CHAPTER 4
FACILITY REQUIREMENTS

The existing and future facility needs of Rocky Mountain Metropolitan Airport (Metro or Airport) are the focus of this chapter. The facility needs are based on the Airport's existing facilities, aviation activity forecast, and Jefferson County's strategic vision and direction for the future of the Airport and community. Specific facility expansion and airport development alternatives to meet the future facility needs are addressed in **Chapter 5, Identification, and Evaluation of Alternatives**.

4.1 SUMMARY

A summary of the facility development needed to accommodate the forecast growth at Metro is provided in this section. Certain identified facilities will need further analysis based on the recommended development alternatives. Key conclusions from the facility requirement analysis include:

- Critical aircraft changes from a Grumman Gulfstream II to a Gulfstream G550, which is an adjustment in Aircraft Reference Code (ARC) from D-II to D-III. (See section 4.2.2 - Critical Aircraft Identification and Airport Reference Code)

- The demand capacity ratio is expected to grow throughout the planning period from 54 percent today to 93 percent in 2030. Additional airfield capacity analysis should be done to support major airfield investment decisions, and to help reduce the Annual Service Volume (ASV) ratio during this planning period. (See section - 4.3.2 Airfield Capacity)

- The runway magnetic azimuths for Runways 11L/29R, 11R/29L and 2/20 are several minutes over the existing declination; therefore, the runways are in need of a redesignation. The redesignation should be timed to correspond with the pavement maintenance or improvements to the runways. (See section 4.3.3 - Runway Analysis)

- Runway 11L/29R should be designed to accommodate ARC C/D-III aircraft. Runway 11R/29L should be designed to accommodate ARC C-II. The secondary facilities (Runway 2/20) should remain designed as ARC B-II. (See section 4.3.3 - Runway Analysis)

- Runway 11L approach end does not meet the FAA's Runway Safety Area standards. It is recommended that the non-compliant conditions be corrected. (See section 4.3.3.3 - Runway Safety Areas)

- Airfield development should focus on the runways' abilities (length, width, and strength) to support the existing aircraft operational needs of its users. Specifically, the primary runway (11L/29R) should have non-standard RSA conditions corrected and protect the land required for a future runway extension and strengthened to 100,000 pounds Dual Wheel Gear (DWG), the parallel runway (11R/29L) should be lengthened by 2,000 feet and strengthened to 75,000 pounds DWG, and the crosswind should be extended at least an additional 860 feet. (See section 4.3.3.6 - Runway Length and section 4.3.3.7 - Runway Strength)

- Due to pavement's age and weathering, pavement maintenance such as a pavement overlay, slurry seals, surface treatments, and/or crack sealing is necessary for all runways within the short term. (See section 4.3.3.8 - Runway Condition)
- Development of airfield accessible land should be maximized for the future growth of general aviation and aviation-related businesses. (See section 4.5.1 - General Aviation Facility)
- Development of off-airport land should be utilized to maximize its revenue potential with the expected realignment of Simms Street and the Jefferson Parkway. (See section 4.6.10 - Future Development Opportunities)
- The Airport should implement a Safety Management System study in the short-term planning period because of expected Federal requirements for such studies and the general concern over facility safety standards. (See section 4.8 Safety Management Systems)
- The Airport should conduct a Wildlife Hazard Assessment in the short-term planning period because of the threat of collisions between aircraft and wildlife. (See section 4.9 Wildlife Hazard Assessment)

4.2 GENERAL

The facility requirements chapter analyzes the ability of the current facilities at Metro to accommodate existing and forecast enplanements, operations, based aircraft, and associated activity throughout the planning horizon of the Master Plan. The chapter provides the detailed methods and logic upon which the facility requirements are based. After establishing the Airport's role and FAA technical classification, the chapter describes the requirements for future airfield, airspace, terminal area, general aviation, air cargo, aviation support facilities, and airport access.

4.2.1 Airport Role and Service Level

The Airport is identified in the National Plan of Integrated Airports System (NPIAS) as a reliever airport. An airport must be included in the NPIAS to be eligible for funding under the FAA's Airport Improvement Program (AIP). The NPIAS is prepared by the FAA every two years and identifies public use airports considered necessary to provide a safe, efficient, and integrated system of airports to meet the needs of civil aviation. The NPIAS comprises all commercial service airports within the U.S., all reliever airports, and selected general aviation airports.

The airport service level reflects the type of public use the airport provides to the community and funding categories established by Congress to assist in airport development. With the different operating requirements between small general aviation aircraft and large commercial aircraft, general aviation pilots often find it difficult to use a congested commercial service airport. The FAA recognizes this and continues to encourage the development of high-capacity general aviation airports in major metropolitan areas.

These specialized general aviation reliever airports near major commercial service airports provide pilots with an alternative to using congested hub airports. These reliever airports provide general aviation access to their surrounding areas. The Airport's NPIAS role (as a reliever) and service level are not anticipated to change during the planning horizon. A detailed description of the NPIAS can be found in **Appendix B, National Plan of Integrated Airport Systems** of this master plan study.

4.2.2 Critical Aircraft Identification and Airport Reference Code

To determine airfield facility requirements, FAA planning guidelines recommend the identification of an existing and future design aircraft. The design aircraft is typically defined as the most demanding aircraft in terms of size and/or facility needs that performs, or is projected to perform, at least 500 annual operations at an airport. At airports designed to accommodate multiple types of traffic, the runways, taxiways, and aprons may have different design aircraft. For example, one runway may be designed to accommodate large general aviation, charter service aircraft and another runway designed to serve smaller general aviation aircraft.

The airport reference code (ARC) is a coding system used by the FAA to relate airport design criteria to the operational and physical characteristics of the aircraft intended to operate at an airport. The ARC is defined by a letter designating the aircraft approach category, which relates to the approach speed of an aircraft, and a Roman numeral designating the design group, which refers to the wingspan and tail height. When an aircraft specification results in two design groups, the most demanding category should be used. The FAA's aircraft approach categories and airplane design groups are listed in Table 4-1 and Table 4-2.

Table 4-1
AIRCRAFT APPROACH CATEGORY AND AIRPLANE DESIGN GROUP

Approach Category	Approach Speed	
Category A	Speed less than 91 knots	
Category B	Speed 91 knots to less than 121 knots	
Category C	Speed 121 knots to less than 141 knots	
Category D	Speed 141 knots to less than 166 knots	
Category E	Speed 166 knots or more	
Design Group	**Tail Height**	**Wingspan**
Group I	Less than 20 feet	Less than 49 feet
Group II	20 feet - less than 30 feet	50 feet to less than 79 feet
Group III	30 feet - less than 45 feet	80 feet to less than 118 feet
Group IV	45 feet - less than 60 feet	119 feet to less than 171 feet
Group V	60 feet - less than 66 feet	172 feet to less than 214 feet
Group VI	66 feet - less than 80 feet	215 feet to less than 262 feet

Source: FAA Advisory Circular 150/5300-13

Chapter 3, Aviation Demand Forecast of this Master Plan verified that the current critical aircraft for Metro is the Gulfstream Business Jet family (G-II, G-III, and G-IV). The G-II has a wingspan of 68.8 feet, a tail height 24.6 feet, and an approach speed of 141 knots, which places this aircraft in the D-II family of aircraft. The forecast projects an increase in the business jets currently utilizing the airport. The new generation of Gulfstream's business jets, have larger wingspans, which place these aircraft in the D-III family of aircraft. It is anticipated that the Gulfstream family will remain as the critical aircraft for the near future, as this family of corporate aircraft is widely used.

Table 4-2
AIRPLANE DESIGN GROUP AIRCRAFT

Design Group	Representative Aircraft
I	Beech Baron 58A, Cessna 150, Gates Learjet 35A, Piper Navajo, F-16 C/D
II	Beech King Air C90, Canadair Regional Jet, Cessna Citation III, Gulfstream II, III, IV, Saab
III	Airbus A320, Boeing 727, Boeing 737, DC-9, Fokker 100, Gulfstream V, 550, MD-80
IV	DC-8, Airbus A300, DC-10, MD-11, B-757, B-767
V	Airbus 340, Boeing 747, Boeing 777
VI	Lockheed C-5B

Source: FAA Advisory Circular 150/5300-13

Based on the largest aircraft anticipated to operate at the Airport in the future, it is recommended that the Runway 11L/29R be designed to accommodate a Gulfstream V/Gulfstream 550, an ARC D-III. Runway 11R/29L should be designed to accommodate ARC C-II to allow for growth for the larger aircraft expected to utilize the south development area. The crosswind runway 2/20 should remain as ARC B-II runway in order to accommodate the aircraft that require a crosswind runway.

4.3 AIRFIELD REQUIREMENTS

The airfield is the system of components upon which aircraft operate. Airfield requirements are dictated by airfield capacity, runway / taxiway design standards, airspace, and navigational and visual aids. Analysis in this section includes the runway orientation, airfield capacity, runway requirements, and taxiway requirements.

4.3.1 Runway Orientation and Wind Analysis

The prevailing winds generally determine runway orientation and the need for a crosswind runway. FAA planning standards recommend that runway systems should provide a minimum of 95 percent wind coverage. If a single runway cannot provide this level of coverage, then an additional crosswind runway may be justified, or alternatively upgrades to the primary runway may be considered.

A runway wind coverage analysis was conducted using the National Climatic Data Center from the weather reporting station at No. 72469, Broomfield, CO. Weather data covered the ten-year period between 1999 and 2008.

Wind coverage by runway was evaluated to determine if the runway system offers at least 95 percent cross wind coverage. The results of this analysis are presented in Table 4-3.

Table 4-3
WIND COVERAGE

Crosswind Component (Kts)	Airport Reference Code	Runway 11L/29R and 11R/29L		Runway 02/22		Combined	
		All Weather	IFR	All Weather	IFR	All Weather	IFR
10.5	A-I and B-I	92.3%	87.4%	84.1%	96.8%	97.9%	98.7%
13.0	A-II and B-II	95.8%	92.6%	88.6%	98.4%	99.2%	99.5%
16.0	A/B-III, C/D-I	98.5%	97.4%	93.2%	99.4%	99.8%	99.8%
20.0	A-IV, D-VI	99.5%	99.2%	96.8%	99.7%	100.0%	100.0%

Source: National Climatic Data Center
Rocky Mountian Metropolitan Airport Reporting Period: 1999-2008

* Box denotes 95% crosswind component attained

The analysis considered the existing runway configuration, the primary runways (11L/29R and 11R/29L), crosswind run way (2/20), and the combination of all runways. Acceptable maximum crosswind components are generally defined as they relate to the size and performance of the Airport Reference Code. Smaller aircraft are generally more susceptible to crosswinds, while larger and higher performance aircraft can negotiate higher crosswinds.

Individually, the runways do not meet the percent wind coverage requirements for 10.5 knots crosswinds. However, the combined Runways 11L/29R, 11R/29L and 2/20 at Metro provide more than 95 percent wind coverage during all weather and IFC conditions. Therefore, the current runway configuration, or a combination of Runways 11/29 and 2/20, is adequate with respect to providing wind coverage.

4.3.2 Airfield Capacity

The goal of this analysis is to determine the airfield capacity, annual service volume (ASV), and the sufficiency of the runways to handle the peak hour and annual demand. The values developed are compared to the long-range forecasts for the Airport to determine whether any shortfalls exist.

Airfield capacity is an estimate of the number of aircraft that can be processed through the airfield system during a specific period of time with acceptable levels of delay. The airfield demand/capacity analysis prescribed for use by the FAA in Advisory Circular 150/5060-5, *Airport Capacity and Delay*[1], identifies the existing annual capacity, referred to as the annual service volume, and hourly capacity at an airport based on the current operational characteristics.

The FAA's methodology for estimated long-range airfield capacity uses specific inputs regarding runway use, percentage of arrivals, and percentage of IFR traffic, taxiway available, runway instrumentation, and absence of airspace limitations. This methodology is used in this analysis.

Other major factors that affect airfield capacity include the runway configuration, air traffic control operating procedures, weather conditions, and aircraft fleet mix. For instance, required separation distances between aircraft are greatly increased during inclement weather. As a result, the number of aircraft that can operate at an airport under Instrument Meteorological Conditions (IMC) will be much less than that during Visual Meteorological Conditions (VMC). Similarly, the other factors identified would have an effect on overall airfield capacity.

The result of this analysis shown in Table 4-4 indicates the demand/capacity rate is expected to grow throughout the planning period from 54 percent to 93 percent. Although this FAA program is adequate for this level of master planning, computer modeling would be a more effective tool in providing detailed analysis to isolate the airfield components that increase the delay and reduce the airport capacity over time.

Aircraft operational delay cost or savings are often used for comparing potential airfield development alternatives. It is recommended that capacity related airfield planning be done as the number of annual operations reaches 200,000.

[1] Federal Aviation Administration, AC 150/5060-5 Airport Capacity and Delay, 1983

Table 4-4
COMPARISON OF FORECAST OPERATIONS AND AIRFIELD CAPACITY

	2008	Planning Activity Level		
		2015	2020	2030
Forecast Operations	152,983	177,865	203,209	265,245
Existing ASV	285,000	285,000	285,000	285,000
ASV Ratio	0.54%	0.62%	0.71%	0.93%

Source: FAA Advisory Circular 150/5060-5 Airport Capacity and Delay

4.3.3 Runway Analysis

The runway analysis addresses the ability of the existing runways at the Airport to accommodate the forecast demand. At a minimum, runways must have the proper length, width, and strength to meet FAA recommended design standards to safely accommodate the design aircraft. This section analyzes specific runway criteria and makes recommendations based on the forecast.

4.3.3.1 Designation Markings

Runway designations provided on each runway indicate the runway orientation according to the magnetic azimuth. The runway designations do change over time. This is due to the slow drift of the magnetic poles on the Earth's surface; however, the runways stay fixed and the magnetic bearing will change. Depending on the airport's location and how much drift takes place, it may be necessary over time to change the runway designation. As runways are designated with headings rounded to the nearest 10 degrees, this will affect some runways more than others.

Since the magnetic azimuth changes over time, this section examines the amount of magnetic drift that has occurred to assure that the current designations are appropriate. The runway designation consists of a number, and on parallel runways, is supplemented with a letter. The designation number represents the whole number nearest the magnetic azimuth, divided by 10, when viewed from the direction of approach. For example, where the magnetic azimuth is 163°, the runway designation is 16, and for magnetic azimuth of 27°, the runway designation is 3. The magnetic azimuth is determined by correcting the runway's true bearing for magnetic declination. To accomplish this modification, westerly magnetic declination values are added to a runway's true bearing, while easterly magnetic declination values are subtracted.

The current magnetic declination at Metro is 9° 16' and is changing by 0° 8' East per year. Since the magnetic declination is easterly, the magnetic azimuths associated with the runways at the Airport are determined by subtracting the declination value to the true bearing values. The analysis conducted to determine the designation of the runways at Metro is predicted on information obtained from the National Geophysical Data Center.

The true bearing information, shown in Table 4-5 for all runways, is obtained from actual survey data. The runway magnetic azimuths for Runways 11L/29R, 11R/29L, and 2/20 have recently drifted a few minutes over the existing designation; therefore, the runways are in need of a redesignation.

- Runway 11L/29R is the primary runway at Metro and has a southeast by northwest orientation. The true bearing of Runway 11L is 124° 17' 30.4019", while the true bearing of Runway 29R is 304° 18' 31.5955". Applying the magnetic declination value is 9° 16' east, the magnetic azimuth of Runway 11L was determined to be 115° 01' 30.4019" and the magnetic azimuth of Runway 29R was determined to be 295° 02' 31.5955. Runway 11L/29R should be redesignated as Runway 12L/30R.

- Runway 11R/29L is the secondary runway at Metro and has a southeast by northwest orientation. The true bearing of Runway 11R is 124° 17' 19.1290", while the true bearing of Runway 29L is 304° 18' 6.7411". Applying the magnetic declination value is 9° 16' east, the magnetic azimuth of Runway 11R was determined to be 115° 01' 1290" and the magnetic azimuth of Runway 29L was determined to be 295° 02' 6.7411". Runway 11R/29L should be redesignated as Runway 12R/30L.

- Runway 2/20 is the crosswind runway at Metro and has a northeast by southwest orientation. The true bearing of Runway 02 is 034° 19' 1.7036", while the true bearing of Runway 20 is 214° 19' 18.4078". Applying the magnetic declination value 9° 16' east, the magnetic azimuth of Runway 02 is 025° 03' 1.7036", and the magnetic azimuth of Runway 20 was determined to be 206° 03' 18.4078". Runway 2/20 should be redesignated as Runway 3/21.

For simplicity, the existing runway designation for the runways will continue to be used for the balance of this Master Plan Update. Redesignation of the runways will require airspace procedure changes, navigational charts to be updated, and remarking of airfield pavement and replacement of the airfield signage. This should be combined with other projects, and timed to correspond with the replacement or rehabilitation of these facilities. A summary of the runway headings and numbering is shown on Table 4-5.

Table 4-5
TRUE RUNWAY BEARING

Runways	Existing Heading	Runway True Bearing	Magnetic Declination	Runway Magnetic Azimuth	Future Heading
Runway 11L	110°	124°17′ 30.4019″	9°16′ E	115° 01′ 30.4019″	120°
Runway 29R	290°	304°18′ 31.5955"	9°16′ E	295° 02′ 31.5955"	300°
Runway 11R	110°	124°17′ 19.1290″	9°16′ E	115° 01′ 19.1290″	120°
Runway 29L	290°	304°18′ 6.7411″	9°16′ E	295° 02′ 6.7411″	300°
Runway 2	20°	034°19′ 1.7036″	9°16′ E	025° 03′ 1.7036″	30°
Runway 20	200°	214°19′18.4078″	9°16′ E	205° 03′ 18.4078″	210°

Source: National Geophysical Data Center, 2009

4.3.3.2 Runway Design Standards

The FAA runway design standards are based upon the critical design aircraft as provided in Table 4-6. The existing design aircraft at Rocky Mountain Metropolitan Airport is the G-II, which is an Airport Reference Code (ARC) of D-II. The future design aircraft is the G550, which is an ARC D-III. Based on the analysis, Runway 11L/29R should be designed to accommodate ARC D-III aircraft. Runway 11R/29L should be designed to accommodate ARC C-II, and Runway 2/20 should remain as a ARC B-II. Table 4-6 reflects the existing and proposed design standards for the runways and Table 4-7 illustrates the changes between the ARCs. As portions of an airfield may be designed to meet one standard, while other areas may be designed for another, additional taxiway and taxi lane design standards may be identified to serve particular areas on the airfield.

Table 4-6
FAA RUNWAY DESIGN STANDARDS

Items	B-II	C/D-II	C/D-III	11L/29R		11R/29L		02/20	
				Existing	Proposed	Existing	Proposed	Existing	Proposed
Runway Width	75'	100'	100'	100'	100'	75'	100'	75'	75'
Runway Shoulder Width	10'	10'	20'	50'	50'	35'	35'	35'	35'
Runway Blast Pad Width	95'	120'	140'	0'/140'	0'/140'	0'/95'	0'/95'	0'	0'
Runway Blast Pad Length	150'	150'	200'	0'/200'	0'/200'	0'/150'	0'/150'	0'	0'
Runway Safety Area Width*	150'	500'	500'	500'	500'	150	400'	150'	150'
Runway Safety Area Length Prior to	300'	600'	600'	600'	600'	300'	600'	300'	300'
Runway Safety Area Length Beyond RW	300'	1000'	1000'	600'	1,000'	300'	1000'	300'	300'
Runway Object Free Width	500'	800'	800'	800'	800'	500'	800'	500'	500'
Runway Object Free Area Length Beyond	300'	1,000'	1,000'	600'	1000'	300'	1,000'	300'	300'
Runway Obstacle Free Zone Length	200'	200'	200'	200'	200'	200'	200'	200'	200'
Runway Obstacle Free Zone Width	250'	400'	400'	400'	400'	250'	400'	250'	250'

Source: FAA Advisory Circular 150/5300-13

Notes
* For Airport Reference Code C-I and C-II, a runway safety area width of 400 feet is permissible.

Table 4-7
CHANGES IN AIRPORT DESIGN STANDARDS

ARC Upgrade	Changes in Airport Design Standards
B-II to C-II	Increase in Crosswind Component Increase in Runway Separation Standards Increase in RPZ Dimensions Increase in Runway Design Standards Increase in Surface Gradient Standards
C-II to D-II	Increase in RSA Width
B-III to C-III	Increase in Runway Separation Standards Increase in RPZ Dimensions Increase in Runway Design Standards Increase in Surface Gradient Standards
C-III to D-IIII	Increase in RSA Width

Source: FAA Advisory Circular 150/5300-13

RUNWAY 11L/29R

The runway design deviation between ARC C/D-II and C/D-III for Runway 11L/29R are Shoulders, Blast Pads, Runway Safety and Object Free Areas. The Runway Safety and Object Free Areas are addressed independently in sections 4.3.3.3 and 4.3.3.4.

Shoulders and blast pads both provide blast erosion protection. A natural surface such as turf normally reduces the possibility of soil erosion and engine ingestion of foreign objects. However, if the soil is not turf or deemed unsuitable, a stabilizer or low cost paved surface is required. The condition of the existing soil provides adequate erosion protection; therefore, no additional shoulder width or blast pads are recommended for this runway.

RUNWAY 11R/29L

The upgrade in ARC for runway 11R/29L as discussed will result in an increase in several airport design standards. The changes to the design standards are shown in Table 4-7 and summarized below:

- Crosswind Component – The runway must increase its crosswind capability from 13 knots to 16 knots. In this area, the Runway meets the standard.

- Runway Separation Standard – The runway must maintain a minimum of 700 feet separation between centerlines. In this area, the Runway meets the standard.

- Runway Protection Zone (RPZ) dimensions - The RPZ dimensions increase from 1,000 feet by 500 feet by 700 feet to 1,700 feet by 500 feet by 1,010 feet. RPZ’s are addressed in detail in Section 4.3.3.5.

- Runway Design Standards – The geometry of the runway and safety areas increase. The width of the runway will increase from 75 feet to 100 feet. The Runway Safety Area will increase by 150 feet, and lengthen by an additional 700 feet. The Object Free Areas should be widened by 300 feet and lengthen by an additional 700 feet. The Runway Safety and Object Free Areas are addressed in Sections 4.3.3.3 and 4.3.3.4.

- Surface Gradient Standards – The surface gradient standards, which are standards applied to the airport surfaces required for landing, takeoff, and ground movement of airplanes will need to be adjusted. The longitudinal gradient standards for the runway will increase from 2 percent to 1.5 percent. However, longitudinal grade change may not exceed .8 percent in the first and last quarter of the runway length. The vertical curve tolerance changes from 300 feet to 1,000 feet. As well as the minimal allowable distance from an intersection of vertical curve increase from 250 feet to 1,000 feet for each 1 percent of change. The Surface Gradient Standards are addressed in Sections 4.3.3.6.

RUNWAY 2/20

Runway 2/20 should remain as an ARC B-II and meets all the design standards, except for the runway blast pads standards and the proximity to Taxiway B. A natural surface such as turf normally reduces the possibility of soil erosion and engine ingestion of foreign objects. However, if the soil is not turf or deemed unsuitable a stabilizer or low cost paved surface is required. In consideration of the types of the aircraft using Runway 2/20 and the condition of the existing turf, blast pads are not recommended on Runway 2/20. As for the non-standard separation between Runway 2/20 and Taxiway B, it is recommended that the taxiway be relocated or removed.

In summary, the Airport currently has design elements that do not meet FAA design standards, as well as design elements that are recommended to be upgraded based on future facility requirements. These design changes are discussed in detail in the following sections.

4.3.3.3 Runway Safety Areas

A Runway Safety Area (RSA), as defined by the FAA, is a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. The RSA must be:

- Cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;

- Drained by grading or storm sewers to prevent water accumulation; and

- Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

- Free of objects, except for objects that need to be located in the RSA because of their function.

RUNWAY 11L/29R

Analysis shows that conditions on Metro's primary runway 11L/29R do not meet the FAA's RSA standards as shown in Table 4-6*.* Specifically, the RSA on the 11L end does not meet these standards. The required RSA dimensions for this runway are 500 feet wide by 1,000 feet long off the end of the runway. An additional 400 feet in length is needed to become compliant. The Airport is required to meet FAA RSA design criteria by 2015. Therefore, it is recommended that the non-compliant conditions be corrected in the near term to meet this federal timeline.

RUNWAY 11R/29L

Metro's Parallel Runway 11R/29L meets the FAA's RSA standards for a B-II runway; however upgrading the runway to ARC C-II improvements will be required. The required RSA dimension for this runway as ARC C-II is 500 feet. However, 400 feet RSA may-be permissible due to the year the runway was originally designed. Therefore, the RSA will increase from 150 feet wide by 300 feet long to 300 feet wide and 1,000 feet long. This is a 150-foot increase in width and a 700-foot increase in length.

RUNWAY 2/20

Runway 2/20 meets the FAA's RSA standards for a B-II runway and no ARC upgrades are recommended. Therefore, the Runway Safety Area should maintain 150 feet wide by 300 feet long.

4.3.3.4 Runway Object Free Area

A Runway Object Free Area (OFA), as defined by the FAA, is an area on the ground, centered on the runway, taxiway, or taxilane centerline to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

RUNWAY 11L/29R

Analysis shows that conditions on Metro's primary runway 11L/29R do not meet the FAA's OFA standards as shown in Table 4-6*.* Specifically, the OFA on the 11L approach end does not meet these standards. The required OFA dimensions for this runway are 800 feet wide by 1,000 feet long off the end of the runway. An additional 400 feet is needed to become compliant. The Airport is required to meet FAA RSA design criteria by 2015. Therefore, it is recommended that the non-compliant conditions be corrected in the near term to meet this federal timeline.

RUNWAY 11R/29L

Metro's parallel runway 11R/29L meet the FAA's OFA standards for an ARC B-II runway; however upgrading the runway to ARC C-II improvements will be necessary. To meet the FAA OFA standards the OFA will need to increase from 500 feet wide by 300 feet long to 800 feet wide to 1,000 feet long. This is a 300-foot increase in width and a 700-foot increase in length.

RUNWAY 2/20

Runway 2/20 meets the FAA's OFA standards for an ARC B-II runway and no changes are recommended. Therefore, the OFA should maintain 500 feet wide by 300 feet long.

4.3.3.5 <u>Runway Protection Zone Analysis</u>

For the protection of people and property on the ground, the FAA has identified an area of land off each runway end as the runway protection zone (RPZ). The size of the zones vary according to the design aircraft characteristics and the lowest instrument approach visibility minimum defined for each runway. It is desirable to have all areas within the RPZ cleared, or at a minimum, maximize ground safety through land use control measures, such as property deeds or aviation easements.

The Airport should acquire all property within the RPZs as it becomes available. For paved runways, the trapezoidal-shaped RPZ is centered on the extended runway centerline starting 200 feet from the runway end. The RPZ dimensional standards for the Airport's existing and forecast approach minimums are shown in Table 4-8.

RUNWAY 11L/29R

Runway 11L/29R is designed to accommodate aircraft in the approach category C and D. The runway also has an instrument approach on 29R's end, which reduces the visibility minimums down to lower than ¾ mile, while the 11L end has approach minimums of not lower than 1 mile. Therefore, both runway ends have an existing RPZ that is appropriately sized for the existing forward visibility minimum and cloud ceiling height necessary. The existing RPZ dimensions are sufficient throughout the planning period, thus no changes to the PRZ's are needed.

RUNWAY 11R/29L

Runway 11R/29L is currently designed to accommodate aircraft in the approach category A and B. The runway does not have an instrument approach, which results in the runway visibility minimums to be visual. Therefore, both runway ends have an existing RPZ that is appropriately sized for the existing forward visibility minimum and cloud ceiling height necessary. However, it has been recommended that the runway be upgraded to ARC C-II. At which time the runway is expected to serve aircraft in the approach categories C and D. As illustrated in Table 4-8 this change in aircraft categories will require an increase to the RPZ dimensions. The RPZ for Runway 11R/29L should increase to 1,700 feet in length, by 500 feet in inner width, by 1,010 feet in outer width.

RUNWAY 2/20

Runway 2/20 is currently designed to accommodate aircraft in the approach category A and B. The runway does not have an instrument approach, which results in the runway visibility minimums to be visual. Therefore, both runway ends have an existing RPZ that is appropriately sized for the existing forward visibility minimum and cloud ceiling height necessary. The existing RPZ dimensions are sufficient throughout the planning period, thus no changes to this approach are needed.

Table 4-8
RUNWAY PROTECTION ZONE DIMENSIONS

Runway	Approach Visibilty Mininums	Facility Expected to Serve	Dimensions		
			Standard $L \times W_1 \times W_2$	**Exisitng** $L \times W_1 \times W_2$	**Future** $L \times W_1 \times W_2$
11L/29R	Lower than 3/4-Mile	All Aircraft	2,500	2,500	2,500
			1,000	1,000	1,000
			1,750	1,750	1,750
11R/29L	Visual and Not lower than 1-Mile	Aircraft Approach Categoires C & D	1,700	1,000	1,700
			500	500	500
			1,010	700	1,010
2/20	Visual and Not lower than 1-Mile	Aircraft Approach Categoires A & B	1,000	1,000	1,000
			500	500	500
			700	700	700

Source: FAA Advisory Circular 150/5300-13

4.3.3.6 Surface Gradient and Line of Sight

According to the FAA Advisory Circular 150/5300-13, Runways for approach categories A and B aircraft, the longitudinal slope must not exceed 2 percent. Runways for approach categories C and

D aircraft, the standard requires that the longitudinal slope must be within 0.0 percent and 0.8 percent within the first and last ¼ length of the runway with a maximum of 1.5 percent within the middle ½ of the runway.

A runway should have adequate transverse slope to prevent the accumulation of water on its surface. The FAA recommends a transverse slope of 1.0 to 1.5 percent from the runway centerline to the edges of the pavement. The existing transverse slopes on all three runways are adequate.

As for existing runway line-of-sight requirements, any two points located five feet 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. Metro has a full-length parallel taxiway adjacent to all existing runways. The existing runways comply with the FAA line-of-sight requirements.

RUNWAY 11L/29R

Runway 11L/29R is designed to serve approach categories C and D aircraft. The overall surface gradient of Runway 11L/29R is 1.00 percent. The effective surface gradient of the first quarter of Runway 11L is 0.60 percent and the last quarter is 1.02 percent. The slope of the first half of Runway 11L is 0.86 percent and the slope of the second half is 1.16 percent. Each of these slopes meet the FAA requirements, except for the last quarter of Runway 11L (first quarter of 29R), which is 0.22 percent over the maximum allowable slope to meet FAA criteria.

The runway slopes downward from west to east. There is approximately 95 feet difference between runway thresholds. Due to this change in gradient, aircraft operations prefer to depart to the east and land to the west. It is estimated that an additional six feet would be needed to bring the last quarter of Runway 11L into FAA standards. Therefore, it is recommended that the surface gradient of Runway 11L/29R be corrected when the runway undergoes a major reconstruction or lengthening.

RUNWAY 11R/29L

Runway 11R/29L is currently designed to serve approach categories A and B aircraft, the effective surface gradient of the existing runway is 1.10 percent, which meets the FAA requirements. However, Runway 11R/29L should be redesigned to serve approach categories C aircraft. Therefore, the longitudinal slope must be within 0.0 percent and 0.8 percent within the first and last ¼ length of the runway with a maximum of 1.5 percent within the middle ½ of the runway.

The longitudinal slope for the first quarter of Runway 11R is 0.78 percent and 1.07 percent for the last quarter. The slope of the first half of the Runway 11R is 1.02 percent and the slope of the second half is 1.18 percent. Each of these slopes meets the FAA requirements, except for the last quarter of Runway 11R (first quarter of 29L), which is 0.27 percent over the maximum allowable slope to serve approach categories C and D aircraft. The runway slopes downward from west to east. There is approximately 75 feet difference between runway thresholds. It is estimated that an additional five feet would be needed to bring the last quarter of Runway 11R into FAA standards. Therefore, it is recommended that the surface gradient of Runway 11R/29L be corrected when the runway undergoes a major reconstruction or lengthening.

RUNWAY 2/20

Runway 2/20 is designed to serve approach categories A and B aircraft, the effective surface gradient of the existing runway is 0.45 percent, which meets the FAA requirements.

4.3.3.7 <u>Runway Strength</u>

Pavement strength is an important criterion in determining the usability of the runways. As shown in Table 4-9, the primary Runway 11L/29R has the highest weight bearing strength, which is designed for the typical small/mid-sized aircraft. The runway bearing capacities were designed for the typical aircraft operations at Metro, such as aircraft weighing less than 50,000 pounds.

Table 4-9
RUNWAY WEIGHT BEARING CAPACITIES

	Runway		
Item	**11L/29R**	**11R/29L**	**02/20**
Runway Length	9000'	7002'	3600'
Runway Width	100	75	75
Pavement Type	Grooved Asphalt	Grooved Asphalt	Asphalt
Pavement Strength (lbs)			
Single Wheel Gear	55,000	12,500	40,000
Dual Wheel Gear	75,000	-	45,000

Source: FAA 5010 Form, 2009

A list of sample aircraft, gear configurations, and maximum certificated weights are listed in Table 4-10. Many of these aircraft exceed the existing bearing capacity of the runways, and operate at a growing level of frequency.

Table 4-10
AIRCRAFT WEIGHT AND GEAR CONFIGURATION
(Representative Aircraft)

Aircraft Type	Airport Refernce Code (ARC)	Gear Configuration	Maximum Aircraft Weight (lbs)
Cessna 150	A-I	Single Wheel Gear	1,600
Beech King Air C-90-	B-II	Single Wheel Gear	9,650
Piper Seneca	B-I	Single Wheel Gear	12,050
Lear 35	D-I	Dual Wheel Gear	18,300
Cessna Citation III	B-II	Single Wheel Gear	22,000
Gulfstream 200 (G-II)	D-II	Dual Wheel Gear	65,500
Gulfstream 550 (G550)	D-III	Dual Wheel Gear	91,400
Gulfstream 650 (G650)	D-III	Dual Wheel Gear	99,600
Boeing BBJ (737-700)	C-III	Dual Wheel Gear	174,700

Source: FAA Advisory Circular 150/5300-13 & Aircraft Manufacturers

RUNWAY 11L/29R

Runway 11L/29R is currently rated 55,000 pounds single-wheel, and 75,000 pounds dual-wheel. In order to accommodate the future critical aircraft (G550) a strengthening of this runway will be needed. It is recommended that a three to four inch asphalt overlay be conducted in the short term to increase the runway strength to approximately 100,000 lbs dual wheel gear.

RUNWAY 11R/29L

Runway 11R/29L is currently rated 12,500 pounds single-wheel. In order to accommodate the future growth of this Runway should at least be strengthened to 55,000 pounds single-wheel, and 75,000 pounds dual-wheel. It is recommended that a six to seven inch asphalt overlay be conducted in the midterm to increase the runway strength to the recommended strength. Also, based on the existing cross section of Runway 11R/29L and the California Bearing Ratio (CBR), increasing the strength to approximately 100,000 lbs dual wheel gear may require a runway reconstruction.

RUNWAY 2/20

Runway 2/20 is currently rated 40,000 pounds single-wheel, and 45,000 pounds dual-wheel. The strength of this runway is adequate to serve the existing and future aircraft expected to operate on this runway. No runway strengthening is recommended for this runway during this planning period

4.3.3.8 *Runway Pavement Condition*

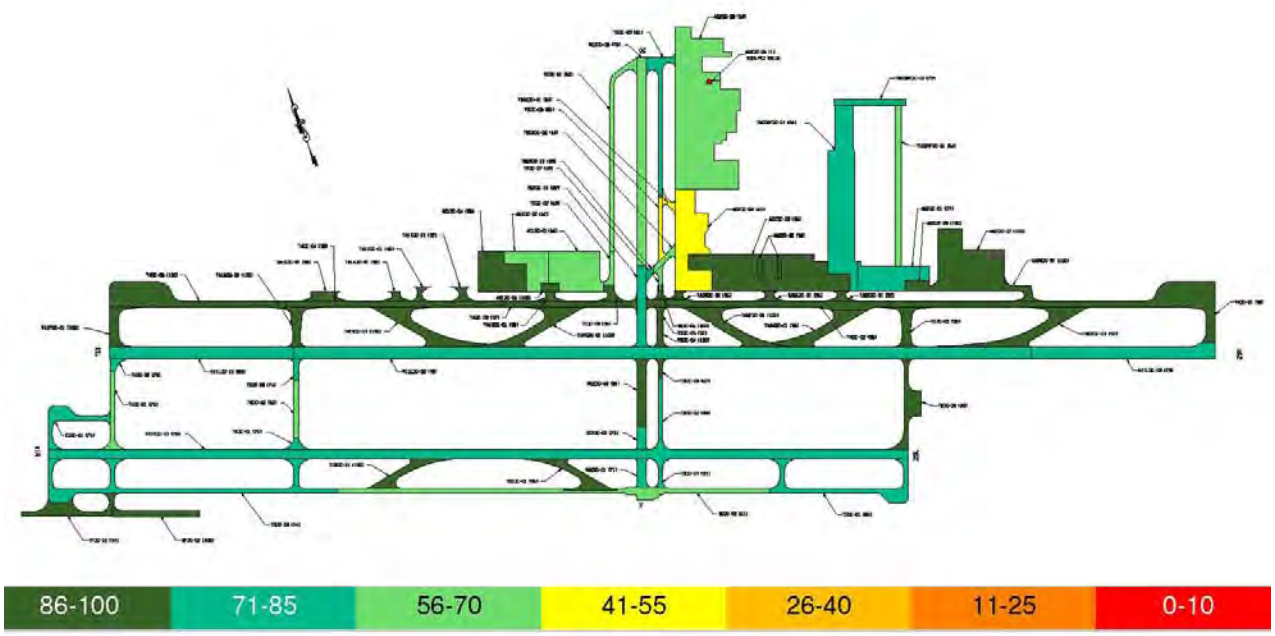
A pavement condition evaluation is a visual analysis of the primary distress manifestations exhibited on the surface of a pavement. It serves as an indicator of pavement mode and mechanism. Data is computed and presented in the form of a Pavement Condition Index (PCI) Study. A PCI Study for the Airport was recently completed This study updated the 2006 PCI Study and provides data regarding each major section of airfield pavement, as well as a five-year projection of the PCI values.

PCI values range from zero, representing pavement that has failed and is no longer usable, to 100, which represents new pavement in pristine condition. The PCI values are then broken down into categories indicating what type of repair work needs to occur and includes reconstruction (0 to 40), major rehabilitation (40 to 75), or preventative maintenance (75 to 100). Runway 11L/29R, the primary runway has PCI scores ranging from 80 to 75. The vast majority of the runway pavement is in need of repairs and should consider preventative maintenance within in the short term. Runway 11R/29L has a PCI score of 76. The vast majority of this falls in the range requiring short term preventative maintenance in order to prevent major rehabilitation. Runway 2/20 has PCI scores ranging from 70 to 91,, which would require short term preventative maintenance in order to prevent major rehabilitation in the long term.

Based on the results discussed above and illustrated in Figure 4-1, it is recommended that preventative maintenance, such as a pavement overlay, slurry seals, surface treatments, and crack sealing on all three runways be conducted within the short term.

The sequence and schedule of planned pavement maintenance/rehabilitation projects is still contingent upon the selection and execution of the preferred airfield development alternative. Once a preferred development alternative is selected, the pavement improvement plan will be identified and incorporated into the Airport's Capital Improvement Plan (CIP).

Figure 4-1
2009 PCI VALUES



Source: Applied Pavement Technology, Inc. 2009

4.3.3.9 <u>Runway Length</u>

Runway length planning and analysis is conducted to determine recommended runway length requirements for various categories of aircraft, as well as for Airport's critical aircraft. The FAA Airport Design Microcomputer Program was utilized in this analysis.

The FAA Advisory Circular 150/5325-4 Runway Length Requirements for Airport Design*,* data is used as an initial screening tool to determine general runway length requirements and the aircraft manufacturer's data is used to develop specific stage length and payload requirements for Metro. Input to the analysis include, airport specific data, such as the airport elevation (5,673 feet), average daily maximum temperature of the hottest month (86.70^{F}), and the difference in runway centerline elevation (95 feet). The results of the FAA runway length analysis are provided in Table 4-11.

Utilizing the FAA data, the runway length requirements for small aircraft that have less than 10 seats is 6,560 feet. This category represents the majority of aircraft operating and based at the Airport. For a general aviation airport that accommodates larger business jet aircraft, it is recommended that at a minimum the primary runway accommodate 75 percent of the large aircraft with a 90 percent useful load.

The majority of airports provide a single primary runway; in certain cases, airports require two or more primary runways as a means of achieving specific airport operational goals. At Metro, a parallel runway is available to achieve two specific goals.

- To better accommodate the existing traffic. The parallel runway separates the smaller, slower, training aircraft from larger, faster business aircraft arriving and departing the Airport. In addition, the parallel runway provides flexibility to air traffic and airport operations staff when the primary runway is closed for maintenance.
- To accommodate the forecast growth. The parallel runway increases the capacity and flexibility of the airfield to accommodate the existing aircraft fleet and the projected growth.

A valuable byproduct of the parallel runway system is that it can defuse the overall noise impacts over two centerlines rather than over one.

Table 4-11
FAA AIRCRAFT RUNWAY LENGTH REQUIREMENTS

Aircraft Category	Recommended Runway Length
Small airplanes with approach speeds of less than 50 knc	1,250'
Small airplanes (Less than 12,500 lbs.)	
75 % of these small airplanes	4,660'
100% of fleet (Less than 10 seats)	6,560'
Small airplanes (Less than 12,500 lbs.)	
100% of fleet (10 or more seats)	6,560'
Large airplanes (Between 12,501 lbs.-60,000 lbs.)	
75% of fleet @ 60% Useful Load	7,350'
75% of fleet @ 90% Useful Load	9,370'
100% of fleet @ 60% Useful Load	10,280'
100% of fleet @ 90% Useful Load	11,540'
Large airplanes (Greater than 60,000 lbs.)	
500 Mile Stage Length	7,000'
1,000 Mile Stage Length	8,310'
2,000 Mile Stage Length	10,620'
3,000 Mile Stage Length	12,500'
4,000 Mile Stage Length	13,970'

Source: FAA Advisory Circular 150/5325-4 Runway Length Requirements For Airport Design.

A common practice is to assign individual primary runways to different airplane classes. An example would be separating general aviation aircraft from air carrier aircraft as a means to increase the airport's efficiency. Also, additional primary runways for capacity should be equal in length to the existing primary runway, unless they are intended for smaller airplanes.

In conclusion, the existing runway system at Metro can accommodate 100 percent of small airplanes, 75 percent of large airplanes less than 60,000 pounds at 90 percent useful load and large airplanes (greater than 60,000 pounds) with a stage length up to 1,000 miles. However, with the forecast growth and critical aircraft changing the following recommendation should be carried forward to an evaluation of alternative to meet these recommendations related to Metro's runways.

- The primary runway (11L/29R) is designed to serve large airplanes over 60,000 pounds and should protect the land required for a future runway extension to a total length of 10,280 feet. This length would be adequate to serve 100 percent of aircraft weighing less than 60,000 pounds with a 90 percent useful load. As well as provide a stage length of approximately 2,000 miles to aircraft over 60,000 pounds

- The parallel runway (11R/29L) should be lengthened to 9,370 feet to match the existing length of the primary runway (11L/29R), as it is expected to be lengthened to accommodate a much larger group of aircraft. This length would be adequate to serve 75 percent of aircraft weighing less than 60,000 pounds with less than 90 percent useful load.

- The crosswind runway (2/20) is designed to serve smaller aircraft. Therefore, the recommended runway length is 4,460 feet. This length would be adequate to serve 75 percent of aircraft weighing less than 12,500 pounds with less than 10 passengers.

4.3.3.10 Runway Widths

The existing runways have widths ranging from 75 - 100 feet. Runway 11L/29R is 100 feet wide, Runway 11R/29L and 2/20 are 75 wide. The FAA runway standard for an ARC C/D-II and C/D-III runway width is 100 feet and 75 feet for ARC B-II. Therefore, it is recommended that the primary runways 11L/29R remain 100 feet wide, and Runway 11R/29L be widened by 25 feet to meet the 100-foot standard when the runway undergoes a major rehabilitation or reconstruction. The crosswind Runway (2/20) should also maintain the current width of 75 feet.

4.3.3.11 Runway Exits

The location of a properly placed runway exit has an effect on runway capacity. Runway exits should be located so that aircraft can exit the runway in a minimum time within reasonable aircraft operating procedures (i.e., no excessive reverse thrust or braking). The aim is to minimize runway occupancy time. Runway occupancy time has an effect on arrival and departure separations and in-trail arrival separations, both of which can negatively affect hourly runway capacity. Intersecting runways are not considered exits since the assumption is that both runways could be in use simultaneously, and the use of an intersecting runway as an exit would negatively affect airfield capacity.

The runway exits available on each Runway and the distance from the threshold in the direction of landing area aredefined in Table 4-12. The distances are measured in the direction of landing from the threshold to the exit point. Runway exists are intended to provide opportunities for landing aircraft to clear the runway. The optimum locations are variable since headwind, surface conditions, and terminal or facility locations are factors in landing distance. The optimum exit locations therefore have a degree of variability.

In the case of Metro, the exact number and location of future runway exits will be determined by the layout and configuration of the runways selected as the preferred alternative in the subsequent chapters.

Table 4-12
RUNWAY EXITS

11L		29R		11L		29R		2		29R	
Exit	**Distance**	**Exit**	**Distance**	**Exit**	**Distance**	**Exit**	**Distance**	**Exit**	**Distance**	**Exit**	**Distance**
A-1	8,999	A-1	0	E	7,004	E	18	D	74	D	3,524
A-2	7,279	A-2	1,800	D-1	8,248	D-1	1,000	A	1,599	A	2,000
E	6,493	E	2,505	B	4,984	B	2,019	B-3	1,768	B-3	1,768
A-4	5,479	A-4	3,618	D-2	4,012	D-2	3,004	B-2	2,479	B-2	1,118
A-7	5,479	A-7	3,618	D-3	3,191	D-3	3,814	B-1	3,551	B-1	0
B	4,482	B	4,517	D-4	2,022	D-4	4,918	C-1	3,551	C-1	0
A-9	3,120	A-9	5,916	G	2,022	G	4,918				
A-13	3,120	A-13	5,916	D-5	520	D-5	6,483				
A-16	1,520	A-16	7,478	H	520	H	6,483				
G	1,520	G	7,478	D-6	0	D-6	6,983				
A-17	0	A-17	8,988	J	0	J	6,983				

Source: Airport Layout Plan, 2009

4.3.3.12 Runway Blast Pads

Blast pads are added at the end of the runways to provide erosion protection control during aircraft takeoff operations. Currently, only two of the six runway ends (29R and 29L) have blast pads. It is recommended that blast pads be considered on both Runway 11L and 11R ends. With the minimal operations and smaller aircraft types utilizing Runway 2/20, blast pads may not be necessary.

4.3.3.13 Runway Hold Pads

Hold pads are typically provided in those areas on an airfield where significant aircraft queuing is expected. These hold pads allow sufficient room for aircraft awaiting takeoff clearance, completion of engine run-ups, or various other takeoff delays to wait clear of the active taxiway. Based on the preferred alternative identified in the following chapter, construction of hold pads in key locations may be necessary.

4.3.3.14 Runway Shoulders

Paved runway shoulders are typically provided for the following reasons: to support aircraft that may inadvertently run off the primary pavement, to improve drainage, and to provide erosion protection control during aircraft takeoff and landing operations. It is recommended that paved runway shoulders be considered on the primary departure and arrival runways in conjunction with rehabilitation or reconstruction.

4.3.4 Taxiway Analysis

The taxiway analysis addresses specific requirements relative to the ability of the existing taxiways at Metro to accommodate the projected demand. At a minimum, taxiways must provide efficient circulation and meet FAA design standards.

Taxiways are classified as either:

- **Parallel** - these taxiways facilitate the movement of aircraft to and from the runway.
- **Connector** - these taxiways connect the parallel taxiways with the aprons and aircraft storage facilities.
- **Apron Taxiways** - these taxiways provide primary aircraft access on an aircraft parking apron.
- **Apron Taxilanes** - these taxilanes provide access to individual aircraft parking positions and/or hangar areas.
- **Exits** - these taxilanes provide a means of entering and exiting the runway (does not include those taxiways designated as connector, parallel, or apron edge taxiway).

Airport runways should be supported by a system of taxiways that provide an access interface between the runways and the aircraft parking and hangar areas. The airport design aircraft determines taxiway design standards and dimensional criteria. Since Metro is planning to upgrade Runway 11R/29L to ARC C-III, it is recommended that the airfield taxiway system be designed and built to that standard where possible. Taxiways serving Runway 2/20 could remain at ARC B-II standards; however, at areas intersecting the primary runway, ARC D-III should be observed.

Areas where new development is occurring such as, the south development area and east development area, ARC D-III standards should be met for taxiways and ARC C-II for taxilanes in hangar areas

4.3.4.1 Parallel Taxiways

The primary taxiways serving the runways are the parallel taxiways. Currently, each runway has a full-length parallel taxiway; however, the lateral separation is different on each runway:

- Taxiway A has a lateral separation from Runway 11L/29R of 400 feet. This is an acceptable dimension for the aircraft expected to operate at the Airport into the future.

- Taxiway B is a full-length parallel taxiway with a lateral separation from Runway 2/20 of 150 feet. This is not an acceptable dimension for the aircraft currently operating at the Airport. However, Taxiway C is a partial parallel taxiway with a lateral separation from Runway 2/20 of 240 feet. This is an acceptable dimension for the aircraft currently and expected to operate at the Airport. Consideration should be given to removing Taxiway B and the extension to Taxiway C.

- Taxiway D has a lateral separation from Runway 11R/29L of 300 feet. This is an acceptable dimension for a taxiway paralleling an ARC C-II Runway. Consideration was given to expand the lateral separation to 400 feet to accommodate ARC-III aircraft expected to operate on this runway in the future. However, to do so would require a taxiway centerline separation from a fixed or moveable object of 93 feet. The location and setbacks required from the Broomfield's above ground potable water storage tanks prevent a 400 foot lateral separation from Runway 11R/29L.

- Taxiway F has a lateral separation from Runway 11R/29L of 500 feet and 152 feet lateral separations from Taxiway D. This taxiway has an acceptable dimension for a Group III taxiway paralleling another Taxiway. Consideration should be given to extending this taxiway to accommodate the larger aircraft expected to operate at the Airport in the future.

- Taxiway J has a lateral separation from Runway 11R/29L of 300 feet; however, this taxiway only parallels the runway for 500 feet and connects into Taxiway H. Consideration should be given to extending this parallel taxiway to accommodate the steady growth in aircraft traffic expected during this planning period.

4.3.4.2 Connector Taxiways

The majority of the airfield and facility layout is efficiently arranged to provide access directly off of the parallel taxiways and does not require additional connector taxiways. However, with airfield improvements recommended throughout this chapter the addition of connector taxiways may be necessary to maintain airfield efficiency.

4.3.4.3 Apron Taxiways/Taxilanes

Aircraft taxi capability around the perimeter of the terminal apron, and the several aircraft parking aprons are sufficiently provided. This taxi capability is considered a non-movement area, meaning that the air traffic control tower does not direct aircraft operations in this area. When an area is designated as a non-movement area, lesser dimensional standards applied that vary as a function of the taxilane location relative to the building.

4.3.5 Airport Signage

The FAA recommends that all airports install a system of runway and taxiway guidance signs in accordance with the standards found in FAA Advisory Circular 150/5340-18C, Standards for Airport Signage Systems. Guidance signs include mandatory holding position signs for runway/runway and runway/taxiway intersections, ILS critical areas, and runway approach areas. Additional taxiway guidance signs include runway and taxiway location, runway exit, taxiway direction, inbound/outbound destination, information signage, and surface painted holding position marking signs. The signage plan at Metro was last updated in July 2009. This update indicated that all existing airport signage is meet current FAA standards. It is recommended that the signage plan be updated with the construction of any new taxiway, taxilanes, or runways.

In addition, as each runway is redesignated to 12L/30R, 12R/30L, and 03/21 guidance signs such as, runway/runway and runway/taxiway intersections, ILS critical areas, and runway approach area signage will need to be updated to remain compliant with FAA standards.

4.4 AIRSPACE REQUIREMENTS

The national airspace system consists of various classifications of airspace that are regulated by the FAA. Airspace classification is necessary to ensure the safety of all aircraft utilizing the facilities, including during periods of inclement weather.

4.4.1 Capacity Enhancements / Operational Efficiency Analysis

The current Class D Airspace is adequate for the existing and future operational requirements expected at Metro. Although the Airport currently provides precision approaches to only one runway, it should be noted that the existing 752-foot separation of parallel Runways 11R/29L is sufficient for dual operations under visual conditions but is insufficient for simultaneous instrument approaches in IMC.

4.4.2 Navigational Aids

NAVAIDs consist of equipment that helps pilots locate the airport, provides horizontal guidance information for a non-precisions approach, or provides horizontal and vertical guidance information for a precision instrument approach.

Runways 11R/29L and 2/20 at Metro have appropriate NAVAIDs that are sited correctly and in working condition. Runway 29R has an instrument landing system (ILS) that utilizes a glide slope, localizer, and approach lighting system. This system meets Category I landing requirements, which require ceilings above 200 feet and visibility greater than 1/2 statute mile. At a minimum, further improvements to the existing ILS system would require the installation of runway centerline lights, touchdown zone lights, and runway visual range meters in the touchdown areas.

The FAA has officially adopted global positioning satellite-based navigation as the standard navigational system for the future. Runways 11L/29R and 11R/29L currently utilize global positioning system (GPS) for their non-precision approaches. The existing radio based ground systems will be retained for the foreseeable future, but ultimately will be decommissioned with proper evolution of the satellite-based systems and procedures. The current deployment of the satellite based navigation system is referred to as a GPS, which is supported by the wide area augmentation system (WAAS). The capability is fully functional; however, airport standards for implementing the system and aircraft equipment have not been standardized. WAAS is currently authorized for use only as a non-precision approach. Future procedure improvement with approach visibility minimums may produce reductions to precision approaches. This will ultimately produce Category III ILS comparable capabilities. Satellite based systems have the benefit of not requiring ground-based station/antenna systems such localizers, glide slopes, and approach markers. Significant benefits of WAAS include added system reliability and accuracy as a result of the artificially created real vision of an aircraft's position relative to surrounding terrain and man-made structures.

As part of the FAA's Next Generation Air Transportation System (NextGen), new technology is being deployed to improve safety and efficiency across the national airspace system where existing radar coverage is not available or insufficient. A specific technology being implemented is the Automatic Dependent Surveillance-Broadcast (ADS-B). ADS-B uses global positioning satellite signals along with aircraft cockpit avionics to transmit the aircraft's location to ground receivers. The ground receivers then transmit the information to controller screens and cockpit displays on aircraft equipped with ADS-B avionics.

ADS-B gives pilots a greater situational awareness by allowing them to see other aircraft in their vicinity and to receive updated flight information including Notices to Airmen and Temporary Flight Restrictions. ADS-B also allows air traffic controllers to precisely identify aircraft locations and their proximity to other aircraft. This technology should reduce delays, shorten flight times, increase airport and airspace capacity, help operate aircraft more efficiently and improve safety.

Currently, the Denver Metro Area, which includes Rocky Mountain Metro and Denver International Airport already have complete Radar coverage. Therefore, the aircraft utilizing airports in the Denver area may not see any changes in the airport or airspace capacity; however, pilots flying aircraft equipped with ADS-B will know precisely where they are and will be able to see other aircraft increasing their safety.

The FAA is in the process of defining the requirements of the future capabilities of the satellite-based system. The focus is on the presence and elimination of obstructions, airport geometry standards compliance, and lighting systems. Each of these areas has renewed focus for strict adherence to FAA standards and is a priority item for assuring compatibility with future NAVAID capabilities.

4.4.3 Visual Aids

Visual aids at Metro include an airport beacon, Runway End Identifier Lights (REIL), threshold lights, Precision Approach Path Indicators (PAPI), and runway and taxiway edge lights and markings. These visual aids were discussed in **Chapter 2, *Inventory*** and additional information is available in **Appendix C, *Visual and Navigational Aids***.

4.4.3.1 Rotating Beacon

The Airport rotating beacon is located on the Northwest side of Runway 2/20 adjacent to Stevens Aviation. The beacon is in good condition and only in need of routine maintenance.

4.4.3.2 Threshold Lights / Edge Lighting System

Threshold lights are located at the end of each runway. Threshold lights consist of a single row of lights used to indicate the beginning or end of the usable landing surface. While, the threshold lights are maintained by the FAA, they are in serviceable condition and only in need of routine maintenance.

Runway and Taxiway Edge Lights consist of a single row of lights bordering each side of the runway or taxiway and can be classified according to three intensity levels. High Intensity Lights are the brightest runway or taxiway lights available. Medium Intensity Lights and Low Intensity Lights are, as the names indicate, lower in intensity. Runway 11L/29R, Runway 11R/29L, and Runway 2/20 are all equipped with Medium Intensity Lights. Taxiways A, B, D, G, E, H, and J are also equipped with Medium Intensity Lights. Rocky Mountain Metropolitan Airport runway and taxiway lighting are in good condition, and will continue to require routine maintenance.

4.4.3.3 Approach Lighting System

A Medium Intensity Approach Lighting System (MALSR) is installed on Runway 29R and maintained by the FAA. The MALSR is in good condition and only in need of routine maintenance; however, if improvements are made to the instrument approaches described above in Section 4.4.2 Navigational Aids, consideration should be given to upgrading the lighting system.

4.4.3.4 Precision Approach Path Indicators

Precision Approach Path Indicators (PAPI) are installed on all runways. Runway 2/20 and 11R/29L have two-box PAPIs, while Runway 11L/29R have four-box PAPIs. Both type of PAPIs provide pilots with visual guidance information during landing. This system gives more precise indication to the pilot of the approach path of the aircraft. PAPI consists of four lights on either side of the approach runway. The lights are either housed together in two boxes or separately in four boxes. The PAPIs are in good condition and only in need of routine maintenance.

4.4.3.5 Runway End Indicator Lights

Runway End Identifier Lights (REIL) are installed on Runway 11L, 11R, and 29L. REILs consist of high intensity white strobe lights placed on each side of the runway to enable rapid and positive identification of the runway’s threshold are typically installed on runways where an approach lighting system is not available. The REILs are in good condition and are only in need of routine maintenance.

4.4.3.6 Runway and Taxiway Markings

Runway and Taxiway Markings may vary depending on whether the runway is used exclusively for Visual Flight Rule (VFR) operations or Instrument Flight Rule (IFR) operations. A visual runway, such as Runway 2/20 is typically marked with the runway designator numbers and a dashed white centerline. Threshold and aiming point markings were added to a visual runway to complete non-precision instrument markings, such as Runway 11R/29L. A precision instrument runway such as Runway 11L/29R, also includes, touchdown zone markings.

Surface Painted Holding Position Marking Signs (SPHPMS) are also included for each runway. SPHPMS are surface painted markings that supplement holding position signs. These marking have a red background with a white inscription painted directly onto the taxiway surface. In addition, Thermoplastic pavement markings are on A1 and A17 taxiway connectors. The airfield markings are in good condition and are only in need of routine re-marking. It is recommended that remarking occur in conjunction with any airfield rehabilitation or reconstruction.

4.5 GENERAL AVIATION FACILITY REQUIREMENTS

Metro facilities focus on supporting general aviation activity. Since air charter operations utilize the same facilities as general aviation operations they are included together in the general aviation analysis.

A number of Metro's operators use higher performance, ultra-large cabin aircraft type, such as G-550, and BBJ (B-737). These aircraft are usually conducting operations or occupying the Airport apron facilities between operations. These aircraft require support facilities, maintenance hangars and apron facilities. These aircraft are almost always stored in a hangar with certain maintenance functions performed on the apron. The airport has three major development areas (east, west, and south) where these facilities are located.

4.5.1 General Aviation Facilities

General aviation itinerant and based aircraft facility requirements at an airport consist of FBO services, hangar storage, and apron space. Included in this section are the charter operations needs, which utilize the same facilities as the general aviation operations. These facility requirements are an analysis of the existing and forecasted general aviation operations, the based aircraft levels, and the capacity and condition of existing facilities.

4.5.1.1 Fixed Base Operators

An FBO is the primary provider of services to general aviation aircraft. The current fixed base operators (Denver Air and Stevens Aviation) provide a wide variety of services including aircraft fueling, pilot lounge, flight planning facilities, food services, car rental, aircraft parking services and hangar storage for general aviation aircraft. Denver Air is located on the East GA Ramp, while Stevens Aviation is located on the West GA Ramp.

Consideration should be given to allocating space for an additional FBO hangar on the South Development Area. This could be a satellite facility for one of the existing FBO's or an entirely new provider. Most likely an existing FBO will be interested in expanding their business and will branch out with providing the basic services such as, flight planning and aircraft fuel. Over time as demand grows so will the services offered on the south side by that FBO.

The remaining provisions of services to general aviation and charter operations are considered sufficient to serve the existing demand. Expansion of the building and aprons associated with of the businesses will need to be considered as demand increases throughout the planning period. Aprons used to serve itinerant general aviation aircraft are covered in more detail in the general aviation apron section.

4.5.1.2 General Aviation Hangars

The amount of general aviation hangar space required at an airport is often a function of local weather conditions, aircraft type, airport security, and user preference. Airports that experience moderate weather conditions generally store less than half of the based general aviation aircraft in hangars. Airports in more severe climates may store closer to 90 percent of the general aviation aircraft in hangars.

Currently, all the aircraft storage facilities are located on the north side of Runway 11L/29R, and on either side of the crosswind Runway 2/20. The Airport has several options for aircraft storage available to users. Starting with tie-down areas, the Airport has over 100 individual aircraft spaces. There are 120 T-hangars, 61 port-a-ports, and 70 conventional hangars that vary in size.

Conventional hangars are primarily used to store corporate aircraft, multiple small aircraft, or to facilitate operations being conducted by aviation support facilities. T-hangars are primarily used to provide covered storage for single-engine and light multi-engine aircraft. Approximately 90 percent of all single and multi-engine general aviation based aircraft are stored in either conventional or T-hangars and 100 percent of general aviation based jet aircraft are stored in conventional hangars.

The future needs for general aviation aircraft storage will continue to consist of a combination of conventional hangars and t-hangars. Analysis conducted to determine the number and type of hangar facilities required assumed that the existing ratio of aircraft in hangars would remain consistent throughout the planning period, as shown in Table 4-13.

Conventional hangars can vary in size from small box hangars to large hangars capable of storing multiple aircraft. For planning purposes, it is assumed that each conventional hangar will store an average of two single or multi-engine aircraft or one small jet inside. T-hangar units are single aircraft units. Based on these assumptions, 29 additional conventional hangars and 130 additional T-hangars will be needed by Planning Activity Level 3 to accommodate the forecasted based aircraft fleet mix.

In addition, the future location of these different types of hangars should be considered. Specifically, the separation of the different size aircraft by weight and wing span should be analyzed to ensure the maximum use of the limited space available. Proper placement of hangars and adjoining taxilanes can minimize unnecessary construction expenses, future pavement maintenance, and minimize the mixing of aircraft types.

Table 4-13
GENERAL AVIATION HANGAR STORAGE REQUIREMENTS

		Planning Activity Level		
	2008	**1**	**2**	**3**
Based General Aviation Aircraft				
Single Engine	343	366	356	425
Multi- Engine	19	20	21	23
Turbo- Prop	16	17	17	19
Jet	38	43	45	50
Helicopter	14	15	16	18
Total General Aviation Based Aircraft	**430**	**461**	**455**	**535**
Hangar Space				
T-Hangar Needed	326	347	339	403
T-Hangar Available	181	181	181	181
Additional T-Hangars Needed	**145**	**166**	**158**	**222**
Conventional Hangar Needed	68	75	78	87
Conventional Hangar Available	70	70	70	70
Additional Conventional Hangars Needed	**0**	**5**	**8**	**17**
Total Hangars Needed	**145**	**171**	**166**	**239**

Sources: Airport Records and RS&H 2009

4.5.1.3 General Aviation Apron

Apron facilities serve various areas for transient parking, aircraft tie-down, fueling, and general circulation for aircraft. Demand for apron space is driven by based non-hangar aircraft, itinerant fixed wing and rotorcraft aircraft, and other user and tenant parking and maneuvering allocations. Determination of future apron requirements involves an assessment of aircraft fleet mix, daily aircraft parking demand, and tenant space planning considerations. Apron sizing for tie-down positions varies according to the aircraft size, and includes space for circulation.

Existing aprons dedicated to general aviation operations are located in the three separate locations:

- **West GA Apron** - Parallel to Runway 11L/29R and west of crosswind Runway 2/20, the apron is approximately 1,100’ long by 400’ wide (440,000 square feet). This apron is constructed from concrete.

- **East GA Apron** - Parallel to Runway 11L/29R and east of crosswind Runway 2/20, the apron is approximately 2,050' long by 300' wide (615,000 square feet). This apron is constructed from asphalt.

- **Northeast GA Apron -** Parallel to crosswind Runway 2/20 on the northeast side adjacent to Taxiway B, the apron is approximately 1,600' long by 170' wide (272,000 square feet). This apron is constructed from asphalt.

Together the three apron areas total approximately 1,327,000 square feet. Transient aircraft parking spaces are provided on both the west apron and the east apron. The west apron, adjacent to Stevens Aviation, contains approximately 24 small tie-downs spaces and approximately 5 large business jets spaces. The east apron, adjacent to Denver Air, contains approximately 90 small tie-downs spaces and approximately 20 large business jet spaces. The Northeast Apron does not contain any transient aircraft parking spaces.

Analysis conducted to determine parking requirements for itinerant aircraft calculated daily aircraft parking demand by spreading the annual demand evenly throughout the year. The analysis, shown in Table 4-14, assumes a maximum of 50 percent of the total daily itinerant aircraft would be on the apron at any given time and that overnight storage on the apron would be limited to small single-engine and multi-engine aircraft. Historically, there has been a very small demand for based aircraft apron space. For planning purposes, it is assumed that this small demand will continue in the future.

The existing aircraft aprons combined, provide sufficient space and circulation for over 130 aircraft. Based on the identified facility requirements, additional movement areas and tie downs may be needed on the general aviation apron areas within the short-term. In addition, the development of the south apron area will provide sufficient growth potential.

Table 4-14
GENERAL AVIATION APRON REQUIREMENTS

		Planning Activity Level		
	2008	**1**	**2**	**3**
Based General Aviation Aircraft				
Single Engine	343	366	356	425
Multi- Engine	19	20	21	23
Turbo- Prop	16	17	17	19
Jet	38	43	45	50
Helicopter	14	15	16	18
Total General Aviation Based Aircraft	**430**	**461**	**455**	**535**
Based Aircraft Tie-Downs				
Required Spaces	74	79	78	92
Available Spaces	50	50	50	50
Additional Spaces Needed	24	29	28	42
Additional Square Feet Needed	**9,600**	**11,600**	**11,200**	**16,800**
Itinerant Aircraft Tie-Downs				
Required Spaces	60	70	80	105
Available Spaces	90	90	90	90
Additional Spaces Needed	-30	-20	-10	15
Additional Square Feet Needed	**-**	**-**	**-**	**6,000**
Total Square Feet Needed	**9,600**	**11,600**	**11,200**	**22,800**

Source: Airport Records and RS&H, 2009

4.5.2 Air Cargo Requirements

The purpose of the section is to identify the facilities required to support air cargo operations at the Airport. Since the Airport does not have any dedicated/scheduled cargo operators, a ground lease with any cargo operators, or any buildings dedicated for cargo operations, no new air cargo facilities are required. However, occasionally small items are shipped via cargo through the airport. These items are moved to and from off-airport cargo facilities via truck directly to aircraft on the ramp adjacent to the terminal building.

Therefore, for planning purpose an area of ramp should be reserved adjacent to the terminal building to allow for air cargo operations. The required cargo facilities at an airport can vary greatly depending on the aircraft type, cargo type and size, and operating procedures utilized by individual operators. Utilizing the FAA AC 150/5300-13, Aircraft Characteristics Database, the aircraft cargo space requirements, are determined for five groups of aircraft sizes. Included in the aircraft space requirements is sufficient area for the aircraft parking, ground support equipment, cargo truck staging, aircraft separation, and aircraft taxiing distances. Utilizing the FAA's data for smaller aircraft (such as the Cessna Caravan) it is recommend that 3,600 square feet of aircraft space be reserved adjacent to the terminal building for air cargo operations.

4.6 AVIATION SUPPORT FACILITY REQUIREMENTS

Support facilities at an airport encompass a broad set of functions that exist to ensure the smooth and efficient operations of the airport's primary role and mission. Support at Rocky Mountain Metropolitan Airport includes:

- Aircraft Rescue and Fire Fighting
- Airport Maintenance and Snow Removal Equipment Storage
- Airport Fuels
- Utilities
- Aircraft Deicing
- Air Traffic Control Tower
- Terminal Building
- Fencing and Security
- Rental Cars
- Future Development Opportunities

4.6.1 Aircraft Rescue and Fire Fighting

Airports that serve scheduled and unscheduled air carrier flights are required to provide firefighting facilities and equipment. The FAR Part 139 certified Airport, ARFF equipment requirements are identified by an airport's index ranking (A, B, C, D, or E). The index is determined by the length of the largest air carrier aircraft operating at the airport and average number of daily departures conducted by this aircraft.

Rocky Mountain Metropolitan Airport is currently an Index B airport. The ARFF facility at Rocky Mountain Metropolitan Airport is located in the maintenance complex, adjacent to the terminal building, along Runway 2/20. A portion of the maintenance facility is dedicated to ARFF, which includes one ARFF vehicle bay, equipment storage, and office space. The maintenance facility is located on prime revenue generating property, which may better serve the airport if leased for revenue generating uses and relocating the ARFF facility.

The existing ARFF facility is adequate to meet demand through the planning period. The ARFF Index is not expected to change throughout the planning period. However, it will be necessary to move the ARFF facility based on the best future land use.

4.6.2 Airport Maintenance and Snow Removal Equipment Storage

The need for airport maintenance and snow removal equipment facilities correlates to the amount of pavement, lighting equipment, buildings, and overall storage grounds maintained by an Airport. The Airport's primary maintenance and snow removal equipment storage facility is located midfield of Runway 2/20, north of the passenger terminal. The maintenance building provides approximately 17,850 square feet of storage and vehicle maintenance space. This building includes several vehicle service bays, offices, and storage bays. At the present time, the facility is too small to properly store the airport's existing equipment. Several plow trucks, sweepers, and loaders are stored outside the building which reduces the equipment useful life and increases the operating and maintenance cost of the equipment. In addition, the maintenance facility is located on prime revenue generating property. This location would better serve the airport by generating revenue. This location could be reserved for terminal expansion, or corporate business development.

4.6.3 Airport Fuels Facilities

Fuel storage at the Airport is done through a combination of above ground storage tanks (AST) and underground storage tanks (UST). The Airport has begun an extensive project to consolidate all fuel storage into one location. The fuel storage area, also called a fuel farm, is located on the far east side of the airfield north of Runway 11L/29R. The fuel farm is controlled by the Airport; however, the FBOs and other private tenants own the fuel storage tanks and lease the rights to store their fuel in the farm. It is the intent of the Airport to relocate all privately owned fuel storage facility into this fuel farm over time. Furthermore, as new operators request fuel storage, they will be required to store their fuel in this consolidated fuel farm facility.

The existing fuel farm is large enough to accommodate a significant amount of additional 100LL, Jet A, unleaded, and/or Diesel privately owned fuel tanks of the same or similar size. However, as the South Development Area begins to be developed, land should be set aside to accommodate a secondary fuel farm to accommodate the growth expected in that area.

4.6.4 Utilities

Utilities provided at the Airport include potable water, sanitary sewer, gas, electric, storm water drainage, phone, fiber, and cable television. All of the existing utilities are currently adequate to meet the existing demand. However, it should be noted that the above ground potable water tanks provided by the City of Broomfield should be relocated. The current location of these water tanks negatively affects the development of the south facilities. According to the Broomfield City Master Plan, the removal of two tanks is expected, which is an improvement but not ideal.

Each utility will need further evaluation coinciding with the design and development of the recommended improvement at the Airport.

4.6.5 Aircraft Deicing

Airports that frequently experience snow and/or freezing rain, such as Metro, should provide designated deicing areas for aircraft in order to facilitate safe and efficient deicing procedures in accordance with environmental regulations. Currently, Metro does not have a designated deicing area that allows the containment of deicing agent run off. It is recommended that designated deicing areas be constructed, and include the capability of deicing fluid containment and recycling. A designated deicing area should be provided at each of the three major apron areas.

4.6.6 Airport Traffic Control Tower

The Federal Aviation Administration (FAA) has completed the design and has begun construction on a new Air Traffic Control Tower at the Airport. The existing tower cab is located midfield between Runway 29R and Runway 20 and north easterly adjacent to the terminal building. The new tower is located on the south side of the airfield, east of the water tanks. The new tower is 125 feet tall and improves the air traffic controllers' line of sight.

4.6.7 Terminal Building

A passenger terminal facility at Metro is located at the corner of Runway 11L/29R and Runway 2/20 on the north side. The 25,000 square foot terminal building includes a restaurant, passenger-waiting areas, the Airport's administrative offices, FAA offices, U.S. Customs, and several other tenants.

The Airport terminal building contains adequate facilities to accommodate the existing conditions. However, as demand grows for additional business space within the terminal, considerations should be given to expanding the building to provide additional space.

4.6.8 Fencing and Security

Airport perimeter fencing is instrumental to overall airport security. It aids in meeting the security requirements of the FAA Transportation Security Administration (TSA), complies with Title 14 Part 139 of the Code of Federal Regulations, Certification, and Operations, and assists in preventing wildlife encounters on the operational areas of the airport.

The airfield at Metro is currently encompassed by several different types of fencing and provides access to the airfield through a series of gates. However, based on the preferred alternative identified in the following chapter, further analysis of the location of new access points and additional fencing may be needed.

4.6.9 Rental Car

Rental cars are available on-airport through Enterprise and Hertz. Enterprise is located at Stevens Aviation and Hertz at Denver Air. The rental car ready and return lots for their vehicles are also located at their associated FBOs parking lots. Airport rental car demand is typically based on the number of passenger enplanements through charter operations. Due to the relativity low number of passengers deplaned at the Airport the demand for rental cars is infrequent. The current FBO automobile parking lots have sufficient space to accommodate rental cars throughout the planning horizon.

4.6.10 Future Development Opportunities

There are several parcels of land that are owned by the Airport that are deemed unusable for aviation related development such as the corner of highway 128 and Simms, the parcels adjacent to proposed Jefferson Parkway and the Relocated Simms Street. These parcels would be very effective for non-aviation development sites that would produce revenue for the airport. These sites should be analyzed and alternatives should be developed to utilize the parcels and provide additional revenue to the Airport.

4.7 AIRPORT ACCESS REQUIREMENTS

All airport access roadways can be characterized as either on-airport or off-airport. For most airports, some portion of the route that the majority of airport users utilize is within the property line of the airport, but can only be accessed via public roadways. Therefore, for the purpose of this Master Plan, both on- and off-airport access roadways have been analyzed to assist in determining not only the facility requirements for existing roadways, but also the ability of alternate routes to support future facilities.

A needs analysis of local and airport roads to adequately accommodate existing and future airport activities including the following:

- Expand Terminal Parking
- Improve intersection of Wadsworth and Metro Avenue
- Improve Rocky Road.
- Reserve adequate land to provide vehicle access and parking in the south side development area.
- Reserve adequate land to provide vehicle access and parking in existing hangar area expansion.

The basis for these items are discussed in the following Off-Airport Access, On-Airport Access, and Vehicle Parking.

4.7.1 Off-Airport Access

All off-airport roadways are on public land, and are maintained by municipalities, counties or the State. Access along all off-airport roadways, except for Interlocken Blvd. and the intersection of Wadsworth and Metro Avenue are adequate throughout the planning horizon and will meet the strategic goals of the Airport to improve accessibility.

The City of Broomfield determined that future demand on the Interlocken Blvd. will not reach projected traffic counts to justify the expansion on Interlocken Blvd. Therefore, the City removed the expansion project from their future development plans. However, improvements to the intersection of Wadsworth and Metro Ave are necessary to accommodate the existing traffic. The intersection should be widened and additional left hand turn lanes should be installed.

4.7.2 On-Airport Access

With the development of the Northwest Parkway and the anticipated realignment of Simms Road, the challenge the Airport will face will be vehicle access and the need for new interior roadways. Access to the control tower, Navaids, and future development will need to be resolved. Therefore, it is recommended that the alternative analysis consider the realignment of the existing roadways and develop alternatives that identify access and interior roadway locations sufficient to provide for future aviation and non-aviation users. The layout should optimize land use, natural barriers, and potential development options.

In addition, it is recommended that Rocky Road be improved in the near future to better accommodate fuel delivery trucks and new airside development. Vehicle access and parking options should be developed and reserved in the south development area.

4.7.3 Vehicle Parking

Public vehicle parking is provided in one parking lot adjacent to the terminal building for passengers, employees, and users of the aviation facilities. The parking lot provides approximately 110 paved parking spaces.

It is recommended that public vehicle parking lot be expanded. While the parking lot does not distinguish between long-term, short-term, and employee parking, the parking lot remains full a majority of the time. It is recommended that additional parking alternatives be developed and constructed with in the short-term. Each airport business including the FBOs has a private parking lot for passenger, user, and employees utilizing their facility.

4.8 SAFETY MANAGEMENT SYSTEMS

Safety Management System (SMS) is a formal, top-down business-like approach to managing airport safety risk. It includes systematic procedures in practices and policies for the management of safety, allowing airports to incorporate safety mechanisms to mitigate the safety risk of actions and activities at the airport. This not only results in the reduction of aircraft accidents/incidents on the airfield, but also adds an extra layer of protection to help save lives.

SMS made its debut at airports shortly after British Airports Authority privatized in 1987. As airports continued to evolve from public utilities to businesses concerned with making a profit, the International Civil Aviation Organization (ICAO) took steps to promote safety management as a prerequisite for a sustainable aviation business. The FAA supports harmonization of international standards, and has worked to make U.S. aviation safety regulations consistent with ICAO standards and recommended practices. The FAA intends to implement the use of SMS at U.S. airports to meet the intent of the ICAO standard in a way that complements existing airport safety regulations in 14 CFR Part 139.

It is anticipated that SMS will become a requirement for all Part 139 airports by 2012. Therefore, it is recommended that the Airport implement a Safety Management System study in the short-term planning period.

4.9 WILDLIFE HAZARD ASSESSMENT

The risk of wildlife strikes to aircraft has been increasing over the past decade. Because of this the FAA has issued a Cert-Alert on June 11, 2009 to Airport Operators and FAA Airport Certification Safety Inspectors to remind them of their obligations under Part 139 to conduct Wildlife Hazard Assessments if they have experienced a trigger event at their airport. According to Part 139 a triggering event is it any of the following events occur on or near the airport:

- An air carrier aircraft experiences multiple wildlife strikes;
- An air carrier aircraft experiences substantial damage from striking wildlife.
- An air carrier aircraft experiences an engine ingestion of wildlife;
- Wildlife of a size, or in numbers, capable of causing an event described above is observed to have access to any airport flight pattern or aircraft movement area.

The Wildlife Hazard Assessment must be conducted by a qualified wildlife biologist who meets the requirements in Advisory Circular 150/5200-36, *Qualifications for Wildlife Biologists Conducting Wildlife Hazard Assessments and Training Curriculums for Airport Personnel Involved in Controlling Wildlife Hazards at Airports*. In addition the Wildlife Hazard Assessment must be conducted in accordance with Advisory Circular 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports* and the Wildlife Hazard Management Manual.

According to the FAA Wildlife Strike Database, the Airport has experienced a triggering event. Specifically, the records indicated that an air carrier aircraft experienced substantial damage from striking wildlife. Therefore, it is recommended that the Airport implement a Wildlife Hazard Assessment in the short-term planning period.

4.10 CONCLUSION

This chapter evaluated the facility development needs to accommodate the forecast growth at Metro. Certain identified facilities will need further analysis based on the recommended development alternatives. Alternatives to satisfy the facilities requirements for each of the fundamental design areas are addressed in the following chapter. Key conclusions from the facility requirement analysis include:

- Critical aircraft changes from a Grumman Gulfstream II to a Gulfstream G550, which is an adjustment in Aircraft Reference Code (ARC) from D-II to D-III.
- The demand capacity ratio is expected to grow throughout the planning period from 54 percent today to 93 percent in 2030.
- The runway magnetic azimuths for Runways 11L/29R, 11R/29L and 2/20 are several minutes over the existing declination.
- Runway 11L/29R should be designed to accommodate ARC C/D-III aircraft.
- Runway 11R/29L should be designed to accommodate ARC C-II.
- Runway 2/20 should remain designed as ARC B-II
- Runway 11L end does not meet the FAA's Runway Safety Area standards.
- Airfield development should focus on the runways' abilities (length, width, and strength).
- Development of airfield accessible land should be maximized for the future growth of general aviation and aviation-related businesses.
- Development of off-airport land should be utilized to maximize its revenue potential with the expected realignment of Simms Street and the Jefferson Parkway.
- The Airport should implement a Safety Management System study in the short-term planning period.
- The Airport should conduct a Wildlife Hazard Assessment in the short-term planning period