MASTER PLAN UPDATE

GUNNISON-CRESTED BUTTE
REGIONAL AIRPORT

3

CAPACITY ANALYSIS &
FACILITY REQUIREMENTS

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Capacity Analysis and Facility Requirements

Introduction

The capacity analysis for Gunnison-Crested Butte Regional Airport is composed of two distinct elements: the ability of airport facilities to accommodate existing and projected aircraft operations (airfield capacity), and the ability of airport facilities to accommodate existing and projected ground vehicle operations (airport access capacity). 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. Airport access capacity is a function of the existing and/or future vehicular roadways located in the vicinity of the airport and their interface with the various airport specific access roads.

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 are 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, Gunnison-Crested Butte Regional Airport operates around two runways. The primary runway, Runway 06/24, is served by a full-length north side parallel taxiway with eight (8) connector taxiways, while the crosswind runway, Runway 17/35, is constructed of compacted dirt and not served with an existing taxiway system.

The airport's existing landside facilities are located on the north side of Runway 06/24, and include the passenger terminal facility, FBO hangars, T-hangar/executive hangar facilities, apron areas, ARFF and snow removal equipment, and airport administrative offices. Each of these facilities is well situated to efficiently utilize 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 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. 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.

However, meteorological data obtained for Gunnison-Crested Butte Regional Airport, from the National Climatic Data Center for use in this study, has been categorized into 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 3 statute miles. These conditions occur at the Airport approximately 97.7% of the time annually.
- VFR minimums to Existing Category I ILS minimums - ceiling less than 1,000 feet and/or visibility less than 3 statute miles, but ceiling equal to or greater than 840 feet and visibility equal to or greater than 2¾-statute miles. These conditions occur at the Airport approximately 0.4% of the time annually.
- Below minimums - ceiling less than 840 feet and/or visibility less than 2¾-statute miles. These conditions occur at the Airport approximately 1.9% of the time annually.
- VFR minimums to typical Category I ILS 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. These conditions occur at the Airport approximately 2.0% of the time annually.

Therefore, in consideration of the Airport's existing approach instrumentation (i.e., the precision instrument approach to the runway and historical meteorological records), the Airport can be expected to experience VFR conditions approximately 97.7% of the time, IFR conditions approximately 0.4% of the time, and below minimums approximately 2.0% of the time.

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 Gunnison-Crested Butte Regional Airport, wind data to construct the all weather wind rose was obtained for the period January 1993-March 2003 from observations taken at the Airport. There were approximately 74,158 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 that utilize the Airport on a regular basis. According to the existing Airport Layout Plan, the current Airport Reference Code (ARC) for Runway 06/24 is ARC C-IV;

however, it is anticipated that ARC D-IV would likely be applicable within the 20-year planning period.

In consideration of the ARC D-IV classification, these standards specify that the 20-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 20-knot and 10.5-knot crosswind components should be analyzed for this Airport. The following illustration, entitled *ALL WEATHER WIND ROSE: 20-, 16-, 13-, & 10.5-KNOT CROSSWIND COMPONENTS*, illustrates the all weather wind coverage provided at Gunnison-Crested Butte Regional Airport. For comparison purposes, the 16-knot and 13-knot crosswind components have also been included.

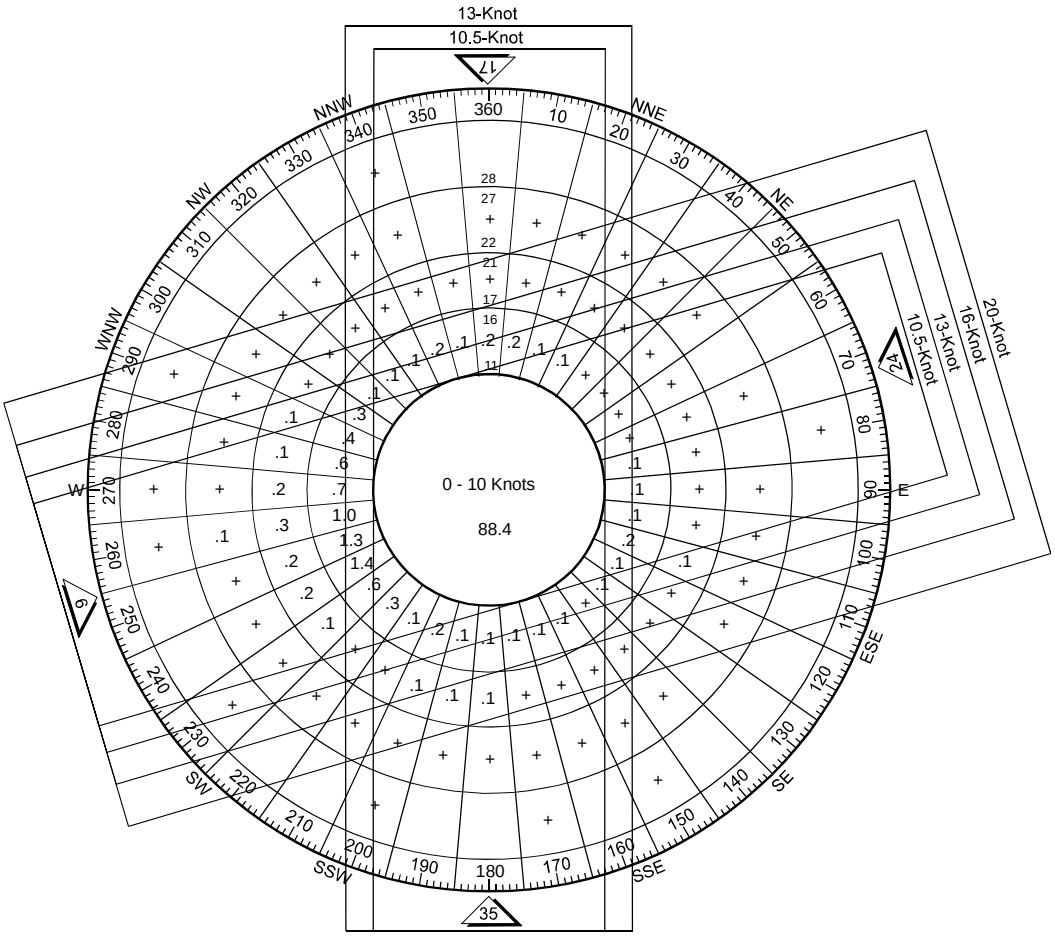
The desirable wind coverage for an airport's runway system is 95%. This means that the runway orientation and configuration should be developed so that the maximum crosswind component is not exceeded more than 5% of the time annually. The following table, entitled *ALL WEATHER WIND COVERAGE SUMMARY*, 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 Gunnison-Crested Butte Regional Airport, utilizing the FAA Airport Design Software supplied with AC 150/5300-13, the existing runway configuration provides 99.86% wind coverage for the 20-knot crosswind component; 99.51% wind coverage for the 16-knot crosswind component; 99.98% wind coverage for the 13-knot crosswind component; and, 99.99% 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
Gunnison-Crested Butte Regional Airport Master Plan Update

Runway Designation	20-Knot Crosswind Component	16-Knot Crosswind Component	13-Knot Crosswind Component	10.5-Knot Crosswind Component
Runway 06/24	99.86%	99.51%	98.59%	97.37%
Runway 06	68.46%	68.36%	67.95%	67.42%
Runway 24	68.80%	68.56%	68.05%	67.35%
Runway 17/35	---	---	95.18%	92.01%
Runway 17	---	---	60.53%	58.20%
Runway 35	---	---	72.20%	71.34%
Combined	99.86%	99.51%	99.98%	99.96%

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

Figure C1
ALL WEATHER WIND ROSE: 20-, 16-, 13-, & 10.5-KNOT CROSSWIND COMPONENTS
Gunnison-Crested Butte Regional Airport Master Plan Update



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center
Station # 72467 – Gunnison, Colorado. Period of Record – January 1993-March 2003. Total Observations: 74,158.

The Airport is served by an ILS precision approach, a straight-in GPS and VOR/DME, and a circling VOR or GPS-A. In an effort to evaluate the effectiveness of these approaches and analyze the potential benefits of implementing lower approach visibility minimums, an Instrument Flight Rules (IFR) wind rose has been constructed. The following table and illustration quantify the wind coverage offered by each runway end in consideration of 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).

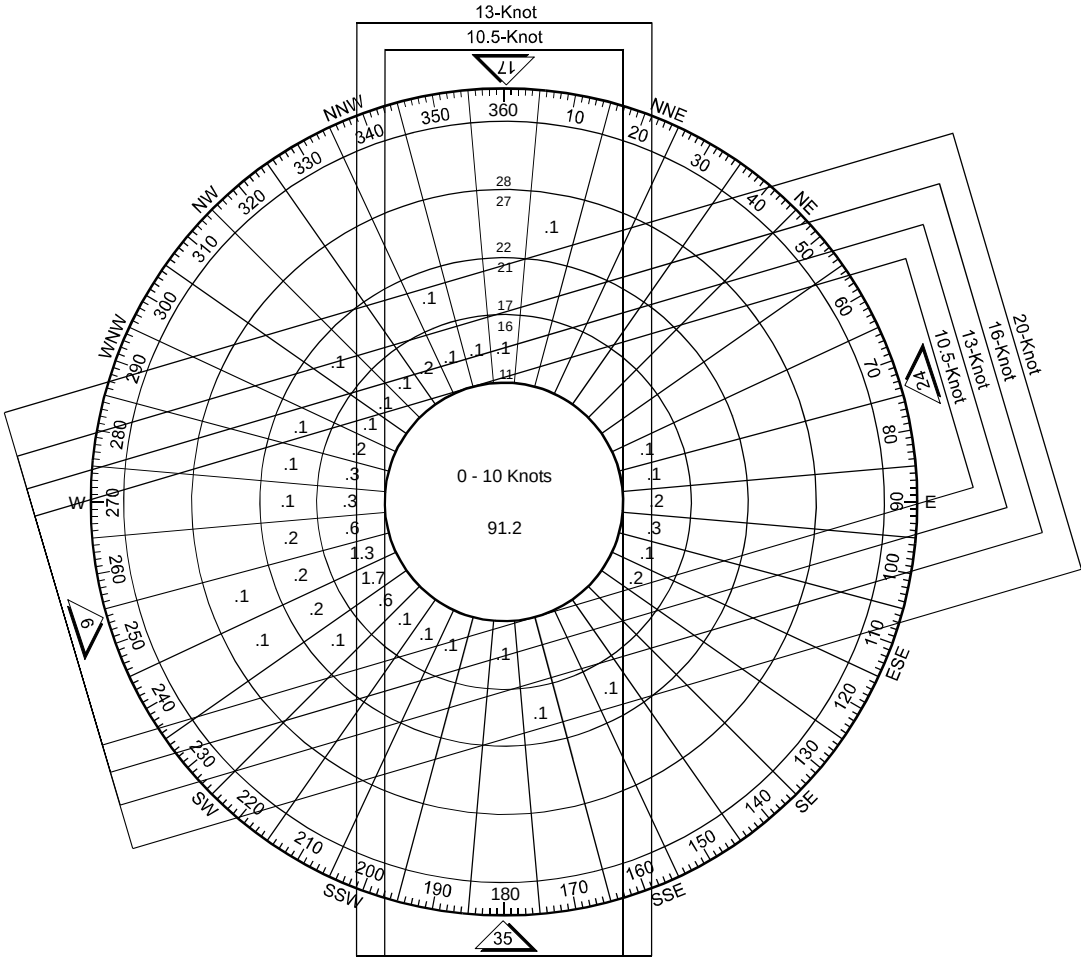
Table C2
IFR WIND COVERAGE SUMMARY
Gunnison-Crested Butte Regional Airport Master Plan Update

Runway Designation	Wind Coverage Provided Under IFR Conditions[1] 20-Knot Maximum Crosswind	Wind Coverage Provided Under IFR Conditions[1] 16-Knot Maximum Crosswind	Wind Coverage Provided Under IFR Conditions[1] 13-Knot Maximum Crosswind	Wind Coverage Provided Under IFR Conditions[1] 10.5-Knot Maximum Crosswind
Runway 06	70.18%	70.11%	70.03%	69.90%
Runway 24	75.05%	74.89%	74.53%	74.08%
Runway 06/24	99.82%	99.58%	99.14%	98.56%
Runway 17	---	---	71.02%	68.77%
Runway 35	---	---	70.63%	70.14%
Runway 17/35	---	---	96.10%	93.38%
Combined	99.82%	99.58%	99.94%	99.93%

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

[1] Ceiling 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.

Figure C2
IFR WIND ROSE: 20-, 16-, 13-, & 10.5-KNOT CROSSWIND COMPONENTS
Gunnison-Crested Butte Regional Airport Master Plan Update



Source: National Oceanic and Atmospheric Administration, National Climatic Data Center
Station # 72467 – Gunnison, Colorado. Period of Record – January 1993-March 2003. Total Observations: 74,158.

From this IFR wind coverage summary, it can be determined that Runway 24 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. Aircraft mix is defined as the relative percentage of operations conducted by each of these four classes of aircraft. In consideration of the forecasts presented in the previous chapter, an aircraft mix table has been generated. The following table, entitled *AIRCRAFT CLASS MIX FORECAST, 2002-2022*, presents the projected operational mix for the selected forecasts.

Table C3
AIRCRAFT CLASS MIX FORECAST, 2002-2022
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	VFR Conditions			IFR Conditions		
Year	**Class A & B**	**Class C**	**Class D**	**Class A & B**	**Class C**	**Class D**
2002[(1)]	70.0%	30.0%	---	10.0%	90.0%	---
2007	70.0%	30.0%	---	10.0%	90.0%	---
2012	70.0%	30.0%	---	10.0%	90.0%	---
2017	70.0%	30.0%	---	10.0%	90.0%	---
2022	70.0%	30.0%	---	10.0%	90.0%	---

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)]Existing percentage breakdown was estimated by Barnard Dunkelberg & Company (BD&Co.)

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 Gunnison-Crested Butte Regional 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*, local operations are estimated to represent approximately 42% of the total annual operations being conducted at the Airport; flight training represents a majority of this activity. It is anticipated that the level of flight training will remain through the planning period; however, the Airport will continue to be a center for both business and tourism-related itinerant general aviation operations in the future and the percentage of touch-and-go operations is expected to remain relatively consistent 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 the existing runway facility at Gunnison-Crested Butte Regional Airport combine to dictate the utilization of the existing runway system. According to the all-weather wind coverage data and airport management observations, there is not a stand-alone primary use runway end, even though Runway 24 provides slightly better payload capability in consideration of the narrow-body passenger jet fleet. It's estimated that there is an approximate equal split of operations to each runway end, with approximately 50% of the airport's operations being conducted to both the west utilizing Runway 06 and to the east utilizing Runway 24.

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 Gunnison-Crested Butte Regional Airport, the number of available exit taxiways for use in the capacity calculation is adequate. 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 3,000 and 5,500 feet from the landing threshold. Therefore, landings to Runway 06 received an exit rating of two (2) and Runway 24 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. According to this analysis, two (2) additional exit taxiways would have to be constructed to achieve the maximum credit for each operating configuration. Given the existing close proximity of a third exit taxiway serving Runway 06, and the airport's existing/projected operational levels, it is unlikely that additional

exit taxiways will be needed at the Airport. 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, 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. In addition, Gunnison-Crested Butte Regional Airport does not have an Air Traffic Control Tower (ATCT); therefore, approach control is provided by the Denver Air Route Traffic Control Center (ARTCC). Due to the mountainous terrain in the vicinity of the Airport, which prohibits continuous radar coverage by the ARTCC, the hourly capacity of the existing runway system under IFR operating conditions is severely restricted.

Airfield Capacity Analysis

As previously described, determination of capacity figures for Gunnison-Crested Butte Regional Airport will utilize the throughput method of calculation, described in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*. These formulae, applying information generated from preceding analyses, illustrate capacity and demand in terms of the following results:

- Hourly Capacity of Runways
- Annual Service Volume (ASV)

The following capacity computations provide assistance in evaluating the ability of the existing airport facilities, both airside and landside, to accommodate forecast demand.

Hourly Runway Capacity

Calculations of hourly runway 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, existing IFR operating conditions and taxiway exit rating, an hourly capacity was calculated. For all runway use configurations, the airport's average VFR hourly capacity was determined to be approximately 60 operations, which compares to an IFR hourly capacity of approximately 6 operations.

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 also the percent utilization of each possible runway use configuration. The weighted hourly capacity for Gunnison-Crested Butte Regional Airport for 2002 was determined to be approximately 65 operations per hour. This weighted hourly capacity can then be used in calculating the 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

In consideration of the existing runway configuration, runway utilization patterns and 2002 operation counts (i.e., 14,672), Gunnison-Crested Butte Regional Airport has been determined to have a daily demand ratio (D) of 310 operations and an hourly demand ratio (H) of 4.73 operations, and thus, an ASV of approximately 96,419 operations.

Conditions that are involved with the determination of the weighted hourly capacity and the daily demand are not forecast to change significantly in the future, and those numbers will remain fairly constant through the planning period. The hourly ratio, as specified in the formula, is the inverse of the daily operations that occur during the peak hour. In other words, as operations increase, the peak periods tend to spread out, increasing the hourly ratio (H). As the hourly ratio increases, the ASV will increase. Thus, as presented in the following table, even without additional runway or taxiway facilities, the ASV at Gunnison-Crested Butte Regional Airport would increase to approximately 140,066 operations by the year 2022.

For comparison purposes, this ASV tabulation should also be compared with the long-range planning figures for hourly capacity and ASV that are presented in FAA Advisory Circular 150/5060-5. Based on a single runway use configuration with a specified mix index ranging from 21 to 50, the VFR and IFR hourly capacities are projected at 74 and 57 operations, respectively, with a projected ASV of 195,000 operations per year. As can be noted, the projected ASV at Gunnison-Crested Butte Regional Airport is significantly restricted due to a variety of factors, which include a very low IFR hourly capacity at the Airport, due to the relatively high instrument approach minimums, the existing operational peaking characteristics throughout the year, the surrounding terrain, and a lack of local Air Traffic Control capabilities. Given the projected operational levels at the Airport, adequate airfield capacity will be available at the facility beyond the twenty-

year planning period of this document. It should be noted that the IFR hourly capacity could potentially be enhanced with the addition of airport surveillance radar or the future use of new generation GPS technology [i.e., Automatic Dependent Surveillance-Broadcast (ADS-B)]. However, the surrounding terrain will continue to impose restrictions on arriving aircraft under IFR conditions for the foreseeable future, due to the line-of-sight restrictions associated with current use ground-based NAVAIDs and radar facilities.

Table C4
AIRFIELD CAPACITY FORECAST SUMMARY, 2002-2022
Gunnison-Crested Butte Regional Airport Master Plan Update

Year	Annual Operations	Design Hour Operations	Annual Service Volume (ASV)
2002	14,672	10	96,419
2007	16,839	11	101,529
2012	18,917	11	114,058
2017	21,286	11	128,342
2022	23,982	12	140,066

Source: Barnard Dunkelberg and Co.

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 Gunnison-Crested Butte Regional 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.

Airport Access Roadways

The capacity of roadways providing access to the Airport is based on the *Highway Capacity Manual*, published by the Transportation Research Board, Special Report 209, 1985. It is normally preferred that a roadway operate below capacity to provide reasonable flow and minimize delay to the vehicles using it. The *Highway Capacity Manual* defines different operating conditions, known as levels-of-service. The levels-of-service are functions of the volume and composition of the traffic and the speeds attained. Six

levels-of-service have been established, designated by the letters A-F, providing for best to worst service in terms of driver satisfaction. Level-of-service F defines a road operating beyond its maximum capacity; traffic is typically almost at a standstill causing major delays to road users. Level-of-service A is defined as a road with free flow operational characteristics at average travel speeds. Vehicles on a level-of-service A roadway are completely unimpeded in their ability to maneuver within the traffic stream. A level-of-service C, represented by stable traffic flow and minimal delays, is generally the preferred level of service on a road system such as in the vicinity of Gunnison-Crested Butte Regional Airport. Average hourly volumes of airport service roadways of typical facilities at level-of-service C and D are summarized in the following table.

Table C5
GROUND ACCESS FACILITY VOLUME
Gunnison-Crested Butte Regional Airport Master Plan Update

Facility Type	**Average Hourly Volume[1] (Vehicle/Hour/Lane)[2]**
Main-access and feeder freeways (controlled access, no signalization)	1,000-1,600
Ramp to and from main-access freeways, single lane	900-1,200
Principal arterial (some cross streets, two-way traffic)	900-1,600
Main-access road (signalized intersections)	700-1,000
Service road	600-1,200

Source: Measuring Airport Landside Capacity, Transportation Research Board, 1987.
[1]Highway level-of-service C and D.
[2]Passenger-car equivalents.

The breadth of ranges given in the above table makes their use in defining roadway capacity analysis useful, primarily in initial testing for problems. The focus of the access roadway capacity assessment for the Airport is on the service provided between the terminal curb or parking area and the interchange linking the Airport with the regional transportation system. Thus, the analysis for Gunnison-Crested Butte Regional Airport is focused on the airport's Passenger Terminal Access Road and Rio Grand Avenue.

The information presented in the previous table would indicate that the existing two-lane airport access roadway system has a capacity in the neighborhood of 600 to 1,200

vehicles per hour, per lane, at a level-of-service in the C to D range. This information can be compared to the following table, which presents existing and forecast peak hour passenger cars in the peak direction. For planning purposes, it is preferable that these forecast numbers are somewhat high; therefore, they are based upon the majority of passengers (approximately 74%) arriving at the Airport in rental cars or private automobiles, with an average vehicle occupancy rate estimated for Gunnison at approximately 2.0 passengers per automobile. The remaining airport's peak hour passengers are shuttled to and from the area hotels and ski area via small buses with occupancy rates ranging from 10 to 12 passengers.

Table C6
AIRPORT ACCESS DEMAND FORECAST, 2002-2022
Gunnison-Crested Butte Regional Airport Master Plan Update

Year	Peak Hour Passengers In Peak Direction (Enplanements)[1]	Peak Hour Passenger Cars/Buses In Peak Direction[1]
2002	304	89/9
2007	445	143/12
2012	482	154/14
2017	523	168/16
2022	569	182/18

[1]Peak hour enplanement and traffic projections by Barnard Dunkelberg & Company.

It appears that the existing airport access road has adequate capacity to accommodate forecasted passenger traffic through the planning period. However, this analysis does not take into consideration background traffic (i.e., the normal City traffic, unrelated to the operation of the Airport, which could affect the future ability of this roadway to accommodate demand). Therefore, even though the background traffic is not a problem at present, the capacity of the entire terminal roadway system should be analyzed periodically to determine if improvements are needed.

Terminal Curb Frontage

Most passengers, their baggage, and sometimes accompanying visitors are dropped off and picked up at the terminal building curb frontage. In this area, passengers leave ground transportation (automobile, taxi, bus, limousine, or courtesy van) and become pedestrians on their way to or from the aircraft loading gate. Therefore, the terminal

curb is the interface between the terminal building and the ground transportation system. The length of curb required for the loading and unloading of passengers is determined by the type and volume of ground vehicle traffic anticipated in the peak period on the design day.

As with the terminal access roadway system, levels-of-service have been identified for the terminal curb *(Measuring Airport Landside Capacity, Transportation Research Record 215*, published by the Transportation Research Board, 1987). The five levels-of-service for the terminal curb range from level A, defining a curb that experiences no traffic queues and no double-parking; to level E, that is indicative of a curb area with numerous operational breakdowns and an effective curb utilization equal to two (2) times the actual curb frontage. A curb length, which will provide a minimum of a level-of-service C, is generally the goal for airport passenger terminals. Level-of-service C defines a curb with an effective curb utilization equal to 1.3 times the actual curb frontage.

The one-way roadway system in front of the passenger terminal at Gunnison-Crested Butte Regional Airport currently consists of two (2) lanes: a loading and unloading lane adjacent to the terminal curb, and a driving lane that is separated from the parking area by a single row of Jersey barriers. The existing curb frontage adjacent to the terminal building totals approximately 300 feet in length (there is no physical distinction between enplaning and deplaning curbs). Based upon estimates of existing and forecast peak period passenger enplanements and deplanements, the current curb length does not provide adequate capacity to accommodate the existing or forecast passenger demand.

In addition to automobile traffic, the existing terminal roadway at Gunnison-Crested Butte Regional Airport also accommodates a significant number of small shuttle buses, in addition to the occasional large charter bus associated with transport to the area ski resort. At present, the buses drop off passengers at the west end of the terminal building (at the terminal curb), and pick up passengers at the east end of the terminal.

Capacity Summary

This section has analyzed the capacity of existing facilities at Gunnison-Crested Butte Regional Airport. Both adequate airfield and ground access facilities are critical components in the ability of the airport as a whole 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, will provide the basis for formulating the alternative development scenarios for

the Airport, ensuring that the new recommended development plan can adequately accommodate the long-term aviation development requirements of the region.

Facility Requirements

In efforts to identify future demand at the Airport for those facilities required to adequately serve future needs, it is necessary to translate the forecast aviation activity into specific types and quantities. This section addresses the actual physical facilities and/or improvements to existing facilities needed to safely and efficiently accommodate the projected demand that will be placed on the Airport. This section consists of two separate analyses: those requirements dealing with *airside* facilities and those dealing with *landside* facilities.

Airfield Requirements

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.

Airfield Dimensional Criteria

The types of aircraft that currently operate at Gunnison-Crested Butte Regional 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 facility in the future. As previously mentioned, a combination of the Boeing 757 (B-757) and the Grumman Gulfstream II has been identified as the airport's "Design Aircraft" for Runway 06/24 with regard to physical dimensions (i.e., 124.8-foot wingspan) and approach speed (i.e., 141 knots). In addition, the Cessna 170 has been identified as the critical aircraft for Runway 17/35 with regard to physical dimensions (i.e., 36.0-foot wingspan) and approach speed (i.e., 65 knots).

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). A runway/airport that accommodates aircraft with an approach speed as great as 141 knots, but less than 166 knots and with wingspans as great as 118 feet, but less than 171

feet should be designed utilizing ARC D-IV dimensional criteria. Due to the slower approach speed and smaller wingspan of the Cessna 170, the crosswind runway (Runway 17/35) is to be designed utilizing ARC A-I Small Aircraft Only dimensional criteria. The previously mentioned aircraft are the Design Aircraft for dimensional criteria only (i.e., runway/taxiway separation, runway/taxiway safety areas, aircraft parking separation, etc.), and are not intended to be used solely to dictate runway length requirements; although, it may be used as a guide in the process of determining runway length. The dimensional criteria illustrated in the following tables, entitled *ARC D-IV DIMENSIONAL STANDARDS FOR RUNWAY 06/24 (In Feet)* and *ARC A-I DIMENSIONAL STANDARDS FOR RUNWAY 17/35 (In Feet)*, are those required for the specified Design Aircraft for each runway, in conjunction with specified approach visibility minimums, and include the existing dimension for the corresponding facility.

Table C7
ARC D-IV DIMENSIONAL STANDARDS FOR RUNWAY 06/24 (In Feet)
Gunnison-Crested Butte Regional Airport Master Plan Update

Item	Existing Dimension	ARC D-IV with ≤ ¾ Mile Visibility Minimums	ARC D-IV with ≥ ¾ Mile Visibility Minimums[1]
Runway Width	150	150	150
Runway Centerline to Parallel Taxiway Centerline	400	400 [2]	400 [2]
Runway Centerline to A/C Parking	529	500	500
Runway Centerline to Holdline	326	326	326
Runway Safety Area Width			
Runway 06	500	500	500
Runway 24	500	500	500
Runway Safety Area Length Beyond Departure Runway End			
Runway 06	1,000	1,000	1,000
Runway 24	1,000 [3]	1,000	1,000
Runway Object Free Area Width			
Runway 06	800	800	800
Runway 24	800	800	800
Runway Object Free Area Length Beyond Departure Runway End			
Runway 06	1,000 [4]	1,000	1,000
Runway 24	1,000	1,000	1,000
Runway Obstacle Free Zone Width	400	400	400
Runway Obstacle Free Zone Length Beyond Departure Runway End			
Runway 06	200	200	200
Runway 24	200	200	200
Taxiway Width	75	75	75
Taxiway Safety Area Width	171	171	171
Taxiway Object Free Area Width	259	259	259
Taxilane Object Free Area Width	---	225	225
Threshold Siting Criteria	Criteria Met	---	---

Source: AC 150/5300-13, Federal Aviation Administration.
[1]Existing runway approach visibility minimums.
[2]The specified runway centerline to taxiway centerline dimension is for sea level elevation airports. According to data generated by the FAA Airport Design Software supplied with AC 150/5300-13, a separation dimension of 382.4 feet was specified for the Boeing 757 aircraft, which compares to a generalized dimension of 405.5 for Category D and E aircraft.
[3]The previous RSA length deficiency was resolved with grading and drainage improvements associated with the runway shift project that was completed in 2004.
[4]The previous ROFA deficiency was resolved with the roadway relocation and additional threshold relocation made possible by the runway shift project that was completed in 2004.

Table C8
ARC A-I SMALL AIRCRAFT ONLY DIMENSIONAL STANDARDS FOR RUNWAY 17/35 (In Feet)
Gunnison-Crested Butte Regional Airport Master Plan Update

Item	Existing Dimension	ARC A-I Visual Approach Minimums[1]
Runway Width	150	150
Runway Centerline to Parallel Taxiway Centerline	---	150
Runway Centerline to A/C Parking	---	125
Runway Centerline to Holdline	---	125
Runway Safety Area Width	120	120
Runway Safety Area Length Beyond Departure Runway End	240	240
Runway Object Free Area Width	250	250
Runway Object Free Area Length Beyond Departure Runway End	240	240
Runway Obstacle Free Zone Width	250	250
Runway Obstacle Free Zone Length Beyond Departure Runway End	200	200
Taxiway Width	---	25
Taxiway Safety Area Width	---	49
Taxiway Object Free Area Width	---	89
Taxilane Object Free Area Width	---	79
Threshold Siting Criteria	Criteria Met	---

Source: AC 150/5300-13, Federal Aviation Administration.
[1]Existing runway approach visibility minimums.

As can be seen in the above tables, both Runway 06/24 and Runway 17/35 at Gunnison-Crested Butte Regional Airport comply with FAA specified dimensional criteria.

Runways

In consideration of the forecasts of future aviation activity, the adequacy of the runway system must be analyzed from several perspectives. These include runway orientation and airfield capacity, which were analyzed in the previous section, as well as runway length, pavement strength and runway visibility, which will be evaluated in the following text. The analysis of these various aspects pertaining to the runway system will provide a basis for recommendations of future improvements.

Runway Orientation. Gunnison-Crested Butte Regional Airport currently operates with two runways, Runway 06/24, which provides a northeast-southwest orientation and Runway 17/35 (i.e., the crosswind runway), which offers a north-south orientation. As presented in a previous section, the existing two-runway configuration provides excellent wind coverage (i.e., in excess of 99%) for the 20-, 16-, 13-, and 10.5-knot crosswind components; therefore, no additional runways are required from a *wind coverage* standpoint. Additionally, Runway 06/24 alone satisfies the airport's minimum 95% wind coverage requirements; therefore, it is possible that future development projects associated with the crosswind runway would not be eligible for FAA AIP funding participation.

Currently, recommended Runway 06/24 improvements for Gunnison-Crested Butte Regional Airport, as depicted on the Airport Layout Plan, include relocating the Runway 06 end 505 feet from the existing threshold to accommodate the runway object free area deficiencies on the southwest portion of the Airport. Additionally, a runway extension of 505 feet to the northeast will compensate for the threshold relocation, thus, maintaining the runway's existing length of 9,400 feet.

Airfield Capacity. The evaluation of airfield capacity, as presented in previous sections, indicates that the Airport will not exceed the capacity of the existing runway/taxiway system before the end of the planning period.

Under existing operating conditions, the airport's Annual Service Volume (ASV) for the year 2022 was projected to be 140,066 operations. FAA planning standards indicate that when sixty percent (60%) of the ASV is reached (i.e., 84,040 operations), the Airport should start planning ways to increase capacity and when eighty percent (80%) of the ASV is reached (112,053 operations), construction of facilities to increase capacity should be initiated. These conditions should be monitored as *trends* and not just as one-time occurrences. This trend monitoring will provide lead-time in recognizing demand for facilities before the need occurs and will help to keep expenditures within budgetary constraints.

During 2002, aircraft operations at Gunnison-Crested Butte Regional Airport totaled 14,672, which is substantially short of the sixty percent (60%) level of the ASV. In addition, 23,982 annual operations are forecast to occur at the Airport by the end of the planning period, which is also well below the sixty percent (60%) level of the ASV. Therefore, no additional runway facilities will be required at the Airport to increase operational capacity.

Runway Length. The determination of runway length requirements for Gunnison-Crested Butte Regional 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; and,
- Stage length of the longest nonstop trip destination.

The runway length operational requirements for aircraft are greatly affected by elevation, temperature, and runway gradient. The calculations for runway length requirements at Gunnison-Crested Butte Regional Airport are based on an elevation of 7,678.4 feet AMSL, 83.0 degrees Fahrenheit NMT (Mean Normal Maximum Temperature), and a maximum difference in runway elevation at the centerline of 22.6 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 large aircraft fleet under 60,000 pounds (i.e., the business jets that operate at the Airport). As can be seen in the following table, entitled *RUNWAY TAKEOFF LENGTH REQUIREMENTS*, there are four (4) runway lengths shown for small aircraft type runways. Each of these provides the required length to accommodate a certain type of aircraft that will utilize the runway. The lengths range from 6,570 feet to 9,230 feet in length, with the runway length being 9,230 feet for small aircraft seating more than ten (10) passengers.

There are four (4) different lengths given for large aircraft under 60,000 pounds. The specified large aircraft runway lengths pertain to those general aviation aircraft, generally jet-powered, of 60,000 pounds or less maximum certificated takeoff weight. The requirements of the large aircraft fleet range from 7,930 feet to 11,230 feet in length for Gunnison-Crested Butte Regional 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's the load that can be carried by the aircraft composed of passengers, fuel, and cargo. Generally speaking, the following aircraft comprise 75 percent of the large aircraft fleet weighing less than 60,000 pounds: Learjets, Sabreliners, Citations, Falcons, Hawkers, and the Westwind.

In consideration of the existing seasonal commercial service flights being provided by the narrow body air carrier fleet, the table also illustrates the generalized runway takeoff length requirements for large aircraft over 60,000 pounds at various stage lengths. A generalized runway length of approximately 7,710 feet is required for a 500-nautical mile (500-NM) stage length, 9,150 feet are required for a 1,000-NM stage length, while approximately 10,470 feet are required to accommodate a 1,500-NM stage length.

Table C9
RUNWAY TAKEOFF LENGTH REQUIREMENTS
Gunnison-Crested Butte Regional Airport Master Plan Update

Runway Requirement	Runway Takeoff Length (Feet)[1]
Existing Condition	
Runway 06/24	9,400
Small Aircraft with less than 10 seats	
75% of Small Aircraft	6,570
95% of Small Aircraft	9,230
100% of Small Aircraft	9,230
Small Aircraft with more than 10 seats	9,230
Large Aircraft less than 60,000 pounds	
75% of fleet/60% useful load	7,930
100% of fleet/60% useful load	8,830
75% of fleet/90% useful load	11,230
100% of fleet/90% useful load	11,230
Large Aircraft greater than 60,000 pounds	
500/1,000/1,500 NM stage lengths	7,710/9,150/10,470

Runway Lengths Based on 7,678.4' AMSL, 83.0°F NMT, and Maximum difference in runway end of 22.6 feet.
[1]The recommended runway lengths for both dry and wet runway conditions are the same.

An important factor to note when considering the generalized large aircraft runway takeoff length requirements presented in Table C9 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, for example, if an airport is designed to accommodate seventy-five percent (75%) of the fleet at ninety percent (90%) useful load, this does not mean that at certain times a larger business jet cannot use the Airport or that aircraft cannot use it with heavier loadings than that represented by ninety percent (90%) of the maximum useful load.

Following an examination of the various runway lengths provided in the previous table, it should be noted that Runway 06/24, with an existing length of 9,400 feet, is 1,830 feet deficient in accommodating large aircraft less than 60,000 pounds at 90% useful load. However, due to the airport's relatively high elevation and surrounding mountainous terrain, it is mandatory that these generalized runway length requirements be evaluated in consideration of the specific

climb-limited and obstacle-limited operating weight requirements from Gunnison. This additional investigation was undertaken as a planning element of the 2001 *Gunnison County Airport Environmental Assessment (2001 EA)* and this runway length evaluation table, entitled *AIRLINE RUNWAY LENGTH REQUIREMENTS*, has been included for reference.

Table C10
AIRLINE RUNWAY LENGTH REQUIREMENTS
Gunnison-Crested Butte Regional Airport Master Plan Update

Aircraft	Stage Length (NMs + IFR Res.)	Passengers/ BLF	Temp.	Takeoff Weight (lbs.)	Runway Takeoff Length (Feet)
Charter Operator/					
Climbed Limited Weights:					
Runway 06 & 24 Departures					
Boeing 727-200	700	173/100%	35° F	173,950 (1)	10,600 (2)
Boeing 727-200	700	133/77%	60° F	168,160 (1)	10,400 (2)
Estimated Mission Weight: 170,000 lbs.					
Obstacle Limited Weights:					
Runway 24 Departures					
Boeing 727-200	700	173/100%	0° F	170,460 (1)	9,400 (3)
Boeing 727-200	700	123/71%	35° F	159,820 (1)	8,800 (2)
Boeing 727-200	700	91/53%	60° F	153,410 (1)	8,600 (2)
Estimated Mission Weights: 170,000 lbs.					
Obstacle Limited Weights:					
Runway 06 Departures					
Boeing 727-200	700	161/93%	0° F	167,710 (1)	9,400 (3)
Boeing 727-200	700	109/63%	35° F	157,070 (1)	8,500 (2)
Boeing 727-200	700	77/45%	60° F	150,690 (1)	8,500 (2)
Scheduled Air Carrier/Delta Airlines					
Estimated Mission Weights: 205,000					
Runway 24 Departures					
Boeing 757-200	1,500	188/100%	35° F	210,000 (4)	8,500 (5)
Boeing 757-200	1,500	188/100%	60° F	210,000 (4)	8,800 (5)
Boeing 757-200	1,500	106/56%	83° F	188,700 (4)	9,400 (6)
Scheduled Air Carrier/American Airlines					
Estimated Mission Weights:					
Runway 24 Departures					
Boeing 757-200	700	188/100%	35° F	203,000 (7)	6,800 (8)
Boeing 757-200	700	188/100%	60° F	203,000 (7)	7,100 (8)
Boeing 757-200	700	159/85%	83° F	197,300 (7)	9,400 (9)

Runway length based upon an elevation of 7,674 feet AMSL and dry pavement conditions.
NMs Nautical Miles
IFR Res. Instrument Flight Rule reserves.
BLF Boarding Load Factor
(1) Takeoff weights were tabulated by Jeppesen OpsData utilizing the modified JT8D-17 engine with FedEx hush kit.
(2) Runway lengths were tabulated by Barnard Dunkelberg & Co. utilizing the RJT8D engine as specified in Boeing 727 *Airplane Characteristics-Airport Planning/* April 1985.
(3) A runway length could not be tabulated for 0° F utilizing *Boeing 727 Airplane Characteristics-Airport Planning/* April 1985; however, it is estimated that the existing runway length could accommodate the specified obstacle limited weight.
(4) Takeoff weights were tabulated by the Aircraft Performance Engineering division of Delta Airlines.
(5) Runway lengths were tabulated by Barnard Dunkelberg & Co. utilizing the RB211-535C engine, as specified in *Boeing 757 Airplane Characteristics-Airport Planning/* September 1989.
(6) A runway length could not be tabulated for 83° F utilizing *Boeing 727 Airplane Characteristics-Airport Planning/* April 1985; however, it is estimated that the existing runway length could accommodate the specified takeoff weight.
(7) Takeoff weights were tabulated by the Ops. Performance Engineering Division of American Airlines.
(8) Runway lengths were tabulated by Barnard Dunkelberg & Co. utilizing the RB211-535E4B engine, as specified in *Boeing 757 Airplane Characteristics-Airport Planning/* September 1989.
(9) A runway length could not be tabulated for 83° F utilizing *Boeing 757 Airplane Characteristics-Airport Planning/* September 1989; however, it is estimated that the existing runway length could accommodate the specified takeoff weight.

In consideration of the estimated takeoff weights and performance characteristics for each aircraft, the B-727 aircraft was identified as the "critical aircraft" from a runway length standpoint. It was determined that the existing runway length of 9,400 feet is adequate to accommodate the wintertime operation of the B-727 in consideration of the "obstacle-limited" operational weights. These weights are dictated by the clearance requirements over terrain within the departure surfaces. However, the "obstacle-limited" weights are more restrictive on Runway 06 departures (i.e., takeoffs to the east) and potentially require some passenger/payload penalties during the winter. The specified runway lengths for the B-757 aircraft ranged from approximately 6,800 to 8,500 feet for winter operations and approximately 7,100 to 8,800 feet for summer operations. As can also be noted, the B-757 does become "obstacle weight-limited" when temperatures approach 83° F., and these weight restrictions would impose passenger and/or payload penalties if operations were conducted on hot summer days.

Since the preparation of the 2001 EA, the Airport has begun to accommodate the operation of some passenger regional jets (i.e., Continental Express operating the 50-seat Embraer 145 aircraft and Delta Connection operating the 37-seat Embraer 135 aircraft), in addition to their traditional narrowbody air carrier passenger jet activity. Due to the performance characteristics of these regional jets at high elevations and warm temperatures, these aircraft are susceptible to passenger payload penalties when operating from Gunnison during the summer months. According to a telephone conversation with the Continental Express Station Manager, the summertime operation of the Embraer 145 aircraft is limited to early morning departures, with 50° F being the generally recognized threshold temperature for imposing payload penalties. In addition, it should be noted that the potential requirement for payload penalties at Gunnison is not a function of runway length, and the lengthening of the runway would not improve the operational capability of the regional jet fleet. The Station Manager was not aware of any passenger payload penalties being imposed during the 2003 summer season at the Airport, and does not anticipate any changes to this service for 2004.

Based on the runway length data presented, it was determined that the existing runway length of 9,400 feet is adequate to accommodate the projected aircraft operational requirements at the Airport. Therefore, a 9,400-foot runway length requirement will be examined in conjunction with the previously identified dimensional criteria deficiencies to identify alternative airfield development recommendations.

Runway Pavement Strength. As identified in the *Inventory* chapter of this document, Runway 06/24 is rated in poor condition, with an existing gross weight bearing capacity of 75,000 pounds single wheel, 160,000 pounds dual-wheel, and 250,000 pounds dual tandem 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.

Runway Line of Sight and Gradient. 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. Gunnison-Crested Butte Regional 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 described earlier, the taxiway system at Gunnison-Crested Butte Regional Airport meets the required standards.

Taxiway improvements that will be recommended for Gunnison-Crested Butte Regional Airport include the extension of Taxiway "A" to coincide with the previously mentioned runway extension compensating for relocated threshold on the Runway 06 end. Currently, Runway 06/24 is served by a full-length parallel taxiway on its north side with eight (8) taxiway exits. In addition, if future general aviation aircraft storage development were identified on the south side of Runway 06/24, then additional partial parallel and access taxiway development would be required.

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 equipped with an ILS instrument approach to Runway 06, which offers relatively high minimums. Additionally, the Airport maintains a circling VOR or GPS-A and GPS-B.

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 at many airports would be significantly reduced. Because of the expected continued use of sophisticated general aviation, air carrier, and corporate aircraft at Gunnison-Crested Butte Regional Airport, the ability to implement improved instrument approaches should also be considered due to its impact on the airport's specified design and FAR Part 77 airspace criteria.

As specified in AC 90-RNP RNAV, Area Navigation (RNAV) is defined as a "method of navigation that permits aircraft operations on any desired flight path". Thus, during

flight routes and instrument procedures, aircraft are *not* required to overfly typical ground-based navigation aids. Required Navigation Performance (RNP) refers to a "statement of the *navigation performance accuracy* necessary for operation within a defined airspace". This required performance is derived through a combination of aircraft capability (i.e., avionics, pilot procedures, training, etc.) and the level-of-service (i.e., signal-in-space performance/availability and air traffic management) provided by the corresponding navigation infrastructure. The performance requirements also include a set of interrelated "containment parameters" that include containment integrity, containment continuity, and containment region. Integrity and continuity are specified relative to a containment region, whose limit is equal to twice the RNP value (e.g., for RNP-0.3 RNAV, the containment region is 0.6 NM).

Alaska Airlines pioneered the use of RNP RNAV approach and departure operations at Juneau, Alaska in 1996 using Boeing 737-300 aircraft that were RNP-certified in 1994. Due to the proven success of the RNP RNAV program, these procedures were subsequently developed at other Alaska cities, including Sitka, with RNP aircraft certification being expanded to include the airline's Boeing 737-400 & 900 fleet. There are numerous mountain airports located within the lower 48 states, including Gunnison, that could likely benefit from the application of RNP RNAV approach and departure technology; however, the costs associated with the equipage of the aircraft, the additional pilot training, and development of the procedures are still prohibitive to most of the U.S. domestic air carriers. A comprehensive procedure evaluation of RNP RNAV approach and departure capabilities for Gunnison is not warranted at this time, but the FAA's Airspace and Procedures Specialist with the Denver ARTCC did not anticipate an instrument approach enhancement scenario in which the existing Runway 06 visibility minimums would be improved to lower than one mile.

Visual Landing Aids (Lights). Presently, the runway at Gunnison-Crested Butte Regional Airport is equipped with Medium Intensity Runway Lights (MIRL) edge lights, and a Precision Approach Path Indicator (PAPI) serving both runway ends. Runway 06 is equipped with an ILS and a Medium Intensity Approach Lighting System with Sequenced Flashers (MALSF). In addition, Runway 24 has Runway End Identifier Lights (REIL). 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.

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 an 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 that regularly operate at the Airport, in conjunction with the specified visibility minimums of the approach (if applicable).

In consideration of the existing and future instrument approach minima for each runway, and the type of aircraft each runway is designed to accommodate, it is projected that the existing RPZ dimensions will be maintained for each runway for the balance of the 20-year planning period. 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
Gunnison-Crested Butte Regional Airport Master Plan Update

Item	Width at Runway End (feet)	Width at Outer End (feet)	Length (feet)
Existing RPZ Dimensions:			
Runway 06	500	1,010	1,700
Runway 24	500	1,010	1,700
Runway 17	250	450	1,000
Runway 35	250	450	1,000
Required RPZ Dimensions for Various Visibility Minimums:			
Visual and not lower than 1-mile, Small Aircraft Exclusively	250	450	1,000
Not lower than 1-Mile (Statute), Approach Categories A & B	500	700	1,000
Not lower than 1-Mile (Statute), Approach Categories C & D	500	1,010	1,700
Not lower than 3/4-Mile (Statute), All Aircraft	1,000	1,510	1,700
Lower than 3/4-Mile (Statute), All Aircraft	1,000	1,750	2,500

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

Future Lighting. Based on existing and future approach visibility minimums, it is recommended that the Medium Intensity Approach Lighting System with Sequenced

Flashers (MALSF) be maintained serving Runway 06 and a future medium intensity approach lighting system (MALS) is to be installed to Runway 24.

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) or Visual Approach Slope Indicators (VASIs) are designed for day and nighttime use during VFR (i.e., good weather) conditions. The Precision Approach Path Indicators (PAPIs) are recommended to be retained at each runway end, but may require repositioning in conjunction with the proposed threshold shifts/relocations at each runway end.

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. At present, Runway 24 is equipped with REILs and it is recommended that these be relocated in conjunction with the shift of the Runway 24 threshold.

As mentioned previously, Runway 06/24 is equipped with Medium Intensity Runway Lights (MIRLs). These lights should be maintained in conjunction with the existing ILS system. In addition, Medium Intensity Taxiway Lights (MITLs), which are presently in place on Taxiway "A", should be installed on all future taxiways.

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 current redevelopment issues associated with the passenger terminal complex at Gunnison-Crested Butte Regional Airport, a detailed terminal building space and gate analysis are presented in the following chapter entitled *Passenger Terminal Facility Requirements*. However, an evaluation of the terminal area ground access and parking facilities is presented in the following text.

Ground Access/Parking Requirements. Terminal area ground access facility requirements, based upon the previously presented demand and capacity analysis, have

been developed for the access roadway system, the terminal curb frontage requirements, and vehicle parking.

Terminal Area Access Roadways. The capacity analysis presented in the previous chapter indicated that a two-lane airport entrance road, with additional dedicated turning lanes, would have adequate capacity to accommodate the forecast passenger traffic through the planning period. However, the demand placed on the entrance road should be analyzed periodically to determine if facility improvements are needed.

Terminal Area Vehicle Parking. There are three (3) types of automobile parking typically located in the terminal area of the Airport. These include public (passenger), rental car, and employee parking. For long-range planning purposes, the provision of an appropriate area for passenger terminal parking is an important consideration.

FAA planning guidelines indicate that, at non-hub airports, one parking space should be provided for each 500 to 700 annual enplaned passengers. This guideline would indicate that parking for as many as 157 vehicles could be required by the year 2022. However, this generalized planning formula typically underestimates the automobile parking requirements at resort/destination airports. According to airport management estimates, the existing parking facility is operating at capacity, and there is insufficient space to adequately accommodate the existing shuttle bus and rental car storage requirements. In addition, federally mandated safety regulations may impact the utilization of parking lots in close proximity of the terminal. It has yet to be determined what future restrictions will be enforced; however, the Master Plan Update must make every effort to identify areas for parking and preserve enough space to accommodate flexibility in meeting the changing security restrictions. Given the airport's size and restricted site, providing this flexibility will prove to be a challenge, and may require the acquisition of additional property and the relocation of existing facilities.

Automobile access to the passenger terminal facilities is also an important consideration. The Airport is the front door to the community for air travelers. Peak hour passenger demand is forecast to increase to over 500 peak hour passengers by the end of the 20-year planning period. With this increase in the volume of passengers, it is likely there will be a significant impact related to the need to increase the efficiency and capacity of the existing roadway system serving the terminal area. Therefore, it will be important to take into consideration the configuration of the passenger terminal area and the access roadway. The terminal should be aesthetically pleasing, portraying a sense of arrival, while the access roadway system should be efficient, non-confusing, and have an ease of use for egress/ingress routing.

The following table, entitled *PASSENGER TERMINAL PARKING REQUIREMENTS, 2002-2022*, presents the airport's existing and future projected parking space requirements.

Table C12
PASSENGER TERMINAL PARKING REQUIREMENTS, 2002-2022
Gunnison-Crested Butte Regional Airport Master Plan Update

Type	2002[1]	2007	2012	2017	2022
Public	120	247	271	288	378
Short-Term	---	---	---	---	---
Long-Term	---	---	---	---	---
Rental Car	48	156	170	184	228
Employee	32	50	50	60	60
Bus (drop-off)	0	9	9	10	10
Bus (pick-up)	0	12	14	16	18
Total	200	474	514	558	694

Source: Estimates prepared by Barnard Dunkelberg & Co.
[1]Actual

According to the passenger terminal parking projections, there is adequate space within the existing terminal area to accommodate the future parking demands throughout the specified planning period. However, because the projections in the above table are based on broad rules-of-thumb, their use should be limited to judging the order of magnitude of future demand.

Terminal Curb Frontage. As presented in the previous chapter, according to rule-of-thumb planning guidelines (*Measuring Airport Landside Capacity*, Transportation Research Board, 1987), it appears that the projected passenger terminal curb frontage would be adequate to accommodate the forecast passenger demand through the majority of the planning period.

Table C13
TERMINAL CURB FRONTAGE REQUIREMENTS, 2002-2022 (In Feet)
Gunnison-Crested Butte Regional Airport Master Plan Update

Item	2002[2]	2007	2012	2017	2022
Curb Frontage (lineal feet)[1]	300	450	450	450	450

Source: BD&Co. analysis based on *Measuring Airport Landside Capacity*, Transportation Research Board, 1987, and on a level-of-service B or C with a low vehicle occupancy rate.
[1]Curb frontage length reflects both enplaning and deplaning curb.
[2]Actual. (Existing curb frontage is shared by both passenger cars and shuttle buses).

Air Cargo Requirements

Air cargo services at Gunnison-Crested Butte Regional Airport are currently provided by contract carriers, operating general aviation aircraft that utilize the existing general aviation ramp on the southwest portion of the Airport. In addition, airmail and smaller size freight are carried on-board passenger commuter aircraft serving the Airport. It is expected that passenger aircraft will continue to carry airmail and freight, which will require that a certain portion of the airport's cargo 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

Aircraft based at Gunnison-Crested Butte Regional Airport are stored in one of three areas: large storage hangars, T-hangars, or apron tiedowns. Currently, 30 aircraft are based at the Airport. Over the course of the twenty-year planning period the number of based aircraft is forecast to increase to 44, indicating that an increase in storage facilities to accommodate approximately fourteen (14) 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. Past trends indicate that as more aircraft are based at the Airport, hangar storage capacity is surpassed before additional hangars are supplied.

This indicates that increased tiedown space for based aircraft should be included in the development plan.

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 Gunnison-Crested Butte Regional Airport. This storage is provided in the form of transient aircraft tiedown space. In calculating the area requirements for these tiedowns, typically, an area of 400 square yards per aircraft is used. However, because of the uniqueness of the Airport in accommodating various sizes of business jets for extensive periods during the winter season, an area of 500 square yards per aircraft has been used to reflect a more accurate assessment of the existing situation. The development plan for the Airport will designate adequate areas for apron development to satisfy this demand.

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. It is expected that most of the owners of aircraft that will be newly based at the Airport will desire some type of indoor storage facility. The actual type of hangar storage facility to accommodate based aircraft has been identified as T-hangars and larger corporate and/or FBO type hangars; although, the actual number, size, and location of these hangars will depend on user needs and financial feasibility.

Access and perimeter roadway locations, auto parking requirements, and land requirements are not included in this tabulation because the amount of land necessary for these facilities will be a function of the location of other facilities, as well as the most effective routing of roadways. The following table, entitled *GENERAL AVIATION FACILITY REQUIREMENTS, 2002-2022*, depicts the area required for general aviation landside facilities during all stages of development. This will assist in the development of detailed facility staging discussed later.

Table C14
GENERAL AVIATION FACILITY REQUIREMENTS, 2002-2022
Gunnison-Crested Butte Regional Airport Master Plan Update

Facility	2000[1]	Total Number Required (In yd²) 2007	2012	2017	2022
Itinerant/GA Apron		6,772	7,673	8,707	9,892
Based A/C GA Apron		3,600	4,680	4,680	5,544
Total Apron (yd²)[1]	33,212	10,372	12,353	13,387	15,436
Hangar Space					
T-hangars (no./yd²)	5/300	5/2,420	10/4,839	10/4,839	10/4,839
Exec./Corp. (no./yd²)	5/2,684	6/17,423	6/12,583	7/16,455	7/19,360
Total Requirement	36,196	30,215	29,775	34,681	39,635

Source: BD& Co. projections based on FAA AC 150/5300-13.
[1]Does not differentiate between based and/or itinerant apron.

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 Gunnison-Crested Butte Regional Airport that require further evaluation include the aircraft rescue and firefighting facility and the fuel storage facility.

Aircraft Rescue and Firefighting Facility (ARFF). As identified in the *Inventory* 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 air carrier and 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 AIR CARRIER/COMMUTER AIRCRAFT LENGTHS & ARFF INDEX*, presents the existing commercial aircraft fleet that currently 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. Additionally, according to existing planning documents, the ARFF is scheduled to be relocated to a new location east of the passenger terminal building.

Table C15
REPRESENTATIVE AIR CARRIER/COMMUTER AIRCRAFT LENGTHS & ARFF INDEX
Gunnison-Crested Butte Regional Airport Master Plan Update

Jet Aircraft	Length (In Feet)	ARFF Index
BAe 146-300	101.8'	B
B-737-700	110.3'	B
B-757-200	155.3'	C
CRJ-200	87.10'	A
Turboprop Aircraft	**Length**	**ARFF Index**
Dash 8	84.3'	A
Dornier 328	69.8'	A

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. Over the past four years, there has been an average of 663,323 gallons of fuel sold per year at Gunnison-Crested Butte Regional Airport. Based on 2002 total operation counts, this equates to approximately 43.2 gallons per operation. As operations increase, fuel storage requirements can be expected to increase proportionately. By increasing the ratio of gallons sold per operation to adjust for the increase size of aircraft forecast to operate and be based at the Airport, an estimate of future fuel storage needs can be calculated as a two-week supply during the peak month of operations. As can be seen in the following table, entitled *FUEL STORAGE REQUIREMENTS, 2002-2022*, it appears that the airport's fuel storage requirements can be accommodated through the year 2022 utilizing existing storage facilities.

Table C16
FUEL STORAGE REQUIREMENTS, 2002-2022
Gunnison-Crested Butte Regional Airport Master Plan Update

	2002	2007	2012	2017	2022
Average Day of Peak Month Operations	47	54	61	69	77
Two Week Operations	663	760	854	961	1,083
Gallons per Operation	43.2	44	44	45	45
Fuel Storage (gallons)	70,000 (1)	33,461	37,591	43,258	48,738

(1)Existing fuel storage capacity.

Summary

The need for facilities, which has been identified in this chapter, can now be utilized to formulate the overall future Development Plan of the Airport. The following table summarizes the projected facility requirements necessary to accommodate the projected operational demands through 2022. The formulation of this plan will begin by establishing goals for future airport development and an analysis of development alternatives, whereby demand for future airport facilities can be accommodated. These alternatives will be presented in the following chapter, entitled *Development Concepts and Recommendations*.

Table C17
FACILITY REQUIREMENTS SUMMARY, 2002-2022
Gunnison-Crested Butte Regional Airport Master Plan Update

Facility	2002[1]	2007	2012	2017	2022
Dimensional Standards					
Runway 06/24	ARC C-IV	same	same	same	same
Runway Length/Width					
Runway 06/24	150' x 9,400'	same	same	same	same
Gross Terminal Building Area (ft.²)	38,400[2]	(To Be Determined)			
Terminal Apron Gate/Parking Positions					
Air Carrier	2	(To Be Determined)			
Commuter	1	(To Be Determined)			
Terminal Parking (automobiles)	200	474	514	558	694
Terminal Curb (lin. ft.)	300	450	450	450	450
General Aviation Apron Requirements (In yds.²)					
Itinerant		6,772	7,673	8,707	9,892
Based		3,600	4,680	4,680	5,544
General Aviation Aircraft Storage Facilities (No./yds.²)					
T-hangars	5/300	5/2,420	10/4,839	10/4,839	10/4,839
Exec./Corp.	5/2,684	6/17,423	6/12,583	7/16,455	7/19,360
ARFF Index	B	B	B	B	B

(1) Actual.
(2) Square footage does not include previously attached ARFF facility.