Chapter 5

Facility Requirements

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INTRODUCTION

The Baseline Forecast was used to determine facility requirements.

Chapter 4 produced a forecast of traffic volumes expected to be generated at the airport during the 20-year forecast period. The next step in the planning process is to determine the type and magnitude of airport facilities that will be needed during the 20-year master planning period to satisfactorily accommodate future traffic volumes.

The process of determining facility requirements involves the application of acceptable airport planning standards to the various forecast components to identify the needed facilities that will provide sufficient capacity to handle the expected traffic. By comparing the sizes and capacities of the future facility needs with existing facility sizes and capacities, facility deficiencies can be determined and quantified.

The deficiencies are then resolved by increasing facility capacities over a phased development program. This chapter of the report addresses the calculation of theoretical airport facility requirements as discussed above. The facilities developed through this planning process must be considered theoretical until they have been related to existing facilities. In Chapter 6, Concept Development, the recommended improvements derived from the facility requirements are delineated in a series of plans and drawings.

The uncertainty of long-range forecasting was noted in Chapter 4, and a range of forecasts was provided. It is important to note that it will be ***actual*** demand that dictates the eventual development of facilities and not forecast demand. Should traffic actually materialize faster than forecast, then facility improvements should be accelerated. Should demand actually lag the forecast, then facility improvements may be deferred. Thus, the use of the Baseline Forecast does not commit the City to construct the facilities associated with projected demand, but it provides an assumed schedule for planning purposes.

Airport facility requirements are grouped into the two main operating elements - the airside facilities and the landside facilities. Before addressing the facility requirements, a brief discussion of airport classification is presented.

AIRPORT CLASSIFICATION

Merced Municipal Airport functions in several roles as defined by FAA and explained in Chapter 3. The airport is contained in the National Plan of Integrated Airport Systems (NPIAS) and is classified as a Commercial Service – Non-Primary airport which means it receives scheduled commercial air service and enplanes 2,500 or more, but less than 10,000 enplaned passengers a year. The airport is also contained in the California Aviation System Plan (CASP) and is classified as a Commercial/Primary Non-hub Airport.

Airport Reference Code

The FAA in its current AC 150/5300-13, Airport Design, has developed an airport reference code (ARC) which is a coding system that relates airport design criteria and planning standards to two components: the operational and physical characteristics of aircraft operating at or expected to operate at the airport. It is an alphanumeric code with the numeric component consisting of a Roman numeral. The letter element of the code is the aircraft approach category and thus relates to operational characteristics. The aircraft approach category is a grouping of aircraft that is based on 1.3 times the stalling speed as follows:

Category	Speed
A	Speed less than 91 knots
B	Speed 91 knots or more but less than 121 knots
C	Speed 121 knots or more but less than 141 knots
D	Speed 141 knots or more but less than 166 knots
E	Speed 166 knots or more

The second component of the ARC is the airplane design group and relates to the wingspan and tail height of aircraft and is a physical characteristic. The grouping of aircraft by Aircraft Design Group is as follows:

Airplane Design Group	Wingspan	Tail Height
I	Up to but not including 49 feet	Up to but not including 20 feet
II	49 feet up to but not including 79 feet	20 feet up to but not including 30 feet
III	79 feet up to but not including 118 feet	30 feet up to but not including 45 feet
IV	118 feet up to but not including 171 feet	45 feet up to but not Including 60 feet
V	171 feet up to but not including 214 feet	60 feet up to but not including 66 feet
VI	214 feet up to but not including 262 feet	66 feet up to but not including 80 feet

The aircraft approach speed element of the ARC will generally deal with runways and runway related facilities whereas the Airplane Design Group relates to separations required between airfield elements, i.e., runway-taxiway separations, taxilane and apron clearances, etc.

Critical Aircraft and Associated Airport Reference Code

The Airport Reference Code (ARC) to be used for airport master planning, as well as airport layout plans, is the ARC category applicable to the most demanding class of aircraft estimated to fly at least 500 annual operations at the airport. The ALP indicates an existing ARC of C-III for the airport. This was identified during the previous master plan in 1990 and was based on a Boeing 737-200 as the critical aircraft. While the airport was served by this model aircraft at one time prior to deregulation of the airline industry, operations by this (or similar) aircraft model have essentially been eliminated from the aircraft fleet mix. The current model B737 in production that has replaced the B737-200 is the B737-700. The B737-700 is recommended as the design aircraft for the ALP.

There are two newer model business jet aircraft that are at least ARC C-III and visit the airport on a transient basis. These are the Bombardier Global Express (ARC C-III) and Gulfstream V (ARC D-III). Based on input from the present FBO, it is estimated that the frequency of operations by these aircraft currently may be 10 visits per month (20 monthly operations). Many of these occur on weekends and are associated with visits to Yosemite National Park.

While the current number of annual operations by these aircraft types does not meet the FAA threshold for "critical aircraft", it is recommended that an ARC of C-III be retained for existing and future uses. The visits by these aircraft types are often concentrated during weekend periods, and the frequency these aircraft operations will increase in the future.

Therefore, ARC C-III will be used for existing and future planning purposes. Application of planning and design standards for ARC C-III ensures that all general aviation aircraft, including large business jets (such as the Global Express and G-V) and airline aircraft (Beech 1900, regional jets and others) that use the airport will be provided facilities that are designed to appropriate standards, in accordance with the planning standards contained in FAA AC 150/5300-13, Airport Design. Table 5-1 presents the airport planning standards for Airport Reference Code C-III.

AIRFIELD CAPACITY REQUIREMENTS

Annual and Hourly Capacity

Hourly runway capacities and annual service volume (ASV) estimates are needed to design and evaluate airfield development and improvement projects. The approach for estimating airport capacity in this study used capacity estimates contained in FAA Advisory Circular 150/5060-5, Airport Capacity and Delay. The advisory circular contains capacity and delay estimates suitable for long range planning and the conditions at Merced. The capacity assumptions listed in the advisory circular are applicable to Merced. These include:

- A mix index of 0 to 20.
- A runway configuration (single runway) addressed in the AC.
- Percent arrivals equal to departures.
- Percent touch and go's between 0 and 50 percent.
- A full length parallel taxiway with ample runway exits.
- No airspace limitations that adversely impact flight operations.
- At least one ILS and ATC facilities to carry out operations in a radar environment.

Based on guidelines presented in the advisory circular the Annual Service Volume (ASV) is identified as 230,000 operations. An hourly VFR capacity estimate of 98 operations and an hourly IFR capacity of 59 operations are also identified in the advisory circular.

It should be noted that the ASV represents the capacity of the present airport. It is also important to note the capacity of an airport is not constant and may vary over time depending upon airfield improvements, airfield or airspace geometry, ATC procedures, weather and mix of aircraft operating at the airport. The capacity of an airport can change with or without airfield improvements.

Demand Versus Capacity

The existing airfield capacity is sufficient to accommodate forecast operations.

By comparing ASV and hourly capacities with the forecast annual and peak hour demand, the relationship between demand and capacity can be determined. Table 5-2 presents the comparisons of demand versus capacity and as seen the present airfield will accommodate annual demand through the planning period.

Table 5-1
AIRPORT PLANNING STANDARDS
FOR AIRPORT REFERENCE CODE C-III

AIRPORT DESIGN AIRPLANE AND AIRPORT DATA

Aircraft Approach Category C
Airplane Design Group III
Airplane wingspan .... 117.99 feet
Primary runway end (Runway 30) approach visibility minimums are not lower than Category I (½ mile)
Other runway end (Runway 12) approach visibility minimums are not lower than 1 mile
Airplane undercarriage width (1.15 x main gear track) .... 18.75 feet
Airport elevation .... 156 feet
Airplane tail height .... 41.17 feet

SEPARATION STANDARDS

Runway centerline to parallel runway centerline .... 700 feet
wider runway separation may be required for capacity (See AC 150/5060-5)
Runway centerline to parallel taxiway/taxilane centerline .... (309.0) 400 feet
Runway centerline to edge of aircraft parking .... (400.0) 500 feet
Taxiway centerline to parallel taxiway/taxilane centerline .... 152 feet
Taxiway centerline to fixed or movable object .... 93 feet
Taxilane centerline to parallel taxilane centerline .... 140 feet
Taxilane centerline to fixed or movable object .... 81 feet

RUNWAY PROTECTION ZONES

Runway protection zone Runway 30:
Length .... 2,500 feet
Width 200 feet from runway end .... 1,000 feet
Width 2,700 feet from runway end .... 1,750 feet

Runway protection zone Runway 12:
Length .... 1,700 feet
Width 200 feet from runway end .... 500 feet
Width 1,900 feet from runway end .... 1,010 feet

OBSTACLE FREE ZONES

Runway obstacle free zone (OFZ) width .... 400 feet
Runway obstacle free zone length beyond each runway end .... 200 feet
Inner-approach obstacle free zone width .... 400 feet
Inner-approach obstacle free zone length beyond approach light system .... 200 feet
Inner-approach obstacle free zone slope from 200 feet beyond threshold 50:1
Inner-transitional OFZ height (H) .... 49.4 feet
Inner-transitional surface OFZ slope 6:1

Table 5-1 (cont'd)
AIRPORT PLANNING STANDARDS
FOR AIRPORT REFERENCE CODE C-III

RUNWAY DESIGN STANDARDS

Runway width	100 feet
Runway shoulder width	20 feet
Runway blast pad width	140 feet
Runway blast pad length	200 feet
Runway safety area width	500 feet
Runway safety area length beyond each runway end or stopway end, whichever is greater	1,000 feet
Runway object free area width	800 feet
Runway object free area length beyond each runway end or stopway end, whichever is greater	1,000 feet
Clearway width	500 feet
Stopway width	100 feet

TAXIWAY DESIGN STANDARDS

Taxiway width	(38.8)	50 feet
Taxiway edge safety margin		10 feet
Taxiway shoulder width		20 feet
Taxiway safety area width		118 feet
Taxiway object free area width	(185.2)	186 feet
Taxilane object free area width		162 feet
Taxiway wingtip clearance		34 feet
Taxilane wingtip clearance		22 feet

Note: Numbers in parenthesis represent minimum dimensions for the critical aircraft.
Source: FAA Advisory Circular 150/5300-13, Airport Design, Change 10 dated September 29, 2006.

Table 5-2
DEMAND VERSUS CAPACITY

	2011	2016	2026
ANNUAL:			
Demand	91,300	97.300	110,400
Capacity	230,000	230,000	230,000
% Capacity Utilized	40%	42%	48%
HOURLY VFR:			
Demand	37	39	44
Capacity	98	98	98
% Capacity Utilized	38%	40%	45%
HOURLY IFR:			
Demand	19	20	22
Capacity	59	59	59
% Capacity Utilized	32%	33%	37%

Source: DMJM Aviation.

Throughout the twenty year planning period capacity is adequate and the relationship of demand and capacity is below a threshold when capacity improvements are usually considered. Generally, capacity improvements should be recommended when demand is forecast to utilize 60 percent of capacity. This allows sufficient lead time to develop the improvement before the airport becomes saturated. Airport activity levels warranting capacity improvements are contained in FAA Order 5090.3B. As seen in Table 5-2, the forecast demand utilizes less than 50 percent of annual and hourly capacity, which is slightly below the 60 percent planning threshold. Since the Baseline Forecast is being used, and capacity near but not at to the planning threshold, the need for capacity enhancing projects are not warranted, but should be considered where feasible and where they improve operations.

From this comparison of demand and capacity it is concluded that airfield capacity is sufficient to accommodate forecast operations and airfield (runway/taxiway) improvements are not warranted based upon capacity reasons. Although the implementation of additional airfield capacity is not warranted strictly from a capacity standpoint, there may be equally important considerations that dictate otherwise.

AIRSIDE FACILITY REQUIREMENTS

As discussed earlier, the airside operating element as used in this report includes the runway and taxiway system, the runway approach areas and the associated appurtenances such as airfield lighting, visual aids, and navigation aids. With the exception of aircraft aprons which, due to their interface with terminal facilities, are analyzed as a landside element, airside refers to those airport areas where aircraft operations are conducted. The ability of the present airside facilities to accommodate existing and future traffic loads and the facilities required through the year 2026 are examined in the following subsections.

Runway System

The existing runway system was described in Chapter 3. This section deals with runway requirements needed to satisfy the forecast demand in terms of runway length, pavement strength requirement, crosswind coverage, and safety areas. Planning and design standards set forth in FAA AC 150/5300-13, Airport Design, for Airport Reference Code C-III are the basis of this analysis. This will provide satisfactory facilities for the variety of aircraft expected to use the airport.

When determining runway requirements it is important to account for the type of approach the airport has or can be expected to have. Runways with lower visibility minimums have more restrictive requirements. Currently Runway 30 is equipped with an Instrument Landing System (ILS) Category I (Cat I) approach with visibility minimums not lower than ½ mile and Runway 12 is equipped for non-precision instrument approaches with visibility minimums not lower than 1 mile. Therefore, for the purpose of the master plan, the instrument approach capabilities are assumed in the future for Runways 30 and 12.

Crosswind Runway

The existing runway system provides 99.52 percent coverage for a 10.5 knot (12 mph) crosswind, 99.78 percent coverage for a 13 knot (15 mph) crosswind, and 99.96 percent for a 16 knot (18 mph) crosswind. FAA states in AC 150/5300-13 that the allowable crosswind is 10.5 knots for Airport Reference Codes A-I and B-I, 13 knots for Airport Reference Codes A-II and B-II and 16 knots for Airport Reference Codes A-III, B-III and C-I through D-III. The coverage provided by the existing runway alignment meets the FAA recommendation of 95 percent crosswind coverage, thus additional runways for improved crosswind coverage are not required.

Runway Length

The existing runway accommodates most business jets. Extension of the runway may be considered to the extent that aircraft payloads are limited or for specific airline requirements.

This subsection deals with the runway length requirements for the existing runways at Merced. Runway length is a critical consideration in airport planning and design. Aircraft need specified runway lengths to operate safely under varying conditions of wind, temperature and takeoff weight.

FAA Advisory Circular 150/5325-4A contains criteria used in developing runway lengths required for various general aviation utility and transport airports. The recommended runway lengths are based on performance information from manufacturer's flight manuals in accordance with provisions in FAR (Federal Aviation Regulations) Part 23, Airworthiness Standards: Normal, Utility and Acrobatic Category Airplanes, and FAR 91, General Operating and Flight Rules.

Aircraft performance combined with significant site characteristics are considered in analyzing runway length. The site characteristics that are evaluated include: airport elevation, temperature (mean maximum temperature of the hottest month), runway gradient and wind conditions.

The FAA Airport Design (Version 4.2d) software package contains a program to calculate typical runway requirements for various classes of aircraft. This model was applied and the results are presented in Table 5-3. The airport site characteristics used in the runway length analysis were:

- Elevation - 156 feet MSL
- Temperature - 97°F
- Maximum Difference in Runway Centerline Elevation – 1 foot
- Surface Winds - Calm

The critical aircraft for Merced Municipal Airport are business jets which primarily are large airplanes that weigh less than 60,000 pounds. However, aircraft such as the Bombardier Global Express and Gulfstream models are more than 60,000 pounds. As seen in Table 5-3, the recommended runway lengths for business jet aircraft less than 60,000 pounds range from 4,780 to 9,400 feet, depending on the percent of the large aircraft fleet and percent of useful loads. For aircraft more than 60,000 pounds the recommended runway length depends on the length of haul being flown.

The present length of Runway 12-30 is 5,903 feet which is estimated to satisfy the requirements for approximately 75 percent of all airplanes of 60,000 pounds or less at 60 percent useful load. Interpolating the data in Table 5-3 concludes that the existing runway length will accommodate approximately 75 percent of large airplanes at approximately 73 percent useful loads. As also seen in Table 5-3, the existing runway basically satisfies requirements of aircraft more than 60,000 pounds with haul lengths of 1,000 miles.

A review of runway requirements for approximately 2,500 medium and large business jets concluded that a runway length of approximately 6,438 feet would accommodate the aircraft evaluated operating at maximum takeoff weights (Table 5-4). Therefore, the existing runway length provides reasonable capabilities for business jets. It accommodates a representative sampling of the business aircraft fleet mix at reasonable loads, but limits the length of haul for aircraft greater than 60,000 pounds to approximately 1,000 miles. Extension of the runway may be considered to the extent that this becomes an issue.

Table 5-3
FAA RECOMMENDED RUNWAY LENGTHS
FOR MERCED MUNICIPAL AIRPORT

AIRPORT AND RUNWAY DATA

Airport elevation.......... 156 feet
Mean daily maximum temperature of the hottest month..........97° F
Maximum difference in runway centerline elevation .... 1 foot

RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN

Small airplanes with approach speeds of less than 30 knots .... 300 feet
Small airplanes with approach speeds of less than 50 knots .... 810 feet
Small airplanes with less than 10 passenger seats
75 percent of these small airplanes .... 2,630 feet
95 percent of these small airplanes .... 3,190 feet
100 percent of these small airplanes .... 3,790 feet
Small airplanes with 10 or more passenger seats.......... 4,410 feet

Large airplanes of 60,000 pounds or less
75 percent of these large airplanes at 60 percent useful load.......... 4,780 feet
75 percent of these large airplanes at 90 percent useful load.......... 7,300 feet
100 percent of these large airplanes at 60 percent useful load.......... 5,800 feet
100 percent of these large airplanes at 90 percent useful load.......... 9,410 feet

Airplanes of more than 60,000 pounds
Length of haul of 500 miles.......... 5,070 feet
Length of haul of 1,000 miles .... 6,010 feet
Length of haul of 1,500 miles .... 6,890 feet
Length of haul of 2,000 miles .... 7,680 feet
Length of haul of 2,500 miles .... 8,400 feet

Sources: FAA Advisory Circular 150/5325-4A, Runway Length Requirements for Airport Design.
DMJM Aviation application of FAA Airport Design (Version 4.2d).

Table 5-4
RUNWAY LENGTH REQUIREMENTS FOR TYPICAL
MEDIUM AND LARGE BUSINESS JETS (feet)

Aircraft	No. of Acft. Manufactured	ARC	TO Dist. ISO	Altitude Correction	Temp. Correction	Gradient Correction	Corrected R/W Length
Challenger 601-3A/CL-604	374	C-II	5,700	5,762	6,873	6,883	6,883
Citation 650 (III)	241	C-II	5,150	5,206	6,210	6,220	6,220
Citation 650 (VII)	119	C-II	4,850	4,903	5,848	5,858	5,858
Citation 750 (X)	160	C-II	5,140	5,196	6,198	6,208	6,208
Falcon 50	310	B-II	4,715	4,766	5,685	5,695	5,695
Gulfstream IV	469	D-II	5,450	5,510	6,572	6,582	6,582
Gulfstream V	160	D-III	5,990	6,055	7,223	7,233	7,233
Hawker 125-800	533	B-II	5,380	5,439	6,487	6,497	6,497
Astra 125	135	C-II	5,300	5,358	6,391	6,401	6,401
Total	2,501						
Weighted average for these aircraft							**6,438**

Source: DMJM Aviation analysis.

The latest California Aviation System Plan identifies a minimum standard runway length of 7,000 feet for the airport as a Primary Commercial Service Non-hub airport. Based on the state's guidelines, this would provide adequate runway length to support scheduled air service. For comparison, other airports also identified for this requirement are Inyokern, Meadows Field, Modesto City-County, Stockton Metropolitan and Visalia. A runway length of 7,000 feet would support greater useful loads of business jets, and permit longer haul lengths (approximately 1,570 miles).

A major extension of the runway is not recommended unless future operational issues warrant. This could involve haul lengths of large business jet aircraft or specific operational requirements of scheduled air carriers (i.e. to support aircraft such as regional jets).

Runway Width

Runway width is a dimensional standard that is based upon the physical and performance characteristics of aircraft using the airport (or runway). The characteristics of importance are wingspan and approach speeds. In this case, FAA Airplane Design Group III (wingspans up to but not 118 feet) and Approach Category C are used and will provide adequate width and separation for current and anticipated aircraft operations. FAA AC 150/5300-13 specifies a runway width of 100 feet for an Airport Reference Code of C-III. The present runway is 150 feet wide and meets the standard.

Runway Grades

The maximum longitudinal grade is 1.5 percent for runways serving Aircraft Approach Category C and D aircraft. The existing maximum longitudinal runway grade is almost flat (barely a 1-foot difference in runway centerline elevation), and therefore longitudinal grade for the runway is not an issue. The runway should have adequate transverse slopes to prevent the accumulation of water on the surface. A maximum transverse grade of 1.0 to 1.5 percent is recommended for the Airport by FAA. The runway complies with these standards.

Pavement Strength

As mentioned in Chapter 3, based on information contained in the latest U.S. Government Flight Information Publication/Facility Directory the runway pavement strength is 30,000 pounds for single wheel landing gears, 100,000 pounds for dual wheel landing gears, and 140,000 pounds for dual tandem landing gears. This is adequate to accommodate aircraft expected to use the airport in the future including B737/Airbus models as well as regional jets. Therefore strengthening of the runway pavement is not required. However, it is recommended that the existing Pavement Management Plan be followed and updated as needed to assess the condition of all airfield pavements, and identify appropriate maintenance actions to obtain maximum life of airfield pavements. The preparation of a Pavement Management Plan should follow guidelines in FAA Advisory Circular 150/5380-7, Pavement Management Systems.

Runway Signage

The existing runway distance remaining signs should be replaced due to their age and difficulty in obtaining replacement parts. Emergency generators to provide back-up emergency power for the airfield should also be acquired.

Runway Blast Pads

A runway blast pad provides blast erosion protection beyond runway ends. Runway 12-30 requires blast pads that are 140 feet wide and 200 feet long in accordance with Airport Reference Code C-III criteria. Presently, Runway 12-30 has blast pads which are 190 feet wide and 500 feet long. The purpose of blast pads is to protect areas off the ends of the runway from blast erosion.

Runway Safety Areas

A runway safety area (RSA) is defined as a rectangular area centered about the runway that is cleared, drained, graded and usually turfed. Under normal conditions, this area should be capable of accommodating occasional aircraft that may veer off the runway, as well as fire fighting equipment. For Merced Municipal Airport, the existing and future requirement for Runway 12-30 to accommodate Airport Reference Code C-III is an area 500 feet wide centered on the runway centerline and extending 1,000 feet beyond each runway end. There are specific FAA clearing and grading standards for runway safety areas.

As noted in Chapter 3, the RSA for Runway 12 is non-standard as it is traversed by Thornton Road. The City recently enhanced the RSA under AIP Project No. 3-06-0152-11 by relocating the perimeter fence and covering a ditch between Thornton Road and the airport fence. While a small portion of the RSA will still extend beyond Thornton Road after the project, FAA has concluded that this is the most practical approach to meeting RSA standards.

Runway Object Free Areas

The runway object free area (ROFA) is a two dimensional ground area surrounding the runway and its clearing standard precludes parked aircraft, agricultural operations and objects, except those fixed by function. The criterion replaces the former design standard of the aircraft parking limit line and is designed with the intention of providing adequate wing-tip clearance. The design standards for an ARC of C-III call for a ROFA extending 400 feet on either side the runway centerline and extending 1,000 feet beyond the end of the runway. Object free areas also exist for taxiways and are 186 feet wide (93 feet on either side of centerline) for Airplane Design Group III.

As with the RSA, the existing ROFA extends beyond the end of the property line along Thornton Road, a deficiency of approximately 275 feet along the west edge of the ROFA. This appears to be a reasonable candidate for a modification to FAA design standards. Object free area criteria along Taxiway A is satisfied.

Approach Surfaces and Runway Protection Zones

The approach surface and the runway protection zone (formerly called clear zone) are important elements in the design of runways which help to ensure the safe operations of aircraft. A brief description of these two areas follows:

- **The Approach Surface** is an imaginary inclined plane beginning at the end of the primary surface and extending outward to distances up to 10 miles depending on runway use (i.e., instrument or visual approaches). The width and slope of the approach surface are also dependent on runway use. The approach surface governs the height of objects on or near the airport. Objects should not penetrate or extend above the approach surface. If they do, they are classified as obstructions and must be either marked or removed.

- **The Runway Protection Zone (Clear Zone)** is an area at ground level that provides for the unobstructed passage of landing aircraft through the above airspace and is used to enhance the protection of people and property on the ground. The runway protection zone (RPZ) begins at the end of the primary surface and has a size which varies with the designated use of the runway. Land uses specifically prohibited from the RPZ are residences and places of public assembly (churches, schools, hospitals, office buildings, shopping centers, and other uses with similar concentrations of persons typify places of public assembly). Fuel storage facilities also should not be located in the RPZ.

Federal Aviation Regulations Part 77 indicates that the approach surface should be kept free of obstructions to permit the unrestricted flight of aircraft in the vicinity of the airport. As the type of instrument approach to a runway becomes more precise, the approach surface increases in size and the required approach slope becomes more restrictive.

The runway protection zone is the most critical safety area under the approach path and should be kept free of all obstructions. No structure should be permitted nor the congregation of people allowed within the runway protection zone. Control of the runway protection zone by the airport owner is essential. It is desirable, therefore, that the airport owner acquire adequate property interests, preferably in fee title, in the runway protection zone to ensure compliance with the above.

As indicated above, the approach and runway protection zone dimensions are dependent on the type of approach being made to a runway. Presented in Table 5-5 are runway protection zone dimensions for various type runways. As noted in Table 5-1, visibility minimums for Runway 12 are not lower than 1 mile and visibility minimums for Runway 30 are lower than ¾ mile. Part of the west side and the southwest corner of runway protection zones for Runway 30 extends beyond airport property. A portion of this area is controlled by the City through an easement. A small portion of the northeast corner of the runway protection zone for Runway 12 also extends off airport property and crosses Wardrobe Avenue. Portions of the RPZs not controlled by the City should be acquired by the City, either in fee or through an easement.

The City should take necessary steps to prevent the construction of any structure within the RPZ that is a hazard to air navigation or which might create glare or misleading lights or lead to the construction of residences, fuel handing and storage facilities, smoke generating activities, or places of public assembly such as schools, churches, office buildings, shopping centers and stadiums. Control of the runway protection zone may be acquired in fee or through easement and is an eligible item under the FAA Airport Improvement Program.

Taxiways

Runway 12-30 has a centerline-to-centerline separation from Taxiway A of 350 feet, which does not meet requirements contained in FAA AC 150/5300-13, Airport Design (Change 10 dated September 29, 2006) for Airport Reference Code C-III (400 feet is specified in the advisory circular). The FAA runway to parallel taxiway standard precludes any part of an airplane (tail, wingtip, nose, etc.) on a parallel taxiway centerline from being within the runway safety area or penetrating the OFZ. In the case of Merced, Design Group III aircraft taxiing on the centerline of Taxiway A will not be within the RSA or penetrate the OFZ. A minimum separation of 309 feet will prevent Design Group III aircraft from being within the RSA. This suggests that the existing runway centerline-to-taxiway centerline separation is acceptable, but planning to relocate the taxiway at the standard separation distance should be considered.

Airspace and Navigational Aids

The airspace in the vicinity of Merced is relatively simple, compared to complicated airspace structures in the Bay Area or other metropolitan areas. There are no special use airspace areas such as restricted, prohibited or warning areas that influence the airport, and with the closure of Castle AFB, the controlled airspace associated with it has been removed. When Castle AFB was operational, there was an agreement between the air traffic control facilities of Merced and Castle for coordination of air traffic between the two facilities.

Table 5-5
RUNWAY PROTECTION ZONE DIMENSIONS

Approach Visibility Minimums	Facilities Expected To Serve	Runway Protection Zone Dimensions: Length (Feet)	Inner Width (Feet)	Outer Width (Feet)	Area (Acres)
Visual and Not lower than 1 mile	Small Aircraft Exclusively	1,000	250	450	8.035
	Aircraft Approach Categories A & B	1,000	500	700	13.770
	Aircraft Approach Categories C & D	1,700	500	1,010	29.465
Not lower than ¾ mile	All Aircraft	1,700	1,000	1,510	48.978
Lower than ¾ mile	All Aircraft	2,500	1,000	1,750	78.914

Source: FAA Advisory Circular 150/5300-13, Airport Design.

The airspace in the immediate vicinity of Merced is Class E with Class D associated with Castle Airport to the north. As it was described in Chapter 3, the airport has a variety of instrument approaches, is an uncontrolled airport, and has various visual aids.

Runway 30 is equipped with an Instrument Landing System Category I (Cat I) approach that permits landings with visibilities as low as 1,800 feet RVR and a 200 foot decision height. This system allows landings in IFR conditions and should be retained. It was pointed out in Chapter 3 that the glide slope signal is subject to distortion when aircraft are on approach and over-flying Dickenson Ferry Road. Power lines along Dickenson Ferry Road may be creating the distortion and should be evaluated by FAA to determine their impact on the glide slope signal. If the power lines are found to be the cause of interference with the glide slope signal they should be placed underground. Runway 30 is also equipped with a Medium Intensity Approach Light System with Runway Alignment Indicator Lights (MALSR).

Runway 12 is equipped with a four box Visual Approach Slope Indicator (VASI) system. The FAA recommends that PAPI be installed as the visual glide path aid at airports under Airport Improvement Program funding grants. Therefore, the replacement of the existing VASIs with PAPIs at some point during the planning period may be considered as needed. Runway 12 is also equipped with runway end identifier lights (REIL).

The FAA document Airway Planning Standard Number One-Terminal Air Navigation Facilities and Air Traffic Control Services (FAA Order 7031.2C) contains criteria for identifying candidate airports for NAVAIDS and visual aids. The criteria for NAVAIDS are based upon the number of annual instrument approaches (AIA), and for visual aids, criteria are keyed to the number of annual landings per runway. Based upon criteria in FAA Order 7031.2C, a runway (equipped with an ILS) is a candidate for a visual approach slope indicator

(VASI) if there are at least 18,500 annual GA and military landings per year. The FAA plans to install a 4-light PAPI system on Runway 30.

While the airport is presently equipped with a control tower that is not operating, reactivation of the control tower as a "contract tower" should be pursued. In this case the airport sponsor contracts with an air traffic control company to provide air traffic services, with the cost of services borne by the airport sponsor. This is recommended because of increased operations which has involved airline activity mixed with heavy general aviation flight training operations at the airport. Reactivation of the control tower as a contract tower is justified based on activity levels and safety, the latter involving separation of airline and GA flight training by air traffic control.

LANDSIDE FACILITY REQUIREMENTS

The airport landside system is comprised of all facilities supporting the movement of passengers and goods between the community's ground transportation system and the airport's airside system, and also any facilities used in the maintenance or protection of those facilities. For Merced, these include scheduled airline service terminal facilities, general aviation terminal/administration building, aircraft storage and services, and airport support facilities. The landside elements, together with the previously discussed airside elements, form all of the airport development facilities required to accommodate the forecast level of traffic.

Since the airfield development program has been based upon an ultimate level of some 110,400 operations and 180 based aircraft (under the Baseline Forecast), the planning of landside facilities should be based upon striking a balance of airside and landside capacity. The determination of general aviation and support area facilities has been accomplished for the three future planning periods of 2011 (short term), 2016 (medium term), and 2026 (long term).

The following subsections present the rationale for determining future landside facility requirements to serve the commercial service and general aviation role of the airport.

Administration/Terminal Building

Terminal facilities at Merced relate to those required to support scheduled air service and general aviation operations. Two major issues expressed by the Technical Advisory Committee at the outset of the planning process is the need to renovate or rebuild the terminal (and other) buildings, and the need for better GA facilities (including an executive lounge) to accommodate pilots and travelers. The existing terminal building is about 4,868 square feet and accommodates scheduled air service and airport management functions. The terminal requirements for airline and general aviation functions are identified separately as it is desirable to separate these two functions from operational and security standpoints.

Passenger Terminal

A building area of 11,000 square feet is recommended to accommodate airline passenger and airport administration functions.

Advisory Circular 150/5360-9, Planning and Design of Airport Terminal Facilities at Nonhub Locations, indicates a minimum size terminal from 6,000 to 8,000 square feet for airports such as Merced. This does not include mechanical, utility or building maintenance areas. For planning purposes, a passenger terminal requirement of 11,000 square feet is therefore identified to accommodate passenger, airport management, mechanical, utility and building maintenance functions. Aircraft parking apron capable of accommodating two aircraft comparable in size to the Beech 1900 should be provided as a minimum in the near term, with ultimate apron space capable of parking two regional jets. Considering the poor condition of the existing building, it is recommended that a new passenger terminal be included in the master plan.

General Aviation Terminal Facilities

A building area of 5,400 square feet is recommended to accommodate general aviation terminal functions.

The amount of general aviation terminal space required is based upon the expected demand, i.e., the peak hourly volume of pilots and passengers who will use the facilities. A planning standard of 49 square feet per peak hour pilot/passengers is used to determine the required area. Table 5-6 shows the breakdown of the planning standard. An estimated 2.5 pilot/passengers are assumed per peak hour operation. Table 5-7 shows the building requirements that were calculated using the above approach.

Table 5-6
DERIVATION OF REQUIREMENTS FOR GENERAL AVIATION TERMINAL BUILDINGS

Operational Use	Area Required (SF) Per Peak Hour Pilot/Passenger
Waiting Area/Pilot's Lounge	15
Management Operations	3
Public Conveniences	1.5
Concessions, Dining, etc.	5
Circulation, Mechanical, Maintenance	24.5
Total	49

Note: Space requirements for circulation, mechanical and maintenance should be allocated equally among other terminal building uses in calculating total building requirements.

The present transient pilots lounge is very small (576 square feet) and in poor condition. As Table 5-7 indicates a terminal area requirement of approximately 5,400 square feet is required in 2026. The need for improved terminal facilities was an important issue identified by the Technical Advisory Committee. Considering the poor condition and extent of transient pilot facilities, it is recommended that a new general aviation terminal with approximately 5,400 square feet be provided. Additional space should be provided if the building is to include a restaurant.

Table 5-7
GENERAL AVIATION TERMINAL AREA REQUIREMENTS

Item	2011	2016	2026
Peak Hour Operations	37	39	44
Total Peak Hour Occupants	93	98	110
Area/Occupant (SF)	49	49	49
Total Building Area (SF)	4,557	4,802	5,390

Source: DMJM Aviation.

Transient Aircraft Parking Apron

Additional parking apron (2,150 square yards) is required for transient aircraft. The existing number of tie-downs for based aircraft is adequate.

The overall requirements for facilities are driven by the desires of the market. Aircraft parking apron is required primarily for visiting transient aircraft as most based aircraft are stored in hangars. These are aircraft that land at Merced, but are based elsewhere. A busy itinerant day is derived from the average day of the peak month forecasts (ADPM) of aircraft activity and forms the basis of estimating transient parking apron requirements. Currently transient aircraft park on the transient apron east of the terminal building. Summarized in Table 5-8 are the transient apron requirements.

Table 5-8
TRANSIENT AIRCRAFT TO BE ACCOMMODATED
ON TRANSIENT AIRCRAFT APRON

Number of Aircraft to be Accommodated		2011	2016	2026
Annual Transient Operations		12,300	14,200	17,800
Peak Month Transient Operations		7,380	8,520	10,680
ADPM Transient Operations		738	852	1,068
Number of Aircraft Parked		12	14	17
Size of Transient Aircraft Apron				
Single Engine:	Number of Aircraft [a]	10	11	13
	Area/Aircraft (SY)	300	300	300
	Apron Area (SY)	3,000	3,300	3,900
Multi- Engine/	Number of Aircraft [a]	1	2	2
Helicopter:	Area/Aircraft (SY)	625	625	625
	Apron Area (SY)	625	1,250	1,250
Turboprop/	Number of Aircraft [a]	1	1	2
Business Jet:	Area/Aircraft (SY)	1,600	1,600	1,600
	Apron Area (SY)	1,600	1,600	3,200
Total Aircraft		12	14	17
Total Apron Area (SY)		5,225	6,150	8,350

Source: DMJM Aviation.
[a] Based upon estimated mix of transient aircraft

Transient aircraft parking apron requirements were determined by applying the following assumptions to itinerant movements performed by transient aircraft on an ADPM.

- Transient operations are approximately 60 percent of itinerant aircraft operations.
- The majority of transient aircraft will arrive and depart on the same day, thus it is assumed that the actual number of aircraft utilizing the parking apron is one-half (50 percent) of the transient movements being performed on the average day of the peak month.

- During the planning period, 50 percent of the transient aircraft will be on the ground at any given time.
- Thus, 25 percent of transient operations will be temporarily parked on the transient apron.
- Single engine aircraft require 2,700 square feet (300 square yards) of apron space; multi-engine aircraft and helicopters require 5,625 square feet (625 square yards); and business jets require 14,400 square feet (1,600 square yards) of apron for parking and maneuvering.

The analysis concludes that roughly 8,350 square yards of apron for 17 aircraft are required to accommodate transient demand in 2026. It is estimated that the present transient apron provides parking space for five business jets, with tie-downs also available in the central ramp area for ten smaller aircraft. The present number of spaces for business jets appears adequate, however additional transient ramp for smaller aircraft is recommended to accommodate requirements through the year 2026. Approximately 2,150 square yards is recommended to provide additional transient parking for seven aircraft (three single engine and two multi-engine).

Based Aircraft Storage

Based aircraft in the future will primarily be stored in hangars as opposed to tie-downs. There are 48 existing individual hangar spaces. In the year 2026, 109 additional individual hangar spaces will be required to accommodate the Baseline Forecast. These hangars will primarily serve smaller, personal use aircraft. There are presently 12,720 square feet of larger, bay-type (conventional) hangar space. An additional 53,520 square feet of conventional hangar space will be needed in 2026 and will primarily serve larger business aircraft. The existing number of based aircraft tie-downs is adequate.

Aircraft based at the airport can be stored either by occupying a paved tie-down parking space or by storage within a hangar. The number of aircraft stored in hangars varies according to the desire for hangar space versus apron storage, the economics of providing hangars and the severity of weather conditions prevailing at the airport location. The number of based aircraft at Merced may increase from the present level of approximately 100 to 180 aircraft in the year 2026 under the Baseline Forecast. Adequate storage facilities should be provided to accommodate forecast based aircraft. In determining the demand for the various types of storage, the following assumptions were made:

- Approximately 90 percent of the present based aircraft at Merced are stored in hangars.
- Due to the apparent underutilization of the existing apron areas and prevailing weather conditions present at Merced, it is assumed that all based aircraft will be stored in hangars.
- It is assumed that all single engine and multi-engine aircraft will be stored in T-hangars. Multi-engine aircraft will require a larger size T-hangar or box hangar.
- All turboprops and business jets will be stored in conventional hangars and each will require 4,500 square feet of floor space.
- It is assumed that helicopters will be stored in conventional hangars with each helicopter requiring 1,620 square feet of floor space.

For the purpose of this analysis of facility requirements, hangars are generally categorized into two basic types, “conventional”, bay-type hangars and “individual” hangars. Conventional hangars are large structures that will accommodate several aircraft of different sizes in an open bay, while individual hangars are sized to accommodate one aircraft. Individual hangars may be portable hangars, T-hangars or rectangular (“box”) hangars. Conventional hangars can serve business jets and individual hangars primarily serve personal use aircraft and smaller business use aircraft. Individual hangars can be combined to create an apparently larger structure (such as the existing Building 21). Figure 5-1 presents the different types of individual hangars and a typical conventional hangar.

For the purpose of this analysis, individual hangar requirements are determined as number of spaces, or units and may be provided through a mix of rectangular, T-hangar and portable hangars. Table 5-9 summarizes the storage hangar requirements for based aircraft determined in this analysis. The analysis is based on the Baseline Forecast.

Table 5-9
BASED AIRCRAFT STORAGE HANGAR
REQUIREMENTS BASED ON BASELINE FORECAST

	2011	2016	2026
Single Engine Piston			
Number of Based Aircraft	102	116	142
Number of Aircraft in Individual Hangar*	102	116	142
Multi-Engine Piston			
Number of Based Aircraft	11	14	17
Number of Aircraft in Individual Hangar*	11	14	17
Turboprop/Business Jets			
Number of Based Aircraft	7	10	14
Number of Aircraft in Conventional Hangar	7	10	14
Area/Aircraft (SF)	4,500	4,500	4,500
Conventional Hangar Floor Area (SF)	31,500	40,500	63,000
Helicopters			
Number of Based Aircraft	1	1	2
Number of Aircraft in Conventional Hangar	1	1	2
Area/Aircraft (SF)	1,620	1,620	1,620
Conventional Hangar Floor Area (SF)	1,620	1,620	3,240
Total Based Aircraft	123	144	180
Total Aircraft Hangared	121	141	175
Required Individual Hangars (Spaces)*	113	130	159
Required Conventional Hangar Area (SF)	33,120	42,150	66,240

*May be rectangular, T-hangar or portable hangar.
Source: DMJM Aviation analysis.

As mentioned previously there is approximately 12,720 square feet of aircraft storage hangar (conventional hangars) and 50 individual (mainly portable) hangar spaces at Merced which house over 80 based aircraft. This does not include 18 spaces in Buildings 3, 4, 5 and 6 that are planned to be demolished. Other based aircraft are housed in hangars on adjacent land leases. There is a waiting list for hangar space that presently includes twelve people. The table below notes the deficiencies assuming that existing hangars cannot accommodate more based aircraft.

		Deficiency		
Item	**Existing**	**2005-2011**	**2012-2016**	**2017-2026**
Individual Hangar (Spaces)	50*	63	80	109
Conventional Hangar (SF)	12,720	20,400	29,430	53,520

* Existing individual hangars do not include 18 spaces in Buildings 3, 4, 5 and 6, planned to be demolished.

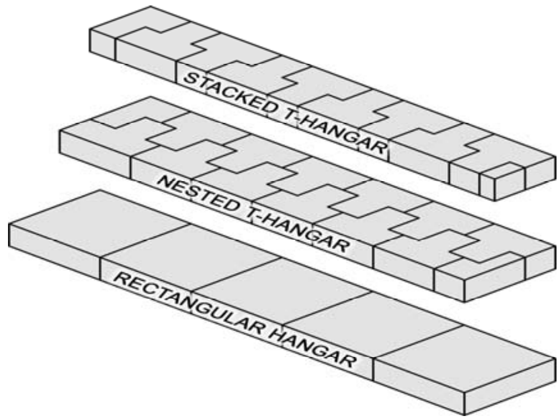
Source: DMJM Aviation analysis.

INDIVIDUAL HANGARS

Portable Hangar

T-Hangar

Rectangular Hangar



Hangar Configurations

CONVENTIONAL HANGARS

Conventional Hangars

Figure 5-1
Hangar Types

The Baseline Forecast projects 159 single engine and multi-engine aircraft in the year 2026. These are assumed to be stored in individual hangars. As it can be seen from the previous summary table, an additional 109 individual hangars and 53,520 square feet of conventional hangar space are required in 2026. While individual hangars (T-hangars and/or rectangular hangars) are expected to be the primary means of housing based aircraft, the airport layout plan should also provide adequate space for construction of conventional hangars for aircraft storage or servicing.

Three approaches are available to the City in providing hangars. The first would involve leasing land to aircraft owners and allowing them to construct their own hangars. To assure uniformity in construction as well as visually pleasing results, the airport owner (the City) could control the type of hangar built by a clause in the land lease. An alternative to the above would be for the airport owner to construct the hangars and then rent or lease them to aircraft owners. If this approach is followed, firm commitments for their use should be made before construction of the hangars are undertaken. A third approach is to have a complex of hangars built by a private party on property leased by the airport.

An alternative to aircraft storage hangars is to provide space on the parking apron with tie-down facilities to secure the aircraft during severe weather or periods of high winds. For planning purposes, an allowance of 300 square yards for single engine and 625 square yards for multi-engine and helicopters can be used to calculate the size of the based aircraft tie-down area. While all based aircraft are assumed to be hangared, planning for provision of a nominal apron for based aircraft tie-downs is prudent. For the purposes of establishing an overall facility program of the master plan, an area suitable for 30 (9,000 square yards) single engine aircraft will be provided. It is noted that the City currently operates 42 based aircraft tie-downs, with additional based aircraft tie-downs available on the FBO leasehold. Therefore, the existing ramp should be capable of meeting based aircraft tie-down requirements.

Aircraft Maintenance Facilities

There are 7,500 square feet of existing hangar space that is dedicated to aircraft maintenance activities. Approximately 18,000 square feet of space should be planned which will require that an additional 10,500 square feet of hangar space be provided.

Maintenance facilities play an important role at an airport as they permit the based and transient aircraft to receive the full line of services necessary for safe flight. Presently there are approximately 7,500 square feet of hangars used for aircraft maintenance, or approximately 75 square feet per based aircraft. For projecting future maintenance facility requirements a factor of 100 square feet of aircraft maintenance per based aircraft can be used. By applying this factor, a long-term estimate of approximately 18,000 square feet for maintenance hangar space is identified. As it can be seen, this results in a planning deficiency of roughly 10,500 square feet of aircraft maintenance space. Timing will be contingent on demand and investment from the private sector. It should be noted that adequate apron should be planned for maintenance hangar(s) with allowances for clearances between aircraft and buildings, aircraft towing/taxiing and parking positions for run-ups and maintenance checks.

Automobile Parking

There are 98 existing automobile parking spaces for airline passengers and a total of 110 spaces are required. There is a need for 12 additional spaces for airline passengers by 2026. The present number of spaces and the use of hangars and tie-downs by based aircraft owners are adequate to meet auto parking requirements for general aviation users.

Parking areas must be provided at the airport for those using its facilities. In the case of Merced this includes airline passengers and general aviation users.

Passenger Terminal

For airline passengers, data contained in FAA Advisory Circular 150/5360-9, Planning and Design of Airport Terminal Facilities at Nonhub Locations suggests that a total of 100 public parking spaces are appropriate for enplanement levels of approximately 50,000 annual enplanements. This is within the range of the Baseline enplanement projections presented in Chapter 4. In order to accommodate passenger levels forecasted in the High Growth Forecast a total of 200 public parking spaces are required. This is also believed to be adequate to accommodate airline and airport employees at the terminal. An allowance for 10 additional spaces for rental car parking should also be included to support a potential rental car vendor(s) in the terminal. Therefore, a total of 110 automobile parking spaces are proposed for airline passengers as a future requirement for the year 2026. Since the existing parking area is sometimes subject to crowding this is also recommended as an existing requirement. There will be approximately 98 parking spaces available in early 2007 for airline passengers.

General Aviation

For general aviation users, the parking areas are designed to accommodate peak activity periods. A generally accepted value for computing the amount of general aviation parking space needed is 1.3 spaces per peak hour general aviation pilot/passenger. This factor takes into account airport employees, rental car spaces, and visitors as well as pilots/passengers. The area required per automobile is 350 square feet, which includes circulation routes and other necessary clearances within the parking area. The projected general aviation auto parking requirements are summarized in Table 5-10.

Table 5-10
AUTOMOBILE PARKING REQUIREMENTS
FOR GENERAL AVIATION USERS

Item	2011	2016	2026
Peak Hour Operations	37	39	44
Total Occupants	93	98	110
Spaces/Occupant	1.3	1.3	1.3
Total Parking Spaces (Each)	121	127	143
Area/Parking Space (SF)	350	350	350
Total Parking Area (SF)	42,350	44,450	50,050

Source: DMJM Aviation.

There are approximately 14 existing parking spaces provided for general aviation at the terminal building, with additional parking (28 spaces) available at the FBO. The existing auto parking facilities were documented in Chapter 3. As seen in Table 5-10 a requirement of 143 spaces is identified. Considering that based aircraft owners will park their cars in hangar or tie-down space, and roughly 50 percent of peak hour operations are Castle Training School operations, it is estimated that the present number of parking spaces is adequate to accommodate general aviation users through the year 2026. However, additional parking facilities may need to be constructed as part of individual hangar developments. Parking should be conveniently located with respect to future facilities and FBO leaseholds.

Table 5-11 summarizes the auto parking requirements for the passenger terminal and general aviation users.

Table 5-11
SUMMARY OF AUTOMOBILE PARKING REQUIREMENTS (Number of Spaces)

Area	Existing	2011	2016	2026
Passenger Terminal	98*	110	110	110
General Aviation	42**	121	127	143
Restaurant	10	10	10	10
Airport Administration/Other	7	7	7	7
Total	107	248	254	270

* Includes parking expansion project expected to be completed early 2007.

** Does not include use of hangars and tie-downs by based aircraft owners.

Source: DMJM Aviation analysis.

Aircraft Rescue and Fire Fighting (ARFF) Facilities

ARFF is responsible for aircraft incidents and structural fires at the airport. ARFF facilities need to be provided at an airport in accordance with FAR Part 139. The FAR specifies an airport index system for determining the level of protection for fire fighting and rescue services, with an index based on the length of aircraft (expressed in aircraft groups) and the number of average daily departures by aircraft groups. Merced Municipal Airport is currently classified as an Index B, which accommodates aircraft with fuselage lengths of 90 feet to 126 feet. The airport provides at least Index B level ARFF capability during any scheduled or unscheduled air carrier operations at the airport. Index C equipment can be made available with 24 hour request.

One ARFF vehicle is stationed at the airport and is housed at the Airport Fire Station located approximately 200 yards south of the Terminal Building. The heated storage area is centrally located on the airport and has direct access to all ramp areas, taxiways and runways. This unit is maintained in a quick response readiness status for schedule small air carrier operations. The ARFF vehicle is a 2001 E-One Mobile Equipment (KME) 4X4 that provides the following capabilities:

- 1,585 gallons of water/205 gallons AFFF
- Roof Turret Discharge Rate – 40/800 gpm
- 2 – 120 BC rated dry chemical extinguishers

ARFF service for air carrier operations is provided by the City of Merced Fire Department with a total of nine firefighters designated as ARFF personnel.

Based on the forecast of aircraft operations the airport is not anticipated to meet requirements greater than Index B. Fire protection is provided by the City of Merced Fire Department and this arrangement should be continued from the present Airport Fire Station building.

Airport Maintenance

Space for airport maintenance activities are presently housed in a hangar bay in Building 4, which is planned for demolition. It is recommended that future facility requirements include a modest building and area dedicated to airport maintenance and storage. A building of 1,500 square feet is recommended with suitable vehicle/equipment storage area and parking included as part of the airport maintenance facility.

Aviation Fuel Storage

There are currently two fuel storage tanks at the airport. One is a 20,000 gallon above ground tank for 100 LL fuel and the other is a 12,000 gallon underground tank for Jet-A. It is expected that the Jet A tank will be removed and replaced by an above ground tank in the next 12 to 18 months. Currently 4,000 gallon deliveries of Jet A are received every two to three days. It is expected that the Jet A tank will be replaced by a 20,000 gallon tank. It is assumed that a second 20,000 gallon Jet A storage tank is required in the next five years.

Summary of Landside Requirements

Table 5-12 summarizes existing facilities and planning requirements for Merced Municipal Airport. These requirements accommodate the forecasted 180 based aircraft and 110,400 operations of the Baseline scenario that was assumed for facility planning purposes. As previously stated, the commitment to build and provide facilities will depend on the actual demand that materializes, and not forecast demand.

Table 5-12
SUMMARY OF LANDSIDE REQUIREMENTS

Item	Existing	2011	2016	2026	Additional Facilities (2026)
Passenger Terminal (square feet)	3,328	11,000	11,000	11,000	11,000*
GA Terminal (square feet)	576	4,557	4,802	5,390	5,390*
Transient Apron (number of aircraft/area in square yards)					
Single engine/Multi-engine	10 acft.	11/3,625	13/4,550	15/5,150	5/2,150
Turboprops/Business jets	5 acft.	1/1,600	1/1,600	2/1,250	0
Individual hangars (spaces)	50	113	130	159	109
Conventional Hangar Space (square feet)	12,720	33,120	42,150	66,240	53,520
Based Aircraft Tie-downs (number of aircraft)	57	15	18	24	0
Auto Parking (spaces)					
Passenger Terminal	98**	110	110	110	12
General Aviation	42	121	127	143	0***
Restaurant	10	10	10		0
Airport Administration/Other	7	7	7		0
Aircraft Maintenance Hangar (square feet)	7,500	12,300	14,400	18,000	10,500
Fuel Storage (gallons)					
Avgas	20,000	20,000	20,000	20,000	0
Jet A	20,000	40,000	40,000	40,000	20,000
Airport Maintenance Building (square feet)	0	1,500	1,500	1,500	1,500

Notes:
* New terminal facilities are recommended. Additional facilities represents requirement.
** Includes parking expansion project expected to be completed early 2007.
***Requirement met through use of hangars and tie-downs for auto parking by based aircraft owners.

Source: DMJM Aviation.

AIRPORT DRAINAGE

The City commissioned the preparation of a Drainage Master Plan for the airport in 2000. The assessment concluded that the combination of limitations in the outfall systems with the under-sizing of some on-site drainage facilities created flooding problems on-airport. Areas identified as areas of significant flooding include:

- The southeast corner of the airport in the area of Kenneth Riggs Avenue.
- Near the center of the airport at the west ends of Falcon Way and Fly-In Way.
- Grogan Avenue west of Macready Drive.
- The northwest corner of the airport along Wardrobe Avenue between the intersections of Grogan Avenue and Thornton Road.
- Along Thornton Road near the southwest corner of the airport.

The Drainage Master Plan included recommended improvements which are also recommended herein as part of master plan requirements and improvements. Recommendations of the Drainage Master Plan will be included as part of capital improvements proposed in the master plan.

GROUND ACCESS

Access to the airport is primarily provided by V Street (arterial), North West Avenue (arterial), Grogan Avenue (connector), and Macready Drive (local street). V Street connects directly to State Route 99. Plans identify the need to widen SR 99 from 4 to 6 lanes, which will require improvements at the V Street interchange. While V Street is sufficient for airport related traffic, improvements to the interchange may facilitate the need for other improvements along V Street.

Goal T-3.3 of the City's General Plan states that the City should "Provide adequate ground transportation systems that complement air transportation." Caltrans, in its Airport Ground Access Study, identified major needs at the Merced Municipal Airport to be parking, alternative mode access [Merced Area Regional Transit (MART) does stop in front of the passenger terminal], roadway geometrics and roadway condition. In addition, the Technical Advisory Committee identified the need for improved signage and better access to the airport. Alternatives developed will take into the City's goal and needs identified above, will account ground access impacts on existing roads, and will identify the benefits of future SR 99 widening and V Street interchange improvements.

LAND AREA REQUIREMENTS

The land use on an airport will vary depending on the role and volume of traffic. For Merced Municipal Airport, the on-airport land uses can be broadly categorized into three categories described herein.

The ***aircraft operating area (AOA)*** is defined as that area on-airport that lies within the building restriction lines (BRL) and runway protection zones (formerly clear zones). It includes the runways, taxiways, associated safety areas and lateral clearances, and runway approaches. The FAA defines the BRL as a line which identifies suitable building area locations and encompasses the runway protection zones, the runway object free area, the runway visibility zone, NAVAID critical areas, areas required for terminal instrument procedures (TERPS), and areas required for clear line of sight from the control tower (when applicable).

The building restriction line is set at 660 feet from the runway centerline on each side of Runway 12/30. As seen above and as defined by FAA, runway protection zones (RPZs) are also encompassed within the BRL. Therefore, the BRL is assumed to be the general boundary of the AOA.

Areas of the airport serving landside aviation facilities can be categorized as ***aeronautical use areas***. This would include general aviation uses such as storage hangars, tie-downs and transient aprons, terminal and administration building, potential FBO sites, aircraft maintenance, and auto parking.

The current airport is approximately 450 acres. The breakdown of airport property is shown on Table 5-13. Areas classified as "Other" reflect undeveloped, vacant area on the airport. The acreage shown is that which is currently within airport property and it should be noted that Runway Protection Zones are not entirely within the airport property line.

As seen in Table 5-13, roughly two-thirds of the airport is within the AOA. The future planning of the airport must determine the area required for aeronautical use to accommodate forecast demand. Any residual property may be considered for other uses.

Table 5-13
LAND AREAS AT MERCED MUNICIPAL AIRPORT

Category	Acreage	Percent
Aircraft Operating Area (AOA)	305	68
Aeronautical Use Areas	40	9
Other	105	23
Total	450	100

Note: Other reflects undeveloped, vacant area on the airport.
Source: DMJM Aviation.