SECTION 5

FACILITY REQUIREMENTS

SECTION 5
FACILITY REQUIREMENTS

The process of determining facility requirements involves the application of airport planning standards to the projected airport activity to identify the facilities needed to handle the expected traffic. By comparing the future facility needs with existing facility sizes and capacities, facility deficiencies (and needed improvements) are determined.

AIRPORT CLASSIFICATION AND FAA PLANNING STANDARDS

The FAA in its Advisory Circular AC 150/5300-13, Airport Design, has developed an Airport Reference Code (ARC) system that relates airport design criteria and planning standards to two components: (1) the operational characteristics and (2) the physical characteristics of aircraft operating at or expected to operate at the airport.

The first element of the code, the aircraft approach speed category, relates to operational characteristics. The aircraft approach category is a grouping of aircraft that is based on 1.3 times the stalling speed (Table 5-1).

Table 5-1
Aircraft Approach Categories

Category	Approach 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

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

The second component of the ARC is the airplane design group and relates to the wingspan of aircraft and therefore is a physical characteristic (Table 5-2). Airplane Design Group I has a further subdivision for those airports serving small airplanes (12,500 pounds or less maximum takeoff weight) exclusively.

Table 5-2
Airplane Design Groups

Airplane Design Group	Wingspan
I	Up to but not including 49 feet
II	49 feet up to but not including 79 feet
III	79 feet up to but not including 118 feet
IV	118 feet up to but not including 171 feet
V	171 feet up to but not including 214 feet
VI	214 feet up to but not including 262 feet

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

The aircraft approach speed element of the ARC generally deals with runways and runway related facilities whereas the wingspan (and relevant airplane design group) relates to separations required between airfield elements, such as runway-taxiway separations and taxilane-apron clearances.

The airport is currently designed to meet the ARC A-I standards, for small airplanes only. This category includes primarily single engine piston aircraft such as the Beech Baron 55, Beech Bonanza, and Cessna 172. The airport is also regularly used by larger single engine and twin engine aircraft, such as the Beech Baron 58, Cessna 402, and Piper Navajo. Therefore, the ARC B-I planning and design standards for small airplanes have been used in this Master Plan update for Fullerton Municipal Airport. Although there are occasional transient aircraft at the airport exceeding this classification, the numbers of operations by those aircraft have been and will continue to be relatively small. The planning and design standards for ARC B-I are identical to the ARC A-I standards.

Table 5-3 compares the existing airfield dimensions with the airport planning and design standards, taken from FAA Advisory Circular AC 150/5300-13, Airport Design, for an Airport Reference Code of B-I, for small airplanes.[1] Presently, the airport meets the FAA standards for the aircraft regularly using the airport (i.e., ARC B-I), with the following exceptions:

[1] Throughout the remainder of this report, ARC B-I will refer to the ARC B-I standards for small airplanes, unless noted otherwise.

Table 5-3
Airport Planning and Design Standards
For Airport Reference Code B-I

Item	Existing Dimension (Feet)	ARC B-I Requirement for Small Airplanes (Feet) [a]	Deviation from Standard
AIRPORT CATEGORY AND AIRPORT DATA			
Aircraft Approach Category		B	
Airplane Design Group (ADG)		I [a]	
Maximum airplane wingspan for ADG I		48.99	
Airport elevation (MSL)	96		
SEPARATION STANDARDS			
Runway centerline to parallel runway centerline	NA	700	
Runway centerline to parallel taxiway/taxilane centerline	150	150	
Runway centerline to edge of aircraft parking	200-280 [b]	125	
Taxiway centerline to parallel taxiway/taxilane centerline	110-120	69	
Taxiway centerline to fixed or movable object	50 [b]	44.5	
Taxilane centerline to parallel taxilane centerline	NA	64	
Taxilane centerline to fixed or movable object	25-40 [b]	39.5	Some tie-down and hangar areas [c]
RUNWAY DESIGN STANDARDS			
Runway width	75	60	
Runway shoulder width	[d]	10	
Runway blast pad width	0	80	No blast pad
Runway blast pad length	0	60	No blast pad
Runway safety area width	120	120	
Runway safety area length beyond each runway end or stopway end, whichever is greater	240 [e]	240	Runways 6 and 24 [e]
Runway object free area width	250	250	
Runway object free area length beyond each runway end or Stopway end, whichever is greater	240 [e]	240	Runways 6 and 24 [e]
Clearway width	NA	500	
Stopway width	NA	60	
TAXIWAY DESIGN STANDARDS			
Taxiway width	30-60	25	
Taxiway edge safety margin	[d]	5	
Taxiway shoulder width	[d]	10	
Taxiway safety area width	[d]	49	
Taxiway object free area width	[d]	89	
Taxilane object free area width	[d]	79	
Taxiway wingtip clearance	[d]	20	
Taxilane wingtip clearance	[d]	15	

Table 5-3
Airport Planning and Design Standards
For Airport Reference Code B-I
(Continued)

[a] For small airplanes only (up to 12,500 pounds maximum certificated takeoff weight).
[b] Estimated.
[c] Based on aerial photography, some aircraft were parked closer to the taxilane parallel to Taxiway B than the required separation. Separation is below standard in areas where the standard separation is not needed due to the smaller aircraft sizes in those areas.
[d] Not shown on existing Airport Layout Plans.
[e] The existing length from end of runway is measured from each displaced threshold only. This does not provide for the standard length beyond the useable runway end.
[f] Requirements are based on the currently published instrument approach procedures. Runway 24 has a non-precision straight-in instrument approach procedure (day and night) with visibility minimums not lower than 1 mile. The airport has a circling instrument approach procedure (day and night) with visibility minimums not lower than 1 mile .
[g] FAR Part 77 surfaces are not airport design standards. However, they provide an identification of potential obstacles to air navigation.
NA = Not applicable.
Sources: FAA Advisory Circular AC 150/5300-13, Airport Design; Federal Aviation Regulations Part 77, Objects Affecting Navigable Airspace.

- The distance between taxilane centerline and parked aircraft or hangars is less than standard in some areas. The standard separation is not needed in those areas because of the smaller aircraft there.

- Runways 6 and 24 do not have blast pads. However, blast pads are required only if blast or propeller-wash erosion is a problem.

- The Runway Safety Areas, Runway Object Free Areas, and Runway Obstacle Free Zones at the ends of Runways 6 and 24 do not meet the standards, as measured from the useable ends of the runways, as described in Section 3. The standard distances are provided, measured from the displaced thresholds at each end. However, this would meet the FAA standards only by shortening the available runway landing and takeoff distances. This issue is further discussed later in this section and in Section 6.

- Some objects penetrate the Threshold Siting Surfaces for Runways 6 and 24. This issue is further discussed later in this section and in Section 7.

AIRFIELD CAPACITY REQUIREMENTS

Hourly runway capacities and annual service volume (ASV) estimates are needed to compare projected operations activity with airfield capacity and identify the potential need for airfield improvements. The method for computing airport capacity is described in FAA Advisory Circular AC 150/5060-5, Airport Capacity and Delay. The ASV is a reasonable estimate of an airport's annual capacity for aircraft operations. It accounts for differences in such factors as runway use, aircraft mix, and weather conditions that would be encountered over a year's time.

Runway Capacity

The hourly capacity estimates were derived in accordance with instructions and capacity curves set forth in FAA AC 150/5060-5. Based on this methodology, the visual flight rules (VFR) hourly capacity of the runway is approximately 130 operations (each touch-and-go is two operations). VFR conditions occur whenever the cloud ceiling is at least 1,000 feet above ground level and visibility is at least three statute miles. The instrument flight rules (IFR) hourly capacity is approximately 50 operations.

Runway hourly capacity is based on the following parameters:

- Touch-and-go operations are approximately 35 to 40 percent of the total in VFR conditions.
- Operations are 50 percent arrivals and 50 percent departures.
- Two or more exit taxiways are available.

The ASV is calculated to be approximately 270,000 operations a year based on FAA AC 150/5060-5. The runway ASV is based on the hourly capacities described above and the following parameters:

- VFR weather conditions occur about 93.1 percent of the time.
- IFR weather conditions for which an instrument approach procedure exists at the airport occur about 4.8 percent of the time.
- IFR weather conditions for which no instrument approach procedure exists at the airport occur about 2.1 percent of the time.
- The ratio of annual demand to average daily demand during the peak month is estimated to be 290.
- The ratio of daily demand to average peak hour demand during the peak month is estimated to be 8.

Aircraft operations at the airport reached a peak of about 260,000 in 1977, about 96 percent of the ASV. Operations can exceed the ASV, with a resulting increase in aircraft operating delays.

Hourly and Annual Delay

The estimated aircraft operating delays in 2001 were about 0.1 to 0.3 minutes per aircraft operation, using the methodology of FAA AC 150/5060-5. In 2023, when there are projected to be 99,300 annual operations, the average delay is expected to reach 0.3 to 0.4 minutes an operation.

Demand Versus Capacity

By comparing ASV and hourly capacities with the forecast annual and peak hour demand, the potential need for airfield improvements is determined. As seen in Table 5-4, the present airfield will easily accommodate the projected demand through the planning period. Generally, planning for capacity improvements should be initiated when demand is forecast to utilize 60 percent of capacity (FAA Order 5090.3B). This allows sufficient lead-time to develop the improvement before the airport experiences intolerable delays.

From this comparison of demand and capacity it is concluded that airfield (runway/taxiway) improvements are not needed for the purpose of increasing airfield capacity.

Table 5-4
Airfield Demand Versus Capacity
At Fullerton Municipal Airport

		Projected		
Item	**2003**	**2008**	**20013**	**2023**
Annual Operations				
Demand	89,453	92,000	94,100	99,300
Capacity	270,000	270,000	270,000	270,000
% Capacity Utilized	33%	34%	35%	37%
VFR Hourly Operations				
Peak Hour Demand	37	38	39	41
Capacity	130	130	130	130
% Capacity Utilized	28%	29%	30%	32%
IFR Hourly Operations				
Peak Hour Demand	14	15	15	16
Capacity	50	50	50	50
% Capacity Utilized	28%	30%	30%	32%

Source: Analysis by P&D Aviation.

RUNWAY REQUIREMENTS

This section identifies runway requirements needed to satisfy the forecast demand in terms of crosswind coverage, runway length and other parameters, pavement strength requirement, and safety areas. Planning and design standards set forth in FAA AC 150/5300-13, Airport Design, for Airport Reference Code B-I form the basis of this analysis.

Crosswind Runway

According to FAA criteria in AC 150/5300-13, Airport Design, an airport's runway system should provide at least 95 percent wind coverage. This means that winds with a crosswind component exceeding the standard velocity for the airport's ARC should occur less than five percent of the time, on an annual basis. Wind coverage is based on a 10.5-knot (12 mile per hour) crosswind for ARC B-I. The existing runway provides a 99.3 percent average annual coverage for a 10.5-knot crosswind, based on surface wind data collected at the airport over a recent 10-year period (see Table 3-12 for winds at Fullerton municipal by velocity and direction). This meets FAA recommendations for wind coverage, and an additional runway for improved crosswind coverage is not needed.

Runway Safety Area, Runway Object Free Area and Obstacle Free Zone

A Runway Safety Area (RSA) is defined as a rectangular area centered about the runway that is cleared, drained and graded. This area should be capable of accommodating an aircraft in the event that it veers off the runway, as well as fire fighting equipment. The ARC B-I criteria for the RSA is an area 120 feet wide centered on the runway centerline and extending 240 feet beyond each runway end.

The Runway Object Free Area (ROFA) is a rectangular area surrounding the runway provided to enhance the safety of aircraft operations by having the area free of objects. Its clearing standard precludes parked aircraft and other objects, except those objects that need to be located there for air navigation or aircraft ground maneuvering purposes. The design standard for an ARC of B-I is a ROFA 250 feet wide centered on the runway centerline and extending 240 feet beyond the ends of the runway. The RSA and ROFA cannot extend beyond the airport property fence-line at each end of the runway.

The Obstacle Free Zone (OFZ) is an area of airspace centered about a runway that is required to be clear of all objects, except for frangible visual navaids that need to be located in the OFZ because of their function. The OFZ provides clearance protection for aircraft landing or taking off from the runway, and for missed approaches. The design standard for an ARC of B-I is an OFZ 250 feet wide centered on the runway centerline and extending 200 feet beyond the ends of the runway. The runway OFZ is the airspace above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline.

The present airfield configuration accommodates the ARC B-I requirements for the widths of the RSA, ROFA and OFZ at the sides of the runway. However, the portion of the RSA, ROFA and OFZ at the ends of the runway is significantly shorter than FAA standards.

Options for addressing RSA, ROFA and OFZ standards are described in Section 6.

Runway Length

Runway length is a critical consideration in airport planning and design. Aircraft need sufficient runway lengths to operate safely under varying conditions of airport elevation, 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 aircraft performance information from manufacturers' flight manuals in accordance with provisions in Federal Aviation Regulations (FAR) Part 23, Airworthiness Standards: Normal, Utility and Acrobatic Category Airplanes, and FAR 91, General Operating and Flight Rules.

Site characteristics are also considered in analyzing runway length. The site characteristics include: airport elevation, temperature (mean maximum temperature of the hottest month), runway gradient and wind conditions. The FAA Airport Design (Version 4.2) software package contains a program to calculate typical runway requirements for various classes of aircraft. This model was applied, with the airport site characteristics and results shown in Table 5-5. As seen in Table 5-5, the recommended runway lengths for small airplanes (up to 12,500 pounds) with approach speeds of 50 knots or more and less than ten passenger seats range from 2,510 to 3,640 feet. This is the category of aircraft predominantly using the airport now and expected to use the airport in the future. The Runway 6 and 24 takeoff lengths of 3,121 feet satisfy the requirements for over 95 percent of these aircraft.

Runway Width

The runway width requirement is based upon the physical and performance characteristics of aircraft using the runway. The characteristics of importance are wingspan and approach speeds. FAA Advisory Circular AC 150/5300-13 specifies a runway width of 60 feet for ARC B-I. The present runway width of 75 feet exceeds the standard for the ARC B-I classification. The 75-foot width meets the standard for ARC B-II, which includes aircraft such as the Beech Super King Air, Beech 1900C, Cessna 441, and Cessna Citation III.

Runway Grades

The FAA standard for maximum longitudinal runway grade is 2.0 percent for the critical aircraft at Fullerton Municipal Airport (Approach Category B). The runway conforms to this standard as the maximum gradient is approximately 0.44 percent, located near the center of the runway. Generally the grades vary between 0.32 and 0.38 percent, averaging 0.36 percent.

A 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 by FAA for Approach Category B. The runway meets the transverse grade requirement. The runway "crown" is located along the runway centerline.

Table 5-5
FAA Recommended Runway Lengths
For General Aviation Airplanes

AIRPORT AND RUNWAY DATA

Airport elevation	96 feet
Mean daily maximum temperature of the hottest month	88° F
Maximum difference in runway centerline elevation	11 feet
Surface winds	calm

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 approach speeds of 50 knots or greater and less than 10 passenger seats	
75 percent of these small airplanes	2,510 feet
95 percent of these small airplanes	3,070 feet
100 percent of these small airplanes	3,640 feet
Small airplanes with approach speeds of 50 knots or greater and 10 or more passenger seats	4,240 feet

Sources: AC 150/5325-4A, Runway Length Requirements for Airport Design; P&D application of FAA Airport Design (Version 4.2).

Runway Blast Pads

Runway blast pads are surfaces adjacent to the ends of the runways provided to reduce the erosive effects of jet blast and propeller wash if such erosion is a problem. Blast pad pavement should be strong enough to support the occasional passage of aircraft as well as emergency and maintenance vehicles. The runway ends do not have blast pads, and blast or propeller-wash erosion has not been a problem.

Pavement Strength

Runway 6-24 has a rated pavement strength of 12,500 pounds gross weight with single-wheel landing gear configurations. This is sufficient to accommodate all anticipated aircraft. Therefore, the need for runway strengthening is not required. The last runway rehabilitation project was a runway overlay in 2000. It is recognized that one or more additional pavement rehabilitation programs (crack repair and seal coat and/or overlay) will be required during the planning period of this Airport Master Plan update.

Runway Protection Zones

The Runway Protection Zones (RPZs) are areas at the ends runways that provides for the unobstructed passage of aircraft through the airspace above them, and are used to enhance the protection of people and property on the ground. For Fullerton Municipal Airport, the FAA has permitted two sets of RPZs – The "RPZ-Part 77" provides obstruction protection while the "RPZ-Land Use" provides land use protection. Section 7 addresses the conformance of heights of objects around the airport with FAR Part 77 regulations. Section 9 discusses the conformance of land uses in the RPZs with applicable standards.

The RPZ dimensions meeting ARC B-I criteria (for small airplanes) are shown in Table 5-3. These RPZ dimensions are the same for a runway with straight-in instrument approach visibility minimums not lower than one mile (Runway 24) and a runway with a circling approach only (Runway 6). The RPZ-Part 77 and RPZ-Land Use have the same dimensions.

Control over the use of the RPZ areas through the acquisition of sufficient property interest is strongly encouraged by the FAA to prohibit unsafe uses within the RPZs. Presently, the City of Fullerton does not have controlling interest in all the property within the RPZs (refer to Figure 3-4 for the location of the RPZs). The acquisition of avigation easements by the City is recommended for RPZ areas not now controlled by the City.

Avigation easements are recommended by the FAA for property where noise impacts are substantial or where limitations on the height of structures and trees are essential to protection of runway approaches. These easements convey certain enumerated property rights from the property owner. As commonly applied in the aviation industry, avigation easements convey:

- A right-of-way for free and unobstructed passage of aircraft through the airspace over the property at any altitude above an imaginary surface specified in the easement.
- A right to subject the property to noise, vibration, fumes, dust, and fuel particle emissions associated with normal airport activity.
- A right to prohibit the erection or growth of any structure, tree, or other object that would enter the acquired airspace.
- A right-of-entry onto the property, with appropriate advance notice, for the purpose of removing, making or lighting any structure or other object that enters the acquired airspace.
-

- A right to prohibit electrical interference, glare, misleading lights, visual impairments, and other hazards to aircraft flight from being created on the property.

Threshold Siting Surfaces

The Threshold Siting Surfaces are used to establish the location of runway thresholds to meet approach obstacle clearance requirements, particularly as they affect instrument approach visibility minimums. The Threshold Siting Surfaces are imaginary inclined planes extending from the runway thresholds (the approach end of the portion of runway used for landing). The dimensions of these surfaces for ARC B-I are given in Table 5-3. For runways serving small planes only (up to 12,500 pounds maximum gross weight) and having an instrument approach visibility minimum of one mile or greater, the slope is 20:1. If objects penetrate these imaginary surfaces they must be obstruction-lighted.

Section 7 further discusses objects in the Threshold Siting Surface areas. Some objects penetrate these surfaces. These objects will be lowered (trees) or provided with obstruction lights to comply with FAA standards. It is not anticipated that penetrations to the Threshold Siting Surfaces will further affect the instrument approach visibility minimums for the airport since the penetrating objects pre-date the establishment of the instrument approach procedures and/or recent FAA landing minima determinations.

TAXIWAY REQUIREMENTS

Runway 6-24 is served by two full-length parallel taxiways, Taxiway A on the south and Taxiway B on the north. There are four exit taxiways between the ends of the runway, designated Taxiways C through F, respectively, from east to west. The parallel taxiways are 30 feet wide. The exit taxiways vary in width from 35 to 100 feet.

A taxiway width of 25 feet is the standard to accommodate Airport Reference Code B-I aircraft (Table 5-3). Thus the taxiways at the airport exceed the standard width.

The existing runway-to-taxiway centerline separation for the parallel taxiways is 150 feet. This meets the ARC B-I standard of 150 feet. The ARC B-I standard for separation between the centerlines of a taxiway and a parallel taxilane is 69 feet. Taxiway B has parallel taxilanes with centerline separations of 110 feet (at the east end) and 120 feet (at the west end).

The separations between the Taxiway A centerline and "fixed or moveable objects" meet or exceed the ARC B-I standard of 44.5 feet. The separations between the Taxiway B parallel taxilanes and "fixed or moveable objects" meet or exceed the ARC B-I standard of 39.5 feet.

NAVIGATIONAL AIDS, LIGHTING AND RELATED FACILITIES

Instrument Approach Capability

Under existing FAA standards, the present configuration of Fullerton Municipal Airport cannot readily accommodate instrument approach visibility minimums lower than existing (which are as low as one statute mile) for reasons described below. For Runway 24 visibility minimums between ¾ statute mile and one statute mile, the Runway Protection Zones (RPZs) would be six times larger than the present. Its inner width would expand from 250 feet to 1,000 feet. The larger RPZs would contain many residential units south of the existing RPZs. For visibility minimums below ¾ statute mile, the width of the Runway Object Free Area (ROFA) would expand from the present 250 feet to 800 feet. This expanded ROFA would encompass many facilities that would have to be removed, including many hangars and most of the south ramp. Therefore, unless FAA standards are changed, for example due to technological advances in air navigation under instrument conditions, a significantly improved instrument approach capability at Fullerton Municipal could not be justified.

Airfield Lighting and Marking

Low intensity runway edge lights (LIRLs) or medium intensity runway edge lights (MIRLs) are required for runways with instrument approach procedures with visibility minimums as low as one statute mile. Thus the FAA runway edge lighting standards are met with the existing MIRLs. Runway approach lights are required for approach visibility minimums below one statute mile.

The runway has all required markings, in accordance with FAA Advisory Circular 150/5340-1H, Standards for Airport Markings, August 31, 1999.

AIRPORT LANDSIDE FACILITIES

Administration Building

Although the administration building provides the necessary functions for airport administration, air traffic control, and general aviation terminal uses, it has some drawbacks. The building, constructed in the late 1940s and 1950s, would probably not meet today's seismic and Americans with Disabilities Act standards, and the airport administration and operations space is small.

In spite of these limitations, the building has some historical significance due to its time of construction and the airport's role then as one of the busiest airports in the state. Furthermore, airport management considers the available space adequate for its needs. For these reasons, the administration building is considered adequate for the planning horizon. The option to expand or reconstruct the building at some future time should not be compromised, however, and the parking areas on each side of the building should not be developed for other uses.

Aircraft Storage Hangars

The City maintains hangar waiting lists for T-hangars, rectangular / junior executive hangars, and executive hangars. In early 2003, the City reviewed the lists to purge entries that were no longer valid. The lists had the following number of names as of April 2003: 86 for T-hangars, 72 for rectangular / junior executive hangars, and 30 for executive hangars. Some names appear on more than one list and some individuals listed currently have an aircraft in another hangar at the airport. Airport management believes that at least 30 individuals on the lists would rent a hangar immediately if one were available.

Further evidence of the need for individual hangar space is seen in the response to the based aircraft owners survey. Fifteen respondents who currently have aircraft on tiedowns at the airport indicated they would rent a hangar for their aircraft if one were available at the airport. If this response is representative of all aircraft on tiedowns, there would be a demand for about 35 additional hangars by aircraft owners who now rent tiedown space at the airport. In addition, the survey responses indicated eight hangars could be rented, if available, for aircraft which are not now at Fullerton Municipal.

The potential demand for individual hangar space at Fullerton Municipal was estimated by examining the percentage of hangars to total based aircraft at comparable general aviation airports within a 25-mile radius of the airport (see Table 3-3). The following nine airports were considered in this analysis: Compton, El Monte, Brackett, Hawthorne, Chino, Zamperini (formerly Torrance Municipal Airport), Corona, Cable, and Santa Monica. These nine airports had a total of 3,889 based aircraft and 2,334 individual hangar units (T-hangars or rectangular hangars) in 2002. Thus, hangar spaces were 60 percent of based aircraft at these comparable airports, compared with about 45 percent at Fullerton Municipal in 2002. Moreover, some of the other airports have plans to build additional hangars in the near-term.

Based on this demand for hangars in the region, it is conservatively estimated that there is an existing hangar demand at Fullerton Municipal for 55 percent of based aircraft, or 39 additional hangars. Moreover, the hangar demand is conservatively projected to grow to 60 percent of based aircraft beyond 2008, equaling the present percentage for general aviation airports within 25 miles of Fullerton Municipal.

The projected hangar demand represents a need to add 39 additional hangars between now and 2008, another 22 between 2009 and 2013, and another 12 from 2014 to 2023 (Table 5-6). This hangar demand does not include hangars that need to be built to replace old wooden hangars on the north side. The estimated hangar demand assumes that the hangars could be built at a cost that would allow them to be rented at a competitive price. Further, before proceeding with any new hangar development, commitments would be obtained from prospective lessees prior to development. This would further clarify the hangar demand at Fullerton, including the demand by size of hangar.

Table 5-6
Aircraft Hangar, Tiedown and Transient Parking Requirements
Fullerton Municipal Airport

Item	Actual 2002	Required 2008	Required 2013	Required 2023
Individual hangar requirement				
Total based aircraft	348	354	362	382
Hangars percent of based aircraft [a]	44.8%	55%	60%	60%
Number of individual hangars	156	195	217	229
Based aircraft tiedown requirement				
Total based aircraft	348	354	362	382
Less aircraft in individual hangars [b]	183	222	244	256
Less aircraft in conventional hangars	18	18	18	18
Number of based aircraft on tiedowns	147	114	100	108
Tiedown contingency allowance [c]		50	50	50
Based tiedowns with contingency		164	150	158
Transient parking space requirement				
Transient parking operated by City	12	12	13	13
Transient parking operated by FBOs	12	12	13	13
Total transient parking spaces	24	24	26	26

[a] The long-term hangar requirement percentage is assumed to be equal to the existing combined percentage of other airports in the Fullerton Municipal Airport region.
[b] Some hangars have more than one aircraft. Future requirements assume all new hangars will have one aircraft each.
[c] Although not a requirement, these spaces would provide a contingency for unforeseen needs and potential needs beyond 2023.
Source: Analysis by P&D Aviation.

Aircraft Parking Ramp for Based Aircraft Tie-Downs

The requirements for based aircraft tiedown spaces were developed by subtracting the number of aircraft expected to be in individual and conventional hangars from the total based aircraft (Table 5-6). The resulting based aircraft tiedown requirements are a total of 114 in 2008, 100 in 2013, and 108 in 2023. Up to 50 tiedown spaces from 2008 to 2023 could potentially be needed to provide for aircraft relocating to Fullerton from other airports, and other contingencies such as growth beyond 2023.

Some short-term improvements to existing aircraft parking ramp areas are needed. These include:

- Rehabilitation of the west end of the north aircraft parking ramp. This pavement is in very poor condition. The area was used for pavement crushing operations during the south ramp reconstruction project.

- Rehabilitation of other areas of the north aircraft parking ramp, particularly the east end.

Transient Aircraft parking

Transient parking for aircraft not based at the airport is regularly provided by the City of Fullerton as well as the two full-service FBOs, Aviation Facilities, Inc. and General Aviation Company.

City Transient Parking. The City currently reserves 12 tiedown spaces on the south ramp for transient users. Ten are push-back positions for single engine airplanes, and two are taxi-through positions for twins. The demand for this space is expected to increase in proportion to the increase in based aircraft. Using this approach, the demand for City transient spaces will increase to 13 by 2023.

FBO Transient Parking. The FBOs provide a total of 12 transient parking spaces, within their own main leasehold areas and/or space allocated to them on the south ramp. The combined FBO transient space requirements, based on this need increasing in proportion to the increase in based aircraft is 13 by 2023.

Fixed Base Operator Lease Area

The two primary fixed base operators (FBOs), Aviation Facilities, Inc. (AFI) and General Aviation Company, lease about 6.3 acres, excluding tiedown spaces leased from the City on the south ramp (Table 3-7). When tiedowns leased from the City and taxilanes adjacent to the tiedown spaces in the southwest corner of the airport leased to Aviation Facilities, Inc. are included, the effective space available to the two primary FBOs is approximately 8.2 acres (5.5 at AFI and 2.7 at General Aviation Company). Additional general aviation services typically provided by an FBO are furnished by Ray's Flying Club, which occupies about 0.9 acres. Therefore, companies that are regularly providing general aviation services at the airport effectively occupy a total of about 9.1 acres.

Typically, a full service FBO would like a minimum of about five acres. This size is representative of an FBO that generally services small piston and turbo-prop aircraft (up to 12,500 pounds), which are the size of aircraft normally serviced at Fullerton Municipal.[2] An FBO's space needs will depend on the services it provides, particularly the number of tiedowns and hangars it provides for based aircraft.

[2] FBOs that regularly service turbojet aircraft often occupy from 7 to 16 acres.

The existing operators were surveyed to assess their long-term needs and desires for space. The results were:

- Aviation facilities, Inc. expressed a near-term desire for an additional 1,200 to 1,500 square feet of space for office and classroom functions, and space for additional based aircraft hangars equivalent in size to the area leased in the southwest corner.

- General Aviation Company would like space for a maintenance hangar 300 feet by 150 feet in the near term, and eventually another 20 tiedown spaces.

- Ray's Flying Club expressed a desire for 20 to 25 additional tiedowns, space to provide aircraft fueling services, and another 40 vehicle parking spaces, which includes the replacement of about 25 vehicle parking spaces in the tiedown area.

- Air Combat U.S.A. would like to replace its building with a new facility with about the same office space but with hangar space to accommodate their eight aircraft. A need for about 20 additional vehicle parking spaces was also stated.

The ability for the City to provide additional FBO space will depend on space available at the airport and other competing uses. Alternative concepts for FBO and other airport development are discussed in Section 6.

Aviation Fuel Storage

Aviation Gas (Avgas). Bulk avgas storage requirements were determined for the airport based upon the forecast of aviation gas (avgas) flowage contained in Section 4. Avgas flow was projected in gallons pumped per peak month, which was estimated to be the same as the percentage of annual aircraft operations in the peak month (10.2 percent of annual). The bulk avgas storage requirement is determined on the basis of the projected consumption, using a 14-day storage capacity as a target (Table 5-7). Based on this approach, it was found that the existing avgas tanks totaling 22,000 gallons will provide adequate storage capacity through 2023.

Jet-A Fuel. A similar analysis for Jet-A fuel (Table 5-7) indicates that the existing bulk storage tanks for Jet-A fuel will also be adequate throughout the planning period.

Drainage and Utilities

Future requirements for storm water runoff improvements and the expansion of utility facilities will depend on planned construction at the airport, such as hangars, other buildings and lighting.

Table 5-7
Aviation Fuel Storage Requirements
For Fullerton Municipal Airport [a]

Item	Average 2000 - 2001	Required 2008	Required 2013	Required 2023
Aviation Gas (Gallons)				
Annual Flowage	274,000	276,000	282,000	298,000
Peak Month Flowage [b]	27,900	28,100	28,800	30,400
Average Day Flowage in Peak Month [c]	900	910	930	980
Storage Capacity [d]	22,000	12,700	13,000	13,700
Jet-A Fuel (Gallons)				
Annual Flowage	165,000	166,000	169,000	179,000
Peak Month Flowage [b]	16,800	16,900	17,200	18,300
Average Day Flowage in Peak Month [c]	540	550	560	590
Storage Capacity [d]	22,000	7,600	7,800	8,200

[a] Source: P&D Aviation analysis.
[b] Estimated to be 10.2 percent of annual flowage, which is equal to the percent of operations in the peak month of 2001.
[c] Peak month divided by 31.
[d] Storage requirement based on a 14-day reserve.

Ground Access and Vehicle Parking

The major access roadways serving the airport are Commonwealth Avenue and West Artesia Avenue (providing primary access) and Dale Street and Magnolia Avenue (providing secondary access). Table 5-8 shows the average daily traffic (ADT, the number of vehicle movements along the street) on these streets where they are nearest the airport. The table also indicates the estimate of traffic generated by the airport at these locations.

The airport traffic is estimated based on the Institute of Transportation Engineers methodology, whereby the average ADT is estimated to be 1.97 times the number of average daily takeoffs. Using this approach, average airport traffic in 2000 is estimated to have been about 243 ADT (250 ADT in 2001). In 2000, airport traffic was 0.3 to 1.4 percent of the total ADT at these locations, which is not a significant amount.

Table 5-8
Comparison of Traffic Generated by Fullerton Municipal Airport With Total Traffic on Major Airport Access Roads [a]

Item	Actual	Projected		
	2000	2008	2013	2023
Total ADT Nearest the Airport [b]				
Commonwealth Avenue	15,400	18,000	19,900	24,300
West Artesia Avenue	5,400	6,300	7,000	8,500
Dale Street	8,800	10,300	11,400	13,900
Magnolia Avenue	19,500	22,800	25,200	30,700
Average Daily Takeoffs	123	126	129	136
ADT Generated by Airport	243	248	254	268
Airport ADT on Affected Streets [c]				
Commonwealth Avenue (90%)	219	223	229	241
West Artesia Avenue (15%)	36	37	38	40
Dale Street (20%)	49	50	51	54
Magnolia Avenue (20%)	49	50	51	54
Airport Percent of Total ADT on Affected Streets				
Commonwealth Avenue	1.4%	1.2%	1.2%	1.0%
West Artesia Avenue	0.6%	0.6%	0.5%	0.5%
Dale Street	0.6%	0.5%	0.4%	0.4%
Magnolia Avenue	0.3%	0.2%	0.2%	0.2%

ADT = Average Daily Traffic (vehicle movements)
[a] Source: P&D Aviation analysis, except as noted.
[b] Source for 2000 data: City of Fullerton. Future traffic is projected by the City to grow at 2% a year.
[c] Based on methodology in Trip Generation, 6th Edition, 1997, by the Institute of Transportation Engineers. Airport ADT was estimated to occur on the access roads at the following percentages: Commonwealth Avenue – 90%, West Artesia Avenue – 15%, Dale Street – 20%, and Magnolia Avenue – 20%.

The City of Fullerton projects the traffic on the major airport access streets will grow at an average of two percent a year (Table 5-8). In the future, the percentage of ADT contributed by the airport will decrease. Thus, the airport traffic will not be a significant portion of traffic on the major access routes. It is expected that the access roadway system will be adequate to accommodate airport-generated traffic together with all other traffic.

The occupancy of vehicle parking space at the airport was surveyed four times between February and June of 2002. On a typical busy day (defined as the average day of the peak month), a maximum of about 152 spaces of the 284 marked spaces at the airport would be occupied. The number of parked vehicles surveyed was adjusted proportionately to the number of aircraft operations for the day to reflect busy day conditions. There were 304 busy day aircraft operations in 2001, and busy day operations in 2003 were estimated to be 294. On a peak operations day (e.g., 400 operations or more), it is estimated that about 190 to 200 spaces would be occupied.

Assuming the need for parking spaces at the airport increases in proportion to the number of busy day aircraft operations, there will be a requirement for about 163 spaces in a typical busy day in 2023 (Table 5-9). Although the total number of vehicle parking spaces appears adequate through 2023, there is a significant deficiency of spaces at Ray's Flying Club. Most vehicles there must park in the tiedown area.

Table 5-9
Vehicle Parking Requirements
For Fullerton Municipal Airport [a]

Item	Actual 2002	Spaces Used on Busy Day 2002	Required 2008	Required 2013	Required 2023
Busy Day Aircraft Operations	304	--	301	308	327
Vehicle Spaces					
Southwest Area (near AFI)	115	46	46	47	49
Terminal Area	34	16	16	16	17
Southeast Area (near Aviation Facilities)	64	32	32	32	34
Orange County Fire Authority	27	9	9	9	10
Air Combat	21	17	17	17	18
Ray's Flying Club [b]	9	21	21	21	23
Biggles Aviation Area	14	11	11	11	12
Total Spaces	284	152	152	153	163

[a] Source: P&D Aviation analysis.
[b] Actual number of spaces excludes parking in tiedown area.

SUPPORT FACILITIES AND SERVICES

Aircraft Rescue and Fire Fighting (ARFF)

FAA Advisory Circular 150/5210-6C establishes recommended scales of fire fighting protection for general aviation airports. Presented in the Advisory Circular are two indices used in determining the level of protection based on the number of operations of aircraft by aircraft length category. The two indexes are as follows:

- Index 1 -- Airports having at least 1,825 annual departures of aircraft more than 30 feet but no more than 45 feet long.

- Index 2 -- Airports having at least 1,825 annual departures of aircraft more than 45 feet but not more than 60 feet long.

Presently there are 12 aircraft between 30 and 40 feet long based at the airport, and one over 40 feet in length. Although there are no counts of aircraft operations by aircraft type, it is estimated that there are somewhat less than 1,825 annual departures of aircraft over 30 feet long, judging from the average number of operations per based aircraft.[3] Departures by aircraft over 40 feet long are not expected to exceed 1,825 a year now or over the master planning period.

The recommended minimum equipment to meet the Index 1 standard for an aircraft crash is:

- One fire truck with primary agent capability of (a) a capacity for 190 gallons of water for Aqueous Film Forming Foam (AFFF) production and a solution application rate of 150 gallons per minute, or (b) a capacity of 290 gallons of water for protein foam and a solution application rate of 230 gallons per minute.

- Supplementary agent capability 300 pounds of dry chemical powders.

- Necessary communications equipment, fire fighter protective clothing, and miscellaneous safety equipment.

As described in Section 3, The City of Fullerton has two fire stations within about 1.8 miles of the airport. In the event of an aircraft crash or other emergency, fire-fighting vehicles from these stations can arrive at the airport within about six minutes from the time of dispatch. Medical aid services from the stations can reach the airport within five minutes. The equipment at these two stations meets the FAA standards set forth above for Index 1.

[3] If the 12 aircraft over 30 feet in length were flown at the airport's average rate of about 260 annual operations (11 departures a month) per based aircraft, they would fly about 3,120 operations a year (1,560 departures a year).

Airport Security

The existing system of security fencing, restricted access gates, video monitoring, and security lighting at the airport provides excellent protection against theft, vandalism and related crimes. Further additions to this system were evaluated in response to recommendations for other airport facility improvements or modifications.

PROPERTY REQUIREMENTS

There is no present opportunity for the City of Fullerton to purchase property adjoining the airport that would be economically viable. The acquisition of avigation easements is recommended for property in the RPZ areas not owned or under easement by the City.

NEEDS IDENTIFIED IN AIRCRAFT OWNERS SURVEY

A survey of based aircraft owners was conducted to obtain information on their use of the airport and solicit comments and suggestions for master plan improvements. The survey questionnaire is in Appendix B. Questionnaires were sent to all City of Fullerton tie-down and hangar customers and given to FBOs for distribution to their based aircraft customers from February to August, 2002. One hundred twenty-seven completed questionnaires were received and tabulated. These questionnaires represented 151 based aircraft, about 43 percent of the airport's total. Characteristics of owners of aircraft based at the airport are shown in Table 5-10.

In the survey of owners of aircraft based at the airport, respondents were asked to indicate the most important facility improvement needs of the airport. Their responses are summarized in Table 5-11. The facility improvements noted with the greatest frequency were the construction of new T-hangars and the replacement of the old wooden T-hangars.

Table 5-10
Profile of Owners of Aircraft
Based at Fullerton Municipal Airport, 2002 [a]

Characteristic	Survey Response
Owner's residence (percent of respondents)	
Fullerton	18.9%
Other Orange County	57.5%
Outside Orange County	23.6%
Reasons for basing aircraft at airport (percent of respondents)	
Proximity to home	86.6%
Availability of facilities	39.4%
Proximity to business	32.3%
Favorable flying conditions	32.3%
Availability of services	25.2%
Cost of services	15.8%
Use of aircraft (average of responses)	
Personal	68.4%
Business	17.9%
Training	10.9%
Other	2.8%
Average dollars spent annually in Fullerton area for operation of aircraft based at the airport (based on average of responses)	$15,200

[a] Source: Airport survey, February – August 2002.