Camarillo Airport



ALP Update and Narrative Report

Chapter 3

Demand/Capacity and Facility Requirements

The objective of this section is to identify, in general terms, the adequacy of the existing airport facilities at Camarillo Airport (CMA) and to outline what facilities may be needed to accommodate projected future aviation activity as outlined in the previous chapter. Any future facility recommendations must be consistent with the current airport master plan which was completed in 2011. That master plan will not change based on this study, instead, this study is primarily focused on updating the five-year airport capital improvement program (ACIP) and airport layout plan (ALP), which are required to continue to be eligible for federal airport improvement grants. Consistent with the 2011 master plan, the current role of the airport as a general aviation facility will not change based upon this ALP Update. This study may include planning for improvements within the airport boundary to meet forecast aviation demand, meeting FAA design standards, supporting current business demands, addressing aging facilities, and potentially accommodating future aircraft demands such as electric or hydrogen powered aircraft.

Airport facilities include both airside and landside components. Airside components include the runway system (runways and taxiways), navigational aids, lighting, and markings. The landside components include terminal facilities, storage and maintenance hangars, auto parking, access, utilities, and support facilities. Having established these facility needs, alternatives for providing these facilities will be evaluated in the following chapter.

Recognizing that facility needs are based upon demand (rather than a point in time), the requirements may be expressed in short-, intermediate-, and long-range planning horizons, which correlate generally to 2027, 2032, and 2042 projections as developed in the previous chapter. This chapter will examine several components of the airport and their respective capacities to determine future facility needs over the planning period. The identified deficiencies will then be examined in the alternative's evaluation.

The facility requirements were evaluated using guidance contained in Federal Aviation Administration (FAA) publications, including:

- Advisory Circular (AC) 150/5300-13B (as amended), *Airport Design*
- AC 150/5060-5, *Airport Capacity and Delay*
- AC 150/5325-4B, *Runway Length Requirements for Airport Design*
- 14 Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace*
- FAA Order 5090.5, *Formulation of the National Plan of Integrated Airport Systems* (NPIAS) and the *Airports Capital Improvement Plan* (ACIP)

AIRFIELD CAPACITY

An airport's airfield capacity is expressed in terms of its annual service volume (ASV) and is a reasonable estimate of the number of operations that can be accommodated in a year before significant delay occurs. ASV accounts for runway use, aircraft mix, and weather conditions. The airport's ASV was analyzed following guidance from FAA AC 150/5060-5, *Airport Capacity and Delay*.

A single runway with less than 20 percent of operations by aircraft weighing more than 12,500 pounds has an unconstrained ASV of 230,000 annual operations. In 2022, the airport had 187,076 operations, which is approximately 81 percent of ASV. According to FAA Order 5090.5, planning for capacity improvement projects should begin when operations reach approximately 60 percent of ASV. The capacity project that has the most significant impact directly on airfield capacity is a parallel runway, which would increase the ASV to 355,000 annual operations. The current Airport Layout Plan for the airport shows a potential parallel runway. Other capacity improvement projects could be additional runway exits and hold aprons; however, their impact is much less. Since the current ALP already depicts a future parallel runway, this ALP Update will continue to reflect this facility and not propose any development that could preclude its long-range implementation. Any decision to implement development of additional airfield capacity is beyond the scope of this ALP Update and would be addressed in a future master plan update, when conducted.

AIRSIDE REQUIREMENTS

The following section will examine the projected airside requirements, including runway length, runway width, pavement strength, line-of-sight, and gradient. The taxiway system will be examined with respect to current design standards for safety, including separation and wingtip clearances.

RUNWAY CONFIGURATION

Runway 8-26 is the single runway on the airfield and is oriented in an east/west manner with a true bearing of 186.05 degrees. For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as close as possible to the direction of the prevailing winds, which reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off. FAA AC 150/5300-13B, *Airport Design,* recommends a crosswind runway when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is computed based on wind not exceeding a 10.5-knot (12 mph) component for runway design code (RDC) A-I and B-I, 13-knot (15 mph) component for RDC A-II and B-II, 16-knot (18 mph) component for RDC A-III, B-III, C-I through C-III, and D-I through D-III, and 20 knots for larger wingspans.

It is preferable to analyze weather data that is local to the airport being studied. The airport has a WX-ASOS on the airfield, and that data is transmitted to the National Oceanic and Atmospheric Administration (NOAA). This data has been analyzed for meteorological trends covering the period from January 1, 2013, through December 31, 2022 (10 years).

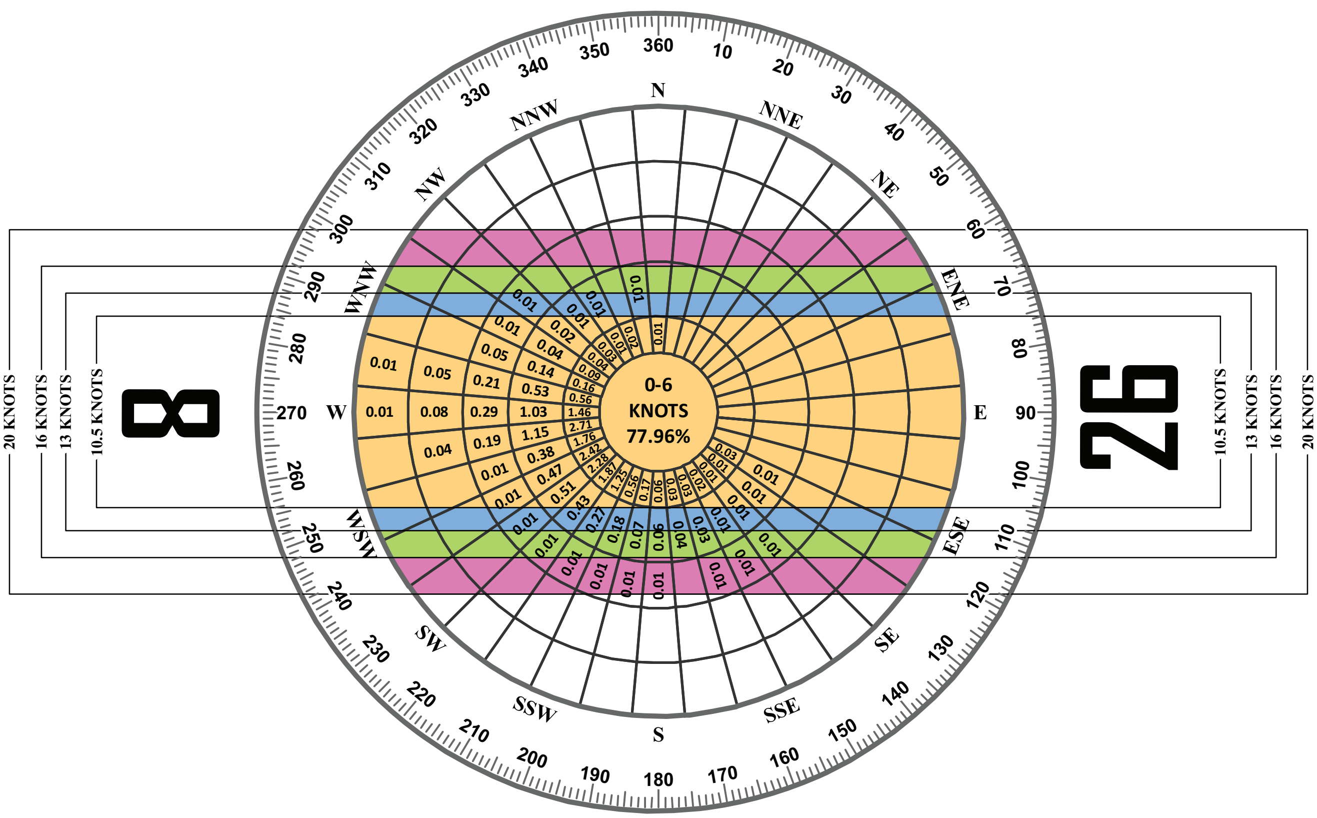
Exhibit 3A presents both all-weather and instrument flight rules (IFR) wind roses as sourced from the on-airport weather sensor. A wind rose is a graphic tool that gives a succinct view of how wind speed and direction are historically distributed at a location. The table at the top of the wind rose indicates the percent of wind coverage for the runway at specific wind intensity levels. Runway 8-26 provides 98.74 percent coverage at 10.5 knots.

RUNWAY DESIGN STANDARDS

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

The entire RSA, ROFA, OFZ, and RPZ should be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. It is not required that the RPZ be under airport ownership, but it is strongly recommended by the FAA. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having enough land use control measures in place to ensure the RPZ remains free of incompatible development. Currently, the airport owns the entirety of the RSA, ROFA, and OFZ. The airport owns the RPZ land except for those portions with roadways through both RPZs.

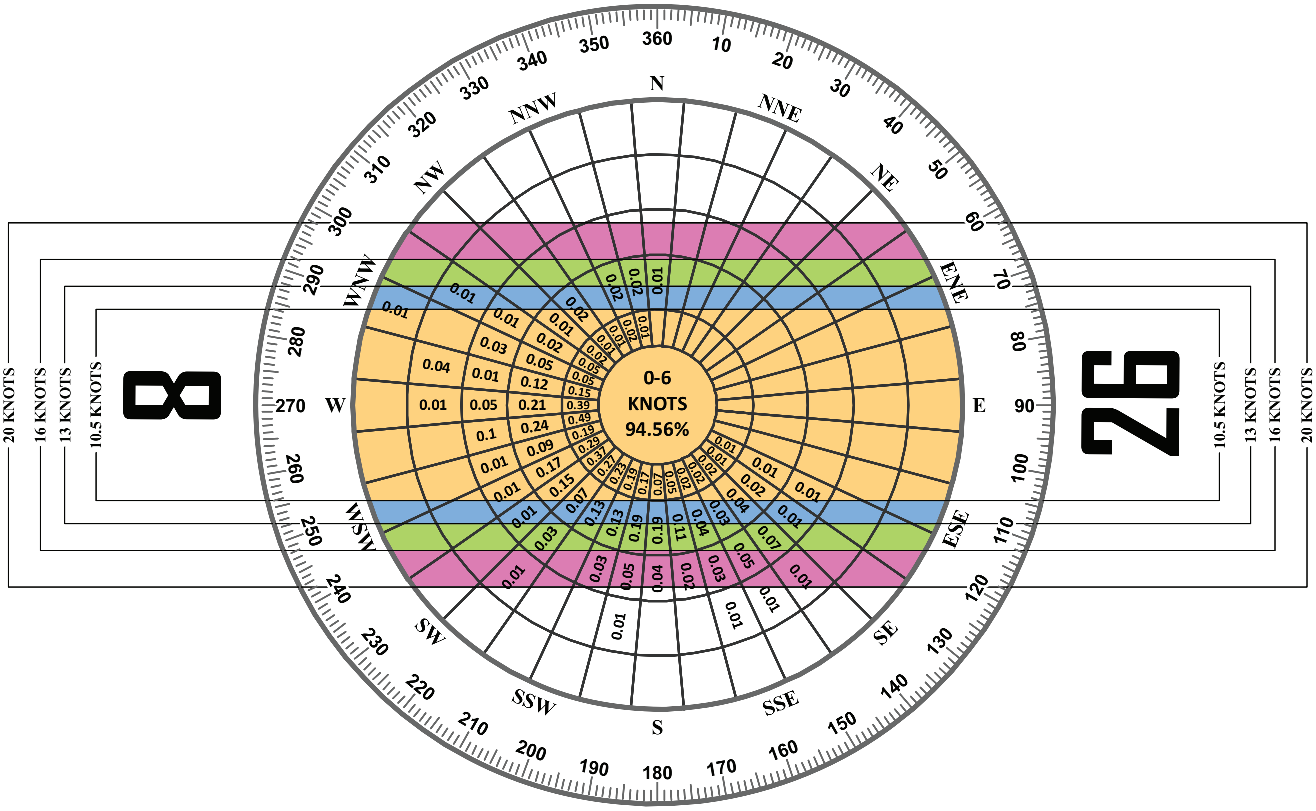
ALL WEATHER WIND COVERAGE				
Runway	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 8-26	98.74%	99.51%	99.90%	99.98%



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

OBSERVATIONS:
104,244 All Weather Observations
Jan. 1, 2013 - Dec, 31 2022

IFR WIND COVERAGE				
Runway	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 8-26	98.85%	99.30%	99.76%	99.94%



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

OBSERVATIONS:
18,184 IFR Observations
Jan. 1, 2013 - Dec, 31 2022

Dimensional standards for the various safety areas associated with the runways are a function of the type of aircraft expected to use the runways, as well as the instrument approach visibility minimums. As documented in the forecast chapter, the current operational data indicates that Runway 8-26 should meet the design standards for a runway design code (RDC) of D-III-4000 and a future RDC of D-III-2400. The airport meets all design standards currently, and because C and D design standards are the same, the airport also meets the future design standards. **Table 3A** presents the runway design standards.

TABLE 3A | Runway Design Standards

AIRPORT DATA	Runway 8 (Current)	Runway 26 (Current)	Runway 8 (Future)	Runway 26 (Future)
Airport Critical Aircraft	D-III-2B		D-III-3	
Runway Design Code	D-III-4000		D-III-2400	
Visibility Minimums	1-Mile	¾-Mile	¾-Mile	½-Mile
RUNWAY DESIGN				
Runway Width	100 ***(150)***		100	
Runway Shoulder Width	20		20	
Blast Pad Width/Length (if provided)	140x200		140x200	
RUNWAY PROTECTION				
Runway Safety Area (RSA)				
Width	500		500	
Length Beyond Departure End	1,000		1,000	
Length Prior to Threshold	600		600	
Runway Object Free Area (ROFA)				
Width	800		800	
Length Beyond Departure End	1,000		1,000	
Length Prior to Threshold	600		600	
Runway Obstacle Free Zone (OFZ)				
Width	400		400	
Length Beyond End	200		200	
Approach Runway Protection Zone (RPZ)	Rwy 8	Rwy 26	Rwy 8	Rwy 26
Length	1,700	1,700	1,700	2,500
Inner Width	500	1,000	500	1,000
Outer Width	1,010	1,510	1,010	1,750
Departure Runway Protection Zone (RPZ)	Rwy 8-26		Rwy 8-26	
Length	1,700		1,700	
Inner Width	500		500	
Outer Width	1,010		1,010	
RUNWAY SEPARATION				
Runway Centerline to:				
Parallel Runway	NA		700 Minimum	
Holding Position	251		251	
Parallel Taxiway	400		400	

Note: All dimensions in feet.

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

Runway Safety Area (RSA)

The RSA is defined in FAA AC 150/5300-13B, *Airport Design,* as a "surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of undershoot, overshoot, or excursion from the runway." The RSA is centered on the runway and dimensioned in accordance with the approach speed of the critical aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose.

The existing, and future, RSA is 500 feet wide, centered on the runway, and extends 1,000 feet beyond the runway ends. The RSA meets the design standard in both the existing and future conditions.

Runway Object Free Area (ROFA)

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

The ROFA is 800 feet wide, centered on the runway, and extends 1,000 feet beyond the runway ends. The TOFA meets design standards and should be maintained.

Obstacle Free Zone (OFZ)

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

The OFZ for Runway 8-26 is 400 feet wide, and it extends 200 feet beyond the runway ends. The existing and future OFZ meet design standards.

Runway Protection Zone (RPZ)

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 ft beyond the runway end. When an RPZ begins at a location other than 200 ft beyond the end of a runway, two RPZs are required (i.e., a departure RPZ and an approach RPZ). The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses to enhance the protection of people and property on the ground.

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

- Airport ownership of the RPZ property;
- Possessing sufficient interest in the RPZ property through easements, deed restrictions, etc.;
- Possessing sufficient land use control authority to regulate land use in the jurisdiction containing the RPZ;
- Possessing and exercising the power of eminent domain over the RPZ property; or
- Possessing and exercising permitting authority over proponents of development within the RPZ.

Expectations of Airport Sponsors

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

Existing Incompatible Land Uses

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

TABLE 3B | Expectations of Airport Sponsors - Existing Incompatible Land Uses

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

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

Proposed Incompatible Land Uses

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

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

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

TABLE 3C | Expectations of Airport Sponsors - New Incompatible Land Uses

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

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

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

- Farming that meets airport design clearance standards in FAA AC 150/5300-13B, *Airport Design* and guidance as outlined in AC 150/5200-33C, Hazardous Wildlife Attractants on or Near Airports;
- Irrigation channels meeting the standards of AC 150/5200-33C and FAA/USDA manual, *Wildlife Hazard Management at Airports*;
- Airport service roads, as long as they are not public roads and are directly controlled by the airport operator;
- Underground facilities, as long as they meet other design criteria (such as RSA standards), as applicable;
- NAVAIDs and aviation facilities, such as equipment for airport facilities considered fixed-by-function in regard to the RPZ; or
- Above-ground fuel tanks associated with backup generators for unstaffed NAVAIDs.

The RPZ on the Runway 8 end extends off airport property to the west and over private farming land. Approximately 8.1 acres, or approximately 27.6 percent, of the 29.4-acre RPZ is outside airport property. The farming taking place within the RPZ is covered by low, tent-like structures, thus preventing an attraction to birds. The farming activity is well outside any of the protective runway surfaces such as the RSA. The farming activity begins approximately 1,600 feet from the landing threshold. This type of farming activity is acceptable.

Inside the airport property and within the Runway 8 RPZ is an irrigation channel that wraps around the end of the runway. The irrigation channel is approximately 1,280 feet from the landing threshold and 280 feet from the end of the RSA. Irrigation channels that meet standards for not becoming a wildlife attractant, are acceptable.

The Runway 26 RPZ is entirely on airport property and is over compatible land that is not used for any other aviation purposes. No action is necessary to specifically address any incompatible land use within the current RPZs. The visibility minimums to Runway 26 are planned to remain the same at ¾-mile, which means there is no change to the size of the RPZ, which is planned to be maintained.

Runway/Taxiway Separation

The design standards for the separation between runways and parallel taxiways are determined by the RDC. The RDC for Runway 8-26 is D-III-4000, which has a minimum separation standard of 400 feet from the centerline of the runway to the centerline of a parallel taxiway. Taxiway H, which was constructed in 2012, is 700 ft from the runway, thus exceeding the separation standard. Ultimately, Taxiway H is planned to be replaced with a shorter parallel runway, therefore Taxiway H should be maintained until such a time.

Parallel Runway Consideration

The current ALP and 2011 master plan reflect a potential parallel runway in the same location as Taxiway H. The runway to taxiway separation for this planned new runway to Taxiway F is 300 feet. Under certain visibility approach minimums, 300 feet of separation is the design standard, therefore Taxiway F should be maintained in its current location. The minimum runway to runway separation standard is 700 feet, which allows simultaneous VFR approach and will improve airfield capacity. The location of the planned parallel runway, 700 feet from the primary runway and 300 feet from Taxiway F, will be maintained on the ALP to be consistent with the 2011 master plan.

Hold Line Separation

The distance that aircraft hold lines should be marked on taxiways is a function of the RDC. The hold lines for Runway 8-26 should be positioned 251 ft from the runway centerline. The standard distance of 250 ft is adjusted upward one foot for every 100 ft of elevation of the airport. At 76.8 ft above mean sea level (MSL), an additional one foot is added to the standard. The existing hold lines on Taxiways A, B, C, and D meet or exceed this standard and should be maintained until the next re-marking project, at which time they should be set at the standard distance.

Aircraft Parking Area Separation

Aircraft parking should be established outside any obstacle clearance surface. Based on the layout of the airfield and the location of the taxiways, no aircraft should be allowed to park in the taxiway/taxilane object free areas. Currently no aircraft parking positions are within any obstacle clearance surface.

Aircraft Hold Aprons

There are two primary aircraft hold aprons which are used for engine-runs up and final preflight checks. The larger of the two hold aprons is located adjacent to Taxiway A. This hold apron is designed to allow aircraft to pull into a designated spot prior to departure. There are eight designated hold apron positions. The hold apron is designed in a manner that places the holding aircraft outside the Taxiways A and G TOFA. This allows other aircraft to bypass those holding aircraft to access the runway threshold for departure. There have been several runway incursions at the threshold to Runway 26 from Taxiway A. As a result, FAA has identified this hold apron/threshold taxiway as an area of concern and have included it in the Runway Incursion Mitigation (RIM) program. The airport and FAA have agreed on a plan to re-design this hold apron to current standards by installing non-movement islands between each hold position. This project will reduce the hold apron capacity from eight to two. In the alternatives chapter, opportunities to increase aircraft holding capacity will be examined.

The other hold apron is located at the end of Taxiway E, and it is of a non-standard design. There are no marked centerlines to ensure that holding aircraft are not too close to the TOFA. The alternatives chapter will examine opportunities to reconfigure this hold apron.

RUNWAY LENGTH REQUIREMENTS

Aircraft operate on a wide variety of available runway lengths. Many factors will govern the suitability of those runway lengths, such as elevation, temperature, wind velocity, aircraft operating weight, wing flap settings, runway condition (wet or dry), runway gradient, vicinity airspace obstructions, and any special operating procedures. Runway 8-26 is 6,013 feet long. This runway length analysis will identify the optimal runway length based on these many factors and by following the FAA methodology, however, it should be noted that the maximum length of the runway, in accordance with the 1976 Joint Powers Agreement is 6,000 feet.

Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*, provides a five-step process for determining runway length needs.

1. Identify the list of critical design airplanes or airplane group.
2. Identify the airplanes or airplane group that will require the longest runway length at maximum certificated takeoff weight (MTOW).
3. Determine which of the three methods described in the AC will be used for establishing the runway length.
4. Select the recommended runway length from the appropriate methodology.
5. Apply any necessary adjustments to the obtained runway length.

The three methodologies for determining runway length requirements are based on the MTOW of the critical design aircraft or the airplane group. The airplane group consists of multiple aircraft with similar design characteristics. The three weight classifications are those with a MTOW of 12,500 pounds or less, those airplanes weighing over 12,500 pounds but less than 60,000 pounds, and those weighing 60,000 pounds or more. **Table 3D** shows these classifications and the three possible methodologies to use in runway length determination.

TABLE 3D | Airplane Weight Classification for Runway Length Requirements

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

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

Utilizing FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, the following presents the five-step process for determining the recommended runway length for Runway 8-26.

Step 1: Identify the critical design airplanes or airplane group.

The first step in determining the recommended runway length for an airport is to identify the critical aircraft or family grouping of aircraft with similar design characteristics. The critical aircraft or airplane group accounts for at least 500 annual operations. The FAA's Traffic Flow Management System Count (TFMSC) database documents those aircraft that fly IFR and/or file a flight plan to or from the airport. Local operations are not captured. **Table 3E** summarizes a selection of the aircraft in each of the three categories and shows their total operations count from 2022. All three categories exceed the 500 operations threshold.

TABLE 3E | Business Jet Categories for Runway Length Determination

75 PERCENT OF THE NATIONAL FLEET			75-100 PERCENT OF THE NATIONAL FLEET			GREATER THAN 60,000 POUNDS		
Make/ Model	**MTOW**	**Ops 2022**	**Make/ Model**	**MTOW**	**Ops 2022**	**Make/ Model**	**MTOW**	**Ops 2022**
Lear 35/36	20,350	14	Lear 55	21,500	6	Gulfstream II	65,500	28
Lear 40/45	20,500	252	Lear 60	23,500	120	Gulfstream IV	73,200	406
Cessna 550	14,100	226	Hawker 800XP	28,000	296	Gulfstream V, 500, 550	90,500	266
Cessna 560XL	20,000	398	Cessna 650	22,000	20	Gulfstream 600, 700	91600	246
IAI Westwind	23,500	12	Falcon 900/2000	45,500	266	Global 5000	92,500	100
Beechjet 400	15,800	56	Cessna 750 (X)	36,100	312	Global 7500	106,250	176
Falcon 50	40,780	116	Challenger 600/604	47,600	372	Global Express	98,000	336
Challenger 300	38,850	858	IAI Astra	23,500	8	Falcon 7x, 8x	70,000	48
	TOTAL	**1,932**		**TOTAL**	**1,400**		**TOTAL**	**1,606**

MTOW: Maximum Take Off Weight

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

While FAA guidance indicates that the recommended runway length should be determined by utilizing individual aircraft planning manuals, the following will first examine the runway length curves from the AC for business jets weighing between 12,500-60,000 pounds. This will provide a point of comparison and an indication of a minimum runway length to accommodate those aircraft. This will be followed by analysis of the individual aircraft planning manuals.

Step 2: Identify the airplanes or airplane group that require the longest runway length at maximum certificated takeoff weight (MTOW).

According to the TFMSC data, there have been between 5,000 and 8,000 annual jet operations over the last eight years at CMA. Since jet aircraft typically require the longest runway lengths, it is the grouping of large business jets that will be examined.

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

For this analysis, the runway length requirements will be examined utilizing the runway length charts in chapter three of FAA AC 150/53225-4B which groups business jets weighing over 12,500 pounds but less than 60,000 pounds into the following two categories:

- 75 percent of the fleet; and
- 100 percent of the fleet.

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

The AC indicates that the airport designer must determine which category to use for runway length determination. For each of the past 10 years, there have been over 500 operations by jet aircraft in the 100 percent of the fleet category; therefore, the 100 percent of the fleet category is used to determine future runway length for CMA.

There are two runway length curves presented in the AC under the 100 percent of the fleet category:

- 60 percent useful load; and
- 90 percent useful load.

The useful load is the difference between the maximum allowable structural weight and the operating empty weight (OEW). The useful load consists of passengers, cargo, and usable fuel. The determination of which useful load category to use will have a significant impact on the recommended runway length; however, it is inherently difficult to determine because of the variable needs of each aircraft operator.

Stage length is the term used to describe the length of the flight from take-off to landing in a single leg. If an aircraft has multiple stops along its route, then it would have multiple stage lengths. It is desirable for commercial and non-commercial operators to avoid unnecessary stops and multiple stage lengths for re-fueling purposes, if possible. Multiple fuel stops add cost, but more importantly, they add additional time to a total trip. For shorter flights, aircraft may carry less fuel/weight. For longer flights, aircraft must carry more fuel/weight. When high ambient temperatures and density altitudes (less dense air) are present, a higher fuel/weight becomes very critical in take-off performance; it requires longer available runway length. Currently, if ambient temperatures are high, many operators of large business jets may not be able to carry enough fuel to depart from CMA to the east coast, or to international destinations with full passenger and cargo useful loads without making an intermediate fuel stop; therefore, requiring multiple stage lengths. This is undesirable for both local based turbine aircraft operators, as well as transient aircraft who may be flight planning a fuel stop. In the case of a transient fuel stop for example, a flight crew transiting across the country will select an airport with adequate runway length for the fuel stop, so that additional fuel stops would not be necessary for the duration of the trip. This problem is compounded with FAR Part 135 charter operators who are required by regulation to comply with accelerate-stop distance (ASDA), accelerate-go distance, and balanced-field length. For cost and time purposes, sometimes pilots may also wish to “ferry fuel” so they may take on no fuel or less fuel at destinations, although, this is more of a common practice with FAR Part 135 or 121 air carriers than FAR Part 91 private operators.

Because of the variability in aircraft weights and stage lengths, the 60 percent useful load category is considered the default, unless there are specific known operations that would suggest using the 90 percent useful load category. Examples of a need to use the 90 percent useful load include regular air cargo flights, long stage flights (i.e., cross-country), or known fuel ferrying needs.

Utilizing subscription data available from the flight tracking company GCR, Inc., information about city pairs was obtained. From that data, in 2022, there were approximately 120 departures from CMA to destinations more than 1,000 miles away. These may be considered long-haul flights. Common destinations included New York, Florida, Hawaii, and Washington D.C. Because of these long-haul flights, there is a case to be made that the 90 percent useful load calculation should apply for determining a recommended runway length at CMA; however, for this analysis, the default 60 percent useful load category will be used as the long-haul flights are a small portion of the operations.

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

The next step is to examine the 100 percent of the fleet at 60 percent useful load performance chart in the AC (**Figure 3-1**). This chart requires the following knowledge:

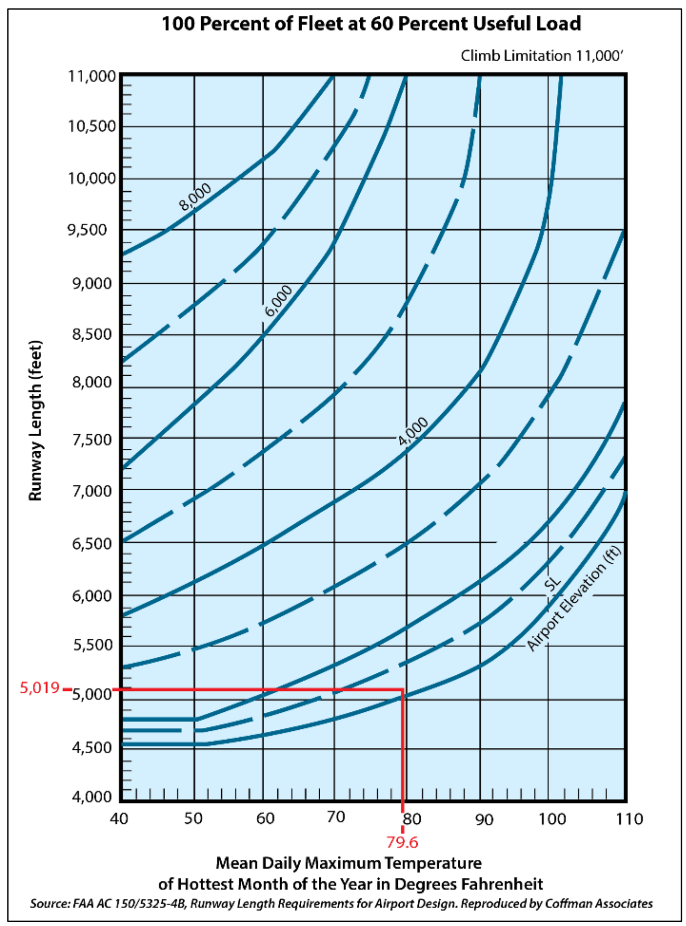


Figure 3-1: Raw Runway Length Estimate

- The mean maximum daily temperature of the hottest month: September at 79.6°(F).
- The airport elevation: 76.8 feet above mean sea level (MSL).

By locating the appropriate temperature and airport elevation on the performance chart, the recommended runway length, without any adjustments, is 5,019 feet as shown on **Figure 3-1**.

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

The recommended runway length determined in Step #4 is based on no wind, a dry runway surface, and zero effective runway gradient; therefore, the following criteria are applied:

- Wet runway surface
- 0.22 percent effective runway gradient (13.7 feet of elevation difference for Runway 8-26)

By regulation, the runway length obtained from the 60 percent useful load performance chart used in Step #4 is increased by 15 percent or up to 5,500 feet, whichever is less, for wet runway conditions.

The runway lengths obtained from Step #4 are increased at the ratio of 10 feet for each foot of elevation difference between the high and low points of the runway centerline. At CMA, this equates to an additional 137 feet of required runway length.

Table 3F summarizes the data inputs and the final recommended runway length of 5,500 feet for business jets with a maximum takeoff weight between 12,500-60,000 pounds. This runway length applies to the category of "100 percent of the fleet at 60 percent useful load". The table also shows the calculated runway length associated with the three other fleet mix categories, including the "100 percent of the fleet at 90 percent useful load" category (7,600 feet) as a point of comparison.

TABLE 3F | Runway Length Requirements

Airport Elevation	76.8' feet above mean sea level			
Average High Monthly Temp.	79.6 degrees (Sept.)			
Runway Gradient	0.22% Runway 8-26 (13.7')			
Fleet Mix Category	**Raw Runway Length from FAA AC**	**Runway Length with Gradient Adjustment**	**Wet Surface Landing Length for Jets (+15%)***	**Final Runway Length**
75% of fleet at 60% useful load	4,594'	4,731'	5,283'	5,300'
100% of fleet at 60% useful load	5,019'	5,156'	5,500'	5,500'
75% of fleet at 90% useful load	6,008'	6,145'	6,909'	6,900'
100% of fleet at 90% useful load	7,441'	7,578'	7,000'	7,600'

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

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

Aircraft Flight Planning Manual Method for Runway Length Determination

CMA has over 1,000 documented operations by aircraft weighing more than 60,000 pounds; therefore, the appropriate method for determination of a recommended runway length is to examine the flight planning manuals of common aircraft operating at the airport with a maximum takeoff weight of more than 60,000 pounds.

The required take-off and landing lengths for maximum load and range (adjusted for temperature and elevation) for many of the turbine aircraft utilizing the airport are presented in **Table 3G**, for both dry and wet pavement conditions. The table includes several aircraft with MTOW over 60,000 pounds, but it also includes other common business jets. The takeoff distance requirements reflect the maximum gross weight for the aircraft; however, the percentage of useful load has also been calculated for the existing 6,013-foot runway length. When the runway length requirement exceeds the available runway length at the given design temperature, aircraft operators may be required to reduce payload. Runway length requirements that exceed the current length of Runway 8-26 are noted in red type.

Business jets may operate under different regulations depending on the type of flight being conducted, as noted in **Table 3G**. These regulations may impact the calculated runway available for landing. CFR Part 91 subpart k refers to operations conducted via fractional ownership, and Part 135 refers to commuter/on-demand (charter) operations. Fractional operators must be capable of landing within 80 percent of the landing distance available (LDA), and commuter/on-demand operators must be capable of landing within 60 percent of LDA. Operations conducted under CFR Part 25 are general aviation operations conducted by private owners, which are unfactored. It should be noted that the landing length requirements assume the aircraft is at maximum landing weight, which is rare because during flight, fuel is burned, and the aircraft becomes lighter.

Under normal operating conditions (MTOW and 79.6°F) nearly all business jets can take off from the airport under both wet and dry conditions. The Gulfstream V (and 550/650) and the Lear 60 may be slightly weight restricted. In terms of landing length requirements, those operating under Part 25 (general aviation), only the Gulfstream IV needs a landing length greater than the existing runway length at maximum landing weight. As we look at the landing length requirements for Part 135 or Part 91k operators, at maximum landing weight some of these may be restricted.

Runway Length Summary

Camarillo Airport is a reliever airport and is thus designed and intended to accommodate business jet activity. Two FAA methodologies for determining a recommended runway length have been calculated. The first applies to those business jets with a MTOW of less than 60,000 pounds, and the second applies to those with a MTOW of more than 60,000 pounds. The first resulted in a recommended runway length of 5,500 feet; however, it is the second method that applies to CMA because the number of documented operations conducted by business jets with a MTOW of more than 60,000 pounds exceeds the 500 annual operations threshold. The second method requires the examination of the flight planning manuals for individual aircraft. A few aircraft may be weight restricted for takeoff and a few more on landing, depending on the operating type. Overall, the existing runway length is adequate and is consistent with the JPA, however, when feasible and associates with a runway rehabilitation project, consideration should be given to reducing the length to 6,000 feet as specified in the JPA.

TABLE 3G | Runway Length Requirements for Business Jets

Airfield Parameters	Elevation: 76.8' MSL										
	Temp: 79.6°F										
	0.22% Runway 8-26 (13.7' difference)										
Runway Parameters	Take-off Length Required at MTOW		% Useful Load for Takeoff on 6,013' Runway		Landing Length Requirements						
					C.F.R. Part 25 (Unfactored)		C.F.R. Part 135 (60% factored)		C.F.R. Part 91k (80% factored)		
Runway Condition	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	
Beechjet 400A	4,736	5,901	100%	100%	3,631	5,377	6,052	8,962	4,539	6,721	
Citation 560 XLS	3,906	3,943	100%	100%	3,389	5,333	5,648	8,888	4,236	6,666	
Citation X	5,898	6,672	100%	100%	3,698	5,220	6,163	8,700	4,623	6,525	
Citation Bravo	4,323	4,628	100%	100%	3,459	5,422	5,765	9,037	4,324	6,778	
Citation Encore	3,831	5,208	100%	100%	2,988	4,531	4,980	7,552	3,735	5,664	
Citation I/SP	3,422	3,936	100%	100%	2,345	2,696	3,908	4,493	2,931	3,370	
Citation Sovereign	4,215	4,501	100%	100%	2,853	3,604	4,755	6,007	3,566	4,505	
Citation (525) CJ1	4,325	N/A	100%	100%	2,852	3,865	4,753	6,442	3,565	4,831	
Citation (525A) CJ2	3,668	3,964	100%	100%	3,175	4,618	5,292	7,697	3,969	5,773	
Citation CJ3	3,440	3,905	100%	100%	2,994	4,091	4,990	6,818	3,743	5,114	
Challenger 300	5,737	6,018	100%	100%	2,610	5,003	4,350	8,338	3,263	6,254	
Falcon 50EX	5,490	6,058	100%	98%	2,930	3,369	4,883	5,615	3,663	4,211	
Gulfstream V	6,832	7,610	91%	82%	2,789	3,207	4,648	5,345	3,486	4,009	
Gulfstream IV	5,862	6,703	100%	87%	3,637	6,971	6,062	11,618	4,546	8,714	
Lear 45XR	5,475	N/A	100%	100%	2,755	3,484	4,592	5,807	3,444	4,355	
Lear 60	6,478	6,967	91%	81%	3,521	4,690	5,868	7,817	4,401	5,863	

KEY: MSL - Mean Sea Level; MTOW - Maximum takeoff weight; CFR - Code of Federal Regulations.
CFR Part 25: Standard unfactored landing lengths.
CFR Part 135: 60% factored landing length as required by commuter/on-demand operators.
CFR Part 91k: 80% factored as required by fractional operators.
BL: Brake Limited
O/L: Weight limited due to climb performance
N/A: No data available
Figures in red exceed the available runway length.

Source: Aircraft operating manuals from UltraNav software.

RUNWAY WIDTH

Currently, the runway width (150 feet) at CMA meets the requirement for the current and projected future aircraft mix. In fact, it exceeds the design standard of 100 feet. There are certain conditions where a runway that is wider than standard can be maintained (by FAA standard):

- If the critical aircraft has a MTOW of more than 150,000 pounds, then a 150-foot-wide runway is acceptable; or
- If a crosswind runway is eligible but not feasible, then a wider primary runway is acceptable.
- If the sponsor agrees to fund the extra width until a time when the wider standard applies.

It is not anticipated that the critical aircraft will ever have a MTOW greater than 150,000 pounds because of the Joint Powers Agreement which specifically limits aircraft to 115,000 pounds. With a current wind coverage of greater than 95 percent, the airport is not eligible for a crosswind runway; therefore, to maintain the current runway width in the future, the sponsor may have to maintain the additional width. It is not typical for the FAA to require narrowing a runway for routine maintenance or rehabilitation. But when it comes time to reconstruct the runway, that is when FAA may only support the standard 100-foot width.

RUNWAY BLAST PADS

Some runways are equipped with blast pads beyond the ends of the runway to reduce the erosive effect of jet blast and propeller wash. Blast pads are not a required element of a runway. Both ends of Runway 8-26 have blast pads. The standard dimensions for a blast pad for Camarillo are 200 feet long by 140 feet wide. The blast pads at CMA far exceed this standard. Behind the Runway 8 threshold the blast pad is 990 feet long and 150 feet wide. This is acceptable, and it does provide additional paved area in the event of an overrun. Maintaining it at its current length would represent a modest expense. The blast pad behind the Runway 26 threshold is 2,700 feet long and 150 feet wide. It is this size because of the reduction in runway length to comply with the JPA. It is not necessary to maintain all that pavement. The airport might consider removing a portion of this very long blast pad to prevent an aircraft from inadvertently taxiing directly to the runway threshold from the blast pad. If the airport were to consider removing a portion of this blast pad, it should remove a center section that is contained within the RPZ. By doing this, the eastern section can be utilized and accessed via Taxiway G1.

PAVEMENT STRENGTH

The most important feature of airfield pavement is its ability to withstand repeated use by aircraft of significant weight. The current published strength rating for Runway 8-26 is 50,000 pounds single wheel type gear, and 80,000 pounds for dual wheel gears. The airport currently has activity by dual wheel business jets that exceed the current strength rating of the runway. In fact, the critical aircraft has a MTOW of nearly 100,000 pounds; therefore, it is recommended that the pavement strength be increased to accommodate the MTOW weight of the critical aircraft. The pavement should be no more than 115,000 for dual wheel gears, but a strength of 100,000 pounds would be adequate for the current and future critical aircraft.

It should be noted that the pavement strength rating is not the maximum weight limit. Aircraft weighing more than the certified strength can operate on the runway on an infrequent basis; however, frequent operations by heavier aircraft shorten the lifespan of airport pavements.

Any taxiway that will accommodate movements of the critical aircraft should be strong enough to support those movements. This includes Taxiways A, B, C, D, E, F, and any taxilanes providing access to hangars that may be used to store larger aircraft. In addition, aircraft aprons that will support the movement or parking of the critical aircraft should also be strength rated to accommodate these heavier aircraft.

RUNWAY LINE-OF-SIGHT AND GRADIENT

FAA has instituted various line-of-sight requirements to facilitate coordination among aircraft and between aircraft and vehicles that are operating on active runways. This allows departing and arriving aircraft to verify the location and actions of other aircraft and vehicles on the ground that could create a conflict.

Line-of-sight standards for an individual runway are based on whether there is a parallel taxiway available. When a full-length parallel taxiway is available (as it is for Runway 8-26), thus facilitating faster runway exit times, then any point five feet above the runway centerline must be mutually visible, with any other point five feet above the runway centerline for a distance of up to half the length of the runway. The runway meets the line-of-sight standard.

Most runways are not perfectly flat; therefore, there are standards for runway surface gradient, which is maximum allowable slope for a runway. For Runway 8-26, the maximum longitudinal grade is no more than 1.5 percent; however, longitudinal grades may not exceed 0.8 percent in the first and last quarters of the runway or the first and last 2,500 feet of the runway. The runway slopes upward from west to east at a grade of 0.22 percent, thus meeting the gradient standard.

TAXIWAY/TAXILANE DESIGN STANDARDS

Design standards are different for taxiways and taxilanes. Taxiways are the primary movement surfaces to and from the runway and typically include a parallel taxiway, runway connectors, and apron connectors serving the critical aircraft. Taxilanes are distinguished from taxiways in that they do not provide access to or from the runway system directly. Taxilanes typically provide access to hangar areas and thus accommodate a slower movement speed. As a result, taxilanes can be constructed to varying design standards depending on the type of aircraft utilizing the taxilane. For example, a taxilane leading to a T-hangar area only needs to be designed to accommodate those aircraft accessing a T-hangar.

The taxiway width standard is a function of the taxiway design group (TDG) of the critical aircraft. As documented in the forecast chapter, the current and future TDG is “2B”, which has a width standard of 35 feet. All the taxiways and taxilanes at CMA are 50 feet wide except for Taxiway E, at the Runway 8 threshold, which is 75 feet wide.

As noted in the forecast chapter, there is a possibility that the critical TDG could transition to “3”, which has different standards than TDG “2B;” however, when any of the taxiways are planned to be reconstructed the airport should re-evaluate the current operating fleet mix to determine if TDG “2B” remains the critical TDG. If so, then FAA may only fund reconstruction at 35 feet in width. Should the airport wish to maintain 50-foot-wide taxiways, then they would have to fund the remaining 15 feet of width. For purposes of this study, 35-foot-wide taxiways are the applicable planning standard and will be depicted on the airport layout plan.

Table 3H outlines the taxiway and taxilane standards that apply at CMA. In addition to the standard width, taxiways/taxilanes also have obstacle clearance surfaces centered on them to protect the aircraft.

TABLE 3H | Taxiway Dimensions and Standards

STANDARDS BASED ON WINGSPAN	ADG III	
Taxiway Protection		
Taxiway Safety Area (TSA) width	118'	
Taxiway Object Free Area (TOFA) width	171'	
Taxilane Object Free Area width	158'	
Taxiway Separation		
Taxiway Centerline to:		
Fixed or Movable Object	85.5'	
Parallel Taxiway/Taxilane	144'	
Taxilane Centerline to:		
Fixed or Movable Object	79'	
Parallel Taxilane	138'	
Wingtip Clearance		
Taxiway Wingtip Clearance	27'	
Taxilane Wingtip Clearance	20'	
STANDARDS BASED ON TDG	**TDG 2B**	**TDG 3**
Taxiway Width Standard	35'	50’
Taxiway Edge Safety Margin	7.5'	10’
Taxiway Shoulder Width	15'	20’

ADG: Airplane Design Group
TDG: Taxiway Design Group

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

OTHER TAXIWAY DESIGN CONSIDERATIONS

FAA AC 150/5300-13B, *Airport Design*, provides guidance on taxiway design that has a goal of enhancing safety by providing a taxiway geometry that reduces the potential for runway incursions. A runway incursion is defined as, “any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft.”

The following is a list of the taxiway design guidelines, as well as the basic rationale behind each recommendation:

- *Taxi Method*: Taxiways are designed for “cockpit over centerline” taxiing, with pavement being sufficiently wide to allow a certain amount of wander. On turns, enough pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading existing intersections should be undertaken to eliminate judgmental over-steering, which is when the pilot must intentionally steer the cockpit outside the marked centerline to assure the aircraft remains on the taxiway pavement.
- *Steering Angle*: Taxiways should be designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing.
- *Three-Node Concept*: To maintain pilot situational awareness, taxiway intersections should provide a pilot with a maximum of three choices of travel. Ideally, these are right and left angle turns and a continuation straight ahead.

- *Intersection Angles*: Design turns to be 90 degrees wherever possible. For acute angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.
- *Runway Incursions*: Design taxiways to reduce the probability of runway incursions.
- *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiway systems simple using the “three nodes” concept.
- *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot’s eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, avoid direct access to a runway.
- *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold – through simple reduction in the number of occurrences, and through a reduction in air traffic controller workload.
- *Avoid “High Energy” Intersections*: These are intersections in the middle third of runways. By limiting runway crossings to the first and last thirds of the runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
- *Increase Visibility*: Right angle intersections, both between taxiways and runways, provide the best visibility. Acute angle runway exits provide for greater efficiency in runway usage but should not be used as runway entrances or crossing points. A right angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.
- *Avoid “Dual Purpose” Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.
- *Indirect Access*: Do not design taxiways to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.
- *Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other hot spots should be corrected as soon as practicable.

Runway/Taxiway Intersections:

- *Right Angle*: Right angle intersections are the standard for all runway/taxiway intersections, except where there is a need for a high-speed exit. Right angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs, so they are visible to pilots.
- *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high-speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage.

- *Large Expanses of Pavement*: Taxiways must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a single area create large expanses of pavement, making it difficult to provide proper signage, marking, and lighting.
- *Taxiway/Runway/Apron Incursion Prevention*: Apron locations that allow direct access into a runway should be avoided. Increase pilot situational awareness by designing taxiways in such a manner that forces pilots to consciously make turns. Taxiways originating from aprons and forming a straight line across runways at mid-span should be avoided.
- *Wide Throat Taxiways*: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and make lighting and marking more difficult.
- *Direct Access from Apron to a Runway*: Avoid taxiway connectors that cross over a parallel taxiway and directly onto a runway. Consider a staggered taxiway layout that forces pilots to make a conscious decision to turn.
- *Apron to Parallel Taxiway End*: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.

FAA AC 150/5300-13B, *Airport Design,* states that "existing taxiway geometry should be improved whenever feasible, with emphasis on designated hot spots. To the extent practicable, the removal of existing pavement may be necessary to correct confusing layouts."

Taxiway B is of an unusual geometry. It has a wide throat at the intersection with the runway, and it is a curving taxiway. Taxiways C and D are similar in that they are also curving taxiways. Taxiways B and C may also be considered to provide direct access from apron areas to the runway. Taxiway E, leading to the Runway 8 threshold, is at an angle which forces pilots to hold at an angle to the runway, thus limiting peripheral views. All taxiways will be examined in the alternatives analysis to determine if there are potential re-alignment opportunities that will enhance operational safety.

Exhibit 3B identifies the main standards and geometry issues to be addressed during this study.

INSTRUMENT NAVIGATIONAL AIDS, APPROACH LIGHTING AND VISUAL AIDS

Camarillo Airport has a good level of instrument approach capability to both runway ends. Runway 8 has a GPS approach with 1-mile visibility minimums. Runway 26 has a GPS approach with ¾-mile visibility minimums. The approach to Runway 26 is a Localizer Performance with Vertical Guidance (LPV) instrument approach. Even though LPV approaches have vertical guidance, they are not considered a precision approach. LPVs are an approach with vertical guidance (APV). APV approaches do not meet the ICAO and FAA precision approach definitions, which apply mostly to localizer and glideslope transmitters.

Previous study and the current ALP recommended improving the approach to Runway 26 with an instrument landing system (ILS), which would provide both vertical and horizontal guidance and may allow for ½-mile visibility minimums. The approach RPZ associated with an ILS instrument approach is larger than the current ¾-mile RPZ. The airport has proactively protected the additional land where the ½-mile RPZ would lay. Generally, ½-mile visibility minimums are the lowest available to general aviation airports and are standard for reliever airports like CMA. The benefit of low visibility minimums is that airports can remain operational even in poor visibility conditions, which has an economic impact benefit. An ILS approach requires a medium intensity approach lighting system with runway alignment indicator lights (MALSR). A MALSR is a lighted grid that is 2,400 feet long leading to the landing threshold. It also requires a localizer and glideslope antenna.

FAA, through its NextGen program, desires to increase the accuracy of GPS approaches so that they can provide ½-mile visibility minimums without the need for a localizer or glideslope antenna. In fact, installations of traditional ILS approaches are rare and reserved for busy commercial service airports. While the existing ¾-mile visibility minimums for approaches to Runway 26 are good, the current 2011 master plan reserves space for ½-mile visibility minimums. Continuing to reserve the space needed and the potential for ½-mile visibility minimums is recommended.

The current ALP and 2011 master plan consider improving the approach to Runway 8 with a GPS LPV approach with ¾-mile visibility minimums. Approaches with ¾-mile visibility minimums do not require any additional ground-based equipment, so this approach is planned as a GPS approach.

To provide pilots with visual guidance information during landings on the runway, electronic visual approach aids are commonly provided at airports. Currently, both ends of the runway are equipped with a four-light precision approach path indicator (PAPI-4). These should be maintained. Both ends are also equipped with runway end identifier lights (REIL). REILs provide landing pilots with a quick indication of the location of the landing threshold. These should be maintained.

The airport has three lighted windsocks which provide pilots with a visual indication of the wind direction and intensity. These should be maintained. The primary windsock is located within the segmented circle. The segmented circle provides pilots with a visual understanding of the traffic pattern to each runway end. The segmented circle is required for airports that do not have a 24-hour ATCT. The segmented circle should be maintained.

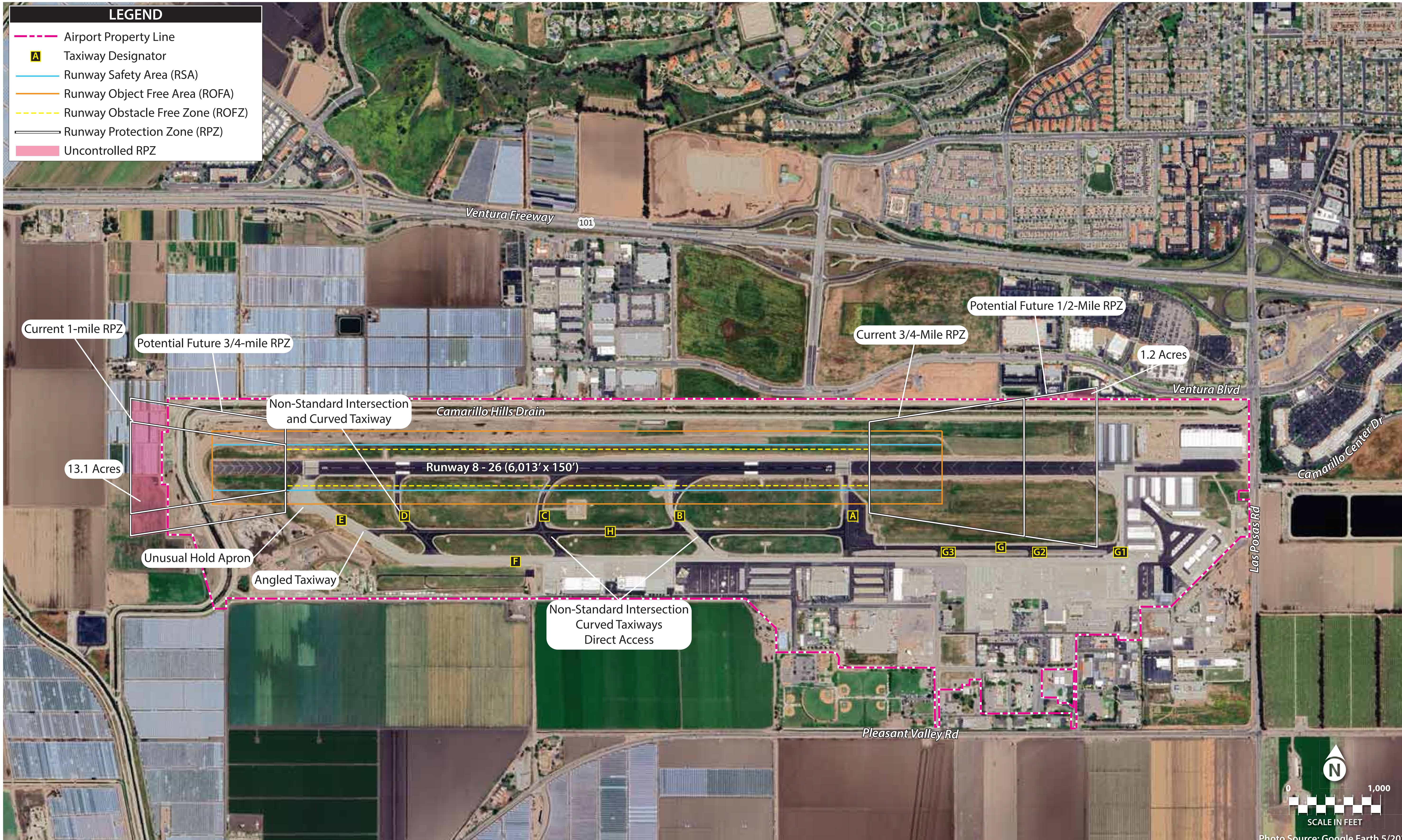
AIRFIELD MARKING, LIGHTING AND SIGNAGE

Runway markings are designed according to the type of straight-in instrument approaches available to each runway end. Currently, both ends have non-precision markings. If a precision approach is implemented for Runway 26, then precision markings should be installed. The current non-precision marking for Runway 8 should be maintained. The runway is equipped with medium intensity edge lighting. If a precision approach is implemented, the edge lights should be upgraded to high-intensity edge lights.

All taxiways are equipped with medium intensity taxiway edge lighting. This is appropriate and should be maintained.

The airport has a full sign system that meets the standards outlined in FAA AC 150/5340-18G, *Standards for Airport Sign Systems*. The signage system should be maintained.

The airport beacon is in the process of being relocated from atop the old water tower to a stand-alone tilt pole located near the airfield electrical vault. This is a good location, and the beacon should be maintained.


LEGEND
Airport Property Line
Taxiway Designator
Runway Safety Area (RSA)
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Runway Protection Zone (RPZ)
Uncontrolled RPZ
Ventura Freeway
101
Current 1-mile RPZ
Potential Future 3/4-mile RPZ
Non-Standard Intersection and Curved Taxiway
Camarillo Hills Drain
Current 3/4-Mile RPZ
Potential Future 1/2-Mile RPZ
1.2 Acres
Ventura Blvd
Camarillo Center Dr
Runway 8 - 26 (6,013' x 150')
13.1 Acres
Unusual Hold Apron
Angled Taxiway
Non-Standard Intersection
Curved Taxiways
Direct Access
Las Posas Rd
Pleasant Valley Rd
A
B
C
D
E
F
G
G1
G2
G3
H
N
0
1,000
SCALE IN FEET
Photo Source: Google Earth 5/2023

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AIRPORT TRAFFIC CONTROL

The tower at CMA was constructed in 1992. It is open from 7:00 a.m. to 9:00 p.m. daily. It is located south of the mid-point of the runway, which is an ideal location. Controllers have direct visibility to all movement areas that they control including the runway and parallel taxiways. The control tower should be maintained.

AIRSIDE SUMMARY

Camarillo Airport has a nice complement of airside systems with only a few noted areas of improvement needed. At 6,113 feet in length, the runway can meet the needs of most aircraft operating there today. Under certain heavy loading conditions, some aircraft may be slightly weight restricted. The runway is 13 feet longer than the limitation of the JPA. It is recommended that the runway be shortened to 6,000 feet to fully comply with the JPA. A loss of 13 feet will have little if any impact on aircraft operations.

The primary taxiways are all at least 50 feet wide while the applicable design standard is 35 feet. When reconstruction is considered for any of the taxiways, they should be constructed at the standard width, unless the airport wishes to maintain wider taxiways. Any additional width beyond standard would be the responsibility of the airport sponsor.

The airport has good instrument approaches with 1-mile visibility minimums to Runway 8 and ¾-mile visibility minimums to Runway 26. Consideration is given to ¾-mile visibility minimums to Runway 8 and ½-mile visibility minimums to Runway 26. The alternatives chapter will address the airside element improvements identified in this chapter; however, it is anticipated that potential implementation of lower visibility minimums would occur beyond the five-to-10-year scope of this ALP Update.

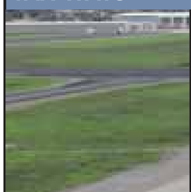
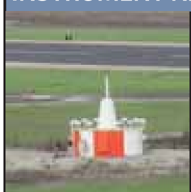
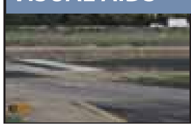
A summary of the airside facility needs is shown on **Exhibit 3C**.

LANDSIDE REQUIREMENTS

Landside facilities provide the essential interface between the airside facilities and ground access to and from the airport. The capacities of existing facilities have been examined against the projected requirements to gauge anticipated timing of needs. The following are included in the analysis: aircraft storage, aircraft apron requirements, general aviation terminal services, automobile parking, and fuel storage capacity.

AIRCRAFT STORAGE HANGARS REQUIREMENTS

The demand for aircraft storage hangar space is based upon the forecast number and mix of aircraft expected to be based at Camarillo Airport in the future. Most based aircraft are stored in either individual hangars or shared conventional hangars; however, a portion of based aircraft owners will elect to utilize apron tie-down positions. Over time, if hangar space was available, more owners who currently utilize tie-down positions are likely to instead lease a hangar space.

	AVAILABLE	POTENTIAL IMPROVEMENT/CHANGE
RUNWAYS		
	RUNWAY 8-26	
	RDC: D-III-4000	D-III-2400
	Runway length/width: 6,013' x 150'	6,000' x 100'
	Pavement strength: 50(S)/80(D)/125(DD)	Increase to 60(S) and 100,000 (D)
	RSA: 500' wide x 1,000' beyond runway ends	Acceptable - Maintain
	ROFA: 800' wide x 1,000' beyond runway ends	Acceptable - Maintain
	OFZ: 400' wide x 200' beyond runway ends	Acceptable - Maintain
	RPZ ownership: Partial ownership	Acceptable - Maintain (Acquire if feasible)
	RPZ Incompatibilities	Acceptable - Maintain (No incompatibilities)
	Markings: Non precision (8)/ Non precision (26)	Markings: Acceptable- Maintain
	Medium intensity runway lighting (MIRL)	Acceptable - Maintain
TAXIWAYS		
	TDG-2B	TDG - 3
	Centerline markings	Acceptable - Maintain
	Width standard is 35 feet	Consider 50' taxiway width
	Medium intensity taxiway lighting (MITL)	Acceptable - Maintain
	Taxiway layout/geometry deficiencies	Redesign taxiway layout/geometry deficiencies
INSTRUMENT NAVIGATION AND WEATHER AIDS		
	ASOS	Acceptable - Maintain
	Beacon (new location)	Acceptable - Maintain
	3 Windsocks/Segmented Circle	Acceptable - Maintain
	1-mile GPS approach (Rwy 8)	Consider ¾-mile GPS approach (Rwy 8)
	¾-mile GPS approach (Rwy 26)	Consider ½-mile GPS approach (Rwy 26)
VISUAL AIDS		
	PAPI-4L (8-26)	Acceptable - Maintain
	REILs (8-26)	Acceptable - Maintain
	Approach Lighting System (N/A)	Not Required

KEY

ASOS - Automated Surface Observation System
MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
OFZ - Obstacle Free Zone
PAPI - Precision Approach Path Indicator
RDC - Runway Design Code
REIL - Runway End Identification Lights
RSA - Runway Safety Area
ROFA - Runway Object Free Area
RPZ - Runway Protection Zone
TDG - Taxiway Design Group

An estimate of future hangar space needs has been developed and is presented in **Table 2J**. Some aircraft will be stored in smaller T-hangars while others may be stored in larger box and conventional hangars. Hangar needs are based on the average space an aircraft may occupy in a hangar which is estimated at 3,000 square feet per aircraft.

TABLE 3J | Forecast Hangar Needs

	2022	2027	2032	2042
Based Aircraft	350	371	389	444
Based Aircraft to be Hangared	262	289	319	382
New Hangar Area (sf)	NA	81,000	171,000	360,000
Note: New hangar area need estimated at 3,000 sf per new hangered based aircraft.				

Source: Coffman Associates analysis.

It is estimated that the airport will need an additional 81,000 square feet of hangar space over the next five-to-10-years to accommodate demand within the scope of this study. The landside alternatives evaluation will examine the options available for hangar development at the airport and determine the best location for each type of hangar facility. With the addition of the new Cloud 9 hangar complex, the airport has some capacity available for those needing space in large conventional hangars. There is a current need for smaller T-hangars and smaller box hangars. In addition, several of the existing smaller T-hangars/ Port-a-Ports/ and box hangars are well beyond their useful life. The location of these hangars may be an opportunity for redevelopment. The alternatives chapter will identify potential redevelopment sites.

AIRCRAFT PARKING APRON REQUIREMENTS

Aircraft parking aprons should provide for the locally based aircraft that are not stored in hangars and transient aircraft. As noted in Chapter 1 – Inventory, it is estimated there are approximately 113,500 square yards (sy) of aircraft parking apron available. Of this total, approximately 48,600 sy are primarily utilized for locally based aircraft owners. The remaining 64,900 sy are intended for transient users, including approximately 20,000 sy available for public transient users. In total, there are 193 individual parking positions which include four helicopter hardstands.

For planning purposes, the percentage of based aircraft not assigned to hangars will be used to determine the parking apron requirements for local aircraft. The average area requirement for parking of locally based aircraft is smaller than for transient aircraft since the typical mix of transient aircraft has a larger footprint. A planning criterion of 650 sy per local tie-down aircraft position was used to determine the apron requirements for local aircraft.

Future transient apron need is a function of transient busy day operations and an estimate of how many operators may utilize the transient aprons and how many may be on the ground at the same time. A planning criterion of 800 sy for smaller aircraft and 1,600 sy for larger aircraft is utilized. Total aircraft parking apron requirements are presented in **Table 3K**.

TABLE 3K | Aircraft Apron Requirements

	FORECAST			
	Currently Available (2022)	Short Term	Intermediate Term	Long Term
Local Apron Positions	130	92	80	72
Local Apron Area (sy)	48,600	59,600	52,000	46,900
Transient Apron Positions	63	62	66	75
Piston Transient Positions	38	31	33	38
Turbine Transient Positions	25	31	33	38
Transient Apron Area (sy)	64,900	74,700	78,700	90,100
Total Apron Area (sy)	**113,500**	**134,300**	**130,700**	**137,000**

Source: Coffman Associates analysis

The existing local apron area does not meet the short-term demand; however, as more hangars are constructed and more of the currently tied-down aircraft are moved to hangars, the long-term local tie-down apron area need is met. As transient activity increases, there is a projected need for additional transient apron, especially for larger turbine aircraft. Some portion of the identified apron needs may also be dedicated for other parking needs such as helicopters or urban air mobility (UAM) aircraft.

It is estimated that over the next 20 years, an additional 23,500 sy of total apron area will be needed. A portion of the new apron area is likely to be met by private developers that construct hangars. Additional public transient apron may also be needed should forecast demand materialize. It should be noted that on busier days, it is common for areas generally intended for local tie-down needs to be used for transient needs.

GENERAL AVIATION TERMINAL SERVICES

General aviation terminal services have several functions: a pilots' lounge, flight planning, concessions, airport management, and restrooms. Many airports will also have leasable space in the terminal building for such features as a restaurant or concessions area, FBO line services, and other needs. These functions at CMA are generally provided by the FBO as there is not a dedicated terminal building.

The methodology used in estimating general aviation terminal facility needs is based on the number of airport users expected to utilize these facilities during the design hour. General aviation space requirements are based upon providing 120 square feet per design hour itinerant passenger. Design hour itinerant passengers are determined by multiplying design hour itinerant operations by the estimated number of passengers on the aircraft (multiplier).

Combined, it is estimated that the FBOs provide approximately 15,000 square feet of public space available to aviation customers. Based on calculation estimates of space needed, this will be adequate through the long-term planning period. Certain airport businesses may find it desirable to provide some of these terminal services as part of their overall business plan as well.

The department of airports should consider providing a dedicated general aviation terminal building. These facilities meet certain needs of the flying public such as flight planning services, restrooms, meeting space, restaurants, but they also serve as the “front door” to the community. That first impression can be important to a business developer or corporate executive who is involved in investment decisions in the community. A good first impression can be an important consideration. Since the FBO’s already provide some of the typical terminal services, the size of a county owned terminal is variable. In addition to the above-mentioned functions, GA terminals often include administration space. For planning purposes, a county-owned terminal of at least 15,000 square feet will be considered and sited during the alternatives analysis.

Table 3L summarizes the terminal needs at the airport.

TABLE 3L | General Aviation Terminal Area Facilities

	Existing	Short Term	Intermediate Term	Long Term
Design Hour Operations	89	92	95	103
Design Hour Itinerant Operations	47	49	50	55
Multiplier (people per aircraft)	2.0	2.0	2.0	2.0
Total Design Hour Itinerant Passengers	94	98	101	109
FBO GA Services Space (sf)	15,000 (est.)	11,700	12,100	13,100

Source: Coffman Associates analysis

AUTOMOBILE PARKING

Planning for adequate automobile parking is a necessary element for any airport. Parking needs can effectively be divided between transient airport users and locally based users. Transient users include those employed at the airport and visitors, while locally based users primarily include those attending to their based aircraft. A planning standard of 1.9 times the design hour passenger count provides the minimum number of vehicle spaces needed for transient users. Locally based parking spaces are calculated as half the number of based aircraft.

Most of the larger corporate and conventional hangars have dedicated vehicle parking lots, while the smaller hangars and T-hangars do not. Users of the T-hangars typically will traverse the non-movement areas (aprons and taxilanes) to access their hangar, then park the car in the hangar when using their aircraft. Ideally, dedicated parking lots would be available for T-hangar users. Any future corporate and conventional hangar construction should include dedicated vehicle parking lots. Consideration should also be given to future T-hangars; however, this is not required.

FUEL STORAGE CAPACITY

Additional fuel storage capacity should be planned if CMA is unable to maintain an adequate supply and reserve—a 14-day reserve being common for general aviation airports. From 2015 through 2018, total fuel sales increased by 3.07 percent annually. In 2022, Jet A sales were 80.0 gallons per turbine operation, and AvGas sales were 3.0 gallons per piston operation.

Table 3M presents a forecast of fuel demand through the planning period. By the long-term planning period, additional Jet A storage capacity may be needed to maintain a 14-day reserve supply. Avgas fuel storage capacity is adequate through the planning period.

TABLE 3M | Fuel Storage Requirements

	Current Capacity (gal.)	Baseline Consumption (2022)[1]	Short Term	Inter. Term	Long Term
Jet A Requirements					
Annual Usage (gal.)	128,000	1,307,840	1,979,280	2,612,800	4,457,840
Daily Usage (gal.)		3,583	5,423	7,158	12,213
14-Day Storage (gal.)		50,164	75,918	100,217	170,986
Avgas Requirements					
Annual Usage (gal.)[2]	46,000	512,184	503,390	499,592	481,347
Daily Usage (gal.)		1,403	1,379	1,369	1,319
14-Day Storage (gal.)		19,645	19,308	19,162	18,463

[1]*Airport fuel report. Gal. = gallon*

Several alternative fuel types are currently being researched for use as aviation fuel. This includes unleaded fuel, high octane automobile fuel, and hydrogen fuel. Each of these would need dedicated storage tanks. The need for these fuels is not apparent yet but may come on-line in the coming years. Generally, the need for these alternative tanks would be in addition to Jet A and Avgas fuel needs. **Exhibit 3D** summarizes the landside facility requirements.

SUMMARY

This chapter has outlined facility requirements for CMA for a 20-year planning period. An ALP Update like this study only requires a five-to-10-year analysis but a full 20-years has been shown so that airport management can anticipate potential improvements well in advance of actual need. In addition, the forecast element of this study was used in the concurrent Part 150 noise study and that study requires a 20-year forecast.

At its current length of 6,013 feet, Runway 8-26 is adequate to meet the needs of current airport users. There may be times, especially on very hot days, where certain business jets may be weight restricted but this likely is not a regular occurrence. In addition, the JPA airport operating agreement restricts the total length of the runway; therefore, the existing runway length is planned to be maintained until a major runway rehabilitation project, at which time the runway would be shortened to 6,000 to comply with the JPA.

The instrument approach minimums are important to the economic viability of an airport. The existing visibility minimums at CMA are ¾-mile to Runway 26 and 1-mile to Runway 8. The current 2011 master plan considers improvements to the instrument approaches with future visibility minimums of ¾-mile to Runway 8 and ½-mile to Runway 26. These potential improvements are planned to be preserved in this ALP Update; however, implementation of lower visibility minimums is not anticipated in the five-to-10-year term of this ALP Update.

	2022	2027	2032	2042
Based Aircraft	***350***	***371***	***389***	***444***
Aircraft to be Hangared	***262***	***289***	***319***	***382***
Hangar Area Needed (s.f.)	***NA***	***81,000***	***171,000***	***360,000***

Aircraft Parking Positions

	Available	Short Term	Intermediate Term	Long Term
Local Positions	130	92	80	72
Transient Positions	63	62	66	75
Total Aircraft Parking Positions	193	154	146	147

Aircraft Parking Apron

	Available	Short Term	Intermediate Term	Long Term
Local Apron Area	48,600	59,600	52,000	46,900
Transient Apron Area	64,900	74,700	78,700	90,100
Total Apron	113,500	134,300	130,700	137,000
GA Terminal Services (s.f.)	***15,000 (est.)***	***11,700***	***12,100***	***13,100***

Fuel Storage (Static)

	Available	Short Term	Intermediate Term	Long Term
Jet A Capacity	128,000 gal.	Maintain	Add Capacity	Maintain
AvGas Capacity	46,000 gal.	Maintain	Maintain	Maintain

Exhibit 3D
LANDSIDE FACILITY REQUIREMENTS

Several new hangars have been constructed in recent years including the 100,000 square foot Cloud Nine development. There continues to be a projected need for approximately 81,000 square feet of additional hangar space within the five-to-10-year term of this ALP Update. The alternatives chapter will examine potential locations for new hangar construction. Certain aging hangars may be replaced with new hangars, which would not count to the overall needs for the airport. Overall, there is a projected need for additional aircraft parking apron which should coincide with new hangar development.

The next chapter of this ALP update will examine future development alternatives. The priority will be various geometry solutions to the curving and direct access taxiways. Various new hangar development layouts will also be presented.