Asheville REGIONAL AIRPORT Master Plan Update

Chapter 4
Facility Requirements

Airport planning for facilities requirements is based upon the probable demand that may occur over time. Chapter 3, *Aviation Forecasts*, describes projections of aviation demand at Asheville Regional Airport for 5-, 10-, and 20-year time increments. This chapter provides an account of the existing condition of airside and landside facilities at the Airport and provides recommendations for facility requirements based on the projections contained in Chapter 3. The recommendations developed in this chapter offer the basis for the development of alternatives related to Airport needs, facilities, staffing, and funding.

The general elements that will be addressed in this chapter include the following:

- 4.1 Airfield Demand/Capacity Analysis
- 4.2 Airfield Facility Requirements
- 4.3 Terminal Area Requirements
- 4.4 General Aviation Facility Requirements
- 4.5 Support Facility Requirements
- 4.6 Additional Facility Requirements

4.1 Airfield Demand/Capacity Analysis

The purpose of the airfield demand/capacity analysis is to assess the capability of the airfield facilities to accommodate projected levels of aircraft operations. A number of factors can impact airfield capacity and delay, including:

- Airfield layout, the number of runways, and runway configuration
- Number and location of exit taxiways
- Runway use restrictions
- Runway use as dictated by wind conditions
- The percentage of time the airport experiences poor weather conditions
- The level of touch-and-go activity
- Types of aircraft that operate at the airport

- Surrounding terrain/local geography
- Changes in air traffic control procedures

FAA Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay,* defines Annual Service Volume (ASV) as a reasonable estimate of an airport's annual practical capacity. It accounts for differences in runway use, aircraft mix, weather conditions, pattern of demand (peaking), and other factors that impact an airport. A demand/capacity analysis was conducted in accordance with FAA Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay* and found the ASV at Asheville Regional Airport to be 121,272 annual operations.

The relationship between the ratio of demand to ASV and delay is shown in **Table 4-1**. The chart depicts the average delay per aircraft based upon the ratio of annual demand to annual service volume, the FAA guidance notes that the upper part of the band applies to air carrier airports and the full band applies to general aviation airports. The upper part of the band has been used to determine annual average delay per aircraft at the Airport. The FAA guidance also notes that individual aircraft delays can be 5 to 10 times the average delay.

Table 4-1: Ratio of Demand to ASV and Delay

Ratio of Annual Demand to ASV	Annual Average Aircraft Delay (min)	Peak Delays for Individual Aircraft (min)
0.1	0.05 - 0.05	0.25 - 0.50
0.2	0.10 - 0.15	0.50 - 1.50
0.3	0.20 - 0.25	1.00 - 2.50
0.4	0.25 - 0.30	1.25 - 3.00
0.5	0.35 - 0.50	1.75 - 5.00
0.6	0.50 - 0.75	2.50 - 7.50
0.7	0.65 - 1.05	3.25 - 10.50
0.8	0.95 - 1.45	4.75 - 14.50
0.9	1.40 - 2.15	7.00 - 21.50
1.0	2.30 - 3.50	11.50 - 35.00
1.1	4.40 - 7.00	22.00 - 70.00

Source: FAA AC 150/5060-5, *Airport Capacity and Delay*

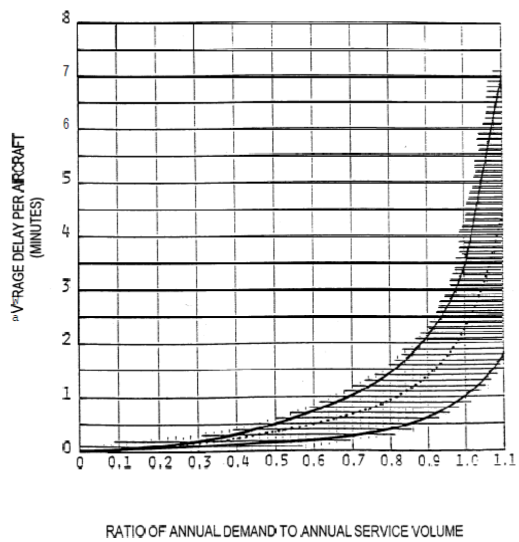


Table 4-2 depicts the ratio of annual demand to annual service volume for Asheville Regional Airport and the anticipated range of average and peak aircraft delays. Average delays are anticipated to increase from a range of 0.41 to 0.57 minutes to a range of 0.66 to 0.96 minutes in 2030.

Table 4-2: FAA Estimated Delay Ranges

Year	Annual Demand	Ratio of Demand to ASV*	Range of Avg Aircraft Delay (min)	Range of Peak Aircraft Delays (min)
	ASV =	**121,272**		
Historical:				
2005	70,532	0.58	0.45 - 0.64	2.27 - 6.37
2006	74,373	0.61	0.52 - 0.73	2.58 - 7.31
2007	81,674	0.67	0.66 - 0.95	3.28 - 9.49
2008	76,840	0.63	0.56 - 0.80	2.80 - 7.98
2009	66,437	0.55	0.40 - 0.55	1.98 - 5.51
2010	67,340	0.56	0.41 - 0.57	2.04 - 5.69
Projected:				
2015	70,191	0.58	0.45 - 0.63	2.25 - 6.30
2020	74,025	0.61	0.51 - 0.72	2.55 - 7.22
2025	77,868	0.64	0.58 - 0.83	2.89 - 8.28
2030	82,066	0.68	0.66 - 0.96	3.32 - 9.62

Source: FAA AC 150/5060-5, *Airport Capacity and Delay*

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, notes that capacity improvements should be recommended with sufficient lead time so that the improvement can be before the problem becomes critical and delays are excessive. For runway capacity it is recommended that capacity development begin when demand reaches 75 percent annual capacity. As shown in **Table 4-2**, demand at the Airport in 2010 was 56 percent of capacity while demand in 2030 is projected to be 68 percent of capacity. These levels are near the FAA recommended thresholds, but are not anticipated to exceed the 75 percent threshold within the planning period. Additionally in 2007, the Airport accommodated nearly 82,000 operations, which is near the 2030 projected level of operational demand. Therefore, airfield capacity at the Airport appears adequate for projected operational demand through the planning period.

4.2 Airfield Facility Requirements

Airfield facility requirements have been developed and organized in this subsection by the following functional areas:

- 4.2.a Airfield Layout & Wind Coverage
- 4.2.b Identification of Design Standards
- 4.2.c Runway Length
- 4.2.d Runway Width
- 4.2.e Runway Pavement Strength

4.2.f Runway Grade
4.2.g Taxiway System
4.2.h Airfield Safety Areas
4.2.i FAR Part 77 Surfaces
4.2.j Navigational Aids (NAVAIDs) and Weather Reporting Equipment

4.2.a Airfield Layout & Wind Coverage

Asheville Regional Airport has a single runway, Runway 16/34, with a length of 8,001 feet and a width of 150 feet. Runways are designated with a number between 1 and 36; the FAA's Aeronautical Information Manual (AIM) notes that this designation is the whole number nearest 1/10 the magnetic azimuth of the centerline of the runway, measured clockwise from the magnetic north. Runway designations can change over time because the magnetic poles slowly drift over the Earth's surface and the magnetic bearing will change. Runway 16/34 has a true north bearing of North 159.82 degrees East (N159.82E). According to the National Oceanic and Atmospheric Administration (NOAA), magnetic declination at the Airport's location in December 2011 was estimated to be 6 degrees 17 minutes west and changing by 0 degrees 4 minutes west per year. The magnetic headings of the runway were found to currently be 166.10 and 346.10 degrees. Dividing by 10 and rounding these magnetic headings to the nearest whole number indicates that the Runway's designation should be changed from 16/34 to 17/35. For the purposes of this master plan report the runway numeration will continue to be referred to as 16/34, as that is what its current designation is in all FAA publications and reports; however, a future change to 17/35 is recommended to conform to FAA design standards.

Runway location and orientation are paramount to airport safety, efficiency, economics, and environmental impact. Since operational safety is highest when aircraft land and takeoff into the wind, it is important that the orientation of an airport's runway is aligned in the same direction as local prevailing winds. FAA Advisory Circular 150/5300-13, *Airport Design* recommends that a runway orientation provide at least 95 percent wind coverage for any aircraft forecasted to use the airport on a regular basis. If runway coverage cannot be provided by a single runway a crosswind runway is recommended. FAA guidance notes that the 95 percent wind coverage is computed on the basis that crosswinds not exceed the following (*Airport Reference Codes are defined in the next section of this report*):

- 10.5 knots for Airport Reference Codes A-I and B-I,
- 13 knots for Airport Reference Codes A-II and B-II,
- 16 knots for Airport Reference Codes A-III, B-III, and C-I through D-III, and
- 20 knots for Airport Reference Codes A-IV through D-VI.

Wind coverage provided by the current orientation of Runway 16/34 was presented in Section 2.3.a of the Inventory Chapter of this Master Plan report. Based on hourly wind observation data obtained from the NCDC, the orientation of Runway 16/34, with up to a 10.5 knot allowable crosswind, provides wind coverage 99.56 percent of the time during all weather conditions, 99.51 percent during Visual Flight Rules weather conditions, and 99.91 percent in Instrument Flight Rules weather conditions. The all-weather conditions wind coverage for allowable crosswinds of 13 knots, 16 knots, and 20 knots is 99.87 percent, 99.97 percent, and 99.99 percent, respectively. Therefore the orientation of the airport's single runway, Runway 16/34, provides sufficient wind coverage that exceeds the FAA's recommended standards of 95 percent wind coverage for all types of aircraft.

4.2.b Identification of Design Standards

Significant elements in the planning and design of an airport include the role of the airport and the functional requirements of critical aircraft that operate there. The FAA outlines guidance for planning and design in several ACs, which promote safety, economy, efficiency, and longevity of airport facilities.

For planning and design purposes, it is necessary to establish design standards that apply to operations and facilities at Asheville Regional Airport. The selection of the appropriate design standards for airfield facilities is based primarily upon the characteristics of the most demanding aircraft projected to use the airport on a regular basis, along with the types of approaches to be provided to each runway at the Airport. FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, states the following regarding selection of airport design standards:

"Airport dimensional standards (such as runway length and width, separation standards, surface gradients, etc.) should be selected which are appropriate for the critical aircraft that will make substantial use of the airport in the planning period. Substantial use means either 500 or more annual itinerant operations, or scheduled commercial service. The critical aircraft may be a single aircraft or a composite of the most demanding characteristics of several aircraft. The critical aircraft (or composite aircraft) is used to identify the appropriate Airport Reference Code for airport design criteria."

FAA AC 150/5300-13, *Airport Design*, provides guidance defining the Airport Reference Code (ARC). The ARC is a system developed by the FAA to relate airport criteria to the operational and physical characteristics of the aircraft at an airport. The ARC has two components that relate to the airport design aircraft. The first component, depicted by a letter, is the Aircraft Approach Category (ACC) and relates to certified aircraft approach speed. Generally, aircraft approach speed applies to runways and runway related facilities. Based on FAA AC 150/5300-13, *Airport Design,* aircraft are grouped into five categories:

- Category A: Approach speeds less than 91 knots.
- Category B: Approach speed of 91 knots or more, but less than 121 knots.
- Category C: Approach speed of 121 knots or more, but less than 141 knots.
- Category D: Approach speed of 141 knots or more, but less than 166 knots.
- Category E: Approach speed of 166 knots or more.

Aircraft Approach Categories A and B typically include small piston engine aircraft and a limited number of smaller, commuter turboprops as well as business jets having approach speeds of less than 121 knots. Category C consists of business jets with approach speeds greater than 121 knots as well as regional jet and narrow-bodied commercial aircraft. Category D and E aircraft include higher performance business and narrow-bodied jets as well as larger wide-bodied commercial and military aircraft.

The second component of the Airport Reference Code, depicted by a Roman numeral, is the airplane design group, which is categorized by wingspan or tail height. Where an airplane is in two categories, the most demanding category should be used. Aircraft wingspan primarily relates to separation requirements of taxiways and ramp space area as shown in **Table 4-3**.

Table 4-3: Airplane Design Groups

Group	Tail Height	Wingspan
I	Less than 20 feet	Less than 49 feet
II	From 20 feet to less than 30 feet	From 49 feet to less than 79 feet
III	From 30 feet to less than 45 feet	From 79 feet to less than 118 feet
IV	From 45 feet to less than 60 feet	From 118 feet to less than 171 feet
V	From 60 feet to less than 66 feet	From 171 feet to less than 214 feet
VI	From 66 feet to less than 80 feet	From 214 feet to less than 262 feet

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

Airplane Design Groups (ADG) I and II primarily include small piston aircraft, business jets, turboprop aircraft and some commercial regional jets. ADG III includes large business jets and most regional and narrow body commercial aircraft. ADG IV and V include large jetliners utilized for commercial service and military service. ADG VI only includes the largest transport aircraft such as the Airbus A380, Boeing 747-8, C-5 Galaxy and Antonov An-124.

The 2010 update of the Airport Layout Plan (ALP) identified airfield design standards were based upon ARC Category C-III aircraft which were the most demanding type anticipated to operate at the Airport. Though operations by Category C-III aircraft are forecasted to increase over the 20 year planning period, operations from larger ARC Category C-IV aircraft are also expected to increase. The reduction and elimination of 50-seat regional jet aircraft will increase operations at the Airport from larger ARC Category C-III aircraft such as the Boeing 737, Airbus A319 & A320, and Embraer ERJ-170 & ERJ-190 as well as Category C-IV aircraft such as the Boeing 757. Should areas be developed for dedicated air cargo processing, additional ARC Category C-IV aircraft operations can be expected from freighter versions of the Boeing 757, 767, MD-11, and Airbus A300/A310 aircraft that are operated by air cargo haulers such as FedEx and UPS. In preparation of expected operations from these larger aircraft types, the airfield should be planned to ARC Design Group IV standards.

Table 4-4 compares ARC Airplane Design Group III and IV airfield design standards as outlined in FAA AC 150/5300-13, *Airport Design*. As summarized in the table, the dimensions of most existing airfield design surfaces meet ADG IV standards while the width of Runway 16/34 and parallel Taxiway A exceed minimum requirements for Airplane Design Group III.

Table 4-4: Airfield Design Standards			
Criteria	**FAA Requirements**		**Runway 16/34**
Airplane Design Group	III	IV	III
Runway Length	n/a*	n/a*	8,001 ft.
Runway Width	100 ft.	150 ft.	150 ft.
RSA Width	500 ft.	500 ft.	500 ft.
RSA Length	1,000 ft.	1,000 ft.	1,000 ft.
OFZ Width	400 ft.	400 ft.	400 ft.
OFZ Length	200 ft.	200 ft.	200 ft.
Runway OFA Width	800 ft.	800 ft.	800 ft.
Runway OFA Length	1,000 ft.	1,000 ft.	1,000 ft.
Parallel Taxiway Width	50 ft.	75 ft.	75 ft.
Parallel Taxiway Safety Area	118 ft.	171 ft.	118 ft.
Parallel Taxiway OFA Width	186 ft.	259 ft.	186 ft.

* Note: As a result of several factors that influence the length of a runway, the FAA does not require a minimum runway distance for each ARC classification; Advisory Circular 150/5325-4 and aircraft operating manuals provide guidance on recommended runway lengths by aircraft type.

Source: FAA Advisory Circular 150/5300-13, *Airport Design*; 2010 Airport Layout Plan; Mead & Hunt, Inc.

At the time of the 2010 Airport Layout Plan (ALP) update, the Airbus A320 was chosen as the existing and ultimate critical aircraft types as it was anticipated to frequently operate at the Airport over the 20 year planning period. A review of commercial airline departures per week by aircraft type since 2010 indicates the Airport has received more frequent operations from the McDonnell Douglas MD-80-88 series aircraft and the Boeing 737-700, which both have a maximum takeoff weight (MTOW) greater than 150,000 pounds. Airfield design standards listed in FAA AC 150/5300-13, *Airport Design*, indicates surfaces intended for ADG III aircraft with an MTOW of greater than 150,000 pounds should meet runway width, shoulder width, and blast pad requirements of the next higher classification of aircraft in ADG IV.

Since the dimensions of a number of the airfield surfaces meet ADG IV standards and the MTOW of the Airbus A320 is less than 150,000 pounds, it is recommended the current critical aircraft type be changed to the Boeing 737-700. Though the MD-80-88 series aircraft conducts multiple weekly operations at the Airport, the Boeing 737-700 is similar in size and has a greater wingspan which is one of the design criteria for airfield surfaces according to the ARC. This change will more accurately reflect the most demanding size of aircraft that operates at the Airport while supporting airfield surface design criteria for existing and future infrastructure improvement projects.

Activity projections presented in the forecasting chapter indicate operations from larger ARC Category C-IV aircraft will increase throughout the planning period as airlines shift away from using smaller 50-seat regional jets to serve the Asheville market. A popular ARC Category C-IV aircraft that is operated by three of the four airlines at the Airport and is anticipated to remain in service throughout the next 20 years is the Boeing 757-200. It is recommended the ultimate critical aircraft type be changed to the Boeing 757-200 in an effort to plan future infrastructure improvements that meet the design standards of this larger ARC category of aircraft. **Figure 4-1** illustrates the existing, recommended existing, and ultimate critical aircraft types.

Figure 4-1: Recommended Critical Aircraft Types

Existing Critical Aircraft
Airbus A320
ARC Category C-III

Recommended Existing Critical Aircraft
Boeing 737-700
ARC Category C-III

Recommended Ultimate Critical Aircraft
Boeing 757-200
ARC Category C-IV

Photo Sources: US Airways, Delta Air Lines, Mead & Hunt, Inc.

4.2.c Runway Length

An airport's required runway length is determined by the operating characteristics of the most demanding (current or projected) aircraft in its operational fleet. According to FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, when the maximum takeoff weight of a critical design aircraft exceeds 60,000 pounds or is considered a regional aircraft, the recommended runway length is determined based on individual airplanes. The FAA states that the design objective for the primary runway is to provide a runway length for all airplanes that will regularly use it without causing operational weight restrictions.

Runway length is determined by applying the Airport's mean high temperature (83.2 degrees Fahrenheit) for the hottest month (July), elevation (2,165 feet), and length of haul performed by aircraft operating on the runway. Airport Planning Manuals (APMs) were obtained from aircraft manufacturers, where available, to determine required runway lengths. The required runway lengths for aircraft that currently operate or are highly likely for potential service at the Airport are presented in **Table 4-5**.

Table 4-5: Commercial Aircraft Required Runway Lengths				
	Maximum Takeoff		Runway Length Required	
Aircraft	Weight (lbs)	Engines	Stnd Day (51.3° F)	Hot Day (83.2° F)
Current Service				
MD-83	160,000	JT8D-219	10,100 ft.[1]	10,900 ft.[2]
737-700	154,500	CFM56-7	7,500 ft.[1]	7,800 ft.[2]
737-400	150,000	CFM56-3	10,700 ft.[1]	11,300 ft.[2]
717	121,000	BR715	10,200 ft.[1]	10,700 ft.[2]
CRJ-700	75,000	G.E. CF34-8C5	7,500 ft.[1]	7,800 ft.[2]
ERJ-145	53,131	AE 3007 A1E	7,900 ft.[1]	8,200 ft.[2]
CRJ-200	53,000	G.E. CF34-3B1	7,800 ft.[1]	8,600 ft.[2]
Dash 8-300	43,000	PW123	*	*
Potential Service				
737-300	270,000	PW2043	10,200 ft.[1]	10,800 ft.[2]
757-200	255,000	PW2040	9,200 ft.[1]	9,500 ft.[2]
737-800	174,200	CFM56-7	8,400 ft.[1]	9,400 ft.[2]
737-900	174,200	CFM56-7	8,800 ft.[1]	10,000 ft.[2]
A320/A321	171,960	CFM56	8,600 ft.[1]	8,800 ft.[2]
A319	166,448	CFM56	9,100 ft.[1]	9,200 ft.[2]
MD-87	160,000	JT8D-217C	9,700 ft.[1]	10,300 ft.[2]
MD-90	156,000	V2500-D5	8,500 ft.[1]	8,900 ft.[2]
MD-88	149,500	JT8D-217A	9,600 ft.[1]	9,900 ft.[2]
DC-9-50	121,000	JT8D-17	10,000 ft.[1]	12,000 ft.[2]
ERJ-195	115,280	CF34-10EA1	8,400 ft.[1]	9,300 ft.[2]
ERJ-190	114,199	CF34-10E5	8,900 ft.[1]	9,300 ft.[2]
CRJ-1000	91,800	CF34-8C5A1	8,000 ft.[3]	9,300 ft.[3]
ERJ-175	85,517	CF34-8E5	10,700 ft.[1]	11,600 ft.[2]
CRJ-900	84,500	CF34-8C5	7,900 ft.[1]	8,300 ft.[2]
ERJ-170	82,012	CF34-8E	6,400 ft.[1]	6,900 ft.[2]
ERJ-135	44,092	AE 3007 A3	7,100 ft.[1]	7,900 ft.[2]

Notes: * = Aircraft does not require more than 8,000 ft. of runway under any circumstances
[1] = ISA temperature 51.31°F (taken from manufacturers standard day chart plus 530 ft. for runway elevation difference)
[2] = Approx. Hot day distance (taken from manufacturers hot day chart plus 530 ft. for runway elevation difference)
[3] = Manufactures runway length charts not available, runway lengths approximated based upon S.L. ISA published lengths
Source: Aircraft Manufactures' Airport Planning Manuals

It should be noted that the runway length requirements listed are based on the MTOW of each aircraft which would apply primarily to those flying long-haul routes. As illustrated in the table, several aircraft currently operating or anticipated to operate at the Airport require more than 8,001 feet of runway at maximum takeoff weight. In order for these aircraft to operate from 8,001 feet of runway, concessions must be made to passenger, cargo, and/or fuel loads to reduce the runway length needed. Those payload reductions can ultimately impact the range aircraft can travel unrefueled from the Airport.

In an effort to evaluate the impacts the 8,001 feet runway has on range and passenger load capabilities of aircraft operating at the Airport, stage lengths and frequency of operations were examined by airline and equipment type. **Table 4-6** presents the number of departures per week by airline and equipment type as well as the distance in nautical miles each destination is away from the Airport.

Table 4-6: Airline Service by Aircraft Type & Destination

		Departures per Week													
		ATL	CLT	DFW	DTW	EWR	IAH	LGA	MCO	ORD	PHL	SFB	TPA	VPS	
		Nautical Miles from AVL													
Carrier	**Equipment**	**143**	**79**	**737**	**408**	**506**	**725**	**520**	**424**	**466**	**438**	**404**	**447**	**358**	**Total**
American Airlines	ERJ-145			7											7
Continental Airlines	ERJ-145					7	7								14
Delta Air Lines	CRJ200	65			8										73
Delta Air Lines	ERJ-145				12			7							19
AirTran Airways	B717								4				1		5
AirTran Airways	B737-700												3		3
Allegiant Air	MD-83											2			2
United Airlines	CRJ200									16					16
US Airways	CRJ700		27												27
US Airways	CRJ200		13					11			1				25
US Airways	Dash8-300		24												24
Vision Airlines	B737-400													2	2
		65	64	7	20	7	7	18	4	16	1	2	4	2	217

Source: FAA Flight Schedule Data System (FSDS)

As illustrated in the table, most of the departures per week are conducted by CRJ-200 aircraft that account for 114 of the 217 weekly departures at the Airport while ERJ-145, CRJ-700, and Dash 8-300 round out the remaining majority of the operations, respectively. Approximately 59 percent of departures are traveling within a 200 mile radius of the Airport to either Charlotte (CLT) or Atlanta (ATL) while an additional 23 percent of departures are to a destination within 500 miles of Asheville. Combined, 82 percent of departures per week are within a 500 mile radius of the Airport.

Table 4-7 illustrates the ranges of current and potential aircraft types at the Airport operating from an 8,001 feet runway at full passenger loads on a hot day with concessions made for fuel and cargo loads. As presented in the table, the 8,001 feet length of Runway 16/34 provides sufficient takeoff distance to meet the runway length requirements of current aircraft types and the destinations they serve with a full passenger load. The maximum range of anticipated aircraft types operating from an 8,001 feet runway with full passenger loads are also provided to indicate the markets that could be served by these equipment types at the Airport. With the exception of the DC-9-50, the range for existing and potential aircraft types with a full passenger load from the existing 8,001-foot runway is over 1,200 nautical miles, providing adequate range for the entire eastern U.S. and as far west as Denver and the Rocky Mountains.

Table 4-7: Maximum Aircraft Ranges From 8,001-Foot Runway at Full Passenger Loads

Current Service Aircraft Type	Current Destinations	Max. Distance (Nautical Miles)	Runway Length Required – Hot Day	Max range from current 8,001 ft. runway with full passenger load[1]
717	TPA, MCO	447	5,900 ft.	1,600 nm
737-400	VPS	358	5,400 ft.	1,600 nm
737-700	TPA	447	4,400 ft.	2,600 nm
CRJ-200	LGA, ORD, PHL, DTW, ATL, CLT	520	5,500 ft.	1,800 nm
CRJ-700	CLT	79	4,200 ft.	1,400 nm
Dash 8-300	CLT	79	*	*
ERJ-145	DFW, IAH, LGA, EWR, DTW	737	5,700 ft.	1,900 nm
MD-83	SFB	404	5,900 ft.	1,500 nm
Potential Service Aircraft Type				**Max range from current 8,001 ft. runway with full passenger load[1]**
757-300				2,000 nm[2]
757-200				2,600 nm[2]
737-800				2,600 nm
737-900				1,900 nm
A320				2,300 nm[2]
A319				2,600 nm[2]
MD-90				1,400 nm
MD-87				2,300 nm
MD-88				1,200 nm
DC-9-50				700 nm
ERJ-195				1,400 nm
ERJ-190				1,600 nm
CRJ-1000				n/a
ERJ-175				1,800 nm
CRJ-900				1,800 nm
ERJ-170				2,100 nm
ERJ-135				1,700 nm

Note: * = Aircraft does not require more than 8,000 ft. of runway under any circumstances
[1] = Concessions necessary in fuel and cargo loads
[2] = Range varies based on engine type; max range attainable from all available engine types listed

Source: Aircraft Manufacturers' Planning Manuals; Mead & Hunt, Inc.

The airport has occasionally received inquiries regarding non-stop west coast flights. As illustrated in **Figure 4-2**, potential far west markets include Denver at 1,084 nautical miles (NM), Los Angeles at 1,767 NM, San Francisco at 1,916 NM, and Seattle at 1,908 NM. The runway length required for stage lengths of 2,000 NM was assessed for each of the existing and potential service aircraft types. **Table 4-8** presents the runway length required for 2,000 NM range for each of these aircraft types. Note that some of the aircraft are not capable of a 2,000 NM range with a full passenger load, in these instances the runway length required to provide the maximum range with a full passenger load is noted.

Figure 4-2: Potential West Coast Non-Stop Markets

Source: Great Circle Mapper – copyright © Karl L. Swartz

Table 4-8: Runway Length Required for Non-stop West Coast Service

Current Service Aircraft Type	Range (NM)	Takeoff Weight Required for 2,000 NM Range (or Max Range)	Runway Length Required for 2,000 NM Range (or Max Range) - Hot Day (ft)
MD-83	2,000	158,000	11,000
737-700	2,000	146,000	6,900
737-400	2,000	142,000	9,200
717	2,000	121,000	10,600
CRJ-700	Max Range 1,700 NM[1]	75,000	7,800
CRJ-200	Max Range 1,775 NM[1]	53,000	8,600
ERJ-145	Max Range 1,900 NM[1]	53,000	8,200
Potential Service Aircraft Type			
757-300	2,000	255,000	9,000
757-200	2,000	222,000	6,700
737-900	2,000	172,000	9,800
737-800	2,000	166,000	8,300
A320	2,000	165,000	8,200
MD-90	Max Range 1,400 NM[1]	156,000	8,900
A319	2,000	154,000	7,400
MD-88	Max Range 1,500 NM[1]	149,500	9,800
MD-87	2,000	138,000	8,000
DC-9-50	Max Range 1,200 NM[1]	121,000	12,000
ERJ-195	Max Range 1,600 NM[1]	115,000	9,300
ERJ-190	2,000	111,000	8,900
CRJ-900	Max Range 1,800 NM[1]	84,500	8,300
ERJ-175	2,000	81,000	10,000
ERJ-170	2,000	81,000	6,700
ERJ-135	Max Range 1,700 NM[1]	44,000	7,900
CRJ-1000	n/a	n/a	n/a

Note: [1] = Maximum range with full passenger load, assuming 225 pounds per passenger & baggage
n/a = payload/range charts not available in aircraft manufactures' current airport planning manual

Source: Aircraft Manufacturers' Planning Manuals; Mead & Hunt, Inc.

As shown in **Table 4-8**, there are a number of aircraft types that would require additional runway length, above the 8,001 feet currently provided, to provide nonstop service to west coast markets (approximately 2,000 nautical miles), or to provide the aircraft's maximum range with a full passenger load.

The 8,001 feet length of Runway 16/34 appears adequate to meet the runway length requirements of existing and anticipated aircraft types throughout the planning period to operate at full passenger loads and serve current and the majority of likely markets, as far away as Denver. However, as noted, some equipment types and markets could require additional runway length for aircraft to operate with full passenger loads. As the Airport has had past inquiries regarding service to the west coast, it is recommended that alternatives be evaluated to extend the runway up to 10,000 feet, or to maximize the runway length between the major physical constraints of North Carolina Route 280 on the south and the French Broad River on the north. It is recommended the Airport continue to monitor the runway length needs of equipment types operated by airlines and the destinations they serve to ensure sufficient runway length is available for commercial aircraft.

4.2.d Runway Width

The width of a runway is determined based upon the ADG designation of the most demanding type of aircraft expected to conduct regular operations on the surface. According to FAA AC 150/5300-13, *Airport Design*, the required width of a runway for ADG III aircraft is 100 feet, unless the maximum certificated takeoff weight is greater than 150,000 pounds, upon which the width is 150 feet. Since Runway 16/34 is currently classified as an ADG III runway that receives regular operations for ARC Category C-III aircraft greater than 150,000 pounds such as the MD-83, MD-88 and Boeing 737-700, the existing runway width at 150 feet meets the current FAA design standard.

The future critical aircraft has been designated as the Boeing 757-200, which is an ARC C-IV aircraft. In accordance with FAA AC 150/5300-13, *Airport Design*, the recommended runway width for ARC C-IV design group is 150 feet. Therefore the existing runway width meets the recommended airfield design standard for the future critical aircraft.

Also, it is recommended in FAA AC 150/5300-13, *Airport Design*, that runways designed for operations from aircraft in ADG III and greater have paved shoulders; currently, Runway 16/34 does not have paved shoulders. The width of a paved shoulder is based upon the ARC of the critical design aircraft intended to operate on the surface. For ADG III aircraft with a MTOW greater than 150,000 pounds, the width of each shoulder should be 25 feet meeting requirements of the next highest ADG (design group IV). Since the recommended future critical aircraft type is in ADG IV and the current critical aircraft type is in ADG III and has a MTOW greater than 150,000 pounds, it is recommended the Airport plan for the inclusion of 25 feet width shoulders as a part of any future reconstruction or relocation of the runway. The inclusion of paved shoulders not only allows the runway to meet recommended design standards for ADG III and ADG IV aircraft, it also will help to provide resistance from blast erosion as a result of operations from larger aircraft types and help to support the passage of maintenance and emergency vehicles.

4.2.e Runway Pavement Strength

The pavement strength of Runway 16/34 is rated for aircraft weighing up to 120,000 pounds with single wheel main landing gear configurations, 160,000 pounds for aircraft with dual wheel main landing gear configurations, and 260,000 pounds for aircraft with dual tandem wheel main landing gear configurations. A review of the maximum gross weight and main landing gear configuration of the existing (Airbus A320), recommended (Boeing 737-700), and recommended ultimate (Boeing 757-200) critical aircraft types indicate the strength of the runway is sufficient to meet demand throughout the planning period. Though no changes are necessary to increase the strength of the runway, it is recommended that pavement be designed as a part of any future runway reconstruction or rehabilitation projects that is capable of retaining existing weight bearing capacities.

One method used in evaluating the strength and condition of pavement surfaces is the Pavement Condition Index (PCI), which is a subjective evaluation based on inspection, testing, and observation. The PCI system rates the condition of pavement using a score of 0 to 100 where 100 designates that the pavement is in excellent condition while scores of 10 or less are designated for those pavements that have failed. A pavement rehabilitation/reconstruction assessment conducted in 2008 by RS&H found the weighted PCI rating of Runway 16/34 to be 50, which is well below the minimum PCI of 70 recommended by industry experts for primary surfaces at airports. The assessment also forecasted the remaining useful life expectancy of the pavement. Assuming no major rehabilitation projects were completed to the runway, the average PCI was forecasted to decrease from 50 to 35 by 2013.

In an effort to provide a short term solution to extend the useful life of the runway and slow its further deterioration, a pavement rejuvenation project was completed in 2011 after the pavement assessment reference above was conducted. The pavement rejuvenation project included crack routing and sealing, application of a runway rejuvenator seal, and re-striping of the paved surfaces to extend its useful life for another five years. It is recommended a major rehabilitation or reconstruction of the runway occur in the immediate future to improve the condition of the pavement and increase its PCI rating to a satisfactory value of greater than 70.

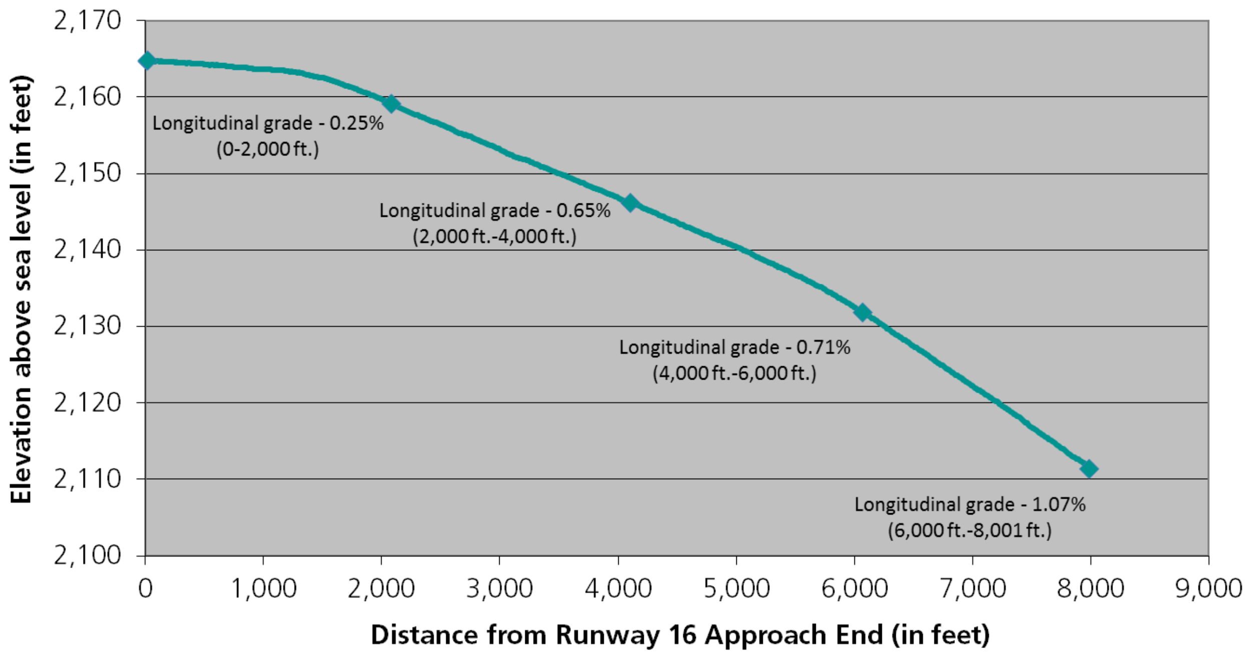
4.2.f Runway Grade

FAA Advisory Circular 150/5300-13, *Airport Design*, lists runway gradient design standards to ensure pilots and air traffic controllers are able to see at any one point that the surface is clear of aircraft, vehicles, wildlife, and other hazardous objects. The design standards for longitudinal and transverse runway gradients are based on the AAC of the critical design aircraft. For Category C and D aircraft, the maximum longitudinal grade is plus/minus 1.5 percent and may not exceed plus/minus 0.8 percent in the first and last quarter of the runway.

Runway 16/34's overall longitudinal grade of 1.075 percent meets FAA design standards; however, on the approach end of Runway 34 the longitudinal grade of the first quarter of the runway is greater than 0.8 percent due to the airfield topography. The significance of this grade change at the approach end of Runway 34 is such that aircraft positioned for takeoff cannot view the opposite end of the runway to visually confirm the surface is clear of aircraft and ground vehicles. This concern is particularly an issue during periods when the control tower is closed and pilots are responsible for determining the runway is clear for takeoff or landing through radio communication and visual means.

Figure 4-3 illustrates the longitudinal grade on each quarter of Runway 16/34 while **Table 4-9** lists the change in elevation for each quarter of the runway and its longitudinal grade.

Figure 4-3: Runway 16/34 Longitudinal Grade



Source: Woolpert, Inc.

Table 4-9: Runway 16/34 Longitudinal Slope by Quarter

Distance From Rwy 16 Approach End	Elevation (MSL)	Change in Elevation	Longitudinal Grade
0 ft.	2,164 ft.	-	-
2,000 ft.	2,159 ft.	5 ft.	0.25%
4,000 ft.	2,146 ft.	13 ft.	0.65%
6,000 ft.	2,132 ft.	14 ft.	0.71%
8,001 ft.	2,111 ft.	21 ft.	1.07%

Source: Woolpert, Inc.

As a result of this non-standard longitudinal grade in the last quarter of the runway, a modification of standards was approved by the FAA in 1978 for the first and last quarter of the runway (Aeronautical Study Number ATL-603-7268). It is recommended as a part of any future runway rehabilitation or reconstruction project that the variance of the longitudinal grade for the approach end of Runway 34 be corrected to comply with FAA airfield design standards. It has been brought to the attention of the Airport by the FAA that the modification of standards for the non-standard longitudinal grade will only be extended for a maximum of five years, requiring a solution to be developed to correct the variance.

4.2.g Taxiway System

Design standards for taxiways outlined in FAA AC 150/5300-13, *Airport Design*, are based upon a combination of wingspan and approach speed of the critical design aircraft intended to use the surface. While the dimensions of some standards such as a taxiway's width, safety area, and object free area, for example, are based upon the wingspan of the critical design aircraft, others such as a parallel taxiway's separation distance from the runway is based upon both wingspan and approach speed. The following section presents the facility needs that were identified for the taxiway system at the Airport:

Taxiway Designations – FAA AC 150/5340-18F, *Standards for Airport Sign Systems*, lists standards in naming taxiways and aprons at an airport. General guidelines that should be followed include keeping the naming designation simple and logical, using letters of the alphabet in sequential order from one end of the airport to the other (e.g. east to west or north to south), and using designations such as "A1", "A2", and "A3" for short taxiways that are parallel to a runway or a taxiway adjacent to a ramp area. A review of the naming convention of the existing taxiway system indicated that the Airport could benefit from a re-designation of taxiways as a part of any future planned airfield improvements. It is recommended that if a parallel taxiway is planned for the west side of the airfield it should be named "Taxiway B" to align with the naming of the existing parallel Taxiway A while the existing connector taxiways between Taxiway A and Runway 16/34 would be renamed "A1", "A2", "A3", etc. from south to north. Likewise, connector taxiways between Taxiway A and the aprons on the east side of the airfield should also then be renamed "C", "D", "E", etc. from south to north. A south to north naming convention would allow for the naming of future connector taxiways if they are constructed north of the North Apron for future aviation development areas to follow the same pattern. **Figure 4-4** illustrates the proposed renaming of all taxiways at the Airport.

Figure 4-4: Proposed Taxiway Designations

Note: Taxiway B would be reserved in the event a parallel taxiway is constructed on the west side of the airfield
Aerial Photo: Woolpert, Inc.

Taxiway A – A review of taxiway design standards is most critical for Taxiway A since it parallels Runway 16/34 and provides access to the runway for all aircraft. Since the current critical design aircraft for Runway 16/34 is the Boeing 737-700, the dimensions of Taxiway A design surfaces must meet standards for ARC Category C-III aircraft. The ultimate critical design aircraft has been identified as the Boeing 757 aircraft; therefore, the dimensions of the Taxiway A design surfaces must meet standards for ARC Category C-IV aircraft in the future.

AC 150/5300-13 states taxiways for ARC Category C-III aircraft should be 50 feet wide, have paved shoulders 20 feet in width, have a safety area width of 118 feet, and have an object free area width of 186 feet. While Taxiway A meets or exceeds the standards for taxiway width (75 feet), safety area width (118 feet), and object free area width (186 feet), it does not have paved shoulders which are required for taxiways that accommodate ADG III and higher aircraft to reduce the possibility of blast erosion and engine ingestion problems associated with jet engines that overhang the edge of the taxiway pavement.

It should be noted that the 75 feet width of Taxiway A meets the taxiway design standard for the next larger classification of aircraft in ADG IV and was widened from 50 feet to 75 feet in 1994 to accommodate Boeing 757 charter operations that were occurring at the time. It is recommended the Airport retain the existing width of the taxiway to accommodate the future critical aircraft which is ADG IV.

Changing the size of the critical design aircraft to ARC Category C-IV would require no improvements to the width of Taxiway A, as the taxiway is already 75 feet in width. A larger taxiway safety area and object free area would be needed to meet ARC Category C-IV standards. Taxiway safety areas are similar to runway safety areas in that they must be clear, graded, and capable of supporting under dry conditions snow removal equipment, firefighting apparatuses, and the occasional passes of an aircraft without causing structural damage. As a result of these requirements, taxiway safety areas must meet transverse grade standards identified in FAA AC 150/5300-13, *Airport Design*. It appears the width of the Taxiway A safety area does not meet grade requirements for ADG IV standards along the east side of the taxiway near the approach ends of Runway 16 and 34 as a result of the change in topography in these areas. Currently, the sharp change in topography in these areas lie outside the boundary of the taxiway safety area that meets ADG III standards; increasing the width of the taxiway safety area to meet ADG IV standards will require fill and grading of the land to meet transverse grade standards.

Standards for the taxiway object free area also identified in FAA AC 150/5300-13, *Airport Design*, states no objects may be present in this area except those required for aviation purposes that are below aircraft wing tip elevations. Taxiway object free areas designed for ARC Category C-IV aircraft must be 259 feet in width, or 129.5 feet from either side of the taxiway centerline. Review of potential objects that may need to be relocated if the taxiway object free area was increased to meet ARC Category C-IV standards indicate that a portion of the perimeter fence near the employee parking lot adjacent to the ASOS unit and the throat of the service road at the intersection of Taxiway D1 may need to be relocated.

Runway/Parallel Taxiway Separation – FAA AC 150/5300-13 lists separation distances between runways and parallel taxiways based on the different ARC categories of aircraft to satisfy the requirement that no part of an aircraft (tail tip, wing tip, etc.) on a taxiway is within the runway safety area or penetrates the obstacle free zone (OFZ). Runways for critical design aircraft in approach categories C and D with wingspans at least 79 feet but less than 118 feet and an approach visibility minimum lower than 3/4 statue mile are required to have a separation of 400 feet between the runway and parallel taxiway centerlines. This 400 feet of separation is also required for runways that serve ARC Category C-IV aircraft with approach visibility minimums lower than 3/4 statue mile. The existing separation between Runway 16/34 and Taxiway A is 325 feet, which is 75 feet less than the 400 feet design standard for surfaces intended for ARC Category C-III aircraft. As a result of this non-standard runway/taxiway separation, a modification of airport design standards was requested to the FAA and approved on August 16, 1978 (Aeronautical Study Number ATL-603-7268). Increased operations that are forecasted from larger ARC Category C-IV aircraft at the Airport raises the potential that a wing tip with one of these aircraft while on the taxiway will penetrate the runway safety area or obstacle free zone while another C-IV aircraft is operating on the runway.

It is recommended that the design of any future reconstruction of the runway or taxiway system increase the separation between Runway 16/34 and Taxiway A by 75 feet to a total distance of 400 feet between centerlines. This would allow the airfield to comply with FAA airport design standards and provide a sufficient safety margin between aircraft simultaneously operating on the taxiway and runway. Increasing the separation between the two surfaces would also satisfy design requirements for ARC Category C-III aircraft and larger ARC Category C-IV aircraft that are anticipated to increase in operations over the planning period.

Taxiway/Parallel Taxilane Separation – East of Taxiway A along the west edge of the terminal apron is a taxilane that parallels the taxiway. As with runways/parallel taxiways, separation standards identified in FAA AC 150/5300-13, *Airport Design*, that are based on the ARC of the critical design aircraft intended to use the surface help satisfy the requirement no part of an aircraft on the taxilane is within the safety area or penetrates the OFZ of the taxiway. Currently, the separation distance between Taxiway A and the parallel taxi lane along the west edge of the terminal ramp is currently 200 feet. FAA design standards require that the distance from a taxiway centerline to a parallel taxiway or taxi lane centerline be at least 1.2 times the critical aircraft wingspan plus 10 feet. This indicates that the current 200 feet separation is adequate for aircraft up to 158 feet wingspans, but not up to 171 feet as is categorized by ADG IV. However, it should be noted that the design standard does meet separation requirements for the future critical design aircraft (Boeing 757) which has a wingspan of up to 125 feet. Should the Airport receive operations from ADG IV aircraft with wingspans larger than 158 feet, consideration should be given to increase the separation between Taxiway A and the terminal apron taxilane, or operating procedures established to make certain that adequate wingtip clearances as provided between aircraft on these centerlines.

Taxiway R Manhole Cover – Located at the intersection of Taxiway R and Taxiway A within the taxiway fillet is a manhole cover. This structure is depressed compared to the grade of the surrounding pavement surface and may not be in compliance with the taxiway surface transverse grade limitations presented in FAA AC 150/5300-13, *Airport Design*. Though not identified by the FAA as a non-compliance issue, it is recommended as a part of any future runway or taxiway reconstruction/relocation project that a topography survey of the depression in comparison with the surrounding pavement surface grade be conducted to determine whether it is consistent with FAA design standards.

Taxiway P Transverse Grade – Operators of larger aircraft at the Airport will on occasion refuse to taxi on Taxiway P to enter or exit Runway 16/34 as a result of an inverted angled low elevation line that cuts across the taxiway. Though the transverse grade of the taxiway has not been identified by the FAA as a non-compliant issue, it is recommended a topography survey be conducted as a part of any future runway or taxiway reconstruction/relocation project to determine if the low elevation line meets gradient requirements identified in FAA AC 150/5300-13, *Airport Design*. Regardless of whether it complies with design standards, consideration should be given to correct the inverted low elevation portion of the pavement to provide a more level surface for taxiing aircraft entering or exiting Runway 16/34.

Taxiway H Width – Taxiway H is a connector taxiway used by aircraft to transition between the south apron and parallel Taxiway A. Often, larger aircraft that are being serviced by the FBO such as ADG III types including the Boeing 737 and Airbus A319 and ADG IV types including the Lockheed Martin C-130 and Boeing 757 are parked on the south apron, requiring them to taxi on Taxiway H. Likewise, the width of Taxiway H should meet design standards of ADG IV aircraft since these are the most demanding type parked on the south apron. Currently, Taxiway H is 50 feet wide; review of FAA design standards indicates that taxiways serving ADG IV aircraft should be 75 feet in width. Since other airfield design surfaces are recommended to meet ADG IV standards of the future critical design aircraft, the width of Taxiway H should also be increased. This would allow the taxiway to better accommodate larger charter and military aircraft such as the Boeing 757 and Lockheed Martin C-130 that are occasionally parked on the south apron when being serviced by the FBO. It should be noted that the width of adjacent Taxiway K which also provides access to the south apron would remain at 40 feet to discourage ADG III and IV aircraft from using this surface. This taxiway would instead be used by smaller single-, twin-engine, and jet aircraft to access the south apron so that adequate wingtip clearances can be maintained at the south end of the apron in the event this area is used for future development purposes, such as the construction of a new public safety building or expansion of the terminal apron.

North Apron/Mid Ramp Connector Taxiway Width – Review of the remaining connector taxiway widths between parallel Taxiway A and the north apron/mid ramp areas indicate their 35 feet width is consistent with design standards up to ADG II aircraft which includes most single-, twin-, and jet engine general aviation aircraft. Consideration should be given to increase the widths of those connector taxiways (Taxiways D1, D2, F, and G) that provide access to apron areas for ADG III general aviation aircraft which routinely conduct operations at the Airport such as the Bombardier Global Express and Boeing Business Jet. Increasing the width of the connector taxiways would result in a 15 foot expansion from 35 feet to 50 feet to meet ADG III standards. Future development of general aviation areas should also consider connector taxiways with widths that meet ADG III standards in order to provide sufficient lateral room for the wheelbases of the most common types of general aviation aircraft that conduct operations at the Airport in these areas.

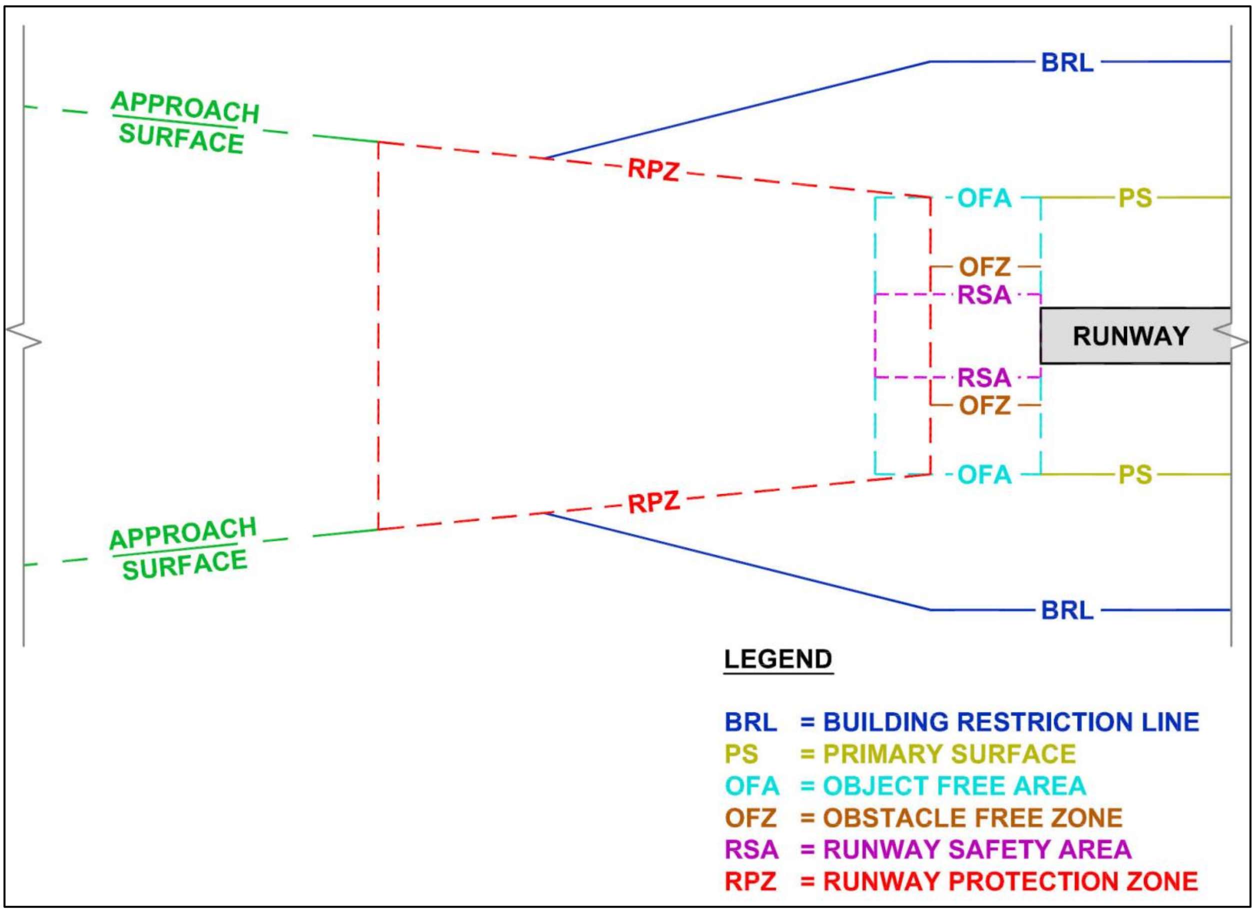
West Side Development Taxiways – While no additional improvements are necessary for the remainder of the taxiway system to meet existing demand, it should be noted that if future development occurs on the west side of the airfield an additional parallel taxiway and complementing connector taxiways may be required. Addition of these taxiways would minimize the need for aircraft to taxi across Runway 16/34 and increase the potential of a runway incursion. It is recommended that as a part of any future development planning on the west side of the airfield that the need for an additional parallel or connector taxiways be considered if aircraft activity levels result in frequent crossings of Runway 16/34..

4.2.h Airfield Safety Areas

This section presents FAA design standards for various airfield safety areas as they relate to Asheville Regional Airport. A visual depiction of various safety areas is shown in **Figure 4-5**. The following airfield safety areas are described in this section:

- Runway Safety Area (RSA)
- Runway Object Free Area (OFA)
- Obstacle Free Zone (OFZ)
  - Runway OFZ
  - Inner-Approach OFZ
  - Inner-Transitional OFZ
- Runway Protection Zone (RPZ)

Figure 4-5: Airfield Safety Areas



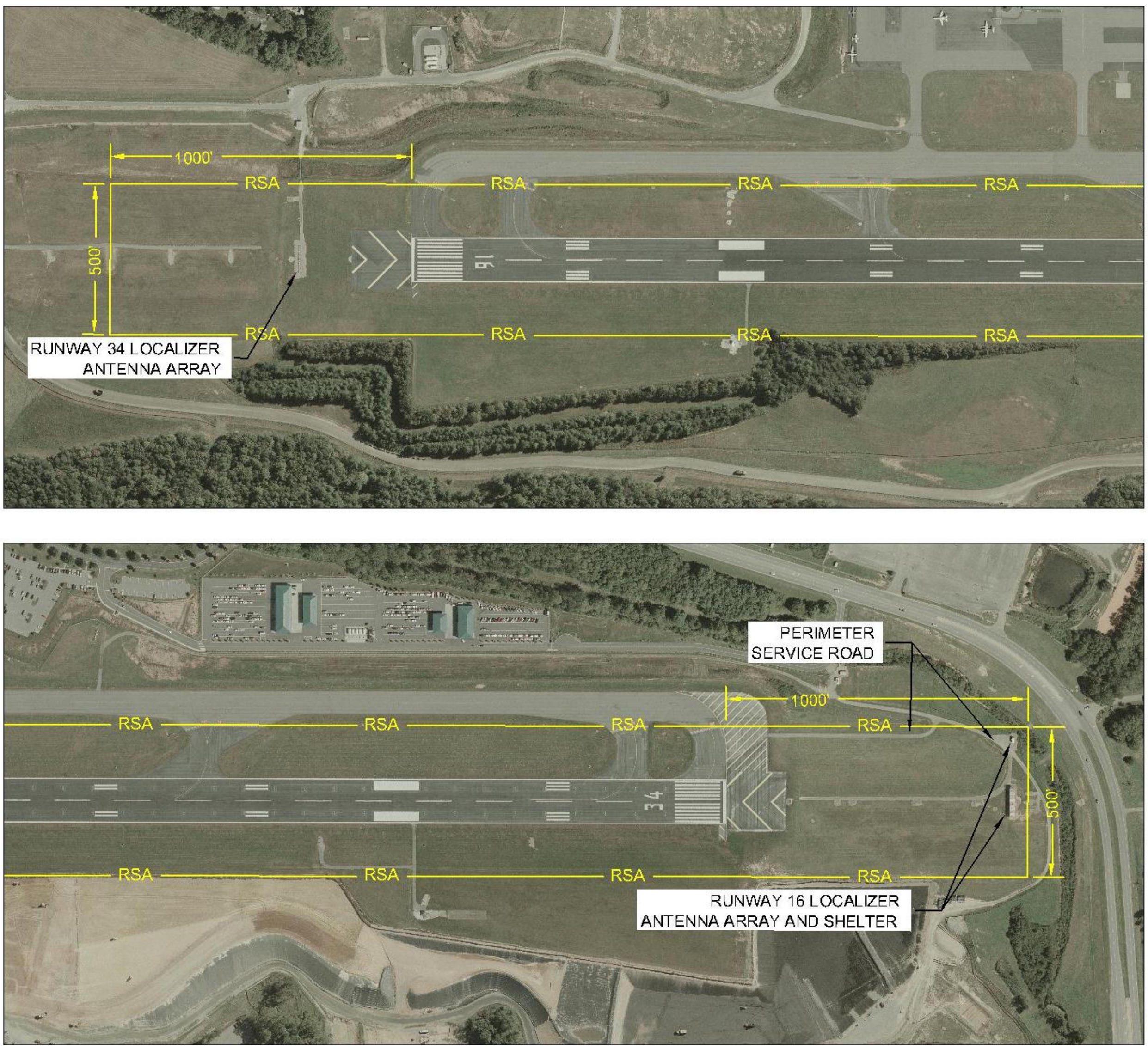
Source: Mead & Hunt, Inc.

Runway Safety Area – The Runway Safety Area (RSA) is a two-dimensional ground area that surrounds the runway. Based on FAA criteria, the RSA for Runway 16/34 should be 500 feet wide centered on the centerline and extend 1,000 feet beyond each runway end. The FAA mandates that the RSA be:

- Cleared, graded, and free of potential hazardous surface variations and be properly drained.
- Capable of supporting snow removal equipment (SRE), aircraft rescue and firefighting (ARFF) equipment, and aircraft (without causing damage to the aircraft).
- Free of objects except those mounted on low-impact resistant supports whose location is fixed by function.

Figure 4-6 depicts the RSA off each end of the runway at Asheville Regional Airport.

Figure 4-6: Runway Safety Area



Source: Mead & Hunt, Inc.

Localizer antennas are generally placed on a runway centerline off the end of a runway, however they can be located far enough from a runway end to place them outside the RSA, therefore they are generally not considered fixed by function. The Airport's RSA currently has the following objects within it which are not fixed by function:

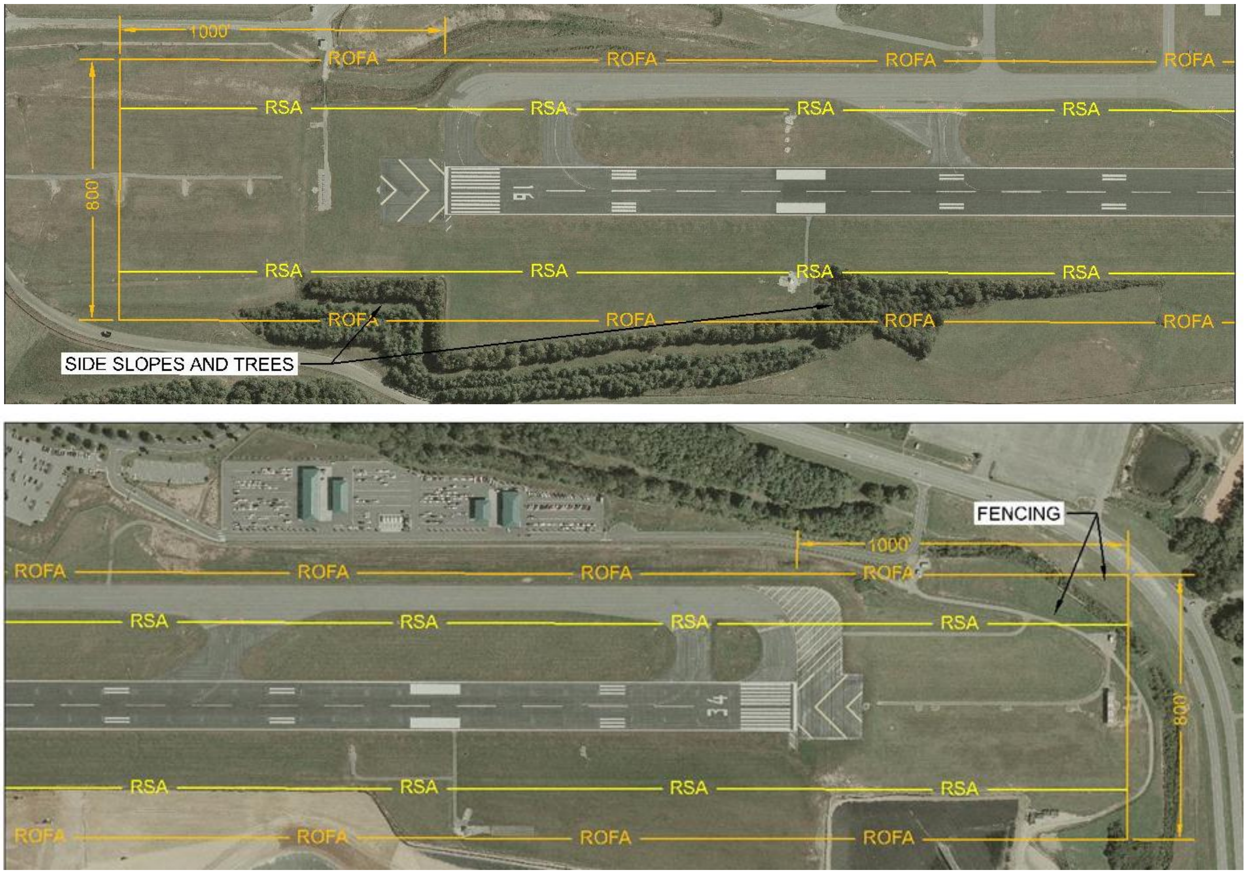
- Runway 34 localizer antenna array (FAA owned)
- Runway 16 localizer antenna array and equipment shelter building (FAA owned)
- Perimeter service road

Though the perimeter service road lies below the elevation of the runway, it is still non-compliant since the RSA must be free of objects at its surface elevation except those required because of their function. It should also be noted that the runway approach lighting systems installed for Runway 16 and Runway 34, which are owned by the FAA and not the Airport, do not meet all current FAA frangibility requirements and are therefore non-compliant within the RSA. All of the remaining items within the RSA such as the Runway 34 VASI and Runway 16 PAPI that are considered fixed by function are mounted on frangible bases and meet RSA requirements. It is recommended as a part of any future runway reconstruction or safety area improvement project that the relocation of the objects not fixed by function within the RSA be considered while those fixed by function meet all frangibility requirements. It should be noted that it will be the responsibility of the FAA and not the Airport to relocate these non-compliant objects.

In addition, it also appears a portion of the perimeter fencing and drainage ditch along North Carolina Route 280 may encroach upon the southeast corner of the RSA. It is recommended as a part of any future runway reconstruction or relocation project that the locations of these objects are surveyed to determine if they encroach upon the RSA. If it is found these objects penetrate the RSA, removal or relocation of the fence and drainage ditch may be required as a part of any future airfield development project. While solutions to relocate these potentially non-compliant objects are discussed and evaluated in the alternatives analysis chapter, one noteworthy option may be to pipe the ditch in an effort to set back the perimeter fencing from the corner of the RSA.

Runway Object Free Area – The Runway Object Free Area (ROFA) is a two-dimensional ground area centered on the runway. FAA standards prohibit parked aircraft and all above-ground objects protruding above the edge of the Runway Safety Area edge elevation, except objects for air navigation or aircraft ground maneuvering purposes. The length and width of the ROFA are determined by the type of aircraft that are anticipated to use the runway. Dimensions are based on aircraft approach categories and approach visibility minimums. Based on FAA criteria, the ROFA for Runway 16/34 should be 800 feet wide centered on the centerline and extend 1,000 feet beyond each runway end. **Figure 4-7** depicts the Runway Object Free Area at the approach ends of Runway 16 and Runway 34.

Figure 4-7: Runway Object Free Area – Runway 16 & Runway 34



Source: Mead & Hunt, Inc.

In the Runway 34 approach area, there are two areas of fencing within the ROFA that extend up above the elevation of the edge of the runway safety area. The noncompliant fencing within the ROFA should be evaluated for removal along with any RSA improvement alternatives evaluated. Along the west side of the runway near the end of Runway 16 , part of the sides within the ROFA slope away from the edge of the runway safety area and have trees on them.. Many of these trees are below the elevation of the runway safety area edge; however the 2010 ALP does note a FAR Part 77 primary surface penetration by a tree near the Runway 16 Glide Slope Antenna. Any trees extending up above the edge of the runway safety area elevation are in the ROFA and should be trimmed or removed. These areas should continue to be monitored by the airport to keep the vegetation cut to keep them from protruding up into the ROFA.

Obstacle Free Zone – The Obstacle Free Zone (OFZ) is a three-dimensional segment of airspace. OFZ clearing standards prohibit taxiing and parked aircraft and object penetrations, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function. The OFZ is comprised of the runway OFZ, the inner approach OFZ, and the inner-transitional OFZ.

The FAA design standards for the Obstacle Free Zone are as follows:

- The Runway OFZ is a volume of airspace above the runway centerline. It extends 200 feet beyond each end of the runway and is 400 feet wide for runways that serve large aircraft over 12,500 pounds such as Runway 16/34 at Asheville Regional Airport.

- The Inner-approach OFZ overlies the approach area and applies to runways with an approach lighting system, both Runway ends at AVL have an approach lighting system and therefore both have an inner-approach OFZ. The inner-approach OFZ begins 200 feet from runway threshold and extends 200 feet beyond the last unit in the approach lighting system. Its width is the same as the Runway OFZ and it rises at a slope of 50 (horizontal) to 1 (vertical) from its beginning.

- The Inner-transitional OFZ is a defined volume of airspace along the sides of the Runway OFZ and Inner-approach OFZ. For CAT I runways such as Runway 16/34 at AVL, it rises vertically for a height of "H", and then slopes 6 (horizontal) to 1 (vertical) out to height of 150 feet above the established airport elevation. The height "H" is defined in a formula by the FAA dependent upon the runway threshold elevation (E) and the wingspan of the most demanding airplanes using the runway (S). The Runway 16 threshold elevation is 2164.7 and is greater than the Runway 34 elevation. The ultimate design aircraft are anticipated to be from ARC Category C-IV, which have wingspans up to 171 feet. Therefore the height is defined by the FAA as follows:

$$H = 61 – 0.094(S) – 0.003(E)$$
$$H = 61 – 0.094(171) – 0.003(2164.7)$$
$$H = 38.4 \text{ feet}$$

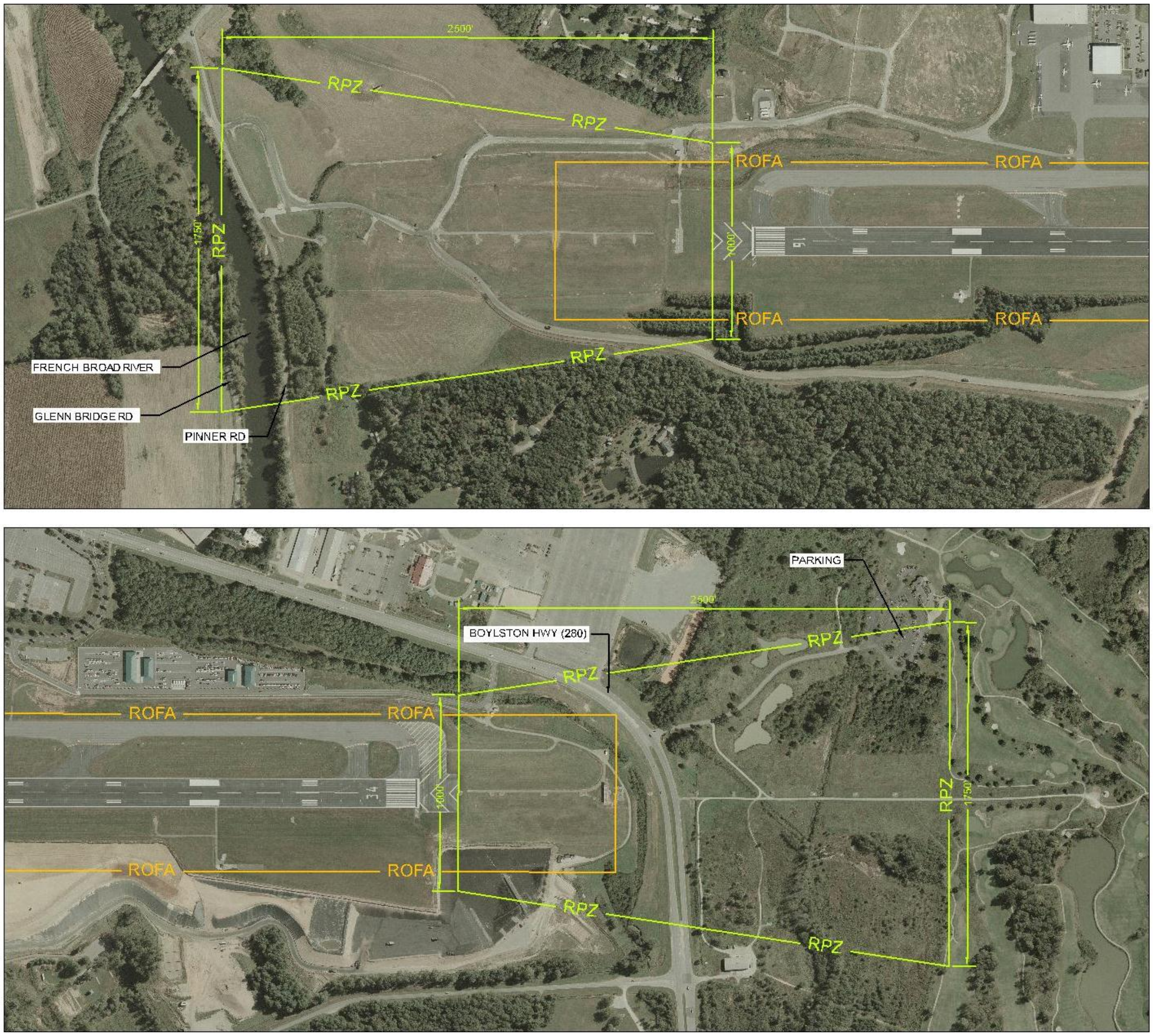
According to the existing Airport Layout Plan (ALP), the OFZ is compliant with FAA standards and no object penetrations exist.

Runway Protection Zone – The function of the Runway Protection Zone (RPZ) is to enhance the protection of people and property on the ground. This is achieved through airport owner control over RPZ's, to clear the RPZ of any incompatible land uses. While it is desirable to clear all objects from the RPZ, some uses are permitted, provided they do not attract wildlife, are outside the Runway OFA, and do not interfere with NAVAIDs. Land uses prohibited from the RPZ are residences and places of assembly (churches, schools, hospitals, office buildings, etc.).

The RPZ is trapezoidal in shape and centered about the extended runway centerline in the approach/departure area for each runway. The RPZ begins 200 feet past the end of the runway pavement useable for takeoff or landing. RPZ length and width dimensions are contingent on the type of aircraft that operate at a particular airport. Generally, as aircraft size increases and the type of approach becomes more precise, the dimensions of the RPZ increase. As both ends of Runway 16/34 have precision approaches, the dimensions of the RPZs on each end are the same. They have an inner width of 1,000 feet, an outer width of 1,750 feet, and a length of 2,500 feet.

Figure 4-8 depicts the Runway Protection Zone at either end of Runway 16/34.

Figure 4-8: Runway 16 Runway Protection Zone



Source: Mead & Hunt, Inc.

There are some public roadways, the French Broad River, and a public parking lot within the RPZs of the runway; however, all of these are below the runway elevation and none have a substantial adverse effect on the Airport, nor do the RPZs include land uses that are residential or places of assembly. Therefore the RPZs are compliant with FAA design standards.

4.2.i FAR Part 77 Surfaces

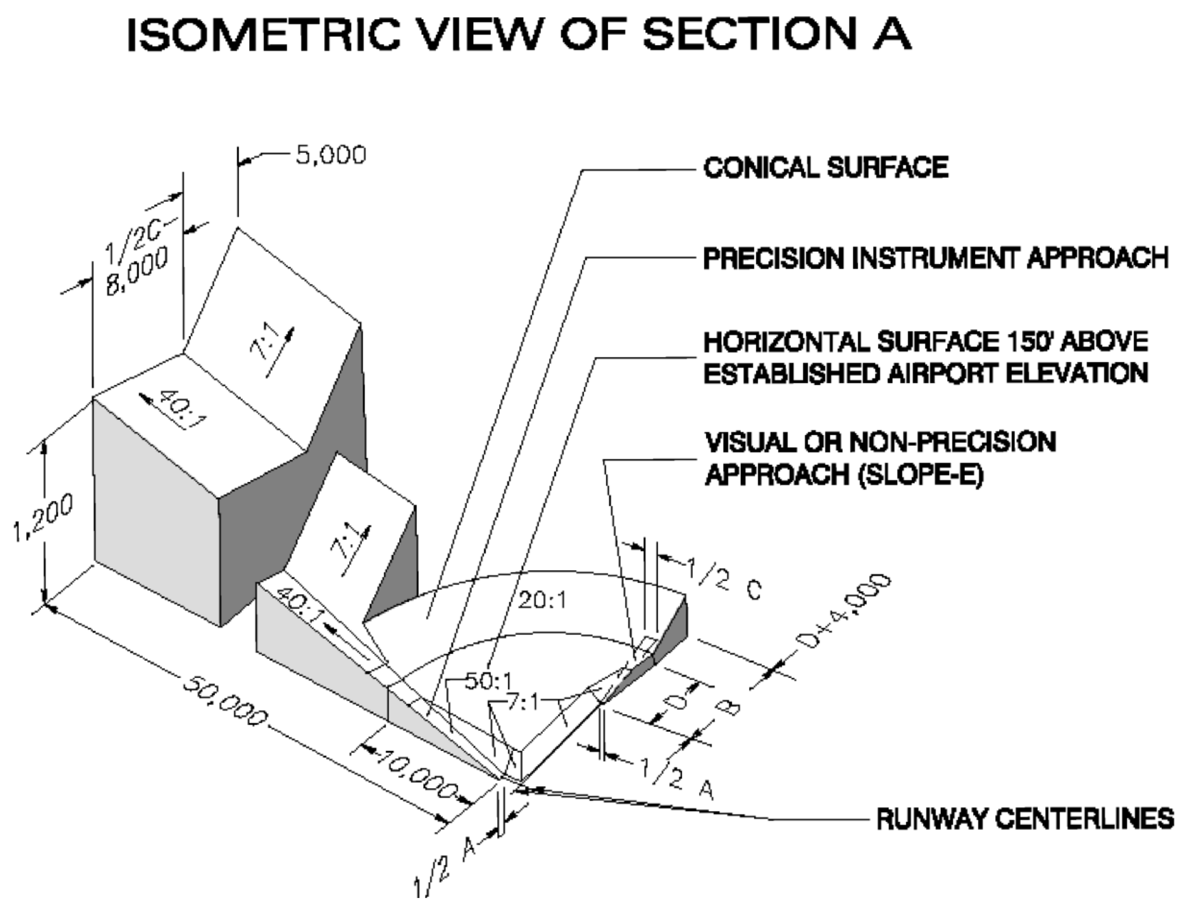
Federal Aviation Regulation (FAR) Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, establishes standards that determine potential obstructions to air navigation. FAR Part 77, Subpart C, Section 77.19, *Civil Airport Imaginary Surfaces*, defines a set of “imaginary surfaces” that surround an airport. Objects affected include existing or proposed objects, natural growth, terrain, or permanent and temporary construction.

The “imaginary surfaces” defined in FAR Part 77 include:

- Primary Surface
- Transitional Surface
- Horizontal Surface
- Conical Surface
- Approach Surface

A graphical depiction of FAR Part 77 surfaces is shown in **Figure 4-9**.

Figure 4-9: FAR Part 77 Standards



Source: Mead & Hunt, Inc.

FAR Part 77 civil airport imaginary surfaces are established with relation to the airport and to each runway. The size of each such imaginary surface is based on the category of each runway according to the type of approach available or planned for that runway. The slope and dimensions of the approach surface applied to each end of a runway are determined by the most precise approach existing or planned for that runway end.

Horizontal Surface – The horizontal surface is a plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway of each airport and connecting the adjacent arcs by lines tangent to those arcs. The radius of each arc is based upon the designation of the runway. At the Airport the radii of the horizontal surface is 10,000 feet, meeting criteria set forth in FAR Part 77.

Conical Surface – The conical surface extends outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

Primary Surface – The primary surface is centered longitudinally on a runway, extending 200 feet beyond the end of each runway that has a specially prepared hard surface; when the runway has no specially prepared hard surface, or planned hard surface, the primary surface ends at each end of that runway. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. The width of a primary surface is based upon the designation of the runway and type of approach. The primary surface at the Airport is 1,000 feet in width meeting requirements for precision instrument runways and extends 200 feet beyond the threshold of each end of the runway.

Approach Surface – The approach surface is centered longitudinally on the extended runway centerline and extends outward and upward from each end of the primary surface. An approach surface is applied to each end of the runway based upon the type of existing or planned approach for that runway end. The inner edge of the approach surface is the same width as the primary surface and expands uniformly to a width based on the designation and type of approach to that runway. As such, the inner edge of the approach surface to each end of Runway 16/34 is 1,000 feet and expands to a width of 16,000 feet, meeting criteria for precision instrument runways. The slope and horizontal distance of the approach surface is also based on the designation of the runway and type of approach; for Runway 16/34, the approach surface extends upward at a slope of 50:1 for a distance of 10,000 feet and then extends upward at a slope of 40:1 for an additional distance of 40,000 feet.

Transitional Surface – Transitional surfaces extend outward and upward at right angles from the extended runway centerline at a slope of 7 to 1 from the sides of the primary surface and approach surface. Transitional surfaces for those portions of the precision approach surfaces which project through and beyond the limits of the conical surface extend a distance of 5,000 feet measured horizontally from the edge of the approach surface and at right angles to the runway centerline.

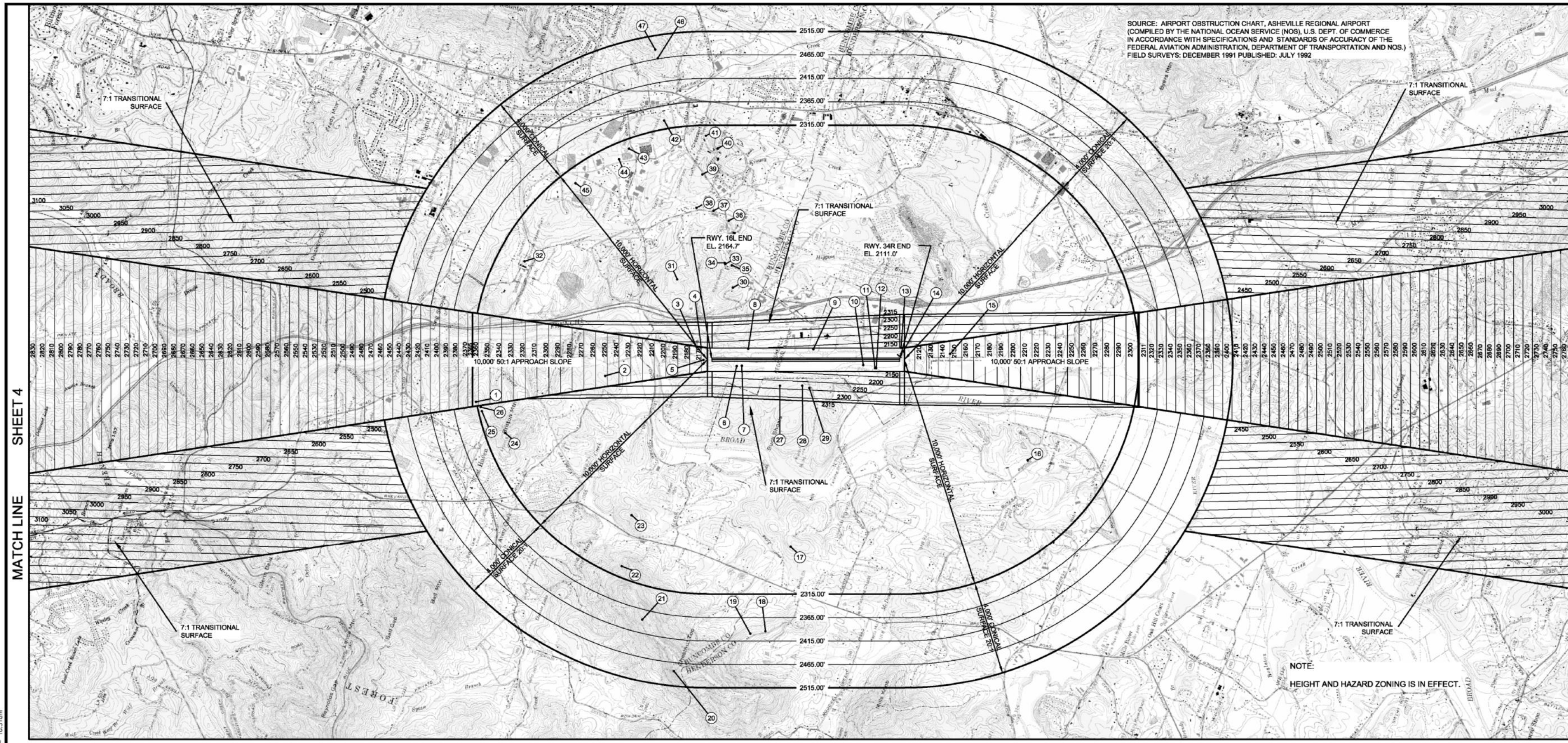
Any penetrations of the FAR Part 77 surfaces are considered obstructions and are presumed hazards to air navigation unless further aeronautical study concludes that the object is not a hazard. Once a further aeronautical study has been initiated, the FAA will use the standards in FAR Part 77, along with FAA policy and guidance material, to determine if the object is a hazard to air navigation. It should be noted that there is no specific authorization in any statute that permits the FAA to limit structure heights or determines which structures should be lighted or marked. In every aeronautical study determination, the FAA acknowledges that state or local officials have control over the appropriate use of property beneath an airport's airspace. Further evaluation of the height and hazard zoning in proximity of the Airport is discussed in the Environmental Overview chapter of this master plan.

Similar to RPZs, dimensions of FAR Part 77 surfaces vary by the type of runway approach. All runways at Asheville Regional Airport are designed for precision approaches. **Figure 4-10** and **Figure 4-11** depicts the Airport's Airport Airspace plan from the June 2010 Airport Layout Plan Update. This includes the FAR Part 77 surfaces and a schedule of obstructions. Additional obstruction evaluation will be done as part of an ALP update towards the conclusion of this master plan project; the obstructions identified on the 2010 ALP will be updated and any additional obstructions will also be identified and evaluated.

The Airport is responsible for protecting their FAR Part 77 surfaces to avoid the introductions of obstructions into their airspace. FAR Part 77 obstructions identified on the airspace plan such as the number of trees noted for trimming should be removed or pruned below the airspace surfaces if possible. Those obstructions that are fixed by function, or are unable to be removed should be identified with an obstruction light if possible.

There may be instances where nearby airports or surrounding airspace restrictions are more controlling factors in the protection of airspace than the FAR Part 77 surfaces of the Airport. In considering this, it is important to note the FAR Part 77 surfaces of the Asheville Regional Airport overlap the FAR Part 77 surfaces associated with the Hendersonville-Winkler Airport located approximately ten miles to the southeast. Though the location of the Hendersonville-Winkler Airport lies outside the boundary of all FAR Part 77 at the Asheville Regional Airport, the horizontal, approach, and conical surfaces appear to overlap the approach surface associated with Runway 34 at the Hendersonville-Winkler Airport. Typically in situations where FAR Part 77 surfaces overlap, each airport is responsible for protecting their own airspace needs. While addressing the overlap in FAR Part 77 surfaces is not required as a part of this master plan nor is it required to be identified in the airspace plan drawing of the ALP, it is encouraged the Airport inform others of this circumstance as a courtesy when engaging in airspace protection discussions.

Figure 4-10: Airport Airspace Plan



PART 77 OBSTRUCTIONS

NO.	OBJECT	TOP ELEV. (MSL)	PART 77 CLEAR (FT.)	PART 77 VIOLATION (FT.)	PART 77 SURFACE PENETRATED	ACTION TO BE TAKEN
1	TREE	2387		25.0	APPROACH SURFACE	TRIM TREE
2	TREE	2248	3.50		APPROACH SURFACE	N/A
3	TREE	OBSTRUCTION HAS BEEN CLEARED				
4	TREE	OBSTRUCTION HAS BEEN CLEARED				
5	OL ON LOCALIZER	2168	0.10		APPROACH SURFACE	N/A
6	ROD ON OL GLIDE SLOPE	2192		29.6	PRIMARY SURFACE	NONE – FIXED BY FUNCTION
7	TREE	2176		14.1	PRIMARY SURFACE	TRIM TREE
8	BUILDING	2164		2.80	PRIMARY SURFACE	NONE – FIXED BY FUNCTION
9	OL ON WINDSOCK	2174		29.2	PRIMARY SURFACE	NONE – FIXED BY FUNCTION
10	ROD ON OL TRANSMISSOMETER	2138		11.2	PRIMARY SURFACE	NONE – FIXED BY FUNCTION
11	ROD ON OL TRANSMISSOMETER	2138		15.7	PRIMARY SURFACE	NONE – FIXED BY FUNCTION
12	ROD ON OL GLIDE SLOPE	2146		24.2	PRIMARY SURFACE	NONE – FIXED BY FUNCTION
13	TREE	OBSTRUCTION HAS BEEN CLEARED				
14	RADAR REFLECTOR	2113		2.00	PRIMARY SURFACE	NONE – FIXED BY FUNCTION
15	TREE	2145	4.90		APPROACH SURFACE	N/A
16	ANTENNA ON OL POLE	2324		9	HORIZONTAL SURFACE	NONE – FIXED BY FUNCTION
17	TREE	2315		0	HORIZONTAL SURFACE	TRIM TREE
18	TERRAIN VIOLATION	2450		100	CONICAL SURFACE	NO ACTION (LIGHT IF POSSIBLE)
19	TREE	2443		88	CONICAL SURFACE	TRIM TREE
20	TERRAIN VIOLATION	3137		697	CONICAL SURFACE	NO ACTION (LIGHT IF POSSIBLE)
21	TERRAIN VIOLATION	2953		609	CONICAL SURFACE	NO ACTION (LIGHT IF POSSIBLE)
22	TREE	2450		135	HORIZONTAL SURFACE	TRIM TREE
23	TREE	2370		55	HORIZONTAL SURFACE	TRIM TREE
24	TERRAIN VIOLATION	2610		295	HORIZONTAL SURFACE	NO ACTION (LIGHT IF POSSIBLE)
25	TREE	2434		119	HORIZONTAL SURFACE	TRIM TREE
26	TREE	2422		107	HORIZONTAL SURFACE	TRIM TREE
27	TREE	2264		139	TRANSITIONAL SURFACE	TRIM TREE
28	TREE	2291		166	TRANSITIONAL SURFACE	TRIM TREE
29	ANTENNA ON OL POLE	2358		218	TRANSITIONAL SURFACE	NONE – FIXED BY FUNCTION
30	TREE	2336		21	HORIZONTAL SURFACE	TRIM TREE
31	TREE	2327		12	HORIZONTAL SURFACE	TRIM TREE
32	ROD ON OL STACK	2567		252	HORIZONTAL SURFACE	NONE – FIXED BY FUNCTION
33	ANTENNA ON OL RTR TOWER	2423		108	HORIZONTAL SURFACE	NONE – FIXED BY FUNCTION
34	ANTENNA ON OL POLE	2486		171	HORIZONTAL SURFACE	NONE – FIXED BY FUNCTION
35	TERRAIN VIOLATION	2404		89	HORIZONTAL SURFACE	NO ACTION (LIGHT IF POSSIBLE)
36	TREE	2413		98	HORIZONTAL SURFACE	TRIM TREE
37	BUILDING	2379		64	HORIZONTAL SURFACE	REMOVE OR LIGHT
38	TREE	2333		18	HORIZONTAL SURFACE	TRIM TREE
39	TREE	2372		57	HORIZONTAL SURFACE	TRIM TREE
40	TERRAIN VIOLATION	2484		169	HORIZONTAL SURFACE	NO ACTION (LIGHT IF POSSIBLE)
41	TERRAIN VIOLATION	2555		240	HORIZONTAL SURFACE	NO ACTION (LIGHT IF POSSIBLE)
42	TREE	2366		51	HORIZONTAL SURFACE	TRIM TREE
43	TREE	2355		40	HORIZONTAL SURFACE	TRIM TREE
44	TREE	2357		42	HORIZONTAL SURFACE	TRIM TREE
45	TREE	2332		17	HORIZONTAL SURFACE	TRIM TREE
46	TREE	2495		34	CONICAL SURFACE	TRIM TREE
47	TREE	2539		58	CONICAL SURFACE	TRIM TREE

REVISIONS	
DATE	DESCRIPTION

SPONSOR: Asheville Regional Airport – Asheville Regional Airport Authority

PROJECT: AIRPORT LAYOUT PLAN UPDATE

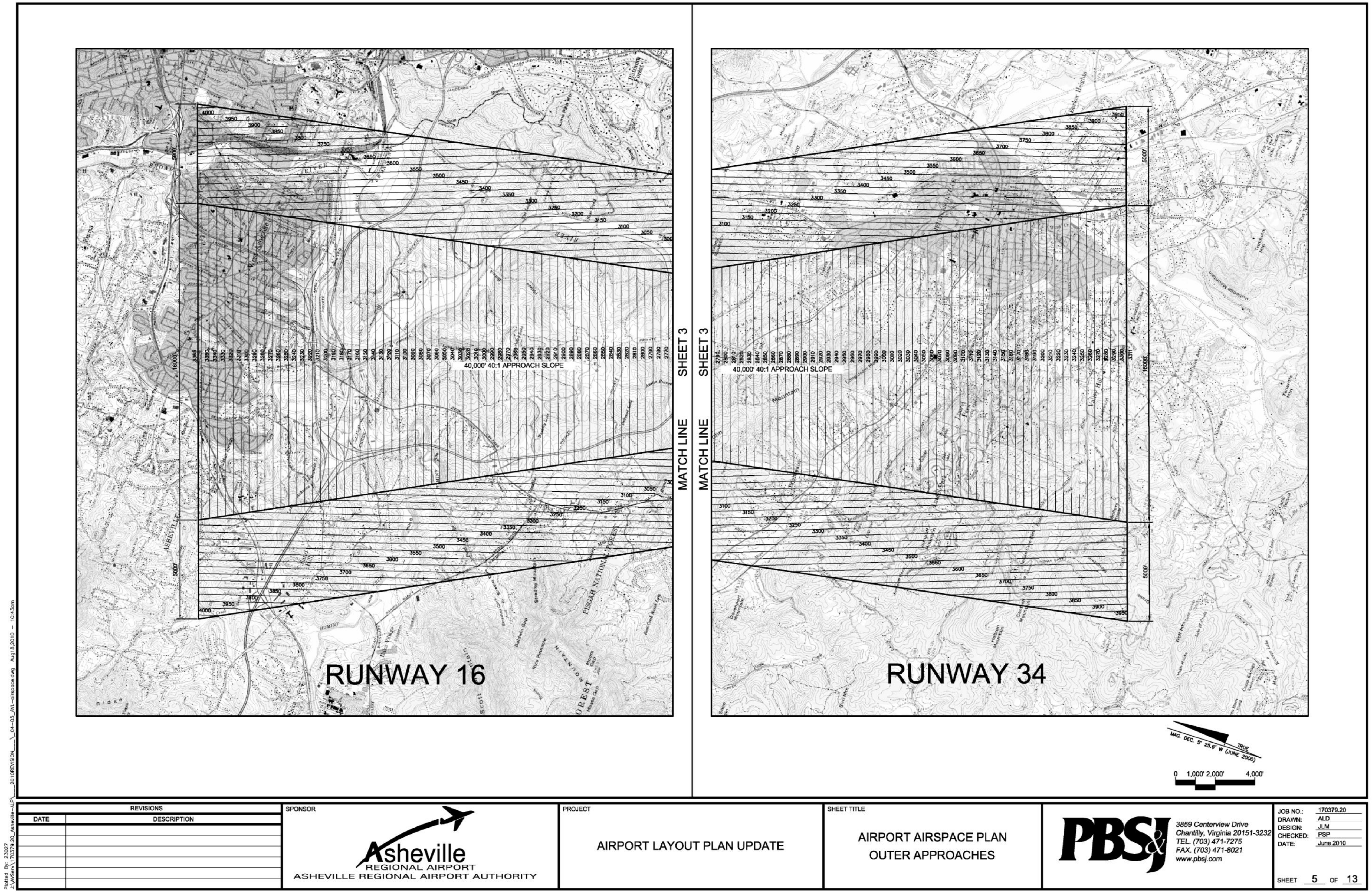
SHEET TITLE: AIRPORT AIRSPACE PLAN FULL

PBS&J, 3859 Centerview Drive, Chantilly, Virginia 20151-3232, TEL. (703) 471-7275, FAX. (703) 471-8021, www.pbsj.com

JOB NO.: 170379.20
DRAWN: ALD
DESIGN: JLM
CHECKED: PSP
DATE: June 2010
SHEET 4 OF 13

Source: 2010 Airport Layout Plan

Figure 4-11: Airport Airspace Plan (Continued)



Source: 2010 Airport Layout Plan

4.2.j Navigational Aids (NAVAIDs) and Weather Reporting Equipment

Navigational Aids (NAVAIDs) provide guidance for pilots during flight preparation and operation. Several factors such as the type, mission, and volume of aviation activity, as well as local meteorological conditions and types of established instrument approach procedures dictate the appropriate navigational aids (NAVAIDs) that should be installed at an airport. AC 150/5300-13, *Airport Design*; AC 150/5340-30F, *Design and Installation Details for Airport Visual Aids*; Order 7031.2C, *Airway Planning Standard Number One – Terminal Air Navigation Facilities and Air Traffic Control Services*; FAR Part 139; and the Aeronautical Information Manual (AIM) offer guidance on the appropriate visual and electronic NAVAIDs that should be present at an airport given FAA policy and other criteria considerations. A review was conducted of each NAVAID presented in Chapter 3 to determine if any improvements to existing equipment or installation of additional NAVAIDs are necessary to meet anticipated demand. **Table 4-10** lists the existing and proposed NAVAIDs for Runway 16/34.

Table 4-10: Existing & Proposed Runway 16/34 NAVAIDs

Runway	ILS	Cat II/III	RNAV/ GPS	MALSR	ALSF	VASI	PAPI	HIRL	RCL	TDZ
16	E	P	E	E	P	-	E	E	E	P
34	E	P	E	E	P	E	P	E	E	E

Notes: E – Existing; P – Planned; ILS – Instrument Landing System (precision approach);
CAT II/III – Precision approach with Category II/III minimums; RNAV/GPS – Area Navigation / Global Positioning System
MALSR – Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights;
ALSF – High Intensity Approach Lighting System with Sequenced Flashing Lights;
VASI – Visual Approach Slope Indicator; PAPI – Precision Approach Path Indicator; HIRL – High Intensity Runway Lights
RCL – Runway Centerline Lights; TDZ – Runway Touchdown Zone Lights

Source: Mead & Hunt, Inc.

NAVAIDs will be discussed in three categorizations: Terminal Area NAVAIDs, Electronic Approach NAVAIDs, and Visual NAVAIDs.

Terminal Area NAVAIDs - Terminal area NAVAIDs provide positive control of aircraft and help maintain orderly flow of air traffic within a specified area. Terminal area NAVAIDs assist to prevent collisions between aircraft during landing and take-off sequence, as well as to support sufficient maneuvering. Terminal area NAVAIDs at the Asheville Regional Airport includes the Airport Traffic Control Tower (ATCT), Asheville Terminal Radar Approach Control Facilities (TRACON), Atlanta Air Route Traffic Control Center (ARTCC), and the Airport Surveillance Radar (ASR).

The ATCT is operated by the FAA and occupies the third floor of the passenger terminal building. The facility operates from 6:30 a.m. to 11:00 p.m. The Asheville Approach Control is responsible for assisting both arrivals to and departures from the Airport. En route control for aircraft to and from the Airport is initially provided by the Atlanta ARTCC; control is transferred as aircraft approach Asheville Regional Airport.

The existing tower on the third floor of the passenger terminal building is quite old and nearing the end of its useful life. Typically, the FAA recommends an area of approximately seven acres for an ATCT and associated facilities such as automobile parking. Potential locations and evaluation regarding the relocation of the ATCT will be addressed in Chapter 5.

The Airport is also equipped with an Airport Surveillance Radar (ASR) that is located off Wright Brothers Way just north of the T-hangar structures on the middle ramp. The ASR antenna scans 360 degrees to provide the airport traffic controller with location information on aircraft within line of sight and in range. This equipment offers the Airport the ability to more precisely handle aircraft within the immediate vicinity of the Airport.

Electronic Approach NAVAIDs - Electronic Approach NAVAIDs assist aircraft during instrument approach procedures. An instrument approach procedure consists of a series of predetermined maneuvers that allows orderly transfer of an aircraft during instrument flight conditions to a point where a visual landing may be made.

The availability of instrument approach procedures permits aircraft landings during periods of limited visibility. The extent to which approach minimums, with respect to ceiling and visibility, can be lowered depends on available instruments to develop an approach procedure and on obstructions within the runway approach and in missed approach areas. Instrument approaches may be restricted to particular aircraft models or to certain flight crews that are certified to conduct such a procedure with the appropriate equipment.

Precision instrument approaches that can be flown with the lowest visibility and cloud ceiling height minima are categorized by these two criteria. **Table 4-11** presents the decision height and visibility criteria for each category of precision instrument approach.

Table 4-11: Precision Instrument Approach Categories and Criteria

Approach Category	Decision Height	Visibility
I (w/ MALSR)	200 feet	½ mile or 2,400 ft.
I (w/ centerline & TDZ lights and Runway Visual Range (RVR) Equipment)	200 feet	1,800 ft.
II	100 feet	1,200 ft.
IIIA	*	700 ft.
IIIB	*	150 ft.
IIIC	*	**

Notes:
* = Decision height not specified, only visibility limits apply
** = Aircraft must have auto land capability and a qualified pilot
Source: FAA AC 150/5300-13, *Airport Design*

The Airport is equipped with a Category I Instrument Landing System (ILS) on the approaches to Runway 16 and 34 that appears adequate to meet existing demand. However, as illustrated in **Table 4-12**, 2.27 percent of the time weather conditions exceed visibility and cloud ceiling height minimums that prevent aircraft from conducting instrument approaches into the Airport. Though these weather conditions can result in possible flight delays and cancellations until visibility and/or cloud ceiling heights improve, the small percentage of time they are present does not significantly impact operations at the Airport nor does it justify the development of a Category II or III precision instrument approach.

Table 4-12: 2000-2009 Weather Condition Analysis		
Weather Condition	**Number of Hourly Occurrences**	**% of Total Observations**
Visual Flight Rules (VFR)	69,638	88.74%
Instrument Flight Rules (IFR)	7,053	8.99%
Below IFR Minimums	1,783	2.27%
Total	78,474	100.00%

Note: IFR minimums are 1/2 mile visibility and cloud ceiling 200 feet AGL

Source: National Climatic Data Center

Period of Record: 2000-2009

Though there is no justifiable need for a Category II or III precision instrument approach, it is recommended that the Airport plan to protect for increased precision approach minimums to Runways 16 and 34 should upgrades be needed in the future. **Table 4-13** lists the required infrastructure and operational improvements that would be needed to gain a Category II or III approach.

Table 4-13: ILS Category II and III Infrastructure and Operational Requirements		
Required Element	**Installed**	**Needed**
Equipment		
• Glideslope and Localizer equipment for Category II/III authorization		X[1]
• Runway Visual Range (RVR) equipment (touchdown, roll-out, and midfield for runways over 8,000 feet in length)		X[2]
• Inner marker (typically required)		X
• Uninterrupted secondary power source and switchgear	X	
• Remote monitoring		X
Lighting System Requirements		
• ALSF-1 or ALSF-2 approach lights		X
• In-pavement touchdown zone lights		X[3]
• In-pavement runway centerline lights	X	
• High intensity runway lights	X	
Operational Requirements		
• Surface Movement Guidance Control System (SMGCS) plan		X
• Runway/taxiway centerline separation of 500 feet or greater[4]		X[5]
• Airport Traffic Control Tower (ATCT) open while aircraft are conducting Cat II/III approaches	X	
• 3° glide path and threshold crossing height between 50 and 60 feet	X	
• Runway centerline consistent with localizer final course	X	
Airspace / Terminal Instrument Procedures (TERPS)		
• No aircraft/ground vehicle penetration of Object Free Zone (OFZ), Obstacle Clearance Surfaces (OCS), or Precision Obstacle Free Zone (POFZ)		X[6]

Notes: 1 = Upgrade of existing glideslope and localizer needed
2 = RVR equipment needed at midfield
3 = Currently on Runway 34 only, needed on Runway 16
4 = For low visibility operations requiring a SMGCS, separation of at least 500 ft. should typically exist; When this distance is less than 500 ft., an on-site evaluation on a case-by-case basis may be appropriate to establish SMGCS procedures.
5 = As a result of the surrounding topography, limited lateral distance is available to separate Runway 16/34 and Taxiway A. It is recommended to request SMGCS procedures be developed to accommodate 400 feet of separation.
6 = Establishment of obstacle clearance surface needed

Source: FAA Order 8400.13D, *Procedures for the Evaluation and Approval of Facilities for Special Authorization Category I Operations and All Category II and III Operations*

It should be noted that technology improvements through Global Positioning System (GPS) based approaches are making Category I precision approach minimums attainable without the costly installation of ground-based ILS systems. While the potential to use GPS for Category II or III approaches is uncertain at this time, protecting for an increased precision instrument approach would position the Airport favorably to receive a Category II or III should technology advancements be made in GPS approaches.

Airfield infrastructure and operational improvements required for a Category II or III precision instrument approach include upgrades to the existing localizer and glide slope equipment; increased separation between the runway and taxiway centerlines; revised air traffic control procedures to prevent ground vehicle and taxiing aircraft penetration into the OFZ and POFZ; the establishment of an obstacle clearance surfaces (OCS); revised Terminal Instrument Procedures (TERPS); installation of an High Intensity Approach Lighting System With Sequenced Flashing Lights (ALSF); and the possible creation of a Surface Movement Guidance Control System (SMGCS) plan if operations are conducted below 1,200 feet Runway Visual Range (RVR).

It should be noted that the installation of runway centerline lighting will typically allow airline operators to request specific authorization for departures below the minimum visibility criteria. Specific authorization Category II approaches offering 100 feet decision height and 1,600 feet RVR, or 1,200 feet RVR for aircraft equipment with auto land or Heads Up Display (HUD) equipment certified for touchdown, can be conducted on Category I approaches that may not have dual localizer and glide slope transmitters, runway touchdown zone lighting, runway centerline lighting, and approach lighting systems. Should the Airport and any airline operators request specific authorization for departures below 1,200 feet RVR, a Surface Movement Guidance and Control System (SMGCS) plan is required by the FAA. SMGCS plans for operations below 1,200 feet RVR also have a set of infrastructure and operational criteria that must be met separate from the elements listed in a Category II or III instrument approach system. **Table 4-14** lists the required infrastructure and operational elements needed for a SMGCS plan designed for operations below 1,200 feet RVR. Currently, none of the airlines operating at the Airport have procedures that would permit them from departing when the RVR is less than 1,200; therefore, a SMGCS plan has not been developed. Should the airlines seek to request authorization for departures below 1,200 feet RVR or the Airport gains a Category II or III instrument approach, a SMGCS plan would be required.

Table 4-14: SMGCS Plan Requirements For Operations Below 1,200 Feet RVR

Required Element	Installed	Needed
Taxiway lights	X	
Runway guard lights		X
12 inch taxiway markings with black borders	X	
Taxiway guidance signs at all intersections	X	
Consideration of local issues	*	*
Ground vehicle training and control		X
Low visibility taxi route chart		X
Initial and periodic operational inspections		X
Review and revision of SMGCS plan as needed		X

Notes: * = Local issues would be considered as a part of plan development

Source: FAA AC 120-57A, *Surface Movement Guidance and Control System*

Visual NAVAIDs – Visual NAVAIDs are classified as those navigational devices that require visual recognition by a pilot and includes approach lighting, windsocks, and airfield signage. In particular, visual NAVAIDs are most beneficial in assisting a pilot to visually locate a runway and complete the transition from flight to touchdown on the runway. Visual NAVAIDs often compliment electronic NAVAIDs and may be required in certain circumstances to fulfill the installment of an electronic NAVAID. The following summarizes the facility requirements of visual navigational equipment found on the airfield:

- **Rotating Beacon –** The rotating beacon at the Airport is located on the top of the air traffic control tower and helps to identify the location of the Airport to pilots from the air. When the rotating beacon is illuminated at night it indicates that the Airport is open; if illuminated during the day it indicates the cloud ceiling height is below 1,000 feet and/or the visibility is less than three miles. The angle of the light should be positioned as such that on- and off-airport structures and the surrounding terrain do not block the light when viewed from the air. Currently, there are no obstructions or surrounding terrain penetrating the light beam; it is recommended that the angle of the light be reevaluated as a part of any future on- or off- airport development to determine if the rotating beacon will need to be repositioned.

- **Wind Indicators –** Wind indicators, or otherwise known as wind cones, are devices that provide surface wind direction information to pilots. FAR Part 139 directs that a wind indicator must be installed at each end of an air carrier runway or at least at a point visible to the pilot on final approach and prior to takeoff. If an airport is open for air carrier operations at night, wind indicators are also required to be illuminated. At the Airport, three wind indicators are present; one at each runway end and one located in the segmented circle. All three are illuminated; therefore, no wind indicator improvements are anticipated throughout the planning period other than routine inspections and replacement to worn or faded fabric.

- **Segmented Circle –** A segmented circle is a series of ground based markings arranged in a circle with a wind indicator positioned in the center used to indicate wind strength and the traffic pattern of each runway at an airport. FAR Part 139 states that a segmented circle, landing strip indicator, and traffic pattern indicator must be installed around a wind indicator for each runway that has a right-hand traffic pattern. FAR Part 139 also states that airports serving air carrier operations much install a segmented circle when a control tower is not present or is not in operation. The segmented circle installed at the Airport is equipped with landing strip indicators, traffic pattern indicators, and a lighted wind indicator in the middle. No changes are anticipated to the Airport's segmented circle which is located adjacent to the south apron.

- **MALSR –** Medium Intensity Approach Lighting System and Runway Alignment Indicator Lights (MALSR) is an approach lighting system that compliments an Instrument Landing System (ILS) in helping pilots visually identify the centerline of the runway prior to its threshold. MALSR and other approach lighting systems installed on the approach end of a runway vary based upon the needs and requirements of an airport, its users, and the FAA. Typically, MALSRs are installed for Category I ILS approaches while ALSFs are installed for ILS Category II and III approaches. The MALSRs on the approach ends of Runway 16 and Runway 34 appear adequate to meet the approach lighting demands throughout the planning period. Consideration should be given to the installation of an ALSF-2 approach lighting system should the ILSs be upgraded to a Category II approach or the minimum approach visibility and cloud ceiling height criterion are reduced below 1/2 mile and 200 feet above ground level (AGL).

- **VASI –** Visual Approach Slope Indicators (VASIs) are another form of approach lighting systems that indicate the correct glide path to pilots through a combination of red and white lights. VASI installations may consist of 2, 4, 6, 12, or 16 lights arranged in sets of two or three bars, depending on whether an additional visual glide path is necessary to accommodate high cockpit aircraft. Though increased operations are anticipated throughout the planning period by aircraft with cockpits that are higher off the ground than the current fleet mix, no changes are anticipated to the two-bar, four light VASI unit installed on the approach end of Runway 34.

- **PAPI –** Precision Approach Path Indicators (PAPIs) are similar to VASIs as they provide the correct glide path to pilots through a more simplified combination of red and white lights. Arranged in a single row of either two- or four-light units, they convey the same information as a VASI and are typically a less costly visual glide path indicator solution. The four-light PAPI unit installed on the approach end of Runway 16 meets standards and no improvements to the visual guidance approach lighting system are anticipated. Consideration should be given to upgrade to a PAPI, replacing the VASI on Runway 34 when it approaches the end of its serviceable life.

- **Runway Edge Lighting –** High intensity runway lighting (HIRL) installed on Runway 16/34 offers five intensity light settings and the greatest illumination intensity of available runway lighting systems. When the ATCT is closed, pilots can remotely control the intensity of the lights through a series of microphone keys on the Common Traffic Advisory Frequency (CTAF). Given the seven-and-a-half-hour period the control tower is closed each evening and the requirement that runways with instrument approaches must be equipped with medium- or high-intensity lighting, maintaining the HIRL lighting system is anticipated. The existing HIRL system is quite old and in generally poor condition. It is recommended the HIRL system be replaced as part of any runway reconstruction or relocation project in the near future.

  Longitudinal spacing between runway edge light units must not exceed 200 feet as directed in FAA AC 150/5340-30F, *Design and Installation Details for Airport Visual Aids*. In instances where a connecting taxiway or other pavement surface impedes the placement of an edge light, an in-pavement light must be installed. Currently at the Airport, the runway edge lighting system is outdated and in need of replacement as a result of deterioration that has occurred to aging system components. In addition, a non-compliance issue exists with runway edge lighting since there are several locations at runway/taxiway intersections where in-pavement edge lights should be present and are missing. In anticipation of a major reconstruction or relocation of the runway, the Airport has postponed the installation of these fixtures given the high cost of the project and the likelihood that lights may need to be removed if the runway is relocated. It is recommended that as a part of any future runway reconstruction or relocation project that the installation of in-pavement HIRL edge lights be considered at locations where runway/taxiway intersection pavement is present 200 feet from the next adjacent light.

- **Runway Centerline Lighting –** Runway centerline lights are installed on some precision approach runways to facilitate landings, rollouts, and takeoffs under low visibility weather conditions. Required for runways with ILS Category II and III approaches, centerline lighting is also required for ILS Category I runways when landing operations are conducted below 2,400 feet Runway Visual Range (RVR). Though instrument approaches to Runway 34 may be conducted when the visibility is no less than a 1/2 mile, aircraft equipped and utilizing a flight director, autopilot, or heads up display may fly the ILS or localizer published approach to a decision height of 200 feet AGL when the RVR is no less than 1,800 feet. Though no changes are necessary to existing runway centerline lighting to meet existing published instrument approach requirements or those meeting ILS Category II or III criteria, replacement of the electrical components of the system are recommended since the lighting equipment is outdated, requires high maintenance, and is inefficient since power distributed through the underground cabling is lost due to the age and deterioration of the system.

- **Runway Touchdown Zone Lighting –** As with centerline lighting, runway touchdown zone (TDZ) lighting is required for ILS Category II and III runways and ILS Category I runways when used for landing operations below 2,400 feet RVR. Since instrument approaches can be conducted on Runway 34 when RVR is no less than 1,800 feet if aircraft are equipped with a flight director, autopilot, or heads up display and can visually locate the runway at 200 feet AGL, TDZ lighting is installed on the approach end of this runway. Consideration should also be given to installing TDZ lighting on Runway 16 should the Category I ILS be upgraded or Category II and III approaches be developed as a result of future improvements to satellite-based navigation technology.

- **Airfield Pavement Markings –** Airfield pavement markings are applied to runways, taxiways, and apron surfaces to provide location and navigational information to pilots and ground vehicle operators. Markings indicate the location to hold short of a runway and its associated safety area, provides turn guidance for aircraft maneuvering taxiway intersections, and identifies the boundary of the movement/non-movement area. Pavement markings applied to runways provide pilots with visual and perceptional cues about its designation, threshold location, centerline, and aiming point and vary based on the type of runway approach. Runways that support precision instrument approaches are required to include runway designation markings, centerlines, threshold markings, aiming point marking, touchdown zone markings, and side stripes. Runway

16/34 meets these marking requirements; only routine maintenance is anticipated throughout the planning period to ensure markings meet reflectivity standards for reduced visibility and nighttime conditions.

- **Airfield Signage –** Airfield signage complements pavement markings by providing locational and directional information to pilots and ground vehicle operators maneuvering on an airfield. Signage found on an airfield includes runway hold position signs, runway distance remaining signs, taxiway location signs, taxiway direction signs, and destination signs. A review of existing airfield signage found that improvements are needed to bring all airfield signage up to standards addressed in AC 150/5340-18F, *Standards for Airport Sign Systems*. As a result of the reduced separation between Runway 16/34 and the parallel taxiway, several mandatory hold signs have been placed in locations. These hold signs are not compliant with standards identified in FAA AC 150/5340-18F, *Standards for Airport Sign Systems*, which state that signs must be adjacent to the pavement hold markings. It should be noted that while the hold line markings in some places have been angled or adjusted to help account for the decreased separation between the runway and parallel taxiway, the hold signs have never been moved to correspond with the relocated pavement markings. Installation of an additional mandatory runway hold sign on Taxiway A at the approach end of Runway 34 (on the south side of the intersection) and replacement of the remaining mandatory runway hold signs (with panels that have black borders around the white legends) is needed to meet FAA standards. Replacement of panels for the remaining guidance signs that are experiencing de-lamination of the retro-reflective background is also recommended to improve visibility during nighttime and low-visibility weather conditions.

- **Taxiway Edge Lighting –** Taxiway edge lighting is used as a navigational tool by pilots and ground vehicle operators to help delineate the edge of the surface when conditions limit visibility such as during night and in inclement weather. Medium Intensity Taxiway Lighting (MITL) systems are recommended for airports with commercial airline service since they offer three illumination intensity settings. Since the existing airfield lighting system is outdated and requires frequent maintenance, replacement of aging and inefficient electrical components is recommended to improve taxiway edge lighting at the Airport. It should also be noted that the eventual conversion of all taxiway lights to more energy efficient Light-Emitting Diode (LED) fixtures could help reduce energy usage which in turn could reduce airfield operating expenses.

Weather Equipment – Adverse weather has a significant impact on airport operations as it can affect efficiency, capacity, and safety. It is important airports install appropriate weather reporting equipment specific to the operational needs and the atmospheric characteristics of the surrounding environment. The employment of specific types of weather reporting equipment capable of accurately reporting existing weather conditions is essential in some instances for an airport to gain precision instrument approaches, such as those offered by Category II and III minima.

Existing weather equipment installed at the Airport meets the accuracy of weather reporting required for aircraft to conduct Category I, II, and III instrument approaches as well as conduct departures in low visibility/low cloud ceiling conditions. The existing ASOS with Runway Visual Range (RVR) instrumentation offers a level of accuracy to report the visibility in feet below a half mile which is critical for pilots operating in Instrument Flight Rules (IFR) conditions. CAT II/III operations will require the installation of a third RVR sensor, in a midfield location to complement the touchdown and rollout sensors required. The Low Level Wind Shear Alert System (LLWAS) installed around the proximity of the Airport also offers an additional method for reporting local wind conditions especially when wind shear and downdraft phenomenon are present. Additionally, an installed SCAN Web weather system offers a complementary method for Airport personnel to obtain information on local weather conditions as well as determine environmental information about the runway surface. In-pavement sensors detecting and measure such environmental elements such as pavement surface temperatures, moisture, snow, ice, and deicing and anti-icing chemicals that are present.

Though it appears the instrumentation of existing weather equipment is sufficient to meet demand throughout the planning period, consideration should be given to relocate the ASOS unit. The distance of the equipment to the taxiway has been a concern for the wingtip clearances of larger aircraft such as the Boeing 767 and 747 that occasionally conduct operations at the Airport. Also, the National Weather Service (NWS) has noted that the close proximity of the ASOS to the taxiway is possibly affecting temperature readings as a result of heat being reflected off the paved surface. At the time of the ASOS unit installation, the topography of the Airport limited locations for its placement; ongoing work with the west side fill project will create additional airside land that may offer a more suitable location for the ASOS unit. It is recommended an evaluation be conducted to find a more desirable site for the ASOS unit that is well situated away from the aircraft wingtip clearance distances of larger aircraft, is not affected by radiating heat from concrete or asphalt surfaces, and is located near the touchdown zone of the runway. FAA Order 6560.20B, *Siting Criteria for Automated Weather Observing Systems (AWOS),* offers guidance on siting weather observing equipment so that sensors are not influenced by artificial conditions such as large structures, cooling towers, and expanses of concrete and tarmac. It should be noted that these general siting requirements apply to an ASOS as well. While each ASOS sensor (wind, temperature, cloud ceiling, etc.) has specific siting requirements, all ASOS sensors should be located together and outside of runway and taxiway object-free areas. Generally ASOS sensors are best placed between 1,000 and 3,000 feet from the primary runway threshold and between 500 and 1,000 feet from the runway centerline.

Consideration should also be given by the FAA to relocate its LLWAS tower directly west of the Airport. The tower may be an obstruction for the proposed temporary runway and its location on private property may interfere with future development plans of that property. Since the Airport is prone to low-level wind shear as a result of the surrounding mountainous topography, accurate and timely warnings to ensure passenger safety and comfort during takeoff and landing is necessary; therefore, it is recommended that the FAA-owned LLWAS be maintained. It is recommended that the FAA evaluate relocating the tower to a place that does not penetrate FAR Part 77 surfaces and does not interfere with future land use development plans around the Airport. .

4.3 Terminal Area Requirements

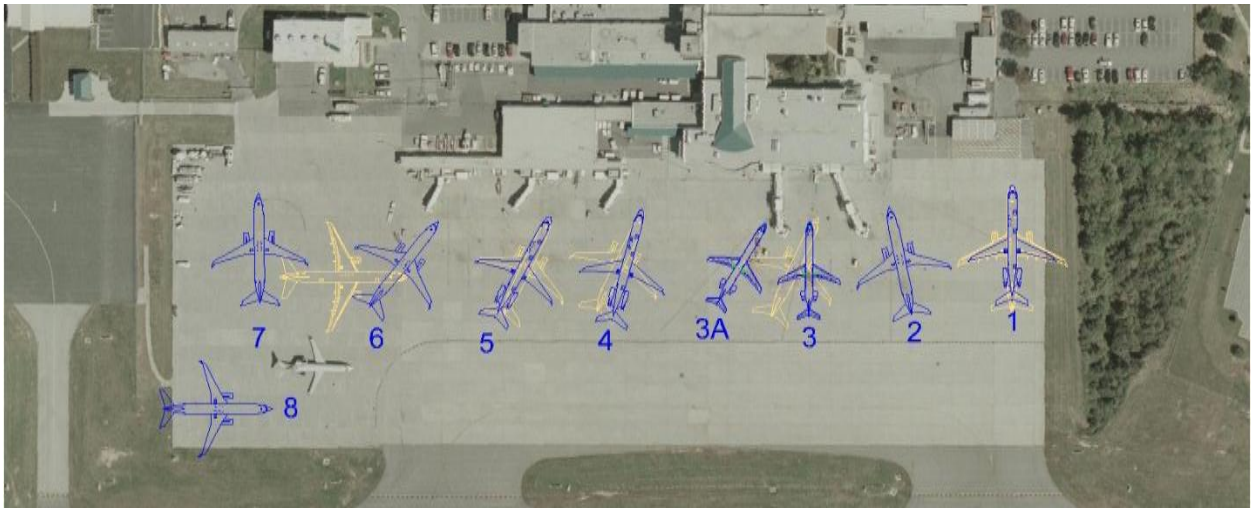
In addition to airside elements, a review of the facility needs in the terminal area was also conducted as a part of this master plan study. Terminal area elements that were assessed include the terminal gates and apron, terminal building, landside vehicular access, and vehicle parking. For the purposes of this master plan, the terminal area review is organized in the following four elements:

4.3.a Terminal Gate & Apron Requirements
4.3.b Terminal Building Requirements
4.3.c Landside Access Requirements
4.3.d Vehicle Parking Requirements

4.3.a Terminal Gate & Apron Requirements

The number of gates needed to support forecasted activity is a critical element in determining the overall size and configuration of the terminal complex. A gate is defined as an aircraft parking position near the terminal that is used on a daily basis for the loading and unloading of passengers. The Airport is currently in process of replacing the loading devices and installing passenger boarding devices for Gates 4, 5, and 6. This project will also include a slight reconfiguration of lead-in lines and parking positions for all the gates at the terminal. **Figure 4-12** depicts the terminal apron parking configuration after the passenger boarding bridge replacement project is complete.

Figure 4-12: Terminal Apron Aircraft Layout



Source: Mead & Hunt, Inc.

Terminal Apron – The terminal apron aircraft parking layout can typically accommodate 9 aircraft parking positions for the fleet mix that operates at the Airport shown as blue in **Figure 4-12**. Parking positions 1 and 7 are typically used last as they do not have loading bridges, involve ramp loading and unloading, and require passengers to walk some distances across the apron. Parking position 8 in the corner of the apron is used primarily for remote parking and is not typically used for the loading or unloading of passengers. Therefore, there are eight gate positions and one remote aircraft parking position on the terminal apron.

Delta Air Lines typically utilizes the single loading bridge at Gate 3 to service two regional jet parking positions. Alternatively, Gate 3 space can be used by a single Boeing 737/Airbus A320 narrow body. Gates 4/5 and 6/7 can also accommodate larger aircraft, typically replacing two smaller aircraft with the one larger aircraft. These alternative aircraft positions are shown in yellow on Figure 4-12. **Table 4-15** summarizes the aircraft parking by gate, after the completion of the upcoming passenger boarding bridge replacement project.

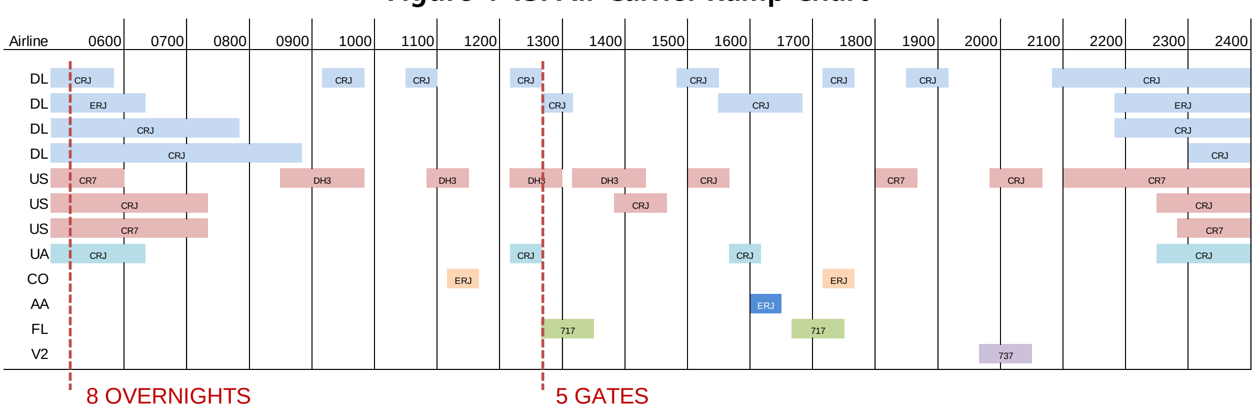
Table 4-15: Aircraft Parking by Gate / Position

Gate / Position	Aircraft Types
1	B757 at remote parking position stand
2	B737 (all series)
3 & 3A	(2) CRJ 900; or (1) B737 (all series)
4	(1) MD80; or (1) B737; however Gate 5 will be closed for aircraft over MD80 in size at Gate 4
5	(1) MD80; or (1) B737; however Gate 4 will be closed for aircraft over MD80 in size at Gate 5
6	B737 (all series); or (1) B757; however parking position 7 will be closed for B757
7	B737 (all series)
8 (remote)	B737 (all series)

Note: Gates can typically accommodate aircraft type noted above and all aircraft with smaller wingspans.
Source: RS&H PBB Replacement B-Gates Layout Plan
Mead & Hunt, Inc.

The size of the terminal apron should be able to accommodate the fleet mix of commercial aircraft types present during periods where the demand for space is at its greatest. **Figure 4-13** depicts the peak month (July 2011) airline schedule depicted as a ramp chart by carrier. This ramp chart shows a bar for each aircraft at the Airport plotted with time, showing when each aircraft arrives and departs, which indicates when it is occupying a gate or parking position on the airline parking apron.

Figure 4-13: Air Carrier Ramp Chart



Source: Asheville Regional Airport

The greatest demand for terminal apron space occurs during the overnight period when aircraft from the final arriving flights of the day are parked and staged for departure the following morning. Remain overnight (RON) aircraft parking during the peak month of July are presented in the air carrier ramp chart. As shown in Figure 4-13, airlines schedule eight overnight aircraft. It should also be noted that the Airport experiences occasional RON charter flights that are not included in the ramp chart of scheduled passenger activity.

The forecasted demand for RON aircraft parking on the terminal apron through 2030 is presented in **Table 4-16**. It is assumed that the total number of typical day departures is directly proportional to the total number of annual scheduled passenger aircraft departures. The total number of daily departures by aircraft type was projected along with the number of daily RON aircraft. Using the demand for RON aircraft parking on a typical Sunday in the peak month of July 2011 as a benchmark, the projected demand for RON aircraft parking by aircraft type was extrapolated from the projected typical daily departures.

Table 4-16: Projected RON Aircraft Parking Demand

Seats	Typical Aircraft		2011	2015	2020	2025	2030
		Annual Enplanements:	362,295	410,793	446,328	484,937	526,886
		Total Annual Scheduled Passenger Aircraft Departures:	9,368	9,321	9,699	9,791	10,158
		Peak Month Typical Day (PMTD) Departures:	34	34	35	36	37
Less than 40	SAAB 340, Dornier 328, ERJ-135, Beech 1900, EMB-120, DHC-8	Projected Annual Departures:	131	0	0	0	0
		Projected PMTD Departures:	*0.5*	*0*	*0*	*0*	*0*
		Daily RON Aircraft:	**0**	**0**	**0**	**0**	**0**
40-60	CRJ-200, ERJ-140, ERJ-145, DHC-8-300	Projected Annual Departures:	8,271	7,942	7,497	6,472	6,054
		Projected PMTD Departures:	*30.0*	*28.8*	*27.2*	*23.5*	*22.0*
		Daily RON Aircraft:	**6**	**6**	**5**	**4**	**4**
61-99	Avro RJ, CRJ-700, CRJ-900, ERJ-170, ERJ-175	Projected Annual Departures:	627	811	1,513	2,360	2,915
		Projected PMTD Departures:	*2.3*	*2.9*	*5.5*	*8.6*	*10.6*
		Daily RON Aircraft:	**2**	**1**	**2**	**2**	**3**
100-130	717, DC-9, ERJ-190, ERJ-195, A319	Projected Annual Departures:	272	466	533	656	772
		Projected PMTD Departures:	*1.0*	*1.7*	*1.9*	*2.4*	*2.8*
		Daily RON Aircraft:	**0**	**1**	**1**	**1**	**1**
131-150	A320, MD-81/82/83/87/88, 737-400, 737-500	Projected Annual Departures:	67	103	155	206	284
		Projected PMTD Departures:	*0.2*	*0.4*	*0.6*	*0.7*	*1.0*
		Daily RON Aircraft:	**0**	**0**	**0**	**1**	**1**
151 or more	MD-90, 737-800, 737-900, 757-200	Projected Annual Departures:	0	0	0	98	152
		Projected PMTD Departures:	*-*	*0.0*	*0.0*	*0.4*	*0.6*
		Daily RON Aircraft:	**0**	**0**	**0**	**0**	**0**
		TOTAL RON AIRCRAFT:	**8**	**8**	**8**	**8**	**9**
		Percent of Total Average Daily Depatures:	***23.5%***	***23.5%***	***23.5%***	***23.5%***	***23.5%***

Projections: Mead & Hunt, Inc. (2012)

As illustrated in Table 4-16, the total number of daily RON aircraft is not expected to significantly increase through the planning period; however, the fleet mix of RON aircraft is anticipated to change. The projected growth rate in scheduled passenger departures is less than the predicted growth rate in the number of overall passengers primarily due to projected increases in average aircraft sizes and load factors. Even with significant passenger growth, only modest growth is expected in scheduled passenger departures and RON aircraft. Therefore, it is anticipated that daily RON aircraft in 2030 (with nearly 527,000 enplanements), will consist of nine aircraft, which is an increase over current airline schedules.

Additionally it is desirable for the terminal apron to be sized to accommodate at least one or two additional aircraft beyond those projected to accommodate late arriving or departing flights, changes in airline flight schedules, charter activity, a new entrant service carrier, or aircraft diversions from other airports due to weather. Therefore, the Airport should plan to accommodate at least 10 or 11 RON aircraft parking positions. The existing terminal apron accommodates nine aircraft, indicating that planning should be initiated for at least one or two additional parking positions.

Terminal Gates – In addition to RON aircraft parking, terminal gate demand during peak activity hours was also evaluated. As noted previously, there are currently eight gate positions, but only five loading bridges. The loading bridge at Gate 3 is typically used by Delta Air Lines to serve two regional jet parking positions. As was shown on the airline ramp chart, the peak gate demand outside of RON aircraft parking occurs around 12:30 p.m. when there are five gates used simultaneously. However, it should be noted US Airways only has one gate occupied during this period, but at another times during the day has two gates occupied simultaneously. Additionally, there are some airlines that are not represented in the peak hour such as Continental/United Airlines and American Airlines that also require gate facilities and RON charter flights, typically during peak months of activity. As shared or common use gate facilities become more commonplace in the industry, these carriers could utilize an unoccupied gate assigned to another carrier provided flights and boarding gate occupancy times do not overlap. To determine the required number of peak hour gates, **Table 4-17** illustrates an analysis similar to the forecasted RON aircraft parking demand to determine gate demands through 2030.

Table 4-17: Projected Peak Hour Aircraft Gate Demand

Seats	Typical Aircraft		2011	2015	2020	2025	2030
		Annual Enplanements:	362,295	410,793	446,328	484,937	526,886
		Total Annual Scheduled Passenger Aircraft Departures:	9,368	9,321	9,699	9,791	10,158
		Peak Month Typical Day (PMTD) Departures:	34	34	35	36	37
Less than 40	SAAB 340, Dornier 328, ERJ-135, Beech 1900, EMB-120, DHC-8	Projected Annual Departures:	131	0	0	0	0
		Projected PMTD Departures:	*0.5*	*0*	*0*	*0*	*0*
		Peak Hour Gate Demand:	**0**	**0**	**0**	**0**	**0**
40-60	CRJ-200, ERJ-140, ERJ-145, DHC-8-300	Projected Annual Departures:	8,271	7,942	7,497	6,472	6,054
		Projected PMTD Departures:	*30.0*	*28.8*	*27.2*	*23.5*	*22.0*
		Peak Hour Gate Demand:	**4**	**3**	**3**	**3**	**2**
61-99	Avro RJ, CRJ-700, CRJ-900, ERJ-170, ERJ-175	Projected Annual Departures:	627	811	1,513	2,360	2,915
		Projected PMTD Departures:	*2.3*	*2.9*	*5.5*	*8.6*	*10.6*
		Peak Hour Gate Demand:	**0**	**1**	**1**	**1**	**1**
100-130	717, DC-9, ERJ-190, ERJ-195, A319	Projected Annual Departures:	272	466	533	656	772
		Projected PMTD Departures:	*1.0*	*1.7*	*1.9*	*2.4*	*2.8*
		Peak Hour Gate Demand:	**1**	**1**	**1**	**1**	**1**
131-150	A320, MD-81/82/83/87/88, 737-400, 737-500	Projected Annual Departures:	67	103	155	206	284
		Projected PMTD Departures:	*0.2*	*0.4*	*0.6*	*0.7*	*1.0*
		Peak Hour Gate Demand:	**0**	**0**	**0**	**0**	**1**
151 or more	MD-90, 737-800, 737-900, 757-200	Projected Annual Departures:	0	0	0	98	152
		Projected PMTD Departures:	-	*0.0*	*0.0*	*0.4*	*0.6*
		Peak Hour Gate Demand:	**0**	**0**	**0**	**0**	**0**
		Total Peak Hour Gate Demand:	**5**	**5**	**5**	**5**	**5**
		Percent of Total Average Daily Depatures:	***14.7%***	***14.7%***	***14.7%***	***14.7%***	***14.7%***

Projections: Mead & Hunt, Inc. (2012)

As illustrated in the table, the peak gate demand is not anticipated to significantly increase through the planning period; however, the fleet mix of the aircraft is anticipated to change. Due to the fact that airline schedules are constantly changing, and considering a shared or common use approach can help to more effectively meet boarding gate demand, it is recommended that planning be initiated for at least two or three additional gates beyond projected demand. These additional gates will accommodate various carriers' equipment, changes in airline flight schedules, late arriving or departing flights, charter activity, a new entrant service carrier, and aircraft diversions from other airports for weather or other reasons. Therefore, for terminal and space planning purposes, the airport should plan to have at least six to eight gates through the planning period. The existing terminal has 8 gate parking positions but only 5 loading bridges and hold rooms, indicating that planning should occur for at least one to three additional gates and hold rooms.

4.3.b Terminal Building Requirements

The 102,588 square foot terminal building space at the Airport consists of seven boarding gates, five passenger boarding bridges, two baggage claim devices, a single security checkpoint, airline and rental car spaces, Transportation Security Administration (TSA) offices, concessions spaces, and other ancillary spaces. This master plan study does not include a detailed space programming study of the individual components within the terminal building facility, but it does include an assessment and planning for overall gross terminal building space needs.

The 2005 Terminal Area Planning Study included a detailed assessment of the terminal building and its various functional areas. Terminal facility needs are generally a function of peak passenger demands placed upon the facility. The total terminal gross area recommended by the 2005 Terminal Area Planning Study for various total peak hour passenger levels is depicted in **Table 4-18**. Total gross terminal building space needs were developed using the total peak hour passenger projections from this Master Plan and interpolating between the peak hour passenger levels and terminal building space needs from the prior master plan study.

Table 4-18: Projected Terminal Building Space Needs

2005 Terminal Area Planning Study Findings					
Peak Hour Total Passengers		360	460	540	670
Total Gross Terminal Area Recommended (SF)		91,300	106,800	115,900	132,899
Master Plan Projections	**2010**	**2015**	**2020**	**2025**	**2030**
Annual Enplanements	369,576	410,793	446,328	484,937	526,886
Peak Hour Total Passengers	436	465	502	545	593
Total Gross Terminal Area Recommended (SF)*	102,247	106,091	110,996	116,695	123,058
Approximate Existing Terminal Facilities (SF)	102,588				
Terminal Facilities Surplus (+) / Deficiency (-) (SF)	341	(3,503)	(8,408)	(14,107)	(20,473)

Note: *Interpolated from 2005 Terminal Area Planning Study Findings
Source: 2005 Terminal Area Planning Study Findings
Mead & Hunt, Inc.

As shown in the projected terminal building space needs table, the existing terminal building will require an expansion of approximately 20,500 square feet through the planning period.

4.3.c Landside Access Requirements

Landside vehicular access to the Airport was also reviewed as a part of the master planning study. In addition to on-Airport roadways and traffic circulation around the terminal area, access to the Airport from major regional traffic arteries was also evaluated to determine if roadway infrastructure improvements are needed. Below are the findings:

Existing Landside Access Roadways – As stated in Chapter 2, the Airport is located adjacent to the intersection of North Carolina Route 280 and Interstate 26, with three access points located along North Carolina Route 280. South of the intersection of North Carolina Route 280 and Interstate 26, Aviation Way provides access to the general aviation area while approximately 1/2 mile south, Terminal Drive provides access to the terminal, passenger parking, and rental car areas. An exit ramp to Terminal Drive from North Carolina Route 280 directly south of the Aviation Way intersection provides an additional entrance to the terminal area for southbound traffic on North Carolina Route 280.

Terminal area traffic is circulated on Terminal Drive from North Carolina Route 280 around the short- and long-term vehicle parking lots to the front of the terminal building. Terminal Drive continues adjacent to the employee lot, rental car ready/return lot, and consolidated rental car service facility until it is joined up again with North Carolina Route 280. Wright Brothers Way, which intersects Aviation Way, provides access to the general aviation area including the air cargo facility occupied by US Airways, the Landmark Aviation fixed base operator (FBO), and fuel farm adjacent to the approach end of Runway 16.

Off-Airport Access – Overall, the Airport is well situated in close proximity to Interstate 26 which is the major north-south traffic artery in the region. In combination with other major east-west traffic arteries that intersect Interstate 26 such as Interstate 40, U.S. Route 64, and U.S. Route 74, most of the eleven county service area has sufficient access to the Airport. It appears no highway infrastructure improvements in the region are needed for the community to more efficiently access the Airport.

It should be noted that the North Carolina Department of Transportation (NCDOT) issued a request for proposal (RFP) in 2011 to re-design the Interstate 26/North Carolina Route 280 interchange to a diverging diamond design with construction planned for 2013. As a result of the modifications needed to alter North Carolina Route 280 for this type of interchange, access to the general aviation area from Aviation Way may be impacted. It is recommended Airport staff work with the NCDOT during the design and construction of this interchange to prevent and/or limit potential roadway access impacts to the Airport.

On-Airport Access – The existing network of on-Airport roadways appears sufficient in providing adequate access to destinations on the east side of the airfield. Recent improvements to Wright Brothers Way that included rehabilitation, widening, and extension appear adequate to meet the existing and future landside access needs of the general aviation area. Further extension of this roadway to the north will likely be needed to support development at the north general aviation area site. Improvements to the roadway leading to the fuel farm adjacent to the approach end of Runway 16 is needed to support the increase in traffic to and from the fuel farm and to allow adequate separation between passing vehicles.

The existing network of roadways on the east side of the Airport is considered to be in good condition as a result of recent improvements to Wright Brothers Way and a resurfacing of Terminal Drive. While it is not anticipated that significant roadway improvements will be needed over the planning period other than preventative maintenance such as crack sealing and seal coating, consideration should also be given to add a dedicated right turn lane on Terminal Drive at the intersection of North Carolina Route 280 for traffic exiting the Airport. A dedicated right turn lane will help to alleviate congestion and traffic backups at this intersection by separating right turn traffic from the existing two lanes that permit a left turn.

Roadway and access improvements will also be needed on the west side of the airfield should it be developed for future aeronautical and non-aeronautical uses. Currently, Old Fanning Bridge Road is scheduled to be improved with a pavement overlay and paved shoulders. It also will be equipped a high pressure water main and a roundabout at the intersection of Westfeldt Road, that will serve the new Sierra Nevada Brewery site, which is under construction. Access roads leading to the planned roundabout on Old Fanning Bridge Road and/or Pinner Road to the north should be considered pending as they are dependent on the location of future development.

Terminal Area Traffic Circulation –The Institute of Transportation Engineers (ITE) published a formula used to calculate the average level of daily traffic associated with passengers arriving and departing from an airport. The formula, $Y = 7.395(x)^{0.8526}$, is based on the number of average daily arriving and departing passengers (x) to calculate the average level of daily traffic at an Airport. **Table 4-19** illustrates the projected level of average daily traffic at the Airport based on enplanement projects presented in Chapter 3.

Table 4-19: Projected Airport Vehicle Traffic Calculations

Year	Enplanements	Average Daily Arriving/Departing Passengers	Average Daily Traffic	Trips Per Passenger
2010	378,087	1,036	2,753	2.66
2015	410,793	1,125	2,954	2.63
2020	446,328	1,219	3,163	2.59
2025	484,937	1,329	3,405	2.56
2030	526,886	1,444	3,654	2.53

Sources: Airport Trip Generation, *ITE Journal* (May 1998), Vol. 68, Page 26; Mead & Hunt, Inc.

As illustrated in the table, the average level of daily traffic from 2010 to 2030 is anticipated to increase approximately 33 percent, which will affect traffic circulation. Typically, the optimal service level of a road is 1,000 vehicles per hour per lane, depending on the speed limit and number of vehicles exiting and changing lanes on the roadway. Given the three through traffic lanes in front of the terminal building, it appears the existing roadway network is more than adequate to accommodate traffic circulation demand throughout the planning period

As noted, Terminal Drive is a one-way continuous loop that requires entering traffic to navigate the entire roadway before exiting at desired destination. This direction of traffic circulation most particularly impacts the transfer of rental vehicles from the consolidated rental car service center to the rental car ready/return lot. It requires vehicles to navigate the entire roadway, often resulting in additional congestion in front of the terminal building during peak periods of activity. Development of a new roadway that creates a direct route from the consolidated rental car service center to the rental car ready/return lot to the would eliminate the need for serviced rental cars to pass in front of the terminal building, reducing congestion during peak periods and improving traffic circulation.

Also in an effort to reduce congestion in front of the terminal building, a dedicated commercial vehicle lane or curb lane for taxis and limousines is recommended to separate these activities from circulating traffic. Currently, taxis, limousines, and vans that are dropping off or waiting to pick up passengers are required to park in front of the terminal in designated locations that are adjacent to the terminal entrances. Particularly during peak hours, taxis, limousines, and vans may be blocked not only by pedestrian traffic entering or exiting the terminal, but also by personal vehicles that are dropping off or picking up passengers. Often, this restricts the arrival and departure of commercial ground transportation vehicles and results in temporarily parked personal vehicles on the through lanes of traffic. Development of a commercial vehicle lane or curb away from the front of the terminal building will help to reduce congestion by separating taxi, limousine, and shuttle van vehicles from pedestrian and personal vehicle traffic in front of the terminal building.

4.3.d Vehicle Parking Requirements

Walker Parking Consultants was selected as a part of the master plan project team to conduct an assessment of vehicle parking at the Airport that assures adequate, convenient parking is available throughout the planning period as enplanements and facilities grow. In addition, an evaluation of employee parking and rental car ready/return parking needs was conducted to determine if future expansion of these lots will be necessary. The basis of these analyses involved benchmarking past and current relationships between parking demand and originating enplanements to project future parking demand based on anticipated levels of enplanements.

Parking Supply – There are currently 1,469 spaces available for public parking in the short term lot (193 spaces), the long term lot (752 spaces), the long term overflow lots (520 spaces), and at the maintenance facility (four spaces). There is also a Cell Phone Lot available for vehicles awaiting arriving passengers that contains 48 spaces. Employee parking is currently provided in the upper employee lot (87 spaces), the lower employee lot (240 spaces), the Greater Asheville Regional Airport Authority lot (34 spaces), the Department of Public Safety (DPS) lot (six spaces), and at the maintenance facility (14 spaces), for a total of 381 parking spaces. Rental car ready/return spaces are provided in a separate lot immediately south of the terminal which provide 107 spaces for the six agencies operating on the Airport while 578 spaces are available for the servicing of vehicles at the Consolidated Rental Car Service Facility. All the parking lots at the Airport are within walking distance to the terminal and no shuttle buses are needed. **Table 4-20** summarizes the current parking supply at the Airport.

Table 4-20: Existing Parking Supply

Parking Lot	Spaces	Fee
Public Parking		
Short Term	193	$1 first 30 min, $1 each additional 30 min.; $12 daily maximum
Long Term	752	$1.50 first hour, $1 each additional hour; $8 daily maximum; $48 weekly maximum
Long Term Overflow	520	Same as long term
Visitors @ Maintenance Facility	4	No fee
Subtotal Public	**1,469**	
Employee Parking		
Lower Employee	240	n/a
Upper Employee	87	n/a
Airport Authority	34	n/a
DPS	6	n/a
Maintenance Facility	14	n/a
Subtotal Employee	**381**	
Rental Cars		
Ready/Return	107	n/a
Consolidated Service Facility	578	n/a
Subtotal Rental Cars	**685**	
Other		
Cell Phone Waiting	48	No fee
AIRPORT TOTAL	**2,583**	

Source: Walker Parking Consultants

Public Parking Demand – Parking demand at an airport is normally expressed as a ratio of spaces required per 1,000 annual originating enplanements. Walker Parking Consultants recommends an approach where a “design day” is chosen. This “design day” should be a typical day with a high level of passenger activity and smooth and normal operations, but not necessarily the peak day of activity.

Like most systems, a parking system runs most efficiently when it is at 85 percent to 95 percent of capacity. The allowance of 5 percent to 15 percent of spaces allows for the dynamics of cars moving into and out of spaces, reduces search time for a space, and allows for temporary loss of spaces due to minor construction, snow cover, or unforeseen circumstances. Ideally, this cushion can also accommodate parking on days which are busier than the design day. On those extremely busy days, there should still be a space for everyone, but the cushion will be very small and parking space search times will be higher. **Table 4-21** presents the parking occupancy counts for September 2010 through December 2011. During that timeframe, the peak month of enplanements and the peak 2:00 p.m. occupancy count of the long term lot occurred during July 2011.

Table 4-21: Occupancy of the Public Parking Lots

Month	Enplanements	Short Term		Long Term		
		Average Overnight	Maximum Overnight	Average Overnight	Maximum Overnight	Maximum 2:00 p.m.
2010						
September	34,250	90	120	831	935	1,066
October	39,034	76	115	763	915	1,022
November	31,061	68	106	646	1,059	1,069
December	26,919	57	119	551	880	875
2011						
January	21,093	57	121	488	685	764
February	19,453	65	113	553	691	801
March	24,796	69	107	607	716	807
April	27,379	63	110	620	733	846
May	31,711	68	112	645	759	983
June	38,080	74	109	740	883	1,025
July	41,409	67	114	722	809	1,173
August	38,646	69	108	696	855	1,005
September	32,503	77	121	717	844	966
October	36,530	70	109	683	845	923
November	30,850	70	122	644	1,064	1,099
December	28,522	57	124	603	994	1,039

Note: July 2011 highest month of enplanements and parking demand
Source: Walker Parking Consultants

The 2:00 p.m. occupancy of the long term lot is considered by Airport staff to be the approximate daily peak. In the short term lot, no comparable daily counts were taken. Airport staff estimates that the short term lot is approximately 70 percent full on a normal busy day, or 135 spaces are occupied. Therefore, the total public parking demand at present is estimated at 1,308 spaces.

Walker Parking Consultants recommends that a conservative approach be used in determining the design day for parking at the Airport, and thus the parking demand ratio. While many Airport facilities are designed for the average day of the peak month (ADPM), it is recommended that the parking system be designed for the peak day of the peak month (PDPM). The reasons for this recommendation are as follows:

- The peak day of the peak month of enplanements does not represent the peak day of the year. For example, the parking demand on a holiday weekend may be higher than the busiest day in July.
- The history of enplanements at the Airport has fluctuated over the years, so it is necessary the Airport remains flexible in order to accommodate demand when enplanements increase.
- If a low-cost carrier (LCC) enters the market or enplanements on LCCs increase, the parking demand at Airport may grow more quickly than enplanements.

The current PDPM parking demand at the Airport is estimated to be 1,308 spaces. A cushion of 10 percent is added to this demand so that the system operates efficiently on the design day. On days that are busier than the design day, the cushion becomes smaller as the demand for parking increases. The demand for parking including a 10 percent cushion is therefore calculated as 1,308/0.90 = 1,453. When compared to 2011 annual enplanements, the public parking demand ratio is 1,453/370.972 = 3.92 spaces per 1,000 annual originating enplanements.

This ratio is applied to the forecast enplanements throughout the planning period as shown in **Table 4-22**. This calculation results in a small 2010 public parking deficit of 17 spaces, growing to a deficit of 145 spaces in 2015 and eventually to 600 spaces in 2030.

Table 4-22: Public Parking Demand Projections

Year	Enplanements	Demand Ratio per 1,000 Enplanements	Projected Demand	Parking Capacity	Surplus/Deficit
2010	378,087	3.92	1,482	1,465	- 17
2015	410,793	3.92	1,610	1,465	- 145
2020	446,328	3.92	1,750	1,465	- 285
2025	484,937	3.92	1,901	1,465	- 436
2030	526,886	3.92	2,065	1,465	- 600

Notes:
Parking demand ration includes 10 percent cushion.
Parking capacity includes short-term lot, long-term lot, and long-term overflow lot.
Visitor spaces at maintenance lot were not included in the parking capacity total.
Source: Walker Parking Consultants

It should be noted that the parking demand ratio can be measured with some precision for any particular year as long as the proper data is collected. However, it is not a static number, although it has been treated as such in the projections because the nature of airline passengers can change over time due to a number of factors. For example, if enplanements on LCCs comprise of a large portion of the increase in enplanements at the Airport, the parking demand may increase more quickly than enplanements for reasons stated previously. Therefore, it is good practice to check this calculation each year to track trends, and adjust accordingly to changing patterns.

It should also be noted that the above calculation is quantitative, not qualitative; in other words, there may be enough parking, but it may not provide the level of customer service desired by the Airport. It is also noted that a large percentage of patrons in the short term lot are daily or long term parkers. The average overnight inventory is about 70 spaces occupied and the monthly maximum is about 115 spaces. Consideration should be given to raise the daily maximum rate in the short term lot so that long term parkers are discouraged from using it; therefore, the most convenient spaces at the Airport could then be available for short term parkers who typically constitute two-thirds to three-quarters of all customers.

An additional public parking need demonstrated by passengers using the Airport is a reduced grade walking path from the long term and overflow parking lot to the terminal building. Currently, passengers are required to walk up an increasing grade to access the terminal building from these lots, which is occasionally a difficult task for elderly, disabled, and other passengers who have difficulties walking long distances. As a part of any future expansion of the public parking lot, consideration should be given to developing a method to reduce or eliminate the need for walking passengers to transverse this grade change such as an escalator, elevator, and/or pedestrian bridge if a parking garage is planned.

Employee Parking Demand – Employees parking at the Airport include those from the Greater Asheville Regional Airport Authority, TSA, FAA, car rental agencies, tenants, and airlines. These employees are assigned to a variety of on-Airport parking lots which, in the aggregate, provide 381 spaces. No occupancy counts were taken in the employee lots, but their use was estimated by Airport staff to approximate the percentages illustrated in **Table 4-23**. Since employees are familiar with the parking system and generally create only low turnover in the lots, the cushion afforded to employee facilities is typically 5 percent rather than the 10 percent assigned to public facilities.

Table 4-23: Estimated Occupancy of Employee Lots

Parking Lot	Capacity	Estimated Occupancy	Parking Demand
Upper Lot	87	90%	78
Lower Lot	240	40%	96
Authority Lot	34	100%	34
DPS	6	100%	6
Maintenance Facility	14	85%	12
TOTAL	**381**	**59%**	**226**

Source: Walker Parking Consultants

Employee parking demand is estimated to remain at 226 spaces under existing conditions. Since the peak demand occurs during shift changes, a five percent cushion is incorporated that results in a parking demand of 238 spaces. Relating this demand to 2010 enplanements yields a demand ratio of 0.64 spaces per 1,000 annual originating enplanements. **Table 4-24** contains the projections of employee parking demand throughout the planning period upon which a surplus of capacity is projected to occur through 2030.

Table 4-24: Employee Parking Demand Projections

Year	Enplanements	Demand Ratio per 1,000 Enplanements	Projected Demand	Parking Capacity	Surplus/Deficit
2010	378,087	0.64	238	381	+ 143
2015	410,793	0.64	263	381	+ 118
2020	446,328	0.64	286	381	+ 95
2025	484,937	0.64	310	381	+ 71
2030	526,886	0.64	337	381	+ 44

Notes: Parking demand ratio includes a five percent cushion

Source: Walker Parking Consultants

Rental Car Ready/Return Spaces – In 2010, the rental car ready/return lot directly south of the terminal contained 107 spaces allocated as follows:

- Avis – 18 spaces
- Budget – 15 spaces
- Enterprise – 22 spaces
- Hertz – 30 spaces

- National – 22 spaces

Interviews were conducted with each rental car agency manager that focused on the current operations of the ready/return lot. Each manager was asked to estimate the number of spaces they needed for optimum conditions under today's circumstances. The total came to 144 ready/return spaces, which is three quarters more than the current 107-space lot.

Each manager related that the rental car business at the Airport is quite seasonal and that they are able to sufficiently meet demand during the winter months. However, in the summer and fall, the demand for spaces in the ready/return lot often exceeds capacity. During those periods, the shuttling of vehicles between the ready/return lot and consolidated service center cannot keep up with the demand for vehicles as one agency reported having drivers deliver cars to terminal building curbside because space was not available in the ready/return lot.

Although they are able to operate under existing conditions, all the rental car agency managers expressed the need for more space. Although the managers expressed a cumulative desire for 144 spaces compared to the existing 107, our experience is that the balance between operating expenses, particularly the labor to shuttle vehicles back and forth and the cost of leasing the ready/return spaces, typically results in fewer spaces being leased. Therefore, we estimate the 2010 need for ready/return spaces at 136, or about 27 percent more than currently provided. The parking demand ratio is therefore 0.36 spaces per 1,000 annual enplanements (136/378.087).

Demand projections for rental car ready/return spaces are shown in **Table 4-25**. As passenger traffic increases, it is anticipated that rental car transactions will increase at the same rate. Fleet sizes will grow and more spaces will be needed to accommodate the operation of each rental car agency.

Table 4-25: Rental Car Ready/Return Parking Demand Projections

Year	Enplanements	Demand Ratio per 1,000 Enplanements	Projected Demand	Parking Capacity	Surplus/ Deficit	Approx. Maximum Fleet Size
2010	378,087	0.36	136	107	- 29	950
2015	410,793	0.36	148	107	- 41	1,032
2020	446,328	0.36	161	107	- 54	1,121
2025	484,937	0.36	175	107	- 68	1,218
2030	526,886	0.36	190	107	- 83	1,324

Note: Annual enplanements are assumed to equal the annual number of deplanements
Source: Walker Parking Consultants

The rental car operation is already in need of expansion to provide customers with an acceptable level of rental car service. Office space and counter space in the terminal were not mentioned as current issues, but may need expansion in the future.

The actual growth rate of rental car business compared to the passenger growth rate is contingent on the traffic mix (business versus pleasure travel) and future expansion of the Airport service area. For example, high levels of leisure passenger traffic would result in increased rental terms which also would affect the number of spaces needed. Such phenomena could require expansion of the ready/return lot on a different schedule than originally planned. Other factors, currently unknown, can greatly influence the accuracy of any current projections. Rental car company mergers and technological or marketing innovations could remake the entire system. In any case, it is factual that expansion is needed now and that passenger traffic growth projections indicate that further expansion will be necessary in the near future.

Parking Needs Summary – A summary of existing and projected parking supply and demand throughout the planning period is presented in **Table 4-26**. Review of the table indicates the parking situation at the Airport is generally balanced except for the rental car ready/return lot. However, parking deficits will develop throughout the planning period as enplanements increase. The desired level of customer service should be considered along with the number of spaces provided as plans are developed for future parking facility needs.

Table 4-26: Parking Supply/Demand Summary

Year	Projected Annual Enpl.	Public Parking			Employee Parking			Rental Ready/Return			Total		
		Projected Parking Demand	Parking Supply	Parking Surplus/ (Deficit)	Projected Parking Demand	Parking Supply	Parking Surplus/ (Deficit)	Projected Parking Demand	Parking Supply	Parking Surplus/ (Deficit)	Parking Supply	Parking Demand	Surplus/ (Deficit)
2010	378,087	1,482	1,465	(17)	238	381	143	136	107	(29)	1,953	1,856	97
2015	410,793	1,610	1,465	(145)	263	381	118	148	107	(41)	1,953	2,021	(68)
2020	446,328	1,750	1,465	(285)	286	381	95	161	107	(54)	1,953	2,197	(244)
2025	484,937	1,901	1,465	(436)	310	381	71	175	107	(68)	1,953	2,386	(433)
2030	526,886	2,065	1,465	(600)	337	381	44	190	107	(83)	1,953	2,592	(639)

Notes: Parking supply numbers exclude visitor spaces at the maintenance facility and consolidated rental car service facility
Source: Walker Parking Consultants

Additional Parking Needs – Thought not directly related to aviation activities at the Airport, it is recommended that an expanded parking area be considered for the Advantage West headquarters located on Wright Brothers Way. Typically, the parking lot adjacent to the building provides adequate capacity for demand during normal business activities; however, meetings occasionally held at the Advantage West headquarters have resulted in a demand for parking that exceeds available capacity. When demand exceeds capacity, overflow vehicles are forced to park along Wright Brothers Way and near the entrance of the US Airways air cargo processing facility which increases traffic congestion. It is recommended the Airport work with Advantage West to help provide additional parking capacity during these short periods of increased demand so that vehicles are not parking on Wright Brothers Way and restricting traffic to other facilities such as the US Airways air cargo processing facility.

A review of vehicle parking lot pavement conditions indicates that rehabilitation or reconstruction of some of these surfaces is anticipated to be needed during the 20-year planning period. Parking lots such as the lower long-term lot, employee parking lot, and rental car ready/return lot are considered to be in “fair” condition and are anticipated to need improvements within the next five to 10 years. Planning should be initiated to improve those parking lot pavement surfaces that are considered to be in “fair” condition through preventative measures such as crack sealing and/or seal coating before complete reconstruction is needed.

4.4 General Aviation Facility Requirements

General aviation (GA) accounts for the largest percentage of annual activity at the Airport with 62 percent of all aircraft operations in 2010 conducted by itinerant and local GA aircraft. Therefore, it is important to evaluate the adequacy of GA facilities at the Airport when reviewing facility requirements. The size and type of GA facilities needed are directly proportional to the size and type of GA aircraft that operate at an airport, as well as local conditions such as climate, availability of developable land, and anticipated demand. The review of GA facilities at the Airport focused on four components where demand is related to the anticipated level of GA activity: space available for itinerant aircraft, based aircraft apron space/hangar availability, apron pavement condition, and fixed base operators.

4.4.a Itinerant Aircraft Apron Space

The demand for itinerant GA aircraft apron space calculated based upon guidance established within Appendix 5 of FAA AC 150/5300-12, *Airport Design,* which suggests the best method for determining the total amount of ramp space needed is to evaluate demand during the busiest day of operation. The total number of daily itinerant general aviation aircraft operations was obtained from the FAA's Air Traffic Activity Data System. It is assumed that 50 percent of these daily itinerant GA aircraft are parked on the ramp at a single time. Data from the FAA's Enhanced Traffic Management System, which utilizes IFR flight plan data, was used to estimate the percent of these operations by general aviation aircraft size groupings. The approximate number of square yards needed per aircraft was then used to calculate the approximate apron area needed. The existing and anticipated transient apron area needed for transient GA aircraft based on these calculations is presented in **Table 4-27**.

Table 4-27: Apron Needs for Transient Aircraft

Criteria			2010	2015	2020	2025	2030
Total Annual GA Itinerant Operations			28,843	31,298	33,356	35,609	38,062
x Percentage peak month annual ops			10.29%	10.29%	10.29%	10.29%	10.29%
= Peak month operations			2,968	3,221	3,432	3,664	3,917
Busiest Day Itinerant Operations			145	157	168	179	191
Percent of Month on Busy Day			4.89%	4.89%	4.89%	4.89%	4.89%
Itinerant GA Landing Operations			73	79	84	90	96
Assume 50% of Itinerant Ops on Ground			37	40	42	45	48
GA Aircraft Size Groupings	**Percent by Type**	**Apron SY per type**					
Single & Twin	48%	300	5,328	5,760	6,048	6,480	6,912
Beechjet, Citation I, King Air	32%	550	6,512	7,040	7,392	7,920	8,448
Hawker, Falcon, Citation II	17%	800	5,032	5,440	5,712	6,120	6,528
G-IV, G-V, Global	4%	1,500	2,220	2,400	2,520	2,700	2,880
Total Itinerant Apron Demand (SY)			19,092	20,640	21,672	23,220	24,768
Total Itinerant Apron Demand (SF)			171,828	185,760	195,048	208,980	222,912
Existing North Apron Itinerant Aircraft Parking Area (SF)			185,000				
Itinerant Apron Surplus/Deficiency (SF)			13,172	-760	-10,048	-23,980	-37,912

Note: Apron SY per type includes 10 feet wingtip clearances and apron maneuvering dimensions

The north apron totals approximately 250,000 square feet; however, some of that space is located in front of hangar doors or is used for fuel truck staging and is not appropriate for the parking of itinerant aircraft.

Considering this, there is approximately 185,000 square feet of space available for itinerant aircraft parking and maneuvering purposes on the north apron. It appears from the table that additional apron space will be needed to complement the north apron. As a result of Landmark Aviation's t 2012 relocation project that moved its FBO terminal to the old Odyssey Aviation hangar, an increase in transient aircraft parking is projected occur on the mid-ramp and south apron. While this shift in parking is anticipated to alleviate demand on the north apron, planning should be initiated for additional apron space if the mid-ramp and south aprons are unable to accommodate the increase in demand for transient aircraft parking.

4.4.b Based Aircraft Parking and Storage Areas

Apron parking and hangar storage areas for aircraft based at the Airport vary between box- and T-style hangars, designated areas on apron surfaces, and apron tie-down locations. It is typically assumed that all based aircraft desire hangar storage, so aircraft parked on apron surfaces is often used as an indicator of the need for additional hangars. However, as a result of the influx of seasonal-based aircraft, some aircraft owners may prefer to not lease hangars for their temporary stay at the Airport or may prefer to park their aircraft on the apron. This section evaluates the need for apron space and hangar storage at the Airport throughout the planning period for based aircraft with consideration given to the seasonal peak demand for based aircraft parking.

Forecasts prepared in Chapter 3 projected the number of based aircraft by fleet mix that can be anticipated at the Airport throughout the 20-year planning period. As summarized in **Table 4-28**, based aircraft are anticipated to grow from a total of 174 aircraft in 2010 to a total of 217 aircraft in 2030. Based single-engine aircraft are projected to increase approximately 21 percent throughout the planning period while based multi-engine and jet aircraft are projected to increase approximately 30 percent and 63 percent, respectively.

Table 4-28: Based Aircraft Fleet Mix Projections Summary

Year	Single Engine	Multi Engine	Jets	Helicopters	Total
2010	115	37	16	6	174
2015	122	39	20	4	184
2020	129	41	21	4	195
2025	134	43	25	4	206
2030	139	48	26	4	217

Projections: Mead & Hunt, Inc.

Landmark Aviation manages the apron tie-down and hangar leases for based aircraft at the Airport and keeps an updated inventory of the parking locations of each aircraft. A snapshot of based aircraft parking locations obtained from Landmark Aviation in September 2011 offered a method to evaluate the demand for apron and hangar space. **Table 4-29** summarizes the September 2011 count of based aircraft parking locations at the Airport. As indicated in the table, 25 percent of based aircraft are parked at a tie-down location on an apron surface while 75 percent of aircraft are parked in either a box-style or T-style hangar.

Table 4-29: Based Aircraft Parking Locations

Aircraft Type	Box-Style Hangar	% of Total	T-Style Hangar	% of Total	Tie-down/ Apron	% of Total	Total
Single Engine	33	30%	48	43%	30	27%	111
Multi Engine	11	44%	10	40%	4	16%	25
Jets	12	75%	0	0%	4	25%	16
Helicopters	2	100%	0	0%	0	0%	2
TOTAL	**58**	**38%**	**58**	**38%**	**38**	**25%**	**154**

Note: Percentages may not add to 100% due to rounding

Source: Landmark Aviation based aircraft information, September 2011

In order to establish a baseline for evaluating whether additional capacity may be needed, an inventory was collected on available area for based aircraft parking. The total area in square feet designated for aircraft parking on the mid-ramp and in each hangar was calculated and is summarized in **Table 4-30**. As indicated in the table, there are a total of 15 hangar structures and two aprons that provide approximately 688,900 square feet of area for aircraft parking. In addition, the middle ramp is approximately 444,700 square feet in area and has 113 tie-down locations. It should be noted that the number of aircraft parking positions in both hangars and on apron surfaces can vary based on the size of aircraft being accommodated in each hangar and positioned at each tie-down location. Also, the available apron area for aircraft parking can also vary as additional space can be made available based on the positioning of parked aircraft adjacent to designated parking areas, hangar structures, and taxi lanes. For the purposes of this needs analysis, only the areas designated for aircraft parking on the mid-ramp and south apron were included in the parking summary.

Table 4-30: Available Based Aircraft Parking Summary

Parking Method	Number Available	Number of Aircraft Parking Positions	Total Approximate Sq. Ft. Available
Box Style Hangar	12 hangars	*	155,600 sq. ft.
T-Style Hangar	3 hangars	68	88,600 sq. ft.
Tie Down/Apron Space	2 aprons	113*	444,700 sq. ft.
TOTAL	15 hangars & 2 aprons	181*	688,900 sq. ft.

Notes:

* = Number of available parking positions varies based on aircraft type

Belle Air Maintenance Facility hangar not included in calculations

Source: Mead & Hunt, Inc.

Discussions with Airport officials and Landmark Aviation staff as well as a review of the breakdown in existing based aircraft parking locations, indicates there is hangar availability at the Airport as no hangar waiting list is presently maintained. It is assumed then that a percentage of based aircraft owners prefer to park their aircraft at tie-down locations or within designated parking areas on apron surfaces. Given the percentage of based aircraft parked in hangars versus tie-down locations on apron surfaces remains constant throughout the planning period, the demand for future apron space and hangar availability can be projected. A summary of anticipated demand for tie-down apron space and hangar demand for the projected fleet mix of based aircraft at the Airport is presented in **Table 4-31**. As indicated in the table, growth in demand for box-style hangars, T-style hangars, and tie-down locations on the apron surfaces is anticipated through 2030.

Table 4-31: Projected Based Aircraft Apron Parking and Hangar Demand by Fleet Mix

Aircraft Type/ Year	Projected Based Aircraft	Box-style hangar	% of total	T-style hangar	% of total	Tie-down/ apron	% of total
Single Engine							
2015	122	37	30%	52	43%	33	27%
2020	129	39	30%	55	43%	35	27%
2025	134	40	30%	58	43%	36	27%
2030	139	42	30%	60	43%	38	27%
Multi Engine							
2015	39	17	44%	18	40%	6	16%
2020	41	18	44%	19	40%	7	16%
2025	43	19	44%	20	40%	7	16%
2030	48	21	44%	23	40%	8	16%
Jets							
2015	20	15	75%	0	0%	5	25%
2020	21	16	75%	0	0%	5	25%
2025	25	19	75%	0	0%	6	25%
2030	26	20	75%	0	0%	7	25%
Helicopters							
2015	4	4	100%	0	0%	0	0%
2020	4	4	100%	0	0%	0	0%
2025	4	4	100%	0	0%	0	0%
2030	4	4	100%	0	0%	0	0%
TOTAL DEMAND							
2015	185	73	-	70	-	44	-
2020	195	77	-	74	-	47	-
2025	206	82	-	78	-	49	-
2030	217	87	-	83	-	53	-

Notes: Aircraft demand by hangar/apron space may not equal projected total due to rounding

Source: Mead & Hunt, Inc.

As indicated previously, the available parking capacity for based aircraft on apron surfaces and in hangar structures is dependent upon the size of each aircraft and how each one is positioned with other aircraft within each designated parking area. Before an evaluation can be conducted to compare whether additional based aircraft capacity is necessary to meet projected demand, the area needed to park aircraft within each fleet mix classification must first be determined. **Table 4-32** summarizes the approximate parking area in square feet for each type of based aircraft anticipated in the projected fleet mix. Since the amount of area required to park an aircraft varies between model types, planning ratios were established for each fleet mix classification based upon the size of common aircraft types. Size approximations for each aircraft classification included a safety margin for wingtip, nose, and tail clearances.

Table 4-32: Typical Parking Area Sizes for Based Aircraft

Aircraft Type	Examples	Approximate Square Feet
Single Engine	Cessna 172, Cirrus SR-22	1,400 square feet
Multi Engine	Piper Seneca, Beechcraft King Air	2,500 square feet
Small & Mid-Sized Jets	Cessna Citation, LearJet	3,600 square feet
Large Business Jets	Gulfstream G550, Global Express	10,000 square feet
Helicopters	Sikorsky S-76, Bell 206	1,400 square feet

Note: Approximately 3,935 square feet of apron space required for each aircraft with taxilanes included.

Source: Mead & Hunt, Inc.

The anticipated demand for box-style hangar space, T-style hangar units, and apron tie-down space for the planning period is presented in **Table 4-33**. It should be noted that a T-style hangar unit is defined as a covered parking space for one single-engine or small twin-engine aircraft and that it is assumed 15 percent of projected based jets parked in hangars are large business jets. As illustrated in the table the demand for box-style hangar area is anticipated to increase to approximately 208,100 square feet by 2030 while the demand for T-hangar space will increase to 83 units. Approximately 53 tie-downs and 208,500 square feet of tie-down apron area are also anticipated by 2030 for based aircraft.

Table 4-33: Projected Hangar and Apron Area Requirements

Aircraft Type/ Year	Approx. Area per Aircraft (Sq. ft.)	Box-Style Hangar		T-Style Hangar	Tie-down/Apron Area	
		Projected Demand (aircraft)	Needed Capacity (Sq. ft.)	Projected Demand (aircraft)	Projected Demand (aircraft)	Apron Area (Sq. ft.)
Single Engine						
2015	1,400	37	51,800	52	33	129,855
2020	1,400	39	54,600	55	35	137,725
2025	1,400	40	56,000	58	36	141,660
2030	1,400	42	58,800	60	38	149,530
Multi Engine						
2015	2,500	17	42,500	18	6	23,610
2020	2,500	18	45,000	19	7	27,545
2025	2,500	19	47,500	20	7	27,545
2030	2,500	21	52,500	23	8	31,480
Small & Mid-sized Jets & Turboprops						
2015	3,600	13	46,800	0	5	19,675
2020	3,600	14	50,400	0	5	19,675
2025	3,600	16	57,600	0	6	23,610
2030	3,600	17	61,200	0	7	27,545
Large Business Jets						
2015	10,000	2	20,000	0	0	0
2020	10,000	2	20,000	0	0	0
2025	10,000	3	30,000	0	0	0
2030	10,000	3	30,000	0	0	0
Helicopters						
2015	1,400	4	5,600	0	0	0
2020	1,400	4	5,600	0	0	0
2025	1,400	4	5,600	0	0	0
2030	1,400	4	5,600	0	0	0
TOTAL DEMAND						
2015	-	73	166,700	70	44	173,140
2020	-	77	175,600	74	47	184,945
2025	-	82	196,700	78	49	192,815
2030	-	87	208,100	83	53	208,555

Note: It is assumed 15 percent of total based jet projections will be large business jets and that all large business jets will require storage in a box-style hangar.

Projections: Mead & Hunt, Inc.

The needed capacity for projected hangar and apron area demand for based aircraft is presented in **Table 4-34**. As illustrated in the table, approximately 52,500 square feet of additional box-style hangar space and an additional 15 T-hangar units will be needed to accommodate anticipated demand by 2030. Existing tie-down and apron space for based aircraft appears sufficient to meet anticipated demand throughout the planning period.

Table 4-34: Projected Hangar and Apron Area Needed Capacity				
Aircraft Type/ Parking Method	**2015**	**2020**	**2025**	**2030**
BOX-STYLE HANGAR				
Needed Capacity	166,700 sq. ft.	175,600 sq. ft.	196,700 sq. ft.	208,100 sq. ft.
Available Capacity	155,600 sq. ft.	155,600 sq. ft.	155,600 sq. ft.	155,600 sq. ft.
Surplus/Deficit	**- 11,100 sq. ft.**	**- 20,000 sq. ft.**	**- 41,100 sq. ft.**	**- 52,500 sq. ft.**
T-STYLE HANGAR				
Needed Capacity	70 units	74 units	78 units	83 units
Available Capacity	68 units	68 units	68 units	68 units
Surplus/Deficit	**- 2 units**	**- 6 units**	**- 10 units**	**- 15 units**
TIE-DOWN/APRON AREA				
Needed Capacity	173,140 sq. ft.	184,945 sq. ft.	192,815 sq. ft.	208,555 sq. ft.
Available Capacity	444,700 sq. ft.	444,700 sq. ft.	444,700 sq. ft.	444,700 sq. ft.
Surplus/Deficit	**+272,560 sq. ft.**	**+259,755 sq. ft.**	**+251,885 sq. ft.**	**+236,145 sq. ft.**

Projections: Mead & Hunt, Inc.

It is recommended that the Airport plan for the construction of additional box-style hangar or hangars with an available capacity of at least 52,500 square feet to accommodate the anticipated demand for based aircraft parking. Construction of a structure or structures that can meet this expected demand will allow the Airport to adequately meet the demand for hangar space of single-engine, multi-engine, jet, and helicopter aircraft owners. Planning should also be initiated for the development of additional T-hangar units to meet the expected increase in demand for single-engine aircraft owners.

No improvements or expansion of tie-down areas and designated apron parking locations are anticipated as sufficient area is available to accommodate the projected demand. The surplus in the mid-ramp tie-down apron areas can be used to meet the deficiency in itinerant apron needs identified for the north ramp. It is anticipated that the northern portion of the mid-ramp will be used primarily for itinerant aircraft parking, particularly given the pending relocation of the FBO terminal building to the old Odyssey hangar.

4.4.c Apron Pavement Condition

The Terminal Area Planning Study conducted in 2005 indicated the north apron and mid-ramp have a weight bearing capacity of 60,000 pounds for aircraft with dual wheel main landing gear configurations while the south apron has a weight bearing capacity of 100,000 pounds for aircraft with the same landing gear configuration. A review of empty ramp weight and MTOW of the most demanding types of aircraft parked on each surface found that additional pavement strength may be needed for the north apron, south apron, and mid ramp. For the north apron and mid-ramp, the Bombardier Global Express XRS and the Gulfstream G550, each with an empty weight of 51,200 pounds and 48,300 pounds, respectively, are typically the largest aircraft parked on each surface. While capable of supporting the empty weights of each aircraft, additional weight-bearing capacity is needed to support Global Express and G550 if each is at their MTOW (98,000 pounds and 91,000 pounds, respectively). If it is planned to continually park these aircraft types on each surface at their MTOW, it is recommended the pavement strength be increased as a part of any future apron pavement reconstruction or rehabilitation project.

The weight bearing capacity of the south apron is greater than the north apron/mid-ramp areas and is typically used to service and park larger aircraft types such as the Boeing Business Jet and the Lockheed Martin C-130. A review of the empty ramp weight and MTOW of these aircraft types also concluded that additional pavement strength is needed in order to support these aircraft at their MTOW. While the pavement strength appears sufficient for the empty weight of the Boeing Business Jet (94,980 pounds) and the Lockheed Martin C-130 (73,000 pounds), additional pavement strength is needed to support the MTOWs of each aircraft (171,000 pounds and 165,000 pounds, respectively).

It is also important to note the weight bearing capability of the south apron to support the Boeing 757 since this aircraft occasionally conducts charter operations at the Airport and is projected to be increased in use commercial airlines throughout the planning period. As noted, the weight bearing capacity of the south apron is 100,000 pounds for aircraft with dual wheel main landing gear configurations. Since the Boeing 757 has a dual-tandem main landing gear configuration, FAA AC 150/5335-5B, *Standardized Method of Reporting Airport Pavement Strength – PCN*, was referenced to determine the dual tandem wheel weight capacity based on the duel wheel weight capacity. According to Appendix 6 of the AC, pavement surfaces with an optimal subgrade designed to support dual wheel main landing gear configuration aircraft weighing up to 100,000 pounds should be capable of supporting dual tandem wheel main landing gear configuration aircraft weighing up to 195,000 pounds. Likewise, pavement supported by less desirable subgrade conditions capable of supporting the weight of a dual wheel main landing gear configuration aircraft weighing approximately 100,000 pounds should be able to support a dual tandem main landing gear configuration aircraft weighing approximately 160,000 pounds. Review of the empty ramp weight and MTOW of the Boeing 757-200 (130,440 pounds and 255,000 pounds, respectively) indicates the surface is capable of supporting the empty weight of the aircraft but not at its MTOW. As such, it is recommended the weight bearing capacity of the south apron be increased as a part of any future apron reconstruction or rehabilitation project if the Airport anticipates that fully loaded Boeing 757s will be parked on the surface at any time throughout the planning period.

In addition to increasing the weight bearing capacity of the apron surfaces, consideration should also be given to replace sections of apron pavement that have deteriorated beyond acceptable conditions. This includes areas that have excessive cracks, severe spalling, loose debris, and depressions or low spots. While a majority of the pavement on the north apron and south apron is considered to be in “good” condition, large sections of pavement on the mid-ramp are considered to be in “poor” condition and should be repaired before the pavement is considered “failed”. If it is not economically feasible to plan for a major apron rehabilitation or reconstruction project, it is recommended apron pavement repair efforts should focus on the most deteriorated sections of apron pavement.

4.4.d Fixed Base Operators

Fixed base operators (FBOs) are aeronautical-related businesses that provide services to general aviation aircraft, pilots, and passengers, as well as provide support services for commercial airlines and air cargo operators. FBOs typically offer the sale of aviation fuel and line services, but may also provide aircraft maintenance, flight training, aircraft rental, catering, air taxi, charter services, sale of aircraft parts, and storage facilities for itinerant and based aircraft. The services offered by FBO vary from airport to airport based on the level and type of aviation activities conducted at an airport. Landmark Aviation operates the only FBO at the Airport and offers full service Jet A and 100 low lead (100LL) aircraft refueling as well as self-serve 100LL aircraft fueling, ground handling services, and storage for itinerant and based aircraft. Landmark Aviation's facility also serves as the terminal facility for passengers, pilots, and crew members departing and arriving from GA flights.

Landmark Aviation recently opened a modern, state-of-the-art facility in 2009 that was based on a comprehensive evaluation of user needs and aeronautical services demanded at the Airport. A renovation of the former Odyssey Aviation building (Building # 40) scheduled for completion in 2012 will expand the aircraft storage and service capabilities of Landmark Aviation and move the transient FBO operations into the renovated building. Space occupied in the existing Landmark Aviation building for transient aircraft operations will then be converted to serve corporate and based customers. As a result of these recent improvements, it is anticipated level of FBO services provided at the Airport will be sufficient to meet demand throughout the planning period. It should be noted that several variable and unforeseen factors can impact an FBO business model at an airport such as changes in local, national, and global economies, cost of aviation fuel, competition with competing FBO service provides, number and type of aircraft based at an airport by tenants, and the demand for specific aeronautical services. Continual evaluation should take place throughout the planning period as activity levels change to assess how well aeronautical needs are being addressed and determine if improvements or expansion of the FBO is needed.

4.5 Support Facility Requirements

Support facilities required for the operation and maintenance of the Airport were evaluated as a part of the facility needs analysis and focused on structures and buildings that provide essential services to help keep the airfield operational. Support facilities included in this review are as follows:

- Department of Public Safety (DPS) Facility / Aircraft Rescue and Fire Fighting (ARFF)
- Airport Maintenance Facility
- Aircraft Fuel Storage Facilities
- Vehicle Fuel Storage Facilities

4.5.a Department of Public Safety (DPS) Facility / Aircraft Rescue and Fire Fighting (ARFF)

The Airport Department of Public Safety (DPS) is responsible for police, fire, and first response medical services at the Airport in addition to providing Aircraft Rescue and Fire Fighting (ARFF) services for aircraft operations. Review of facility requirements for the Department of Public Safety focused on two elements: the capability of the DPS facility to meet the operational needs of the department throughout the planning period and whether the existing ARFF Index is sufficient to accommodate the types of commercial aircraft anticipated to operate at the Airport. The following section will evaluate these two elements and identify any improvements that may be necessary to meet anticipated user needs.

DPS Facility – The DPS facility serves as the centralized center for public safety operations at the Airport and is located on the south end of the terminal apron adjacent to the passenger terminal building. In addition to providing office space, locker rooms, and break areas for DPS officers, this building also houses the Airport's Aircraft Rescue and Fire Fighting (ARFF) equipment and communication center. Vehicle bays included in the structure provide sheltered, heated storage of fire apparatuses and storage areas for materials, supplies, and equipment. Adjacent rooms in the facility provide personnel quarters, training areas, a day room, and additional storage space for DPS officers.

The most recent renovation of the DPS facility occurred in 1993 when an expansion project added additional office areas, an expanded kitchen area/day room, and a training room. Since then, the existing facility has reached its available capacity for the storage of equipment and supplies. Most notably, the apparatus bays of the existing DPS facility are not large enough to house next generation ARFF equipment that the Airport will be required to purchase in the next few years to replace outdated equipment. In addition, there is concern with maintaining unobstructed access from the DPS facility to the airfield for responding DPS and ARFF vehicle due to the close proximity of parked air carrier aircraft on the terminal apron.

At the time of this master planning the study, the Airport was working with an architect to develop an initial design of a new DPS facility that addresses the inadequacies of the existing facility. The new DPS facility will be planned to incorporate larger vehicle bays capable of housing larger next generation ARFF equipment while providing adequate space for work areas and the storage of equipment and supplies. Since a comprehensive effort was being undertaken by the Airport to conceptualize a new DPS facility, a detailed reviewed of needs will not be discussed in this master plan. It is recommended that the design of the new DPS facility be based on the findings of this comprehensive evaluation of existing and future needs.

ARFF Index – In addition to reviewing the needs of the existing DPS facility, the level of ARFF services provided in accordance with FAR Part 139 was also evaluated to determine if an increase in the Airport's index can be anticipated throughout the planning period. Operators of airports that hold an FAR Part 139 certificate are required to provide ARFF services during air carrier operations determined by a combination of the length and average daily departures of the longest air carrier aircraft that has an average of five or more daily departures. Presently, the Airport is classified as an Index B facility that must meet the following minimum equipment and agent requirements:

- One vehicle carrying at least 500 pounds of sodium-based dry chemical, Halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of Aqueous Film Forming Foam (AFFF) or;

- Two vehicles with one carrying 500 pounds of sodium-based dry chemical, Halon 1211, or clean agent or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of AFFF to total 100 gallons for simultaneous dry chemical and AFFF application and the other vehicle carrying an amount of water and commensurate quantity of AFFF so that the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons.

Based on the future aviation activity projections presented in Chapter 3, the Airport can expect increased operations from larger ARC Category C-II and C-IV aircraft throughout the planning period. Though the projected number of average daily operations by these larger aircraft types is not anticipated to be greater than five, consideration should be given to meet Index C requirements should the number of average daily operations by these aircraft types exceed projections. Increasing the ARFF Index from B to C would require the Airport to maintain:

- Three vehicles with one carrying 500 pounds of sodium-based dry chemical, Halon 1211, or clean agent or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of AFFF to total 100 gallons for simultaneous dry chemical and AFFF application and two vehicles carrying an amount of water and commensurate quantity of AFFF so the total quantity of water for foam production carried by all three vehicles is at least 3,000 gallons or;

- Two vehicles with one carrying at least 500 pounds of sodium-based dry chemical, Halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of AFFF for foam application and one vehicle carrying water and the commensurate quantity of AFFF so the total quantity of water for foam productions carried by both vehicles is at least 3,000 gallons.

Based on the projected frequency of aircraft types anticipated to operate at the Airport during the planning period, an ARFF Index B classification appears adequate to meet FAR Part 139 firefighting requirements.

4.5.b Airport Maintenance Facility

The maintenance facility at the Airport is a three-building complex located landside near the intersection of Aviation Way and Wright Brothers Way that provides approximately 30,680 square feet of area for the storage of equipment, supplies, materials, and office/work space for maintenance personnel. Multiple vehicle bays at each facility provide covered, heated areas to store airfield snow removal apparatuses such as plow trucks, brooms, and snow blowers; airfield maintenance equipment such as trucks, tractors, trailers, and mower decks; and airfield deicing and anti-icing materials such as sand and potassium acetate. Dedicated vehicle bays equipped with vehicle lifts and an overhead crane that provide an area to conduct maintenance and repairs on all types of Airport vehicles. Adjacent to the vehicle bay facilities is the maintenance office building that includes office space, work areas, a locker room, break room/kitchen area, and dormitories for maintenance personnel. Land north of the maintenance facility complex provides additional area for the overflow storage of equipment, supplies, and vehicles.

Recent improvements to the maintenance facility complex in 2006 that constructed the state-of-the-art vehicle service bay facility and work space/office areas for maintenance personnel addressed long-term vehicle, equipment, and material storage needs; no significant improvements to the complex are anticipated throughout the planning period. Consideration should be given, however, to necessary facility improvements as new equipment is purchased. For example, larger available widths for snow plows and brooms may require an increase in the size of vehicle doors to permit transition of the equipment into and out of the vehicle bays. Likewise, the construction of an additional vehicle storage facility may be needed if existing facilities are unable to accommodate the fleet mix of maintenance equipment, supplies, and materials.

Additionally, improved facilities are needed near the terminal building for the storage of winter deicing chemicals, maintenance equipment, and supplies. Current facilities and areas in the terminal building for the storage of deicing chemicals, supplies, and equipment are not adequately sized to meet needed demand, requiring some items to be kept at the maintenance facility complex. This proves to be most inefficient during the winter season when required travel between the terminal and the maintenance facility complex for supplies and equipment results in delayed snow removal operations around the terminal area. It is encouraged that planning be initiated to improve and expand deicing chemical storage facilities and maintenance storage areas near the terminal building to meet anticipated demand throughout the planning period.

Continual evaluation of the storage capacity needs of the maintenance department is recommended throughout the planning period to determine if any further improvements may be needed to the maintenance facility complex.

4.5.c Aircraft Fueling Facilities

Two aircraft fuel farm facilities are located on Wright Brothers Way, one adjacent to the Landmark Aviation facility and the second east of the approach end of Runway 16. Combined, the two fuel farms have a total capacity of 80,000 gallons of Jet-A fuel and 24,000 gallons of 100 low lead (LL) fuel that are stored in above ground tanks surrounded by secondary containment walls and dykes to control fuel in the event of accidental leakage. Aircraft fuel farm improvements scheduled for 2012 will add two 20,000 gallon Jet-A fuel tanks to the fuel storage facility adjacent to the approach end of Runway 16 and relocate a 1,000 gallon 100LL tank near the Landmark Aviation hangar to Building # 40. In addition, the fuel farm facility adjacent to the Landmark Aviation FBO will be removed. After the completion of the planned fuel farm improvements in 2012, Jet-A storage capacity will remain at 80,000 gallons while 100LL capacity will decrease to 13,000 gallons.

In evaluating the aircraft fuel storage requirements of the Airport throughout the planning period, it is first important to review historical fuel sales to establish a baseline of demand. Historical annual fuel sales at the Airport from 2008 to 2011 are presented in **Table 4-35**. As illustrated in the table, an average of 4,212,530 gallons of Jet-A fuel has been sold annually between 2008 and 2011; likewise during the same period an annual average of 225,652 gallons of 100LL fuel has been sold. It should also be noted from the table that approximately 68 percent of fuel sold at the Airport, on average, is for commercial airline operations (Jet-A) while approximately 27 percent and five percent of fuel sold, respectively, is for GA turbine (Jet-A) and GA reciprocal engine aircraft (100LL) operations.

Table 4-35: 2008-2011 Aviation Fuel Sales (In Gallons)

Year	Airline Jet-A	% of Total	GA Jet-A	% of Total	Total Jet-A	% of Total	GA 100LL	% of Total	TOTAL SALES
2008	2,811,980	63%	1,365,815	31%	4,177,795	94%	287,488	6%	4,465,283
2009	2,499,258	66%	1,073,280	28%	3,572,538	94%	213,093	6%	3,785,631
2010	3,517,752	72%	1,137,293	23%	4,655,045	96%	216,837	4%	4,871,882
2011	3,251,904	70%	1,192,838	26%	4,444,742	96%	185,190	4%	4,629,932
'08-'11 Avg.	3,020,224	68%	1,192,307	27%	4,212,530	95%	225,652	5%	4,438,182

Note: Percentages may not add to 100% due to rounding
Source: Asheville Regional Airport

Aircraft fuel storage requirements can be projected assuming the percentage in total annual fuel sold for commercial airline, GA turbine, and GA reciprocal engine aircraft remains constant throughout the planning period. The historical average of Jet-A fuel sales per commercial airline operation is presented in **Table 4-36**. As illustrated in the table, an average of 152.065 gallons of fuel is sold per operation given that historically commercial airlines account for 72 percent of Jet-A fuel sales.

Table 4-36: Historical Commercial Airline Jet-A Fuel Demand

Year	Total Jet-A Fuel Sales	Historical Average of Sales	Commercial Jet-A Fuel Sales	Commercial Operations	Gallons per Operation Ratio
2008	4,177,795	72%	3,008,012	20,376	147.625
2009	3,572,538	72%	2,572,227	17,597	146.174
2010	4,655,045	72%	3,351,632	20,765	161.408
2011	4,444,742	72%	3,200,214	20,909	153.054
				AVERAGE	**152.065**

Source: Historical Operations – FAA Air Traffic Activity Data System (ATADS)
Projections: Mead & Hunt, Inc.

Based on the average gallons-per-operation ratio, projections presented in **Table 4-37** were developed for future commercial airline Jet-A fuel consumption. Nearly 3.5 million gallons of Jet-A fuel are projected to be sold to commercial airlines at the Airport by 2030.

Table 4-37: Projected Commercial Airline Jet-A Fuel Demand

Year	Projected Operations	Gallons per Operations	Projected Demand (in Gallons)
2015	20,922	152.065	3,181,504
2020	21,780	152.065	3,311,976
2025	22,074	152.065	3,356,683
2030	22,922	152.065	3,485,634

Projections: Mead & Hunt, Inc.

Table 4-38 illustrates the historical gallons-per-operation ratio for the remaining 28 percent of Jet-A aviation fuel sales at the Airport associated with turbine-powered general aviation aircraft. As illustrated in the table, a ratio of 27.222 gallons of Jet-A fuel is sold per general aviation operation.

Table 4-38: Historical GA Jet-A Fuel Demand

Year	Total Jet-A Fuel Sales	Historical Average of Sales	GA Jet-A Fuel Sales	Total GA Operations	Gallons per Operation Ratio
2008	4,177,795	28%	1,169,783	52,912	22.108
2009	3,572,538	28%	1,000,311	45,125	22.168
2010	4,655,045	28%	1,303,413	41,752	31.218
2011	4,444,742	28%	1,244,528	37,267	33.395
				AVERAGE	**27.222**

Source: Historical Operations – FAA Air Traffic Activity Data System (ATADS)
Projections: Mead & Hunt, Inc.

The projected demand in Jet-A fuel sales at the Airport for GA turbine-powered aircraft is presented in **Table 4-39**. As illustrated in the table, fuel consumption is expected to increase from approximately 1.2 million gallons in 2015 to almost 1.5 million gallons in 2030.

Table 4-39: Projected GA Jet-A Fuel Demand

Year	Projected Operations	Gallons per Operation Ratio	Projected Demand (in Gallons)
2015	45,306	27.222	1,233,320
2020	48,285	27.222	1,314,414
2025	51,547	27.222	1,403,212
2030	55,097	27.222	1,499,851

Projections: Mead & Hunt, Inc.

Table 4-40 illustrates the historical gallons-per-operation ratio for 100LL fuel consumption at the Airport from 2008 to 2011. Since single- and twin-engine GA aircraft are typically powered by 100LL fuel, calculating the ratio of fuel sales to total GA operations offers a satisfactory method to find the gallons-per-operation ratio. As indicated in the table, an average of 5.079 gallons of fuel was sold per general aviation aircraft operation from 2008 to 2011.

Table 4-40: Historical 100LL Fuel Demand

Year	Total 100LL Fuel Sales	Total GA Operations	Gallons per Operation Ratio
2008	287,488	52,912	5.433
2009	213,093	45,125	4.722
2010	216,837	41,752	5.193
2011	185,190	37,267	4.969
		AVERAGE	**5.079**

Source: Historical Operations – FAA Air Traffic Activity Data System (ATADS)
Projections: Mead & Hunt, Inc.

The projected demand for 100LL fuel throughout the planning period is presented in **Table 4-41**. The demand for 100LL fuel at the Airport is anticipated to increase to 279,838 gallons in 2030, a 22 percent increase from the 230,109 gallons of fuel projected to be consumed in 2015.

Table 4-41: Projected 100LL Fuel Demand

Year	Projected Operations	Gallons per Operation Ratio	Projected Demand (in Gallons)
2015	45,306	5.079	230,109
2020	48,285	5.079	245,239
2025	51,547	5.079	261,807
2030	55,097	5.079	279,838

Projections: Mead & Hunt, Inc.

Projected demand and fuel storage requirements for Jet-A and 100LL fuel at the Airport throughout the planning period is presented in **Table 4-42**. Approximately 4.9 million gallons of Jet-A fuel is anticipated to be sold at the Airport annually by 2030 in addition to nearly 280,000 gallons of 100LL fuel. As indicated in the table, additional capacity will be needed to store a seven day supply of Jet-A fuel throughout the planning period. The planned 13,000 gallon storage capacity for 100LL fuel appears well sufficient to meet anticipated demand for in excess of two weeks.

Table 4-42: Projected Demand and Fuel Storage Requirements

Demand/ Year	Commercial Demand	GA Demand	Total Demand	7 Day Demand	Available Capacity	Surplus/ Deficit
Jet-A						
2015	3,181,504	1,233,320	4,414,824	84,668 gal.	80,000 gal.	- 4,668 gal.
2020	3,311,976	1,314,414	4,626,390	88,483 gal.	80,000 gal.	- 8,483 gal.
2025	3,356,683	1,403,212	4,759,895	91,286 gal.	80,000 gal.	- 11,286 gal.
2030	3,485,634	1,499,851	4,985,485	95,612 gal.	80,000 gal.	- 15,612 gal.
100LL						
2015	0	230,109	230,109	4,413 gal.	13,000 gal.	+ 8,587 gal.
2020	0	245,239	245,239	4,690 gal.	13,000 gal.	+ 8,310 gal.
2025	0	261,807	261,807	5,021 gal.	13,000 gal.	+ 7,979 gal.
2030	0	279,838	279,838	5,367 gal.	13,000 gal.	+ 7,633 gal.

Projections: Mead & Hunt, Inc.

Overall, it appears additional aircraft fuel storage capacity will be needed to meet a seven day supply throughout the planning period. It is recommended planning be initiated by 2015 to construct an additional tank or tanks with the capacity to meet the projected fuel storage deficit through 2030. Though the storage capacity of 100LL fuel at the Airport will decrease by 19,000 gallons after planned fuel farm improvements are completed in 2012, the remaining 13,000 gallon capacity appears more than sufficient to meet anticipated demand. Since other various unforeseen factors can impact the demand for aviation and likewise the demand for aviation fuel, it is recommended the level of commercial airline operations, general aviation activity, and the sale of aviation fuel be continually monitored throughout the planning period to determine if any fuel storage capacity improvements will be needed.

It should be noted that the demand in fuel projected throughout the planning period includes consumption from larger sized aircraft that are expected to increase in operations at the Airport throughout the planning period. Larger aircraft such as the Boeing 737, Airbus A320, and the Boeing 757 have fuel capacities that are up to four times larger than the current fleet mix of commercial aircraft. While the projected demand for aviation fuel is based on a historical gallons-per-operation ratio from the existing fleet mix, it is anticipated the increase in demand from larger aircraft will offset the loss in demand from smaller regional jets that are expected to conduct less frequent operations at the Airport.

4.5.d Vehicle Fuel Storage Facilities

In addition to aircraft fuel storage facilities, there are also two vehicle fuel storage facilities at the Airport that provide rental car agencies fuel for returned rental vehicles and to refuel Authority owned vehicles, equipment, and self-propelled apparatuses. An assessment of the existing capacity at each facility and its ability to meet demand projected throughout the planning period was conducted as a part of the facility needs analysis. The following sections summarize whether the existing capacity at each facility is adequate to store a seven day supply of fuel or if additional improvements may be needed to meet anticipated demand.

Rental Car Fuel Storage Facility – The rental car fuel storage facility located between the two vehicle service buildings at the consolidated rental car service facility is comprised of five above ground, double walled tanks that each has a capacity of 5,000 gallons for unleaded fuel. Data obtained from Airport records on the total amount of unleaded fuel delivered at the facility in 2011 by car rental agency is presented in **Table 4-43**. As indicated in the table, a total of 150,431 gallons of fuel was delivered to the facility in 2011, averaging approximately 2,893 gallons of fuel consumed each week. Given that the combined total capacity of the five fuel tanks is 25,000 gallons, it appears the rental car fuel storage facility is well suited to provide a seven day supply of fuel to meet existing demand.

Table 4-43: Summary of 2011 Rental Car Agency Fuel Deliveries

Agency	Total Unleaded Fuel Delivered
Avis / Budget	25,257 gallons
Enterprise / National / Alamo	84,619 gallons
Hertz	40,555 gallons
ANNUAL TOTAL	150,431 gallons
Weekly Average	2,893 gallons

Source: Asheville Regional Airport

As indicated in the rental car ready/return discussion of the Vehicle Parking Requirements section of this chapter, the rental car fleet at the Airport is projected to grow approximately 39 percent from 950 vehicles in 2010 to 1,324 vehicles in 2030. Assuming fuel consumption by the rental car agencies increases at this same rate, approximately 4,032 gallons of fuel is projected to be consumed each week on average by 2030. Again, the capacity of the rental car fuel storage facility well exceeds what is needed to provide a seven day supply of fuel. As such, it appears no improvements are necessary to increase the capacity of the rental car fuel storage facility to provide a seven day supply of fuel throughout the planning period.

Fuel Storage Facility – The fuel storage facility operated by the Authority is intended to refuel Authority vehicles and equipment and is located at the Airport maintenance facility that consists of one double walled, 1,800 gallon unleaded gasoline tank and one double walled, 1,800 gallon diesel tank. In 2011, approximately 3,750 gallons of unleaded gasoline and 7,590 gallons of diesel fuel were pumped for Authority use, averaging to approximately 72 gallons of unleaded gasoline and 145 gallons of diesel fuel each week. Given that the total capacity of each tank is 1,800 gallons, the fuel storage facility is well capable of storing a seven day supply of fuel to meet existing demand. Considering that the amount of unleaded gasoline and diesel fuel consumed by the Authority remains relatively constant from year to year, an increase in demand is not projected throughout the planning period. As such, it appears no improvements are necessary to increase the capacity of the fuel storage facility to meet an average seven day demand for fuel through 2030.

4.6 Additional Facility Requirements

In addition to airside and landside infrastructure, a review of other aeronautical and non-aeronautical related elements critical to the overall operation of the Airport was conducted to identify other facility requirements. This review focused on two infrastructure components that the Airport has received numerous requests from existing and potential tenants over the past several years: development areas for air cargo operations and vehicle service facilities for rental car operations. The following section evaluates these infrastructure inquires to determine what improvements may be necessary to meet anticipated demand throughout the planning period.

4.6.a Air Cargo Development

The existing air cargo facility at the Airport is a 2,178 square foot facility operated by US Airways located adjacent to the DPS facility on the terminal apron. The facility primarily processes small packages for US Airways commercial passenger jets, single-engine, and small twin-engine aircraft. Given the size of the facility, an expansion is necessary if it is desired to significantly increase the throughput of air cargo at the Airport.

Past inquiries from air cargo operators about the availability of space to establish an air cargo operation at the Airport has led to initial planning and consideration for space to support a possible development. The Airport's close proximity to major traffic arteries in the region and centralized location between the population centers of Charlotte, North Carolina; Knoxville, Tennessee; and Greenville/Spartanburg, South Carolina makes it an attractive location to process and distribute air cargo throughout the Western North Carolina and Blue Ridge Mountain regions. A regional FedEx Ground sorting facility located one mile in proximity to the southwest of the Airport serves as an example of the value of the Airport's location for regional freight and cargo operations. As such, planning for the development of an expanded area for air cargo operations serves to not only benefit economic development and the exchange of goods in the region, but also the local economy of the Airport.

Planning initiated as a part of the 2001 update of the Airport master plan identified a site on the west side of the airfield near the approach end of Runway 34 for future general aviation and air cargo development. As a result of the topography of the selected site, a regional partnership was established in 2009 between the Airport, Progress Energy Carolinas Inc., and Charah Inc. to grade and fill land with a coal combustion product known as fly ash to develop additional aeronautical areas at the Airport. Scheduled for completion in 2014, this development area will create approximately 53.5 acres of land adjacent to the airfield for aeronautical development. It is intended this area would be selected for development by a potential air cargo operator to build infrastructure needed to support the transfer of packages, freight, and servicing of air cargo aircraft.

Review of the air cargo projections prepared for this master plan indicate that approximately 20 to 30 million pounds of cargo can be anticipated annually throughout the planning period if a dedicated air cargo company begins operations at the Airport. To gain an understanding of the size of facilities required to support this level of air cargo activity, a review of similar cargo facilities at other airports was conducted to calculate the approximate area of buildings, aprons, and support infrastructure (such as roads and parking lots) needed. For planning purposes, a summary of the approximate size of facilities needed to accommodate projected levels of air cargo activity should a dedicated operator establish an operation at the Airport is presented in **Table 4-44**.

Table 4-44: Air Cargo Facility Size Requirements

Facility	Approximate Size
Package sorting building/offices	7,000 sq. ft. – 13,000 sq. ft.
Aircraft apron	100,000 sq. ft. – 300,000 sq. ft.
Employee/delivery truck/ground support vehicle parking lots	30,000 sq. ft. – 70,000 sq. ft.
TOTAL	**137,000 sq. ft. – 383,000 sq. ft.**

Source: Mead & Hunt, Inc.

As illustrated in the table, approximately 137,000 square feet to 383,000 square feet of total area should be planned to support infrastructure necessary for a dedicated air cargo operation. Various factors such as the fleet mix of cargo aircraft, level of packaging transfer activity, available land for development, number of workers, and level of freight truck activity will ultimately determine the total amount of area needed. It is recommended sufficient area be planned to accommodate the infrastructure necessary to support an air cargo operation of at least two narrow-bodied aircraft daily. With consideration given to other site development needs such as driveways, landscaping, utilities, and storm water drainage, approximately ten acres of land is anticipated to be needed for air cargo operations. Alternatives presenting initial site layout and development plans are discussed in further detail in Chapter 5.

4.6.b Rental Car Service Facilities

Prior to 2008, a need was identified for improved rental car service facilities at the Airport. At the time, each rental car agency operated independent facilities that were located both on- and off-airport to service, clean, and maintain vehicles in-between rentals. These facilities were outdated, in need of improvements, and as a result of the increasing demand were reaching their capacity to process vehicles. Collaboration between the Airport and the individual car rental agencies identified a need for a consolidated vehicle service facility that could provide a modern, expanded, and centralized on-airport location to clean, refuel, service, and perform maintenance on rental car vehicles.

An eight-acre site south of the employee parking lot was selected for the development of a consolidated rental car service facility to be shared by each of the agencies conducting business at the Airport. Completed in 2008, the rental car service facility consists of two vehicle maintenance buildings, approximately 5,000 square feet and 7,500 square feet in size, as well as two fuel island canopies, a fuel storage area, and three surface lots with parking capacity for 578 vehicles. Each rental car maintenance building is equipped with vehicle bays, car washing equipment, vehicle lifts, and overhead hose reels that provide pressurized air and fluids for automobile engines while gasoline pumps and vacuums are installed at each of the fuel island canopies.

Findings from a comprehensive evaluation of long-term needs led to the planning and design of the rental car service facility; therefore, no significant infrastructure improvements are anticipated through the planning period. Since numerous unknown factors can greatly impact the demand for rental vehicles, it is recommended the facility be continually evaluated to determine if additional vehicle service bays, fuel storage capacity, vehicle service equipment, parking space, or other facility improvements are needed.

4.7 Summary

Overall, the level of investment and planning that has been made to improve facilities by the Airport over the years has positioned it well to meet the air transportation demands of the Western North Carolina region for the next 20 years. A review of existing infrastructure and its ability to accommodate projected levels of demand has identified a few areas that should be the focus of future facility planning and development at the Airport. The following summarizes these facility requirements that were identified in this chapter as a part of the facility requirement analysis:

- **Airfield Demand/Capacity –** An airfield demand/capacity analysis that reviewed factors affecting runway capacity such as weather conditions, number of local and itinerant operations, aircraft fleet mix, peak hour capacity, annual service volume, and range of delay found capacity at the Airport appears adequate for demand projected throughout the planning period.

- **Wind Coverage –** The airfield configuration and orientation of Runway 16/34 provides sufficient wind coverage that exceeds the FAA's recommended standards.

- **Airfield Design Standards –** In preparation of expected operations from larger passenger and cargo aircraft types, the airfield should be planned to meet ARC design group IV standards. The widths of most existing airfield surfaces meet group IV design requirements.

- **Critical Design Aircraft –** The current critical design aircraft should be changed from the Airbus A320 to the Boeing 737-700; the future critical design aircraft should be changed to the Boeing 757-200.

- **Runway 16/34 –** Review of the takeoff distance requirements for existing and anticipated commercial aircraft types indicates that the existing length of the 8,001 feet runway is sufficient to serve markets for the entire eastern United States and as far west as the Rocky Mountains. It is recommended alternatives be evaluated to extend the runway up to 10,000 feet, or to the maximum extent possible between the major physical constraints of the French Broad River to the north and North Carolina Route 280 to the south to support non-stop service to destinations on the west coast if or when such service is initiated.

  Paved shoulders are recommended for Runway 16/34 to meet runway design standards for ADG III and IV aircraft.

  A major rehabilitation or reconstruction of Runway 16/34 is recommended to address the following items that do not meet FAA design standards:

  - **Pavement Condition** – The PCI value and condition of existing runway pavement does not meet preferred industry standards and is anticipated to deteriorate to an unsatisfactory condition within five years.
  - **Longitudinal Grade –** The longitudinal grade of Runway 16/34 at the approach end of Runway 34 exceeds the allowable variance addressed in FAA design standards.
  - **Runway/Parallel Taxiway Separation –** An increased separation of 75 feet is needed between Runway 16/34 and parallel Taxiway A to meet the required 400 feet distance separation between centerlines to meet design standards for ARC Category III and IV aircraft.

  As a part of any future reconstruction of Runway 16/34, the following objects not fixed by function are recommended to be relocated outside of the runway safety area:

  - Runway 34 localizer antenna array
  - Runway 16 localizer antenna array and equipment building
  - Perimeter service road

  A portion of the perimeter fencing and drainage ditch along North Carolina Route 280 may need to be removed as it appears to penetrate the southeast corner of the RSA.

  The designation of Runway 16/34 should be changed to Runway 17/35.

Installation of in-pavement runway edge lights are needed at runway/taxiway intersection locations that are 200 feet longitudinally from adjacent edge lights to meet FAA standards.

Potential non-compliant fencing that extends up above the elevation of the RSA within the ROFA should be evaluated for removal as well as any trees along the west of Runway 16 near its approach end.

- **Taxiway Naming Designation –** It is recommended that if a parallel taxiway is planned for the west side of the airfield it should be named “Taxiway B” to align with the naming of the existing parallel Taxiway A while the existing connector taxiways between Taxiway A/Runway 16/34 and Taxiway A/aprons should be renamed “A1”, “A2”, “A3”, etc., and “C”, “D”, “E”, etc. from south to north, respectively.

- **Taxiway A –** It is recommended the 75 feet width of Taxiway A be retained in anticipation of future operations by ADG IV aircraft. Paved shoulders are also recommended to meet ADG III and IV airfield design standards.

  Planning must be initiated to change the topography along the east side of Taxiway A near its north and south junctures with Runway 16/34 to meet safety area requirements should the critical design aircraft be changed to ADG IV.

  Should the critical aircraft type change in the future to ADG IV, the increased width required for the Taxiway A object free area may require the relocation of a portion of the perimeter fencing near the ASOS unit and the throat of the service road at the intersection of Taxiway D1.

- **Taxiway R Manhole Cover –** Improvements may be needed to a manhole cover located within the taxiway fillet at the intersection of Taxiway R and Taxiway A if it is found to be non-compliant with taxiway surface gradient standards.

- **Taxiway P Transverse Grade –** Consideration should be given to correct an inverted low elevation portion of Taxiway P as it may not meet transverse grade design standards.

- **Taxiway H Width –** The width of Taxiway H needs to be increased to 75 feet in order to meet the design standards of ADG IV aircraft that are often parked on the south apron.

- **North Apron/Mid-Ramp Connector Taxiway Width –** An increase in taxiway width is needed for Taxiways D1, D2, F, and G to meet ADG III design standards as this is the most demanding category of aircraft to regularly taxi on the surfaces.

- **FAR Part 77 Surface Obstructions –** FAR Part 77 obstructions identified in the updated airspace plan as a part of the ALP update to be completed towards the conclusion of this master plan project should be removed if possible or identified with an obstruction light.

- **Air Traffic Control Tower –** Sites should be evaluated to relocate the air traffic control tower as the structure is outdated and nearing the end of its useful life.

- **Precision Instrument Approaches –** Planning should be initiated to protect airspace for a Category II or III precision instrument approach should a need be demonstrated in the future to improve the visibility and cloud ceiling height minimums at the Airport. Considerations should be given for the installation of an ALSF-2 runway approach lighting system and a mid-field RVR, if a Category II or III approach is developed for either runway end as well as touchdown zone lighting if such an approach is developed for Runway 16. Though it appears there is no justifiable need for a Category II or III precision instrument approach, the Airport should plan to protect for CAT II or III minimums and associated to Runway 16 and Runway 34 facilities to the extent feasible, for potential implementation in the future.

- **Specific Authorization For Category II Approaches –** Runway centerline lighting, touchdown zone lighting, and approach lighting on the approach end of Runway 34 allows airline operators to request specific authorization for a Category II approaches. Should airlines seek to request authorization for operations below 1,200 feet Runway Visual Range, a Surface Movement Guidance Control System plan will be required.

- **Precision Approach Path Indicator –**The Visual Approach Slope Indicator on Runway 34 is recommended to be replaced with a Precision Approach Path Indicator when it approaches the end of its serviceable life.

- **Airfield Signage –** Installation of an additional mandatory hold sign on Taxiway A is needed at the approach end of Runway 34 on the south side of the intersection. Replacement of the remaining mandatory hold signs with panels that have black boarders around the white legends is also needed to meet FAA standards. Also, replacement of guidance sign panels are recommended for those experiencing de-lamination of the retro-reflective background to improve visibility in nighttime and low-visibility weather conditions. In addition, several mandatory hold signs need to be relocated to align with the hold markings on the taxiway pavement surface.

- **Airfield Lighting –** In general, most airfield lighting equipment is old, requires high maintenance, and is inefficient since the intensity of power distributed through the system is lost due to age and deterioration of underground cabling. Replacement of aging, deteriorated, and inefficient electrical components is recommended to improve the reliability of the system.

- **ASOS Weather Equipment –** Consideration should be given to relocate the ASOS unit as its current location is a wingtip clearance concern for larger aircraft such as the Boeing 767 and 747 that occasionally conduct operations at the Airport. Siting for a relocated ASOS should also consider a location that is unaffected by heat radiating from nearby paved surfaces.

- **LLWAS Wind Shear Tower –** Consideration should be given by the FAA to relocate its LLWAS tower west of the Airport since its location may be an obstruction to the proposed temporary runway and it may interfere with the future development of the private property upon which it is located.

- **Terminal Apron –** Planning should be initiated for at least one or two additional parking locations on the terminal apron to accommodate late arriving or departing flights, future changes in airline flight schedules, charter activities, entrance of a new service carrier, or aircraft diversions from other airports.

- **Boarding Gates –** The terminal building should have at least six to eight boarding gates for commercial aircraft throughout the planning period; planning for the construction of at least one to three additional gates and passenger holding areas should occur.

- **Terminal Building –** An additional 20,500 square feet should be planned for the terminal building to meet the demands of tenants and passengers throughout the planning period.

- **Off-Airport Access –** It is recommended Airport staff participate in the planning of a proposed interchange re-design at the of Interstate 26 and North Carolina Route 280 to prevent temporary and permanent roadway access impacts to the Airport.

- **Landside Access Roadways –** An extension and widening of Wright Brothers Way to the north should be considered so landside access can be provided to the north general aviation site. While the existing networks of roadways on the east side of the Airport are considered to be in “good” condition, planning should also be initiated for preventative maintenance such as crack sealing throughout the planning period.

  Consideration should be given to the installation of a dedicated right turn lane on Terminal Drive at the intersection of North Carolina Route 280 to help alleviate congestion and traffic backups. In addition, development of a new roadway to create a direct route from the consolidated rental car service facility to the ready/return lot is recommended to reduce traffic congestion in front of the terminal building during peak periods and help to improve the efficiency vehicle transfers between the two locations.

  Construction of a commercial vehicle lane or curb lane for commercial vehicle operators away from the front of the terminal building is recommended to help reduce congestion between taxi, limousine, and shuttle van operations from pedestrian and personal vehicle traffic.

- **Public Parking Lot –** An expansion of the public parking facilities is needed to meet growing demands. There is currently a small public parking deficit of 17 spaces that is anticipated to grow to a deficit of 145 spaces in 2015 and eventually to 600 spaces in 2030. Additionally, a public parking need demonstrated by passengers is a reduced grade walking path from the long term and overflow parking lot to the terminal building. Consideration should also be given for additional public parking at the Advantage West facility and rehabilitation for those parking lot pavement surfaces that are considered to be in “fair” condition and are anticipated to need improvements within the planning period such as the lower long-term parking lot, employee parking lot, and the rental car ready/return lot.

- **Rental Car Ready/Return Lot –** An expansion of the rental car ready/return lot is needed to meet the existing deficiency in available parking spaces. An anticipated 190 parking spaces is projected to be needed to accommodate demand by 2030.

- **Based Aircraft Storage –** Planning should be initiated for the construction of an additional box-style hangar or hangars with an available capacity of at least 52,500 square feet to accommodate anticipated demand. Development of an additional 15 T-style hangar units should also be planned to meet the projected increase in single engine based aircraft.

- **Apron Pavement Condition –** It is recommended the pavement strength of the north ramp and the mid-apron be increased to accommodate large business jet aircraft such as the Global Express and the Gulfstream G550 on these surfaces. The weight bearing capacity of the south apron should also be increased to accommodate ADG III and IV aircraft on the surface at their maximum gross weights. In addition, deteriorated sections of apron pavement surfaces that have excessive cracks, severe spalling, loose debris, and depressions or low spots should be repaired.

- **Department of Public Safety Facility/Aircraft Rescue and Fire Fighting –** It is recommended that the design of the new DPS facility include increased area for workspaces, storage of equipment and materials, and larger apparatus bays for next generation ARFF equipment.

- **ARFF Index Classification –** Though the existing Index B classification of aircraft rescue and fire services appears adequate to meet FAR Part 139 firefighting requirements throughout the planning period, consideration should be given to meet Index C requirements should the frequency of average daily operations from larger aircraft types exceed projections. Any new ARFF facility should be planned to accommodate future Index C requirements.

- **Terminal Building Maintenance Facilities –** Improved and expanded facilities are needed for the storage of deicing chemicals and maintenance equipment at the terminal building

- **Aircraft Fuel Storage –** Overall, it does not appear additional aircraft fuel storage capacity will be needed to meet anticipated demand throughout the planning period unless it is found necessary to maintain a one week supply of Jet-A fuel. Should this be desired, planning should be initiated by 2015 to construct an additional tank or tanks.

- **Air Cargo Development –** Consideration should be given to plan for a dedicated air cargo operation at the Westside Development site after the fill and grading project with fly ash coal combustion project is complete. Development of an air cargo facility is supported by past inquiries from air cargo operators, the Airport's location near major regional traffic arteries, and its centralized location between major population centers. Should such a facility be constructed, additional taxiways and landside access may be needed on the west side of Runway 16/34.