Buchanan Field Airport

Master Planning Program

C. CAPACITY ANALYSIS & FACILITY REQUIREMENTS

Buchanan Field

C > Capacity Analysis and Facility Requirements

INTRODUCTION. The capacity of an airfield is primarily a function of the major aircraft operating surfaces that compose the facility and the configuration of those surfaces (runways and taxiways). However, it is also related to and considered in conjunction with wind coverage, airspace utilization, and the availability and type of navigational aids. Capacity refers to the number of aircraft operations that a facility can accommodate on either an hourly or yearly basis. It does not refer to the size or weight of aircraft. Facility requirements are used to determine those facilities needed to meet the forecast demand related to the aircraft fleet. Evaluation procedures will analyze runway length, dimensional criteria, aprons, hangars, and vehicular access.

Airport Reference Code (ARC)/Critical Aircraft Analysis

As a foreword to capacity analysis and facility requirements, it is important to first determine the Airport Reference Code (ARC) for each runway and establish a critical aircraft to properly establish capacity or facility considerations that are specific to the ARC and design aircraft operating from Buchanan Field Airport, or forecast to operate during the 20-year planning horizon of this Master Plan. A discussion follows on airport design consideration relating to the Airport Reference Code and the critical aircraft analysis.

The types of aircraft presently utilizing an airport and those projected to utilize the facility in the future are important considerations for planning airport facilities. An airport should be designed in accordance with the Airport Reference Code (ARC) standards that are described in *AC 150/5300-13 Airport Design.* The ARC is a coding system used to relate and compare airport design criteria to the operational and physical characteristics of the aircraft intended to operate at the airport. The ARC has two components that relate to the airport's "Design Aircraft." The first component, depicted by a letter (i.e., A, B, C, D, or E), is the aircraft approach category and relates to aircraft approach speed based upon operational characteristics. The second component, depicted by a Roman numeral (i.e., I, II, III, IV, or V), is the aircraft design group and relates to aircraft wingspan (physical characteristic). Generally speaking, aircraft approach speed applies to runways and runway-related facilities, while aircraft wingspan is primarily related to separation criteria associated with taxiways and taxi lanes.

Runway 1L/19R. This is the main runway and primary parallel runway at Buchanan Field Airport. Past planning studies have identified this runway as one that mostly accommodates small to medium size general aviation aircraft (up to and including many of the business jets). The historic “Design Aircraft” fleet for this runway has been made up of turbo-props such as the Beech Super King Air 200, various Cessna Citations, the majority of the Dassault Falcons, etc., along with the BAe-146, which was used for commercial air service at Buchanan Field Airport. As indicated in the 1990 Airport Master Plan for Buchanan Field Airport, this runway has been designed using an Airport Reference Code for Runway 1L/19R of B-III, which was a combination of the “B” approach speed category, for aircraft such as the King Air and Citation, and aircraft design group “III” to account for the larger wingspan of the BAe-146. The BAe-146 has ceased operating from Buchanan Field Airport; however, larger business jet aircraft with design group III wingspans (Gulfstream V and the Bombardier Global Express) have begun to occasionally operate from the Airport. Therefore, it seems prudent and appropriate to recommend the continuation of the ARC B-III designation for Runway 1L/19R.

Runway 1R/19L. The secondary parallel runway at Buchanan Field Airport has historically been designed to accommodate the smaller single- and twin-engine general aviation aircraft weighing less than 12,500 pounds (ARC B-I Small Aircraft Only). This is still the proper Airport Reference Code for Runway 1R/19L and will be maintained.

Runway 14L/32R. This is the primary crosswind runway at Buchanan Field Airport. Past planning studies have identified this runway as one that mostly accommodates small to medium size general aviation aircraft (up to and including many of the business jets). The historic “Design Aircraft” fleet for this runway has been made up of turbo-props such as the Beech Super King Air 200, various Cessna Citations, the majority of the Dassault Falcons, etc., along with the BAe-146, which was used for commercial air service at Buchanan Field. As indicated in the 1990 Airport Master Plan for Buchanan Field Airport, this runway has been designed using an Airport Reference Code for Runway 14L/32R of B-III, which was a combination of the “B” approach speed category, for aircraft such as the King Air and Citation, and aircraft design group “III” to account for the larger wingspan of the BAe-146. The BAe-146 has ceased operating from Buchanan Field Airport; however, larger business jet aircraft with design group III wingspans (Gulfstream V and the Bombardier Global Express) have begun to occasionally operate from the Airport. Therefore, it seems prudent and appropriate to recommend the continuation of the ARC B-III designation for Runway 14L/32R.

Runway 14R/32L. The secondary crosswind runway at Buchanan Field Airport has historically been designed to accommodate the smaller single- and twin-engine general aviation aircraft weighing less than 12,500 pounds (ARC B-I Small Aircraft Only). This is still the proper Airport Reference Code for Runway 14R/32L and will be maintained.

Airfield Capacity Methodology

The evaluation method used to determine the capability of the airside facilities to accommodate aviation operational demand is described in the following narrative. Evaluation of this capability is expressed in terms of potential excesses and deficiencies in capacity. The methodology used for the measurement of airfield capacity in this study is described in the Federal Aviation Administration (FAA) Advisory Circular 150/5060-5, *Airport Capacity and Delay.* From this methodology, airfield capacity is defined in the following terms:

- *Hourly Capacity of Runways*: The maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period.

- *Annual Service Volume*: A reasonable estimate of an airport's annual capacity (i.e., level of annual aircraft operations that will result in an average annual aircraft delay of approximately one to four minutes).

The capacity of an airport's airside facilities is a function of several factors. These factors include the layout of the airfield, local environmental conditions, specific characteristics of local aviation demand, and air traffic control requirements. The relationship of these factors and their cumulative impact on airfield capacity are examined in the following paragraphs.

Airfield Layout

The arrangement and interaction of airfield components (runways, taxiways, and ramp entrances) refers to the layout or "design" of the airfield. As previously described, Buchanan Field Airport is served by four runways (two sets of parallel runways): Runway 1L/19R, Runway 1R/19L, Runway 14L/32R, and Runway 14R/32L. Each of the four runways is served by a full parallel taxiway. There are also numerous runway exit taxiways and connector taxiways that are designed to minimize aircraft runway occupancy time, thus increasing the capacity of the runway system.

Existing landside facilities, which include private hangars, corporate hangars, FBO hangars, aprons, and other various aviation, use facilities on both the east and west sides of the Airport, located mostly south of Taxiway "C" east of Runway 1R and west of Runway 32R; west of Runway 1L/19R; and, northwest of Runway 14R. These facilities are well situated to take advantage of the existing taxiway system.

Environmental Conditions

Climatological conditions specific to the location of an airport not only influence the layout of the airfield, but also impact the use of the runway system. Variations in the weather resulting in limited cloud ceilings and reduced visibility typically lower airfield capacity, while changes in wind direction and velocity typically dictate runway usage and also influence runway capacity.

CEILING AND VISIBILITY. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, describes three categories of ceiling and visibility minimums for use in both capacity and delay calculations. Visual Flight Rules (VFR) conditions occur whenever the cloud ceiling is at least 1,000 feet above ground level and the visibility is at least three statute miles. Instrument Flight Rules (IFR) conditions occur when the reported cloud ceiling is at least 500 feet, but less than 1,000 feet and/or visibility is at least one statute mile, but less than three statute miles. Poor Visibility and Ceiling (PVC) conditions exist whenever the cloud ceiling is less than 500 feet and/or the visibility is less than one statute mile.

Meteorological data from the National Climatic Data Center has been used to tabulate information at Buchanan Field Airport in more specific terms:

- *VFR conditions - Ceiling equal to or greater than 1,000 feet above ground level and visibility is equal to or greater than three statute miles. These conditions occur at the Airport approximately 95% of the time annually.*

- *VFR minimums to existing Runway 19R approach minimums (LDA Approach) - Ceiling less than 1,000 feet and/or visibility less than three statute miles, but ceiling equal to or greater than 380 feet and visibility equal to or greater than ¾-mile. These conditions occur at the Airport approximately 3.6% of the time annually.*

- *Category I ILS minimums - Ceiling less than 1,000 feet and/or visibility less than three statute miles, but ceiling equal to or greater than 200 feet and/or visibility equal or greater than ½-statute mile. These conditions occur at the Airport approximately 4.3% of the time annually.*

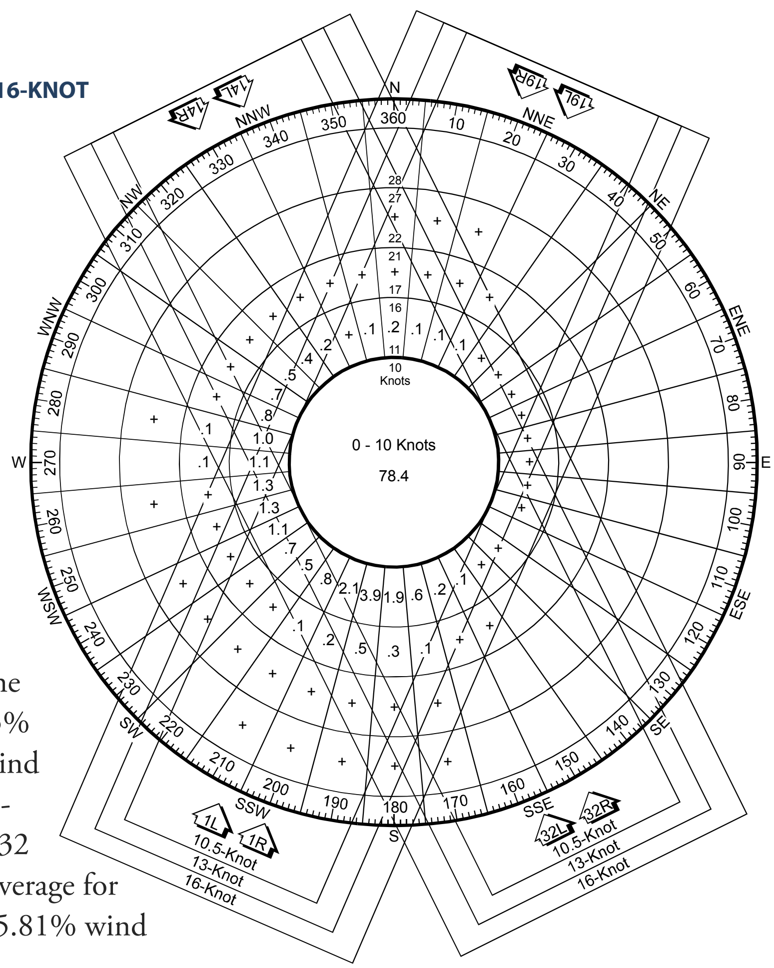
WIND COVERAGE. Surface wind conditions have a direct effect on the operation of an airport; runways not oriented to take the fullest advantage of prevailing winds will restrict the capacity of the airport to varying degrees. When landing and taking off, aircraft are able to properly operate on a runway as long as the wind component perpendicular to the direction of travel (defined as a crosswind) is not excessive. To determine wind velocity and direction at Buchanan Field Airport, wind data from the Airport were obtained and an all-weather wind rose was constructed, which is presented in the following illustration, entitled *ALL- WEATHER WIND ROSE: 10.5-, 13-, AND 16-KNOT CROSSWIND COMPONENTS*. The wind data to construct the all-weather wind rose were obtained for the period January 2000 through July 2005.

The appropriate crosswind component is dependent upon the Airport Reference Code (ARC) for the type of aircraft that use an airport on a regular basis. As described earlier in this chapter, B-III is the appropriate ARC for Buchanan Field Airport. However, a large percentage of aircraft operating at the Airport fit into the ARC A-I, B-I, or B-II categories. According to FAA AC 150/5300-13, for ARC-A-I and B-I airports, a crosswind component of 10.5 knots is considered maximum. For ARC A-II and B-II airports, a crosswind component of 13 knots is considered maximum. Finally, for ARC C-I through D-III airports (which, in this case, is inclusive of ARC B-III airports), a crosswind component of 16 knots is considered maximum. Because Buchanan Field Airport is utilized by various ARC categories of aircraft regularly, this wind coverage analysis will consider all three crosswind components.

Figure C1

ALL-WEATHER WIND ROSE: 10.5-, 13-, AND 16-KNOT CROSSWIND COMPONENTS

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center Station 72493 - Concord, California. Period of Record - 2000-2005.



The desirable wind coverage for an airport is 95%. This means that the runway should be oriented so that the maximum crosswind component is not exceeded more than 5% of the time. Based on the wind analysis for Buchanan Field Airport, the 1/19 runway alignment provides 99.64% wind coverage for the 16-knot crosswind component, 96.95% wind coverage for the 13-knot crosswind component, and 93.59% for the 10.5-knot crosswind component. The 14/32 orientation provides 99.45% wind coverage for the 16-knot crosswind component, 95.81% wind coverage for the 13-knot crosswind component, and 90.84% for the 10.5-knot crosswind component. Combined, the two runways provide 99.90% wind coverage for the 16-knot crosswind component, 99.07% wind coverage for the 13-knot crosswind component, and 96.52% for the 10.5-knot crosswind component. This analysis indicates that the existing runway configuration provides adequate wind coverage for the 16-, 13-, and 10.5-knot crosswind components, and no new runways are required from a *wind coverage* standpoint. Table C1, entitled *ALL-WEATHER WIND COVERAGE SUMMARY*, presents the wind coverage provided by the Buchanan Field Airport runway system during all weather conditions.

Table C1
ALL-WEATHER WIND COVERAGE SUMMARY

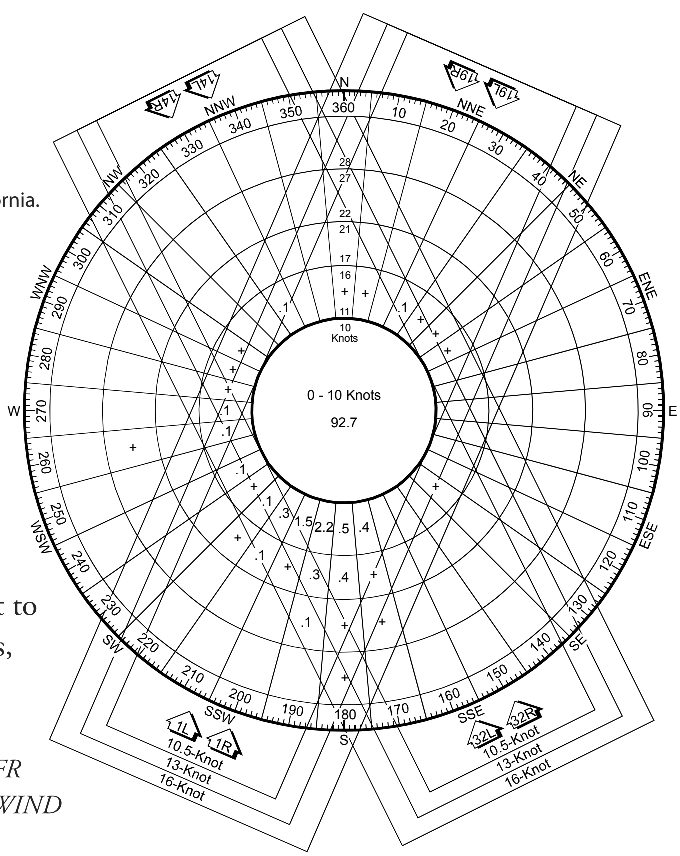
	Crosswind Component		
	10.5-Knot	**13-Knot**	**16-Knot**
Runway 1/19	93.59%	96.95%	99.64%
Runway 14/32	90.84%	95.81%	99.45%
Combined	96.52%	99.07%	99.90%

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center. Station 72493 - Concord, California. Period of Record - 2000-2005.

Figure C2
IFR[1] WIND ROSE: 10.5-, 13-, AND 16-KNOT CROSSWIND COMPONENTS

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center Station 72493 - Concord, California. Period of Record - 2000-2005.

Notes: [1]Ceiling of less than 1,000 feet, but equal to or greater than 200 feet and/or visibility less than three statute miles, but equal to or greater than ½-statute mile.



As stated previously, the Airport currently has three published straight-in instrument approach procedures to Runway 19R. The procedure with the lowest minimums provides a decision height of 380 feet and visibility minimums of ¾-mile. In an effort to analyze the effectiveness of these approaches, the following Instrument Flight Rules (IFR) wind rose has been constructed and is presented in the following figure, entitled *IFR WIND ROSE: 10.5-, 13-, AND 16-KNOT CROSSWIND*

COMPONENTS. Again, wind data from Buchanan Field Airport have been used in the construction of the IFR wind rose.

The following table, Table C2, entitled *IFR WIND COVERAGE SUMMARY*, quantifies the wind coverage offered by the various runways under IFR meteorological conditions.

Table C2
IFR WIND COVERAGE SUMMARY

	Wind Coverage Provided Under IFR Conditions[1]	
	10.5-Knot Crosswind 5-Knot Tailwind to Maximum Headwind	**16-Knot Crosswind 10-Knot Tailwind to Maximum Headwind**
Runway 1	86.41%	93.46%
Runway 19[2]	79.64%	99.17%
Runway 14	88.03%	99.41%
Runway 32	87.51%	95.67%
Runway 1 & 19[2]	99.42%	99.94%
Runway 1 & 14	97.86%	99.80%
Runway 1 & 32	89.50%	95.86%
Runway 14 & 32	97.82%	99.80%
Runway 14 & 19[2]	93.90%	99.85%
Runway 19[2] & 32	99.39%	99.94%

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center Station 72493 - Concord, California. Period of Record - 2000-2005.

Notes: [1]Ceiling of less than 1,000 feet, but equal to or greater than 200 feet and/or visibility less than three statute miles, but equal to or greater than ½-statute mile. [2]Runway 19R equipped with existing instrument approach capabilities.

It should be noted that the above table provides information for both the 10.5-knot crosswind component and the 16-knot crosswind component. A maximum tailwind of 5-knots is utilized for the 10.5-knot crosswind component, while a 10-knot tailwind is utilized for the 16-knot crosswind component. This variation is considered appropriate for proper estimation of conditions for small aircraft where a 10.5-knot crosswind is considered maximum and for large aircraft where the 16-knot maximum crosswind is utilized.

From this IFR wind coverage summary, it can be determined that if a single runway orientation is considered, Runway 14 provides the best wind coverage, followed closely by Runway 19 (for the 16-knot crosswind component). If two runway orientations are considered, Runways 1 and 19 offer the best IFR wind coverage for the 10.5-knot crosswind component (i.e., 99.42%), and

Runways 19 and 32 provide only fractions of a percent less coverage (i.e., 99.39%). Runways 1 and 19 and Runways 19 and 32 provide equal amounts of coverage when considering the 16-knot crosswind component (i.e., 99.94%). Thus, the existing instrument approach capabilities to Runway 19R provide good wind coverage during IFR conditions, but improvements can be made if additional instrument approach procedures are provided to other runway ends. The potential and benefits of the provision of additional and improved instrument approach capabilities at the Airport are examined in the following chapters.

Characteristics of Demand

Certain site-specific characteristics related to aviation use and aircraft fleet makeup impact the capacity of an airport. These characteristics include aircraft mix, runway use, percent arrivals, touch-and-go operations, exit taxiways, and airport traffic control rules.

AIRCRAFT MIX. The capacity of a runway is dependent upon the type and size of the aircraft that use the facility. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, categorized aircraft into four classes based on maximum certificated takeoff weight. This differs from the Airport Reference Code (ARC) defined previously, which classifies aircraft based on aircraft approach speed (A-E). For aircraft mix, aircraft Classes A and B consist of small single-engine and twin-engine aircraft (both prop and jet), weighing 12,500 pounds or less, which are representative of the general aviation fleet. Classes C and D aircraft are larger jet and propeller aircraft typical of the business jet fleet, along with those aircraft used by the airline industry and the military. Buchanan Field Airport has no operations by Class D aircraft (over 300,000 pounds), nor are any expected to occur in the future. Class C aircraft operations at the Airport are primarily executive-type prop and general aviation jet aircraft. Aircraft mix is defined as the relative percentage of operations conducted by each of these four classes of aircraft. The aircraft mix for Buchanan Field Airport is depicted in the following table, entitled *AIRCRAFT CLASS MIX FORECAST, 2004-2024.*

Table C3
AIRCRAFT CLASS MIX FORECAST, 2004-2024

	VFR Conditions			IFR Conditions		
Year	**Class A & B**	**Class C**	**Class D**	**Class A & B**	**Class C**	**Class D**
2004[1]	90%	10%	0%	80%	20%	0%
2009	88%	12%	0%	78%	22%	0%
2014	86%	14%	0%	76%	24%	0%
2019	84%	16%	0%	74%	26%	0%
2024	83%	17%	0%	73%	27%	0%

Class A - Small Single Engine, < 12,500 pounds.
Class B – Small Twin-Engine, < 12,500 pounds.
Class C - 12,500 - 300,000 pounds.
Class D - > 300,000 pounds.
[1]Actual.

RUNWAY USE. Runway use is defined by the number, location, and orientation of the active runway(s) and relates to the distribution and frequency of aircraft operations to those facilities. Airport Traffic Control Tower personnel estimate that annual landings and takeoffs occur in a southerly direction (Runways 19R and 19L) approximately 22% and 20% of the time, respectively, and to the northwest (Runways 32R and 32L) roughly 22% and 18% of the time, respectively. Annual operations occur on Runway 1L about 8% of the time, on Runway 1R approximately 6% of the time, and on Runways 14L and 14R roughly 2% of the time each.

PERCENT ARRIVALS. Runway capacity is also significantly influenced by the percentage of all operations that are arrivals. Because aircraft on final approach are typically given absolute priority over departures, higher percentages of arrivals during peak periods of operations reduce the Annual Service Volume. The operations mix occurring on the runway system at Buchanan Field Airport reflects a general balance of arrivals to departures. Therefore, it was assumed in the capacity calculations that arrivals equal departures during the peak period.

TOUCH-AND-GO OPERATIONS. A touch-and-go operation refers to an aircraft maneuver in which the aircraft performs a normal landing touchdown followed by an immediate takeoff without stopping or taxiing clear of the runway. These operations are normally associated with training and are included in local operations figures. Touch-and-go operations comprise approximately 46% of all operations at the Airport. By the end of the 20-year planning period, local operations are expected to decrease to approximately 42% of the total aircraft operations at the Airport.

EXIT TAXIWAYS. The capacity of a runway is greatly influenced by the ability of an aircraft to exit the runway in the quickest and safest manner possible. Therefore, the quantity and design of the exit taxiways can directly influence aircraft runway occupancy time and the capacity of the airfield system. The number of exit taxiways at Buchanan Field Airport appears adequate for existing operations. However, from a capacity standpoint, some improvements can be made. The capacity analysis gives credit to only those runway exit taxiways located between 2,000 and 4,000 feet from the threshold of each runway. It appears that the capacity of the runway system may benefit from the construction of additional exit taxiways. The potential for future taxiway locations will be examined as the Airport Development Plan is formulated.

AIR TRAFFIC CONTROL RULES. The FAA specifies separation criteria and operational procedures for aircraft in the vicinity of an airport contingent upon aircraft size, availability of radar, sequencing of operations and noise abatement procedures, both advisory and/or regulatory, which may be in effect at the airport. The impact of air traffic control on runway capacity is most influenced by aircraft separation requirements dictated by the mix of aircraft utilizing the airport. Presently, there are no special air traffic control rules in effect at Buchanan Field Airport that significantly impact operational capacity.

Airfield Capacity Analysis

As previously described, the determination of capacity for Buchanan Field Airport uses the methodology described in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, along with the Airport Design Computer Program that accompanies AC 150/5300-13. Several assumptions are incorporated into these capacity calculations: arrivals equal departures, the percent of touch-and-go operations is between 0 and 50% of total operations, there is a full-length parallel taxiway with ample exits and no taxiway crossing problems, there are no airspace limitations, the Airport has at least one runway equipped with an ILS and the necessary air traffic control facilities to carry out operations in a radar environment, IFR weather conditions occur roughly 10% of the time, and, approximately 80% of the time, the Airport is operated with the runway use configuration that produces the greatest hourly capacity.

Applying information generated from the preceding analyses, capacity and demand are formulated in terms of the following results:

- *Hourly Capacity of Runways (VFR and IFR)*
- *Annual Service Volume (ASV)*

Hourly Runway Capacity

Calculations of hourly capacity begin with an evaluation of each possible runway-use configuration at the airport. With consideration of the Airport's aircraft mix index, annual percentage of touch-and-go operations and taxiway exit rating, an hourly capacity was calculated. In its normal operating configurations, the VFR hourly capacity of the Airport is potentially as high as 121 operations and the IFR hourly capacity is potentially as high as around 58 operations per hour.

Annual Service Volume

After determining the hourly capacity for each potential runway use configuration, a weighted hourly capacity of the entire airport can be calculated. The weighted hourly capacity takes into consideration not only the aircraft mix index, but the percent utilization of each possible runway use configuration as well. The weighted hourly capacity for Buchanan Field Airport for 2004 was determined to be approximately 112 operations per hour. This weighted hourly capacity can then be used in calculating the Annual Service Volume (ASV) for the Airport.

The ASV is calculated using the following formula:

$ASV = C_W \times D \times H$

C_W	weighted hourly capacity
D	ratio of annual demand to average daily demand
H	ratio of average daily demand to average peak hour demand

With the existing runway configuration, and in consideration of existing utilization patterns, the Airport has been determined to have a daily ratio (D) of 284 and an hourly ratio (H) of 10.04 and, thus, an ASV of approximately 300,688.

With one exception, conditions involving the determination of the weighted hourly capacity, the daily ratio, and the hourly ratio are not forecast to change significantly at Buchanan Field Airport in the future. The exception is the aircraft mix, which is expected to have a slight increase in Class C aircraft operating at the Airport during the planning period (i.e., from 10% to 17% during VFR conditions and from 20% to 27% during IFR conditions). The increase in aircraft mix reduces the amount of operations an airport can accommodate by increasing the separation criteria required during approaches.

The hourly ratio, as specified in the formula, is the inverse of the daily operations that occur during the peak period. In other words, as operations increase, the peak periods tend to spread out, increasing the hourly ratio. As the hourly ratio increases, the ASV increases accordingly, even without runway improvements. However, as presented in the following table, entitled *AIRFIELD CAPACITY FORECAST SUMMARY, 2004-2024*, the ASV at Buchanan Field Airport is expected to decrease as the aircraft mix increases in the future.

This analysis indicates that the forecast demand does not indicate the need for a new runway at Buchanan Field Airport. However, because of increased demand, other improvements (e.g., taxiway improvements, approach improvements, etc.) should be programmed to maintain an efficient and safe aviation operational environment.

Table C4
AIRFIELD CAPACITY FORECAST SUMMARY, 2004-2024

Year	Total Annual Operations	Future Design Hour Operations[1]	Annual Service Volume
2004	128,375	45	300,688
2009	141,161	49	259,598
2014	156,365	54	258,095
2019	169,878	59	253,149
2024	181,465	64	245,829

Notes: [1]See Table B9, Entitled *PEAK PERIOD OPERATIONS FORECAST*, for information on design hour operations calculation.

Ground Access Capacity

As an employment center, and to facilitate air travelers, ground access is an important element in the overall ability of an airport to function properly.

Regional Auto Access-Highways

Buchanan Field Airport enjoys excellent regional access from many Bay Area locations. The Airport is located within a triangle created by Interstate 680 and State Routes 4 and 242, providing it with regional freeway access north, south, east, and west. Of these connections, I-680 is the busiest, carrying 160,000 vehicles per day on Concord Avenue, while State Routes 4 and 242 both carry approximately 92,000 vehicles per day in the project vicinity.

Capacity improvements to highways have and continue to focus on creating continuous carpool lanes and improving interchanges. In the past decade, a carpool lane in each direction was added to State Route 242 between I-680 and State Route 4, and along I-680 between Walnut Creek and Martinez. Recently passed County Measure J provides funding to close remaining gaps in the carpool lanes south of the project area, and the current rebuilding of the Benicia-Martinez Bridge will complete carpool lanes in Solano County over the next decade. A project to rebuild the I-680/State Route 4 interchange focuses on easing congestion; the project has completed environmental clearance and awaits final design and funding, with an anticipated construction start in 2010.

Local Auto Access-Streets

Concord Avenue and Marsh Drive are the local streets providing access to the Airport. Concord Avenue serves the more developed east side facilities, and provides direct connections to State Route 242 and I-680, as well as downtown Concord. Three through lanes in either direction are augmented by turning lanes at intersections. This roadway system is sufficient to handle the current east side development, and has sufficient capacity for a significant densification of use. Marsh Drive provides access to west side facilities. Access from Concord Avenue and the south requires a circuitous route under I-680, along Pacheco Boulevard and via Center Avenue adjoining a residential neighborhood. Access from State Route 4 is similarly circuitous, skirting the northern border of the Airport, but there are relatively direct highway connections that avoid residential neighborhoods.

On-Airport Roadways

John Glenn Drive provides access to east side facilities on Airport property, and Sally Ride Drive provides access to west side facilities. Both roadways provide a sufficient level of access for the current uses on Airport property. John Glenn Drive is a two-lane road with center median, sidewalks, and curbside parking. This roadway provides sufficient capacity for significant densification of use, and there is sufficient width available to create turn pockets should they be needed in the future. Sally Ride Drive is a two-lane drive, but, for much of its length, lacks sidewalks and paved shoulders. As one of the few areas on Buchanan Field Airport not built out to capacity, the west side is perhaps the most appropriate and logical location for short-term landside development. Therefore, should this increased development occur, the Sally Ride Drive facilities should be upgraded. Sally Ride Drive, currently is a dead end street, but could be connected with Marsh Drive to complete a loop should additional capacity be required.

Facility Requirements

This section presents the analysis of requirements for airside and landside facilities necessary to meet aviation demand at Buchanan Field Airport. For those components determined to be deficient, the type and size of facility required to meet future demand are identified. Airside facilities examined include the runways, taxiways, runway protection zones, thresholds, and navigational aids. Landside facilities include such facilities as hangars, aircraft apron areas, and airport support facilities.

This analysis uses the growth scenario set forth in the forecast of demand for establishing future development needs at the Airport. This is not intended to dismiss the possibility that, due to the unique circumstances in the region, either accelerated growth or consistently higher or lower levels of activity may occur. Aviation activity levels should be monitored for consistency with the forecasts. In the event of changes, the schedule of development should be adjusted to correspond to the demand for facilities rather than be set to predetermined dates of development. By doing this, over-building or under-building can be avoided.

Airside Facilities

DIMENSIONAL CRITERIA. The FAA Advisory Circular 150/5300-13, *Airport Design*, recommends standard widths, minimum clearances, and other dimensional criteria for runways, taxiways, safety areas, aprons, and other physical airport features. Dimensions are recommended with respect to the Aircraft Approach Category and Airplane Design Group designations (the Airport Reference Code), and availability and type of approach instrumentation. Because different aircraft types utilize the four runways at Buchanan Field Airport, each has an appropriate Airport Reference Code (ARC). Existing dimensions and the corresponding design criteria applicable to Buchanan Field Airport are contained in the following Tables C5 through C9, entitled *DIMENSIONAL STANDARDS.* One table is provided for each runway. Due to the commonality of issues, tables will be presented for the primary runway system (Runway 1L/19R and Runway 14L/32R) first, then for the secondary runway system (Runway 1R/19L and Runway 14R/32L).

As identified in the tables, most of the facilities at Buchanan Field Airport meet or exceed most of the appropriate requirements. However, there are some noticeable deficiencies with the primary runway system, including: the Runway Safety Area (RSA) and Runway Object Free Area (ROFA) standards are not met on the north end of Runway 1L/19R and the RSA and ROFA standards are not met on both the north and south ends of Runway 14L/32R. These deficiencies are primarily due to property boundary and site constraints that do not allow for the runway longitudinal design standards to be met off the ends of the above-referenced runways. However, these deficiencies are principally remedied by the use of Declared Distances, which will be discussed following Table C6. It should also be mentioned that the required design standard for the separation of parallel runways operating under Visual Flight Rule (VFR) conditions is not met for all four runways at Buchanan Field Airport.

The correction of these dimensional standard deficiencies will be considered in the formulation of the development plan for the Airport.

Table C5
ARC B-III DIMENSIONAL STANDARDS – RUNWAY 1L/19R (in feet)

Item	Existing Dimension	ARC B-III
Runway:		
Width	150	100
Safety Area Width	300	300
Safety Area Length (beyond runway end)		
Runway 1L	***0***	600
Runway 19R	600	600
Safety Area Length (prior to threshold)		
Runway 1L	600	600
Runway 19R	600	600
Object Free Area Width	800	800
Object Free Area Length (beyond runway end)		
Runway 1L	***-200***	600
Runway 19R	600	600
Obstacle Free Zone Width	400	400
Obstacle Free Zone Length (beyond runway end)		
Runway 1L	200	200
Runway 19R	2,600	2,600
Taxiway:		
Width (see note below)	***40-50***	50-60
Runway Centerline to:		
Holdline	250	200
Parallel Runway Centerline - VFR	***500***	700
Parallel Taxiway Centerline	500	300
Aircraft Parking Area	550	400

Source: FAA Advisory Circular 150/5300-13, *Airport Design*, and actual airport conditions.

Runway Safety Area: An area adjacent to the runway that is cleared and graded and that has no potentially hazardous ruts, humps, depressions, or other surface variations. Under dry conditions, the safety area shall be capable of supporting aircraft rescue equipment, snow removal equipment, and the occasional passage of aircraft without causing structural damage.

Runway Object Free Area: A two-dimensional ground area surrounding a runway that is clear of objects protruding above the safety area edge elevation. Objects are acceptable within the ROFA if the location is required for the purpose of air navigation or aircraft ground maneuvering purposes.

Bold/Italic Numbers: Indicate existing non-standard condition.

Taxiway dimensions:
Taxiway E – 50 feet   Taxiway F – 50 feet
Taxiway K – 40 feet   Taxiway J – 50 feet
Taxiway G – 50 feet   Taxiway N – 50 feet (proposed)

Table C6
ARC B-III DIMENSIONAL STANDARDS – RUNWAY 14L/32R (in feet)

Item	Existing Dimension	ARC B-III
Runway:		
Width	150	100
Safety Area Width	300	300
Safety Area Length (beyond runway end)		
Runway 14L	***70***	600
Runway 32R	***480***	600
Safety Area Length (prior to threshold)		
Runway 14L	600	600
Runway 32R	***420***	600
Object Free Area Width	800	800
Object Free Area Length (beyond runway end)		
Runway 14L	***-230***	600
Runway 32R	***480***	600
Obstacle Free Zone Width	400	400
Obstacle Free Zone Length (beyond runway end)		
Runway 14L	200	200
Runway 32R	200	200
Taxiway:		
Width (see note below)	***25-50***	50-60
Runway Centerline to:		
Holdline	250	200
Parallel Runway Centerline - VFR	***500***	700
Parallel Taxiway Centerline	300	300
Aircraft Parking Area	500	400

Source: FAA Advisory Circular 150/5300-13, *Airport Design*, and actual airport conditions.

Runway Safety Area: An area adjacent to the runway that is cleared and graded and that has no potentially hazardous ruts, humps, depressions, or other surface variations. Under dry conditions, the safety area shall be capable of supporting aircraft rescue equipment, snow removal equipment, and the occasional passage of aircraft without causing structural damage.

Runway Object Free Area: A two-dimensional ground area surrounding a runway that is clear of objects protruding above the safety area edge elevation. Objects are acceptable within the ROFA if the location is required for the purpose of air navigation or aircraft ground maneuvering purposes.

Bold/Italic Numbers: Indicate existing non-standard condition.

Taxiway dimensions:
Taxiway J (south) – 25 feet
Taxiway A – 50 feet
Taxiway J (north) – 50 feet
Taxiway C – 50 feet
Taxiway H – 45 feet
Taxiway M – 35 feet

Declared Distance Application

FAA Airport Design Advisory Circular 150/5300-13 describes the use of declared distances for applications such as "existing constrained airports where it is impracticable to provide the runway safety area (RSA), the runway object free area (ROFA) or the runway protection zone (RPZ) in accordance with the design standards" for airport geometry and runway design. The Advisory Circular further states "by treating the airplane's runway performance distances independently, provides an alternative airport design methodology by declaring distances to satisfy the airplane's takeoff run, takeoff distance, accelerate-stop distance, and landing distance requirements. The declared distances are takeoff run available (TORA), takeoff distance available (TODA), accelerate-stop distance available (ASDA), and landing distance available (LDA)."

At Buchanan Field Airport, the implementation of these standards permits the boundaries of the Runway 1L/19R and Runway 14L/32R RSA and ROFA lengths to be specified independently with the establishment of displaced thresholds for Runways 14L and 32R and a clearway for Runway 32R to remedy these conventional dimensional deficiencies. The resulting revised distances are listed in the following table.

Table C7
DECLARED DISTANCES (IN FEET)

	Runway			
	1L	**19R**	**14L**	**32R**
Displaced Threshold (Approach Ends)	0	0	300	350
Stopway (Stop End)	0	0	0	0
Clearway (Stop End)	0	0	0	450
Takeoff Run Available (TORA)	4,410	5,010	4,601	4,601
Takeoff Distance Available (TODA)	5,001	5,001	4,601	5,081
Accelerate-Stop Distance Available (ASDA)	4,410	5,010	4,001	4,481
Landing Distance Available	4,410	4,410	3,701	4,131

Source: February 1997 Buchanan Field Airport Layout Plan.

Table C8
ARC B-I DIMENSIONAL STANDARDS – RUNWAY 1R/19L (IN FEET)

Item	Existing Dimension	ARC B-I Small Aircraft Only
Runway:		
Width	60	75
Safety Area Width	120	120
Safety Area Length (beyond runway end)		
Runway 1R	240	240
Runway 19L	240	240
Safety Area Length (prior to threshold)		
Runway 1R	240	240
Runway 19L	240	240
Object Free Area Width	250	250
Object Free Area Length (beyond runway end)		
Runway 1R	240	240
Runway 19L	240	240
Obstacle Free Zone Width	250	250
Obstacle Free Zone Length (beyond runway end)		
Runway 1R	200	200
Runway 19L	200	200
Taxiway:		
Width	***25***	35,50
Runway Centerline to:		
Holdline	125	125
Parallel Runway Centerline - VFR	700	500
Parallel Taxiway Centerline	***150***	200
Aircraft Parking Area	***125***	330

Source: FAA Advisory Circular 150/5300-13, *Airport Design*, and actual airport conditions.

Runway Safety Area: An area adjacent to the runway that is cleared and graded and that has no potentially hazardous ruts, humps, depressions, or other surface variations. Under dry conditions, the safety area shall be capable of supporting aircraft rescue equipment, snow removal equipment, and the occasional passage of aircraft without causing structural damage.

Runway Object Free Area: A two-dimensional ground area surrounding a runway that is clear of objects protruding above the safety area edge elevation. Objects are acceptable within the ROFA if the location is required for the purpose of air navigation or aircraft ground maneuvering purposes.

Bold/Italic Numbers: Indicate existing non-standard condition.

Table C9
ARC B-I DIMENSIONAL STANDARDS – RUNWAY 14R/32L (IN FEET)

Item	Existing Dimension	ARC B-I Small Aircraft Only
Runway:		
Width	***60***	75
Safety Area Width	120	120
Safety Area Length (beyond runway end)		
Runway 14R	240	240
Runway 32L	240	240
Safety Area Length (prior to threshold)		
Runway 14R	240	240
Runway 32L	240	240
Object Free Area Width	250	250
Object Free Area Length (beyond runway end)		
Runway 14R	240	240
Runway 32L	240	240
Obstacle Free Zone Width	250	250
Obstacle Free Zone Length (beyond runway end)		
Runway 14R	200	200
Runway 32L	200	200
Taxiway:		
Width	***25***	35,50
Runway Centerline to:		
Holdline	125	125
Parallel Runway Centerline - VFR	700	500
Parallel Taxiway Centerline	***150***	200
Aircraft Parking Area	***125***	330

Source: FAA Advisory Circular 150/5300-13, *Airport Design*, and actual airport conditions.

Runway Safety Area: An area adjacent to the runway that is cleared and graded and that has no potentially hazardous ruts, humps, depressions, or other surface variations. Under dry conditions, the safety area shall be capable of supporting aircraft rescue equipment, snow removal equipment, and the occasional passage of aircraft without causing structural damage.

Runway Object Free Area: A two-dimensional ground area surrounding a runway that is clear of objects protruding above the safety area edge elevation. Objects are acceptable within the ROFA if the location is required for the purpose of air navigation or aircraft ground maneuvering purposes.

Bold/Italic Numbers: Indicate existing non-standard condition.

RUNWAY PAVEMENT STRENGTH. The primary runway system (Runways 1L/19R and 14L/32R) pavement at Buchanan Field Airport can currently support aircraft with gross weights of 60,000 pounds single-wheel; 90,000 pounds dual-wheel; and, 140,000 pounds dual tandem-wheel main landing gear configuration. This provides superior pavement strength to accommodate the existing and forecast aircraft fleet utilizing Buchanan Field Airport.

The secondary runway system (Runways 1R/19L and 14R/32L) pavement strength can support 17,000 pounds and 12,500 pounds, respectively, for single-wheel main landing gear aircraft. The pavement strength currently exhibited by the secondary runway system pavement is adequate to accommodate the existing and forecast aircraft utilization as “small-aircraft only” runways.

AIRFIELD CAPACITY. The evaluation of airfield capacity presented earlier indicates that the Airport will not exceed the capacity of the existing runway/taxiway system before the end of the planning period. The Airport’s Annual Service Volume (ASV) at the end of the planning period was determined to be approximately 245,000 operations. FAA planning standards indicate that when 60% of the ASV is reached (in this case, some 147,000 operations), the Airport should start planning ways to increase capacity. Accordingly, should 80% of the ASV be reached (representing about 196,000 operations), construction of facilities to increase capacity should be initiated.

During 2004, aircraft operations at Buchanan Field Airport totaled approximately 128,162, which is short of the 60% ASV level. However, forecasts of aircraft operations indicate that approximately 181,000 aircraft operations will occur at the Airport by the year 2024. These forecasts indicate the Airport will reach 60% of its operational capacity during the 20-year planning period, but not 80%. Although programming of additional runways at the Airport would appear not needed, it will be essential to maintain and upgrade the existing runway/taxiway/approach system to efficiently and safely accommodate increasing demand.

Even before an airfield reaches capacity, it begins to experience certain amounts of delay in aircraft operations. As an airport’s operations increase toward capacity, delay increases exponentially. Therefore, it is important to monitor the number of aircraft operations regularly and identify factors that may be acting as capacity constraints. This will enable airport management to react to unexpected trends before the lack of operational capacity might become a critical issue.

RUNWAY LENGTH. Generally, runway length requirements for design purposes at a general aviation airport like Buchanan Field Airport are premised upon the category of aircraft using the Airport. The categories are small aircraft under 12,500 pounds maximum takeoff weight and large aircraft under 60,000 pounds maximum certificated takeoff weight. The general aviation large aircraft fleet (over 12, 500 pounds) includes the majority of the active business jet fleet.

Runway length requirements are derived from the computer based FAA Airport Design Software supplied in conjunction with Advisory Circular 150/5300-13, *Airport Design*. Using this software, three values are entered into the computer, including the airport elevation of 23 feet Above Mean Sea Level (AMSL), the Mean Normal Maximum Temperature (NMT) of 91 degrees Fahrenheit[1], and the maximum difference in runway elevation at the centerline of one foot. This data generates the general recommendations for runway length requirements at Buchanan Field Airport, which are provided in the following table, entitled *RUNWAY LENGTH REQUIREMENTS*.

Table C10
RUNWAY LENGTH REQUIREMENTS

Aircraft Category	Length (Feet) Dry	Wet
Airplanes less than 12,500 lbs. with less than 10 seats		
75% of Small Aircraft Fleet	2,520	2,520
95% of Small Aircraft Fleet	3,090	3,090
100% of Small Aircraft Fleet	3,650	3,650
Airplanes less than 12,500 lbs. with 10 or more seats	4,280	4,280
Airplanes greater than 12,500 lbs. and less than 60,000 pounds		
75% of fleet at 60% useful load	4,670	5,360
75% of fleet at 90% useful load	6,790	7,000
100% of fleet at 60% useful load	5,470	5,500
100% of fleet at 90% useful load	8,460	8,460

Source: FAA Advisory Circular 150/5300-13, *Airport Design*. Lengths based on 23' AMSL, 91° F NMT, and a maximum difference in runway centerline elevation of one foot with 500 miles length of haul for airplanes of more than 60,000 pounds.

As shown in the above table, the small aircraft fleet (under 12,500 pounds) requires a runway length in wet conditions between 2,520 and 4,280 feet, while the aircraft over 12,500 pounds, but less than 60,000 pounds, requires between 5,360 and 8,460 feet. Each of the runway lengths given for large aircraft under 60,000 pounds provides a runway sufficient to satisfy the operational requirements of a certain percentage of the aircraft fleet at a certain percentage of the useful load (i.e., 75% of the fleet at 60% useful load). Useful load is defined as the difference

[1] Source: February 1997 Buchanan Field Airport Layout Plan Data Table.

between the maximum gross takeoff weight and the empty weight of the aircraft, exclusive of fuel. Generally, the following aircraft comprise 75% of the general aviation aircraft fleet between 12,500 and 60,000 pounds: Learjets, Sabreliners, Citations, Challengers, Falcons, Hawkers, and Westwinds.

One factor to consider when analyzing the generalized runway length requirements given in the above table is that the actual length necessary for a runway is a function of elevation, temperature, and aircraft stage length. As temperatures change on a daily basis, the runway length requirements change accordingly. The cooler the temperature, the shorter the runway necessary. Therefore, if a runway is designed to accommodate 75% of the fleet at 60% useful load, this does not mean that, at certain times, a larger or more heavily loaded aircraft cannot use the airport. However, the amount of time such operations can safely occur can be greatly restricted.

The analysis presented in the table above indicates that Runway 1L/19R, with a length of 5,001 feet, can accommodate all of the aircraft fleet weighing less than 12,500 pounds and accommodate a significant percentage of the larger general aviation aircraft fleet. Runway 14L/32R, with a length of 4,601 feet, provides an excellent length for the smaller general aviation fleet, but is limited in its ability to accommodate aircraft over 12,500 pounds. Runways 1R/19L and 14R/32L, with lengths of 2,770 feet and 2,799 feet, respectively, are able to accommodate approximately 75% of the general aviation aircraft fleet under 12, 500 pounds, due to their shorter lengths.

TAXIWAYS. Taxiways are constructed primarily to enable the movement of aircraft between the various functional areas on the airport and the runway system. Some taxiways are necessary simply to provide access between aircraft parking aprons and runways, whereas, other taxiways become necessary to provide more efficient and safer use of the airfield. As described earlier, the taxiway system at Buchanan Field Airport generally meets the required standards.

RUNWAY PROTECTION ZONES (RPZS). The function of the RPZ is to enhance the protection of people and property on the ground beyond the runway ends. This is achieved through airport control of the RPZ areas. The RPZ is trapezoidal in shape and centered about the extended runway centerline. It begins 200 feet beyond the end of the area usable for takeoff or landing. The RPZ dimensions are functions of the type of aircraft operating at the airport and the approach visibility minimums associated with each runway end.

In consideration of the existing instrument approach minimums and the type of aircraft each runway is designed to accommodate, the following table, entitled *RUNWAY PROTECTION ZONE DIMENSIONS*, lists existing RPZ dimensional requirements, along with the requirements for improved approach capabilities.

Table C11
RUNWAY PROTECTION ZONE DIMENSIONS

Item	Width at Runway End (feet)	Length (feet)	Width at Outer End (feet)	Airport Controls Entire RPZ
Existing RPZ Dimensional Requirements:				
Runway 1L	1,000	1,700	1,510	Yes
Runway 19R	1,000	2,500	1,750	T.B.D.[1]
Runway 14L	500	1,000	700	Yes
Runway 32R	500	1,700	1,010	Yes
Runway 1R	250	1,000	450	Yes
Runway 19L	250	1,000	450	Yes
Runway 14R	250	1,000	450	Yes
Runway 32L	250	1,000	450	Yes
Required RPZ Dimensions for Various Visibility Minimums:				
Visual and not lower than one mile, Small Aircraft Only	250	1,000	450	---
Visual and not lower than one mile, Approach Categories A & B	500	1,000	700	---
Visual and not lower than one mile, Approach Categories C & D	500	1,700	1,010	---
Not lower than ¾-mile, all aircraft	1,000	1,700	1,510	---
Lower than ¾-mile, all aircraft	1,000	2,500	1,750	---

Source: FAA Advisory Circular 150/5300-13, *Airport Design*. [1] To Be Determined – requires detailed analysis of Buchanan Field Airport Exhibit "A" Airport Property Map.

ELECTRONIC LANDING AIDS. Electronic landing aids, including instrument approach capabilities and associated equipment, airport lighting, and weather/airspace services, were detailed in the *Inventory of Existing Conditions* chapter of this document. The Airport is currently equipped with an LDA, VOR, and NDB or GPS instrument approaches to Runway 19R.

Global Positioning System (GPS) approaches are emerging as the FAA's new standard for instrument approach technology. With GPS, the cost of establishing improved instrument approaches should be significantly reduced. Because of the expected continued use of sophisticated business and corporate aircraft, as well as the trickledown of technology enhancements to smaller general aviation aircraft operating at Buchanan Field Airport, the ability to implement improved instrument approaches is analyzed in the next chapter.

VISUAL LANDING AIDS (LIGHTS). Presently, three of the four runways at Buchanan Field Airport are equipped with runway lighting. Runway 1L/19R is equipped with High Intensity Runway Lights (HIRLs) and Runways 14L/32R and 1R/19L are equipped with Medium Intensity Runway Lights (MIRLs). Runways 19R, 1L, and 32R are equipped with Visual Approach Slope Indicator (VASI) lights. Finally, Runway 19R is equipped with a Medium Intensity Approach Light System (MALS) and Runway 32R is equipped with Runway End Indicator Lights (REILs). Runway 14R/32L has no visual landing aids. In conjunction with the examination of improved instrument approaches described above, improved Airport lighting will also need to be evaluated. The type of Airport lighting will be dependent on the type of instrument approach capabilities and will be examined in the next chapter.

Landside Facilities

Landside facilities are those facilities that support the airside facilities, but are not actually part of the aircraft operating surfaces. These consist of such facilities as terminal buildings, aprons, access roads, hangars, and support facilities. Following an analysis of these existing facilities, current deficiencies can be noted in terms of accommodating both existing and future needs.

AIRCRAFT STORAGE. Aircraft based at Buchanan Field Airport are stored in several types of hangar structures: FBO hangars, large corporate hangars, individual executive hangars (accommodating one or several aircraft), individual portable hangars (accommodating one or sometimes two small aircraft), T-hangars (accommodating one or sometimes two small aircraft), and shade hangars (accommodating one aircraft per stall). Currently, there are five FBO hangars, 178 T-hangars, 42 portable-type hangars, 18 shade hangars, and 9 commercial/corporate hangars at the Airport. In addition, based aircraft at the Airport are stored outside on apron tiedowns (approximately 214 of the 497, or roughly 43% aircraft based at the Airport are stored on apron tiedowns).

AIRCRAFT STORAGE NEEDS. Over the course of the 20-year planning period, the number of based aircraft is forecast to increase to 660, indicating that an increase in storage facilities to accommodate approximately 163 new aircraft will be required. It is assumed that future storage spaces will reflect some of the characteristics of current storage patterns, with the majority of the based aircraft fleet being stored in hangars.

TIEDOWN STORAGE REQUIREMENTS/BASED AIRCRAFT. Aircraft tiedowns are provided for those aircraft that do not require, or do not desire to pay the cost for, hangar storage. Space calculations for these areas are based on 360 square yards of apron for each aircraft to be tied down. This amount of space allows for aircraft parking and circulation between the rows of parked aircraft. While the actual number varies, presently, approximately 214 based aircraft use the tiedown facilities at the Airport. Past trends indicate that as more aircraft are based at the Airport, hangar storage capacity is surpassed before additional hangars are supplied. However, it would appear that an excess of tiedown space exists at the Airport in an amount well sufficient to handle any likely lag in new hangar construction. Therefore, additional based aircraft tiedown space would generally not be indicated as part of the development plan for this Master Planning effort.

TIEDOWN STORAGE REQUIREMENTS/ITINERANT AIRCRAFT. In addition to the needs of the based aircraft tiedown areas addressed in the preceding section, transient aircraft also require apron parking areas at Buchanan Field Airport. This storage is provided in the form of transient aircraft tiedown space. In calculating the area requirements for these tiedowns, an area of 400 square yards per aircraft is used. There are two reasons this area is larger than the area required for based aircraft. First, the users of the transient tiedown spaces will not be as familiar with the layout and circulation patterns as based aircraft operators, and, additional maneuvering room is essential. Secondly, whereas typically smaller, single-engine based aircraft use tiedowns as storage, all types of transient aircraft use tiedowns, making it necessary to provide additional space for the larger aircraft. The development plan for the Airport will designate adequate areas for apron development to satisfy this demand.

SUMMARY. The accompanying table shows the type of facilities and the number of units or acres needed for that facility in order to meet the forecast demand for each development phase. The actual types of indoor storage facilities to accommodate based aircraft have been identified as T-hangars (including portable hangars and shade hangars) and conventional hangars (corporate and executive). Conventional hangars, as defined by this Airport Master Plan, are individually owned hangars grouped together, either under one roof or separate free standing structures. It is also recognized that FBO hangars will continue to accommodate some of the aircraft storage demand (with a likely focus to include jet aircraft), although the actual number, size, and location of these large hangars will depend on user needs and financial feasibility. Therefore, the quantity of future FBO hangars has not been projected; however, potential development sites will be identified in the *Airport Plans* chapter of this document.

The following table, entitled *GENERAL AVIATION FACILITY REQUIREMENTS*, depicts the area or number of required general aviation landside facilities during all stages of development. This will assist in the development of project construction phasing.

Table C12
GENERAL AVIATION FACILITY REQUIREMENTS

Facility	Existing	2009	2014	2019	2024
Itinerant Apron	1.9 acres	12.3[1] acres	13.5[1] acres	14.6[1] acres	16.0[1] acres
Based Aircraft Apron	25.7 acres	16.5 acres	16.0 acres	15.7 acres	15.5 acres
Hangars					
T-hangars (no.)	238	294	326	359	390
No. Acres per units/bays	13.8 acres	17 acres	18.9 acres	20.8 acres	22.6 acres

Source: Existing building survey and BD&C projections based on FAA AC 150/5300-13.
[1] Inclusive of FBO Itinerant Apron needs.

Support Facilities Requirements

In addition to the aircraft storage facilities described above, there are several Airport support facilities that have quantifiable requirements and that are vital to the efficient and safe operation of the Airport.

SERVICE ROADS. An additional important consideration at Buchanan Field Airport is programming for the appropriate location of a service road system, which will accommodate the need for maintenance, emergency, and fueling vehicles to access all areas on Airport property without the need to drive on public roads or the taxiway/runway surfaces. When additional hangars and other aviation use areas are developed on the southwest side of the Airport, it is likely that a fuel truck service road may be appropriate to segregate aircraft and vehicular traffic to connect these facilities with other development areas on the Airport. A comprehensive perimeter/service road proposal is programmed as part of the development plan proposal in later chapters.

PASSENGER TERMINAL FACILITIES. No proposal is currently being considered that would return scheduled commercial passenger service to Buchanan Field Airport, with no specific activity forecast for commercial passenger service, as stated in the *Forecasts of Aviation Activity* chapter presented in Working Paper One. A generalized narrative of possible facilities and space reservation considerations will be included in the overall discussion of development alternatives to be presented in the next chapter of this Master Plan.

Summary

The information provided in this chapter provides the basis for understanding what facility improvements at the Airport might help in the effort to efficiently and safely accommodate future demands. Following are the major improvement considerations that are indicated in this *Capacity Analysis and Facility Requirements* chapter:

- **Airfield Configuration.** Consideration should be given to simplifying the airfield by reducing or reconfiguring the number of runways, particularly secondary parallel runways 1R/19L and 14R/32L. The potential merits of this measure must be examined against overall airfield capacity implications, capital costs, and local airport user preferences. Merits may include: simplifying the airport layout, reducing airfield operating and maintenance expenses, increasing airport landside development opportunities, and reducing aircraft flight tracks.

- **Primary Runway Orientation & Length.** Consideration should be given to both the orientation and length of Runway 1L/19R. From an airport design perspective, a runway extension is appropriate to meet the operational needs of 75% of aircraft under 60,000 pounds operating at 60% of their useful load. A principal goal of this analysis should be to determine if re-orienting this runway will allow for *functional* additional length, and will such extension yield sufficient aircraft benefit that it merits the disruption of the primary runway's orientation and use patterns? Physical site limitations, airport obstructions, existing wind data, FAA design requirements and declared distance analysis, and off-airport land use considerations are representative examples of some of the benchmark issues that must be addressed.

- **Instrument Approach Capabilities.** Consideration should be given to an examination of potential benefits of enhanced instrument approach capabilities at Buchanan Field Airport. Currently, the Airport has three published instrument approach procedures – all serving Runway 19R. Moreover, due to site constraints and surrounding terrain, a conventional Instrument Landing System (ILS) approach had been determined to be unsuitable for Buchanan Field Airport. A summary analysis will be undertaken to determine if newer technologies (e.g., Global Positioning System (GPS) satellite-based navigation systems, etc.) achieve improved instrument approach capabilities. Limitations to implementation include: surrounding airspace considerations, terrain, FAA design requirements and declared distance, airport obstructions, operational benefits, aircraft equipage, and environmental impacts.

- **Hangar Development.** Consideration should be given to the existing unmet demand for hangar development. According to the *Association of Bay Area Governments Regional Airport System Plan – General Aviation Element 2003*, "an increasing number of aircraft owners want hangar, rather than open tiedown space because of the investment in their aircraft, as well as the cost of maintaining and operating the aircraft." In addition, the study cites that "current (Bay Area) general aviation airport capacity issues are generally not airfield-related, but are concerned more about the availability and type of aircraft parking spaces, in particular, the shortage of hangar spaces for both small and large corporate business aircraft." Indeed, it would seem that Buchanan Field Airport is a prime example of this situation.

As reported by Airport management, an extensive waiting list approaching 150 requests for hangar space exists, while at the same time, ample aircraft tiedown spaces exist with facilities outstripping demand. Characteristic of such waiting lists, the majority of aircraft desiring hangar space are smaller twin-engine and single-engine aircraft. Conversely, turbo-prop and jet aircraft generally require greater space than is offered in a typical T-hangar; therefore, owners of such aircraft tend to make their space desires known to clear-span hangar operators such as Fixed Based Operators (FBOs). Construction is underway for 40,000 square feet of additional clear-span hangar space providing added facilities for larger aircraft, as described in the *Forecasts of Aviation Activity* chapter to meet the assumed present hangar needs for larger aircraft space. Therefore, it should be assumed that virtually all of the individuals on the current Buchanan Field Airport waiting list are interested in T-hangar type enclosed storage for their smaller aircraft. With a hangar waiting list, it is reasonable to assume that no less than one-third would be willing to make a serious financial commitment to secure hangar space for their aircraft. Thus, the immediate development of approximately 50 T-hangar units would most likely be appropriate. Moreover, considering the pent-up demand within the Bay Area for hangar space, should the County let it be known that T-hangars are to be constructed at Buchanan Field Airport, it may be reasonable to contemplate that immediate demand could be much stronger yet.

- **On-Airport Aircraft Rescue & Fire Fighting Station.** Consideration should be given to the limits of the existing ARFF facilities at Buchanan Field Airport. Currently, Aircraft Rescue and Firefighting (ARFF) facilities are located in a lean-to with the Airport administrative offices and were originally intended to be temporary. The present site has no room for expansion and requires that the ARFF truck be staged frequently outside the building. Space for supplies, firefighting agents, and support equipment is remotely located and makes recommended stockpiling and equipment servicing difficult. Periodic maintenance and non-scheduled repairs are required to be completed without cover from the elements, for the most part. Further, while acceptable and within federal guidelines, the present ARFF facilities are not optimal for emergency response to aircraft incidents/accidents. The functionality and requirements of a new on-airport ARFF station are appropriate for consideration as a part of the alternative analysis for this master planning process.

- **General Aviation Terminal Building.** At present, there is no centralized terminal facility to meet the landside needs of transient general aviation (GA) aircraft, their operators, or passengers. While FBOs provide such things as aircraft tiedowns, flight planning, and lobby space that is available to their transient and based customers, catering to the small general aviation customer may not be a focus of their business plan. Therefore, it would seem appropriate to consider the development of such a facility that would provide adequate transient parking and tiedowns, public greeting and lobby space, restrooms, vending/catering/restaurant facilities, meeting spaces, and other items of public convenience and necessity. It is appropriate that a comprehensive examination of best possible on-airport facilities include consideration of the need for a GA Terminal Building and that such examination should pit the benefits of such a facility against competing space planning needs to determine its merits and viability.

- **Area Plans.** Additional areas will be needed to accommodate future general aviation storage facilities, along with aircraft maintenance and FBO facilities and generalized aviation-related facilities, which provide the County with the flexibility to include aviation enterprises yet undetermined, when the opportunities arise. This will likely include the recommendation to construct hangar and aviation-support facilities on the few remaining areas of the Airport that are undeveloped, as well as the consideration of the redevelopment of underutilized areas. Programming of the implementation of these various area development plans into the long-term development plan is a key component of the overall development recommendation of this Airport Master Plan. As with many of the other Facility Requirements recommendations, a careful analysis of the potential benefits of each area plan will need to be considered to ensure its appropriateness.

It is important to note that the recommendations in this Master Plan are provided to best understand what facilities improvements might be needed at the Airport, and where those facilities might be best placed. In other words, the Master Plan provides recommendations on how various parcels of the Airport might be best developed, in consideration of potential demand and community/environmental influences. One of the basic assumptions for a master plan, for a complex facility like an airport is: if a future improvement is identified on the recommended development plan, it will only be built if there is actual demand; if the project is financially feasible; and, if environment impacts are insignificant. In addition, a recommended development plan for an airport must also be flexible and allow for adaptation as needs and circumstances arise.

In summary, the facility needs information provided in this chapter is used to develop alternatives for the configuration of Airport facilities in the future, and to help provide a basis for evaluation of the Master Plan alternatives and recommended development.