lengths from the APMs and/or tables from AC 150/5325-4B must be adjusted (i.e., increased by a length of 10 feet per foot of difference in runway centerline elevations between the high and low points of the runway centerline). This required adjusted increase in length for the two runways at PSP is presented as follows:

- Runway 13R/31L @ 782’
- Runway 13L/31R @ 422’

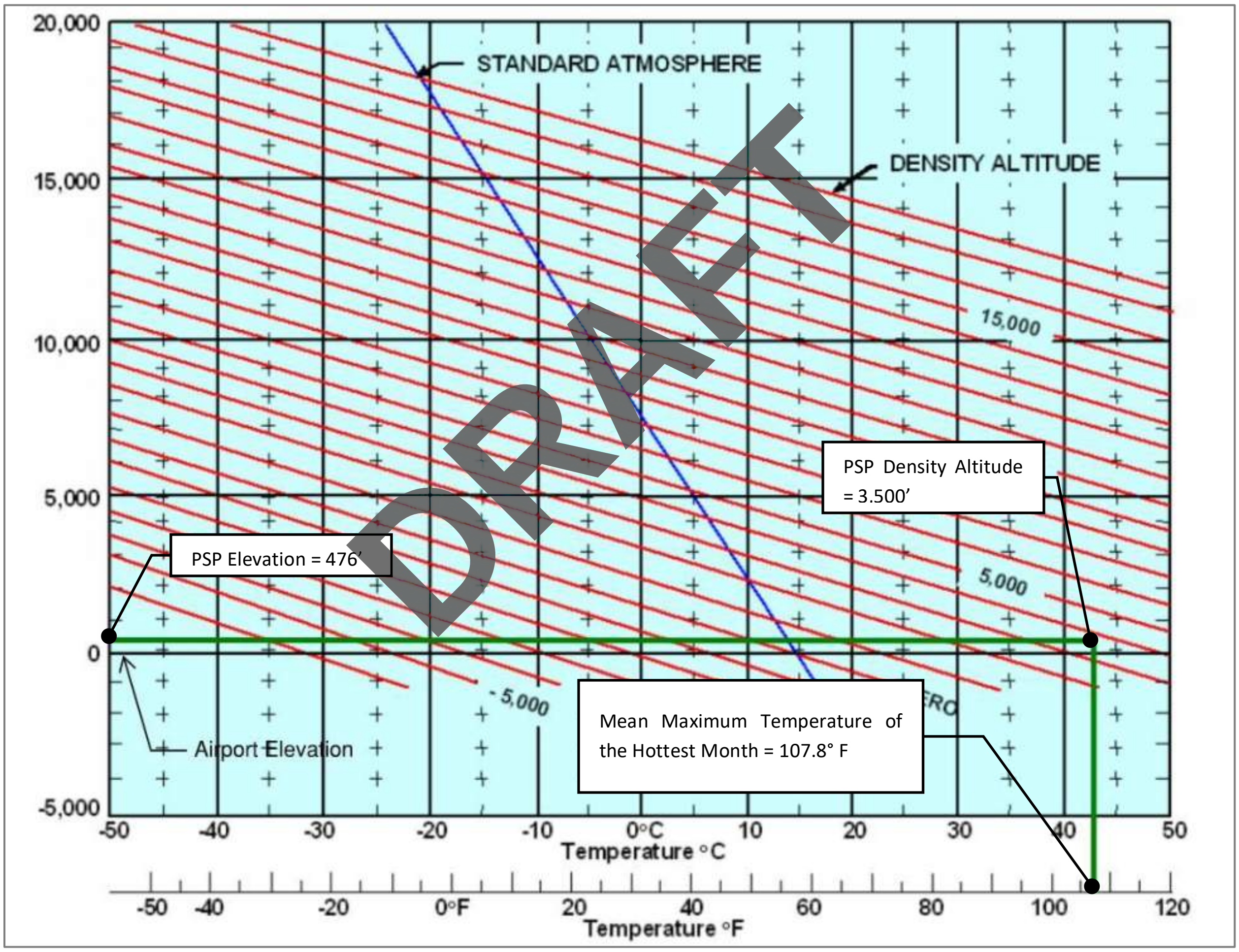
International Standard Atmosphere

International Standard Atmosphere (ISA) is a mathematical model that describes how the earth’s atmosphere, or air pressure and density, changes relative to altitude. The atmosphere is less dense at higher elevations. ISA is frequently used in aircraft performance calculations because conditions that deviate from ISA will affect aircraft performance. ISA at sea level occurs when the temperature is 59 degrees Fahrenheit. According to the 1976 Standard Atmosphere Calculator, the ISA at PSP’s 476 feet AMSL occurs when the temperature is 55 degrees Fahrenheit.

Density Altitude

Density Altitude (DA) compares air density to ISA at a point in time and specific location and is also a critical component of aircraft performance calculations. DA is used to describe how aircraft performance differs from the performance that would be expected under ISA. DA is primarily influenced by elevation and air temperature. **Figure 5-5** illustrates how DA is impacted when factoring in the average maximum temperature of the hottest month. The PSP DA during the hottest month, when the ambient air temperature is 107.8 degrees Fahrenheit, is 3,500 feet AMSL. As a measure of high temperature impacts on aircraft performance, this DA will be applied in the aircraft performance assessment and the resulting runway length recommendation.

Figure 5-5: Density Altitude Adjustment



Sources: *Mead & Hunt, 2023; FAA Aircraft Performance.*

Required Takeoff Weight and Flight Distance

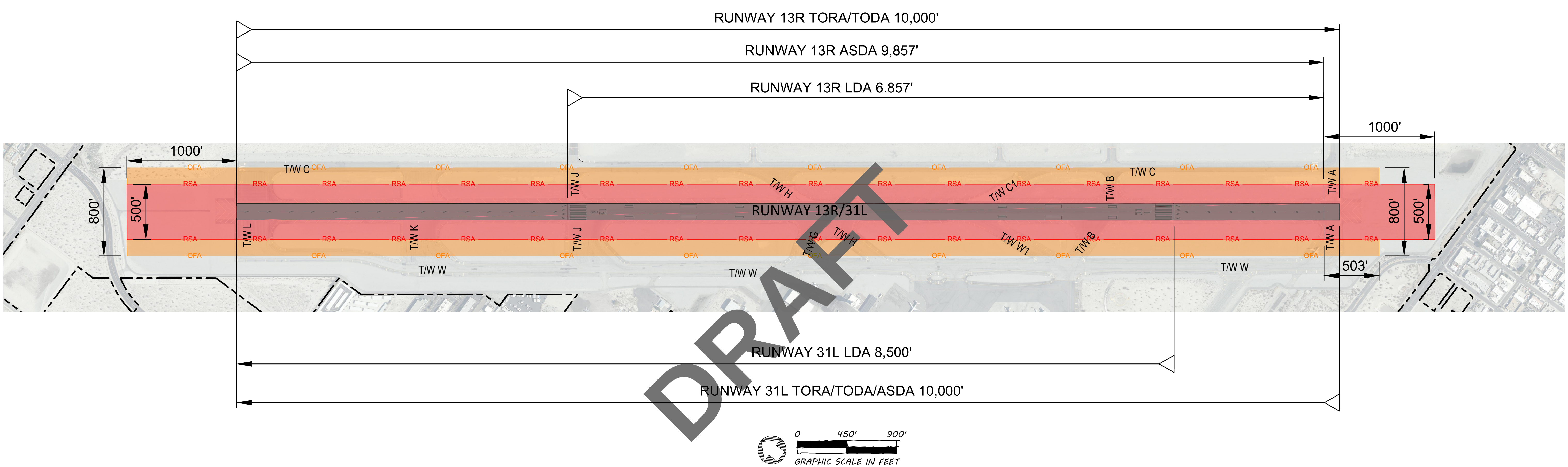
Aircraft takeoff weight is directly related to the distance of the flight flown (i.e., the stage length) and the required payload (e.g., passengers, cargo, and fuel) that the aircraft is carrying. For shorter flights, aircraft may depart with a full passenger load and less than full fuel tanks. In those instances, the operational weight of the aircraft will be below the MTOW, and thus the required runway takeoff length can be reduced. Aircraft require more fuel for longer stage length flights, which increases the required takeoff weight of the aircraft. These longer stage length flights can at times require payload restrictions on the passengers, baggage, and cargo that can be carried. An aircraft with full passenger and fuel loads will require operational weights near its MTOW.

Given the seasonal variability of the commercial passenger service schedule at PSP (i.e., the year-round flights provided by the carriers vs. the additional cities served in the winter season), the runway length requirements will vary throughout the year based upon the stage length distances flown and the temperatures at the time of the flight. For example, the majority of the year-round flights that operate during the hot summer months generally benefit from the shorter stage lengths (e.g., less than 1,000 nautical miles [nms]) being flown to U.S. cities along the West Coast and the Mountain West, which reduces the required takeoff weights and associated runway length requirements. However, given the extreme high temperatures that occur at PSP during the summer months (e.g., averaging well above 100 degrees Fahrenheit during the months of June – September), it is expected that some passenger payload penalties could be required. These conditions are contrasted by the additional winter seasonal passenger flights that require longer stage lengths to central and east coast U.S. cities, ranging between 1,000 and 2,000 nms. For these flights, heavier aircraft takeoff weights are required, but the impact of this weight on the runway length requirement is often offset by the cooler operating temperatures resulting from the improved engine performance of the aircraft.

Weather Conditions

From a runway length evaluation standpoint, weather conditions at the airport typically impact the landing length requirements of the aircraft due to the presence of moisture on the runway pavement in the form of rain, snow, or combinations thereof. The majority of the APMs include separate landing length requirements for both dry and wet pavement landings that are to be used for general planning assessments. In most cases, an aircraft's runway takeoff length requirements will be greater than the length required for landings. However, due to the length of the existing displaced thresholds at each end of Runway 13R/31L and the resulting published declared distances for the runway, the specified Landing Distance Available (LDA) is reduced for each runway end (particularly for landings to Runway 13R). Therefore, a detailed landing length evaluation will be conducted for this runway. **Figure 5-6** and **Figure 5-7** present the existing published declared distances for each runway at PSP.

Figure 5-6: Runway 13R/31L Declared Distances

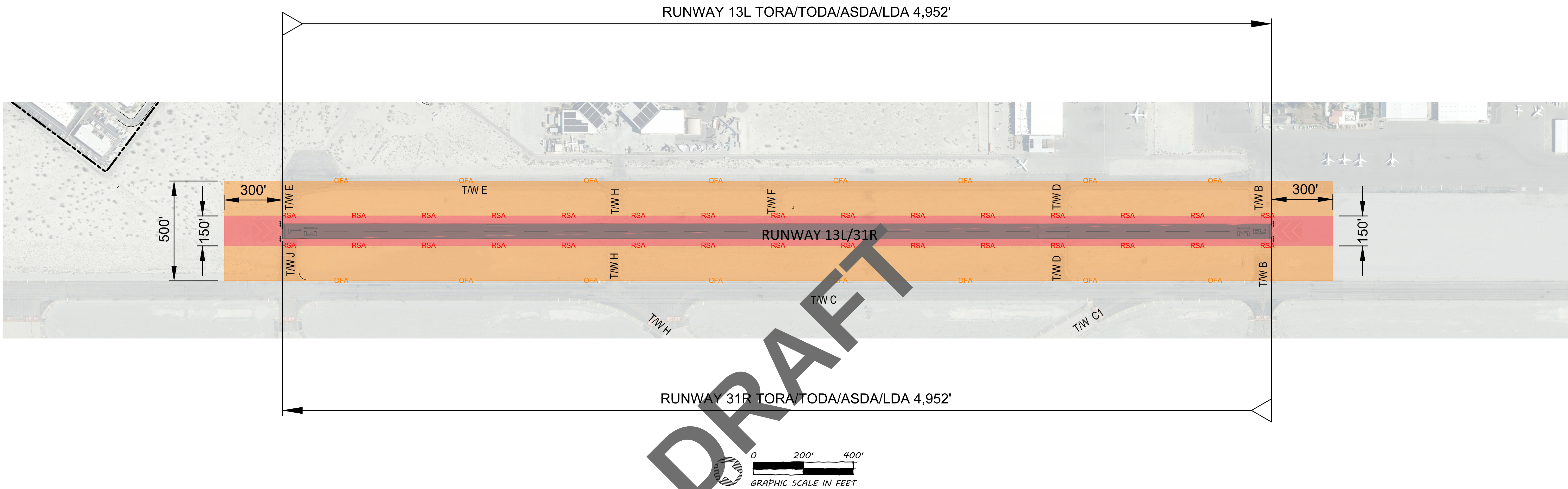


Legend

- Runway Safety Area
- Runway Object Free Area
- Runway
- Airport Property Line

ASDA - Accelerate Stop Distance Available
LDA - Landing Distance Available
TODA - Takeoff Distance Available
TORA - Takeoff Run Available

Figure 5-7: Runway 13L/31R Declared Distances



Legend

- Runway Safety Area
- Runway Object Free Area
- Runway
- Airport Property Line

ASDA - Accelerate Stop Distance Available
LDA - Landing Distance Available
TODA - Takeoff Distance Available
TORA - Takeoff Run Available

As shown in **Figure 5-6**, landings to the south (to Runway 13R) provide an LDA of 6,857 feet, while landings to the north (to Runway 31L) have a published LDA of 8,500 feet. In addition, the Accelerate Stop Distance Available (ASDA) for Runway 13R takeoffs to the south is published at 9,857 feet, which is less than the 10,000 feet of physical runway length. This existing reduction in runway length available for takeoffs is due to the specified ROFA at the south end of the runway, which will also be evaluated in the required runway takeoff length analysis.

As shown in **Figure 5-7**, the published declared distances for Runway 13L/31R are equal to its physical runway length of 4,952 feet. This means the pavement length available for both takeoffs and landings in both directions is the same.

Selected Critical Aircraft for Runway Length Analysis

Runway 13R/31L (Primary Runway)

Based upon the existing and forecast operational counts of the commercial passenger aircraft fleet at PSP, presented in the **Aviation Activity Forecast** chapter, a total of five (5) air carrier passenger aircraft have been identified for this runway length analysis:

- Boeing 737-900 (185 Passengers)
- Boeing 737 MAX 9 (204 Passengers)
- Airbus 321neo (185 Passengers)
- Embraer 175 (76 Passengers)
- Boeing 787-8 (248 Passengers)

As noted in **Table 5-4** below, three of these aircraft (i.e., the Airbus 321neo, Boeing 737-900, and Embraer 175) satisfy the current "substantial use" operations threshold (i.e., >500 annual operations) for this analysis, while the Boeing 737 MAX 9 is forecast to replace the Boeing 737-900 within the 20-year (2042) planning period. In addition, the Airport Sponsor has requested the Boeing 787-8 aircraft be included in this analysis to document the operational performance characteristics of this aircraft and associated runway length requirements in consideration of the addition of potential future international passenger service to Ireland and/or England from PSP.

Table 5-4: Critical Aircraft Operations

Aircraft	2022	2027	2032	2037	2042
Boeing 737-900	2,962	1,736	1,277	650	0
Boeing 737 MAX 9	174	1,517	2,343	3,329	4,355
Airbus A312neo	1,602	1,543	2,159	2,941	3,343
Embraer 175	8,810	12,335	15,821	18,317	20,806
Boeing 787-8	0	0	0	0	0

Source: *Unison Consulting, Inc.*

Runway 13L/31R (GA Additional Runway)

As previously noted, the recommended runway lengths for the smaller general aviation fleet are generated from specified tables provided in AC 150/5325-4B that are based upon a family grouping of aircraft, which are characterized by various weight categories. Due to the existing length of 4,952 feet, Runway 13L/31R predominantly serves smaller general aviation aircraft with maximum certificated takeoff weight of 12,500 pounds or less. However, in consideration of current planning objectives initiated by the future expansion of the passenger terminal facility, there are potential long-term planning opportunities to improve the separation of commercial service and small general aviation aircraft operations at PSP with the extension of this runway to serve a percentage of the larger general aviation aircraft fleet with maximum certificated takeoff weights ranging from 12,500 pounds to 60,000 pounds (e.g., 75 percent of the fleet at 90 percent useful load).

Recommended Runway Length Determination

Runway 13R/31L (Primary Runway) – Takeoffs

Table 5-5 below presents each of the aircraft takeoff length requirements that were evaluated based upon their certified MTOWs and an estimated aircraft operational weight that can be accommodated by the existing 10,000-foot runway length. **Figure 5-8** graphically depicts Runway 13R/31L's MTOW length requirements. As can be noted, the runway length requirements at MTOW, prior to required adjustments for the effective runway gradient, exceed the existing 10,000-foot runway for four of the aircraft (i.e., the Boeing 737-900, Boeing 737 MAX 9, Airbus A312neo and Boeing 787-8). However, based upon the payload/range analysis at the specified 107.8 degrees Fahrenheit mean max temperature for PSP (in accordance with the planning guidelines in AC 150/5325-4B), each of the aircraft can operate without passenger payload penalties at the existing 10,000-foot runway length. This does not mean that some passenger payload penalties can be required for some of the passenger aircraft during the extreme summertime afternoon temperatures that can occur at PSP, but no additional runway length for takeoff is recommended at this time. In addition, the required adjustments for the effective runway gradient for this runway are accounted for by the pilot prior to takeoff, in consideration of the existing 10,000-foot runway length.

Table 5-5: Runway 13R/31L Takeoff Length Analysis

Aircraft/Engine	Maximum Takeoff Weight (MTOW)	Required RWY Length @ MTOW[1]/Adjusted RWY Length for Effective RWY Gradient[2]	Estimated Aircraft Operational Weight[3] @ 10,000’ Runway Length[4]	Percent of MTOW @ 10,000’ Runway Length	Estimated Stage Length at Existing 10,000’
Boeing 737-900/CFM56-7B24	174,200 lbs.	13,500’/14,290’	164,000 lbs.	94.1%	1,300 nms.
Boeing 737 MAX 9/LEAP-1B27	183,000 lbs.[5]	11,200’/11,990’	176,000 lbs.	96.2%	1,100 nms.
Airbus A321neo/PW Engines	213,848 lbs.	12,500’/13,290’	203,000 lbs.	94.9%	3,000 nms.
Embraer 175/CF34-8E5	85,517 lbs.	9,850’/10,640’	85,517 lbs.	100%	1,600 nms.
Boeing 787-8/Typical Engine	502,500 lbs.	15,200’/15,990’	455,000 lbs.	90.5%	5,000 nms.

Sources: *Mead & Hunt, 2023; Manufacturer Aircraft Planning Manuals (APMs).*

Notes: *[1] Runway lengths required at the specified 107.8°F mean max temperature for PSP.*

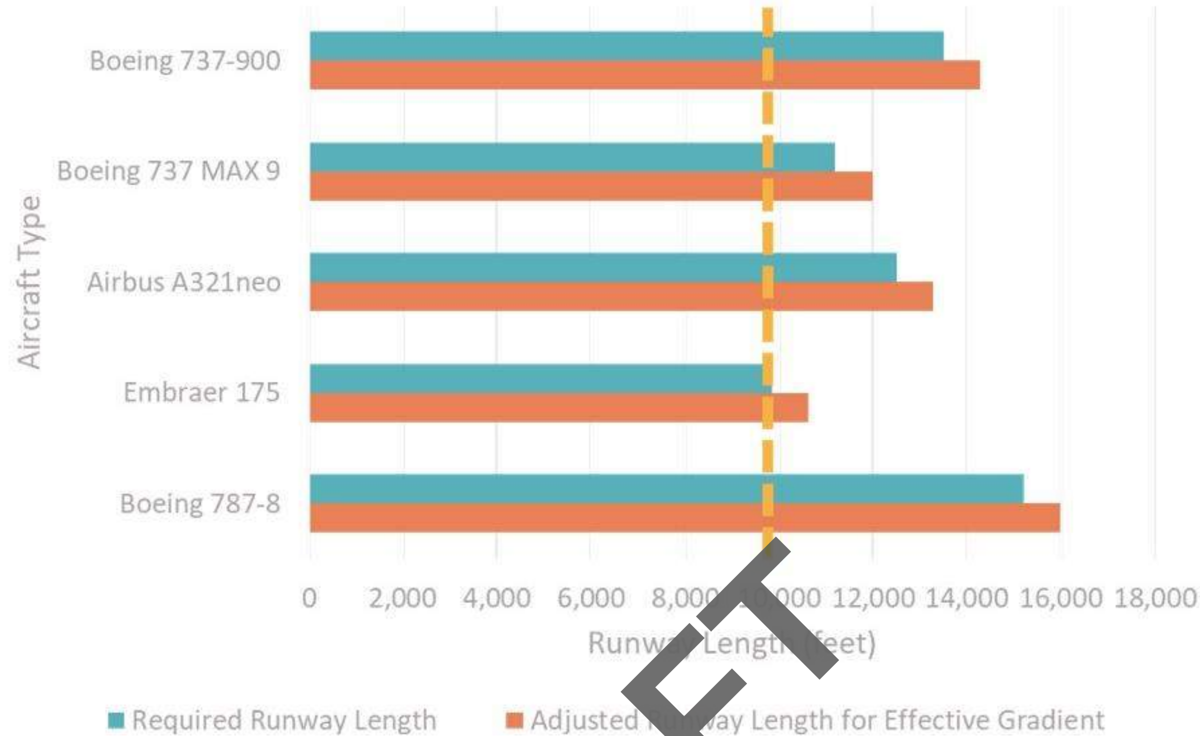
[2] Effective runway gradient length adjustment = 790’

[3] Weight includes 100% Passenger Payload plus aircraft Operational Empty Weight (OEW)

[4] Estimated aircraft operational weight is slightly reduced for Runway 13R takeoffs due to published 9,857’ ASDA length.

[5] Estimated brake Energy Limit Weight is less than 194,700 lbs. MTOW.

Figure 5-8: Runway 13R/31L MTOW Length Requirements



Sources: *Mead & Hunt 2023; Various Aircraft Characteristic Manuals.*

Note: *Runway length analysis is based on the worst-case scenario at an airport. At PSP, the worst-case scenario is taking off to the north because the aircraft is taking off in the direction of the uphill gradient.*

Runway 13R/31L (Primary Runway) – Landings

As with takeoff operations, the runway landing length requirements of aircraft are dictated by the aircraft operational weight at the time of the landing. As noted in AC 150/5325-4B, this specified landing weight for planning purposes is based on the certified maximum landing weight for the aircraft. In addition, most landing length tables in the APMs provide the minimum required landing lengths for both dry and wet pavement conditions for various flap settings. **Table 5-6** below presents the recommended landing length data for each of the five (5) aircraft identified for analysis at PSP. **Figure 5-9** graphically depicts Runway 13R/31L's landing length requirements.

As can be noted, the required landing lengths for each aircraft (i.e., for both dry and wet pavements) must be compared to the existing published LDA for each runway end. Due the runway's existing displaced thresholds at each end, the specified LDAs are less than the physical length of the runway that is available for takeoffs. The existing Runway 13R LDA, measuring 6,857 feet, is the most restrictive, but slightly exceeds the recommended minimum runway landing length for the Boeing 737-900, which is identified as the most demanding aircraft for landings at PSP. In addition, the 2015 Master Plan for PSP identified previous land use compatibility/noise migration efforts (i.e., increasing the altitude of aircraft overflying adjacent residential land uses during landings) as the reason for establishing the existing Runway 13R/31L threshold displacements. Landing lengths are met for each of the aircraft; therefore, the existing threshold displacements in their existing conditions is adequate.

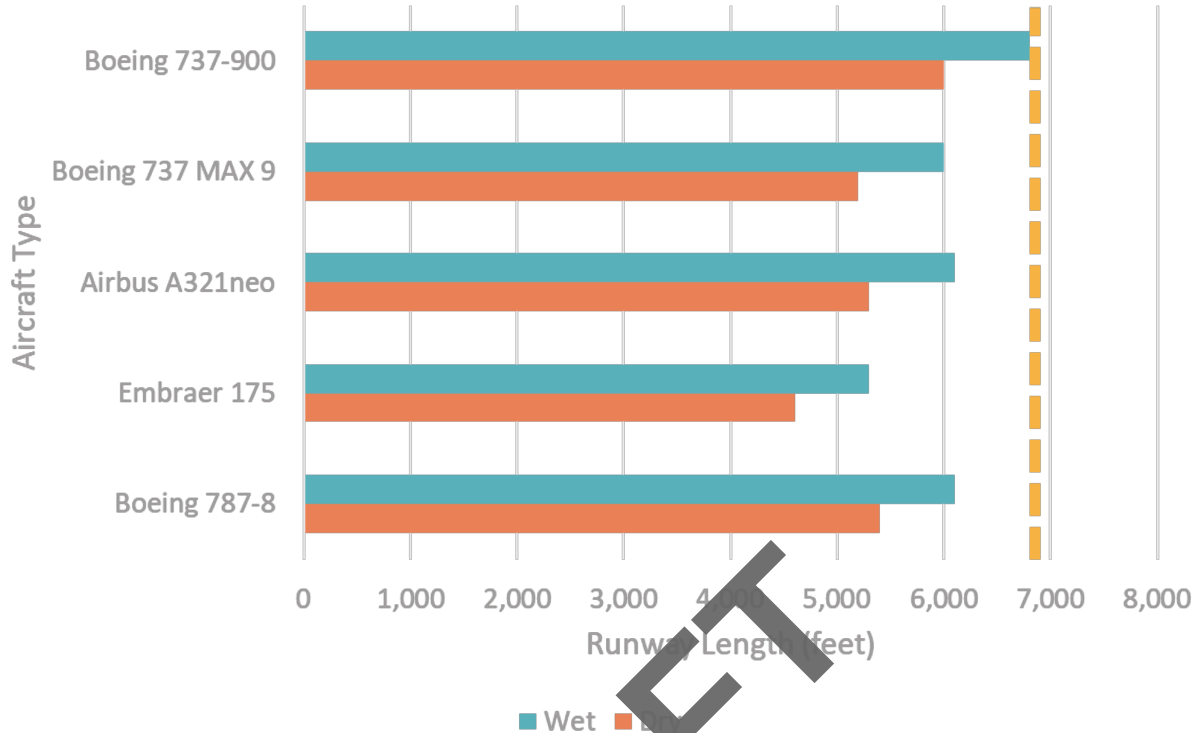
Table 5-6: Runway 13R/31L Takeoff Length Analysis

Aircraft/Flap Setting	Maximum Landing Weight (MLW)	Estimated Runway Length @ MLW (Dry/Wet)	Existing Runway 13R LDA	Existing Runway 31L LDA	Existing LDA for each Runway end meets minimum recommended length
Boeing 737-900/Flaps 30	146,300 lbs.	6,000'/6,800'	6,857'	8,500'	Yes
Boeing 737 MAX 9/Flaps 40	163,900 lbs.	5,200'/6,000'	6,857'	8,500'	Yes
Airbus A312neo/Flaps 40	175,000 lbs.	5,300'/6,100'[1]	6,857'	8,500'	Yes
Embraer 175/Flaps 5 & Full	74,957 lbs.	4,600'/5,300'[1]	6,857'	8,500'	Yes
Boeing 787-8/Flaps 30	380,000 lbs.	5,400'/6,100'	6,857'	8,500'	Yes

Sources: *Mead & Hunt, 2023; Manufacturer Aircraft Planning Manuals (APMs).*

Note: *[1] Dry pavement landing length data from APM was increased by 15% to estimate wet pavement length requirements.*

Figure 5-9: Runway 13R/31L Landing Length Analysis



Sources: *Mead & Hunt 2023; Various Aircraft Characteristic Manuals.*

Note: *Runway length analysis is based on the worst-case scenario at an airport. At PSP, the worst-case scenario is landing to the south because the aircraft is landing in the direction of the downhill gradient.*

Runway 13L/31R (Additional Runway) Length Analysis

Serving as the Airport's additional parallel runway, Runway 13L/31R primarily accommodates small general aviation users at PSP, with aircraft having a MTOW of less than 12,500 pounds. However, it is understood that Airport Traffic Control Tower (ATCT) personnel along with jet users themselves would like to operate on this runway separate from the air carrier traffic operating on Runway 13R/31L. Therefore, the runway length analysis for Runway 13L/31R included business and midsize jets in addition to small aircraft. The recommended runway lengths for these weight categories of airplanes are derived from AC 150/5325-4B. The runway length recommendations are dependent on meeting the operational requirements of a certain percentage of the fleet (i.e., 100 percent of the fleet at 60 and 90 percent useful load). **Table 5-7** presents takeoff distance required, and **Figure 5-10** graphically depicts the runway length requirements for Runway 13L/31R.

Table 5-7: Runway 13L/31R Runway Length Requirements

Aircraft Type	Takeoff Distance Required			
	60% of Useful Load Factor[1]		90% of Useful Load Factor	
	Takeoff	Landing[2]	Takeoff	Landing[2]
Business Jet[3]	6,120’	7,038’	9,320’	10,718’
Mid-size Jet[4]	5,220’	6,003’	7,420’	8,533’
Small Aircraft[5]	4,300’			

Sources: *Mead & Hunt 2023; AC 150/5323-4B.*

Notes: *[1] Useful load factor – the difference between the maximum allowable structural gross weight and the operating empty weight.*

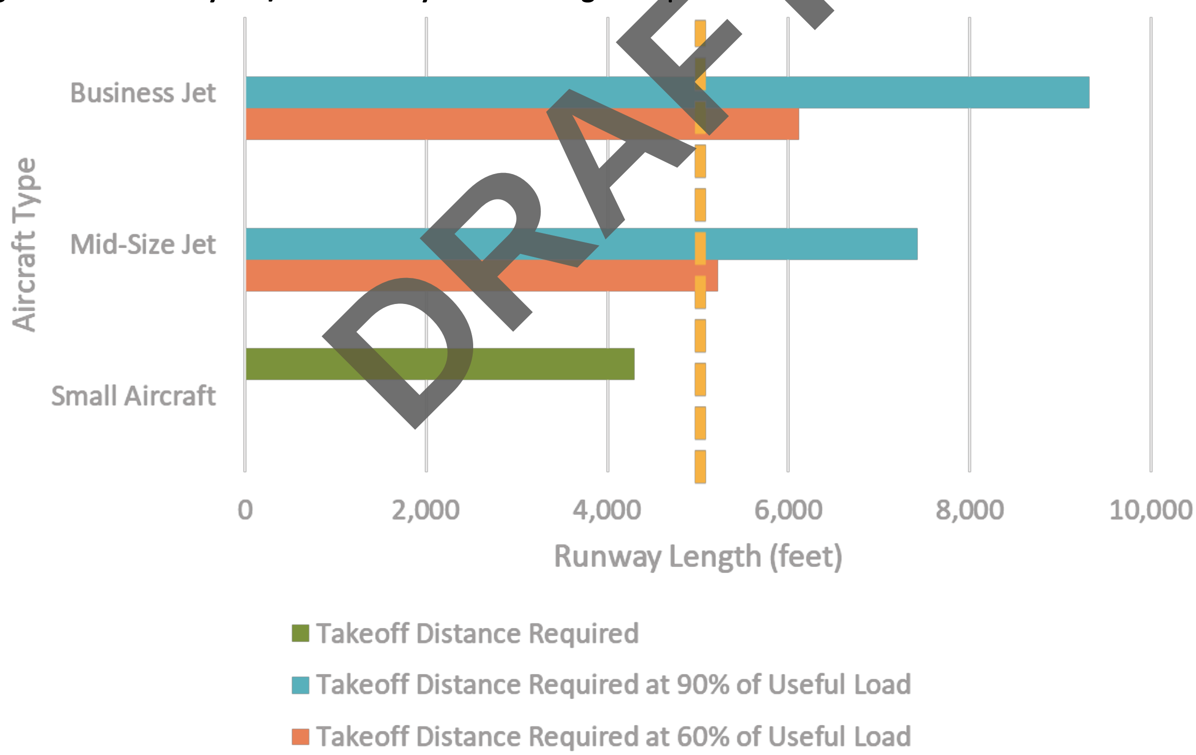
[2] Dry pavement landing length data from AC 150/5325-4B was increased by 15% to estimate wet pavement length requirements. However, PSP experiences mostly dry conditions; therefore, the takeoff length will be used for the runway length analysis.

[3] Business Jet – Airplanes that make up 25% of “greater than 12,500 pounds but less than 60,000 pounds” fleet.

[4] Mid-Size Jet – Airplanes that make up 75% of “greater than 12,500 pounds but less than 60,000 pounds” fleet.

[5] Small Aircraft – Airplanes that are less than 12,500 pounds and have more than 10 seats.

Figure 5-10: Runway 13L/31R Runway Takeoff Length Requirements



Sources: *Mead & Hunt 2023; AC 150/5323-4B.*

Notes: *For the purposes of this aircraft definitions of Business Jet, Mid-Size Jet, Small Aircraft are as follows.*

Business Jet – Airplanes that make up 25% of “greater than 12,500 pounds but less than 60,000 pounds” fleet.

Mid-Size Jet – Airplanes that make up 75% of “greater than 12,500 pounds but less than 60,000 pounds” fleet.

Small Aircraft – Airplanes that are less than 12,500 pounds and have more than 10 seats.

Runway 13L/31R Analysis Conclusion

Figure 5-10 shows that the existing runway length for Runway 13L/31R is adequate for small aircraft. However, the runway cannot accommodate any jets with the existing length. Extending the runway to meet the requirements of business jets is likely unfeasible given how much length they require, but it is possible to extend the runway by approximately 1,000 to 2,000 feet to meet the needs of small to mid-size jets.

Due to discussions with ATCT personnel and Airport staff, the **Alternatives Analysis** chapter will consider extending the runway to allow some small to midsize jets to operate on it. It is important to note that this runway extension would not be eligible for FAA funding. However, this extension could potentially provide the following benefits:

- The extension may reduce runway crossings.
- The extension may create a more efficient airfield by separating some of the general aviation traffic from the air carrier traffic.

Runway Pavement Strength

According to AC 150/5320-6G, *Airport Pavement and Evaluation*, airport pavements should be able to support loads of the aircraft that operate at the Airport. The pavement must be free of foreign object debris, be able to accommodate aircraft loads year-round, and be skid resistant.

Airport pavements are either rigid (concrete) or flexible (asphalt). Both runways are currently paved with asphalt. The types of aircraft landing on runways will determine the type and strength of the pavement. PSP runway pavement strengths are summarized below.

- **Runway 13R/31L** @ 105,000 pounds single wheel, 200,000 pounds dual wheel, 330,000 pounds dual tandem wheel, and 800,000 pounds dual double tandem wheel main landing gear configuration.
- **Runway 13L/31R** @ 12,500 pounds single wheel and 60,000 pounds dual wheel main landing gear configuration.

Runway Pavement Strength Conclusion

Both runways' pavement strength at PSP are considered adequate. It is recommended that the Airport continue to maintain both runways at their current published runway pavement strength.

Runway Protection Zones

The function of a runway protection zone (RPZ) is to enhance the protection of people and property on the ground beyond the runway ends. This is achieved through airport control of the RPZ areas, and control is preferably exercised through the acquisition of sufficient property interest within the RPZ. It is desirable to clear all above ground objects from within RPZs; where this is impractical, airport owners, at minimum, should maintain the RPZ clear of all facilities supporting incompatible activities.

As defined in AC 150/5300-13B, RPZs are trapezoidal in shape, are centered about the runway centerline, and are specified as either Approach or Departure RPZs. The RPZs extend from a point 200 feet beyond the end of the area usable for takeoff or landing. The RPZ dimensions are functions of the type of aircraft using the runway and the approach visibility minimums associated with each runway end. Existing RPZ dimensions are summarized in **Table 5-8**.

Table 5-8: Runway Protection Zone (RPZ) Dimensions

Item	Width at Inner End	Length	Width at Outer End	Meets Dimensional Standards	Airport Controls Entire RPZ	RPZ Clear of all Objects on Ground
Runway 13R/31L						
Runway 13R (Departure)	500’	1,700’	1,010’	Yes	**No**	**No**[1]
Runway 13R (Approach)	500’	1,700’	1,010’	Yes	Yes	Yes
Runway 31L (Departure)	500’	1,700’	1,010’	Yes	**No**	**No**[2]
Runway 31L (Approach)	500’	1,700’	1,010’	Yes	Yes	**No**[1]
Runway 13L/31R						
Runway 13L (Approach & Departure)	250’	1,000’	450’	Yes	Yes	Yes
Runway 31R (Approach & Departure)	250’	1,000’	450’	Yes	Yes	Yes

Source: *Mead & Hunt, 2023.*

Notes: *[1] Existing roadway is classified as an incompatible land use within the boundary of the RPZ.*
[2] Existing objects (i.e., roadways, perimeter roads, fence, and off-airport structures) within the boundary of the RPZ are classified as incompatible land uses).

Incompatible activities are evaluated in **Table 5-9** according to AC 150/5190-4B, *Airport Land Use Compatibility Planning*.

Table 5-9: Runway Protection Zone Land Use Compatibility

Land Uses	Noise Sensitivity	Concentration of People	Tall Structures	Visual Obstructions	Wildlife & Bird Attractants
Residential Uses	I	I	P	P	P
Commercial Activities	I	I	P	P	P
Industrial and Mining Activities	N	P	P	P	P
Institutional Activities	I	I	I	I	I
Infrastructure/Utilities/Energy Production Activities	N	N	I	I	P
Agriculture and Open Space Activities	N	N	N	I	I
Parks and Recreation Activities	I	P	P	P	P

Sources: *Mead & Hunt, 2023; AC 150/5190-4B.*

Notes: *I – Impact*
P – Potential Impact
N – No Impact

Using **Table 5-9**, the four runway ends' RPZs were evaluated in the following sections.

Runway 13R RPZ

The land use underneath the departure RPZ is mostly on airport property. As shown in **Figure 5-11**, the existing development underneath the departure RPZ includes portions of two roadways: N Farrell Drive and E Vista Chino. The portion of N Farrell Drive underneath the departure RPZ is on airport property, while small portions of E Vista Chino underneath the departure RPZ are off-airport property. This means this portion of roadway is the only development inside the RPZ that is not under the control of the Airport. **Table 5-10** shows the analysis findings, which indicate potential impacts to Wildlife and Bird Attractants, that can be mitigated through the Airport's Wildlife Management Plan. Runway 13R's approach RPZ, depicted in **Figure 5-12**, is clear of development and is on airport property, meeting FAA standards.

Table 5-10: Runway 13R Departure RPZ Land Use Compatibility

Land Uses	Noise Sensitivity	Concentration of People	Tall Structures	Visual Obstructions	Wildlife & Bird Attractants
Commercial Activities	N	N	N	N	P

Source: *Mead & Hunt, 2023.*

Figure 5-11: Runway 13R Departure RPZ Design Standards D-III-5000

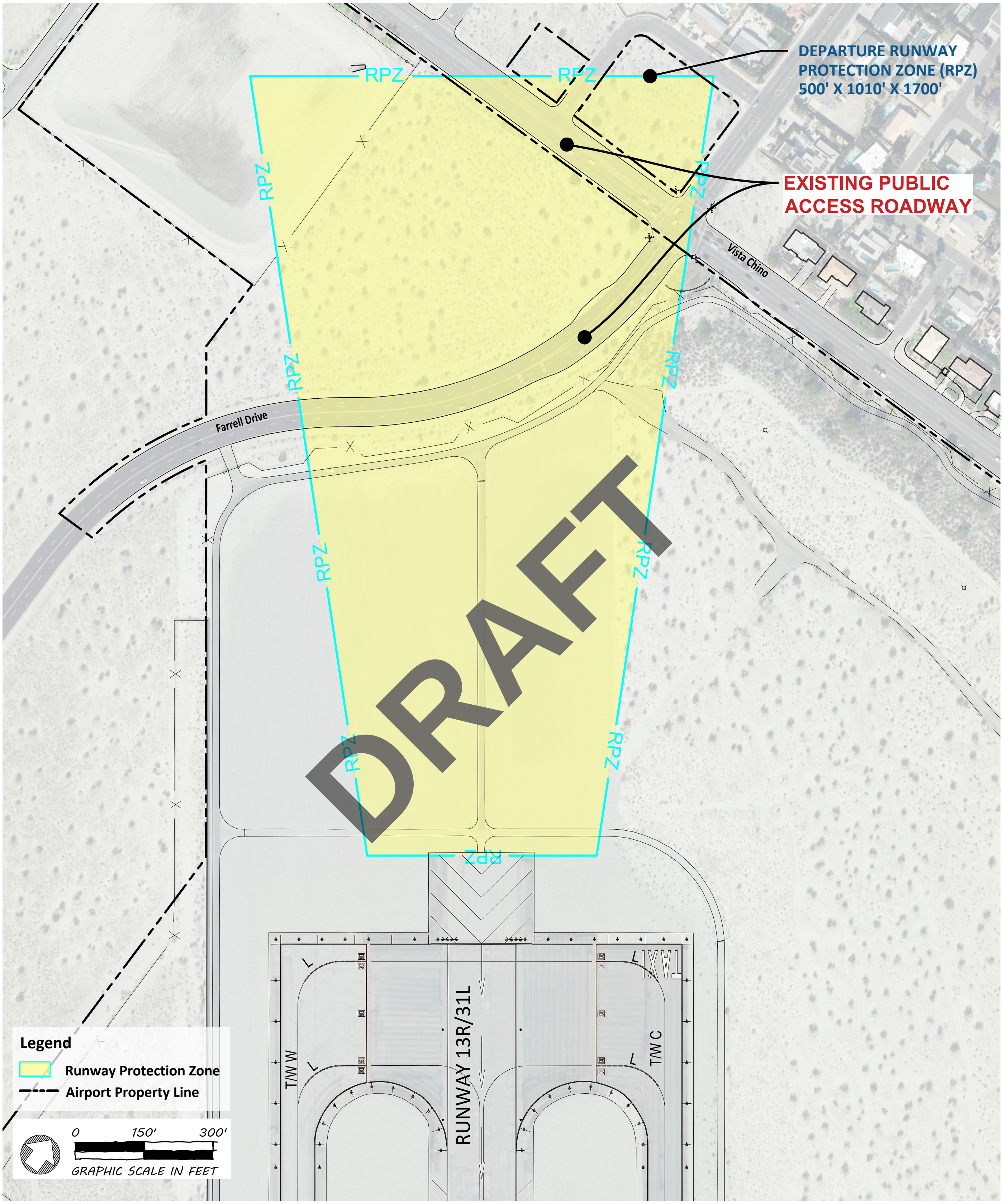
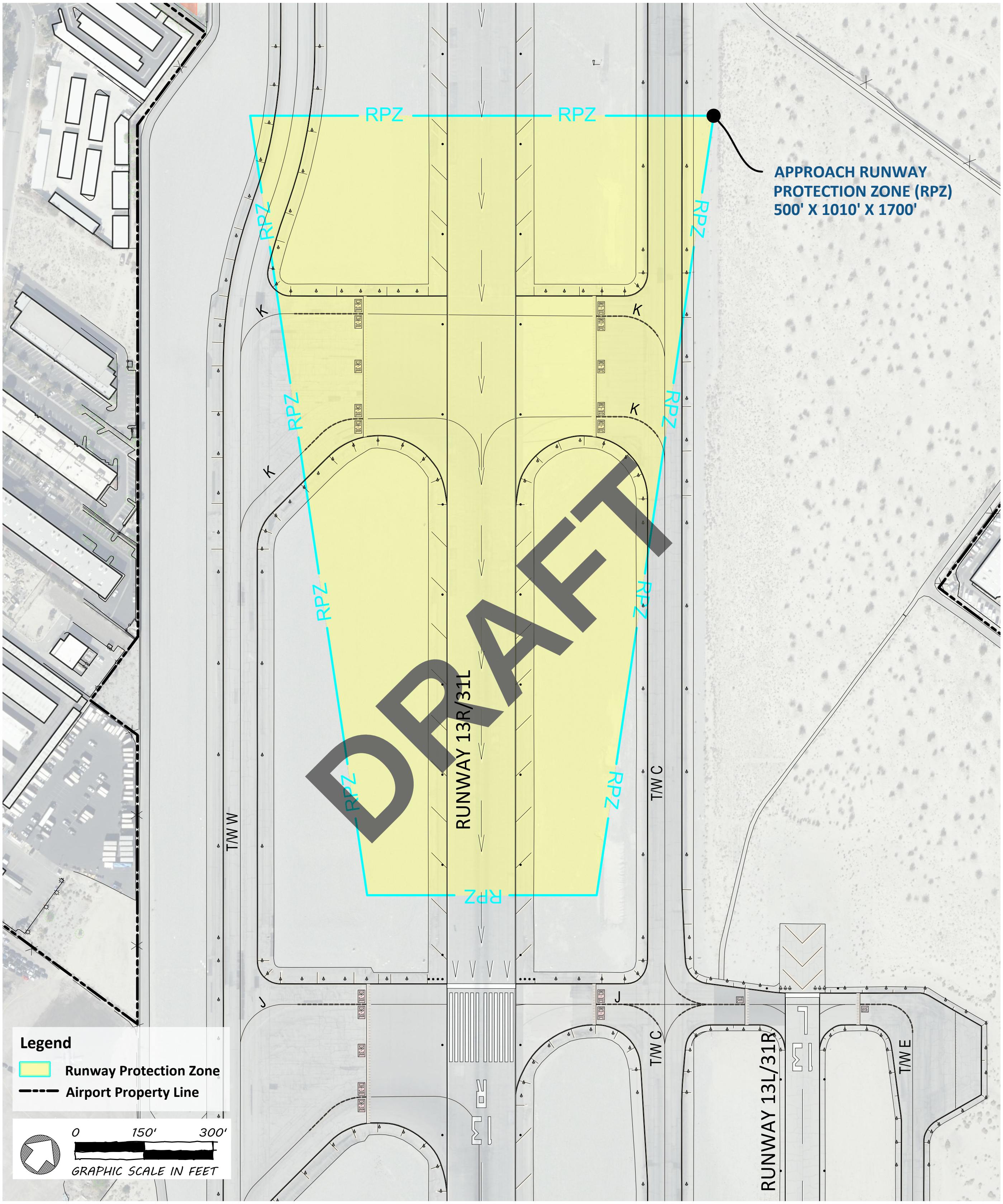


Figure 5-12: Runway 13R Approach RPZ Design Standards D-III-5000



Runway 31L RPZ

The land use underneath the departure RPZ is designated as commercial and light industrial according to the City of Palm Springs current records. As shown in **Figure 5-13**, the variety of development underneath the departure RPZ includes a public roadway, airport service road, and several off-airport structures. The airport service road and the public roadway, E Ramon Road, are both on airport property. Although off airport property, the Airport has an existing avigation easement over the commercial and industrial development underneath the RPZ, which means the Airport does maintain control of the land underneath the RPZ.

Table 5-11 shows the existing land use compatibility for Runway 31L's departure RPZ. Although commercial development typically scores as impactful for both Noise Sensitivity and Concentration of People, in the case of the Runway 31L departure RPZ, this development is being considered as no impact and potential impact, respectively. The reason for this evaluation is that the type of commercial development is not the typical shopping centers, supermarket, hotels, or office buildings where people congregate in high numbers for long periods of the day. The type of commercial development underneath the Runway 31L RPZ includes a butcher shop, warehouses, and paint stores. Given the type of commercial development and the sizes of these existing structures, it is not anticipated that Noise Sensitivity and Concentration of People have a significant impact on the land use compatibility. Tall Structures and Visual Obstructions were determined to be of No Impact for two reasons: the existing structures all have relatively low roofs and are not current obstructions, and the Airport has an avigation easement over these structures and, therefore, control over the airspace above them. Similar to Runway 13R, Wildlife & Bird Attractants could be a potential impact that can be mitigated in the Airport's Wildlife Management Plan.

Table 5-11: Runway 31L Departure RPZ Land Use Compatibility

Land Uses	Noise Sensitivity	Concentration of People	Tall Structures	Visual Obstructions	Wildlife & Bird Attractants
Commercial Activities	N	P	N	N	P
Industrial Activities	N	P	N	N	P

Source: *Mead & Hunt, 2023.*

Runway 31L's approach RPZ, shown in **Figure 5-14**, is on airport property and is mostly clear of development except that a corner of the RPZ covers a portion of a public roadway. Since the Airport controls this land, and only a small portion of the roadway is inside the RPZ, this was determined to be compatible land use.

Figure 5-13: Runway 31L Departure RPZ Design Standards D-III-5000

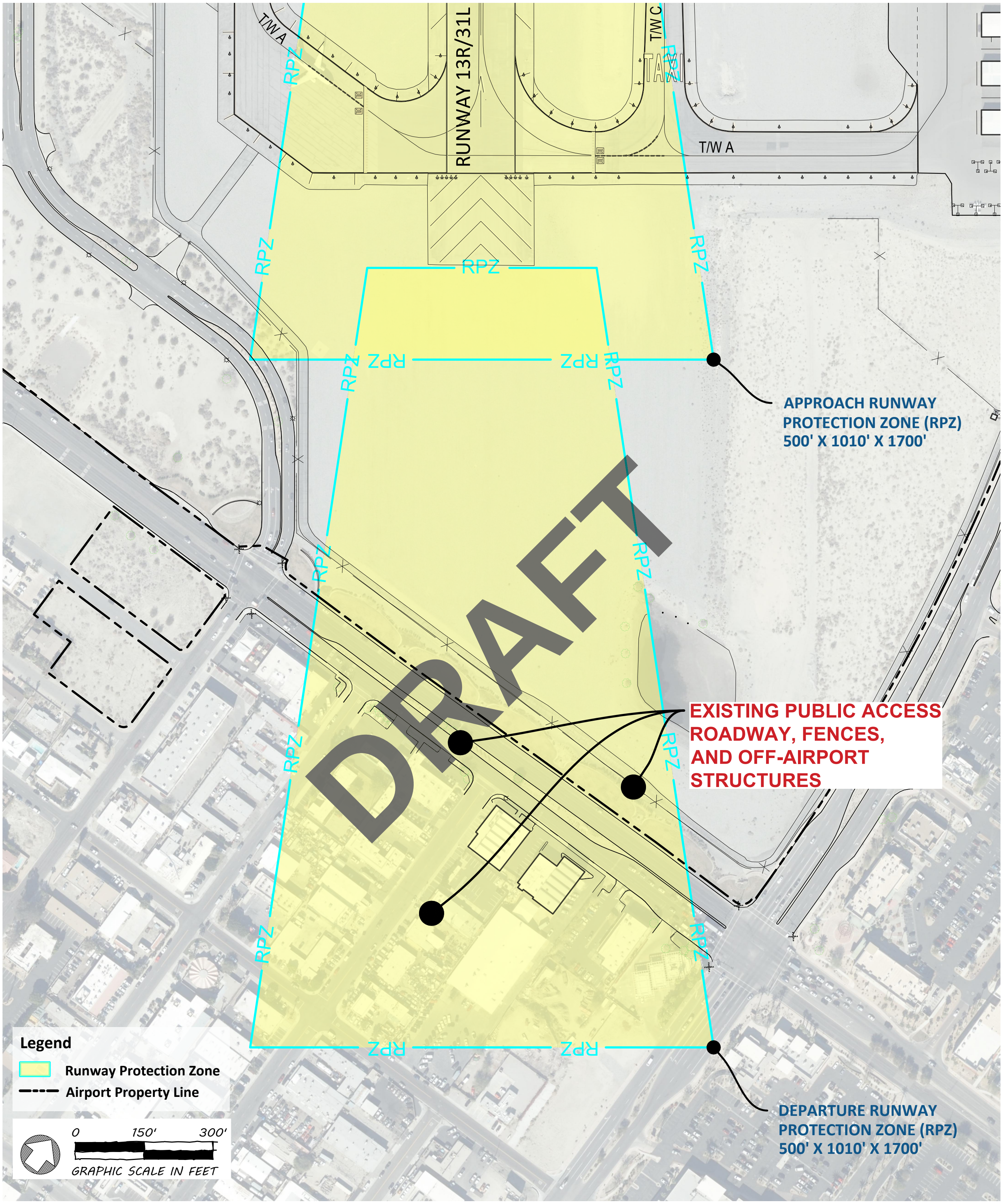
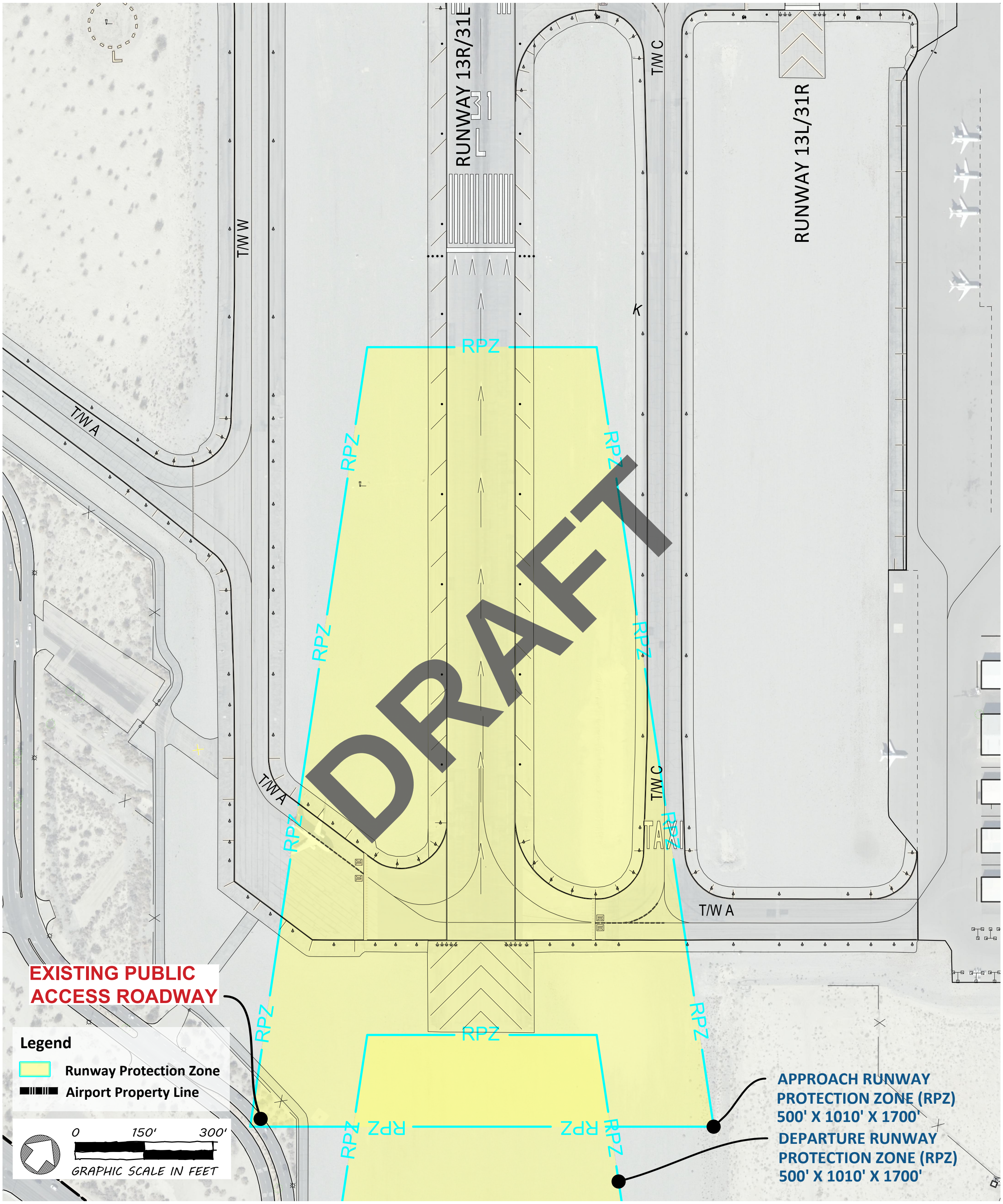


Figure 5-14: Runway 31L Approach RPZ Design Standards D-III-5000



Runway 13L/31R RPZs

The land use underneath both RPZs is on airport property. As shown in **Figure 5-15** and **Figure 5-16**, both RPZs are clear of development.

RPZs Analysis Conclusion

The existing land use was determined to be compatible with each runway's RPZ so further analysis will not be conducted. Any changes to the runways that will result in a change to a RPZ in the **Alternative Analysis** chapter should be free from development in accordance with FAA design standards.

Figure 5-15: Runway 13L RPZ Design Standards B-II (Small)-VIS

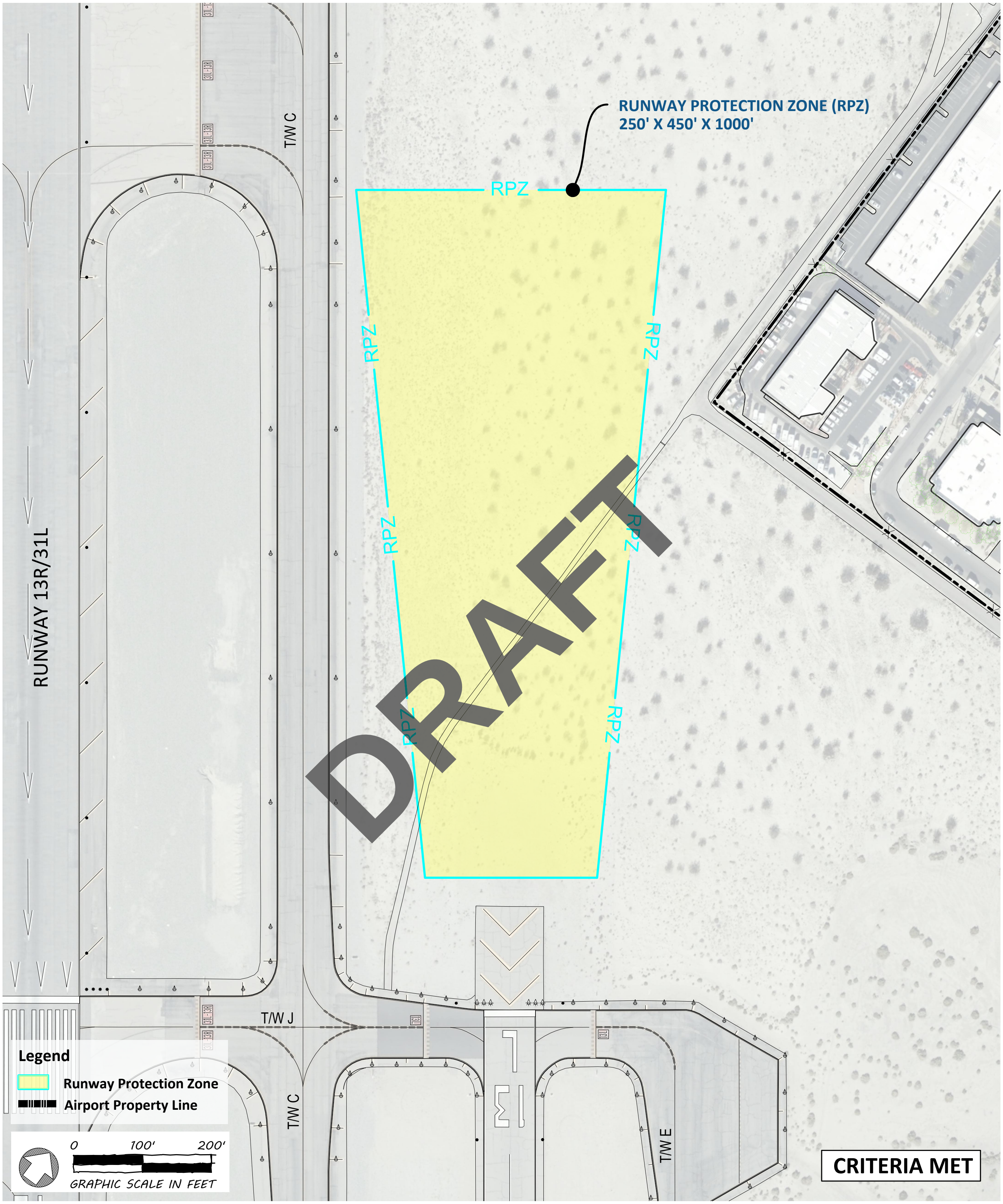
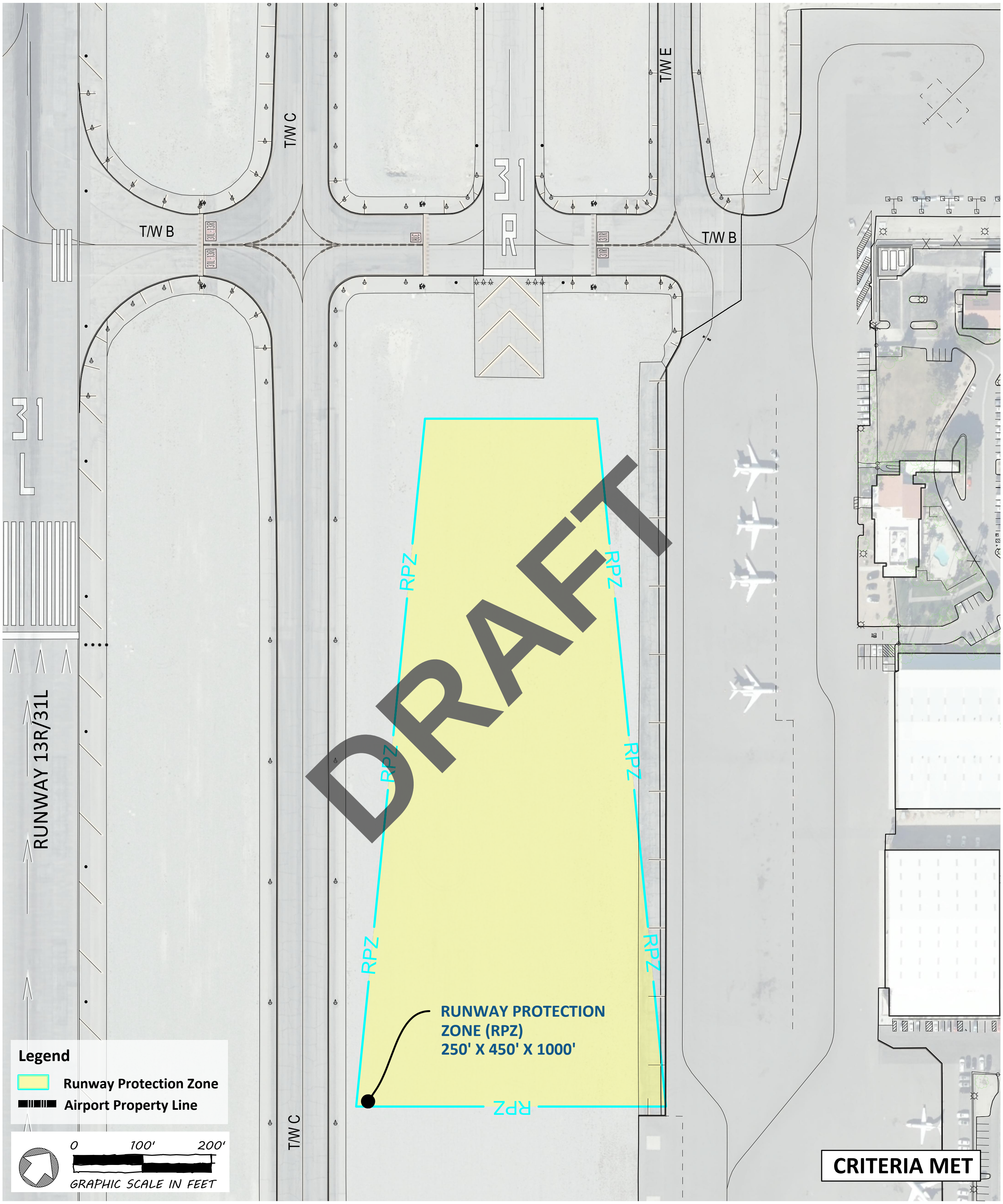


Figure 5-16: Runway 31R RPZ Design Standards B-II (Small)-VIS



Runway End Siting Surfaces

Criteria contained in AC 150/5300-13B provides guidance for the proper siting of runway ends and thresholds. The criteria are in the form of evaluation surfaces that are typically trapezoidal shaped and extend away from the runway ends along the centerline at a specific slope, expressed in horizontal feet by vertical feet. The specific size, slope, and starting point of the trapezoid depends upon the visibility minimums and the type of procedure associated with the runway end. The existing criteria for PSP are presented in **Table 5-12**.

Table 5-12: Runway End Siting Criteria

Runway Type	Distance from Runway End	Width at Inner Edge	Length	Width at Outer Edge	Slope
Existing Approach Surface					
Runway 13R/31L					
Runway 13R (Type 5)	200’	400’	10,000’	3,400’	20:1
Runway 13R (Type 6)	0’	350’	10,200’	1,520’	30:1
Runway 13R (Type 7)	0’	150’	12,152’	7,512’	40:1[1] 2.83:1[2]
Runway 31L (Type 5)	200’	400’	10,000’	3,400’	20:1
Runway 31L (Type 6)	0’	350’	10,200’	1,520’	30:1
Runway 31L (Type 7)	0’	150’	12,152’	7,512’	40:1[1] 2.83:1[2]
Runway 13L/31R					
Runway 13L (Type 2)	0’	250’	5,000’	700’	20:1
Runway 13L (Type 7)	0’	75’	12,152’	7,512’	40:1[1] 3.08:1[2]
Runway 31R (Type 2)	0’	250’	5,000’	700’	20:1
Runway 31R (Type 7)	0’	75’	12,152’	7,512’	40:1[1] 3.08:1[2]

Sources: *Mead & Hunt, 2023; FAA Advisory Circular 150/5300-13B.*

Notes: [1] *Section 1 slope.*
[2] *Section 2 slope.*

Approach Surfaces Analysis

Thresholds are located to provide proper clearance over obstacles for landing aircraft on approach to a runway end. When an object that is beyond an airport owner’s ability to remove, relocate, or lower obstructs the airspace required for aircraft to land at the beginning of the runway for takeoff, the landing threshold may require a location other than the end of the pavement (i.e., a displaced threshold). Like the RPZ criteria, the approach surface criteria are based on the type of aircraft and approach visibility minimums associated with each runway end. Both runway ends for Runway 13R/31L have two types of approach surface, but both runway ends for Runway 13L/31R have a single type of approach surface. Obstructions, if any, to each runway’s approach surfaces are listed below:

Runway 13R/31L

- Runway 13R Approach Surface Type 5 with 0 Obstructions
- Runway 13R Approach Surface Type 6 with 2 Obstructions
- Runway 31L Approach Surface Type 5 with 0 Obstructions
- Runway 31L Approach Surface Type 6 with 2 Obstructions

Runway 13L/31R

- Runway 13L Approach Surface Type 2 with 2 Obstructions
- Runway 31R Approach Surface Type 2 with 3 Obstructions

Departure Surfaces Analysis

Departure ends of runways normally mark the end of the full-strength runway pavement available and suitable for departures. Departure surfaces, when clear of obstacles, allow pilots to follow standard departure procedures. If obstacles penetrate the departure surface, then the obstacles must be evaluated through the Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) process. After the OE/AAA process, departure procedure amendments such as non-standard climb rates, non-standard (higher) departure minimums, or a reduction in the length of Takeoff Distance Available (TODA) may be required. Departure surfaces begin at the end of the TODA, are trapezoidal in shape, extend along the extended runway centerline, and have a slope of 40:1 for Section 1 and a transverse slope for Section 2, which is dependent on the runway width. Obstructions, if any, to each runway's departure surfaces are listed below:

Runway 13R/31L

- Runway 13R Departure Surface Type 7 with 101 Obstructions
- Runway 31L Departure Surface Type 7 with 5 Obstructions

Runway 13L/31R

- Runway 13L Departure Surface Type 7 with 0 Obstructions
- Runway 31R Departure Surface Type 7 with 0 Obstructions

Code of Federal Regulations Part 77

Safe and efficient landing and takeoff operations at an airport require that certain areas on and near the airport are clear of objects or restricted to objects with certain function, composition, and/or height. Obstruction clearing standards and criteria are established to create a safer environment for aircraft operations on or near the airport. Any existing or proposed object, whether man-made or of natural growth that penetrates obstruction clearance surfaces is classified as an obstruction and is presumed to be a hazard to air navigation. These obstructions are subject to FAA aeronautical study, after which the FAA issues a determination stating if the obstruction is in fact considered a hazard.

The criteria contained in Code of Federal Regulations (CFR), *Part 77 Safe, Efficient Use, and Preservation of Navigable Airspace*, apply to existing and proposed manmade objects and/or objects of natural growth and terrain. These guidelines define the critical areas in the vicinity of an airport that should be kept free of obstructions. Secondary areas may contain obstructions if they are determined to be non-hazardous by aeronautical study and/or if they are marked and lighted as specified in the aeronautical study determination. Airfield navigational aids, as well as lighting and visual aids, by nature of their location, may constitute obstructions. However, these objects do not violate CFR Part 77 requirements, as they are essential to the operation of the Airport.

The surfaces contained in CFR Part 77, commonly referred to as Part 77 Imaginary Surfaces, are summarized below:

- **Primary Surface.** Longitudinally centered on the runway with an elevation equal to the nearest point on the runway centerline. The primary surface extends 200 feet beyond each runway end at PSP. The width of the primary surface for Runway 13R/31L is 500 feet and 250 feet for Runway 13L/31R.
- **Approach Surface.** Begins at the edge of the primary surface (200 feet beyond each runway end for each runway at PSP). The dimensions of the approach surface depend on the approach capabilities of each runway end and are summarized below:
    - **Runway 13R and 31L**: Inner width of 500 feet, length of 10,000 feet, outer width of 3,500 feet, and a slope of 34 to 1 (horizontal to vertical).
    - **Runway 13L and 31R**: inner width of 250 feet, length of 5,000 feet, outer width of 1,250 feet, and a slope of 20:1 (horizontal to vertical).
- **Transitional Surface.** Begins at the edges of the primary and approach surfaces. The transitional surface extends upward and outward at a slope of 7 to 1 (horizontal to vertical) for a total horizontal distance of 5,000 feet.
- **Horizontal Surface.** A plane 150 feet above the established airport elevation that is constructed by swinging arcs of specified radii from the center end of the primary surface of each runway and connecting adjacent arcs with tangent lines. The radius for the arcs on Runway 13R/31L is 10,000 feet and the radius for the arcs on Runway 13L/31R is 5,000 feet.
- **Conical Surface.** Extends upward and outward from the horizontal surface at a slope of 20 to 1 (horizontal to vertical) for a total horizontal distance of 4,000 feet.

CFR Part 77 Approach Surface Obstructions

Runway 13R/31L

- Runway 13R Approach Surface with 34 Obstructions
- Runway 31L Approach Surface with 7 Obstructions

Runway 13L/31R

- Runway 13L Approach Surface with 0 Obstructions
- Runway 31R Approach Surface with 0 Obstructions

The specific mapping of the various CFR Part 77 imaginary surfaces for each runway at PSP and the known associated obstacle and terrain penetrations of these surfaces will be prepared as sheets of the ALP Drawing Set. The ALP set will include proposed dispositions for each obstruction for each surface.

Instrumentation and Lighting

The Airport is currently looking at a new Required Navigation Performance approach for Runway 13R/31L. Any additional future approach lighting system (ALS) improvements to Runway 13R/31L will be evaluated in conjunction with the findings of the obstruction survey and the alternatives development analysis presented in the following chapter. There are no future ALS improvements recommended for Runway 13L/31R.

NAVAIDs and Airfield Lighting

Navigational aids (NAVAIDs) and airfield lighting assist pilots with navigation, takeoffs, and landings especially during times of low visibility. AC 150/5300-13B provides standards and recommended practices for both NAVAIDs and airfield lighting. The existing NAVAIDs at PSP are understood to meet FAA standards. Various existing NAVAIDs may require relocation as a result of potential projects including but not limited to:

- **Terminal Apron Expansion** – may require the Automated Surface Observing Systems (ASOS) and segmented circle and wind cone to relocate.
- **Runway Extensions** – may require precision approach path indicators (PAPIs), runway end identifier lights (REILs), and wind cones to relocate.
- **Aviation-Related Development** – may require the Airport Surveillance Radar (ASR) to relocate.

Any relocation of NAVAIDs and airfield lighting will comply with FAA standards. The applicable FAA standards for the NAVAIDs listed above are summarized below.

ASOS Criteria

An ASOS is a climate recording instrument that measures cloud cover and ceiling, visibility, wind speed and direction, temperature, dew point, precipitation accumulation, icing, and sea level pressure for altimeter settings. This information assists pilots with flight procedures. ASOS siting criteria depends on the runway approach types at the airport and whether they have runway visual range (RVR) instrumentation. Runway 13R/31L is an instrument approach runway without RVR instrumentation; therefore, siting criteria indicates that the sensors be:

- Located 1,000 to 3,000 feet from the primary runway threshold (Runway 31L since it is the end with lowest visibility minimums).

- Located 500 to 1,000 feet from the runway centerline.
- Must remain outside of RSAs and ROFAs.
- Obstructions must be at least 15 feet lower than the height of the sensor within the 500-foot radius and be at least 10 feet lower than the height of the sensor from 500 to 1,000 feet.

Segmented Circle and Wind Cones Criteria

Segmented circles and wind cones visually indicate prevailing wind directions that assist pilots with the direction in which they should operate. The primary wind cone typically is located within a segmented circle. Siting criteria includes:

- Must remain outside of RSAs and ROFAs.
- The primary wind cone must be readily visible to pilots.
- Supplemental wind cones should be placed 1,000 feet from the runway threshold.

PAPIs and REILs Criteria

PAPIs assist pilots with their approaches by visually indicating whether they are approaching too high or too low. PAPIs siting criteria includes:

- Ideally located on left side of approach runway.
- Site and aim PAPI so there is sufficient clearance over obstacles.
- Site PAPI to be approximately 1,000 feet from runway threshold.
- Is considered fixed-by-function and therefore is allowed in both the RSA and ROFA.

REILs help pilots identify the runway end. REILs siting criteria includes:

- Lights may be placed 30 feet downwind and 100 feet upwind of the runway threshold lights.
- Locate a minimum of 40 feet from runway or taxiway.
- Is considered fixed-by-function and therefore is allowed in both the RSA and ROFA.

ASR Criteria

An ASR is a radar that detects and displays azimuth, range, and elevation of aircraft operating within terminal airspace. ASR siting criteria includes:

- Must remain outside RSAs and ROFAs.
- Typical ASRs range from 17 to 77 feet above ground level with a standard antenna tower 24 feet by 24 feet.
- Locate buildings and other facilities at least 1,500 feet from ASR antennas to avoid potential signal reflections.
- Locate electronic equipment at least half a mile from ASR antennas.
- Ensure trees and structures remain below the elevation of the ASR mezzanine level.

Taxiway Design

Taxiways provide defined movement corridors for aircraft between the various functional landside areas on an airport and the runway system. Some taxiways are necessary simply to provide access between aircraft parking aprons and runways, whereas other taxiways become necessary to provide more efficient and safer use of the airfield. Parallel taxiways eliminate the use of the runway for taxiing, thus increasing capacity and protecting the runway under low visibility conditions. Taxiway turns and intersections are designed for safe and efficient taxiing by aircraft while minimizing excess pavement. The common taxi routes for arrivals and departures at PSP are depicted on **Figure 5-17** and **Figure 5-18**, respectively. These routes were provided by ATCT personnel.

Figure 5-17: Existing Taxi Routes - Arrivals

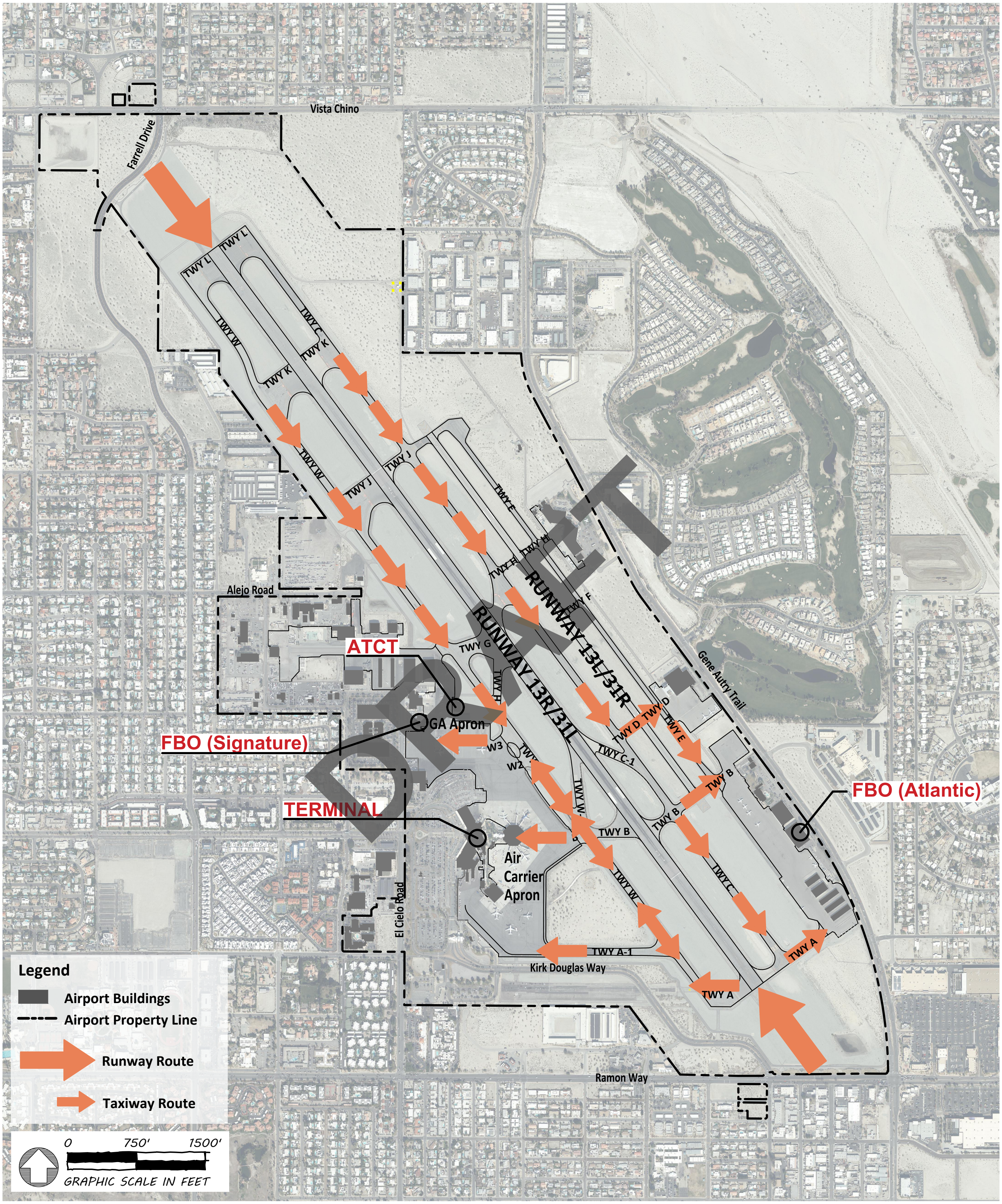
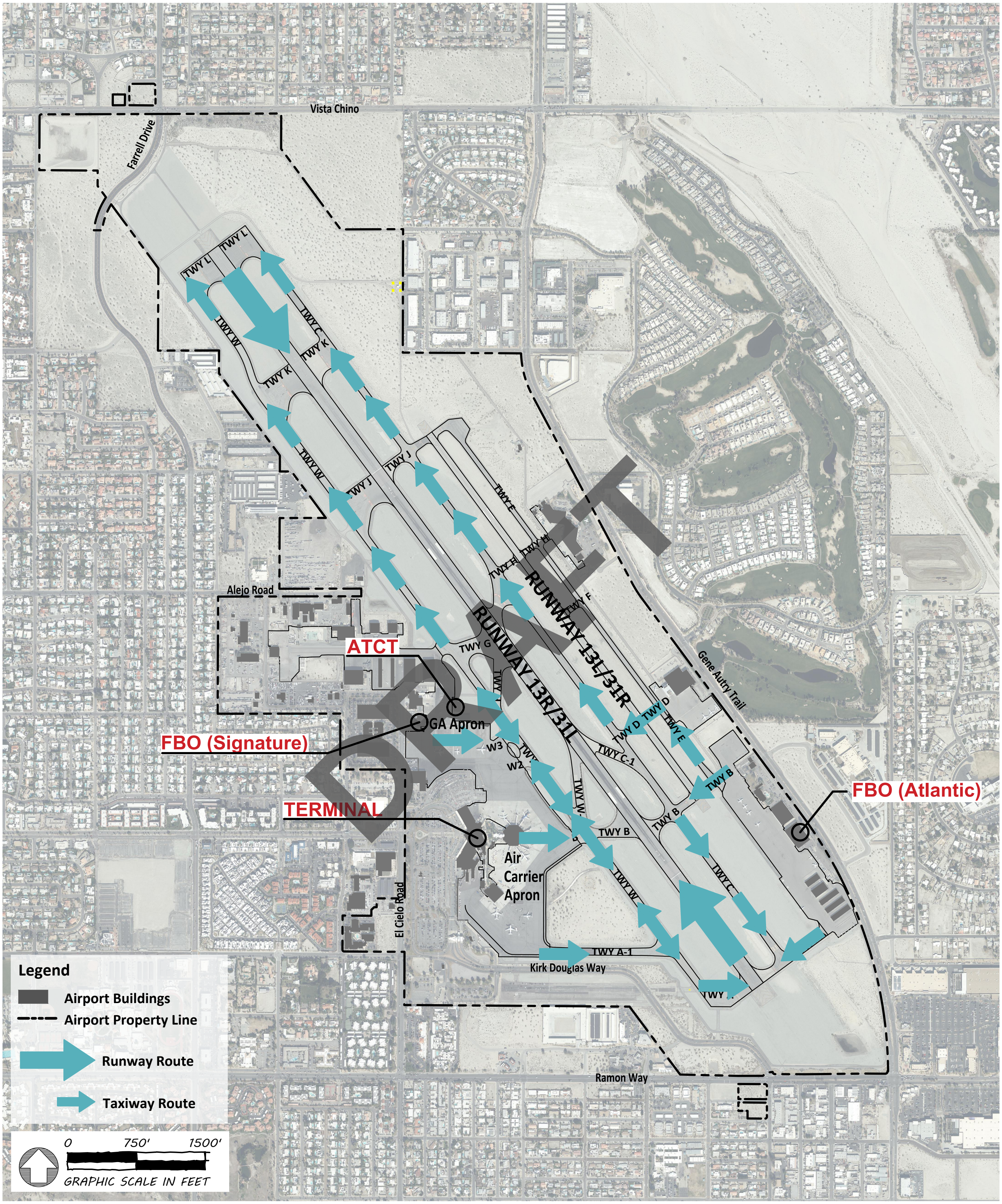


Figure 5-18: Existing Taxi Routes - Departures

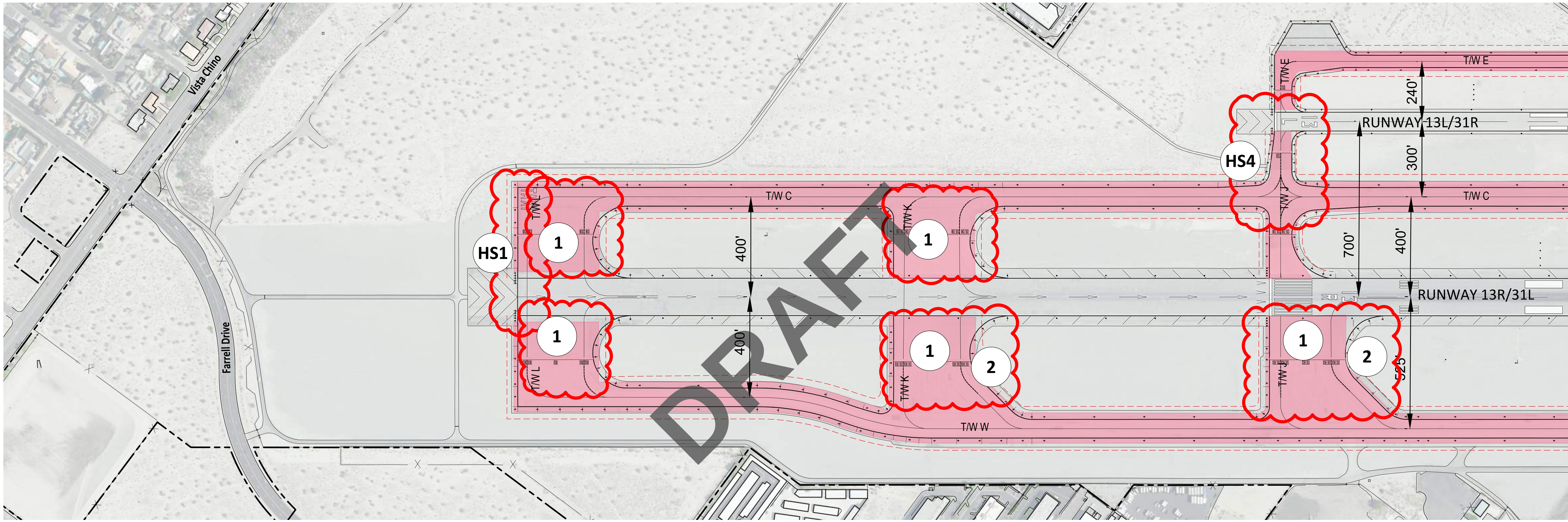


Taxiway Design Methodology

Taxiways are designed for cockpit over centerline taxiing with pavement being of sufficient width to allow a certain amount of wander. Potential runway incursions should be kept to a minimum by proper taxiway design, choosing simplicity over complexity wherever possible. AC 150/5300-13B provides basic taxiway design concepts and methodologies that are outlined in the following narrative and are depicted on **Figure 5-19** through **Figure 5-21**.

- **Increased Pilot Awareness.** Taxiway intersections should be kept simple by using the three-node concept, which means that a pilot is presented with no more than three choices at each intersection – ideally, left, right, and straight ahead. Intersection angles should be 90 degrees wherever possible, but standard angles of 30, 45, 60, 120, 135, and 150 degrees are acceptable.
- **Wide Expanses of Pavement.** Taxiway to runway interface encompassing wide expanses of pavement should be avoided, as wide pavements require placement of signs far from a pilot's eyes and reduce the conspicuity of other visual cues. Taxiways A, G, H, J, K, and L currently have wide expanses of pavement.
- **Limit Runway Crossing.** Opportunities for human error can be reduced by limiting the need for runway crossings, especially crossings within the middle third of runways defined as high energy intersections. Limiting runway crossings to the outer thirds of the runway keeps clear the portion of the runway where pilots can least maneuver to avoid collisions. Taxiway H crosses Runway 13R/31L in the middle third of the runway.
- **Increase Visibility.** Right-angle intersections, both between taxiways and between taxiways and runways, provide the best visibility to the left and right for a pilot. A right-angle turn at the end of the parallel taxiway is a clear indication of approaching a runway. Acute-angle exit taxiways provide greater runway efficiency but should not be used for runway entrance or crossing points. Taxiway A is a non-right-angle entrance, and Taxiway H is an angled crossing point.
- **Avoid Dual Purpose Pavement.** Runways used as a taxiways and taxiways used as runways only lead to confusion and should be avoided. Runways should be clearly identified as a runway and only a runway. All the runways and taxiways serve only their designated purpose.
- **Indirect Access.** Taxiways should not lead directly from an apron to a runway without requiring a turn. This layout only leads to confusion when a pilot typically expects to encounter a parallel taxiway. PSP has several locations of direct access including:
  - Taxiway A from east apron to Runway 31L
  - Taxiway B from both aprons to both runways
  - Taxiway D from east apron to Runway 31R
  - Taxiway G from west apron Runway 13R/31L.
- **Hot Spots.** In recent years, PSP has seen a number of incidents at four hot spots on the airfield. In response, the Airport created the Runway Safety Action Team (RSAT) to evaluate ways to eliminate the four hot spots on the airfield. RS&H led the efforts in the hot spot study and recommendations from the study will be discussed in the **Alternative Analysis** chapter.

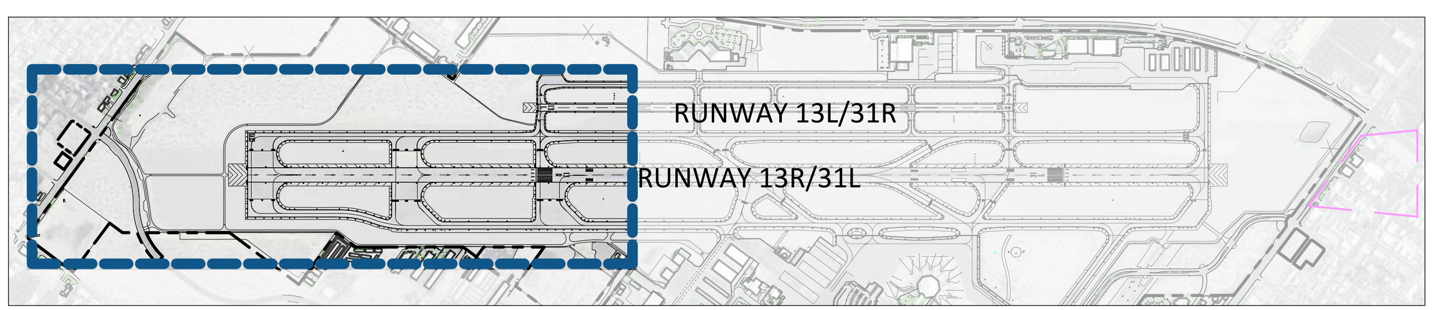
Figure 5-19: Existing Taxiway Design Standards - North Detail



0 200' 400'
GRAPHIC SCALE IN FEET

Legend

- Taxiway Safety Area
- Taxiway Object Free Area
- Airport Property Line



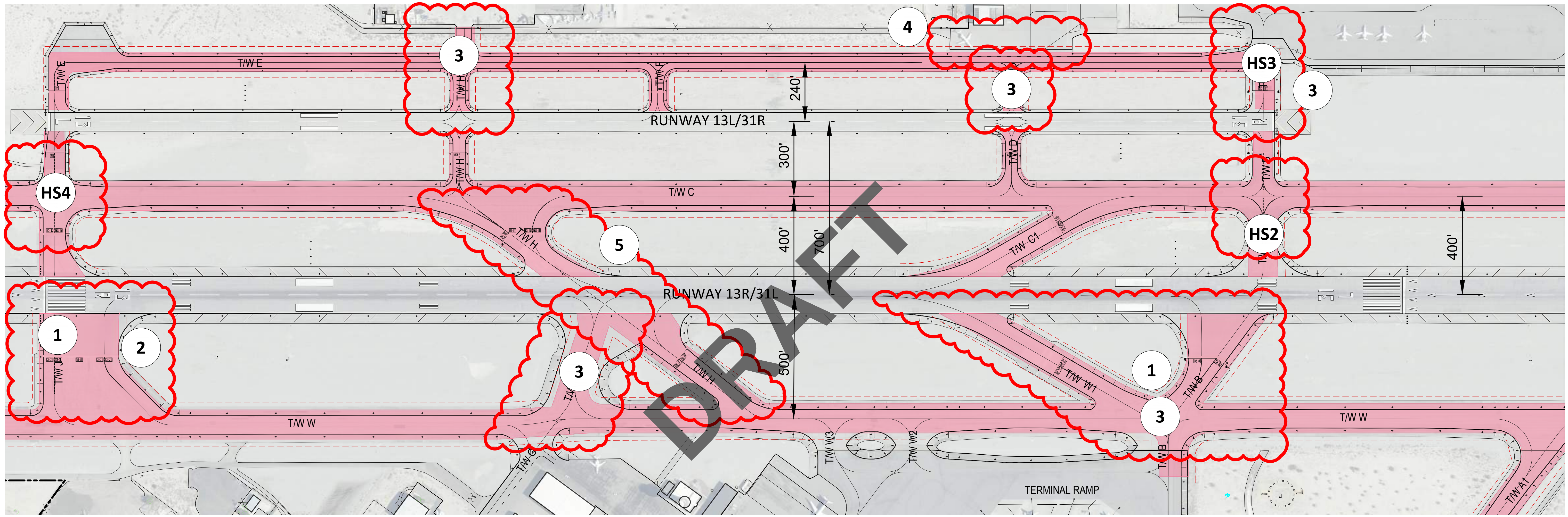
Keymap

0 1000' 2000'
GRAPHIC SCALE IN FEET

Non-Standard Taxiway Condition

1 Wide Pavement
2 Aircraft does not hold 90 degrees
HS1 Taxiway C mistaken for Runway 13R/31L
HS4 Aircraft taxiing to Taxiway E from Runway 13R/31L mistake Runway 13L for Taxiway E

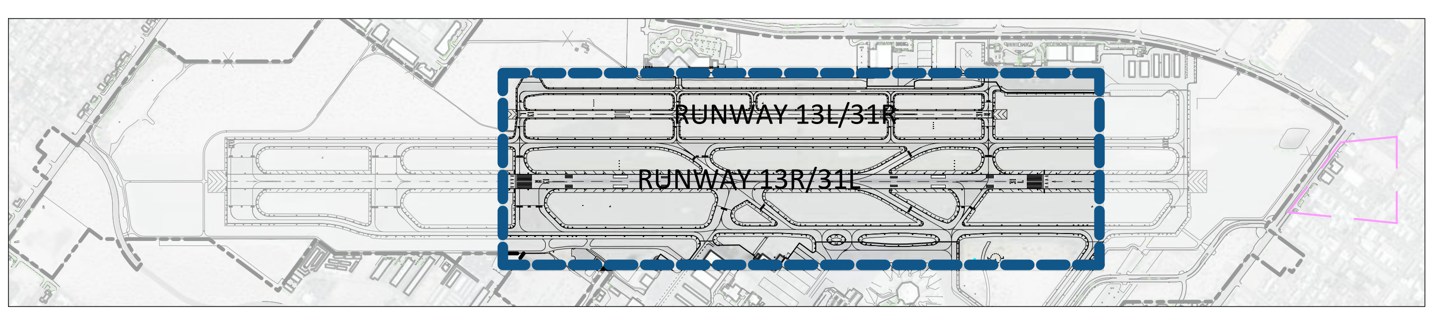
Figure 5-20: Existing Taxiway Design Standards - Central Detail



0 200' 400'
GRAPHIC SCALE IN FEET

Legend

- Taxiway Safety Area
- Taxiway Object Free Area
- Airport Property Line



Keymap

0 1000' 2000'
GRAPHIC SCALE IN FEET

Non-Standard Taxiway Condition

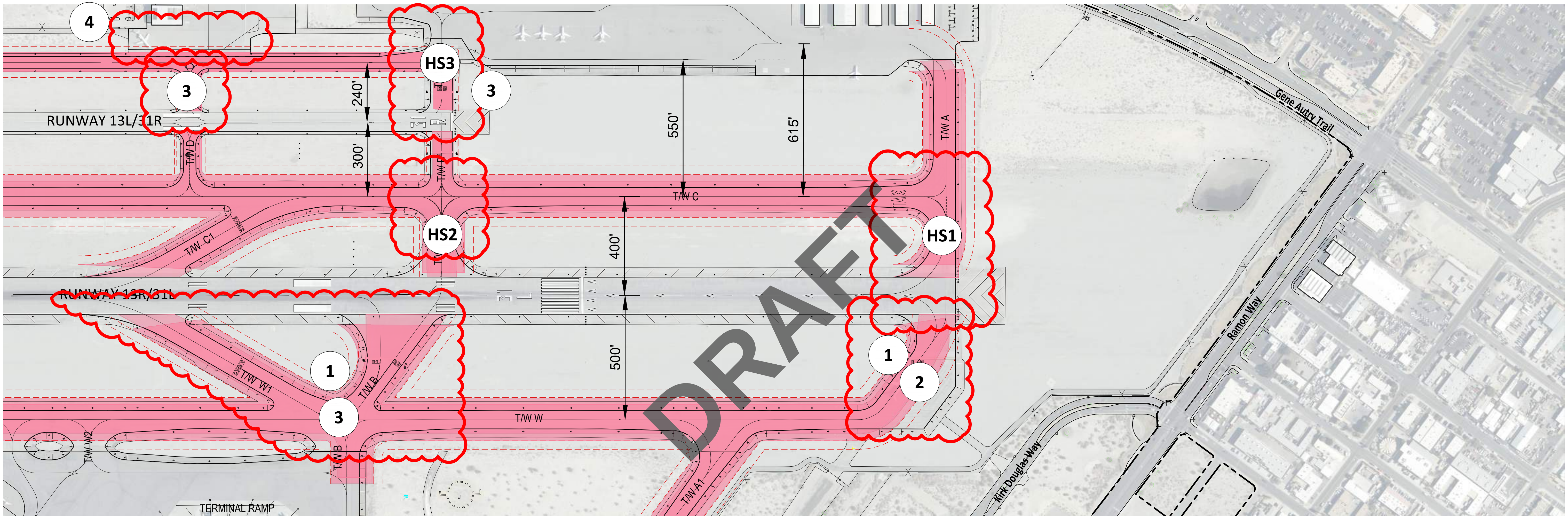
1. Wide Pavement
2. Aircraft does not hold 90 degrees
3. Direct access
4. Aircraft parking on apron inside TOFA
5. Taxiway crossing in middle third of runway

HS2 Aircraft miss turn on Taxiway C and enter Runway 13R/31L without authorization

HS3 Aircraft miss Hold Short line

HS4 Aircraft taxiing to Taxiway E from Runway 13R/31L mistake Runway 13L for Taxiway E

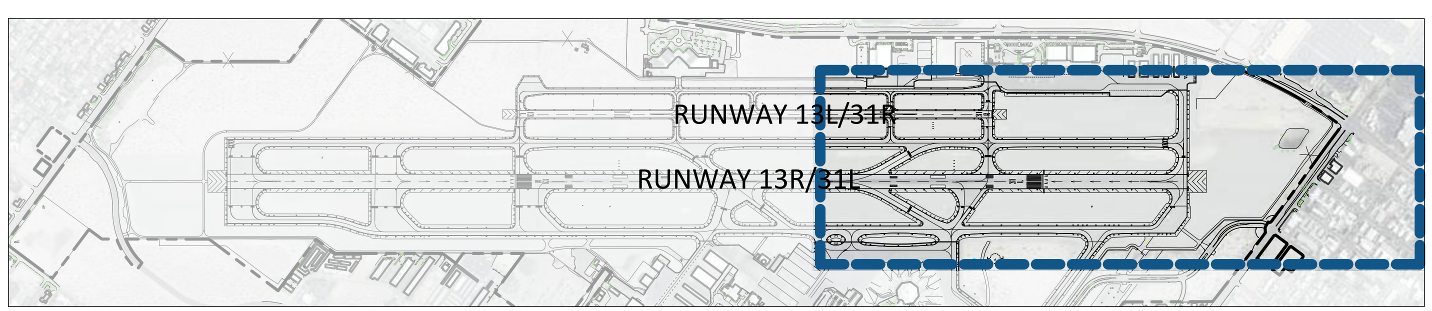
Figure 5-21: Existing Taxiway Design Standards - South Detail



0 200' 400'
GRAPHIC SCALE IN FEET

Legend

- Taxiway Safety Area
- Taxiway Object Free Area
- Airport Property Line



Keymap

0 1000' 2000'
GRAPHIC SCALE IN FEET

Non-Standard Taxiway Condition

1 Wide Pavement
2 Aircraft does not hold 90 degrees
3 Direct access
4 Aircraft parking on apron inside TOFA
HS1 Taxiway C mistaken for Runway 13R/31L
HS2 Aircraft miss turn on Taxiway C and enter Runway 13R/31L without authorization
HS3 Aircraft miss Hold Short line

Taxiway Design Conclusion

Each of the taxiway systems at PSP will be examined in consideration of these taxiway design concepts and methodologies in conjunction with the alternatives analysis presented in the following chapter, and potential taxiway reconfiguration recommendations will be identified. Reconfiguration of taxiways will be discussed with ATCT personnel to coordinate a safe and efficient airfield.

Taxiway Dimensional Criteria

Taxiway and taxilane clearance requirements are the required distances between a taxiway/taxilane centerline and other objects, which are based upon the required wingtip clearance, a function of the wingspan, and therefore are determined by the ADG as it relates to the critical aircraft. Taxiway and taxilane pavement design standards are related to the TDG, which is based on the overall main gear width and the cockpit to main gear distance of the critical aircraft. Based on the approved aviation forecast presented in the **Aviation Activity Forecast** chapter and ATCT discussions, it was determined that ADG III and TDG 3 are the appropriate design standards for the west taxiway system, while ADG II and TDG 2B are the appropriate design standards for the east taxiway system. However, certain taxiways (i.e., Taxiway E) on the east side of the Airport should allow for an ADG III aircraft to taxi as business jets taxi to and from the fixed-base operator (FBO). **Table 5-13** summarizes current FAA design standards. **Table 5-14** presents the existing dimensional criteria for each taxiway and documents its ability to meet current FAA standards.

Table 5-13: Taxiway Design Standards

Item	ADG II	ADG III
Taxiway Safety Area	79’	118’
Taxiway Object Free Area	124’	171’
Taxiway Centerline to parallel Taxiway/Taxilane centerline	102’	145’
Taxiway Centerline to Fixed or Movable Object	62’	86’
Taxiway Wingtip Clearance	23’	27'
Item	**TDG 2B**	**TDG 3**
Taxiway Width	35’	50’
Taxiway Edge Safety Margin	7.5’	10’
Taxiway Shoulder Width	15’	20’

Sources: *Mead & Hunt, 2023; AC 150/5300-13B.*

Table 5-14: PSP Taxiway Design Standards Evaluation

Taxiway Segment	Width	Shoulder	TOFA [1]	Standards Met
A	90-190’	25’	171’	Yes
A1	75’	25’	171’	Yes
B	75’-150’	25’	124’ – 171’	Yes
C	75’	25’	171’	Yes
C1	75’	25’	171’	Yes
D	50’	**12’**	124’	**No**
E	50’	**12’**	**124’**[2]	**No**
F	50’	**12’**	124’	**No**
G	165’	35’	171’	Yes
H	85’-215’	**12’**-35’	124’ – 171’	**No**
J	50’-300’	25’	171’	Yes
K	300’	25’	171’	Yes
L	300’	25’	171’	Yes
W	75’	35’	171’	Yes
W1	75’	35’	171’	Yes
W2	125’	35’	171’	Yes
W3	130’	35’	171’	Yes

Sources: *Mead & Hunt, 2023; AC 150/5300-13B; NV5 Survey.*

Notes: *[1] TOFA – Taxiway Object Free Area.*
[2] Aircraft apron is inside TOFA.

The taxiway dimensional standards are mostly met; however, several of the taxiway shoulders do not meet the minimum standard shoulder widths. The ALP will indicate that the future taxiway conditions meet the standard shoulder widths. In addition, a portion of Taxiway E’s TOFA does not meet standards because an aircraft parking apron fall inside the TOFA. It is recommended to restripe a portion of the apron to indicate aircraft should not park inside the limits of the TOFA.

Several of the existing taxiways, especially those on the west side of the airfield, measure 75 feet or more in width (exceeds standards). For funding purposes, the Airport recently completed a cost-benefit analysis of the reconstruction of Taxiway W, that showed the cost of retaining the existing taxiway width at 75 feet would be less than t he cost of reducing the taxiway width to meet critical aircraft guidance. For this reason, the FAA will permit the Airport to maintain Taxiway W’s existing width. It is recommended to complete cost-benefit analysis for the taxiways that exceed dimensional standards, as needed, in case the findings from the analysis are similar to those of Taxiway W.

Taxiway Dimensional Criteria for Potential Widebody Scenario

As discussed in the **Runway Length Analysis** section above, the Airport is working with *Visit Greater Palm Springs* to explore the possibility of international widebody flights between PSP and European destinations. Although the FAA approved forecast does not include any widebody enplanements, the future addition of widebody flights at PSP would also require a safe and efficient taxi route for that aircraft type. **Table 5-15** summarizes the FAA's taxiway clearance and dimensional standards (i.e., ADG V and TDG 5) for a Boeing 787-8 aircraft. **Table 5-16** evaluates the west side taxiway system's ability to meet the more restrictive standards for an ADG V and TDG 5 aircraft. The larger aircraft will only use the west side taxiways; therefore, only taxiways on the west side of the airfield were evaluated.

Table 5-15: Taxiway Design Standards for Widebody Aircraft

Item	ADG V
Taxiway Safety Area	214'
Taxiway Object Free Area	285'
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	250'
Taxiway Centerline to Fixed or Movable Object	143'
Taxiway Wingtip Clearance	36'
Item	**TDG V**
Taxiway Width	75'
Taxiway Edge Safety Margin	14'
Taxiway Shoulder Width	30'

Sources: *Mead & Hunt, 2023; AC 150/5300-13B.*

Table 5-16: PSP Taxiway Design Standards Evaluation for Widebody Aircraft

Taxiway Segment[1]	Width	Shoulder	TOFA[2]	Standards Met
A	90'-190'	**25'**	**214'**[3]	**No**
A1	75'	**25'**	**214'**[4]	**No**
B	150'	**25'**	214'	**No**
G	165'	35'	214'	Yes
H	215'	35'	214'	Yes
J	300'	**25'**	214'	**No**
K	300'	**25'**	214'	**No**
L	300'	**25'**	214'	**No**
W	75'	35'	**214'**[3]	**No**
W1	75'	35'	214'	Yes
W2	125'	35'	214'	Yes
W3	130'	35'	214'	Yes

Sources: *Mead & Hunt; AC 150/5300-13B; NV5 Survey*

Notes: *[1] A widebody aircraft would only use the taxiways on the west side of Runway 13R/31L; therefore, only those taxiways were evaluated.*
[2] TOFA – Taxiway Object Free Area.
[3] Portion of service road inside TOFA.
[4] Several objects inside TOFA including service road, fence, and objects outside of airfield (vegetation and portion of public roadway).

Taxiway Dimensional Criteria for a Potential Widebody Conclusion

If widebody aircraft were to begin regular service at PSP that exceed more than 500 operations per year, then several of the existing taxiways may require additional shoulder width upgrades. In addition, Taxiways A, A1, and W would have to clear their expanded Taxiway Object Free Areas (TOFAs) of any impeding objects. As noted previously, the aviation activity forecast does not support significant growth of widebody aircraft at the Airport; however, PSP does have the desire to protect for the future accommodations of these aircraft. Therefore, future taxiway modifications to accommodate the larger aircraft will be shown on the ALP for planning purposes.

Exit Taxiway Analysis

As noted in the previous section, each of the runways at PSP are served by parallel taxiway systems that serve both sides of the runways and are provided with connector/exit taxiways at various locations along the runway that are designed to varying standards and dimensions. According to the FAA taxiway design guidance provided in AC 150/5300-13B, right-angled taxiways are the standard for all runway/taxiway intersections, except where there is a need for high-speed or angled exit taxiways at congested airports to enhance throughput capacity.

Optimally located/aligned exit taxiways minimize runway occupancy times and allow the airfield to be used more efficiently. Figure 4-17 from AC 150/5300-13B provides the cumulative percentages of aircraft typically able to exit runways at specific exit taxiway locations. Percentages for both right-angled and acute-angled exit taxiway configurations are included.

As presented in **Table 5-17** and **Table 5-18**, the performance capabilities of the existing exit taxiway system for both runways at PSP has been evaluated. Based upon this analysis, the optimal exit taxiway location for each AAC is listed below:

- A – between 2,600 and 4,000 feet
- B – between 3,900 and 5,200 feet
- C – between 5,500 and 6,500 feet
- D – between 6,200 and 7,800 feet

Table 5-17: Runway 13R/31L Exit Taxiway Analysis

Exit	Distance from Landing Threshold	AAC A		AAC B		AAC C		AAC D	
Runway 13R (West Side)		**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**
Taxiway G (A)	2,000’	23	36	3	8	0	0	0	0
Taxiway H (A)	2,200’	40	52	7	12	0	0	0	0
Taxiway W1 (A)	3,200’	94	98	42	55	0	0	0	0
Taxiway B (R)	4,700’	100	100	95	98	20	30	0	0
Taxiway A (A)	6,900’	100	100	100	100	100	100	89	92
Runway 13R (East Side)		**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**
Taxiway H (A)	3,200’	94	98	42	55	0	0	0	0
Taxiway B (R)	4,700’	100	100	95	98	20	30	0	0
Taxiway A (R)	6,900’	100	100	100	100	100	100	89	92
Runway 31L (West Side)		**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**
Taxiway H (A)	2,900’	79	89	24	34	0	0	0	0
Taxiway G (A)	3,100’	97	99	43	54	0	0	0	0
Taxiway J (R)	5,000’	100	100	98	99	40	50	2	4
Taxiway K (R)	6,700’	100	100	100	100	99	100	81	90
Taxiway L (R)	8,200’	100	100	100	100	100	100	100	100
Runway 31L (East Side)		**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**
Taxiway H (A)	3,100’	97	99	43	54	0	0	0	0
Taxiway J (R)	5,400’	100	100	100	100	62	73	10	28
Taxiway K (R)	6,700’	100	100	100	100	99	100	81	90
Taxiway L (R)	8,200’	100	100	100	100	100	100	100	100

Sources: *Mead & Hunt, 2023; AC 150/5300-13B derived from Figure 4-17.*

Note: *R = right-angle and A = acute-angle configurations.*

Table 5-18: Runway 13L/31R Exit Taxiway Analysis

Exit	Distance from Landing Threshold	AAC A		AAC B		AAC C		AAC D	
Runway 13L (West Side)		**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**
Taxiway H (R)	1,500’	2	4	0	0	-	-	-	-
Taxiway D (R)	3,500’	99	100	55	65	-	-	-	-
Taxiway B (R)	4,900’	100	100	96	98	-	-	-	-
Runway 13L (East Side)		**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**
Taxiway H (R)	1,500’	2	4	0	0	-	-	-	-
Taxiway F (R)	2,400’	48	62	9	15	-	-	-	-
Taxiway D (R)	3,500’	99	100	55	65	-	-	-	-
Taxiway B (R)	4,900’	100	100	96	98	-	-	-	-
Runway 31R (West Side)		**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**
Taxiway D (R)	1,000’	0	0	0	0	-	-	-	-
Taxiway H (R)	3,200’	94	98	42	55	-	-	-	-
Taxiway J (R)	4,900’	100	100	96	98	-	-	-	-
Runway 31R (East Side)		**R**	**A**	**R**	**A**	**R**	**A**	**R**	**A**
Taxiway D (R)	1,000’	0	0	0	0	-	-	-	-
Taxiway F (R)	2,400’	48	62	9	15	-	-	-	-
Taxiway H (R)	3,200’	94	98	42	55	-	-	-	-
Taxiway J (R)	4,900’	100	100	96	98	-	-	-	-

Sources: *Mead & Hunt,2023; AC 150/5300-13B derived from Figure 4-17.*

Exit Taxiway Conclusion

In the **Alternatives Analysis** chapter, the existing layout and/or configuration of the exit taxiway system will be evaluated in consideration of the location analysis above. However, any future recommendations to modify the layout of the existing exit taxiway system will be coordinated with input from the PSP ATCT personnel and Airport Operations Staff.

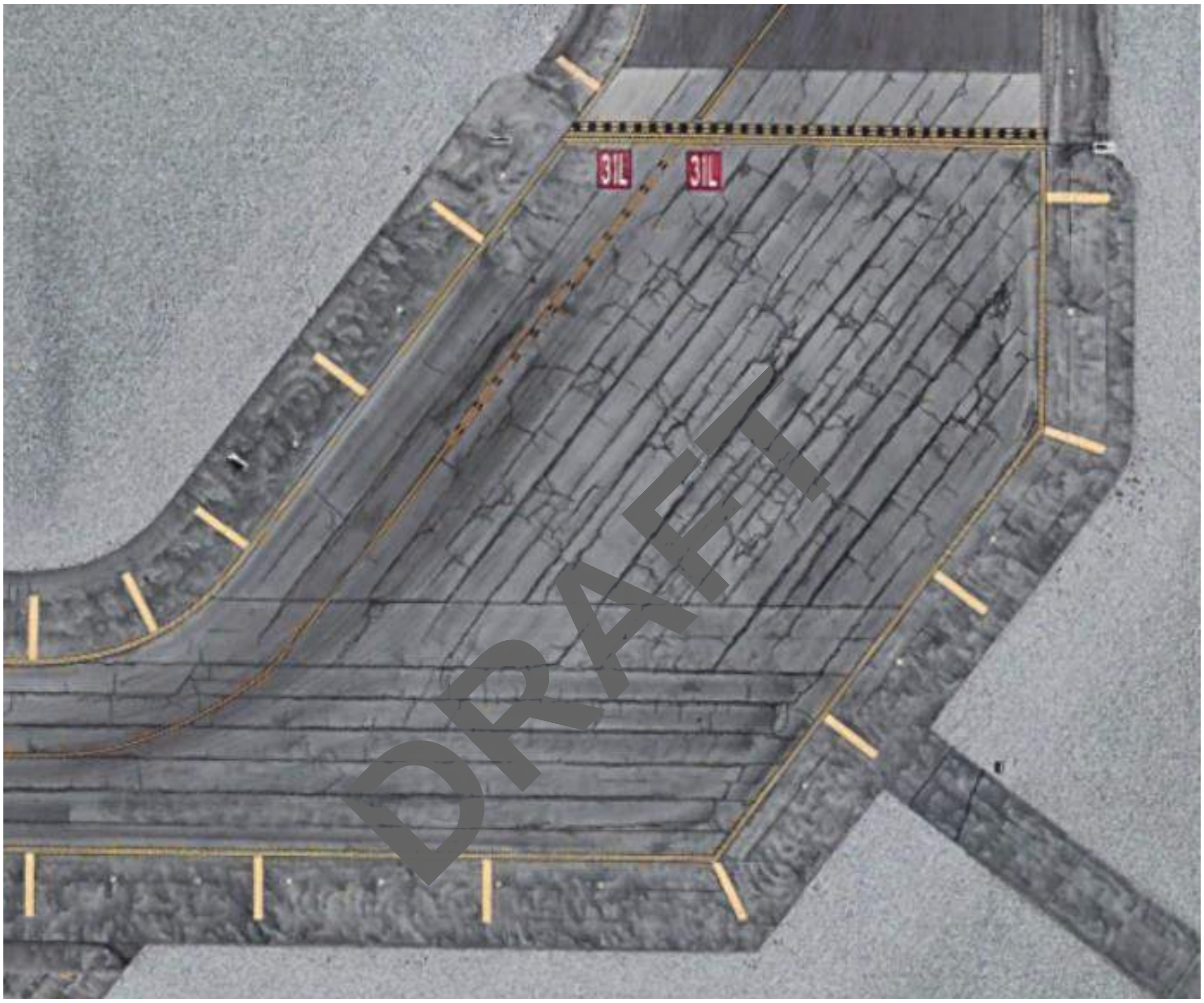
Holding Bays

PSP has two areas designated as holding bays where aircraft can wait before taking off that help aircraft move and bypass each other, enhancing airfield capacity. One holding bay is located off Runway 31L on Taxiway A (**Figure 5-22**). The other holding bay is located off Runway 13L on Taxiway E (**Figure 5-23**). Discussions with ATCT personnel were held to better understand existing issues with holding bays. The biggest issues that the ATCT noted are discussed below:

- The ATCT is not able to hold enough aircraft on the holding bay located on Taxiway A. This forces them to sometimes hold aircraft on Taxiways W2 and W3 which could potentially cause congestion around the air carrier apron.

- When landing on Runway 31L (in north flow), the ATCT faces the issue of not having anywhere to hold the arriving aircraft because its gate is not available. The aircraft are not clear to land until they have a location to park after landing.

Figure 5-22: Runway 31L Existing Holding Bay



Source: *Google Earth, 2023.*

Note*:* *Not to scale.*

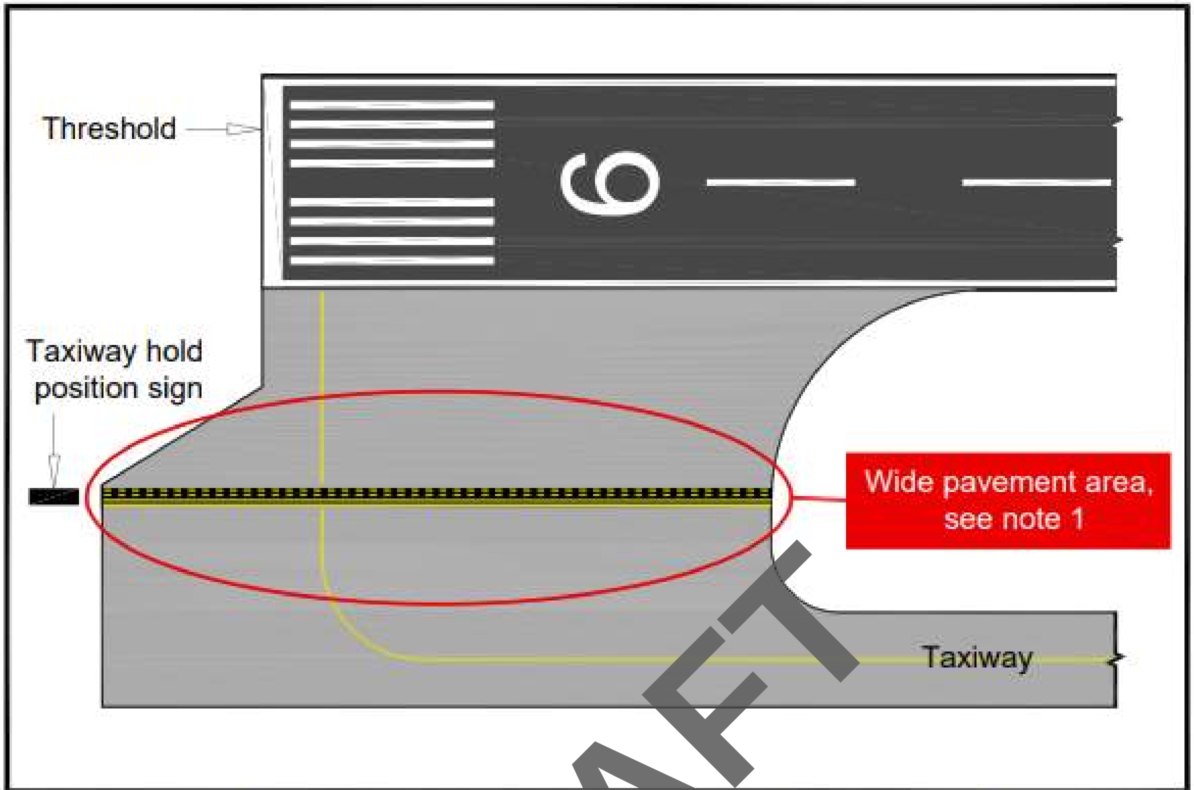
Figure 5-23: Runway 13L Existing Holding Bay

Source: *Google Earth, 2023.*

***Note**:* *Not to scale.*

Updated holding bay standards and recommended practices are provided in AC 150/5300-13B. Holding bays are required to keep aircraft out of the Obstacle Free Zone (OFZ), Precision Obstacle Free Zone (POFZ), RSA, and Instrument Landing System (ILS) critical areas (POFZ and ILS critical areas are not applicable for the runways at PSP). They are also required to be designed to the geometry of the applicable ADG and TDG standards. The holding bay off Runway 13L meets FAA standards. The holding bay off Runway 13R meets the requirements of holding outside of the OFZ and RSA. However, since the holding bay is not marked, it is possible that a pilot might accidentally not be holding outside of the required taxiway OFA. This holding bay also falls under the example that the FAA has identified as a poor holding bay configuration depicted in **Figure 5-24**.

Figure 5-24: Poor Holding Bay – Elevated Risk Configuration



Note 1: The wide distance of the holding bay places the vertical signs outside of the pilot's normal viewing range.

Source: *FAA AC 150/5300-13B.*

Holding Bay Conclusion

The **Alternatives Analysis** chapter will explore the reconfiguration of the holding bay off Runway 31L end to align with FAA recommended practices and maximize the number of accommodated aircraft. Taxiway reconfiguration on both ends of Runway 13R/31L will be assessed for bypass capability, aiming to enhance operational efficiency and minimize delays during takeoffs. Additionally, the evaluation will include the placement of remain overnight (RON) positions around the commercial service terminal area to hold aircraft after landing in the instances that their gates are occupied.

Potential Vertiport Development

The primary operations conducted on Runway 13R/31L are air carrier and air taxi operations; the primary operations conducted on Runway 13L/31R are small general aviation operations. Although the Airport is not capacity constrained, general aviation operations are supported by local airports within the PSP catchment area such as Blythe Airport (BLH), Jacqueline Cochran Regional Airport (TRM), San Bernardino International Airport (SBD), and Ontario International Airport (ONT), which could provide opportunities for growth at the Airport.

Advanced Air Mobility (AAM) and airport electrification could potentially present several opportunities for PSP that include:

- Developing a new and safe air transportation that moves people and goods between areas that have historically been underserved.
- Replacing conventional aircraft with electric vertical takeoff landing (eVTOL) to:
    - Reduce noise impacts to the surrounding community and,
    - Reduce fuel emissions.
- Receiving new regional AAM air service opportunities through regional air mobility (RAM).

Figure 5-25 shows the potential for PSP to conduct RAM operations to in demand regions such as the Greater Los Angeles area.

Figure 5-25 Potent ial Electric Aircra f Opportuni t es from PSP

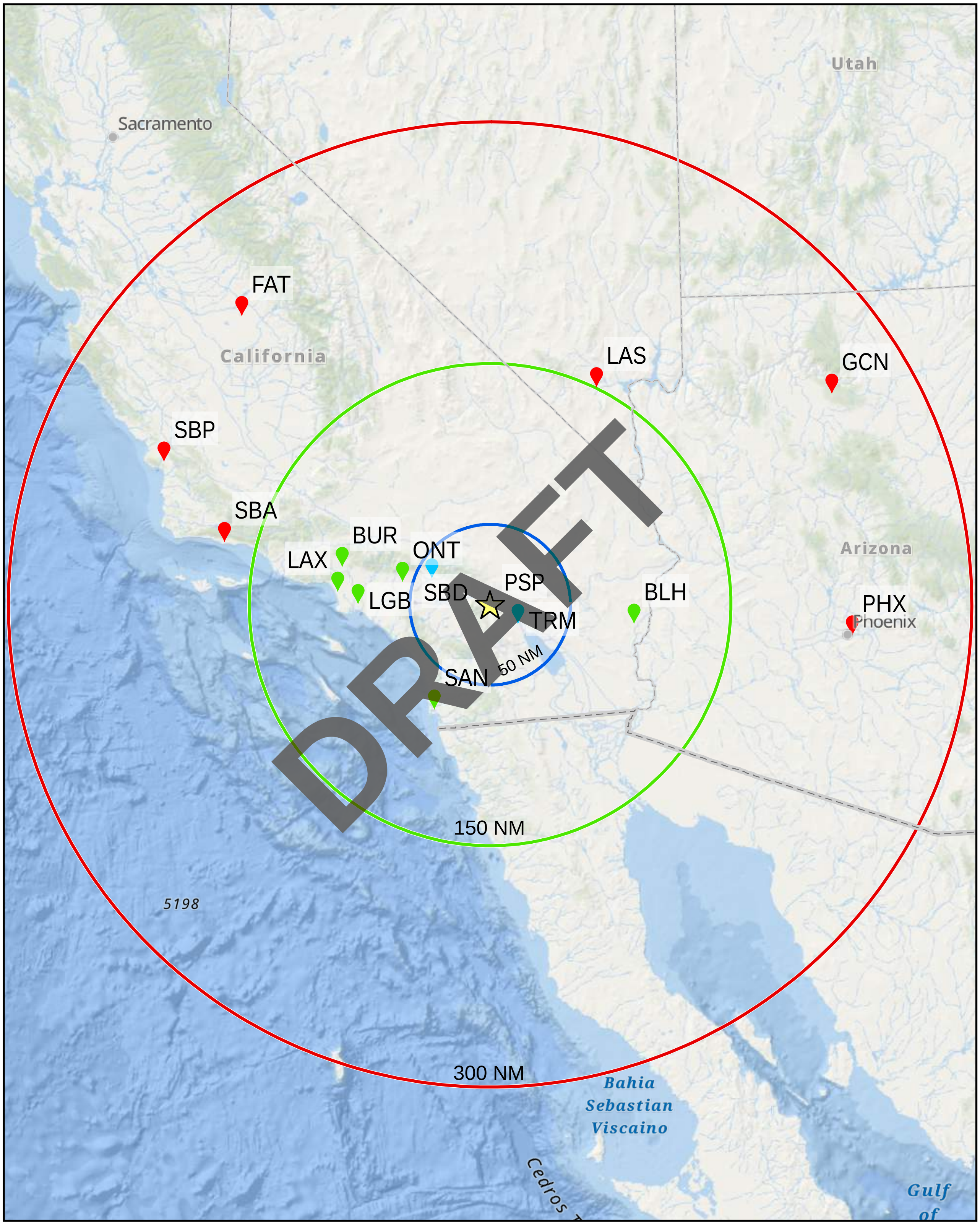


Table 5-19 shows the ranges and potential markets electric aircraft will be able to reach according to different data provided by original equipment manufacturers (OEMs). Various emerging electric aircraft are being designed to ranges between 50 and 250 nms. eVTOL aircraft are capable of taking off vertically. An example of an eVTOLs includes BETA Technology's ALIA-250c, which will be able to reach destination airports within 250 nms. Destination airports within a 150-nms radius will be reached using eVTOLs similar to the Pipistrel 801. eVTOLs such as Archer's Maker 101 have the capability to provide air service within the 50-nms range.

Table 5-19: Advanced Air Mobility Examples

eVTOL	Characteristics		
	Range (nms)	ARI[1]	Wingspan
BETA (Alia-250c)	250	8.0	50'
Pipistrel (801)	162	7.2	45'
Archer (Maker 101)	52	7.4	40'

Sources: *Mead & Hunt, 2023; FutureFlight, BETA Technologies, Archer, and AAM Reality Index.*
Note: *[1] ARI – AAM Reality Index*

Table 5-19 is derived from the AAM Reality Index (ARI), which is a rating tool that is derived from a formula that accounts for public information and expert knowledge. The formula considers funding a company receives, the company's leadership team, the readiness of the company technology, the certification process, and readiness for full-scale manufacturing. The greater the ARI value on a zero to ten scale, the greater probability that the company will be able to commercially mass produce their aircraft. A company who receives an ARI value of zero has little to no financing and is considering entering the market.

Potential Vertiport Development Conclusion

AAM could potentially provide new opportunities that could benefit both PSP and its surrounding communities; therefore, it is necessary to plan for areas that these aircraft are able to operate at the Airport in a safely manner. For the purpose of this Master Plan, it is assumed that eVTOL aircraft will operate at PSP the same way that helicopters currently operate, by taking off and landing on Runway 13L/31R and hover taxiing to their designated parking positions. The **Alternatives Analysis** chapter will identify locations where these aircraft can park. The aircraft will likely need FBO services and will therefore be sited by one or both FBOs.

The FAA released Engineering Brief (EB) Number 105, *Vertiport Design* as interim guidance for the design of vertiports for aircraft with VTOL capabilities and will serve as the design guidelines for all related vertiport development as part of this Master Plan.

LANDSIDE AND SUPPORT

Landside and support requirements are driven by either aviation forecasts, goals set by the Airport and its tenants, by FAA standards, or a combination of all three. This section discusses the requirements and their drivers for landside and support facilities at PSP.

FBO, Corporate, and General Aviation Facilities

PSP has two FBOs: Signature Aviation and Atlantic Aviation. Signature Aviation is currently located on the west side of the airfield while Atlantic Aviation is located on the east. Both FBOs have expansion plans that will be incorporated, to the extent possible, into the preferred alternative.

Signature Aviation

Signature Aviation is currently located on the west side of the airfield, just north of the commercial service terminal. It is understood that Signature may be required to relocate depending on the preferred terminal alternative. It is also understood that there is a great desire from the Airport to develop a portion of Signature's lease, where the general aviation (GA) terminal and aircraft parking apron are located, due to its proximity to the commercial service terminal regardless of the selected preferred alternative. The master plan team met with representatives of Signature Aviation to discuss their goals and desires from this master plan. Signature Aviation's goals are summarized below.

Signature Aviation Goals

- **Fuel farm expansion.** Projected aircraft activity requires additional fuel tanks.
- **Additional Hangar.** 30,000 square foot hangar.
- **Maintain operation efficiency.** If Signature Aviation is relocated, it is necessary for their operation that all their facilities are co-located.
- **Capacity.** Signature Aviation would like a location that allows them to expand and does not box them in.
- **Cost.** Signature Aviation is concerned about cost of relocating its facilities and apron.

The **Alternatives Analysis** chapter will consider these goals when developing and evaluating the relocation concepts.

Atlantic Aviation

Atlantic Aviation is located on the east side of the airfield. The Master Plan team met with representatives of Atlantic Aviation to discuss their goals and desires from this Master Plan. Atlantic Aviation's goals are summarized below.

Atlantic Aviation Goals

- **Construct or Expand Terminal.** New 8,000 square foot terminal or expansion of existing terminal.
- **General Aviation Customs facility.** A new facility that processes international GA passengers.
- **AAM.** Atlantic Aviation is interested in AAM and would like to accommodate future vertical takeoff and landing aircraft parking.
- **Expand aircraft parking apron.** Atlantic Aviation lost some of its aircraft parking positions due to a portion of the apron falling inside Runway 31R's RPZ. They would like to maximize the available space for aircraft parking.
- **Maximize current lease hold.** Atlantic Aviation has undeveloped land in their existing leasehold, and they would like to find the highest and best use for that available land.

Aircraft Storage Hangars and Transient Aircraft Parking Apron

Hangars and transient aircraft parking apron demand are driven by the GA forecasts that can be found in the **Aviation Activity Forecast** chapter. Hangar demand is typically associated with projected based aircraft, while transient aircraft parking apron is typically associated with annual GA itinerant operations and in particular, peak hour GA itinerant operations.

The FAA approved forecast, Scenario 2, projects an increase of 31 based aircraft at PSP through the planning period. Of these 31 additional aircraft, 7 are jets, 5 are helicopters, and 23 are designated as other (i.e., eVTOL). The forecast shows a decrease of single engine and multi-engine aircraft. There is a need to plan for additional large hangars to accommodate the increase in jets, helicopters, and other aircraft. No additional single-engine and multi-engine aircraft hangars are needed based on the forecast.

The forecast also shows an increase of annual GA itinerant operations through the planning horizon, which was used to calculate both the number of tiedowns required and the total transient aircraft parking apron demand. Both FBOs have indicated a trend toward larger higher performance GA aircraft and increases in peak hour activity. Both of these trends require an increase in transient aircraft parking apron at PSP. Since the FBOs accommodate more jets than piston/turbo props, the calculation is based on planning for larger aircraft. It was assumed that most of the transient aircraft would park on the apron rather than inside a hangar, which is common especially in warm climates. A total of 20 tiedowns and approximately 5 acres of transient aircraft parking apron are required through the planning horizon for transient aircraft. PSP currently has 24 tiedowns; therefore, based on the forecast, additional tiedowns are not required. PSP has approximately 4.1 acres of transient aircraft parking apron. Additional parking apron for higher performance GA aircraft will need to be planned for in the **Alternatives Analysis** chapter.

Aircraft Storage Hangars and Transient Aircraft Parking Apron Conclusion

The **Alternatives Analysis** chapter will need to consider options for providing additional large hangars and transient aircraft parking apron to meet the forecasted demand. The Airport meets the requirements of both smaller aircraft storage hangars and tiedowns that are projected throughout the planning horizon.

Fuel Farm

PSP has two fuel farms that are operated by the FBOs. Each FBO has its own fuel farm. Discussions with both FBOs led to the following conclusions:

- **Signature Aviation Fuel Farm.** Signature Aviation provides fuel for both GA and air carrier aircraft. They currently have five 20,000-gallon above ground storage tanks (100,000 gallons total), one 10,000-gallon tank of 100 low-lead (LL) aviation gas (Avgas), one 1,000-gallon tank of unleaded gas, and one 1,000-gallon tank of diesel. Due to the air carrier growth that is forecasted at PSP over the next 20 years, Signature Aviation requires an expansion to their fuel farm. The preferred alternative will provide Signature Aviation's required expansion.
- **Atlantic Aviation Fuel Farm.** Atlantic Aviation provides fuel for GA aircraft. They currently have three 20,000-gallon above ground storage tanks (60,000 gallons total), one 1,200-gallon above ground storage tanks, one 60,000-gallon tank of Jet A, and one 1,200-gallon tank of Avgas. The Atlantic Aviation Fuel Farm is anticipated to be adequate throughout the planning period and will not be evaluated further.

Cargo Facilities

As discussed in the **Aviation Activity Forecast** chapter, the Airport is not served by any all-cargo carriers, which means that all recorded cargo at the Airport is belly cargo on scheduled passenger carriers. The forecast anticipates a growth in cargo activity on scheduled passenger carriers. Cargo requirements will not be evaluated any further as part of this Master Plan, unless there is a desire to evaluate the possibility of an all-cargo facility at PSP in the **Alternatives Analysis** chapter.

Support Facilities

Support facilities at PSP include maintenance and storage facilities, aircraft maintenance, and the Palm Springs Air Museum. Several of the rental car companies have their own designated facilities and all of those facilities are located on western portion of the airfield, adjacent to Signature Aviation's current location. The Airport has their own designated maintenance and storage facility in this area as well. SkyWest Airlines has an aircraft maintenance facility on the opposite end of the airfield, adjacent to Atlantic Aviation's current location. The PS Air Museum is located north of SkyWest's aircraft maintenance facility. The Master Plan team met with the PS Air Museum, and their goals are to construct two new hangars on the south end of their existing apron.

Electric Aircraft Charging Facilities

As discussed above, the **Alternatives Analysis** chapter, will plan for the ability for eVTOL aircraft to safely operate at PSP. Since these aircraft are electrically charged, they require charging facilities. EB 105, currently states the following:

At the time of this publication, consensus has not been achieved regarding classes of charging or connection standards and could vary based on the aircraft duty cycle, charging speed, battery chemistry, charging system, and battery cooling system, etc. Charging infrastructure design for vertiports should consider adapting to multiple aircraft specific systems. Additional guidance is currently being developed as the AAM industry continues to evolve.

Battery charging must be done in a safe and secure manner. Any aircraft batteries stored on site should be stored safely away from TLOF, FATO, and Safety Areas. As additional research is developed, further recommendations will be released.

The **Alternatives Analysis** chapter will site charging facilities away from touchdown and liftoff (TLOF) and final approach and takeoff area (FATO). Electric aircraft charging facilities will also remain outside of all critical and safety areas discussed in AC 150/5300-13B.

Emergency Services

PSP has a dual-purpose aircraft rescue and firefighting (ARFF) and city fire station facility on airport property, which is located behind the ATCT. AC 150/5300-13B states that ARFF vehicles need to have clear access to potential accident areas on the airfield. The AC also requires the ARFF to meet the standards presented in CFR 139.315-139.319, *Aircraft Rescue and Firefighting*. Those standards are dependent on an airport's ARFF index, which is determined by the longest aircraft that regularly uses the airport. The standards dictate the number of equipment, type of firefighting agents, and response times required. ARFF index requirements are presented in **Table 5-20**.

Table 5-20: ARFF Index

ARFF Index	Aircraft Length
A	Less than 90 feet
B	At least 90 feet but less than 126 feet
C	At least 126 feet but less than 159 feet
D	At least 159 feet but less than 200 feet
E	At least 200 feet

Source: *CFR 139.315.*

PSP's existing ARFF index is C. Based on the information presented in the **Aviation Activity** chapter, **Table 5-21** presents the ARFF index for each aircraft that is forecasted to regularly use the Airport throughout the planning period. The ARFF index for PSP remains as C based on the aircraft that are forecasted to regularly use the Airport.

Table 5-21: PSP ARFF Index Based on Regularly Used Aircraft

Aircraft	Aircraft Length	ARFF Index
Airbus A220-100	115’	B
Airbus A321-200neo	146’	C
Airbus A321neo	146’	C
Boeing 737-700	110’	B
Boeing 737-8	130’	C
Boeing 737 MAX 7	117’	B
Boeing 737 MAX 8	130’	C
Boeing 737 MAX 9	138’	C
Embraer 175	104’	B

Sources: *CFR 139.315; FAA Aircraft Characteristics Database.*

The ARFF building is an old building that has reached the end of its useful life. The Airport is planning to replace the existing building with a new one. Up to three sites will be considered in the **Alternatives Analysis** chapter including rebuilding the facility in its current location.

Part 139 directs that within three minutes from the time of an alarm, at least one ARFF vehicle must reach the midpoint of the farthest runway serving air carrier aircraft from its assigned post or reach any other specified point of comparable distance on the movement area that is available to air carriers and begin application of extinguishing agent. As a result, the location of an ARFF building must be sited so that these response time requirements can be met.

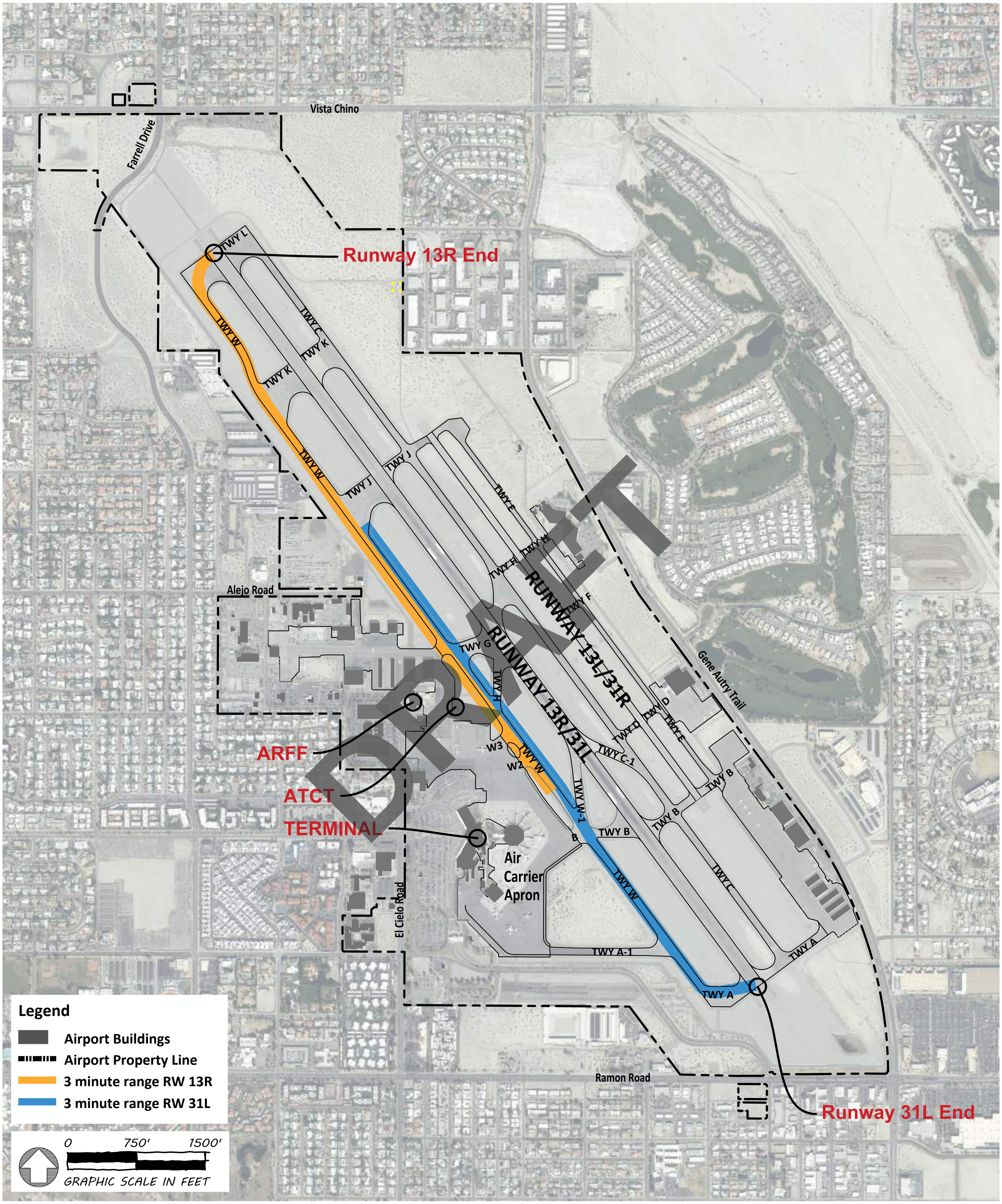
In determining potential sites for a new ARFF facility at PSP, an evaluation was conducted to determine where a new building could be placed so that response to the midpoint and approach ends of Runway 13R/31L could occur within three minutes. For this evaluation, guidance from National Fire Protection Agency (NFPA) 403, Standard for Aircraft Rescue and Fire-Fighting Services at Airports was referenced in determining the rates of acceleration, deceleration, and cruise of ARFF vehicles. In summary, the following assumptions were used:

- Time taken from alarm to vehicles exiting ARFF station: 45 seconds
- Time/distance taken to accelerate from 0 to 25 miles per hour (mph): 17.5 seconds/330 feet
- Time/distance taken to accelerate from 25 to 50 mph: 17.5 seconds/970 feet
- Time/distance taken to decelerate from 50 to 25 mph: 8.7 seconds/490 feet
- Time/distance taken to decelerate from 25 to 0 mph: 8.7 seconds/160 feet
- Speed in a turn: 25 mph/36.7 feet per second
- Speed in a straight line: 50 mph/73.3 feet per second

As a basis for comparison, an evaluation was completed of the response time from the existing ARFF building located on the west side of the airfield. From this location, the time estimated to respond to the midpoint of Runway 13R/31L from notice of alarm was estimated at two minutes, 45 seconds. To respond to the approach end of Runway 13R, the response time was estimated at two minutes, 29 seconds, and the response to the approach end of Runway 31L was estimated at two minutes, 34 seconds.

With this information, evaluations were conducted to determine the range of potential sites on the west side of the airfield so that response to the midpoint and approach ends of Runway 13R/31L could continue to occur within three minutes. As shown in **Figure 5-26**, this evaluation found that placement of an ARFF building on the west side of the airfield south of the intersection of Taxiway W with Taxiway J and north of the air carrier terminal building would continue to allow ARFF vehicles to respond to all points of Runway 13R/31L within three minutes. Sites on the east side of the airfield adjacent to Taxiway E were not considered since ARFF vehicles would need to cross Runway 13L/31R. This has the potential to increase response times since a delay would occur if responding ARFF vehicles needed to wait until the runway is cleared of landing and departing aircraft.

Figure 5-26: ARFF Response Route -3 Minute Range



SUMMARY

This section summarizes the facility requirements evaluated in this chapter. Expansion and development of these facilities will be explored further in the **Airfield and Landside Alternatives Analysis** chapter.

- Runway 13R/31L – resolve non-standard ROFA.
- Runway 13L/31R – provide up to a 1,000-foot runway extension.
- Taxiways and Holding Bays – reconfigure to meet current FAA design standards and incorporate RSAT Hot Spot Study.
- Vertiport – provide potential locations for AAM activity.
- Signature Aviation – relocate Signature Aviation, expand fuel farm, and provide a 30,000-square-foot hangar.
- Atlantic Aviation – maximize existing leasehold, maximize aircraft parking, and provide a customs facility.
- Aircraft Storage Hangars and Transient Aircraft Parking Apron – provide aircraft storage hangars for based aircraft and additional transient aircraft parking apron.
- SkyWest – park aircraft on apron outside of ADG II TOFA, mark if needed.
- PS Air Museum – provide space for the construction of up to two hangars on south end of existing apron.
- ARFF – provide potential sites that meet ARFF response times to rebuild the facility as a dual-purpose airport and city fire station.