Chapter C. Capacity Analysis and Facility Requirements

Introduction

The capacity of an airfield is primarily a function of the major aircraft traffic surfaces (runways and taxiways) that compose the facility and the configuration of those surfaces, but 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 what facilities will be needed to accommodate the forecast demand. Evaluation procedures focus on runway length, dimensional criteria, aircraft parking aprons, commercial passenger facilities, and general aviation storage/service facilities. In addition, an analysis of the ability to appropriately access the airport from the regional roadway/ground transportation system is also provided in this chapter.

The capacity of the existing airfield and access facilities is analyzed with respect to the ability of each to accommodate current and forecast demand. This analysis aids in the identification of possible deficiencies in the present and/or future airport physical plant.

Airfield Capacity Methodology

This section addresses the evaluation method used to determine the capability of the airside facilities to accommodate aviation operational demand. Evaluation of this capability is expressed in terms of potential excesses and deficiencies in capacity. The methodology utilized for the measurement of airfield capacity in this study is described in 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 (ASV):* A reasonable estimate of an airport's annual capacity (i.e., the 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 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 is examined in the following paragraphs.

Airfield Layout

The layout or "design" of the airfield refers to the arrangement and interaction of the airfield components, which include the runway system, taxiways, and ramp entrances. As previously described, Aspen/Pitkin County Airport is operated around a single runway, Runway 15/33, which is served by a partial-length east side parallel taxiway with six (6) connector taxiways running from the approach end of Runway 33 approximately 4,500 feet to the north.

The airport's existing landside facilities are located on the east side of the runway/taxiway system, and include the passenger terminal complex, FBO hangars, aircraft parking aprons and tie down areas, and the airport air traffic control tower. Each of these facilities is well situated to utilize the existing taxiway system. In addition, the airport's multi-use ARFF/SRE Facility is located on the east side of the runway, north of the terminal complex and south of the ABO General Aviation Terminal.

Environmental Conditions

Climatological conditions specific to the location of an airport not only influence the layout of the airfield, but also impact the utilization 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.

From a weather standpoint, VFR flight is also sometimes referred to as operating under Visual Metrological Conditions (VMC). 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 obtained for the airport from the National Climatic Data Center for use in this study, has been categorized in typical VFR and IFR terms:

- Typical VFR Conditions - ceiling equal to or greater than 1,000 feet above ground level and visibility is equal to or greater than 3 statute miles. These conditions occur at the airport approximately 95.80% of the time annually.

- Typical IFR Conditions (VFR minimums to Category I ILS minimums) - ceiling less than or equal to 1,000' and/or visibility less than or equal to 3 statute miles & ceiling above or equal to 200' AGL and visibility greater than or equal to ½ mile. These conditions occur at the airport approximately 2.6% of the time annually.

This standard classification of the local weather conditions indicates the airport would experience VMC over 95% of the time and would be out of service due to poor weather conditions (below Category I ILS minimums) only about 2% of the time. Due to the fact that the airport does not have an instrument approach that provides CAT I minimums and because the winter weather at the airport is significantly less conducive to aircraft operations than the summer weather, this data is misleading.

To provide a better understanding of this issue's impact on the operational capabilities of the airport an analysis of daytime (6:00 am to 8:00 pm) winter season (October 15 to April 14) weather conditions specifically related to existing and potential instrument approach capabilities has been prepared. The data for this analysis is taken from the May 2001 *Aspen/Pitkin County Airport Advanced Navigation Airspace Feasibility Study*. As can be seen, the circumstances in Aspen are far from "standard".

The following information indicates the average number of total daytime winter season hours when Aspen area weather is below the minimums needed to utilize the various existing and likely future instrument approach procedures:

- ROARING FORK VISUAL APPROACH conditions - ceiling equal to or greater than 6,000 feet above ground level and visibility is equal to or greater than 10 statute miles. The number of winter daytime hours when local weather conditions fall below these parameters is approximately 955 (37.5% of the winter daytime hours).

- Current Public Instrument Approach (VOR/DME, GPS-C) for C Category approach speed aircraft – ceiling less than or equal to 2400' AGL and visibility less than 3 miles. The number of winter daytime hours when local weather conditions fall below these parameters is approximately 444 (17.4% of the winter daytime hours).

- Current Special Use Instrument Approach (GPS straight in approach to Runway 15) for C Category approach speed aircraft – ceiling less than or equal to 1,449' AGL and visibility less than 3 miles. The number of winter daytime hours when local weather conditions fall below these parameters is approximately 329 (12.9% of the winter daytime hours).

- Proposed *Public* Localizer Approach (LOC/DME-E) - ceiling less than or equal to 2,240' AGL and visibility less than 3 statute miles. The number of winter daytime hours when local weather conditions fall below these parameters is approximately 428 (16.8% of the winter daytime hours).

- New *Special* Localizer Approach (LOC/DME-W) - ceiling less than or equal to 1,043' AGL and visibility less than 3 statute miles. The number of winter daytime hours when local weather conditions fall below these parameters is approximately 299 (11.8% of the winter daytime hours).

The above-listed statistics provide important verification which indicates that improved approach capabilities at the airport are essential to increase its reliability for use during the winter season. Such operational reliability is an essential quality for strengthened commercial airline passenger service. A passenger who cannot make it to his or her final destination because the airport suffers from frequent foul weather closures is likely to consider different travel choices for future air travel.

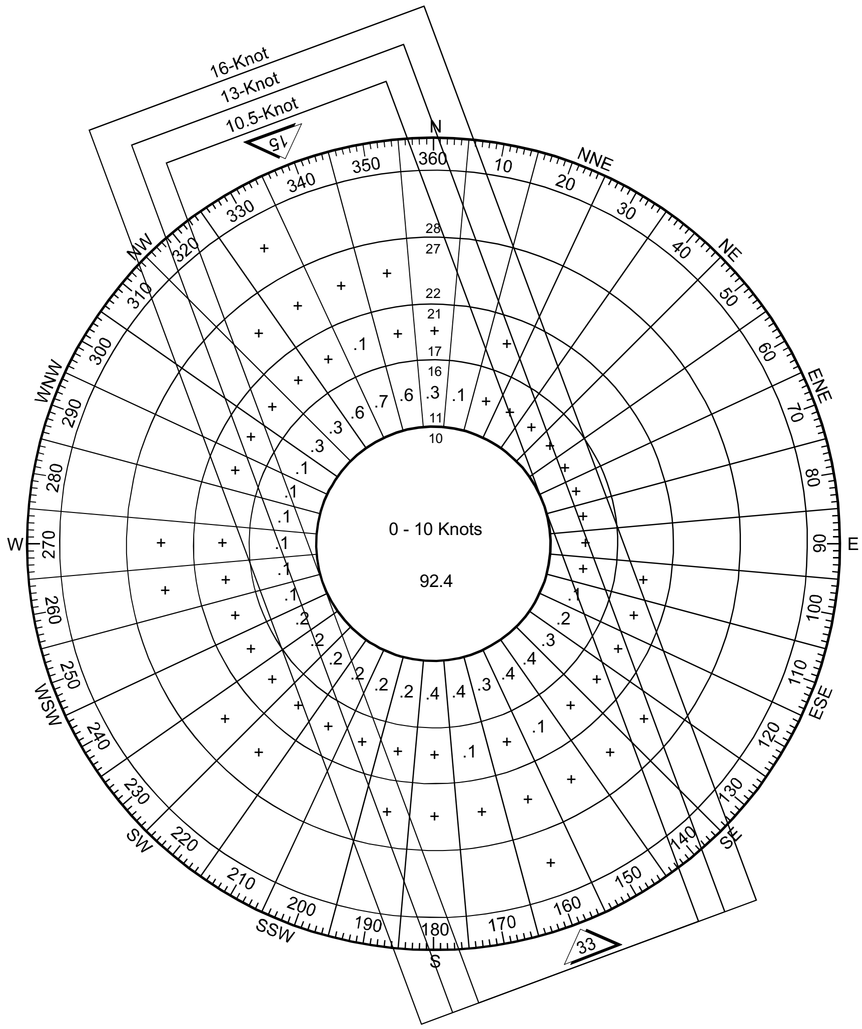
With this as background information, one focus of the Airport Master Plan is to continue the investigation as to how lower minimum approaches can safely be implemented to serve Aspen/Pitkin County Airport.

Wind Coverage. Surface wind conditions (i.e., direction and speed) generally determine the desired alignment and configuration of the runway system. Runways, which are not oriented to take advantage of prevailing winds, will restrict the capacity of the airport. Wind conditions affect all airplanes in varying degrees; however, the ability to land and takeoff in crosswind conditions varies according to pilot proficiency and aircraft type. Generally, the smaller the aircraft, the more it is affected by the crosswind component.

To determine wind velocity and direction at Aspen/Pitkin County Airport, wind data to construct the all-weather wind rose was obtained for the period 1993-2002 from observations taken at the airport. There were approximately 60,392 observations available for analysis during this ten-year period. The allowable crosswind component is dependent upon the Airport Reference Code (ARC) for the type of aircraft, which utilize the airport on a regular basis. As discussed in the previous chapter, the Airport Reference Code (ARC) for Runway 15/33 at Aspen/Pitkin County Airport is ARC D-III

In consideration of the ARC D-III classification, these standards specify that the 16-knot crosswind component be utilized for analysis. In addition, it is known that the airport will continue to also serve small single and twin-engine aircraft for which the 10.5-knot crosswind component is considered maximum; therefore, the 16-knot and 10.5-knot crosswind components should be analyzed for this airport. The following illustration, entitled *ALL WEATHER WIND ROSE: 16-, 13, & 10.5-KNOT CROSSWIND COMPONENTS*, illustrates the all weather wind coverage provided at Aspen/Pitkin County Airport. For comparison purposes, the 13-knot crosswind component has also been included.

Figure C1
ALL WEATHER WIND ROSE: 16-, 13- & 10.5-KNOT CROSSWIND COMPONENTS
Aspen/Pitkin County Airport Master Plan



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center
Station # 72467 –Aspen, Colorado. Period of Record – 1993-2002. Total Observations: 60,392.

The desirable wind coverage for an airport's runway system is 95%. This means that the runway orientation and configuration should be developed so that the maximum crosswind component is not exceeded more than 5% of the time annually. The following table, entitled *ALL WEATHER WIND COVERAGE SUMMARY*, quantifies the wind coverage offered by the airport's existing runway system, including the coverage for each runway end. Based on the all weather wind analysis for Aspen/Pitkin County Airport, utilizing the FAA Airport Design Software supplied with AC 150/5300-13, the existing runway configuration provides 99.90% wind coverage for the 16-knot crosswind component and 98.83% for the 10.5-knot crosswind component. Therefore, no additional runways are required from a *wind coverage* standpoint.

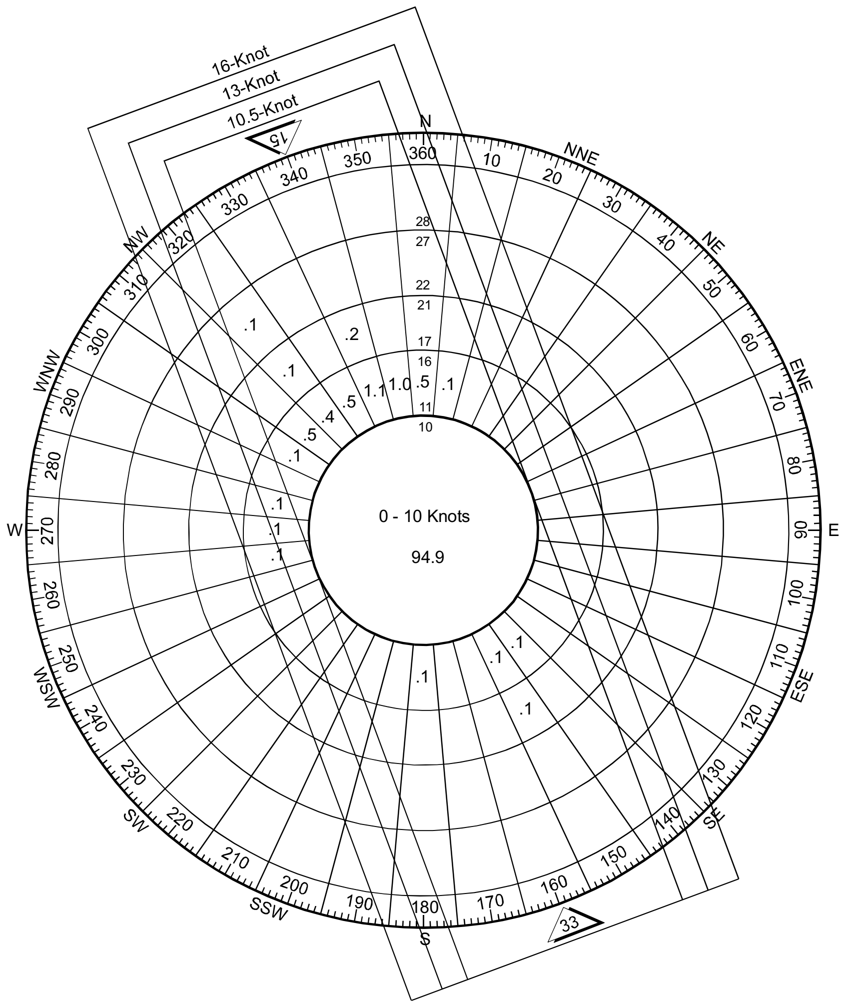
Table C1
ALL WEATHER WIND COVERAGE SUMMARY
Aspen/Pitkin County Airport Master Plan

Runway Designation	16-Knot Crosswind Component	10.5-Knot Crosswind Component
Runway 15/33	99.90%	98.83%
Runway 15 [1]	77.44%	76.53%
Runway 33 [1]	76.92%	76.26%

Source: Wind analysis tabulation provided by Barnard Dunkelberg & Company utilizing the FAA Airport Design Software supplied with AC 150/5300-13.
1 – Maximum Tail Wind 5 Knots

The airport is served by a circling VOR/DME or GPS-C approach. In an effort to evaluate the effectiveness of these approaches and analyze the potential benefits of implementing a future precision instrument approach and lower approach visibility minimums, an Instrument Flight Rules (IFR) wind rose has been constructed. The following illustration and table quantifies the wind coverage offered by each runway end in consideration of potential lower precision approach minimums (ceiling less than 1,000 feet and/or visibility less than 3 statute miles, but ceiling equal to or greater than 200 feet and visibility equal to or greater than ½ statute mile).

Figure C2
IFR WEATHER WIND ROSE: 16-, 13-, & 10.5-KNOT CROSSWIND COMPONENTS
Aspen/Pitkin County Airport Master Plan



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center
Station # 72467 –Aspen, Colorado. Period of Record – 1993-2002. Total Observations: 60,392.

Table C2
IFR WIND COVERAGE SUMMARY
Aspen/Pitkin County Airport Master Plan

Runway Designation	Wind Coverage Provided Under IFR Conditions [1] 16-Knot Maximum Crosswind	Wind Coverage Provided Under IFR Conditions [1] 10.5-Knot Maximum Crosswind
Runway 15/33	100.00%	99.82%
Runway 15 [2]	67.23%	67.14%
Runway 33 [2]	96.49%	96.31%

Source: Wind analysis tabulation provided by Barnard Dunkelberg & Company utilizing the FAA Airport Design Software supplied with AC 150/5300-13.
1 - Ceiling of less than 1,000 feet, but equal to or greater than 200 feet and/or visibility less than 3 statute miles, but equal to or greater than ½ statute mile.
2 – Maximum Tail Wind 5 Knots

From this IFR wind coverage summary, it can be determined that Runway 33 provides better wind coverage for each crosswind component. The information provided by this analysis will be incorporated into the formulation of various future airside development alternatives and the ultimate development recommendations for the airport.

Characteristics of Demand

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

Aircraft Mix. The capacity of a runway is dependent on the type and size of the aircraft that utilize the facility. Aircraft are categorized into four classes: 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. Class C and D aircraft are large jet and propeller aircraft typical of those utilized by the airline industry and the military, along with the majority of the business jet fleet. Aircraft mix is defined as the relative percentage of operations conducted by each of these four classes of aircraft. The existing percentage of aircraft weighing less than 12,500 pounds (i.e., Class A and B) is estimated to be approximately forty percent of total aircraft operations. This percentage is expected to decrease somewhat in the future, but to remain at nearly forty percent even in the long term.

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 (ASV). The operations mix occurring on the runway system at Aspen/Pitkin County 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 activity and are included in local operations figures when reported by an air traffic control tower. According to FAA *Form 5010*, touch-and-go operations are estimated to represent only 5% of the total annual operations being conducted at the airport. It is anticipated that the airport will continue to be a center for both business and tourism-related itinerant general aviation operations in the future and that the percentage of touch-and-go operations is expected to remain relatively low (approximately 5% of total operations throughout the planning period).

Runway Use. The use configuration of the runway system 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. Both the prevailing winds in the region and local approach/departure procedures combine to dictate the utilization of the existing runway system. According to ATCT and airport management observations, the airport normally operates in a contra-flow configuration, with departures occurring on Runway 15 approximately 99% of the time and arrivals occurring on Runway 15 approximately 98% of the time.

Exit Taxiways. The capacity of a runway system is greatly influenced by the ability of an aircraft to exit the runway as quickly and safely as possible. Therefore, the quantity and design of the exit taxiways can directly influence aircraft runway occupancy time and the capacity of the runway system.

Due to the location of the existing exit taxiways serving the runway system at Aspen/Pitkin County Airport, the number of available exit taxiways for use in the capacity calculation is acceptable for non-peak periods. Based upon the mix index of aircraft operating at the airport under VFR conditions, the capacity analysis, as described in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, gives credit to only those runway exit taxiways located between 3,500 and 6,500 feet from the landing threshold. Therefore, landings on Runway 15 received an exit rating of two (2), with four (4) being the maximum and no credit given for an exit within 750 feet of another exit. Possible taxiway system modifications may need to be considered to enhance traffic flow during periods of peak activity. However, the future location of all taxiway improvements (if any) will be evaluated in conjunction with the formulation of airside development alternatives.

Air Traffic Control Rules

The FAA specifies separation criteria and operational procedures for aircraft in the vicinity of an airport contingent upon aircraft size/speed, availability of radar, sequencing of operations and noise abatement procedures, both advisory and/or regulatory, which may be in effect at the airport. Typically, 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. While Pitkin County Airport does have an Air Traffic Control Tower with an approach control (ATCT); enroute sequencing to and from Aspen is provided by the Denver Air Route Traffic Control Center (ARTCC) and has a great impact upon the smooth handling of air traffic, especially during periods of IFR weather, as mentioned in the previous chapters. Also, due to the mountainous terrain in the vicinity of the airport, the contra-flow normal operational configuration for the runway, and coordination with arrival/departure activity at airports located in Eagle and Rifle, hourly capacity for the Aspen/Pitkin County Airport under IFR operating conditions is significantly restricted.

Airfield Capacity Analysis

As previously described, the determination of capacity for Aspen/Pitkin County 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. Ultimately, the goal of the capacity analysis is to understand if additional runway facilities will be needed at an airport. With that ultimate goal in mind, several “ideal” assumptions are incorporated in these capacity calculations: arrivals equal departures, the percent of touch-and-go operations is between zero and fifty percent (0-50%) 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 (1) 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 ten percent (10%) of the time, and approximately eighty percent (80%) of the time the airport is operated with the runway use configuration that produces the greatest hourly capacity.

It is recognized that several of these “ideal” assumptions are not appropriate for Aspen/Pitkin County Airport (i.e., there is not a full parallel taxiway, the airport does not have a full ILS, in consideration of existing instrument approach capabilities and depending on season the airport often experiences IFR conditions more than 10% of the time, and more than 90% of the time the runway is operated in a contra-flow configuration (departures to the north and arrivals to the south).

It remains important to understand the capacity of the runway system under most optimal conditions to help determine future facility needs. Applying information generated from the analyses described, the optimized capacity for the airport's one runway system can be formulated in terms of the following results:

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

A single runway airport, with a fleet mix similar Aspen/Pitkin County Airport's can have an ASV as high as 195,000 operations, with a VFR capacity of roughly 74 operations per hour and an IFR capacity of approximately 57 operations per hour. As can be seen, this optimized Annual Service Volume is significantly greater than the number of annual operations forecast for the end of the planning period (63,044). Thus, the construction of more runways at the airport is not needed to provide additional aircraft operational capacity.

The more significant airfield capacity impediments are implied in the assumption discussion at the beginning of this section and relate primarily to the contra-flow runway utilization of the runway and the need for improved instrument approach capabilities. For instance, air traffic control tower personnel indicate that during Instrument Metrological Conditions (IMC), the practical capacity for the airport is five to six inbound operations per hour.

Given this modest number of aircraft arrivals during IMC, the practical physical constraints of the airport, and an understanding of the nature of peak period traffic demand holiday weekends experienced at ASE, airfield capacity and delay can not fully be expressed in terms of Annual Service Volume and Hourly Capacity averages. Therefore, reasonable consideration is warranted for the examination of measures that can be employed to aid in meeting the traffic demands of these extraordinary periods of aircraft/airport activity.

Ground Access Capacity

The capacity of the landside access system is a function of the maximum number of vehicles that can be accommodated by a particular ground access facility. At Aspen/Pitkin County Airport, this relates primarily to the access roadway system capacity, the number of vehicles that can utilize a certain roadway section in a given time period; and the passenger terminal curb capacity, which is equal to the linear length of curb required to adequately accommodate peak period passenger use. Because these items are most directly associated with the passenger terminal facilities, the facility needs analysis is presented in the next chapter entitled *Passenger Terminal Facility Requirements*.

Capacity Summary

This section has analyzed the capacity of existing facilities at Aspen/Pitkin County Airport. Facilities providing adequate capacity are critical to the ability of the airport to efficiently serve the public. Capacity deficiencies that cause delays associated within one area will often be reflected in the ability or inability of the entire facility to function properly.

The following facility requirements section will delineate the various facilities required to properly accommodate future demand. That information, in addition to the capacity analysis, provides the basis for formulating the alternative development scenarios for the airport and ensuring that the new recommended development plan can adequately accommodate the long-term airport development needs.

Facility Requirements

This section presents the analysis of requirements for airside and landside facilities necessary to meet aviation demand at Aspen/Pitkin County Airport. For those components determined to be deficient, the type and size of the facilities 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 the terminal area, hangars, aircraft apron areas, and airport support facilities.

This analysis uses the forecasts set forth in the preceding chapter for establishing future development of 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 set to a predetermined schedule for development. By doing this, over-building or under-building can be avoided.

Airfield Facilities

The analysis of airfield requirements focuses on the determination of needed facilities and spatial considerations related to the actual operation of aircraft on the airport. This evaluation includes the delineation of airfield dimensional criteria, the establishment of design parameters for the runway and taxiway system, and an identification of airfield instrumentation and lighting needs.

Dimensional Criteria. The types of aircraft that currently operate at Aspen/Pitkin County Airport and those that are projected to utilize the facility in the future have an impact on the planning and design of airport facilities. This knowledge assists in the selection of FAA specified design standards for the airport, which include runway/taxiway dimensional requirements; runway length; and runway, taxiway and apron strength. These standards apply to the "Design Aircraft" which either currently utilizes the airport or which is projected to utilize the airport in the future. The British Aerospace Bae 146-200 and the Gulfstream IV (G-IV) have been identified as the airport's "Design Aircraft". Based on the airport's projected aviation activity, which includes operational counts and aircraft types, it is anticipated that the group of aircraft generally defined by these "Design Aircraft" will continue to be recognized as the critical aircraft with regard to physical dimensions (i.e., 86.4 foot/77.8 foot wingspan respectively) and approach speed (i.e., 117-knots/145-knots respectively). It should be noted that by county ordinance (see appendix) and by FAA mandate, aircraft operating at Aspen/Pitkin County Airport are restricted to wingspans no greater that 95 feet.

According to FAA Advisory Circular 150/5300-13, Airport Design, the first step in defining an airport's design geometry is to determine its Airport Reference Code (ARC). An airport which accommodates aircraft with an approach speed as great as 141 knots, but less than 166 knots and with wingspans as great as 79 feet, but less than 118 feet should be designed utilizing ARC D-III dimensional criteria. The previously mentioned aircraft are the "Design Aircraft" used to determine appropriated dimensional criteria for airport facility layout (i.e., runway/taxiway separation, runway/taxiway safety areas, aircraft parking separation, etc.). The dimensional criteria illustrated in the following table, entitled *ARC D-III DIMENSIONAL STANDARDS FOR RUNWAY 15/33 (In Feet)* are those required for Aircraft Approach Category D and Airplane Design Group III (in conjunction with specified approach visibility minimums), along with the existing dimension for the corresponding facility.

Table C3
ARC D-III DIMENSIONAL STANDARDS (In Feet)
Aspen/Pitkin County Airport Master Plan

Item	Standard	Existing Dimension
Runway Length	(see Table C4)	
Runway Width	100	100
Runway Centerline to Taxiway Centerline	400	221.5 [1]
Runway Centerline to BRL	---	500
Runway Centerline to Holdline	328	150 [2]
Runway Safety Area Width	500	500
Runway Safety Area Length (beyond runway end)		
Runway 15	1,000	800 [3]
Runway 33	1,000	1,000
Runway Object Free Area Width	800	<800 [4]
Runway Object Free Area Length (beyond runway end)		
Runway 15	1,000	100 [5]
Runway 33	1,000	1,000

Source: AC 150/5300-13, Federal Aviation Administration.

Runway Safety Area (SA): An area adjacent to the runway, which is capable of supporting the occasional passage of aircraft without causing structural damage under dry conditions.
Runway Object Free Area (OFA): A two dimensional ground area centered on the runway centerline which is clear of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.
Building Restriction Line (BRL): The BRL encompasses the runway protection zones (RPZ), the runway object free area, the runway visibility zone, NAVAID critical areas, areas required for terminal instrument procedures and areas required for airport traffic control tower clear line of sight.

--- Varies
1 Approved Modification of Standard (97-DEN-178-NRA) – Programmed for 320' w/relocation of parallel taxiway.
2 Approved Modification of Standard (97-DEN-178-NRA) – Programmed for 272.5' following relocation of parallel taxiway.
3 To be corrected with relocation of fence and re-grading in area southwest of the approach end of Runway 33.
4 Tree, wind cone, barn and terrain on west side of airport inside of ROFA. Programmed for correction w/runway rehabilitation.
5 To be corrected with relocation of fence and re-grading in area southwest of the approach end of Runway 33.

As can be seen in the above table, the issues involved with FAA's dimensional criteria and Aspen/Pitkin County airport are complex. In general, the layout of airport facilities is in compliance with FAA criteria, and where the standards are not met, appropriate improvements are programmed. An important aspect of the Master Plan is to ensure that these upgrades continue and are prioritized in the Airport's capital improvement programming.

Other Modifications of Standards. The FAA has also accepted several Modifications of Standards related to runway surface gradients, taxiway surface gradients, and runway/taxiway safety area gradients. Although it is not critical that these Modifications be described in detail as part of this facility requirements analysis, it will be critical that these Modifications are tracked as part of the Master Planning process, that improvements/corrections are identified if possible, and that the Modifications be appropriately documented on the Airport Layout Plan drawings.

Runway Orientation. Aspen/Pitkin County Airport operates with a single north/south runway, Runway 15/33. As presented in a previous section, the existing runway configuration provides excellent wind coverage (i.e., in excess of 99%) for the 16- and 10.5-knot crosswind components; therefore, no additional runways are required from a *wind coverage* standpoint.

There are two other critical factors that have been considered with regard to the runway orientation/location at Aspen/Pitkin County Airport. The first is the location of the runway in relationship to the developable area at the airport. The location of the runway currently provides only a narrow strip of land between the runway and Highway 82. Could a more optimum location for the runway within the confines of existing airport property be identified that would provide additional aviation development area?

The second factor is the orientation of the Runway with regard to surrounding terrain. Could the runway be reoriented slightly to provide better/safer approach paths?

These runway relocation/reorientation issues have been discussed in working sessions with the Staff Technical Committee, the Study Advisory Committee, and the Federal Aviation Administration and it was concluded that any relocation or reorientation of the runway is impractical due to terrain related obstruction concerns.

Airfield Capacity. The evaluation of airfield capacity, as presented in previous sections, indicates that the airport will not exceed the optimized capacity of the existing runway/taxiway system before the end of the planning period. Therefore, no additional runways will be required at the airport to increase operational capacity.

Runway Length. The determination of runway length requirements for Aspen/Pitkin County Airport is based on several factors. These factors include:

- Airport elevation;
- Mean maximum daily temperature of the hottest month;
- Runway gradient;
- Critical aircraft type expected to use the airport;
- Stage length of the longest nonstop trip destination; and,
- Obstruction and terrain considerations.

The runway length operational requirements for aircraft are greatly affected by elevation, temperature and runway gradient. Therefore, using the FAA's computer program, calculations for runway length requirements at Aspen/Pitkin County Airport are based on an elevation of 7,820 feet AMSL, 79.7 degrees Fahrenheit NMT (Mean Normal Maximum Temperature), and a maximum difference in runway elevation at the centerline of 140 feet.

Generally for design purposes, runway length requirements at commercial service airports are premised on a combination of the specific requirements of the commercial service air carrier fleet, and the general aviation aircraft fleet under 60,000 pounds (i.e., the business jets which operate at the airport). As can be seen in the following table, entitled *RUNWAY TAKE-OFF LENGTH ANALYSIS*, there are four (4) runway lengths shown for small (under 12,500 pounds) general aviation aircraft runways. Each of these provides the required length to accommodate a certain type of aircraft that will utilize the runway. The lengths range from 6,610 to 9,260 feet.

There are four (4) different lengths given for larger general aviation aircraft under 60,000 pounds. These runway lengths pertain to those general aviation aircraft, generally jet-powered, of 60,000 pounds or less maximum certificated takeoff weight. The requirements of this aircraft fleet range from 9,100 feet to 12,400 feet in length for the runway at Aspen/Pitkin County Airport. Each of these lengths provides a runway sufficient to satisfy the operational requirements of a certain percentage of the fleet at a certain percentage of the useful load, (i.e., 75 percent of the fleet at 60 percent useful load). The useful load of an aircraft is defined as the difference between the maximum allowable structural gross weight and the operating weight empty. In other words, it is the load that can be carried by the aircraft composed of passengers, fuel, and cargo. Generally speaking, prevailing examples of such aircraft (under 60,000 lbs.) include Lear Jets, Falcon Jets, Cessna Citations, Hawkers, Canadair Challengers, among others.

In consideration of the existing commercial service being provided by the air carrier fleet, the table also illustrates the generalized runway take-off length requirements for aircraft over 60,000 pounds (e.g., the BAe-146) at various stage lengths. A generalized runway length of approximately 7,760 feet is required for a 500 nautical mile (500 NM) stage length, 9,210 feet is required for a 1,000 NM stage length, while approximately 10,540 feet is required to accommodate a 1,500 NM stage length.

Table C4
RUNWAY TAKE-OFF LENGTH ANALYSIS
Aspen/Pitkin County Airport Master Plan

Runway Requirement	Wet Runway Take-off Length (Feet)	Dry Runway Take-off Length (Feet)
Existing Condition		
Runway 15/33	7,006	7,006
Small Aircraft[1] with less than 10 seats		
75% of Small Aircraft	6,610	6,610
95% of Small Aircraft	9,260	9,260
100% of Small Aircraft	9,260	9,260
Small Aircraft[1] with more than 10 seats	9,260	9,260
Aircraft less than 60,000 pounds		
75% of fleet /60% useful load	9,100	9,100
100% of fleet /60% useful load	12,400	12,400
75% of fleet /90% useful load	10,000	10,000
100% of fleet /90% useful load	12,400	12,400
Large Aircraft greater than 60,000 pounds		
500/1,000/1,500 NM stage lengths	7,760/9,210 /10,540	7,760/9,210 /10,540
Specific Air Carrier Aircraft		See Discussion Below

Runway Lengths Based on 7,820' AMSL, 79.70˚F NMT and Maximum difference in runway end of 140 feet.
1 – Under 12,500 pounds.

An important factor to note when considering the generalized large aircraft runway take-off length requirements is that the actual length necessary for a runway is a function of elevation, temperature, aircraft stage length, and whether or not the runway's pavement is dry or wet and slippery (contaminated). As temperatures change on a daily basis, the runway length requirements change accordingly (i.e., the cooler the temperature - the shorter the runway necessary, the hotter the temperature - the longer the runway necessary).

Perhaps the most critical aspects related to runway length requirement analysis for Aspen/Pitkin County are the specific needs of the existing and likely future air carrier aircraft serving the airport. This would include the BAe-146-200, BAe-146-300, and the Avro 146-RJ85A, which presently are utilized at the airport, and a representative "new configuration" regional jet (e.g., the CRJ-700), which airlines have identified as the aircraft that are likely to serve the airport in the future if operational capabilities prove to be acceptable. Inquires have been made to airlines and Jeppesen OpsData requesting complete operational weight data in consideration of existing and potential runway lengths. Following is a summary of summer season and winter season data obtained for various aircraft in consideration of the airport's elevation (7,820' AMSL), runway gradient (2%), and surrounding terrain.

Selection of Potential Extension Length for Analysis. The following tables illustrate payload differences achieved when the existing runway length of 7,006 feet is compared to a runway that is extended by 1,000 feet to the south to be used for northern takeoffs only. In consideration of FAA object clearing and safety area requirements, the only practical way to provide additional runway length at Aspen/Pitkin County Airport would be for use as "takeoff only" for the initiation of the take-off run. Because the vast majority of aircraft departures are conducted using Runway 33 (take-offs to the north), a runway extension to the south is proposed. It would be available for use only for departures to the north and would not be considered in determining runway length available for landing in either direction. Initial analysis indicates that a 1,000-foot runway extension (including the associated parallel taxiway) is approximately the maximum feasible length that can be accommodated on the south end of the runway. Therefore, for this preliminary runway length needs analysis and the preliminary analysis of benefit, a 1,000-foot extension is examined. If further investigation of a potential runway extension is deemed appropriate, a comprehensive analysis of the exact length achievable will be required as an important next step in this planning process.

It should be noted that a practical way to increase the landing runway length at this airport has not been identified. To achieve FAA safety and object clearing standards, an extension that could be used for landing would require the relocation of Highway 82. The relocation of Highway 82 is considered to be impractical.

Table C5
AIRCRAFT OPERATIONAL PAYLOAD ANALYSIS (SUMMER SEASON)
Aspen/Pitkin County Airport Master Plan

Aircraft/Runway Length Data	Temperature	Maximum Takeoff Weight (lbs.)[2]	Climb Limited Weight (lbs.)[3]	Obstruction Limited Weight (lbs.)[4]	Takeoff Payload Increase (lbs.)[5]
BAe 146-200 [1][8]					
7,006’ RW (Existing)	80° F.	93,000	74,010	72,320[6]	---
8,006’ RW (Potential)	80° F.	93,000	74,010	72,630	310[7]
BAe 146-200 [9]					
7,006’ RW (Existing)	79° F.	93,000	74,300	73,400	---
8,006’ RW (Potential)	79° F.	93,000	74,300	74,300	900[7]
BAe 146-300 [1][8]					
7,006’ RW (Existing)	80° F.	97,500	73,083	72,069[6]	---
8,006’ RW (Potential)	80° F.	97,500	73,083	74,670	1,014[7]
BAe 146-300 [9]					
7,006’ RW (Existing)	79° F.	97,500	77,300	73,800	---
8,006’ RW (Potential)	79° F.	97,500	77,300	77,300	3,500[7]
Avro 146-RJ85A [1][8]					
7,006’ RW (Existing)	80° F.	97,000	77,740	76,220	---
8,006’ RW (Potential)	80° F.	97,000	77,740	76,490	270[7]
Bombardier CRJ-700 [1][8]					
7,006’ RW (Existing)	80° F.	72,750	66,590	61,080	---
8,006’ RW (Potential)	80° F.	72,750	66,590	61,090	10[7]

(1) Aircraft takeoff performance data was evaluated in consideration of non-standard engine-out Runway 33 departure tracks prepared by Jeppesen OpsData. The analysis was conducted for the existing 7,006-foot runway and a potential 1,000-foot extension to the south. These takeoff procedures are not authorized for Runway 15.
(2) Weight data reflects full passenger, cargo, and fuel loads as defined by manufacturer.
(3) Climb-limited weights were tabulated by Jeppesen OpsData and reflect the engine-out performance at 7,820-feet AMSL and specified temperature.
(4) Obstruction-limited weights were tabulated by Jeppesen OpsData and reflect the Federal Aviation Regulation (FAR) Part 25 climb regulations, which specify the obstacle-free minimum climb gradients required for turbine-powered aircraft with one engine inoperative at 7,820-feet AMSL and the specified temperature.
(5) Takeoff payload weight increases attributable to runway extension could be applied to either passenger and cargo gains or fuel reserves to extend stage lengths.
(6) See typical payload restrictions detailed below.
(7) Payload weight increase resulting from the potential 1,000-foot runway extension.
(8) Data compiled by Barnard Dunkelberg & Company, December 2002.
(9) Original data compiled by Air Wisconsin Airlines Corporation, August 2002.

BAe 146-200 (Air Wisconsin Airlines): 88 passengers
BAe 146-300 (Air Wisconsin Airlines): 100 passengers
Avro 146-RJ85A (Mesaba Airlines): 69 passengers
Bombardier CRJ-700 (typical configuration – not currently operating at Aspen/Pitkin County Airport): 70 passengers

Table C6
AIRCRAFT OPERATIONAL PAYLOAD ANALYSIS (WINTER SEASON)
Aspen/Pitkin County Airport Master Plan

Aircraft/Runway Length Data	Temperature	Maximum Takeoff Weight (lbs.)[2]	Climb Limited Weight (lbs.)[3]	Obstruction Limited Weight (lbs.)[4]	Takeoff Payload Increase (lbs.)[5]
BAe 146-200 [1][8]					
7,006' RW (Existing)	40° F.	93,000	88,930	83,320[6]	---
8,006' RW (Potential)	40° F.	93,000	88,930	86,480	3,160[7]
BAe 146-200 [9]					
7,006' RW (Existing)	32° F.	93,000	91,400	86,200	---
8,006' RW (Potential)	32° F.	93,000	91,400	91,400	5,200[7]
BAe 146-300 [1][8]					
7,006' RW (Existing)	41° F.	97,500	88,052	82,960[6]	---
8,006' RW (Extension)	41° F.	97,500	88,052	88,515	5,092[7]
BAe 146-300 [9]					
7,006' RW (Existing)	32° F.	97,500	94,500	86,200	---
8,006' RW (Extension)	32° F.	97,500	94,500	91,600	5,400[7]
Avro 146-RJ85A [1][8]					
7,006' RW (Existing)	40° F.	97,000	91,740	89,160	---
8,006' RW (Extension)	40° F.	97,000	91,740	89,450	290[7]
Bombardier CRJ-700 [1][8]					
7,006' RW (Existing)	32° F.	72,750	73,220	66,390	---
8,006' RW (Extension)	32° F.	72,750	73,220	67,850	1,460[7]

(1) Aircraft takeoff performance data was evaluated in consideration of non-standard engine-out Runway 33 departure tracks prepared by Jeppesen OpsData. The analysis was conducted for the existing 7,006-foot runway and a potential 1,000-foot extension to the south. These takeoff procedures are not authorized for Runway 15.
(2) Weight data reflects full passenger, cargo, and fuel loads as defined by manufacturer.
(3) Climb-limited weights were tabulated by Jeppesen OpsData and reflect the engine-out performance at 7,820-feet AMSL and specified temperature.
(4) Obstruction-limited weights were tabulated by Jeppesen OpsData and reflect the Federal Aviation Regulation (FAR) Part 25 climb regulations, which specify the obstacle-free minimum climb gradients required for turbine-powered aircraft with one engine inoperative at 7,820-feet AMSL and the specified temperature.
(5) Takeoff payload weight increases attributable to runway extension could be applied to either passenger and cargo gains or fuel reserves to extend stage lengths.
(6) See typical payload restrictions detailed below.
(7) Payload weight increase resulting from the potential 1,000-foot runway extension.
(8) Data compiled by Barnard Dunkelberg & Company, December 2002.
(9) Original data compiled by Air Wisconsin Airlines Corporation, August 2002.

BAe 146-200 (Air Wisconsin Airlines): 88 passengers
BAe 146-300 (Air Wisconsin Airlines): 100 passengers
Avro 146-RJ85A (Mesaba Airlines): 69 passengers
Bombardier CRJ-700 (typical configuration – not currently operating at Aspen/Pitkin County Airport): 70 passengers

Typical Payload Restrictions. One factor that is not expressed in the tables above but is critical to understanding the potential benefit of a longer takeoff runway is the typical passenger payload restrictions that are experienced by airlines currently operating at the airport. Airline personnel indicate that during an average year a departure by the 88-passenger seat BAe 146-200 is typically restricted to 75 passengers from June 15th to August 15th for departures at 10:00 am. From the period June 1st to September 1st a departure by the BAe 146-200 is typically restricted to 65 passengers at 2:00 pm and to 60 passengers at 4:00 pm. Average passenger weights used by Air Wisconsin are 180 pounds in the winter and 170 pounds in the summer. It is also important to note that Air Wisconsin limits the use of the BAe 146-300 during the summer months because of severe weight restrictions. It is likely that weight restrictions during winter months have not been a critical consideration for the Air Wisconsin BAe 146s in the past because of the limited stage length of most flights (Aspen-Denver). As more experience is gained with longer stage lengths (e.g., Aspen-San Francisco and Aspen-Los Angeles) winter time weight restrictions may also become a more important issue, particularly if afternoon departures are scheduled.

Reported Benefit Data Differences. It can certainly be noted in Table C5 above, that the reported summer season payload benefit of the longer runway for the BAe 146 is greater in the data provided by Air Wisconsin, than it is in the data provided by Jeppesen OpsData. Air Wisconsin personnel have indicated that this difference is potentially attributable to the following factors:

- The Air Wisconsin analysis is specifically based on an exact aircraft configuration.
- The Air Wisconsin aircraft have been modified to allow for higher takeoff weights.
- These modifications where completed following acquisition of the aircraft by Air Wisconsin and, therefore, not considered in the Jeppesen OpsData analysis.
- Because Air Wisconsin operates into and out of several airports with challenging physical environments (e.g., Aspen/Pitkin County Airport), the airline is extremely conscious of physical and operational considerations that allow for safe use with the highest payload.

The engineering staff at Jeppesen OpsData was also contacted to inquire about possible explanations regarding the differences in the calculated payload data. They reported that there are a number variables associated with the modeling program that could influence the analysis. These variables include:

- A slightly different "obstacle set" could have been used for each analysis.
- The selected "turn procedure" for the analysis would impact the calculated weights.

- The selected "level-off" altitude for the departure procedure is chosen by the engineer and ranges from a legal minimum of 400 feet, to a maximum of 1,500 feet. Jeppesen typically uses a median altitude of 1,000' AGL for a standard analysis. The selection of a lower "level-off" altitude would result in increased payload weights.
- The Jeppesen payload analysis cannot compensate for potential after-market "engine modifications" unless the specific engine data is provided.

Runway Length Requirement Summary. The consistent thread that runs through the information provided above is that the availability of a longer take-off runway at the airport could be of benefit to the existing aircraft fleet utilizing the airport. In addition, a longer take-off runway might be of benefit to the air carrier aircraft that are likely to serve the airport in the future (i.e., the regional jets); however, the benefit to the future air carrier aircraft fleet requires additional information from the airlines that will actually operate those aircraft at Aspen. Detailed information from airlines on operational capabilities of potential aircraft that they might operate at the airport is obviously difficult data to generate. From a long-term planning perspective, the information provided above is substantial enough to provide the impetus to investigate a detailed alternative analysis related to how a runway extension might be implemented and the consequences that might be associated with that alternative.

Although in consideration of FAA requirements, the extension of the runway to the south will only be usable for takeoffs to the north, the pavement will be in place and will provide an extra safety margin for aircraft landing to the south. This “additional safety margin for landings to the south” is not a factor to be considered in the justification of the need for the extension; however, it is appropriate to recognize it as a positive attribute, particularly in consideration of performance limited braking characteristics associated with a wet, icy, or slushy runway surface.

It should also be noted that the recommendations of this Master Plan, including a runway extension alternative, are to be structured around the 95-foot wing span restriction and the continued use of a maximum aircraft weight restriction based on pavement strength and county ordinance (see *Runway Pavement Strength* section on page C.25).

If it is decided that a runway extension provides adequate benefits worthy of further investigation in this Master Plan, it will be shown on the Airport Layout Plan, which will be considered for a conditional approval from the FAA. One condition will be that an environmental determination will be required prior to construction of the runway extension. The environmental determination will be made pursuant to the preparation of an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). Which of these documents is prepared will be determined based on the environmental impacts, and the public input received. Normally, an EA is prepared to determine whether an EIS should be prepared. An EA is prepared by the sponsor (Pitkin County) and an EIS is prepared by the FAA. An EA would most likely require 12-18 months to prepare and an EIS anywhere from 2-3 years. Depending upon the cost of the extension, a Benefit/Cost Analysis may be required to determine the feasibility of the proposed project. In summary, if the runway extension is an element of the recommended Master Plan, it will require further local and federal review and approval before it is constructed.

Unintended consequences. Input from the Airport Master Plan's Study Advisory Committee, the Woody Creek Caucus and the Board of County Commissioners indicates the improvements contemplated as part of this planning effort should not only be understood from the standpoint of identified benefits, an understanding of potential unintended consequences is also important. Some unintended consequence concerns associated with the runway extension that have been expressed include:

- Will the runway extension allow larger commercial passenger service aircraft (i.e., B-737 and larger aircraft) to operate at the airport?

  There is no identified benefit for the runway extension related to the operation of larger commercial service aircraft. The regional jet and turboprop aircraft that currently serve the airport are programmed to continue to be the type of commercial passenger aircraft to provide service in Aspen. It should be emphasized that the airport's existing wingspan and gross operating weight limitations are to remain in place. By FAA guidance and County Ordinance, aircraft with wingspans in excess of 95 feet are restricted from operation at the airport. In addition, the operation of heavier aircraft at the airport will also continue to be restricted (see *Runway Pavement Strength* section on page C.25).

- Will the runway extension encourage older, louder business jets to operate at the airport?

  A longer takeoff runway will benefit the business jets operating at the airport by allowing them to operate with heavier pay loads. The primary area of benefit will be to allow these aircraft to carry more fuel and fly longer distances without stopping to refuel. The longer runway will not allow a different group of business jet to operate at the airport [basically the airport can presently accommodate the entire business jet fleet with the exception of those with weights over 100,000 pounds (see *Runway Pavement Strength* section on page C.25) or those with wingspans over 95 feet] and there is no evidence uncovered that indicates that older louder aircraft will benefit to a greater degree than others.

- Could the County be required to lift 95-foot wingspan and existing weight restrictions that are currently in place for aircraft operating at the airport?

  The 100,000-pound weight restriction is set by the strength of the existing pavement (see *Runway Pavement Strength* section below). As noted below, this Master Plan's recommendation is to maintain the runway pavement strength at 100,000 pounds. The 95-foot wingspan restriction is set to maintain an adequate level of safety with a non-standard runway centerline to taxiway centerline separation of 320 feet. The runway centerline to taxiway centerline separation will be 320 feet following the taxiway relocation project that is currently underway. Because the runway/taxiway separation cannot be increased the FAA will not allow the wingspan restriction to be lifted unless the currently safety policies are changed, which is considered to be highly improbable. Historic review of FAA safety policies indicates that they have become more restrictive over the years, not less restrictive.

- Could the FAA safety area and object free area standards that would limit the use of an extended runway to "take-off only" be changed to allow its use for landings also?

  Although FAA safety area and object free area standards have changed over the years, they have become more restrictive rather that less restrictive. So a change in criteria that would allow the runway extension to be used for landing is considered to be very unlikely. It should also be noted that even if the extended runway could be used for landings, its benefit for larger commercial passenger service and general aviation aircraft would be minimal.

Runway Pavement Strength. As identified in the *INVENTORY* chapter of this document, current engineering estimates indicate that Runway 15/33 has an existing gross weight bearing capacity of 60,000 pounds for aircraft with single wheel main-gear configuration and 100,000 pounds for aircraft with a dual-wheel main-gear configuration. According to the existing and projected operational fleet mix, this pavement strength is adequate to accommodate both the commercial service aircraft and business jet fleet. However, all existing airfield pavement should be tested periodically to properly ascertain existing pavement strengths.

It should be noted that there is a 1984 County Ordinance that prohibits aircraft with a certificated maximum allowable gross take-off weight in excess of 90,000 pounds from operating at the airport (see appendix). To prevent the enforcement of this ordinance from being viewed as discriminatory by the FAA, it should be coordinated with the actual runway pavement strength (100,000 dual) and should be based on aircraft operating weight (not on certificated maximum allowable gross take-off weight). The FAA is currently reviewing the pavement strength and aircraft weight restriction issue on a nation-wide basis. It is recommended that Pitkin County's ordinance be reviewed and revised to bring it in line with current FAA policies.

Runway Line of Sight. According to existing runway line-of-sight standards, any two (2) points located five feet (5') above the runway centerline must be mutually visible for the entire length of the runway. If the runway has a full-length parallel taxiway, the visibility requirement is reduced to a distance of one-half the runway length. Aspen/Pitkin County Airport does comply with the runway line-of-sight standards for the entire length of the runway.

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 mentioned previously, one of the significant capital improvement programs which has been underway at the airport for several years is the relocation of partial parallel Taxiway "A" from its existing position (with its centerline 221.5 feet east of the runway centerline) to a location that provides a separation of 320 feet between the runway and taxiway centerlines. If required, taxiways that will be needed to access new aviation use development areas are proposed as part of the Master Plan. The benefit of additional runway exit taxiways is also investigated.

Instrumentation and Lighting

Electronic landing aids, including instrument approach capabilities and associated equipment, airport lighting, and weather/airspace services, were detailed in the *Inventory* chapter of this document. The airport is not equipped with an ILS instrument approach; however, there are two published circling approaches (a VOR/DME and a GPS-C) and one straight in "special approach" (a GPS) that provide navigation to the airport.

In addition, it should be noted that equipment to provide a new localizer approach has recently been installed at the airport. The public-use minimums associated with this new localizer approach are ceiling less than or equal to 2,240' Above Ground Level (AGL) and visibility less than 3 statute miles, while the special (training required) minimums are ceiling less than or equal to 1,043' AGL and visibility less than 3 statute miles.

Within the near future, Global Positioning System (GPS) approaches are expected to be the FAA's standard approach technology. With GPS the cost of establishing improved instrument approaches should be significantly reduced. Because of the expected continued use of sophisticated general aviation, air carrier, and corporate aircraft at

Aspen/Pitkin County Airport, the ability to implement improved instrument approaches will be analyzed in later chapters.

Visual Landing Aids (lights). Presently, the runway at Aspen/Pitkin County Airport is equipped with an edge lighting system. In addition, Runway 15 has Precision Approach Path Indicator Lights (PAPI) and a Medium Intensity Approach Lighting System with Sequenced Flashing Lights (MALSF). Runway End Identifier Lights (REILS) have recently been installed on Runway 33. In conjunction with the examination of improved instrument approaches described above, improved airport lighting could be needed.

Runway Protection Zones (RPZs). The function of the RPZ is to enhance the protection of people and property on the ground off the end of runways. This is achieved through airport control of the property within the RPZ area. This control can be exercised through either fee-simple ownership or the purchase of RPZ easement. The RPZ is trapezoidal in shape and centered about the extended runway centerline. Its inner boundary begins 200 feet beyond the end of the area usable for takeoff or landing. The dimensions of the RPZ are functions of the type of aircraft, which regularly operate at the airport, in conjunction with the specified visibility minimums of the approach (if applicable).

In consideration of the existing instrument approach minimums and the type of aircraft that the 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 C7
RUNWAY PROTECTION ZONE DIMENSIONS
Aspen/Pitkin County Airport Master Plan

Item	Width at Runway End (feet)	Width at Outer End (feet)	Length (feet)
Existing RPZ Dimensions:			
Runway 15	500	1,010	1,700
Runway 33	500	1,010	1,700
Required RPZ Dimensions for Various Visibility Minimums:			
Not lower than 1-Mile, Approach Categories C & D	500	1,010	1,700
Not lower than 3/4-Mile, All Aircraft	1,000	1,510	1,700
Lower than 3/4-Mile, All Aircraft	1,000	1,750	2,500

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

The potential for improved instrument approaches and the effect on the size of the required runway protection zone is considered in the formulation of development alternatives for the airport.

Future Lighting. Based on existing and future approach visibility minimums, it is recommended that the medium intensity approach lighting system with sequenced flashers (MALSF) serving Runway 15 should be maintained.

Glide path indicator lights are a system of lights that provide visual vertical approach slope guidance to aircraft during an approach to the runway. Precision approach path indicators (PAPIs) are designed for day and nighttime use during VFR (i.e., good weather) conditions. Runway 15 is currently equipped with PAPIs and these should be maintained.

Runway End Identifier Lights (REILs) are a system of lights that provide an approaching aircraft a rapid and positive identification of the approach end of the runway. REILs on Runway 33 have recently been installed. The runway is equipped with an edge lighting system that has recently been renovated. Other approach and taxi guidance lighting improvements that might increase aircraft operational safety are also to be investigated as part this Master Plan Update.

Landside Requirements

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

Terminal Area Requirements

Components of the terminal area complex include the terminal building, gate/parking positions, apron area, vehicular access and auto parking. Because of the complexities of the passenger terminal issue at Aspen/Pitkin County Airport, the facility requirement analysis is presented in a separate chapter entitled *Passenger Terminal Facility Requirements,* which follows.

Air Cargo Requirements

Air cargo services at Aspen/Pitkin County Airport are currently provided by contract carriers, operating general aviation aircraft that utilize the existing general aviation ramp directly west of the Air Traffic Control Tower. It is expected that commercial passenger aircraft will continue to carry air mail and freight, which will require that a certain portion of the airport's freight/mail handling facilities be located inside or in close proximity to the passenger terminal. It is projected that the demand for both air cargo storage and apron will increase through the planning period, and it is recommended that future development areas be identified and reserved along the flight line to accommodate cargo transfer/handling facilities.

General Aviation Requirements

At many airports, the number and type of projected general aviation operations and based aircraft can be converted into generalized projections of landside facility needs. These projections are always inexact and reflect average requirements. In the case of Aspen/Pitkin County Airport, an analysis that reflects averages will not adequately represent the needs where extremes are the norm, rather than the exception. In most cases, modest increases in general aviation activity growth forecast, as is the case with Aspen/Pitkin County Airport, suggests that only minimal additional landside facilities would be required. The compelling operational realities at Aspen/Pitkin County Airport include the high percentage of itinerant aircraft traffic, the significant peak period aircraft activity, and the unmet demand for based aircraft parking space and indoor storage facilities. Therefore, use of average projections falls significantly short of addressing landside facility needs. The following description of current deficiencies provides a better understanding of how future improvements might best be targeted.

At many airports, the number and type of projected general aviation operations and based aircraft can be converted to generalized projections of landside facility needs. These projections are always inexact and, in the case of Aspen/Pitkin County Airport, with relatively small increases in general aviation activity growth forecast and with significant existing unmet demand for aircraft parking space and indoor storage facilities, they are not meaningful. The following description of current deficiencies provides a better understanding of how future improvements might best be targeted.

The current itinerant/based aircraft general aviation apron is approximately 500,000 ft^2 (55,555 yds.^{2}) in area, it is basically fully utilized during busy periods and it has been assumed that any additional based aircraft or itinerant general aviation itinerant aircraft demands will require additional apron or hangars to adequately accommodate. It is also assumed that new based aircraft owners at the airport will prefer a covered storage facility rather than open, on-apron storage.

From historical observation, FBO personnel indicate that there is a need for approximately 100 transient general aviation aircraft parking positions [35-45 for corporate sized aircraft (e.g., Gulfstreams), 35 to 45 for mid-sized business jets (e.g., Learjets), and 20 for smaller single-engine and light twin general aviation aircraft. For safety and efficiency, these aircraft parking positions should be arranged for the aircraft to be positioned and to depart under their own power, if possible.

In addition, FBO personnel and airport staff indicate that there is significant demand for aircraft storage hangars if there was land available for development. It should also be noted that there has been a significant discussion in the past that the airport/community might benefit from having a second FBO; however, a parcel of ground appropriate for this development has not been identified.

The above information indicates that identifying areas large enough to meet general aviation demands at the airport will continue to be a challenge and, because of lack of developable area, some demand is likely to be remain unmet. Therefore, the task for this Master Plan will be to identify potentially developable areas for general aviation facilities, along with a comprehensive alternative analysis, that will allow appropriate policy decisions in light of potential impacts.

Support Facilities Requirements

In addition to the aviation and airport access facilities described above, there are several airport support facilities which have quantifiable requirements and which are vital to the efficient and safe operation of the airport. The support facilities at Aspen/Pitkin County Airport that require further evaluation include the aircraft rescue and firefighting facility, the fuel storage facility and the air traffic control tower.

Aircraft Rescue and Firefighting Facility (ARFF). As identified in the *Inventory of Existing Conditions* chapter of this document, Index B ARFF facilities and equipment are provided at the airport as required to serve the existing type and number of commercial passenger commuter aircraft operations. The specified Part 139 certification ARFF equipment and staff requirements are based on the length of the largest air carrier or commuter aircraft that serves the airport with an average of five (5) or more daily departures. The following table, entitled *REPRESENTATIVE COMMERICAL PASSENGER SERVICE AIRCRAFT LENGTHS & ARFF INDEX*, presents the existing and potential commercial aircraft fleet that are likely to serve the airport, along with their respective lengths and ARFF Index. In consideration of the commercial service operations forecast, the airport will likely be classified as an ARFF Index B throughout the planning period.

To compensate for area lost when the parallel taxiway is relocated, recent planning documents (ESID) have programmed the use of the existing ARFF area for general aviation purposes. In ESID, a new ARFF building containing approximately 15,000 square feet is proposed for the west side of the airport.

Table C8
REPRESENTATIVE COMMERICAL PASSENGER SERVICE AIRCRAFT LENGTHS & ARFF INDEX
Aspen/Pitkin County Airport Master Plan

Aircraft	Length	ARFF Index
BAe 146-200/300	93.7'/101.8'	B
ERJ 135/140/145	86.5'/93.3'/98'	B
Fairchild Dornier 328	69.7'	B
ERJ 145xr	98.0'	B
CRJ-700	106.7'	B

Source: FAR Part 139 *Certification and Operations: Land Airports Serving CAB-Certificated Scheduled Air Carriers Operating Large Aircraft (Other Than Helicopters)*
FAA AC 150/5300-13 *Airport Design*

Fuel Storage Facility. The fuel storage facility at the airport is in good condition and has been constructed to meet all environmental requirements. It is sized to accommodate demand for the foreseeable future. If additional storage would be needed in the future, it is likely that the capacities of the tanks will be expanded or additional tanks will be added in the existing location.

Air Traffic Control Tower (ATCT). At a towered airport, the ATCT is the facility that supervises, directs, and monitors the arrival and departure traffic at the airport, including the immediate airspace surrounding the airport (i.e., within approximately 5 miles). The tower at Aspen/Pitkin County Airport is currently located on the east side of the airport, north of the FBO hangars. Past discussions have indicated the need to relocate the ATCT cab to better accommodate requirements associated with the future taxiway object free area (following the relocation of the parallel taxiway).

The Airport's Role as a Multi-Modal Transportation Facility

The airport's role as a multi-modal transportation facility has been recognized in several previous planning studies, most notably in the *Entrance To Aspen* documents. These multi-modal roles include accommodation of a light rail transit line adjacent to Highway 82 and additional parking. The multi-modal role that the airport will continue to play in the regional transportation system is an important consideration in the development of this Master Plan.

Summary

The information provided in this chapter, along with the information provided in the following Chapter entitled *Passenger Terminal Facility Requirements*, 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 the *Capacity Analysis and Facility Requirements* chapter.

- The position and orientation of the airport runway cannot be effectively improved in consideration of surrounding terrain and development (i.e., the roadway/highway system).

- Forecast demand does not necessitate the development of an additional runway at the airport. The airport will continue be operated with a single runway.

- It is very important that the effort to implement improved instrument approach capabilities at this airport be continued. This will allow the airport to be safely operated more consistently during inclement weather conditions. Because of surrounding terrain considerations, these improvements are more difficult to implement at Aspen/Pitkin County Airport than at most airports.

- The previously approved East Side Infrastructure Development program to relocate the east side parallel taxiway from its existing location (221.5 feet runway centerline to taxiway centerline separation), to a new position providing with 320 feet of centerline to centerline separation, is critical and will continue.

- In light of the potential benefits for the existing and forecast commercial passenger aircraft fleet (i.e., turboprops and regional jets with wingspans of less that 95 feet and with weights of less than 100,000 pounds), a runway extension to the south, that would be used only for departures to the north would appear to provide adequate benefits to warrant consideration in the development of Master Plan alternatives.

- There is current and future unmet demand for additional general aviation transient aircraft parking area and additional general aviation aircraft storage hangars. These needs will be considerations in the development of Master Plan alternatives. The Master Plan alternatives will include options to provide additional general aviation facilities for both a single, and if practical, a second FBO development area layout.

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 (or not 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 that if a future improvement is identified on the recommended development plan it might be built at some point in the future, depending on actual demand, financial feasibility, and community support. If a facility improvement is not shown on the recommended development plan, land will not be reserved for that use, and the ability to construct that facility at some point in the future will likely be lost.

In summary, the facility needs information provided in this chapter and the next will be used to develop alternatives for the configuration of airport facilities in the future. The recommendations for the long-term development plan for the airport will then be produced in consideration of community input on those alternatives.