Roanoke Regional Airport

Airport Master Plan Update
Technical Report

June 2008




HNTB

ROANOKE REGIONAL AIRPORT

MASTER PLAN UPDATE EXECUTIVE SUMMARY

June 2008

Prepared by
HNTB Corporation

Prepared for
Roanoke Regional Airport Commission

INTRODUCTION

Roanoke Regional Airport (ROA) serves the air transportation needs of Southwest Virginia. In 2007, ROA was ranked sixth in passenger commercial service among the Commonwealth of Virginia's airports.

Ownership of the Airport was transferred to the Airport Commission in 1987. Together with the Virginia Department of Aviation and the Federal Aviation Administration, the Commission ensures that the Airport continues to meet the traveling needs of the region. The Commission uses the Airport's Master Plan to guide future development and periodically updates the Plan to ensure that it reflects the latest trends and policies in the industry.

The Master Plan Update process consisted of nine steps:

- Establish goals and objectives
- Conduct an inventory of existing facilities
- Forecast aviation activity
- Determine long-term facility requirements
- Develop alternative concepts and plans
- Identify potential environmental considerations
- Select a preferred development plan
- Prepare financial analysis for proposed development
- Invite public participation

This executive summary provides an overview of the Master Plan Update process and presents the recommended 2025 development plan for the Airport.

KEY ISSUES

While the overall purpose of the Master Plan Update was to revise the long-term development strategy for the Airport, several key issues required more detailed focus. These included:

- Exploring cost-justifiable options for providing a longer runway if it could help promote improved air service;
- Determining the most cost-effective option for providing improved safety areas on the ends of the Airport's primary runway;
- Analyzing whether new procedures and technologies can provide improved landing minimums to improve service reliability;
- Identifying terminal upgrades to improve customer service;
- Selecting a long-term development plan to meet future auto parking requirements;
- Identifying options for providing an improved secondary ground access route that would avoid the increasingly congested Hershberger Road;
- Confirming the most appropriate aviation use for the "flex area" (the site of the former terminal's parking lot);
- Analyzing the tradeoffs of providing a ground run-up enclosure for nighttime aircraft engine run-ups;
- Selecting a preferred location for a new airport rescue fire fighting station; and
- Developing a user-friendly obstruction identification computer program.

GOALS AND OBJECTIVES

To guide the Master Plan Update process, the Commission developed an initial list of goals and objectives. The draft list was reviewed by a Technical Advisory Committee specifically formed to provide stakeholder input. The final list contained eight goals established for the Master Plan Update:

1. Develop a Plan that ensures the Airport is safe and reliable;
2. Develop a Plan that ensures the Airport meets security requirements;
3. Develop the Airport's physical facilities to meet the region's future aviation needs for passengers, cargo, and general aviation (GA);
4. Provide facilities at a reasonable cost to all users, while ensuring that the Airport is self-sustainable;
5. Develop the Airport in a manner that is flexible, adaptable to changing conditions, and recognizes the highest and best land uses;
6. Develop the Airport in a manner that will minimize and reduce adverse environmental effects;
7. Support local and regional economic goals and plans without constraining long-term Airport development; and,
8. Build and maintain community confidence and support.

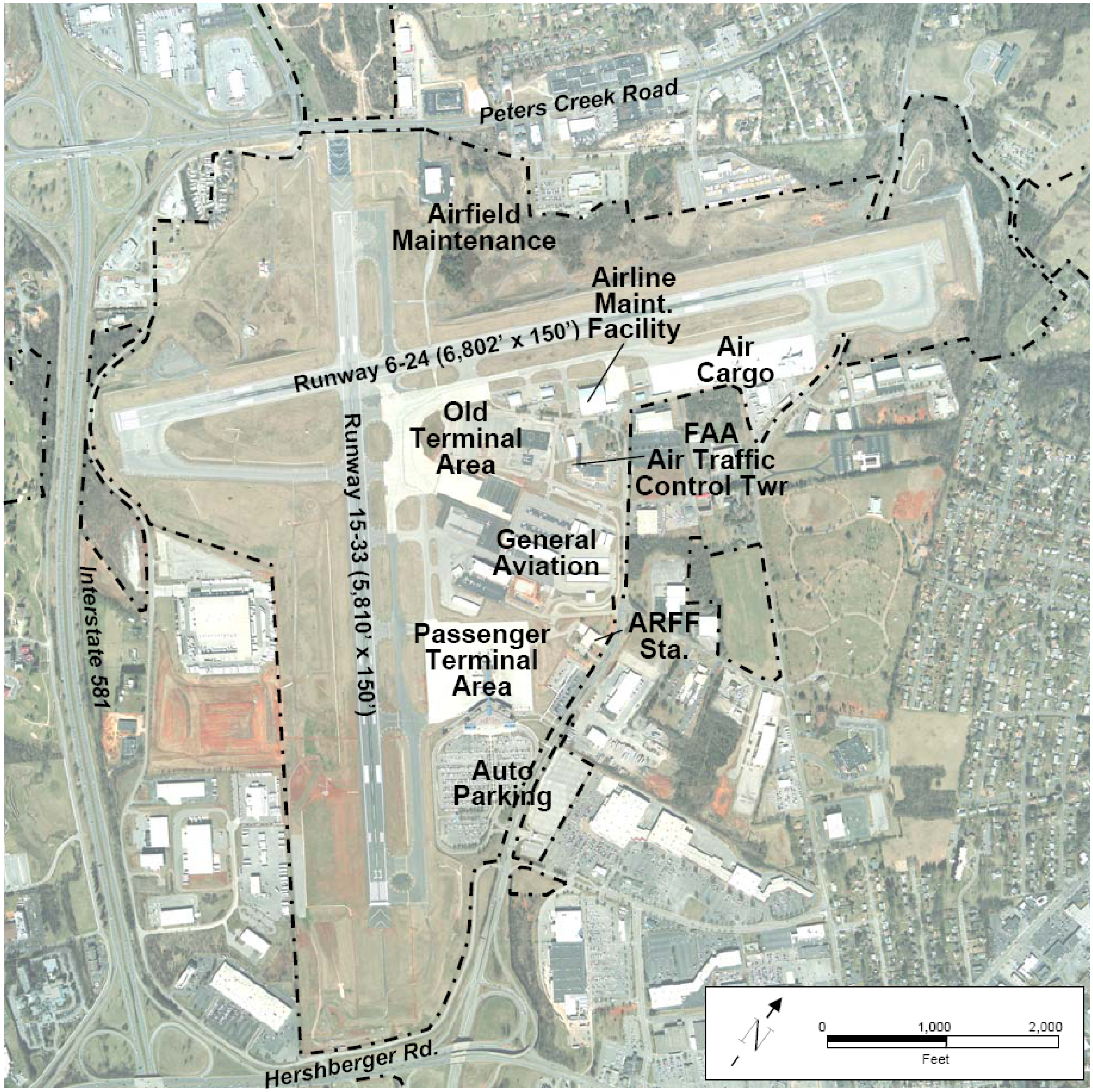
A set of specific objectives was also developed for each goal to identify how the goal would be achieved.

INVENTORY

An Airport inventory was undertaken to determine the type, number, and condition of existing facilities and to document changes that had occurred since the previous master plan. **Figure 1** is an aerial photo showing the exiting Airport layout.

The Airport covers an area of 904 acres of which 647 acres is within the security fence (including the airport operations area (AOA), aircraft movement area, and non-movement area) and 257 acres is outside the fence. Most of the area lies within the City of Roanoke; the remaining land is located in Roanoke County. The predominant features of the Airport include two intersecting runways, associated taxiways, the passenger terminal and support area, cargo area, and a GA area.

Existing Airport Layout **Figure 1**



During the inventory phase, each major functional element of the Airport was visited, plan documents were obtained, pertinent socioeconomic data was gathered, and interviews were conducted with Commission staff and Airport tenants. In addition, a departing passenger survey was conducted to obtain information on travel characteristics of Airport users, and observations were conducted of roadways, curb activity, ticketing, security, baggage claim, and other elements.

The information obtained from the inventory phase was used to help assess the current level of customer service provided by the Airport and served as input for developing activity forecasts and determining future facility needs.

AVIATION ACTIVITY FORECASTS

Forecasts of passengers, cargo, and aircraft operations (takeoffs and landings) were prepared to project the level of activity the Airport could experience in the 20-year planning horizon. The forecasts were based on regional socioeconomic projections and local, regional, and national aviation industry trends.

Aviation activity forecasts are based primarily on the strength and growth of the local economy. Through the year 2025, the region's population, employment, and income are forecast to grow, but, in general, at a rate that is slightly below the national average, indicating that aviation activity will also grow more slowly than at the national level.

To ensure that Airport facilities are developed in a flexible manner and can accommodate unforeseen changes in the industry, both a base case forecast and alternative forecasts were prepared which resulted in a range of forecast activity, as shown in **Figure 2**. The FAA-approved base case forecast assumes what industry experts believe to be the most likely long-term scenario for the Airport. It shows annual passenger enplanements (passenger boardings) increasing from 327,000 in 2005 to 485,000 in 2025, a 50 percent increase. Air cargo activity is forecast to increase from 15,800 annual tons in 2005 to 18,300 annual tons by 2025, a 16 percent increase. Finally, annual aircraft operations are forecast to grow from about 86,000 in 2005 to 106,300 in 2025, a 24 percent increase.

The alternative forecasts produced a range of activity levels to reflect possible deviations from the base case forecast. Several scenarios were tested.

The first scenario assumed that the economy would grow at half the rate anticipated in the base case forecast which would, in turn, result in aviation activity at ROA growing more slowly.

The second scenario assumed that the regional economy would grow more quickly than assumed in the base case forecast, resulting in a more rapid increase in aviation activity.

The third scenario reflected the impact of a fuel shock or economic recession. Assuming that fuel prices would rise at a rate higher than the inflation rate, airlines would have to pass the cost on to consumers, dampening demand.

Recognizing that the region's passengers are willing to use a more distant commercial service airport to take advantage of lower fares, the fourth scenario examined the impact of low fare service at Greensboro's Piedmont Triad International Airport.

The fifth scenario assumed that low fare service would come to ROA, stimulating demand for air travel.

Finally, the sixth scenario considered the possible impacts stemming from airline consolidation, which typically results in less competition and higher air fares.

FACILITY REQUIREMENTS

The next step in the Master Plan Update process was to translate the forecasts into facility requirements.

Facility requirements were determined by comparing future facility needs to the Airport's existing inventory of facilities (including their remaining useful life), reviewing FAA design criteria to ensure the Airport met safety and operational standards, and considering the need to maintain or improve customer service.

Table 1 summarizes existing and future facility needs. To meet future passenger processing functions, the terminal needs to expand from 97,000 square feet to 128,000 square feet by 2025. Public parking requirements will increase from 1,817 spaces to 1,979 spaces. To accommodate air cargo growth, cargo storage requirements would need to increase from 28,600 square feet to 33,000 square feet. To serve GA activity, the Fixed Base Operator/GA terminal will need to expand from 6,300 square feet to 9,900 square feet, and hangar space would need to increase from 152,000 square feet to 261,000 square feet.

Summary of Aviation Activity Forecasts **Figure 2**

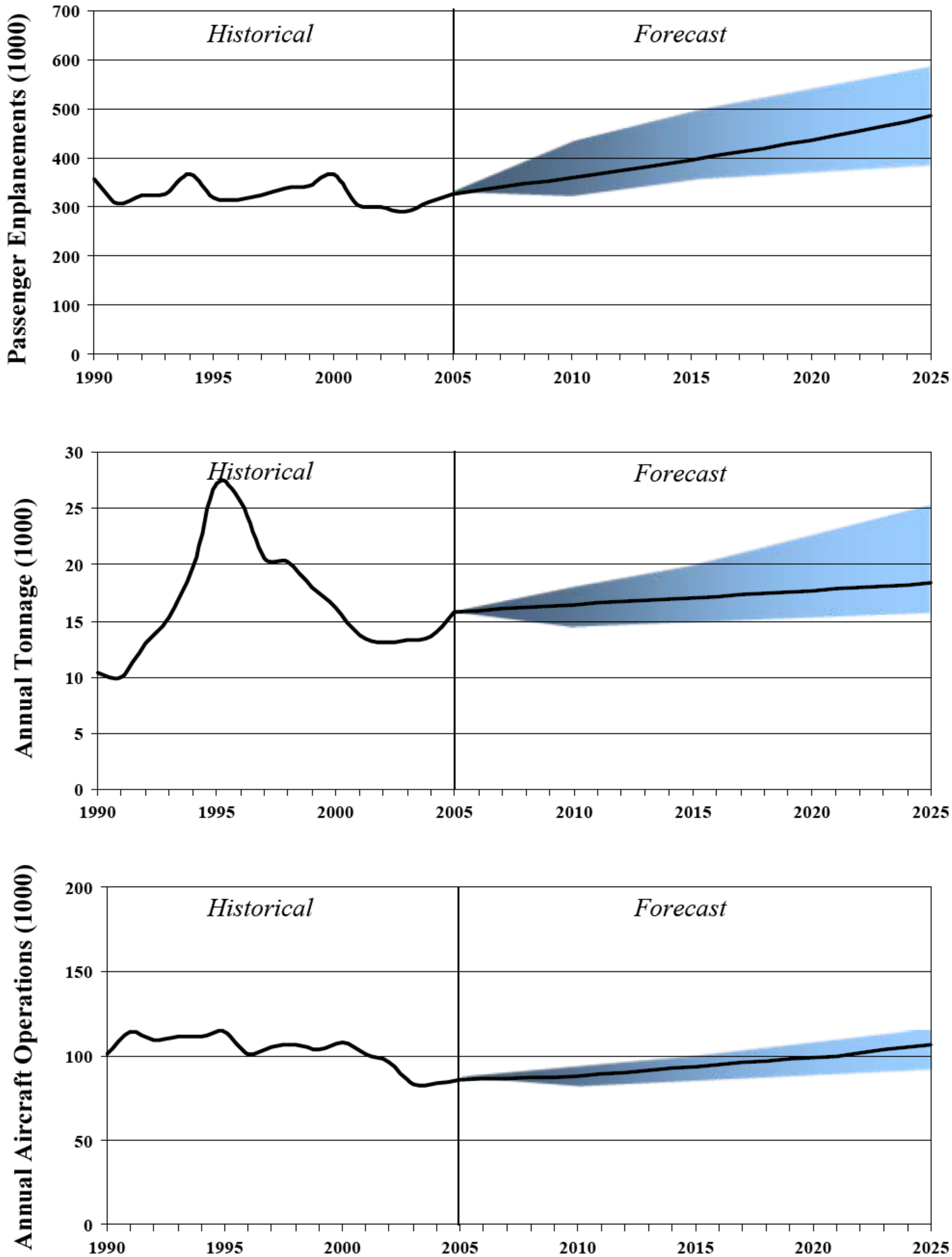


Table 1 summarizes existing and future facility needs. To meet future passenger processing functions, the terminal needs to expand from 97,000 square feet to 128,000 square feet by 2025. Public parking requirements will increase from 1,817 spaces to 1,979 spaces, while the number of rental car spaces will need to increase from 160 to 237. The employee lot is suitably sized to meet future requirements. To accommodate air cargo growth, cargo storage requirements would need to increase from 28,600 square feet to 33,000 square feet. To serve GA activity, the Fixed Base Operator/GA terminal will need to expand from 6,300 square feet to 9,900 square feet, and hangar space would need to increase from 152,000 square feet to 261,000 square feet.

Summary of Facility Requirements **Table 1**

Facility	2005 Existing	2025 Required
Terminal (SF)	97,400	127,900
Gates (No.)	5	6
Public Parking (Spaces)	1,817	1,979
Rental Car (Spaces)	160	237
Employee	284	217
Cargo Building (SF)	28,600	33,000
Cargo Apron (SY)	32,000	34,000
Gen'l Aviation Term'l (SF)	6,271	9,900
Hangars (inc. T's) (SF)	152,400	260,800
Apron (SY)	57,400	59,000

RECOMMENDED DEVELOPMENT PLAN

After future facility needs were identified, alternative concepts were developed and evaluated, and a recommended development plan for each functional element was prepared. These projects were then further refined to produce an overall recommended Airport development plan as shown in **Figure 3**.

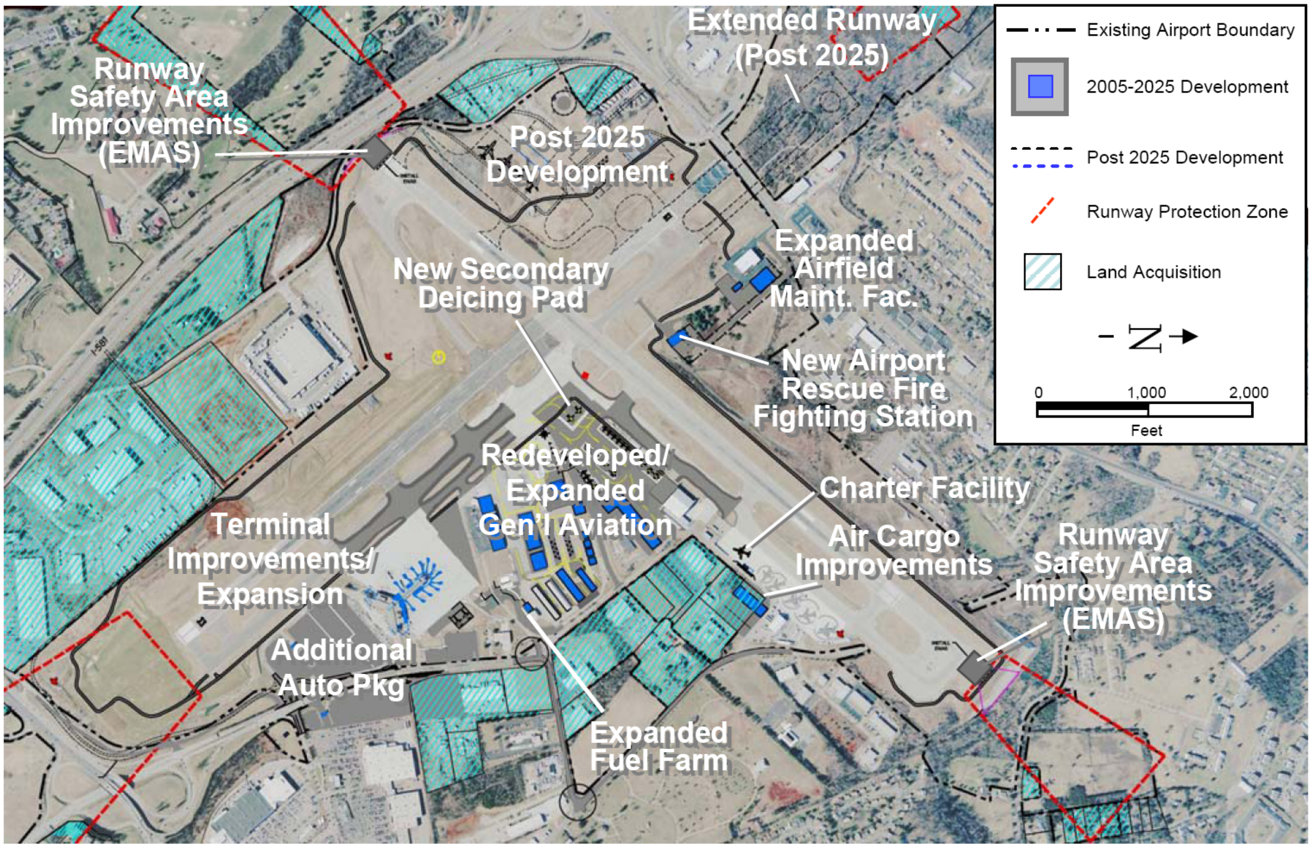
Recommended Airfield Development Plan

The 2007 Master Plan Update recommends three significant airfield projects to be undertaken within the 20-year planning horizon of the Study. The first is constructing partial engineered materials arresting systems (EMAS) installations on both ends of Runway 6-24. The partial EMAS installations are constructed out of "collapsible" pavement capable of stopping a Boeing 757 exiting the runway at 40 knots. Providing partial EMAS installations would cost approximately $25 million. Both a full-length safety area and a full-performance EMAS were considered to be cost-prohibitive, with either of these options costing nearly $300 million.

The second airfield project recommended by the Master Plan Update is the construction of a secondary deicing facility near the intersection of Taxiway G and Taxiway T. This location is considered optimal because it provides short taxi times to all runway ends.

The third project recommended by the Master Plan Update is upgrading the Airport's perimeter road network to a fully-paved, 20-foot wide road where feasible.

Recommended Development Plan Figure 3



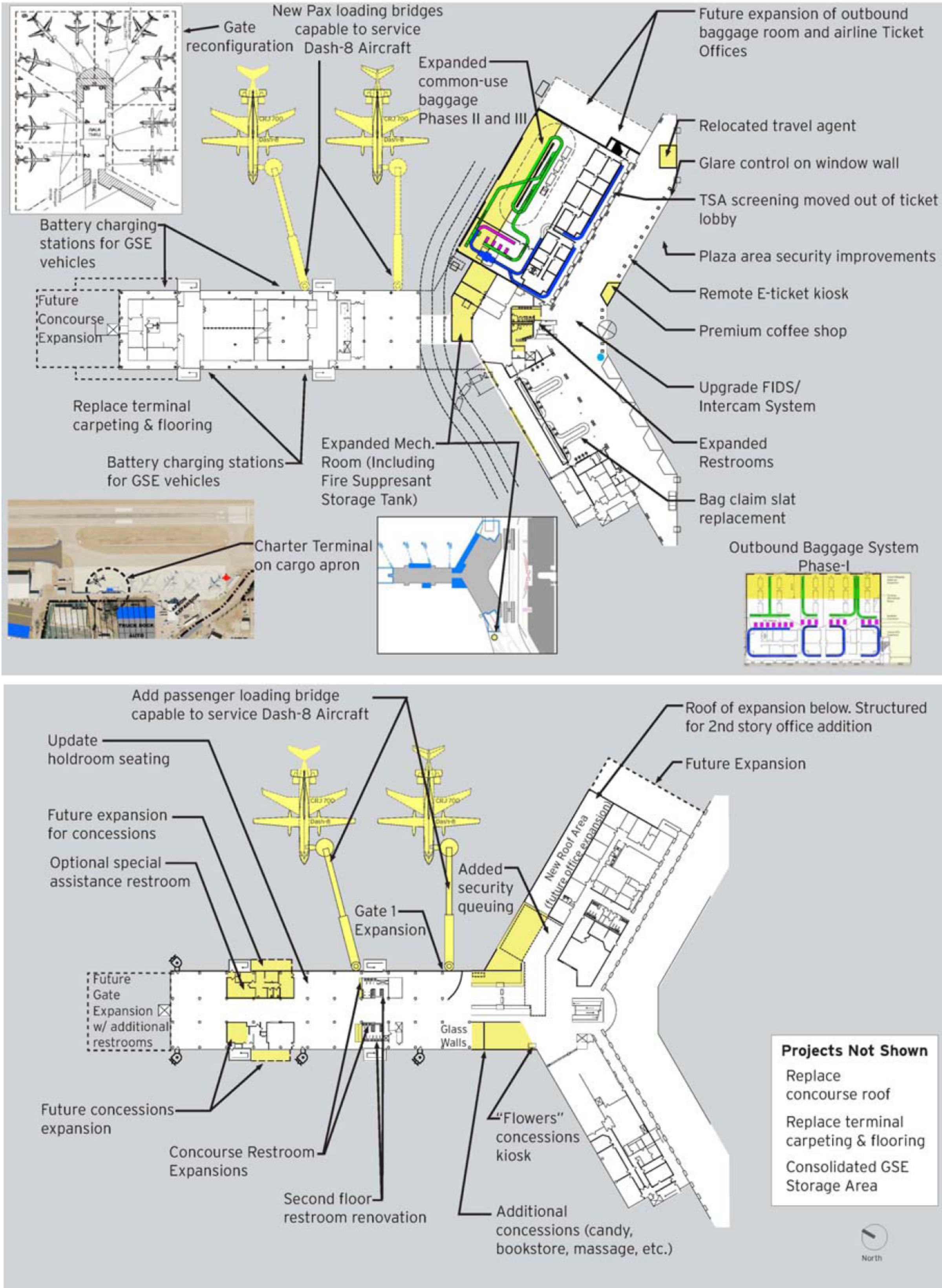
Because the Airport is located in mountainous terrain, the landing minimums are higher at Roanoke than at most other airports. Higher minimums can result in more flight delays, diversions, or cancellations. Additional analysis was undertaken as part of the Master Plan Update to determine if lower minimums could be published to improve Airport reliability. This analysis concluded that little additional improvement can be realized in the near term; however, as new technologies and procedures are developed, opportunities for providing lower minimums should be explored.

Lastly, analysis suggested that Roanoke could receive nonstop scheduled commercial airline service from markets up to 1,000 miles away. A longer runway (7,700 feet) would enable airlines to serve these markets with higher loads; several options were therefore considered to provide additional runway length. Due to existing non-airport development and topography, the most cost-effective option would be lengthening Runway 15-33 to the northwest. The estimated cost, however, of $90 million suggests that this project would not be cost-justifiable within the 20-year planning horizon of the Study. Nevertheless, the Master Plan Update recommends that land be acquired and preserved to provide for this extension in the future.

Recommended Terminal Development Plan

Figure 4 shows the recommended terminal development plan. The Master Plan Update recommends relocating TSA hold bag screening functions to a new area behind the airline ticket offices. This project will improve the functioning of the ticketing area at the front of the terminal.

Recommended Terminal Development Figure 4



To meet forecast demand, the Master Plan Update recommends expanding the terminal's first floor restrooms and mechanical room, enlarging the entrances and exits to the inbound baggage layout area, expanding the passenger security screening checkpoint, expanding concourse restrooms, and providing a new meeter/greeter area on the second floor.

The Master Plan Update also recommends several concession improvements and amenity upgrades to provide a higher level of customer service. These improvements include a premium coffee shop on the lower level, additional concession space on the second floor and on the concourse, and greater use of passenger loading bridges.

To address the unique needs of university-related charter activity, the Master Plan Update recommends constructing a semi-permanent terminal facility on a portion of the cargo ramp.

Recommended Landside Development Plan

The recommended landside plan includes the Airport entrance road, circulation roads, parking, and Airport access.

Several options for meeting the forecast growth in parking demand were considered. Based on an evaluation of these options, the Master Plan Update recommends reorganizing and expanding the Airport's parking system. Short-term parking would be expanded into the existing rental car area, while the current rental car area, in turn, would be expanded into the long-term parking area. To meet long-term parking requirements, the overflow lot should be converted to long-term parking, and the site of the trucking depot north of the current overflow lot would be acquired and converted into long-term parking.

To improve secondary access routing to the Airport, the Master Plan Update recommends modest reconstruction of Airport Road and Municipal Drive, and the two intersections at either end of Municipal Drive to give better orientation and priority to Airport traffic coming from Peters Creek Road.

Lastly, the Master Plan Update recommends constructing a new interchange for the Airport from I-581 (or I-73). This long-range project is planned to create an Airport access route of uninterrupted flow directly from the interstate.

Recommended Air Cargo Development Plan

While future air cargo activity can be accommodated at the existing facility, the Master Plan Update recommends that adjoining land be acquired to provide room for a more efficient cargo layout. A second option that was not recommended was developing the Northwest Quadrant for cargo activity as it would require significant site preparation costs. For this reason, this move should only be taken if the current cargo site cannot be expanded and cargo activity grows much more rapidly than forecast.

Recommended General Aviation Development Plan

The recommended plan for GA development concluded that the most cost-effective approach to meet future GA requirements was through a combination of expansion into the former midfield "flex area" and redevelopment of parcels currently used for GA purposes. This option was viewed as more cost-effective than relocating GA facilities to the Northwest Quadrant due to the significant amount of investment that would be required at the undeveloped site.

Key projects include the construction of a new FBO/GA terminal and maintenance/storage hangar in the former midfield area, constructing additional convention hangars and T-hangars in the current GA area, and providing more tie-down space.

Should GA requirements grow beyond that point, the Master Plan Update recommends ultimately developing additional facilities in the Northwest Quadrant.

Recommended Support Facilities Development Plan

Various alternatives for meeting ARFF requirements, fuel storage, and airfield maintenance were considered. In summary, the Master Plan recommends relocating the ARFF station to north side of the Airfield, near the runway intersection as this option is the most cost-effective and provides superior response times. Additional fuel farm capacity should be provided at the existing facility off Waypoint Drive. Likewise, the site of the Airport's airfield maintenance facility is sufficient for expansion to meet long-term requirements.

Because aircraft maintenance activities occur regularly at ROA, the Master Plan Update examined the feasibility of constructing a ground run-up enclosure (GRE) to reduce noise impacts generated from aircraft engine run-ups. Based on the analysis, it was concluded that its construction cost and land requirements would outweigh this benefit; therefore, the Master Plan Updated did not recommend building a GRE.

Land Acquisition

The Master Plan Update recommends the acquisition of an additional 220 acres of land to provide for future facility development, to meet FAA design standards, and to ensure compatible land uses in the Airport vicinity.

ENVIRONMENTAL CONSIDERATIONS

The Master Plan Update process included an initial environmental overview of the potential impacts that will need to be considered prior to construction of the improvements identified by the recommended Plan. The FAA's Airport Environmental Handbook identifies 20 impact categories that should be considered when evaluating possible environmental impacts. Overall, none of projects in the recommended Plan appear to significantly affect the environment or result in an impact that could not be mitigated. In the future, as projects are considered for construction, more detailed environmental analysis would need to be conducted in the form of an Environmental Assessment.

FINANCIAL ANALYSIS

A financial plan was prepared, outlining the general cost of each project, its timing, and potential revenue sources. Through 2025, the Master Plan Update identified approximately $236 million of development projects, as shown in **Table 2**. The scheduling of projects in the Capital Improvement Program (CIP) reflects a balance between meeting capacity requirements and anticipated funding availability.

Capital Improvement Program **Table 2**
(Millions of 2007 Dollars)

Project	Phase I (2007-2012)	Phase II (2013-2017)	Phase III (2018-2025)	Total
Airfield/NAVAID	$8.3	26.5	$0.0	$34.8
Terminal	$10.3	$4.3	$5.1	$19.6
Ground Access/Parking	$5.3	$6.9	$1.0	$13.2
Air Cargo	$0.0	$0.0	$5.8	$5.8
General Aviation	$7.3	$23.2	$9.7	$40.1
Airfield/Airline Maint. & Support Facilities	$4.6	$6.9	$0.3	$11.8
Construction Total	$35.8	$67.7	$21.8	$125.3
Contingencies @ 10%	$3.6	$6.8	$2.2	$12.5
Admin., Engin., & Testing @ 15%	$5.4	$10.2	$3.3	$18.8
Land Acquisition	$18.8	$17.6	$29.7	$66.2
Miscellaneous	$6.9	$3.5	$2.5	$12.9
Grand Total	$70.5	$105.8	$59.5	$235.7

Note: Totals may not add due to rounding.
Source: HNTB analysis.

At this time, there are five primary sources of funding for capital projects:

- Passenger Facility Charges (PFCs)
- The federal Airport Improvement Program (AIP)
- Commonwealth of Virginia grants
- Third-party sources (bonding, etc.)
- Airport revenues

The financial analysis concluded that the development program is generally financially feasible, and that the most critical projects can be funded when needed. Some projects, however, may have to be delayed due to funding limitations.

PUBLIC PARTICIPATION

To ensure that the interests of all stakeholders were considered, a public participation process was established. The two key elements of the process included the formation of a Technical Advisory Committee (TAC) and holding a public workshop. The TAC met regularly throughout the Update process to review technical work and provide overall guidance. The TAC consisted of Commission staff, the consultant, airlines, general aviation users, and local planners from the City and County. The public information workshop was held in November 2007, toward the end of the process, to give the general public an opportunity to review and comment on the proposed development plan.

TABLE OF CONTENTS

CHAPTER ONE–GOALS AND OBJECTIVES

CHAPTER TWO– INVENTORY OF EXISTING CONDITIONS

CHAPTER FOUR– AVIATION ACTIVITY FORECASTS

CHAPTER SIX–ALTERNATIVE DEVELOPMENT CONCEPTS

CHAPTER SEVEN–ENVIRONMENTAL OVERVIEW

CHAPTER EIGHT– RECOMMENDED PLAN

CHAPTER NINE – FINANCIAL PLAN

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Chapter One
Goals and Objectives

The purpose of this Master Plan is to provide the Roanoke Regional Airport Commission (RRAC, or Commission) with a blueprint for short- (five-year), intermediate- (10-year), and long-term (20-year) development of the Roanoke Regional Airport/Woodrum Field (ROA).

This chapter establishes the general direction of the study by stating the goals and objectives to direct Airport development. These goals and objectives will provide the basis for evaluation criteria to assess the qualities of alternative Airport development plans. The goals and objectives listed below are not in any order of priority.

1.1 GOAL NO. 1

Develop a plan that ensures the Airport is safe and reliable.

Objectives

1.1.1 Provide navigational, landing aid, and meteorological facilities which enhance the safety and reliability of Airport operations.

1.1.2 Protect FAA-mandated safety areas, runway protection zones, and other clear areas.

1.1.3 Provide Aircraft Rescue and Fire Fighting (ARFF) facilities, a hydrant system to recharge trucks, and access routes to obtain specified response times under all weather conditions.

1.1.4 Provide a facility which can readily handle all weather conditions.

1.1.5 Ensure that Airport facilities meet all applicable safety, regulatory, and Americans with Disabilities Act (ADA) standards.

1.2 GOAL NO. 2

Develop a plan that ensures the Airport meets security requirements.

Objectives

1.2.1 Incorporate security measures in support of the Airport's security program into long-term plans.

1.2.2 Ensure interface between secure and non-secure elements of the perimeter and terminal are logical and invulnerable to security breaches.

1.2.3 Incorporate provisions for potential vehicle inspection facilities and the potential for physical barriers at the terminal curb.

1.2.4 Develop a plan or process to relocate the checked baggage screening activity from the ticket lobby to regain the original ticket lobby queue space.

1.2.5 Reconfigure and expand the passenger screening area at the security checkpoint to increase screening throughput potential and to provide adequate queue area.

1.3 GOAL NO. 3

Develop the Airport's physical facilities to meet the region's future aviation needs for passengers, cargo, and general aviation (GA).

Objectives

1.3.1 Provide sufficient airfield capacity for forecast demand.

1.3.2 Provide adequate runway length to meet the existing, forecast, and potential needs of departing and arriving flights.

1.3.3 Provide sufficient terminal and concourse facilities to meet any anticipated airline requirements and to encourage continued air service improvements.

1.3.4 Balance opportunity for additional and expanded corporate and general aviation (GA) facilities with other Airport facilities.

1.3.5 Provide other facilities needed to support a full range of aviation services, including air cargo facilities, a noise enclosure, a back up water supply, and other facilities to provide a high level of service to the public to meet forecast demand levels. Explore the reuse of existing ARFF building if relocated. Where possible, consolidate functions into specific land use areas.

1.3.6 Provide convenient circulation roads and parking facilities. Consideration shall be given to the recent studies.

1.4 GOAL NO. 4

Provide facilities at a reasonable cost to all users (passengers, airlines, GA, employees, etc.), while ensuring that the Airport is self-sustaining through the exploration of new revenue sources.

Objectives

1.4.1 Prepare a realistic development program considering all costs (e.g., major maintenance, capital projects, and Operations and Maintenance (O&M)).

1.4.2 Explore potential new non-aeronautical revenue generation sources for the Airport.

1.4.3 Implement airfield, terminal, and landside capacity enhancement measures only when they are financially justifiable.

1.4.4 Design efficient facilities.

1.4.5 Identify Airport improvements that minimize Airport maintenance costs.

1.4.6 Identify and use alternative funding sources.

1.4.7 Distribute charges and cost of the development program appropriately.

1.5 GOAL NO. 5

Develop the Airport in a manner that is flexible, adaptable to changing conditions, and recognizes the highest and best land uses.

Objectives

1.5.1 Allow for changes in Federal Aviation Administration (FAA) and Transportation Security Administration (TSA) standards.

1.5.2 Develop so that options for development are retained to respond to changes in the type or size of aircraft using the Airport.

1.5.3 Develop terminal facilities using concepts which permit ready responses to expansion or reductions in operations, while maintaining passenger service and revenue flows.

1.5.4 Maintain or acquire adequate land to meet contingencies for future demand, while minimizing disruption to the community and roadway system.

1.5.5 Develop parking facilities in a manner to permit a shift in the balance between Hourly and Daily Parking in the main parking lot.

1.6 GOAL NO. 6

Develop the Airport in a manner that will minimize and reduce adverse environmental effects.

Objectives

1.6.1 Minimize potential environmental impacts identified in FAA Order 5050.4.

1.6.2 Locate Airport facilities so that growth of associated uses may best be controlled through land use planning and zoning measures.

1.6.3 Plan for an energy-efficient Airport layout providing ease of air and ground access while preserving for long-term Airport capacity needs.

1.6.4 As part of the Roanoke Valley Early Action Compact Area, the Airport will consider air quality emission control measures identified in the Ozone Early Action Plan as applicable.

1.6.5 Create an items list of specific Environmental Protection Agency (EPA) environmental issues that the Airport will most probably encounter as the master plan is implemented.

1.7 GOAL NO. 7

Support local and regional economic goals and plans without constraining long-term Airport development.

Objectives

1.7.1 Create aviation and non-aviation business opportunities which foster economic community development and create jobs.

1.7.2 Maintain a level of service and convenience which will enhance regional economic development.

1.7.3 Provide for appropriate and achievable commercial opportunities at or near the Airport.

1.7.4 Ensure that long-term Airport development requirements are reflected in Federal, State, regional, and local development and transportation plans.

1.8 GOAL NO. 8

Build and maintain community confidence and support.

Objectives

1.8.1 Maintain an effective working relationship between the project team, the FAA, the Virginia Department of Aviation, the City and County of Roanoke, local communities, and the private sector.

1.8.2 Maintain a positive relationship with Airport users.

1.8.3 Encourage public participation.

1.8.4 Identify the region's implementation mechanisms for the plan and determine the implementation responsibilities at the Federal, State, and local level and in the private sector users.

1.8.5 Engage in a public relations effort as appropriate to enhance public awareness and foster a positive climate relative to Airport activity.

Chapter Two
Inventory of Existing Conditions

2.1 INTRODUCTION

ROA is a commercial service airport located in Southwest Virginia (**Figure 2-1**). It is owned and operated by the RRAC. In 2005, ROA was ranked sixth in passenger commercial service among the Commonwealth of Virginia's airports.

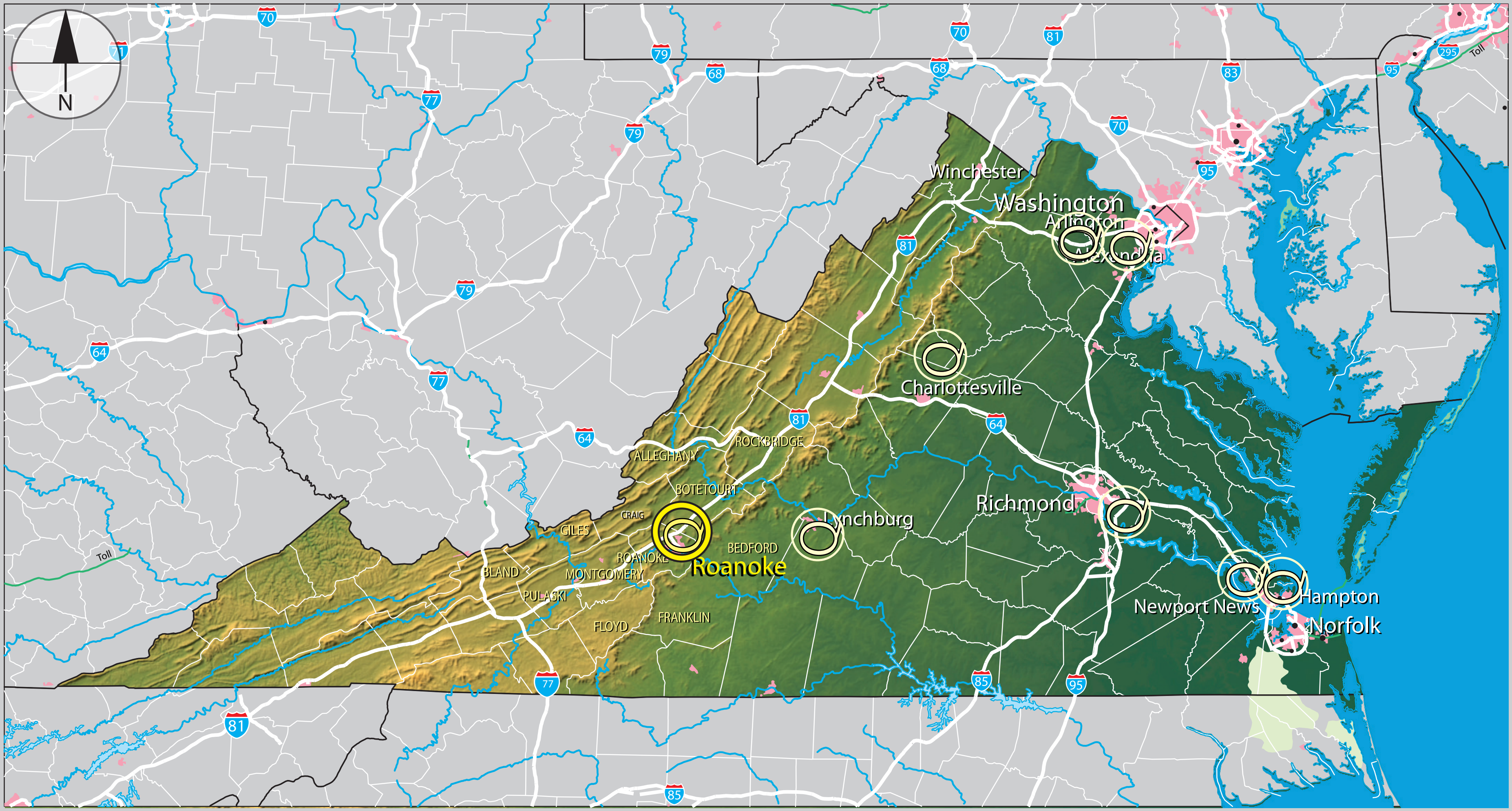
ROA is located approximately three miles northwest of Roanoke's downtown business district, as shown in **Figure 2-2**. The Airport covers an area of 904 acres of which 647 acres is within the security fence (including the airport operations area (AOA), aircraft movement area, and non-movement area) and 257 acres is outside the fence. Most of the area lies within the City of Roanoke; the remaining land is located in Roanoke County.

In 1929, the City of Roanoke leased 136 acres of the A. A. Cannaday farm to become the City's airport. In 1934, the City purchased the entire farm consisting of 319 acres. The first commercial passenger service was initiated by American Airlines in 1934. However, service was discontinued shortly thereafter due to the lack of paved runways and other needed improvements. In 1937, the City took over the operation from the fixed base operator (FBO) and named its first Airport manager. The runways were also paved during this year as part of the Works Project Administration. In 1940, the Roanoke Airport was declared a national defense project, which resulted in the construction of three paved runways in typical military configuration.

Numerous projects have been completed at the Airport since the 1940s. The previous terminal building, located at the intersection of Runway 5-23 and Runway 15-33, was constructed in 1950. At one time, Piedmont Airlines utilized Roanoke as its hub of operations. In 1967, Piedmont initiated jet service at Roanoke. In 1981, Federal and State funding was obtained to extend Runway 6-24 to 6,800 feet. The most recent Airport master plan was completed in 1998 and the current passenger terminal building was dedicated in 1989. The Airport Commission was formed in 1987 as an independent regional public agency, and ownership of the Airport was transferred from the City to the Commission.

Based on a recent air service study[1] the Airport's primary service area encompasses all of the following jurisdictions: Alleghany County, Amherst County, Bedford City, Botetourt County, Buena Vista City, Clifton Forge City, Covington City, Craig County, Floyd County, Franklin County, Lexington City, Montgomery County, Pulaski County, Roanoke City, Roanoke County, and Salem City. The primary service area also includes portions of the following jurisdictions: Bedford County, Giles County, Rockbridge County, and Wythe County.

1 *Passenger Demand Analysis*, Mead & Hunt (September 13, 2005), Draft.



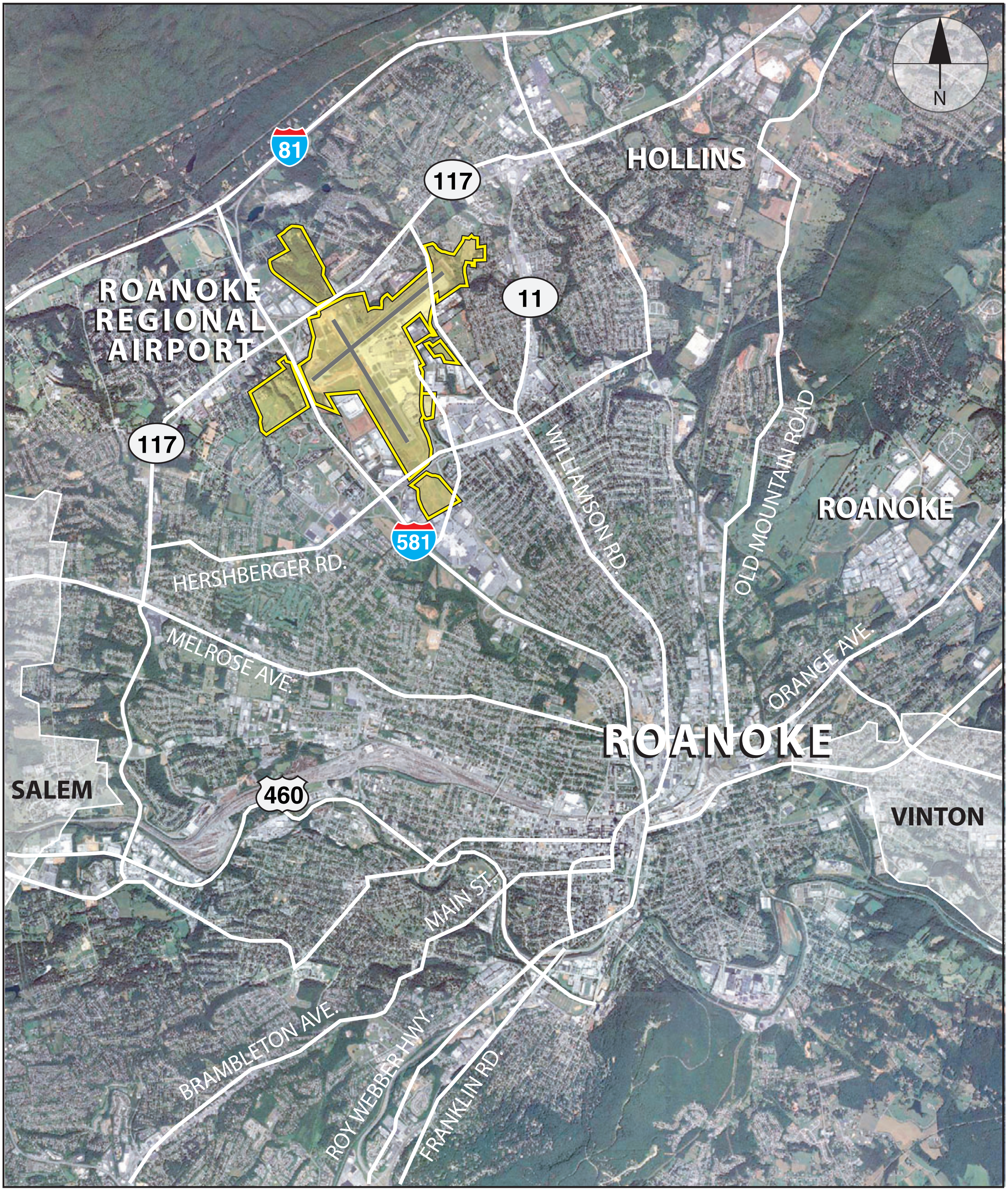
ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

Airport Location Map

FIGURE 2-1

SOURCE: Cartesia Software, HNTB Analysis.



ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

0 1 2 MILES

Airport Vicinity Map

FIGURE 2-2

SOURCE: HNTB Analysis. Aerial Photography, 2003

The air service study also identified a secondary service area which included all or a portion of Augusta County, Bath County, Bedford County, Bland County, Carroll County, Galax City, Giles County, Grayson County, Greenbrier County (WV), Highland County, Lynchburg City, Monroe County (WV), Pocahontas County (WV), Rockbridge County, Smyth County, Staunton City, Summers County (WV), Waynesboro City, and Wythe County.

A passenger survey conducted as part of this Master Plan Update showed that nearly 90 percent of passengers departing ROA in November 2005 originated from within the primary service area identified above, while an additional three percent came from within the secondary service area. The remaining eight percent originated from outside the primary and secondary service areas. (See Chapter 3 of this Master Plan Update for a detailed analysis of the passenger survey results.)

The predominant features of the Airport include two intersecting runways, associated taxiways, the passenger terminal and support area, cargo area, and a GA area. These features are depicted in **Figure 2-3**. An inventory of existing buildings is provided in **Table 2.1**.

ROA is an important factor influencing economic growth and development in Roanoke and the surrounding area. The Airport serves as a catalyst for business enterprise, job growth, and investment throughout the region by providing accessible and efficient air service for passengers and cargo. Not only is the Airport a vital component of the State's transportation infrastructure, but it also serves as a major center of economic activity, generating significant levels of employment and income. The Virginia Department of Aviation conducted an economic impact study in 2004 which concluded the following:

- Direct employment by the Airport and its tenants totaled 637 employees.
- Total wages, salaries, and benefits paid by Airport employers and tenants exceed $21.49 million annually.
- Visitors to the region were responsible for an additional 2,092 jobs and $32.54 million in associated payroll.
- The combined impact of on-airport employers, visitor spending, and spin-off impacts equaled more than 4,100 jobs, almost $95 million in payroll, and more than $252 in economic activity.

2.2 AIRSPACE MANAGEMENT SYSTEM

The airspace over Roanoke, like all of the airspace in the U.S., is under the jurisdiction of the FAA. This authority was granted by Congress via the Federal Aviation Act of 1958. The FAA has established the National Airspace System (NAS) to protect persons and property on the ground and to establish a safe and efficient airspace environment for civil, commercial, and military aviation. The NAS is defined as the common network of U.S. airspace, including air navigation facilities; airports and landing areas; aeronautical charts and information;

Table 2.1

Building Inventory

Bdg. No.	Description	Type of Construction	Condition	Year Built	Size (SF)	Use	Tenants
2	Hangar	Metal & Cinder	Poor	1930	8,932	Apt. Maintenance Storage	Roanoke Aero Services
3	Hangar	Metal & Cinder	Poor	1938	9,252	Aircraft Storage, FBO Charter	LC's Flying Service
4	Maintenance Hangar	Metal	Good	1961	43,200	Large Aircraft Maintenance	Piedmont Aviation
5	Cargo Building	Metal	Fair	1974	7,900	Cargo Storage	Burlington
6	RDP Building	Cinder Block	Good	2000	130	Telecommunications Routing	Verizon
7	ATCT Facility	Masonry	Excellent	2004	1,500	Air Traffic Control	FAA
8	Storage Building	(1)	(1)	(1)	250	FAA Airways Storage	FAA
9	Storage Building	(1)	(1)	(1)	450	FAA Airways Storage	FAA
16	T-hangar	(1)	Excellent	2004	17,000	Aircraft Storage	Midland Development
17	Storage Hangar	Metal	Good	1964	5,000	Aircraft Storage	Chuck Waring
18	Storage Hangar & Office	Metal	Poor	1964	3,080	Aircraft Storage, FBO Office	Executive Air
19	Storage Hangar	Metal	Good	1964	5,000	Aircraft Storage	Summit Helicopters
20	Storage Hangar	Metal	Good	1964	5,000	Aircraft Storage	
21	ARFF Facility (Sta. 10)	Brick	Good	1974	11,000	Aircraft Rescue, Fire Fighting	RRAC/City of Roanoke
22	Storage Hangar	Metal	Good	1975	29,667	Aircraft Storage & Maint.	Landmark Aviation
23	GA Terminal	Brick & Metal	Good	1975	3,750	FBO Services/Offices	Landmark Aviation
24	T-hangar	Metal	Good	1975	11,500	Aircraft Storage	Landmark Aviation
25	Storage Hangar	Metal	Good	1978	34,560	Aircaft Storage	Landmark Aviation
26	T-hangar	Metal	Good	1995	18,000	Aircraft Storage	Landmark Aviation
27	Electrical Vault Building	Block	Excellent	1994	2,400	Airfield Electrical Vault	RRAC
28	Parking Exit Toll Bdg		Good	1989	450	Cashier's Office	RRAC
29	Hangar	Metal	Excellent	2006	18,000	Aircraft Storage	Landmark Aviation
30	Passenger Terminal	Brick/Masonry	Good	1989	96,000	Passenger Terminal	Airlines, Concessions, RRAC
31	Airfield Maintenance Bdg.	Metal & Cinder	Excellent	1997	24,000	Airfield Maintenance	Airport Commission
32	Corp. Hangar	Metal	Good	1997	4,900	Corporate Hangar/Office	Nordt
33	Overflow Parking Booth	Metal	Good	1998		Parking Booth	Standard Parking Corp.
N/A	ASR Building	(1)	(1)	(1)	900	Navigation	FAA
N/A	Storage Building	(1)	(1)	(1)	1,900	Haz. Mat. Storage	FAA
N/A	Building-Trailer	Metal	(1)	1998	2,700	Office Trailer	UPS
N/A	Building	Metal	(1)	1998	800	Air Cargo Sort Facility	UPS
N/A	Building	Sprung Structure	Excellent	1998	14,700	Air Cargo Sort Facility	FedEx
N/A	Trailer	Metal	(1)	1998	1,100	Office	FedEx
N/A	Trailer	Metal	(1)	1998	1,400	Operations	FedEx
N/A	Trailer	Metal	(1)	1998	800	Operations	ABX

Note: (1) Not available.

Source: RRAC, HNTB analysis.

ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

Existing Airport Features

FIGURE 2-3

SOURCE: HNTB Analysis

0 1000 2000 SCALE IN FEET

associated rules, regulations, and procedures; technical information; personnel; and material. System components shared jointly with the military are also included.

2.2.1 Airspace Structure

Airspace is currently classified as either controlled or uncontrolled. Controlled airspace is supported by ground-to-air communications, navigation aids, and air traffic services. FAA airspace classifications and terminology are depicted in **Figure 2-4**.

The types of controlled airspace in the Roanoke area are:

- Class A airspace, which includes all airspace between 18,000 feet mean sea level (MSL) and 60,000 feet MSL;
- Class C airspace includes airspace from Airport elevation up to 5,200 feet MSL centered about the Airport for a 5-mile radius, and from 3,400 to 3,800 feet MSL to 5,200 feet MSL for a 10-mile radius; and,
- Class E airspace, which includes transition areas and surface areas for airports without air traffic control towers.

Uncontrolled airspace is referred to as Class G airspace. Only those areas which pertain to the study are described further.

Class C Airspace

Figure 2-5 shows Roanoke's Class C airspace. Class C airspace is established at many medium-density airports in the U.S. as a means of regulating air traffic activity in these areas.

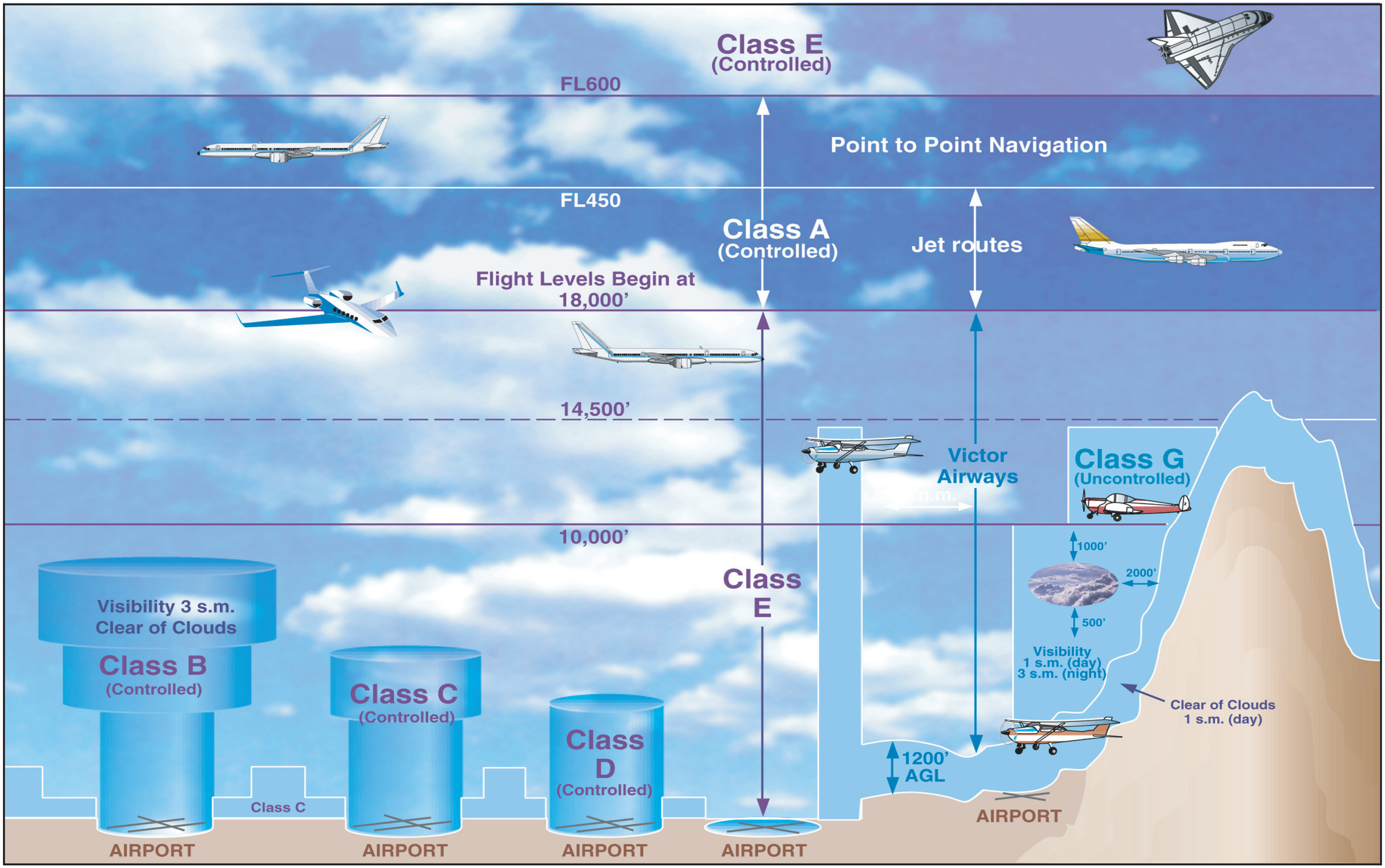
Class C airspace is designed to regulate the flow of uncontrolled traffic above, around, and below the arrival and departure airspace required for high-performance, passenger-carrying aircraft at commercial airports. Class C airspace is the second most restrictive controlled airspace routinely encountered by pilots operating under visual flight rules (VFR) in an uncontrolled environment.

In order to fly through Class C airspace, an aircraft must have a two-way radio and a transponder with Mode C, and VFR aircraft must establish two-way communications with air traffic control (ATC). In order to operate within the ROA Class C airspace, a pilot must have at least a private pilot's certificate. Helicopters do not need special navigation equipment or a transponder if they operate at or below 1,000 feet and have made prior arrangements in the form of a Letter of Agreement with the FAA.

2.2.2 Delegation of Air Traffic Control Responsibilities

Air Traffic Control

The FAA's Roanoke air traffic control tower (ATCT) personnel are responsible for air control within the Roanoke terminal area. Based on its activity level, the Roanoke ATCT is a Level 7 facility, and controls the airspace in an area extending approximately 125 nautical miles (NM) east to west and 40 NM to 50 NM north to south. The airspace boundaries within the Terminal Radar Approach Control (TRACON) area extend from the surface to between 5,000 feet and 23,000 feet MSL, but primarily up to between 9,000 and 10,000 feet MSL. The Roanoke Class C airspace is centered within

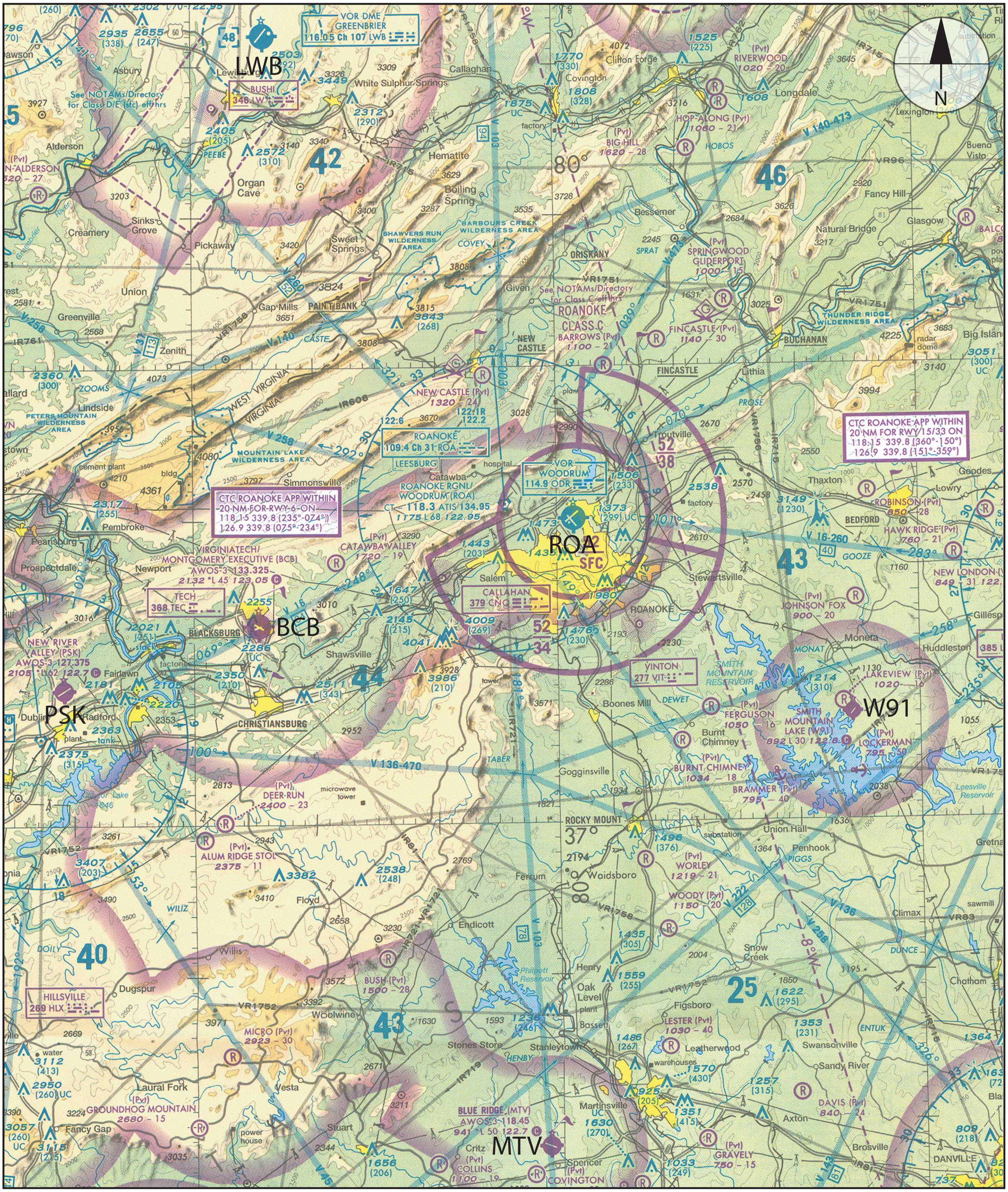


ROANOKE
REGIONAL
AIRPORT

FAA Airspace Classifications

FIGURE
2-4

SOURCE: Federal Aviation Administration, HNTB Analysis



ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

0 5 10
NAUTICAL MILES

Roanoke Airspace Structure and Neighboring Airports

SOURCE: Cincinnati Sectional Aeronautical Chart, NOAA, U.S. Department of Commerce, Roanoke Regional Airport ATC, and HNTB analysis.

FIGURE 2-5

this area. The TRACON maintains agreements with the Atlanta Air Route Traffic Control Center, the Indianapolis Center, the Washington Center, the Potomac TRACON, and the Greensboro Air Traffic Control Tower.

The Roanoke local tower position clears aircraft for takeoff and for landing. The tower operates 24-hours a day seven days a week. Arriving aircraft are typically handed off from approach control to the tower 5 to 10 miles from the runway. Departures are handed off to departure control within a mile of the runway. Because of the shortness of runway exit taxiways, landing aircraft must enter the parallel taxiway in order to completely clear the runway. The local controller therefore also is assigned the responsibility for controlling the ground movement of aircraft on certain portions of taxiways under certain operational configurations.

The ground controller position is responsible for directing aircraft within all movement areas along all taxiways except under the conditions described above. Non-movement areas include the passenger terminal ramp, the GA area (taxilanes and ramps), the cargo ramp, the aprons serving the hangars along Taxiway Golf, and apron directly adjacent to the site of the former terminal.

2.2.3 En route Navigational Aids

En route navigational aids (NAVAIDs) are established to maintain accurate en route air navigation. These use ground-based transmission facilities and onboard receiving instruments. Several en route NAVAIDs operate in the Roanoke area.

The nondirectional beacon (NDB) is a general purpose, low-frequency radio beacon that a pilot can use to determine a bearing. ROA is served by two NDBs—the VINTON NDB, located eight nautical miles off the approach end of Runway 33 and the TECH NDB, located about 22 miles from the Airport.

Another important NAVAID is the very high-frequency (VHF) omni-directional range station (VOR). The VOR is a ground-based NAVAID which transmits radio signals 360 degrees in azimuth from the station. These radio signals enable pilots to turn at a given point above the ground or fly along a radial and home in on the station. VORs are often combined with distance-measuring equipment (DME). Four VORs are located within the Roanoke airspace. These are the ROA VOR about five miles west of the field, the Woodrum (ODR) VOR, located on the field, the Lynchburg (LYH) VOR, located about four miles southwest of Lynchburg, and the Pulaski (PSK) VOR, located about six miles southwest of Dublin.

VORs also are used to define low-altitude (Victor) and high-altitude (jet route) airways through the area. Low-altitude airways are designated from 1,200 feet above the surface up to 18,000 feet MSL. They generally are used to accommodate lower-speed, nonjet aircraft. They are also sometimes used to vector jet traffic into and out of airports. The jet routes are defined as above 18,000 feet MSL and are used by high-speed, pressurized jet aircraft. The VOR facilities and low altitude airways are shown in Figure 2-5.

2.2.4 Neighboring Airports

Figure 2-5 shows the airports in the Roanoke terminal area. There are currently nine airports operating within 20 miles of ROA. These airports are all private use and include:

- Robinson
- Springwood
- Fincastle
- Barrows
- New Castle
- Johnson Fox
- Ferguson
- Burnt Chimney
- Catawba Valley

2.2.5 Local Air Traffic Control Procedures

Visual Flight Rules Procedures

Aircraft under VFR departing and arriving ROA are under positive control of Roanoke ATC. An aircraft departing the Airport will receive departure instructions from the ATC. The departure procedure will vary depending on destination, runways in use, and the volume of traffic. Aircraft leaving ROA Class C airspace must comply with local airspace restrictions and contact the appropriate controlling agency to enter controlled or special use airspace. Aircraft landing at ROA must contact ATC prior to entering the Class C airspace. The arrival procedure will vary depending on the operational flow of the Airport and volume of traffic.

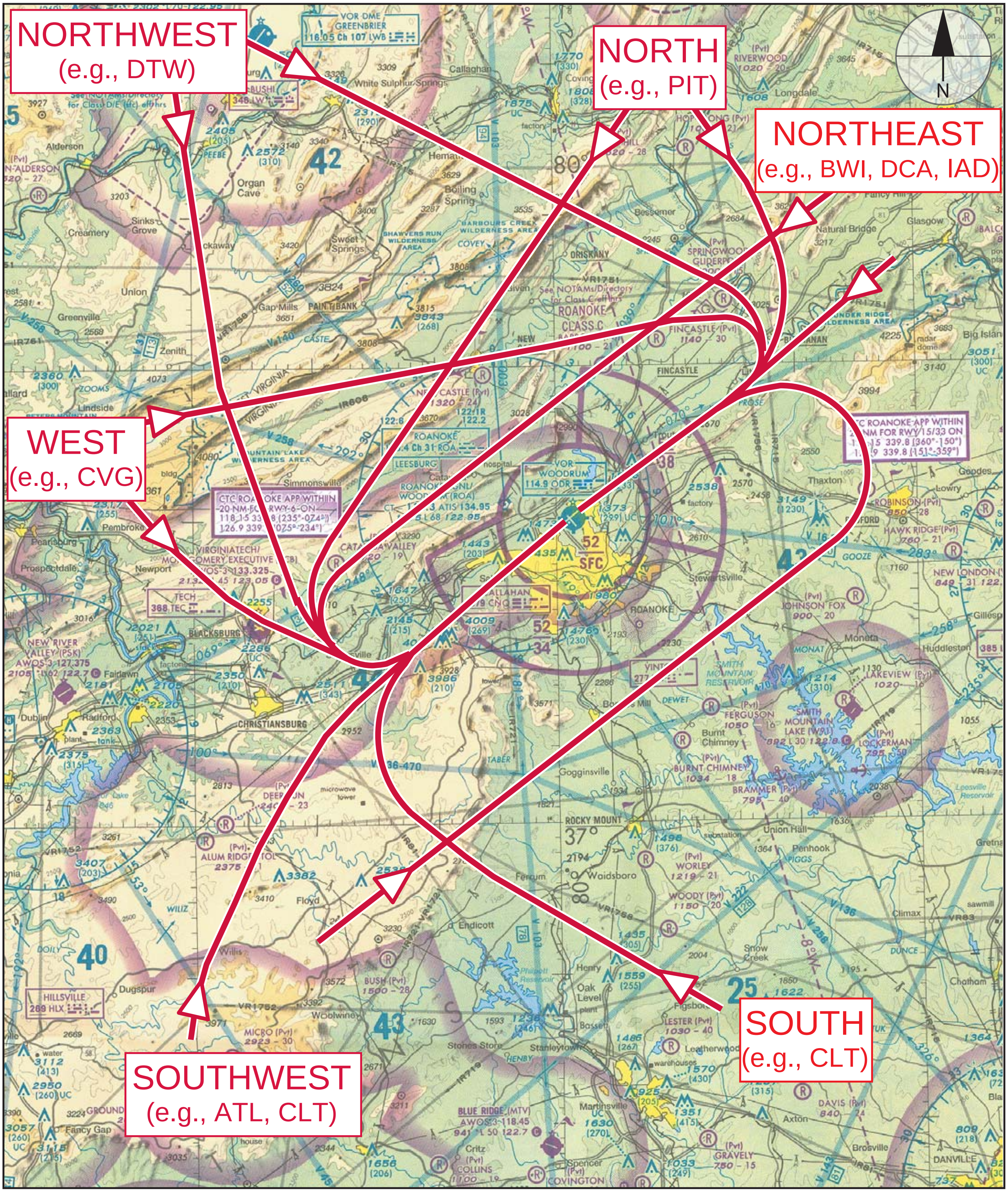
Instrument Flight Rules Procedures

For departing instrument flight rules (IFR) aircraft, the FAA assigns headings during VFR weather and issues standard instrument departures (SIDs) during IFR weather. SIDs improve pilot/controller communication by making it more convenient to issue departure clearances. The departure sequence is to fly a heading and altitude assigned by the controller prior to departure, and then proceed with the assigned SID after being cleared by the controller. SIDs also aide the transition from the terminal airspace to the en-route airways and facilitate the hand-off of aircraft from ATC to Center controllers. The two SIDs at ROA are the DIXXY FOUR for departure off of Runway 24 and the HOKEY ONE for departures off of Runway 15 and Runway 24.

In addition, takeoffs from Runway 33 and landings on Runway 15 are not authorized at night or during IFR conditions due to terrain. Also, no IFR departures are permitted on Runway 6. The flight tracks for arrivals and departures are shown in **Figures 2-6a through 2-6d**.

2.3 AIRFIELD

The components of the airfield as they exist in 2005 are summarized in this section. Included are the airfield pavement system (comprising the runways, taxiways, and aprons), landing navigational aids, and obstacles to air navigation. The existing Airport layout is presented in **Figure 2-7**.



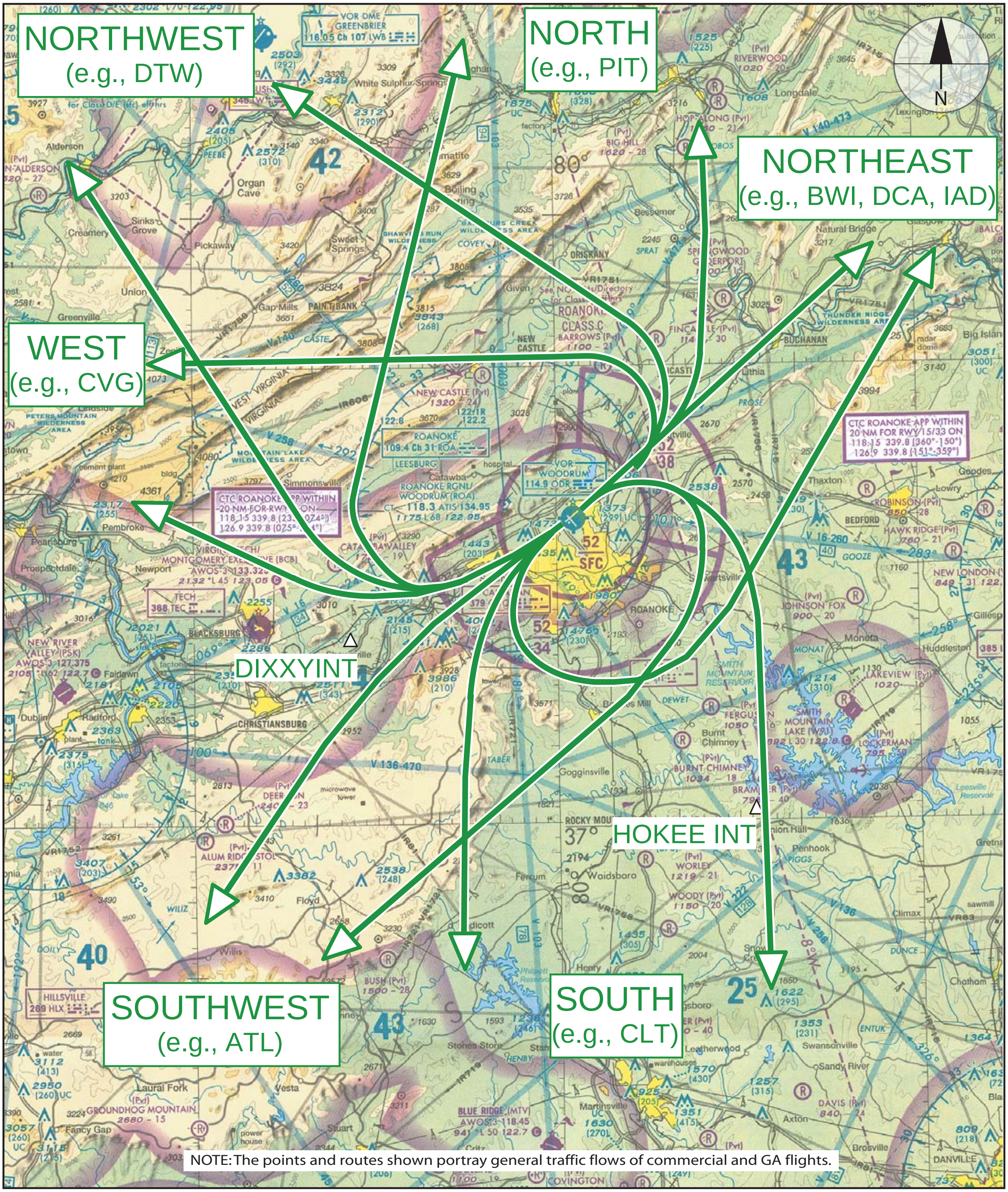
ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

Runway 6-24 Arrival Routes

FIGURE 2-6a

SOURCE: Cincinnati Sectional Aeronautical Chart, NOAA, U.S. Department of Commerce, Roanoke Regional Airport ATC, and HNTB analysis.



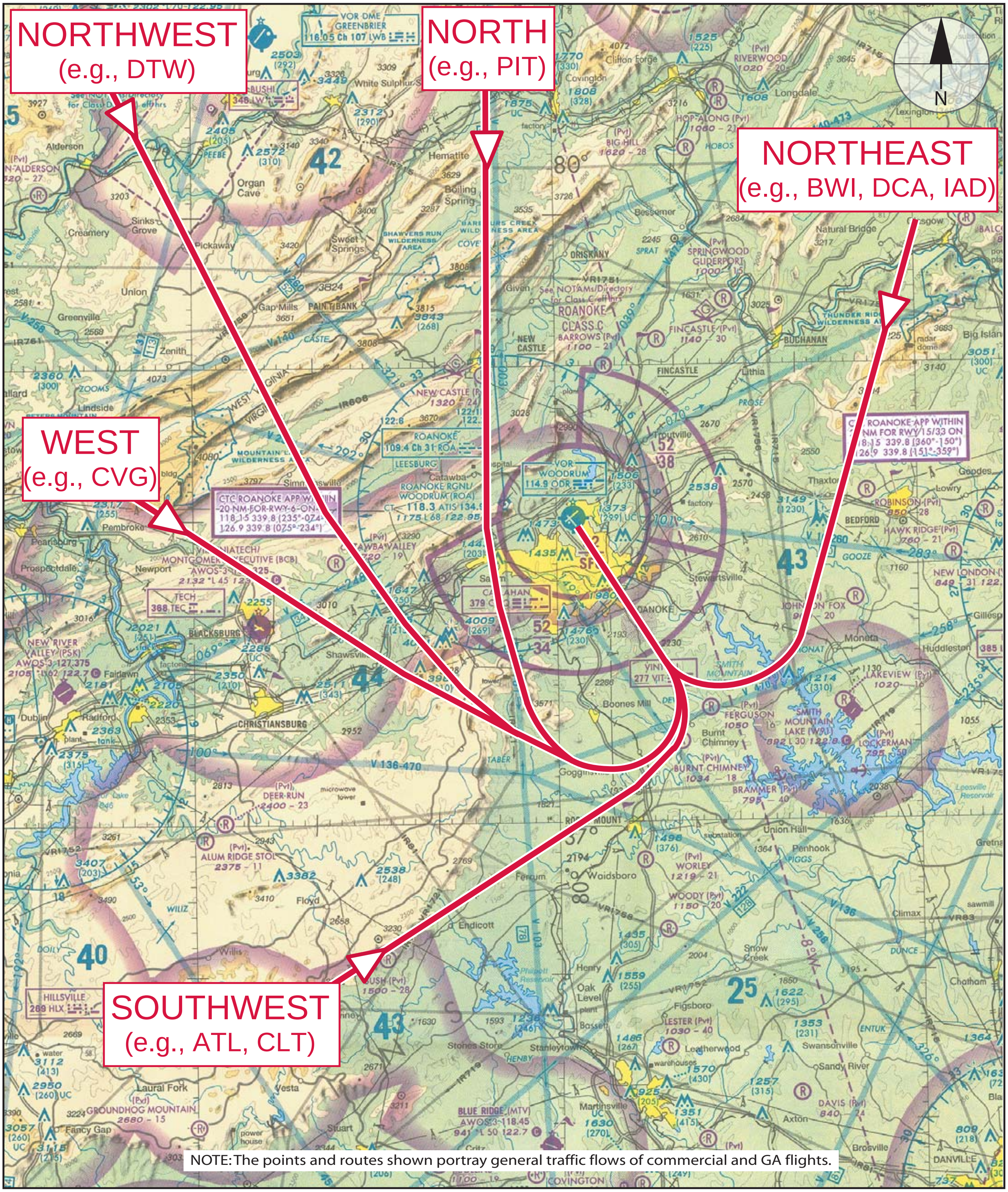
ROANOKE REGIONAL AIRPORT

0 5 10
NAUTICAL MILES

Runway 6-26 Departure Routes

SOURCE: Cincinnati Sectional Aeronautical Chart, NOAA, U.S. Department of Commerce, Roanoke Regional Airport ATC, and HNTB analysis.

FIGURE 2-6b



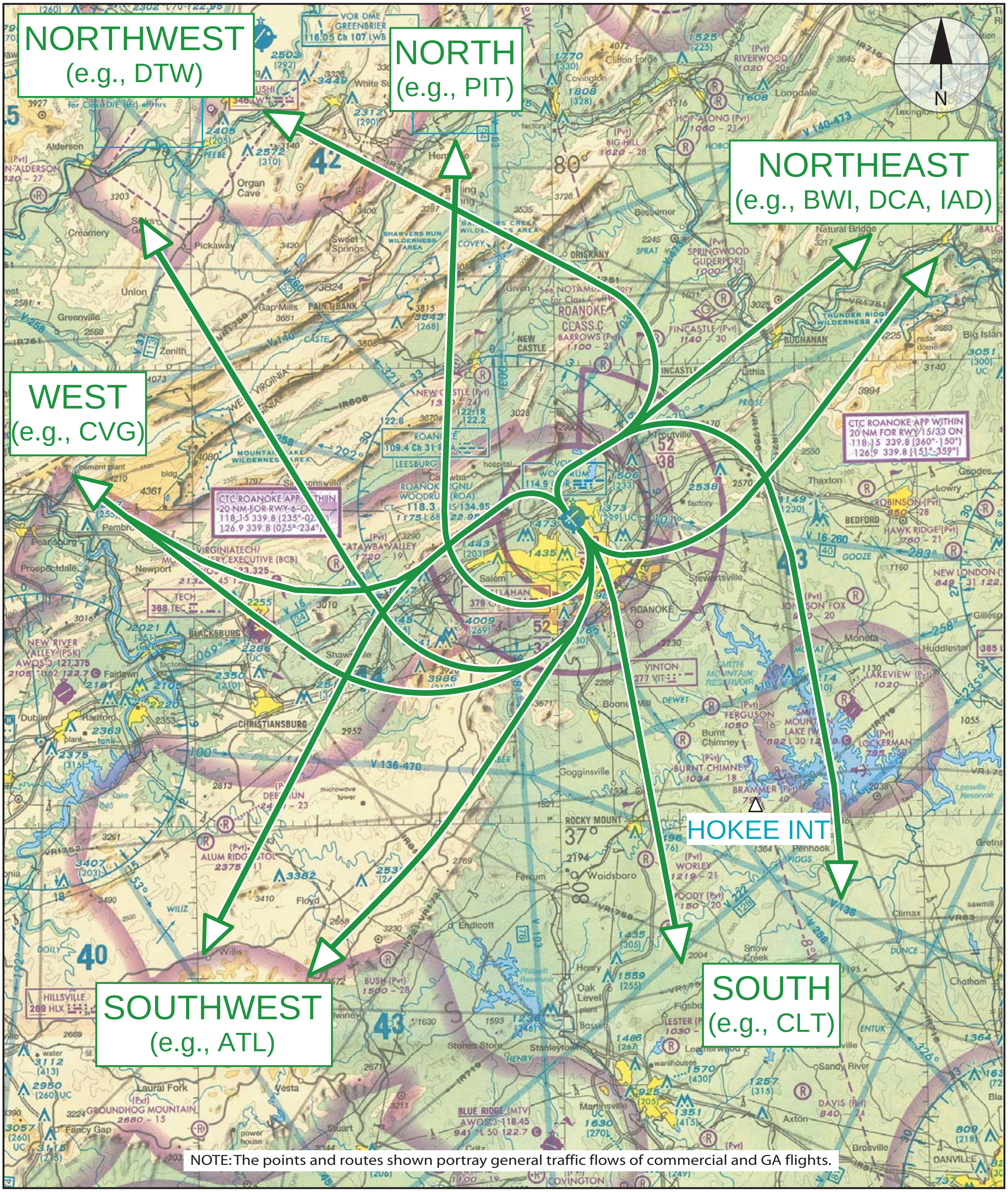
ROANOKE REGIONAL AIRPORT

0 5 10
NAUTICAL MILES

Runway 33 Arrival Routes

FIGURE 2-6c

SOURCE: Cincinnati Sectional Aeronautical Chart, NOAA, U.S. Department of Commerce, Roanoke Regional Airport ATC, and HNTB analysis.



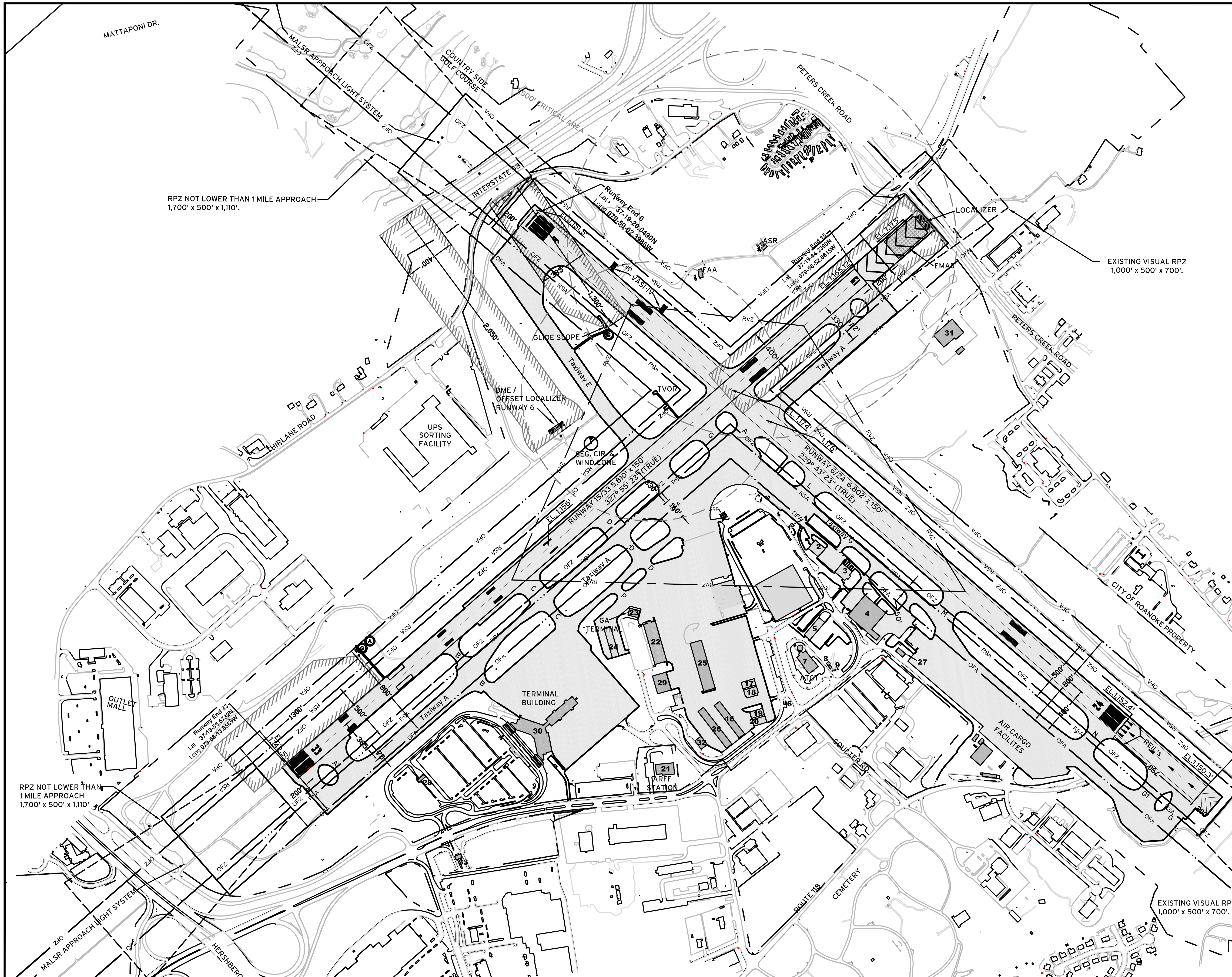
ROANOKE REGIONAL AIRPORT

0 5 10
NAUTICAL MILES

Runway 15-33 Departure Routes

SOURCE: Cincinnati Sectional Aeronautical Chart, NOAA, U.S. Department of Commerce, Roanoke Regional Airport ATC, and HNTB analysis.

FIGURE 2-6d



LEGEND

	EXISTING
Object Free Area	
Runway Safety Area	
Object Free Zone	
Roads/Landside Pavement	
Airfield Pavement	
Ultimate Airfield Development	N/A
Runway Protection Zone	
On-Airport Property Buildings	
Ultimate On-Airport Buildings	N/A
Off-Airport Property Buildings	
Property Line	
Fence Line	

AIRPORT BUILDINGS

BLDG. NO.	DESCRIPTION
2	Hangar
3	Hangar
4	Maintenance Hangar
5	Cargo Building
6	RDP Facility
7	ATCT Facility
8	Storage Building - FAA
9	Storage Building - FAA
16	T-hangar
17	Storage Hangar
18	Storage Hangar & Office
19	Storage Hangar
20	Storage Hangar
21	ARFF Facility
22	FBO Maintenance Hangar
23	GA Terminal Building
24	FBO T-hangar
25	FBO Maintenance Hangar
26	FBO T-hangar
27	Electrical Vault
28	Parking Exit Toll Building
29	FBO Hangar
30	Terminal Building
31	Airfield Maintenance Bldg.
32	Corp. Storage Hangar

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET, SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

EXISTING AIRPORT LAYOUT

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: May 12, 2008

FIGURE 2-7

P:_Projects\40311 RDA Master Plan Update\CAD\Report Figures Final\2-7 EXISTING AIRPORT LAYOUT.dwg S2 May 12, 2008 - 4:26pm

2.3.1 Runways

The existing airfield configuration at ROA consists of two runways: a northeast-southwest runway designated as Runway 6-24, and a northwest-southeast crosswind runway designated as Runway 15-33. Runways 6-24 and 15-33 were originally constructed in 1942 as part of a national defense project. A summary of runway characteristics is provided in **Table 2.2**. The pavement strength data will be updated as part of this planning study.

Runway 6-24 was extended to 6,802 feet in 1983 and is 150 feet wide, with an effective gradient of 0.0 percent. It has a grooved asphalt surface and pavement strengths of 150,000 pounds for single-wheel, 200,000 pounds for dual-wheel, and 310,000 pounds for dual-tandem landing gear configurations. The runway was rehabilitated in 2001 and is in good condition. A project to install precision approach path indicators (PAPIs) on the west (24) end of the runway is currently in the design phase.

Runway 15-33 is 5,810-feet long and 150-feet wide, with an effective gradient of 0.4 percent. It has a grooved asphalt surface and pavement strengths of 150,000 pounds for single-wheel, 200,000 pounds for dual-wheel, and 310,000 pounds for dual-tandem landing gear configurations. The northern third of the runway was rehabilitated in 2002, the middle third of the runway was rehabilitated in 2004, and the southern third was rehabilitated in 2005. Based on the pavement evaluation conducted as part of this Master Plan Update, the runway is in good condition. The southeast (33) end of the runway has PAPIs. To improve safety, an Engineered Materials Arresting System (EMAS) was installed at the northwest end of the Runway in 2004 and the runway safety area (RSA) at the southeast end was regraded in 2005.

2.3.2 Taxiways

The existing taxiway system, also illustrated in Figure 2-7, connects all runway ends to the terminal area and other Airport facilities.

Taxiway A is a full-length parallel taxiway serving Runway 15-33. Its southeast end, which was relocated in 2000, is separated from the centerline of the Runway by 365 feet; this portion is in good condition. Its northwest end was relocated in 2002; it is separated from the Runway by 330 feet. This pavement is in good condition. Its middle section is separated by 275 feet from the Runway. The middle portion, from Taxiway B to Taxiway E will be shifted by about 60 feet in 2006. The width of Taxiway A varies from 50 feet to 75 feet.

Taxiways A-1, A-2, B, C, and D are right angle exit taxiways. Taxiways A-1 and A-2 are bypass taxiways located at the southeast and northwest ends, respectively, and are 100 feet wide with 25-foot shoulders. Taxiway B is located about 1,500 feet from the Runway 33 threshold. It connects the Runway with Taxiway A and the terminal apron. It is 110 feet wide and has 25-foot shoulders. Taxiway C is located approximately 2,300 feet from the Runway 33 threshold. It connects the runway with Taxiway A, the terminal apron, and Taxiway T. Taxiway D is located midway between the two runway ends. It

Table 2.2

Runway Characteristics

	Runway 6-24		Runway 15-33	
	6	**24**	**15**	**33**
Length (ft.)	--6,802--		--5,810--	
Displaced Threshold (ft.)	-None-	790	-None-	-None-
Width (ft.)	--150--		--150--	
Blast Pads (ft.)	50 x 200	150 x 200	200 x 200	300 x 200
Surface	-Bituminous grooved-		-Bituminous grooved-	
Design Pavement Strength (lbs.)				
Single Gear	--150,000--		--150,000--	
Dual Gear	--200,000--		--200,000--	
Dual Tandem	--310,000--		--310,000--	
Marking	Nonprec. Inst.	Nonprec. Inst.	Visual	Precision Inst.
Lighting	HIRL REIL MALSR	HIRL REIL	HIRL	HIRL MALSR PAPI (P4L)

Abbreviations: HIRL: High Intensity Runway Lighting
MALSR: Medium Approach Light System with Runway Alignment Indicator Lights
PAPI (P4L): Precision Approach Path Indicator, four lights on left
RNAV: Area Navigation
VASI (V4L): Visual Approach Slope Indicator, 4-box on left

Source: U.S. Terminal Procedures, U.S. Dept. of Commerce, Dec. 22, 2005; Northeast U.S. Airport/Facility Directory, FAA Dec. 22, 2005.

connects the Runway with Taxiway A, Taxiway T, and the GA area. The width of Taxiway D varies between 75 feet and 115 feet. The portion that connects Taxiway A and Runway 15-33 has 25-foot shoulders. All pavements are in good condition.

Taxiway E connects the Runway 6 threshold with Taxiway A and the GA ramp. It was realigned in 2003. Taxiway E crosses Runway 15-33 about 2,200 feet from the 15 threshold. This taxiway and Taxiway E1 (a bypass taxiway) are both 75 feet wide with 25-foot shoulders. Taxiway E is separated from Runway 6-24 by 430 feet at the Runway's southwest end. The pavement is in good condition.

Taxiway G is a partial parallel taxiway serving Runway 6-24. Its width varies from between 50 feet to 100 feet. Taxiway G begins at the approach end of Runway 24 and terminates at Runway 15-33. The runway-taxiway separation varies between 275 feet (between Taxiway A and Taxiway M) and 400 feet (between Taxiway M and its northeast terminus). The northeast end was constructed as part of the Runway 6-24 extension project completed in 1984. The portion between Taxiway M and Taxiway N was relocated/reconstructed in 1996 as part of the cargo apron project. This portion is in good condition. The western half of Taxiway G is slated for relocation/ reconstruction in 2008. Taxiway G1 is a bypass taxiway located at the approach end of Runway 24; it is 100 feet wide and has 25-foot shoulders.

Taxiways M and N are right-angle exit taxiways connecting Runway 6-24 with Taxiway G. Taxiway M is approximately 2,400 feet from the northeast end of Runway 6-24; Taxiway N is about 900 feet from the end of the Runway. Taxiway M is 100 feet wide with 25-foot shoulders; Taxiway N is 90 feet wide with 25-foot shoulders. Both taxiways are in good condition.

Taxiway P connects the GA ramp with Taxiway T. It is 65 feet wide and in good condition. Taxiway Q connects Taxiway T with Taxiway A. It is 70 feet wide and in good condition. Taxiway T parallels Taxiway A and connects Taxiway Q with the terminal apron. This taxiway is being rehabilitated.

2.3.3 Aprons

There are three main areas of the Airport with aircraft parking aprons: the passenger terminal area, the GA area, and the air cargo ramp area.

The passenger terminal apron area covers approximately 62,500 square yards, including taxilanes and maneuvering space. The portion west of the concourse is in satisfactory condition, while the portion east of the concourse is in fair condition.

The GA apron area available for tie down of based and transient aircraft is approximately 60,000 square yards. This pavement, including the associated taxilanes, is in satisfactory condition, overall. The pavement adjacent to the box hangars (Buildings 17 through 20) is in fair condition.

The air cargo ramp is adjacent to Taxiway G and covers approximately 32,000 square yards. This pavement is in satisfactory condition.

2.3.4 Landing Navigational Aids

Table 2.3 summarizes the instrument approach procedures available at ROA. There are six instrument approach procedures published for ROA, including:

- Runway 33—Category I-ILS and RNAV/GPS;
- Runway 6—LDA/DME, with glideslope and RNAV (GPS); and,
- Runway 24—RNAV and VOR/DME.

These terminal procedures (including SIDs) are illustrated in **Figures 2-8a through 2-8e**.

The Airport is also equipped with an airport surveillance radar (ASR-8) system.

Because of mountainous terrain, the precision approaches to Runways 6 and 33 do not have the lowest possible operating minimums. The Master Plan Update will evaluate the potential use of new technology Global Positioning Systems (GPS) and Flight Management Systems (FMS) to achieve lower possible operating minimums.

2.3.5 Imaginary Surfaces and Obstructions

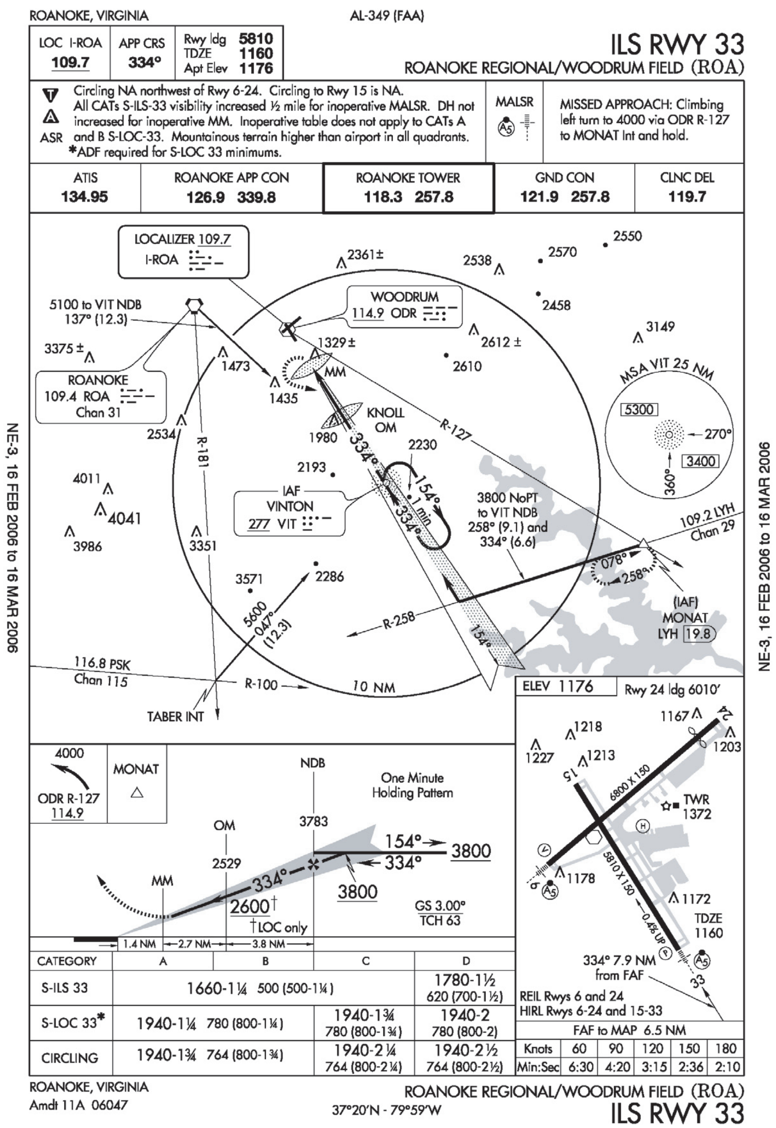
The Federal Aviation Regulations (FAR) Part 77 define the standards used for determining obstructions in navigable airspace around an airport. Objects which penetrate the imaginary surfaces established in FAR Part 77 are defined as obstructions. Part 77 imaginary surfaces are three-dimensional planes that are defined based on the type of runway (air carrier, GA, etc.) to which they are assigned. The imaginary surfaces include approach, transitional, primary, horizontal, and conical surfaces. Information on the dimensional standards of the surfaces is shown in **Figure 2-9**. **Figures 2-10a through 2-10d**, identify obstructions in the approach and primary surfaces of the runways based on field surveys conducted in 2006 as part of the Master Plan Update. **Appendix A** documents the obstruction analysis in more detail.

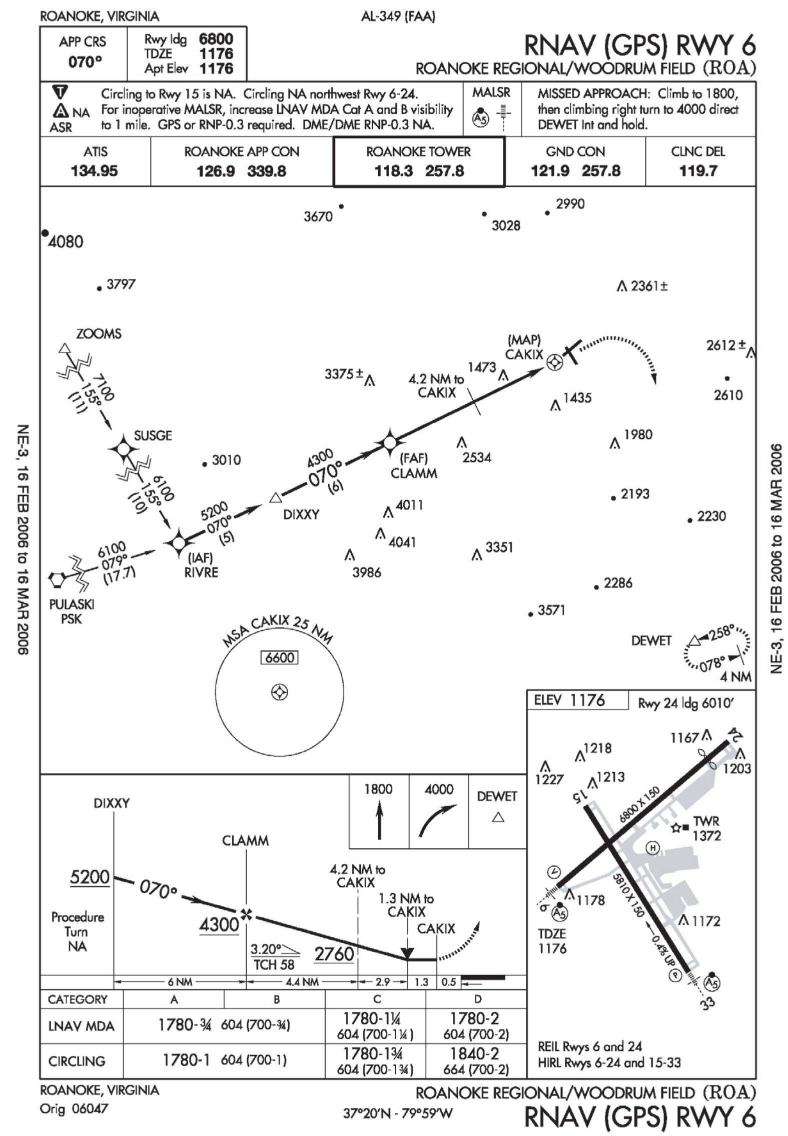
2.4 PASSENGER TERMINAL BUILDING

The existing terminal building was opened in September 1989 to replace the former terminal built in 1950. The terminal was initially designed to accommodate six narrow body aircraft with expansion capabilities to handle twelve aircraft gates. Since the opening of the terminal, most of the narrow body aircraft equipment has been replaced by regional jets and smaller, but more frequently utilized, turboprop aircraft. As the terminal was not designed to accommodate the current level of turboprop and low sill regional aircraft, the Master Plan Update will evaluate concepts that will provide a higher level of service to the deplaning and enplaning process of regional/commuter passengers.

2.4.1 General Description

The passenger terminal is located along a common terminal approach access loop road which serves the terminal, delivery access, and passenger parking areas. The terminal area is located on the southeastern quadrant of the Airport near the southeast end of Runway 15-33 and is connected via





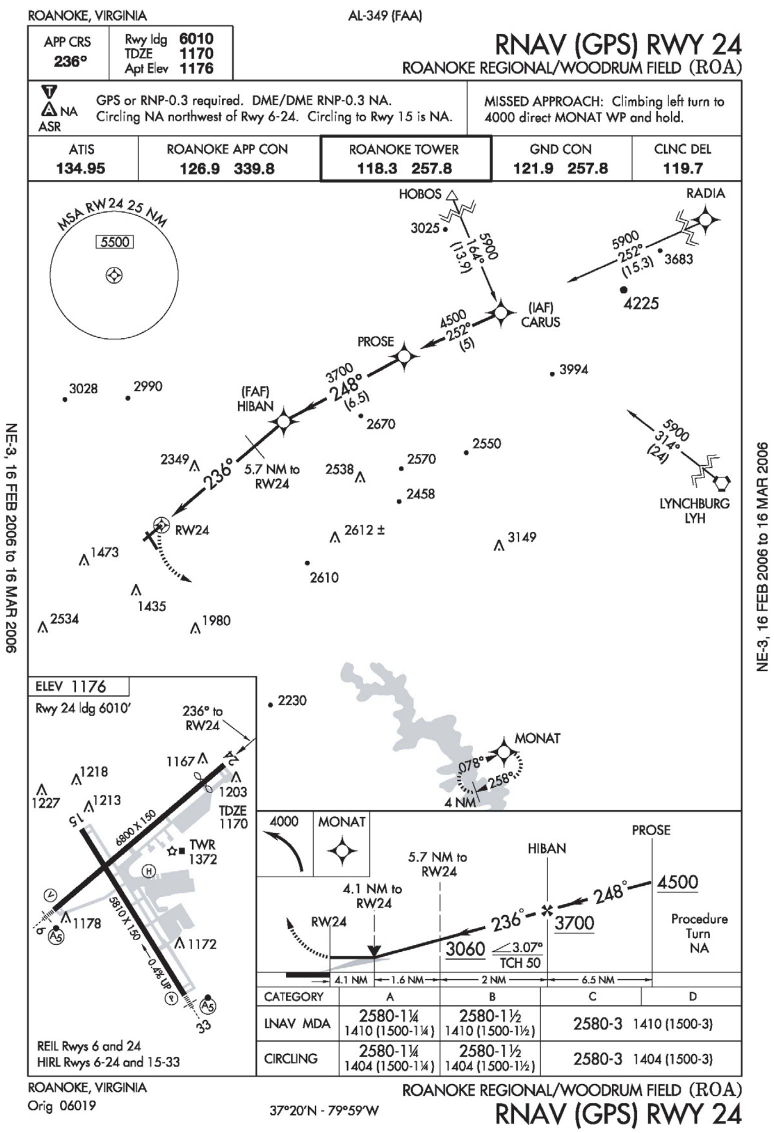
R O A N O K E   R E G I O N A L   A I R P O R T   M A S T E R   P L A N   U P D A T E

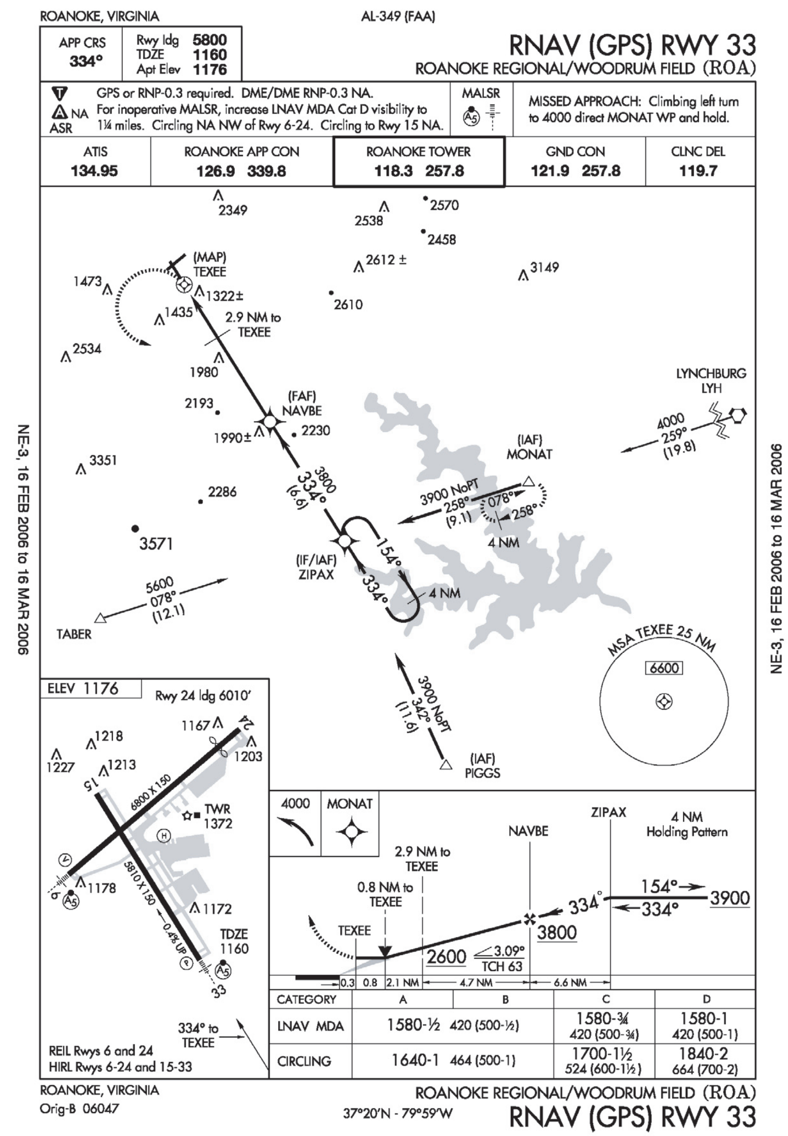
ROANOKE REGIONAL AIRPORT

Terminal Procedures
ILS RWY 33 & RNAV (GPS) RWY 6

SOURCE: U.S. Terminal Procedures, Federal Aviation Administration.

FIGURE 2-8a





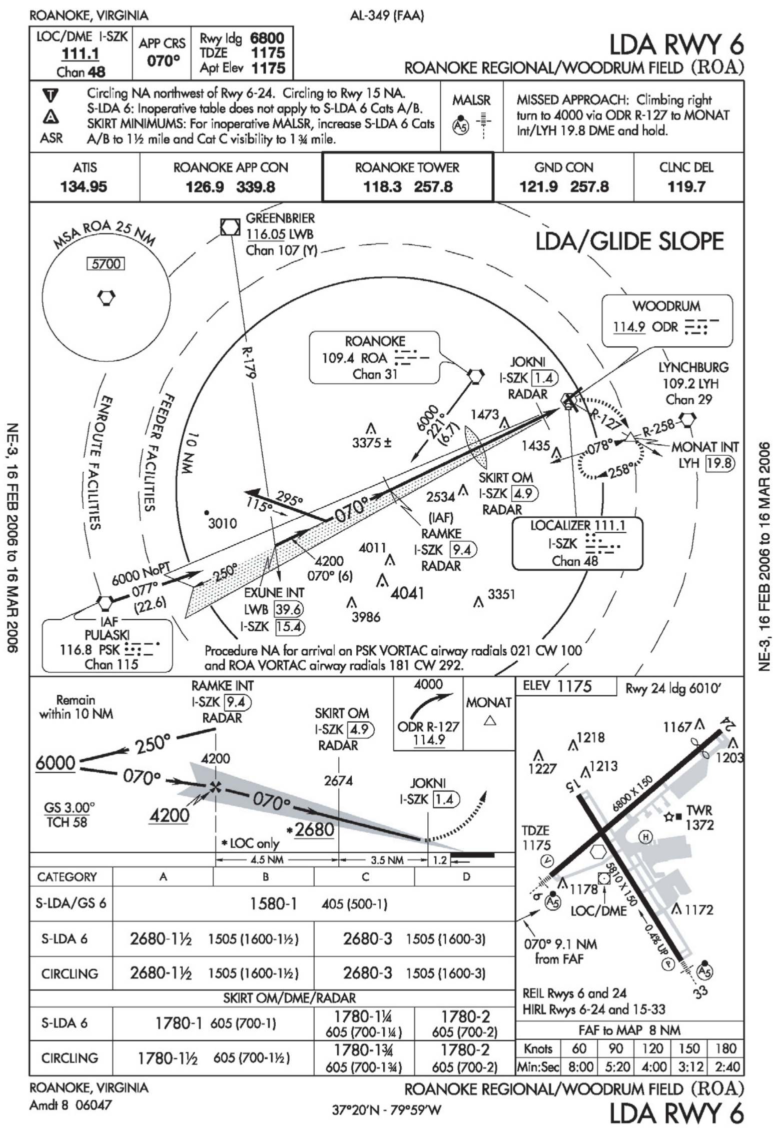
R O A N O K E R E G I O N A L A I R P O R T M A S T E R P L A N U P D A T E

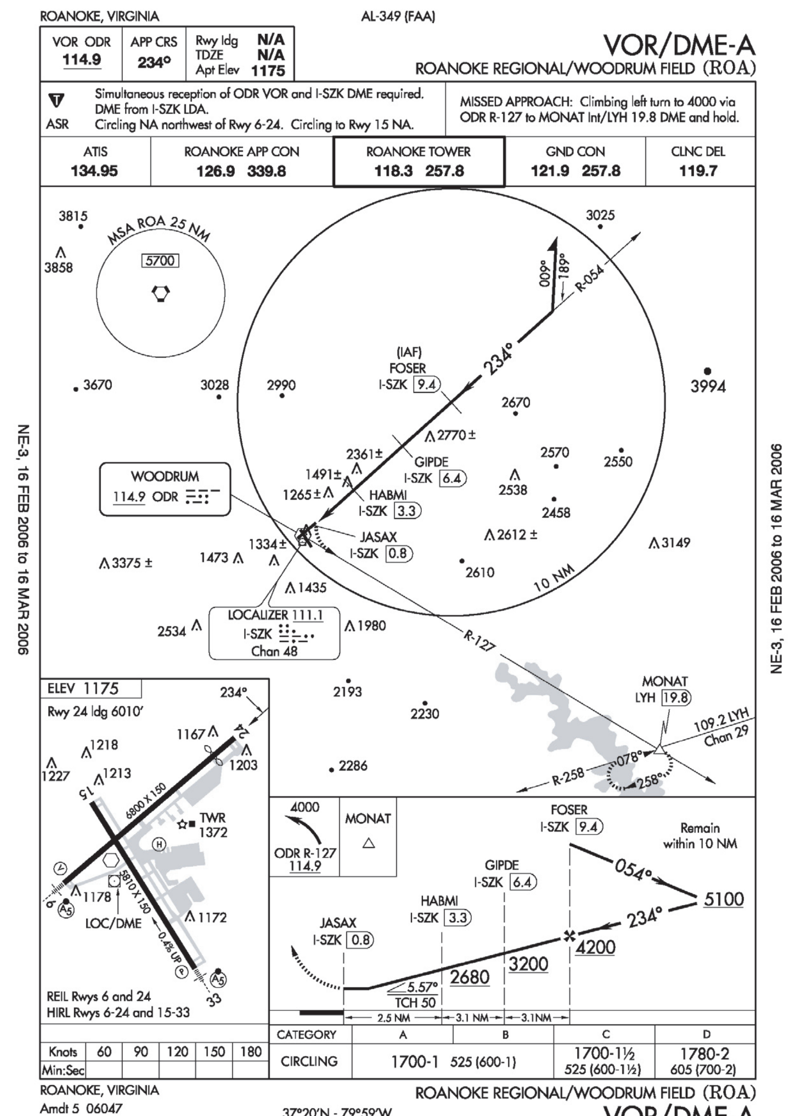
ROANOKE REGIONAL AIRPORT

Terminal Procedures
RNAV (GPS) RWY 24 & RNAV (GPS) RWY 33

SOURCE: U.S. Terminal Procedures, Federal Aviation Administration.

FIGURE 2-8b





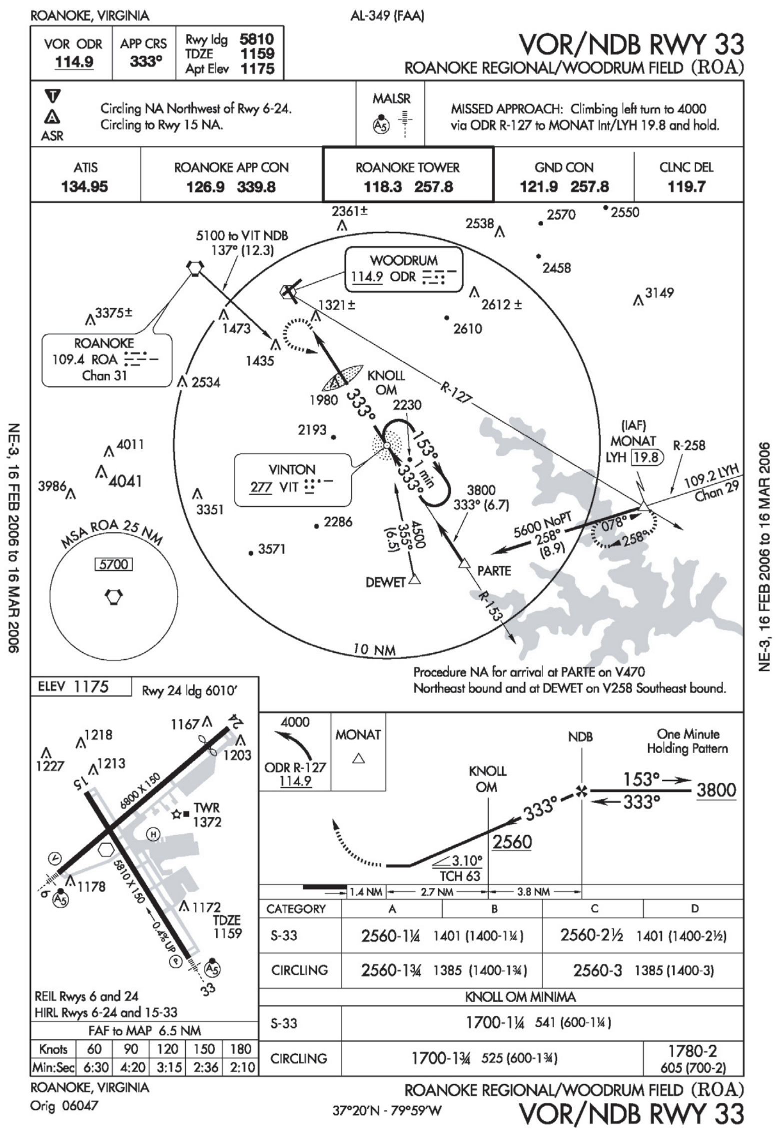
ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

SOURCE: U.S. Terminal Procedures, Federal Aviation Administration.

Terminal Procedures
LDA RWY 6 & VOR/DME A

FIGURE 2-8c



ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

SOURCE: U.S. Terminal Procedures, Federal Aviation Administration.

Terminal Procedures
VOR/NDB RWY 33

FIGURE 2-8d

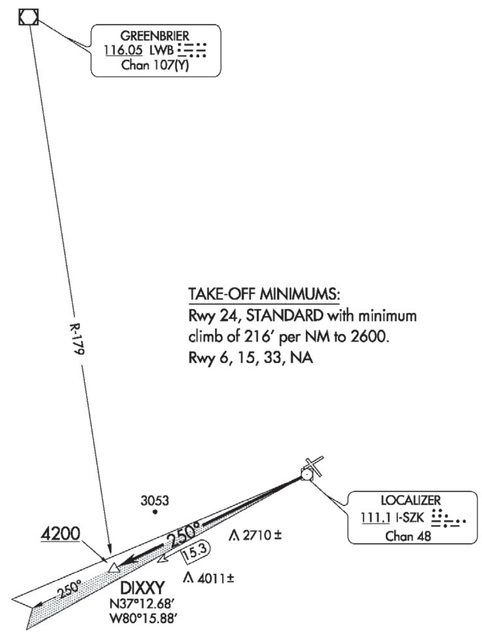
(DIXXY4.DIXXY) 04162

DIXXY FOUR DEPARTURE (OBSTACLE)

ROANOKE REGIONAL/ WOODRUM FIELD (ROA)
SL-349 (FAA)
ROANOKE, VIRGINIA

NE-3, 16 FEB 2006 to 16 MAR 2006

ROANOKE CLINC DEL
119.7
ROANOKE GND CON
121.9
ROANOKE DEP CON
118.15



TAKE-OFF MINIMUMS:
Rwy 24, STANDARD with minimum climb of 216' per NM to 2600.
Rwy 6, 15, 33, NA

TAKE-OFF OBSTACLE NOTES:
Rwy 24: Bush 86' from DER, 385' left of centerline, 4' AGL/1163 MSL.
Tree 150' from DER, 415' right of centerline, 60' AGL/1171' MSL.
Tree 737' from DER, 454' right of centerline, 60' AGL/1179' MSL.
Tree 1164' from DER, 726' right of centerline, 60' AGL/1206' MSL.

DEPARTURE ROUTE DESCRIPTION

RUNWAY 24: Climb west on I-SZK LDA Localizer course to 4200, to DIXXY INT/I-SZK 15.3 DME. Expect radar vectors to filed/assigned route.

NE-3, 16 FEB 2006 to 16 MAR 2006

DIXXY FOUR DEPARTURE (OBSTACLE)
(DIXXY4.DIXXY) 04162
ROANOKE, VIRGINIA
ROANOKE REGIONAL/ WOODRUM FIELD (ROA)

(HOKEE1.HOKEE) 04162

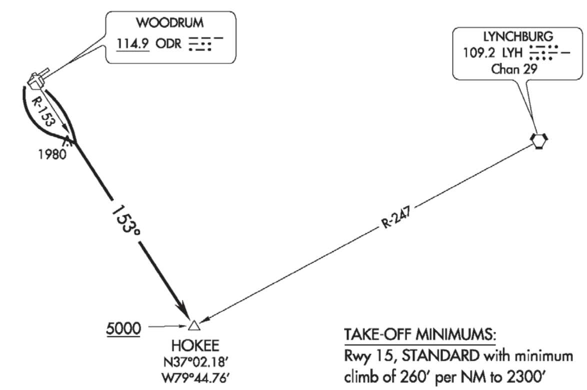
HOKEE ONE DEPARTURE

ROANOKE REGIONAL/ WOODRUM FIELD (ROA)
SL-349 (FAA)
ROANOKE, VIRGINIA

NE-3, 16 FEB 2006 to 16 MAR 2006

ROANOKE CLINC DEL
119.7
ROANOKE GND CON
121.9
ROANOKE DEP CON
118.15

TAKE-OFF OBSTACLES:
Rwy 15: Tree 1.2 NM from DER, 2,122' left of centerline, 60' AGL/1321' MSL.
Rwy 24: Bush 86' from DER, 385' left of centerline, 4' AGL/1163 MSL.
Tree 150' from DER, 415' right of centerline, 60' AGL/1171' MSL.
Tree 737' from DER, 454' right of centerline, 60' AGL/1179' MSL.
Tree 1164' from DER, 726' right of centerline, 60' AGL/1206' MSL.



TAKE-OFF MINIMUMS:
Rwy 15, STANDARD with minimum climb of 260' per NM to 2300'
Rwy 24, STANDARD
Rwy 6, 33, NA - Obstacles

DEPARTURE ROUTE DESCRIPTION

RUNWAY 15: Climbing right turn to 5000 via ODR R-153 to HOKEE Int.
RUNWAY 24: Climbing left turn within 2 NM to 5000 to intercept ODR R-153 to HOKEE Int.
Expect radar vectors to filed/assigned route.

NE-3, 16 FEB 2006 to 16 MAR 2006

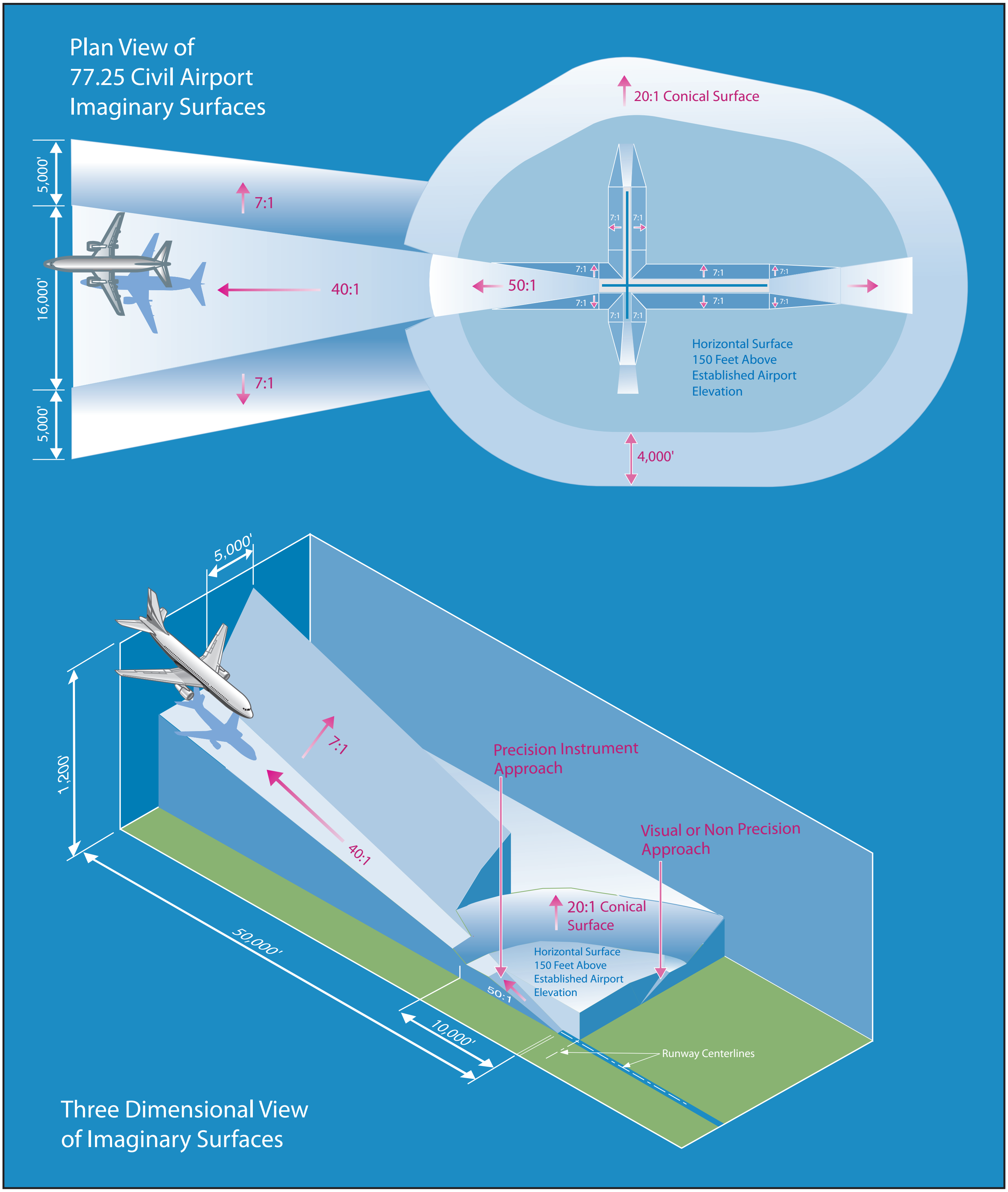
HOKEE ONE DEPARTURE
(HOKEE1.HOKEE) 04162
ROANOKE, VIRGINIA
ROANOKE REGIONAL/ WOODRUM FIELD (ROA)

ROANOKE REGIONAL AIRPORT

SOURCE: U.S. Terminal Procedures, Federal Aviation Administration.

Terminal Procedures
DIXXY FOUR & HOKEE ONE

FIGURE
2-8e

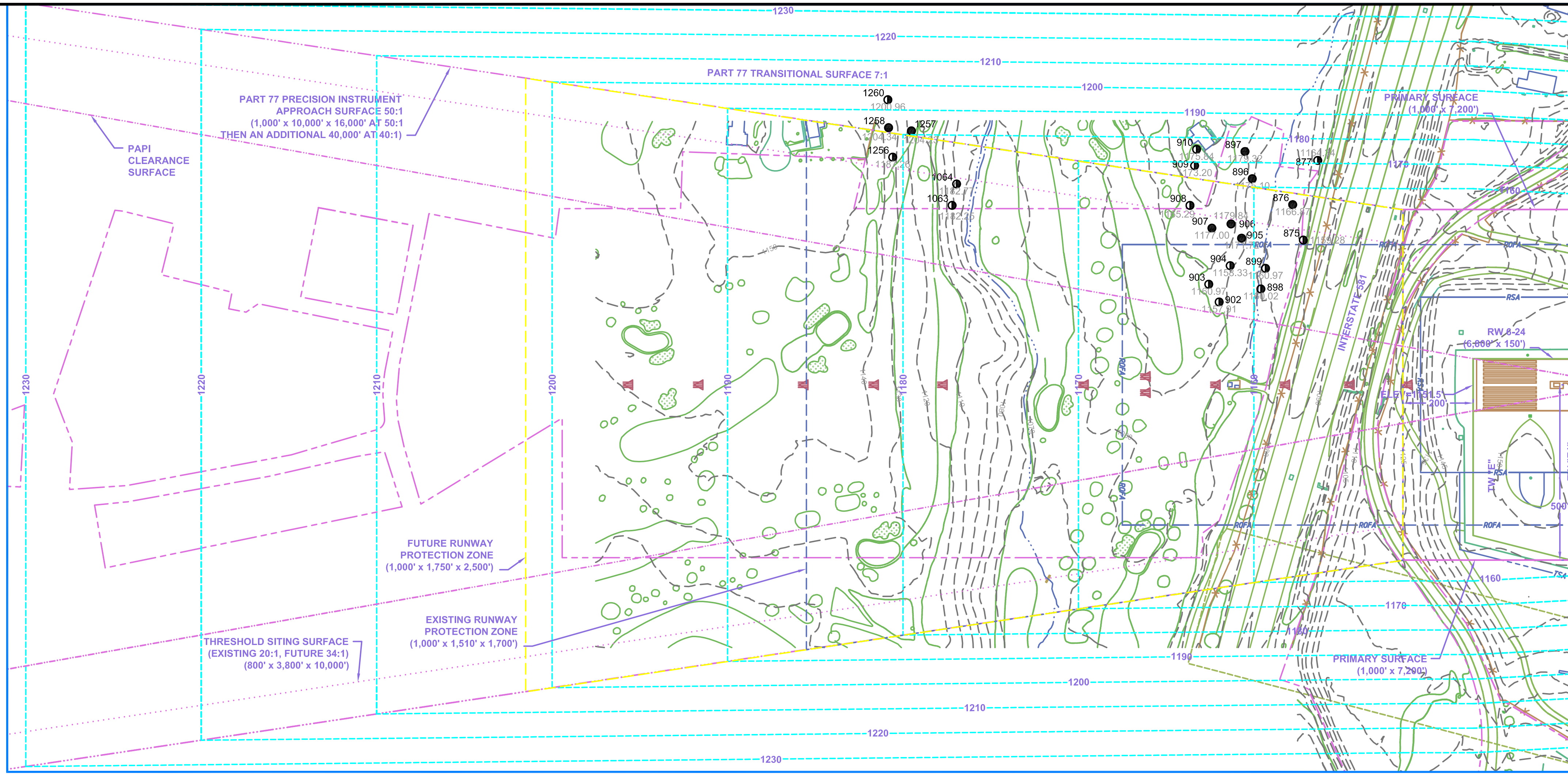


ROANOKE REGIONAL AIRPORT

FAR Part 77 Imaginary Surfaces

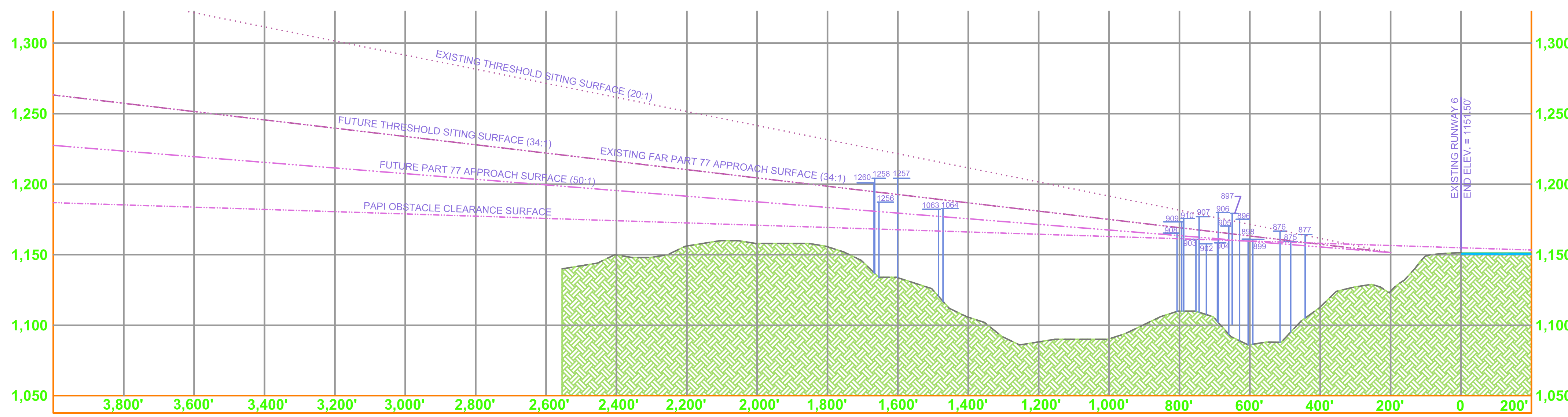
FIGURE 2-9

SOURCE: Federal Aviation Administration, HNTB Analysis



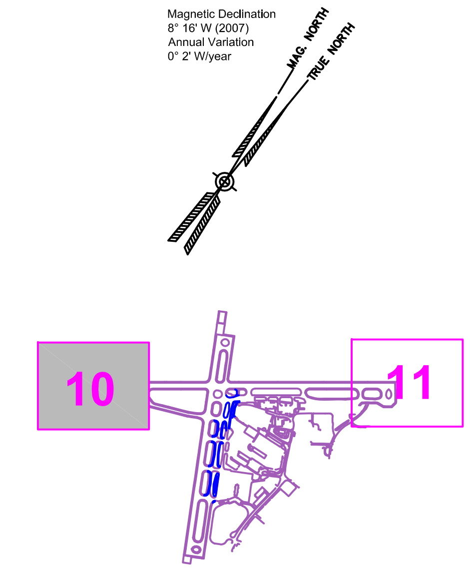
RUNWAY 6 APPROACH - PLAN VIEW

SCALE: 1" = 200' (HORIZ)



RUNWAY 6 APPROACH - PROFILE VIEW

SCALE: 1"=50' (VERT)
SCALE: 1"=200' (HORIZ)



SHEET INDEX

LEGEND

- AIRPORT PROPERTY LINE
- APPROACH SURFACE
- PART 77 IMAGINARY SURFACE CONTOUR
- RUNWAY OBJECT FREE AREA
- RUNWAY SAFETY AREA
- TAXIWAY SAFETY AREA
- OBJECT FREE ZONE
- EXISTING GROUND CONTOUR
- 1260.23 OBSTRUCTION OBJECT
- 1250.91 BUFFER OBSTRUCTION OBJECT (WITHIN 10'
- 1208.2 EXISTING GROUND ELEVATION
- MALSR TOWERS/FIXTURES

200' 0' 200' 400'

Note: Obstruction Study conducted by Delta Airport Consultants.

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

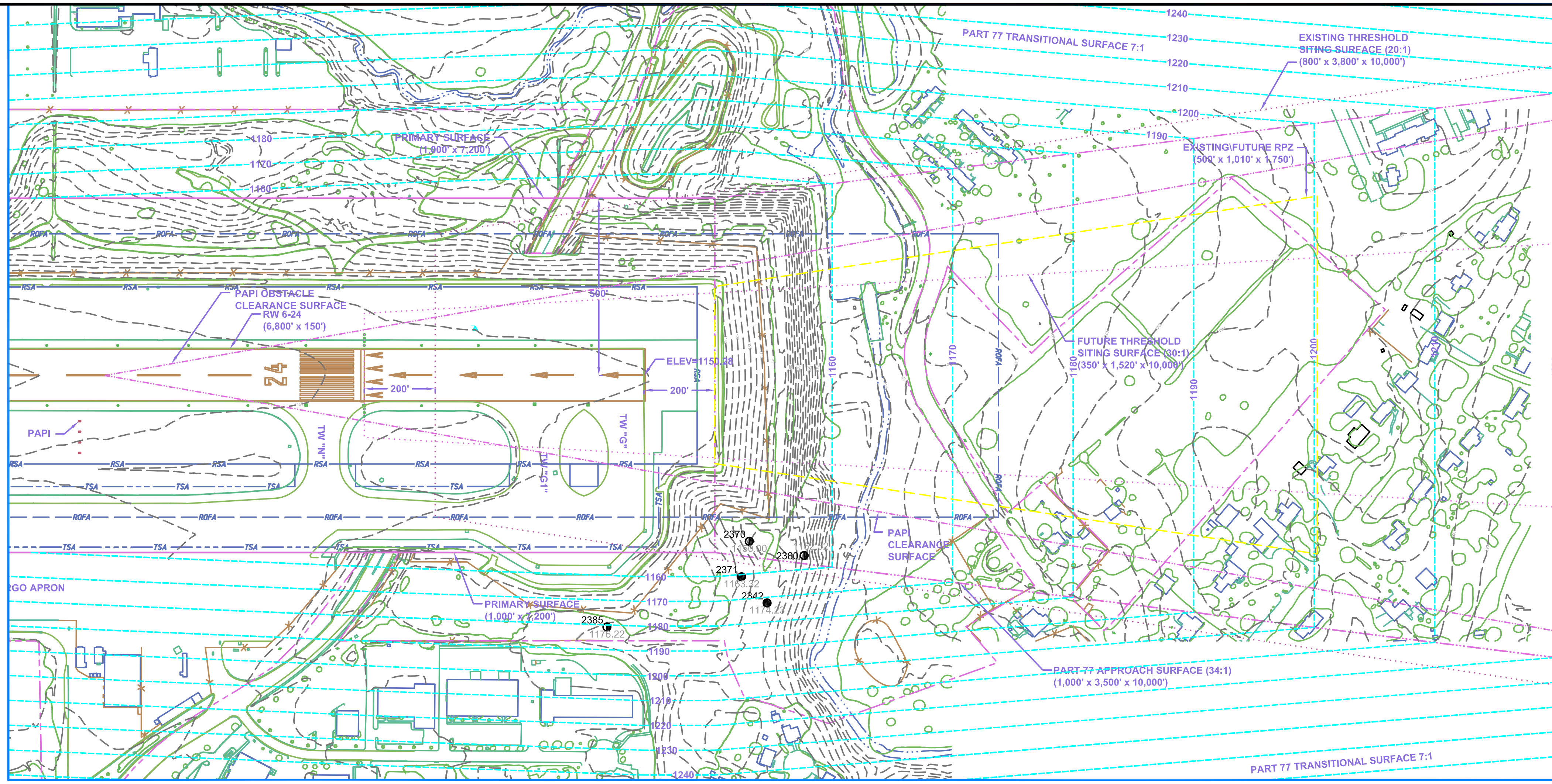
RUNWAY 6 APPROACH

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Feb 29, 2008

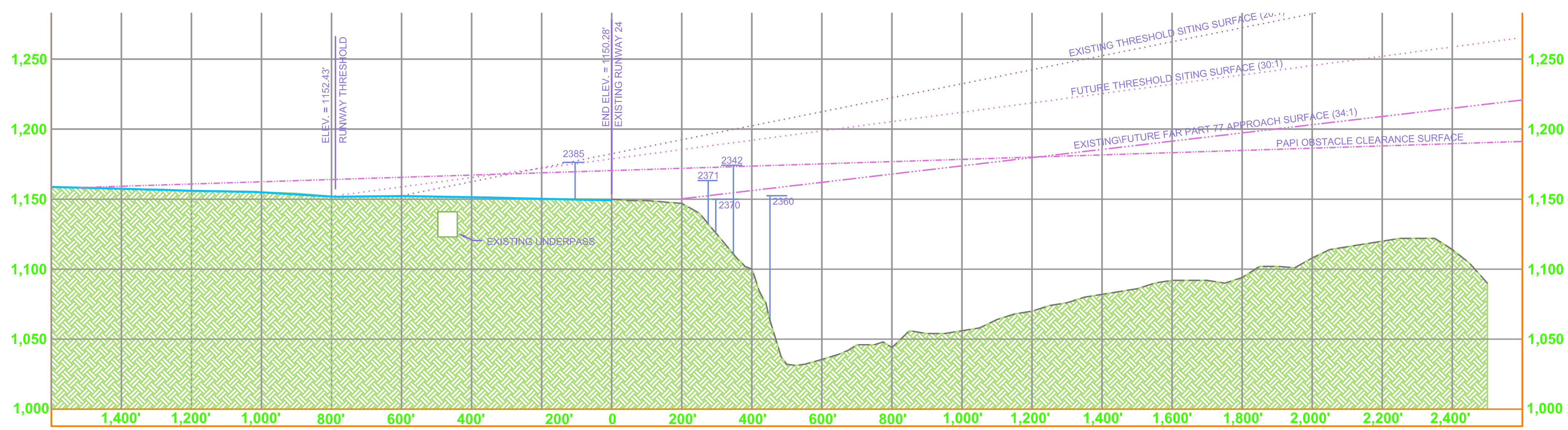
SHEET No. 2-10A

P:_Projects\40311 ROA Master Plan Update\Report\MP Final\Chapter 2 Graphics\2-10A through 10D OBSTRUCTION STUDY_V1.dwg L1 Feb 29, 2008 - 9:25am



RUNWAY 24 APPROACH - PLAN VIEW

SCALE: 1" = 200' (HORIZ)



RUNWAY 24 APPROACH - PROFILE VIEW

SCALE: 1"=50' (VERT)
SCALE: 1"=200' (HORIZ)

Magnetic Declination
8° 16' W (2007)
Annual Variation
0° 2' W/year

MAG. NORTH
TRUE NORTH

SHEET INDEX

10
11

LEGEND

- AIRPORT PROPERTY LINE
- APPROACH SURFACE
- PART 77 IMAGINARY SURFACE CONTOUR
- ROFA — RUNWAY OBJECT FREE AREA
- RSA — RUNWAY SAFETY AREA
- TSA — TAXIWAY SAFETY AREA
- OFZ — OBJECT FREE ZONE
- EXISTING GROUND CONTOUR
- 1260.23 OBSTRUCTION OBJECT
- 1250.91 BUFFER OBSTRUCTION OBJECT (WITHIN 10'
- 1208.2 EXISTING GROUND ELEVATION
- MALSR TOWERS/FIXTURES

200' 0' 200' 400'

Note: Obstruction Study conducted by Delta Airport Consultants.

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

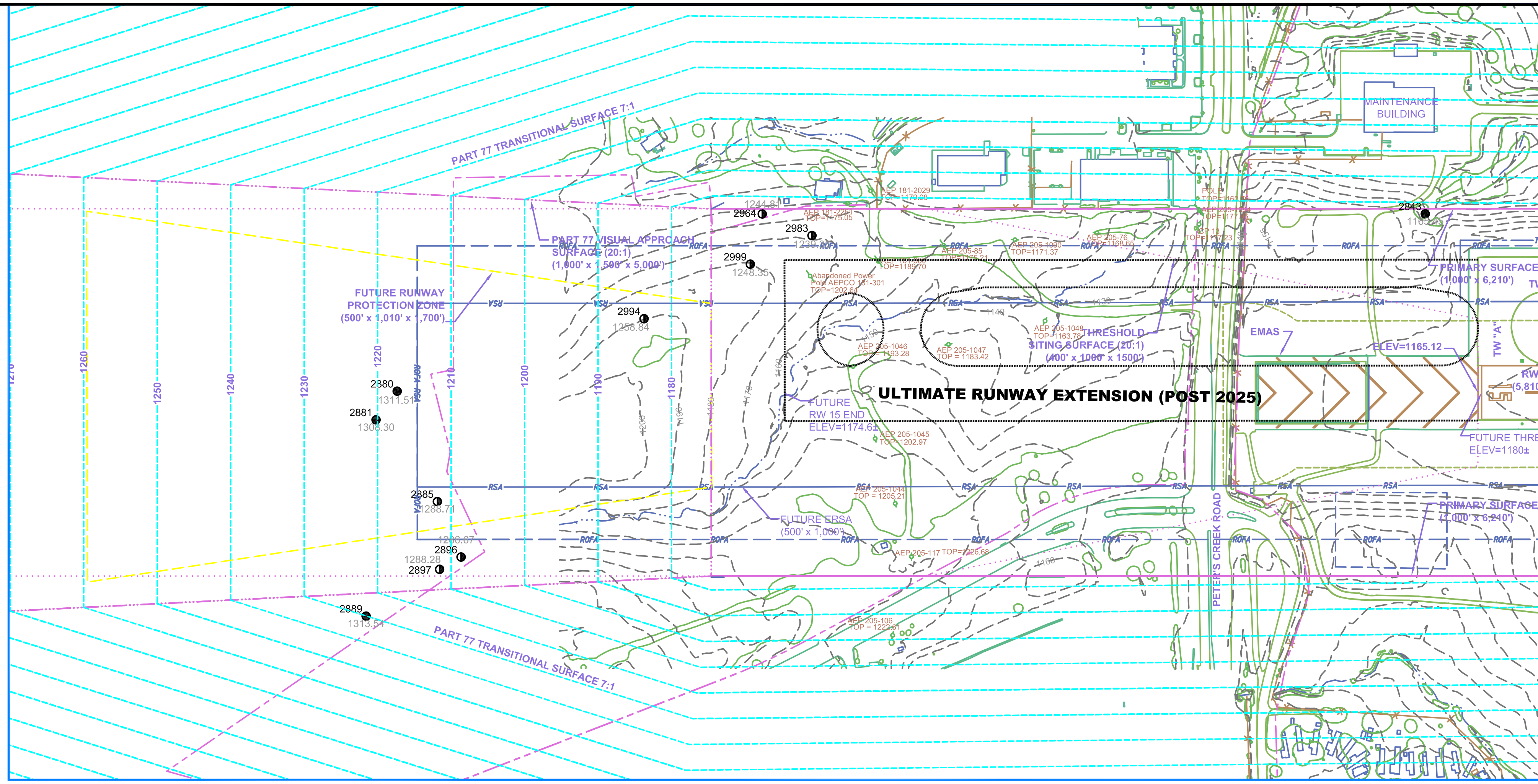
RUNWAY 24 APPROACH

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Feb 29, 2008

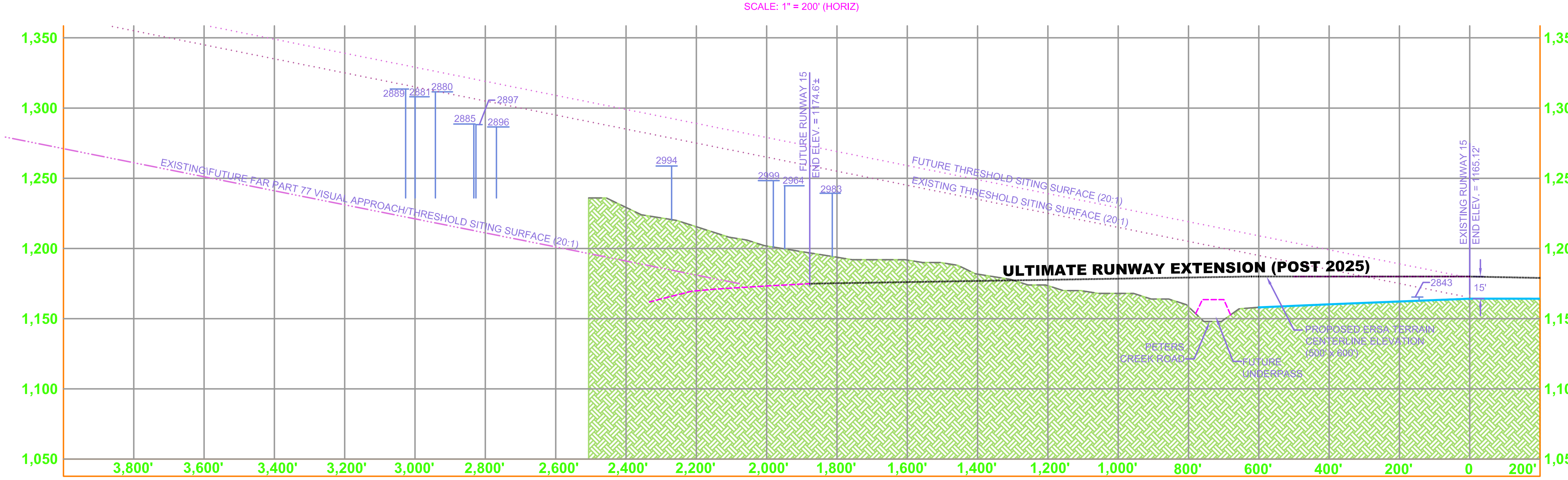
SHEET No. 2-10B

P:_Projects\40311 ROA Master Plan Update\Report\MP Final\Chapter 2 Graphics\2-10A through 10D OBSTRUCTION STUDY_V1.dwg L2 Feb 29, 2008 - 9:27am



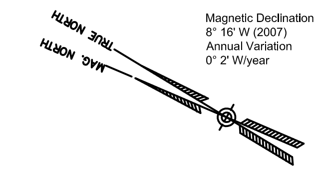
RUNWAY 15 APPROACH - PLAN VIEW

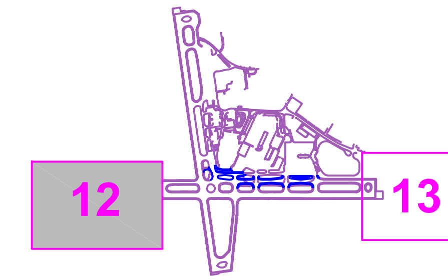
SCALE: 1" = 200' (HORIZ)



RUNWAY 15 APPROACH - PROFILE VIEW

SCALE: 1"=50' (VERT)
SCALE: 1"=200' (HORIZ)





SHEET INDEX

LEGEND

- AIRPORT PROPERTY LINE
- APPROACH SURFACE
- PART 77 IMAGINARY SURFACE CONTOUR
- ROFA — RUNWAY OBJECT FREE AREA
- RSA — RUNWAY SAFETY AREA
- TSA — TAXIWAY SAFETY AREA
- OFZ — OBJECT FREE ZONE
- EXISTING GROUND CONTOUR
- 1260.23 OBSTRUCTION OBJECT
- 1250.91 BUFFER OBSTRUCTION OBJECT (WITHIN 10')
- × 1208.2 EXISTING GROUND ELEVATION
- MALSR TOWERS/FIXTURES

200' 0' 200' 400'

Note: Obstruction Study conducted by Delta Airport Consultants.

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

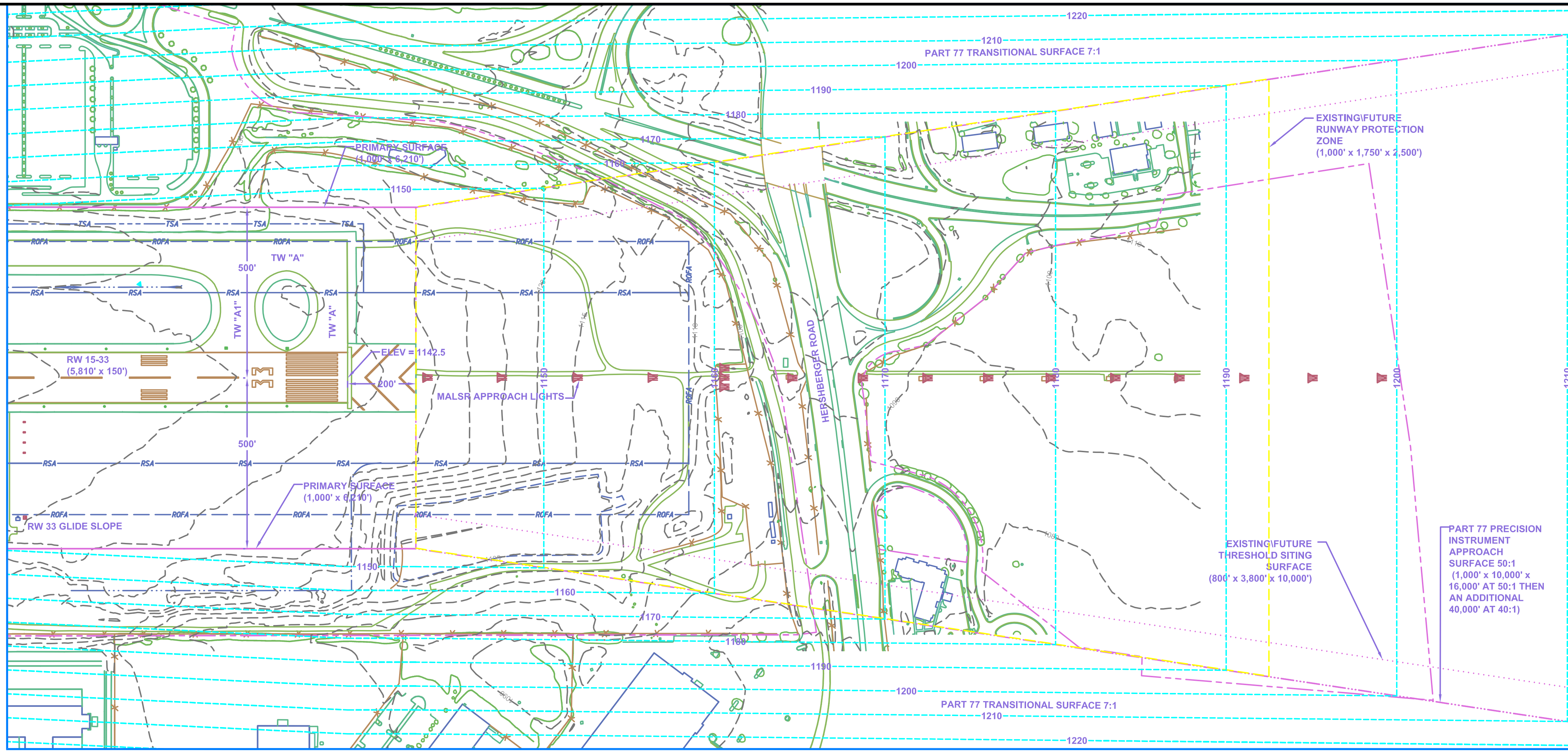
RUNWAY 15 APPROACH

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Feb 29, 2008

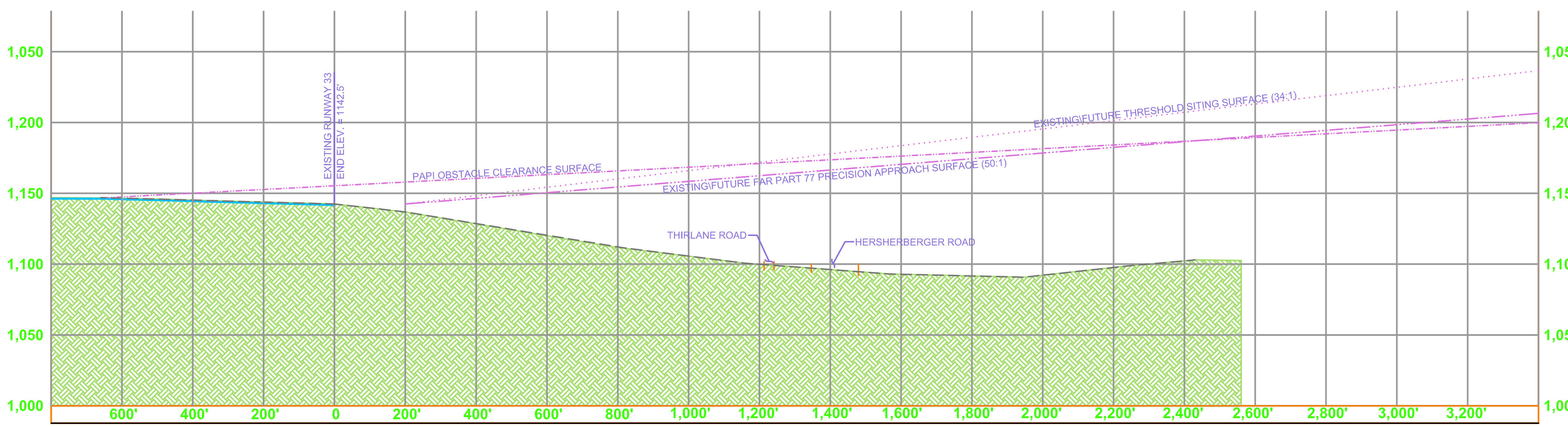
SHEET No. 2-10C

P:_Projects\40311 ROA Master Plan Update\Report\MP Final\Chapter 2 Graphics\2-10A through 10D OBSTRUCTION STUDY_V1.dwg L3 Feb 29, 2008 - 9:28am



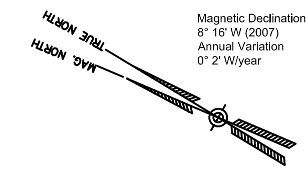
RUNWAY 33 APPROACH - PLAN VIEW

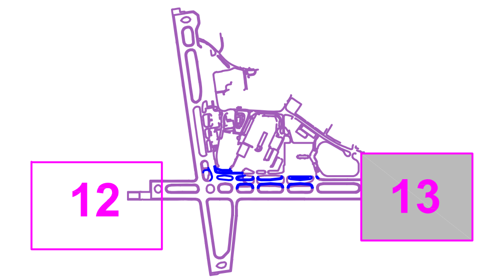
SCALE: 1" = 200' (HORIZ)



RUNWAY 33 APPROACH - PROFILE VIEW

SCALE: 1"=50' (VERT)
SCALE: 1"=200' (HORIZ)





SHEET INDEX

LEGEND

- AIRPORT PROPERTY LINE
- APPROACH SURFACE
- PART 77 IMAGINARY SURFACE CONTOUR
- ROFA — RUNWAY OBJECT FREE AREA
- RSA — RUNWAY SAFETY AREA
- TSA — TAXIWAY SAFETY AREA
- OFZ — OBJECT FREE ZONE
- EXISTING GROUND CONTOUR
- 1260.23 OBSTRUCTION OBJECT
- 1250.91 BUFFER OBSTRUCTION OBJECT (WITHIN 10
- × 1208.2 EXISTING GROUND ELEVATION
- MALSR TOWERS/FIXTURES

200' 0' 200' 400'

Note: Obstruction Study conducted by Delta Airport Consultants.

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

RUNWAY 33 APPROACH

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Feb 29, 2008

SHEET No. 2-10D

P:_Projects\40311 ROA Master Plan Update\Report\MP Final\Chapter 2 Graphics\2-10A through 10D OBSTRUCTION STUDY_V1.dwg L4 Feb 29, 2008 – 9:28am

Table 2.3

Instrument Approaches

		Minimums		
Runway End	**Approach Procedure**	**Approach Speed Cat. (1)**	**Ceiling (Feet AGL)**	**Visibility (Miles)**
33	ILS (CAT-I)	A-C	500	1.25
		D	620	1.50
	RNAV (GPS)	A-B	420	0.50
		C	420	0.75
		D	420	1.00
6	RNAV (GPS)	A-B	604	0.75
		C	604	1.25
		D	604	2.00
	LDA/GS	A-D	405	1.00
	LDA	A-B	1,505	1.50
		C-D	1,505	3.00
24	RNAV (GPS)	A	1,410	1.25
		B	1,410	1.50
		C-D	1,410	3.00
	VOR/DME-A	A-B	530	1.00
		C	530	1.50
		D	610	2.00

Note: (1) A 0-90 kts, B 91-120 kts, C 121-140 kts, D 141-165 kts.

Abbreviations: AGL: Above Ground Level
CAT: Category
DME: Distance Measuring Equipment
GPS: Global Positioning System
ILS: Instrument Landing System
NDB: Nondirectional Beacon
RNAV: Area Navigation
VOR: Very High Frequency Omni-directional Range

Source: U.S. Terminal Procedures, Dec. 22, 2005, FAA.

the loop road to Aviation Drive.

The building has a main terminal element with two levels: level one provides space for the TSA checked baggage screening function, airline ticket counter functions, airline ticket offices (ATO), baggage claim, and ground transportation services, loading dock/trash area, restrooms and mechanical/electrical equipment rooms. Level two contains the passenger security screening checkpoint, security screening queue area, concessions, Airport administrative office space, the departure concourse, holdrooms, restrooms and airline gates. The total area of these passenger terminal elements is approximately 97,000 square feet and is depicted in **Figures 2-11a and 2-11b**. A summary of the approximate sizes of the areas within the facility is provided in **Table 2.4**. The main terminal and concourses are described in detail in the following sections.

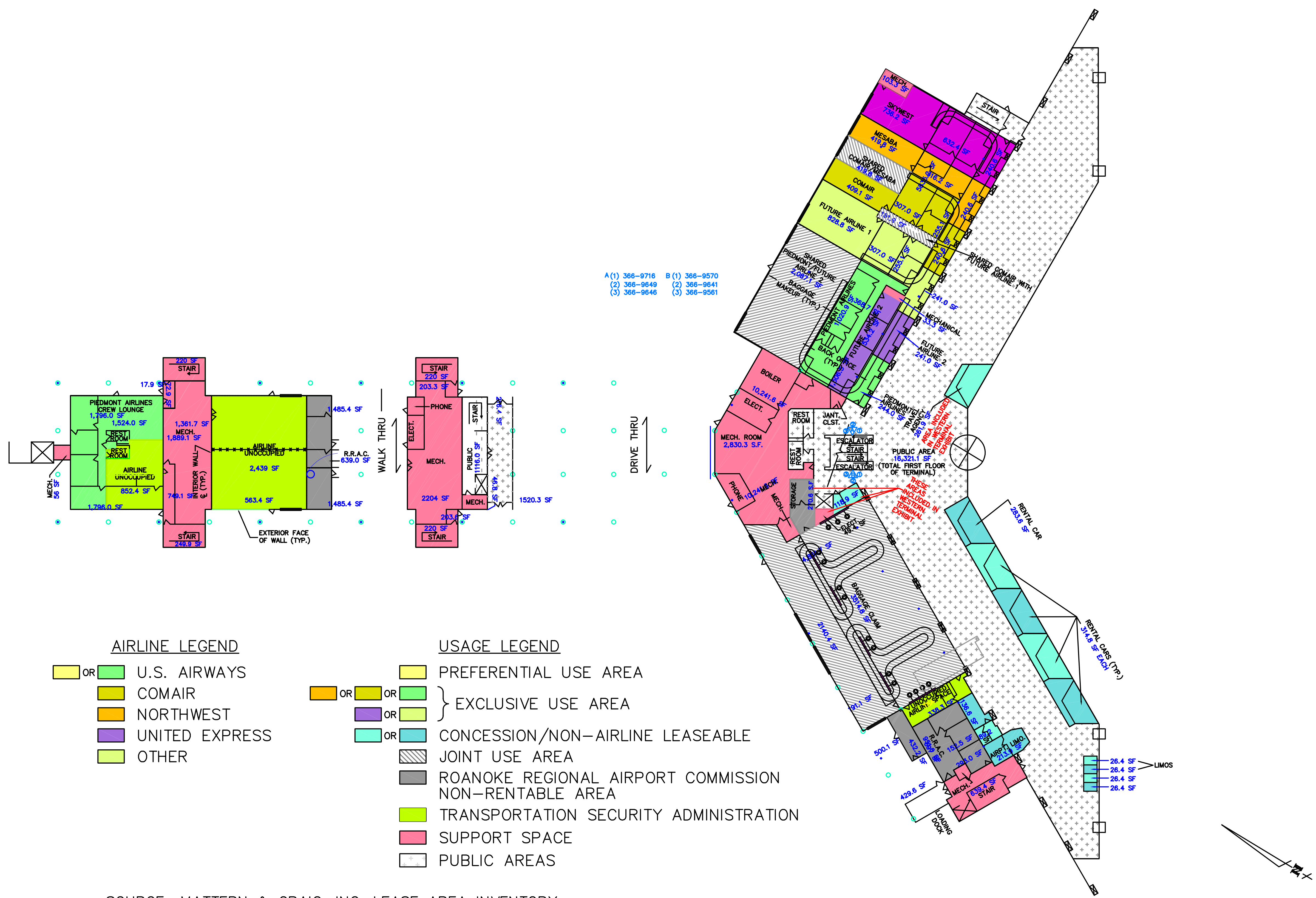
2.4.2 Main Terminal

The main terminal element consists of two levels: level one is used primarily for ticketing and baggage claim; level two is used for concessions, concessions support, Airport administrative functions, and holdrooms or airline gates.

The east portion of level one is used to process enplaning (or departing) passengers through ticketing facilities located on the north side of the building. Ticket counters are provided for US Airways Express, Delta Connection, Northwest Airlink, and United Express. As a result of the terrorist events on September 11, 2001, the TSA has been tasked to screen checked baggage for explosives. This baggage screening function was installed in the ticketing lobby directly in front of the ticket counters using explosive trace detection (ETD) apparatus to check for explosive residue in and on passengers' baggage and manual dump search inspections. The area required for this process has displaced the area for passengers queuing for ticketing, causing congestion in the ticket lobby. Solutions to alleviate this congestion will be fully explored in the concepts section in this report.

Behind the ticket counters are ATO and outbound baggage sort areas for each carrier. Ticketing offices and baggage sort areas are not fully utilized at this time with some areas vacant. In some instances, airline support spaces are not currently directly behind their ticket counters which results in less efficient operation and compromises the privacy desired by the airline. This and other airline requirements will be addressed in the concepts phase of the Master Plan Update.

In the center of the terminal, in the ticket lobby against the exterior glass curtainwall, a concession space is occupied by a travel agency. The Master Plan will explore if this is the highest and best use for this highly-visible and accessible space. Also in the center of the terminal, directly behind the escalators and stairs, is a set of public restrooms. The restrooms are undersized for the demand in this portion of the terminal (see Chapter 3); the Master Plan Update will determine the appropriate number of fixtures, ADA requirements, and enhanced signage to provide adequate and compliant restroom accommodations. Restroom requirements at other locations will also be addressed in the study. Other



AIRLINE LEGEND

- [yellow] OR [green] U.S. AIRWAYS
- COMAIR
- NORTHWEST
- UNITED EXPRESS
- OTHER

USAGE LEGEND

- PREFERENTIAL USE AREA
- EXCLUSIVE USE AREA
- CONCESSION/NON-AIRLINE LEASEABLE
- JOINT USE AREA
- ROANOKE REGIONAL AIRPORT COMMISSION NON-RENTABLE AREA
- TRANSPORTATION SECURITY ADMINISTRATION
- SUPPORT SPACE
- PUBLIC AREAS

SOURCE: MATTERN & CRAIG, INC. LEASE AREA INVENTORY

SCALE
1" = 50'

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET, SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

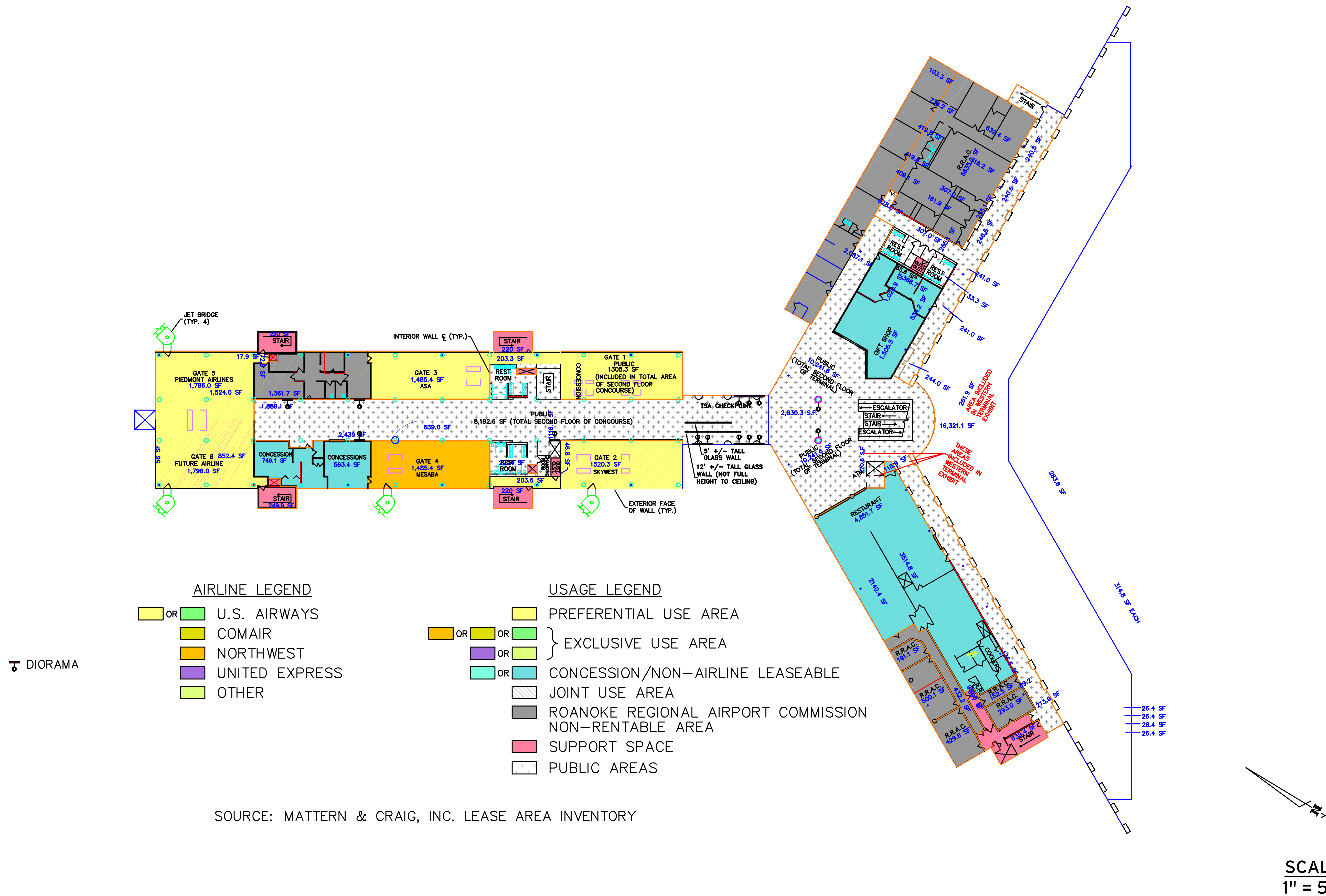
OVERALL VIEW - 1ST FLOOR PLAN

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Apr 20, 2006

FIGURE 2-11A

P:_Projects\40311 ROA Master Plan Update\CAD\Terminal\Terminal Master to HNTB 3-30-06.dwg 2-11A Apr 20, 2006 - 3:06pm



NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

OVERALL VIEW - 2ND FLOOR PLAN

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Apr 20, 2006

FIGURE 2-11B

P:_Projects\40311 ROA Master Plan Update\CAD\Terminal\Terminal Master to HNTB 3-30-06.dwg 2-11B Apr 20, 2006 - 3:08pm

Table 2.4

Passenger Terminal Building - Total Area by Function (1)

Space	Area (SF)	Area Not Used (2)
Terminal Ground Level		
Ticket Counter Area	1,691	241
TSA Bag Screening Area	1,160	
Ticketing Que Area	2,320	
Ticket Lobby Public Circulation	4,850	
Airline Ticket Office	3,841	562
Airline Bag Make-up Area	5,730	829
Travel Agency Concession	262	
Public Restrooms	336	
Arrivals Lobby Public Circulation	7,724	
Airline Bag Service Offices	676	338
Baggage Claim Area	3,515	
Airline Bag Claim Tug Drop Area	2,140	
Rental Car Concessions	1,544	
Ground Transportation Tenants	546	
Shoe Shine Tenant	119	
ROA Support Space	1,222	
MEP Space	3,656	
Subtotal	**41,332**	**1,970**
Terminal Second Level		
ROA Administration Area	7,834	
Restaurant	4,852	
Gift Shop	1,507	
Public Restrooms	555	
Public Circulation	9,722	
Subtotal	**24,470**	
Concourse Ground Level		
Airport Operations Offices	3,802	
Airline Operations Office	1,232	
TSA Offices	1,144	
Ground Level Pax Holdroom	886	
MEP/Support Space	4,030	
Subtotal	**11,094**	**-**
Concourse Second Level		
TSA Pax Screening Area	1,536	
Public Circulation	4,452	
Public Restrooms	932	
Pax Holdrooms	10,692	1,305
ROA Administration Space	1,362	
Concessions	1,529	
MEP/Support		
Subtotal	**20,503**	**1,305**
Total All Areas	**97,399**	**3,275**

Notes: (1) Based on latest available terminal drawings and terminal walkthrough.
(2) The area is assigned for function, but is currently unoccupied. 814 sf of this space is used for TSA passenger screening queues.

Source: HNTB analysis.

areas of the terminal may not meet ADA requirements, and will be comprehensively compiled in the facility requirements section.

Between the ticket lobby and baggage claim lobby is the major mechanical area where heating and cooling units and the electrical system for the terminal and concourse are located. Expansion capabilities for this area will be explored.

Deplaning (arriving) passengers after descending from the course level are directed to the west side of level one where two flat-plate re-circulating claim devices deliver bags. These devices are individually fed from an inbound baggage tug drive located behind the claim devices. The tug drive and baggage off-loading area are limited in size and do not allow baggage carts to easily access and exit the area. Alternatives will be studied to determine if options are available to alleviate this issue as part of the Master Plan Update.

Opposite the baggage claim area/lobby are rental car facilities serving Hertz, Avis, National, Budget, and Enterprise. Further to the west in the arrival area are ground transportation services, including limousine, taxi, and hotel shuttles as well as other arrival information displays.

Lastly, in the southwest corner of the lower level is miscellaneous Airport administration and support space including the terminal's receiving loading dock and trash pick-up area, which is located on the non-secure landside of the AOA security fence.

The second level of the terminal is a partial level that has a balcony corridor overlooking the ticketing and baggage claim lobby. Primary access from level one to level two is via a central vertical circulation core consisting of one up and one down escalator, a stair, and an elevator. Facilities at level two are separated into two main areas: pre-security screening and post-security, which is the secure passenger concourse. The areas prior to the passenger screening checkpoint include checkpoint passenger queuing, meeter-greeter waiting areas, a restaurant, a bar/lounge area, and a news/gift/sundry concession. Additionally, most of the Airport administrative staff offices are housed on this level in the area above the airline ticket counters and the baggage claim facilities. Other facilities include limited-sized restrooms, support spaces and work carrels for business travelers to plug into outlets and use their laptops. Many of these functions are competing for the pre-security screening space; this will be addressed in the concepts section of this Master Plan Update.

2.4.3 Secure (Sterile) Passenger Concourse

The single concourse is joined to the main terminal by a second level connector. The concourse is a typical two-level configuration with non-public areas at level one and primarily public departure areas at level two. Level two, the public level, begins with the passenger screening checkpoint which has been increased in area substantially since September 11, 2001, due to new TSA equipment and screening protocol. The passenger security exit lane for arriving passengers has been reduced to a narrow corridor. Checkpoint space requirements and how they will be accommodated will be addressed in this Master Plan Update.

After processing through the checkpoint, passengers will find a central concourse with departure lounges, concessions, and restrooms on either side. Limited passenger amenities and business services are available past the screening checkpoint. The concourse was initially designed with the potential to accommodate six aircraft gates with passenger boarding bridges, but only four were installed. During the course of the terminal project and the subsequent years thereafter, a decline in the use of narrow body aircraft and an increase in regional aircraft operations have been adopted by the airlines serving ROA. The passenger loading bridges were modified and retrofitted by the RRAC to accommodate lower sill height regional jets; however, some airlines have reported that they are not compatible with their turboprop aircraft models. The Master Plan will investigate what can be done to maximize the use of passenger boarding bridges to make the passenger arrival and departure sequence more comfortable and convenient. There are 11 aircraft on the apron during the busiest time of the day. Recognizing the dynamic nature of the industry, the Master Plan Update must plan for facilities and gates that are flexible to accommodate future changes in fleet mix service schedules.

The majority of space at the lower level of the concourse is restricted to airline and AOAs and other authorized personnel areas. The airline operational area consists of offices, storerooms, shops, locker rooms, and employee facilities. There are also miscellaneous mechanical rooms used to house air-handlers and electrical panels. Additionally, at the southern end of the lower level near the drive-through area at the bottom of the internal stairs from the concourse level, there is a small area for passengers, which is used as a transition space from the stairs and elevator to the apron area for the ground loading of passengers. Some airlines that ground load passengers are currently using emergency exit stairs for accessing passengers to and from the apron. With the increase in ground loaded aircraft, the vertical movement of passengers should be addressed in future terminal plans.

Although the overall size of the terminal is sufficient to accommodate current activity levels, current space allocations and the locations of certain functions are inadequate. Additionally, terminal infrastructure needs to be updated to adequately address changes in emerging technologies, security protocols, and fire code requirements. Restrooms are inadequately sized and utilities, including water pressure, need to be updated. Lastly, future improvements to the terminal should address making it more energy-efficient. The Master Plan Update will address these key terminal issues.

2.5 GROUND ACCESS

The following section outlines the regional approaches to ROA, ground access to the Airport, and the layout of on-airport roadways at the main terminal.

2.5.1 Regional Access

Regional access to ROA is provided by Interstate 81 (I-81). From I-81, Airport-bound traffic takes Exit 143 onto I-581/Route 220, then takes Exit 3E to Hershberger Road, and finally takes a ramp to Aviation Drive and the Airport.

To access the Airport from downtown Roanoke, approaching vehicles take Interstate 581/Route 220 north, then Exit 3C to Valley View Boulevard, which becomes Aviation Drive after passing under Hershberger Road. Traffic continues on Aviation Drive to the Airport.

2.5.2 Airport Roadways and Circulation

The Airport's main terminal is accessed off Aviation Drive via a two-way stop-controlled intersection. This intersection is also used to access the Airport's overflow parking lot which is used a few days per month.

The general configuration of the Airport roadways and landside facilities in the vicinity of the passenger terminal is shown in **Figure 2-12**. The main public access roadways consist of a two-lane loop road which provides access to the parking lots, the terminal curbs, and the rental car lot.

A vehicle entering the Airport takes an immediate right-hand bend and then proceeds northbound towards the terminal building. The entrance into the long-term parking lot is located approximately 525 feet from the Airport entrance; the entrance to the short-term parking lot is 225 feet beyond this point.

Beyond the entries to the parking lots are the terminal curbs. The first half of the curbs serves the departures area; the second half serves the arrivals area.

Following the curbs are the second entrance to the short term parking lot, the entrance to the rental car lot, and the second entrance to the long-term parking lot. These are 70 feet, 250 feet, and 620 feet, respectively, from the end of the terminal curbs. The exit from all parking is 245 feet beyond the second entrance to long-term parking; the rental car lot exit is between the entry to that lot and long-term parking.

The rest of the roadway then extends around the parking lots to Aviation Drive with an opportunity to recirculate shortly before the Airport exit.

Access to GA facilities, the ARFF station, ATCT, the Piedmont Airlines maintenance base, and cargo facilities is provided by Aviation Drive. Route 118 (Airport Road) lies to the east of Aviation Drive and provides a second access point to the cargo facilities.

There was no observed capacity deficiency in the Airport roadway operations.

A pavement condition survey undertaken as part of this Master Plan Update assessed roadway pavements as being in satisfactory condition in terms of an area-weighted PCI. (Additional detail on a feature-by-feature basis will be provided in the pavement management plan.) The overall area-weighted condition of the parking lots is in the good range.

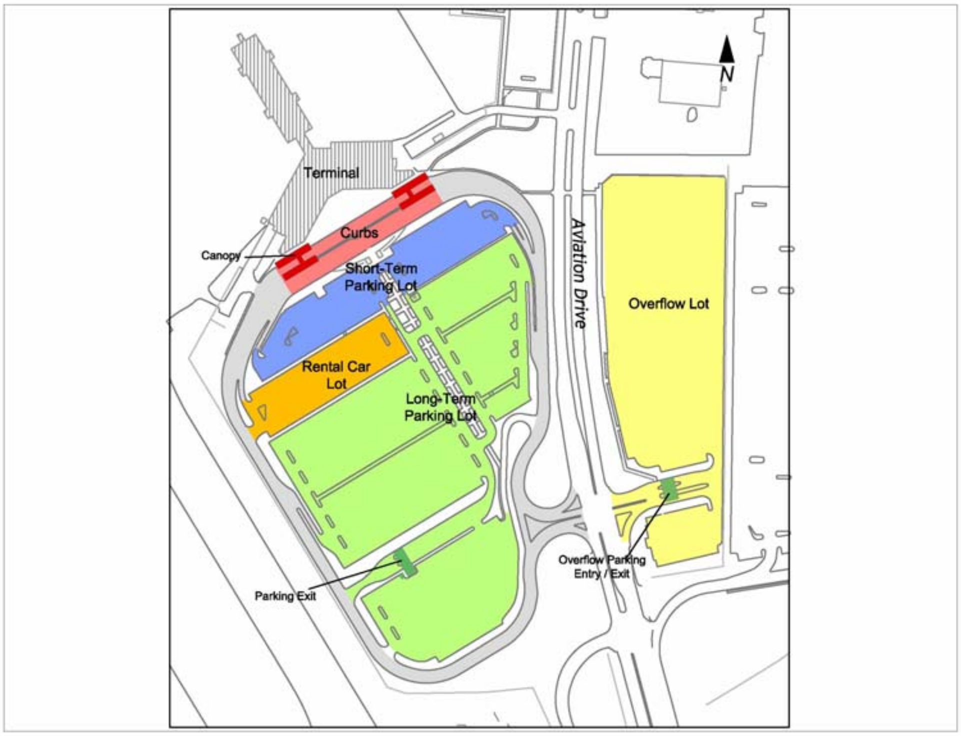


Figure 2-12

Airport Terminal Roadways and Landside Elements

2.5.3 Roadway Traffic Volumes and Observations

Traffic counts and observations were made in the Airport vicinity (See **Figure 2-13** for locations and **Table 2.5** for results) and at several off-airport locations to identify patterns in traffic flow and to assess whether improvements would be necessary to meet future demand. The counts were obtained by automatic tube counters which collected data for a one-week period.

Airport Vicinity Roadway Observations

Approximately two-thirds of Airport traffic comes from the south. A similar split is noted in exiting traffic, with two-thirds heading south upon leaving the Airport. This split was observed in both the morning and in the afternoon.

The proportion of traffic on Aviation Drive which is Airport-related varies over the day; **Figure 2-14** shows the proportion of traffic by movement at the Aviation Drive/Airport Entry intersection.

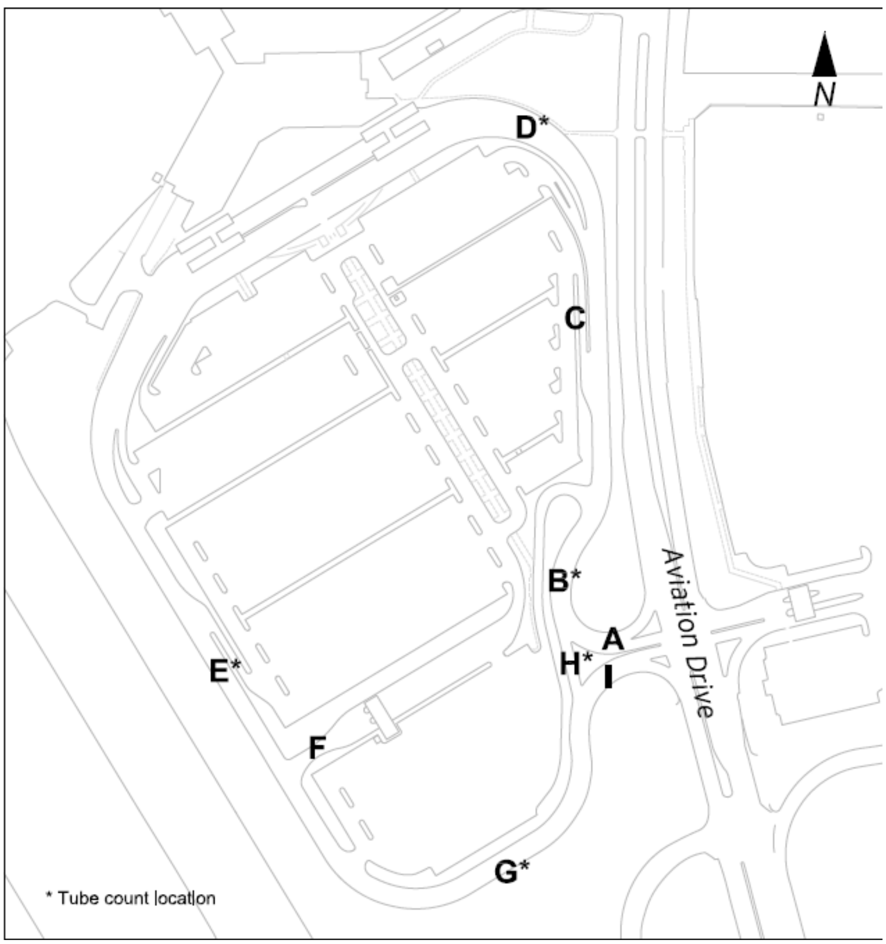


Figure 2-13

On-airport Traffic Counting Locations

Table 2.5

On-airport Vehicular Volumes (November 2005)

		Peak Day		Peak Hour					
				AM			PM		
Location		Day	Volume	Day	Time	Volume	Day	Time	Volume
A	Airport Entrance	Monday	2,068	Monday	8:30-9:30	169	Sunday	3:45-4:45	222
B	Before Parking	Monday	2,394	Monday	8:30-9:30	190	Sunday	3:45-4:45	258
C	Long Term Pkg Entrance	Wednesday	1,015	Wednesday	11:15-12:15	121	Wednesday	2:00-3:00	177
D	Approach to Curbs	Thursday	1,808	Monday	10:45-11:45	139	Sunday	3:45-4:45	189
E	After 2nd Pkg Ent. & Rental Car Lot	Monday	1,621	Monday	11:30-12:30	154	Sunday	4:00-5:00	182
F	Parking Exit	Friday	750	Friday	9:15-10:15	66	Sunday	4:30-5:30	116
G	Before Apt. Exit & Recirculation	Thursday	2,352	Monday	11:30-12:30	189	Sunday	4:00-5:00	283
H	Recirculation	Wednesday	350	Wednesday	9:30-10:30	32	Thursday	2:15-3:15	48
I	Airport Exit	Thursday	2,007	Monday	11:30-12:30	165	Sunday	4:00-5:00	243

Source: HNTB analysis.

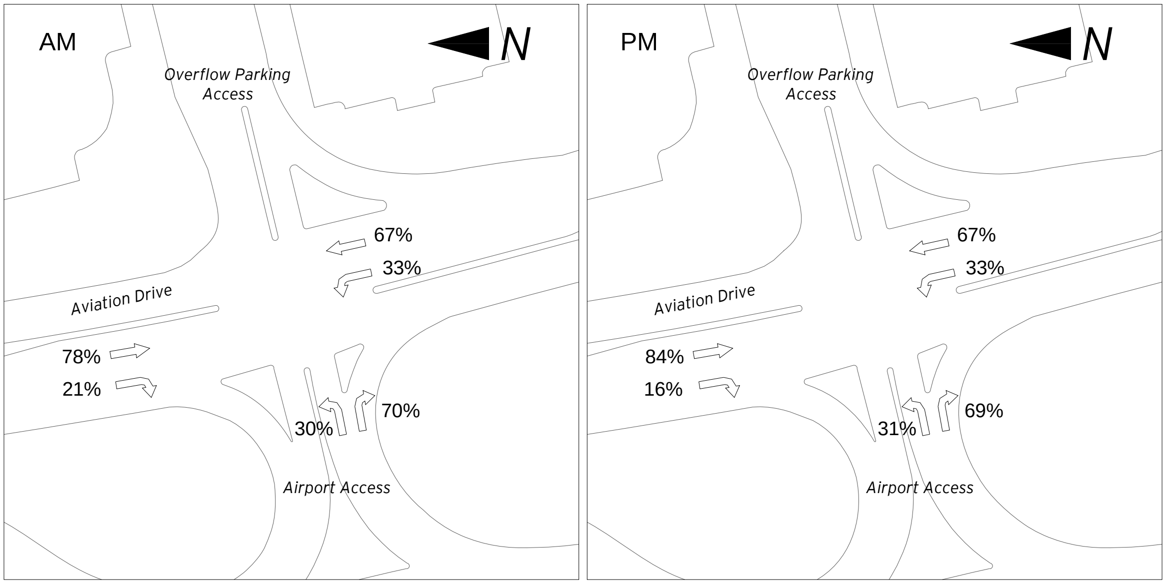


Figure 2-14

Turning Proportions at Aviation Drive/Airport Access

Immediately east of the Airport is a large shopping center which shares an access off of the Hershberger Road Ramp with the Airport. The shopping center generates significant traffic at peak times, especially in the afternoon as shown in **Table 2.6**.

The northbound approach to the Airport is signed via an overhead gantry as shown in **Figure 2-15**. The sign is located shortly before the entrance to the Airport. It is consistent with good practice to place signing as far as practicable before the driver has to make a decision and maneuver; however, in this case the issue is complicated by the intersection of Aviation Drive and Thirlane Road which is located south of the Airport entrance all a few feet before the sign gantry. The location of the existing signing clearly causes confusion: A number of vehicles were observed maneuvering to take a left-hand turn into Thirlane Road only to bail out and access the Airport.

Table 2.6

Hershberger Road Traffic Splits

	Proportion of Traffic From Hershberger Road Ramp to…			
Time Period	**Valley View Mall**	**Airport**	**Northbound (Beyond Airport)**	**Thirlane Road**
AM Peak Period	28%	27%	33%	12%
PM Peak Period	74%	6%	12%	8%

Source: HNTB analysis.

Figure 2-15

Existing Gantry with Airport Entrance Sign

Peripheral Roadway Observations

Several off-site roadway locations were investigated. Tube counts were taken at:

- Airport Road, 150 feet north of the tunnel under the runway;
- Peters Creek Road, south of the intersection with Airport Road; and,
- Municipal Road, east of the intersection with Aviation Drive.

Also, an AM observation was made at the intersection of Aviation Drive and Municipal Road.

The tube counts on Airport Road, conducted over three days, show that the activity peaks around noon and, to a lesser extent, between 4:30 and 5:00 PM. There is a significant difference between the northbound and southbound movements. Between 7:30 AM and 5:30 PM, the southbound traffic ranges from 420 to 550 vehicles per hour, the volume being relatively steady throughout the day. The northbound volume in the same period varies from 190 to 700 vehicles per hour.

Peters Creek Road, which was counted over the same period, displayed two distinct peaks which were coincidental northbound and southbound. The morning peak occurs between 7:30 AM and 8:30 AM; the evening peak between 4:45 PM and 5:45 PM. The magnitudes of these peaks are comparable ranging from 800 to 1,100 vehicles in the hour. Over the course of the day (between 7:30 AM and 5:30 PM), the volume in any one direction varies between 600 and 1,100 vehicles.

The three-day tube counts at Municipal Road show that there is a difference in the eastbound and westbound flows. The eastbound flow (away from the Airport) peaks in the middle of the day, approximately 11:45 AM to 1:45 PM; traffic builds up over the morning but remains reasonably steady in the afternoon, ranging from 270 to 350 vehicles between 12:00 PM and 5:30 PM. The westbound movement (toward the Airport) peaks between 11:45 AM to 1:45 PM, but does so again in the afternoon between 4:45 PM and 5:45 PM. The traffic volumes vary more significantly, ranging from 250 to 500 vehicles between 12:00 PM and 5:30 PM.

The intersection observations show that the majority of the traffic on Aviation Drive is going to (70 percent) or coming from (80 percent) Municipal Road.

2.5.4 Terminal Curbs

The curb roadways are split into an inner curb with two through lanes and one curb lane, and an outer curb consisting of three through lanes and one curb lane. The inner curb is 435 feet in length; the outer (median) curb is a little shorter at 400 feet.

The extreme ends of the terminal curbs have canopied sections that are designed to encourage drop-off and pick-up functions away from the center of the terminal.

2.5.5 Parking

The Airport provides parking for both members of the public and for its employees. Other tenants located at the Airport also provide parking for their employees.

Public Parking

Public parking at the Airport is divided between short-term and long-term parking; the general layout of the parking lots is shown in Figure 2-12.

The short-term lot is situated opposite the terminal building immediately south of the curb roadways. The short-term lot has 223 spaces. Friday and Sunday are the busiest days for this lot with activity peaking in the early evening, around 5 PM. A smaller peak is reported to occur at around 11 PM.

The long-term lot is located directly south of the short-term parking and rental car lots and has 1,041 spaces. The number of vehicles in the long-term lot typically peaks on Wednesday or Thursday. Peak exit times are reported to occur on Sunday afternoon.

The Airport also has an overflow lot located on a parcel of land adjacent to the Airport on the east side of Aviation Drive, providing an additional 574 addition spaces. The overflow lot is used a few times a month during peak travel periods.

Current parking rates are shown in **Table 2.7**.

Employee Parking

The employee parking lot is northeast of the terminal building and is accessed from Aviation Drive. The lot serves those working at the terminal building and based aircrew and has 287 spaces. Other tenants provide parking for their own employees elsewhere on the Airport.

Table 2.7

Existing Parking Rates

Short-Term Lot	Rate	Time
	$1.00	Each hour after the free first 15 minutes.
	$10.00	Daily maximum
Long-Term Lot		
	$1.00	Remainder of hour after first 15 minutes
	$1.00	Next hour
	$1.00	Each additional hour
	$6.50	Daily maximum

Source: RRAC.

2.5.6 Rental Cars

There are five rental car operators at ROA: Hertz, Avis, Enterprise, Budget, and National/Alamo. Each of the operators has a rental counter in the terminal building opposite the bag claim area. The rental car lot, situated between the short- and long-term parking lots, is divided among the operators in proportion to market share. None of the stalls are designated as ready or return stalls by any of the operators. Occasionally, the curb immediately in front of bag claim is used for rental car pick-up with vehicles shuttled in from the off-site storage facilities maintained by each of the operators.

The off-site storage facilities generally consist of fueling stations, wash lanes, light maintenance facilities, and some office space. The majority of these sites (located on Municipal Road, Aviation Drive, and Coulter Drive) are dedicated to the storage of vehicles during periods of low rentals.

Rental car information and activity are summarized in **Table 2.8**.

2.6 AIRPORT CARGO FACILITIES

The existing air cargo facilities are located on a 13-acre site adjacent to the south side of Taxiway G. Directly adjoined to Taxiway G is the air cargo aircraft apron currently used by DHL, FedEx, and United Parcel Service (UPS). The cargo apron is 1,350 feet long and 225 deep from the edge of the Taxiway G object free area (OFA). The depth of the apron requires the cargo carriers to park large aircraft diagonally on the apron in order to keep clear of Taxiway G's OFA and to stay clear of the Runway 6-24 transitional slope. Tail heights are the primary limiting factor when aircraft are parked on the cargo apron. Access to the cargo building sort facilities and offices is through AOA access-controlled gates in the perimeter fence.

An air cargo access road connects the facility with Aviation Drive on the west (at the old former terminal loop road) along the AOA perimeter fence line. Access is also provided to Airport Road (Route 118) on the east. The intersection at the air cargo access road and Airport Road is at a curve which creates a dangerous intersection for vehicles moving south on the air cargo road turning to the northeast onto Route 118. The air cargo road is also being used by non-air cargo vehicles including private vehicles making a shortcut from Airport Road to Aviation Drive.

2.6.1 FedEx Cargo Facility

FedEx has three buildings at the cargo facility: a sort building with truck docks and employee parking and two trailers that serve as offices. FedEx stages 727-200 aircraft parked diagonally on the aircraft apron. The sort building is approximately 14,700 square feet; the trailer closest to the sort building provides space for aircraft maintenance operations and is approximately 1,100 square feet in size; the second trailer is approximately 1,400 square feet in size and houses the FedEx operations center.

The truck apron area for the Fed Ex truck docks requires the full width of the air cargo road for maneuvering room to exit and enter the dock area.

Table 2.8

Rental Car Facility Inventory

Facilities (Combined)		
	On-Airport	**Off-Airport**
Ready/Return Stalls	148	
Wash Lanes	--	3
Storage (Vehicles)	--	1,675-1,725
Maintenance Bays	--	6
Fueling Stations	--	6

Activity (Overall)		
	Day	**Peak Period**
Peak Rentals (Busy Monday) (1)	360 vehicles	140-170 vehicles
Peak Returns (Busy Friday) (2)	340 vehicles	160-190 vehicles

Notes: (1) Aggregate demand: 9 AM to 11 AM; individual peaks may differ.
(2) Aggregate demand: 3 PM to 5 PM; individual peaks may differ.

Source: HNTB analysis.

2.6.2 United Parcel Service Cargo Facility

UPS has two small buildings, a 2,700 square-foot office and an 800-square foot sort building, with adjacent truck staging area and employee parking. UPS must take special care to position its A300 aircraft so it does not violate the transitional slope of Runway 6-24 and Taxiway G OFA. UPS also has a large regional sort facility east of I-581 off of Thirlane Road.

2.6.3 DHL Cargo Facility

DHL has minimal facilities and uses the aircraft apron area primarily to off-load cargo directly onto trucks.

2.6.4 Burlington Air Cargo Facility

Burlington Air Cargo occupies a portion of a 10,000-square-foot building (Building 5) located off of Aviation Drive directly north of the new control tower. It operates no aircraft into or out of Roanoke.

2.7 GENERAL AVIATION AREA

The Airport's GA facilities are located on a 30-acre site north of the passenger terminal apron. The GA area consists of approximately 60,000 square yards of apron area for itinerant aircraft and base aircraft tie-down areas, a terminal for a FBO, T-hangars, and conventional hangars. Figure 2-13 depicts the facilities in the GA area at ROA.

2.7.1 GA Terminal/FBO Building

Landmark Aviation (formerly Piedmont/ Hawthorne) provides FBO services at ROA. Their recently refurbished terminal building is approximately 3,800 square feet in size. The building includes a passenger lounge, pilot lounge, conference room, staff offices, restrooms, and other facilities.

2.7.2 Conventional Hangars

Landmark has two conventional hangars. Maintenance activity is performed in a 34,000-square foot hangar (Building 25). A 30,000-square foot hangar directly east of the FBO terminal building is used to store based aircraft. An 18,000-square foot aircraft storage hangar is under construction.

There are seven other conventional GA hangars at the Airport. Four box hangars (Buildings 17 through 20) are located directly east of the tie-down ramp. Each of these hangars provides approximately 5,000 square feet of aircraft storage space. Building 17 is occupied by Chuck Waring. Building 18 is occupied by Executive Air, which provides charter services. Building 19 is occupied by Summit Helicopters. Building 20 is occupied by Saker Flying Service.

Building 32, located in the southeast portion of the GA area, is 4,800 square feet and occupied by the Nordt Company.

Two hangars are located directly south of Taxiway G to the west of the air cargo apron. Building 2 is occupied by Roanoke Aero Services which provides tie-down service and aircraft maintenance. Their hangar is approximately 8,500 square feet in size. Building 3 is occupied by LC's Flying Service which provides hangar and tie-down space, as well as aircraft maintenance, a flight school, and charter services. This hangar is approximately 9,500 square feet in size. These two hangars, which are in poor condition, will have to be razed as part of the Taxiway G realignment project.

2.7.3 T-hangars

There are three T-hangars providing aircraft storage. Two are owned by Landmark Aviation. The first, Building 24, is located directly south of the FBO Terminal building. It is approximately 12,000 square feet in size. The second is Building 26. This T-hangar is about 18,000 square feet in size and provides storage for 15 aircraft. A third T-hangar (Building 16), located directly north of Building 26, is about 17,000 square feet in size and provides storage for 13 aircraft, and is owned by Midland Development Corporation.

The total number of aircraft based at the Airport is 125. **Table 2.9** lists these aircraft by type.

Table 2.9

Based GA Aircraft by Type

Type	Number
Single Engine	91
Multi-Engine	28
Jet	6
Helicopter	0
Total	125

Source: VA Airport Annual Based Aircraft Survey Summary Report.

2.8 AIRCRAFT RESCUE AND FIRE FIGHTING FACILITIES

The existing ARFF station is located on a 2.5-acre site on the east side of the Airport on Aviation Drive just south of Waypoint Drive. The Commission owns the land and building; however, it is a joint-use facility with the City (Fire Station 10) which provides staffing and management. The Commission provides all Airport-related equipment. The Airport ARFF facilities and equipment are responsible for responding to aircraft rescue and fire fighting, and the City facilities and equipment respond to City fire fighting responsibilities including structural fires.

The station currently comprises approximately 11,000 square feet and features six bays (three bays facing the landside and three bays facing the airside), public entry foyer, chief's office, central kitchen/dining area, men's and women's lockers, men's and women's dormitories, chief's sleeping area, exercise room, restrooms, communications room, training room, storage, and an exterior patio.

The current Part 139 required index level based on the length of aircraft and daily operations at the Airport is Index B. Index B requires two ARFF vehicles. The station has three bays with structural fire fighting apparatus facing Aviation Drive and ARFF vehicles facing the access road to the airfield. The equipment consists of two primary trucks, one tanker truck, and one foam tender vehicle. Specifically, the ARFF equipment includes two Oshkosh vehicles with 1,500-gallon water and dry chemical capacity. In August 2006, a new E-One vehicle with a 1,500-gallon capacity and a "snozzle" will be delivered to replace the older of the two Oshkosh vehicles, which will then be retired.

The combined station is an old building which serves the purpose as a fully compliant station but lacks many of the modern standards of new fire stations. In addition, the vehicles must transit an active air carrier ramp when responding to calls. A new communications center and a direct communication line to the ATCT cab are important assets the ARFF facility should have in the future. The Airport would benefit with the ARFF facility at a more central location on the Airport with direct airfield access to taxiways and closer to the two runways to minimize response time to aircraft incidents.

New sites for an ARFF station will be reviewed as part of the Master Plan Update Process. Along with the ARFF station, a new ARFF simulator training site, currently located on the cargo ramp, will be identified. The Master Plan Update will also explore providing fire hydrants at key locations along the runways to enable vehicle recharging.

2.9 FUEL STORAGE/ DISTRIBUTION

The airlines have contracted with Landmark Aviation to fuel their aircraft at the passenger terminal from a tank farm located just north of the air carrier apron. There are three tanks storing Jet-A. Two 20,000-gallon tanks are above ground and one 12,000-gallon tank is below ground, for a combine total of 52,000 gallons of Jet-A storage capacity. There is also one 12,000-gallon tank below ground to store Avgas. All of the previously abandoned underground fuel tanks owned by Piedmont Airlines or US Airways have been removed.

2.10 AIRPORT FIELD MAINTENANCE BUILDING

The Airport's field maintenance facility sits on a 2.5-acre site located on the north side of the Airport. The facility opened in 1997. It is part of the security fence line and is accessible from Peters Creek Road for landside access and from the airfield via the perimeter road.

A 24,000-square-foot maintenance/ storage building houses snow equipment, grass mowing equipment, and other outdoor maintenance vehicles and trucks. The building is in good condition.

There are also deicing tanks and a vehicle fuel station at the maintenance center.

The site has ample land available for additional building area, parking, and outdoor storage.

2.11 PIEDMONT AIRLINES AIRCRAFT MAINTENANCE CENTER

The Piedmont Airlines aircraft maintenance center is located south of Taxiway G, west of the Cargo Center. The hangar was originally constructed in 1961, was expanded in 1989, and was refurbished in 2000. The facility is approximately 43,000 square feet in size of which 32,000 square feet is hangar space and 11,000 square feet is for offices and maintenance area for Ground Service Equipment (GSE). The center is used by Piedmont Airlines to maintain its Dash 8 turboprop aircraft. The facility can comfortably accommodate five aircraft or a maximum of six aircraft. Apron space is at a minimum outside the hangar to the east. The apron to the west needs pavement improvements and is not large enough to accommodate a Dash 8. Piedmont would like to have aircraft access on both sides of the hangar. The hangar includes shop space for avionics, metallurgy, engine repair, hydraulics, and painting. There are 12 to 15 mechanics typically on duty on the night shift. Piedmont Airlines' lease term for the hangar continues until September 2006.

2.12 FAA FACILITIES

A new FAA administrative/TRACON building and control tower were dedicated in May 2005, although controllers had been using the facility since December 2004. The facility is located between the Piedmont Airlines maintenance hangar and the GA area, just west of Aviation Drive. The floor elevation of the cab is 186 feet above ground level. The TRACON facility is 14,500 square feet in size and consists of a training area, staff offices, maintenance area, equipment room, break room, weather office, lockers and restrooms, and a six-position TRACON room.

The FAA also has a 1,900-square foot storage building west of the intersection of the two runways in which is stored materials and equipment.

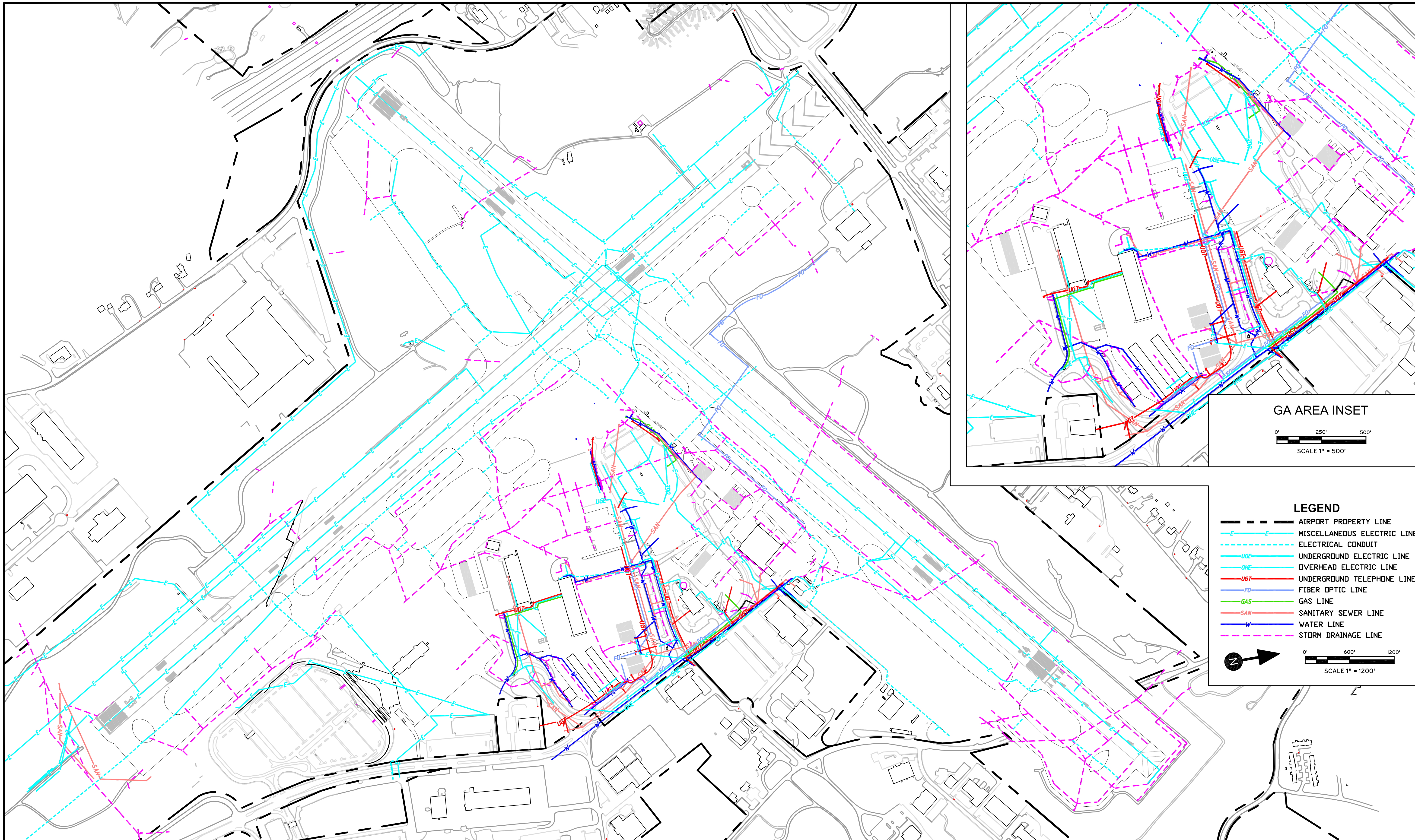
2.13 UTILITIES

Following is a general description of existing utilities serving the Airport. The layout of utilities is shown in **Figure 2-16**.

2.13.1 Electric

Electricity is supplied to the Airport by American Electric Power (AEP). Prior to 2001, the Airport had two main electrical power feeds. The original "Peters Creek" feed came in from the north and crossed under Runway 6-24 to a building which housed electrical switch gear to feed the midfield buildings. When the new terminal was constructed, a south "Mall" feed was brought to the Airport. The Peter's Creek feed was disconnected in 2001 and the new "Mall" feed became the primary feed for the Airport.

The "Mall" service feeder originates from the AEP overhead feeder east of Aviation Drive. At this point, the electrical service is dropped below ground into a two-way five-inch ductbank owned by the Airport. The ductbank extends westward toward the terminal building and terminates at the AEP-owned pad-mounted transformer. The secondary service feeder from the transformer is then brought to the Airport-owned switchboard, which is rated at 2,500 amperes, 480Y/277 VAC, 3-phase, 4-wire. The fusible section of the switchboard is comprised of a 1,000A, 3P fused switch that serves Panel EDP; one 800A, 3P fused switch that serves Panel 1LM; and one 800A, 3P fused switch that serves Panel LDP; one 600A, 3P fused switch that serves Panel LNDP; and one 600A, 3P spare fused switch.



NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

UTILITIES

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Dec 05, 2007

FIGURE 2-16

P:_Projects\40311 RDA Master Plan Update\Report\Fig 2-16 RDA UtilitiesRev4.dwg Figure 2-6 Utilities Dec 05, 2007 - 9:14am

The circuit breaker section of the switchboard is comprised of one 600A, 3P circuit breaker (spare); one 400A, 3P breaker that serves the Motor Control Center (MCC); one 400A, 3P breaker that serves Panel LDPA, one 400 A, 3P breaker that serves Chiller #1; one 400A, 3P breaker that serves Chiller #2; and one 400A, 3P breaker (spare).

Power is distributed from the switchboard to various sub-panels located throughout the terminal complex.

A dedicated, separately-metered service from the pad-mounted transformer serves the second floor food service operations. This service is rated 600A, 480Y/277 VAC, 3-phase, 4-wire.

The main electrical room has no available space for new panels to accommodate any new equipment.

Emergency power for the terminal complex is provided by a 600 KW (750 KVA), 480Y/277 VAC, 3-phase, 4-wire diesel engine generator which is located outside the terminal building close to the pad-mounted transformer. The generator is connected to an automatic transfer switch which will transfer power from the generator when power from the main service is lost. The transfer switch is rated 1,000A and feeds the main emergency distribution panel (EDP).

The EDP serves the following emergency loads: Panel ELA that provides power for emergency lighting circuits and also critical receptacle and equipment loads in the concourse areas served by Panel ERA through a step-down transformer; Panels ELC and ELB that provides power to the emergency lighting and mechanical loads in the baggage and ticketing areas as well as the outdoor power distribution cabinet at the employee parking lot and the outdoor power distribution rack at Gates 33 and 33A; Panels ERC and EDP2, through a step-down transformer, which provides power to the emergency receptacle loads in the Ticketing and Baggage areas; Panel ERB, through a step-down transformer, which provides emergency power for receptacles and equipment loads in the RRAC offices; elevator panel which provides emergency power to the Gate 5 and 6 Handicapped elevator and Panel ERD, through a step-down transformer that provides power to the lower level concourse emergency operations center; Emergency MCC that serves the main mechanical equipment; Parking Toll Plaza; and Panel HV-1 that provides power to lighting circuits, as well as the emergency receptacle loads in the second floor Airport Security Operations area that are served by Panel LV-1.

Panels EDP2, ERB, the elevator panel, ERD, Parking Toll Plaza, and Panel HV-1 (and LV-1) were the additions to the emergency power system since the original building construction. The existing Panel “Bank” located in the Finance Office was also reconnected from the normal power distribution to the emergency power distribution system.

Previous studies have indicated that there is some spare capacity that could be available for expansion. A detailed evaluation needs to be undertaken for any expansion in order to determine the actual available spare capacity that could be utilized.

The Airport maintenance facility located at the north side of the Airport along Peter's Creek road is served by electrical power from Peter's Creek Road.

There have been no major changes to the airfield electrical vault power supply since 1996.

The Runway 6 ILS equipment and TVOR are served by a feed from Thirlane Road.

FAA NAVAIDs on the south end of Runway 33 are served by electrical feed from the southeast corner of the Airport.

2.13.2 Water

Water is supplied to the Airport by an eight-inch water service from the Western Virginia Water Authority (WVWA) piping system. The water main is routed from the Thirlane Road-Peter's Creek Road intersection at the northwest corner of the Airport. The water line runs along Thirlane Road, south, east, and then north to the terminal and along Aviation Drive to the rest of the Airport.

Water supply to the terminal is provided by a three-inch line tapped off the eight-inch combined fire and domestic water service. Based on existing plans, the terminal facility has the following breakdown of fixtures:

- Lavatories 32
- Water closets 32
- Urinals 10
- Service sinks 4
- Drinking fountains 8
- Cooling tower makeup 15 GPM-peak

This fixture count allows for a design demand of approximately 135 gallons per minute (GPM) plus an allowance for the food service needs and cooling tower peak demand.

The present water supply from the WVWA experiences low water pressure periods and has been retrofitted with a small booster pump located in the fire pump room. The booster pump selected for this application (a one-inch diameter single booster) and the piping system modification do not appear to be adequate (or installed properly); thus, this modification does not appear to have resolved the low-pressure conditions. It is recommended that a duplex pump set with a compression tank and controls be added to the Airport's water system. The duplex system would provide the Airport with increased reliability.

Additionally, we recommend a water storage tank to store a relatively small amount of potable water for emergency periods in order to allow flush water for toilets and urinals. This could be limited to 1,000-gallon storage tank that could be placed in an enclosed space and fed independently into the system for this purpose.

2.13.3 HVAC System

The main HVAC system serving the passenger terminal consists of a series of boilers, chillers, cooling towers, circulators, and air handlers. The majority of the main systems date back to the 1989 original building installation, and therefore, are over 16-years old.

The existing building ventilation system consists of air handling units, which are provided with hot or chilled water to maintain an interior comfort level for each season demand.

For cooling, a system of chilled water is circulated to the air-handling units. The chilled water is generated by two centrifugal chillers, each capable of providing 225 tons of cooling for a total of 450 tons. It has been reported in previous studies that this system was designed for approximately 75 percent of its required capacity, thus having approximately 100 tons of excess capacity.

Due to its age, location, and condition, the existing system may not be suitable for any future expansion; rather, the available excess capacity should serve as a reserve to the existing system to increase its reliability and further simplify any future design and construction.

The heating system consists of two gas-fired boilers, each having a capacity of 2,900,000 BTU/HR for a total capability of 5,800,000 BTU/HR. It has been reported in previous studies that this system was designed for approximately 75 percent of its required capacity, thus having approximately 25 percent excess capacity. Due to its age, location within the building, and condition, using this system for any future expansion is not recommended. The excess capacity should be considered a reserve to the existing system to increase its reliability and further simplify any future design and construction.

2.13.4 Fire Protection

The existing facility is fully equipped with a sprinkler system and has hose cabinets at appropriate locations. In areas subject to freezing, a dry system has been incorporated and all other locations utilize a wet pipe system. Water supply to the sprinklers and standpipe system is provided through a combined domestic/fire water service with a fire pump, which is incorporated into the system. The 20 horsepower electric fire pump is rated at 1000 gpm and 100 pounds per square inch (psi). Expansion of the fire system could be done with little or no modifications to the existing system provided the additional piping is designed within the present system hydraulics.

The present water supply from the WVWA experiences low water pressure periods and has run dry on a few occasions. The fire sprinkler water demand is based on hydraulic calculations and is required to be maintained for a 30-minute period. The required water flow, based on ordinary hazard group 1 occupancies, is estimated as follows:

Sprinkler Flow 1500 SF x .15 GPM/SF =225 GPM

Inside and outside Hose Flow Allowances= 250 GPM

Total Flow = 475 GPM

Total Water for 30 minutes duration=14,250 GPM

Adding a 15,000-gallon water storage tank adjacent to the fire pump machine room to provide a reliable source of firewater storage is recommended.

2.13.5 Sanitary Sewer

Sanitary sewer service is provided by the WVWA. The air carrier terminal is served by a sanitary sewer system that was installed as part of the project in the late 1980s. The air carrier terminal sewer flows to the south around the south end of Runway 15-33.

In 2001, a new utility corridor was installed as part of the improvements in the GA Phase I project. This utility corridor provided new utility infrastructure to serve the new ATCT and proposed GA hangar sites. The existing sewer that served the old terminal can be abandoned once Buildings 2 and 3 are demolished in 2007. Future midfield facilities will be connected to the new sewer line in the utility corridor.

The sanitary sewer flow from the terminal building and concourse is by a gravity and manhole system, which in turn flows to pump stations. Based on the existing fixture count, the approximate demand sewage rate was estimated at 95 gallons per minute (approximately 75 percent of the estimated current capacity). It is recommended that a new sewage pumping station be considered for any major addition to the building facilities.

2.13.6 Gas

Natural gas service to the Airport is provided by the Roanoke Gas Company by a 1-¼-inch gas main.

Gas service for the terminal enters the building adjacent to the electrical service near the boiler room. The primary purpose of the gas service is for heating, partial domestic water heating, and cooking for the food service areas. The service pressure ranges from 40 to 45 psi, and the service has ample capacity for expansion.

The location of the gas service valve assembly, directly in front of the boilers air intake louver, appears to be of some concern, should a gas leak occur. It is recommended that the gas valve assembly be moved to a safer location.

2.13.7 Communication

The communication system for RRAC is provided by Verizon via a 900-pair cable that runs through the building to the main telephone room. The cable supports the RRAC, as well as the individual tenants and provides Wide Area Network (WAN) connections such as T-1 and Frame Relay, Plain Old Telephone Service (POTS) and digital voice circuits. Individual tenants are responsible for providing their cabling connectivity throughout the facility for both voice and data networks. Most tenants rely on Verizon to support their connectivity utilizing the Verizon-maintained "house" cabling.

The Airport cabling system is a star configuration with the network administrator's office in the finance area serving as the Centralized Distribution Node where all cabling originates. From this area, multi-mode (MM) fiber-optic cabling is routed to the operations office in the concourse area and to the field maintenance building located across the airfield. The fiber to the field maintenance building includes 18 strands of MM fiber with 12 strands available. The fiber to the operations area includes 12 strands of MM fiber with 6 strands available. The distribution system also includes a category 5E distribution system from the operations office to the west wing storage closet, to the boiler room, to building maintenance, and to the administration office. The system adequately provides the required connectivity to support the Fast Ethernet Local Area Network (LAN) that sustains the administrative functions of the RRAC and the telephone system.

The LAN provides support for the administrative functions of the Airport including e-mail, finance, time keeping, file sharing, and general office functions such as word processing, spread sheet, etc. In addition, a segregated LAN that includes access points throughout the facility is in place to allow the public to access the internet. The two networks are segregated using a CISCO 2621XM router. On the wireless side of the system, a CISCO Catalyst 2950, 12-port switch is connected to the router and then to two CISCO 1100 AP access points that are located in the concourse and terminal areas. To connect to the public network, a T-1 line from the local internet service provider is connected to the CISCO router. The administrative side of the router includes a Symantec Firewall (VPN 200R) that is connected to certain servers, as well as a 3Com 24-port switch. The 3Com switch is then connected to a 3Com 16-port switch in the west wing storage closet, a 3Com four-port wall switch in building maintenance, a CISCO 12-port switch in Operations, and an SMC 16-port switch in the field maintenance building. The connectivity to these switches is using a mixture of fiber-optic and copper cabling and is all Fast Ethernet (100 Mbps).

The communications infrastructure supports approximately 45 computer users with about 40 actual computers all running Windows 2000 or a new operating system. All the computers are connected to the LAN switches described in the active infrastructure section.

The phone system supports about 30 phone users as well as the courtesy phones. The system is a Meridian System by Nortel (MOX16 with application module). Connection to the Public Switched Telephone Network (PSTN) is through the main phone room and the 900 pair copper cable from Verizon.

The infrastructure also supports the administrative servers. The Exchange 5.5 server is scheduled for an upgrade soon.

The FAA has installed an internal phone system between its facilities and the new ATCT.

2.13.8 Stormwater

The ROA stormwater drainage system has been significantly improved since the construction of the new air carrier terminal in the late 1980s. Prior to the terminal construction, no significant stormwater management facilities were in place. As part of the terminal construction project, a detention basin system was constructed to provide water quality and stormwater management for runoff from the midfield and new terminal areas to the south outfall. The south detention basins have been improved and expanded to accommodate runoff from the runway and taxiway, areas south of Taxiway G and east of Runway 15-33. West of Runway 15-33, a system of smaller basins detains airfield runoff prior to release from the Airport. North of Runway 6-24, a system of channels and storm sewers routes runoff to large detention basins or suitable conveyances prior to release from the Airport property.

Much of the aged stormwater conveyances in the midfield portion of the Airport are being rehabilitated or replaced with ongoing improvement projects. The GA area stormwater drainage system is being incrementally improved by routing runway and taxiway runoff to the south detention basin system which will lessen some of the backups that currently occur in the GA area.

Stormwater runoff for about 70 percent of the GA area flows into conveyances that connect to the City storm sewer un-detained. The GA area east of Hangar 25 drains to newer infrastructure (installed in the early 1990s) that connects to the stormwater system installed as part of the new terminal project and discharges into the south detention basins prior to release into the City system.

The portion of the GA area that is not routed through an on-airport detention basin has been accounted for by detaining more from the Airport areas that are routed through stormwater management basins.

About 95 percent of the GA area does have the ability to capture a fuel spill that may occur prior to entering the City storm sewer. For the west portion of the GA area, the fuel trap is in the manhole in front of the FBO terminal. For the east area, the fuel trap is in the basin south of the terminal parking lot.

Chapter Three
Passenger Survey and Terminal Observations

The inventory phase of the Master Plan Update included a set of surveys and terminal observations (in addition to the data gathering described in Chapter 2) which are described below.

The information obtained from the surveys will be used to develop Airport-specific planning factors to determine future facility needs and will guide the selection of a preferred alternative. This will give the Commission a greater level of confidence that the long-term development plan will accommodate future requirements compared to using general industry-standard planning factors without the survey information. The results of the survey and observation efforts are summarized below.

3.1 DEPARTING PASSENGER SURVEY

3.1.1 Survey Methodology and Design

The purpose of the passenger survey was to obtain travel characteristics of passengers for use in the master planning effort. Following is a description of the survey's methodology.

Data Requirements and Questionnaire Design

Prior to the survey, a draft questionnaire was prepared by determining the information deemed necessary for the Master Plan Update. Questionnaire layout and wording were generally based on previous survey efforts conducted at other airports around the country and then tailored to address the unique issues identified as part of this Master Plan Update.

The draft questionnaire was then reviewed by Commission staff and their comments were incorporated where feasible. **Figure 3-1** shows the 2005 passenger survey questionnaire used for the survey.

The survey included questions about the following key characteristics:

- Start of ground trip location
- Geographic location of ground origin
- Destination
- Trip purpose
- Air party size
- Mode of access to Airport
- Curb and parking lot use
- Parking duration
- Time of arrival at terminal
- Check-in method/location
- Number of well-wishers/meeter-greeters
- Amount of carry-on and checked bags
- Amenities used/not found

ROANOKE REGIONAL AIRPORT 2005 PASSENGER SURVEY

The Roanoke Regional Airport Commission is updating the master plan for the Airport. By taking a few moments to complete this questionnaire, you will help us plan for the Airport's future. No identification is required. Thank you for your help.

1. Including you, how many people are in your immediate travel party *(i.e., family, friends, and/or business associates)*?

_______________ *(number of people)*

2. Where did you begin your ground trip for this flight to Roanoke Regional Airport today?

☐ Your home ☐ Someone else's home
☐ A place of business ☐ A hotel/motel
☐ Other *(specify)*______________________

3. What is the location of the place checked in Question #2?

Zip Code:__________City/State:____________________

OR Building/Intersection/Address:____________________

____

4. Where is your home?

☐ Same as Question #3
☐ Another location *(please specify)*:

____
(city/county) *(state/province)* *(country)* *(postal code)*

5. How did you travel to Roanoke Regional Airport today?

☐ Personal/Company car ☐ Taxi
☐ Rental car ☐ Limousine/Executive sedan
☐ Hotel courtesy vehicle ☐ Smart Way bus (Public Transit)
☐ Other *(specify)*____________________

6. If you came by either personal/company car OR rental car:

✈ Including you, how many **air passengers** were in the car?

___________ *(number of air passengers)*

✈ Was the car driven (*please check one*):
☐ To the curb, then off-airport
☐ To the curb, then to a parking facility or rental car return
☐ Directly to a parking facility or rental car return

✈ If the car was parked, where is/was the car parked?
☐ Short Term (Hourly) ☐ Long Term ☐ Rental Car Lot

✈ If the car was parked, how long was it (*will it be*) parked?
☐ Less than 1 hour ☐ 5-24 hours
☐ 1-4 hours ☐ More than 24 hours

7. At what time did you arrive at Roanoke Regional Airport today?

________:________ **AM / PM** *(please circle one.)*

8. Did any well-wishers come to the Airport to see you off?

☐ No
☐ Yes ⏩How many?_______ *(well-wishers)*
⏩Where did you say goodbye?
☐ Curb ☐ Ticket counter ☐ Security
☐ Gate ☐ Other____________________

9. How many carry-ons and checked bags is your immediate travel party taking on this flight?

_____________ Carry ons *(Enter '0' if none.)*

_____________ Checked bags *(Enter '0' if none.)*

10. Where did YOU check in for this flight AND, if applicable, where did you check your BAGS?

Check-in Location	Passengers	Bags
On-line	☐	☐
Self-serve kiosk at ticket counter	☐	☐
Agent at ticket counter	☐	☐
Other ____________ *(specify)*	☐	____________ *(specify)* ☐

11. Which amenities did (or will) you visit at Roanoke Regional Airport today? *(Check all that apply.)*

☐ Restaurant ☐ Bar/lounge ☐ Snack bar
☐ Vending machine ☐ News/gift shop ☐ Shoeshine
☐ ATM ☐Other *(specify)* ____________

12. List any amenities you looked for but could not find:

a. ____________________
b. ____________________
c. ____________________

13. What is (or was) the MAIN purpose of your trip (*Check one*)?

☐ Business ☐ Convention/Conference
☐ Vacation/Pleasure ☐ Personal
☐ Visit Friends/Family ☐ Travel to/from School
☐ Other *(specify)*____________________

14. From Roanoke, where are you flying today (*final stop*)?
(If returning to Roanoke later today, consider the 1-way portion of your trip.)

____
(airport/city) *(state/province)* *(country)*

15. How many nights will you be (or were you) away on this trip?

_________ Nights *(Enter '0' if you are returning the same day.)*

16. If you are a resident of the area, how many people will come into the Airport terminal to meet you when you return from this trip?

_________ People will meet me/us *(Enter '0' if no one will meet you.)*

17. If you were visiting the area, how many people came into the Airport terminal to meet you when you arrived on this trip?

_________ People met me/us *(Enter '0' if no one met you.)*

18. Please select the most important reason for choosing Roanoke Regional Airport for this flight today?

☐ Closest airport ☐ Most convenient flight times
☐ Least expensive airfare ☐ Airport amenities
☐ Other *(specify)*____________________

19. Which other airports did you consider for this flight today?

☐ Greensboro (Piedmont Triad Int'l) ☐ Charlotte Douglas Int'l
☐ Raleigh/Durham Int'l ☐ Richmond Int'l l
☐ Lynchburg Regional ☐ Washington Dulles Int'l
☐ Wash. Reagan Nat'l ☐ Tri-Cities Reg'l
☐ Other *(specify)*____________________

PLEASE USE THE BACK OF THIS QUESTIONNAIRE FOR YOUR COMMENTS. THANK YOU FOR YOUR HELP.

ROANOKE REGIONAL AIRPORT

2005 Passenger Survey Questionnaire

FIGURE 3-1

Source: HNTB analysis.

- County/state/country of residence
- Trip duration
- Reasons for selecting ROA
- Other airports considered
- Passenger comments

The survey was primarily designed to provide estimates of characteristics of locally originating passengers during average travel periods. Therefore, the survey was conducted in early November, prior to the holiday season.

Sample Plan, Sample Size, Sample Selection

The departing passenger survey was a random single-stage cluster sample. The list of all commercial flights scheduled to depart from ROA during the one-week survey period comprised the *sample frame*. Each flight was a *listing unit*; the passengers on each flight were considered to be *elementary units*. An attempt was made to reach every passenger on each sampled flight (versus a sub-sample of passengers).

The sample size was determined by selecting an appropriate margin of error and confidence level (based on budget limitations), and applying anticipated response rates and load factors to arrive at the total number of flights to be surveyed. **Table 3.1** lists the surveyed flights.

Statistical Validity and Margin of Error

As noted above, the departing passenger survey was a single-stage cluster sample. The theoretical margin of error for each question varied primarily based on the response rate for that question and the homogeneity of respondents within each cluster (flight) relative to the travel characteristic being examined.

For most questions, the theoretical margin of error is estimated to be within approximately plus/minus three percentage points at a 95 percent confidence level.

Survey Conduct

The surveys were conducted at the gate holdrooms. The survey team consisted of Commission staff. Personnel arrived at the gate approximately 90 minutes prior to departure. Staff discussed the survey with airline gate personnel and placed a small survey sign on the gate counter notifying passengers that the flight had been selected to be surveyed. Surveyors then distributed questionnaires as passengers arrived at the gate. Once completed, the surveyors retrieved the questionnaires prior to boarding. Late-arriving passengers (i.e., those coming to the gate once the boarding process had begun) were given both a questionnaire and a postage-paid envelope to enable them to complete the questionnaire at their convenience and return it by mail. After the flight departed, surveyors asked the gate agent for the number of revenue passengers on the flight.

Table 3.1

List of Surveyed Flights

Departure Date	Dep Time	Airline Code	Flight	Destination	Equipment	Seats
8-Nov	6:55 AM	DL	4681	ATL	CRJ	50
8-Nov	7:30 AM	US	4570	LGA	DH8	37
8-Nov	7:43 AM	UA	5827	ORD	CRJ	50
8-Nov	9:33 AM	US	2757	CLT	ERJ	50
8-Nov	10:30 AM	DL	4704	CVG	CRJ	50
8-Nov	5:00 PM	US	2831	CLT	ERJ	50
8-Nov	5:10 PM	US	4158	LGA	DH8	37
8-Nov	7:35 PM	UA	5378	IAD	CRJ	50
9-Nov	5:50 AM	US	4465	CLT	DH3	50
9-Nov	6:00 AM	DL	5772	CVG	CRJ	50
9-Nov	7:43 AM	UA	5827	ORD	CRJ	50
9-Nov	9:35 AM	US	2821	CLT	ERJ	50
9-Nov	2:31 PM	UA	5444	IAD	CRJ	50
9-Nov	7:35 PM	UA	5378	IAD	CRJ	50
9-Nov	8:00 PM	US	2390	PHL	CRJ	50
10-Nov	10:29 AM	UA	7976	IAD	ER4	50
10-Nov	11:00 AM	US	4148	LGA	DH8	37
11-Nov	5:30 AM	US	2327	PHL	CRJ	50
11-Nov	6:00 AM	DL	5772	CVG	CRJ	50
11-Nov	6:03 AM	NW	3086	DTW	SF3	34
11-Nov	6:50 AM	US	4249	CLT	DH3	50
11-Nov	7:43 AM	UA	5827	ORD	CRJ	50
11-Nov	3:25 PM	US	4502	PHL	DH8	37
11-Nov	7:35 PM	UA	5378	IAD	CRJ	50
12-Nov	5:50 AM	US	4465	CLT	DH3	50
12-Nov	6:55 AM	DL	4681	ATL	CRJ	50
12-Nov	7:10 AM	US	4340	PHL	DH8	37
12-Nov	12:00 PM	US	4245	CLT	DH3	50
12-Nov	3:35 PM	US	2827	CLT	ERJ	50
12-Nov	4:27 PM	NW	5853	DTW	CRJ	50
12-Nov	4:55 PM	US	4239	CLT	DH8	37
12-Nov	6:35 PM	US	4206	CLT	DH3	50
13-Nov	6:03 AM	NW	3086	DTW	SF3	34
13-Nov	6:50 AM	US	4249	CLT	DH3	50
13-Nov	7:10 AM	US	4340	PHL	DH8	37
13-Nov	7:43 AM	UA	5827	ORD	CRJ	50
13-Nov	10:29 AM	UA	7976	IAD	ER4	50
13-Nov	10:30 AM	DL	4704	CVG	CRJ	50
13-Nov	12:21 PM	NW	3109	DTW	SF3	34
13-Nov	4:27 PM	NW	5853	DTW	CRJ	50
13-Nov	8:03 PM	DL	4631	ATL	CRJ	50
14-Nov	5:30 AM	US	2327	PHL	CRJ	50
14-Nov	5:50 AM	US	4465	CLT	DH3	50
14-Nov	6:00 AM	DL	5772	CVG	CRJ	50
14-Nov	6:00 AM	UA	7981	IAD	ER4	50
14-Nov	7:10 AM	US	4340	PHL	DH3	50
14-Nov	12:21 PM	NW	3109	DTW	SF3	34
14-Nov	2:31 PM	UA	5444	IAD	CRJ	50
14-Nov	4:27 PM	NW	5853	DTW	CRJ	50
14-Nov	5:05 PM	US	4158	LGA	DH8	37

Source: Official Airline Guide via Back Information Services; HNTB Corporation analysis.

Survey Coding, Data Entry, and Editing

Survey results were entered into a computer database. An editing process was then undertaken to correct obvious respondent errors. When possible, missing values (i.e., item non-response) were imputed based on the remaining information provided by the respondent. Records with a high number of missing responses were removed from the database.

Sample Weighting

A two-step weighting process was undertaken to account for non-respondents and the fact that the information gathered from the survey represented a much larger population.

Boarding Count Weight

The first step in the weighting processes was to expand the number of valid records obtained from each flight to that flight's boarding count. For example, if 25 questionnaires were obtained from a flight with a boarding count of 50 passengers, each questionnaire was weighted by a factor of 2.00 (i.e., 50 total passengers divided by 25 respondents).

Sample Weight

Since each flight was randomly selected from a known population of scheduled flights, all records were further weighted by the inverse of the probability of selecting a flight from the sample frame. There were 238 scheduled departing flights during the survey week, and 50 flights were drawn from this frame; therefore, the sample weight was 4.76 (i.e., 238 divided by 50).

Total Weight

Recognizing that the survey represents the population of passengers departing ROA during the survey week, the boarding count weight and the sample weight were multiplied together to inflate the counts to a one-week total. The total weight therefore provides a weekly estimate of departing passengers during the survey period.

Table 3.2 compares the number of actual boardings and weekly respondents to the total passengers on the surveyed flights and presents an estimate of all passengers departing ROA during the week.

3.1.2 Departing Passenger Survey Results

This section describes the results of the departing passenger survey conducted at ROA in early November 2005. As described above, all results have been weighted to reflect one week of activity.

Air Travel Party Size

Half (50 percent) of the passengers were traveling alone, while more than one third (35 percent) of passengers were traveling with one other person (i.e., a travel party of two), as shown in **Table 3.3**. About seven percent of passengers were traveling in a group of three, and approximately nine percent of respondents were part of a group of four or more passengers. The average air travel party size was 1.4 passengers.

Table 3.2

Number of Respondents Versus Actual Boardings and Weekly Estimate

Respondents	910
Total Passengers on Surveyed Flights (1)	1,203
Response Rate	75.6%
Estimated Total Weekly Passengers (2)	5,730

Notes:
(1) Counts provided by airlines.
(2) Estimated by multiplying passenger counts by the inverse of the probability of selecting a sampled flight.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.3

Air Travel Party Size

	Average Weekly Enplaned Passengers	
Party Size	**Respondents (1)**	**Percent (2)**
1	2,857	49.9%
2	2,012	35.1%
3	373	6.5%
4+	488	8.5%
Total	5,730	100.0%
Average Party Size	1.4	

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Resident/Visitor Status

Nearly 58 percent of departing passengers were residents of the Roanoke area, while about 42 percent were from out of town, as shown in **Table 3.4**.

Trip Purpose

Passengers were asked to identify the purpose of their air trip from the following choices:

- Business
- Vacation/Pleasure
- Visit Friends and Family
- Convention/Conference
- Personal
- Travel to/from School

About half of passengers were traveling on business (including conference/ convention) (See **Table 3.5**.) Most non-business trips were for vacation/pleasure or to visit friends and family.

Destination Region

Table 3.6 and Figure 3-2 display the destination region of originating passengers. Approximately 29 percent of the Airport's originating passengers were bound for cities in the South of the United States. Twenty-four percent were destined to the Midwest, and 18 percent were headed to other states in the West. Approximately seven percent of locally originating passengers were departing from ROA for an international destination.

Trip Duration

Approximately 30 percent of passengers were away on their trip for two nights or less (See **Table 3.7**). Nearly 18 percent had trip durations of more than seven nights. Excluding trips of 100 nights or more, the average trip duration was approximately 4.5 nights.

Start of Ground Trip Location

Nearly 70 percent of locally originating passengers began their ground trip to the Airport from a private residence; about 26 percent started from a hotel or motel; five percent came from a place of business (See **Table 3.8**).

Geographic Distribution of Originations

Table 3.9 shows the county and state of origin for passengers who began their air travel at ROA. The distribution of originations is shown as a dot map in **Figure 3-3**. Approximately 52 percent of the Airport's passengers originated within the Roanoke metropolitan statistical area made up of the counties of Botetourt, Craig, Franklin, and Roanoke, as well as the cities of Salem and Roanoke. Other counties/ cities in Virginia generate nearly 45 percent of the Airport's originations. Montgomery County (the home of Virginia Tech) generated 18 percent of the Airport's originations. About three percent of originations came from North Carolina and West Virginia.

Mode of Access to Airport

Table 3.10 displays the mode of transportation by which originating

Table 3.4

Resident/Visitor Status

Status	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
Resident	3,304	57.7%
Visitor	2,426	42.3%
Total	5,730	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Total may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.5

Trip Purpose

Purpose	Average Weekly Enplaned Passengers Respondents (1)	Percent (2)
Business-related Travel		
Business	2,668	46.6%
Convention/Conference	327	5.7%
Subtotal	2,995	52.3%
Personal-related Travel		
Vacation/Pleasure	1,193	20.8%
Visit Friends/Family	1,051	18.3%
Personal	323	5.6%
Travel To/From School	168	2.9%
Subtotal	2,735	47.7%
Total	5,730	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

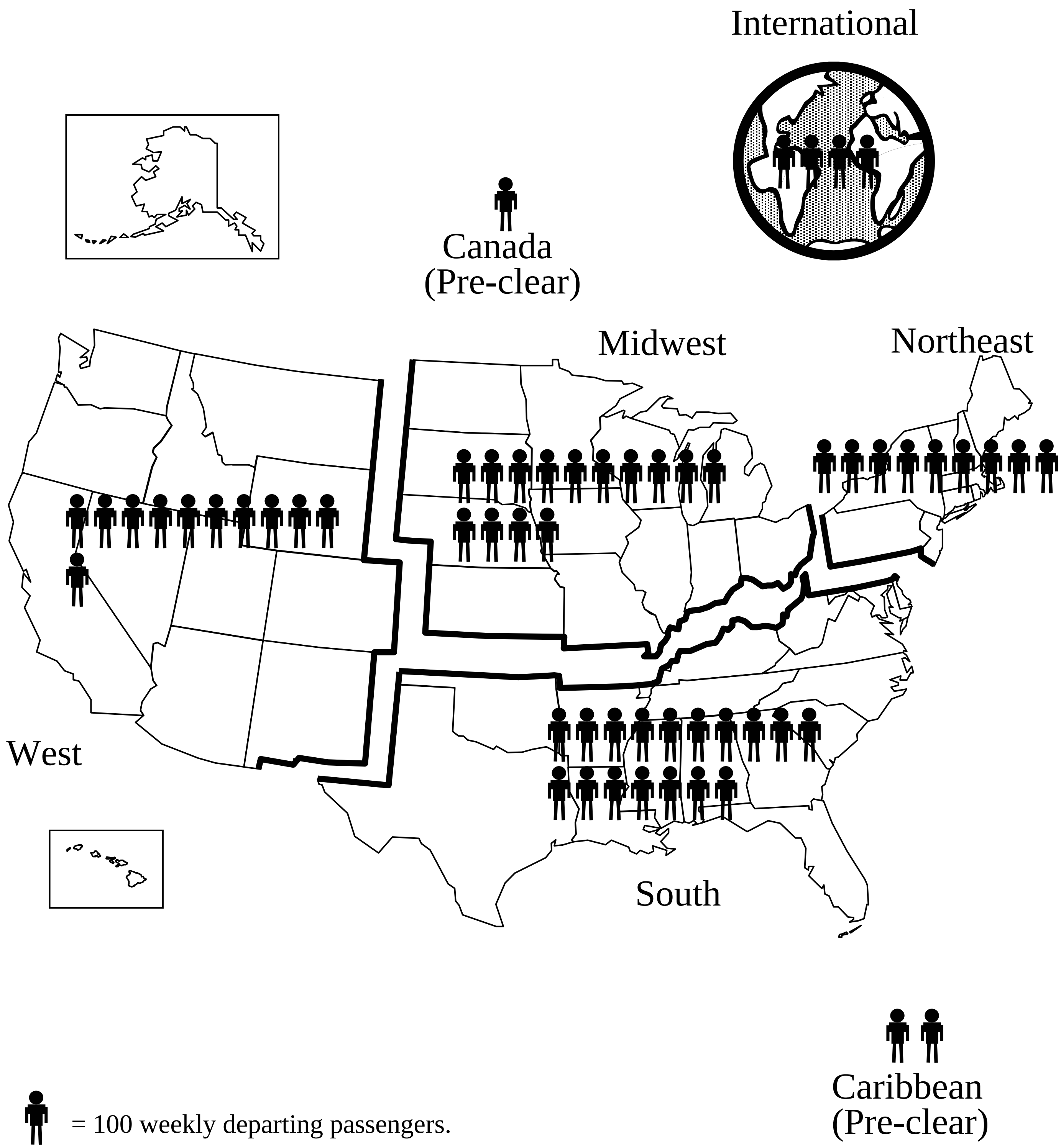
Table 3.6

Destination Region

Region (3)		Average Weekly Enplaned Passengers	
		Respondents (1)	Percent (2)
South (4)	AL, AR, DE, FL, GA, KY, LA, MD, MS, NC, OK, PR, SC, TN, TX, VA, WV	1,671	30.8%
Midwest	IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI	1,374	25.4%
West	AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, WY	1,066	19.7%
Northeast	CT, MA, ME, NH, NJ, NY, PA, RI, VT	924	17.1%
International	China, Costa Rica, Dominican Repulic, France, Israel, Italy, Japan, Korea, Mexico, Netherlands, Singapore, United Arab Emirates	384	7.1%
Precleared	Aruba, Bahamas, Bermuda, Canada, Jamaica, St. Lucia, St. Martin	311	5.7%
Total		5,419	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.
(3) Regions as defined by the U.S. Census Bureau.
(4) Southern states plus Puerto Rico.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.



ROANOKE REGIONAL AIRPORT

Destination Region

Source: HNTB analysis.

FIGURE 3-2

Table 3.7

Trip Duration

Trip Duration	Average Weekly Enplaned Passengers Respondents (1)	Percent (2)
0 (return same day)	189	3.3%
1	564	9.8%
2	1,041	18.2%
3	1,183	20.6%
4	908	15.8%
5	466	8.1%
6	350	6.1%
7-13	790	13.8%
14-20	138	2.4%
21+	101	1.8%
Total	5,730	100%
Average Trip Duration	4.5 nights	

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Total may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.8

Start of Ground Trip Location

Location	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
Resident's Home	3,163	55.2%
Someone Else's Home	786	13.7%
Place of Business	286	5.0%
Hotel/Motel	1,495	26.1%
Total	5,730	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

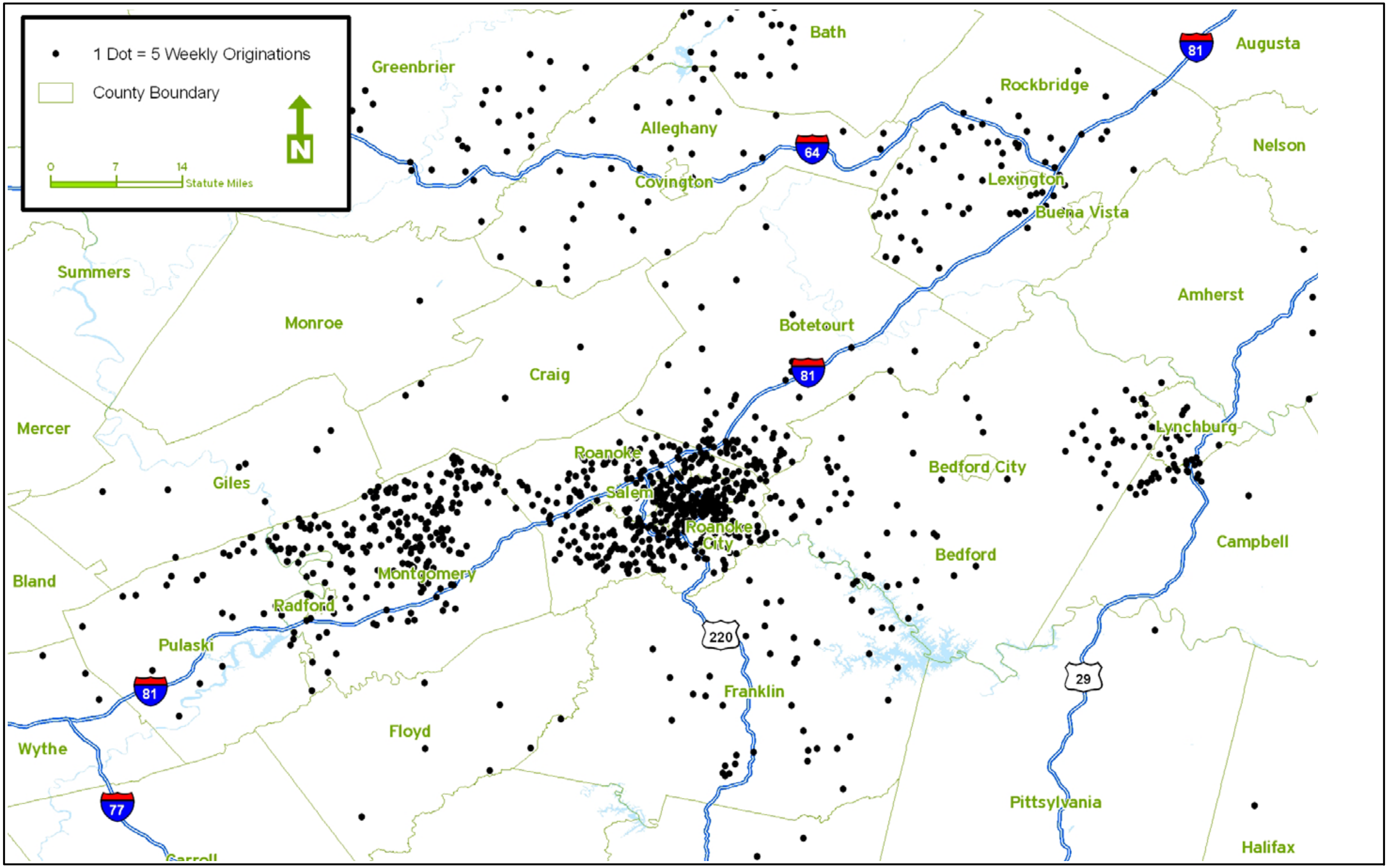
Table 3.9

Geographic Origin of Ground Trip to Roanoke Regional Airport

Area	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
Roanoke Metro Area (3)		
Botetourt County	521	9.1%
Craig County	22	0.4%
Franklin County	180	3.1%
Roanoke City	616	10.8%
Roanoke County	1,210	21.1%
Salem City	432	7.5%
Subtotal Roanoke Metro Area	2,981	52.0%
Other Virginia Counties/Cities		
Amherst County	15	0.3%
Bath County	125	2.2%
Bedford County	261	4.6%
Bedford City	40	0.7%
Buena Vista City	7	0.1%
Campbell County	199	3.5%
Clifton Forge City	27	0.5%
Covington City	136	2.4%
Danville City	8	0.1%
Floyd County	174	3.0%
Giles County	52	0.9%
Grayson County	12	0.2%
Halifax County	7	0.1%
Harrisonburg City	6	0.1%
Henry County	12	0.2%
Lexington City	295	5.1%
Lynchburg City	5	0.1%
Martinsville City	16	0.3%
Montgomery County	1,031	18.0%
Nelson County	7	0.1%
Pittsylvania County	5	0.1%
Pulaski County	30	0.5%
Rockbridge County	28	0.5%
Russell County	6	0.1%
Tazewell County	12	0.2%
Washington County	17	0.3%
Waynesboro City	6	0.1%
Wythe County	35	0.6%
Subtotal Other VA Counties/Cities	2,574	44.9%
Other States		
North Carolina	6	0.1%
West Virginia	169	2.9%
Subtotal Other States	175	3.1%
Total	5,730	100.0%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.
(3) Metropolitan statistical areas and metropolitan divisions defined by the Office of Management and Budget, December 2003.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.



ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

Geographic Distribution of Passenger Originations

FIGURE 3-3

Table 3.10

Mode of Access

Mode of Access	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
Personal/Company Car	3,964	69.2%
Rental Car	1,288	22.5%
Taxi	195	3.4%
Hotel Courtesy Vehicle	162	2.8%
Limousine/Executive Sedan	90	1.6%
SmartWay Bus (Public Transit)	10	0.2%
Other (3)	21	0.4%
Total	5,730	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.
(3) Others include transportation service, private aircraft.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

passengers traveled to the Airport. Nearly seven in 10 passengers came by a private vehicle (either their car, a friend or relative's car, or a company car). An additional 22 percent arrived by rental car. Over three percent came by taxi. Slightly less than three percent took a hotel/motel courtesy vehicle.

Air Passengers Per Vehicle

Table 3.11 shows the number of air passengers per private auto and rental car. The majority of passengers (54 percent) that came by private auto came in a car that carried only one air passenger to the Airport. On average, rental cars carried a slightly higher number of air passengers per car (1.9) than did private vehicles (1.8).

Auto/Rental Car Drop-off or Parked

Among those passengers arriving at the Airport by private auto, 37 percent reported that they were dropped off at the curb with the car leaving the Airport (**Table 3.12**). An additional 19 percent of passengers were dropped-off at the curb by a vehicle that then went to a parking lot. Nearly half (45 percent) were in a private vehicle that went directly to parking.

About 40 percent of rental car passengers were dropped off at the curb before the car was returned.

Auto Parking Location and Duration

Among passengers that came in a private vehicle that was parked, 29 percent said the vehicle was parked in the Short Term Lot. Approximately 71 percent of air passengers arriving by auto said their vehicle was parked in the Long Term Lot (**Table 3.13**).

Table 3.14 shows lot usage by parking duration. Of the passengers using the Short Term (Hourly) Lot, nearly one in four passengers reported their vehicle was parked for at least 24 hours (**Figure 3-4**), suggesting that the price differential between the two lots may not be sufficient.

Nearly all passengers (97 percent) reporting use of the Long Term Lot parked their car there for the duration of the trip; the remaining three percent had the vehicles in which they traveled to the Airport parked for less than the duration of the trip.

Time of Arrival at the Terminal

Passengers were asked to note the time they entered the terminal. It should be noted that passengers arriving late for a flight were less likely to complete a questionnaire; therefore, there is likely a slight bias in the responses presented. Less than 10 percent of passengers entered the terminal earlier than two hours before their scheduled departure time (**Table 3.15**). At large international airports, about one-third of passengers enter the terminal two hours prior to their scheduled departure time. About half of departing passengers at ROA entered the terminal within 70 minutes of their scheduled departure time, as shown in **Figure 3-5**. The average time allowed was one hour and 17 minutes.

Well-Wishers/Meeter-Greeters Entering Terminal

About 14 percent of passengers entered the terminal with a well-wisher (i.e., someone seeing the travel party off). The average number of well-wishers per passenger was 0.2 (See **Table 3.16**). Of

Table 3.11

Number of Passengers per Private Auto or Rental Car

	Average Weekly Enplaned Passengers			
Air Pax	**Respondents per Private Auto (1)**	**Percent (2)**	**Respondents per Rental Car (1)**	**Percent (2)**
1 Passenger	2,127	53.6%	421	32.7%
2 Passengers	1,320	33.3%	667	51.8%
3 Passengers	193	4.9%	167	13.0%
4 Passengers	168	4.2%	6	0.5%
5+ Passengers	157	4.0%	26	2.0%
Total	3,965	100%	1,287	100%
Avg. Passengers per Vehicle:	1.8		1.9	

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.12

Passengers Arriving by Private Auto or Rental Car - Dropped Off or Parked

	Average Weekly Enplaned Passengers			
	Private Auto		Rental Car	
Car Driven	**Respondents (1)**	**Percent (2)**	**Respondents (1)**	**Percent (2)**
To the Curb, Then Off-Airport	1,468	37.0%	0	0.0%
To the Curb, Then to a Parking Facility or Rental Car Return	732	18.5%	512	39.8%
Dircectly to a Parking Facility or Rental Car Return	1,764	44.5%	776	60.2%
Total	3,964	100%	1,288	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.13

Parking Lot Used

Parking Lot Used	Average Weekly Enplaned Passengers Respondents (1)	Percent (2)
Short Term (Hourly)	720	28.9%
Long Term	1,775	71.1%
Total	2,495	100%

Notes:

(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.

(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.14

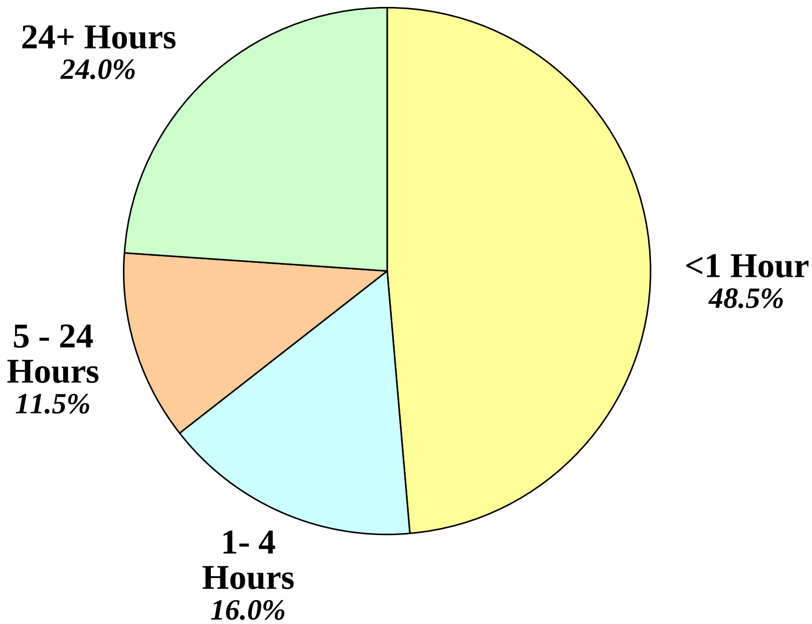
Parking Duration by Lot

	Short Term (Hourly)		Long Term		Total	
Parking Duration	**Respondents (1)**	**Percent (2)**	**Respondents (1)**	**Percent (2)**	**Respondents (1)**	**Percent (2)**
Less than 1 Hour	349	48.5%	18	1.0%	367	14.7%
1 - 4 Hours	115	16.0%	10	0.6%	125	5.0%
5 - 24 Hours	83	11.5%	20	1.1%	103	4.1%
More than 24 Hours	173	24.0%	1,726	97.3%	1,899	76.1%
Total	720	100%	1,774	100%	2,494	100%

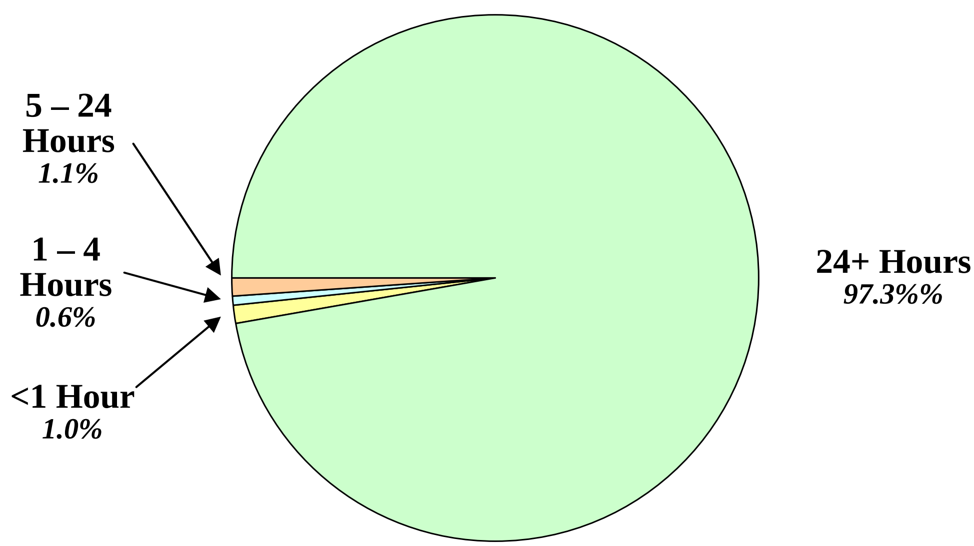
Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Short Term



Long Term



Note: Totals may not add due to rounding.

ROANOKE REGIONAL AIRPORT

Parking Duration

FIGURE 3-4

Source: HNTB analysis.

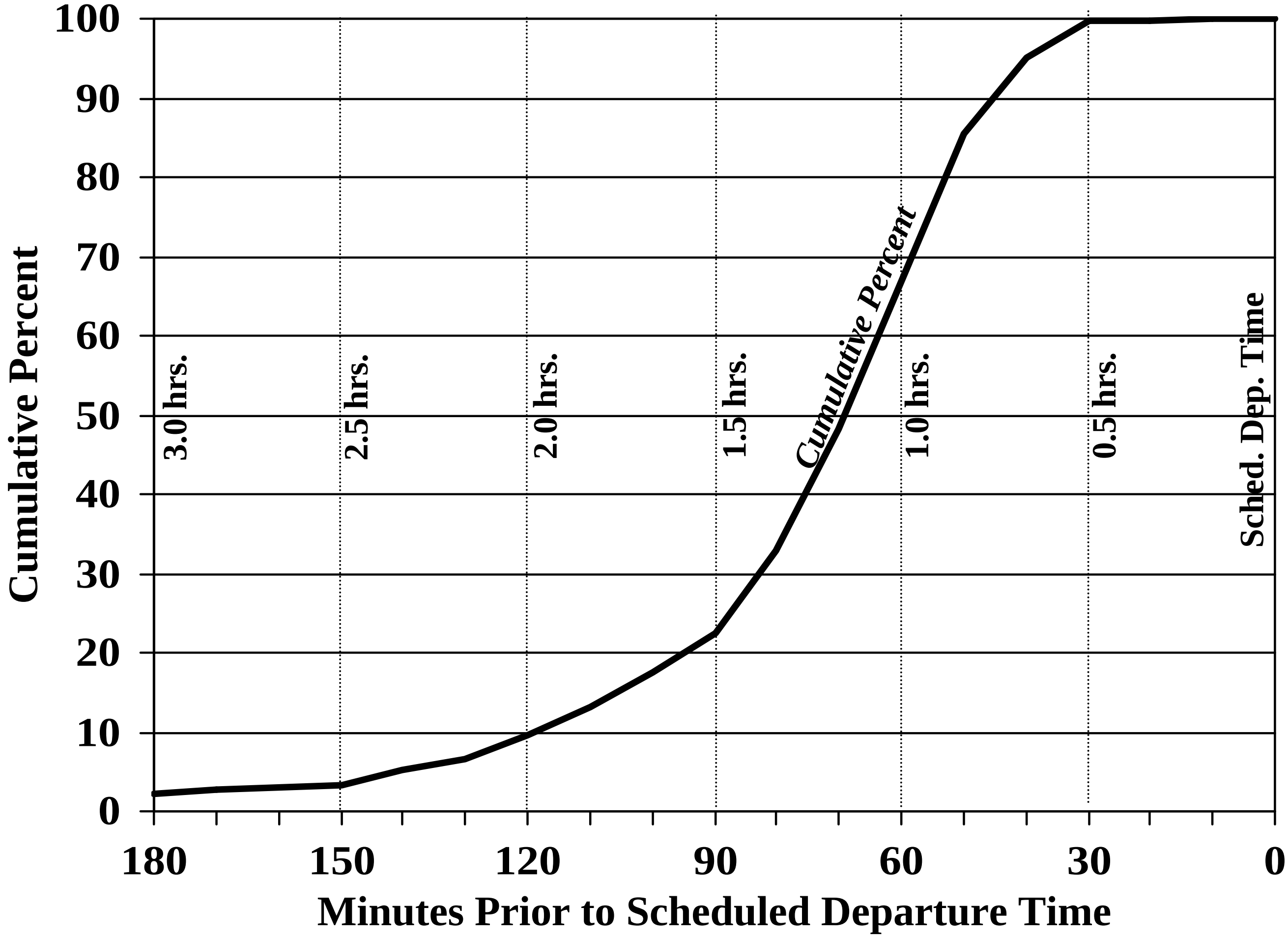
Table 3.15

Time of Arrival at the Terminal

Time Prior to Schedule Departure	Average Weekly Enplaned Passengers Respondents (1)	Percent (2)
More than 3 Hours	129	2.3%
3 Hours - 2.5 Hours	67	1.2%
2.5 Hours - 2 Hours	358	6.2%
2 Hours - 1.5 Hours	744	13.0%
1.5 Hours - 1 Hour	2,530	44.2%
60-30 Minutes	1,798	31.4%
Less Than 30 Minutes	104	1.8%
Total	5,730	100%
Average Arrival Time Prior to Departure (hh:mm)		1:17

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.



Note: Totals may not add due to rounding.

ROANOKE REGIONAL AIRPORT

Time of Arrival at the Terminal

FIGURE 3-5

Source: HNTB analysis.

Table 3.16

Number of Well-Wishers Entering the Terminal

Number of Well-Wishers	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
0 (no well wishers entered the terminal)	4,951	86.4%
1	488	8.5%
2	217	3.8%
3+	74	1.3%
Total	5,730	100%
Average Well-Wishers per Passenger		0.2

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

those passengers accompanied by a well-wisher, 57 percent left their well-wisher at security, as shown in **Table 3.17**. About 29 percent parted at the ticket counter. Nearly 15 percent were accompanied all the way to the gate. (TSA allows well-wishers and meeter/greeters to enter the secure area to accompany minors or other passengers needing special assistance.)

As indicated in **Table 3.18**, about one-third of passengers were met (or planned to be met) by someone (i.e., a meeter-greeter) upon their arrival at ROA. The average number of meeter-greeters per passenger was 0.2.

Amount of Checked and Carry-on Bags per Passenger

Table 3.19 shows each passenger had an average of 1.3 carry-on bags and 1.0 checked bags. These values are similar to those at other airports.

Passenger and Baggage Check-in Location

Nearly half (49.9 percent) of the passengers used a ticket agent to check in for their flight (**Table 3.20 and Figure 3-6**). About 38 percent of passengers checked in at a self-serve e-ticket kiosk. Over 12 percent reported using Internet check-in.

Most passengers (71 percent) checked their bags with an agent at the ticket counter, versus using an e-ticket kiosk or some other method, as shown in **Table 3.21** and Figure 3-6.

Amenities Used

Of the passengers surveyed, nearly 60 percent used an amenity. The most common amenity used was the newsstand/ giftshop (26 percent), as shown in **Table 3.22**. About 17 percent of passengers reported dining at the Airport restaurant. About 15 percent reported using the snack bar.

Amenities Not Found

Nearly eight percent of passengers reported not finding an amenity they were looking for. Of the passengers who could not find an amenity, nearly half (49 percent) could not find an item related to food/beverage services (See **Table 3.23**). About one in four passengers reported not being able to find a particular service. In some instances, an amenity was available but the passenger could not locate it.

Most Important Reason for Choosing ROA

Nearly 88 percent of passengers indicated they chose ROA because it was the closest (**Table 3.24 and Figure 3-7**). Six percent said they chose ROA because of convenient flight times and 5 percent selected the Airport because it offered the least expensive airfare.

Other Airports Considered

Nearly 57 percent of departing passengers surveyed did not consider using another airport for their trip. Of those passengers who did consider another airport, Greensboro (Piedmont Triad International) was the most frequently

Table 3.17

Well-Wisher Parting Location

Location	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
Ticket Counter	222	28.5%
Security	442	56.7%
Gate	115	14.8%
Total	779	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.18

Number of Meeter-Greeters Entering the Terminal

Number of Meeter/Greeters	Average Weekly Enplaned Passengers Respondents (1)	Percent (2)
0 (no meeter-greeters entered terminal)	3,851	67.2%
1	1,155	20.2%
2	479	8.4%
3	174	3.0%
4+	71	1.2%
Total	5,730	100%
Average Meeter/Greeter	0.2	

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Total may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.19

Average Checked and Carry-On Bags per Passenger

Baggage	Pieces (1)
Average Checked Bags	1.0
Average Carry-On Bags	1.3
Average Total Bags per Passenger	2.3

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

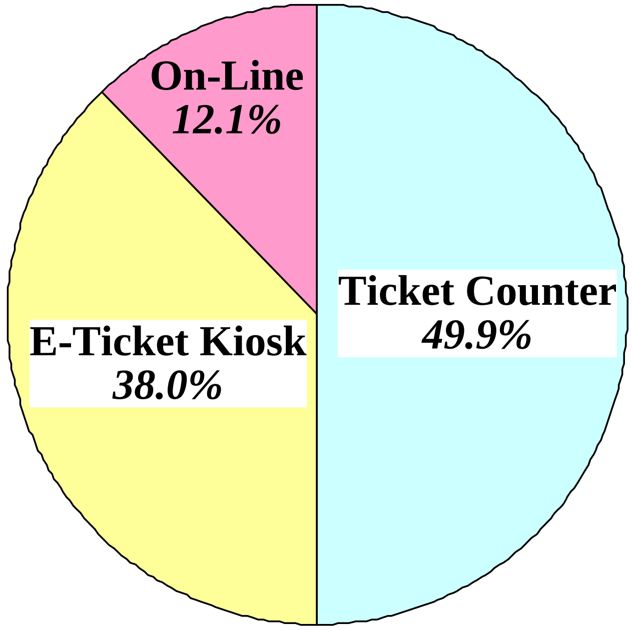
Table 3.20

Passenger Check-in Location

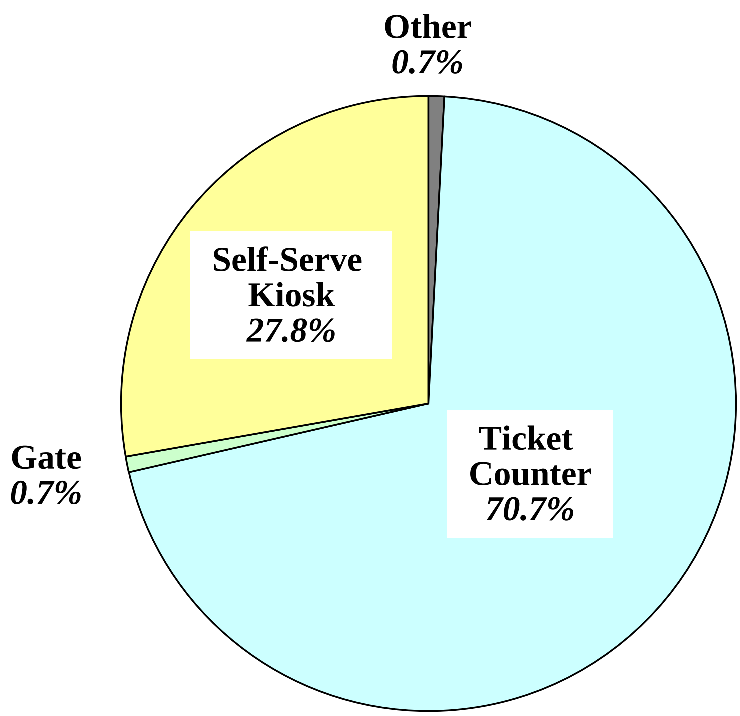
Location	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
On-Line	692	12.1%
Self-Serve Kiosk at Ticket Counter	2,177	38.0%
Agent at Ticket Counter	2,861	49.9%
Total	5,730	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.



Passenger Check-in Location



Baggage Check-in Location

Note: Totals may not add due to rounding.

ROANOKE REGIONAL AIRPORT

Passenger and Baggage Check-in Location

FIGURE 3-6

Source: HNTB analysis.

Table 3.21

Baggage Check-in Location

Location	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
On-Line	29	0.7%
Self-Serve Kiosk at Ticket Counter	1,190	27.8%
Agent at Ticket Counter	3,024	70.7%
Other (3)	32	0.7%
Total	4,275	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.
(3) Includes plane-side and gate.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.22

Amenities Used

Amenity Used	Average Weekly Enplaned Passengers Respondents (1)	Percent (2)
Restaurant (3)	993	17.3%
Bar/Lounge (3)	211	3.7%
Snack Bar (3)	876	15.3%
Vending Machine	92	1.6%
News/Gift Shop	1,508	26.3%
Shoeshine	26	0.5%
ATM	258	4.5%
Other (4)	291	5.1%
Did Not Use an Amenity	2,379	41.5%
Total Passengers	5,730	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.
(3) Some passengers may have classified these facilities differently.
(4) Includes restroom, Wi-Fi, smoking lounge, post box.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

Table 3.23

Amenities Not Found

Amenity not Found	Respondents (1)	Percentage of Passengers Who Could Not Find and Amenity They Were Looking For (2)
News/Gifts		
Better Magazine/Newspaper selection	51	0.9%
Better Gift Selection	11	0.2%
Subtotal News/Gifts	62	1.1%
Services		
Airline Club	11	0.2%
Improved Cell Phone Coverage	10	0.2%
Currency Exchange	5	0.1%
Internet Use Terminal	21	0.4%
Massage	7	0.1%
Post Box	6	0.1%
Rental Car Counters Staffed Longer Hours	7	0.1%
Spa	12	0.2%
TVs in Waiting Areas	6	0.1%
Wi-Fi Services	16	0.3%
Working ATM	18	0.3%
Subtotal Services	119	2.1%
Food/Beverage		
Extended Bar/Lounge Hours	25	0.4%
Fast Food	26	0.5%
Gourmet Coffee	98	1.7%
Healthy Low Calorie Food	6	0.1%
Quality Sit-Down Restaurant	66	1.2%
Subtotal Food/Beverage	221	3.9%
General		
Amenities Beyond Security	51	0.9%
Subtotal General	51	0.9%
Total Passengers	5730	
Total Number of Items That Could Not Be Found	453	
Percent of Passengers Who Could Not Find an Amenity They Were Looking For	7.9%	

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

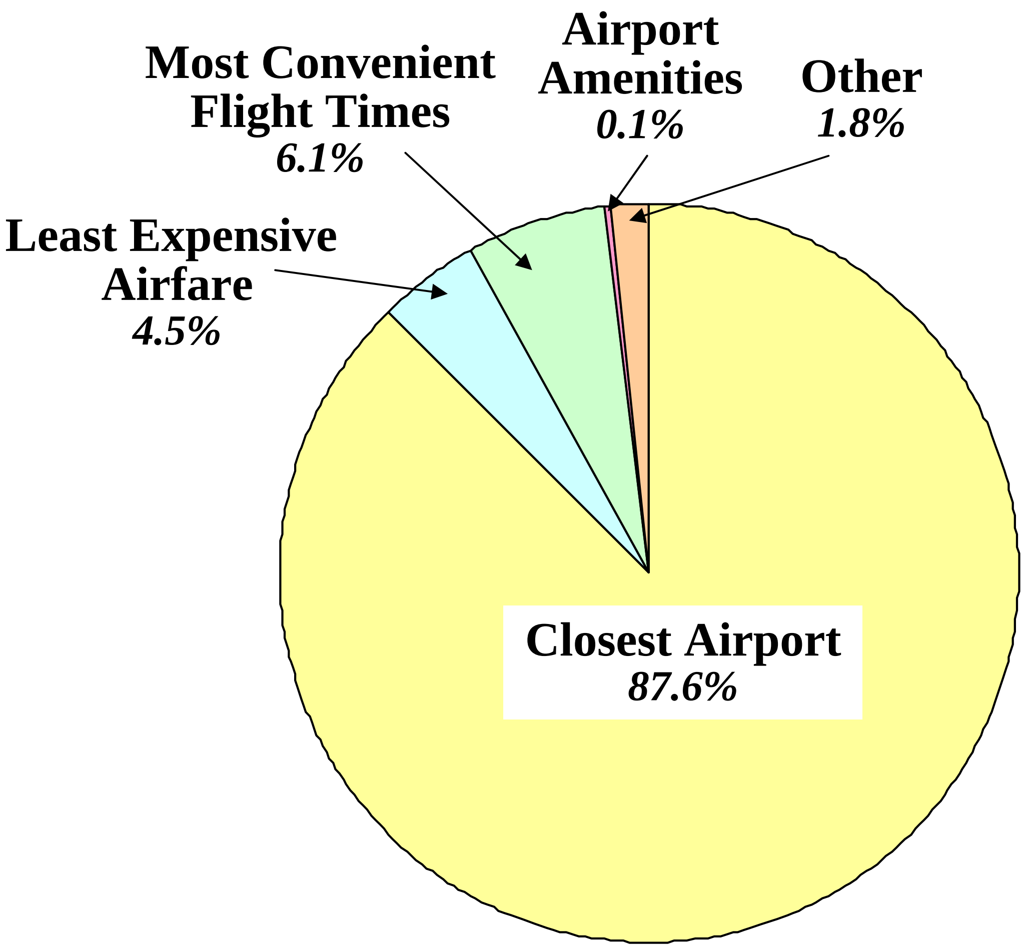
Table 3.24

Most Important Reason for Choosing Roanoke Regional Airport

	Average Weekly Enplaned Passengers	
Reason	**Respondents (1)**	**Percent (2)**
Closest Airport	5,018	87.6%
Most Convenient Flight Times	347	6.1%
Least Expensive Airfare	256	4.5%
Airport Amenities	5	0.1%
Other (3)	104	1.8%
Total	5,730	100%

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Total may not add due to rounding.
(3) Other responses include: preferred airport, use frequent flyer miles, NW offered bereavement fares, only available.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.



Note: Totals may not add due to rounding.

ROANOKE REGIONAL AIRPORT

Most Important Reason for Choosing ROA

Source: HNTB analysis.

FIGURE 3-7

listed—about 36 percent, as shown in **Table 3.25 and Figure 3-8**.

Survey Suggestions and Comments

Passengers were given the opportunity to provide general comments on the back of the questionnaire. **Table 3.26** groups pertinent comments by category to identify general trends. As with previous tables, the comments have been weighted to reflect one week of activity. Verbatim comments are presented in **Appendix B**.

In general, for surveys of this nature, the vast majority of passengers do not provide comments unless they had a particularly positive or negative experience (the latter typically generating more comments than the former). Overall, nearly seven percent of passengers provided at least one comment. The comments received reflect the views of those providing comments; while those not providing comments may have similar issues, the comments may not necessarily reflect the views of passengers not providing comments from a statistical standpoint.

Airline Service and Employees

About 45 percent of commentors provided a comment about air service. The most common requests were for cheaper fares. There were additional positive comments related to excellent service from Airport/airline staff.

Airport Facilities/Layout

Approximately 34 percent of commentors provided a comment about the Airport facilities and/or layout. Of the comments provided, two-thirds were positive. An example of a typical comment was "Easy to get around this airport, clean restrooms, very nice, kind service." An example of a negative comment was, "The only thing I don't like about Roanoke Airport facility is having to lug carry-on baggage up and down stairs when boarding and deplaning."

Concessions

Nearly 10 percent of commentors provided a comment about Airport concessions or amenities. Most comments were requests for a high quality restaurant and a larger selection of food choices. An example of a typical comment was, "The restaurant facility was clean, but the food was bland and not up to par with the other airports. Need more variety."

General

Thirty-six percent of commentors provided general comments; most of these comments related a nice experience: "We love this airport. Nice and clean with friendly, helpful people."

3.2 TERMINAL OBSERVATIONS

A series of terminal observations was undertaken to become familiar with how the various elements of the terminal function and to develop airport-specific planning factors for the Master Plan. Most of the observations concentrated on security elements as part of an on-going security study being conducted in conjunction with the Master Plan. The following terminal elements were observed:

Table 3.25

Other Airports Considered

Airport	Average Weekly Enplaned Passengers	
	Respondents (1)	Percent (2)
Did not Consider Other Airport	3,238	56.5%
Greensboro (Piedmont Triad International)	1,256	35.8%
Lynchburg Regional	564	16.1%
Charlotte Douglas International	442	12.6%
Richmond International	273	7.8%
Raleigh/Durham International	268	7.6%
Washington Dulles International	241	6.9%
Washington Reagan National	153	4.4%
Charlottesville-Albemarle	65	1.9%
Greenbrier Valley	58	1.7%
Tri-Cities Regional	41	1.2%
Norfolk International	41	1.2%
Yeager	34	1.0%
Other (3)	73	2.1%
Total Other Airport Listings	3,509	
Total Passengers	5,730	100%

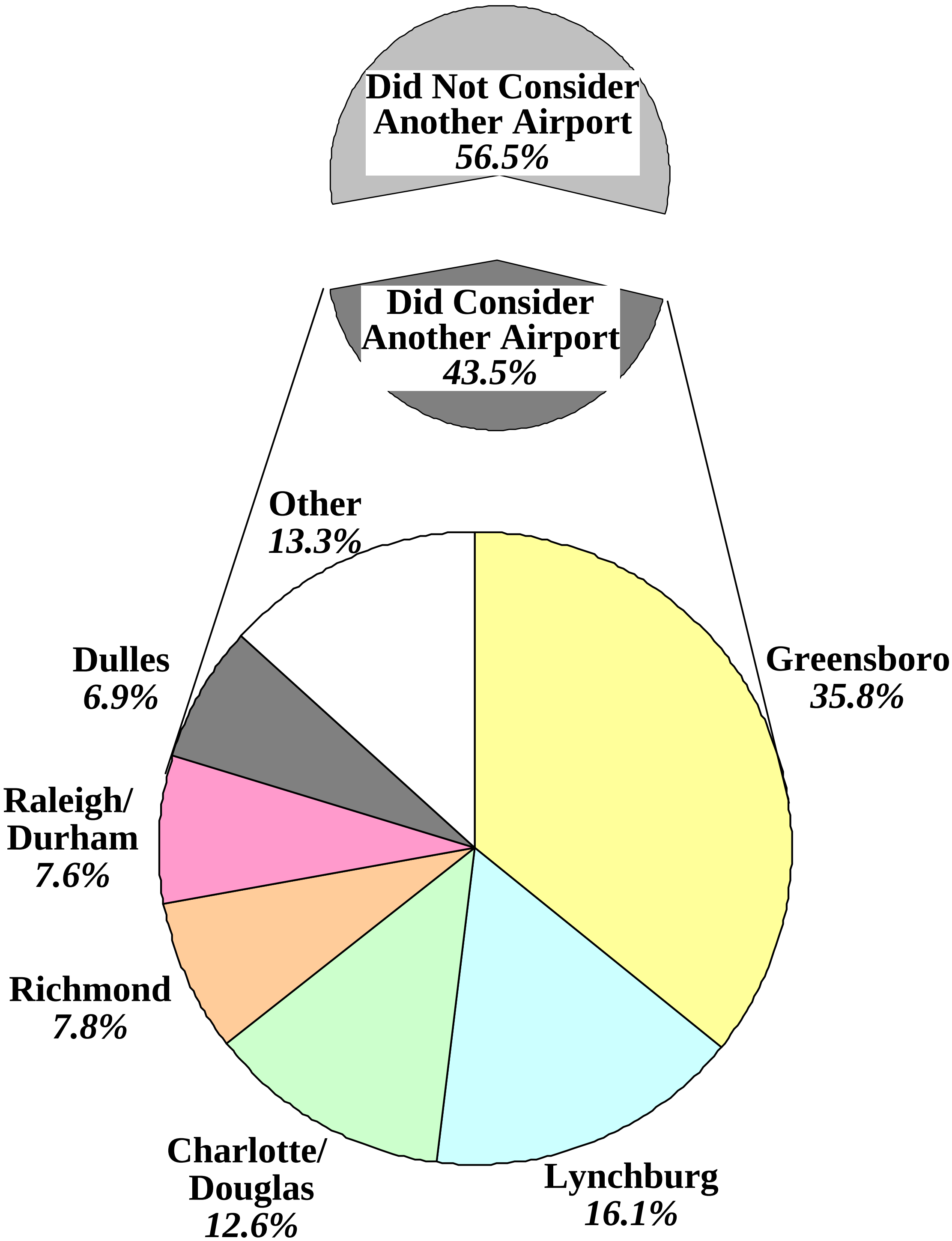
Notes:

(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.

(2) Totals may not add due to rounding.

(3) Includes: Baltimore/Washington International; Cleveland Hopkins International; McGhee Tyson International; Mercer County; Philadelphia International; Raleigh County Memorial; and VA Tech.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.



Note: Totals may not add due to rounding.

ROANOKE REGIONAL AIRPORT

Other Airports Considered

FIGURE 3-8

Source: HNTB analysis.

Table 3.26

Survey of Weighted Passenger Comments

Category	Response Type	Reponses (1)	Percent (2)	Percentage of Passengers Who Provided a Comment
Airline Service and Employees	Favorable	35	21.1%	
	Unfavorable	131	78.9%	
	TOTAL	166	100.0%	44.7%
Airport Facilities/Layout	Favorable	84	67.2%	
	Unfavorable	41	32.8%	
	TOTAL	125	100.0%	33.7%
Concessions	Favorable	0	0.0%	
	Unfavorable	36	100.0%	
	TOTAL	36	100.0%	9.7%
General	Favorable	134	100.0%	
	Unfavorable	0	0.0%	
	TOTAL	134	100.0%	36.1%
Parking	Favorable	0	0.0%	
	Unfavorable	17	100.0%	
	TOTAL	17	100.0%	4.6%
Signage	Favorable	0	0.0%	
	Unfavorable	11	100.0%	
	TOTAL	11	100.0%	3.0%
Total Comments	Favorable	253	51.7%	
	Unfavorable	236	48.3%	
	TOTAL	489	100.0%	
Total Passengers		5,730		
Total Passengers Providing at Least One Comment		371		
Percent Providing Comments		6.5%		

Notes:
(1) Survey results are plus/minus 3 percentage points at a 95 percent confidence interval. Weighted to reflect one week of activity.
(2) Totals may not add due to rounding.

Source: ROA 2005 Departing Passenger Survey; HNTB analysis.

- Terminal curbside
- Airline ticket counters
- Passenger security screening
- Public restrooms
- Baggage claim

The data was gathered from November 8 through November 10, 2005. It is important to note that the data were taken during a limited period of time. Anomalies such as flight cancellations or significant delays could have affected the data. During the week of the surveys, passenger traffic was reported to be lighter than average. Therefore, the results should be used with these factors in mind. A summary of key findings is presented below.

3.2.1 Curbside Observations

Curbside observations were conducted on Thursday, November 10, 2005 between 9 AM and 11 AM and between 3 PM and 7 PM. **Table 3.27** shows observed dwell times for various transportation modes. Taxis had the lowest dwell times, averaging 1.1 minutes for drop-offs. Airport parking shuttles also had fairly low dwell times, averaging 1.6 minutes. Hotel shuttle dwell times averaged 1.6 minutes for drop-off and 3.0 minutes for pick up. **Figure 3-9** compares dwell times at the curb of automobiles dropping off and picking up passengers with industry standards. As shown, private auto drop-off dwell times were measured at slightly more than three minutes, which is higher than the 2.0- to 2.5-minute industry average. Automobile pick up dwell times were significantly longer than industry standards (more than 9 minutes compared to between 3.0 to 4.0 minutes).

3.2.2 Ticket Lobby Observations

Airline ticket counter processing was observed on Tuesday, November 8, 2005.

Four airlines serve ROA: US Airways Express, Delta (through Delta Connection), Northwest Airlink, and United Express.

Overall Peaking Activity

Table 3.28, Figure 3-10 and Figure 3-11 summarize ticket lobby observations. Expressed in terms of the number of passengers checking in for flights, the peak hour occurred early in the morning, between 5:50 AM and 6:49 AM. During this hour, a total of approximately 120 passengers approached airline ticket counters to check in.

US Airways Express

Between 5:30 AM and 6:59 AM, a total of 62 passengers approached the US Airways Express ticket counter. The peak hour at their ticket counter occurred between 6:00 AM and 6:59 AM when a total of 53 passengers arrived for check-in. The peak 10 minutes occurred between 6:00 AM and 6:09 AM when 12 people arrived to check in.

US Airways Express has four ticket agent positions available. The maximum number of positions that were staffed was three. The maximum queue time (i.e., the time standing in line waiting for an available agent at the counter) for coach passengers in the peak hour was less than one minute.

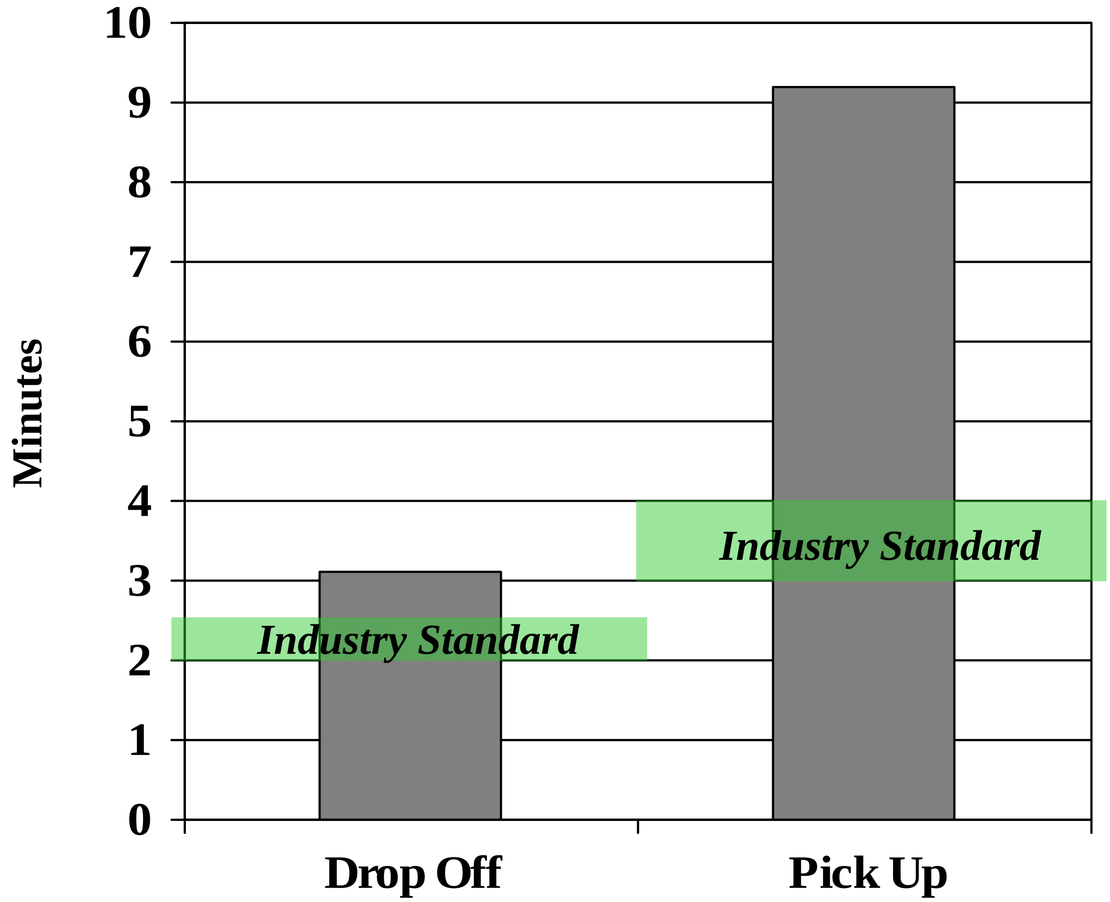
Table 3.27

Curbside Observations

Mode	Drop Off (min:sec)	Pick Up (min:sec)	
Private Auto	3:05	9:11	
Shuttle/Van	4:01	41:37	(1)
Hotel Shuttle	1:42	3:01	
Limousine	(2)	(2)	
Parking Shuttle (PU/DO)	-- 1:36 --		
Taxi	1:05	(2)	

Notes: (1) Includes one van dwelling for more than 50 minutes.
(2) Insufficient traffic to obtain estimate.

Source: ROA 2005 Terminal Observations; HNTB analysis.



ROANOKE REGIONAL AIRPORT

Private Auto Dwell Times at Curb

FIGURE 3-9

Source: HNTB analysis.

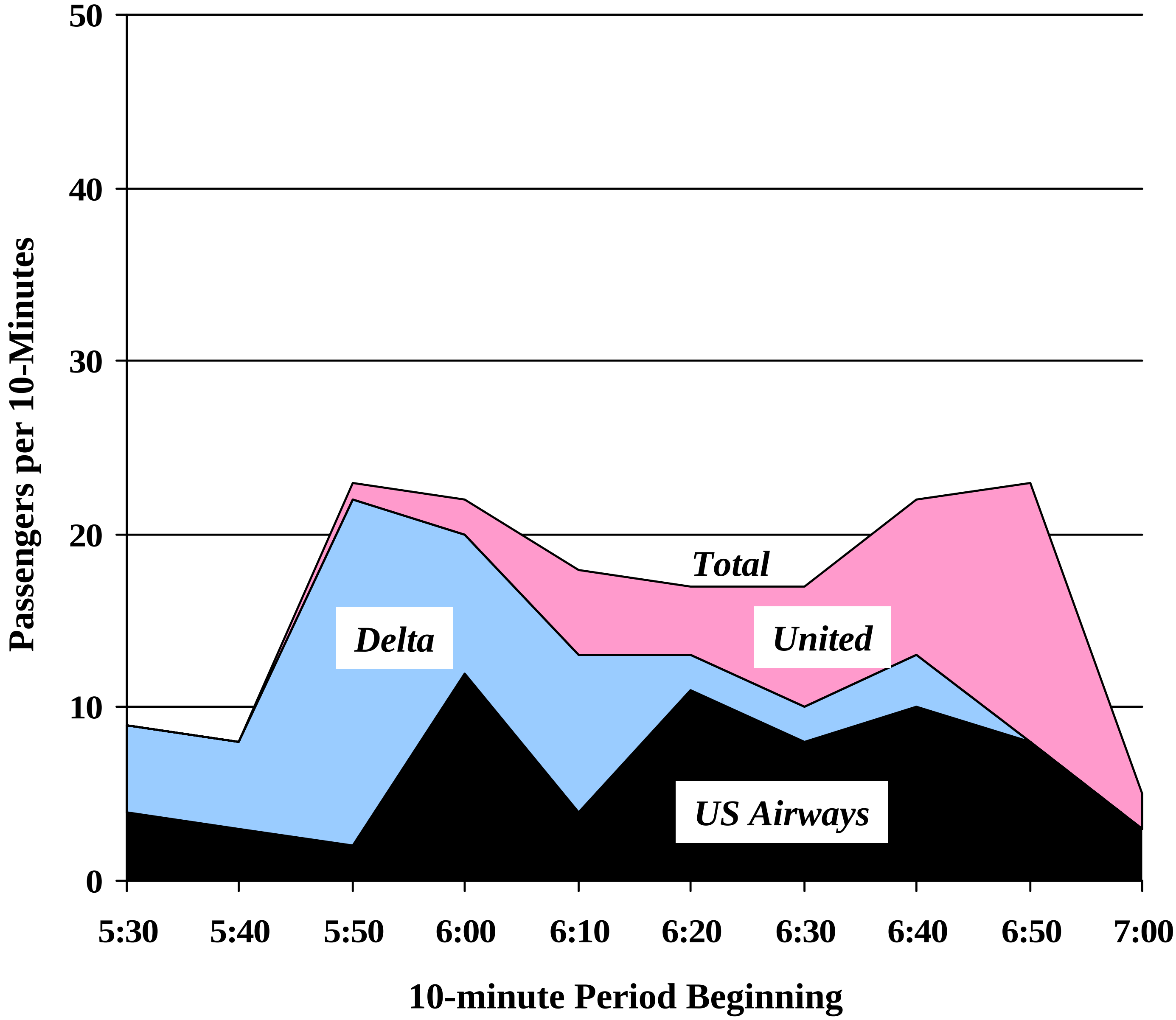
Table 3.28

Ticket Counter Observations

		Demand		Typical Peak Hour Resources				Max. Queue Information		Typical Per-passenger
				Agents		Kiosks				
Airline	Peak Hour	Peak Hour	Peak 10-min.	Positions	Available	Positions	Available	Queue Time (min)	People in Queue	Processing Time (min)
United	0600-0659	42	15	4	2	4	4	1.5	5	2.5
US Airways	0600-0659	53	12	4	3	3	3	<1	1	2.4
Delta	0530-0629	49	20	4	3	0	0	10.2	10	1.8
Northwest	1040-1139	25	8	4	2	4	4	5.3	10	4.1 (1)
Overall (2)	0550-0649	120	23							

Notes: (1) Processing time was affected by numerous passengers being rebooked on other flights.
(2) Totals may not add because overall peaking activity may not occur during same time period as airline peaks.

Source: ROA 2005 Terminal Observations; HNTB analysis.

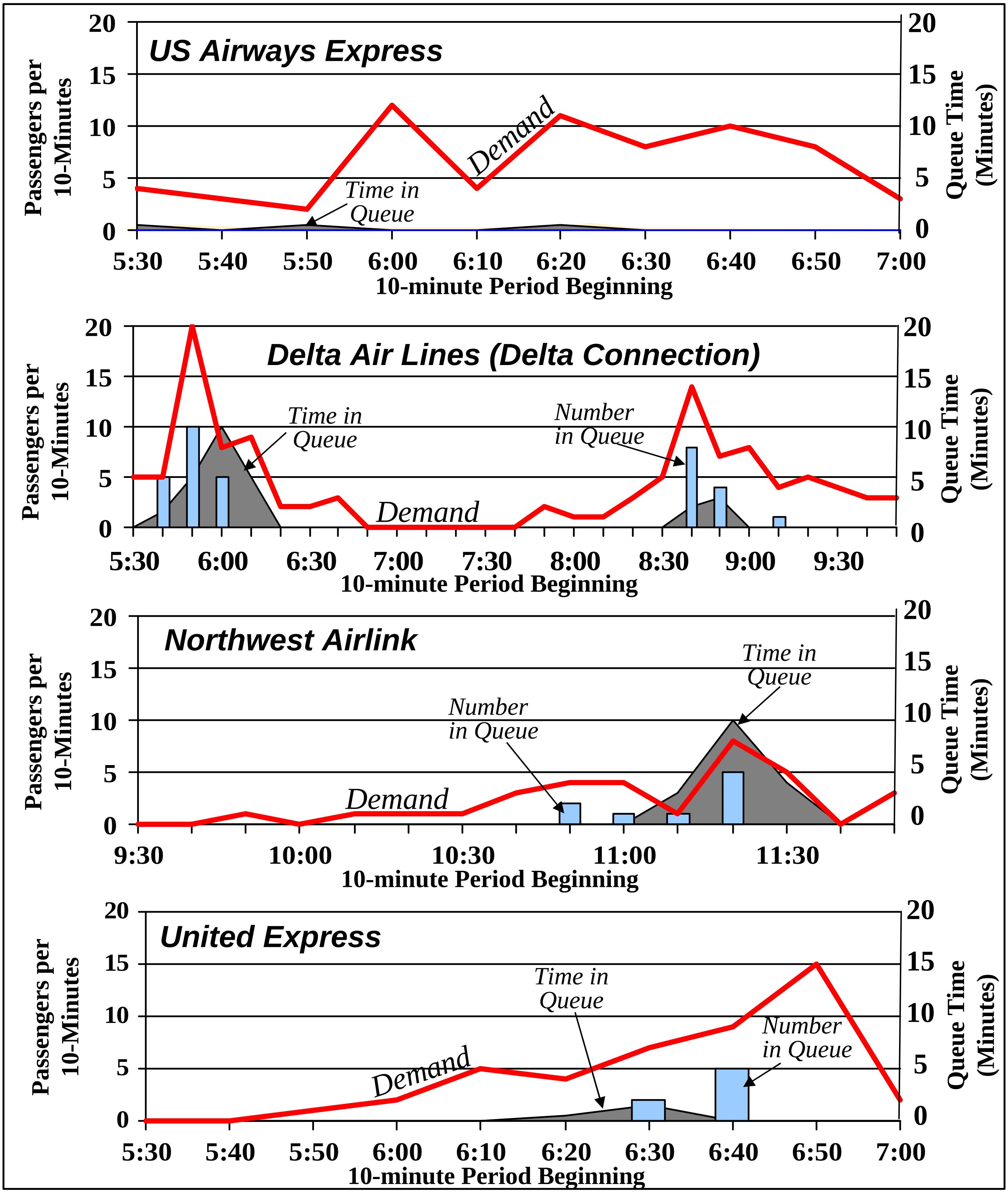


ROANOKE REGIONAL AIRPORT

Ticket Lobby Demand (AM Peak Period)

Source: HNTB analysis.

FIGURE 3-10



ROANOKE REGIONAL AIRPORT

Ticket Counter Observations

FIGURE 3-11

Source: HNTB analysis.

Based on a sample of passenger processing times (i.e., the time a passenger interacts with an agent at the counter), the average per-passenger processing time for US Airways Express was 2.4 minutes.

During the observation period, there never was more than one person in line to check in.

Delta Air Lines (ASA/Comair)

Between 5:30 AM and 6:59 AM, a total of 54 passengers approached the Delta Air Lines ticket counter. The peak hour for Delta occurred between 5:30 AM and 6:29 AM, when a total of 49 passengers approached the ticket counter. The busiest 10-minute period was between 5:50 AM and 5:59 AM when a total of 20 passengers arrived to check in.

Delta has four ticket agent positions available. The maximum number of positions that were staffed was three, which occurred during the early morning peak. The average queue time for passengers in the peak hour was about five minutes, with the maximum queue time at just over 10 minutes. The maximum number of passengers in queue was 10.

Based on a sample of passenger processing times, the average per-passenger processing time for Delta was 1.8 minutes.

United Express

Between 5:30 AM and 6:59 AM, a total of 43 passengers approached the United ticket counter. The peak hour at the United ticket counter occurred between 6:00 AM and 6:59 AM when a total of 42 passengers arrived for check in. The busiest 10-minute period occurred between 6:50 AM and 6:59 AM when a total of 15 passengers arrived to check in.

United has four ticket agent positions, each with a self-serve kiosk. The maximum number of positions that were staffed was two, which occurred during most of the period.

The average peak hour queue time was less than one minute. The maximum number of passengers in queue was five, which occurred at about 6:45 AM.

The average per-passenger processing time for United agents was just over 2.5 minutes.

Northwest Airlink

Between 10:00 AM and 11:59 AM, a total of approximately 31 passengers approached the Northwest ticket counter. The peak hour at Northwest occurred between 10:40 AM and 11:39 AM when a total of 25 passengers arrived for check-in. The busiest 10-minute period occurred between 11:20 AM and 11:29 AM when a total of eight passengers arrived to check in.

Northwest has four ticket agent positions, with one position having a self-serve kiosk. The maximum number of positions that were staffed was two, which occurred throughout the peak.

During the peak, the maximum queue time for passengers was about two minutes. The maximum peak hour queue time recorded was six minutes. During the peak hour, a maximum of 10 passengers in queue was observed.

Based on a sample of passenger processing times, the average per-passenger processing time for Northwest was slightly more than four minutes. This longer processing time was likely due to agents rebooking some passengers on other flights, as the next Northwest departure was delayed by two hours.

3.2.3 Passenger Security Screening

The passenger security checkpoint was observed on Thursday, November 10, 2005 during the morning peak period (5:20 AM to 7:30 AM).

Table 3.29 and Figure 3-12 show demand for the passenger security screening checkpoint. The total number of people processed between the hours of 5:20 AM and 7:30 AM was approximately 180. The peak hour occurred between 6:10 AM and 7:09 AM when 116 passengers reached the checkpoint. The peak 10-minute demand level was about 36 which occurred between 6:10 AM and 6:19 AM. The maximum time in queue was measured at less than two minutes, with the maximum number of people in the security queue reaching 13 people.

The capacity of a security screening checkpoint is determined by the number of resources available (i.e., TSA staff and screening equipment), screening procedures, and the percentage of passengers requiring secondary screening.

Approximately five percent required some form of secondary screening, either re-screening of their person, their bag, of other personal effects (See Table 3.29). This value is slightly lower than the share of passengers requiring secondary screening at a large air carrier hub in the Southeast U.S.

By counting the number of passengers clearing security during a period where demand exceeded capacity (i.e., there was a constant queue of passengers), planners were able to calculate the overall capacity of the security screening checkpoint. Based on these calculations, the capacity is approximately 210 passengers per hour, which is comparable to other airports.

3.2.4 Restroom Observations

There are three sets of public restrooms within the terminal. The first set is located in the concourse. The second set is located on the non-secure side of the upper level of the terminal, adjacent to Commission offices. The last set is located on the first floor of the terminal midway between the ticketing lobby and baggage claim.

The restroom observations consisted of visiting each facility multiple times throughout a peak period of activity in the terminal and documenting the number of occupied fixtures and people in queue. The restroom observations were conducted on Tuesday, November 8, 2005 during the afternoon peak period (3:25 PM to 5:10 PM).

Table 3.30 and Figures 3-13 through 3-15 summarize the results. Based on observation, the greatest utilization of the concourse restrooms occurred immediately

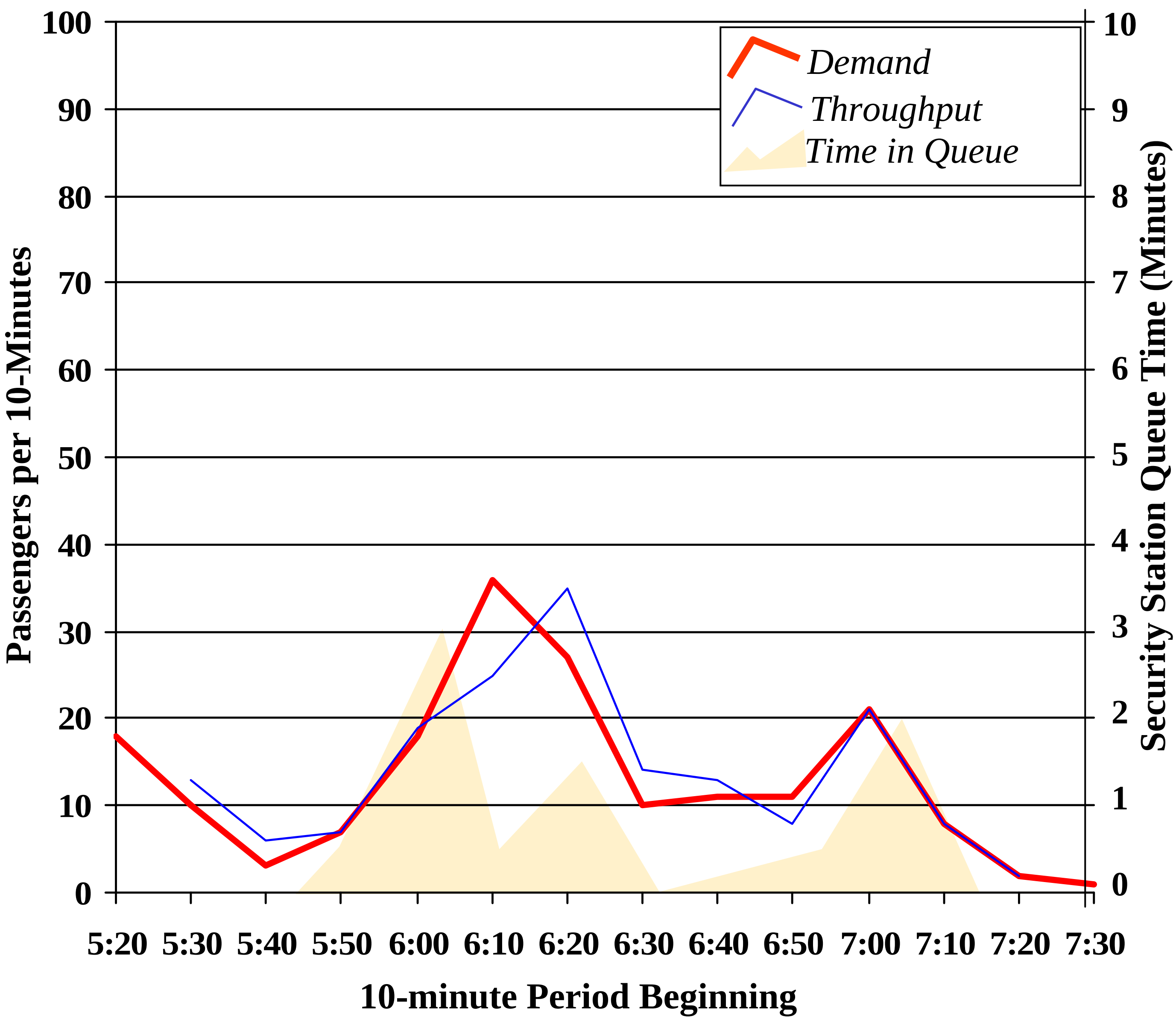
Table 3.29

Security Screening Observations

Peak Hour Demand	116	
Peak Hour Capacity (1)	210	Passengers/Hour
Peak 10-minute Demand	36	
Maximum Queue		
Time	1.8	min.
No. of People	13	
Percent Requiring Secondary (2)	5.3%	

Notes: (1) Estimated by multiplying maximum 10-minute throughput capacity by 6.
(2) Including wanding, bag check, or shoe check.

Source: ROA 2005 Terminal Observations; HNTB analysis.



ROANOKE REGIONAL AIRPORT

Security Checkpoint Observations (AM Peak Period)

Source: HNTB analysis.

FIGURE 3-12

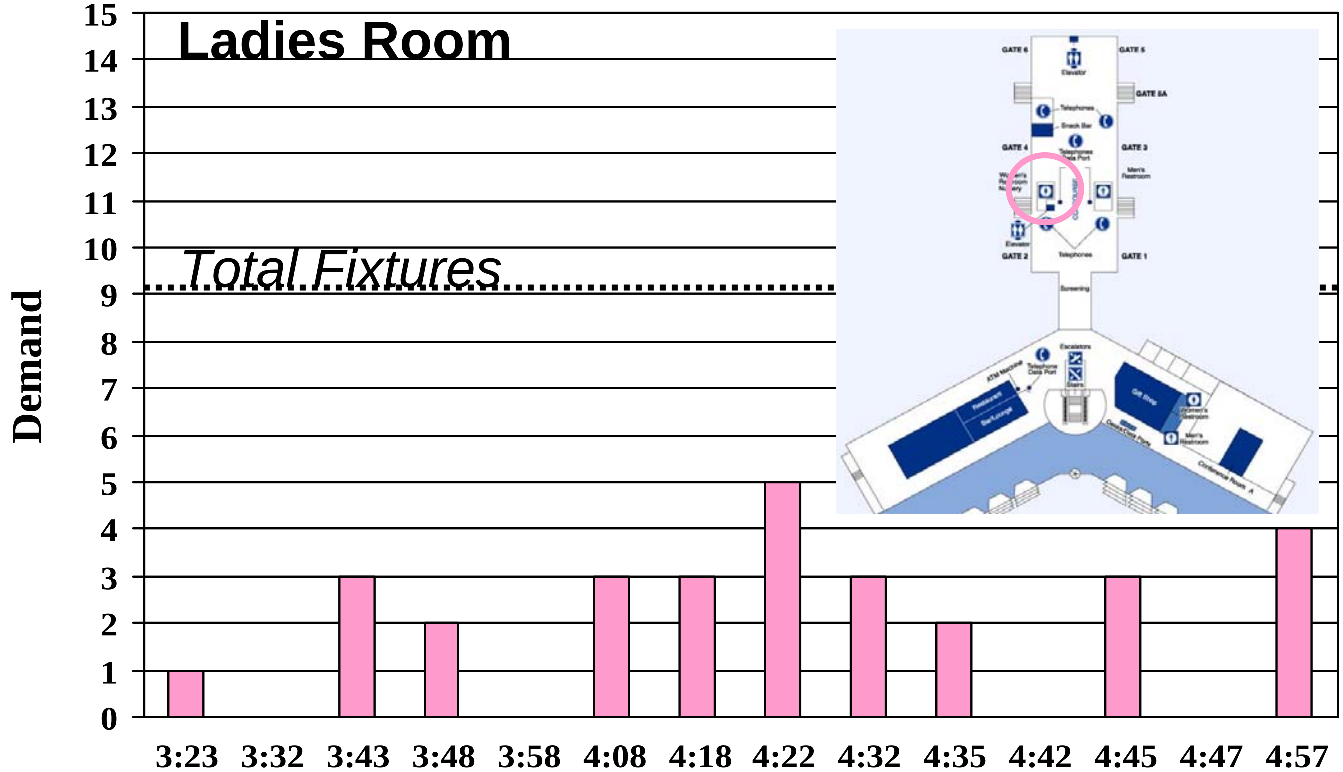
Table 3.30

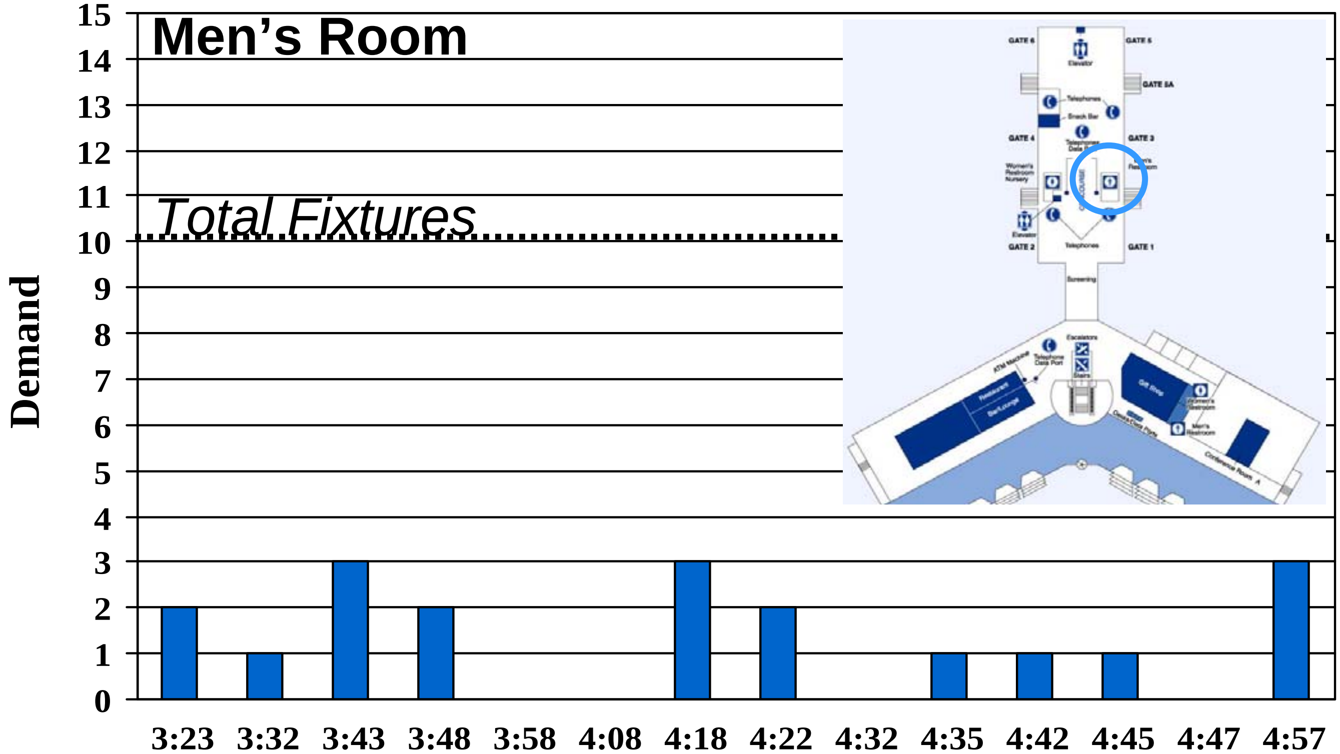
Restroom Observations

Location	Capacity (Fixtures)		Maximum Demand	Surplus/ (Deficit)
Concourse				
Women	9		4	5
Men	10	(1)	3	7
Upper Level				
Women	4		2	2
Men	4	(1)	1	3
Lower Level				
Women	2		3	-1
Men	2	(1)	3	-1

Note: (1) Includes urinals and stalls.

Source: ROA 2005 Terminal Observations; HNTB analysis.





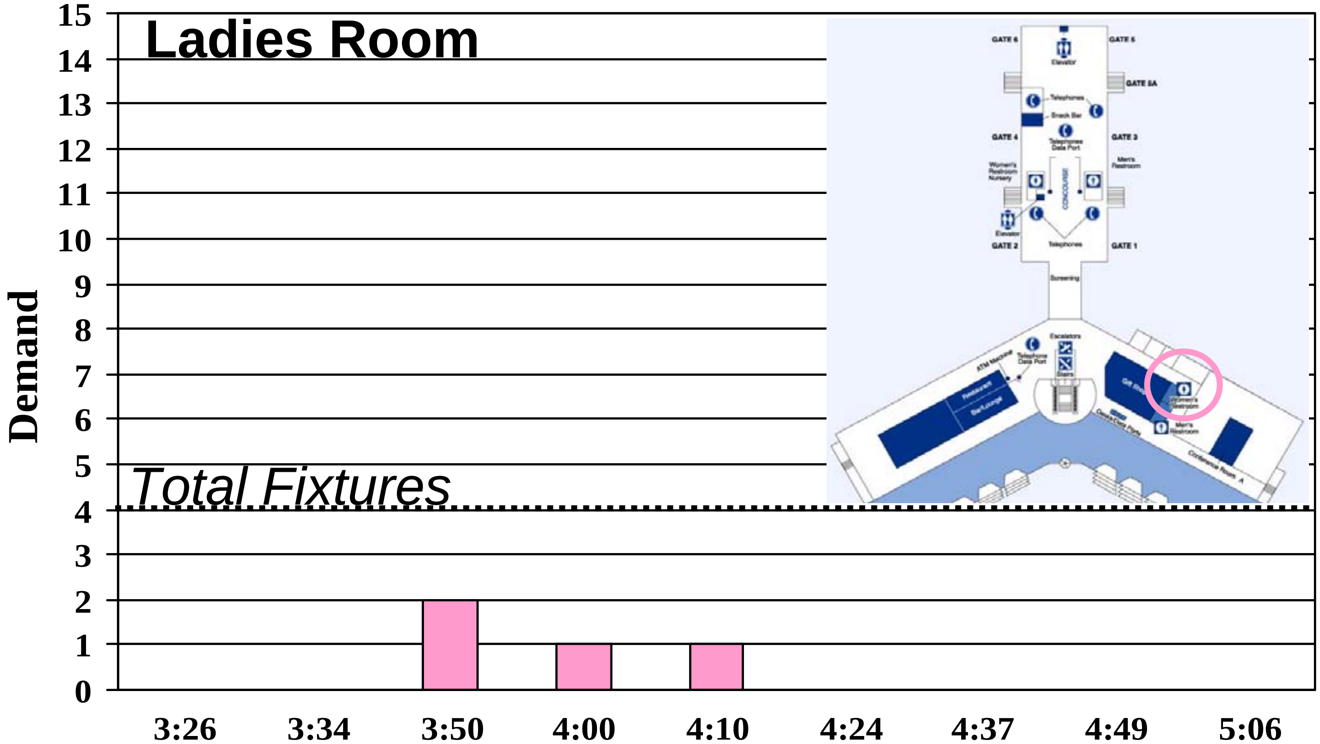
ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

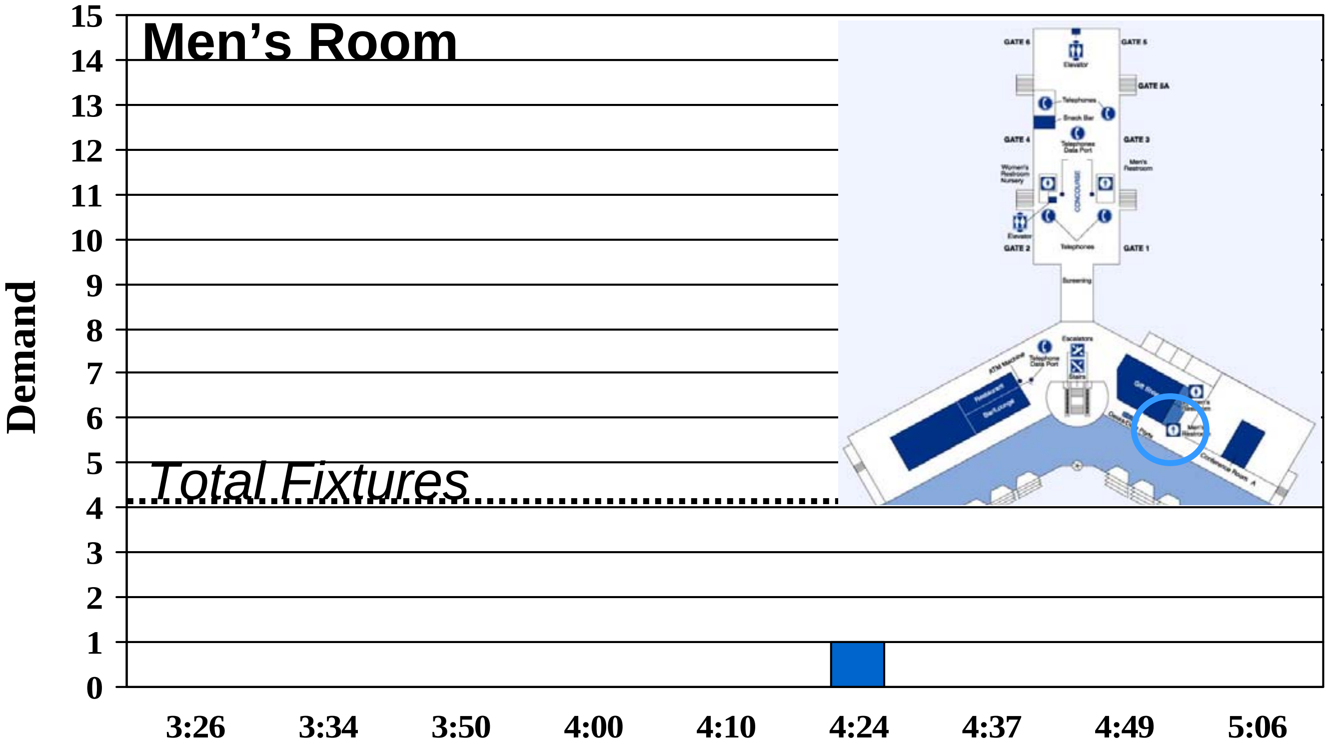
ROANOKE REGIONAL AIRPORT

Restroom Occupancy in Concourse (PM)

FIGURE 3-13

Source: HNTB analysis.



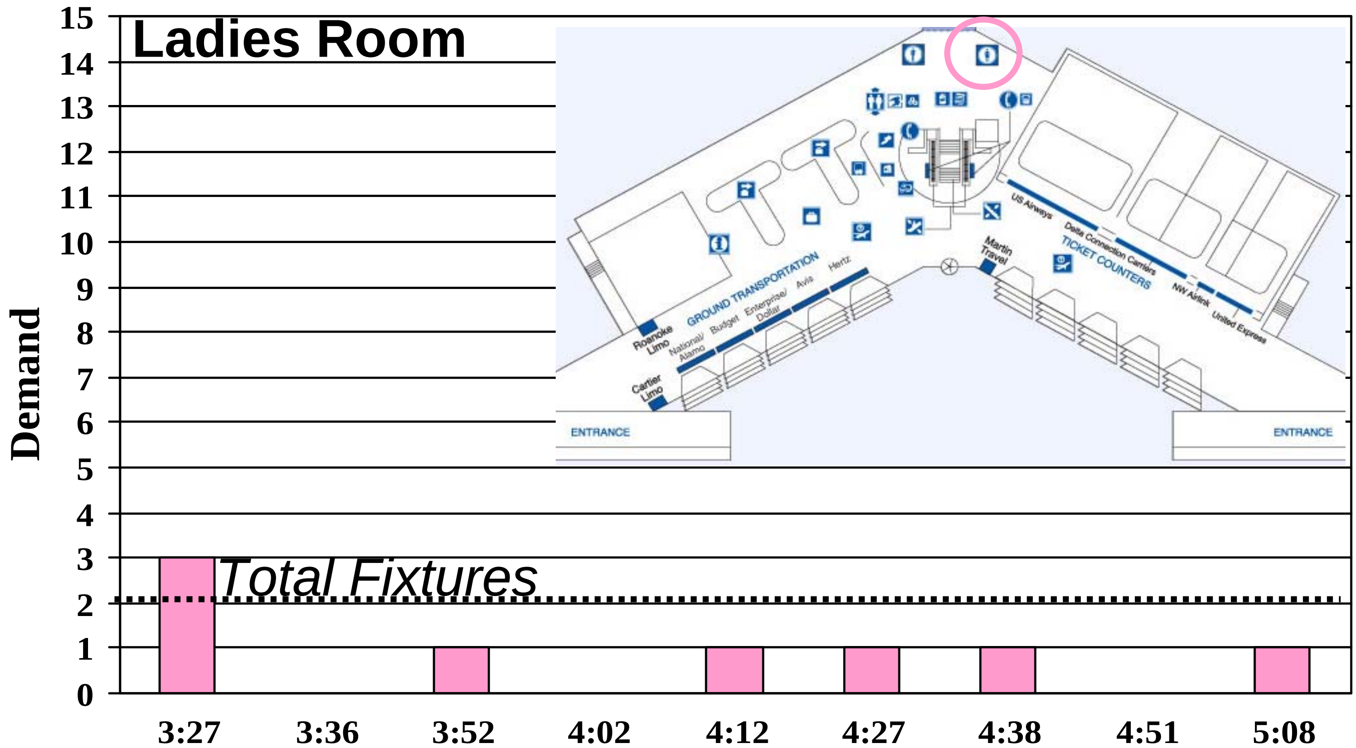


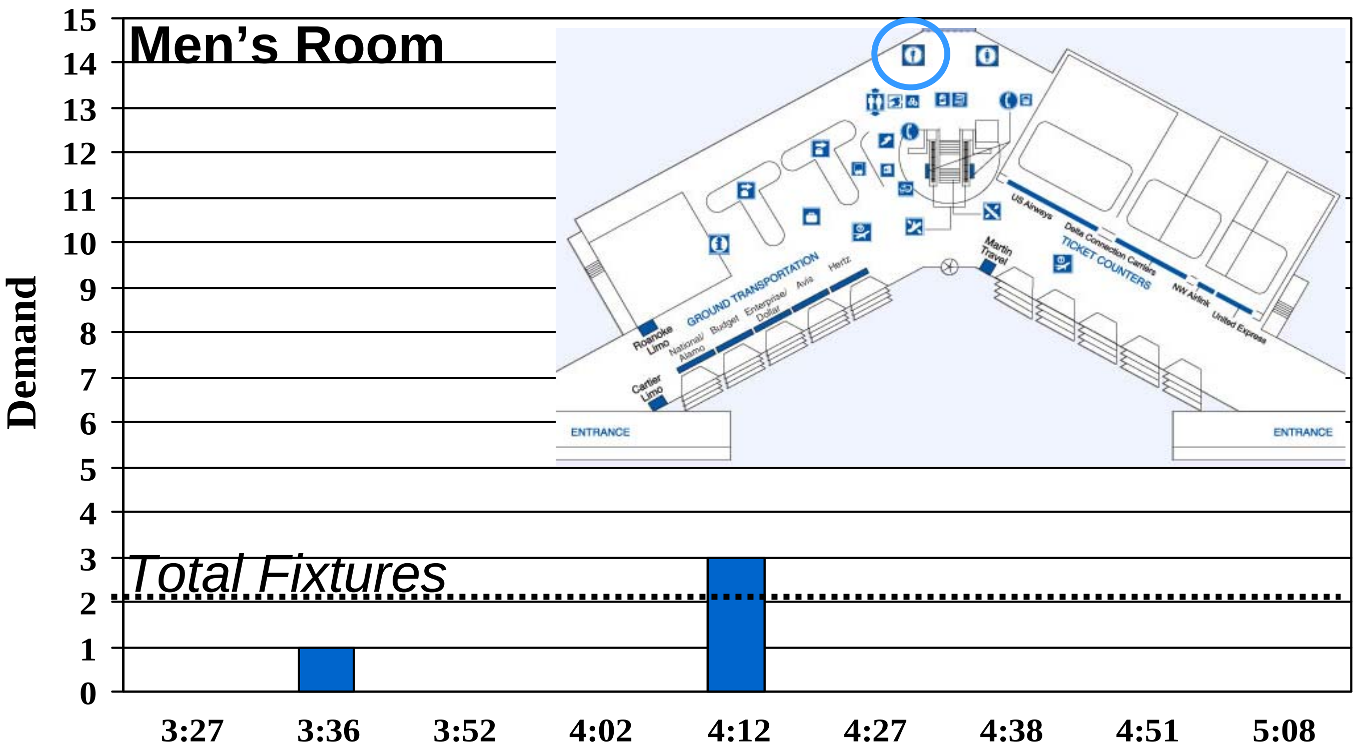
ROANOKE REGIONAL AIRPORT

Restroom Occupancy Upper Level Terminal (PM)

Source: HNTB analysis.

FIGURE 3-14





ROANOKE REGIONAL AIRPORT

Restroom Occupancy Lower Level Terminal (PM)

Source: HNTB analysis.

FIGURE 3-15

upon the arrival of a scheduled flight. This occurred twice during the observation period. At 4:22 PM there were a total of seven people (five women and two men) using the concourse restroom facilities. At 4:57, there were, again, seven people (four women and three men) using the concourse restroom facilities. With a total of 10 fixtures (stalls and urinals) in the men's room and nine fixtures in the women's room, neither experienced a queue.

Of the three sets of public restrooms within the terminal, those located adjacent to the second floor Commission offices were the least utilized. Nine observations were made at this location, and only during four visits were they being used. Both restrooms have a total of four fixtures.

The lower level restrooms have the lowest capacity. The men's room has one stall and one urinal, while the women's room has two stalls. Both these facilities experienced small queues.

3.2.5 Baggage Claim

The public side of the baggage claim area was observed on Tuesday, November 8 from about 3:30 PM until 5:45 PM. Survey personnel counted the number of bags being presented on each carousel and the number of people in the claim area and circulation area every two minutes.

Table 3.31 and Figure 3-16 summarize the observations. During the peak period, both devices were in use.

The general pattern observed began with a few arriving passengers (and frequently, friends and family who came to meet them) entering the bag claim circulation area to wait to see which carousel their bags would be displayed on. It was occasionally observed that passengers would mistakenly queue around the wrong carousel and groups of passengers would have to re-queue around the correct device. In general, passengers arrived at the carousel before their bags. For this reason, the peak number of bags being displayed at any given carousel was relatively low—passengers claimed their bag as soon as it appeared on the carousel.

The maximum number of people waiting to claim bags was 33, which occurred at 4:24 PM next to Carousel 1. The time interval between the first passenger reaching the carousel and the first bags appearing on the carousel was under five minutes.

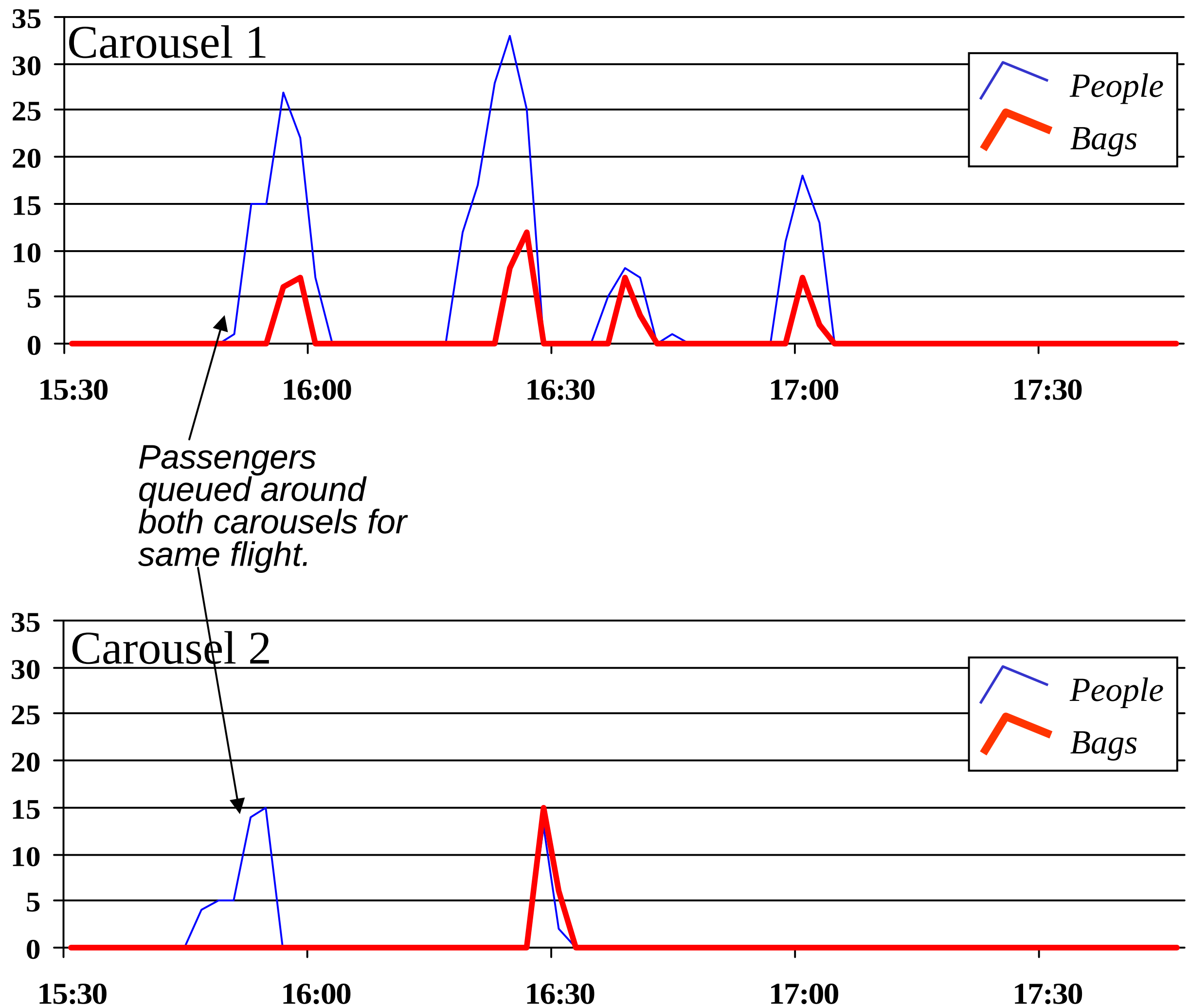
Table 3.31

Baggage Claim Observations

Max. Carousels in Use Simultaneously	2
Max. No. of Passengers Waiting for Bags	
Carousel 1	33
Carousel 2	15
Overall	33
Maximum Bags Displayed Simultaneously on Carousel	
Carousel 1	12
Carousel 2	15
Overall	15
Average Time for First Bag to Appear at Carousel (1)	4.4 min.
Average Time to Clear Carousel	5 min.

Note: (1) Measured from appearance of first person at carousel to the display of first bag.

Source: ROA 2005 Terminal Observations; HNTB analysis.



ROANOKE REGIONAL AIRPORT

People and Bags at Carousels

FIGURE 3-16

Source: HNTB analysis.

Chapter Four
Aviation Activity Forecasts

4.1 INTRODUCTION

This chapter contains the activity forecasts for ROA. The forecasts are intended for use in subsequent facilities requirements analyses for both airside and landside area development. A credible and usable forecast is critical to ensure that the type and size of facilities that are planned are appropriate for future conditions. Consequently, passenger movements, cargo tonnage, and aircraft operations are all examined. Except where noted, the forecasts contained herein are unconstrained. They assume terminal and airfield capacity will be available to accommodate the anticipated demand. Forecasts are presented for 2010, 2015, 2020, and 2025.

This chapter is organized into eight major sections, not including this introduction. Section 2 discusses the Roanoke catchment area and historical and projected socioeconomic activity projected for the area. Section 3 discusses historical aviation activity and trends at ROA. The next section summarizes key assumptions that affect the forecast. Section 5 contains passenger carrier forecasts including enplanements, operations, fleet mix, and peaking activity. Section 6 describes future air freight and mail, and Section 7 discusses air taxi, GA, and military activity. Section 8 provides a summary of the base case ROA projections, including hourly and fleet mix activity, and a comparison with the FAA's Terminal Area Forecast (TAF). The chapter concludes with a series of alternative scenarios that explore potential variations in the base case forecast. These forecasts will be the basis for planning and scheduling Airport improvements through the planning period.

The base case forecast will be used to determine future facility requirements, but the planning program presented in subsequent chapters of this report will be developed to accommodate some of the alternative scenarios that may occur over the next 20 years. The program will have the flexibility to accelerate or be modified to meet less predictable changes in air travel demand. These scenarios and their implications for traffic growth are discussed in more detail in Section 9 of this working paper.

The assumptions inherent in the following analyses are based on input from Airport and airline staff, prior ROA reports, FAA and USDOT data, relevant literature, and professional experience. Forecasting, however, is not an exact science. Departures from forecast levels in the local and national economy and in the airline business environment would have a significant effect on the projections as presented. These uncertainties will increase towards the end of the forecast period, when new technologies and changes in work and recreational practices could unpredictably affect traffic levels. For these reasons, the forecasts should be periodically compared with actual ROA activity levels, and Airport plans and policies should be adjusted accordingly.

4.2 SOCIOECONOMIC PROJECTIONS

Passenger demand is ultimately determined by the strength of the economy and the cost of available services (fares). Consequently, the development of a passenger activity forecast requires a clear understanding of local economic forces and trends.

When developing an aviation forecast, it is important to accurately define the catchment area, because defining it too narrowly would exclude regional economic activity that helps generate passenger traffic and defining it too broadly would inappropriately incorporate economic activity that does not generate any passenger traffic at ROA. Often the metropolitan statistical area (MSA) served by an airport is defined as the catchment area. In the case of ROA, however, there is ample evidence that the true catchment extends beyond the MSA.

Mead & Hunt prepared a passenger demand analysis that analyzed a sample of booking data to determine the airport used by residential passengers in and around the Roanoke area from July 2004 through June 2005.[1] The study defined primary and secondary catchment areas. The primary catchment area was defined on the basis of driving time; any zip code that was a closer drive to ROA than any other commercial airport was included. The secondary catchment area extended the primary catchment area to the east and west, and also into West Virginia. **Figure 4-1** shows the catchment areas as defined by Mead&Hunt.

Table 4.1 shows that ROA serves almost 70 percent of the passengers in the primary catchment area. The passengers that do not use ROA usually use Greensboro (GSO), Charlotte (CLT), or Washington Dulles (IAD). According to the Roanoke departing passenger survey, only about half of ROA's passengers come from the Roanoke MSA, but almost 90 percent come from within the primary catchment area.[2]

Based on the data in Table 4.1, the primary catchment as defined by Mead & Hunt using driving time appears to be the most reasonable definition. It encompasses most of the passengers using ROA, while limiting the inclusion of areas in which substantial numbers of passengers are using other airports.

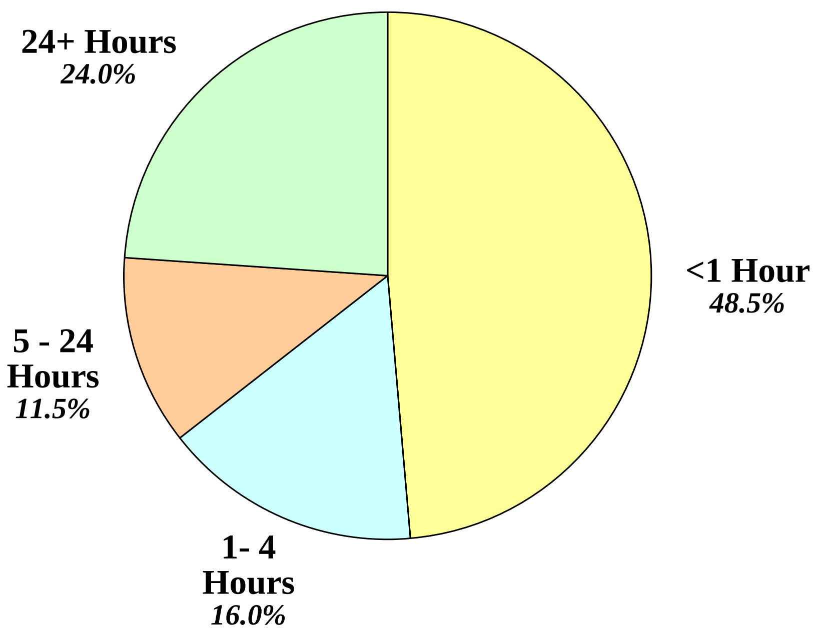
Most socioeconomic data is available by county and incorporated city, rather than by zip code, so the primary catchment area was adjusted slightly to correspond to county borders for use in this analysis. The primary catchment area contains the Roanoke MSA, as well as the counties of Amherst, Allegheny, Bedford, Floyd, Giles, Montgomery, Pulaski and Rockbridge, and cities of Bedford, Buena Vista, Clifton Forge, Covington, Lexington, and Radford.[3]

1 Mead & Hunt, Passenger Demand Analysis – Draft, September 13, 2005.

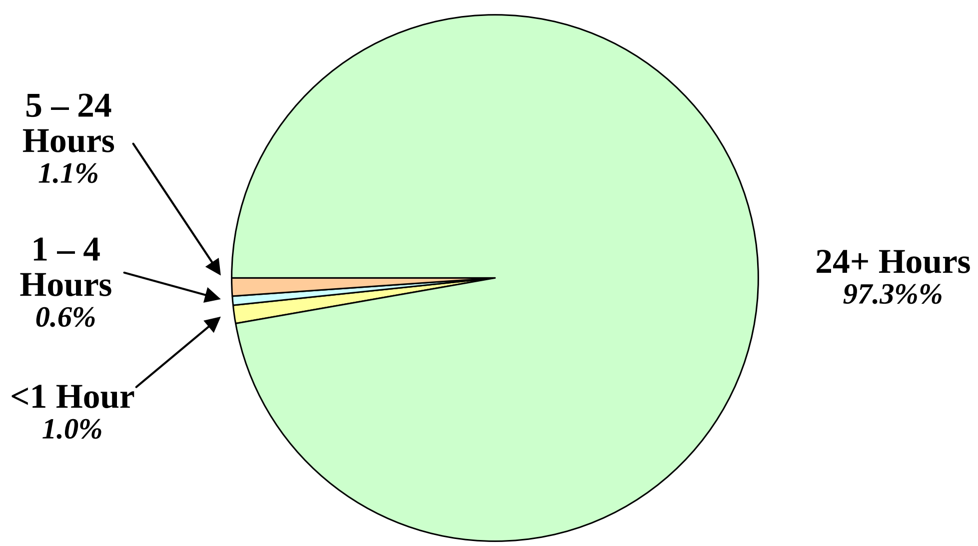
2 See Chapter 3.

3 Blacksburg is an unincorporated town located in Montgomery County.

Short Term



Long Term



Note: Totals may not add due to rounding.

ROANOKE REGIONAL AIRPORT

Parking Duration

Source: HNTB analysis.

FIGURE 3-4

Table 4.1

Distribution of Passengers By Airport and Jurisdiction of Ground Origin

Airport Used By Residential Passengers in Primary Catchment Area (1)

Airport	Number of Passengers	Percent of Total
Roanoke	16,766	69.3%
Greensboro	2,698	11.2%
Charlotte	1,488	6.2%
Washington Dulles	1,194	4.9%
Other	2,040	8.4%
Total	24,186	100.0%

Jurisdiction of Ground Origin for ROA Passengers (2)

Jurisdiction	Number of Passengers	Percent of Total
Botetourt	521	9.1%
Craig	22	0.4%
Franklin	180	3.1%
Roanoke City	616	10.7%
Roanoke County	1,210	21.1%
Salem City	432	7.5%
Subotal Roanoke MSA	2,981	52.0%
Amherst	15	0.3%
Bedford County	261	4.6%
Bedford City	40	0.7%
Buena Vista City	7	0.1%
Clifton Forge City	27	0.5%
Covington City	136	2.4%
Floyd	174	3.0%
Giles	52	0.9%
Lexington City	295	5.1%
Montgomery	1,032	18.0%
Pulaski	30	0.5%
Rockbridge	28	0.5%
Subtotal Primary Catchment Area (3)	5,078	88.6%
Bath	125	2.2%
Campbell	199	3.5%
Danville City	8	0.1%
Grayson	12	0.2%
Halifax	7	0.1%
Harrisonburg City	6	0.1%
Henry	12	0.2%
Lynchburg City	5	0.1%
Martinsville City	16	0.3%
Nelson	7	0.1%
Pittsylvania	5	0.1%
Russell	6	0.1%
Tazewell	12	0.2%
Washington	17	0.3%
Waynesboro City	6	0.1%
Wythe	35	0.6%
Subtotal Other Virginia	478	8.3%
Other States	176	3.1%
Total	5,732	100.0%

(1) Mead & Hunt for Roanoke Regional Airport, *Passenger Demand Analysis* - draft, September 13, 2005.
(2) Roanoke Departing Passenger Survey, November 2005.
(3) Includes Roanoke MSA.

Sources: As noted and HNTB analysis.

Historical and projected population data for the Roanoke MSA and the primary catchment area are presented in **Table 4.2**.[4] All of the economic projections presented in this section were derived from data published by Woods & Poole Economics, Inc. (W&P), a nationally-recognized source of regional and national economic projections.

As shown in Table 4.2, the population in the Roanoke MSA grew from 260,501 in 1980 to 290,218 in 2003, an average annual increase of one half of one percent. The primary catchment area increased at roughly the same rate growing from 532,810 to 613,648 over the same time. This overall rate of growth lagged the rate for the entire United States, which grew at a 1.1 percent annual rate for the same time period.

Over the forecast period, W&P projects that the population of the Roanoke catchment area will grow slightly faster (0.8 percent per year) than it has over the last 20 years, from 613,648 in 2003 to 731,013 in 2025. The population of both the MSA and catchment area is still expected to grow slower than the population of the U.S. as a whole (1.0 percent per year).

Table 4.3 presents historic and projected employment for the Roanoke MSA and catchment area. Over the last 20 years, employment in the MSA has grown at a rate more than twice as fast as population, 1.3 percent per year versus 0.5 percent per year. The nation experienced a slightly higher growth pattern in employment at 1.7 percent. This employment growth is primarily due to the maturing of the "baby boomers" and the increased number of women in the work force.

The Roanoke economy relies more on manufacturing than most metropolitan areas. The manufacturing sector accounts for 11 percent of total employment, and includes companies such as Yokohama Tire and Roanoke Electric Steel. Despite the larger comparative share for Roanoke in manufacturing, the largest sector of employment remains the education and health services sector that accounts for 15 percent of total employment. The school system holds the most jobs in this sector.

In the future, W&P expects employment in the Roanoke catchment area to grow 1.2 percent per year, or twice the rate of population (0.6 percent) from 350,906 employees in 2003 to 453,031 in 2025. The service industry is expected to remain the largest source of new jobs and will continue to increase its share of non-farm employment.

Table 4.4 shows income data for the Roanoke MSA, the Roanoke catchment, and the country. Income is presented in constant 2004 dollars to offset the impacts of inflation. Over the last 20 years, real income in both the MSA and catchment area for Roanoke has grown faster than either population or employment. The income for the MSA and catchment area grew at rates of 2.6 percent and 2.7 percent, respectively. Growth in income did not outpace national income growth which grew at an annualized rate of 3.0 percent during the same time period.

[4] The Roanoke MSA is comprised of Roanoke City, Salem City, Roanoke County and Botetourt, Craig, and Franklin Counties.

Table 4.2

Historical and Projected Population

Year	Roanoke MSA (1)	Primary Catchment Area (2)	United States
Historical			
1980	260,501	532,810	227,224,719
1981	261,693	535,759	229,465,744
1982	261,751	536,436	231,664,432
1983	261,672	536,556	233,792,014
1984	262,643	539,031	235,824,907
1985	263,208	540,750	237,923,734
1986	263,645	543,115	240,132,831
1987	265,026	546,500	242,288,936
1988	265,805	550,691	244,499,004
1989	266,749	553,841	246,819,222
1990	269,440	559,877	249,622,814
1991	272,906	566,328	252,980,941
1992	273,951	570,792	256,514,224
1993	276,643	576,575	259,918,588
1994	279,176	582,746	263,125,821
1995	280,938	587,454	266,278,393
1996	282,915	592,149	269,394,284
1997	284,593	596,290	272,646,925
1998	285,762	601,677	275,854,104
1999	287,193	606,578	279,040,168
2000	288,415	609,997	282,192,162
2001	288,846	611,889	285,102,075
2002	289,243	611,865	287,941,220
2003	290,218	613,648	290,788,976
Projected (3)			
2003	290,218	613,648	290,788,976
2010	304,198	646,956	311,066,043
2015	315,377	673,609	326,524,524
2020	327,166	701,555	342,578,784
2025	339,623	731,013	359,419,734
Average Annual Growth Rate			
1980-2003	0.5%	0.6%	1.1%
2003-2025	0.7%	0.8%	1.0%

(1) Includes Roanoke City, Salem City, Roanoke County and Botetourt, Craig, and Franklin Counties.

(2) Includes Roanoke MSA plus Counties of Amherst, Allegheny, Bedford, Floyd, Giles, Montgomery, Pulaski and Rockbridge, and Cities of Bedford, Buena Vista, Clifton Forge, Covington, Lexington, and Radford.

(3) Projected to grow at Woods & Poole projected growth rates from 2003 base.

Sources: United States Department of Commerce, Bureau of Economic Analysis, Woods and Poole, CEDDS 2005 and HNTB analysis.

Table 4.3

Historical and Projected Employment

Year	Roanoke MSA (1)	Primary Catchment Area (2)	United States
		Historical	
1980	140,627	255,054	114,231,200
1981	138,932	250,532	115,304,000
1982	138,602	249,569	114,557,300
1983	140,617	253,950	116,056,700
1984	147,031	265,234	121,091,100
1985	153,596	276,001	124,509,700
1986	156,808	281,131	126,970,300
1987	161,277	290,401	130,400,400
1988	161,029	292,878	134,506,900
1989	165,478	299,308	137,199,800
1990	168,256	304,718	139,380,900
1991	165,802	299,355	138,605,800
1992	167,520	301,048	139,162,100
1993	170,864	307,673	141,779,400
1994	176,187	315,023	145,223,600
1995	180,995	325,072	148,982,800
1996	184,768	330,444	152,150,200
1997	185,237	333,768	155,608,200
1998	191,848	341,766	159,628,200
1999	191,958	347,648	162,955,300
2000	195,045	352,994	166,758,800
2001	192,305	351,162	167,014,700
2002	190,718	351,190	166,699,000
2003	188,916	350,906	167,174,400
		Projected (3)	
2003	188,916	350,906	167,174,400
2010	207,953	383,448	184,517,327
2015	221,421	406,705	196,904,918
2020	234,733	429,893	209,292,794
2025	247,899	453,031	221,680,553
		Average Annual Growth Rate	
1980-2003	1.3%	1.4%	1.7%
2003-2025	1.2%	1.2%	1.3%

(1) Includes Roanoke City, Salem City, Roanoke County and Botetourt, Craig, and Franklin Counties.

(2) Includes Roanoke MSA plus Counties of Amherst, Allegheny, Bedford, Floyd, Giles, Montgomery, Pulaski and Rockbridge, and Cities of Bedford, Buena Vista, Clifton Forge, Covington, Lexington, and Radford.

(3) Projected to grow at Woods & Poole projected growth rates from 2003 base.

Sources: United States Department of Commerce, Bureau of Economic Analysis, Woods and Poole, CEDDS 2005 and HNTB analysis.

Table 4.4

Historical and Projected Income (000's of 2004 dollars)

Year	Roanoke MSA (1)	Primary Catchment Area (2)	United States
Historical			
1980	$4,969,680	$9,122,154	$4,777,005,851
1981	$5,033,449	$9,190,524	$4,924,887,652
1982	$5,071,177	$9,321,514	$4,999,880,552
1983	$5,307,851	$9,817,541	$5,114,245,551
1984	$5,730,615	$10,527,180	$5,472,533,190
1985	$5,982,369	$10,931,442	$5,678,393,430
1986	$6,176,851	$11,305,688	$5,853,923,915
1987	$6,367,044	$11,669,400	$6,003,223,042
1988	$6,456,581	$11,917,294	$6,219,077,963
1989	$6,685,616	$12,301,823	$6,428,400,752
1990	$6,738,161	$12,382,058	$6,537,865,838
1991	$6,662,754	$12,258,973	$6,529,868,354
1992	$6,813,250	$12,543,568	$6,746,940,488
1993	$6,895,026	$12,752,908	$6,839,801,214
1994	$7,106,780	$13,161,404	$7,043,712,371
1995	$7,319,661	$13,590,773	$7,263,217,121
1996	$7,525,459	$14,028,100	$7,535,788,976
1997	$7,708,097	$14,570,752	$7,860,172,613
1998	$8,093,236	$15,287,371	$8,363,592,036
1999	$8,253,100	$15,713,586	$8,648,738,362
2000	$8,451,376	$16,163,414	$9,116,558,222
2001	$8,722,015	$16,582,225	$9,242,262,190
2002	$8,887,584	$16,771,658	$9,272,771,870
2003	$8,870,304	$16,862,579	$9,388,118,544
Projected (3)			
2003	8,870,304	16,862,579	9,388,118,544
2010	10,135,399	19,223,653	10,824,058,031
2015	11,147,189	21,116,230	11,982,463,283
2020	12,264,113	23,205,967	13,272,837,742
2025	13,498,217	25,517,786	14,713,492,048
Average Annual Growth Rate			
1980-2003	2.6%	2.7%	3.0%
2003-2025	1.9%	1.9%	2.1%

(1) Includes Roanoke City, Salem City, Roanoke County and Botetourt, Craig, and Franklin Counties.

(2) Includes Roanoke MSA plus Counties of Amherst, Allegheny, Bedford, Floyd, Giles, Montgomery, Pulaski and Rockbridge, and Cities of Bedford, Buena Vista, Clifton Forge, Covington, Lexington, and Radford.

(3) Projected to grow at Woods & Poole projected growth rates from 2003 base.

Sources: United States Department of Commerce, Bureau of Economic Analysis, Woods and Poole, CEDDS 2005 and HNTB analysis.

Income in the catchment area grew more quickly between 1980 and 1989 (3.38 percent per annum) than it did in the 1990s (2.68 percent per annum). Although the economy suffered a minor recession in the early 1990s, a significant economic boom followed in the late 1990s.

W&P expects income growth in the MSA and catchment area to slow to 1.9 percent over the next 20 years, but projects it to continue to outpace population and employment growth during the same period.

Table 4.5 reveals that, historically, per capita personal income (PCPI) in the Roanoke MSA and catchment area has been lower than the U.S. average. Although smaller in nominal value, PCPI in the Roanoke catchment area has grown at a faster rate than that of the U.S. for the 23-year period ending in 2003. During this time, the catchment area PCPI grew at an annual rate of 2.1 percent versus a 1.9 percent annual rate for the nation. Over the forecast period in the Roanoke MSA, W&P expects the PCPI to grow at a 1.2 percent rate annually. This projected growth rate of 1.2 percent annually exceeds the projected growth for the nation by 0.1 percent.

In general, the socioeconomic projections show that over the next 19 years, drivers of passenger growth such as population, income, and employment growth at Roanoke should fall slightly below the national rate, but PCPI should grow at a faster rate.

4.3 HISTORICAL AVIATION ACTIVITY AND CURRENT TRENDS

This section discusses historical aviation activity and current trends at ROA. Included are discussions of passenger activity and airline service, air cargo activity, aircraft operations, and existing peaking distributions.

4.3.1 Passenger Activity

Table 4.6 presents the recent history of passenger activity at ROA. Traffic at ROA reached a peak in 1979 just as airline deregulation was beginning. Shortly after deregulation, Piedmont Airlines withdrew its regional hub at ROA and other airlines concentrated their resources on larger markets. As a consequence, ROA lost service and traffic in the early 1980s. Passenger traffic grew in the mid-1980s along with the economic recovery, but then declined during the early 1990s as a result of the national recession, the first Gulf War, and a series of airline bankruptcies. During most of the 1990s, ROA averaged between 300,000 and 400,000 annual enplanements but fell below 300,000 after the September 11, 2001 terrorist attacks and the subsequent complete loss of mainline service. Enplanements at ROA have begun a recovery since 2003.

Table 4.5

Historical and Projected Per Capita Income (2004 dollars)

Year	Roanoke MSA (1)	Primary Catchment Area (2)	United States (3)
		Historical	
1980	19,077	17,121	21,023
1981	19,234	17,154	21,462
1982	19,374	17,377	21,582
1983	20,284	18,297	21,875
1984	21,819	19,530	23,206
1985	22,729	20,215	23,866
1986	23,429	20,816	24,378
1987	24,024	21,353	24,777
1988	24,291	21,641	25,436
1989	25,063	22,212	26,045
1990	25,008	22,116	26,191
1991	24,414	21,646	25,812
1992	24,870	21,976	26,302
1993	24,924	22,118	26,315
1994	25,456	22,585	26,769
1995	26,054	23,135	27,277
1996	26,600	23,690	27,973
1997	27,085	24,436	28,829
1998	28,322	25,408	30,319
1999	28,737	25,905	30,995
2000	29,303	26,498	32,306
2001	30,196	27,100	32,417
2002	30,727	27,411	32,204
2003	30,564	27,479	32,285
		Projected	
2003	30,564	27,479	32,285
2010	33,318	29,714	34,797
2015	35,346	31,348	36,697
2020	37,486	33,078	38,744
2025	39,745	34,907	40,937
		Average Annual Growth Rate	
1980-2003	2.1%	2.1%	1.9%
2003-2025	1.2%	1.1%	1.1%

(1) Includes Roanoke City, Salem City, Roanoke County and Botetourt, Craig, and Franklin Counties.

(2) Includes Roanoke MSA plus Counties of Amherst, Allegheny, Bedford, Floyd, Giles, Montgomery, Pulaski and Rockbridge, and Cities of Bedford, Buena Vista, Clifton Forge, Covington, Lexington, and Radford.

(3) Income from Table 4.4 divided by population from Table 4.2.

Sources: United States Department of Commerce, Bureau of Economic Analysis, Woods and Poole, CEDDS 2005 and HNTB analysis.

Table 4.6

Historical Passenger Enplanements

Year	Major/National Carrier (1)	Regional Carrier (1)	Scheduled Enplanements (2)	Charter Carrier (1)	Total Enplanements (3)
1980	381,012	8,862	389,874	n/a	389,874
1981	332,898	15,748	348,646	n/a	348,646
1982	237,044	29,246	266,290	n/a	266,290
1983	229,747	30,583	260,330	n/a	260,330
1984	204,996	60,372	265,368	n/a	265,368
1985	227,886	80,607	308,493	n/a	308,493
1986	219,421	100,620	320,041	n/a	320,041
1987	216,805	116,617	333,422	n/a	333,422
1988	212,405	135,220	347,625	n/a	347,625
1989	236,703	116,779	353,482	n/a	353,482
1990	237,312	120,742	358,054	n/a	358,054
1991	142,529	163,792	306,321	1,657	307,978
1992	131,052	192,478	323,530	2,300	325,830
1993	130,780	194,433	325,213	4,362	329,575
1994	168,984	197,182	366,166	7,820	373,986
1995	165,355	153,901	319,256	8,589	327,845
1996	154,393	159,978	314,371	6,477	320,848
1997	149,905	173,931	323,836	6,168	330,004
1998	130,517	208,493	339,010	5,001	344,011
1999	112,607	229,245	341,852	3,876	345,728
2000	111,688	245,893	357,581	7,922	365,503
2001	75,821	225,130	300,951	3,377	304,328
2002	-	295,232	295,232	3,807	299,039
2003	-	286,034	286,034	4,290	290,324
2004	-	306,655	306,655	4,034	310,689
2005	-	324,590	324,590	2,680	327,270

(1) Roanoke Regional Airport Commission, Air Traffic Reports.
(2) Major/national plus regional enplanements.
(3) Scheduled plus charter enplanements.

Sources: As noted and HNTB analysis.

4.3.2 Air Service

Passenger activity is closely related to the amount and type of air service provided. **Table 4.7** shows the number of nonstop markets and average weekly flights served by major/national and regional carriers from ROA during the 1980-2006 period. Typically, major and national carriers provide service with jet aircraft containing more than 100 seats, and regional carriers primarily provide turboprop and regional jet service with less than 60-seat aircraft. The distinction will become increasingly blurred in the future as more 70-100 seat jets come into service. The number of nonstop markets has declined over the historic period. This is a result of the relocation of the Piedmont hub and the concentration of service to major airline hubs among remaining carriers. In addition, airlines have largely eliminated the routing of multi-stop flights (tag flights) through non-hubs. As a result, flights to small markets such as CLT and Lynchburg (LYH) have been eliminated.

In addition, all the routes previously served by mainline jet aircraft are now served by regional jets and turboprops. Reasons include the exploitation of niches opened up by deregulation, the advent of code-sharing, the focus on flight frequency, and the transfer of short-haul, low- and medium-density routes from the major/national carriers to regional carriers. The regional carrier industry is also changing as the regional carriers reorganize and as larger regional jets become available.

As shown in Table 4.7, the total number of markets served nonstop from ROA has declined markedly from 21 in 1980 to 8 in 2005. The number of airline hubs served, however, has remained very stable.

Table 4.8 provides more detailed information about the nine nonstop markets served from ROA in 2004. Since that time, service to Pittsburgh was eliminated as US Airways downsized the hub. With the exception of New York LaGuardia (LGA), all the nonstop markets are airline connecting hubs. CLT is the busiest destination measured in terms of aircraft departures and onboard passengers. Chicago O'Hare (ORD), however, is busiest in terms of originating passengers.[5] All the hubs have many more onboard passengers than originating passengers, indicating that most of the passengers going to these hubs continue on to their final destination.

Table 4.9 shows the scheduled passenger fleet mix at ROA from 1994 to 2006. The 2006 numbers are based on published schedules which were not complete at the time of this writing. Over the period there has been a major turnover in the types of aircraft serving ROA. In 1994, the fleet mix was roughly 80 percent turboprop aircraft and 20 percent mainline jets, with no regional jets. By 2005, regional jets accounted for almost 60 percent of the total, and mainline jets had disappeared entirely from the scheduled passenger fleet mix.

Table 4.10 presents historical fares and yields at ROA from 1990 through the first

[5] Originating passengers are passengers that begin the flight portion of their trip at ROA and end the flight portion of their trip at the destination airport.

Table 4.7
(1 of 2)
History of Air Service by Market
Markets with At Least Five Scheduled Flights Per Week

Table 4.7
(2 of 2)
History of Air Service by Market
Markets with At Least Five Scheduled Flights Per Week

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Lexington	Major/National		■		■	■	■	■	■					■														
	Regional	■											■															
Louisville	Major/National																											
	Regional		■																									
Lynchburg	Major/National																											
	Regional	■	■	■	■	■	■	■		■		■			■	■	■											
Myrtle Beach	Major/National																											
	Regional																											
Nashville	Major/National																											
	Regional							■																				
Newark	Major/National																											
	Regional																	■	■									
New York	Major/National	■	■	■	■	■	■	■	■	■	■																	
	Regional											■			■	■									■	■	■	■
Norfolk	Major/National			■																								
	Regional		■			■									■	■												
Philadelphia	Major/National		■	■																								
	Regional																		■	■	■	■	■	■	■	■	■	■
Pittsburgh	Major/National	■	■	■	■	■					■		■			■	■	■	■	■	■	■	■					
	Regional						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Raleigh	Major/National	■	■						■	■																		
	Regional					■			■	■	■	■	■	■	■	■												
Richmond	Major/National	■	■	■	■	■	■	■			■		■	■														
	Regional	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											
Tri-City	Major/National	■	■	■																								
	Regional											■																
Washington	Major/National	■	■	■	■	■					■		■	■														
	Regional		■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Winston-Salem	Major/National																											
	Regional	■																										
Non-Stop Market	Major/National	13	15	15	11	12	9	11	9	6	8	3	6	6	2	3	3	3	2	2	2	2	2	0	0	0	0	0
	Total	21	22	18	14	15	12	15	15	16	12	15	12	11	12	11	10	9	10	9	9	9	10	8	9	9	8	8
Non-Stop Hubs	Major/National											3	5	4	2	3	3	3	2	2	2	2	2	0	0	0	0	0
	Total											8	9	8	8	8	7	8	9	8	8	8	8	8	9	9	8	8

Sources: Official Airline Guide as compiled by BACK Aviation Solutions and HNTB analysis.

Table 4.8

Distribution of Passengers by Destination: 2004

Destination	Distance	Aircraft Departures	On-Board Passengers	Originating Passengers	Average Fare (1)	Average Yield (2)
CLT	155	2,448	74,163	5,020	94.91	61.23
ATL	357	1,720	53,766	12,805	202.23	55.15
ORD	531	1,054	39,154	18,185	123.09	22.06
DTW	382	1,383	31,651	9,305	139.49	34.48
CVG	282	1,337	28,770	3,545	175.21	58.65
IAD	177	1,446	24,844	7,795	95.19	52.43
PHL	310	1,080	20,855	6,830	232.91	68.98
PIT	219	1,086	16,963	3,050	214.64	87.02
LGA	405	792	12,063	13,355	162.05	36.28
Total		13,352	305,557	273,815	176.54	18.63

(1) Prices in 2004 dollars. Does not include fees and taxes.
(2) Cost per passenger mile in 2004 cents. Does not include fees and taxes.

Sources: USDOT Origin-Destination Survey as compiled by Data Base Products, Inc. and HNTB analysis.

Table 4.9

Historical Scheduled Passenger Aircraft Departures by Aircraft Type

Equipment Type	Average Seats	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Turboprop Aircraft														
SWM-FAIRCHILD SA26/SA226/SA227 MERLIN/METRO	19	745	-	-	-	-	-	-	-	-	-	-	-	-
BE1-BEECHCRAFT 1900 AIRLINER	19	-	-	-	-	-	1,024	1,158	-	-	-	-	-	-
J31-BRITISH AEROSPACE JETSTREAM 31	19	2,106	3,262	956	936	1,506	1,867	2,066	989	-	-	-	-	-
EM2-EMBRAER 120 BRASILIA	30	4,366	3,456	4,838	4,070	2,263	1,833	1,605	1,682	1,794	208	-	-	-
J41-BRITISH AEROSPACE JETSTREAM 41	29	1,369	1,334	1,183	1,093	1,265	535	584	1,547	1,452	1,452	678	-	-
D38-FAIRCHILD DORNIER 328-100	32	-	303	753	619	648	307	156	622	152	-	-	-	-
SF3-SAAB 340	33	1,291	912	487	486	1,548	1,742	1,779	1,799	1,892	1,334	1,120	1,212	307
SH6-SHORTS 360 (SD3-60)	36	775	31	-	-	-	-	-	-	-	-	-	-	-
DH3-DE HAVILLAND DHC8-300 DASH8/8Q	50	-	-	-	-	-	-	18	509	2,056	1,823	1,779	1,756	1,962
DH8-DE HAVILLAND DHC8 DASH 8	37	3,814	3,276	3,678	3,246	2,607	3,000	3,237	2,307	1,920	2,862	3,207	1,985	1,211
ATR-AEROSPATIALE/ALENIA ATR42/ATR72	42	-	-	117	89	-	-	-	-	-	-	-	-	-
AT7-AEROSPATIALE/ALENIA ATR72	66	-	-	-	331	-	-	650	180	-	573	600	-	-
Subtotal		14,466	12,574	12,012	10,870	9,837	10,308	11,253	9,635	9,266	8,252	7,384	4,953	3,480
Regional Jets														
FRJ-FAIRCHILD DORNIER 328JET	32	-	-	-	-	-	-	-	-	248	618	395	-	-
ERJ-EMBRAER RJ 135/140/145	50	-	-	-	-	427	1,043	171	492	1,272	361	535	1,250	287
ER4-EMBRAER RJ145	50	-	-	-	-	-	-	-	-	-	-	-	710	1,224
CRJ-CANADAIR REGIONAL JET	50	-	-	166	748	2,348	2,789	3,125	3,237	2,727	3,409	4,518	5,400	4,298
Subtotal		-	-	166	748	2,775	3,832	3,296	3,729	4,247	4,388	5,448	7,360	5,809
Narrow Body Jets														
F28-FOKKER F28 FELLOWSHIP	68	1,166	1,021	1,257	485	-	-	-	-	-	-	-	-	-
100-FOKKER 100	98	28	-	53	137	145	989	539	724	-	-	-	-	-
D9S-MCDONNELL DOUGLAS DC9 (SERIES 30/40/50)	103	159	455	308	570	990	963	455	339	-	-	-	-	-
737-BOEING 737	103	-	253	113	-	-	-	-	-	-	-	-	-	-
73S-BOEING 737 ADVANCED	110	1,889	1,498	1,272	1,590	1,326	243	273	-	-	-	-	-	-
733-BOEING 737-300	128	79	60	114	-	31	220	747	685	-	-	-	-	-
734-BOEING 737-400	146	-	-	-	-	-	1	7	-	-	-	-	-	-
M80-BOEING (DOUGLAS) MD80	142	-	-	-	-	-	-	196	29	-	-	-	-	-
72S-BOEING 727-200	151	-	30	-	-	-	-	-	-	-	2	-	-	-
Subtotal		3,321	3,317	3,117	2,782	2,492	2,416	2,217	1,777	-	2	-	-	-
Total		17,787	15,891	15,295	14,400	15,104	16,556	16,766	15,141	13,513	12,642	12,832	12,313	9,289
Distribution														
Turboprops		81.3%	79.1%	78.5%	75.5%	65.1%	62.3%	67.1%	63.6%	68.6%	65.3%	57.5%	40.2%	37.5%
Regional Jets		0.0%	0.0%	1.1%	5.2%	18.4%	23.1%	19.7%	24.6%	31.4%	34.7%	42.5%	59.8%	62.5%
Narrow Body Jets		18.7%	20.9%	20.4%	19.3%	16.5%	14.6%	13.2%	11.7%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Sources: Official Airline Guide as compiled by BACK Aviation Solutions and HNTB analysis.

Table 4.10

Historical ROA Average Domestic Fares and Yields including Airline Fees and Taxes

					Additional Taxes and Fees									
								Passenger Facility Charge (per Enplanement)						
Year	Nominal Fare (1)	Nominal Yield (1)	Average Distance (1)	Average Segments (1)	Excise Tax (2) (% of Fare)	Segment Tax (3) (per Enplanement)	Security Surcharge (4) (per Enplanement)	ROA (5)	General (6)	Nominal Fare w/ Fees (7)	Nominal Yield w/ Fees (8)	Real Fare w/ Fees (9)	Real Yield w/ Fees (10)	GDP Price Deflator (11)
1990	149.35	19.42	769	1.914	8.2%	$ -	$ -		$ -	161.55	21.00	217.23	28.24	1.345
1991	155.40	20.27	767	1.833	10.0%	$ -	$ -		$ -	170.94	22.29	221.81	28.93	1.298
1992	148.81	19.08	780	1.827	10.0%	$ -	$ -		$ 0.25	163.90	21.02	206.72	26.51	1.261
1993	164.91	19.96	826	1.816	10.0%	$ -	$ -		$ 1.17	182.35	22.07	224.81	27.21	1.233
1994	146.51	17.05	859	1.821	10.0%	$ -	$ -		$ 3.00	163.62	19.05	197.56	23.00	1.207
1995	169.07	20.20	837	1.784	10.0%	$ -	$ -		$ 3.00	188.33	22.50	222.61	26.59	1.182
1996	189.59	22.01	861	1.810	3.5%	$ -	$ -		$ 3.00	198.60	23.05	229.80	26.68	1.157
1997	193.45	22.56	857	1.816	7.9%	$ 0.25	$ -		$ 3.00	211.71	24.69	240.92	28.10	1.138
1998	201.65	23.25	867	1.791	8.8%	$ 1.25	$ -		$ 3.00	223.91	25.82	252.53	29.12	1.128
1999	197.75	23.19	853	1.755	7.9%	$ 2.06	$ -	$ 3.00	$ 3.00	222.21	26.05	246.51	28.90	1.109
2000	198.52	21.71	915	1.793	7.5%	$ 2.50	$ -	$ 3.00	$ 3.00	223.27	24.41	241.68	26.42	1.082
2001	183.66	19.75	930	1.808	7.5%	$ 2.75	$ -	$ 3.13	$ 3.67	208.50	22.42	221.06	23.77	1.060
2002	170.28	18.30	930	1.756	7.5%	$ 3.00	$ 2.29	$ 4.50	$ 3.90	199.79	21.47	208.87	22.45	1.045
2003	170.18	18.51	920	1.756	7.5%	$ 3.00	$ 1.67	$ 4.50	$ 3.90	198.59	21.60	203.72	22.15	1.026
2004	172.57	18.20	948	1.786	7.5%	$ 3.10	$ 2.50	$ 4.50	$ 3.90	203.08	21.42	203.08	21.42	1.000
2005 (12)	173.22	17.83	972	1.824	7.5%	$ 3.20	$ 2.50	$ 3.38	$ 3.90	203.20	20.91	197.74	20.35	0.973

(1) USDOT Origin-Destination Survey as compiled by DataBase Products, Inc.
(2) Historical passenger ticket tax data from Air Transport Association. Values prorated when changes or expirations occurred within calendar year.
(3) Historical data on segment portion of passenger ticket tax from Air Transport Association. Values prorated when changes or expirations occurred within calendar year.
(4) Historical security charge data from Air Transport Association. Values prorated when changes or expirations occurred within calendar year.
(5) Federal Aviation Administration. Values prorated when changes occurred within calendar year.
(6) Federal Aviation Administration. Estimated average of all airports.
(7) Nominal fares with taxes and fees included.
(8) Nominal yields with taxes and fees included.
(9) Average fares with taxes and fees included converted to 2004 prices.
(10) Average yields with taxes and fees included converted to 2004 prices.
(11) Gross Domestic Product Implicit Price Deflator for Consumer Expenditures from U.S. Bureau of Economic Analysis.
(12) First three quarters of 2005.

Sources: As noted, Air Transport Association web site and HNTB analysis.

three quarters of 2005. Yield represents average revenue per revenue passenger mile, and is often used as the price variable in passenger demand forecasting equations. Fares and yields reported to the USDOT do not include fees and taxes. These fees and taxes include the excise and segment taxes (ticket taxes), passenger facility charges, and the TSA security surcharge. Since the fares paid by passengers do include fees and taxes, fares and yields were recalculated to better reflect the true cost to the passenger. Expressed in 2004 prices, fares and yields at ROA have declined. Some of the decline has been offset by increases in fees and taxes, as the average share of ticket costs accounted for by fees and taxes has risen from about 8 percent in 1990 to 17 percent in 2005. As shown, fully loaded real fares have declined from $217.23 in 1990 to $197.74 in 2005. Yields have declined more rapidly than fares since the average trip distance has increased over the same period.

Table 4.11 and Figure 4-2 compare ROA fares and yields with those at surrounding commercial airports. Small airports, such as LYH and Charlottesville-Albemarle Airport (CHO), have fare and yield histories similar to ROA. Richmond International Airport (RIC) initially had higher fares than ROA but is now similar. With new service by AirTran and JetBlue, it is likely that RIC average fares and yields will soon be well below those at ROA. CLT is an airline hub, where US Airways enjoys a quasi-monopoly position that enables it to maintain high fares. Consequently, the fare and yield history at CLT is also similar to that of ROA. GSO is a large enough market to be competitively served by mainline aircraft. Therefore, many of the cost reductions recently achieved by mainline carriers have been passed on in the form of lower fares at GSO, especially since the late 1990s. The largest reduction in fares has been achieved by Raleigh-Durham International Airport (RDU), especially since 1999 when Southwest Airlines began service at that Airport.

The loss of mainline jet service and the relatively high fares and yields have put ROA at a competitive disadvantage compared with the larger commercial airports in the surrounding region. This explains, to a large extent, the lack of long-term growth in passenger enplanements at ROA over the last 25 years.

4.3.3 Air Cargo

Table 4.12 presents the history of air cargo activity, including air freight and air mail, at ROA. Air freight grew significantly in the mid-1990s, attributable to the proximity of businesses involved in catalog order shipments and ROA's favorable geographic location for consolidating truck shipments from the east for forwarding to major Midwest cargo hubs. Since that time, however, air freight has declined. Much of the demand for overnight service has been supplanted by electronic e-mail services. The remaining demand for time-definite service can often be more efficiently served with trucks than with airplanes. The loss of mainline service and more stringent post-9/11 security requirements have also significantly reduced passenger carrier (belly) cargo.

Much of the decline in air mail results from changes in reporting. FedEx, which now contracts to carry most air mail

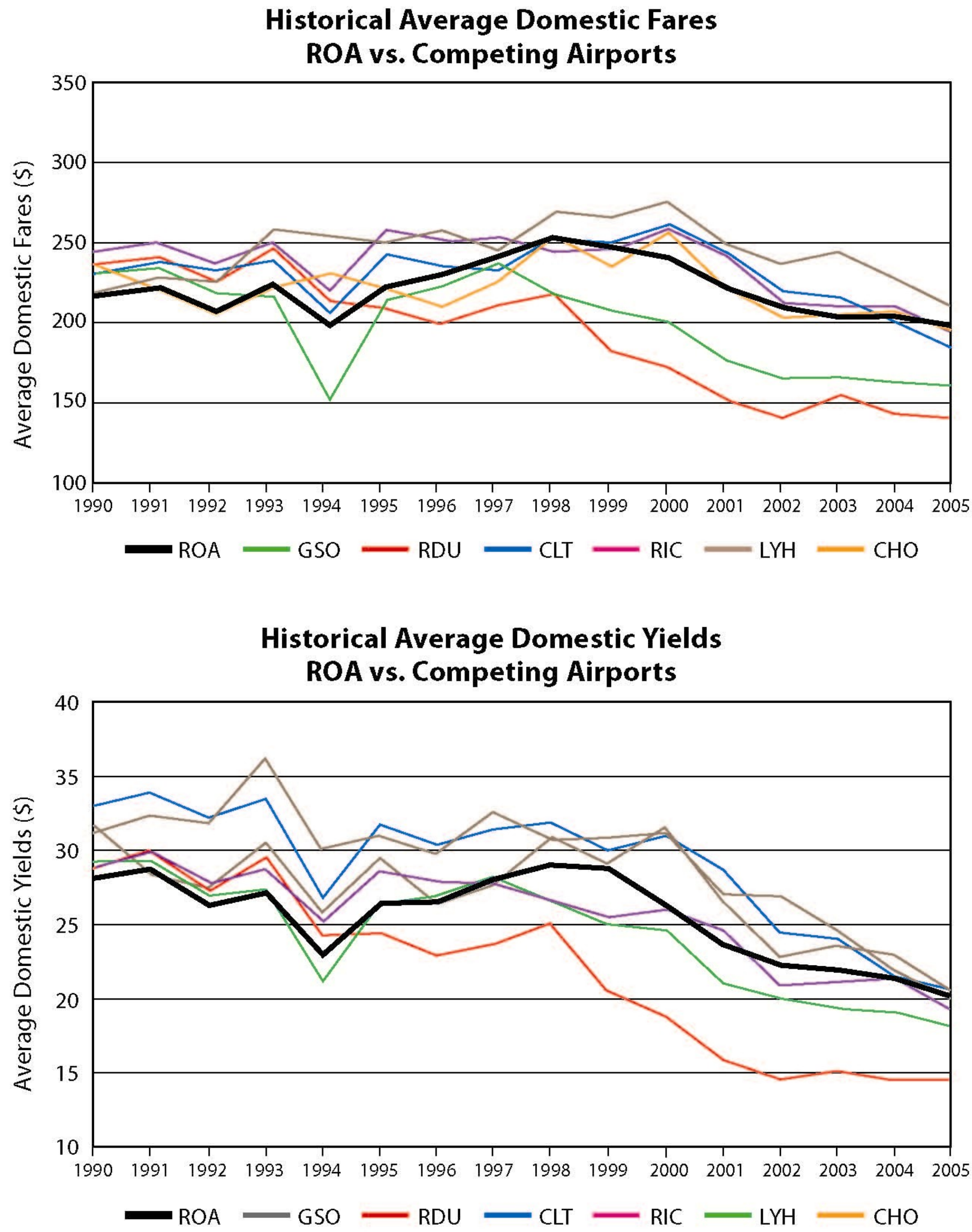
Table 4.11

Historical Average Domestic Fares and Yields including Airline Fees and Taxes at ROA and Competing Airports (1)

	Roanoke		Greensboro		Raleigh-Durham		Charlotte		Richmond		Lynchburg		Charlottesville	
Year	**Fare**	**Yield**	**Fare**	**Yield**	**Fare**	**Yield**	**Fare**	**Yield**	**Fare**	**Yield**	**Fare**	**Yield**	**Fare**	**Yield**
1990	217.23	28.24	231.34	29.37	237.42	29.92	230.66	33.10	244.83	28.92	220.10	31.23	233.93	31.94
1991	221.81	28.93	233.98	29.28	241.21	29.97	237.67	34.06	249.05	29.99	227.81	32.49	220.59	28.60
1992	206.72	26.51	218.92	27.02	226.11	27.44	232.94	32.34	236.88	27.85	226.30	31.95	205.34	27.58
1993	224.81	27.21	216.17	27.47	247.03	29.57	239.05	33.54	249.90	28.91	258.28	36.20	222.10	30.67
1994	197.56	23.00	152.03	21.34	212.91	24.43	205.50	26.86	218.16	25.23	255.73	30.09	231.09	25.86
1995	222.61	26.59	214.09	26.50	208.22	24.57	242.97	31.89	257.34	28.77	249.47	31.11	221.53	29.63
1996	229.80	26.68	223.40	27.00	198.49	23.03	235.09	30.49	252.74	28.04	258.61	29.84	210.55	26.54
1997	240.92	28.10	237.34	28.24	209.80	23.69	232.53	31.64	251.86	27.82	245.47	32.71	225.48	27.89
1998	252.53	29.12	217.57	26.60	217.22	25.11	253.53	32.04	243.68	26.91	269.69	30.90	254.35	30.93
1999	246.51	28.90	207.34	25.18	182.94	20.68	249.08	29.88	244.62	25.73	266.33	30.93	235.86	29.23
2000	241.68	26.42	200.21	24.74	171.71	18.96	260.30	31.13	258.14	26.23	276.38	31.30	256.29	31.53
2001	221.06	23.77	176.50	21.14	151.03	16.04	244.56	28.93	241.82	24.82	249.35	27.28	221.51	26.63
2002	208.87	22.45	165.66	20.08	140.83	14.64	219.63	24.63	213.54	21.10	237.58	27.06	202.88	23.07
2003	203.72	22.15	165.02	19.49	154.27	15.34	216.17	24.20	210.24	21.32	245.83	24.80	206.22	23.78
2004	203.08	21.42	162.81	19.18	143.49	14.66	200.36	21.71	210.46	21.45	228.13	22.14	206.98	23.09
2005 (2)	197.74	20.35	161.22	18.18	139.73	14.59	183.37	20.77	193.02	19.42	209.90	20.17	195.80	20.59

(1) Data sources and methodologies are the same as in Table 4.10.
(2) First three quarters of 2005.

Sources: As noted and HNTB analysis.



ROANOKE REGIONAL AIRPORT

Historical Fares and Yields
ROA vs. Competing Airports

FIGURE 4-2

SOURCE: HNTB Analysis.

Table 4.12

Historic Air Freight and Air Mail Tonnage

	Air Freight and Express			Air Mail			Total Air Cargo		
Year	Enplaned	Deplaned	Total	Enplaned	Deplaned	Total	Enplaned	Deplaned	Total
1981	873	951	1,823	236	1,816	2,052	1,109	2,767	3,875
1982	681	781	1,463	214	1,910	2,124	895	2,691	3,587
1983	1,280	n/a	n/a	2,255	n/a	n/a	3,535	n/a	n/a
1984	1,348	n/a	n/a	2,712	n/a	n/a	4,060	n/a	n/a
1985	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1986	2,131	n/a	n/a	3,095	n/a	n/a	5,226	n/a	n/a
1987	2,374	n/a	n/a	3,236	n/a	n/a	5,610	n/a	n/a
1988	1,323	1,419	2,742	1,323	1,524	2,847	2,646	2,943	5,589
1989	2,376	2,683	5,059	524	2,425	2,949	2,900	5,108	8,008
1990	3,505	3,642	7,147	635	2,583	3,218	4,140	6,225	10,365
1991	3,877	3,139	7,016	593	2,334	2,927	4,470	5,473	9,943
1992	5,910	4,326	10,236	619	2,092	2,711	6,529	6,418	12,947
1993	7,011	5,574	12,585	608	2,074	2,682	7,619	7,648	15,267
1994	9,791	7,669	17,460	558	1,776	2,334	10,349	9,445	19,794
1995	13,437	11,530	24,968	428	1,791	2,219	13,865	13,321	27,186
1996	11,933	11,504	23,437	374	1,677	2,051	12,307	13,181	25,488
1997	9,370	9,093	18,463	520	1,567	2,087	9,890	10,660	20,550
1998	8,838	9,650	18,488	283	1,488	1,771	9,121	11,138	20,259
1999	8,233	8,652	16,885	286	755	1,041	8,519	9,407	17,926
2000	6,993	8,366	15,358	174	685	859	7,167	9,051	16,218
2001	6,076	7,174	13,250	70	337	407	6,146	7,511	13,657
2002	6,131	6,826	12,957	9	119	128	6,140	6,945	13,085
2003	6,010	7,221	13,231	1	93	93	6,010	7,314	13,325
2004	6,130	7,408	13,538	1	104	105	6,130	7,512	13,643
2005	7,184	8,590	15,774	1	27	28	7,185	8,617	15,802

Sources: FAA Airport Activity Statistics, ACI-NA Worldwide Airport Report, and Roanoke Regional Airport Commission.

includes air mail in their air freight statistics. Hence, a good portion of the air mail at ROA is now reported as air freight.

4.3.4 Aircraft Operations

Table 4.13 presents the history of aircraft operations at the Airport. Total aircraft operations have declined slightly over the historical period. Most of the decline has resulted because of the loss in GA operations. The "Other" category includes passenger charter aircraft, all-cargo aircraft, and "for hire" air taxi aircraft.

4.3.5 Peaking Activity

Table 4.14 shows the monthly distribution of passengers, cargo, and aircraft operations in 2005. The peak month at ROA is not as well defined as at many other airports. In 2005, March accounted for the most enplanements but June was busiest in terms of average daily enplanements. May and October are also busy months for passenger activity. December is the busiest month for cargo tonnage, mainly because of Christmas orders. September was the busiest month for aircraft operations in 2005. In past years, however, March, May, August, and October have also been the peak month for operations at ROA.

Table 4.15 shows the hourly distribution of scheduled passenger aircraft operations and seat arrivals and departures for June 2006.[6] Typical of most spoke airports, ROA has a major departure peak early in the morning (6:00 to 8:00 am) and an arrival peak late in the evening (9:00 to 11:00 pm). The peak number of scheduled operations, however, occurs around noon.

[6] The Official Airline Guide provides airline schedules for up to 12 months in advance. Therefore, it was possible to obtain a peak month schedule for the upcoming summer.

4.4 ASSUMPTIONS

This section describes the general forecast assumptions that were applied in this forecast. More detailed assumptions specific to a particular activity category are described in the sections pertaining to those categories. The major assumptions are described below.

4.4.1 Unconstrained Forecasts

The activity forecasts contained herein are physically unconstrained. For the purposes of this study, "physically unconstrained" means that there are sufficient airfield, terminal, and landside facilities at ROA to accommodate all aviation activity dictated by demand. Except as noted, it is assumed that destination airports will be developed sufficiently to accommodate demand from the Roanoke area.

4.4.2 Regulatory Assumptions

No return to airline regulation, as occurred prior to 1979, is assumed. This means that airlines will increase service and change fares as market conditions dictate. There will be no nighttime restrictions on aircraft operations.

4.4.3 Catchment Area

It is assumed that the ground transportation network will not change sufficiently over the forecast horizon to

Table 4.13

Historical Aircraft Operations

Year	Major/National Carrier	Regional Carrier	General Aviation	Military	Other (1)	Total
1979	29,826	n/a	n/a	n/a	n/a	n/a
1980	26,918	n/a	86,259	724	n/a	128,808
1981	23,732	n/a	77,119	596	n/a	115,577
1982	17,938	n/a	78,108	649	n/a	97,758
1983	14,598	n/a	78,402	796	n/a	95,910
1984	12,726	n/a	103,229	949	n/a	117,172
1985	13,340	n/a	n/a	n/a	n/a	n/a
1986	13,102	n/a	90,552	1,407	n/a	133,029
1987	11,412	n/a	81,036	1,381	n/a	123,728
1988	9,666	n/a	78,337	1,577	n/a	119,422
1989	7,862	n/a	78,674	1,418	n/a	114,254
1990	8,918	n/a	90,670	1,713	n/a	128,167
1991	7,256	25,388	74,931	1,420	5,191	114,186
1992	6,060	26,216	68,970	1,737	6,357	109,340
1993	5,712	21,354	70,297	1,902	12,104	111,369
1994	6,322	26,680	69,160	1,813	7,248	111,223
1995	6,506	23,818	74,439	1,962	7,362	114,087
1996	6,472	25,442	62,748	2,044	4,275	100,981
1997	5,400	22,928	69,628	1,235	6,325	105,516
1998	4,832	24,050	69,206	1,433	6,837	106,358
1999	4,522	26,988	61,893	2,109	8,099	103,611
2000	4,266	27,100	65,841	1,744	9,016	107,967
2001	3,064	24,170	60,980	2,124	10,491	100,829
2002	-	26,372	59,627	1,807	8,712	96,518
2003	-	24,264	47,664	1,430	9,610	82,968
2004	-	24,658	46,013	1,292	11,814	83,777
2005	-	23,706	48,892	1,401	11,895	85,894

(1) Includes charter, all-cargo, for hire air taxi, and unclassified aircraft.

Sources: FAA, Airport Activity Statistics, ACI-NA Worldwide Airport Traffic Report, and Roanoke Regional Airport Commission.

Table 4.14

Monthly Distribution of Activity: 2005

	Enplaned	Total	Aircraft Operations						
Month	Passengers	Cargo (tons)	Pax Carrier	Charter	All-Cargo	Air Taxi	GA	Military	Total
January	23,619	1,009.9	1,968	4	151	780	3,603	109	6,615
February	22,379	1,012.3	1,780	6	150	860	3,027	195	6,018
March	29,513	1,202.9	2,034	4	172	946	3,333	138	6,627
April	28,929	1,133.4	1,942	6	157	803	3,536	101	6,545
May	28,891	1,091.0	2,080	2	170	943	4,861	69	8,125
June	29,438	1,199.0	2,052	0	219	768	4,108	99	7,246
July	29,094	1,071.7	2,104	2	198	801	3,886	156	7,147
August	27,795	1,532.5	2,112	2	212	926	4,611	124	7,987
September	26,210	1,638.2	1,914	8	193	849	5,884	211	9,059
October	29,113	1,543.5	1,940	4	180	671	4,301	116	7,212
November	26,651	1,554.5	1,940	4	202	597	4,394	58	7,195
December	25,638	1,813.2	1,840	6	237	632	3,348	55	6,118
Total	327,270	15,802.1	23,706	48	2,241	9,576	48,892	1,431	85,894
Peak	29,513	1,813.2	2,112	8	237	946	5,884	211	9,059
Peak Month Percent	9.0%	11.5%	8.9%	16.7%	10.6%	9.9%	12.0%	14.7%	10.5%
Peak Month	March (1)	December	August	September	December	March	September	September	September

(1) June averaged more enplaned passengers per day, so it is used for subsequent passenger peaking analysis. See Table 4.18.

Sources: Roanoke Regional Airport Commission, Air Traffic Reports.

Table 4.15

Scheduled Passenger Aircraft Arrivals and Departures by Hour
Weekday in June 2006

	Aircraft Arrivals and Departures			Seat Arrivals and Departures		
Hour	Arrivals	Departures	Total	Arrivals	Departures	Total
0000-0559	1		1	50		50
0600-0659		4	4		200	200
0700-0759		**5**	5		237	237
0800-0859			0			0
0900-0959	**4**	2	6	187	100	287
1000-1059		2	2		87	87
1100-1159	3		3	150		150
1200-1259	2	**5**	**7**	100	**250**	**350**
1300-1359	1		1	50		50
1400-1459	2	2	4	100	100	200
1500-1559	2	2	4	87	87	174
1600-1659	**4**	2	6	187	87	274
1700-1759	1	3	4	50	150	200
1800-1859	2	2	4	100	100	200
1900-1959	1	2	3	50	100	150
2000-2059			0			0
2100-2159	**4**		4	**200**		200
2200-2259	3		3	137		137
2300-2359	1		1	50		50
Total	31	31	62	1498	1498	2996
Peak	4	5	7	200	250	350
Peak 60 Minutes	5	5	9	250	250	450
Peak Time	1141-1240	1200-1259	1141-1240	1141-1240	1200-1259	1141-1240

Sources: Official Airline Guide as compiled by BACK Aviation Solutions and HNTB analysis.

materially affect the ground travel time between ROA and the other commercial airports in the region.

4.4.4 Other Regional Airports

CLT is assumed to continue as a major airline hub, and RDU is assumed to continue as a focus city for low-fare carriers. GSO and RIC are assumed to obtain more limited low fare service, while CHO and LYH are assumed to continue to have limited regional carrier service to hub airports.

4.4.5 Economic Assumptions

The forecasts assume no major economic downturn, such as occurred during the depression of the 1930s. The local and national economies will periodically increase and decrease the pace of growth in accordance with business cycles. However, it is assumed that, over the next six years, the high-growth and low-growth periods will offset each other so that the adjusted economic forecasts described in Section 2 will be realized.

4.4.6 Future Security Environment

Security issues related to air travel have changed and will continue to change as new procedures and technology are incorporated to improve airport security. Events that may affect traveler confidence in airport security or air travel security cannot be predicted. It is assumed that there will be no terrorist attacks during the forecast period that will affect confidence in the aviation system to the same extent as 9/11. It is also assumed that the TSA and associated security costs and requirements will continue through the forecast period.

4.4.7 Fuel Assumptions

In accordance with FAA forecasts, fuel costs are assumed to increase significantly (15 percent) in 2006, and then generally grow with inflation. Also, no major increases in fuel taxes are assumed.

4.4.8 Environmental Factors

No major changes in the physical environment are assumed. It is assumed that global climate changes will not be sufficient enough to force restrictions on the burning of hydrocarbons or major fuel tax increases within the forecast period.

4.4.9 National Airspace System

It is assumed that the FAA will successfully implement any required changes and improvements for the national airspace system to accommodate the unconstrained forecast of aviation demand.

4.4.10 Airline Consolidation

It is assumed that factors such as government regulations and labor union resistance will prevent any additional major airline consolidation. Although some minor airline consolidation could continue to occur, no attempt is made to predict the individual airlines that would be affected.

4.5 PASSENGER FORECASTS

This section describes the scheduled and non-scheduled passenger forecasts for ROA. Included is a discussion of assumptions, data sources, and the methodology for the passenger originations forecast. This section also includes the projections of enplanements and connections, load factor, seat departures, fleet mix, and peaking activity. The section concludes with the forecast of non-scheduled (charter) passenger activity.

4.5.1 Methodology, Assumptions, and Data Sources

Following is a summary of the methodology used in the domestic passenger forecast:

- Determine drivers of passenger activity in the Roanoke catchment area.
- Project future passenger enplanements at ROA using regression analysis.
- Project load factor.
- Project seat departures using the enplanement and load factor forecasts.
- Estimate the most likely way that airlines would accommodate the seat departure forecast in terms of aircraft type and frequency of service.
- Convert the scheduled aircraft departure forecast to actual departures using historical departure completion data.

The methodology will be described in greater detail below and in **Appendix C**.

The following data sources were used in the analysis:

- Historical and projected information on population, employment, and real income were obtained from the Regional Economic Accounts prepared by the Bureau of Economic Analysis (BEA) in the U.S. Department of Commerce (see Section 2).
- The USDOT OD1A domestic O&D data base was used to obtain yield (airline revenue per passenger mile) and distance and historical originating traffic.
- Official Airline Guide (OAG) information on scheduled operations was used to determine existing scheduled service by aircraft type.
- The OAG, *JP Fleet Airline-Fleets International*, and individual airline websites were used to determine aircraft seat configurations for each airline.
- *JP Fleet Airline-Fleets International* and other industry publications were used to identify information on airline fleet orders.

4.5.2 Projected Scheduled Passenger Enplanements

The detailed methodology used to project future scheduled passenger enplanements is presented in Appendix C. **Table 4.16** presents the forecast of scheduled passenger enplanements. As shown, total scheduled enplanements are projected to increase from 324,590 in 2005 to 481,182 in 2025, an average annual increase of 1.99 percent.

4.5.3 Projected Load Factor and Seat Departures

Table 4.16 also provides the forecasts of load factor and scheduled passenger aircraft

Table 4.16

Forecasts of Scheduled Enplanements, Load Factor and Scheduled Seat Departures

Year	Scheduled Enplanements (1)	ROA Load Factor (2)	FAA Load Factor (3)	Scheduled Seat Departures (4)
1995	319,256	46.6%		685,806
1996	314,371	46.5%		675,623
1997	323,836	48.3%		670,529
1998	339,010	48.0%		706,226
1999	341,852	45.8%		746,491
2000	357,581	46.3%	59.5%	772,597
2001	300,951	43.0%	58.7%	700,191
2002	295,232	54.2%	61.3%	544,954
2003	286,034	53.4%	64.9%	535,810
2004	306,655	53.9%	68.1%	569,121
2005	324,590	57.0%	69.8%	569,241
2010	355,036	59.9%	73.3%	592,904
2015	392,341	61.0%	74.7%	642,924
2020	432,522	62.2%	76.1%	695,729
2025	481,182	63.3%	77.5%	760,019
Average Annual Growth Rate				
(2005-2015)	1.99%	0.52%	0.52%	1.46%

(1) Table C.4 in Appendix C.
(2) Enplanements divided by scheduled seat departures for historical. Assumed to increase at FAA national domestic rate in future.
(3) FAA Aerospace Forecasts, Fiscal Years 2006-2017.
(4) Official Airline Guide as compiled by BACK Aviation Solutions for historical. Enplanements divided by ROA load factor for future.

Sources: As noted and HNTB analysis.

seat departures.

Over the past several years, the airline industry has experienced a significant increase in the average boarding load factor on both domestic and international flights. The load factor average has increased dramatically, from an average in the mid- to upper-50 percent range in the early 1980s to over 70 percent nationally in 2005. This growth has been fueled by a strong economy, coupled with strong travel demand and actions by the airlines to remove capacity from their systems and to use sophisticated yield management procedures. The FAA projects load factors to continue to increase, but at a more moderate rate than in the past. Load factors at ROA were assumed to increase at the same rate as in the U.S.

Annual scheduled seat departures were estimated by dividing the projections of enplaned passengers by the load factor projections.

4.5.4 Fleet Mix Forecast

The seat departure projections in Table 4.16 were translated into projections of scheduled aircraft flights by type using a set of assumptions regarding airline strategies and available equipment. The projections are guided by the general assumptions outlined in Section 4.4. Based on industry publications and professional experience, additional, more detailed air service assumptions were developed, as listed below:

- No radical changes in airline strategy for how to serve and compete in markets is assumed.
- The current pattern of airline dominance at other airport hubs and non-hubs is assumed to remain substantially in place.
- As projected by the FAA and Boeing, airlines will continue to emphasize frequency when adding service to meet demand. This means that domestic service will be provided principally by regional jets.
- Relaxation of legacy carrier scope clauses will allow their code-sharing regional partners to add regional jets, including larger 70-seat aircraft as necessary, to meet demand.
- The remaining turboprop aircraft are assumed to be gradually retired and replaced by regional jets except for very short-haul flights and flights to airports with airfield configurations that favor turboprop aircraft, such as Philadelphia.
- Since ORD is constrained, it is assumed that increases in demand to that airport will be accommodated with larger 70-seat aircraft.
- Since US Airways already provides scheduled flights from ROA to meet each of CLT's main connecting banks, it is assumed that additional demand to CLT will be accommodated with larger 70-seat aircraft.
- It is assumed that increased traffic to airline hubs other than ORD and CLT will be met with additional frequencies by 50-seat aircraft rather than larger aircraft, since these hubs still have connecting banks that are not yet served from ROA.

- With the exception of niche carriers, such as Allegiant Air, no new service is anticipated to airports that do not accommodate airline hubbing operations.

- No attempt is made to forecast aircraft types not currently in the planning or development stages.

- Future fleet additions beyond those presently announced by the airlines are assumed to be consistent with current announced fleet expansion plans and existing acquisitions.

Using the above assumptions for guidance, fleet mix scenarios were developed for each forecast year. The scenarios were developed so that the selected aircraft types and frequencies, in combination, matched the scheduled seat departure projections for that year.

Table 4.17 presents the forecast of scheduled aircraft departures by aircraft type for ROA. The forecast of scheduled aircraft departures was adjusted by the 2005 ratio of completed departures to scheduled departures to generate a forecast of completed (actual) aircraft departures.

As a percentage of scheduled passenger aircraft departures, regional jets (including 50-seat jets and 70-seat jets) are projected to increase from about 60 percent of the total in 2005 to over 90 percent by 2025. By 2025, 70-seat regional jets are expected to account for slightly above seven percent of the commercial aircraft operation total (compared to 0 percent in 2005) and mainline jets are expected to account for 1.5 percent of the total.

Total annual aircraft operations among scheduled passenger carriers are projected to increase from 23,706 in 2005 to 27,058 in 2025, an average annual increase of 0.7 percent.

4.5.5 Peaking Forecast

Table 4.18 shows the forecasts of peak month, average day peak month (ADPM), and peak hour passengers and passenger aircraft operations. On an ADPM basis, June was the busiest month for passengers at ROA in 2005. Peak month passenger enplanements are projected to grow at the same rate as total passenger enplanements.

Statistical information on historical peak hour load factors is unavailable. Typically, however, airline load factors are near capacity during peak periods. Therefore, 90 percent load factors were assumed during the peak hour and applied to scheduled seat arrivals and seat departures. Like peak month activity, peak hour activity was assumed to increase at the same rate as annual activity.

4.5.6 Non-Scheduled Passenger Activity

Non-scheduled (charter) passengers are a small component of total passenger activity at ROA, never accounting for more than three percent of total enplanements. Historically, charter enplanements at ROA increased during the 1990s but have decreased since 2000, albeit with significant year-to-year fluctuations.[7] Typically, charter

7 The spike in activity occurring in 2000 was related to Virginia Tech's participation in the Sugar Bowl which generated 24 full-sized charter flights.

Table 4.17

Projected Scheduled Passenger Aircraft Departures by Aircraft Type

Equipment Type	Average Seats	2005 (1)	2010	2015	2020	2025
Narrow Body Jets (2)						
M80-BOEING (DOUGLAS) MD80	150	-	104	156	208	208
Turboprop Aircraft (2)						
SF3-SAAB 340	33	1,212	-	-	-	-
DH3-DE HAVILLAND DHC8-300 DASH8/8Q	50	1,756	2,555	2,190	1,825	1,095
DH8-DE HAVILLAND DHC8 DASH 8	37	1,985	882	-	-	-
Subtotal		4,953	3,437	2,190	1,825	1,095
Regional Jets (2)						
ER4-EMBRAER RJ145	50	1,960	1,825	2,754	2,920	3,160
CRJ-CANADAIR REGIONAL JET	50	5,400	6,570	6,935	7,013	7,766
E17-EMBRAER RJ170	70	-	-	365	1,095	1,825
Subtotal		7,360	8,395	10,054	11,028	12,751
Total Scheduled Departures (3)		12,313	11,936	12,400	13,061	14,054
Total Completed Departures (4)		11,853	11,490	11,937	12,573	13,529
Total Operations (5)		23,706	22,980	23,873	25,146	27,058
Distribution						
Turboprops		40.2%	28.8%	17.7%	14.0%	7.8%
Regional Jets		59.8%	70.3%	81.1%	84.4%	90.7%
Narrow Body Jets		0.0%	0.9%	1.3%	1.6%	1.5%
Total		100.0%	100.0%	100.0%	100.0%	100.0%
Total Scheduled Seat Departures		569,241	595,734	642,900	695,750	760,000

(1) Official Airline Guide.
(2) Aircraft mix estimated so that seat departures equal seat departure estimate in Table 4.16.
(3) Sum of scheduled aircraft departures by type.
(4) Existing completed departures from Airport records. Future completion ratio assumed to be the same as in 2005.
(5) Completed departures multiplied by 2.

Sources: Official Airline Guide as compiled by BACK Aviation Solutions and HNTB analysis.

Table 4.18

Projected Peak Activity
Scheduled Passenger Carriers

	2005	2010	2015	2020	2025
Passengers					
Annual Enplanements (1)	324,590	355,036	392,341	432,522	481,182
Peak Month Enplanements (2)	29,438	32,199	35,583	39,227	43,640
Average Day Peak Month Enplanements (3)	981	1,073	1,186	1,308	1,455
Peak Hour Enplanements (4)	225	246	272	300	334
Peak Hour Deplanements (4)	225	246	272	300	334
Peak Hour Passengers (4)	405	443	490	540	600
Operations					
Annual Operations (5)	23,706	22,980	23,873	25,146	27,058
Peak Month Operations (2)	2,052	1,989	2,066	2,177	2,342
Average Day Peak Month Operations (3)	68	66	69	73	78
Peak Hour Departures (6)	5	5	5	5	6
Peak Hour Arrivals (6)	5	5	5	5	6
Peak Hour Operations (6)	9	9	9	10	10

(1) Table 4.16.
(2) Existing data from Table 4.14. June was selected because it accounts for the most average day peak month (ADPM) enplanements. Future peak month percentage assumed to remain constant.
(3) Peak month divided by 30 days.
(4) Existing seat arrival and deparrture data from Table 4.15. Peak hour load factor assumed to be 90 percent. Peak hour levels assumed to increase at same rate as average day peak month enplanements.
(5) Table 4.17.
(6) Existing scheduled aircraft operations data from Table 4.15. Peak hour levels assumed to increase at same rate as average day peak month enplanements.

Sources: As noted and HNTB analysis.

operators cater to tour groups traveling to leisure destinations or to sports teams traveling to road games. In the case of ROA, charter operations have a facilities impact that is disproportionate to their share of enplanements since they employ larger aircraft than the scheduled passenger carriers.

Good historical data on charter activity is difficult to obtain, therefore it is not possible to develop a forecast using regression analysis or trend analysis. The FAA does not publish forecasts of national charter activity so a share analysis is not possible either. Many charter operators compete with low-fare carriers for price-sensitive vacation travelers. Since low-fare carriers are not expected to have a major presence at ROA, charter carriers would be expected to have an advantage. However, charter passengers have been declining since 2000. There is no reasonable basis for projecting a major increase or decrease in charter activity over the forecast period. Therefore, it was assumed that non-scheduled passenger enplanements and operations would remain constant at the 2001-05 average through 2025. **Table 4.19** shows the forecast of charter enplanements and aircraft departures.

Table 4.20 shows the fleet mix forecast for charter aircraft operations. The future fleet mix was estimated based on existing charter carrier fleets and available information on aircraft acquisition plans. Older aircraft were assumed to be gradually retired. The seat departures generated by each aircraft type were calculated and the projected aircraft departures were adjusted so that total projected seat departures remained roughly constant, consistent with the passenger and aircraft operation forecasts. Narrow-body aircraft are forecast to continue to account for the vast majority of charter operations.

4.6 AIR CARGO FORECASTS

Over the past 20 years, air cargo has been one of the most rapidly growing areas of aviation activity, primarily because of new innovative services such as overnight door-to-door delivery and, to some extent, strong economic growth in the U.S and abroad. This section reviews the air cargo forecast for ROA, beginning with the assumptions, methods, and data used in the forecast and ending with a discussion of the forecast results.

4.6.1 Background

Air cargo differs from passenger traffic because the potential service area is much more extensive. While passengers may balk at driving more than an hour to an airport, shippers and freight forwarders routinely truck freight 500 miles or more to an airport offering the best rates and service. Consequently, there is less certainty as to whether an airport is capturing its true air cargo potential. A rapidly changing operating environment and fluid markets make air cargo less predictable than passenger traffic at ROA.

Air cargo is either carried in the belly of passenger aircraft or by all-cargo carriers such as FedEx, UPS, and DHL. Until recently, nearly all international cargo and most domestic and international mail were carried by passenger aircraft. However, in

Table 4.19

Forecast of Passenger Charter Activity

Year	Enplanements (1)	Enplanemen ts per Aircraft Departure (2)	Aircraft Departures (3)	Aircraft Operations (4)
2000	7,922	149.5	53	106
2001	3,377	88.9	38	76
2002	3,807	181.3	21	42
2003	4,290	110.0	39	78
2004	4,034	103.4	39	78
2005	2,680	111.7	24	48
2010	3,638	113.0	32	64
2015	3,638	113.0	32	64
2020	3,638	113.0	32	64
2025	3,638	113.0	32	64
Average Annual Growth Rate				
(2005-2015)	1.54%	0.06%	1.48%	1.48%

(1) Historical data from Table 4.6. Future enplanements assumed to remain constant at average for last five years.
(2) Future enplanements per aircraft departure assumed to remain constant at average for last five years.
(3) Historical data from Roanoke Airport Commission, Air Traffic Activity Reports. Future departures estimated by dividing enplanements by enplanements per aircraft departure.
(4) Aircraft departures multiplied by two.

Sources: As noted and HNTB analysis.

Table 4.20

Projected Annual Charter Passenger Aircraft Departures by Aircraft Type

Equipment Type	Average Seats	2004 (1)	2005 (2)	Forecast (2) 2010	2015	2020	2025
727-200 Boeing	135	3	-	-	-	-	-
737-100/200 Boeing	114	20	11	5		-	-
737-200C Boeing	122	4	1	-	-	-	-
737-700 Boeing	148	4	3	8	9	9	10
737-800 Boeing	173	2	8	8	9	10	10
757-200 Boeing	175	2	1	1	1	1	1
A319 Airbus	122	-	-	5	6	6	7
DC-9-15	50	1	1	1		-	-
Canadair CRJ-200	50				3	3	3
MD-80	150		1	2	2	1	-
MD-87	130	2	-	2	2	2	1
Subtotal		39	24	32	32	32	32
Total Operations		78	48	64	64	64	64
Total Seat Departures		4,922	3,344	4,533	4,506	4,529	4,519

(1) Historical fleet mix from USDOT T100 data base, applied to aircraft departures from Table 4.19.

(2) Forecast fleet mix estimated so that aircraft departures and seat departures remain constant. See text for details.

Sources: As noted and HNTB analysis.

response to the September 11th terrorist attacks, the FAA has issued a new security directive to strengthen security standards for transporting cargo on passenger flights. This directive has caused a significant shift in air cargo activity from passenger carriers to all-cargo carriers.

Another factor that will affect air cargo at ROA will be the operations performed by Airborne Express (ABX Air). ABX Air formerly provided air transportation services for Airborne Express. Upon the acquisition of Airborne Express by DHL, ABX Air became a new independent entity, but DHL remained its primary customer. ABX Air performs cargo operations for DHL at ROA.

The objective of the cargo forecast is to project cargo operations and, therefore, it focuses on the cargo carried by all-cargo carriers. Because belly cargo is carried by passenger aircraft, it does not result in any additional aircraft operations.

4.6.2 Methodology and Data Sources

This section provides a brief overview of the air cargo forecasting methodology, including descriptions of the data sources.

A regression analysis approach, mainly based on national factors, was used to project air cargo activity. A bottom-up approach based purely on local historical data was not possible because there is no data on the "leakage" that may be occurring from the ROA air cargo catchment area to other airports that have a broader range of air cargo services, such as IAD. Therefore, it is not possible to assess the relationship between local economic factors and local air cargo demand.

The selected top-down approach can be briefly summarized as follows:

- Develop forecasting model.
- Project future enplaning and deplaning domestic cargo tonnage for ROA.
- Determine the domestic passenger carrier cargo capacity.
- Allocate tonnage projections to passenger carriers and all-cargo carriers.
- Estimate required domestic all-cargo aircraft capacity.
- Derive projection of all-cargo aircraft departures and fleet mix that will accommodate required domestic all-cargo aircraft capacity.

Historical data and industry forecasts for the air cargo volume forecast were compiled from a variety of sources. Those sources include the Airport, the USDOT's Schedule T-100 and Schedule T-3 Airport Activity Statistics, the FAA, Boeing, Airbus, JP Airline-Fleets International, and other industry publications.

Some carriers have ceased distinguishing between air mail and air freight when reporting their statistics. Consequently, the forecast contained herein combines freight and mail into a single air cargo category. All statistics are presented in short tons (2000 pounds per ton).

4.6.3 Air Cargo Tonnage Forecasts

Regression analysis—a statistical method used to generate an equation that best explains the historical relationship among variables—was used to project future tonnage at ROA. Using historical data (1993-2003), several independent variables were tested. These independent variables included US income, US employment, Roanoke catchment area employment, Roanoke catchment area income, US revenue ton miles (RTMs), and population.

Additionally, a number of instrument variables (dummy variables) were tested, including a variable that represents the rise of a mail order service at ROA during the mid-1990s that eventually became absorbed into ground service and a variable that adjusted for the September 11th terrorist attacks and the concurrent recession. These variables are set to equal one during years that the effect they represent exists, and are set to equal zero in years that the effect is absent. For instance, during 1995 the dummy variable for mail order service was set to one and during 2002 the variable was set to zero.

The model that produced the best results, from a theoretical standpoint, was a logarithmic formulation, which specified ROA cargo tonnage (ROA_TON) as a function of domestic RTM's (USRTM), and the 9/11 dummy variable (9/11). This formula is used to project future cargo tonnage at ROA as a function of the FAA projected growth for US RTM's while adjusting for the 9/11 effect on tonnage. The R-squared for the equation is .88. This shows a strong correlation between the dependent variables (ROA_TON and 9/11) and the independent variable (ROA_TON).

Equation 1.

$$\text{ROA\_TON} = (10^{3.26683})*(\text{USRTM}^{0.24185})*(9/11^{-.1418})$$

As was the case with the passenger forecast model (see **Appendix D**), each of the exponents associated with the input variables is an elasticity. Therefore, every one percent increase in domestic RTM's will increase the cargo tonnage by approximately 0.24 percent. The dummy variable for 9/11 had the effect of decreasing the tonnage by 0.14 percent for the forecast years.

It was assumed that the historical relationship between variables will continue throughout the forecast period and this equation was, therefore, used to forecast cargo tonnage over the forecast period.

Table 4.21 presents projected air cargo tonnage for ROA. Table 4.21 displays the historical US tonnage in RTMs and ROA tonnage as combined freight and mail as well as future tonnage for both the U.S. and for ROA. Based on the forecasting equation, the future air cargo tonnage for ROA was projected as a function of the domestic cargo RTMs.

The ratio between enplaned and deplaned tonnage was assumed to remain the same as in 2005.

As shown in Table 4.21, cargo tonnage is projected to increase from 15,802 tons in 2005 to 18,336 tons by 2025.

Table 4.21

Projected Air Cargo Tonnage

	Domestic	
Year	US RTMs (millions) (1)	ROA Tonnage (2)
1990	n/a	10,365
1991	n/a	9,943
1992	n/a	12,947
1993	10,374	15,267
1994	11,323	19,794
1995	12,416	27,186
1996	12,782	25,488
1997	13,454	20,550
1998	13,828	20,259
1999	13,975	17,926
2000	14,699	16,218
2001	13,934	13,657
2002	12,967	13,085
2003	14,270	13,325
2004	16,341	13,643
2005	16,080	15,802
2010	18,930	16,438
2015	22,033	17,053
2020	25,597	17,683
2025	29,738	18,336
Average Annual Growth Rate		
2005-2025	3.1%	0.7%

(1) FAA forecast of domestic revenue ton miles. Data prior to 2003 does not include Airborne Express.
(2) Historical data from Table 4.12. Forecast based on forecasting equation (see text for details).

Sources: FAA Aerospace Forecasts: Fiscal Years 2006-2017 and HNTB analysis.

4.6.4 Passenger (Belly) Cargo Tonnage Projections

The historical trend in the United States has been for the belly cargo share of air freight to decline as the integrated carriers have gained market share and the passenger carriers have increasingly emphasized quick turnaround times and high passenger load factors, which reduce their ability to load air freight. The trend for decreasing passenger carrier cargo load factors has been consistent in the United States since the 1980s. In the case of ROA, the transition from mainline jets to regional jets and their very limited bellyhold capacity has exacerbated this trend.

The FAA does not publish a specific cargo load factor forecast but, since the FAA projects passenger Available Seat Miles (ASMs) to increase much faster than passenger carrier RTMs, it can be inferred that the FAA anticipates passenger carrier cargo load factors to continue to decline. The relationship between FAA-projected RTMs and ASMs was applied to the forecast of domestic seat departures to prepare a forecast of belly cargo for ROA. As shown in **Table 4.22**, domestic belly cargo is projected to decrease from 160 tons in 2005 to 143 tons in 2025.

4.6.5 All Cargo Tonnage and Capacity

All-cargo tonnage was estimated as the difference between total tonnage and passenger carrier tonnage. All-cargo tonnage in Table 4.22 is projected to increase from 15,643 tons in 2005 to 18,193 tons in 2025.

Future required all-cargo lift capacity was estimated by dividing all-cargo tonnage by the estimated load factor. Cargo load factors were assumed to increase 0.5 percent per year. This assumption is based on the Boeing and Airbus world air cargo forecasts which assume "modest" increases in cargo load factor. Airbus projected that increased aircraft utilization and higher load factors, by themselves, would account for about a one percent per year increase in freight traffic.[8] If the increase is split equally among aircraft utilization and load factor, each would account for about 0.5 percent per year.

Domestic cargo tonnage is sensitive to the cost-effectiveness of transporting the cargo by truck versus air. Due to Roanoke's proximity to Interstate 81, cargo can easily be trucked to and from large metropolitan areas like Washington, D.C., Atlanta, and New York. Competition from trucking has hindered domestic cargo growth in the recent past and will likely continue to hinder it in the future.

As shown in Table 4.22, required freighter departure lift capacity (arriving and departing) is projected to increase from 64,811 tons in 2005 to 68,223 tons in 2025.

4.6.6 All-Cargo Fleet Mix and Aircraft Operations

Belly cargo does not result in any additional operations, so increases in aircraft operations will depend on the amount of all-cargo carrier freight and mail. The forecast of all-cargo aircraft departures was prepared

[8] *Airbus Global Market Forecast 2004-2023* and *Boeing World Air Cargo Forecast 2004/2005.*

Table 4.22

Forecast of Domestic Passenger and All-Cargo Carrier Cargo Tonnage

	2004	2005	2010	2015	2020	2025
Total Tonnage						
Enplaned (1)	6,130	7,185	7,474	7,753	8,040	8,337
Deplaned (1)	7,512	8,617	8,964	9,299	9,643	9,999
Total (2)	13,643	15,802	16,438	17,053	17,683	18,336
FAA Forecasts (3)						
Domestic Passenger RTMs	3,300	3,082	3,379	3,642	3,900	4,176
Domestic ASMs	730	756	869	1,045	1,265	1,531
Ratio	4.52	4.08	3.89	3.49	3.08	2.73
ROA Seat Departures (4)	569,121	569,241	592,904	642,924	695,729	760,019
Passenger Carrier Tonnage (5)						
Enplaned	73	62	62	60	57	55
Deplaned	188	98	97	94	90	87
Total	260	160	159	154	147	143
Total All-Cargo Tonnage (6)						
Enplaned	6,058	7,123	7,412	7,694	7,983	8,281
Deplaned	7,325	8,520	8,867	9,205	9,553	9,912
Total	13,382	15,643	16,280	16,899	17,535	18,193
All-Cargo Carrier Capacity (7)	55,886	64,811	65,789	66,610	67,416	68,223
Load Factor (8)	23.95%	24.14%	24.75%	25.37%	26.01%	26.67%

(1) Future distribution between enplaned and deplaned tonnage assumed to be the same as existing distribution.
(2) Table 4.21.
(3) FAA Aerospace Forecasts: Fiscal Years 2006-2017.
(4) Table 4.16.
(5) Assumed to increase at same rate as ROA seat departures adjusted by national ratio of domestic passenger RTMs to domestic passenger ASMs.
(6) Total tonnage less passenger carrier tonnage.
(7) Historical data from USDOT T100 data base as compiled by Data Base Products, Inc. Future required all-cargo capacity estimated by dividing total all-cargo tonnage by load factor.
(8) Assumed to increase by 0.5 percent per year. See text for details.

Sources: FAA Aerospace Forecasts Fiscal Years 2006-2017 and HNTB analysis.

by using the estimate of future freighter lift capacity requirements, then projecting a fleet mix based on all-cargo carrier aircraft orders. The forecast of all-cargo aircraft departures was derived by dividing the total capacity requirement by the average capacity per aircraft based on the fleet mix.

The future all-cargo fleet mix was estimated using the following assumptions:

- Consistent with the most recent Boeing and Airbus forecasts, the majority of all-cargo carrier fleet additions are expected to come from converted passenger aircraft rather than new aircraft.

- As they approach the end of their useful economic life, the Stage 2 narrow-body aircraft, including those with hush kits, are expected to be gradually phased out.

- Consistent with Boeing projections, more Boeing 737 freighters are projected to be introduced as replacement narrow-body air cargo aircraft.

- FedEx and UPS are projected to continue to operate the Airbus A300 and A310 aircraft.

- ABX is projected to gradually add the Boeing 767 aircraft they have on order as their older aircraft are retired.

- No attempt is made to forecast aircraft not currently in the planning or development stages.

As shown in **Table 4.23**, total all-cargo aircraft operations are projected to decrease from 2,214 in 2005 to 1,860 in 2015, due to the introduction of larger capacity aircraft. By 2025, all-cargo aircraft operations are projected to increase again to 2,011.

4.7 AIR TAXI, GA, AND MILITARY ACTIVITY

This section discusses the forecasts of air taxi which includes for-hire and other non-scheduled commercial aircraft operations, general aviation, and military activity.

4.7.1 Air Taxi and Other

The category of air taxi and other includes operations by non-scheduled charter operators and air taxi operators that are not included in other categories (scheduled and charter passenger, air cargo). GA and military will be discussed later in this section. These additional operators include both specialized cargo carriers and true air taxi operators.

These operations are not separately included in the Airport statistics or OAG schedules and are only intermittently included in the USDOT statistics. The total number of aircraft operations in this category at ROA came from the Airport activity statistics. The air taxi and other category accounted for 9,576 operations in 2005 (see **Table 4.24**). The principal source of information on the fleet mix and hourly distribution of the air taxi and other category is a radar sample taken using Flight Explorer software over a one-week period in December 2005.

Historical data on these operations is scant, so it is difficult to perform any type of statistical analysis on this activity category.

Table 4.23

Cargo Carrier Fleet Mix Projections

Aircraft Type	Average Capacity (Tons) (1)	Aircraft Departures and Arrivals (2)					Capacity (in tons) (2)				
		2005 (1)	2010	2015	2020	2025	2005 (a)	2010	2015	2020	2025
Dassault Falcon	3.0	10	0	0	0	0	30	-	-	-	-
DC-9-15	11.0	7	0	0	0	0	77	-	-	-	-
DC-9-30	17.0	42	0	0	0	0	712	-	-	-	-
DC-9-40	18.0	756	260	51	0	0	13,596	4,676	917	-	-
727-100 Boeing	19.2	92	0	0	0	0	1,765	-	-	-	-
727-200 Boeing	28.7	426	260	93	0	0	12,214	7,455	2,666	-	-
CV-580 Convair	8.0	6	1	0	0	0	48	8	-	-	-
757-200 Boeing	39.3	736	915	1040	1040	1023	28,899	35,927	40,836	40,836	40,168
737-300/400 Boeing	14.0	0	104	260	411	520	0	1,456	3,640	5,754	7,280
A300-600 Airbus	45.0	166	260	260	260	208	7,470	11,700	11,700	11,700	9,360
767-200 Boeing	43.9	0	104	156	208	260	0	4,566	6,848	9,131	11,414
Total		2,241	1,904	1,860	1,919	2,011	64,811	65,787	66,608	67,421	68,222
Required Capacity (3)							64,811	65,789	66,610	67,416	68,223

(1) USDOT T100 data as compiled by DataBase Products, Inc.
(2) Fleet mix estimated so that aircraft capacity sums to required capacity estimated in Table 4.22.
(3) Table 4.22.

Sources: As noted and HNTB analysis.

Table 4.24

Air Taxi and Other Annual Operations Forecast

Year	2005 (1)	2010 (2)	2015 (2)	2020 (2)	2025 (2)	Average Annual Increase
US Income (3)	$9,798,386,969	$10,824,058,031	$11,982,463,283	$13,272,837,742	$14,713,492,048	2.1%
ROA Primary Catchment Area Income (3)	$17,537,171	$19,223,653	$21,116,230	$23,205,967	$25,517,786	1.9%
Single Engine Reciprocating	593	627	661	695	731	1.1%
Multi-Engine Reciprocating	5,693	5,971	6,257	6,555	6,865	0.9%
Multi-Engine Turboprop	475	504	528	549	571	0.9%
Multi-Engine Turbo Jet	2,846	4,927	7,879	10,749	14,661	8.5%
Total	9,606	12,029	15,325	18,548	22,828	4.4%

(1) Table 4.13 for totals and Flight Explorer tracking data for fleet mix. Excludes charter and cargo.
(2) Assumed to increase at FAA projected rate for hours flown in each category and then adjusted for income growth in catchment area relative to income growth inU.S.
(3) Table 4.4.

Sources: FAA Aerospace Forecasts: Fiscal Years 2006-2017, and HNTB analysis.

Non-scheduled operations tend to be more variable and unpredictable than scheduled operations. The FAA includes air taxi activity with regional carrier activity when forecasting. The air taxi and other category also shares some characteristics with GA, specifically in terms of the type of aircraft used.

The principal functions of the air taxi and other category—on-demand transfer of time-sensitive documents and executive personnel—have become increasingly important in today's economy, where speed and flexibility are critical. This suggests that future air taxi activity is poised for significant growth. Conversely, the growth in electronic check transfers will likely cause a reduction in the number of check transfer flights. Very light jets (VLJ's) or microjets, jets smaller than King Air but large enough to carry 3-6 passengers, are forecast by the FAA to grow significantly in the future and could add significant operations to airports as well. According to the FAA, after 2006, 500 VLJs will be added to the national fleet each year. VLJ's, in combination with proposed new innovative air taxi/charter services, are touted as a solution for smaller underserved airports such as ROA. The technology and business models, however, are as yet unproven. Therefore, there is high degree of uncertainty regarding their impact on air taxi operations at ROA and elsewhere.

Acknowledging the lack of historical data and considering potentially contradictory trends in future activity, it was assumed that future ROA air taxi operations in each equipment category would grow at the same rate as the FAA forecast of GA and air taxi hours flown in that category. Since the economy in the ROA catchment area is expected to grow slightly less quickly than in the country, the growth rates were tapered slightly to reflect the projected differential in income growth. The result, as shown in Table 4.24, is a significant increase in jet operations and more moderate increases in the other categories. Most of the operators in the air taxi and other category fly jets. New air taxi initiatives such as Pogo Jet assume the use of the aforementioned VLJ's. Consequently, it is reasonable to expect that most of the new growth in this category will consist of jet aircraft.

Table 4.24 presents the forecast of air taxi and other operations, including the fleet mix. As shown, operations in this category are projected to increase from 9,606 in 2005 to 22,828 in 2025, an average annual increase of 4.4 percent.

4.7.2 General Aviation

General aviation operations at ROA have been declining in the long-term. Most of the decline has been in local operations, but itinerant operations have also diminished. This decline has mirrored national declines in general aviation demand since the late 1970s. There is no consensus regarding the reasons for the decline, but the increased cost and hassle associated with flying, especially personal and recreational flying are considered to be contributing factors.

As shown in **Table 4.25**, 125 GA aircraft were based at ROA in 2005. Most of these aircraft are single-engine piston, but multi-engine aircraft and jets are also represented. Historically, based aircraft at ROA have increased at moderate rates, consistent with increases in the national GA fleet over the

Table 4.25

General Aviation Based Aircraft Forecast

Year	2005 (1)	2010 (2)	2015 (2)	2020 (2)	2025 (2)	Average Annual Increase
US Income (3)	$9,798,386,969	$10,824,058,031	$11,982,463,283	$13,272,837,742	$14,713,492,048	2.1%
ROA Primary Catchment Area Income (3)	$17,537,171	$19,223,653	$21,116,230	$23,205,967	$25,517,786	1.9%
Single Engine Reciprocating	91	92	92	93	93	0.1%
Multi-Engine Reciprocating	19	19	19	19	19	0.0%
Multi-Engine Turboprop	9	10	11	12	13	1.9%
Multi-Engine Turbo Jet	6	8	11	14	17	5.3%
Total	125	129	133	138	142	0.6%

(1) Virginia Airport Annual Based Aircraft Survey Summary Report.
(2) Assumed to increase at FAA projected rate for aircraft fleet in each category and then adjusted for income growth in catchment area relative to income growth inU.S.
(3) Table 4.4.

Sources: FAA Aerospace Forecasts: Fiscal Years 2006-2017, and HNTB analysis.

same period. Therefore, based aircraft at ROA in each GA aircraft category were assumed to grow at the same rate as the FAA forecast of the aircraft fleet in that category. The projected growth in based aircraft was adjusted slightly to reflect the forecast difference in income growth between the ROA catchment area and the United States. Based aircraft are projected to increase from 125 in 2005 to 142 in 2025.

GA operations at ROA stayed relatively flat during the late 1990s, but declined since 2001. As noted earlier, the decline in local operations has been much more prominent than the decline in itinerant operations. Therefore, the two categories were projected separately. **Table 4.26** shows the forecast of GA operations.

Table 4.26 also shows the recent history of itinerant GA operations at ROA and compares it to the FAA count of hours flown by GA and air taxi operations in the U.S. ROA itinerant GA operations, as a share of US hours flown, have been consistently declining. GA activity in the U.S. rose in the late 1990s but then declined as a result of the recession and the 9/11 attacks. Since 2001, US GA activity (hours flown) has been relatively constant. The FAA predicts that GA will begin to grow again in the near future based on the following assumptions:

- Moderate sustained economic growth;
- No dramatic changes in the GA regulatory environment; and,
- Increased growth in the fractional ownership market, which brings new owners and operators into business aviation.

As shown in Table 4.26, the share of US GA activity accounted for by ROA itinerant operations is assumed to continue to decline. The anticipated growth in US GA hours flown, however, is expected to offset the rate of reduction. Therefore, itinerant GA operations at ROA are forecast to reverse their recent decline and increase from 24,060 in 2005 to 30,502 in 2025.

Local operations consist mostly of training (touch and go) flights. Therefore, it is reasonable that the number of local operations should be related to the number of student pilots. This ratio has been falling and is expected to continue to fall, in part because of the increase reliance on aircraft simulators. Based on the ratio of local GA operations to student pilots and the FAA forecast of future student pilots, local operations are predicted to continue to decline but at a lower rate than in the recent past. Local GA operations at ROA are projected to fall from 24,668 operations in 2005 to 22,510 operations in 2025.

Total GA operations at ROA are forecast to increase moderately from 48,892 in 2005 to 53,012 in 2025.

Table 4.27 details the forecast of GA operations by type. The existing distribution of operations is based on an estimate by the FBO. Each category was projected by multiplying by the rate of growth in the FAA forecast for GA hours flown in that category. The projections were then adjusted on a prorated basis so that the total operations equaled those forecast in Table 4.26. The forecast projects substantial growth in jet operations at the expense of turboprop and piston operations.

Table 4.26

Forecast of General Aviation Operations

Year	FAA GA and Air Taxi Hours Flown (1)	Ratio of ROA Itinerant GA Operations to FAA Hours Flown (2)	ROA Itinerant GA Operations (3)	FAA Student Pilots (1)	Ratio of ROA Local GA Operations to FAA Hours Flown (4)	ROA Local GA Operations (5)	Total ROA GA Operations (6)
1990	31,744	1.100	34,906	n/a	n/a	54,156	90,670
1991	31,123	1.041	32,391	n/a	n/a	42,540	74,931
1992	27,401	1.113	30,498	n/a	n/a	38,472	68,970
1993	25,286	1.265	31,995	103,583	0.370	38,302	70,297
1994	24,911	1.230	30,646	96,254	0.400	38,514	69,160
1995	26,612	1.151	30,629	101,279	0.433	43,810	74,439
1996	26,909	1.067	28,718	94,947	0.358	34,030	62,748
1997	27,713	1.007	27,910	96,101	0.434	41,718	69,628
1998	28,100	0.987	27,740	97,736	0.424	41,466	69,206
1999	31,230	0.897	28,005	99,184	0.342	33,888	61,893
2000	30,219	0.903	27,283	99,110	0.389	38,558	65,841
2001	27,017	0.991	26,770	94,420	0.362	34,210	60,980
2002	27,040	0.951	25,703	85,991	0.395	33,924	59,627
2003	27,049	0.843	22,790	87,296	0.285	24,874	47,664
2004	27,255	0.863	23,511	87,910	0.255	22,460	46,013
2005	28,293	0.850	24,060	87,213	0.283	24,668	48,892
2010	33,315	0.781	26,004	92,422	0.253	23,380	49,384
2015	38,977	0.716	27,926	102,041	0.226	23,086	51,012
2020	44,379	0.658	29,186	112,663	0.202	22,796	51,982
2025	50,529	0.604	30,502	124,391	0.181	22,510	53,012

(1) FAA, FAA Aerospace Forecasts: Fiscal Years 1995-2006, 1998-2009, 2000-2011, and 2006-2017.

(2) Historical ratio of GA itinerant operations at ROA to US GA and Air Taxi Hours Flown. Assumed to continue to change at historical rates.

(3) Historial itinerant GA operations from FAA ATADS data base. Future GA operations estimated by multiplying FAA forecast of GA and Air Taxi hours flown by ratio of ROA itinerant GA operations to FAA hours flown.

(4) Historical ratio of GA local operations at ROA to US Student Pilots. Assumed to continue to change at historical rates.

(5) Historial local GA operations from FAA ATADS data base. Future local GA operations estimated by multiplying FAA forecast of Student Pilots by ratio of ROA local GA operations to FAA Student Pilots.

(6) Historical data from Table 4.13. Historical local and itinerant operations may not sum exactly to total operations because data were obtained from different sources. Future estimates equal to sum of local and itinerant operations forecasts.

Sources: As noted and HNTB analysis.

Table 4.27

Forecast of General Aviation Operations by Type

Year	2005 (1)	2010 (2)	2015 (2)	2020 (2)	2025 (2)	Average Annual Increase
Single Engine Reciprocating	9,778	8,559	7,528	6,800	6,041	-2.4%
Multi-Engine Reciprocating	9,778	8,487	7,419	6,676	5,907	-2.5%
Multi-Engine Turboprop	17,112	15,028	13,144	11,738	10,308	-2.5%
Multi-Engine Turbo Jet	11,734	16,805	22,423	26,275	30,276	4.9%
Helicopter	490	505	498	493	480	-0.1%
Total (3)	48,892	49,384	51,012	51,982	53,012	0.4%

(1) Distribution based on FBO estimate.
(2) Assumed to increase at FAA projected rate for hours flown in each category and then adjusted on a prorated basis to sum to total operations estimated in Table 4.26.
(3) Table 4.26.

Sources: FAA Aerospace Forecasts: Fiscal Years 2006-2017, and HNTB analysis.

4.7.3 Military

Military operations are related to national and international political and institutional factors rather than local economic conditions. Military operations at ROA decreased during the past 15 years, albeit with significant year-to-year fluctuations. Due to the uncertainties enumerated above and consistent with national forecasts, military operations are assumed to remain constant at an average of 2003-2005 levels throughout the forecast period. However, future national defense actions could increase or decrease future military operations. **Table 4.28** shows the forecast of military operations.

4.8 SUMMARY OF PROJECTED ACTIVITY

The summary forecasts are presented in this section, including operations, peak activity, a consolidated fleet mix, and a comparison with the TAF.

Table 4.29 summarizes the forecast of aircraft operations for ROA, including annual, peak month, ADPM, and peak hour operations. Total annual operations are projected to increase from 85,894 in 2005 to 106,347 in 2025, an average annual increase of 1.1 percent. Most of the increase is attributable to air taxi operations. Peak month operations in each category were assumed to increase at the same rate as annual operations in that category. Likewise, ADPM and peak hour operations were projected to grow at the same rate as peak month operations in the corresponding category. **Figure 4.3** also provides a summary of the operations forecasts, along with the passenger and cargo forecasts.

Table 4.30 provides a detailed projection of the hourly distribution of aircraft arrivals and departures during the peak month for overall operations. Existing distributions were obtained from the OAG for scheduled passenger aircraft operations and from Flight Explorer radar tracking for non-scheduled operations. Peak hour operations are projected to increase from 30 in 2005 to 37 in 2025. The average time for peak hour operations is projected to shift from the 2:00 PM to 3:00 PM hour to the 5:00 PM to 6:00 PM hour, driven by the increase in air taxi operations.

Table 4.31 summarizes the fleet mix forecasts. Using the FAA definition of a critical aircraft accounting for at least 500 operations per year, the Boeing 757-200 is expected to continue in that role. Cargo carriers, along with some passenger charter carriers are expected to account for all the large aircraft operations. By the end of the forecast period, small jet aircraft, including both regional jets and business jets, are expected to account for the majority of aircraft operations at ROA.

Table 4.32 compares the Master Plan forecast with the FAA's TAF published in February 2006 and the Virginia Department of Aviation's (VDOA) 2003 Virginia Air Transportation System Plan forecast (VATSP). It should be noted the forecasts are not exactly comparable. First the Master Plan forecasts are based on calendar year data and the TAF's are based on fiscal year data. Secondly, the VATSP forecasts were published three years ago and, therefore, use

Table 4.28

Forecast of Military Operations

Year	ROA Military Operations (1)
1990	1,713
1991	1,420
1992	1,737
1993	1,902
1994	1,813
1995	1,962
1996	2,044
1997	1,235
1998	1,433
1999	2,109
2000	1,744
2001	2,124
2002	1,807
2003	1,430
2004	1,292
2005	1,401
2010	1,374
2015	1,374
2020	1,374
2025	1,374

(1) Historical data from Table 4.13. Future military operations assumed to remain constant at 2003-2005 average.

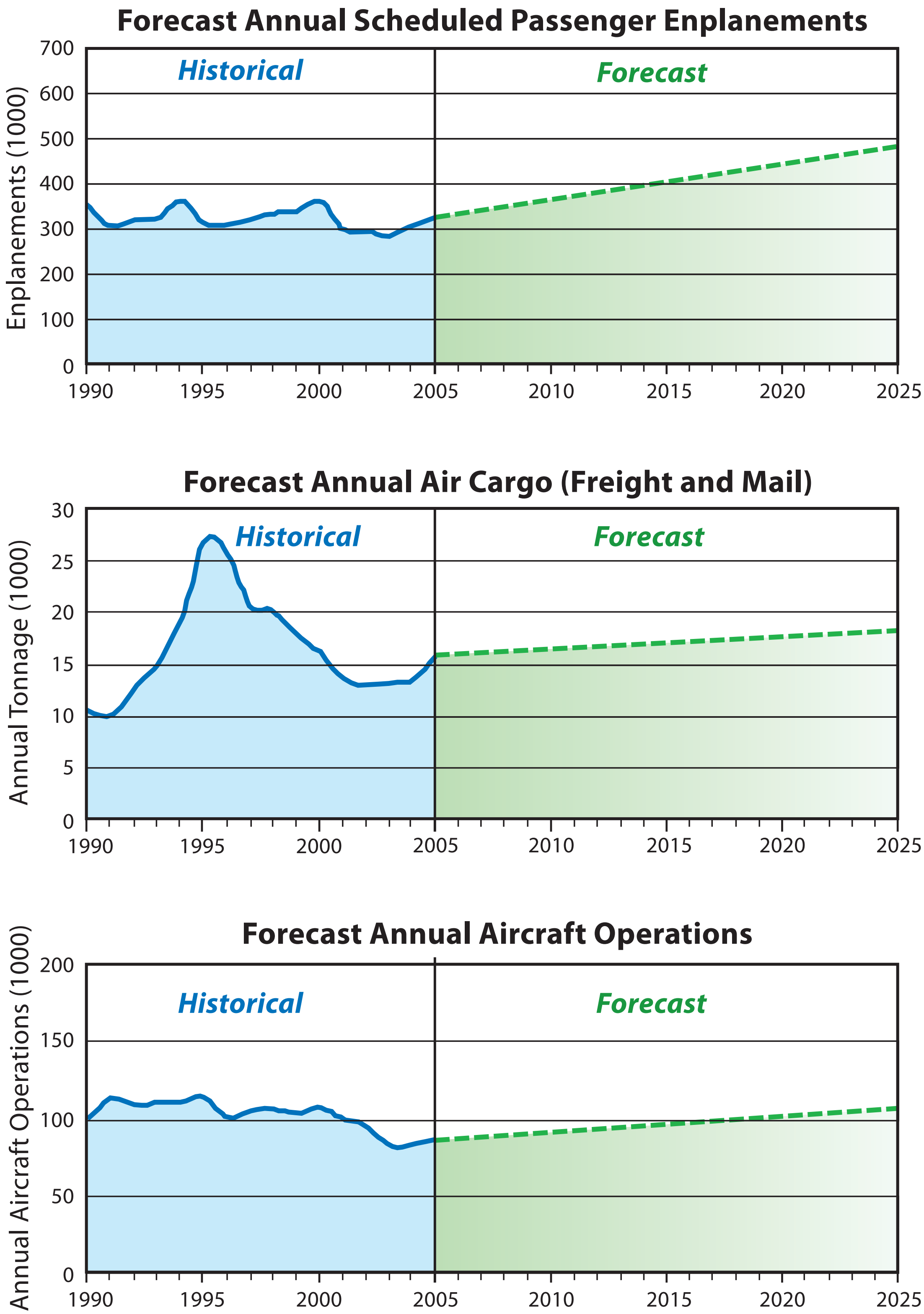
Sources: As noted and HNTB analysis.

Table 4.29

Summary of Aircraft Operations Forecasts

Year	Scheduled Passenger Carrier	Charter Carrier	All-Cargo Carrier	Air Taxi	General Aviation	Military	Total
				Annual			
2005	23,706	48	2,241	9,606	48,892	1,401	85,894
2010	22,980	64	1,904	12,029	49,384	1,374	87,736
2015	23,873	64	1,860	15,325	51,012	1,374	93,509
2020	25,146	64	1,919	18,548	51,982	1,374	99,033
2025	27,058	64	2,011	22,828	53,012	1,374	106,347
				Average Annual Growth			
2005-2025	0.7%	1.4%	-0.5%	4.4%	0.4%	-0.1%	1.1%
				Peak Month			
2005	2,052	8	237	946	5,884	211	9,059
2010	1,989	11	201	1,185	5,943	207	9,119
2015	2,066	11	197	1,509	6,139	207	9,300
2020	2,177	11	203	1,827	6,256	207	9,856
2025	2,342	11	213	2,248	6,380	207	10,366
				Average Day Peak Month			
2005	68	2	8	31	196	7	304
2010	66	2	6	38	198	7	310
2015	69	2	6	49	205	7	329
2020	73	2	7	59	209	7	346
2025	78	2	7	73	213	7	368
				Peak Hour			
2005	9	2	1	6	23	1	30
2010	9	2	1	8	23	1	31
2015	9	2	1	10	24	1	32
2020	10	2	1	12	25	1	34
2025	10	2	1	15	25	1	37

Sources: Tables 4.14, 4.18, 4.20, 4.23, 4.24, 4.26, 4.28, and 4.30 and HNTB analysis.



ROANOKE REGIONAL AIRPORT

Historical and Forecast Annual Activities

FIGURE 4-3

SOURCE: HNTB Analysis.

Table 4.30

Projected Distribution of Hourly Total Operations During Peak Month

	Arrivals					Departures					Total				
Hour	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**	**2005**	**2010**	**2015**	**2020**	**2025**
0000-0059	1.0	1.0	1.0	1.1	1.2	1.3	1.3	1.4	1.4	1.4	2.4	2.3	2.4	2.5	2.6
0100-0159	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0200-0259	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0300-0359	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.6	0.8	0.9	0.4	0.5	0.6	0.8	0.9
0400-0459	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1
0500-0559	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.4	0.3	0.3	0.3	0.3
0600-0659	0.5	0.6	0.7	0.8	1.0	4.4	4.2	4.3	4.6	4.9	4.9	4.8	5.1	5.4	5.9
0700-0759	0.5	0.4	0.4	0.4	0.4	10.7	10.7	11.2	11.7	12.3	11.2	11.1	11.6	12.1	12.8
0800-0859	5.8	5.8	6.0	6.1	6.2	7.7	7.8	8.0	8.2	8.3	13.5	13.6	14.0	14.3	14.5
0900-0959	15.6	15.6	16.2	16.8	17.5	7.3	7.2	7.5	7.7	7.9	22.8	22.8	23.7	24.5	25.4
1000-1059	13.1	13.6	14.6	15.3	16.3	14.3	14.5	15.2	15.8	16.5	27.5	28.2	29.8	31.1	32.9
1100-1159	10.2	10.2	10.7	11.1	11.6	7.7	7.8	8.1	8.2	8.4	17.9	18.0	18.7	19.3	20.0
1200-1259	9.5	9.7	10.2	10.7	11.3	13.2	13.2	13.8	14.3	15.1	22.7	22.9	24.0	25.0	26.3
1300-1359	4.7	4.8	5.1	5.3	5.6	9.3	9.5	9.9	10.2	10.5	14.0	14.3	15.0	15.5	16.1
1400-1459	12.8	13.0	13.6	14.1	14.8	17.3	17.6	18.5	19.3	20.2	**30.1**	**30.6**	**32.2**	33.4	35.0
1500-1559	10.6	10.8	11.4	11.8	12.5	12.2	12.4	13.2	13.8	14.7	22.8	23.2	24.5	25.7	27.1
1600-1659	**16.4**	**16.8**	**18.0**	**19.1**	**20.5**	7.1	7.1	7.4	7.6	7.8	23.5	23.9	25.3	26.6	28.4
1700-1759	9.2	9.6	10.3	10.9	11.7	**18.2**	**19.2**	**21.1**	**23.0**	**25.4**	27.4	28.8	31.4	**33.9**	**37.1**
1800-1859	10.3	10.3	10.8	11.1	11.6	7.1	7.1	7.4	7.6	7.8	17.4	17.5	18.1	18.7	19.5
1900-1959	13.0	13.7	14.9	16.0	17.5	3.8	3.8	4.0	4.3	4.6	16.7	17.5	18.9	20.3	22.2
2000-2059	4.5	4.7	5.2	5.6	6.1	5.1	5.9	7.0	8.2	9.7	9.6	10.6	12.2	13.8	15.8
2100-2159	6.8	7.1	7.7	8.4	9.4	1.9	2.2	2.7	3.2	3.9	8.8	9.3	10.4	11.6	13.2
2200-2259	6.0	5.9	6.2	6.6	7.0	1.0	1.0	1.2	1.3	1.5	7.0	7.0	7.4	7.9	8.5
2300-2359	1.2	1.1	1.2	1.2	1.3	1.6	1.5	1.6	1.6	1.6	2.7	2.7	2.7	2.8	2.9
	152.0	155.0	164.3	172.8	183.8	152.0	155.0	164.3	172.8	183.8	304.0	310.0	328.5	345.5	367.7
Peak Hour	16.4	16.8	18.0	19.1	20.5	18.2	19.2	21.1	23.0	25.4	30.1	30.6	32.2	33.9	37.1

Sources: Table 4.29 and HNTB analysis.

Table 4.31

Summary of Projected Aircraft Operations by Aircraft Type

Equipment Type	2005	2010	2015	2020	2025
A300-600	166	260	260	260	208
767-200	-	104	156	208	260
757-200	738	917	1,042	1,042	1,025
727-200	426	260	93	-	-
727-100	92	-	-	-	-
737-800	15	16	18	20	20
737-700	6	16	18	18	20
737-300/400	-	104	260	411	520
737-200C	1	-	-	-	-
737-100/200	21	10	-	-	-
A319	-	10	12	12	14
MD-80	1	204	304	402	400
MD-87	-	4	4	4	2
DC-9-40	756	260	51	-	-
DC-9-30	42	-	-	-	-
DC-9-15	8	2	-	-	-
Embraer RJ170	-	-	703	2,108	3,514
Embraer RJ145	3,774	3,514	5,302	5,622	6,084
Canadair CRJ-200	10,397	12,649	13,358	13,508	14,958
Dassault Falcon	10	-	-	-	-
CV-580 Convair	6	1	-	-	-
De Havilland DHC8-300 DASH8/8Q	3,381	4,919	4,216	3,514	2,108
De Havilland DHC8 DASH 8	3,822	1,698	-	-	-
Saab 340	2,333	-	-	-	-
Multi-Engine Turbojet	14,580	21,732	30,302	37,024	44,937
Multi-Engine Turboprop	17,587	15,532	13,672	12,287	10,879
Multi-Engine Reciprocating	15,471	14,458	13,676	13,231	12,772
Single Engine Reciprocating	10,371	9,186	8,189	7,495	6,772
Helicopter	490	505	498	493	480
Military	1,401	1,374	1,374	1,374	1,374
Total	85,894	87,736	93,509	99,033	106,347

Sources: Tables 4.17, 4.20, 4.23, 4.24, 4.27 and 4.28 and HNTB analysis.

Table 4.32

Comparison With TAF and VATSP Forecasts

	Passenger Enplanements			Aircraft Operations		
Year (1)	Master Plan	TAF	Percent Difference	Master Plan	2003 VATSP Update	Percent Difference
			Passenger Enplanements			
2005	327,270	296,449	-10.4%	327,270	382,756	14.5%
2010	358,673	338,256	-6.0%	358,673	*435,928* (2)	17.7%
2015	395,978	386,022	-2.6%	395,978	489,099	19.0%
2020	436,160	440,597	1.0%	436,160	555,414	21.5%
2025	484,820	502,951	3.6%	484,820		
			Aircraft Operations			
2005	85,894	85,920	0.0%	85,894	112,092	23.4%
2010	87,736	87,951	0.2%	87,736	*122,317* (2)	28.3%
2015	93,509	90,103	-3.8%	93,509	132,541	29.4%
2020	99,033	92,384	-7.2%	99,033	144,321	31.4%
2025	106,347	94,803	-12.2%	106,347		

(1) Calendar year for Master Plan and VATSP, Fiscal Year ending September 30 for TAF.
(2) Interpolated.

Sources: Tables 4.18, 4.19, and 4.29, FAA Terminal Area Forecast, February 2006, 2003 Virginia Air Transportation System Plan (VATSP) Update, and HNTB analysis.

a different base year. The Master Plan passenger enplanement forecasts are initially higher than the TAF, since they use a higher base year number. By 2025, however, the Master Plan forecast numbers are slightly lower. Conversely, the Master Plan forecasts of aircraft operations are higher than the corresponding TAF forecast. The difference is attributable mainly to air taxi operations. The TAF includes air taxi operations with regional carrier operations and ties them to regional carrier enplanements. The Master Plan provides a separate forecast of air taxi operations that incorporates the anticipated impact of very light jets (see Section 7). The VATSP forecasts were prepared before the negative impacts of the 9/11 terrorist attacks were fully realized. Therefore, the VATSP forecasts contain much higher projected passenger and operations numbers for 2005 than actually occurred. This difference is carried forward through the VATSP forecast. Since the Master Plan forecasts are based on more recent data, they are significantly lower than the VATSP forecasts for ROA.

4.9 FORECAST SCENARIOS

The assumptions used to develop the forecasts are likely to vary over the forecast period, and the variations could be material. One way to explore the impact of these variations is to develop alternative scenarios in which the impact on the forecast of a variation in critical assumption is evaluated. The base case forecast provides the basis for determining what additional facilities will be required at the Airport through 2025. The Airport must be able to respond to a range of contingencies that could occur, taking into account political and economic changes, technological changes, and changes in the policies of individual airlines. The recommended development program must be flexible enough to accommodate these contingencies.

To address these potential changes, six alternative forecast scenarios were selected with the assistance of Airport staff. The six scenarios are:

- Scenario 1–Slow Economic Growth
- Scenario 2–Moderate Economic Growth
- Scenario 3–Fuel Shock/recession
- Scenario 4–Low Fare Service at GSO
- Scenario 5–Reduced Fares at ROA
- Scenario 6–Airline Consolidation

The results of the six forecast scenarios are provided in **Table 4.33**. More detailed results for the individual scenarios are contained in Appendix D. Note that the base case remains the preferred alternative.

4.9.1 Scenario 1 – Low Economic Growth

Scenario 1 assumes that the Roanoke metropolitan area and surrounding counties enter a long-term period of slow economic growth, slower than assumed under the base case and slower than historical experience.

Population, employment and income are all assumed to grow at one-half the growth rates that were assumed under the base case. As a result the demand for passenger travel, air cargo and GA services would be much

Table 4.33

Summary of Forecast Scenarios

Equipment Type	2005	2010	2015	2020	2025
Passenger Enplanements					
Base Case - Preferred Forecast	327,270	358,673	395,978	436,160	484,820
Scenario 1: Low Economic Growth	327,270	332,682	349,065	366,251	388,667
Scenario 2: Moderate Economic Growth	327,270	371,790	419,798	471,854	534,170
Scenario 3: Fuel Shock and Recession	327,270	340,396	367,691	399,763	438,064
Scenario 4: GSO Low Fares	327,270	319,784	353,060	388,927	432,450
Scenario 5: Reduced Fares at ROA	327,270	437,313	482,881	531,962	591,400
Scenario 6: Airline Consolidation	327,270	346,625	372,378	416,574	466,400
Air Cargo Tonnage					
Base Case - Preferred Forecast	15,802	16,438	17,053	17,683	18,336
Scenario 1: Low Economic Growth	15,802	14,436	14,976	15,529	16,103
Scenario 2: Moderate Economic Growth	15,802	17,836	20,077	22,589	25,415
Scenario 3: Fuel Shock and Recession	15,802	15,517	15,823	16,195	16,554
Scenario 4: GSO Low Fares	15,802	16,438	17,053	17,683	18,336
Scenario 5: Reduced Fares at ROA	15,802	16,438	17,053	17,683	18,336
Scenario 6: Airline Consolidation	15,802	16,438	17,053	17,683	18,336
Aircraft Operations					
Base Case - Preferred Forecast	85,894	87,736	93,509	99,033	106,347
Scenario 1: Low Economic Growth	85,894	83,191	85,121	87,009	89,714
Scenario 2: Moderate Economic Growth	85,894	89,428	97,999	105,254	115,069
Scenario 3: Fuel Shock and Recession	85,894	83,187	86,003	87,964	91,701
Scenario 4: GSO Low Fares	85,894	84,686	90,523	96,311	103,165
Scenario 5: Reduced Fares at ROA	85,894	90,693	96,426	102,595	109,448
Scenario 6: Airline Consolidation	85,894	80,965	86,494	90,778	97,561

Sources: Tables 4.18, 4.19, 4.22, and 4.29, Appendix C and HNTB analysis.

less than in the base forecast.

Table D.1 in Appendix D details the results of the scenario. Total passenger enplanements would grow at less than 1.0 percent per year, and still remain below 400,000 by the end of the forecast period. Cargo would remain flat and total operations would rise slightly at 0.2 percent per year. Under this scenario, only air taxi would experience an increase in aircraft operations.

4.9.2 Scenario 2 – Moderate Economic Growth

Scenario 2 differs from the first scenario because it assumes the regional economy will grow more quickly than in the base forecast. Income, employment, and population in the catchment area are assumed to grow 25 percent more quickly than in the base case. The economic growth would stimulate passenger, cargo, and GA activity.

Table D.2 in Appendix D details the results of the scenario. Passenger enplanements would increase to 534,170 by 2025, growing at an average annual rate of 2.5 percent. Cargo tonnage would grow almost as quickly, at a 2.4 percent annual rate. Total aircraft operations would grow at 1.0 percent each year to 115,069 by 2025. Operations would increase in all categories except military, but once again, air taxi would be the most rapidly growing category.

4.9.3 Scenario 3 – Fuel Shock and Recession

Scenario 3 assumes that the oil price shocks experienced in 2005 and 2006 continue through the forecast period. There would be no downward correction in fuel costs as forecast by the FAA. Instead fuel costs would continue to rise from 2006 levels at a long-term rate of 1.5 percent above inflation throughout the forecast period. Under this scenario, the high fuel prices would restrict economic growth to growth rates 10 percent less than in the base case. The high fuel costs would be passed on to passengers through higher fares and would also increase operating costs to air cargo and general aviation.

Table D.3 in Appendix D shows the forecasts resulting from Scenario 3. Higher fares and lower economic growth would restrict growth in passenger enplanements to 1.5 percent per year. Cargo tonnage would only grow at 0.2 percent per year. All-cargo aircraft operations would also decline since average aircraft size and load factors would increase faster than cargo demand. High fuel prices would cause general aviation operations to decline. In this scenario, total operations would increase slightly, at 0.3 percent per year, to 91,701 by 2025.

4.9.4 Scenario 4 – Low Fares at GSO

Scenario 4 assumes that a low fare carrier establishes a focus city at Piedmont Triad International Airport. The resulting low fares at GSO would draw passengers away from the Roanoke catchment area. The low fares would also maintain pressure on carriers at RDU to keep their fares low and increase pressure on CLT carriers to reduce their fares. Because of the high per seat operating costs associated with regional jets, carriers at ROA would not be able to drop their fares to match GSO fares.

Table D.4 in Appendix D shows the results of the Scenario 4 forecast. Low fares at GSO would draw significant traffic away from ROA. Assuming the low fare service at GSO was established by 2010, passenger enplanements at ROA would decline to 2010, and then slowly grow to 432,450 by 2025. The non-passenger activity categories would remain essentially unchanged from the base forecast.

4.9.5 Scenario 5 – Reduced Fares at ROA

As noted earlier, it would be difficult for the airlines serving ROA to reduce their fares to the levels observed at airports like RDU, since the per seat operating costs of regional jets are much higher than those of mainline jets. Nevertheless, there is some potential for reductions in fares at ROA.

Average fares at airports with passenger levels similar to ROA were examined. Among these airports, Wilmington, NC, (ILM) had the lowest average fares in 2005, 20.2 percent lower than at ROA. Scenario 5 assumes that airlines are able and willing to decrease their fares to the levels currently experienced at ILM. Under this scenario, the ROA fleet mix would more closely resemble the ILM fleet mix and would include more 70-seat and 90-seat regional jets. The larger average aircraft size would enable the airlines to achieve the reduced operating costs necessary to lower fares.

With a reduction in fares, ROA airlines would be able to stimulate travel among existing ROA passengers, retain more of the passengers in the primary catchment area that are now using other airports, and draw more passengers from the secondary catchment area.

Table D.5 in Appendix D shows the Scenario 5 forecasts. Under this scenario, passenger enplanements would grow 3.0 percent per year to 591,400 in 2025. Scheduled passenger aircraft operations would grow more slowly (1.2 percent per year) because of the larger average aircraft size. Total aircraft operations would increase 1.2 percent per year to 109,448 by 2025. Non-passenger aircraft categories would be essentially unchanged from the base case forecast.

4.9.6 Scenario 6 – Airline Consolidation

Scenario 6 assumes significant airline consolidation, leading to reduced competition, higher fares, and fewer airline hubs. The scenario assumes that without the pressures of competition, the airlines increase real fares to the levels that were extant in 2000, the last profitable year for the domestic airline industry. Without the competitive pressures that generate improvements in efficiency, real fares would then remain at that level. The number of airlines and hubs serving ROA would be reduced by roughly 50 percent. The number of passengers going to each remaining hub would increase and the pressure to maintain high frequencies would be reduced. Consequently, some mainline aircraft (with their more efficient seat mile operating costs) would be reintroduced to ROA. There would be no pressure, however, for the airlines to pass on the reduced operating costs in the form of lower fares to the passengers.

Table D.6 in Appendix D shows the results of the Scenario 6 forecast. Under this forecast, passenger enplanements would increase 1.8 percent per year to 466,400 by 2025. Compared to the base case, there would be a significant reduction in scheduled passenger aircraft operations because of the larger average aircraft size. As a result, total operations would increase 0.6 percent per year to 97,561 by 2025.

4.9.7 Summary of Forecast Scenarios

The results of the six forecast scenarios are summarized in Table 4.33. Evaluated at 2025, the projected passenger enplanement levels range from a low of 388,667 under Scenario 1 (20 percent lower than the base forecast) to 591,400 under Scenario 5 (22 percent higher than the base forecast). Air cargo tonnage forecasts for 2025 range from 16,106 tons under Scenario 1 to 25,415 tons under Scenario 2. Total aircraft operations for 2025 range from 89,714 under Scenario 1 to 115,069 under Scenario 2.

Chapter Five
Facility Requirements

5.1 INTRODUCTION

This chapter describes the facilities required to accommodate aviation demand at ROA over the 20-year planning period to the year 2025. Facility requirements were developed by taking the aviation demand projections presented in Chapter Four and performing demand/capacity analyses on the various functional elements of the Airport. To ensure a logical sequence of future development, separate facility requirements were developed for the horizon years 2010, 2015, 2020, and 2025. Analyses were performed for the following functional areas:

- Airfield
- Terminal
- Air Cargo
- General Aviation
- Support Facilities
- Surface Transportation and Auto Parking Requirements

The facility requirements in this chapter were developed at a level of detail appropriate for an airport master plan, not the level of detail suitable for an architectural or engineering design study. Required facility improvements are identified and quantified, and in subsequent chapters specific alternative methods of meeting these facility requirements will be identified and evaluated.

5.2 DESIGN CRITERIA

FAA Advisory Circular 150/5300-13, *Airport Design*, lists the recommended design standards for airports. The standards consider safety, economy, efficiency, and longevity; as such, criteria vary based on an airport's role and the existing and anticipated type of aircraft expected to regularly use an airport.

5.2.1 Airport Reference Code

The AC relates airport design criteria to the operation and physical characteristics of the airplanes intended to operate at an airport based on an airport reference code (ARC). The ARC has two components relating to the airport design aircraft. The first component, depicted by a letter, is the *aircraft approach category* and relates to aircraft approach speed (operational characteristic).[1] The second component, depicted by a Roman numeral, is the *airplane design group* and relates to airplane wingspan (physical characteristic). Generally, runway standards are related to aircraft approach speed, airplane wingspan, and designated or planned approach visibility minimums. Taxiway and taxilane

[1] The FAA uses letter categories to designate both approach speeds (as discussed in this section) as well as for aircraft weight categories to determine airfield capacity (as discussed in Section 5.3.1).

standards are related to airplane design group.

To determine the appropriate approach speed category, the current and forecast operational fleet mix for both commercial and GA aircraft was examined. All commercial aircraft operations in the current fleet, including the CRJ, EMB-145, narrow bodies, and widebodies have approach speeds within Category C. A one-week radar data pull showed only four Category D GA operations. Based on this data pull, it is unlikely that the number of Category D operations reaches the threshold of 500 annual operations needed to justify the design criteria associated with the higher approach speed category. In addition, recognizing that nearly all new GA jets have approach speeds in either Category B or C, it is anticipated that the number of operations of Category D aircraft will decrease over the planning period at ROA. Based on this analysis and the forecast fleet mix shown in Table 4.31, the approach category of C will be used for facility planning.

The aircraft with the longest wingspans either currently operating or forecast to operate at ROA on a regular basis include the A300, the B-767, and the B-757. Each of these aircraft is classified by the FAA as design group IV aircraft. The existing and future ARC for ROA is therefore C-IV.

5.2.2 Approach Minimums

Approach minimums refer to the poorest weather conditions in which an appropriately-certified aircraft and flight crew are legally permitted to land. At any particular airport, approach minimums vary by the sophistication of runway instrumentation, obstructions, approach lighting, NAVAIDs, and other factors. In addition, approach minimums can vary by aircraft based on its approach speed and on-board instrumentation. Approach minimums are typically expressed as two values: ceiling (i.e., cloud height) and visibility (i.e., the forward distance a pilot can see).

Typically, the lower the approach minimums (the poorer the weather conditions in which an aircraft is permitted to land), the greater the dimensions for airfield planning and design. For airports with instrument runways, FAA design standards generally make a distinction between runways with visibility minimums greater than or equal to ¾-statute miles and those with visibility minimums less than ¾-statute miles.

At ROA, the current approach minimums vary by runway end and by aircraft approach speed category. The design criteria for airfield facilities at the Airport will reflect the existing and anticipated approach minimums determined for each runway end. Specific requirements are described in Section 5.4.

5.3 AIRFIELD CAPACITY AND DELAY

The calculation of airfield capacity and delay is essential in evaluating the capability of existing runway and taxiway systems to effectively serve existing and future airport activity levels. This section describes the demand/capacity relationship and resulting aircraft delays.

5.3.1 Factors Affecting Airfield Capacity

The capacity of the existing runway system depends on a number of factors including aircraft separation, weather, aircraft mix, and runway operational configurations. Airfield capacity is defined as the maximum number of aircraft that an airfield configuration can accommodate when there is a continuous demand for service (i.e., an aircraft is always waiting to depart or land). Capacity is typically measured in one-hour time periods, which is defined as hourly capacity. Airfield capacity in this chapter was calculated using FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*.

Airfield Layout

The Airport has two runways: Runway 6-24 and Runway 15-33. Due to the mountainous terrain surrounding ROA, each runway has unique operating procedures and functions within the overall operation of the airfield. At night, or in IMC, no departures are permitted on Runway 33 and no arrivals are permitted on Runway 15.

Aircraft Separation

The separation maintained between individual aircraft affects the capacity of both the airspace and airfield. Generally, the closer the spacing between arriving and departing aircraft, the greater the capacity of the airspace and the airfield. Many factors influence the separation between aircraft, including safety considerations, runway occupancy times, the size and type of aircraft that operate within the airspace system or at the Airport, the flight rules under which aircraft operate, and the prevailing weather conditions.

Flight Rules

The flight rules under which aircraft must operate affect aircraft separation and therefore airfield and airspace capacity. The FAA has two basic types of flight rules: visual flight rules (VFR) and instrument flight rules (IFR). The distinction between VFR and IFR is important because aircraft operating under each set of flight rules are subject to different aircraft separation rules, weather minimums, and aircraft equipment. These differences have an effect on the efficiency of the Airport ATC system.

In general, aircraft operating under VFR are not subject to direct ATC control for most phases of flight. The general principle for maintaining aircraft separation under VFR is "see and be seen," which places greater responsibility for maintaining separation on the pilot. In contrast, pilots operating under IFR are required to fly assigned navigational routes and altitudes and maintain a minimum separation of three nautical miles, and are subject to ATC control throughout all phases of flight. Additionally, IFR pilots are required to meet minimum proficiency levels, and IFR aircraft have a minimum equipment requirement.

VFR aircraft are not required to meet the same minimum equipment requirements, because VFR navigation is done by reference to geographic landmarks, charts, and other visual references, while IFR navigation is done by reference to navigational facilities.

Most commercial and corporate aircraft operate under IFR flight plans regardless of weather conditions, and IFR flight plans are required for operations above 18,000 feet MSL, regardless of weather conditions. This is due to the complexity of the existing airspace structure in the U.S., the high volume of traffic in the air, and congestion within terminal areas. Aircraft which do not meet the equipment requirements for IFR flight may only operate under VFR.

Meteorological Conditions

The FAA classifies weather conditions according to two basic types: visual meteorological conditions (VMC) and instrument meteorological conditions (IMC). VMC conditions are weather conditions in which an aircraft can maintain safe separation by visual means. IMC conditions prevail when the visibility or ceiling falls below those minimum prescribed for VMC conditions. VMC minimums are a 1,000-foot ceiling above airport elevation and three statute miles visibility. During periods of IMC, all aircraft must operate under IFR flight plans and operating patterns become the responsibility of ATC. Based on 1995 through 2005 meteorological data from the National Climatic Center, VMC conditions exist 89.5 percent of the time and IMC conditions 10.5 percent of the time at ROA.

Fleet Mix

Fleet mix affects the aircraft separation requirement and, therefore, airfield capacity in two ways. First, light aircraft must be adequately separated from heavy aircraft to avoid wake turbulence generated by the heavy aircraft. Second, faster aircraft must be separated from slower aircraft to maintain minimum spacing requirements. Air traffic controllers, where possible, assign different arrival and departure routes or altitudes within a controlled airspace to segregate faster jet aircraft from the slower propeller aircraft.

The FAA's Advisory Circular 150/5060-5 groups aircraft by four weight classifications:

- A (single engine aircraft weighing 12,500 pounds or less),
- B (multi-engine aircraft weighing 12,500 pounds or less),
- C (multi-engine aircraft weighing 12,500 pounds to 255,000 pounds[2]), and
- D (multi-engine aircraft weighing more than 255,000 pounds).[3]

The current and forecast aircraft operational fleet mix is grouped into these categories in **Table 5.1**. The percentage of each aircraft class in the fleet was developed from the forecasts provided in the previous chapter. In 2005, approximately 58 percent of the aircraft were Class C and one percent were Class D. The mix index (a mathematical expression which equals the percent of Class C aircraft plus three times the percent of Class D aircraft), is a key factor in determining airfield capacity using AC 150/5060-5. In 2005, the mix index was approximately 61. As the percentage of Class C and Class D aircraft increases over

[2] Reduced from 300,000 pounds based on FAA ATC Manual Appendix A.

[3] The FAA uses letters to designate both weight classes and to group aircraft by approach speeds, as discussed in Section 5.2.1

Table 5.1

Existing and Future Mix Index and Aircraft Operations by Class

Class	Weight Range (Pounds)	Example Aircraft	2005 Ann. Ops.	2005 Pct.	2010 Ann. Ops.	2010 Pct.	2015 Ann. Ops.	2015 Pct.	2020 Ann. Ops.	2020 Pct.	2025 Ann. Ops.	2025 Pct.
A/B[1]	12,500 or less	Beech Baron, Cessna 172, Piper Navajo	35,124	40.9% (1)	35,294	40.2% (1)	37,063	39.6% (1)	39,162	39.5% (1)	41,519	39.0%
C[2]	12,501-255,000	King Air, Lear 35, Citation, Falcon, CRJ-200, ER-145, B737, MD80, B727, A320	49,865	58.1% (2)	51,160	58.3% (2)	54,987	58.8% (2)	58,362	58.9% (2)	63,335	59.6%
D[3]	over 255,000	B757, B767, B777, B747, A300, A330, A340	904	1.1% (3)	1,281	1.5% (3)	1,458	1.6% (3)	1,510	1.5% (3)	1,493	1.4%
Total			85,894	100.0%	87,736	100.0%	93,509	100.0%	99,033	100.0%	106,347	100.0%
Mix Index[4]				61		63		63		64		64

Notes:
(1) From Table 4.35; includes all forecast single engine piston and multi-engine piston operations, 50% of GA turboprop operations, and light GA jet operations.
(2) Includes half of turboprop operations, a portion of GA jet operations, and all other operations by aircraft within weight category as shown in Table 4.35.
(3) Includes all aircraft in Table 4.35 weighing more than 255,000 pounds.
(4) Percent Class C aircraft + 3 times Class D aircraft.

Source: HNTB analysis.

the planning horizon, the mix index will also increase, reaching 64 by 2025.

5.3.2 Airfield Capacity

ROA's hourly capacity and annual capacity were estimated based on the factors described above and input from the tower staff.

The current (2005) estimated hourly capacity for ROA is estimated to range from 66 to 70 operations in VMC and from 49 to 58 operations in IMC, depending on operating mode. Although the mix index is forecast to increase slightly, the Airport's hourly capacity is not expected to change significantly. As shown in **Figure 5-1**, the existing hourly capacity of the Airport's airfield is adequate to meet long-term hourly demand; no additional capacity is required to meet the Airport's forecast peak hour operations.

5.3.3 Annual Service Volume

Annual Service Volume (ASV) is an FAA capacity measure that provides a reasonable estimate of the capacity of an airport on an annual basis, and is useful for long-range planning. FAA Advisory Circular 150/5060-5 was used to estimate the Airport's ASV. While hourly capacities are physical capacities that generally cannot be exceeded, ASV can be exceeded, sometimes by significant amounts, with corresponding increases in delay. ASV is calculated based on hourly capacity estimates and historical demand patterns, such as the ratio of annual demand to average daily demand in the peak month and the ratio of average daily demand to average peak hour demand in the peak month. As annual aircraft operations approach the ASV of an airport's airfield, average annual aircraft delays increase rapidly with relatively small increases in aircraft operations.

The ASV for the existing airfield system at ROA was calculated to be 196,000 annual operations. The small increase in the percentage of heavy aircraft in the fleet does not change the Airport's ASV by 2025.

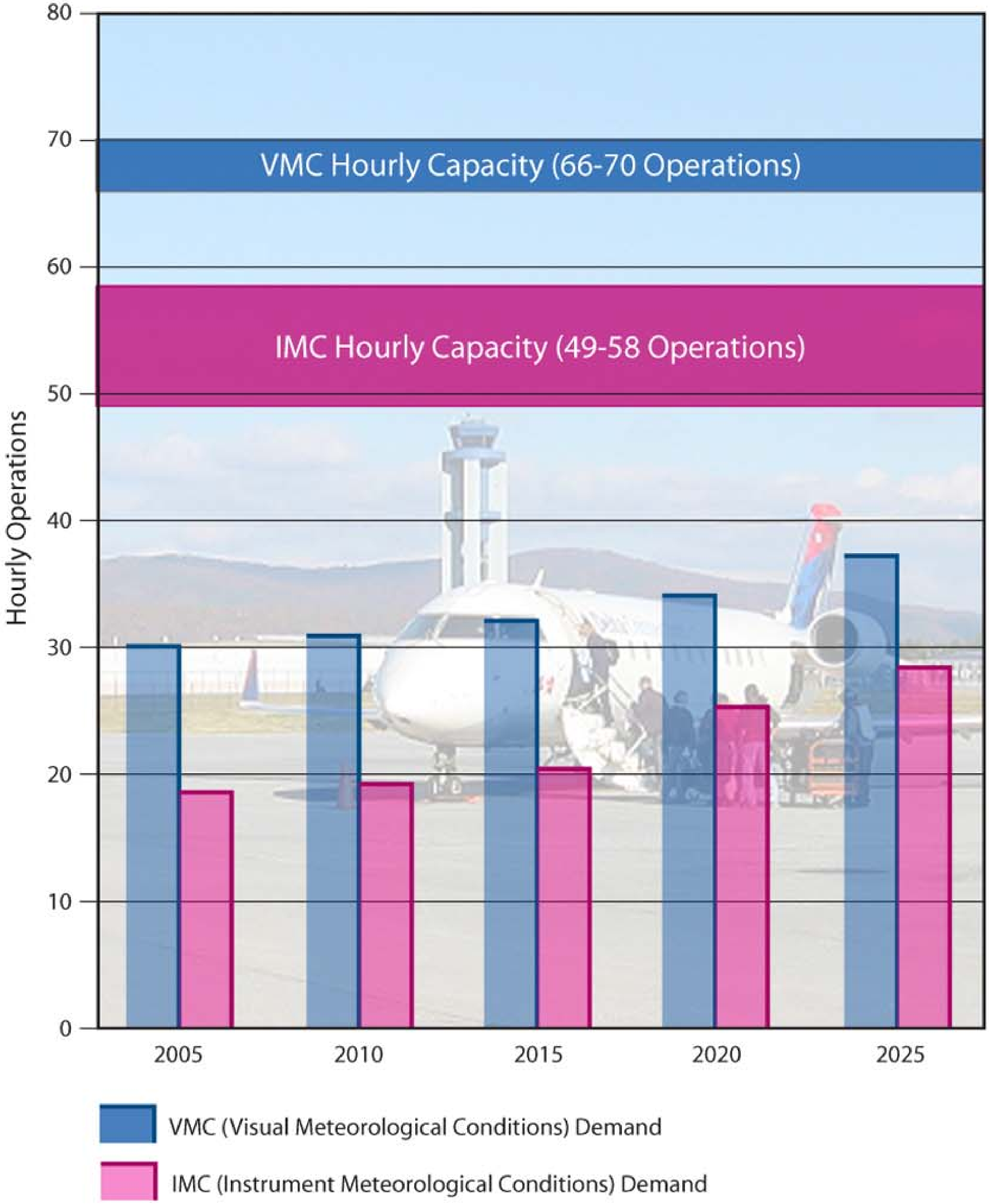
5.3.4 Airfield Delay

Based on the ASV methodology, average annual delays can be estimated by the ratio between annual operations and the calculated ASV. When the ratio is between 0 and 80 percent, average annual delays increase in a roughly linear manner. When the ratio is greater than 80 percent, delays increase geometrically.

In 2005, ROA was operating at about 44 percent of its ASV, resulting in an average annual delay of 0.4 minutes. By 2025, the Airport is forecast to be operating at 54 percent of its capacity, resulting in average annual delay of about 0.5 minutes. It should be noted that, during the peak hour, individual aircraft may experience delays of five to 10 times the average annual delay. This means that, by 2025, some aircraft operating at ROA during peak periods may have delays of up to five minutes.

5.4 AIRFIELD REQUIREMENTS

Runway and taxiway requirements are planned according to the recommendations in the latest version of the FAA's Advisory Circular (AC) 150/5300-13, *Airport Design*.



ROANOKE REGIONAL AIRPORT

Airfield Hourly Demand vs. Capacity

FIGURE 5-1

SOURCE: FAA AC 150/5060-5, ROA ATCT, and HNTB Analysis

5.4.1 Additional Runways

Additional runways are needed at airports for two main reasons: to alleviate capacity constraints and/or to improve wind coverage.

Based on the previous analysis of airfield capacity, no additional runways are needed to accommodate either peak hour or annual demand.

When feasible, aircraft typically land and take off into the wind. Under strong crosswind conditions, aircraft may not be able to operate at an airport. AC 150/5300-13 recommends that an airport's runway system provide 95 percent wind coverage, which is computed on the basis of the crosswind component not exceeding 10.5 knots for ARCs A-I and B-I, 13 knots for ARCs A-II and B-II, 16 knots for ARC A-III, B-III, and C-I through D-III, and 20 knots for ARCs A-IV through D-IV. **Table 5.2 and Figures 5-2 through 5-4** present wind coverage for the existing two-runway system for all crosswind components under VFR, IFR, and all-weather conditions. As shown, the existing two-runway system exceeds the recommended wind coverage in all conditions; therefore, additional runways to increase wind coverage are not required.

5.4.2 Runway Length

Runway length calculations for ROA were developed using guidance provided in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, which was published in July 2005. Runway length requirements were calculated using ROA's mean maximum temperature of 85.3 degrees Fahrenheit (in July) and Airport elevation of 1,176 feet MSL.

ROA accommodates a significant number of both high performance GA aircraft (typically, business jets) and air carrier aircraft. Recognizing the importance of both segments of aviation, separate runway length requirements were calculated for non-commercial aircraft (typically, aircraft weighing less than 60,000 pounds) and commercial aircraft.

Runway Length Requirements for Aircraft Weighing 60,000 Pounds Maximum Takeoff Weight or Less

The AC specifies that for aircraft weighing 60,000 pounds maximum take off weight or less (excluding regional jets), runway length requirements should be estimated using performance curves based on aircraft family groupings as provided in the AC. For regional jets and aircraft weighing more than 60,000 pounds maximum take off weight, the aircraft-specific airport planning manuals (APMs) published by aircraft manufacturers should be used.

Table 5.3 shows runway length requirements for aircraft families for small airplanes and large airplanes weighing up to 60,000 pounds MTOW. For large aircraft weighing up to 60,000 pounds, curves are provided for 75 percent of the fleet and for 100 percent of the fleet. A comparison between the aircraft represented by the two curves and the actual ROA operational fleet[4] shows that there are more than 1,500 annual operations of aircraft not included in the

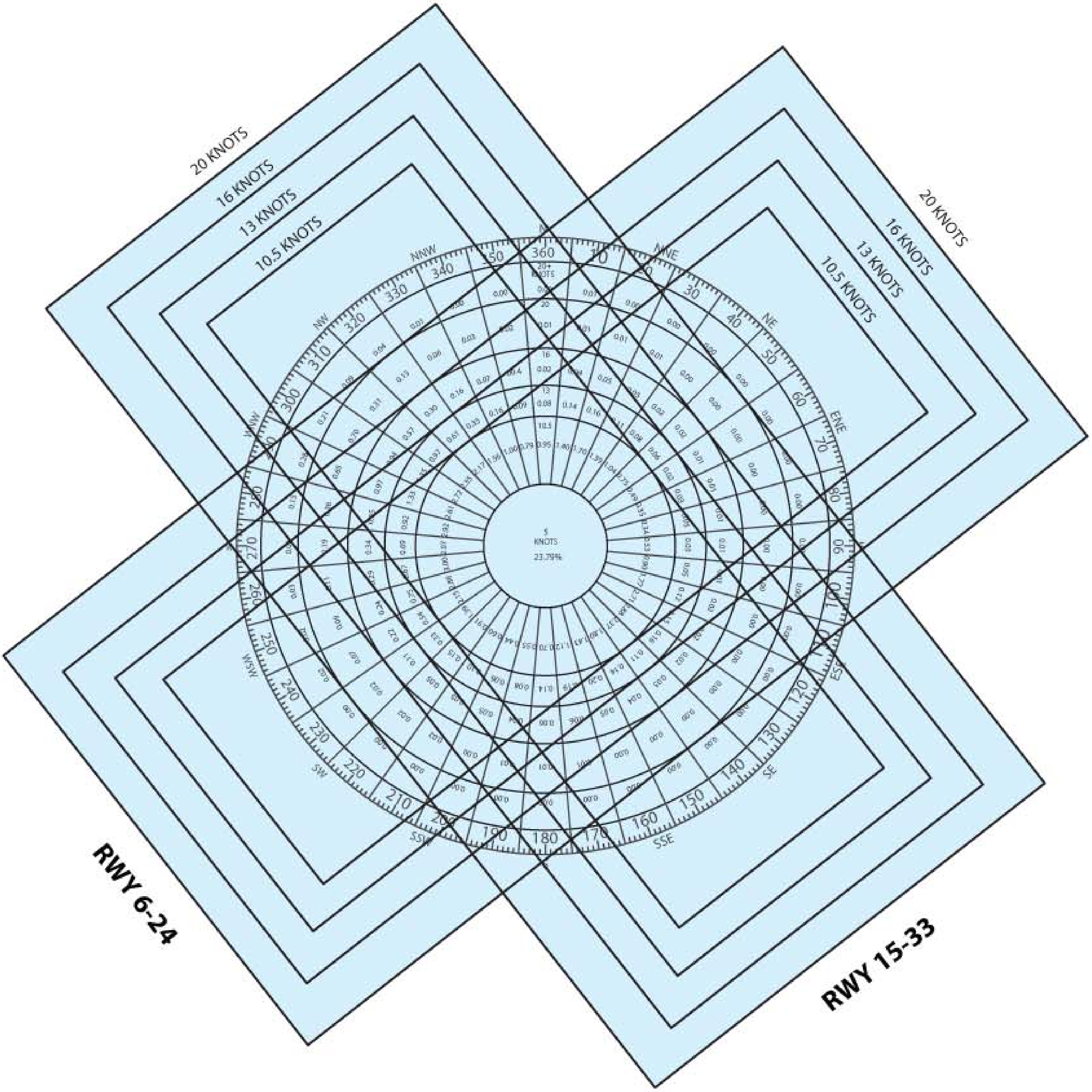
[4] Obtained from a one-week sample of radar data via Flight Explorer software.

Table 5.2

Runway Wind Coverage

Condition	6-24	15-33	Combined
10.5-knot			
VFR	88.1%	93.6%	97.9%
IFR	97.2%	98.0%	99.4%
All-weather	89.1%	94.1%	98.1%
13.0-knot			
VFR	94.5%	97.7%	99.3%
IFR	98.7%	99.0%	99.7%
All-weather	95.0%	97.9%	99.4%
16.0-knot			
VFR	97.9%	99.3%	99.9%
IFR	99.3%	99.4%	99.9%
All-weather	98.0%	99.3%	99.9%
20.0-knot			
VFR	99.6%	99.1%	100.0%
IFR	99.7%	99.8%	100.0%
All-weather	99.6%	99.9%	100.0%

Source: National Climatic Data Center (1996-2005); HNTB analysis.

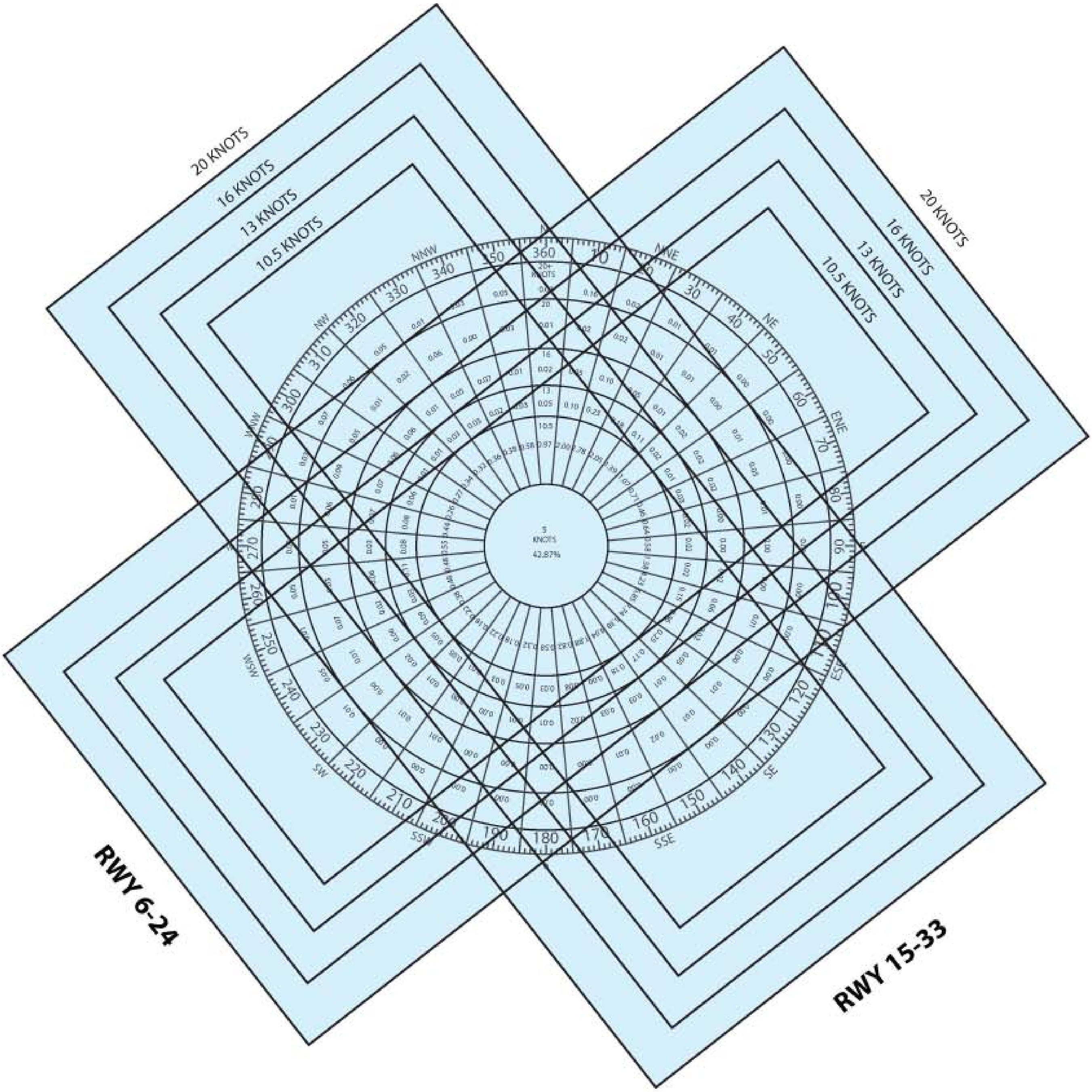


ROANOKE REGIONAL AIRPORT

VFR Wind Rose

FIGURE 5-2

SOURCE: National Climatic Data Center weather observations from 1996 t0 2005 , HNTB Analysis

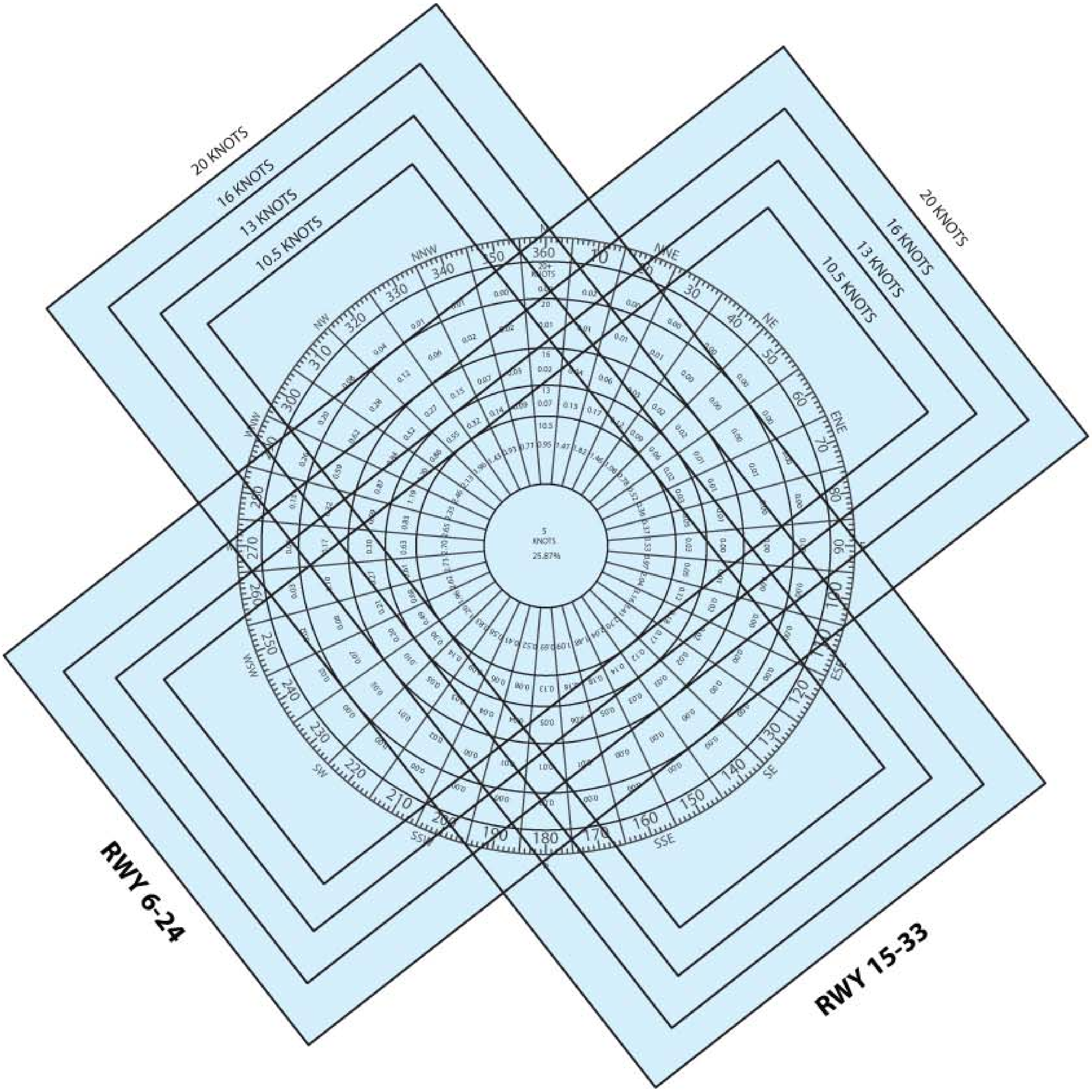


ROANOKE REGIONAL AIRPORT

IFR Wind Rose

FIGURE 5-3

SOURCE: Federal Aviation Administration, HNTB Analysis



ROANOKE REGIONAL AIRPORT

All Weather Wind Rose

FIGURE 5-4

SOURCE: Federal Aviation Administration, HNTB Analysis

Table 5.3

Runway Length Requirements for Aircraft Up to 60,000 Pounds (Excluding Regional Jets) (1)

Aircraft Family Grouping	Length (Ft)
Small Airplanes < 10 Passenger Seats	
95 pct. of fleet	3,400
100 pct. of fleet	4,000
Small Airplanes (12,500 lbs) 10+ Passenger Seats (3)	4,400
Large Airplanes between 12,500 and 60,000 lbs (Excluding Regional Jets)	
75 pct. of fleet at 60 pct. useful load (3)	5,000
75 pct. of fleet at 90 pct. useful load (3)	6,700
100 pct. of fleet at 60 pct. useful load (4)	5,800
100 pct. of fleet at 90 pct. of useful load (4)	8,600

Notes: (1) Mean maximum temperature of 85 degrees, airport elevation 1,176 feet MSL, corrected for runway gradient.
(2) Examples include: Queen Air, King Air, MU2, Metro II.
(3) Examples include: Beechjet; Challenger 300; Citation I, II, III; Falcon 10, 20, 50, 900B; Lear 20, 30, 40 series; Hawker 400, 600; Sabre 40, 60, 75, 80.
(4) Examples include: CL600, 601, 604; Cessna 550, 650, 750; Falcon 900C, 900EX, 2000; Hawker 800, 1000; Sabreliner 65/75.

Source: FAA AC 150/5325-4B; HNTB analysis.

performance curve representing 75 percent of the fleet; therefore, the performance curve for 100 percent of the fleet was used to determine runway length requirements for aircraft weighing less than 60,000 pounds. As shown, a runway length of 8,600 feet is required to serve 100 percent of the fleet at 90 percent of their useful load.

Runway Length Requirements for Aircraft Weighing 60,000 Pounds Maximum Takeoff Weight or More

AC 150/5325-4B states that, for federally-funded projects, the critical aircraft is identified as the one having "substantial use," which is defined as "at least 500 or more annual itinerant operations." The AC also states that the length of haul must be considered when determining runway length requirements, specifically for short haul operations. Appropriate stage lengths should be identified based on the substantial use criterion. Currently, the maximum stage length for scheduled passenger flights flown from ROA and meeting the "substantial use" criterion is to Chicago, Illinois (a distance of 513 statute miles). For cargo flights, the longest stage length meeting the substantial use criterion is to Memphis, Tennessee (a distance of 579 statute miles).

In the spring of 2006, Allegiant Air began service between Roanoke and Orlando, a distance of 611 statute miles. Although their current service frequency does not meet the "substantial use" criterion, the new service suggests that ROA will need to accommodate longer stage lengths in the future.

To determine an appropriate stage length for long-term (i.e., 20-year) planning, existing service patterns at Richmond International Airport (150 statute miles east of ROA) and Piedmont Triad International Airport (90 miles south of ROA) were examined. Both airports enplane approximately four times more passengers than ROA. The longest commercial passenger airline stage length meeting the "substantial use" criterion at both these airports is currently about 1,000 statute miles (to Dallas/Ft. Worth and Houston); therefore, 1,000 miles was assumed to be the longest stage length for scheduled air carrier aircraft flown on a regular basis at ROA for the 20-year planning horizon.

The next tier of hubs, between 1,000 miles and 2,000 miles from ROA (i.e., Denver, Phoenix, and Salt Lake City) are not served nonstop from either Richmond or Greensboro and are, therefore, not assumed to be served nonstop from ROA within the 20-year planning horizon.

Table 5.4 shows runway length requirements for commercial aircraft operating at their maximum payload (or, for landing aircraft, their maximum landing weight). As shown, assuming a 1,000-mile stage length, the Boeing 727, DC-9-40, MD80, and Embraer 170, all require more than the existing 6,800 feet of runway currently available at ROA. Since the forecast fleet mix shows no B-727 and DC-9 operations at ROA after 2015, long-term runway length requirements were based on aircraft with the next longest requirement: the Embraer 145. This aircraft requires approximately 7,730 feet of runway to reach a destination 1,000 miles from ROA. Both American Airlines and Continental Airlines operate this aircraft type from their

Table 5.4

Runway Length Requirements for Aircraft Weighing More Than 60,000 Pounds(1)

	Takeoff @ 100% Payload		Landing @ Max. Ldg. Wt.	
Equipment Type	500 SM	1,000 SM	Dry Rwy	Wet Rwy
A300-600	4,600	5,400	5,100	5,900
767-200	5,700	6,200	5,100	5,900
757-200	5,330	5,430	5,500	6,300
727-200	6,700	7,600	5,100	5,900
737-300	5,400	6,130	5,400	6,200
MD-80	6,300	7,230	5,800	6,800
DC-9-40	6,400	8,130	5,600	6,400
Embraer RJ170	5,700	6,130	4,500	5,200
Embraer RJ145	6,800	7,730	4,750	5,500
Canadair CRJ-200	5,900	6,730	5,000	5,800
DHC8-300 DASH8/8Q	4,700	N/A	3,800	N/A

(1) Assumes mean maximum temperature of 85 degrees; 0 wind; corrected for runway gradient.

Sources: Airport planning manuals published by aircraft manufacturers; HNTB analysis.

respective hubs in Dallas-Ft. Worth and Houston on stage lengths of 1,000 miles or more. As the ROA air service market grows, it is reasonable to assume that nonstop service to a long-distance hub such as Dallas-Ft. Worth or Houston (both approximately 1,000 statute miles from ROA) will be added using regional jets; therefore, the Embraer 145 operating at a 1,000-mile stage length was assumed to be the critical aircraft in terms of runway length.

It should be noted that the landing threshold of Runway 24 is displaced 800 feet, providing a landing length of only 6,000 feet in that direction. This displacement was a condition for approving the runway extension project in the early 1980s under the assumption that it would minimize noise impacts associated with the lengthened runway. As shown in Table 5.4, under wet runway conditions, the landing distances for several aircraft exceed the 6,000-foot landing distance. It would therefore be prudent to consider reducing the Runway 24 threshold displacement to provide a longer landing length in west flow.

The updated AC has revised the determination for crosswind runway length requirements. In instances where the crosswind runway accommodates the same design airplane as the primary runway, it should have the same length as the primary runway.

Runway Length Requirements Summary

Based on the analysis described above, both runways at ROA would need to be 8,600 feet long to accommodate its existing mix of business jets at 90 percent of their useful load. A runway length of 7,730 feet would be required to accommodate the Embraer 145 with a full payload on a flight of 1,000 statute miles.

Due to surrounding topography and development, the cost of providing longer runway lengths at ROA is significant; in addition, the mountainous terrain in the vicinity limits runway lengthening options. Additional analysis concerning the feasibility and cost of providing additional runway length is described in concepts chapter of the Master Plan Update.

5.4.3 Runway Widths and Shoulders

Both runways at ROA are 150 feet wide and have 25-foot paved shoulders which are recommended by FAA for airports serving ADG-IV aircraft.

5.4.4 Runway Blast Pads

AC 150/5300-13 recommends 200-foot by 200-foot blast pads at the end of runways to provide blast erosion protection beyond runway ends. For airports serving Group III or higher aircraft, blast pads should be paved.

The blast pad on the southeast end of Runway 15-33 end is 200 feet by 200 feet. The blast pad on the northwest end Runway 15-33 end is 200 feet wide by 300 feet (excluding the EMAS installation). The blast pad on the northeast end of Runway 6-24 end is 200 feet wide by 150 feet long. There is no paved blast pad on the southwest end of Runway 6-24. The Master Plan Update will explore ways of improving the blast pads on Runway 6-24 in the concepts phase of the study.

5.4.5 Runway Safety Areas

RSAs enhance safety by providing cleared areas for airplanes which undershoot, overrun, or veer off the runway. They also provide improved accessibility for firefighting and rescue equipment during emergencies. The FAA design standards call for 500-foot RSAs centered along the runway and extending 1,000 feet beyond the runway threshold.

The Runway 6-24 RSA extends only 200 feet beyond the southeast threshold. On the northeast end, the RSA extends only 100 feet beyond the threshold. The RSA for Runway 15-33 extends 1,000 feet beyond the Runway 33 threshold. The RSA for Runway 15 is 630 feet long, including a 300-foot EMAS installation. The FAA allows Airports to meet RSA standards using EMAS installations if no other alternative is feasible, so long as the arresting system can stop the critical aircraft exiting the end of the runway at 70 knots to stop. Options for providing full safety areas for those runway ends not meeting design standards will be explored in the concepts chapter of the Master Plan Update.

5.4.6 Runway-Taxiway Separation Standards

Table 5.5 summarizes FAA separation standards. As shown, ADG-IV aircraft require a runway-to-taxiway separation of 400 feet. Through numerous recent airfield

Table 5.5

Separation Standards for ADG-IV Aircraft

	ADG-IV	A300
Runway Centerline to:		
Taxiway/Taxilane Centerline	400.0	330.0
Aircraft Parking Area	500.0	N/A
Taxiway Centerline to:		
Parallel Taxiway/Taxilane Centerline	215.0	186.0
Fixed or Movable Object	129.5	113.0
Taxilane Centerline to:		
Parallel Taxilane	198.0	171.8
Fixed or Movable Oject	112.5	98.0

Source: FAA AC 150/5300-13; HNTB analysis.

projects, the Airport has been able to increase the separation between the two runways and adjacent taxiways to meet this design standard. At other locations, however, the FAA granted permanent modifications to design standards, recognizing it would be infeasible to meet the standards. Taxiway A is separated from Runway 15-33 by 365 feet from the 33 threshold to Taxiway B. From the 15 threshold to Taxiway G, separation between Taxiway A and the runway is 330 feet. Once the portion of Taxiway A between Taxiway B and Taxiway E is reconstructed, it too will be separated by 365 feet from Runway 15-33.

Between Taxiway M and the Runway 24 threshold, Taxiway G is separated from the runway by 400 feet. Between Taxiway M and Taxiway L, the separation is only 275 feet. Taxiway G is being reconstructed in this location to provide a 365-foot separation from the runway, except near Hangar 4 where the separation will be 330 feet.

Taxiway E is separated from Runway 6-24 by a minimum of 400 feet.

5.4.7 Obstacle Free Zone

Obstacle free zones (OFZs) preclude 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 runway OFZ and, where applicable, the precision OFZ, the inner-approach OFZ, and the inner-transitional OFZ.

Runway OFZ

The runway OFZ is a defined volume of airspace centered above the runway centerline. The runway OFZ is the airspace above the surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The runway OFZ extends 200 feet beyond each end of the runway and is 400 feet wide for runways serving large airplanes.

Inner-approach OFZ

The inner-approach OFZ is a defined volume of airspace centered on the approach area and applies only to runways with an approach lighting system. The inner-approach OFZ begins 200 feet from the runway threshold at the same elevation of the threshold and extends 200 feet beyond the last light unit in the approach lighting system. Its width is the same as the runway OFZ and rises at a slope of 50:1 from its beginning.

Inner-transitional OFZ

The inner-transitional OFZ is a defined volume of airspace along the sides of the runway OFZ and inner-approach OFZ. It applies only to runways with lower than ¾-statute mile approach visibility minimums.

Runway 33 provides an RNAV (GPS) approach with a visibility limit of ½-mile for Approach Speed A and B aircraft, and the Master Plan Update will explore the feasibility of providing lower visibility minimums in the concepts phase, and meeting inner-transitional OFZ dimensions will be considered during this analysis.

Precision OFZ

The precision OFZ (POFZ) is a volume of airspace above an area beginning at the runway threshold, at the threshold elevation, and centered on the extended runway centerline, 200 feet long by 800 feet wide.

The surface is in effect only when all the following operational conditions are met:

- Vertically guided approach,
- Reported ceiling below 250 feet and/or visibility less than ¾-mile (or RVR below 4,000 feet), and
- An aircraft on final approach within two miles of the runway threshold.

The POFZ is applicable at all runway ends including displaced thresholds. POFZ requirements will be considered when evaluating options for lower approach minimums.

5.4.8 Runway Object Free Area

The runway OFA is centered on the runway centerline. The runway OFA clearing standard precludes placing above-ground objects protruding above the RSA elevation. Except where precluded by other clearing standards, it is acceptable to place objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes and to taxi and hold aircraft in the OFA. For ADG-IV runways, the OFA is 800 feet wide and extends 1,000 feet beyond the runway end.

5.4.9 Runway Protection Zones

The runway protection zones (RPZs) function is to enhance the protection of people and property on the ground. This is achieved through airport owner control over RPZs. The RPZ is trapezoidal in shape and centered about the extended runway centerline. RPZ dimensions vary approach visibility minimums. There are two components to the RPZ: the controlled activity area and the portion of the runway OFA within the RPZ. Other than with a special application of declared distances, the RPZ begins 200 feet beyond the end of the area usable for takeoff or landing. With a special application of declared distances, separate approach and departure RPZs are required for each runway end.

The FAA recommends clearing all objects from the RPZ; however, it recognizes that some uses are permitted, provided they do not attract wildlife, are outside the runway OFA, and do not interfere with navigational aids. Residences and places of public assembly are prohibited within RPZs; fuel storage facilities should not be located in the RPZ.

Runway 6 provides instrument approach visibility minimums that are ¾-mile or greater (depending on airplane category), requiring an RPZ that is 1,700 feet long (measured 200 feet beyond the runway threshold), 1,000 feet wide along its inner width, and 1,510 along its outer width. The current RPZ does not meet these dimensions. In addition, recognizing that future technology may allow precision approaches to this runway end, it is recommended that a full-size RPZ be assumed for Runway 6 (resulting in an RPZ that is 2,500 feet long, 1,000 feet wide along its inner width, and 1,750 feet long along its outer width. To exercise control of the area within the expanded RPZ, it is preferable for the RRAC to acquire the additional property within this area if feasible. It should be noted that, should the FAA require the threshold to be relocated to meet RSA standards, the location of the RPZ would also be affected.

Runway 15 is currently a visual runway with an RPZ that is 1,000-feet long, 500 feet along its inner width, and 700 feet along its outer width. Based on a review of radar data, current runway use patterns, and the forecast fleet mix, the existing RPZ dimensions should be maintained. The RRAC owns the property within these dimensions, with the exception of roadway right-of-ways.

The Runway 24 RPZ is 1,000 feet long, 500 feet wide along its inner width, and 700 feet wide along its outer width. Because Runway 24 provides instrument approaches to Category C and D aircraft, its length should be increased to 1,700 feet and its inner and outer widths should be increased to 500 feet and 1,010 feet, respectively. The Airport controls most of this land with the exception of the Route 623 right-of-way and a portion of the eastern extent of the PRZ. As noted previously, should the FAA require the threshold to be relocated to meet RSA design standards, the location of the RPZ may also be affected.

The current Runway 33 RPZ is 1,700 feet long, 500 feet wide along its inner width, and 1,010 along its outer width. Recognizing that this runway end currently provides approach minimums less than ¾-mile, the RPZ should be lengthened to 2,500 feet, its inner width should be widened to 1,000 feet, and its outer width should be increased to 1,750 feet. The RRAC currently owns the land within the existing RPZ and the land area under the larger RPZ, with the exception of the roadway right-of-ways.

As options for providing improved instrument approach minimums are explored in Chapter 6, RPZ dimensions may need to be altered to meet FAA design standards.

5.4.10 Ground Vehicle Circulation

A series of roadways provides access to various parts of the airfield. A narrow, single-lane, unpaved perimeter road runs along the edge of much of the AOA. Other on-airfield roadways connect the airfield maintenance base to the rest of the airfield. A series of controlled-access points are also provided along the fence line to connect these service roads to the public road system.

Based on discussions with RRAC staff, the existing airfield roadway network could be improved. The improvements would include paving and widening the perimeter road, providing access from the air carrier apron to the southeast portion of the airfield near the approach end of Runway 33 without transiting the AOA, and improving access to the fence line for security purposes. The concepts phase of the Master Plan Update will identify improvements that will complement the existing system and recommended facility development.

According to AC 150/5300-13, rescue and firefighting access roads are needed to provide unimpeded two-way access for rescue and firefighting equipment to potential accident areas. Connecting these access roads, to the extent practical, with the operational surfaces and other roads will facilitate aircraft rescue and firefighting operations.

The AC recommends that the entire RSA and RPZ be made accessible to rescue and firefighting vehicles so that no part of the RSA or RPZ is more than 330 feet from either an all-weather road or a paved operational surface.

Although the safety areas for each runway are accessible by road, portions of the future Runway 24 RPZ and future Runway 15 RPZ are farther than 330-feet from an all-weather road or paved surface. Improved access should be provided.

5.4.11 Taxiway Requirements

Taxiway requirements at ROA for taxiway-to-taxiway, and taxiway-to-fixed or movable object are based on ADG IV where feasible. For situations where full Group IV separation was not feasible, the current ALP established separation dimensions based on the A300 aircraft. Table 5.5 provides a summary of the separation standards for Design Group IV.

Taxiway A and Taxiway T are located southwest of the terminal building. These two taxiways are being reconstructed in the vicinity of the GA area. When this project is completed, the separation between Taxiway A and Taxiway T will be 160 feet. This distance does not meet the ADG-IV separation standard of 215 feet; however, it will permit dual flow on these two taxiways for aircraft up to the A300. The B767 is forecast to use ROA in the future (although at fewer than 500 annual operations); when a B767 uses one of these taxiways, the wingspan for aircraft on the other taxiway would be limited to 81 feet—the wingspan of some larger regional jets.

Taxiway Width

Taxiways serving larger ADG-III and ADG-IV aircraft should be 75 feet wide. All taxiways at ROA which these aircraft are anticipated to use are either at this width or will be reconstructed at this width.

Taxiway Shoulders

Taxiway shoulders are recommended to be 20 feet wide for ADG-III aircraft and 25 feet wide for ADG-IV aircraft. Taxiway serving ADG-III and larger aircraft should have paved shoulders.

As the Airport reconstructs various portions of its airfield, 25-foot shoulders are being incorporated into the taxiway design.

Taxiway Safety Area

The taxiway safety area (TSA) is centered on the taxiway centerline. The TSA should be cleared and graded, properly drained, capable of supporting snow removal and rescue/firefighting equipment and the occasional passage of aircraft, and free of objects (except those needed to be in the safety area due to their function). The TSA for DG-IV aircraft should be 171 feet wide. In most instances, the TSAs either currently meet design standards or will meet them after the programmed reconstruction projects are completed. However, the portions of the taxiways parallel to the runways in which the separation is less than 360 feet have overlapping taxiway and RSAs and drainage conveyances in the taxiway safety areas. A modification to standard has been approved by the FAA.

Taxiway and Taxilane Object Free Area

Taxiway and taxilane OFAs are clearing standards centered on taxiway and taxilane centerlines. Service vehicle roads, parked airplanes, and above-ground objects (except those that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes) are prohibited from being within the taxiway/taxilane OFA; however, vehicles may operate within the taxiway/taxilane OFA provided they give right of way to oncoming aircraft. For taxiways, the ADG-IV OFA is 259 feet wide; for taxilanes, the ADG-IV OFA is 255 feet wide.

Taxilanes serving the GA area require an OFA width of only 115 feet for Group II aircraft which will provide clearance for the majority of turboprops and jets, including Gulfstream IVs, currently utilizing the Airport. A route for ADG-III aircraft may be desirable to serve larger GA aircraft, including the Boeing Business Jet, the Global Express, and Embraer Lineage 1000.

Exit Taxiways

Well-placed exit taxiways can reduce runway occupancy times for landing aircraft which, in turn, can provide increased airfield capacity. The airfield analysis undertaken to determine the Airport's current hourly capacity suggests that additional exit taxiways may improve capacity. The location of additional exit taxiways will be determined during the concepts phase of the study.

Holding Bays/Bypass Taxiways

Holding bays and bypass taxiways enhances capacity by allowing ATC to operate runways more efficiently. Holding bays provide a standing space for aircraft awaiting final ATC clearance and allow those aircraft already cleared to bypass other aircraft to taxi into takeoff position on the runway. By virtue of their size, they enhance maneuverability for holding aircraft while also permitting bypass operations.

All four runway ends have bypass taxiways, while Runway 24 also has a holding bay, designed for small aircraft only.

5.4.12 Navigational Aids

Typically, a commercial service airport provides at least one precision approach with standard Category I visibility minimums of 200-foot cloud ceiling and ½-mile visibility. At ROA, however, the mountainous terrain surrounding the Airport affects the approach minimums to its runway system.

Although approach minimums still do not meet the Category I standards, revised approach procedures and the advent of GPS technology have improved approach minimums at ROA over the last 10 years. In 1997, the ceiling limit on the ILS to Runway 33 was 1,660 feet. In 2006, the ceiling limit had improved to 500 feet for approach category C aircraft. Likewise, the minimum ceiling for the LDA/DME approach to Runway 6 was 1,540 feet. In 2006, the ceiling limit had improved to 405 feet. Forward visibility minimums have improved only slightly. The lowest visibility minimum in 1997 was one statue mile. By 2006, the RNAV/GPS approach to Runway 33 provides a visibility limit of ¾-mile for approach speed C aircraft.

During the inventory process, several tenants and the FAA ATCT personnel noted impacts on operations associated with poor weather conditions. For this reason, opportunities for new approach procedures which could result in approach minimums closer to Category I standards were explored. The analysis suggests that the terrain surrounding the Airport significantly restricts options for reducing minimums, although emerging new technologies may help. A detailed description of the analysis is provided in **Appendix E**.

A PAPI is scheduled for installment for Runway 24 in the near future. It is recommended that the FAA replace the VASIs on Runway 6 with PAPIs.

Based on discussions with ATC personnel, the existing ASR-8 located on-airport provides poor coverage of the Pulaski and Blacksburg areas. It is recommended that the ASR-8 be upgraded to an ASR-11 and relocated to both improve coverage and permit potential development of the Northwest Quadrant of the Airport.

5.4.13 Compass Calibration Pad

There is no designated, marked compass calibration pad at ROA. Landmark Aviation is currently conducting compass calibration on their apron. The Master Plan Update will identify a site for compass calibration pad using guidance provided in Appendix 4 of AC 150/5300-13.

5.4.14 Deicing Facilities

Deicing events can be broken out into two categories: minimal deicing events (typically frost removal using a Type I agent) and deicing/anti-icing events (typically conducted during times of precipitation when a Type IV agent is applied). Based on discussions with the airlines, deicing activity limited to frost removal can occur frequently in the winter, while the number of deicing/anti-icing events requiring the application of Type IV agents has averaged around four or five times annually.

Deicing and anti-icing activity can occur both at the gate and at a remote deicing pad located on the northwest end of the cargo apron, in proximity to the Runway 24 threshold (the primary departure runway). In general, deicing activity with a Type I agent almost always occurs at the gate, while deicing/anti-icing activity occurs both at the gate and at the remote pad. According to discussions with the operations supervisor for the busiest airline at ROA, the carrier prefers to apply Type IV agents at the remote pad because it reduces the time between application and take off and because it helps keep the terminal apron free of deicing agents, which can result in a slippery ramp for passengers and employees.

Although the remote deicing pad can be used during these events, airlines try to minimize its use because, with today's leaner staffing levels, moving employees away from the terminal area can hamper operations back at the terminal.

While the remote deicing pad sees limited use, the airlines appreciate its availability during poor weather conditions. None of the airlines indicated a need for an additional remote deicing pad; however, should the use of the existing facility be precluded (e.g., through a significant increase in the need for cargo apron beyond what is forecast in the Master Plan), a new location would need to be identified.

Based on anticipated peak period use, the remote pad should be sized accommodate either two regional jets or one large narrow body aircraft. The pad would require a maneuvering area for mobile deicing vehicles, bypass taxiing capability, portable lighting, and environmental mitigation. Based on these requirements, a remote deicing pad would comprise approximately 5,500 square yards. The concepts phase of the Master Plan will examine possible sites for a new remote deicing pad.

5.5 TERMINAL FACILITY REQUIREMENTS

Facility requirements for the passenger terminal building were based on forecast of peak hour activity (including originating and terminating passengers, baggage, and aircraft operations), application of industry standards, and the information gathered during the Master Plan Update inventory process, through tenant interviews, the departing passenger survey, and observations of various terminal functions. The program area for each major terminal functional space for each forecast year is presented in **Table 5.6**. The following sections describe these major functional areas and their respective facility requirements. Recognizing the desire to improve customer service, possible improvements to the terminal—beyond square footage requirements—are also identified; these will be explored in greater

Table 5.6

Passenger Terminal Building - Program Area by Function by Year
(Square Feet)

		Required				
	Existing	**2005**	**2010**	**2015**	**2020**	**2025**
Terminal Ground Level						
Ticket Counter Area	1,691	1,450	1,691	1,691	1,691	1,691
TSA Bag Screening Area	1,160	1,160	2,700	2,700	2,700	2,700
Ticketing Que Area	2,320	2,320	3,482	3,482	3,482	3,482
Ticket Lobby Public Circulation	4,850	4,850	4,850	4,850	4,850	4,850
Airline Ticket Office	3,841	3,279	3,841	4,800	4,800	5,800
Airline Bag Make-up Area	5,730	4,901	9,000	9,000	9,000	9,000
Travel Concession / other	262	262	360	360	360	360
Public restrooms	336	336	800	800	800	1,000
Arrivals Lobby Public Circulation	7,724	7,724	7,724	7,724	7,724	10,300
Airline Bag Service Offices	676	338	676	676	676	1,000
Baggage Claim Area	3,515	3,515	3,515	3,515	3,515	5,275
Airline Bag Claim Tug Drop Area	2,140	2,140	3,600	3,600	3,600	3,600
Rental Car Concessions	1,544	1,544	1,544	1,544	1,544	1,544
Ground Transportation Tenants	546	546	546	546	750	850
Shoe shine tenant	119	119	119	119	119	119
ROA Supporrt Space	1,222	1,222	1,222	1,222	1,222	1,222
MEP Space	3,656	3,656	4,600	4,600	4,600	6,000
Subtotal	41,332	39,362	50,270	51,229	51,433	58,793
Terminal Second Level						
ROA Administration Area	7,834	7,834	8,000	8,600	9,800	11,000
Restaurant	4,852	4,852	4,852	4,852	6,500	6,500
Gift Shop	1,507	1,507	1,507	1,507	1,700	2,200
Public Restrooms	555	555	555	555	960	960
Public Circulation	9,722	9,722	10,172	10,172	10,172	12,200
Subtotal	24,470	24,470	25,086	25,686	29,132	32,860
Concourse Ground Level						
Airport Operations Offices	3,802	3,802	3,802	3,802	3,802	3,802
Airline Operations Office	1,232	1,232	1,232	1,232	1,232	1,232
TSA Offices	1,144	1,144	1,144	1,144	1,144	1,144
Ground Level Pax Holdroom	886	886	886	886	886	886
MEP/Support Space	4,030	4,030	5,000	5,000	6,000	6,000
Subtotal	11,094	11,094	12,064	12,064	13,064	13,064
Concourse Second Level						
TSA Pax Screening Area	1,536	1,536	2,660	2,660	2,660	2,660
Public Circulation	4,452	4,452	4,452	4,452	4,452	4,452
Public Restrooms	932	932	1,000	1,000	1,600	1,600
Pax Holdrooms	10,692	9,387	10,692	10,692	10,692	10,692
Office Space	1,362	1,362	1,362	1,362	1,362	1,362
Concessions	1,529	1,529	1,800	1,800	2,100	2,400
Subtotal	20,503	19,198	21,966	21,966	22,866	23,166
Grand Total	97,399	94,124	109,386	110,945	116,495	127,883

Source: HNTB analysis.

detail during the concepts phase of the Study.

5.5.1 First Floor Terminal Facilities

This section covers the terminal elements on the first floor of the terminal building, including ticketing, concessions, hold bag screening, airline ticket offices, outbound bag make up, bag claim, and restrooms.

Ticketing

The ticketing wing of the terminal consists of a linear ticket counter line parallel to the face of the terminal front facade. The ticket counter line is interrupted by brick piers between every four agent positions. Public seating is located adjacent to the glass curtainwall and a travel concession. A circulation area allows passengers to move laterally through the ticket lobby and the passenger queue area.

In response to new security requirements for 100 percent hold bag screening, the TSA installed explosive trace detection (ETD) equipment and inspection space in the ticket lobby queue area. This has significantly reduced queue and circulation space, creating very crowded conditions and a low level of customer service. Additionally, when customers need assistance with self-serve kiosks check-in, there is sometimes confusion among passengers as to which employees work for the airlines and which work for TSA.

Airport ticketing lobbies and outbound baggage areas are going through significant changes in processes due to new security requirements, the advent of new technologies (such as self-serve e-ticket kiosks, on-line check-in, and potential for remote bag tag printing), low-cost air carrier business models, and airline de-staffing trends. These trends are also occurring at ROA. The passenger survey conducted in November 2005 (described in Chapter 3) indicated that 51 percent of passengers used either self-serve e-ticket kiosks or online ticketing. US Airways reported self-serve e-ticket kiosks and online ticketing are used by 70 percent of their passengers, and United Express reported between 50 and 60 percent use. While Delta stated it only experienced 10 percent use of new technology, there is a desire to increase this percentage significantly. Delta has reported that it intends to install technology upgrades to its ticketing area by October 2006. The planning of ticketing and outbound baggage areas must recognize and accommodate these trends.

With the increasing use of self-serve e-ticket kiosks and online ticketing, the number of ticket counter agent positions is growing at a slower rate than the rate of other functional areas. It is also creating an agent de-staffing trend at ticket counters and more cross-utilization of airline customer service agents for other functions. At ROA, all of the airlines requested stand alone self-serve kiosks away from the manned ticket counter so agents can focus on passengers who need assistance. Passengers with only carry-on baggage and frequent flyers who do not need assistance could use self serve e-ticketing kiosks away from the manned counters. The self-serve kiosks could be located near the glass curtainwall, so that upon arriving in the ticket lobby, the self-serve customer could avoid the ticket queue entirely. In the future, when self bag tagging is allowed, the self-serve customer will attach a bag tag and drop the bag at an airline bag drop location in the ticket lobby.

The greater use of new check-in technology has resulted in the existing ticket counters at ROA being underutilized. US Airways in the past had occupied 10 agent positions, but currently now has five agent positions. The surplus positions, however, provide room for new entrant carriers to move in easily as Allegiant Air has done recently.

Peak hour enplanements are forecast to increase by nearly 50 percent from 225 passengers in 2005 to 334 passengers in 2025; however, due to the amount of under-utilized ticket counters currently available and the increasing use of self-serve kiosks and online ticketing, no additional ticket counter space will be required through the planning horizon, assuming all hold bag screening (HBS) activities are relocated.

Ticket Area Concessions

A travel agency concession, occupying 260 square feet, is located to the right of the central entrance to the terminal. The demand for travel agency use has diminished substantially in recent years. The manager of the concession reported very few actual travel agency transactions occur and that most interaction is referred to their main office via telephone. It is recommended that a much higher grossing concession should be explored at this location. The current space could be increased and converted to food & beverage or a retail concession due to its premium location. If the travel agency wishes to remain at the terminal, it should be relocated to the far end of the ticket lobby or the arrivals lobby.

Hold Bag Screening

HBS requirements are based on the forecast of peak hour bags originating bags. This was calculated by taking the number of peak hour originating passengers, multiplying by 0.7 (the ratio of passenger checking a bag), and multiplying this number by an average 1.5 bags per passenger checking bags. For the year 2015, the peak hour number of bags is forecast to reach nearly 300. By 2025, the peak hour checked bag count will be approximately 350 bags.

As mentioned previously, the existing HBS operation in the ticketing area has degraded customer service. In addition, TSA prefers to have hold bag inspections in a sterile area for security purposes. There are several options for relocating TSA's hold baggage screening activity from the ticket lobby and creating an in-line system, possibly in the ATO area or in the baggage make-up area.

One option is to continue to use the four existing take-away ticket counter belts and set up an in-line EDS device in each of the four baggage make up rooms. Each EDS device in this case would be a lower throughput rated device such as a 'Reveal CT-80' which can process approximately 100 bags per hour. The four EDS devices technically would meet the peak hour capacity of total peak hour bags; however, it may not meet the peak hour capacity of a single ticket counter take-away conveyor if multiple flights by multiple carriers are on the same conveyor. All suspect bags would be identified by the EDS and then sorted by the conveying system to a secondary screening area in which an Explosive Trace Detection (ETD) and/or a physical search of the bag would be executed. The secondary search area would be located in the outbound baggage room or an adjacent room constructed at the rear of the current terminal building.

A second option would be to collect all bags along the ticket counter and convey them through a single high throughput EDS device such as a CTX 9000, or L3 Examiner 6500, which have throughput rates of more than 384 bags per hour. Indexing queue belts would be provided for any peak 10 minute surge of baggage in the system. Suspect bags would be screened as in the previous option.

Both of the proposed schemes would reduce TSA staffing, eliminate ticket lobby TSA activities, and increase the rate and quality of the checked baggage screening process. TSA is going through many in-line system re-organizations at many other airports, and the slower but usable EDS equipment is being phased out at those airports and could be available for use in the near term for the throughput necessary for ROA's needs.

Airline Ticket Office

When the in-line checked bag screening system is created, baggage make–up areas currently not used will be used for the new screening and the baggage make-up area. At that time, the ATO space for each airline should be equitably reallocated and relocated logically behind each air carrier's ticket counter operation.

Outbound Baggage Make-up

Once the bags were fully screened, they would be conveyed to a common baggage make-up device in a new expanded common use baggage room where all air carriers would have sufficient room to make-up their bags. This scheme provides flexibility to accommodate changes in airline market share. The airlines serving ROA expressed no concern about operating in a common use baggage make-up room environment. The actual square footage required will vary depending on the geometry of the system layout, although it will require more baggage make-up space than the existing area. Further consideration of HBS and bag make up area will be explored in the concepts chapter.

Baggage Claim

Currently, there are two flat plate baggage claim devices located in baggage claim, each with sufficient capacity for a narrow body aircraft. The current practice among the airlines has US Airways using one baggage claim device and all other air carriers using the second. To ensure more balanced use of the two carousels, this practice should not continue. Based on the forecast peak hour of five aircraft arrivals and the forecasted aircraft mix, there is ample capacity to handle the baggage claim requirements through year 2025.

ROA does not have a baggage information display system (BIDS) which would enable the Airport to assign either baggage claim device to any carrier at any time. A BIDS would provide a more equitable allocation and utilization of both devices based on the peak hour arrival schedule of aircraft. The system could have LED displays at each baggage claim device showing the airline name, flight number, and the originating city. At the inbound baggage input area, the airline personnel would select the baggage claim device not in use, or the device least in use based on demand, and input the airline name, flight number and originating city to an input device that displays the information inside at the designated bag claim device.

Modifications to the inbound baggage tug lay down area should be made to better accommodate baggage tug turning radius and overall maneuverability inside the drive area to reduce damage to the walls and doors and to improve access to each bag claim device. Additional wall and corner protection should be installed to reduce potential baggage tug damage. Alternatives to address these improvements will be provided in the Concepts section of the Master Plan. Additionally, improved lighting should be installed in the bag claim area to provide more light to identify bags and provide for a fresher and brighter area.

At times when persons or bags miss connections prior to arriving at ROA, large numbers of unclaimed bags can accumulate. Currently, airlines collect unclaimed bags and store them in their baggage make-up rooms. Another option to accommodate these unclaimed bags would be a secure common use lock-up area, with a storage capacity for about 65 bags in the claim area. A common use storage area would be more efficient and cost-effective than a storage room for each carrier in baggage claim. Additional revenue to the Airport could be achieved through an increase in advertising displays in and around the baggage claim areas. This could include backlit advertising displays placed in the center of the baggage claim device or on surrounding walls, video display devices, or free standing kiosks, placed appropriately to avoid circulation paths used for claiming bags.

Signs are needed to direct passengers with baggage claim issues to each airline's ticket counter since the airlines do not staff the baggage claim area.

Restrooms

Although the Airport's restroom facilities meet the Virginia Statewide Uniform Building Code minimum requirements for restrooms, it should be noted that the code does not take the unique peaking characteristics of airports into account. The result has been an insufficient number of fixtures, especially for women. In addition, there is an optional consideration for separate a restroom for persons needing assistance (although it is not needed by code) and additional amenities and design improvements for restroom facilities overall. For this planning effort, restroom requirements for the terminal and concourse were determined based on peak hour occupancy, a higher ratio of fixtures per occupant, and a higher ratio of women occupants than the code requires.

There is one set of restrooms on the first floor, centrally located between ticketing and bag claim, behind the stairs. The men's room contains one urinal, one toilet, and two sinks. The women's room contains two toilets and three sinks.

To provide an adequate level of service, the men's room should be expanded to provide a total of four urinals, two toilets, and four sinks. The women's room should be expanded to provide five toilets and five sinks.

Expansion of the restroom facilities on the first level could be achieved in a number of ways. One option is to expand into the mechanical room and toward the ticket lobby. In addition, their entrances should be relocated to make them more easily found. Other options would be to expand the restrooms without encroaching on the mechanical room, or splitting the men's and women's restrooms, and exploring other locations throughout the first level. These options will be explored further in the concepts section of the Master Plan Update.

5.5.2 Second Floor Terminal Functions

Second floor terminal functions include non-secure concessions, non-secure restrooms, passenger security screening, the secure concourse, secure restrooms, loading bridges, and Airport offices.

Second Level Non-Secure Concessions

The concession space available for food and beverage and retail at the second level central area location is adequate for the current and near-term forecast future passenger growth. The efficiency, layout, and interior architectural décor of the existing food and beverage concession should be updated. A more efficient layout, combining the bar and food portion of the facility, would reduce labor costs and provide better exposure to the bar area from the main circulation space. Better visual access, a renovated attractive décor coupled with an updated menu, would increase the revenue potential of the facility. A smoking section could still be maintained while making the layout of the facility more efficient. In later forecast years, additional seating area would be required as passenger growth grew or a higher per capita use of the restaurant/bar was realized. An expansion could advance outward past the glass wall facing the apron.

It is recommended that additional electrical outlets be provided in the waiting areas, especially at the work desks provided in the upper level for business passengers so computers and cell phones can be charged as the passengers use the free Wi-Fi and conduct work while waiting at the Airport.

Non-Secure Restrooms

A set of public restrooms is located near the Commission offices. The men's room contains two urinals, two toilets, and three sinks. By 2025, the men's room will need an additional toilet on this level. The women's room contains four toilets and three sinks. An additional toilet is required to meet long-term demand. on this level. More detailed design improvements will be discussed in the concepts chapter.

Passenger Security Screening

There is insufficient area for passenger security screening functions especially at peak period. On peak travel days, passenger queues for screening can extend down the corridor to the Airport offices and around the corner to the remotely-located restrooms. Based on the forecast level of peak hour passengers, the measured transaction times from the surveys conducted in the fall, and the need for redundant security lines for when a single line is interrupted for a technical equipment problem or other reason, a second security lane is required. It is recommended that an additional structural bay be added at the throat of the concourse to accommodate the following functions:

- More area for passengers to divest their belonging prior to the checkpoint area;
- A second security line with a magnet-ometer, x-ray, and ETD trace secondary;
- A private pat down interview/inspection room;
- Minimum TSA office space required to be adjacent to screening checkpoint;
- Equipment room for an anti-pass back prevention security system;
- Area to accommodate probable security equipment upgrades in future years;
- Additional queue area; and,
- Area for a gate for securing concourse after last outbound flight.

Additional security queue area could be added by expanding outward from the main terminal building towards the apron. This expansion would open up additional room for meeter-greeter seating. Expansion of the second level in this area may require the relocation of an electrical transformer and a generator below at apron level. This will be explored in the concept phase of the study.

Secure Concourse

Concourse requirements are based on peak hour originating and terminating passengers. The original terminal design sized each of the six passenger gate holdrooms for a standard narrow body aircraft such as a 737, MD-80, or A320 with aircraft capacities from 120 to 140 seats. The current aircraft fleet mix is predominately regional and commuter aircraft with seating capacities of 70 passengers or less. Gate 1 is not currently used as a holdroom, as TSA uses a portion of it for a temporary office and break area. In the concepts phase, options for reclaiming this gate for airline use will be explored. Gate 2 is used by United Airlines. Gate 3 is used by Delta Air Lines. Gate 4 is used by Northwest Airlines. Gate 5 is used by US Airways. Gate 6 is used by Allegiant Air twice a week and for charters on an intermittent basis. As shown in **Table 5.7**, peak hour departures are forecast to increase from five aircraft in 2006 to six by 2025. Therefore, there is sufficient holdroom capacity in the concourse for future growth.

Concession areas on the concourse would benefit with more visual exposure to the main concourse circulation. Over time, as more passengers and frequency of flights increase, additional area may be warranted for food & beverage and retail concessions. Kiosk-type concessions may provide additional revenue and meet the needs for passengers with a low up front capital cost to both the Airport and the potential new concessionaire. These concessionaires should be required to provide services or products different from existing concessionaires with current leases, in order

Table 5.7

Gate Requirements (1)

	Existing	Required				
	2005	2005	2010	2015	2020	2025
Peak Hour Operations (2)	9	9	9	9	10	10
Peak Hour Departures (2)	5	5	5	5	5	6
Gates	5 (3)	5	5	5	5	6

Notes: (1) Assumes exclusive use; one aircraft per gate.
(2) Scheduled passenger carriers.
(3) Includes Gates 2-5; Gate 1 is currently not used.

Source: HNTB analysis.

not to erode the current revenue streams, but instead to create new revenue sources of concession business. Some suggestions from successful new concession ideas in the airport industry include:

- Premium coffee kiosks
- Flowers
- Candy
- Massage services
- Fingernail services (requires specific ventilation at the concession)
- Local specialty artwork

Additional area should be provided for one or more of these concession opportunities and additional allocated area is shown in the Table 5.6.

Other amenities that would enhance the passenger experience and are recommended to be added to the concourse include:

- More electrical outlets throughout the holdrooms for laptops and cell phones
- Improved flight information display system (FIDS) for departures with visual paging capabilities and larger monitors
- Newer updated holdroom seating
- Desk workstations with electrical outlets for business travelers on the concourse to take advantage of the free Wi-Fi provided in the terminal
- Community art work displays along the concourse
- Airport TV (e.g., CNN or Fox News)

Concourse Restrooms

There is one set of restrooms in the secure concourse. The men's room contains six urinals, four toilets, and six sinks. The women's room contains nine toilets and six sinks.

To meet requirements for the 2025 planning horizon, the men's room will require an additional toilet and two sinks; the women's room will require three additional toilets and two sinks. A single accommodation "unisex" restroom could be provided on the secure concourse to serve persons who need assistance such as disabled persons. Additional discussion of design improvements is provided in the concepts chapter of the report.

Passenger Boarding Bridges

Gates 2, 4, 5, and 6 have apron drive boarding bridges, and in recent years the Airport has renovated these bridges to accommodate regional aircraft sill heights. Gates 1 and 3 are not provided with passenger boarding bridges. Air carriers at ROA are not consistent in their use of the bridges. Some airlines have indicated that their particular aircraft model is not compatible with the modified bridges (US Airways operates the Bombardier Dash 8 turboprop which has a particular clearance problem because the passenger door is close to the propeller), while others have lacked properly trained staff to operate the passenger bridges on a consistent basis.

One of the most common complaints by passengers at regional airports is the lack of passenger bridge access to the terminal, as such, ways of increasing loading bridge use should be explored. There are passenger bridge manufacturers who make a model compatible with a Dash 8. Bridges compatible with the Dash 8 could be added to Gates 1 and 3 which do not have any bridges at this time, and the airline using this aircraft could be redirected to those gates. Any remaining incompatibility issues at other bridges and lack of trained personnel should also be remedied.

Airlines have expressed an interest in installing baggage chutes/lifts on the side of the bridges so regional aircraft passengers can claim some of their light baggage in the passenger bridge rather than having to reclaim these bags at baggage claim. Although this provides a higher level of customer service, it further reduces the use of baggage claim, while requiring additional capital investment on an alternative passenger bridge baggage claim system by the Airport. Therefore, it is not recommended at this time.

Until the passenger boarding bridges are available for all passengers, the stairs used by air carriers for ground loading need to be improved. Currently, the stairs used are utilitarian exit stairs. They should be upgraded with better lighting, security access control monitoring, and cameras to monitor doors opened for extended periods during boarding and deplaning activities. Further, if no additional bridges are to be added, then a lower ground level holdroom may be necessary to facilitate the ground boarding process. Clear pedestrian walkway paths should be painted on the apron as a safety precaution to prevent arriving passengers from wandering the apron area in search of stairs to the second level concourse.

Secure Ramp Level

The area below the concourse is used primarily for airline operations and Airport operations. The RRAC has recently renovated the old flight catering area into 3,800 square feet of new Airport office space for Airport operations, the security operations center (SOC), and Airport maintenance. Approximately one-fourth of the area is for US Airways ramp operations, one-half for RRAC space, and the remaining one-fourth of the space for TSA offices. Airlines have reported they have ample space for their operations. Analysis of forecast aircraft operations confirms there will be sufficient space well into the future for ramp operations. There is also space to create a single regional aircraft gate holdroom if required at the lower level adjacent to the drive-through area.

Airlines have an interest in adding/ upgrading electrical power outlets for battery charging stations used for electric powered vehicles and block heaters for vehicles in winter operations at the back of the terminal building.

5.5.3 Airport Offices

ROA's offices are in excellent condition and are sufficient in size to accommodate the Airport's current needs, except for the network center which will have to increase with additional growth in electronic data and security systems. The area of the second level of the terminal building is fully utilized. The Airport staff may grow organically over time and additional space may be required. Options for additional office space include underutilized space below the secure concourse, or spaces outside the terminal in other underutilized buildings on the Airport. Otherwise, an expansion of the terminal offices expanding towards the east side of the terminal building would be required to accommodate growth shown in the program table.

5.5.4 Trash/Truck Dock

The process for transporting trash from the terminal area to the dumpster requires moving trash bins up and down stairs to the trash dumpster. A new AOA/SIDA gate which provides direct access from the airside to the trash disposal area without going through the terminal building is required to enable the airlines to bring waste from the AOA/SIDA to the landside, and is planned to be installed to alleviate this issue.

5.5.5 Additional Terminal Considerations

Terminal Curbside

Passengers arrive at the terminal curb from the parking area using pedestrian crosswalks. At the curb-cuts at the median between the lanes on the terminal access road, rain water drainage concentrates and flows through the median curb cut and pedestrian path, which creates high water where passengers walk. The medians should be provided with additional drains at the down slope curb to prevent rain water accumulation at the main pedestrian routes.

Once the passengers arrive at the terminal curb, there is a sizable concrete plaza expanse in front of the terminal. The

Commission may wish to create a more inviting entry to the terminal building by softening this area with landscape planters. A plan for providing planters to protect the terminal from a vehicle attempting to get close to the terminal for criminal activity has been identified by another consultant. The planters could contain trees, flowers, other shrubbery, or ornamental plants to provide a seasonal variety of plant material in limited areas. The planters should be placed so as to not to impede passenger flow to the main entries of the terminal.

On the outside front glass curtainwall of the terminal façade, the structural steel curtainwall truss support structures protrude four feet away from the terminal façade into the sidewalk. As the truss descends down the curtainwall, it angles back towards the façade at approximately five above the ground. This leaves a protrusion just above eye height, and creates a hazard for persons who could bump into the truss support with their head. A landscaped planter bed should be installed at the base of each truss support to prevent this hazard.

Rental luggage carts may be considered by the Commission to create another source of revenue for the Airport, while providing a needed service to passengers at the sidewalk plaza. The rental luggage carts could be located in banks near the parking lot, at the terminal curb, and in the baggage claim area.

Ticketing Area

In order to provide ADA access, ticket counters should have lower counter height available for transactions. Airlines have the option, however, to facilitate transactions by providing passengers with a clipboard incorporated in the ticket counter, in lieu of an ADA writing surface.

Ticket agents noted that there is a significant issue with glare from the sun in the afternoons from the south facing glass front façade of the terminal building. It is especially pronounced in the winter months when the south winter sun is low as it shines through the front of the terminal façade in the face of agents and renders the reading of e-ticketing CRT screens difficult. Shade devices may need to be considered to reduce the glare from penetrating directly into the ticket counter line. The solution could be a screening effect to reduce the glare or a more expensive automatic system that can be raised and lowered depending on the sun conditions.

Airline ticket offices currently are not necessarily aligned directly behind each airline's ticket counter area. Agents routinely must traverse behind other airlines' counters to get to their offices. This misalignment could be corrected with the expanded bag room and in-line baggage system discussed earlier.

Charter Operations

Based on discussions with Airport staff, the existing facilities in the terminal can have difficulty accommodating charter activity, particularly flights associated with college sports teams. For this reason, about half of all charter flights are currently handled at the cargo apron. In addition to reducing the impact on the terminal, accommodating charter flights at the cargo apron has enabled the flights to depart without HBS, as the cargo area is currently not considered to be part of the SIDA. This last benefit will be eliminated in November 2006, as the TSA will require most of the cargo area to be included in the SIDA.

While it is anticipated that the implementation of an in-line baggage screening system and a second security checkpoint lane will provide greater overall processing capacity for both scheduled and charter flights and, therefore, reduce the need for a secondary site for charter processing, some charter operations will nevertheless place a high level of peak demand on facilities. The staging and management of charter operations will be explored further in the concepts chapter.

5.6 ACCESS AND PARKING REQUIREMENTS

This section documents the forecast of landside activity and requirements at ROA. Forecasts and requirements are presented in five-year increments, starting with 2005 as the base year, through 2025 as the horizon year.

5.6.1 Forecast of Vehicular Traffic

Landside vehicular traffic forecasts were developed from the count data using the peak month passenger growth forecasts, assuming that traffic growth is proportional to passenger growth.

A base volume was established by adjusting the count data to reflect 2005 peak month activity. This was achieved by factoring up the counts based on the average day passenger enplanements in the survey week and the average day passenger enplanements in the peak month of 2005. A summary of these factors and the forecast growth is shown in **Table 5.8 and Figure 5-5**.

Table 5.8

Landside Traffic Growth Factors from Projected Passenger Growth

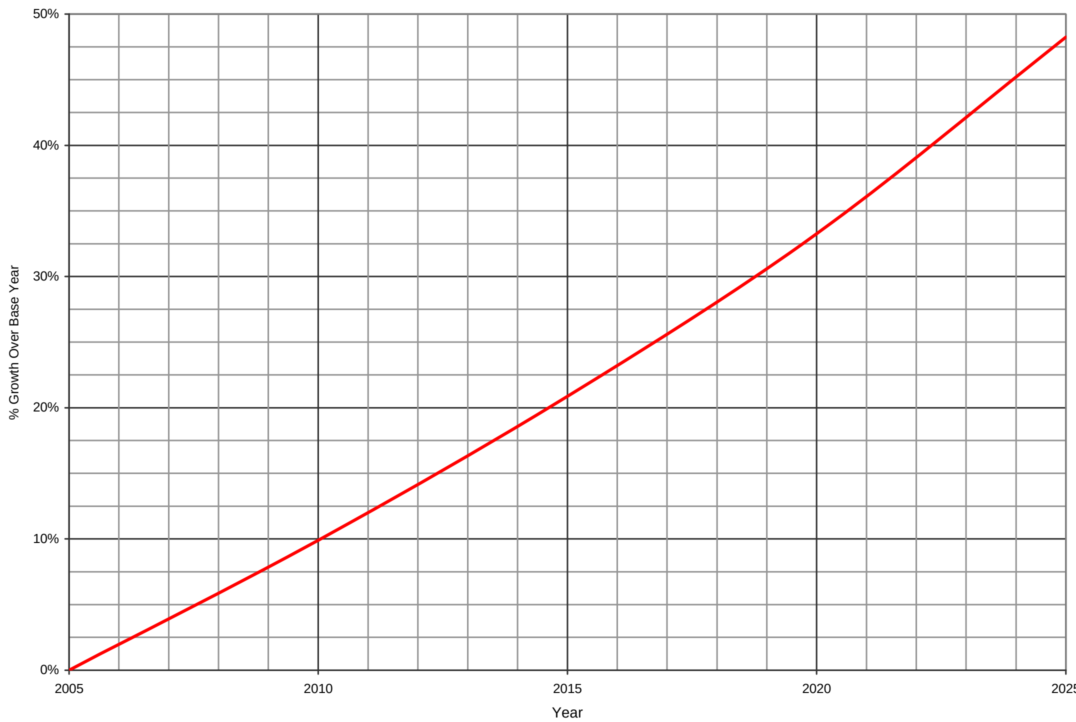
	2005	2010	2015	2020	2025
Average Day Peak Month Enplanements	981	1,078	1,186	1,308	1,455
Factor over Base Year (2005)	(1.20)*	1.10	1.21	1.33	1.48

*Factor to correct survey week data to base year peak month.

Source: HNTB analysis.

Figure 5-5

Landside Traffic Growth Factors from Projected Passenger Growth



Source: HNTB analysis.

The factors were applied to the average day peak hour tube counts collected during the survey week. **Figure 5-6** shows the location of the counts and additional locations where volumes have been derived from the count data.

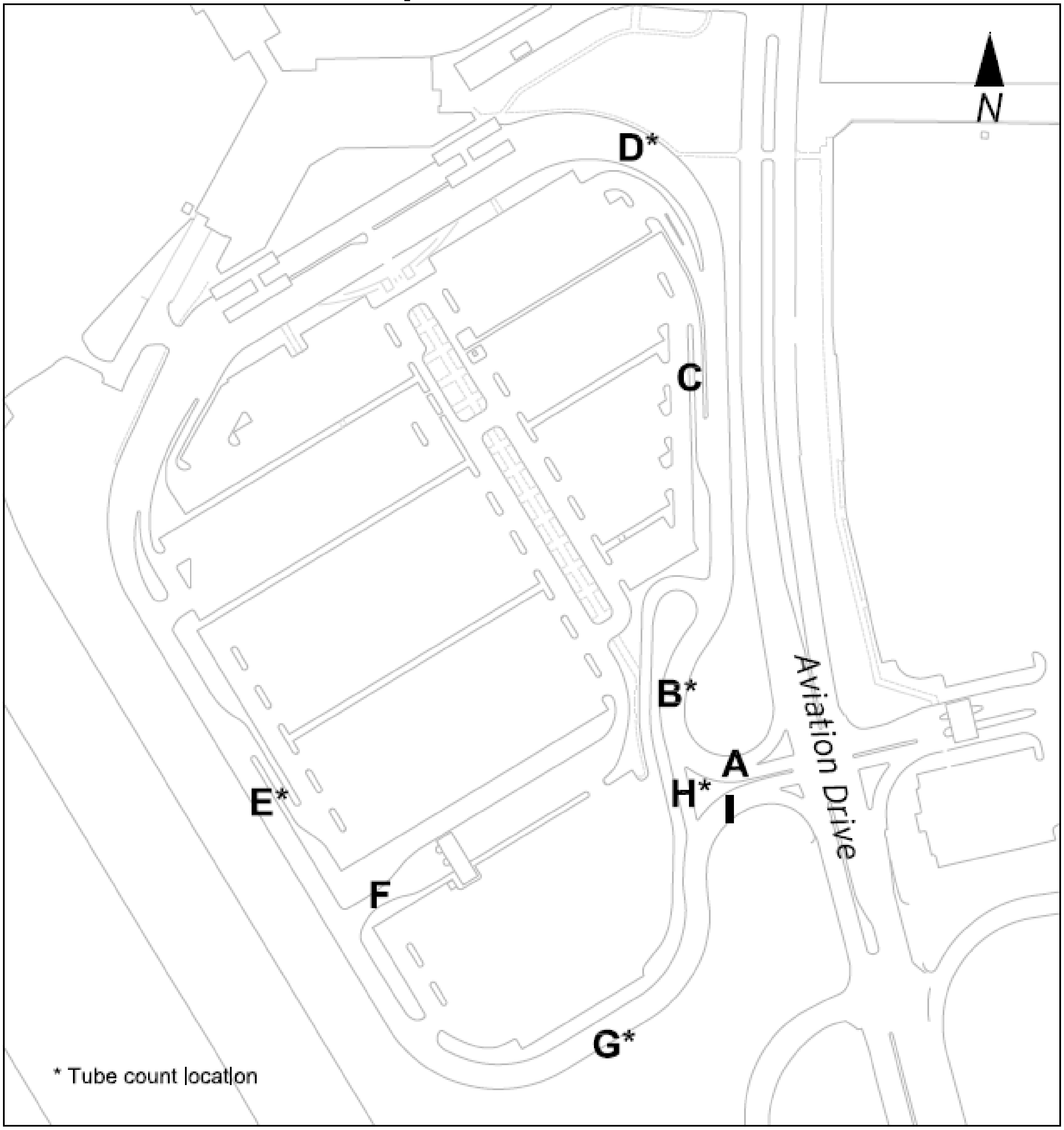
Table 5.9 and 5.10 summarize the forecast volumes. Two sets of forecast volumes were derived. The first covers the inbound and curb roadway peak between 3:45 pm to 4:45 pm, and the second covers the outbound exit peak between 4:30 pm to 5:30 pm.

ROA has a single entry point for passenger access and egress to the terminal on the landside. Entry to the Airport is via an unsignalized two-way stop controlled intersection on Aviation Drive. The intersection also provides access to the overflow parking lot across Aviation Drive from the Airport terminal. This lot is used infrequently and hence the intersection more commonly operates as a one-way stop controlled T-intersection. The general configuration is shown in **Figure 5-7**.

To establish base year volumes on Aviation Drive, the recorded growth on neighboring roads (excluding interstate facilities) was collected. As can be seen in **Figure 5-8**, there has been very little variation in traffic volumes between 2001 and 2005. Therefore, recent counts on Aviation Drive were used, even though those counts did not coincide with counts made at the Airport.

Figure 5-6

On-Airport Vehicular Volume Locations



Source: HNTB analysis.

Table 5.9

Forecast Volumes — Inbound Peak Hour (3:45 PM to 4:45 PM) — ADPM

Location		Survey Week	2005	2010	2015	2020	2025
A	Airport Entrance	160	192	211	232	256	284
B*	Before Parking	180	216	237	261	288	320
C	Long Term Parking Entrance	40	48	53	58	64	71
D*	Approach to Curbs	140	168	184	203	224	249
E*	After Second Parking Entrances and Rental Car Lot	110	132	145	159	176	195
F	Parking Exit	30	36	40	43	48	53
G*	Before Airport Exit and Recirculation	140	168	184	203	224	249
H*	Recirculation	20	24	26	29	32	36
I	Airport Exit	120	144	158	174	192	213

Source: HNTB analysis.

Table 5.10

Forecast Volumes — Outbound Peak Hour (4:30 PM to 5:30 PM) — ADPM

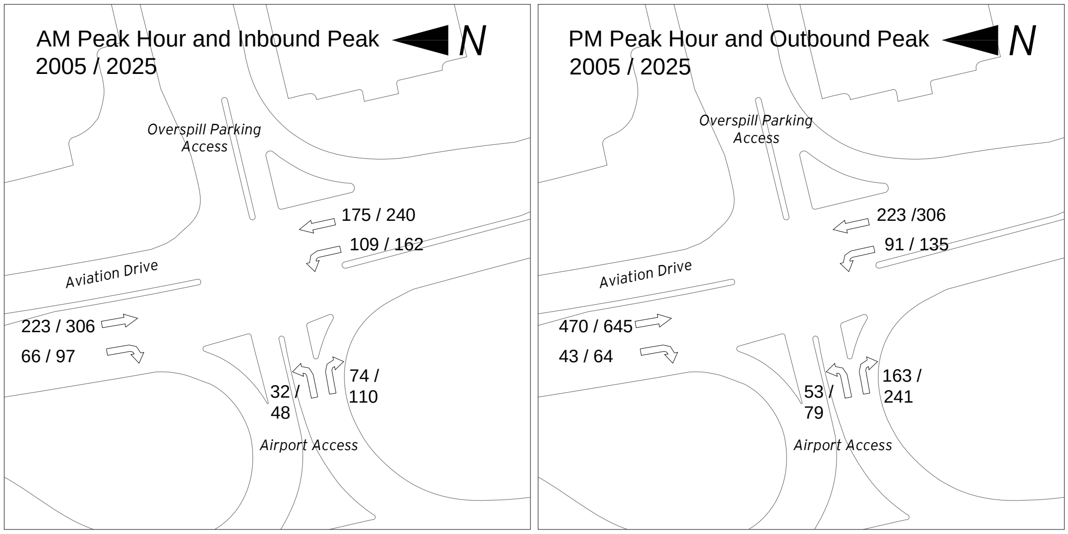
Location		Survey Week	2005	2010	2015	2020	2025
A	Airport Entrance	120	144	158	174	192	213
B*	Before Parking	150	180	198	217	240	267
C	Long Term Parking Entrance	30	36	40	43	48	53
D*	Approach to Curbs	120	144	158	174	192	213
E*	After Second Parking Entrances and Rental Car Lot	130	156	171	188	208	231
F	Parking Exit	80	96	105	116	128	142
G*	Before Airport Exit and Recirculation	210	252	277	304	335	373
H*	Recirculation	30	36	40	43	48	53
I	Airport Exit	180	216	237	261	288	320

* Denotes actual automated traffic recorder count. Other values are derived from actual counts.

Source: HNTB analysis.

Figure 5-7

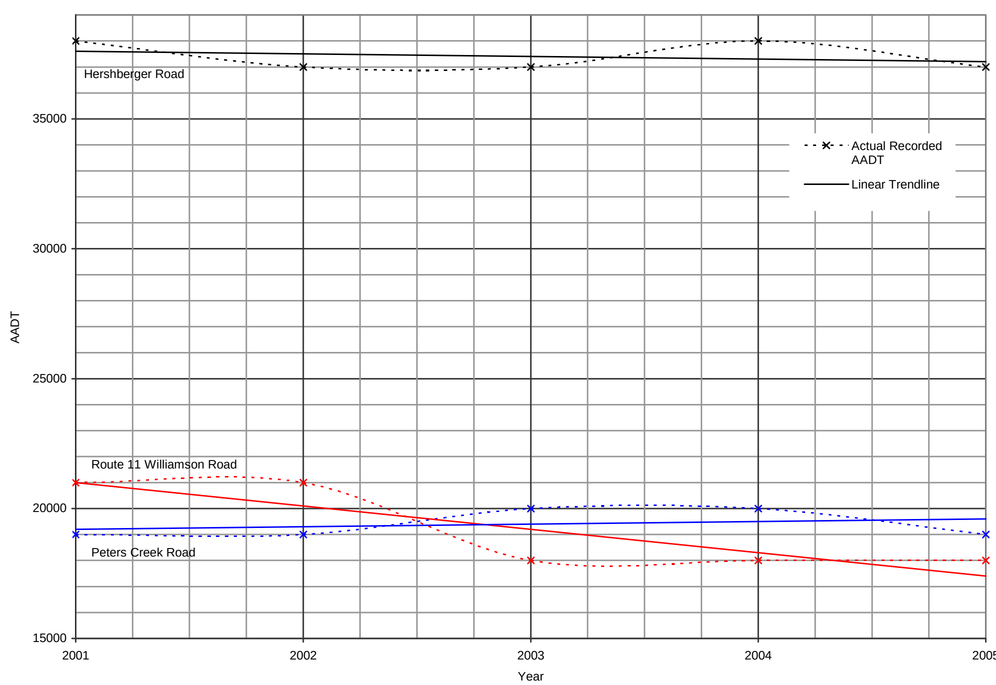
Base Year and Future Year Intersection Volumes



Source: HNTB analysis.

Figure 5-8

General Traffic Growth on Select Roads in the Vicinity of Aviation Drive



Source: VDOT Daily Traffic Volume Estimates for City of Roanoke and Roanoke County.

Future year volumes were established for Airport traffic as described previously. Background traffic on Aviation Drive was projected to grow at 1.6 percent a year based on the reported volume growth on I-81 in the vicinity of Roanoke between 1997 and 2003. It is reasonable to expect that the growth on the interstate is greater than on county and city roads. Hence, this approach yields a higher forecast volume leading to more conservative results.

The forecast was made for the Airport roadway's morning inbound peak hour, 9 AM to 10 AM, and afternoon outbound peak hour, 4:45 PM to 5:45 PM.

The intersection of the Airport access roadway and Aviation Drive was analyzed to test its operation at the base year and future 2025 year conditions. The turning volumes were developed using a combination of the on-airport volumes (locations A and I in Figure 5-6) and preexisting data for the traffic on Aviation Drive.

The intersection was analyzed using the methodology provided in the *Highway Capacity Manual* using Highway Capacity Software Release 5.2. Intersection performance is assessed based upon average delay per vehicle in seconds and then assigned a level of service (LOS) value. For an airport entrance, an LOS C or better is recommended in the design year. The analysis is summarized in **Table 5.11**.

Table 5.11

Unsignalized Intersection Capacity Analysis--Airport Entrance

	Base Year 2005 Approach						Future Year 2025 Approach					
			Eastbound						Eastbound			
	Northbound Left		AM		PM		Northbound Left		AM		PM	
	AM	PM	Left	Right	Left	Right	AM	PM	Left	Right	Left	Right
Movement Delay (second per vehicle)	8.7	8.1	11.9	10.9	12.2	9.2	8.3	9.0	12.1	9.4	12.9	11.8
Movement LOS	A	A	B	B	B	A	A	A	B	A	B	B
Approach Delay (seconds per vehicle)			--- 11.1 ---		--- 10.1 ---				--- 10.2 ---		--- 12.0 ---	
Approach LOS			--- B ---		--- B ---				--- B ---		--- B ---	

Source: HNTB analysis.

The analysis demonstrates that there is available capacity at the entrance intersection. From the Airport's standpoint, no alterations or improvements to this facility are required within the planning horizon.

The City of Roanoke is pursuing a possible alteration to Aviation Drive and Towne Square Boulevard that would impact Airport access. The proposed layout, as of August 2006, is shown in **Figure 5-9**. The proposal is designed to allow an outbound movement from the shopping area on Towne Square Boulevard, relieving pressure on other access points.[5]

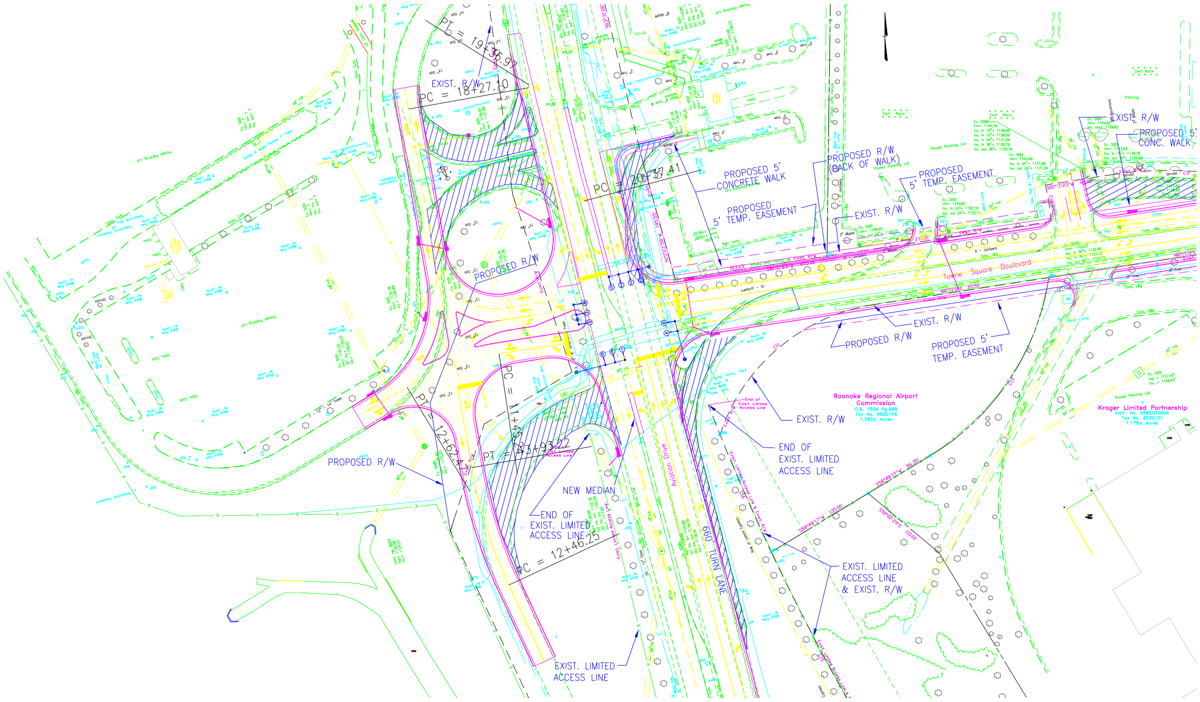
The proposed layout will create a new signalized intersection on Aviation Boulevard. The intersection will consist of four approaches: Aviation Drive (north), Towne Square Boulevard, Aviation Drive (south), and a fourth approach leading from the Airport terminal area and Thirlane Road. This would replace the existing intersections at Thirlane Road and the Airport; access to the Airport's overflow lot would remain as it is today.

An analysis conducted by the City indicates that the intersection will operate at an acceptable LOS, but the impacts on the Airport and Airport-bound traffic could be significant. The following list summarizes expected impacts and other points to be considered:

- Airport-bound traffic heading north on Aviation Drive will be in conflict with the left turning traffic exiting from Towne Center Boulevard. This exiting volume is significant relative to the intersection as a whole and, therefore, is likely to have a disproportional effect on Airport-bound traffic.
- Traffic exiting northbound on Aviation Drive from either the Airport or Thirlane Road will similarly be in conflict with traffic exiting from Towne Square Boulevard.
- The short distance between the proposed signal and the proposed Airport and Thirlane Road intersection is of concern, particularly with a significant proportion of Thirlane Road traffic being trucks. In such circumstances, it would not take many vehicles from Thirlane Road combined with a small surge from the Airport to block access to Thirlane Road and, hence, impact access to the Airport.
- Access to the overflow lot will be made considerably more difficult. Vehicles failing to find parking in the Airport's main lot will have to exit through the signalized intersection, with the same issues as northbound exit traffic discussed above, and make two turns before being able to access the overflow lot.
- The proposed intersection, because it combines access to the Airport and to Thirlane Road, removes the gateway aspect of a dedicated Airport access. In this respect, the proposal can be considered to diminish the visibility of the Airport.

5 An analysis of the likely impacts of the City's proposed intersection project is documented in **Appendix F**.

Figure 5-9
Planned Airport Access Intersection Reconfiguration



Alternative intersection configurations and analysis will be conducted in the concept development phase.

As traffic levels increase in the vicinity of the Airport, the merge between northbound I-581 across Hershberger Road, and onto the flyover ramp to Aviation Drive may become more difficult to negotiate. Although there are several (signed) access points to the Airport from the south, drivers north of the Airport only have one signed route. The concepts phase of the Master Plan Update will explore options for providing a second route to the Airport from the north.

5.6.2 Terminal Loop Roadway

Current and forecast roadway volumes are very low, and therefore the capacity of the existing Airport roadways will not be compromised as demand increases. **Table 5.12** summarizes existing and forecast flow rates and the associated LOS. LOS A is less than 290 vehicles per hour per lane and LOS C is less than 660 vehicles per hour per lane. LOS C is a desirable minimum for the Airport environment.

As shown, the volumes at ROA are well within acceptable limits, as much of the Airport roadway is two lanes and, therefore, could carry almost twice the flow rate (for a particular LOS) shown above. The existing terminal roadway has suitable capacity to meet demand in 2025, the forecast horizon year.

In the future, the terminal loop roadway would need to accommodate a vehicle inspection station for Code Orange and Code Red security alert periods. This inspection station would need to be upstream of both the terminal curb and

Table 5.12

Estimated LOS Flow Rates Compared to Forecast Volumes

Base Year 2005 2-Lane Volume (Vehicles/Hr)		2025 2-Lane Volume (Vehicles/Hr)	
Entry (1)	**Exit (2)**	**Entry**	**Exit**
216 (LOS A)	252 (LOS A)	320 (LOS A)	373 (LOS A)

Notes:
(1) Entry volume taken at location B on Figure 5-6.
(2) Exit volume taken at location G on Figure 5-6.

Source: HNTB analysis.

entrance to the short-term parking lot. Alternative configurations will be examined in the concepts development phase.

5.6.3 Terminal Curb

A capacity analysis of the proposed curb roadway system was conducted to evaluate existing and future LOS.

The curb roadway capacity is determined by balancing its through capacity (the ability to process vehicles moving through the curb) with its service capacity (the ability to accommodate loading and unloading vehicles). Generally, the greater the number of lanes, the greater the through capacity will be. The service capacity is more complex and will be affected by the volume, behavior, and type of vehicles on the curb, as well as the physical extents of the curb. Service capacity will increase as the number of lanes available for loading/unloading increases and as the length of curb increases, but will diminish as the number of vehicles accessing the curb increases, the length of the vehicles increases (e.g., buses require more curb than private autos), and as dwell time at the curb increases.

The analysis used to evaluate the curb roadway capacity generates a volume/ capacity (V/C) ratio. The V/C ratio gives an indication of how well the curb can handle traffic demand. The following thresholds give a general indication as to the operation and performance of the curb roadways:

Level of Congestion	V/C ratio
None	< 0.5
Low	0.5 < V/C < 0.7
Moderate	0.7 < V/C < 1
High	> 1

A V/C ratio of 0.7 or less demonstrates that a curb is operating adequately.

It should be noted that the presence of crosswalks will impact capacity by both reducing the effective length of the curb and by impeding the through movement of vehicles.

The analysis of the Airport's curb roadways was undertaken for the base year 2005 and 2025. As with the Airport roads, vehicular volumes are low, and the capacity of the curbs is more than adequate to accommodate projected growth.

For the analysis the vehicle classification was based upon observations of the existing curb operations. This was then applied to the base year peak inbound volume immediately prior to the curbs and grown to future year 2025 in the same manner as in the previous analysis. Dwell time by vehicle type was similarly based on observation, and effective vehicle lengths were taken from accepted standards.

With one exception, the curb was assumed to operate with 100 percent of loading/unloading vehicle on the inner curb and 100 percent of through vehicles (including rental car returns) to be on the outer curb. Limos have a designated waiting area on the outer curb and therefore were not included on the inner curb. Although this operation is not an exact replica of the existing operation, the majority of loading/unloading activity is conducted on the inner curb with the outer curb being used as a bypass. The curb has been considered as a single entity with drop-off and pick-up functions occurring along its whole length. Again, this is a reasonable approximation of observed practice.

Table 5.13 summarizes volumes and dwell times used in the analysis. The inner curb measures approximately 435 feet but its effective length was reduced to 400 feet to represent the loss of capacity due to crosswalks. Further, in light of the above assumptions only the inner curb has been included in the analysis. The ability of the outer curb to act as a bypass and process a small number of vehicles is not in question.

Table 5.14 below summarizes the outputs of the curb analysis.

It should be noted that several vehicles were observed dwelling on the curb for extended periods (in excess of 15 minutes). These vehicles have been excluded from the analysis; however, if the number of vehicles permitted to do this increases substantially, curb capacity will be reduced significantly. This issue is a matter of operation rather than physical capacity. Should issues pertaining to long-dwelling vehicles arise in the future, the Airport should promote the active policing of the curbs, particularly during peak periods.

As the V/C ratios reported in Table 5.13 are well below 0.7, the existing terminal curb roadway has suitable capacity to meet forecast demand in 2025.

Table 5.13

Vehicle Classification, Volumes, Effective Vehicle Lengths, and Dwell Times Used in Curb Roadway Analysis

Vehicle Type	% of Flow*	Effective Vehicle Lengths (feet)	Dwell Time (minute)	Volume	
				2005	2025
Shuttles	15	35	2.5	25	25
Parking Shuttles	8	35	2.0	13	13
Taxi	2	25	3.5	3	5
POV	70	25	1.0	117	174
Total	95			159	218

* Excludes Limos.

Source: HNTB.

Table 5.14

Inner Curb Capacity Analysis Summary

Year	Forecast Volume	Balance Capacity (veh/hr)	V/C Ratio
2005	159	1053	0.15
2025	218	1129	0.19

Source: HNTB analysis.

5.6.4 Parking

Public Parking

Currently, long-term parking activity occurs in both the short-term and long-term lots. In the future, this activity could continue or long-term parking activity could be transitioned strictly to long-term spaces through pricing policies. Therefore, alternative forecasts were made assuming two different future scenarios:

- Alternative 1: Long-term parking strictly occurs in only long-term spaces.
- Alternative 2: Current parking behavior continues in the future, with long-term parking occurring in both short-term and long-term parking spaces.

In Alternative 1, forecasts would assume overnight occupancies only occur in the long-term lot. Alternative 1, therefore, forecasts the demand for the long-term parking product. In Alternative 2, forecasts would assume overnight occupancy occurs in both the long-term and short-term lots, as it does currently. For both of these alternatives, parking demand was anticipated to grow in proportion to forecast growth in enplanements. Forecasts used monthly ticket report data between July 2004 and July 2005 for all public parking lots and detailed parking transaction data for two days in April 2005 in order to determine peak daytime occupancies during the average day peak month (ADPM). This data was reported by the parking operator.

Long-Term Public Parking

Table 4.14 indicates that March was the peak month for enplanements in 2005. Estimated peak daytime occupancy for an average day in that month is expected to grow in proportion to forecast growth in enplanements. The following equation can be used to determine peak daytime occupancy:[6]

Peak daytime occupancy = average overnight occupancy + (average overnight occupancy / average duration of stay)

The two alternative growth scenarios assumed different average overnight occupancies. For Alternative 1, where long-term parking only occurs in the long-term lot, the overnight occupancy for the ADPM for all lots was used. This was 856 spaces. For Alternative 2, where long-term parking occurs in long-term and short-term parking, the overnight occupancy for only the long-term lot was used. Using the provided parking data, this was estimated to be 768 spaces. The average durations of stay for vehicles in both short-term and long-term lots was estimated to be 4.5 days. This estimated duration was used for both alternatives. The estimated existing peak daytime occupancy for long-term parking activity during the ADPM for Alternative 1 is 1,046 spaces and for Alternative 2 is 939 spaces.[7] These occupancies are anticipated to grow in proportion to forecast growth in enplanements.

6 The second term in the equation reflects turnover in the lot. If, for example, the average duration of stay is three days, then one would expect on average one-third of the vehicles in the lot overnight would depart the next day.

7 The long-term parking forecast was verified through an analysis of the air passenger survey responses.

Existing capacity for long-term parking including spaces in the overflow lot is 1,594 spaces, according to Airport staff. **Table 5.15** shows required long-term parking spaces for each of the forecast years assuming that peak daytime occupancy should not exceed 85 percent of capacity. Setting a threshold at this value will make it easier for customers to find parking spaces.[8] Facility requirements are shown for both alternative growth scenarios: Alternative 1 – where long-term parking activity occurs only in the long-term lot, and Alternative 2 – where some Airport visitors would use short-term spaces for long-term parking.

Under Alternative 1, occupancy in the existing long-term parking spaces would exceed 85 percent of capacity for the ADPM by 2020. An additional 250 spaces would need to be provided around the year 2020 in order to maintain occupancies of 85 percent or less into the 2025 forecast year. Under Alternative 2, occupancy in the existing long-term parking spaces would exceed 85 percent of capacity for the ADPM by 2025. The Airport would need to build approximately 50 spaces prior to 2025 in order to maintain occupancies less than 85 percent for long-term parking.

While the plans by the City of Roanoke to redesign the Airport entrance do not appear to reduce the number of existing parking spaces, they may limit options to expand parking to meet future demand. Alternatives for meeting anticipated shortfall in long-term parking will be examined in the concepts development phase.

Short-Term Public Parking

Forecast short-term parking demand under the two growth scenarios uses a similar approach to the long-term forecast. As with long-term parking, peak daytime occupancy for short-term parking during the ADPM is anticipated to grow in proportion to forecast growth in enplanements. The forecast relies on a daily profile of parking activity obtained from detailed parking transaction data for two days in April 2005. This profile was adjusted to reflect ADPM conditions. **Figure 5-10** shows hourly volumes into and out of the short-term lot over the course of the day.

For Alternative 1, no overnight occupancy was added to the daily profile since in this alternative, overnight parking would only occur in the long-term lot. For Alternative 2, however, an estimated overnight capacity of 88 spaces, reflecting ADPM conditions, was added. The peak daytime occupancy in the short-term lot for the ADPM under Alternative 1 was estimated at 88 spaces. Under Alternative 2, estimated peak daytime occupancy for the ADPM was 176 spaces. These occupancies are expected to grow in proportion to growth in enplanements for each of the forecast years.

8 Monthly ticket reports from July 2004 through June 2005 indicate that parking activity for the ADPM would be exceeded on 86 days or approximately 24 percent of the year.

Table 5.15

Required Long-Term Parking Spaces to Maintain 85 Percent Peak Occupancy on ADPM

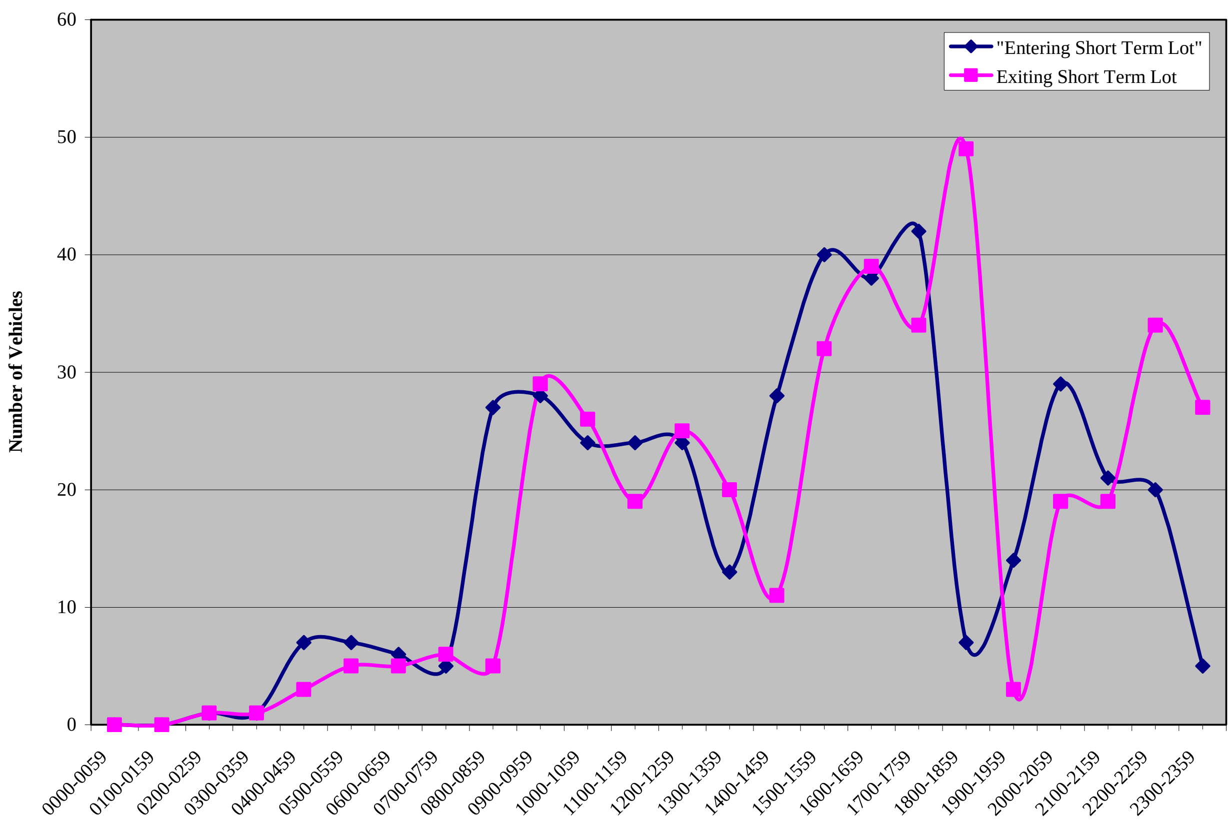
	Forecast Peak Daytime Occupancy		Required Capacity		Additional Spaces Required (1,594 existing)	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2	Alternative 1	Alternative 2
2005	1,046	939	1,231	1,105	0	0
2010	1,150	1,032	1,353	1,214	0	0
2015	1,264	1,135	1,487	1,335	0	0
2020	1,394	1,251	1,640	1,472	46	0
2025	1,551	1,392	1,825	1,638	231	44

Alternative 1 assumes long-term parking activity occurs only in long-term spaces.
Alternative 2 assumes long-term parking activity occurs in both long-term and short-term spaces.

Source: HNTB analysis.

Figure 5-10

ADPM Short Term Parking Diurnal



Sources: Transaction Summary Reports for 4/14/06 – 4/15/06 and HNTB analysis.

Existing capacity for short-term parking is 220 spaces, according to RRAC staff. **Table 5.16** shows required short-term parking spaces for each of the forecast years assuming that peak daytime occupancy on the ADPM should not exceed 85 percent of capacity. Facility requirements are shown for both alternative growth scenarios.

Table 5.16

Required Short-Term Parking Spaces to Maintain 85 Percent Peak Occupancy on ADPM

	Forecast Peak Daytime Occupancy		Required Capacity		Additional Spaces Required (223 existing)	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2	Alternative 1	Alternative 2
2005	88	176	104	207	0	0
2010	95	192	112	226	0	6
2015	107	213	126	251	0	31
2020	114	231	134	272	0	52
2025	131	261	154	307	0	87

Alternative 1 assumes long-term parking activity occurs only in long-term spaces.
Alternative 2 assumes long-term parking activity occurs in both long-term and short-term spaces.
Source: HNTB analysis.

Under Alternative 1, the capacity of the existing short-term parking lot is sufficient to meet demand through the 2025 horizon year; no additional spaces would be needed. Under Alternative 2, forecast peak daytime occupancy in the short-term lot would slightly exceed 85 percent of existing short-term parking capacity by 2010. By 2015, short-term demand would significantly exceed 85 percent of existing capacity. The Airport would need to provide approximately 90 additional spaces by 2015 to maintain daytime peak occupancies of 85 percent or less in the 2025 forecast year.

During Code Orange security alert periods, the first row of short-term parking (which is located within 300 feet of the terminal) either must be closed or all vehicles parked there must be inspected. Closing this row would result in a loss of approximately 46 spaces. In the concepts development phase, alternatives to address the impacts of Code Orange alerts will be examined.

As part of the Master Plan Update process, a study of parking lot lighting was also undertaken. **Appendix G** provides a summary of findings and cost-effective options for improving lighting of the public lots in the terminal area.

Employee Terminal Parking

The existing employee parking lot has 284 spaces (estimated by a review of March 2006 aerial photography of the Airport) and is used by employees in the terminal and based air crew. The number of terminal employees is anticipated to increase proportionally to peak hour passenger airline operations, and the number of based air crew is anticipated to grow proportionally to annual operations. However, based on the forecasts presented in Chapter 4, peak hour levels are assumed to increase the same as ADPM scheduled passenger carrier operations. Therefore, the future demand for employee parking spaces is estimated to be independent of the type of employee.

The forecast estimates current demand from observed lot occupancies. During observations, approximately 140 spaces were occupied and Airport staff report observing a maximum occupancy of 190 spaces. Therefore, 190 spaces are considered the base year demand. Total terminal employee parking requirements are forecast to increase to 217 spaces by 2025; therefore, the employee lot is suitably-sized to meet forecast demand through the horizon year. **Table 5.17** shows forecast employee parking requirements in five-year increments through 2025.

Table 5.17

Forecast Employee Parking Requirements

	Employee parking spaces
2005	190
2010	184
2015	191
2020	202
2025	217

Source: HNTB analysis.

Rental Cars

There are currently 160 on-airport ready/return spaces. Similar to parking demand, it is anticipated that rental car operations will grow in proportion to forecast growth in scheduled enplanements at ROA. Surveys from and interviews with the current rental car operators indicate that there are no serious deficiencies with the Airport's on-airport ready/return lot. Therefore, given that the current number of spaces is sufficient, demand for future rental car operations can be estimated using the current number of on-airport ready/return stalls as a basis. **Table 5.18** shows forecast growth in ready/return stalls in five-year increments.

Table 5.18

Rental Car Ready/Return Spaces

	Ready/return spaces
2005	160
2010	176
2015	193
2020	213
2025	237

Source: HNTB analysis.

The current rental car operators anticipate that approximately 220-240 ready/return spaces would accommodate future needs, based on written survey responses. The lower bound of this estimate is consistent with forecast passenger growth reported in Chapter 4. In order to meet 2025 forecast growth and rental car operator requirements, an additional 70-90 ready/ return stalls would need to be provided.

5.6.5 SIDA Intersection

Waypoint Drive, NW, a public access road, provides access from Aviation Drive to the FBO and other GA facilities. Fuel trucks traveling between the terminal apron (a SIDA) and the fuel farm (also a SIDA) must turn left onto Waypoint Drive and then make an immediate right to the service road which provides access to the fuel farm.

Additionally, the location of the guard house near the gate providing access to the terminal apron is not situated in an efficient location. A study in 2000 recommended removing stop signs on the Waypoint Drive approaches to this intersection to improve traffic operations. Potential modifications to this intersection will be examined in the in the concepts phase.

5.7 AIR CARGO

This section describes the methodology and assumptions used to estimate the cargo facility requirements for the Airport, including cargo building space and apron area. **Table 5.19** summarizes cargo requirements.

5.7.1 Cargo Building

The measurement used to define building requirements for freight facilities is the building utilization rate. Building utilization rates are expressed as square feet per annual ton of cargo. Based on 2005 freight tonnage at ROA, the existing facilities have a building utilization rate of 1.8 square feet per ton, equal to the national average based on a survey of U.S. airports and suggesting ROA's cargo facilities are balanced with existing activity levels. Future building requirements were determined by multiplying the forecast cargo tonnage found in Table 4.21 of the Master Plan Update by the 1.8 square feet per ton building utilization rate. Warehouse requirements are forecast to increase from 28,600 square feet in 2005 to 33,000 square feet by 2025, an overall increase of 15 percent.

5.7.2 Cargo Apron

Cargo apron requirements were determined by estimating the number of required aircraft parking positions by aircraft grouping. Based on a review of cargo activity during December 2005, the peak number of aircraft on the cargo ramp was four. The cargo apron is 32,000 square yards in size. Although the number of annual cargo operations is not forecast to increase (and, therefore, the number of cargo parking positions), the size of the ramp will need to be increased because the air cargo fleet mix is forecast to consist of a larger share of B-757s and widebody aircraft. Additionally, based on discussions with the cargo airlines, a wider apron would improve operational efficiency. The possibility of widening the apron will be explored in the concepts phase of the Master Plan Update. Lastly, Airborne has a maintenance trailer near where Piedmont Airlines does its engine run-up testing. A new site for engine run-ups will be identified in the concepts chapter.

5.7.3 Total Cargo Site Requirements

The total site area required for cargo activity (including cargo building, aircraft apron, truck docks, auto parking, and spacing for setbacks) is forecast to increase from 13 acres to nearly 15 acres.

Table 5.19

Cargo Requirements

	Existing		Required			
	2005	2005	2010	2015	2020	2025
Building (SF)	28,600 (1)	28,400	29,600	30,700	31,800	33,000
Ramp						
Aircraft Positions						
ADG-III	2	2	1	-	-	-
B757	1	1	2	2	2	2
Widebody	1	1	1	2	2	2
Total	4	4	4	4	4	4
Square Yards	32,000	31,000	32,000	34,000	34,000	34,000
Site (Acres)	13.0 (2)	13.5	14.0	14.8	14.9	14.9

Notes: (1) Includes Building No. 5. and associated facilities.
(2) Includes buildings, aprons, truck docks, auto parking and access, setbacks, and landscaping.

Source: HNTB analysis.

5.8 GA FACILITIES

GA facility requirements were identified based on the projections of GA demand presented in Chapter 4. Specific facility needs were identified for the GA terminal/FBO, apron parking (including transient and based tie-down), T-hangars, and conventional hangars. The concepts and financial phases of the Master Plan Update will address whether continued incremental expansion to existing GA facilities would best meet long-term requirements, or whether replacement and redevelopment of some facilities would be more appropriate, recognizing that several GA facilities are nearing the end of their useful life. **Table 5.20** summarizes GA facility requirements.

5.8.1 GA Terminal/FBO

The current GA terminal is 3,750 square feet in size. Based on discussions with the FBO manager, the existing facility was somewhat cramped in previous years when GA activity levels were higher. Currently, it is adequate for existing activity levels and provides a good level of customer service. Currently, there are 111 square feet of terminal building per 1,000 itinerant GA and air taxi operations. Future GA terminal requirements were determined by taking this ratio and multiplying it by the forecast itinerant GA and air taxi operations growth.[9] Future building requirements are forecast to increase to 5,940 square feet by 2025, which is nearly a 60 percent increase.

9 Air taxi is defined in Chapter 4 of this Master Plan Update.

Table 5.20

Summary of General Aviation Facility Requirements

	Existing		Required				
	2005		2005	2010	2015	2020	2025
Terminal/FBO							
Building (SF)	3,750		3,750	4,240	4,820	5,320	5,940
Auto Parking (Spaces)	136		136	154	175	193	215
Auto Parking/Circulation (SY)	6,271		6,271	7,100	8,100	8,900	9,900
Aircraft Storage/Transient Parking							
Transient Parking (Spaces)							
ADG-I	14		9	10	11	12	13
ADG-II	14		10	12	14	15	17
ADG-III	2		1	1	1	1	2
Total	30		20	23	26	28	32
Transient Aircraft Pkg (SY)	37,547		27,200	31,000	34,800	37,100	45,900
Based Aircraft Tie Down (Spaces)							
ADG-I	48		32	33	33	33	33
ADG-II	-		-	-	-	-	-
ADG-III	-		-	-	-	-	-
Total	48		32	33	33	33	33
Based Aircraft Tie Down (SY)	19,890		12,800	13,000	13,000	13,100	13,100
T-hangar							
Units	40		45	47	47	48	48
Building (SF)	47,000		54,000	56,400	56,400	57,600	57,600
Adjacent Ramp/Circ. (SY)	12,650		14,500	15,200	15,200	15,500	15,500
Conventional Hangar							
Building (SF)	86,092	(1)	106,500	123,800	137,300	151,400	164,900
Adjacent Ramp/Circ. (SY)	13,159		16,000	18,600	20,600	22,700	24,700
Aircraft Maintenance (SF)							
Building (SF)	19,300	(2)	24,200	27,300	31,100	34,300	38,300
Adjacent Ramp/Circ. (SY)	2,160		2,700	3,000	3,400	3,800	4,200
Total GA Site Area (Acres) (3)	34.8		31.1	34.5	37.4	39.9	44.3

Notes: (1) Includes 1/2 Bdg. 2, Bdg. 3, Bdg. 17, Bdg. 18, Bdg. 19, Bdg. 20, 1/2 Bdg. 22, and Bdg. 25, and Bdg. 33. Does not include new Bdg. 32 (18,000 SF). Buildings 2 and 3 are scheduled to be removed in 2007.
(2) Includes 1/2 Bdg. 2, 1/2 Bdg. 28, and Bdg. 31. Building 2 is scheduled to be removed in 2007.
(3) Includes building area, aprons, taxilanes, ground access/circulation/parking, and buffer.

Source: HNTB analysis.

The automobile parking lot east of the GA terminal provides approximately 135 spaces and serves both the terminal and adjacent hangars. Based on discussions with the FBO manager, it occasionally reaches 90 percent capacity, suggesting that additional parking spaces will be needed as GA activity grows. Automobile parking space requirements were, therefore, assumed to increase at the same rate as GA itinerant and air taxi operations.

5.8.2 Transient Parking and Aircraft Storage

Transient aircraft parking and aircraft storage includes area apron for parking visiting aircraft, and tie-down apron, T-hangar, and conventional hangar facilities to store based aircraft.

Transient Aircraft Parking

Approximately 37,500 square yards of apron is provided for transient aircraft parking. Based on current striping and markings, this apron area can accommodate about 14 ADG-I aircraft, 14 ADG-II aircraft, and 2 ADG-III aircraft. Based on discussions with the FBO manager, about 20 aircraft parking spaces are needed during a peak period. About 60 percent of the aircraft requiring transient parking are business jets; 20 percent are single engine aircraft; and 20 percent are multi-engine aircraft. For sizing purposes, these aircraft types were grouped into one of three ADGs by wingspan.

The number of transient parking spaces was forecast to increase at the same rate as forecast GA itinerant and air taxi operations. Based on this assumption, the number of itinerant parking positions is forecast to increase to 32 by 2025. The size of the transient apron is forecast to increase at a faster rate, recognizing the growing share of business jet aircraft. By 2025, the size requirement for transient ramp is expected to be 22 percent larger than the existing ramp.

Based Aircraft Storage Requirements

Based aircraft are kept tied down on an apron, kept in T-hangars, or stored in conventional hangars. In general, smaller, less expensive aircraft are parked on the apron while more expensive aircraft are kept in hangars.

In 2006, approximately 33 percent of single engine aircraft were tied down, 40 percent were stored in T-hangars, and 27 percent were stored in conventional hangars. About 13 percent of multi-engine piston aircraft were kept on the apron; more then half (53 percent) were stored in T-hangars, and one-third were kept in conventional hangars. All multi-engine turboprop and business jets were stored in conventional hangars. These distributions are similar to those at other Virginia commercial service airports and were, therefore, used to determine future based aircraft storage requirements.

Hangar requirements are forecast to increase at a faster rate than tie-down requirements since business jets will comprise an increasing share of the fleet.

There are approximately 48 designated tie-down positions located in various parts of the GA area. The existing apron available for based aircraft tie-down is sufficient to meet 2025 requirements.

A net increase of eight T-hangar stalls, sized to accommodate singles and light twins, is also anticipated. Recognizing that Building 24 (a T-hangar with 10 stalls) is scheduled to be removed, a total of 18 additional stalls will be required.

Approximately 86,000 square feet are currently used for aircraft storage. An additional 18,000 square feet will be available in the summer of 2006, for a total of 104,000 square feet. It should be noted, however, that Building 2 and 3 are scheduled to be removed in 2007 as part of the Taxiway G relocation project. Conventional hangar space required for based aircraft storage is forecast to increase to 165,000 square feet by 2025.

5.8.3 GA Aircraft Maintenance

GA maintenance activity occurs in portions of two hangars: Building 2 and Building 22. The combined hangar square footage allocated for maintenance activity (assuming half of both hangars is utilized for maintenance) is approximately 19,000 square feet. Building 2 is scheduled to be removed in 2007 as part of the Taxiway G relocation project. Additionally, the FBO manager indicated that more hangar space is needed for maintenance activity. Total hangar square footage requirements for GA aircraft maintenance was assumed to increase based on the forecast number of itinerant GA and air taxi operations over the planning horizon. By 2025, the amount of hangar space required for maintenance is anticipated to double from what is currently provided (i.e., 38,300 square feet versus the 19,300 square feet provided today).

5.8.4 Total GA Site Requirements

Total GA site requirements include the land occupied by buildings, aircraft aprons, automobile parking, circulation roads, setbacks, and landscaping. The total site area needed for GA facilities by 2025 is estimated to be approximately 44 acres.

5.9 AIRPORT AIRFIELD MAINTENANCE

The Airport's field maintenance facility, located on the north side, occupies a 2.5-acre site. The current maintenance/storage building is 24,000 square feet in size.

Airfield maintenance requirements are directly related to the amount of developed area within the Airport boundary, including areas that are cleared, graded, or paved. Based on discussions with Airport staff, the existing facility has adequate capacity for current activity levels; however, the building may need to be expanded in the future. Although significant increases in the amount of developed area and overall activity levels are not anticipated, for planning purposes, it is recommended to reserve an additional 50 percent of land area (i.e., an additional 1.3 acres) for future airfield maintenance facilities.

5.10 AIRPORT RESCUE AND FIRE FIGHTING REQUIREMENTS

ROA is currently classified as an ARFF Index B facility. Based on the forecast fleet mix presented in Chapter 4, the Airport will remain an Index B facility through the 20-year planning horizon. ARFF Index B requires airports to provide either:

- 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 AFFF for foam production; or

- Two vehicles, with one vehicle carrying the extinguishing agents as specified above and one vehicle carrying an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons.

The ARFF equipment includes two Oshkosh vehicles with 1,500 gallon water and dry chemical capacity. In August 2006, a new E-One vehicle with a 1,500-gallon capacity and a "snozzle" will be delivered to replace the older of the two Oshkosh vehicles, which will then be retired.

FAR Part 139 also sets response time requirements. Within three minutes of an alarm, at least one required ARFF vehicle must reach the midpoint of the farthest runway serving air carrier aircraft from its assigned post, or reach any other specified point of comparable distance of the movement area that is available to air carriers, and begin application of the extinguishing agent. Within four minutes of the alarm, all other required vehicles must reach the points noted above from their assigned posts and begin application of an extinguishing agent.

The existing joint-use station meets current requirements, but lacks many of the modern standards of new fire stations. In addition, the vehicles must cross the air carrier ramp when responding to calls on the airfield. The Airport would benefit from a new replacement ARFF facility more centrally located on the Airport with direct airfield access to taxiways and closer to the two runways to minimize response time to aircraft incidents. A new site for an ARFF station and opportunities for the reuse of the existing station will be identified in the concepts chapter.

The National Fire Protection Association (NFPA) provides recommended guidance on locating hydrants within industrial locations which would include the Airport's air cargo area, maintenance hangars, and airfield. The hydrants serving developed areas should be within 300 feet of each other and located within the building complexes. Discussions with the ROA battalion chief indicate that currently, hydrants are located thousands of feet from each other and do not have adequate water pressure. The greatest deficiency is currently on the west and south sides of the Airport and on the airfield.

The concepts phase of the Master Plan Update will recommend locations for additional hydrants, including locations within the airfield, based on further discussion with the battalion chief, industry guidance, and the current Airport utility layout.

5.11 FUEL FARM

The existing fuel farm is located in the GA area, directly east of the new corporate hangar (Building 29). There are two 20,000-gallon above-ground tanks and one 12,000-gallon below-ground tank storing Jet-A fuel, for a combine total of 52,000 gallons of Jet-A storage capacity. There is also one 12,000-gallon below-ground tank to store Avgas.

Based on an average daily Jet-A fuel flowage of 15,900 gallons for calendar year 2005, the current storage capacity has about 3.3 days of reserve. This level of reserve drops during the peak month (September 2005) to 3.0 days. To ensure adequate storage capacity and sufficient space for future fuel farm expansion, storage capacity for a five-day reserve was assumed. Future Jet-A storage requirements were estimated by growing average daily flowage at the same rate as forecast jet aircraft operations while providing a five-day reserve. Based on these planning factors, Jet-A storage capacity would require a near-term (2010) increase of more than 30,000 gallons (for a total capacity of 85,000 gallons). By 2025, Jet-A storage requirements are anticipated to reach 115,000 gallons.

Average daily 100LL (Avgas) flowage was about 329 gallons in 2005, which translates into a reserve capacity of more than one month. Future 100LL fuel storage requirements were forecast by taking the existing (2005) flowage and increasing it at the forecast rate of piston-engine operations. Since the number of operations of these aircraft is forecast to decrease over the 20-year planning horizon, and there is existing storage capacity for more than one month, no additional 100LL fuel storage is required.

Total site requirements are anticipated to double from 0.1 acres to 0.2 acres toward the end of the planning horizon. **Table 5.21** presents the 20-year fuel farm requirements.

5.12 AIRLINE MAINTENANCE

Discussions with the Piedmont Airlines maintenance base representatives indicated that the existing hangar and building space are adequate for current and future activity; however, the adjoining apron area is too small to park Dash-8 aircraft. The concepts chapter will address providing additional pavement area.

As part of the maintenance process, Piedmont Airlines frequently conducts engine run-ups at night which can disturb sleep for nearby residents. The Master Plan process will identify and evaluate alternative locations for a dedicated engine run-up facility in the concepts phase.

5.13 ATCT AND TRACON

The existing ATCT and TRACON, dedicated in 2005, is adequately sized to accommodate existing and future activity.

5.14 UTILITIES

5.14.1 Electrical

A review of previous studies indicates that there is adequate capacity available for expansion to meet long-term (20-year) requirements.

Table 5.21

Fuel Farm Requirements

	Existing	Required (1)				
	2005	2005	2010	2015	2020	2025
Jet A (Gallons)	52,000	79,700	85,100	95,100	103,900	115,200
AvGas (100LL) (Gallons)	12,000	1,600	1,500	1,400	1,300	1,200
Total (Gallons)	64,000	81,300	86,600	96,500	105,200	116,400
Site (Acres) (2)	0.1	0.1	0.1	0.2	0.2	0.2

Notes: (1) Assumes five-day supply.
(2) Assumed to grow at same rate as fuel requirements. Storage space only; excludes space for fuel truck maneuvering and ARFF access around fuel farm.

Source: HNTB analysis.

5.14.2 Water

As noted in the inventory section (Chapter 2), the Airport is at the end of a single water line provided by WVWA. The Airport experiences low water pressure periods requiring a small booster pump for the terminal located in the fire pump room. The booster pump selected for this application (a one-inch diameter single booster) and the piping system modification do not appear to be adequate (or installed properly) and does not appear to have resolved the low-pressure conditions. It is recommended that a duplex pump set with a compression tank and controls be added to the Airport's water system. The duplex system would provide the Airport with increased reliability.

Additionally, it is recommended that a tank be installed to store a relatively small amount of potable water for emergency periods in order to allow flush water for toilets and urinals. This could be limited to a 1,000-gallon storage tank that could be placed in an enclosed space and fed independently into the system for this purpose.

The low water pressure at the Airport also impacts the design of other facilities. For example, the new aircraft hangar (Building 32) requires a tank to maintain water pressure. Opportunities to solve the low water pressure situation at the Airport will be explored in the concepts phase.

5.14.3 HVAC System

Previous studies indicate that the current HVAC system was designed for approximately 75 percent of its required capacity, thus having an approximately 100 ton of excess capacity.

Due to its age, location, and condition, the existing system may not be suitable for any future expansion; rather, the available excess capacity should serve a as a reserve to the existing system to increase its reliability and further to simplify any future design and construction.

It was also reported in previous studies that the heating system was designed for approximately 75 percent of its required capacity, thus having an approximately 25 percent excess capacity. Due to its age, location within the building and conditions, it is recommended not using this system for any future expansion. The excess capacity should be considered to be a reserve to the existing system to increase its reliability and further to simplify any future design and construction.

Recognizing the age of the existing systems, it is recommended that the additional capacity required to meet future requirements be met by expanding the existing system, versus relying on the current excess capacity.

5.14.4 Sanitary Sewer

The sanitary sewer flow from the terminal building and concourse is by a gravity and manhole system, which in turn flows to pump stations. Based on the existing fixture count, the approximate demand sewage rate was estimated at 95 gallons per minute (approximately 75 percent of the estimated current capacity). It is recommended that a new sewage pumping station be considered for any major addition to the building facilities.

5.14.5 Gas

Natural gas service to the Airport is provided by the Roanoke Gas Company by a 1-¼-inch gas main.

Gas service for the terminal enters the building adjacent to the electrical service near the boiler room. The primary purpose of the gas service is for heating, partial domestic water heating, and cooking for the food service areas. The service pressure ranges from 40 to 45 psi, and the service has ample capacity for expansion.

The location of the gas service valve assembly, directly in front of the boilers air intake louver, appears to be of some concern, should a gas leak occur. It is recommended that the gas valve assembly be moved to a safer location.

5.14.6 Communication

The existing communication infrastructure adequately supports voice and data distribution requirements. The fiber-optic cabling currently in place also has an adequate number of spares which appear to be provided for future use. The 900-pair cable that Verizon provided has ample spares since the report mentioned that the present phone system only supports 30 phone users plus the courtesy phones in the Airport. Previous documentation indicates that no modifications would be required to the communication infrastructure unless there is a dramatic modification to the system that is supported by the infrastructure.

5.14.7 Fire Protection System

The existing terminal is fully equipped with a sprinkler system and has hose cabinets at appropriate locations. The existing system can be expanded to meet future long-term requirements with little or no modifications provided the additional piping is designed within the present system hydraulics.

5.14.8 Stormwater

In general, stormwater management facilities are designed to reduce peak stormwater release flow up to the 10-year storm. Detention basins are designed to contain and route stormwater flows through emergency spillways through the 100-year storm event.

Due to site constraints, airfield stormwater conveyances such as ditches, inlets, and pipes are designed to accommodate the maximum practical storm events—typically, the 10-year storm—with greater volumes flowing overland to downstream basins and stabilized outfalls.

The Airport's stormwater facilities are being improved to meet current local and state requirements. As projects are undertaken, the RRAC has been taking all practicable means to provide for fuel spill containment in accordance with interpretations of the latest EPA requirements. By the end of the taxiway relocation projects in 2008, significant fuel spill containment will be provided for the majority of the airfield facilities by use of in-line fuel traps in the stormwater system or fuel trap-capable detention basins on Airport property.

Stormwater considerations will be addressed as various development concepts are identified and evaluated.

Chapter Six
Alternative Development Concepts

6.1 INTRODUCTION

This chapter describes the process used to identify and evaluate alternative development concepts for the Airport. Alternative concepts were analyzed for the following functional areas:

- Airfield,
- Terminal,
- Air Cargo,
- General Aviation,
- Support Facilities, and
- Surface Transportation and Auto Parking.

The result of the analysis undertaken in this effort is a recommended development plan for ROA, which is described in Chapter 8.

6.2 OVERALL DEVELOPMENT STRATEGY

The strategy for identifying and evaluating concepts consisted of several steps. First, general land area requirements were determined for very long-term planning (i.e., out to 2045). Next, several concepts for providing these land area requirements were identified. These concepts were then shared with Airport staff in a two-day planning charrette in October 2006. In summary, it was established that the development of the Northwest Quadrant would be required to meet long-term aviation demand. The timing of when it should be developed (whether within the 20-year Master Plan horizon or beyond) would be explored during the concepts phase.[1]

At the conclusion of the concepts phase, a preliminary recommended development plan will be prepared. See Chapter 8.

6.3 AIRFIELD CONCEPTS

The focus of airfield concepts was to explore ways of providing improved runway length and improved RSAs.

6.3.1 Runway Length

As noted in the previous chapter, the runway requirements for the critical aircraft (in terms of commercial passenger operations) is the EMB-145 operating with a full payload at a 1,000-mile stage length. At the mean maximum temperature of the hottest month, the EMB-145 would require approximately 7,700 feet of runway for this service.

Two concepts were examined to provide the additional runway length: 1) extending the west end of Runway 6-24 by 900 feet, and 2) extending the northwest end of Runway 15-33 by 1,900 feet over Peters

[1] See **Appendix H** for a discussion of development issues and costs associated with development in the Northwest Quadrant.

Creek Road, as shown in **Figure 6-1**. In both instances, full RSAs for each end were assumed. The costs of these two concepts were then compared with their potential economic benefits to determine if they are cost-justified. If the result of this preliminary analysis was favorable, a more detailed benefit-cost analysis would be undertaken.

Benefits of Longer Runway

A general, order-of-magnitude analysis was undertaken to determine whether the runway lengthening project would be economically feasible.[2] The economic benefit of the runway lengthening project was limited to benefits accrued by commercial passenger and cargo airlines. Since the current length is sufficient for existing service, a lengthened runway would not provide a measurable economic benefit unless the airlines introduced service to new markets where the existing runway length would restrict operational payloads.

The primary benefit of a 7,700-foot runway would be the greater payload-carrying capacity (expressed in terms of additional revenue) of commercial and GA flights.

Based on previous analysis, the most likely passenger markets that could benefit from having a longer runway would be Dallas-Ft. Worth and Houston, both of which are approximately 1,000 statute miles from Roanoke. At the current 6,800-foot runway length, a 50-seat EMB-145 regional jet traveling to either of these cities would be limited to 40 passengers and 1,771 pounds of cargo for flights departing at the mean maximum temperature.[3] The additional 900 feet of runway would allow the aircraft to fly nonstop to these two cities with a full passenger load (i.e., 50 passengers) and 1,771 pounds of cargo.

The existing all-cargo fleet mix can currently operate to their respective hubs, i.e., Memphis (503 statute miles from ROA) and Louisville (320 statute miles from ROA), with no payload penalty. Based on discussions with local station managers, it is not anticipated that regular cargo service would be initiated to more distant cargo hubs in the forecast horizon, therefore, it is unlikely that any measurable economic benefit would be realized by providing a longer runway.

Using a conservative analysis, the total annual benefit to the airlines of having a 7,700-foot runway would be approximately $4.3 million. This suggests that the amortized (annual) cost of the extension would have to be equal to or less than this amount in order to make it cost-justifiable. Based on current financing costs, the estimate of $4.3 million could support a project capital cost of between $48 million to $55 million.

[2] See **Appendix I** for detailed runway length benefit-cost analysis.

[3] It is recognized that, in practice, airlines would likely reduce the amount of onboard cargo and choose to carry a full passenger load; however, to quantify the benefit of the additional payload that could be carried with the longer runway, the economic benefit of this additional weight was calculated in terms of additional passengers.

ROANOKE REGIONAL AIRPORT

Runway Lengthening Alternatives

FIGURE 6-1

Costs of Longer Runway

The cost of the lengthened runway would be its construction cost, including planning, engineering, land acquisition, materials, labor, and environmental mitigation. Following construction, there would also be an incremental increase in operating and maintenance (O&M) cost.

Lengthening Runway 15-33 to the northwest would require the acquisition of 15 acres of land to accommodate the additional runway and taxiway pavement, full RSA, and for obstruction mitigation. Approximately one million cubic yards of earthwork would be required to provide adequate grading and drainage and clearance of Peters Creek Road. It also would require an overpass to be constructed over Peters Creek Road. In addition, NAVAIDs would need to be relocated. Environmental impacts are not likely to be significant, but would need to be analyzed through an environmental assessment. The cost to lengthen Runway 15-33 is estimated at $90 million. It should also be noted that that current operational restrictions for this runway would stay in place, including no takeoffs on Runway 33 or landings on Runway 15 at night or in IFR conditions. In addition, the Runway 15 landing threshold would likely have to remain at its current location due to terrain.

The cost of lengthening Runway 6-24 would include spanning I-581 with the lengthened runway, taxiway, and safety area. The total cost is likely to exceed $250 million.

Runway Lengthening Recommendation

Because the annual benefit of a lengthened runway is significantly less than the cost to provide the lengthened runway, it was determined that providing additional runway length was not cost-justifiable within the 20-year planning horizon. Nevertheless, the analysis indicates that the least expensive concept provides additional runway length by lengthening Runway 15-33 to the northwest. Therefore, the plan recommends preserving land owned by the Airport northwest of 15-33 and, ultimately, trying to acquire additional land when feasible to provide the opportunity for adding runway length at the Airport at some later point beyond the 20-year planning horizon.

In addition, as noted in Section 5.4.2, the landing lengths for several commercial aircraft exceed the 6,000-foot length available (due to an 800-foot displaced threshold) of Runway 24 in wet pavement conditions. Opportunities for reducing or eliminating the displacement should be pursued in the future. (See Section 6.3.2.)

6.3.2 Runway Safety Area

Runway 15-33 has a full 1,000-foot safety area at its southeast end and RSA requirements are met with an Engineered Materials Arresting Systems (EMAS) at its northwest end.

Previous analysis of providing full 1,000-foot safety areas for both ends of Runway 6-24 shows that it would be cost-prohibitive, however since that time, the FAA has accepted the use of full standard EMAS in lieu of safety areas. (A full EMAS is defined as one capable of stopping the design aircraft exiting the runway at 70 knots.) Three concepts were considered for addressing Runway 6-24 safety area deficiencies: 1) Providing full 1,000-foot by 500-foot RSAs, 2) Providing standard EMAS on both ends, and 3) Providing a minimum-performance EMAS on both ends.[4]

Full Safety Areas

As shown in **Figure 6-2**, approximately 50 acres of land would need to be acquired to provide full RSAs, and housing units and businesses would need to be relocated. The project would also require stream and road relocation, extensive fill, and a bridge/tunnel over I-581 and Thirlane Road. The total cost for providing full safety areas for both ends of Runway 6-24 is estimated as $294 million.

Full Standard EMAS

Figure 6-3 illustrates the full standard EMAS concept. In this concept, a 500-foot by 600-foot graded area would be constructed at both ends of the Runway and a 200-foot by 400-foot EMAS bed would be installed at each end. This concept would require the acquisition of 51 acres, primarily for grading and drainage. Providing full EMAS would still require spanning I-581, stream relocation, and relocation of homes and businesses. The total cost for providing full standard EMAS is estimated at $283 million.

Minimum-Performance EMAS

Working with the EMAS engineering company, a "minimum performance" EMAS concept was identified. With this concept, a smaller EMAS would be constructed to stop the critical aircraft with an exit speed of 40 knots, versus the 70-knot exit speed design standard of a full EMAS. The result would be a significantly improved safety margin compared to current conditions, although it would not comply with full EMAS design standards.

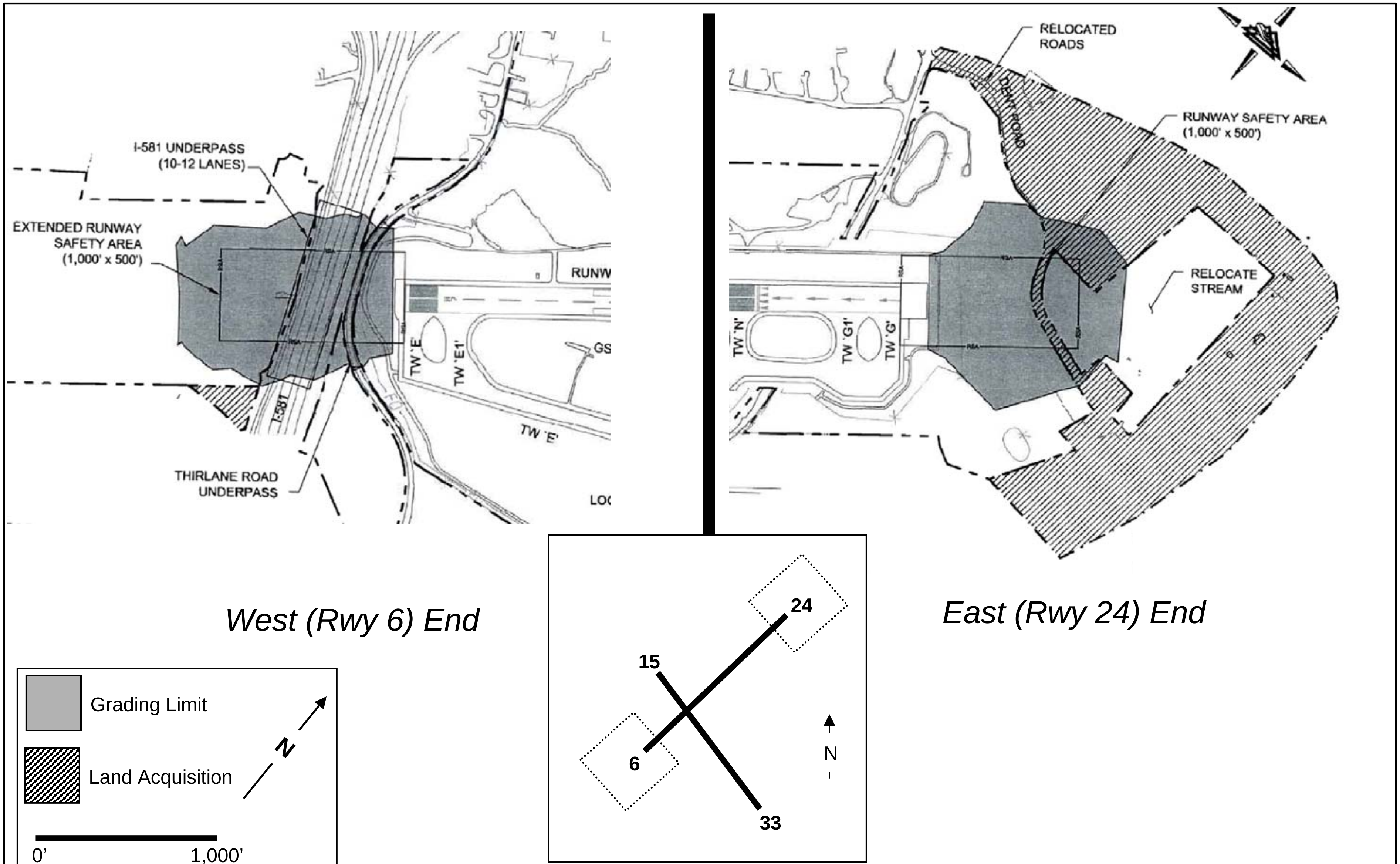
Figure 6-4 illustrates the minimum performance EMAS concept. With this third concept, a graded area approximately 250 feet long and 500 feet wide would be built and a 200-foot by 200-foot minimum performance EMAS bed would be installed. Most of the project could be accommodated within the existing Airport property limit and no homes or businesses would have to be relocated. From a construction standpoint, a minimum performance EMAS would not require spanning Thirlane Road and I-581, however, a retaining wall and reinforced slopes would be required. The total cost for providing minimum-performance EMAS on both ends of the Runway would be approximately $25 million.

RSA Recommendation

Previous cost-benefit studies have demonstrated that both a full safety area and a full EMAS are infeasible for either end of Runway 6-24. The analysis described above validated this finding, however, it also indicated that there is a cost-effective alternative for improving current safety

---

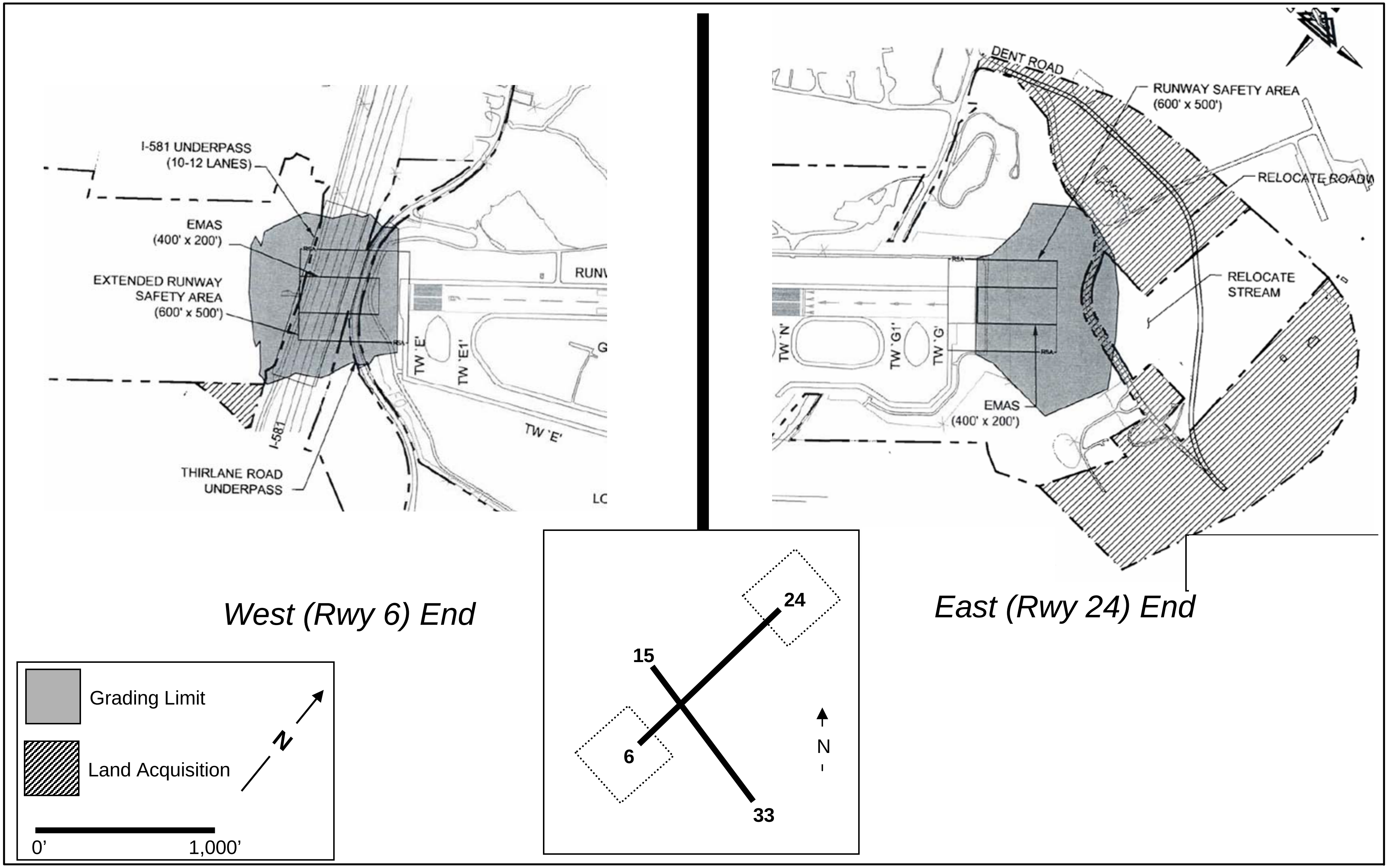
[4] Detailed analysis is provided in a report entitled, *Runway Safety Area Analysis, Runway 6-24* which is found in **Appendix J**.



ROANOKE REGIONAL AIRPORT

Runway 6-24 Safety Area Improvements
Full Safety Area Concept

FIGURE 6-2

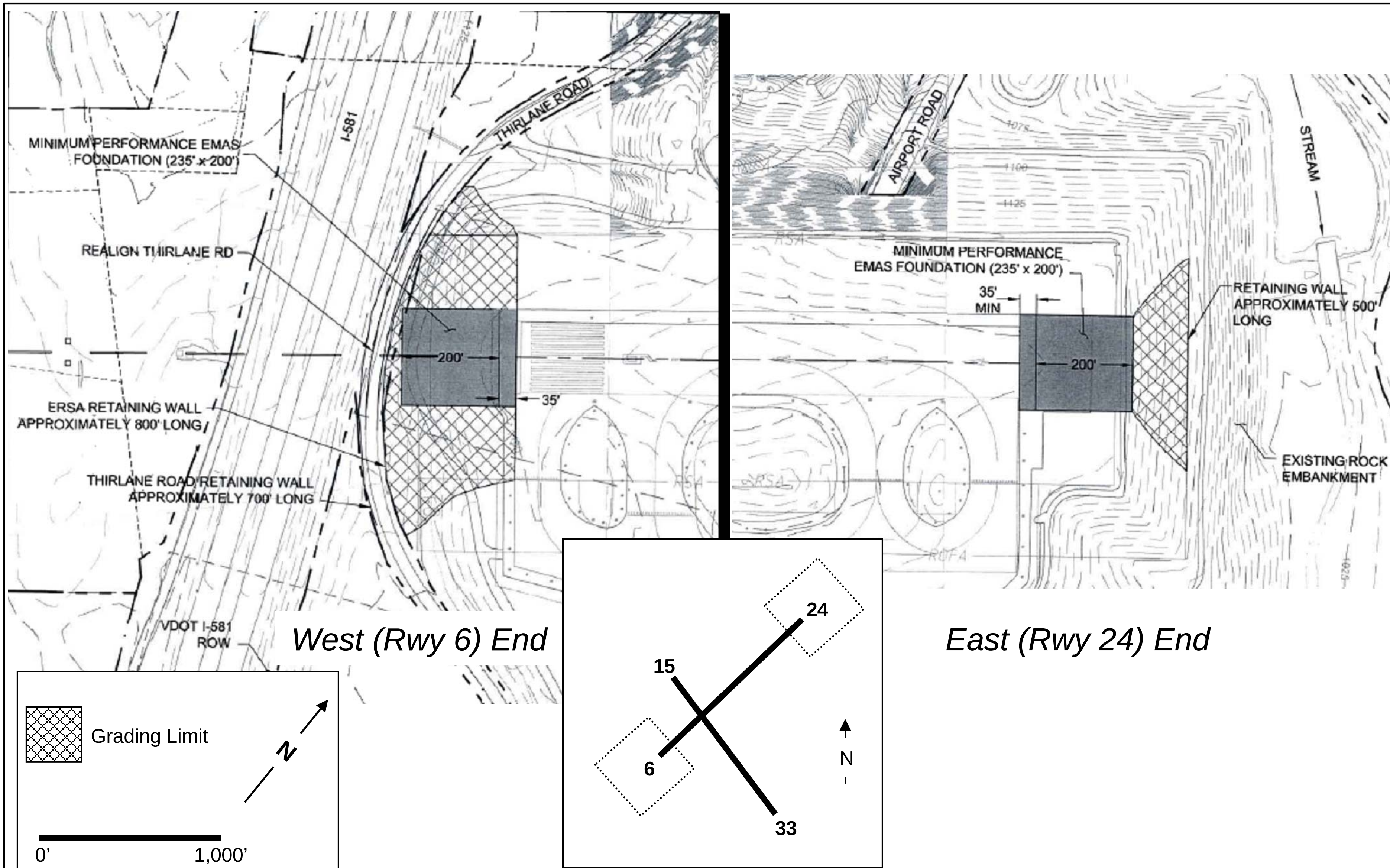


R O A N O K E   R E G I O N A L   A I R P O R T   M A S T E R   P L A N   U P D A T E

ROANOKE REGIONAL AIRPORT

Runway 6-24 Safety Area Improvements
Full EMAS Concept

FIGURE 6-3



R O A N O K E R E G I O N A L A I R P O R T M A S T E R P L A N U P D A T E

ROANOKE REGIONAL AIRPORT

Runway 6-24 Safety Area Improvements
Minimum Performance EMAS Concept

FIGURE 6-4

margins by constructing a minimum performance EMAS.

Also, as noted in Section 6.3.1, future study of EMAS solutions to meeting RSA requirements should include consideration of reducing or eliminating the 800-foot displaced threshold on Runway 24.

6.3.3 Airfield Circulation Roads

As noted in Chapter 5, the current perimeter road is narrow and unpaved. The perimeter road, as well as other airfield circulation roads, should be improved by widening and paving.

In addition, a roadway connecting the air carrier apron and the southeast portion of the airfield near the approach end of Runway 33 without transiting the AOA is recommended, as well as improving access to the fence line for security purposes.

6.4 TERMINAL DEVELOPMENT CONCEPTS

While the passenger terminal overall is sufficiently sized to accommodate existing and 20-year demand, specific functional elements are undersized. Additionally, the terminal was not originally designed to accommodate HBS functions. Finally, the Master Plan Update provides an opportunity to upgrade passenger services and amenities. This section describes the recommended terminal improvements designed to accommodate future demand.[5]

[5] **Appendix K** provides an analysis of terminal recommendations.

6.4.1 First Floor Improvements

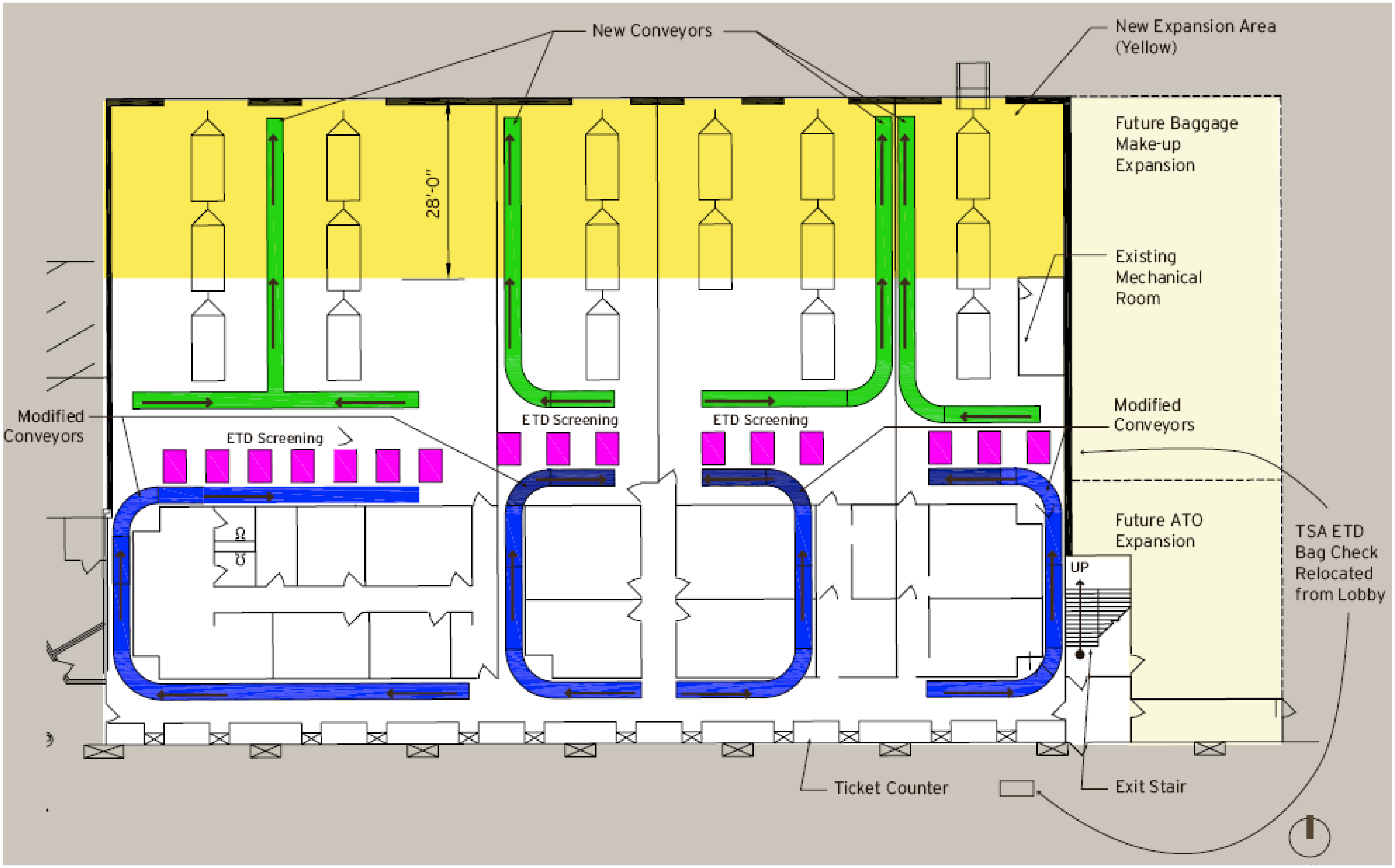
This section outlines the recommended key improvements to the first level of the terminal including, HBS and outbound baggage, concessions in the ticket lobby, restroom improvements, and support space improvements.

Hold Bag Screening and Outbound Baggage

The terminal was not originally designed to accommodate 100 percent HBS activity which was implemented in response to the 9/11 terrorist attacks. The TSA installed ETD equipment and inspection space for the checked baggage in the ticket queue area of the terminal which has significantly reduced queue and circulation space in the ticket lobby, creating crowded conditions and a low level of costumer service during peak periods.

The recommended solution would be to relocate the baggage screening process to a separate HBS area behind the ATO area in phases of sophistication of ETD and baggage make-up equipment as baggage volume increases over the next 10 years. See **Figures 6-5, 6-6, and 6-7**.

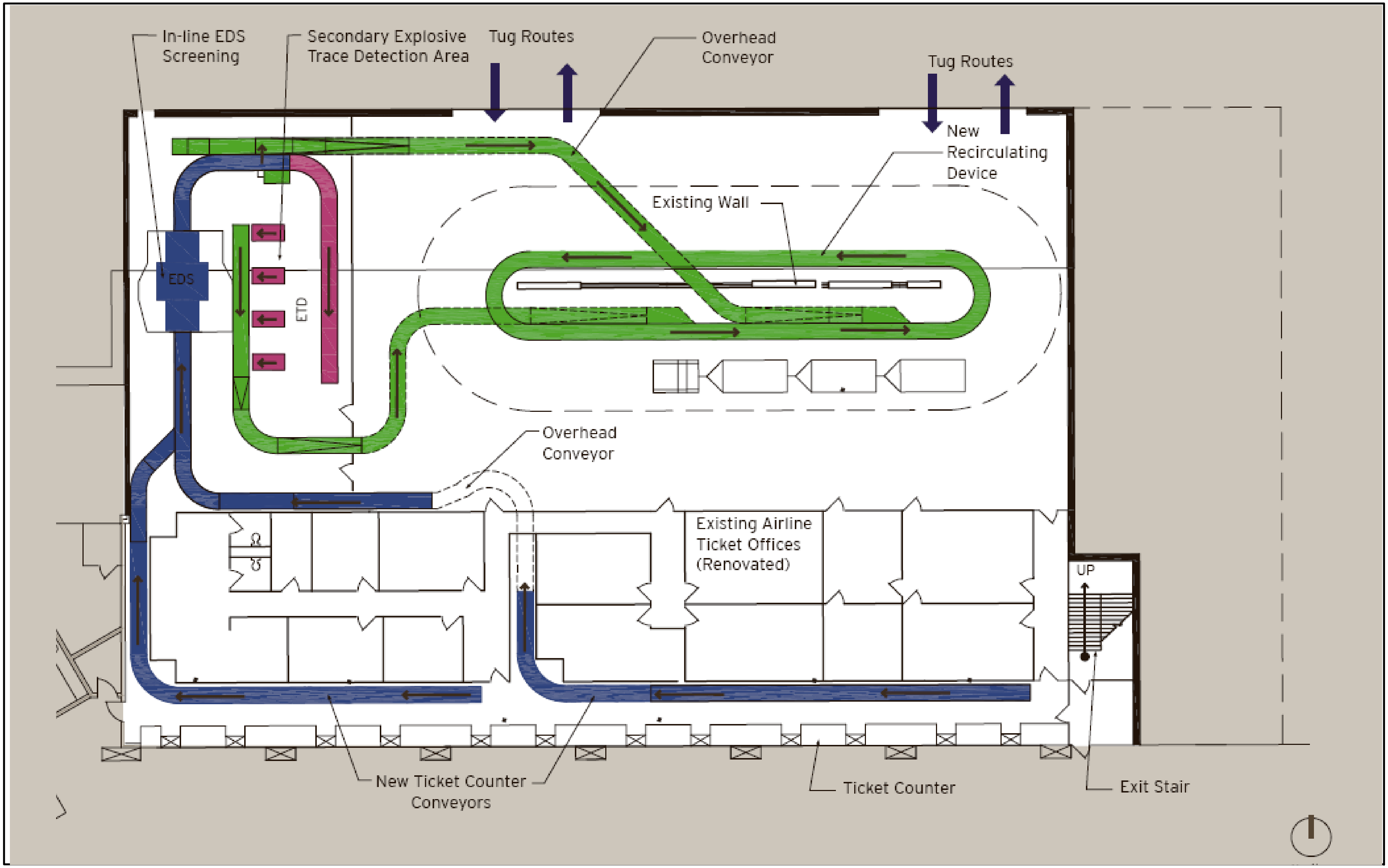
In Phase 1 (Figure 6-5), the existing outbound baggage rooms at the rear of the building would be extended 28 feet towards the aircraft ramp. The existing slot drain would have to be relocated northward to accommodate the expansion and the grades for site drainage. This would create additional room for both airline baggage make-up and TSA baggage screening. The four existing take-away ticket counter belts would continue to be used and existing ETD



ROANOKE REGIONAL AIRPORT

Hold Bag Screening
Phase 1

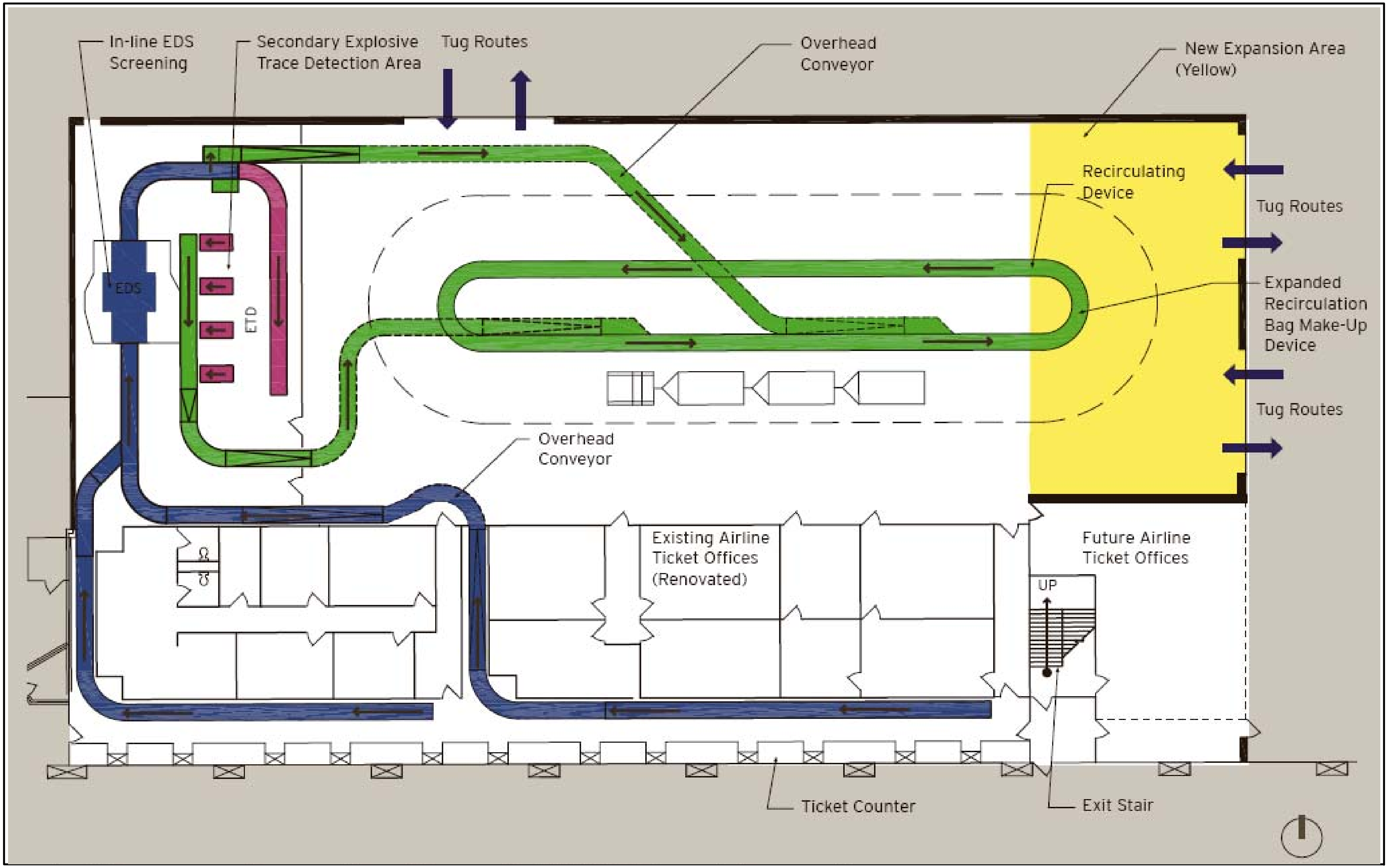
FIGURE 6-5



ROANOKE REGIONAL AIRPORT

Hold Bag Screening Phase 2

FIGURE 6-6



ROANOKE REGIONAL AIRPORT

Hold Bag Screening
Phase 3

FIGURE 6-7

devices would be relocated from the ticket lobby to a new location in each airline bag make up area. All suspect bags would be identified by the ETD process and then be screened by TSA employees in a secondary screening area for a physical search of the bag. The secondary search area would be located in the TSA-designated area of the outbound baggage room. The TSA area will be climate-controlled and adequate lighting for the screening process. New conveyors will transport the bags from the TSA screening area to the expanded airline baggage make-up area for processing bags into carts.

As peak hour checked baggage volume increases, the next step (Phase 2) of the baggage room and TSA screening would be implemented. The existing take-away conveyor system behind the current US Airways ticket counter would be retained and a new consolidated conveyor for all ticket counters to the right of US Airways will replace the three existing individual conveyors. The two conveyors will merge and transport bags to a single consolidated TSA ETD screening system or in-line EDS screening system in the baggage make-up area. TSA will decide which method they prefer when this phase occurs. In Concept 2 (Figure 6-6), the in-line system is shown because it is anticipated that TSA will select that option.

After the bags are screened and cleared, they will travel overhead via conveyor to a common slope-bed baggage make-up device in a new expanded common use baggage room where all air carriers would have sufficient room to make up their bags. The airline baggage tugs would be able to drive completely around the re-circulating make-up device. This provides great flexibility to the airlines and convenient access to airline outbound baggage workers for loading onto carts. All the walls separating the existing bag rooms today would be removed to create the single common use bag room. The tugs would operate in a clockwise flow around the baggage make-up carousel. Tugs adjacent to the carousel could be bypassed using an outside lane.

In order to create the right-of-way for the new conveyors through the ATO area, and to provide corridor access to the offices, some areas and walls of the ATO suite would be modified.

As checked baggage volumes continue to increase with passenger growth, the outbound baggage room would be expanded towards the east as depicted in Figure 6-7 (Phase 3). The re-circulating slope bed baggage make-up device would also be extended to increase outbound baggage capacity. The eastward expansion could also include additional ATOs. The fire exit would be maintained from the second floor with a corridor in front of the ATO, but door access will be maintained through the fire exit to access the ticket counter area. Figure 6-7 shows an all ETD screening process for TSA, but this is interchangeable with the in-line screening process depicted in Figure 6-6. As noted previously, equipment and staffing levels are up to TSA.

The recommended checked baggage screening concepts should be implemented in phases in order to keep all airline baggage make-up operations functioning during the construction of each of the new phases.

When the in-line checked bag screening system is constructed, baggage make–up areas which are currently not used could be used for the new screening and the baggage make-up area.

The ATO space for each airline should be equitably re-allocated and relocated logically behind each air carrier's ticket counter operation. The advantage of the proposed recommendation for the common baggage make-up area and ATO is that it provides for future flexibility and future changes in airline market share.

Concessions in Ticket Lobby

It is recommended the existing travel agency in the ticket lobby, which is not a significant revenue producing enterprise, be relocated or eliminated and replaced with a premium coffee shop (**Figure 6-8**), as it is an excellent location near the main entrance to capture both departing and arriving passengers and produce significant non-airline revenues for the Airport.

First Floor Restroom Improvements

The first floor restrooms would be expanded and improved which would significantly increase the number of fixtures, provide ample space for passengers with luggage, comply with ADA requirements, and place the entrances of the restrooms at a more prominent location. The expanded restroom layout would increase the number of women's fixtures to provide restroom parity by providing an appropriate level of service equal to the men's facilities. **Figure 6-9** shows the recommended expansion. Escalator maintenance access will remain accessible from the second floor as it is today. Ceiling access in the restroom expansion area will also be maintained through accessible ceilings.

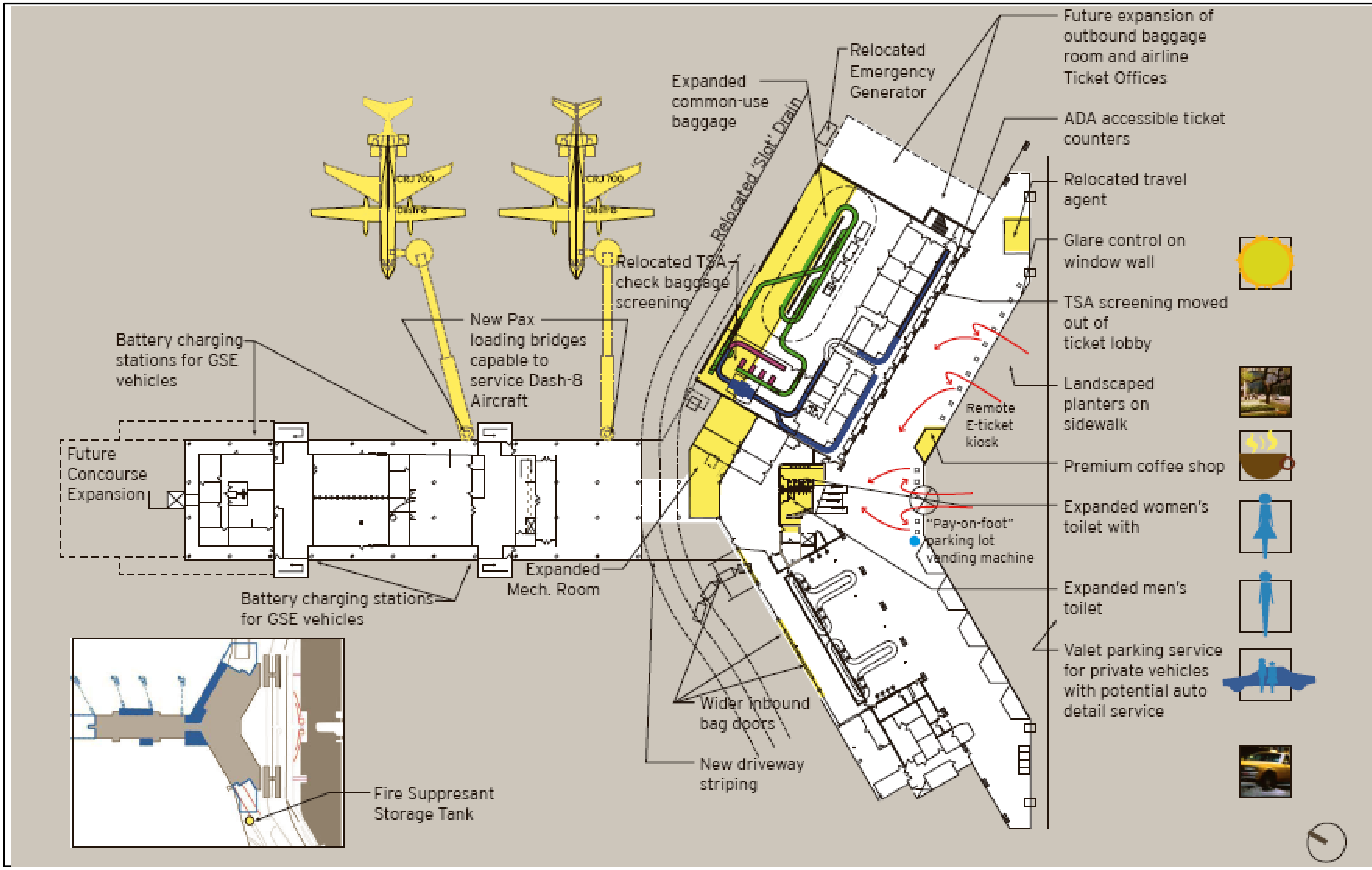
Level One Support Space Improvements

The mechanical room space would be expanded for added chiller and boiler capacity as the terminal spaces increase in the future, as shown in **Figure 6-10**. To create the additional mechanical space, the emergency generator and substation transformer would have to be relocated to a site that would keep the two units close to the current underground electrical utility feed and circuits to the emergency power next to the expanded mechanical room. The emergency generator will be relocated to the east side of the terminal building as depicted in Figure 6-8. The expanded mechanical room would also accommodate an additional duplex water pump, compression tank, and a 1,000-gallon water storage tank.

The recommended 15,000-gallon fire protection water storage tank is suggested to be located just west of the terminal building adjacent to the landside dock on the secure side of the AOA fence.

The ground service vehicle roadway underneath the terminal would have to shift northward to accommodate the mechanical room expansion. This is readily accomplished, as there is ample open space and vehicle headroom clearance below the concourse at this location.

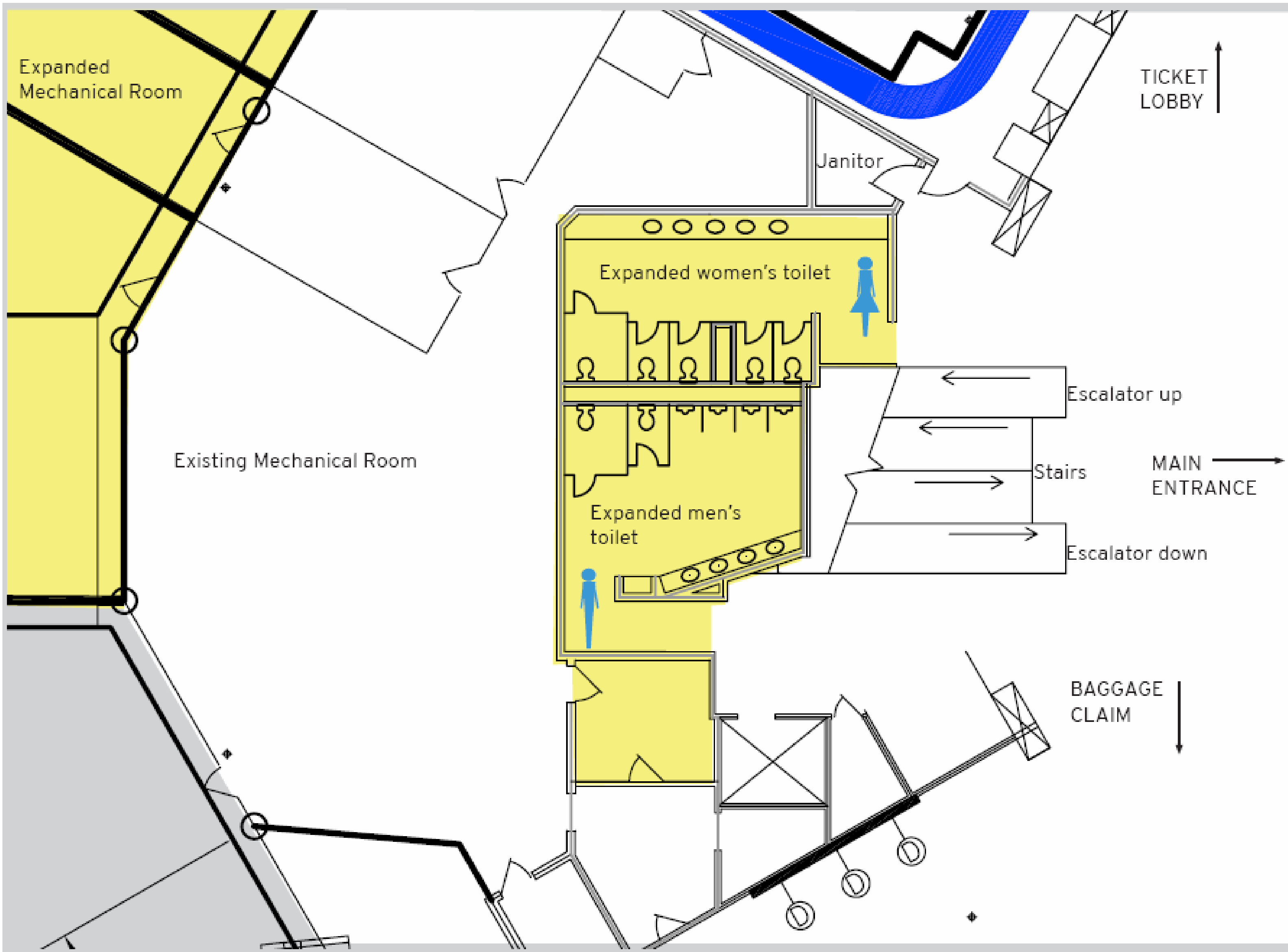
The entrances and exits to the inbound baggage layout area would also be enlarged. The east end of the inbound bag lay down area would be expanded northward and widened with much larger roll-up garage



ROANOKE REGIONAL AIRPORT

Lower Level Passenger Amenity Opportunities

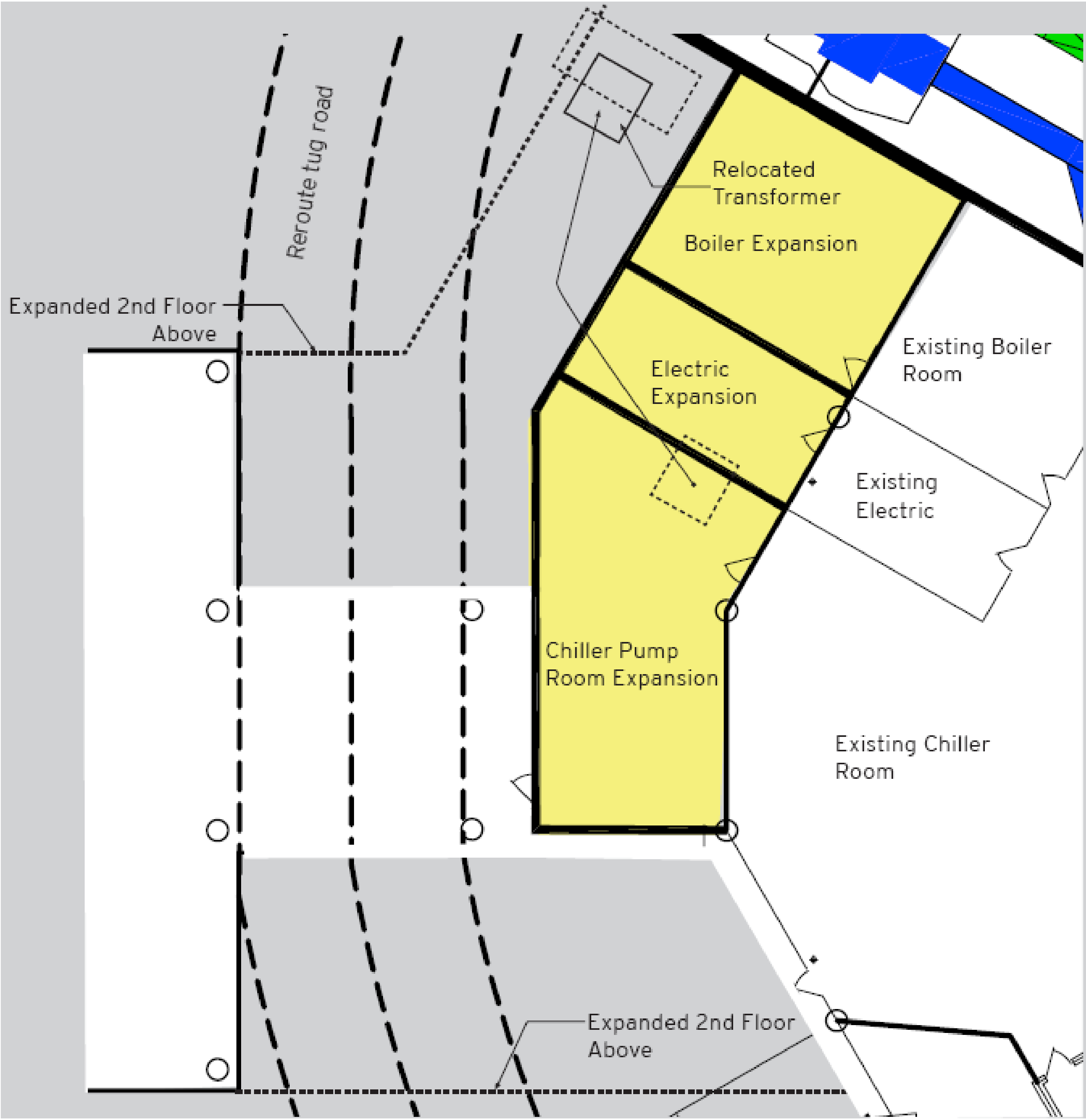
FIGURE 6-8



ROANOKE REGIONAL AIRPORT

Lower Level Restroom Expansion

FIGURE 6-9



ROANOKE REGIONAL AIRPORT

Mechanical Room Expansion

FIGURE 6-10

Source: HNTB analysis.

doors to facilitate easier access to the first baggage claim device. This augmentation should significantly reduce the potential for tug damage to doors and walls in the area. The west entries and exits would also be widened.

Battery charging stations could be added at the ramp level around the concourse for electrically-powered GSE vehicles used by the airlines. This also can be used to a public relations advantage by the Airport in terms of being environmentally sustainable.

Baggage claim area improvements include creating a common-use, secure baggage storage room. This would be located in the currently unused airline lease area (former bag service office) at the west end of the baggage claim area. Each airline could have their own lockable cages in the room and the rent would be divided evenly among airline participants.

6.4.2 Improvements to Second Level of Terminal

After passengers complete their ticketing transaction on the first level, they ascend to the second level of the terminal by escalators, stairs, or an elevator. Upon arriving at the second level, passengers reach the main central area which is used for circulation, meeter/greeter waiting, and queue area for the passenger security checkpoint screening.

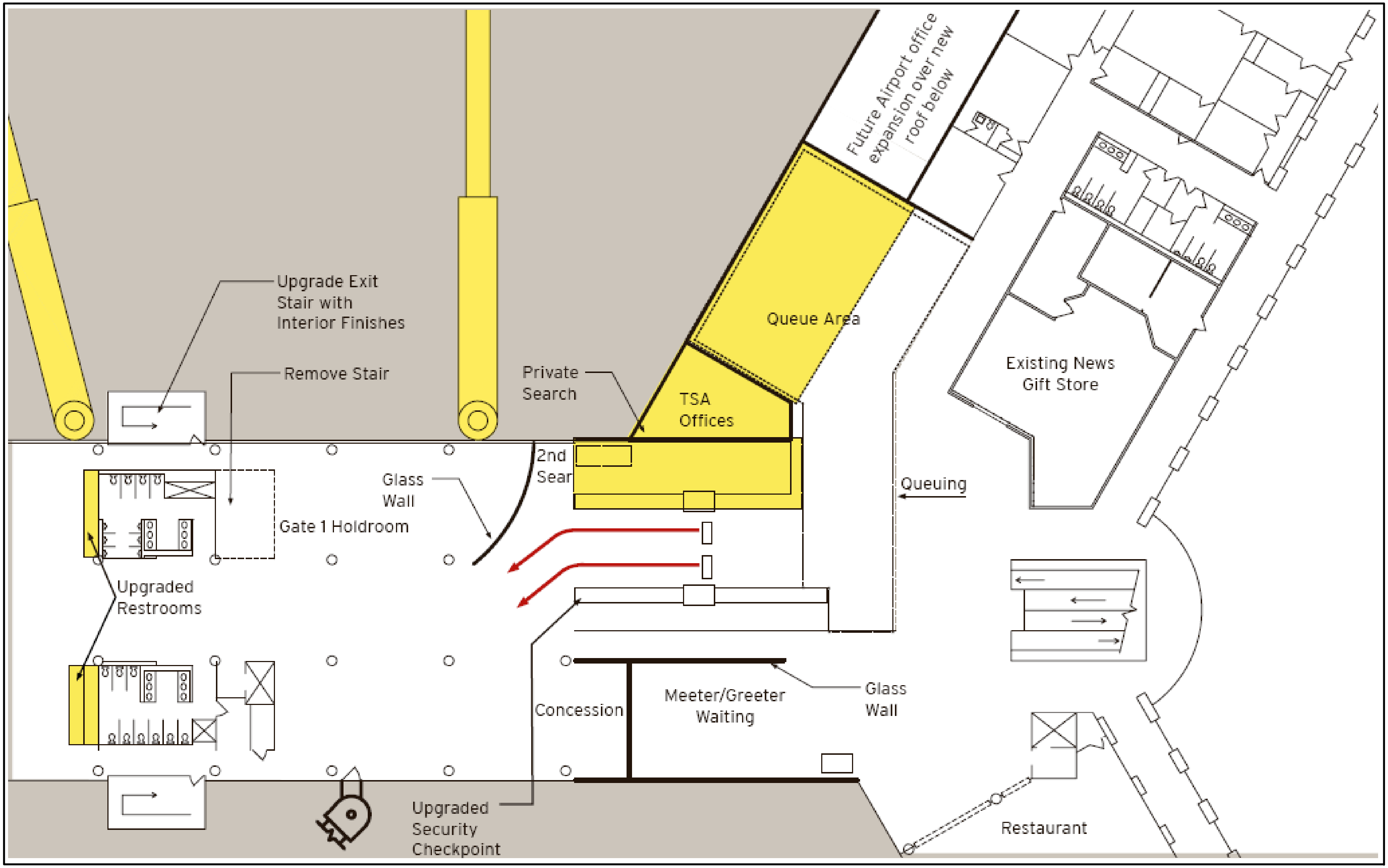
Several key improvements would meet future facility requirements and greatly enhance the level of passenger service at the departure level as described below.

Passenger Security Screening Checkpoint

In its existing configuration, the passenger security screening checkpoint has insufficient area for all the functions, especially at peak periods. It is recommended that an additional building structural bay be added towards the east at the throat of the concourse to accommodate the following improvements:

- Provide more area for passengers to divest their belongings prior to the checkpoint area;
- Add a second security line with a magnetometer, X-ray, and ETD trace secondary;
- Provide a private pat down interview/inspection room;
- Create a permanent TSA supervisor office (to be relocated from Gate 1);
- Provide additional queue area;
- Create sufficient space to accommodate foreseeable security equipment upgrades in future; and
- Provide area for a closable security gate for securing the concourse after last outbound flight.

Figure 6-11 shows a concept for adding a second security checkpoint lane (with a magnetometer and X-ray devices), additional secondary screening areas and a private search room. The area designated for queuing has also been increased significantly, and TSA and Airport office space is added in the building expansion at this level.



ROANOKE REGIONAL AIRPORT

Upper Level Security Screening Checkpoint Expansion

FIGURE 6-11

The outbound baggage expansion area roof could be structured to accommodate a second level above, providing area for long-term growth for additional ROA office space.

Finally, a new meeter/greeter space is created closer to the exiting arriving passengers. The area is enclosed by a glass partition giving an ample visual viewpoint to observe the arriving passengers.

Concession Improvements at the Non-secure Central Area

Although the overall space available for food and beverage and retail at the second level central area location is adequate for the current- and near-term projected passenger growth, its efficiency, layout, and architectural décor have become somewhat dated. The next tenant to take over the lease should be directed to create a more efficient layout which combines the bar and food portion of the facility to reduce labor costs and provide better exposure to the bar area from the main circulation space. Visual exposure to the main passenger circulating areas is key to increasing both food and beverage sales. Better visual access and a renovated attractive space coupled with an updated menu would increase the revenue potential of the facility.

Restroom capacity on this non-secure portion of the second level can be enhanced by creating a staff-only set of restrooms when the Airport offices are expanded. This allows private restrooms for staff while reducing the employee use of the public restrooms providing more public restroom capacity.

Secure Concourse Recommendations

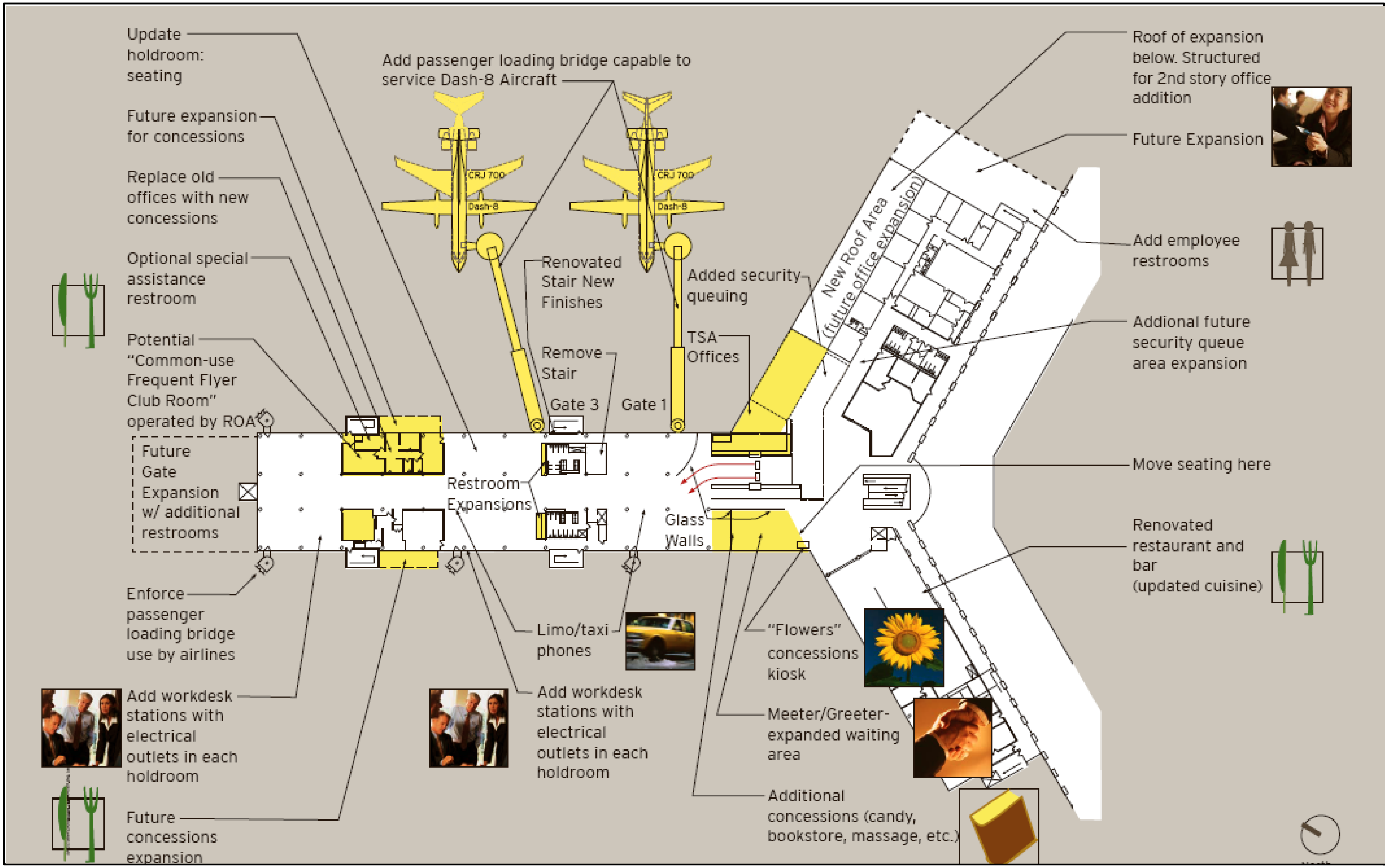
This section focuses on concession improvements, passenger amenities, passenger holdrooms and boarding bridges, restrooms, and other improvements to the secure concourse area.

Concessions on the Departure Concourse

The development concept for the departure concourse provides more visual exposure to the main concourse circulation. Over time, as activity levels increase, additional area would be warranted for food and beverage and retail concessions. **Figure 6-12** shows the recommended concession improvements.

Additional concessions would be added on the concourse, including a retail shop next to the security checkpoint and expanded food and beverage options further down the concourse near Gates 5 and 6. Existing concessions should incorporate architectural features that allow better visual realization that a concession exists from a distance, and that would invite patrons to explore concession offerings. This can be accomplished with exciting signage and graphics, architectural forms, and color.

Kiosk-type concessions may provide additional revenue and meet the needs for passengers with a low up-front capital cost to both the Airport and the potential new concessionaire. These concessionaires should be required to provide services or products different from existing concessionaires in order not to erode current revenue streams, but rather to create new revenue sources of concession business.



ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

Upper Level Passenger Amenity Opportunities

FIGURE 6-12

Suggestions from successful new concession ideas in the airport industry include:

- Premium coffee kiosks,
- Flowers,
- Candy,
- Massage services, and
- Local specialty artwork.

Additional area should be provided for one or more of these concession opportunities.

Other Passenger Amenities

Other amenities that would enhance passenger experience and are, therefore, recommended to be added to the concourse include:

- More electrical outlets throughout the holdrooms for laptops and cell phones,
- Improved FIDS for departures with visual paging capabilities and larger monitors,
- Newer, updated holdroom seating,
- Desk workstations with electrical outlets for business travelers on the concourse to take advantage of the free Wi-Fi provided in the terminal,
- Airport TV (e.g., CNN), and
- A common-use club room for premium frequent flyer passengers and membership passengers provided by the Airport.

Passenger Departure Holdrooms

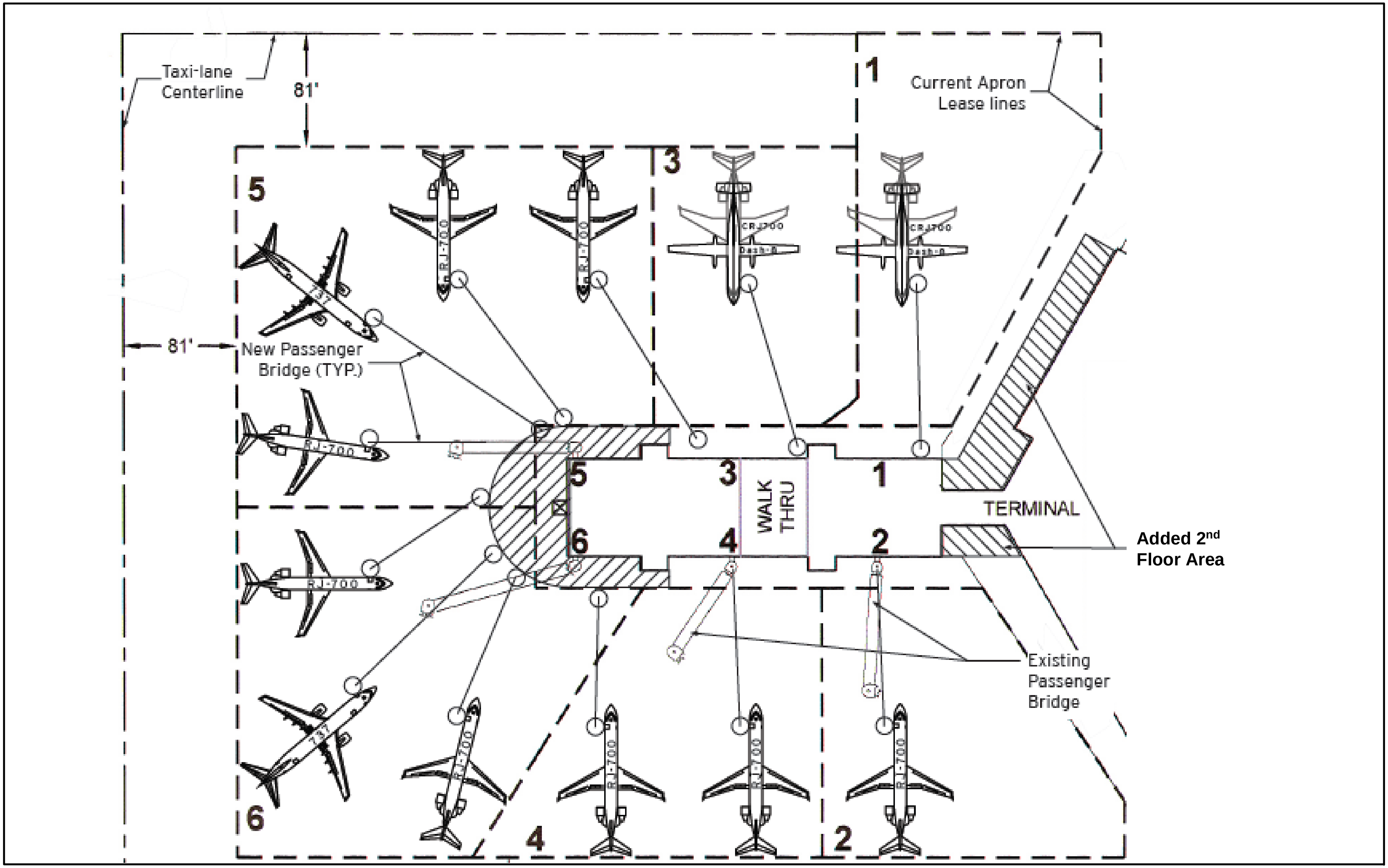
As the TSA activity currently located at Gate 1 would be relocated, the gate could be reactivated as a useable gate. This will provide sufficient area to serve up to a 70-seat aircraft.

The terminal was originally designed for narrow body aircraft at each gate, however, it is currently predominately being served by regional jet and turboprop aircraft. More regional aircraft gates could be provided around the terminal without adding more holdroom area by adding more passenger loading bridges and re-striping the aircraft ramp, as shown in **Figure 6-13**. These modifications would require straight-in aircraft parking and tug push back operations rather than aircraft power out operations.

In the long-term (beyond the 20-year forecast horizon), additional gates and holdrooms could be created by extending the concourse northwestward.

Passenger Boarding Bridges

Although several of the gates are equipped with loading bridges, some airlines typically do not use them. As a result, passengers are required to deplane using air stairs to the apron and then climb stairs to the second level of the concourse. To increase the opportunity of offering loading bridge service, it is recommended that all passenger bridges be made compatible for all aircraft types that either currently, or are anticipated to, serve the Airport. Specifically, bridges that are compatible with the Dash 8 aircraft should be added to Gates 1 and 3 which do not have any bridges at



ROANOKE REGIONAL AIRPORT

Future Maximum Terminal Gate Layout
With Existing Apron Limits

FIGURE 6-13

this time, and this aircraft type should be redirected to those gates. Baggage chutes/lifts should be installed on the side of the passenger boarding bridges so regional aircraft passengers can claim their gate-checked baggage in the passenger bridge rather than having to get their bags at baggage claim.

Until the passenger boarding bridges are available for all passengers, the stairs used by air carriers for ground loading should be improved. Currently, the stairs used are utilitarian exit stairs. They should be upgraded with better finishes, signage, lighting, security access control monitoring, and cameras to monitor doors opened during enplaning and deplaning activities.

Clear pedestrian walkway paths should be painted on the apron as a safety precaution to prevent passengers from wandering across the apron area in search of stairs to the second level concourse.

Finally, use of boarding bridges should be encouraged, rather than air carriers opting for the more simple method of ground loading passengers to save airline labor and training.

Concourse Restrooms

The secure concourse level restrooms would be expanded into the Gate 3 and 4 holdroom areas to accommodate future passenger loads and to improve the ratio of fixtures in the women's restroom. When it becomes necessary to lengthen the concourse to provide more gates (beyond the 20-year planning horizon), additional restrooms should be added.

Although not required by code, a single unisex restroom could be added for passengers who are traveling with small children or adults needing special assistance. This restroom could be located either adjacent to the existing restroom facilities or in some of the vacated office space in the concourse.

6.4.3 Secondary Airline Charter Operations Area

Although public charter aircraft operations should be operated through the terminal building from current gates with passenger boarding bridges, private and university charters (specifically for university bands with very large number of musical instruments) should continue to be accommodated at the air cargo area apron.

To improve the LOS for these flights, operations at this location would require a small facility to screen (through magnetometer wanding) passengers and their baggage prior to boarding the charter aircraft via an air stair. Covered air stairs and potentially a temporary type canopy structure (possibly similar to the FedEx facility) may be appropriate if the volume of charter traffic increases. To provide a good LOS, the structure would need to be approximately 4,000 square feet in area to accommodate a 150-seat aircraft. Fabric structures are relatively inexpensive, costing between \$25 and \$55 per square foot. The cost for a charter building, therefore, would range between \$100,000 and \$220,000. Additional discussion is provided in **Appendix L**.

6.4.4 Other Terminal Recommendations

Opportunities to reduce energy costs should be explored which also reduce long-term operations and maintenance costs including:

- Lighting controls;
- Efficient T12 fluorescent light fixtures and other efficient fixtures;
- State-of-the-art building automation controls;
- Detailed commissioning of new HVAC equipment or re-commissioning of existing HVAC equipment to tune equipment to highest efficiency at periodic check-up times;
- High-efficiency variable-speed motors and pumps;
- Baggage conveyor belt systems that “time-out” quickly after use;
- “Eco”-kits for escalators;
- Waterless urinals;
- Low-flow automatic faucets and toilets;
- Use of preconditioned air and 400 Hz ground power in lieu of aircraft burning APUs;
- Charging stations for electrical GSE equipment;
- Recycling center in terminal; and,
- Recycled building materials on site work and building projects.

6.5 ACCESS AND PARKING CONCEPTS

To accommodate predicted growth and operational change in the future, landside concepts were developed and evaluated for several subsystems:

- Airport terminal campus access and parking: Airport entrance, circulation roads, parking (hourly and daily public parking, employee parking and rental cars), parking access, curb roads, and security check points.
- Airport access: Traffic patterns in the airport vicinity, secondary access, and long-term regional access.

The following sections address these areas and provide a series of concepts for each set of issues. The evaluation of the concepts culminates with a preferred landside and access configuration for future year 2025.

6.5.1 ROA Landside Campus

To plan for necessary parking expansion, and to help resolve the long-standing issues of a well-identified Airport entrance, three concepts for the Airport campus were developed, consisting of the parking lots and curb and circulation roads for future year 2025. These concepts are described below and are followed by an evaluation.

Objective for the Landside Campus

Previous analysis demonstrated that there is sufficient capacity on the existing terminal curb roadways and circulation road infrastructure to accommodate future growth and maintain a high LOS. Therefore, no roadway capacity improvements are required for the future year.

However, the existing road system currently has no provision for vehicular security checks. Security checks would be required if the Homeland Security Advisory System threat level is at Code Orange or Code Red. Thus, an essential part of the terminal campus landside plan was to accommodate such a checkpoint.

Projected parking requirements show a need to increase the size of all public parking lots and the rental car ready/return lot; the existing employee parking lot is expected to meet long-term demand through 2025. A summary of parking requirements is shown in **Table 6.1**. The parking requirements and the security checkpoint served as the basis for developing alternative approaches to campus landside development.

Concept 1: Aviation Drive in Operation and Land Purchase Required

The differences in the several alternative concepts centered around two issues:

- Whether additional land could be acquired for the concept, and
- Whether Aviation Drive past the Airport would remain a public right-of-way, or become an internal Airport road.

The first concept (**Figure 6-14**) assumes that there is no restriction on land that could be acquired, hence the parcel immediately north of the existing overflow lot would be purchased and incorporated into the Airport. This layout also assumes that Aviation Drive would remain in operation and the existing Airport entrance would be maintained. This concept assumes the Towne Square Boulevard-Thirlane Road-Airport entrance intersection will not be built.

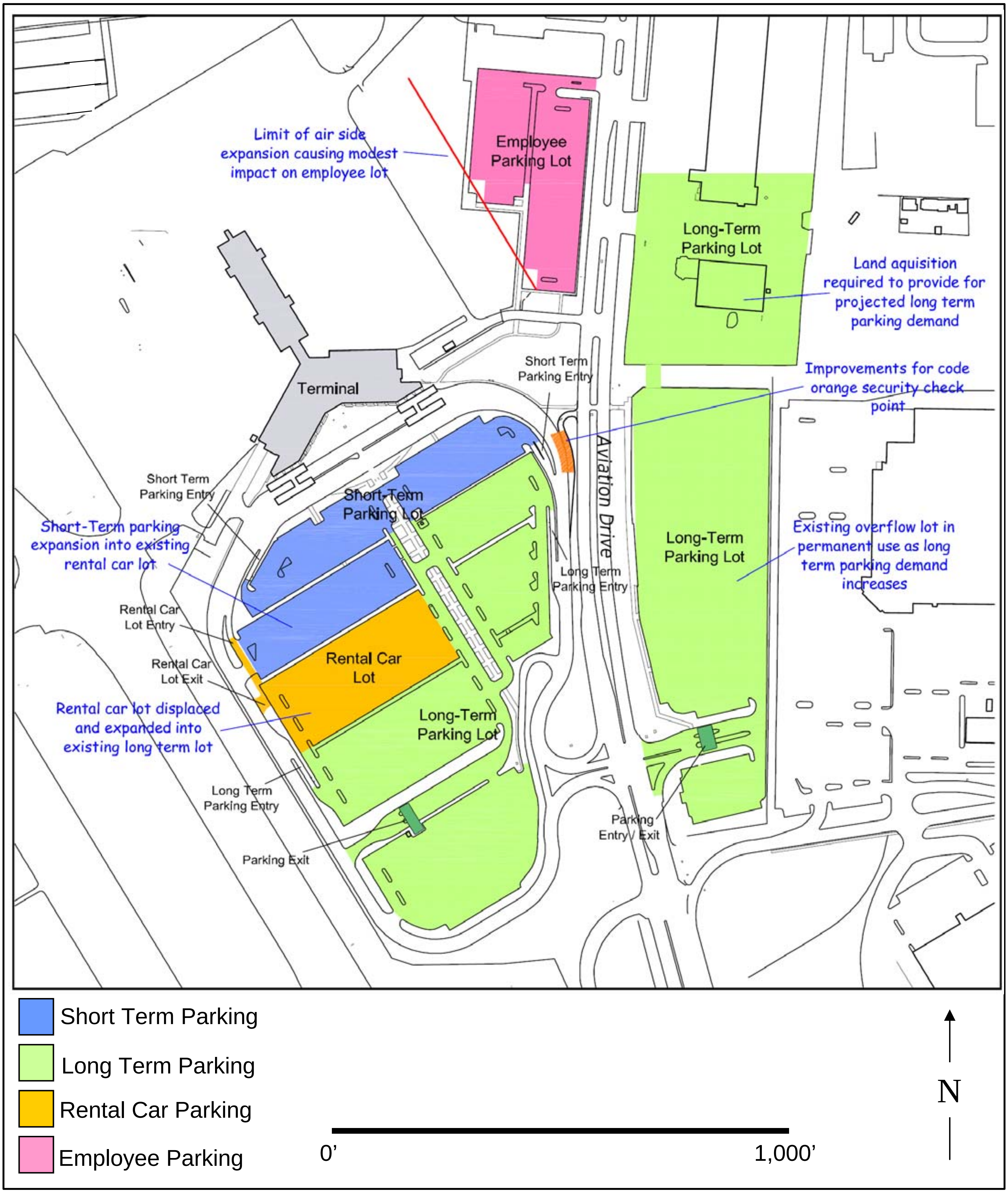
In this concept, there are no alterations to the access and curb roads as explained above. Short-term parking would be expanded and would replace the existing rental car lot. The rental car lot would be moved and expanded into the long-term parking lot immediately south of its current location. In addition to maintaining short walking distances for the public, another advantage of this arrangement is that it allows the existing pre- and post-curb entry points to parking to be maintained. The parking exit plaza is similarly unaffected; however, new access and egress would have to be provided for the new rental car lot.

Long-term parking deficiencies would be addressed in a two-fold manner:

- The existing overflow lot would become a long-term lot in regular use.
- Additional long-term parking would be constructed on newly acquired land immediately north of the existing overflow lot.

The employee lot would be modestly impacted by proposed airside expansion. However, employee requirements are expected to be met with the remaining spaces and the impact lot would be sufficient to meet that demand.

Table 6.2 summarizes Concept 1.



R O A N O K E   R E G I O N A L   A I R P O R T   M A S T E R   P L A N   U P D A T E

ROANOKE REGIONAL AIRPORT

Landside Campus Concept—Layout 1

FIGURE 6-14

Source: HNTB analysis.

Table 6.1

Summary of Parking Requirements

	Short-term Parking	Rental Car Lot	Long-term Parking	Employee Parking
Existing Number of Spaces	220	160	1,594	284
Projected Required Spaces	307	237	1,825	217

Source: HNTB analysis.

Table 6.2

Summary of ROA Landside Campus Concept 1

Product	Existing Spaces	Alteration / Expansion	Net Impact - Spaces	Future Total Spaces	Projected Required Spaces
Short-term Parking	220	Existing rental car lot converted to short-term parking.	160	380	307
Rental Car Lot	160	Rental car lot location moved into existing long-term lot and expanded.	80	240	237
Long-term Lot (including overflow lot)	1,594	Overflow lot would be used permanently for long-term parking. Existing long-term lot impacted by rental car lot expansion and relocation	-240	1,954	1,825
		Long-term parking would be expanded into land to the north of the overflow lot. This land is not owned by the airport and would have to be acquired	600		
Employee Parking	284	Expected airside expansion would marginally impact the existing employee lot.	-14	270	217

Source: HNTB analysis.

Concept 2: Aviation Drive in Operation and No Land Acquisition

Concept 2 (**Figure 6-15**) assumes that land immediately adjacent to the Airport campus would/could not be acquired. In Concept 2, the circulation and curb roads are treated in the same manner as in Concept 1. The same assumptions regarding Aviation Drive and the new intersection configuration also apply. The security check point also would be located as in Concept 1.

The short-term parking lot would be expanded in the same manner as Concept 1, displacing the existing rental car lot. However, in this concept, the rental car lot would be moved east of Aviation Drive. Again, this maintains the existing entry and exit plazas for short- and long-term public parking.

With no land available for expansion, future requirements would be accommodated by constructing a garage on part of the existing overflow lot. This garage would house long-term parking and rental cars. The latter would be located on the first floor at the north end of the garage (the end closest to the terminal) with access and egress independent of the long-term parking.

The proposed garage would be three levels and would have sufficient capacity through future year 2045. Although this means that this concept would have significantly more capacity than others, it is advisable to have a single construction period to minimize impact on Airport operations. Expanding, or otherwise modifying, an existing structure can be difficult and may be impossible without effectively closing down the garage for the period of additional construction.

The proposed garage would be connected to the terminal by a pedestrian walkway that would pass over Aviation Drive and then either ramp down to Level 1 of the terminal, or remain raised and connect to Level 2.

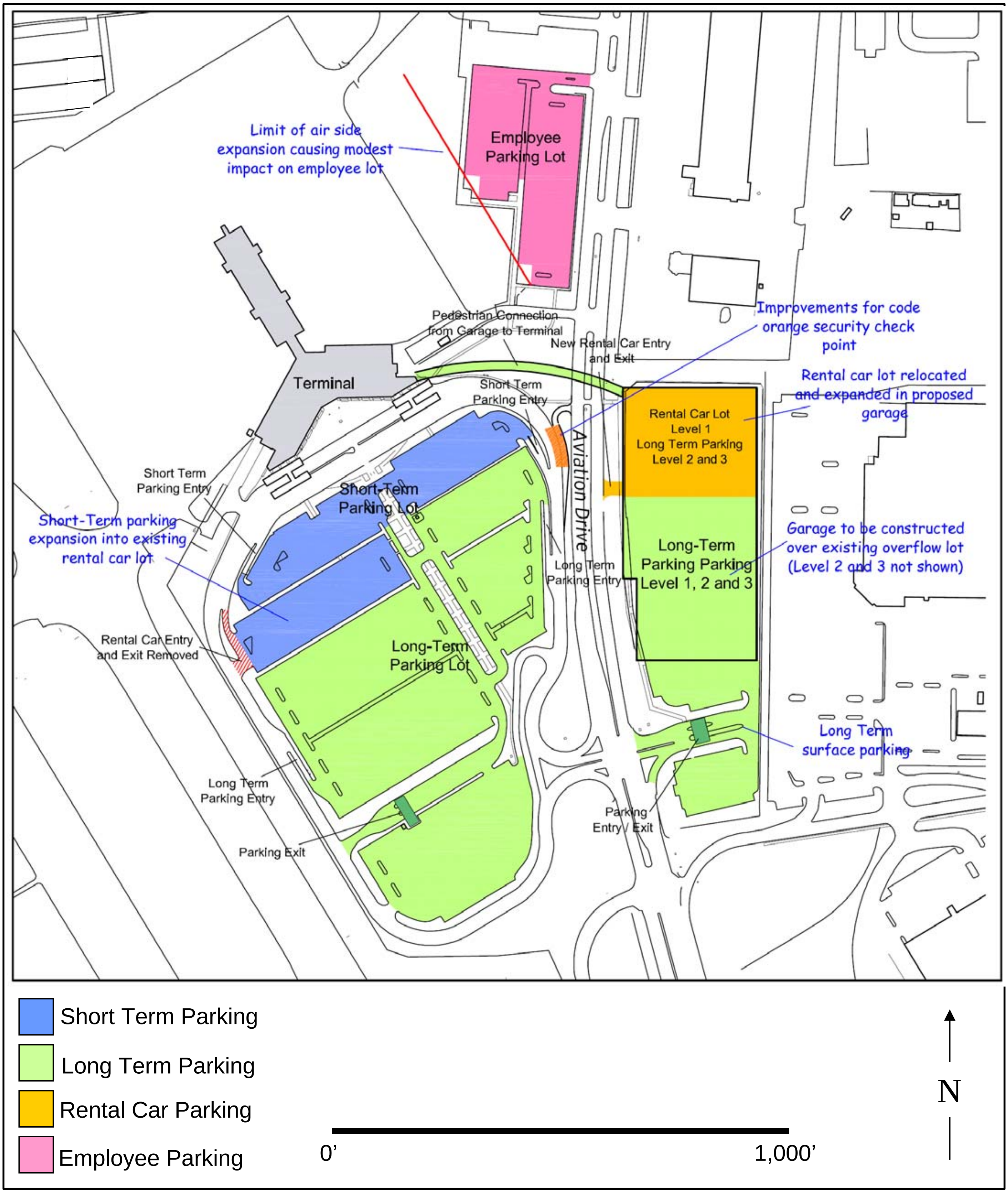
The employee lot in Concept 2 would be modestly impacted but retain sufficient capacity as in Concept 1.

Tables 6.3 and 6.4 summarize Concept 2 both with and without a garage structure.

Concept 3: Consolidated Campus with Loop Road

The idea behind this concept is to resolve confusion as to the location of the entrance to the Airport, and to minimize the impact on the Airport of the growth and development of retail and other land uses adjacent to the Airport. To meet these objectives, this concept requires a significant reconfiguration of the Airport campus and adjacent facilities. The proposed landside configuration is shown in **Figure 6-16**.

This concept proposes the creation of a perimeter loop road with a consolidated parking area within it. It assumes that Aviation Drive could be closed and removed from the regional road network. This land would then be redeveloped to provide parking for the Airport, surrounded by a loop roadway which begins at the new northern terminus of Aviation Drive. The circulation loop road would have a two-lane section matching the existing infrastructure



ROANOKE REGIONAL AIRPORT

Landside Campus Concept—Layout 2

FIGURE 6-15

Source: HNTB analysis.

Table 6.3

Summary of ROA Landside Campus Concept 2

Product	Existing Spaces	Alteration / Expansion	Net Impact - Spaces	Future Total Spaces	Projected Required Spaces
Short-term Parking	220	Existing rental car lot converted to short-term parking.	160	380	307
Rental Car Lot	160	Rental car lot location moved and expanded on level 1 of the proposed garage on existing overflow lot	80	240	237
Long-term Lot (including overflow lot)	1,594	Overflow lot would be used permanently for long-term parking. Existing long-term lot impacted by rental car lot expansion and relocation	-240	~ 2,474*	1,825
		A parking structure would be constructed on a substantial part of the existing overflow lot. The lower level (level 1) would be split between rental cars and long-term parking. Level 2 and 3 would house only long-term parking. A small section of surface parking would be retained.	1,120		
Employee Parking	284	Expected airside expansion would marginally impact the existing employee lot.	-14	270	217

Note* Garage sized for 2045 requirements to allow a single construction period for the proposed structure.

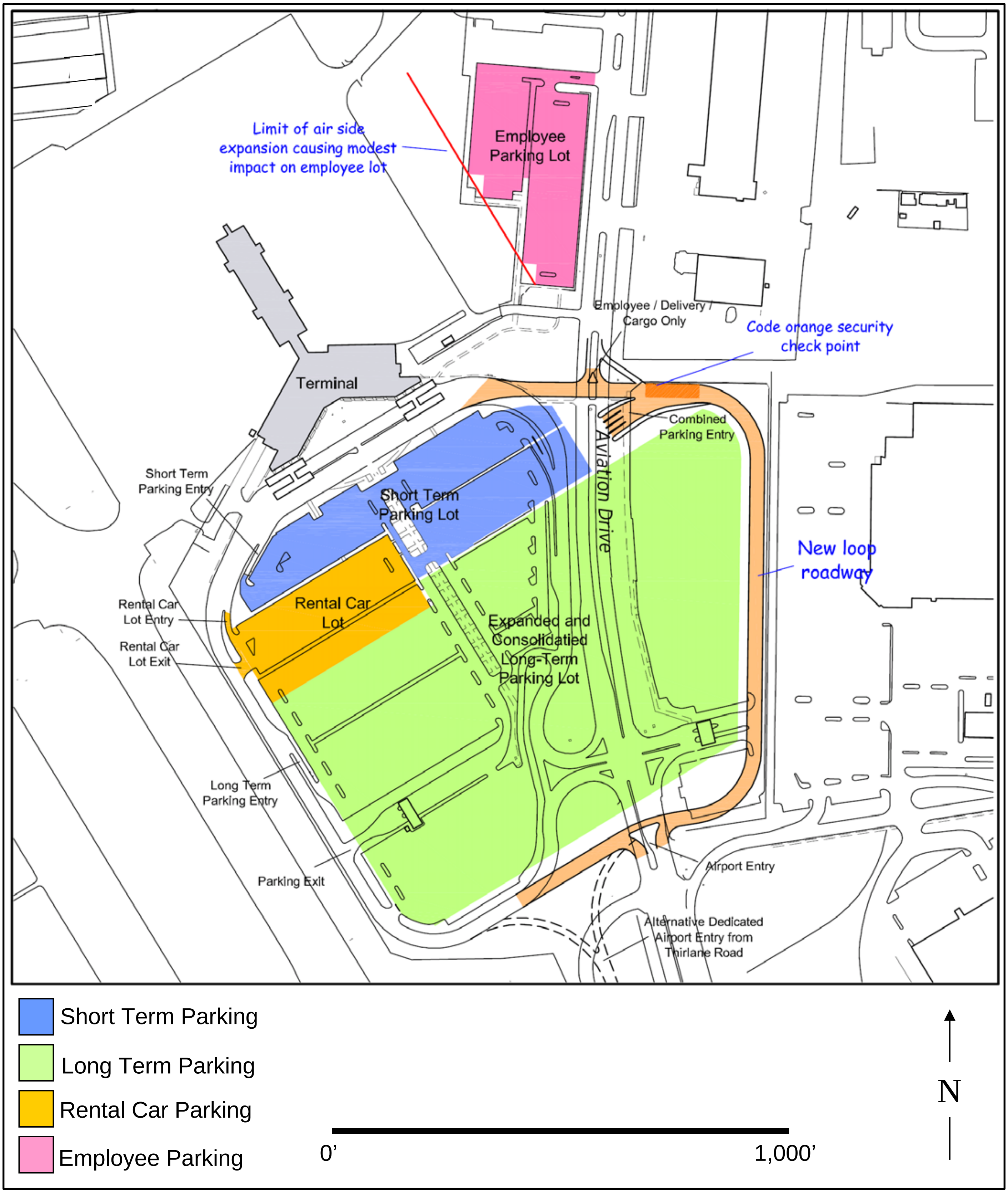
Source: HNTB analysis.

Table 6.4

Summary of ROA Landside Campus Concept 2 Proposed Garage

Garage Location	Use	Capacity 2025	Capacity 2045	Requirements for the Garage 2025	Requirements for the Garage 2045
Level 1 – North	Rental Cars	240	319	237	314
Level 1 – South	Long-Term Parking	325	243		
Level 2	Long-Term Parking	562	562		
Level 3	Long-Term Parking	562	562		
Surface Parking	Long-Term Parking	75	75	784	1,408
Total:		1,760	1,760	1,021	1,722

Source: HNTB analysis.



ROANOKE REGIONAL AIRPORT

Landside Campus Concept—Layout 3

FIGURE 6-16

Source: HNTB analysis.

(the curb roads would remain unchanged) and would be aligned as close to the perimeter of Airport-controlled land as possible. This would maximize both the available distance for wayfinding and the area within the loop for parking.

The security check point would be located at a purpose-built area in the location shown.

Short-term parking would be expanded into the existing long-term lot and the existing circulation road and Aviation Drive. The rental car lot is retained in its current location and expanded into the existing long-term lot. Long-term parking would be located on the remains of the existing and overflow lots, and would be expanded into the existing circulation road, Aviation Drive, and areas of landscaping. A single entry plaza location would replace the existing multiple pre-curb entries. The post-curb entry and exit points, including those for the rental car lot, would be retained.

The employee lot is modestly impacted but retains sufficient capacity as explained under Concept 1. **Table 6.5** summarizes the proposal.

Evaluation and Recommendation of Concepts

The concepts were compared against each other relative to the various objectives of landside improvements. **Table 6.6** presents a summary of the evaluation. From the data in the table, it is clear that the simplest option, Concept 1, was the most feasible. While it requires the acquisition of adjacent property (the trucking terminal just north of overflow parking on Aviation Drive), it does not interfere with the public right-of-way, which could be a major issue with the City. Concept 1 also preserves the ability of the Airport and the City to reach agreement on an entrance improvement in conjunction with the City's desire to revise the intersection of Thirlane/Aviation/Towne Square Boulevard.[6]

Perhaps the biggest downsides of Concept 1 are the walking distances from the farthest sections of long-term parking and the need for an increased number of long-term parkers to cross Aviation Drive. All walking distances, though, are within the current maximum distance, and the Airport has the option of operating a shuttle to assist passengers who desire it. The grade-crossing of Aviation will need to be improved with the latest pedestrian safe-crossing technologies appropriate to the relatively small volume of pedestrians and traffic speeds.

6.5.2 Interim Roadway Proposals – Thirlane Road

One of the continuing issues at ROA is the confusion that some drivers have on the northbound approach to the Airport entrance on Aviation Drive. Some make a premature turn into Thirlane; conversely, some drivers looking for Thirlane miss the earlier left turn, and turn instead into the Airport. One approach to resolving this confusion would be to revise how/where Thirlane Road connects to Aviation.

[6] Analysis of the impact of the City's proposed intersection configuration on Airport traffic is provided in Appendix F.

Table 6.5

Summary of ROA Landside Campus Concept 3

Product	Existing Spaces	Alteration / Expansion	Net Impact - Spaces	Future Total Spaces	Projected Required Spaces
Short-Term Parking	220	Short-term parking expanded into long-term lot.	160	380	307
Rental Car Lot	160	Rental car lot expanded into long-term lot.	80	240	237
Long-Term Lot (including overflow lot)	1,594	Existing long-term lot impacted by short-term parking lot and rental car lot expansion.	-240	1,834	1,825
		Loop roadway replaces Aviation Drive and allows the existing long-term lot and overflow lot to consolidate and utilize the redundant alignment.	680		
Employee Parking	284	Expected airside expansion would marginally impact the existing employee lot.	-14	270	217

Source: HNTB analysis.

Table 6.6

Parking and Roadway Concepts Solution

Criterion	Concept 1: Aviation Drive in Operation and Land Acquisition Required		Concept 2: Aviation Drive in Operation and No Land Acquisition		Concept 3: Consolidated Campus with Loop Road	
	Note	Rank	Note	Rank	Note	Rank
Proximity of short-term parking to the terminal	Expansion as close to terminal as possible	`	Expansion as close to terminal as possible	=	Expansion as close to terminal as possible	=
Proximity of Rental Car parking to the terminal	Rental cars moved slightly further from terminal building	2	Rental cars moved much further from terminal across Aviation Dr.	3	Rental car lot in existing location with some expansion	1
Land acquisition	Requires additional parcel currently in private ownership	2	Does not required additional land	1	Requires additional land taken from existing public right-of-way	3
Walkable parking	All parking within existing ranges	=	All parking within existing ranges	=	All parking within existing ranges	=
Simplicity of circulation / wayfinding	Retains existing layout. Signing and circulation to remote lot somewhat problematic	2	Retains existing layout. Signing and circulation to remote garage somewhat problematic	2	Increased distance for signing and single campus	1
Compatibility with secondary access from north, Peters Creek Road	Compatible with all secondary access options	1	Compatible with all secondary access options	1	Not compatible with secondary access option	3
Compatibility with 2045 requirements	Requires structure or more land acquisition at 2045	2	Compliant with 2045 requirements	1	Requires structure or more land acquisition at 2045	2
Meets 2025 parking requirements	Meets 2025 parking requirements	=	Meets 2025 parking requirements	=	Meets 2025 parking requirements	=
Consolidation of campus	Compact but expanded and split campus	3	Compact but split campus	2	Compact and consolidated campus	1
Impact of construction	Much of the existing infrastructure is retained and new construction is off-site. Disruption would be minimal.	1	Overflow lot lost for duration of construction of parking structure, main campus largely unaffected.	3	Most parts of the existing campus would be affected at some point. However, intelligent phasing should minimize impact overall.	2
Institutional feasibility	One acquisition required, but still feasible.	2	No acquisitions required; feasible	1	Difficult to close public road; City will likely oppose	3
Cost	Dependent upon land costs but otherwise retains much of the existing infrastructure	1	Parking structure required	3	Dependent upon land costs and reconstruction is significant	2
Cumulative Points		16		17		18
Overall Rank		**1**		**2**		**3**

Source: HNTB analysis.

Four concepts for revising the Thirlane/Aviation interface were developed. They are shown in **Figures 6-17 through 6-20**.

Concept 1

The first concept simply closes Thirlane Road beyond its current intersection with Hershberger Road. Thirlane Road would be right-in, right- out only at Hershberger Road in order to not create traffic issues on Hershberger. This eliminates the confusion, but also eliminates the interconnection, which may be troublesome for some Airport-related activities. This concept would increase vehicle miles traveled (VMT) for some vehicles that use Thirlane Road as they divert to alternate routes or recirculate in order to gain access. Also any trucks or other vehicles that currently use Thirlane Road to access the Airport would have to find alternative routes.

Concept 2

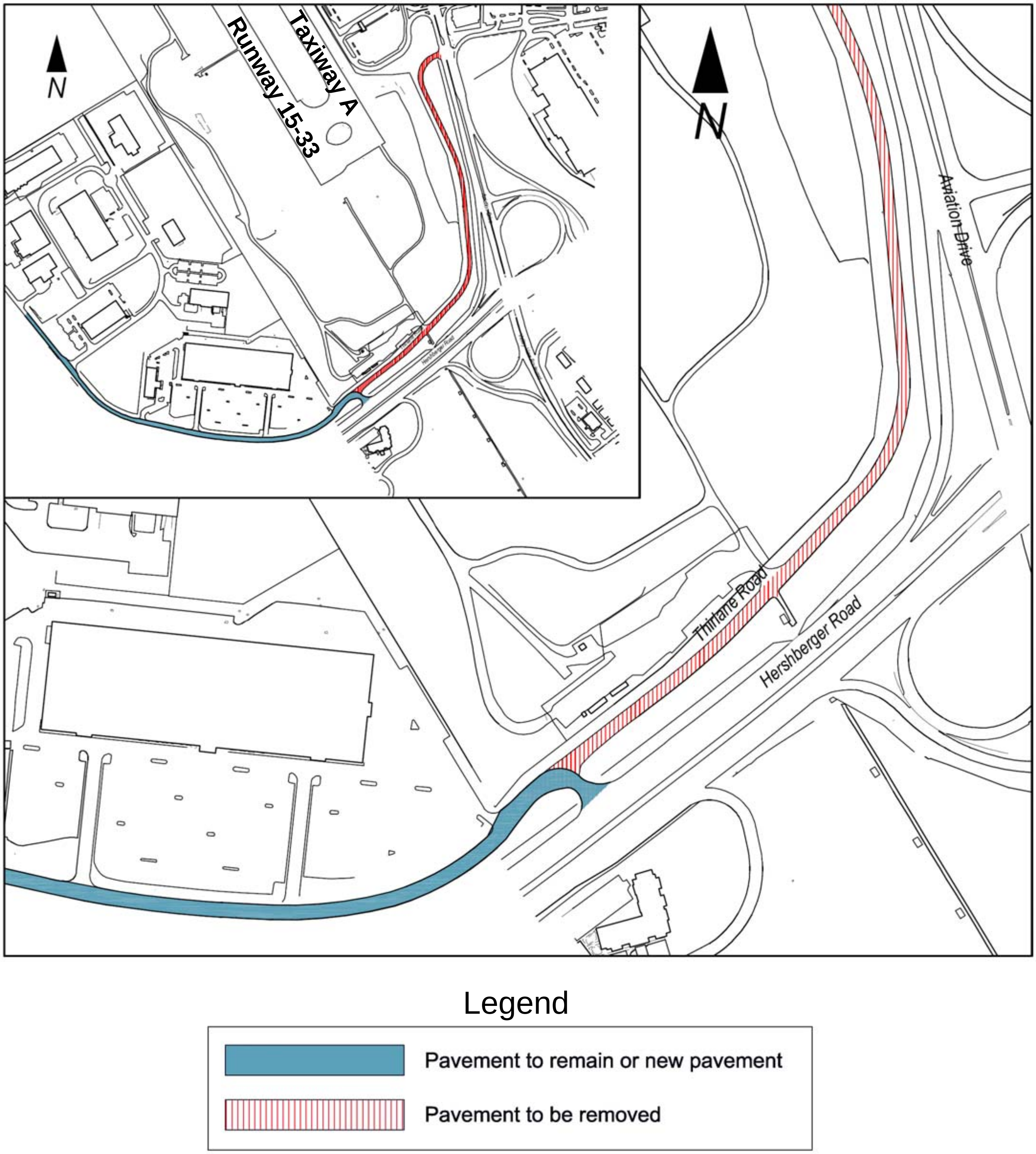
Concept 2 also eliminates the inter-connection between Thirlane and Aviation. It introduces an at-grade intersection of Thirlane with Hershberger Road that would allow all movements. This is an improvement over Concept 1 as it would help reduce overall VMT by providing more direct access to Thirlane Road, rather than via Aviation Drive. However, Hershberger Road, certainly in the impacted section, is a high-speed, limited-access highway, hence, the introduction of a signalized intersection would be incongruent with expectations. The signal would also increase delay for all vehicles using Hershberger Road and Thirlane Road including Airport-destined vehicles heading eastbound on Hershberger Road. The signal potentially would create disruption on an important regional facility.

Concept 3

The third concept involves substantial additional construction, rerouting Thirlane Road under Hershberger Road and ultimately connecting, via a new signalized intersection, with Valley View Boulevard. This avoids impacting Hershberger Road. This concept is, however, the most costly to construct and would increase delay and traffic on Valley View Boulevard. As well, the alignment of Thirlane would pass through the RPZ south of the Airport. It would be problematic to achieve FAA approval of such an alignment.

Concept 4

The final concept relocates the connection of Thirlane and Aviation to the existing intersection of Aviation and the ramps to/from Hershberger Road. The ramp from westbound Hershberger terminates at a stop sign, where ramps to westbound Hershberger leave from northbound and southbound Aviation. While providing for all movements between Thirlane and Aviation, this location does not permit the traffic using the flyover from eastbound Hershberger to northbound Aviation to enter Thirlane from Aviation. Instead, this movement would need to be directed to connect to land uses along Thirlane west of the Airport via the I-81 interchange at Peters Creek Road, rather than via the interchange at Hershberger.

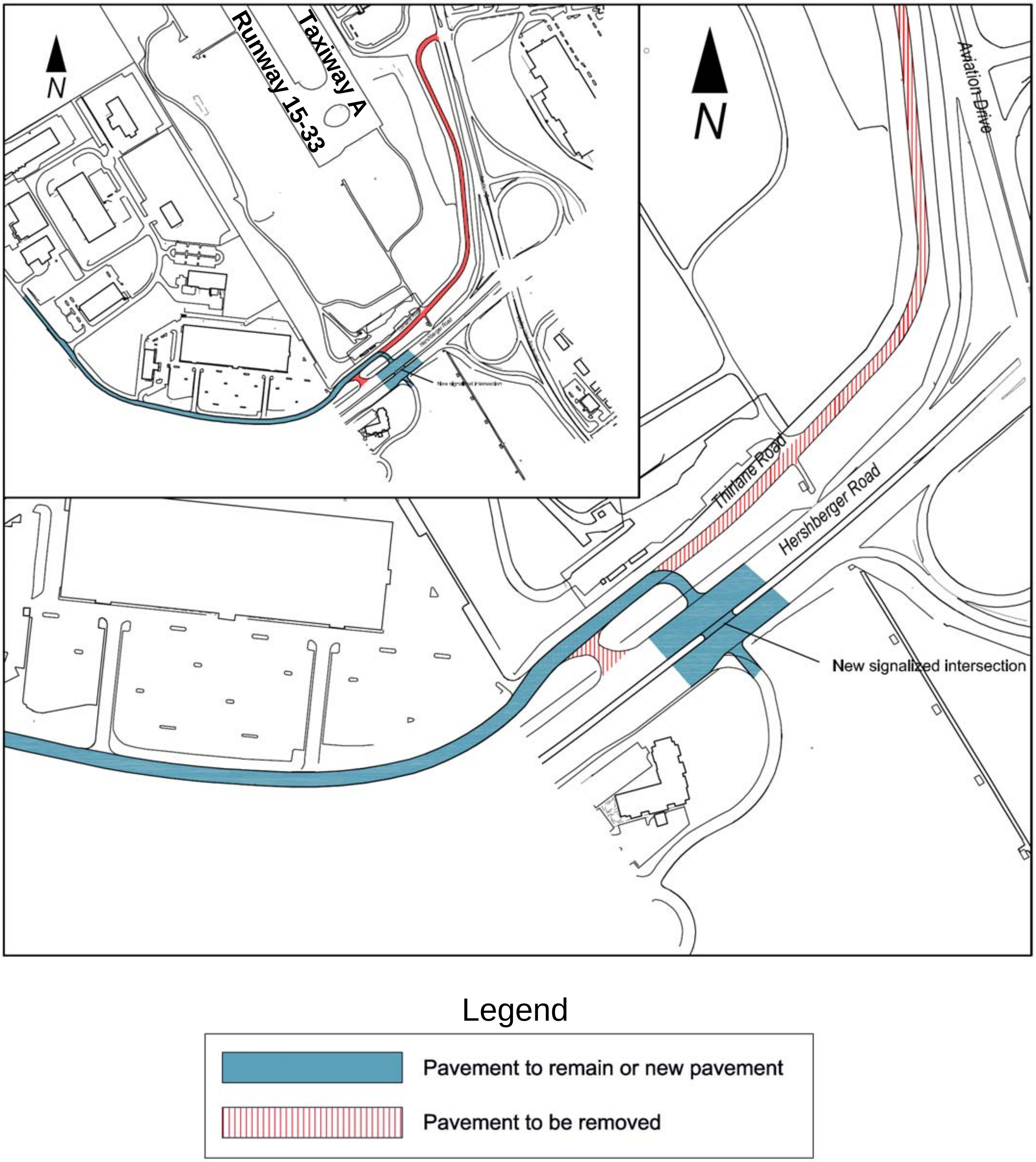


ROANOKE REGIONAL AIRPORT

Thirlane Road--Concept 1

FIGURE 6-17

Source: HNTB analysis.

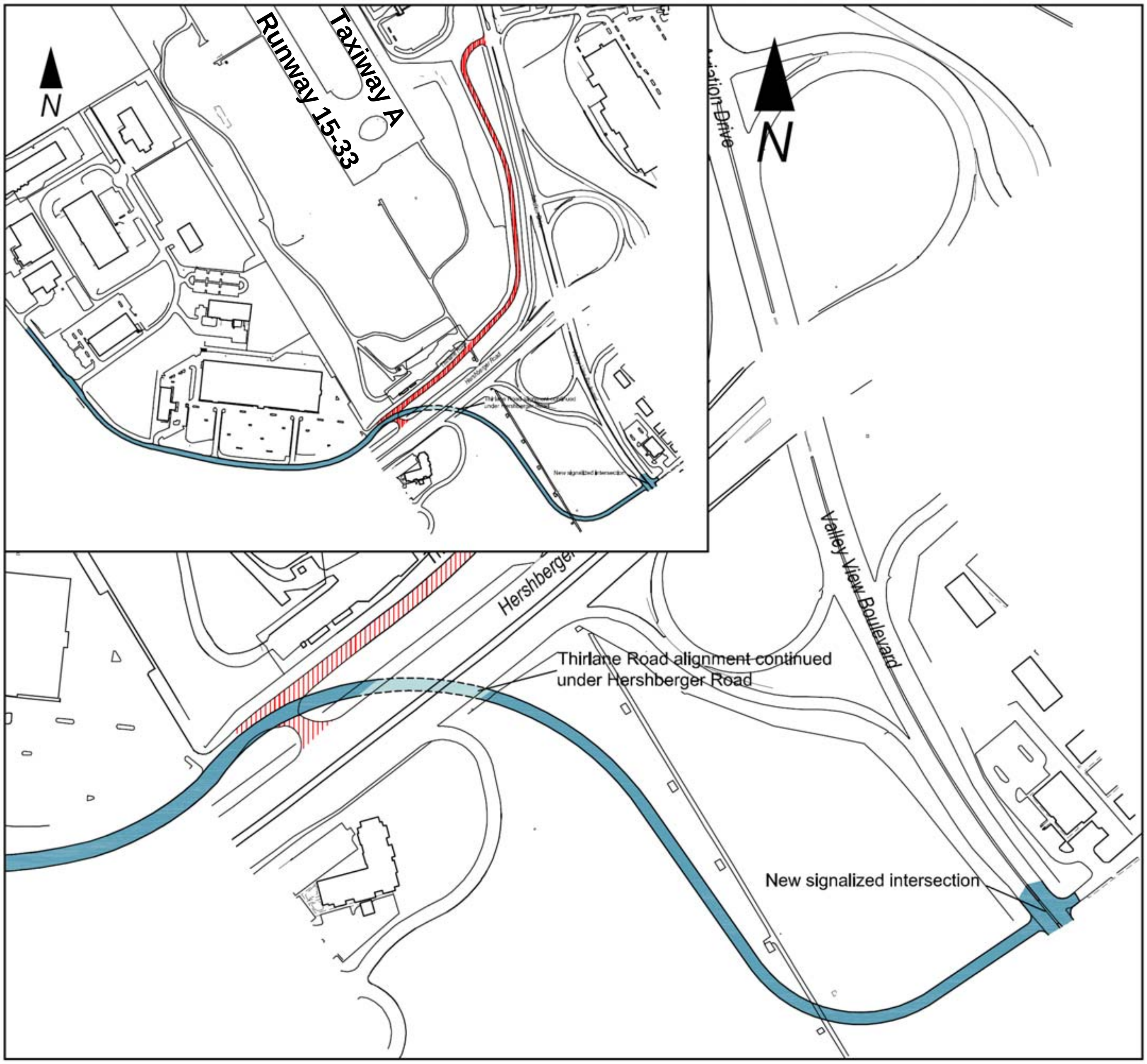


ROANOKE REGIONAL AIRPORT

Thirlane Road—Concept 2

FIGURE 6-18

Source: HNTB analysis.

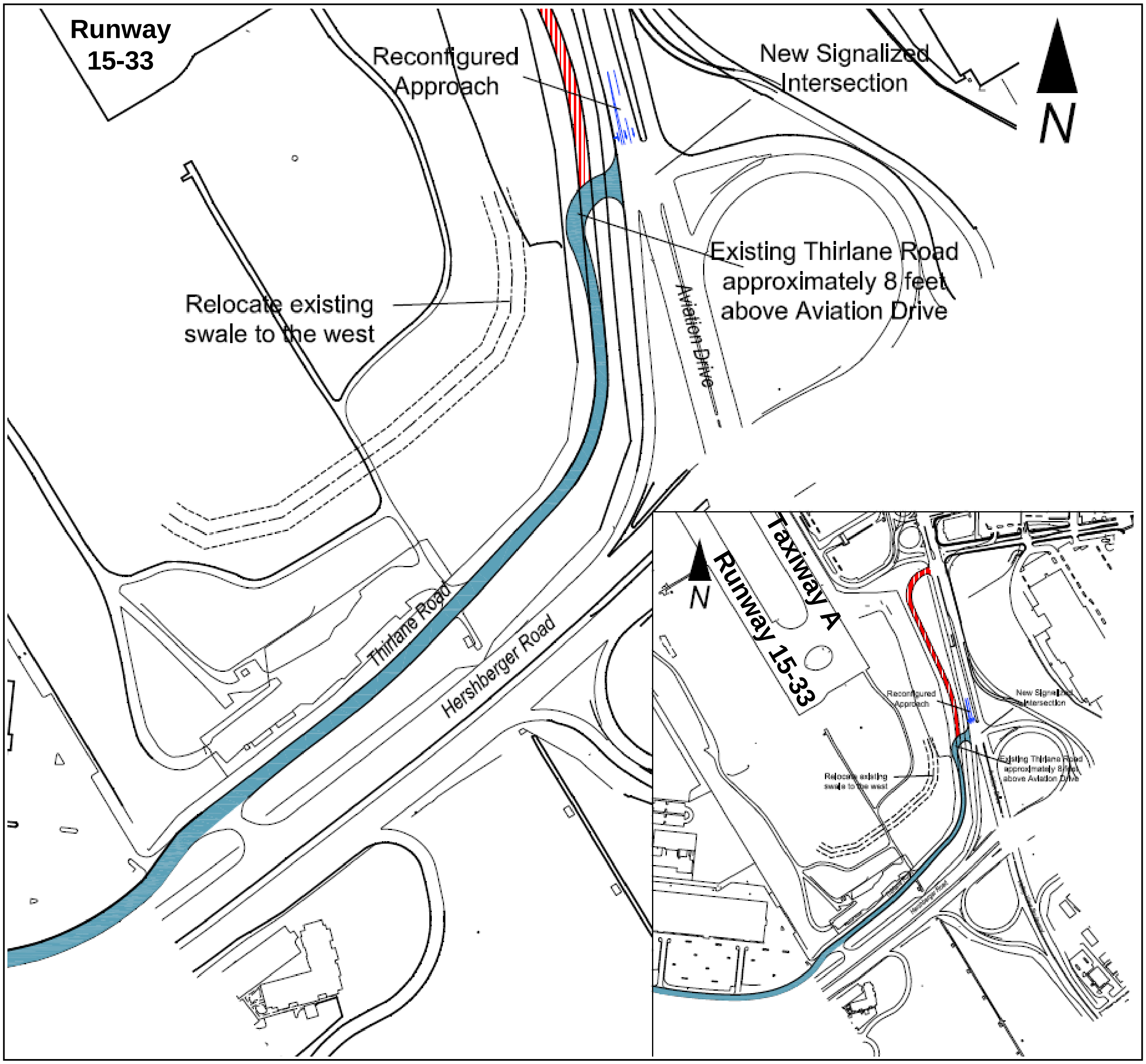


ROANOKE REGIONAL AIRPORT

Thirlane Road--Concept 3

FIGURE 6-19

Source: HNTB analysis.



ROANOKE REGIONAL AIRPORT

Thirlane Road--Concept 4

Source: HNTB analysis.

FIGURE 6-20

Evaluation and Recommendation of Concepts

The four concepts were evaluated relative to:

- Ability to eliminate confusion on the approach to the Airport;
- Maintenance of regional connectivity;
- Ability to segregate Airport traffic from non-airport traffic;
- VMT;
- Traffic operational impacts;
- Safety;
- Cost; and,
- Institutional feasibility.

Based upon the potential for the FAA to not approve a new roadway through the RPZ, Concept 3 was eliminated. Similarly, the safety and traffic operational impacts on Hershberger eliminated Concept 2. Concept 1 was found to not adequately serve Airport-related traffic as well as non-airport traffic. Only Concept 4 was considered feasible. While there are approval issues (relative to the limited access line set by the Virginia Department of Transportation), and engineering feasibility issues which will need to be resolved, this solution decidedly gives the Airport an advantage in eliminating the adverse interference and confusion which a Thirlane connection to Aviation creates, either in its current location or in the proposed revision by the City.

6.5.3 Mid-Range Roadway Proposals – Secondary Access

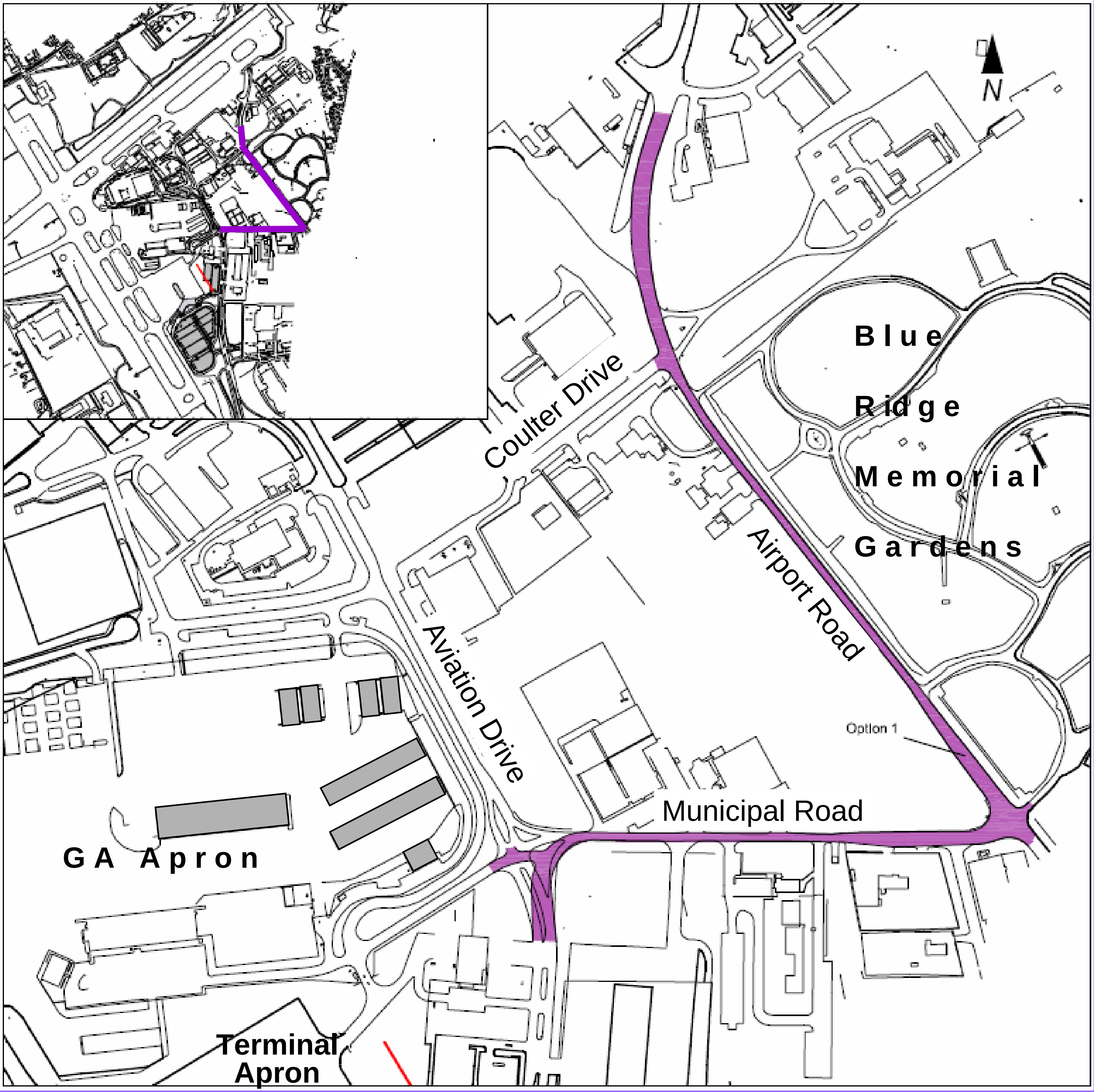
ROA is heavily dependent on its primary access route from the interstate system, which is via Hershberger Road. As part of the access review for the Master Plan Update, a review was made of the secondary access route, via the Peters Creek Road interchange, and then to Airport Road and Municipal Drive. The purpose of this is twofold: To lessen the reliance on Aviation Drive northbound, and to develop an alternate route for traffic from the north via Peters Creek Road and Airport Road. The review considered the capacity, traffic operational, wayfinding, and safety issues associated with a secondary access route. Each concept which was considered is described below.

Concept 1: Municipal Drive

Figure 6-21 shows the simplest secondary access concept. The proposal is to continue to use Airport Road and Municipal Road, and add modest improvements at Aviation Drive to give priority to Airport traffic. Consideration should be given to additional improvements that would further enhance the quality of service provided to Airport traffic. These include widening Airport Road to Municipal Road to increase capacity and LOS, and providing a free right turn lane into Municipal Road from Airport Road, improving service for Airport-bound traffic.

Concept 2: Coulter Drive

The second concept would improve the intersection of Airport Road and Coulter Drive, and extend Coulter Drive to Aviation



ROANOKE REGIONAL AIRPORT

Secondary Access Concept 1—Municipal Drive

Source: HNTB analysis.

FIGURE 6-21

Drive, and is shown in **Figure 6-22**. This would provide a more direct route to the Airport and would separate Airport traffic from the general traffic on Airport Road. This concept would require the acquisition of land not currently part of the Airport.

Concept 3: New Alignment

Concept 3 proposes a new direct alignment, as shown in **Figure 6-23**, between Airport Road and Aviation Drive. This would require the acquisition of a significant amount of additional land; however, this concept provides the highest quality of service for Airport traffic and provides the most direct route between Airport Road and Aviation Drive.

Evaluation and Recommendation of Concepts

The concepts were evaluated based on their ability to serve traffic, cost, and institutional feasibility. **Table 6.7** summarizes their features and key considerations in the evaluation.

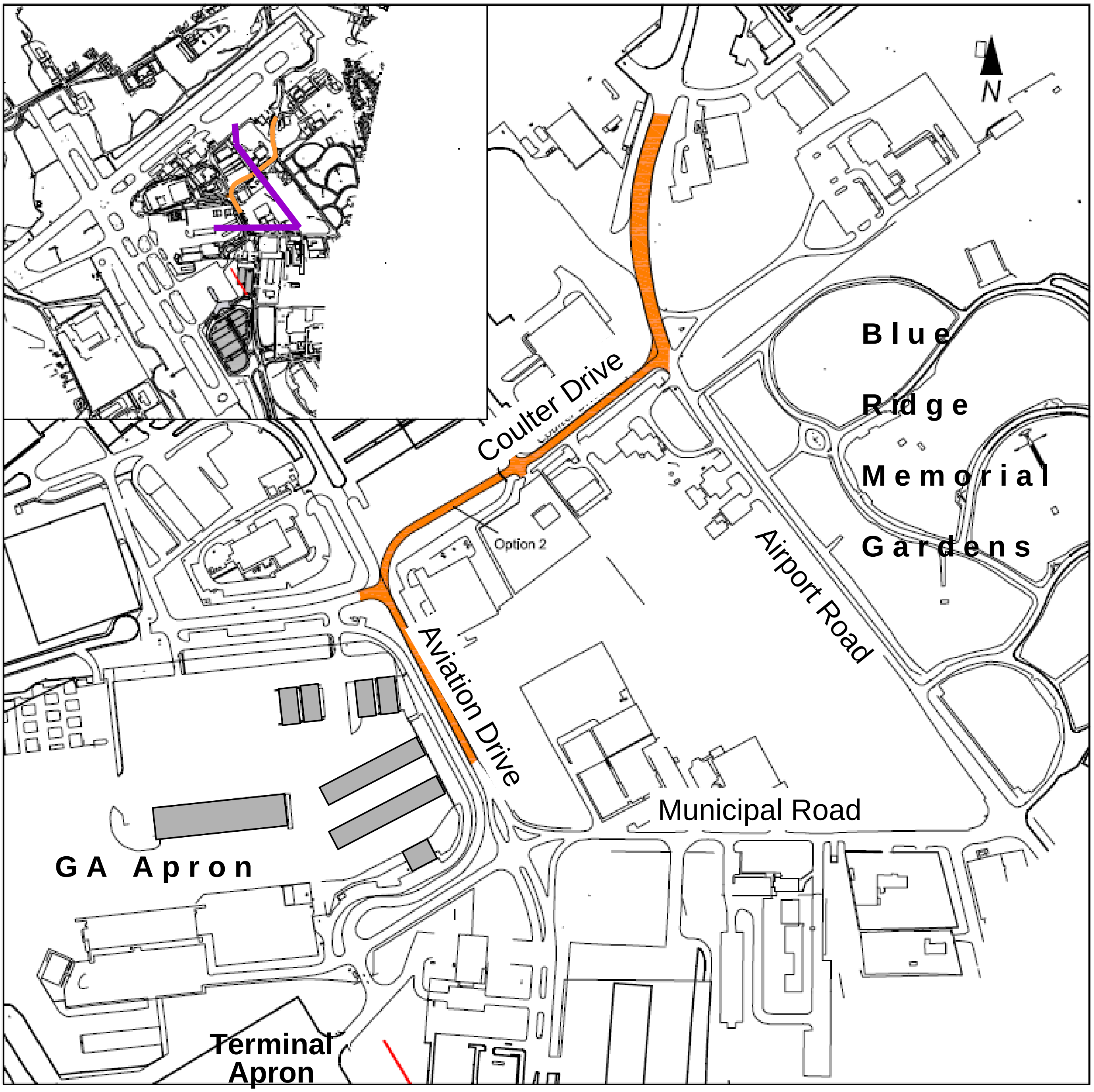
On the basis of this evaluation, Concept 1 was determined to be the most beneficial and rational course to pursue relative to secondary access.

6.5.4 Long-term Roadway Proposals – I-581 Access

Aviation Drive currently serves as the approach road to ROA. Traffic from the regional roadway system is directed from I-581 to the Airport primarily via the Hershberger Road interchange. The majority of Airport traffic comes from the south, and has a secondary option of using the Valley View Drive exit from the freeway, but that entails a longer, slower path through the commercial area near the Mall. From the north, the secondary access options discussed above are intended to reduce dependency on the Hershberger/ Aviation primary access path, as it is congested, especially at times when retail traffic peaks.

With the growth of retail traffic outstripping the growth of Airport traffic, the Hershberger interchange is now primarily a retail access point, and Airport traffic is a secondary concern. Over time, this could prove problematic to the Airport, which needs a clear path from the regional roadway system (i.e., the freeway) to serve the many occasional users who rely on wayfinding and a clear connection to make their flights.

In the long-term, the Airport would be best served by a more direct connection to the interstate, so as to separate Airport traffic from conflicts with background traffic. To this end, two concepts were developed, shown in **Figures 6-24 and 6-25**. Both concepts assume the construction of collector-distributor (CD) roads on both sides of the existing I-581 corridor that would run from north of the interchange at Peters Creek Road to south of the Hershberger Road interchange. These CD roads would provide for a new interchange for the Airport, which would connect to either Thirlane Road or a new dedicated Airport entrance road.

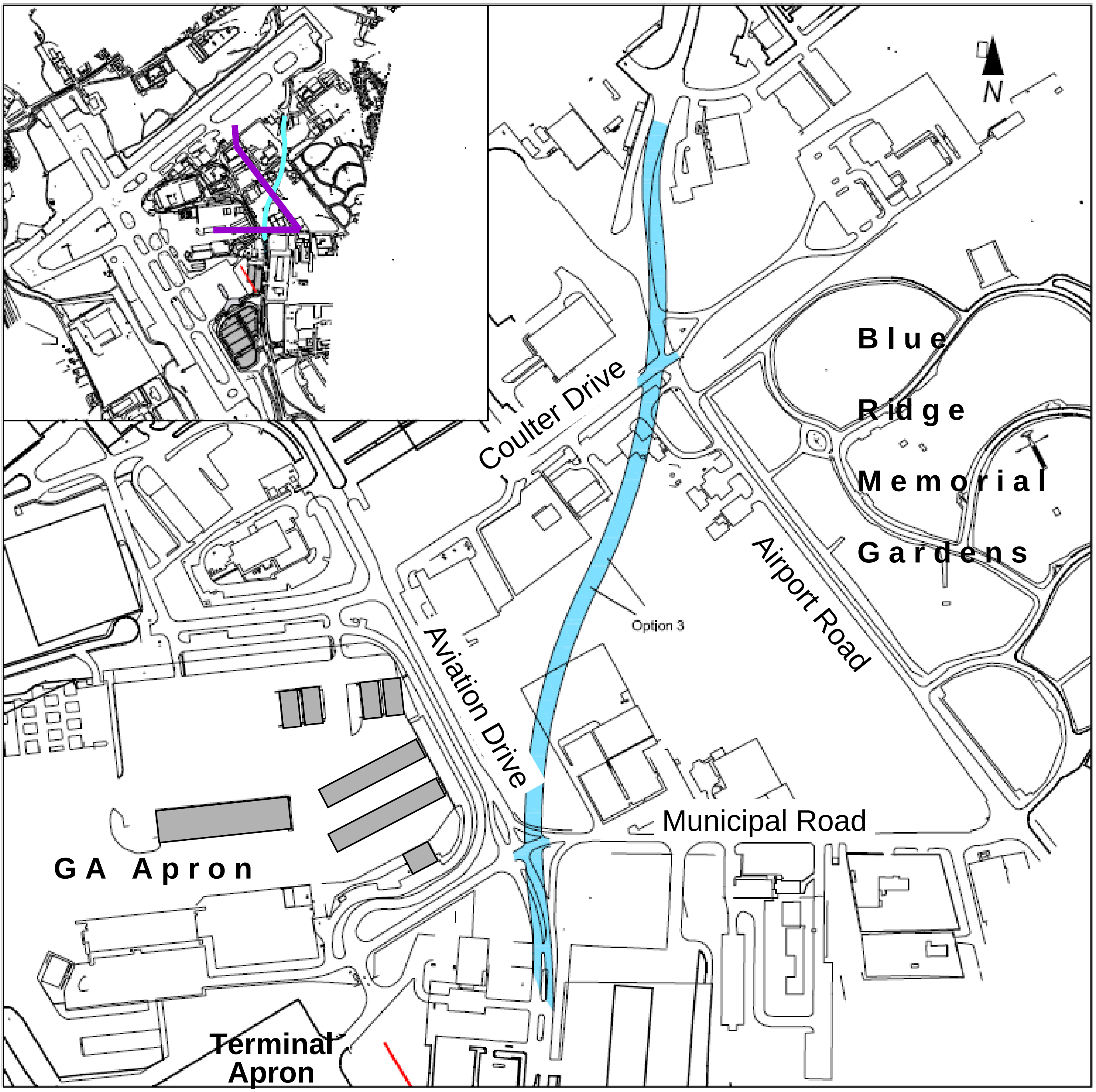


ROANOKE REGIONAL AIRPORT

Secondary Access Concept 2—Coulter Drive

Source: HNTB analysis.

FIGURE 6-22



ROANOKE REGIONAL AIRPORT

Secondary Access Concept 3—New Alignment

FIGURE 6-23

Source: HNTB analysis.

Table 6.7

Secondary Access Evaluation

Option	Features	Evaluation Considerations
Concept 1 – Municipal Road	Minimal disruption to existing network	Provides only small improvements over existing route and is not very direct
	Utilizes existing facilities and alignments	Does not separate airport traffic from other vehicles on Airport Road
	Realignment of Municipal Road and Aviation Drive intersection to create Municipal Road to Aviation Drive through movement. Hence giving priority to traffic bound for airport campus	Lowest cost
	Requires little to no land acquisition	Minimal impacts on other interests
Concept 2 – Coulter Drive	Little disruption to existing network	Requires some land acquisition
	Utilizes some existing facilities and alignments	New intersection would introduce more delay for general traffic on Airport Road
	Separates airport traffic from general traffic on Airport Road	Tie-in between extended Coulter Drive and Aviation Drive would impact airport roads and may require changes to circulation
	Modestly more direct than existing configuration	Moderate cost
		Impacts on others and approvals required
Concept 3 – New Alignment	Separates airport traffic from general traffic	Requires substantial land acquisition
	Provides a very direct route to the airport	Involves significant changes to the existing network
	Provides high quality facility for airport traffic	Highest cost
	Give maximum priority to airport traffic from Airport Road to the airport campus	Highest impacts on others
	Simply signing and wayfinding	

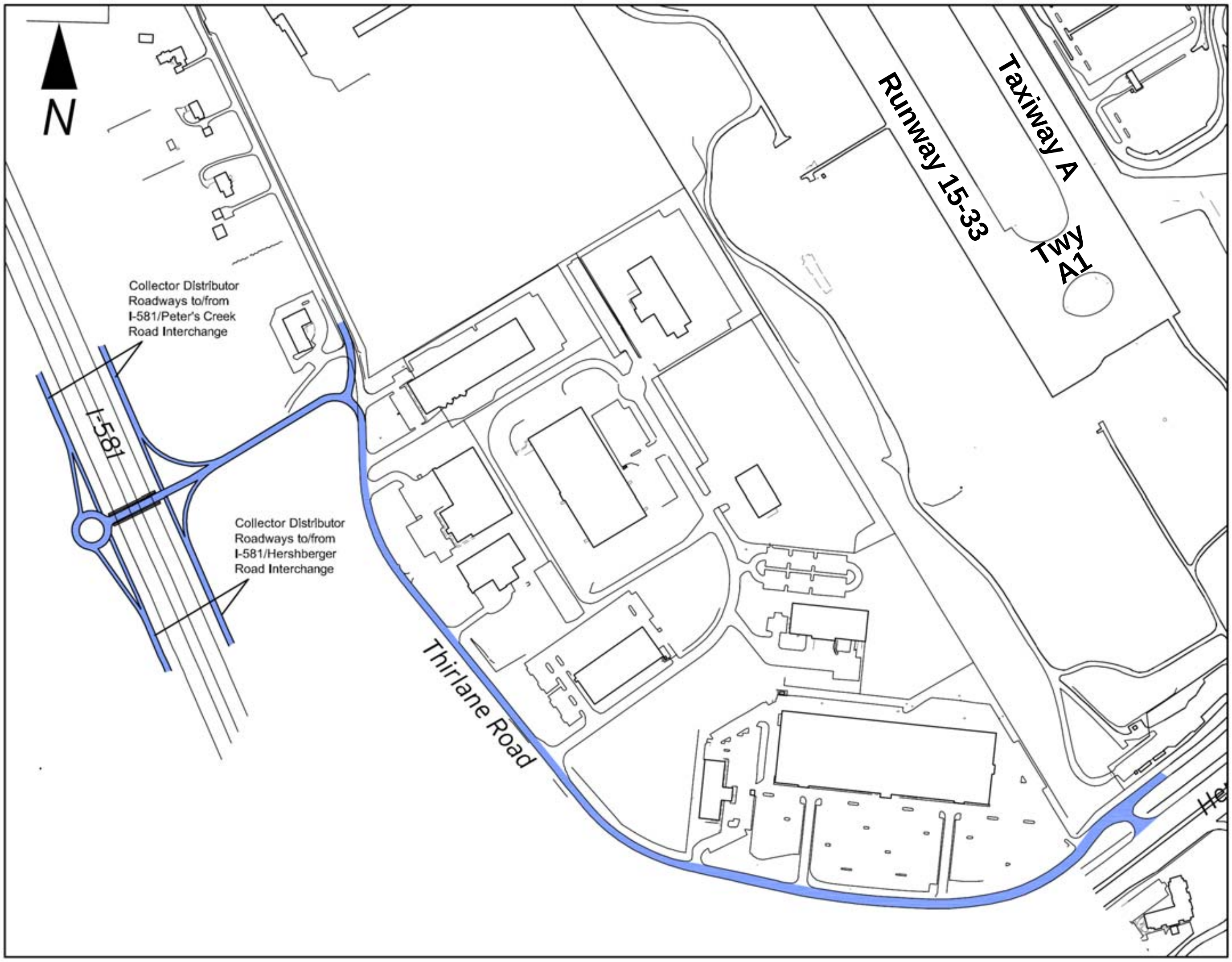
Source: HNTB analysis.

ROANOKE REGIONAL AIRPORT

I-581 Access Concept 1

Source: HNTB analysis.

FIGURE 6-24



ROANOKE REGIONAL AIRPORT

I-581 Access Concept 2

FIGURE 6-25

Source: HNTB analysis.

The timing of these concepts is related to improvements under consideration by others. The VDOT has been developing very long-range plans for I-73/74, a new interstate highway which would connect Charleston, South Carolina to Sault Ste. Marie, Michigan, and pass by the Airport on the current I-581 right-of-way. Alternatively, I-581 may require upgrading independent of the I-73 concept due to regional growth. In either case, the idea of a new Airport interchange is only appropriate at the point when VDOT moves forward with improvements to the adjacent interstate.

Concept 1: New Dedicated Entrance Road

The new dedicated two-lane road would skirt the edge of the AOA around the south end of Runway 15-33. In keeping with the recommended improvement to Thirlane Road and its new intersection with Aviation Drive, the new Airport entrance roadway would be on a separate and parallel alignment between Hershberger Road and the end of the runway, adjacent to the AOA.

Concept 2: Thirlane Road as New Airport Entrance from the Interstate

In this concept, rather than a new roadway on new alignment, the Airport traffic would mix with local traffic on Thirlane Road. From the proposed new intersection of Thirlane and Aviation, the Airport entrance roadway would parallel Aviation Drive (to the west between Aviation and the AOA), connecting to the Airport Terminal loop road where the current entrance is today.

Evaluation and Recommendation of Concepts

The two concepts were considered from the perspectives of traffic operations, wayfinding, degree of separation of Airport traffic, cost, and institutional feasibility. Concept 1, while higher in cost, achieves sound traffic operations, ease of wayfinding, and separation of Airport traffic. Concept 2 would create traffic operational issues at three locations: the new intersection with Thirlane where the ramp comes from the interstate; at the Hershberger Road right in/right out intersection; and, at the proposed new intersection of Thirlane/ Aviation. Each of these would also be wayfinding issues for infrequent Airport users. In summary, if a new access route is to be created, the recommended concept is to provide a separate roadway.

6.6 AIR CARGO CONCEPTS

While the overall cargo site is sufficiently sized for future cargo activity, the existing facility is somewhat site-constrained in terms of its depth. Currently, larger all-cargo aircraft must park either diagonally or perpendicularly in relation to the cargo buildings on the apron. Although the cargo carriers have not expressed a desire to improve the layout of the current cargo site, two concepts were considered for providing a high-quality cargo facility.

In general, an apron depth of approximately 800 feet is necessary to provide sufficient space for a taxiway/ taxilane, service road, straight-in parking for an ADG-IV aircraft, marshaling area, a 100-

foot wide cargo building, truck docks, and auto parking.

Two concepts were considered as sites for air cargo facility expansion: 1) Improve the existing air cargo apron on the southeast end of Runway 6-24, and 2) Relocate cargo activity to a new site in the Northwest Quadrant.[7]

The first concept consists of expanding the depth of the existing cargo site through the acquisition of a portion of the Nordt property directly adjacent to the cargo area, as shown in **Figure 6-26** The estimated cost for this land is approximately $0.5 million. The total cost of improvements at this site to meet future cargo demand with a high LOS ranges between $8 to $12 million. This cost, coupled with the benefit of maintaining reasonable proximity to the passenger terminal area (which would aid in the transfer of belly cargo), are the two key advantages of this concept.

The second concept provides a new 15-acre air cargo facility in the Northwest Quadrant, which provides sufficient space for a well-laid out cargo facility. The advantages of this concept include the site's ability to be expanded beyond 2025 requirements, its direct access to Peter's Creek Road, and its proximity to I-581. The primary disadvantage of this concept is its high development cost (at least $65 million). A second disadvantage is the site's distance from the passenger terminal area, which would increase the time to transfer belly cargo. Finally, this concept would require the relocation of the ASR facility.

Based on the analysis above, continued development of the existing cargo site, including land acquisition when feasible, is the preferred concept, however, if the additional land cannot be acquired, additional air cargo expansion should be accommodated in the Northwest Quadrant.

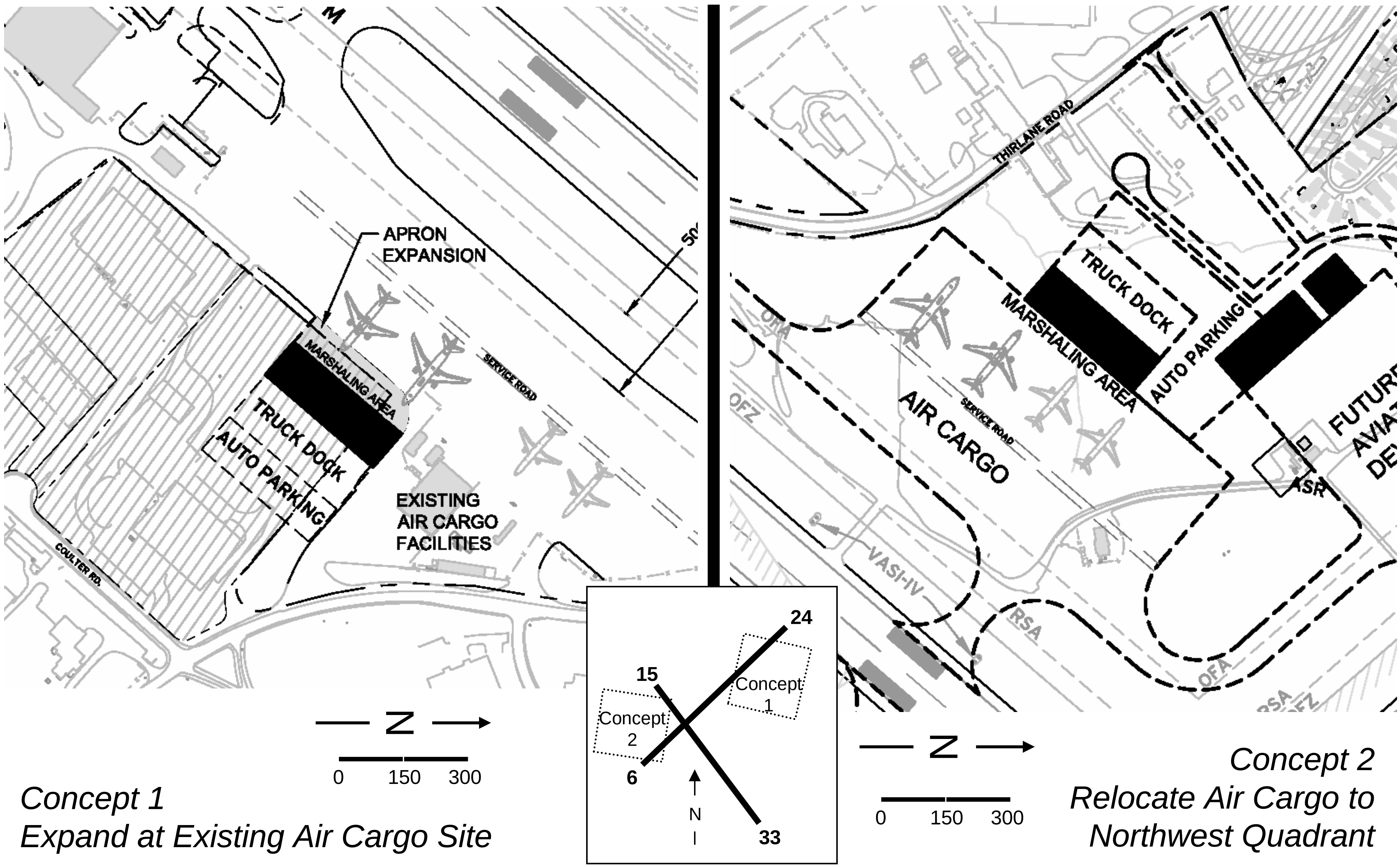
6.7 GA FACILITIES

6.7.1 Review of GA Requirements

Total GA site requirements include the land needed for buildings (i.e., the GA terminal and hangars), aircraft aprons, taxi lanes, automobile parking, circulation roads, setbacks, and landscaping. The total site area needed to accommodate GA facilities by 2025 is estimated to be approximately 44 acres.

Although the forecasts approved by the FAA as part of the ROA Master Plan Update show modest growth in the GA sector through the 20-year planning horizon, the facility requirements needed to accommodate future demand are anticipated to grow much more rapidly. This is due to two key factors. The first is the anticipated shift toward greater use of larger, more complex GA aircraft (e.g., heavy twins and turbojets); these aircraft require more land for maneuvering, parking, and storage. The second reason is that several GA facilities currently in-use have exceeded their useful life and/or need to be relocated to accommodate airfield or other facility improvements.

[7] A detailed analysis of cargo requirements and development concepts can be found in **Appendix M**.



Concept 1
Expand at Existing Air Cargo Site

Concept 2
Relocate Air Cargo to Northwest Quadrant

6.7.2 GA Development Considerations

The Airport is considered to be site-constrained due to topography which slopes away from the site and non-aviation development directly adjacent to the Airport. Although ROA's primary role is a commercial service airport, a goal of the Commission is to offer high-end service to its GA customers when feasible. Finally, current FAA design criteria (as expressed in AC 150/5300-13) provided guidance on how to develop the current GA site, as well as any potential new sites for GA facilities. These criteria include (but are not limited to):

- Runway/taxiway object-free areas, obstacle-free zones, and safety areas;
- Control tower line-of-sight;
- Runway visibility zone; and,
- Taxiway/taxilane separation standards.

There are several goals (some of which are considered to be competing) concerning future GA development:

- For security reasons, there is a desire by the Airport to provide a buffer between light GA activity and commercial airline activity (adjacency between corporate GA activity and commercial airline activity is considered compatible);
- Because the strong growth previously forecast for the Airport's GA activity has frequently not materialized, it was the goal of this planning effort to permit gradual phased development versus radical changes in development strategy;
- There is a desire to further enhance GA facilities and services; and
- Recognizing the high cost of readying at least a portion of the Northwest Quadrant for development ($20-30 million), it was a goal of this planning exercise to see whether a GA concept could be developed that would meet the majority of 2025 requirements within the existing midfield development area.

6.7.3 GA Development Concepts

Two GA development concepts were considered: 1) Expansion/redevelopment of within the existing GA area and the "Midfield" area, and 2) Meet future GA requirements by developing the Northwest Quadrant.

The first concept, expansion/ redevelopment of the existing GA area and the "Midfield" area, has the advantages of maintaining development continuity within the southeast portion of the Airport as well as redeveloping the Midfield area. There are, however, several constraints to this concept:

- The Runway Visibility Zone (RVZ) requires structures/buildings to be located within the eastern two-thirds of the site;
- There is an abrupt grade change between the western and eastern half of the site. While these areas could be made a common elevation, it was considered more desirable to avoid re-grading the area if possible;

- The current preliminary develop-ment plan for the Airport preserves the area along Taxiways T and G, between Taxiway E and Taxiway L, as the location for a future secondary deicing pad, which could reduce the amount of area for GA development;
- The ATCT facility constrains development of a portion of the area;
- The shifting of Taxiway G to the southeast reduces the amount of developable area; and,
- The redevelopment of portions of the area would have to be undertaken to minimize impacts to ongoing operations.

The second concept, developing the Northwest Quadrant for GA facilities, would require a significant investment (at least $20 million just for site preparation) and would require the relocation of the ASR facility. In addition, it would require the development and operation of a second FBO facility and would likely require a second fuel farm to support operations at the new facility.

6.7.4 Recommended GA Development Concept

The GA development plan must meet FAA design criteria; address the anticipated shift toward the use of larger, more complex aircraft; provide an opportunity for offering a higher level of customer service; and, finally, provide a realistic development plan in terms of cost.

For this reason, it was concluded that the most effective way for meeting the Airport's 20-year GA requirements was by expanding and redeveloping the existing GA and "Midfield" areas.

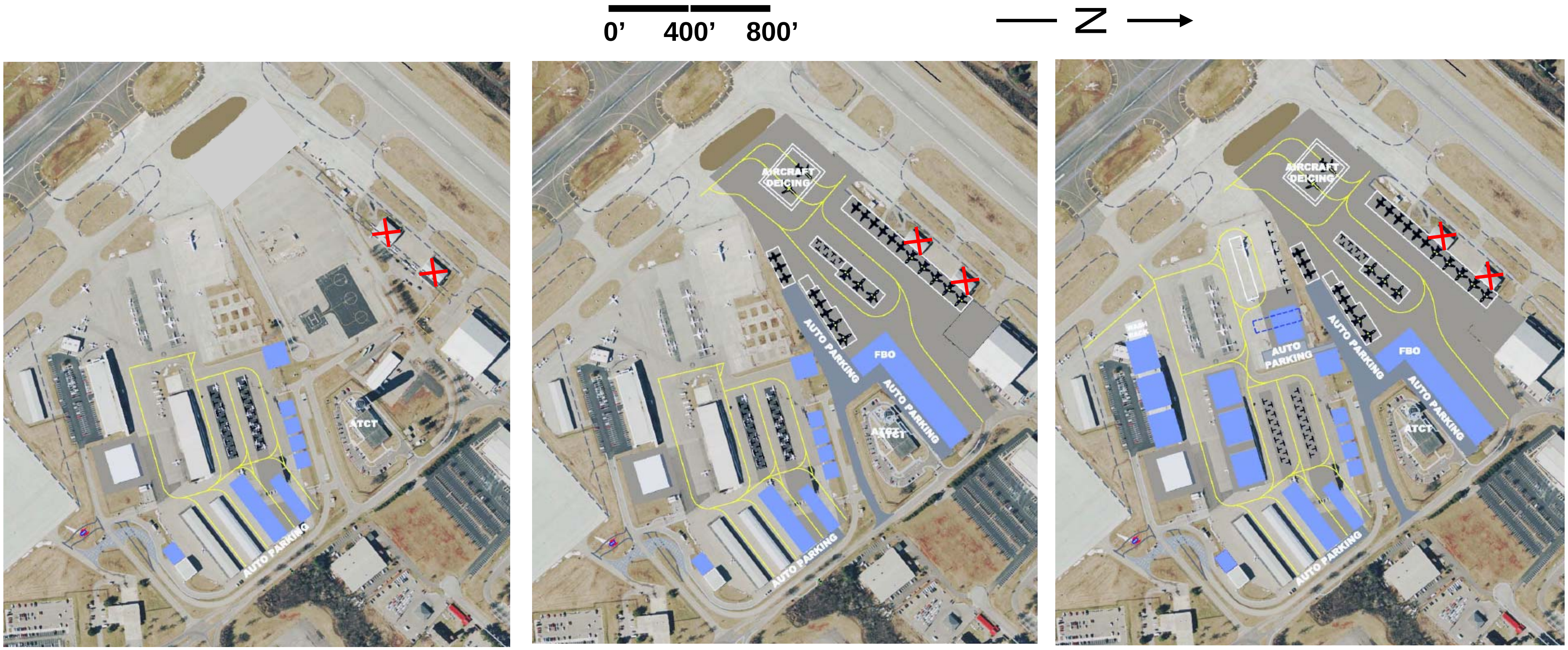
Considerable effort was expended on developing a GA layout within the existing GA area and "Midfield" area that would meet most, if not all, of the Airport's 20-year requirements. **Figure 6-27** shows a general phasing plan of how the area could be developed and is described below.[8]

From the outset, the midfield area closest to the intersection of Runways 15-33 and 6-24 was identified as an ideal location for a new FBO facility. It was decided to take advantage of this location and center a new FBO and related transient aircraft parking in the northern half of the midfield area. The southern half would then primarily accommodate based aircraft facilities.

The plan features a new, large-scale FBO/GA terminal at the site of Building 5 (cargo building). The building would house a new upscale FBO and hangar space for storing/maintaining high-end GA aircraft. The apron to the east of the new FBO building provides sufficient parking for Year 2025 transient parking, with a combination of "flow-through" and back-in spaces. The two ADG-III spaces are able to accommodate B-737/A320-size aircraft and can double as a secondary deicing facility, if required.

The southern half of the GA site serves to meet the needs of the Airport's based aircraft. A series of conventional hangars

[8] **Appendix N** summarizes the analysis associated with developing a preferred GA development plan.



Phase 1
New T-hangars and conventional hangars

Phase 2
Construct new FBO Facility

Phase 3
Redevelop former GA Site

ROANOKE REGIONAL AIRPORT

GA Expansion/Redevelopment Plan

FIGURE 6-27

(both 4,000 square foot and 10,000 square foot) provides sufficient storage capacity for 2025 requirements. Finally, the area provides sufficient tie-down space to meet 20-year requirements. Although the T-hangar directly north of the terminal apron (Building 24) is slated to be demolished at some point, the gate requirements for the terminal building do not require its removal within the 20-year planning horizon. Therefore, this T-hangar can help meet long-term based aircraft requirements

The plan meets nearly all of the forecast requirements through 2025 and delays the requirement for developing the Northwest Quadrant.

6.8 SUPPORT FACILITIES

This section presents the concepts analysis for Airport support facilities, including airfield maintenance, ARFF, GSA support, air carrier deicing tank staging, fuel farm, airline maintenance, ground run-up enclosure, compass calibration pad, and transient airship mooring site.

6.8.1 Airfield Maintenance

The Airport's field maintenance facility, located on the north side of the airfield off Peter's Creek Road, occupies a 2.5-acre site. The current site is adequate for future expansion to accommodate additional requirements.

6.8.2 New Airport Rescue and Fire Fighting Facility

ROA is currently classified as an ARFF Index B facility. Based on the forecast fleet mix presented in Chapter 4, the Airport will remain an Index B facility through the 20-year planning horizon.

FAA AC 150/5210-15, *Airport Rescue and Firefighting Station Building Design*, provides guidance on siting and layout requirements for ARFF stations. The primary factor in locating an ARFF facility is vehicle response time. Other factors include providing immediate access to the airside, minimizing turns, direct access to the terminal apron without crossing runways and taxiways, non-interference with ATCT line-of-site, maximum surveillance of operations area, expansion capability, noninterference with communications, and minimum obstructions or interference with existing structures.

FAR Part 139 sets response time requirements. Within three minutes of an alarm, at least one required ARFF vehicle must reach the midpoint of the farthest runway serving air carrier aircraft from its assigned post, or reach any other specified point of comparable distance of the movement area that is available to air carriers, and begin application of the extinguishing agent. Within four minutes of the alarm, all other required vehicles must reach the points noted above from their assigned posts and begin application of an extinguishing agent.

Although the response times from the existing site are currently adequate in optimal conditions, aircraft maneuvering on the terminal apron (which is the non-movement area the ARFF vehicles must cross), could substantially degrade these times in an actual emergency.

In addition, more stringent response time requirements are currently under consideration by the FAA. These could include reducing the minimum response time requirement to the midpoint of the farthest runway, increasing the distance and/or the number of airfield locations to be reached within the current time requirement, or both. In fact, the NFPA recommends more stringent response times in Publication 403, *Standard for Aircraft Rescue and Fire Fighting Services at Airports*. These recommendations call for first responding vehicles to reach any point on the operational runway within two minutes and to any point remaining within the on-airport portion of the Rapid Response Area within 2.5 minutes.[9] In addition, the NFPA recommends that response times to reach airport movement areas beyond or outside the runway and rapid response area should be three minutes.

Finally, the existing joint-use facility lacks many amenities found in new stations.

For these reasons, the Commission has a desire to construct a replacement ARFF facility and an analysis was performed to identify a preferred site.[10]

Five sites were identified and evaluated:

- Remodeled existing site (for comparison purposes);
- Current FBO site;
- Northeast Quadrant;
- Northwest Quadrant; and,
- Southwest Quadrant.

These five sites were then evaluated by their response times to various points on the airfield, their order-of-magnitude development cost, and other issues that may be unique to the site. **Figure 6-28** shows their location.

Table 6.8 summarizes the results of the analysis. Response times were calculated from each alternative site to the existing midpoint of each runway (per Part 139 requirements), to the midpoint of each runway assuming a lengthening of Runway 15-33 to the northwest, and to the existing and future endpoint of each runway, recognizing the potential for more stringent response time requirements in the future.

As shown, each of the alternative sites provides superior response times compared to the current ARFF facility, which would better position the Airport to meet possible new, more stringent criteria.

From a cost standpoint, the development of a new, relocated ARFF would range from $3.1 million (for relocating to the current FBO site) to $5.6 million (for relocating to the Northeast Quadrant).

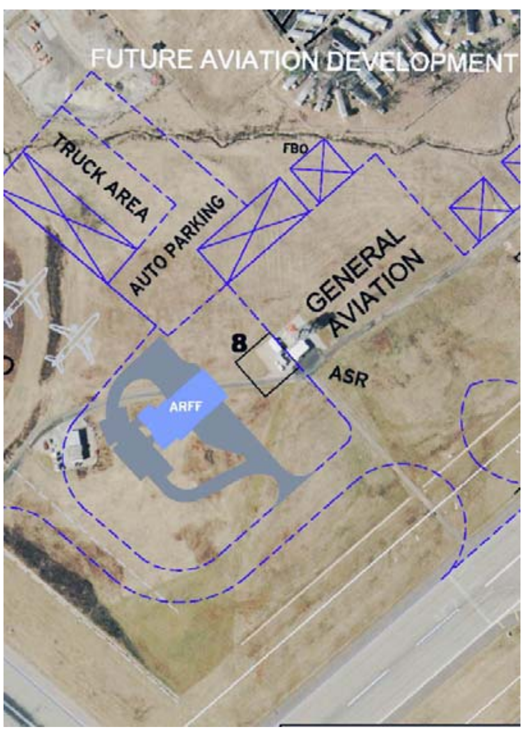
Finally, there are several key issues that need to be considered when selecting a preferred ARFF development concept. As noted previously, the possibility of ARFF vehicle/aircraft interaction will increase with time, making staying at the existing site much less attractive.

9 The Rapid Response Area is defined as a 1,000-foot wide area centered along the runway centerline and extending 1,650 feet from the runway end.

10 See **Appendix O** for a white paper summarizing the analysis.

Site 1—FBO Site

Site 2—Northeast Quadrant



Site 3—Northwest Quadrant

Site 4—Southwest Quadrant

ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

ARFF Development Concepts

FIGURE 6-28

Source: HNTB analysis.

Table 6.8

ARFF Site Evaluation Matrix

	Existing ARFF	Current FBO Site (1)	Northeast Quadrant (1)	Northwest Quadrant (1)	Southwest Quadrant (1)
Response Times (MM:SS) (2)					
Midpoint Rwy 6-24	1:52	1:21	1:15 (3)	1:25	1:35
Midpoint Rwy 15-33 (Existing)	1:18	0:52	1:23	1:31	1:10
Midpoint Rwy 15-33 (Future)	1:37	1:02	1:05	1:12	1:00
Endpoint Rwy 6	2:14	1:50	1:33	1:10	1:18
Endpoint Rwy 15 (Existing)	2:11	1:38	0:58	0:51	1:37
Endpoint Rwy 15 (Future)	2:49	2:17	1:35	1:26	2:11
Endpoint Rwy 24	2:58	2:26	2:21 (3)	2:32	2:43
Endpoint Rwy 33	1:43	1:37	2:19	2:28	1:34
Avg. Response Times					
Existing Midpoints	1:35	1:06	1:19	1:28	1:22
Existing Runway Ends	2:16	1:52	1:47	1:45	1:48
Future Midpoints	2:40	1:52	1:47	2:01	2:05
Future Runway Ends	2:26	2:02	1:57	1:54	1:56
Development Cost ($ Millions)(4)					
ARFF and Related Development	$1.8 (5)	$3.1	$5.6	$5.2 (6)	$4.9 (6)
Enabling Projects	$0.0	$0.0 (7)	$0.0	$0.0	$0.0
Total	$1.8	$3.1	$5.6	$5.2	$4.9
Issues	ARFF vehicle/aircraft conflicts will increase with post 2025 terminal expansion.	Will require prior re-location of FBO and Bdg. 24 (T-hangar). Would reduce GA hangar space in southwest quadrant and require earlier move to Northwest Quadrant.		May impact ASR signal. May affect overall NW Quadrant development flexibility.	Access road may affect Rwy 6 glide slope signal.

Notes: (1) Assumes 11,500 sf facility.
(2) Includes 30 seconds from sound of alarm to rolling of fist responder; assumes 35 mph average speed.
(3) The response time to this location could be reduced by approximately 15 seconds by accessing Runway 6-24 directly, versus via Taxiway A.
(4) Includes construction and 20% engineering, admin. and environmental analysis.
(5) Includes remodeling existing facility for exclusive Airport ARFF use, exclusive ARFF airfield access road to Twy F.
(6) Includes grade work.
(7) Assumes prior relocation of FBO facility to the midfield area.

Source: HNTB analysis.

Relocation to the existing FBO site would first require the relocation of the FBO facility as an enabling project. It would also reduce the amount of developable area available for GA facilities which could, in turn, require earlier development of GA facilities in the Northwest Quadrant.

Development in the Northwest Quadrant could impact the ASR signal and constrain development flexibility of the Northwest Quadrant overall.

In the Southwest Quadrant, a required public access road would cross the Runway 6 glide slope critical area.

Based on this analysis, the recommended concept for meeting future ARFF facilities is to construct a new ARFF station in the northeast sector of the Airport. The current facility could then be reused as a secondary or emergency operations center. Space could also be reallocated to provide office space for some Commission staff that may not need to be in contiguous space with other departments (e.g., Finance Department).

Finally, a site for a mobile ARFF training simulator has also been tentatively identified in the Northwest Quadrant.

6.8.3 Ground Support Equipment Storage Area

Currently, GSE is parked in various locations around the terminal. Recognizing the Commission's desire to provide a consolidated storage area, a site was identified on the northeast side of the terminal apron for this purpose.

6.8.4 Secondary Aircraft Deicing Pad

As noted in Chapter 5, commercial aircraft deicing occurs at the gate and at a remote deicing area on the west end of the cargo apron which serves departures on Runway 24. Recognizing the need for a site for deicing aircraft using Runway 15-33 as well as Runway 6-24 and to allow maximum use of the cargo apron, a site for a new secondary deicing pad was identified.[11]

The overall size for a deicing pad was determined by considering peak hour commercial aircraft departures and the types of aircraft anticipated to operate during that period. For planning purposes, an area of approximately 5,500 square yards was assumed. This would provide sufficient area for either the simultaneous deicing of two regional jets or one large air carrier aircraft.

The primary considerations for choosing a location for the secondary deicing pad were taxi times to each runway end relative to holdover times[12] and minimizing impact to both existing and planned facilities. Section 5.4.14 of Chapter 5 provides a summary of current deicing activities at ROA.

To eliminate runway crossings by either aircraft or service vehicles, the identification of a secondary deicing site was limited to the area east of Runway 15-33 and south of Runway 6-24. Due to current development, no feasible site could be identified between

[11] See **Appendix P** for detailed discussion of selecting a site for a secondary deicing facility.

[12] FAA Publication entitled, *Holdover Time Tables Ice Pellet Allowance Time Heavy Snow Procedures, Winter 2006-2007* was used as a reference.

Taxiway C and Taxiway E, nor would a site east of the current Piedmont maintenance hangar be feasible. (In addition, the current remote deicing pad is currently located in the cargo apron.)

Based on these factors, a location at the west end of the midfield area was identified as a preliminary site, near the site of the old terminal (as shown in **Figure 6-29**). The primary advantages of this site are its relatively central location to all four runway ends, its ease of development, and potential expandability if needed in the future. During deicing events, aircraft departing the terminal would travel down Taxiway A, enter the pad via Taxiway E, exit the pad and continue to their designated runway end via Taxiway G or A.

Aircraft taxi times from the proposed site to each runway end were then calculated to ensure that they were within the holdover times for Type II anti-icing agents. For conservative purposes, an additional 60 seconds were added to allow time for the ground service vehicle to pull away from the aircraft and for the aircraft to taxi out of the pad. The following are the unimpeded travel times to each runway end from the secondary facility, including the additional minute to leave the pad:

- Runway 6: 2.1 minutes
- Runway 24: 2.8 minutes
- Runway 15: 1.6 minutes
- Runway 33: 2.9 minutes

These taxi times were compared to the holdover times for Type II anti-icing agents and were found to be well within the time limits listed and would allow for several additional minutes of departure delay.

Because the southwest portion of the air cargo apron will likely see more activity in the future (both from increased cargo activity as well as additional charter activity), a new secondary deicing site—bounded by Taxiways G, E, and T—should be developed. During non-deicing events, the pad could be used to park helicopters.

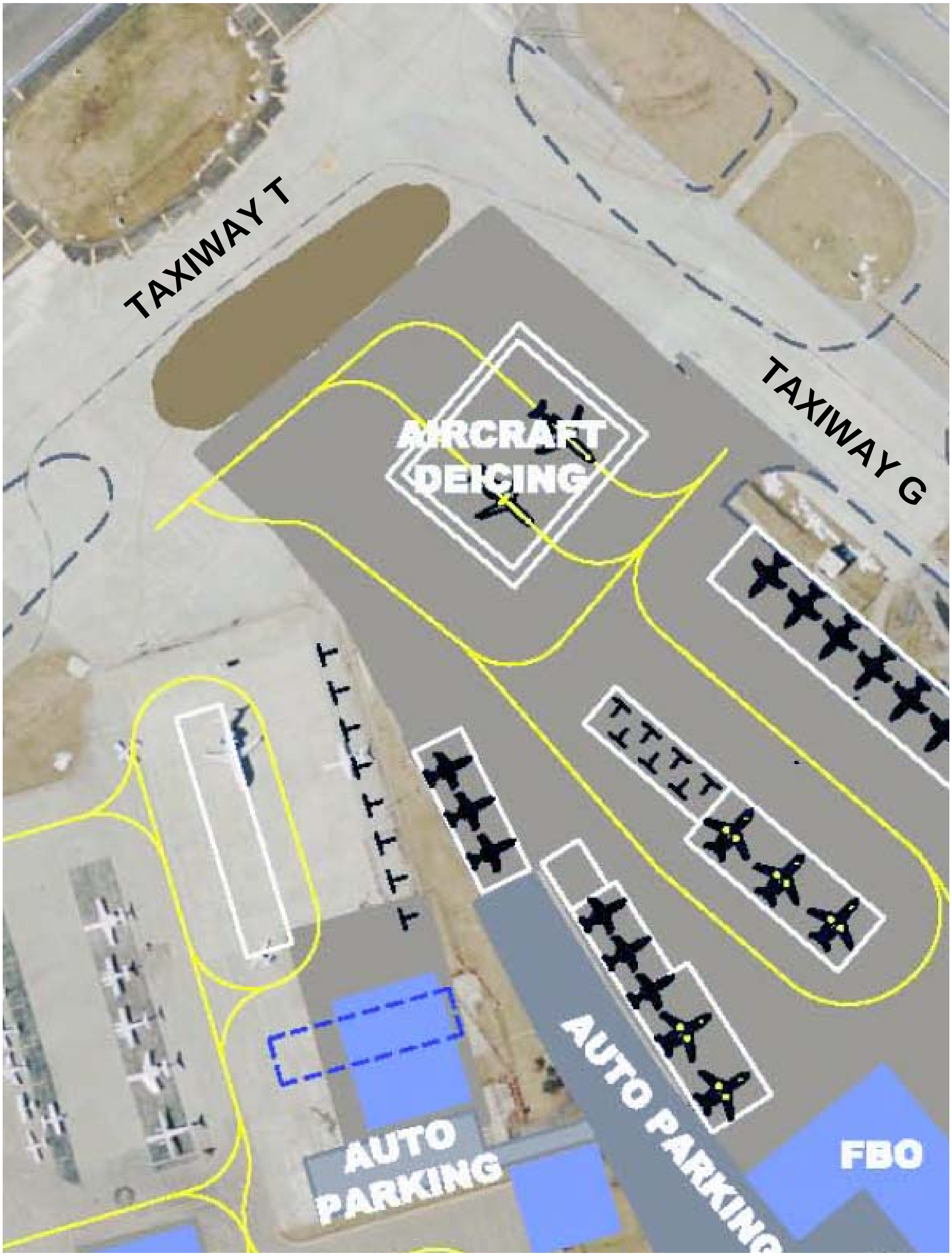
The design of the pad should give consideration for collecting the spent glycol in an environmentally responsible manner. (For example, the drain system could include a diversion system that can be activated during a deicing event to collect the spent glycol in an underground tank.)

6.8.5 Fuel Farm

Airport fuel farms ideally are designed to provide space not only for fuel storage tanks but space for delivery truck maneuvering, fuel spill containment, and area around the tanks for ARFF vehicle access.

Current Fuel Farm Operation

The existing fuel farm is located in the GA area, directly east of the new corporate hangar (Building 32). There are two 20,000-gallon above-ground tanks and one 12,000-gallon below-ground tank storing Jet-A fuel, for a combine total of 52,000 gallons of Jet-A storage capacity. There is also one 12,000-gallon below-ground tank to store Avgas. The combined (i.e., Jet-A and 100LL) fuel tank storage requirements are anticipated to increase from 83,000 gallons to 116,000 gallons by 2025.



ROANOKE REGIONAL AIRPORT

Secondary Deicing Pad Layout

FIGURE 6-29

Source: HNTB analysis.

According to the FBO manager (which operates the fuel farm), there are about 80 tanker deliveries per month. On a busy day, between three to five tanker trucks, each with an 8,000 gallon capacity, offload fuel, usually in the very early morning. Upon reaching Gate 34, delivery trucks are directed by Landmark line staff through the gate and onto the GA apron, where the truck makes a U-turn to face the opposite direction and adjacent to the fuel line hookups inside the fence. After offloading the fuel, the tanker truck exits through the gate.

Aircraft fuel deliveries are made by Landmark's fuel truck fleet. On a typical day, two trucks will pick up fuel from the fuel farm (one on the morning and one in the afternoon), exit through Gate 34, cross Waypoint Drive, and reenter the secure side at Gate 33 to gain access to the passenger terminal apron. The remaining trucks stay near the FBO to fuel GA aircraft.

Fuel Farm Planning Parameters

The analysis undertaken to identify a site and general layout for an expanded fuel farm at ROA considered the following:

- Meet safety guidelines as provided by NFPA, ROA ARFF battalion chief, and Roanoke City fire marshal;
- Provide ARFF vehicle access around fuel farm site;
- Provide room for a containment berm able to hold 1.5 times amount of largest tank (i.e., 1.5 x 20,000 gallons, or 30,000 gallons);
- Provide minimum of 5 feet from building on same property and 20 feet from property line that can be built upon, including opposite side of a public right-of-way;
- Provide space for a fuel truck delivery containment pad (typically, epoxy-coated concrete, sloped to drain, and piped to an oil-water separator);
- Provide location for delivery truck and aircraft fuel truck maneuvering;
- Meet 2025 storage requirements;
- Provide post-2025 site expandability;
- Consider need for proximity to both GA and air carrier ramp; and,
- Minimize development cost.

Fuel Farm Development Concepts

Four concepts were considered for fuel farm expansion.[13] These concepts included:

- Meet 20-year requirements at existing site;
- Replace existing fuel farm with a new, expanded facility near the proposed relocated FBO site;
- Operate two fuel farms—existing to serve airline operations and new fuel farm near proposed relocated FBO site; and,
- Build new, replacement fuel farm at other location.

13 See **Appendix Q** for more detailed analysis.

Figure 6-30 shows the location of these development concepts. A qualitative analysis was then undertaken to select a preferred concept.

Expand Existing FBO Site

Although the existing fuel farm site is somewhat constrained by surrounding development, there are opportunities for expansion to the south and east. The advantages of expansion at the existing site include lower cost and proximity to the terminal apron. Some redevelopment of the area would be required to provide a delivery truck maneuvering area and, if possible, to enable fuel transfers from the non-secure side. A disadvantage of this site would be its greater distance from the proposed relocated FBO facility.

Build Replacement Fuel Farm at Proposed New FBO Site

This concept would entirely relocate fuel farm facilities to the midfield area of the Airport, in the vicinity of the proposed new FBO site.

The advantage of this concept is its being closer to the FBO site (which would enable better monitoring of the fuel farm and would provide a more efficient operation since most fuel calls are to GA aircraft).

The disadvantages of this concept would be a higher development cost and difficulty siting a relocated fuel farm in the midfield area without either impacting existing facilities or reducing the amount of land available for aircraft parking and other FBO operations. This last impact could also force a move to develop the Northwest Quadrant earlier than necessary.

Operate Two Fuel Farms

Under this concept, the existing fuel farm would remain operational and a second fuel farm would be built in the midfield area adjacent to the proposed relocated FBO site.

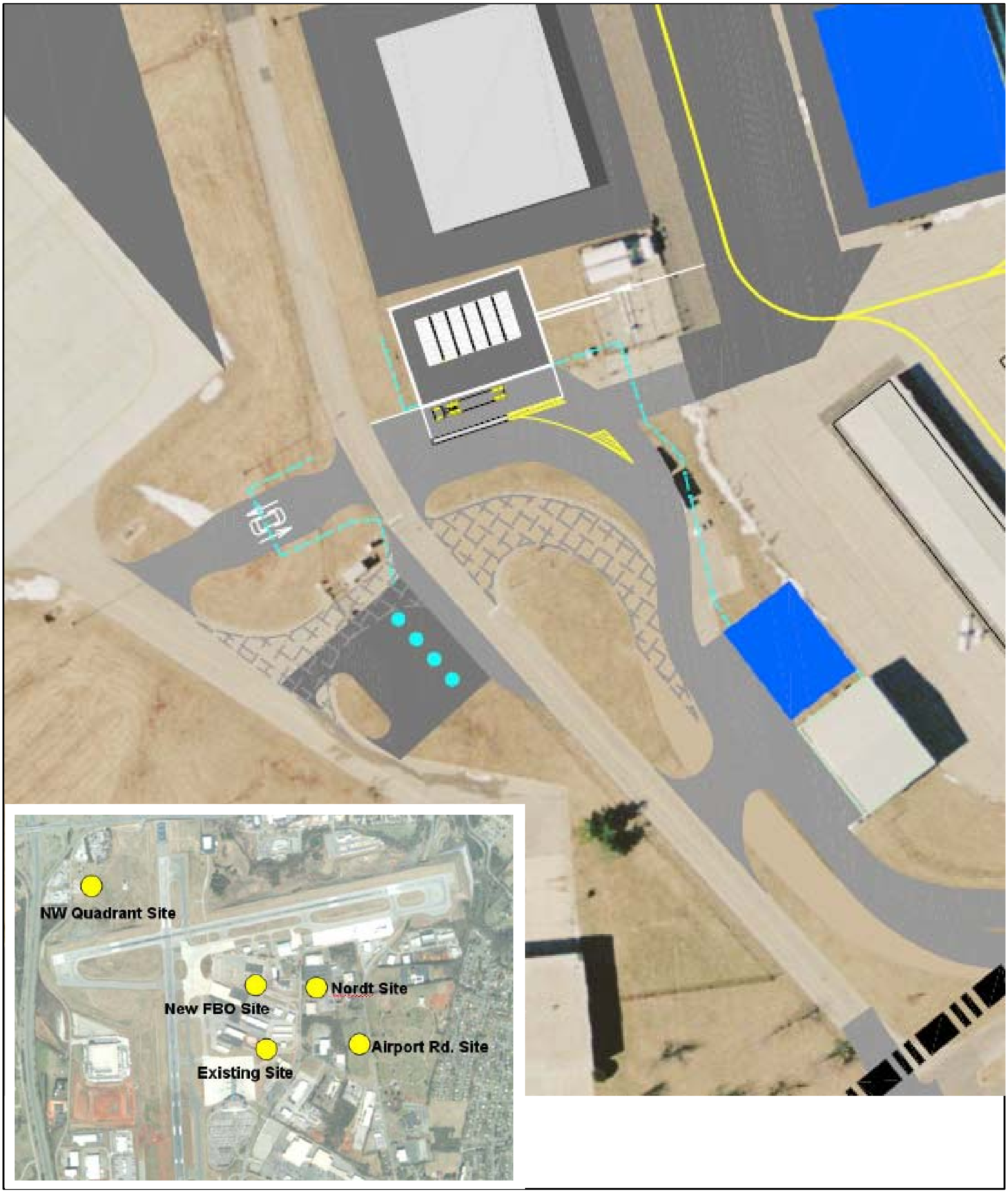
The advantages of this concept include having one fuel farm in proximity to the terminal area (to serve commercial flights) and having a second fuel farm in proximity to the proposed new FBO site to serve GA operations.

The disadvantage of this concept include having to monitor two different locations, having to coordinate tanker deliveries between the two sites, and likely having a greater land impact overall. In addition, since it is likely that a fuel farm would be needed in the Northwest Quadrant to accommodate activity there (albeit beyond the 20-year planning horizon), there would ultimately be a total of three fuel farms. This is considered to be very inefficient and impracticable from an operational standpoint.

Build Replacement Fuel Farm at Another Location

In this concept, the existing fuel farm would be closed and relocated to a site away from the airfield. There are three possible locations for this facility:

- On the existing Airport parcel along Airport Road (across from the cemetery);



ROANOKE REGIONAL AIRPORT

Fuel Farm Development Site Concepts and Recommended Plan

FIGURE 6-30

Source: HNTB analysis.

- On property across Aviation Drive from the control tower and behind the air cargo facility (this land would have to be acquired); and,

- In the Northwest Quadrant.

The advantages of these concepts would include being able to develop a well-laid out fuel farm with room for tanks and a truck maneuvering area. In addition, for the Aviation Drive site, the location would be directly behind the FBO.

The disadvantages for the Airport Road site and the Northwest Quadrant site include their remote locations and access challenges for airfield vehicles. The disadvantages for the Aviation Drive site include having to acquire the property and developing the site so that it would not constrain other aviation development.

Recommendation

Based on a qualitative evaluation of fuel farm expansion concepts, it appears that continued expansion at the existing site is the best concept. Figure 6-30 shows a possible development layout for the site.

As shown, a roadway for fuel truck maneuvering would be constructed. A pull-off lane would be provided for truck loading/unloading, allowing unconstrained vehicle movement along the adjoining service road. The location where fuel trucks would park would be constructed as a containment pad. The service road would continue across Waypoint Drive to a relocated vehicle security checkpoint which controls access to the terminal apron. The fence line in this area would have to shifted, and a new gate would need to be added.

6.8.6 Air Carrier Deicing Tanks Storage Location

Currently, deicing fluid is stored on the east side of the intersection of Taxiway G and Taxiway L, near the old terminal site. As most deicing is done at the gate, deicing vehicles must travel a significant distance and across movement areas to re-fill their vehicles and return to the terminal. For this reason, and in order to accommodate future development in the vicinity of the current storage area, a permanent location for deicing fluid storage was identified.

The primary factors for identifying a deicing tank location were proximity to the passenger terminal, ease of materials delivery, and site expandability.

The only area near the terminal that appeared to be a viable site for deicing storage was east of the terminal apron along Waypoint Drive. This site offered the added benefit of allowing delivery vehicles to use the improved circulation roadway designed for the expanded fuel farm concept on the north side of Waypoint Drive. (See Figure 6-30.)

6.8.7 Airline Maintenance and Ground Run-up Enclosure

Background

Piedmont Airlines typically services four Dash-8-300s per day at its hangar, usually performing maintenance during nighttime hours. As part of the maintenance process, Piedmont frequently conducts engine run-ups which can disturb sleep for nearby residents. Two run-ups are typically conducted for each aircraft, for a total of about eight run-ups each day. Current noise restrictions prohibit full, takeoff thrust run-ups between the hours of 10 PM and 6 AM on weekdays and between 10 PM and 8 AM on weekends. Engine checks at idle power are performed on their east ramp, while full-power run-ups are performed at Taxiway A-2, near the Runway 15 landing threshold.

Concepts for airline maintenance facilities focused on addressing two issues.[14] The first was providing additional apron space for maneuvering aircraft in the areas adjacent to the existing hangar (Building 4). The second issue was providing a location for an engine ground run-up enclosure (GRE). A typical GRE is an open-air, three-sided structure designed to absorb much of the noise produced by engine run-ups. GREs can be sized to accommodate aircraft of various dimensions. A typical GRE facility also includes an adjoining apron and taxilane and comprises about 1.5 acres.

Summary of Analysis

Recognizing both the noise impact stemming from nighttime run-ups, as well as the operational impact of restricting the time period when run-ups can occur, a preliminary site selection study was undertaken for a GRE. There are several factors that need to be considered when locating a GRE. These include:

- Ability of site to accommodate a GRE sized to allow taxi in of ADG-II aircraft and tug in of ADG-III aircraft, including apron;
- Overall noise reduction impact for the surrounding community;
- Aligned as much as feasible with prevailing winds;
- Airside/landside accessibility;
- Minimize impact on airfield circulation;
- Minimize potential interference with radar and NAVAIDS;
- Not block ATCT line-of-sight, Part 77 surfaces and runway visibility zone; and,
- Construction cost.

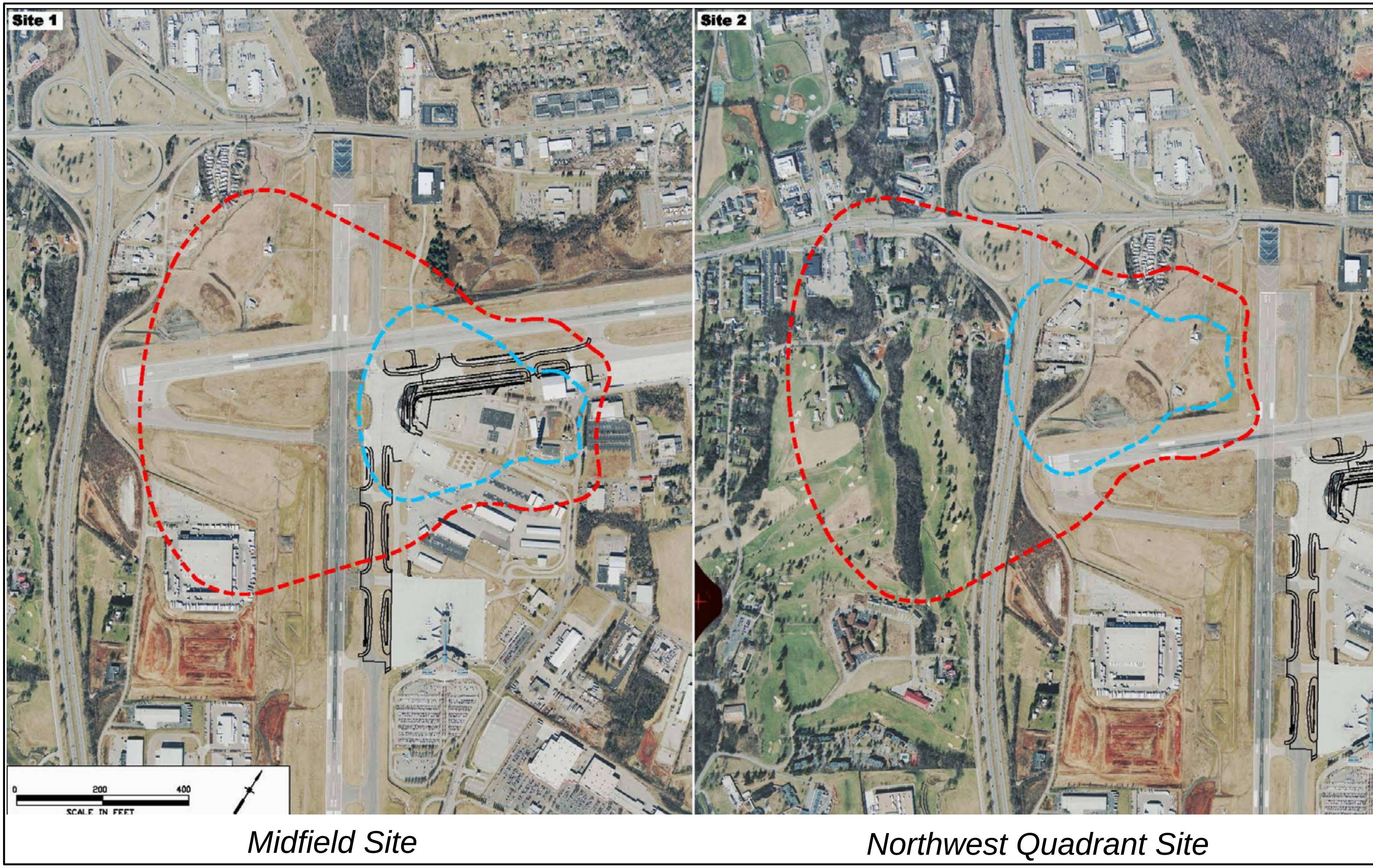
Recognizing that a full-scale study would need to be conducted by a GRE developer to select a recommended site, the Master Plan Update effort focused on screening two possible locations for a GRE and ranking them based on available information. (See **Figure 6-31**.) The first location is in the midfield area. The second location considered is in the Northwest Quadrant.

Based on the preliminary analysis, from the perspective of adjacency to existing airline maintenance activity, noise mitigation benefit, and development cost, it appears that the preferred site for a GRE is in the midfield area directly south of the existing airline maintenance facility on the site of Building 5.

GRE Considerations at ROA

GREs require a significant investment. The total cost for building a GRE at ROA

[14] See **Appendix R** for a detailed discussion of GRE analysis.



ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

Dash 8 Run-up Contour

EMB-145 Run-up Contour

Ground Run-up Enclosure Site Concepts

FIGURE 6-31

could reach between $4 to $6 million, including the facility, the pad, adjoining apron, and connecting taxilane. Additional costs could be incurred based on the site chosen and whether additional investment was desired to attract more airline maintenance activity.

A GRE is eligible for FAA funding; however, depending on whether entitlement or discretionary monies are being used, the level of justification can be significant. In some instances, a benefit-cost analysis is required.

It is difficult to determine the market potential for airline maintenance activity at any particular airport because the factors which determine the level of activity are tied more closely to national and worldwide trends and corporate decision-making than to local socioeconomic factors. For these reasons, the decision to invest in a GRE is made at considerable risk.

Because a GRE within the midfield area would reduce the amount of land that could be developed for other aviation uses in the midfield area, its potential benefit would need to be weighed against its opportunity cost in the context of the overall recommended Master Plan.

Given the uncertainties associated with developing a GRE and its impact on aviation development that would be much more likely to be realized, the Master Plan does not recommend constructing a GRE at ROA.

6.8.8 Air Traffic Control Tower and TRACON

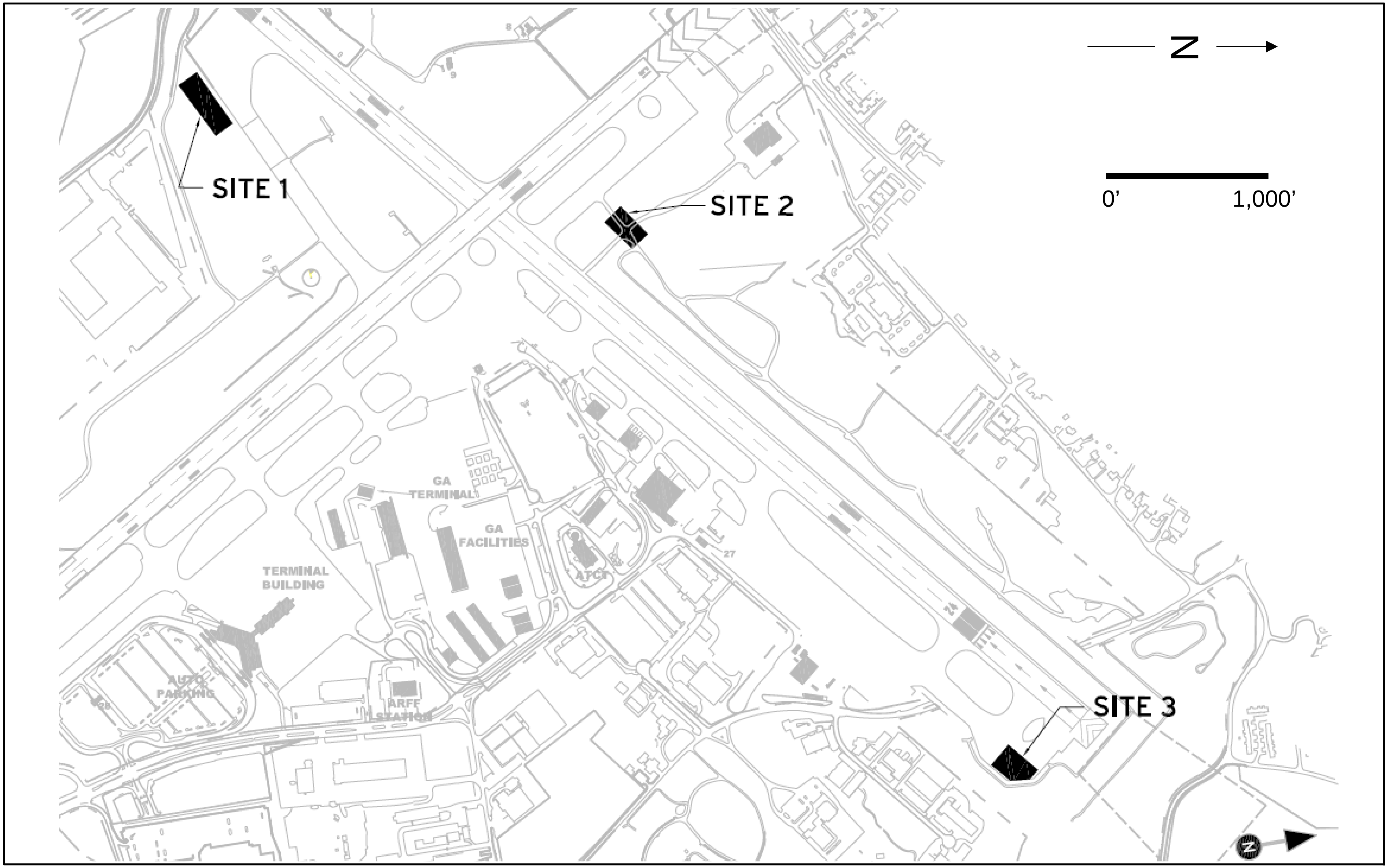
The existing ATCT and TRACON, dedicated in 2005, is adequately-sized to accommodate existing and future activity. No future development of the facility was identified by staff.

6.8.9 Compass Calibration Pad

Both commercial and private aircraft are maintained at the Airport. Frequently, the maintenance process includes calibrating aircraft magnetic compasses. In addition, private aircraft pilots routinely check and reset their compasses prior to departing for their destination. One method for calibrating compasses is to use a compass calibration pad to align the aircraft on known magnetic headings and make adjustments to the compass and/or placard markings to indicate the required corrections. These pads are certified to be within stringent tolerances and without magnetic disturbances and must be recertified periodically. (Many airports also have "compass roses" which are striped areas of pavement marking compass headings—these are not designed to meet certification requirements.) Recognizing the benefits of a compass calibration pad, an analysis was done to identify a potential site.[15]

Three sites were identified and surveyed using a total field magnetometer (as shown in **Figure 6-32**). The first site is at the intersection of Taxiway E and Taxiway E1, near the approach end of Runway 6. The second location is off of Taxiway A, between

[15] See **Appendix S** for a detailed discussion.



ROANOKE REGIONAL AIRPORT

Potential Compass Calibration Pad Sites Surveyed

FIGURE 6-32

the Taxiway's intersections with Runway 6-24 and A2. The third location is on the Runway 24 run-up pad.

A preliminary total field magnetic survey was conducted in February 2007 of the three sites. Based on the survey, the first site is considered to be unusable due to considerable magnetic abnormalities in the area. A significant amount of remediation work would be required to make the site usable.

Site 3 was considered acceptable, although it would require replacing manholes with non-magnetic ones. In addition, from an operational standpoint, the northeast terminus of Taxiway G could not be used by aircraft to enter or exit Runway 6-24 when aircraft were on the compass calibration pad.

The field survey suggested that Site 2 was the best site, although depending on the specific location within the site, a fence may need to be moved and/or limited excavation would be needed to remove buried ferrous material. In addition, the use of the pad at this location would not impact other aircraft movement.

The preferred location (Site 2) is also proximate to the preferred location for a new ARFF facility, which would require the ARFF site to be shifted northwest (to a less optimal location) to meet calibration pad design requirements.

Upon further discussion with the largest FBO and with Piedmont Airlines, it was concluded that, although desirable, a compass calibration pad was not required for continued maintenance activity; and due to difficulties in siting a pad, it was decided to instead mark a "compass rose" on the GA apron for GA users to reset their compass and to provide a site for compass "swinging," although the site would not be certified as a true calibration pad. The location selected for the compass rose was in the GA apron, across from Taxiway E.

6.8.10 Transient Airship Mooring Site

Due to its proximity to Virginia Polytechnic Institute and State University (Virginia Tech), commercial airships occasionally desire to moor at the Airport to cover sporting events. For this reason, the existing airfield was examined to determine if an adequate mooring site could be identified.[16]

There are no standard design criteria for airship landing sites. The planning parameters used in this effort were based on a review of airship design specifications and discussions with the current manager (and a former chief pilot) for a major airship operator.[17] In general, an acceptable site must meet grading and terrain requirements, as well as provide sufficient clearance for airship mooring and maneuvering. For any particular airship flight, the selection of a landing area is ultimately left to the pilot-in-charge. Typically, prior to the arrival of the airship at the proposed landing site, a ground team is sent out to the location to assess the site's potential.

16 See **Appendix T** for detailed discussion.

17 Telephone discussion with Dr. Jim Maloney, manager of airship operations for the Goodyear Tire and Rubber Company, January 12, 2007.

A review of the current Airport property shows that there are no locations that can meet the site requirements identified by the industry representative. This is due to the fact that nearly all level areas that could be used to moor an airship are either of insufficient size or would result in operational restrictions (such as closing a runway). For these reasons, the Airport would have to decide on a case-by-case basis whether to permit the airship to use the airfield. The demand for an airship mooring site at ROA, although infrequent, lends support for acquiring more land.

Chapter Seven
Environmental Overview

7.1 INTRODUCTION

The purpose of the environmental overview within this Master Plan is to identify environmental factors which should be considered as part of the preferred development concept at ROA. This environmental overview assesses how the proposed Airport projects relate to various environmental laws, policies, and guidance. No field work was completed for the development of this environmental overview. Field work for wetland and geologic hazards completed for the previous Master Plan Update (HNTB, 1998) was considered in this analysis; however, it is recommended field work be completed during the design of the Master Plan improvements to complete specific environmental documentation as required.

The National Environmental Policy Act (NEPA) requires that all Federal actions consider the environmental consequences of a proposed action prior to Federal approval. Improvements at ROA are considered a Federal action as changes to the airport layout plan requires the approval of the FAA. Additionally, use of Federal funding for Airport projects requires Federal approval through the FAA. In general, three types of environmental documentation are used by the FAA for environmental approval prior to development of individual projects. The three types of documentation are:

- *Environmental Impact Statement (EIS).* An EIS addresses projects that have the potential to create significant environmental impacts. An EIS documents the need for the action, alternatives to the preferred alternative which would entail less environmental impact, and mitigation measures to offset or reduce impacts.

- *Environmental Assessment (EA).* An EA is conducted to determine if the action under consideration could generate significant impacts requiring preparation of an EIS. If no significant impacts are identified in the EA, a finding of no significant impact (FONSI) is issued. The Eastern Region of the FAA has several variations of the EA which allow reduced effort in meeting the documentation requirements.

- *Categorical Exclusion.* A categorical exclusion addresses action which the FAA and the Council on Environmental Quality (CEQ) have determined do not normally have the potential to generate significant environmental impacts. A wide range of actions have been identified as categorical exclusions. These actions are generally related to repair and maintenance of existing facilities and minor development that is not likely to result in significant impacts. The latest version of FAA Order

10510.1E, Environmental Impacts: Policies and Procedures, must be used to determine if projects are listed as categorically excluded from detailed environmental analysis. Additionally, if a normally excluded action might generate significant impacts or would be highly controversial, an EA is required.

The Master Plan Update recommends improvements for both airfield and landside areas at ROA. The majority of improvements can be constructed without in-depth environmental analysis; however some will require EA level analysis. The projects identified within Chapter Eight, are evaluated in accordance with guidelines specified in FAA Order 1050.1E, Environmental Impacts: Policies and Procedures. Only categories in which potentially significant impacts have been identified are described. **Table 7.1** outlines the proposed improvements and potential normal environmental documentation. **Figure 7-1** illustrates the potential environmental constraints associated with the proposed improvements. The individual sections that follow describe the constraints associated with specific proposed improvements.

7.2 NOISE AND COMPATIBLE LAND USES

A 2025 future noise contour was developed to assess noise impacts and land use compatibility. The FAA's Integrated Noise Model (INM) version 7.0 was used to generate future year contours using the 2025 base case fleet mix forecast developed for this Master Plan Update and the operational assumptions prepared for the Noise Exposure Map (NEM) Update for ROA (HNTB, 2001). **Table 7.2** provides the annual average traffic used to model the future noise levels at ROA. **Table 7.3** provides the runway use modeled for the year 2025.

Figure 7-2 illustrates the 2025 noise levels with the Airport surroundings and surround land use. The noise contours for 2025 are projected to be smaller than those projected for the year 2005 in the previous NEM Update. This reduction in noise is due mainly to operational reductions. The NEM Update for the year 2005 projected approximately 137,000 annual operations, while the new projection for ROA in 2025 is approximately 105,000 annual operations. Additionally, the fleet mix has changed and older B727-200 and B737-300 are no longer part of the fleet mix.

The compatibility of existing land uses in the vicinity of an airport is primarily associated with aircraft noise impacts from the operation of the airport. ROA completed a Part 150 Study in 1994 and then a NEM Update in 2001 in an effort to achieve land use compatibility by either preventative or remedial measures. As shown in Figure 7-2, land uses within the 65 DNL contour are compatible with FAA compatibility guidelines per Part 150, with no noise sensitive land uses (i.e. residential and schools) within the 65 DNL contours. The 60 DNL contours are shown to provide a buffer between the Federal standard for acceptable land use relative to aviation noise and a noise level that many communities are now using to control land use in vicinity of airports.

Table 7.1

Environmental Documenation Requirements for Proposed Improvements

Project		Environmental Documentation[1]	Categorical Exclusion criterion met under FAA Order 1050.1E
Airfield/NAVAIDS			
AN-1	Rehab Taxiway T & GA Taxilane (Proj. No. 29)	Categorical Exclusion	310e
AN-2	Install Fencing Around Rwy 33 RPZ (Proj. No. 52)	Categorical Exclusion	310f
AN-3	Construct Min. Performance EMAS Rwy 24	Environmental Assessment	
AN-4	Construct Min. Performance EMAS Rwy 6	Environmental Assessment	
AN-5	Construct Secondary Deicing Pad	Categorical Exclusion	310d
AN-6	Stripe Compass Rose	Categorical Exclusion	310e
AN-7	Airfield Perimeter Road Improvements	Categorical Exclusion	310a
AN-8	Terminal Apron Rehab.	Categorical Exclusion	310e
Terminal			
T-1	Replace Slats in Bag Claim Belts (Proj. No. 24)	Categorical Exclusion	310h
T-2	Plaza Area Security Improvements (Proj. No. 25)	Categorical Exclusion	310h
T-3	Upgrade FIDS/Intercom System (Proj. No. 26)	Categorical Exclusion	310h
T-4	Replace ConcourseRoof (Proj. No. 40)	Categorical Exclusion	310aa
T-5	Replace Terminal Gate Seating (Proj. No. 41)	Categorical Exclusion	310h
T-6	Replace Terminal Carpeting & Flooring (Proj. No. 43)	Categorical Exclusion	310h
T-7	1st Floor Prem. Coffee Concession Space	Categorical Exclusion	310h
T-8	E-ticket Kiosk Project	Categorical Exclusion	310h
T-9	Hold Bag Screening Project Phase I	Categorical Exclusion	310h
T-10	Hold Bag Screening Project Phase II	Categorical Exclusion	310h
T-11	Hold Bag Screening Project Phase III	Categorical Exclusion	310h
T-12	Second Floor Restroom Renovation	Categorical Exclusion	310h
T-13	First Floor Restroom Expansion	Categorical Exclusion	310h
T-14	Expand Central Term'l (inc. Mech., Sec. Chkpt, & Inbound Bag)	Categorical Exclusion	310h
T-15	Add Loading Bridge Gate 1	Categorical Exclusion	310h
T-16	Add Loading Bridge Gate 3	Categorical Exclusion	310h
T-17	Concourse Restroom Expansion	Categorical Exclusion	310h
T-18	Gate 1 Area Expansion	Categorical Exclusion	310h
T-19	Gate Reconfiguration	Categorical Exclusion	310h
T-20	Additional Concourse Concession Space	Categorical Exclusion	310h
T-21	Energy-savings Projects	Categorical Exclusion	310h
T-22	Front Façade Sun Screening, Ticketing Hall	Categorical Exclusion	310aa
T-23	Airport Administration Office Expansion	Categorical Exclusion	310h
T-24	Concourse Holdroom Expansion	Categorical Exclusion	310h
T-25	New Secondary Pax Charter Facility	Categorical Exclusion	310h
T-26	Expand Ticketing & Outbound Bag Room	Categorical Exclusion	310h
T-27	Construct Consolidated GSE Storage Area	Environmental Assessment	
Landside (Ground Acces/Parking)			
L-1	Tunnel Rehab (Proj. No. 28)	Categorical Exclusion	310a
L-2	Rehab Terminal Roadway Entrance (Proj. No. 36)	Categorical Exclusion	310a
L-3	Terminal Loop Roadway Rehab & Drainage Imp (Proj. No. 42)	Categorical Exclusion	310a
L-4	Public Parking Lot Rehab. (Primary) (1)	Categorical Exclusion	310a
L-5	Waypoint Dr./SIDA Access Gate Intersection Reconfig.	Categorical Exclusion	310a
L-8	Rehab. Tug Road, Waypoint Dr., and Emp. Lot Entrance	Categorical Exclusion	310a
L-9	Parking System Expansion/Reorg.	Categorical Exclusion	310a
L-10	Secondary Access Route Improvements	Categorical Exclusion	310a
Air Cargo			
C-1	Widen Portion of Air Cargo Apron	Categorical Exclusion	310e
C-2	Construct Air Cargo Building	Categorical Exclusion	310f
C-3	Expand Truck Dock and Auto Parking	Categorical Exclusion	310h

Table 7.1 (Cont'd)

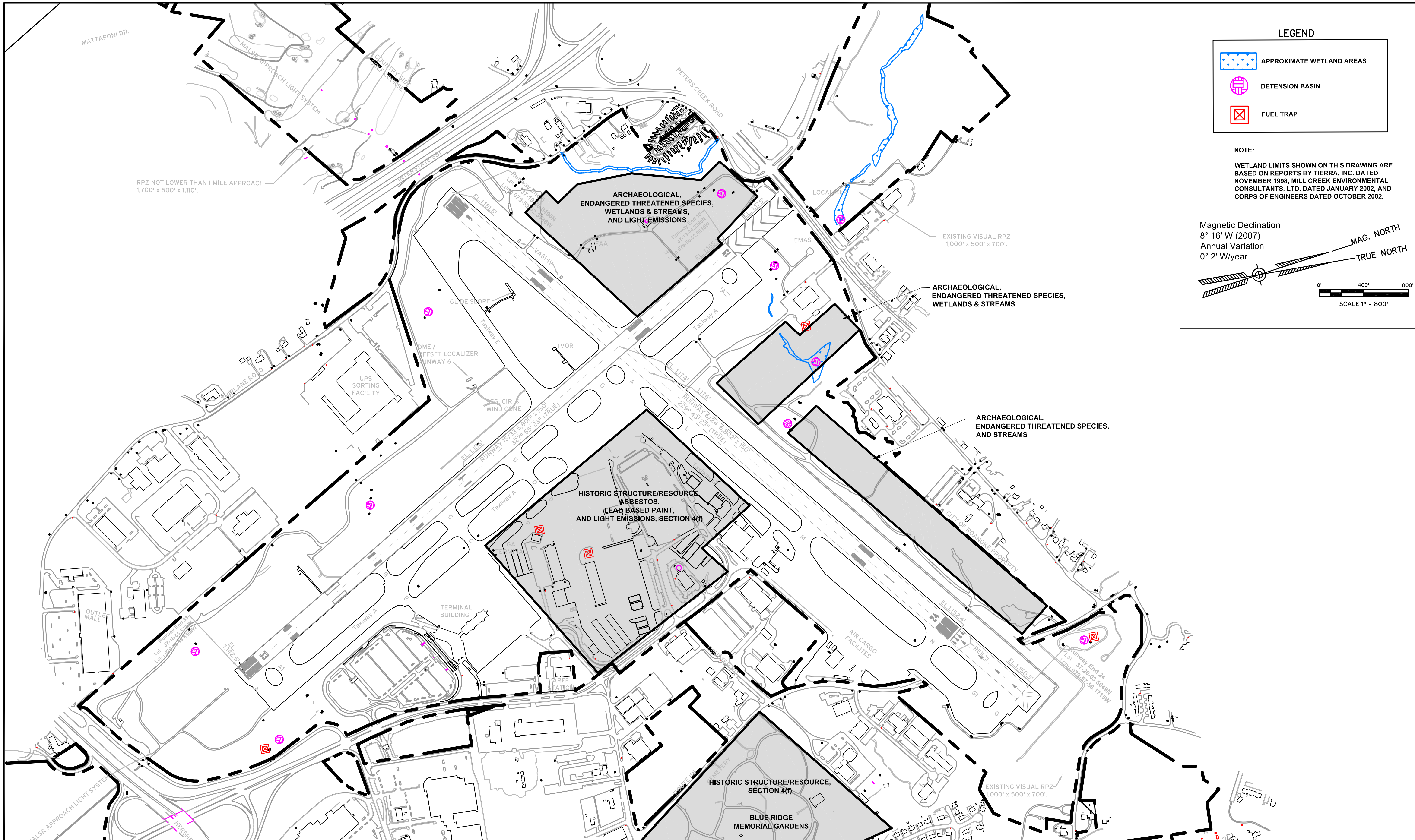
ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

Environmental Documenation Requirements for Proposed Improvements

Project		Environmental Documentation[1]		Categorical Exclusion criterion met under FAA Order 1050.1E
General Aviation				
	Redevelopment and Expansion of General Aviation			
GA-1	Construct Large T-hangar Bdg, Apron, & Auto Pkg	Environmental Assessment (2)		
GA-2	Construct Medium T-hangar Bdg, Apron, & Auto Pkg			
GA-3	Construct GA Apron/Taxilanes in Midfield Area			
GA-4	Construct Four 4,800-SF Conventional Hangars			
GA-5	Construct One 4,800-SF Conventional Hangar			
GA-6	Construct One 10,000-SF Conventional Hangar			
GA-7	Construct New FBO Bdg, Roadways, & Parking			
GA-8	Construct New 60,000-SF FBO Hangar			
GA-9	Other GA-area Roadway/Pkg Improvements			
GA-10	Demolish Building 22			
GA-11	Construct Three 18,000-SF Conventional Hangars			
GA-12	Demolish Building 25			
GA-13	Construct Three 18,000-SF Conventional Hangars			
GA-14	Demolish Current FBO (Bdg 23)			
GA-15	Construct New Wash Rack			
GA-16	Construct One 18,000-SF Conventional Hangar			
Airfield/Airline Maintenance/Support Facilities				
M-1	Expand Fuel Farm	Categorical Exclusion		310f
M-2	Construct Tanker Circulation Road	Categorical Exclusion		310a
M-3	Relocate Glycol Storage Facility	Categorical Exclusion		310f
M-4	Relocate Lav. Disposal Facility (Inc. Proj. 51)	Categorical Exclusion		310f
M-5	Construct ARFF and Training Facility	Environmental Assessment	3	
M-6	Airfield Fire Hydrants	Categorical Exclusion		309c
M-7	Airline Maintenance Hangar Apron	Categorical Exclusion		310e
M-8	Expand Airfield Maintenance Facility	Environmental Assessment	3	
Land Acquisition				
LA-1	Land Acquisition (Rwy Protection Zones)	Environmental Assessment	4	
LA-2	Land Acquisition (Cargo-related)	Categorical Exclusion	5	310b; 310f
LA-3	Land Acquisition (Term'l Auto Pkg-related)	Categorical Exclusion	5	310b; 310f
LA-4	Land Acquisition (Other)	Environmental Assessment	6	
Miscellaneous				
X-1	*Noise Program--Sound Insulation (Proj. No. 30)*	Categorical Exclusion		310q
X-2	*Noise Program--Sound Insulation (Proj. No. 38)*	Categorical Exclusion		310q
X-3	Purchase Snow Removal Equipment	Categorical Exclusion		^
X-4	Replace 2nd ARFF Vehicle	Categorical Exclusion		^
X-5	Master Plan Update	Categorical Exclusion		^

Notes:
1 Final decision regarding necessary documentation rests with the Federal Aviation Administration, and it is recommended that their concurrence be sought early in the process.
2 An Environmental Assessment is needed to cover all General Aviation projects due to the cumulative effect each project may have upon the overall operation of the airport; each individual project would likely meet a Federal Aviation Administration criterion for Order 1051.1E.
3 Consultation with the Virginia Department of Historic Resources (archaeology) and US Army Corps of Engineers (impacts to Waters of the US) needed; based on consultation and anticipated environmental affects of project implementation, the Federal Aviation Administration may determine Categorical Exclusion applicable for the proposed action (Criterion 310f of FAA Order 1050.1E).
4 The proposed action involves land acquisition greater than 3 acres; if the proposed action is less than 3 acres, the proposed action would meet Section 301r of Federal Aviation Administration Order 1050.1E.
5 Land will be aquired with the ultimate proposed action/development meeting Categorical Exclusion action requirement.
6 Federal Aviation Administration will require that Roanoke Regional Airport designate a proposed action for the land prior to determining the level of environmental documentation needed to acquire the land. Land acquisition is estimated to be greater than 3 acres; if the proposed action is less than 3 acres, the proposed action would meet Section 301r of Federal Aviation Administration Order 1050.1E. meet Section 301r of Federal Aviation Administration Order 1050.1E.
^ The designated Categorical Exclusion criterion is not located within in Federal Aviation Administration Order 1050.1E, but action would not cause significant effect.

Source: HNTB analysis.



ENVIRONMENTAL CONSTRAINTS

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

DATE:
Jan 09, 2008

SHEET No.
7-1

P:_Projects\40311 ROA Master Plan Update\Environmental Overview\ENVIRONMENTAL CONSTRAINTS MAP NEW BASE.dwg ENVIRONMENTAL CONSTRAINTS Jan 09, 2008 – 10:28am

Table 7.2

Summary of Projected Aircraft Operations by Aircraft Type

Equipment Type	2005	2010	2015	2020	2025
A300-600	166	260	260	260	208
767-200	-	104	156	208	260
757-200	738	917	1,042	1,042	1,025
727-200	426	260	93	-	-
727-100	92	-	-	-	-
737-800	15	16	18	20	20
737-700	6	16	18	18	20
737-300/400	-	104	260	411	520
737-200C	1	-	-	-	-
737-100/200	21	10	-	-	-
A319	-	10	12	12	14
MD-80	1	204	304	402	400
MD-87	-	4	4	4	2
DC-9-40	756	260	51	-	-
DC-9-30	42	-	-	-	-
DC-9-15	8	2	-	-	-
Embraer RJ170	-	-	703	2,108	3,514
Embraer RJ145	3,774	3,514	5,302	5,622	6,084
Canadair CRJ-200	10,397	12,649	13,358	13,508	14,958
Dassault Falcon	10	-	-	-	-
CV-580 Convair	6	1	-	-	-
DHC8-300 DASH8/8Q	3,381	4,919	4,216	3,514	2,108
DHC8 DASH 8	3,822	1,698	-	-	-
Saab 340	2,333	-	-	-	-
Multi-Engine Turbojet	14,580	21,732	30,302	37,024	44,937
Multi-Engine Turboprop	17,587	15,532	13,672	12,287	10,879
Multi-Engine Reciprocating	15,471	14,458	13,676	13,231	12,772
Single Engine Reciprocating	10,371	9,186	8,189	7,495	6,772
Helicopter	490	505	498	493	480
Military	1,401	1,374	1,374	1,374	1,374
Total	85,894	87,736	93,509	99,033	106,347

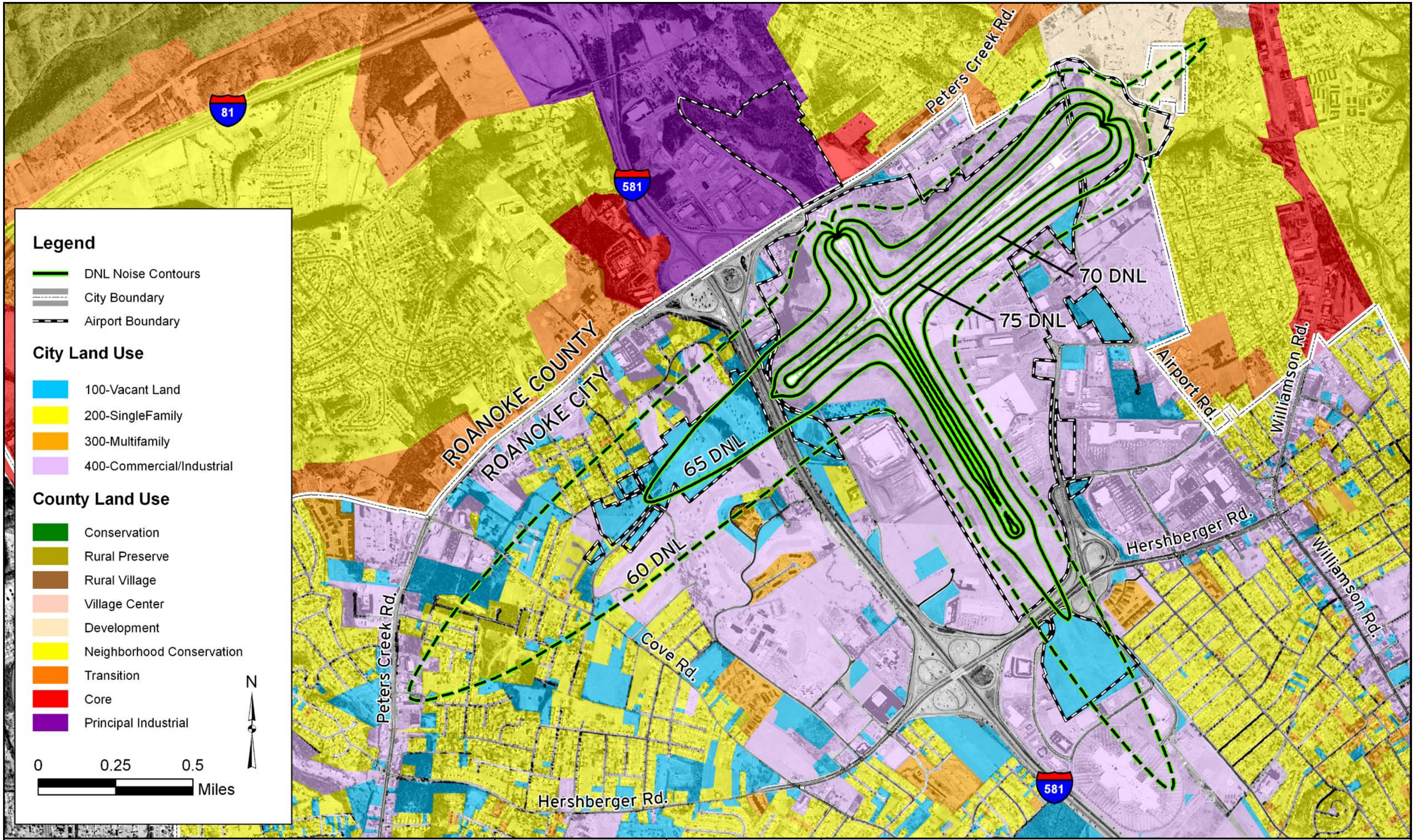
Sources: Table 4.31 and HNTB analysis.

Table 7.3

2025 Runway Use

Runway	Time of Day	Operations Type			
		Arrival	Departure	Touch & Go	Total
6	Day	11.50%	2.38%	0.01%	13.90%
	Night	11.48%	2.67%	0.02%	14.17%
15	Day	0.39%	9.41%	0.01%	9.81%
	Night	0.00%	10.55%	0.00%	10.55%
24	Day	17.44%	34.10%	0.17%	51.71%
	Night	16.90%	38.50%	0.33%	55.72%
33	Day	20.49%	3.74%	0.36%	24.59%
	Night	19.56%	0.00%	0.00%	19.56%
Total Daytime Usage		49.82%	49.63%	0.55%	100.00%
Total Nighttime Usage		47.94%	51.71%	0.35%	100.00%

Source: NEM Update for ROA, HNTB 2001.



NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET, SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

20 YEAR NOISE CONTOUR - OFF-AIRPORT LAND USE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Nov 30, 2007

SHEET No. 7-2

P:_Projects\40311 ROA Master Plan Update\Environmental Overview\7-2 OFF-AIRPORT LAND-USE_NOISE CONTOURS.dwg S9 Nov 30, 2007 - 10:43am

7.3 AIR QUALITY

The Clean Air Act of 1970 (CAA) was enacted to protect the nation's air quality, as well as the public health. Amendments in 1970, 1977, and 1990 established Federal standards to control air pollution emissions and to delegate the implementation of such standards to the states.

The FAA's Air Quality Procedures for Civilian Airports and Air Forces Bases, (April 1997) provides guidance for air quality analysis requirements. The handbook is consistent with all current Federal air quality laws and regulation affecting aviation including National Environmental Policy Act, Council on Environmental Quality Regulations, Clear Air Act and other related statutes, regulations, directives and orders. Air quality analysis is not required for Federally-funded projects if the following conditions apply:

- The facility is in an attainment area for all National Ambient Air Quality Standards (NAAQS) pollutants; and,
- There are less than 1.3 million enplanements (2.6 million passengers) and 180,000 General Aviation (GA) operations annually.

The US Environmental Protection Agency (EPA) has designated the Roanoke area as an 8-hour non-attainment area for ozone. However, the official designation that the Roanoke area is not in attainment has been deferred because officials created and implemented an "Early Action Compact" which is a plan developed to reduce ground-level ozone pollution. Early Action Compacts are agreements by the localities, state air quality department (such as Virginia Department of Environmental Quality) and EPA to develop ozone early action plans to reduce ozone precursor pollutants and improve air quality in a proactive manner. In return, these areas receive a delay in official nonattainment area designations and related requirements. The Early Action Compact includes measures the community must attain at certain milestones. As long as these areas, such as the Roanoke area, are meeting its Early Action Compact agreed upon milestones, the impact of the designations will be deferred. If the Roanoke area meets its milestone by the end of 2007, then the area will be in attainment. The EPA will review the last installment of air quality data and make a decision on attainment for the Roanoke area by April 2008.

The Virginia Department of Environmental Quality (DEQ) monitors the air quality in the Roanoke area. In the latest cover letter to the EPA (dated June 28, 2007) regarding the on-going Early Action Compact (EAC) reporting, the DEQ states the Roanoke area is continuing its efforts to meet attainment measures and is progressing to meet these measures. The letter states that, based on the data collected to date, the Roanoke area is in attainment. It is recommended that information relative to completion of the EAC be monitored, specifically in April 2008.

As part of the EAC, the Roanoke area is required to also complete a "Maintenance of Growth" document to address emissions growth at least five years beyond December 31, 2007, ensuring that the area will remain in attainment of the 8-hour standard during that period. The DEP believes that it met this requirement as part of the Draft of State Implementation Plan for Early Action Compact Area submitted in November 2004. Additionally, since the Roanoke area has never been officially designated as a non-attainment area, technically, a "Maintenance for Growth' plan is not necessary.

Assuming the Roanoke area is in attainment and since the enplanements for the Airport are less than 1.3 million, and the annual GA operations are less than 180,000, ROA would not be required to conduct air quality analysis. If however, the EAC is not met and the area is designated non-attainment, environmental documents for future improvements must analyze air quality impacts.

7.4 BIOTIC RESOURCES (INCLUDING ENDANGERED AND THREATENED SPECIES)

The majority of the improvements in this Master Plan do not involve alterations of vast land areas. The majority of the proposed improvements affect land that is already developed or previously affected by development. However, some projects, such as constructing the ARFF and training facility as well as expanding the airfield maintenance facility, may affect biotic communities due to activities such as tree clearing. Implementation of the proposed projects is not anticipated to greatly affect biotic resources due to the urban nature of the Airport property and surrounding properties.

The Endangered Species Act, as amended, requires each Federal agency to ensure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species. The term "Endangered" is defined as "any species which is in danger of extinction throughout all or a significant portion of its range". The term "Threatened Species" is defined as "any species which is likely to become an Endangered Species within the foreseeable future throughout all or a significant portion of its range". Species with the Federal classification of Endangered (E), Threatened (T), or Proposed (P) for such listing are protected under the ESA, as amended.

The United States Fish and Wildlife Service (USFWS) lists two endangered species for the City of Roanoke. These species are the Roanoke logperch (Percina rex) and the Indiana bat (Myotis sodalis). For Roanoke County, the USFWS lists the Roanoke logperch and Indiana bat and Smooth coneflower (Echinacea laevigata) as endangered species, and Small whorled pogonia (Isotria medeoloides) as a threatened species.

If streams are to be impacted to accommodate development, it is likely that a review of the streams for potential habitat and potential presence of the Roanoke logperch will be required. None of the projects proposed within the 2025 planning horizon would appear to be affected by this species; however, anticipated development of the Northwest Quadrant beyond the planning horizon could be affected and would require a review.

Potential habitat for the Indiana bat may be limited at the Airport. The bats typically roost in caves and feed along streams. Habitat is likely limited due to previous land disturbing activities which have reduced the number of trees on the tract. Projects potentially affected by this species include the new ARFF facility and those proposed in the Northwest Quadrant.

Potential habitat for the two Federally-protected plant species, Smooth coneflower and Small whorled pogonia, exists in the Northwest Quadrant, the northeast portion of the Airport, as well as along Runway 24. Considering the urbanized setting and lack of habitat for the species on Airport property, it is unlikely that endangered or threatened species would be found in future areas of development. A pre-screening review with the Virginia Department of Conservation and Recreation (Virginia Natural Heritage Program) (VNHP) and Virginia Department of Game and Inland Fisheries (VGIF) would likely verify the limited potential for the presence of endangered and threatened species. The VNHP is responsible for screening Federally-listed plant species. The VGIF is for screening federally-listed animal species.

This screening process would determine if the US Fish and Wildlife Service would require a review of the area for potential habitat of one or more Federally-protected species. Information required for the pre-screening review includes: project description, existing site conditions from a natural communities perspective, US Geologic Survey map with project boundaries, and recent aerial orthophotography with the project boundaries on it. Conceptual designs and details for the project would be of value as these designs would assist VNHP and VGIP on whether to request a review of potential habitat at the Airport prior to detailed planning for improvement projects.

7.5 WETLANDS

Section 404 of the Clean Water Act provides Federal protection of waters of the United States, including wetlands and streams. Wetlands are broadly defined as areas inundated by surface or groundwater with a frequency sufficient to support vegetation or aquatic life requiring saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, sloughs, river overflows, mud flats, and natural ponds.

The Airport property should be re-investigated for wetlands and streams prior to formal design of proposed improvements. With the 2025 planning horizon of the Master Plan Update, the proposed improvements located in the northeast quadrant of the Airport are of particular interest. Beyond this horizon, significant development of the Northwest Quadrant is planned and would need to be re-investigated. The US Geologic Survey map and aerial orthophotography from 2006 depicts drainage flowing in a southerly direction. There are several environmental concerns with implementing projects in this area, including wetlands and streams. The area should be delineated for waters of the US using the latest guidance from the US

Army Corps of Engineers (USACE). Based on the delineation and discussions with the USACE regarding impacts to streams, ROA will have more information to better plan for development in this quadrant. The delineation of these features and conversations with the USACE will assist with avoidance and/or minimization of these features to the maximum extent practicable.

The Commonwealth of Virginia has its own regulations to protect wetlands and streams. The Virginia Department of Environmental Quality (VDEQ) administers these regulations. If impacts to wetlands and/or streams are to occur from development projects at the Airport, authorizations from the USACE and VDEP would be necessary to impact these resources.

7.6 HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Two Federal laws apply to this environmental impact category. The two laws are National Historic Preservation Act of 1966, as amended, and the Archaeological and Historic Preservation Act of 1974. These two laws require consultation with the State Historic Preservation Officer. For Virginia, the State Historic Preservation Officer is part of Virginia Department of Historic Resources (VDHR).

It is recommended that discussions with the VDHR occur for the proposed projects planned for the northeast portion of the Airport and the Northwest Quadrant as well as any future improvements north of Runway 24. Consultation is recommended because the proposed projects may affect historic archaeological sites in this area. There is a known archaeological site located downstream of this drainage along Runway 24.

There are several proposed projects involving the demolition of buildings. These buildings will be demolished to accommodate upgrades in the facilities at ROA. If the buildings to be demolished are near 50 years of age, it is recommended that consultation with Virginia Department of Historic Resources (VDHR) be conducted.

Blue Ridge Memorial Gardens (BRMG), located along Airport Road must be considered for historic resources. Proposed improvements associated with roadway improvements include the Airport Road/ Municipal Road intersection improvements and other improvements along Airport Road adjacent to BRMG. It is likely that improvements can be accomplished without the need to acquire additional right of way or easements into the BRMG. However, if right of way or easements along Airport Road are required, it is recommended that the area near Blue Ridge Memorial Gardens be further assessed for compliance with National Historic Preservation Act of 1966, as amended, and the Archaeological and Historic Preservation Act of 1974.

7.7 LIGHT EMISSIONS AND VISUAL IMPACTS

Airports have lighting requirements to ensure safety for employees, aircraft and passengers. Consideration must be given to the impact that additional lighting will have on the surrounding community. The impact of lighting the upgrades proposed for the general aviation projects and whether or how the development and redevelopment of GA may visually affect the surrounding community should be included in project specific environmental documentation.

7.8 CONSTRUCTION IMPACTS

Airport construction may cause various environmental effects primarily due to dust, aircraft and heavy equipment emissions, stormwater runoff containing sediment and/or spilled or leaking petroleum products, and noise. The long-term impacts of the proposed action are usually greater than construction impacts, although improper implementation of best management practices for construction may cause significant short-term impacts.

Generally speaking, the building of new airport facilities may cause temporary impacts water and air quality, ambient noise levels, historic resources, and local traffic patterns. Typical airport actions causing construction impacts include: airside activities (e.g., new or expanded terminal and hangar facilities, new airports or extended runways and taxiways, navigational aids, etc.) and landside activities (e.g., new or relocated access roadways and remote parking facilities and rental car lots).

Impacts from the construction of the proposed airport development will be short in nature, typically not lasting more than a few months at a time during varying construction stages. Impacts from construction are not anticipated to be significant with the short construction duration and the implementation of erosion and sedimentation controls and other standard construction practices. An erosion and sedimentation control permit will be needed for land disturbing activities equal to or exceeding 10,000 square feet in area. A land-disturbing activity is "any land change on private or public land that may result in soil erosion from water or wind and the movement of sediments into state waters or onto lands in the commonwealth, including, but not limited to, clearing, grading, excavating, transporting, and filling of land."

Acquisition of all necessary construction permits will be necessary prior to construction of these projects. The ROA will need to obtain building permits for the proposed improvements. The City of Roanoke Planning Building and Development issues these permits and other permits associated with development.

7.9 DOT SECTION 4(F)

Section 4(f) of the Department of Transportation Act provides that no publicly owned park, recreation area, wildlife or waterfowl refuge, or land of a historic site that is of national, state, or local significance will be used, acquired, or affected by programs or projects requiring Federal assistance for implementation. Most the projects proposed do not affect 4(f) properties, although further review is recommended for any improvements along Airport Road.

As mentioned under Historical/ Architectural/Archaeological/Cultural Resources discussion, there is a cemetery (BRMG) located along Airport Road. If additional right-of-way or easements are needed to accomplish these improvements, it is recommended that projects in the area near BRMG should be further assessed for compliance with Section 4(f).

7.10 HAZARDOUS MATERIALS, POLLUTION PREVENTION, AND SOLID WASTE

7.10.1 Hazardous Materials

Regulatory law affecting airports includes the Resource Conservation and Recover Act of 1976 (RCRA). Through this legislation, the US Congress directed the EPA to develop and implement programs meant to protect human health and welfare, as well as the environment from improper hazardous waste management practices. Hazardous wastes are those materials that can cause injury or death, or that can damage or pollute the air, land, and water. Other pertinent legislation regarding this matter includes legislation that was a national campaign aimed at toxic waste cleanup efforts which included The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), a.k.a. Superfund Act, as well as the Superfund Amendments and Reauthorization Act of 1986 (SARA).

A Phase I Environmental Site Assessment (ESA) must be conducted prior to land acquisition if Federal funding will be used. A Phase I ESA will assure the Airport that it is not acquiring land contaminated with hazardous materials from past land practices.

Additionally, several of the proposed improvements will require the demolition of buildings as part of the redevelopment and expansion of the GA area. These buildings were constructed prior to 1987 and have the potential for the presence of asbestos-containing materials. These hazardous substances have the potential to adversely affect humans, wildlife and ecosystems. It is advisable that Airport determine if asbestos is found in the building as this may affect demolition and disposal costs. If demolition or removal of the structure from the premises is proposed and asbestos is found, then it is recommended that the contractor performing the removal take appropriate precautions during demolition or removal as well as disclose the potential hazard to the receiving land fill.

Many structures constructed prior to 1978 have the potential for the presence of lead based paint. Natural degradation of painted walls can cause paint to chip, crack, or peel, which can create an avenue for human exposure. Lead is a hazardous substance which has the potential to adversely affect humans, especially children. It is advisable that ROA determine if lead-based paint is found in the building as this may affect demolition and disposal costs. If demolition or removal of the structure from the premises is proposed and lead is found, then it is recommended that the contractor performing the removal take appropriate precautions during demolition or removal as well as disclose the potential hazard to the receiving land fill.

7.10.2 Pollution Prevention

Pollution prevention, as defined by Council on Environmental Quality, includes, but is not limited to: reducing or eliminating hazardous or other polluting inputs which can contribute to both point and non-point source pollution; modifying manufacturing, maintenance, or other industrial practices; modifying product designs; recycling (especially in-process, closed loop recycling); preventing the disposal and transfer of pollution from one media to another; and increasing energy efficiency and conservation.

ROA has an approved Stormwater Prevention Plan (SWPP). This plan is part of the Virginia Pollutant Discharge Elimination System (VPDES) permit issued to the ROA, which will expire on June 30, 2009. The SWPP includes a schedule for implementation of best management practices (BMPs), training requirements, and facility inspection protocols. Items covered in the training include prohibited discharges, inspections, spill response, good housekeeping, implementation of BMPs, and record keeping. Additionally, the Airport has installed fuel traps and detention basins at strategic locations to prevent pollution.

Continued adherence to the SWPP will prevent pollution of receiving waters. The proposed projects, including but not limited to, development and redevelopment GA facilities, fuel farm expansion, relocation of glycol stormwater and lavatory fluids disposal facility, as well as expansion of the airfield maintenance facility, should be reviewed for compliance with the SWPP and NPDES.

An erosion and sedimentation control permit for land disturbing activities will be needed if the project disturbance area equals or exceeds 10,000 square feet in area.

7.10.3 Solid Waste

Construction, renovation, or demolition of most airside projects produces debris (e.g., dirt, concrete, asphalt) that must be properly disposed. In addition, new or renovated terminal, cargo, or maintenance facilities may involve construction, renovation, or demolition that produces other types of solid waste (bricks, steel, wood, gypsum, glass). Therefore, ROA should follow Federal, state, or local regulations that address solid waste.

Most of the proposed projects are not anticipated to cause or change greatly the solid waste currently being disposed. Solid waste impacts should be considered with the development and redevelopment of GA facilities, the EMAS projects, and Airfield/Airline Maintenance/Support facility projects.

7.11 NATURAL RESOURCES AND ENERGY SUPPLY

Airport development actions have the potential to change energy requirements or use consumable natural resources. When reviewing the environmental effects of a proposed action and its reasonable alternatives, each alternative's energy requirements, energy conservation, and the use of natural or consumable resources should be assessed. Typical actions that could cause such impacts include airside/landside expansion (new or expanded terminal and hangar facilities, new or extended runways and taxiways, airfield lighting, navigational aids, etc.); land acquisition for aviation-related use, new or moved access roadways, remote parking facilities, and rental car lots; significant changes in air traffic and airfield operations; and significant construction activity.

The proposed improvements at ROA include some of the typical actions noted previously. It is not anticipated that these improvement would result in significant changes in natural resources and energy supply, nor is it anticipated that improvements to stationary facilities, such as those associated with GA development, will have an effect on the ability of local energy suppliers to meet demand. Natural growth will lead to increased fuel consumption; however, these increases would be expected to occur with or without the proposed improvements since the additional aviation demands would still have to be accommodated by the Airport or other nearby airports.

7.12 WATER QUALITY

Airport activities may cause water quality impacts due to their proximity to waterways. In particular, construction activities or seasonal airport anti-icing/deicing activities are major concerns. The Federal Water Pollution Control Act of 1972 (FWPCA) sought to restore the nation's navigable waterways and lakes so that they provide safe conditions to humans and wildlife. The FWPCA, as amended by the Clean Water Act of 1977 (CWA), provides for the establishment of water quality standards, control of discharges into surface and subsurface waters, develop waste treatment management plans and practices, as well as issue permits for discharges and for dredged or fill material.

The proposed improvements at ROA are not expected to impact water quality conditions in the area. Water-dependent projects (i.e., those impacting wetlands and streams) will require a water quality certification verifying that the proposed project will not affect the water quality standards. Continued implementation of the SWPP and adequate sediment and erosion control will prevent degradation of water quality in the receiving waters. Additionally, the ROA has installed fuel traps and detention basins at strategic locations to protect water quality. The proposed improvements that should be examined for water quality impacts include but are not limited to the development and redevelopment of GA facilities, fuel farm expansion, relocation of glycol stormwater and lavatory fluids disposal facility, and expansion of the airfield maintenance facility. The improvements should be reviewed for compliance with the SWPP and NPDES.

7.13 FARMLAND

The Farmland Protection Policy Act (FFPA), PL 97-98 as amended, authorized the Department of Agriculture to develop criteria for identifying the effects of Federal programs on the conversion of farmland to non-agricultural uses. The zoning around the ROA was reviewed and no properties zoned as agricultural were identified.

Coordination with the US Department of Agriculture indicates that the FPPA does not apply to proposed improvements based on prior local zoning.

7.14 OTHER ENVIRONMENTAL CONSIDERATIONS AND POTENTIAL CONSEQUENCES

Unique to ROA improvements considered for the facility includes karst investigation. Karst topography chiefly consists of dissolving rock, and typically features sinkholes, sinking streams, closed depressions, subterranean drainage, and caves. The entire Airport should be considered to be within a karst hazard area. Specific karst hazard areas were not identified during the previous Master Plan Update (April 1998). Development plans should include a subsurface exploration prior to development of construction drawings for potential projects necessitating this analysis.

Chapter Eight
Recommended Plan

8.1 INTRODUCTION

This chapter describes the recommended development plan for ROA. The recommended improvements are based on the facility requirements identified in Chapter Five, which were, in turn, based on the aviation activity forecasts presented in Chapter Four. Finally, the recommended plan reflects the alternatives analysis described in Chapter Six of this Study.

Section 8.2 outlines the overall planning strategy used to develop the recommended plan. Section 8.3 identifies the general development areas as defined by on-airport land use designations. A detailed discussion of the recommended plan is presented in Section 8.4. Lastly, Section 8.5 presents the development cost and phasing of the plan.

8.2 OVERALL DEVELOPMENT STRATEGY

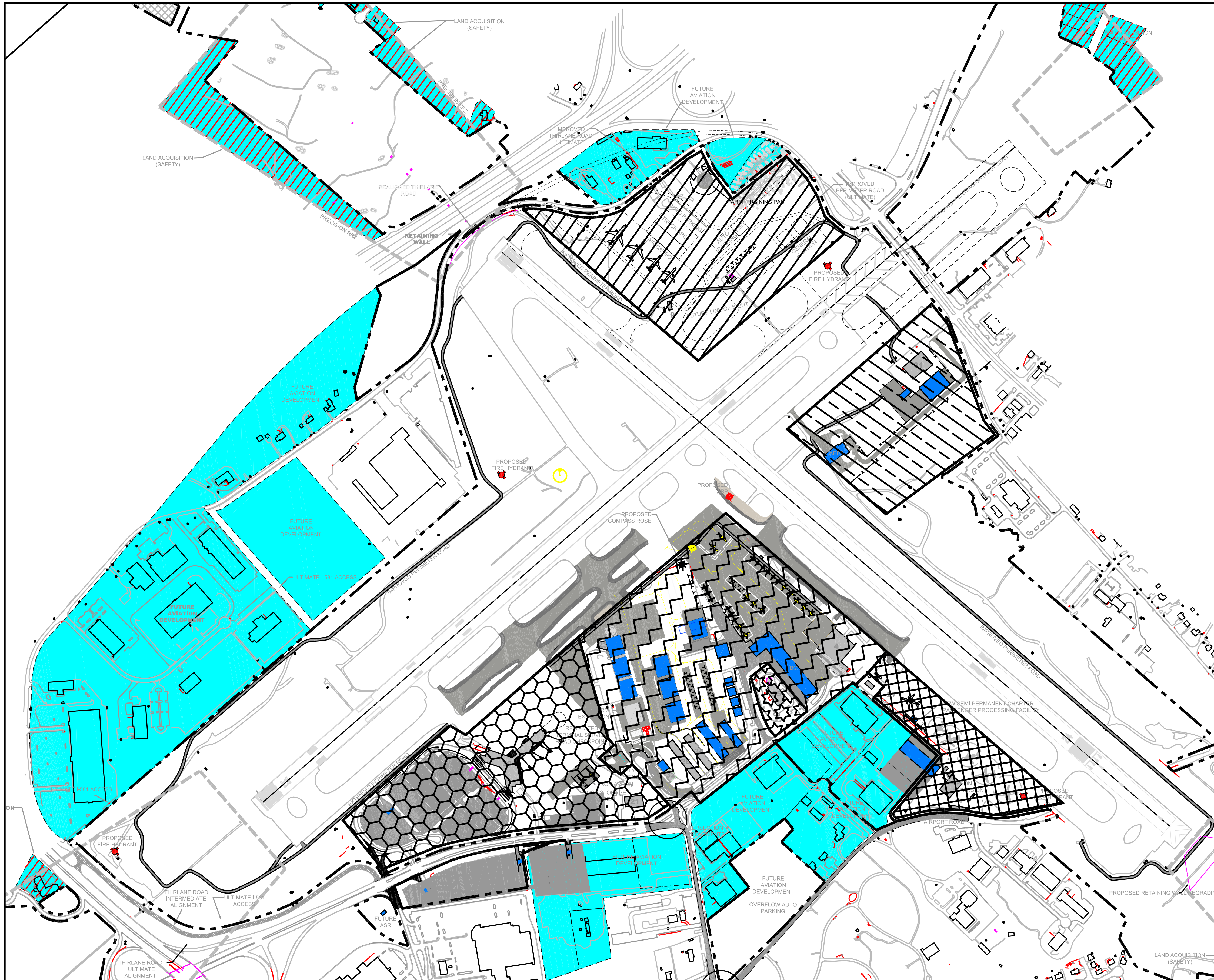
The overall development strategy for the Airport is guided by the goals and objectives outlined in Chapter One. In summary, these included:

- Develop a plan that ensures the Airport is safe and reliable.
- Develop a plan that ensures the Airport meets safety requirements.
- Develop the Airport's physical facilities to meet the region's future aviation needs for passengers, cargo, and GA.
- Provide facilities at a reasonable cost to all users (passengers, airlines, GA, employees, etc.), while ensuring that the Airport is self-sustaining through the exploration of new revenue sources.
- Develop the Airport in a manner that is flexible, adaptable to changing conditions, and recognizes the highest and best land uses.
- Develop the Airport in a manner that will minimize and reduce adverse environmental effects.
- Support local and regional economic goals and plans without constraining long-term Airport development.
- Build and maintain community confidence and support.

8.3 ON-AIRPORT LAND USE

The current Airport boundary encompasses 904 acres, of which 647 acres are within the security fence.

The recommended plan identifies eight land use types for Airport development, the locations of which are shown in **Figure 8-1** and described below:



LEGEND

Airfield (Airport Property Line)	
Property Acquisition (Safety)	
Property Acq. (Aviation Dev.)	
Terminal Area Development	
General Aviation Development	
Air Cargo Development	
Aviation Related Development	
Airport Support Development	
ATCT Development	

Magnetic Declination
8° 16' W (2007)
Annual Variation
0° 2' W/year

MAG. NORTH
TRUE NORTH

0' 800' 1600'
SCALE 1" = 800'

AIRPORT BUILDINGS

BLDG. NO.	DESCRIPTION
2	Hangar
3	Hangar
4	Maintenance Hangar
5	Cargo Building
8	ASR Building
9	Storage Building
17	Storage Hangar
18	Storage Hangar & Office
19	Storage Hangar
20	Storage Hangar
21	ARFF Facility
22	Storage Hangar
23	GA Terminal
24	T-hangar
25	Maintenance Hangar
26	T-hangar
27	Vault Room
28	Parking Exit Toll Bdg
30	New Terminal Bdg
31	Airfield Maintenance Bdg.
32	Corp. Hangar
34	T-hangar
35	ATCT Facility

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

ON-AIRPORT LAND-USE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Nov 02, 2007

SHEET No.
8-1

P:_Projects\40311 ROA Master Plan Update\CAD\ALP SET\SHT-10 On-Airport Land-Use.dwg S3 Nov 02, 2007 – 1:58pm

- Airfield/NAVAID (A/N), including runways, taxiways, safety areas, airfield lighting, and on-airport navigational aids;
- Terminal Area (TA), primarily the passenger terminal, aircraft apron, and landside facilities (parking and roadways);
- Air Cargo (AC), including cargo apron, buildings, and landside facilities;
- General Aviation (GA), including FBO facilities, aprons, taxilanes, and hangars;
- Airport Support (AS), including the control tower, ARFF, airfield maintenance and other support areas;
- FAA Air Traffic Control (ATC);
- Land Acquisition for Future Aviation Development (LA); and,
- Land Acquisition for Safety (LS).

8.4 AIRPORT DEVELOPMENT PLAN

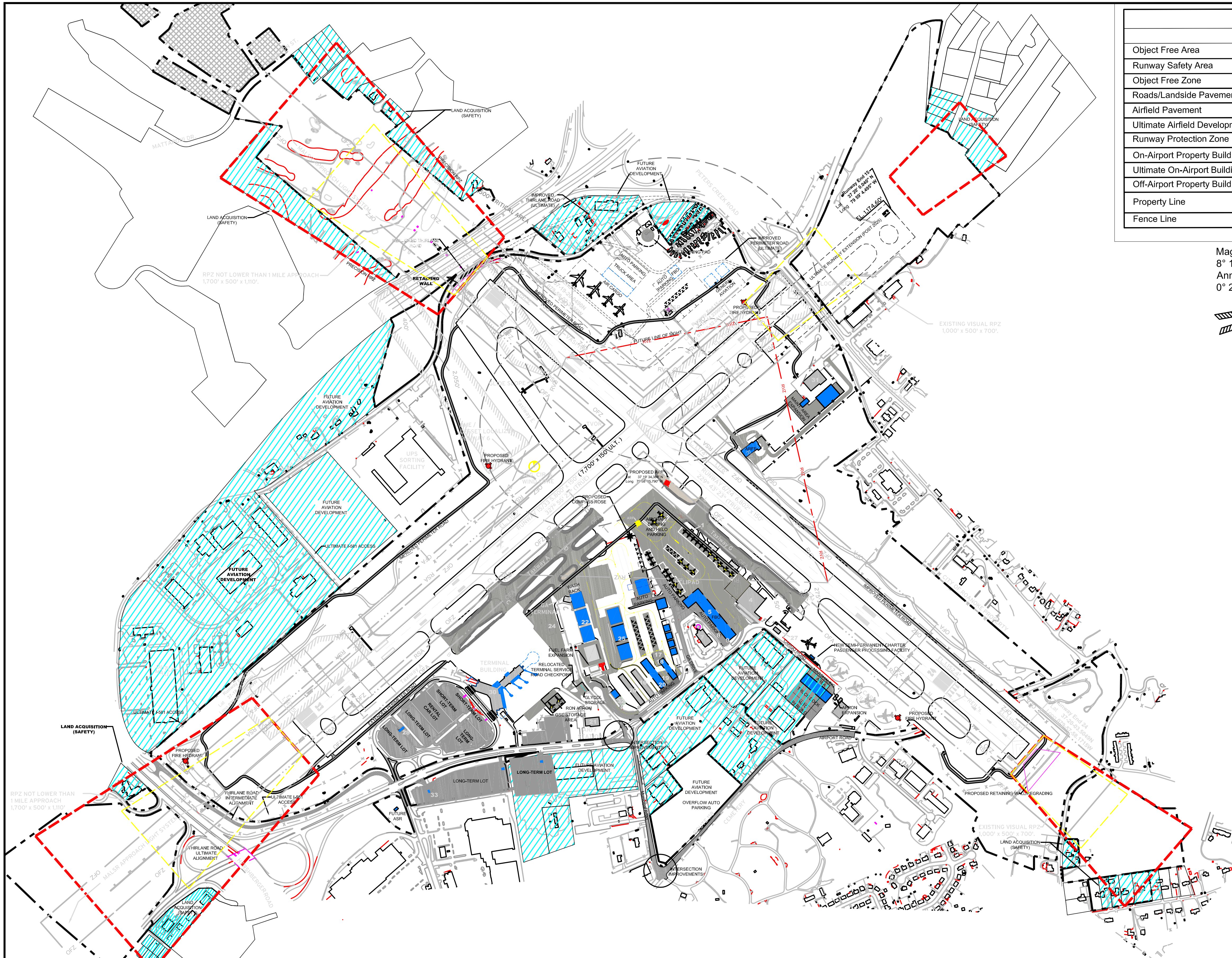
The following sections describe the recommended development plan as depicted on the Airport Layout Plan (shown in **Figure 8-2**).

8.4.1 Airfield/NAVAID

The previous (1998) master plan recommended a significant number of upgrades to improve airfield circulation and meet FAA design criteria. The last of the projects, relocating Taxiway A between Taxiway B and Taxiway E, and relocating Taxiway G between Taxiway A and M, will be completed in 2008. With the airfield almost completely rebuilt over the last 10 years, the focus of this Master Plan Update is to improve the overall safety of the airfield with a primary focus on the runway safety areas for Runway 6-24. The airfield will have adequate capacity for the next 20 years and beyond.

The 2007 Master Plan Update recommends three additional airfield projects. The first project is constructing partial EMAS installations on both ends of Runway 6-24. As described in Section 6.3.2, neither a full safety area nor a full EMAS is feasible from a benefit/cost perspective. Therefore, the Master Plan Update recommends installing a partial EMAS at each end or Runway 6-24. The EMAS would be capable of stopping regional aircraft and narrow body aircraft up to a Boeing 757 exiting the runway end at 40 knots. It is also recommended that further study of providing EMAS installations on Runway 6-24 include consideration for eliminating or reducing the 800-foot displacement of the 24 threshold to provide additional runway length for landing aircraft in west flow.

The second airfield/NAVAID project is upgrading the Airport's perimeter road network, which is currently a narrow, unpaved one-lane facility. The Master Plan Update recommends a fully-paved 20-foot wide road, where feasible. Also included in this project is clearing vegetative growth along the Airport perimeter fence line to enable operations personnel to clearly see the fence line from the perimeter road.



LEGEND

	EXISTING	FUTURE
Object Free Area	OFA	FOFA
Runway Safety Area	RSA	FRSA
Object Free Zone	OFZ	FOFZ
Roads/Landside Pavement		
Airfield Pavement		
Ultimate Airfield Development	N/A	
Runway Protection Zone		
On-Airport Property Buildings		
Ultimate On-Airport Buildings	N/A	
Off-Airport Property Buildings		
Property Line		
Fence Line	—x—x—x—	—x—x—x—

Magnetic Declination
8° 16' W (2007)
Annual Variation
0° 2' W/year

MAG. NORTH
TRUE NORTH

0' 500' 1000'
SCALE 1" = 1000'

AIRPORT BUILDINGS

BLDG. NO.	DESCRIPTION
2	Hangar
3	Hangar
4	Maintenance Hangar
5	Cargo Building
6	RDP Facility
7	ATCT Facility
8	Storage Building - FAA
9	Storage Building - FAA
16	T-hangar
17	Storage Hangar
18	Storage Hangar & Office
19	Storage Hangar
20	Storage Hangar
21	ARFF Facility
22	FBO Maintenance Hangar
23	GA Terminal Building
24	FBO T-hangar
25	FBO Maintenance Hangar
26	FBO T-hangar
27	Electrical Vault
28	Parking Exit Toll Building
29	FBO Hangar
30	Terminal Building
31	Airfield Maintenance Bldg.
32	Corp. Storage Hangar
33	Parking Lot Booth

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

PROPOSED AIRPORT LAYOUT

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Dec 21, 2007

FIGURE
8-2

P:_Projects\40311 RDA Master Plan Update\CAD\ALP SET\SHT-3 PROPOSED ALP.dwg Fig 8-2 Dec 21, 2007 - 2:06pm

The third airfield project is the construction of a secondary remote deicing pad near the intersection of Taxiway G and Taxiway L. As the existing secondary deicing pad located on the air cargo ramp becomes congested due to air cargo growth and a new charter facility, this new location will provide a more efficient operation. The design of the pad should give consideration for collecting the spent glycol in an environmentally responsible manner.

Based on recent mapping, Runway 15-33 will need to be renumbered to 16-34 to account for a change in magnetic declination.

Although the existing runway lengths at ROA support both existing and projected air service at the Airport, the Master Plan Update recommends the Commission maintain the option to provide a longer runway in the event of unforeseen air service changes. The Master Plan Update includes the option to extend Runway 15-33 to the northwest over Peters Creek Road. The resulting 7,500-foot runway would accommodate new service to airlines hubs in Minneapolis-St. Paul, Dallas, and Houston. Given the rapidly rising terrain to the northwest, the longer runway would only be unidirectional (departures on Runway 15). However, the cost of extending any of the other runway ends made this the only cost-efficient option. The runway extension is not included in the 20-year CIP.

With the development of the new ATC tower, the now closed helicopter landing area will be replaced at the site of the secondary deicing pad at the intersection of Taxiways G and L. This will be a very efficient use of pavement as most helicopter operations at the Airport occur during the non-winter months.

8.4.2 Terminal Area

Terminal Building

The recommended terminal plan focuses on providing a designated area for hold bag screening functions, meeting future passenger demand levels, and upgrading passenger services and amenities.

The recommended terminal plan provides a separate hold bag screening area behind the airline ticket office. The area would be developed in phases of sophistication of explosion detection systems and baggage make up equipment as activity increases.

To meet forecast demand levels, the Master Plan Update recommends expanding the terminal's first floor restrooms and mechanical room, enlarging the entrances and exits to the inbound baggage layout area, expanding the passenger security screening checkpoint (including adding a second lane), expanding concourse restrooms, and providing a new meeter/greeter area on the second floor.

The Master Plan Update also recommends several concession improvements and amenity upgrades to provide a higher level of customer service, including placing a premium coffee shop on the lower level, improvements to concession layouts on the non-secure side of the second floor, adding passenger loading bridges, and additional concession space in the secure concourse (e.g., food and beverage and retail concessions).

Lastly, to address the unique needs of University-related charters, the Master Plan recommends designating a portion of the air cargo ramp for these charters and constructing a semi-permanent terminal to process passengers.

Landside

The recommended plan addresses the terminal landside campus (including the Airport entrance, circulation roads, and parking) and Airport access in the Airport vicinity. With the lack of available land on and adjacent to the Airport, the plan focuses on developments that will meet long-term demand, maintain a high level of passenger service, and be cost-effectively implemented.

The landside program incorporates the analysis described in Chapter Six as well as further discussions with the Commission Staff.

Figure 8-3 shows the recommended 2025 landside and access concept for ROA. The concept includes a series of projects, listed in order of their timing.

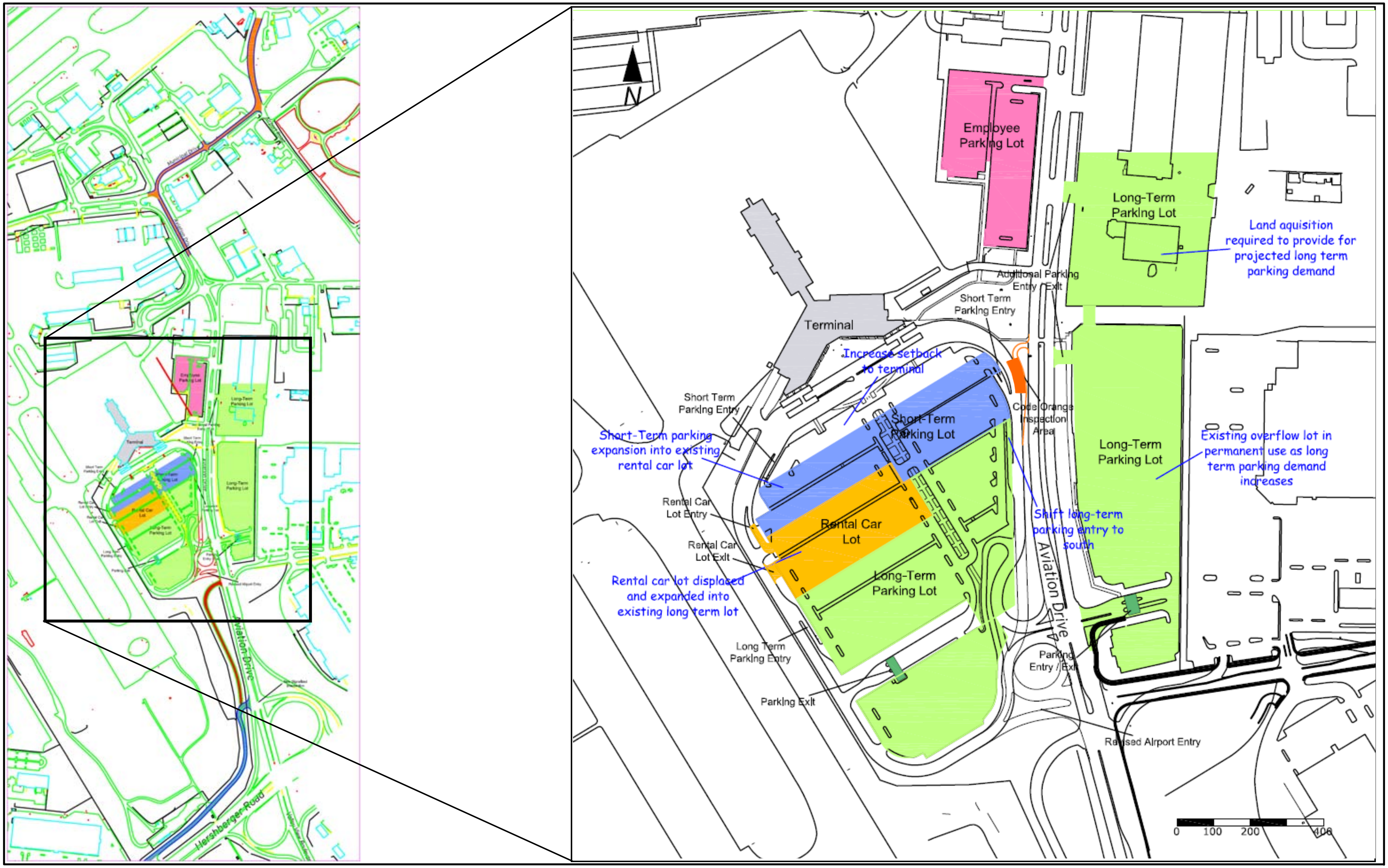
To meet forecast growth in parking demand, the Master Plan recommends reorganizing and expanding the Airport's parking system. Short-term parking would be expanded into the rental car area, while the current rental car area, in turn, would be expanded into the long-term parking area. To meet demand for long-term parking, the Master Plan Update recommends converting the overflow lot to long-term parking and acquiring the trucking depot to the north of that lot, demolishing the warehouse, and converting the area turned into long-term parking. Parking in the main lot would be shifted south to meet the desired setback from the terminal to the nearest parking spaces. If the trucking depot land cannot be purchased, the Master Plan Update recommends development of a parking structure in the existing overflow lot to meet long-term demand.

The Master Plan Update recommends constructing a new intersection between Thirlane Road and Aviation Drive. This project would occur in cooperation with the City on a proposed revision to the Towne Square Boulevard and Airport entrance intersections on Aviation Drive. This project would relocate the Thirlane Road intersection south to opposite the ramp to Aviation Drive from westbound Hershberger. [1]

To fix safety, security, and operational issues at this internal intersection, the Master Plan Update recommends reconfiguring the intersection of Waypoint Drive with the SIDA access gate. With this project, the SIDA gate is relocated; the access to the fuel farm improved for trucks delivering fuel, and cross traffic is guided through an improved intersection with Waypoint Drive.

Concerns about congestion on Herschberger Road and the ability to access the Airport from I-581 necessitate the need to identify an alternative route to the Airport

[1] Analysis of the City's proposed intersection on Airport traffic and recommendations for modifications are documented in Appendix F.



ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

Recommended Access and Parking Plan

FIGURE 8-3

off Peters Creek Road. To improve secondary access routing to the Airport, the Master Plan Update recommends modest reconstruction of Airport Road and Municipal Drive, and the two intersections at either end of Municipal Drive. The purpose of these improvements is to give better orientation and priority to airport traffic coming in from Peters Creek Road.

Lastly, the Master Plan Update recommends constructing a new interchange for the Airport from I-581 or I-73. This long-range project is planned to create an Airport access route of uninterrupted flow directly from the interstate, independent of other traffic. See **Figure 8-4**.

8.4.3 Air Cargo

Future air cargo activity can be accommodated at the existing air cargo facility. The Master Plan Update recommends, however, that adjoining land be acquired to provide room for a more efficient cargo layout and to meet future requirements. If this additional land cannot be acquired, the Master Plan Update recommends that further cargo facility expansion be made in the Northwest Quadrant.

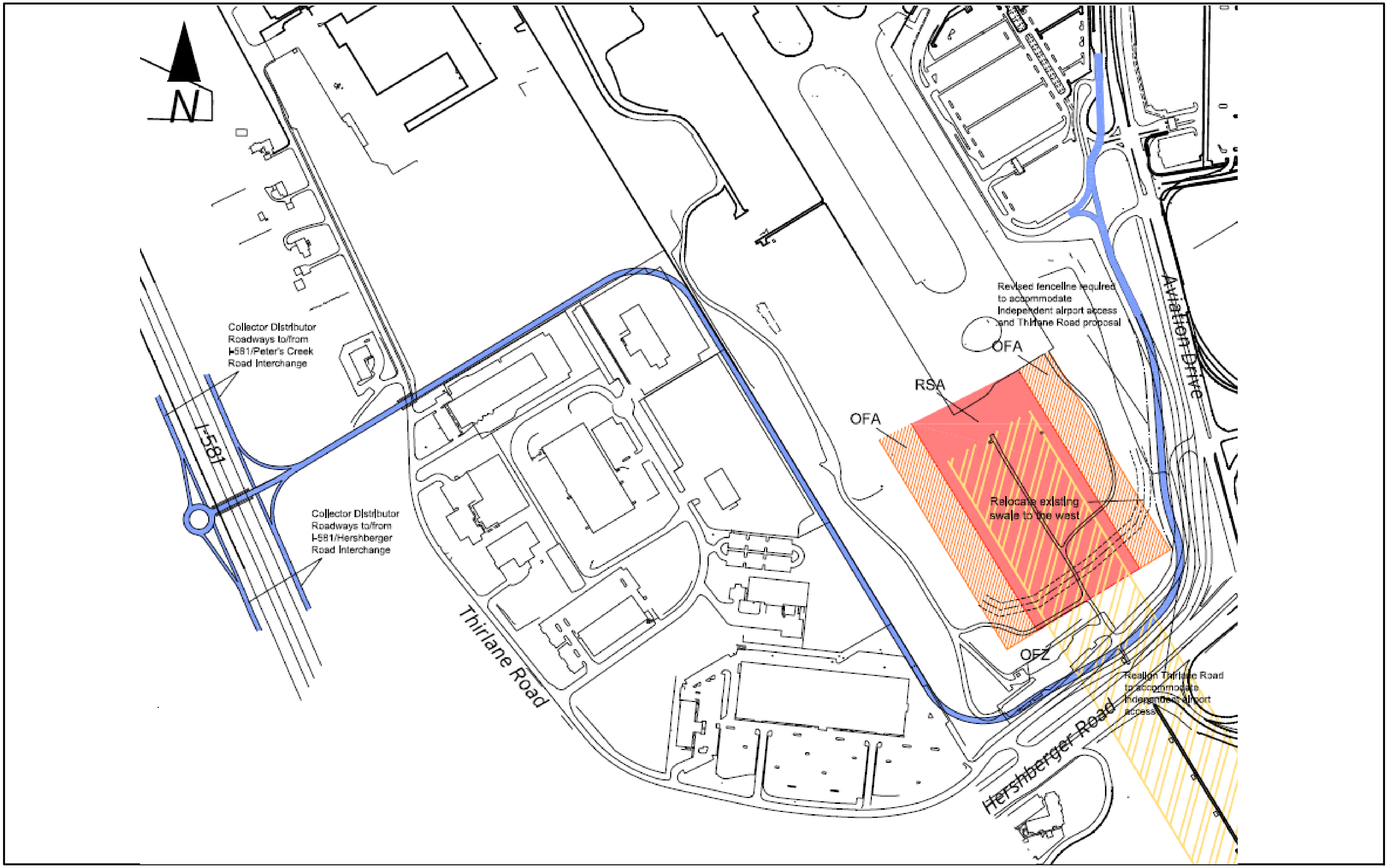
8.4.4 General Aviation Facilities

One of the key issues addressed in the Master Plan Update is determining the proper balance between expansion/ redevelopment of existing development areas and the development of new areas. In addition, the issue of how best to redevelop the old terminal area and whether it is feasible to initiate development of the Northwest Quadrant were addressed. Recognizing the goal of developing cost-effective facilities and ensuring a self-sustaining facility, the plan focuses on maximizing the potential of parcels already developed through expansion or redevelopment. The long-term demand for GA facilities dictates that the old terminal area also be developed over the next 20 years, while delaying for as long as feasible the development of undeveloped land in the Northwest Quadrant. It is also recommended for flexibility that as funds become available, the Commission make investment in site development of the Northwest Quadrant.

The recommended GA development plan addresses meeting FAA design criteria, forecast growth in GA activity, an anticipated increase in the share of business jets in the GA fleet, and a desire to provide a higher level of customer service (for example, many GA facilities have reached the end of their useful life). These goals were also balanced by providing a realistic plan in terms of cost.

To meet 2025 GA requirements, both the existing GA area and the currently undeveloped midfield area will be required. The overall plan is to relocate transient GA activity (including the FBO facilities) to the midfield area and gradually redevelop the existing GA campus for based aircraft facilities.

The Master Plan Update recommends constructing a new, large-scale FBO/GA terminal and hangar facility at the site of Building 5 (cargo building). This site takes advantage of an ideal location—close to the



ROANOKE REGIONAL AIRPORT

Long Range Access from I-581

FIGURE 8-4

runway intersection—and allows for a phased redevelopment of GA facilities.

The apron to the east of the new FBO building will be developed to provide transient parking through 2025, with a combination of "flow-through" and back-in spaces. The southern half of the GA site will serve to meet the needs of based aircraft. As such, additional T-hangars, tie-down space, and conventional hangars will be constructed at this location.

Should GA activity grow at a more rapid pace than in the base case forecast, the Master Plan Update recommends further expansion occur in the Northwest Quadrant.

8.4.5 Support Facilities

This section summarizes the recommended development plans for airfield maintenance, ARFF, GSA support, air carrier deicing tank staging, fuel farm, and airline maintenance.

Airfield Maintenance

The Master Plan Update recommends meeting future airfield maintenance requirements by expanding at the existing site, located on the north side of the airfield off Peters Creek Road.

ARFF

The existing ARFF station provides marginal response times and lacks many amenities found in newer facilities. As the passenger terminal ramp becomes more congested over time, there will continue to be a potential negative impact to response times. The Master Plan Update therefore recommends constructing a replacement ARFF facility between the Airfield Maintenance Facility and the runway intersection. The existing ARFF station could be reused as a secondary/emergency Airport operations command center and could house Commission staff that do not need to be in proximity other departments.

The Commission hosts a mobile ARFF training simulator at the Airport at least twice per year. This simulator requires access and an approximate one-acre parking area to conduct training exercises. A site in the Northwest Quadrant has been identified for these activities.

GSE Storage Area

To provide dedicated space for GSE equipment, a GSE storage apron is provided on the east side of the terminal apron. Additional storage space is also provided on the southwest side of the apron.

Fuel Farm

To meet future fuel farm requirements, the Master Plan Update recommends expanding at the existing fuel farm site. To improve fuel delivery efficiency, a truck maneuvering road should be constructed with a pull off lane for loading and unloading.

Air Carrier Deicing Tank Storage

The development plan for support facilities includes construction of a deicing storage facility east of the passenger terminal apron along Waypoint Drive. This site offers the added benefit of allowing delivery vehicles to use the improved circulation roadway designed for the expanded fuel farm.

Airline Maintenance

To improve airline maintenance efficiency, the Master Plan Update recommends enlarging the apron west of the airline maintenance building.

8.4.6 Land Acquisition

Based on future facility requirements, the need to meet FAA design standards, and to ensure compatible land uses in the Airport vicinity, the Master Plan recommends an additional 220 acres be acquired. A detailed discussion of land acquisition recommendations is presented in **Appendix U**.

Safety-Related Land Acquisition

Consistent with the FAA's guidance that airport sponsors should own land within runway protection zones (RPZs), the Master Plan Update recommends that the Commission place a high priority on acquiring about 44 acres of land within the RPZs of Runways 6, 24, and 33.

Aviation-Related Development Land Acquisition

There are three primary areas where additional land should be acquired to both help the Airport ensure compatible development in the vicinity of the Airport and to provide opportunities for future Airport expansion: 1) Northwest Quadrant, 2) Southwest Quadrant, and 3) eastern half of the Airport.

Northwest Quadrant

While the Airport owns most of the Northwest Quadrant (an area long-identified for future aviation development), the Master Plan Update recommends giving a high priority to acquiring an additional 12 acres which would provide the maximum flexibility for developing this site. An additional six acres northwest of the end of Runway 15 should also be acquired to help protect the option of extending Runway 15-33 to the northwest and owning the land within a future RPZ. Given the fact that a runway extension is not cost-justifiable within the 20-year planning horizon, this acquisition should be given a low priority.

Southwest Quadrant

Within the Southwest Quadrant, the Master Plan Update recommends giving a high priority to acquiring about 18 acres of land adjacent to the UPS ground sort facility as this would enable the Commission to control development and to ultimately provide aviation facilities on that site. An additional 89 acres, extending from the airfield to Thirlane Road and the I-581 right-of-way, should also be acquired; however, this should receive a low priority.

Eastern Half

The Master Plan Update recommends placing a high priority in acquiring 47 acres of commercial/industrial land in the eastern half of the Airport either directly adjacent to the air cargo apron or along Aviation Drive to help control incompatible development in this area, as well as to ultimately provide land for future long-term aviation development. An additional seven acres along Municipal Drive should also be acquired, however because it is further from the Airport, it should be given a lower priority.

8.5 AIRPORT LAYOUT PLANS

The major improvements recommended in the Master Plan Update are incorporated into the updated airport layout plan (ALP) set. The ALP consists of the following drawings:

- Title Sheet
- Existing Airport Layout
- Future Airport Layout
- Terminal Area Drawing
- General Aviation Drawing
- Cargo Area Drawing
- Part 77 Full Airspace
- Part 77 Conical Surface
- 2025 Noise Contour/ Off Airport Land-Use
- Runway Approach Profiles
- On-Airport Land-Use
- Airport Property Map
- Airport Property Map Data Sheet
- Zoning Overlay Map

Appendix V provides a half-size ALP set.

8.5.1 Title Sheet

The Title Sheet shows the Airport name, a location map, vicinity map, an ALP sheet index, and signature blocks.

8.5.2 Existing Airport Layout

The existing ALP portrays the Airport's airfield, structures (keyed to a building index), roadway system, and clearances in their current configuration.

8.5.3 Future Airport Layout

The future ALP overlays the recommended future projects that were identified in the Master Plan Update, including those pertaining to the airfield, buildings, aprons, and roadway/parking system.

8.5.4 Terminal Area Plan

The Terminal Area Plan is an enlargement of the terminal area and features terminal related projects that were identified in the Master Plan Update.

8.5.5 General Aviation Plan

The General Aviation Plan is an enlargement of the GA area and features related projects that were identified in the Master Plan Update.

8.5.6 Cargo Area Plan

The Cargo Area Plan is an enlargement of the cargo area and features related projects that were identified in the Master Plan Update.

8.5.7 Part 77 Drawings

A series of two drawings show the ultimate Part 77 surfaces for each runway, including the horizontal surface, conical surface, approach surfaces, transitional surfaces, and obstacle identification surface (OIS).

8.5.8 2025 Noise Contours/Off-Airport Land Use Drawing

The Noise Contour/Off-Airport Land Use drawing depicts 2025 noise contours and land uses in the area around the Airport (based on GIS data obtained from the City of Roanoke and Roanoke County).

8.5.9 Runway Approach Profiles

A series of four sheets shows existing/ultimate plan and profile diagrams for each runway end. The sheet highlights any objects penetrating Part 77 approach surfaces and Threshold Sighting Surfaces (TSS).

8.5.10 On-Airport Land Use Drawing

The On-Airport Land Use drawing depicts the existing and planned land uses within the Airport property boundary.

8.5.11 Airport Property Plan Sheets

The Airport Property Plan shows land parcels owned by the Roanoke Regional Airport Commission, and avigation easements on adjacent parcels.

8.5.12 Airport Property Map Data Sheet

The Airport Property Map Data Sheet shows the history of each parcel, including parcel number, grantor, instrument of title, acquisition date, acreage, and county location.

8.5.13 Zoning Overlay Drawing

The Zoning Overlay Drawing shows zoning designations in the vicinity of the Airport for the City of Roanoke and Roanoke County.

8.6 PRELIMINARY COST AND PHASING

This section provides a summary of the overall capital costs associated with the recommended development plan and their estimated timing based on the forecasts and facility requirements identified earlier in this Study.

Project timing is based on a balance of meeting forecast facility needs and the Commission's financing ability. Projects may be rescheduled should activity increase either more quickly or more slowly than anticipated. Likewise, the availability of financial resources may also result in either programming some projects sooner or deferring them.

The cost estimates presented in this Study are for planning purposes only; implementation of the recommended capital projects will involve refinement of designs and costs through architectural and engineering analyses. For this reason, the costs shown should be considered "best estimates," sufficient for performing the financial feasibility analyses and financial plan (described in Chapter Nine). Cost estimates are presented in 2007 dollars. **Table 8.1** lists each capital project, its cost, and anticipated schedule of implementation. The total capital cost for the recommended development plan is approximately $236 million, including design, engineering/

Table 8.1

Capital Improvement Program
(Costs rounded to nearest $1,000; totals may not add due to rounding)
(2007 Dollars)

Project		Phase I (2008-2012)	Phase II (2013-2017)	Phase III (2018-2025)	Total
Airfield/NAVAIDS					
AN-1	*Rehab Taxiway T & GA Taxilane (Proj. No. 29)*	*$ 4,616,000*	*$ -*	*$ -*	*$ 4,616,000*
AN-2	*Install Fencing Around Rwy 15-33 RPZs (Proj. No. 52)*	*$ 400,000*	*$ -*	*$ -*	*$ 400,000*
AN-3	Construct Min. Performance EMAS Rwy 24	$ -	$ 5,980,000	$ -	$ 5,980,000
AN-4	Construct Min. Performance EMAS Rwy 6	$ -	$ 13,877,000	$ -	$ 13,877,000
AN-5	Construct Secondary Deicing Pad	$ 3,259,000	$ -	$ -	$ 3,259,000
AN-6	Stripe Compass Rose	$ 10,000	$ -	$ -	$ 10,000
AN-7	Airfield Perimeter Road Improvements	$ -	$ 2,444,000	$ -	$ 2,444,000
AN-8	Terminal Apron Rehab.	$ -	$ 4,182,000	$ -	$ 4,182,000
	Subtotal	$ 8,285,000	$ 26,483,000	$ -	$ 34,768,000
Terminal					
T-1	*Replace Slats in Bag Claim Belts (Proj. No. 24)*	*$ 68,000*	*$ -*	*$ -*	*$ 68,000*
T-2	*Plaza Area Security Improvements (Proj. No. 25)*	*$ 569,000*	*$ -*	*$ -*	*$ 569,000*
T-3	*Upgrade FIDS/Intercom System (Proj. No. 26)*	*$ 425,000*	*$ -*	*$ -*	*$ 425,000*
T-4	*Replace ConcourseRoof (Proj. No. 40)*	*$ 500,000*	*$ -*	*$ -*	*$ 500,000*
T-5	*Replace Terminal Gate Seating (Proj. No. 41)*	*$ 250,000*	*$ -*	*$ -*	*$ 250,000*
T-6	*Replace Terminal Carpeting & Flooring (Proj. No. 43)*	*$ 750,000*	*$ -*	*$ -*	*$ 750,000*
T-7	1st Floor Prem. Coffee Concession Space	$ 30,000	$ -	$ -	$ 30,000
T-8	E-ticket Kiosk Project	$ -	$ 54,000	$ -	$ 54,000
T-9	Hold Bag Screening Project Phase I	$ 1,250,000	$ -	$ -	$ 1,250,000
T-10	Hold Bag Screening Project Phase II	$ 1,450,000	$ -	$ -	$ 1,450,000
T-11	Hold Bag Screening Project Phase III	$ -	$ 570,000	$ -	$ 570,000
T-12	Second Floor Restroom Renovation	$ 200,000	$ -	$ -	$ 200,000
T-13	First Floor Restroom Expansion	$ 340,000	$ -	$ -	$ 340,000
T-14	Central Term'l Improv. (inc. Mech., Sec. Chkpt, & Inbnd Bag)	$ 2,940,000	$ -	$ -	$ 2,940,000
T-15	Add Loading Bridge Gate 1	$ 290,000	$ -	$ -	$ 290,000
T-16	Add Loading Bridge Gate 3	$ 290,000	$ -	$ -	$ 290,000
T-17	Concourse Restroom Expansion	$ 150,000	$ -	$ -	$ 150,000
T-18	Gate 1 Area Expansion	$ 210,000	$ -	$ -	$ 210,000
T-19	Gate Reconfiguration	$ -	$ 1,170,000	$ -	$ 1,170,000
T-20	Additional Concourse Concession Space	$ -	$ 710,000	$ -	$ 710,000
T-21	Energy-savings Projects	$ 300,000	$ -	$ -	$ 300,000
T-22	Front Façade Sun Screening	$ 300,000	$ -	$ -	$ 300,000
T-23	Airport Administration Office Expansion	$ -	$ 1,250,000	$ -	$ 1,250,000
T-24	Concourse Holdroom Expansion	$ -	$ -	$ 3,750,000	$ 3,750,000
T-25	New Secondary Pax Charter Facility	$ -	$ 400,000	$ -	$ 400,000
T-26	Expand Ticketing & Outbound Bag Room	$ -	$ -	$ 1,333,000	$ 1,333,000
T-27	Construct Consolidated GSE Storage Area	$ -	$ 100,000	$ -	$ 100,000
	Subtotal	$ 10,312,000	$ 4,254,000	$ 5,083,000	$ 19,649,000
Landside (Ground Acces/Parking)					
L-1	*Tunnel Rehab (Proj. No. 28)*	*$ 500,000*	*$ 500,000*	*$ 1,000,000*	*$ 2,000,000*
L-2	*Rehab Terminal Roadway Entrance (Proj. No. 36)*	*$ 800,000*	*$ -*	*$ -*	*$ 800,000*
L-3	*Terminal Loop Roadway Rehab & Drainage Imp (Proj. No. 42)*	*$ 1,000,000*	*$ -*	*$ -*	*$ 1,000,000*
L-4	Public Parking Lot Rehab. (Primary) (1)	$ 1,522,000	$ -	$ -	$ 1,522,000
L-5	Waypoint Dr./SIDA Access Gate Intersection Reconfig.	$ 1,500,000	$ -	$ -	$ 1,500,000
L-8	Rehab. Tug Road, Waypoint Dr., and Employee Lot	$ -	$ 452,000	$ -	$ 452,000
L-9	Parking System Expansion/Reorg.	$ -	$ 3,500,000	$ -	$ 3,500,000
L-10	Secondary Access Route Improvements	$ -	$ 2,400,000	$ -	$ 2,400,000
	Subtotal	$ 5,322,000	$ 6,852,000	$ 1,000,000	$ 13,174,000
Air Cargo					
C-1	Widen Portion of Air Cargo Apron	$ -	$ -	$ 404,000	$ 404,000
C-2	Construct Air Cargo Building	$ -	$ -	$ 4,950,000	$ 4,950,000
C-3	Expand Truck Dock and Auto Parking	$ -	$ -	$ 422,000	$ 422,000
	Subtotal	$ -	$ -	$ 5,776,000	$ 5,776,000

Table 8.1 (cont'd)

Capital Improvement Program
(Costs rounded to nearest $1,000; totals may not add due to rounding)
(2007 Dollars)

Project	Phase I (2008-2012)	Phase II (2013-2017)	Phase III (2018-2025)	Total
General Aviation				
GA-1 Construct Large T-hangar Bdg, Apron, & Auto Pkg	$ 632,000	$ -	$ -	$ 632,000
GA-2 Construct Medium T-hangar Bdg, Apron, & Auto Pkg	$ -	$ 331,000	$ -	$ 331,000
GA-3 Construct GA Apron/Taxilanes in Midfield Area	$ 3,824,000	$ 3,824,000	$ -	$ 7,648,000
GA-4 Construct Four 4,800-SF Conventional Hangars	$ 2,800,000	$ -	$ -	$ 2,800,000
GA-5 Construct One 4,800-SF Conventional Hangar	$ -	$ 700,000.00	$ -	$ 700,000
GA-6 Construct One 10,000-SF Conventional Hangar	$ -	$ 1,250,000	$ -	$ 1,250,000
GA-7 Construct New FBO Bdg, Roadways, & Parking	$ -	$ 1,865,000	$ -	$ 1,865,000
GA-8 Construct New 60,000-SF FBO Hangar	$ -	$ 7,550,000	$ -	$ 7,550,000
GA-9 Other GA-area Roadway/Pkg Improvements	$ -	$ 98,000	$ -	$ 98,000
GA-10 Demolish Building 22	$ -	$ 620,000	$ -	$ 620,000
GA-11 Construct Three 18,000-SF Conventional Hangars	$ -	$ 6,750,000	$ -	$ 6,750,000
GA-12 Demolish Building 25	$ -	$ -	$ 700,000	$ 700,000
GA-13 Construct Three 18,000-SF Conventional Hangars	$ -	$ -	$ 6,750,000	$ 6,750,000
GA-14 Demolish Current FBO (Bdg 23)	$ -	$ 90,000	$ -	$ 90,000
GA-15 Construct New Wash Rack	$ -	$ 100,000	$ -	$ 100,000
GA-16 Construct One 18,000-SF Conventional Hangar	$ -	$ -	$ 2,250,000	$ 2,250,000
Subtotal	$ 7,256,000	$ 23,178,000	$ 9,700,000	$ 40,134,000
Airfield/Airline Maintenance/Support Facilities				
M-1 Expand Fuel Farm	$ -	$ 2,000,000	$ -	$ 2,000,000
M-2 Construct Tanker Circulation Road	$ 419,000	$ -	$ -	$ 419,000
M-3 Relocate Glycol Storage Facility	$ 250,000	$ -	$ -	$ 250,000
M-4 Relocate Lavatory Disposal Facility (Inc. Proj. 51)	$ -	$ -	$ 250,000	$ 250,000
M-5 Construct ARFF and Training Facility	$ 3,948,000	$ -	$ -	$ 3,948,000
M-6 Airfield Fire Hydrants	$ -	$ 830,000	$ -	$ 830,000
M-7 Airline Maintenance Hangar Apron	$ -	$ 536,000	$ -	$ 536,000
M-8 Expand Airfield Maintenance Facility	$ -	$ 3,556,000	$ -	$ 3,556,000
Subtotal	$ 4,617,000	$ 6,922,000	$ 250,000	$ 11,789,000
Construction Total	$ 35,792,000	$ 67,689,000	$ 21,809,000	$ 125,290,000
Contingencies @ 10%	$ 3,579,200	$ 6,768,900	$ 2,180,900	$ 12,529,000
Administration, Engineering, & Testing @ 15%	$ 5,368,800	$ 10,153,350	$ 3,271,350	$ 18,793,500
Land Acquisition				
LA-1 Land Acquisition (Rwy Protection Zones)	$ 15,869,000	$ -	$ -	$ 15,869,000
LA-2 Land Acquisition (Cargo-related)	$ -	$ 2,794,000	$ -	$ 2,794,000
LA-3 Land Acquisition (Term'l Auto Pkg-related)	$ 2,969,000	$ -	$ -	$ 2,969,000
LA-4 Land Acquisition (Other)	$ -	$ 14,854,000	$ 29,707,000	$ 44,560,000
Subtotal	$ 18,838,000	$ 17,648,000	$ 29,707,000	$ 66,192,000
Miscellaneous				
X-1 *Noise Program--Sound Insulation (Proj. No. 30)*	*$ 1,895,000*	*$ -*	*$ -*	*$ 1,895,000*
X-2 *Noise Program--Sound Insulation (Proj. No. 38)*	*$ 4,000,000*	*$ -*	*$ -*	*$ 4,000,000*
X-3 Purchase Snow Removal Equipment	$ -	$ 2,500,000	$ 2,500,000	$ 5,000,000
X-4 *Replace 2nd ARFF Vehicle*	*$ 1,000,000*	*$ -*	*$ -*	*$ 1,000,000*
X-5 Master Plan Update	$ -	$ 1,000,000	$ -	$ 1,000,000
Subtotal	$ 6,895,000	$ 3,500,000	$ 2,500,000	$ 12,895,000
GRAND TOTAL	**$ 70,473,000**	**$ 105,759,250**	**$ 59,468,250**	**$ 235,700,500**

Projects and costs in italics from Airport Capital Asset Plan *dated June 7, 2007.*

Notes: (1) Assumed to include CAP Project #27.

Source: HNTB analysis.

inspection, and construction contingency. **Figures 8-5 through 8-11** show the location of these projects.

8.6.1 Phase I (2007-2012)

In Phase I, the most significant airfield projects are rehabilitating Taxiway T and the GA taxilane (AN-1) and constructing a secondary deicing pad (AN-5). The construction cost for the taxiway/taxilane project is $4.6 million; the construction cost for the secondary deicing pad is $3.3 million.

Key Phase I terminal projects include Phases I and II of the hold bag screening project ($1.3 million and $1.5 million, respectively) (T-9 and T-10) and improvements to the central terminal area (including mechanical, security checkpoint, and inbound baggage facility expansion) ($2.9 million) (T-14). Also included in Phase I are other terminal improvement projects associated with meeting increased passenger activity and improving customer service.

Several important landside projects are also scheduled for Phase I, including the rehabilitation of the Terminal Loop Road (L-3) and public parking lot (L-4), and the reconfiguration of the Waypoint Drive/ SIDA intersection (L-5). The total construction cost of these and other landside projects is approximately $5.3 million.

General aviation development for Phase I includes construction of T-hangars (GA-1) and conventional hangars (GA-4) and construction of GA apron and taxilanes in the midfield area (GA-3), for a total construction cost of $7.3 million.

The most significant support-related project in Phase I is the construction of the new ARFF facility (M-5). The construction cost of this project is estimated at $3.9 million.

The total construction cost for Phase I of the recommended plan is approximately $35.8 million.

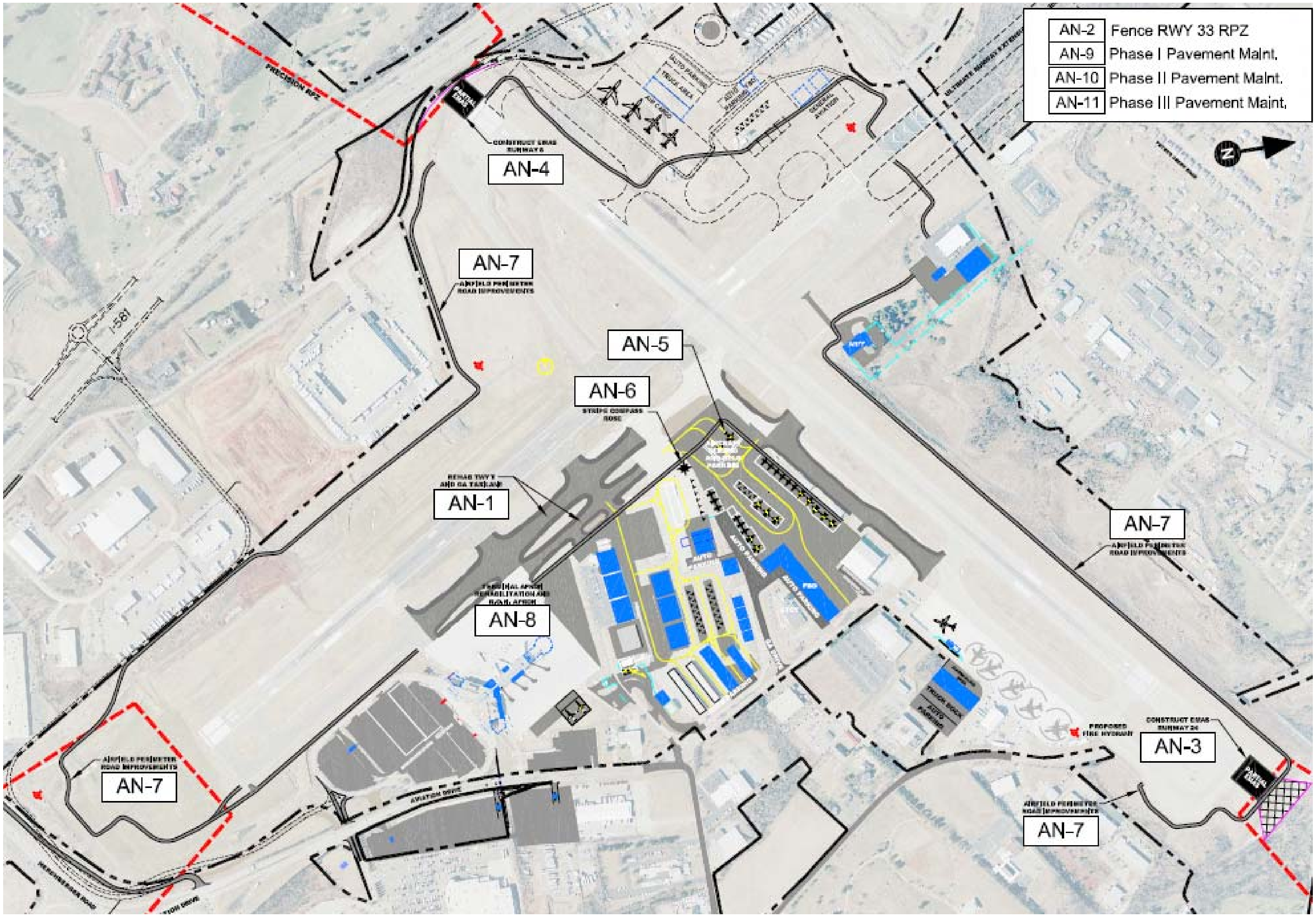
In addition to construction projects, the Master Plan Update recommends acquiring land for the purpose of future aviation expansion and for safety (LA-1 and LA-3). The anticipated Phase I land acquisition cost is $18.8 million.

Lastly, approximately $6.9 million is shown for miscellaneous projects which include noise insulation projects (X-1 and X-2) and the purchase of ARFF equipment (X-4).

The total cost for Phase I, including contingencies, administration, engineering, and testing is estimated at $70.5 million.

8.6.2 Phase II (2013-2017)

In Phase II, four significant airfield projects are scheduled to be implemented: construction of EMAS installations for the east and west ends of Runway 6-24 (AN-3 and AN-4), improving the airfield perimeter road system (AN-7), and rehabilitation of the terminal apron (AN-8). The combined cost of the two EMAS projects is $19.9 million. The perimeter road project is estimated to cost $2.4 million; the terminal apron rehabilitation cost is approximately $4.2 million.

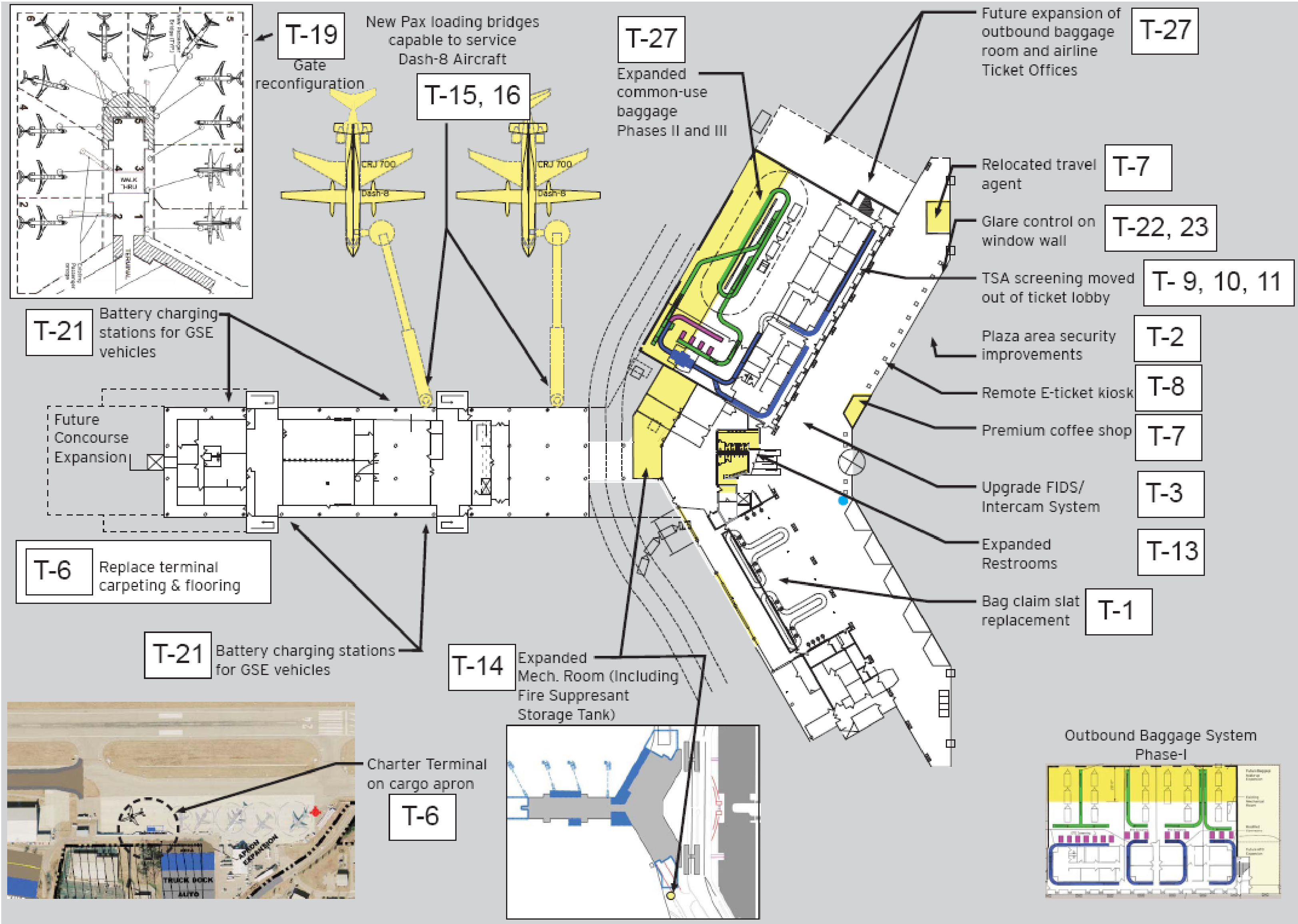


R O A N O K E R E G I O N A L A I R P O R T M A S T E R P L A N U P D A T E

ROANOKE REGIONAL AIRPORT

Airfield/Navaid Projects

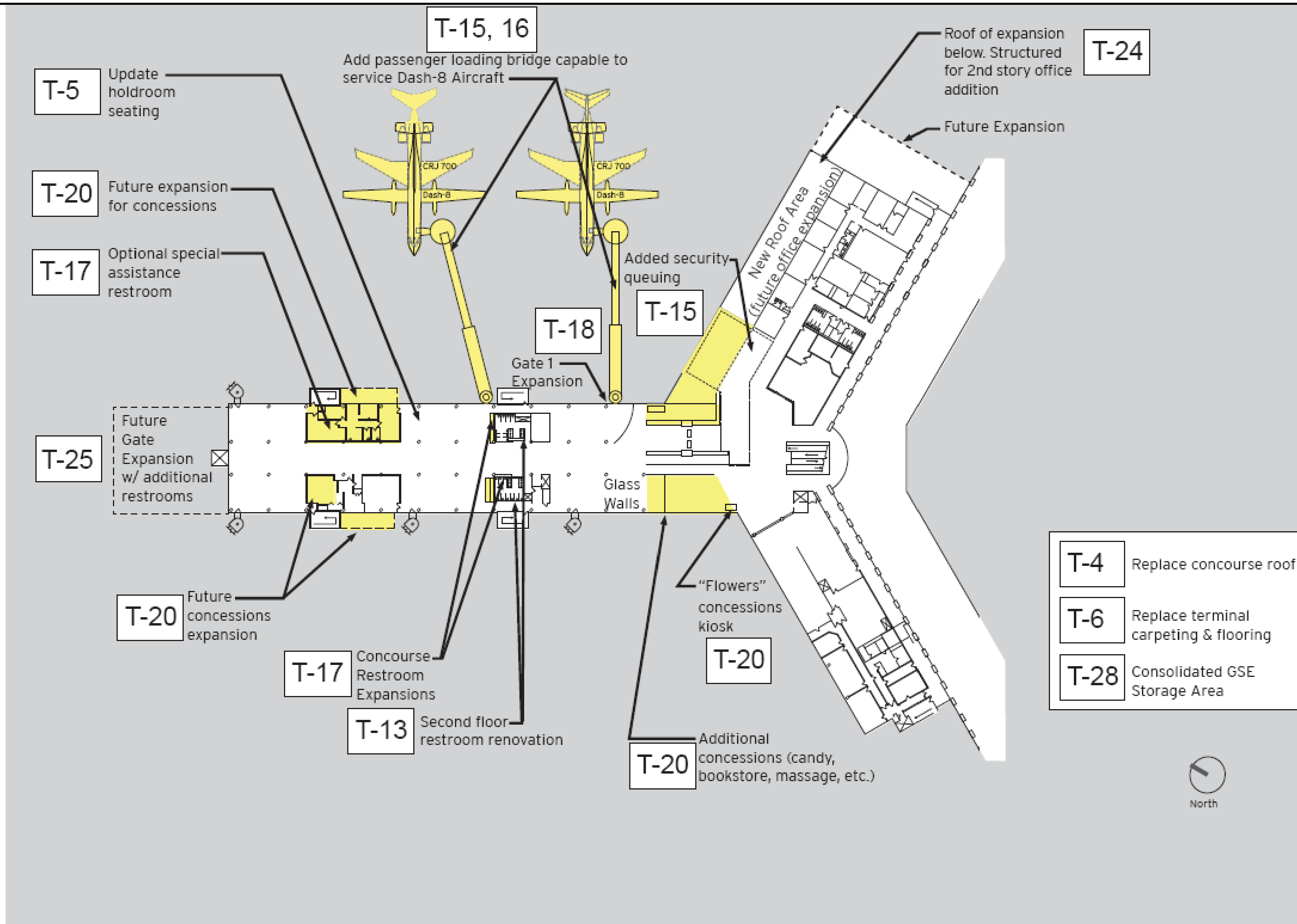
FIGURE 8-5



ROANOKE REGIONAL AIRPORT

Lower Level Terminal Projects

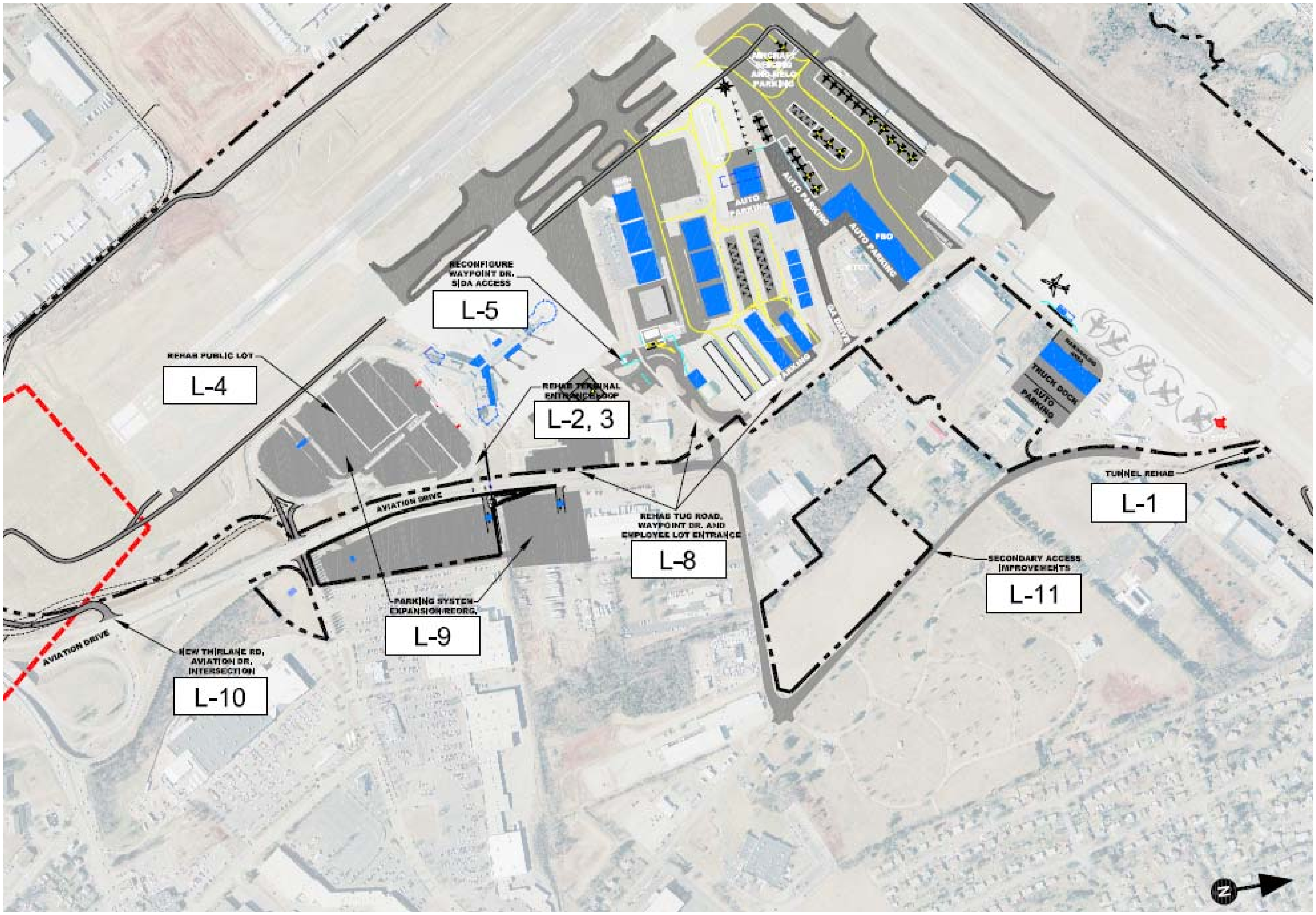
FIGURE 8-6



ROANOKE REGIONAL AIRPORT

Upper Level Terminal Projects

FIGURE 8-7

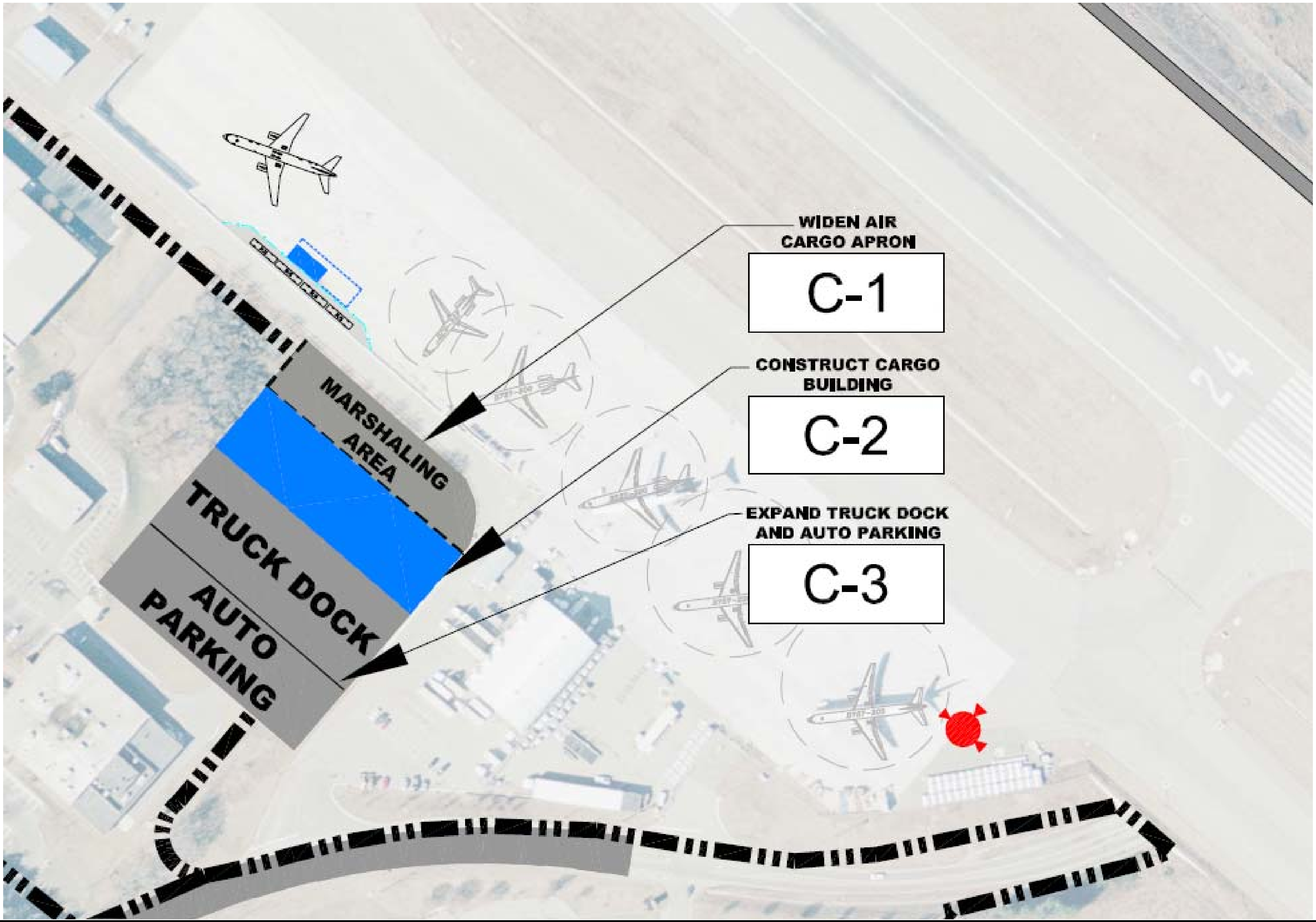


ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

Landside Projects

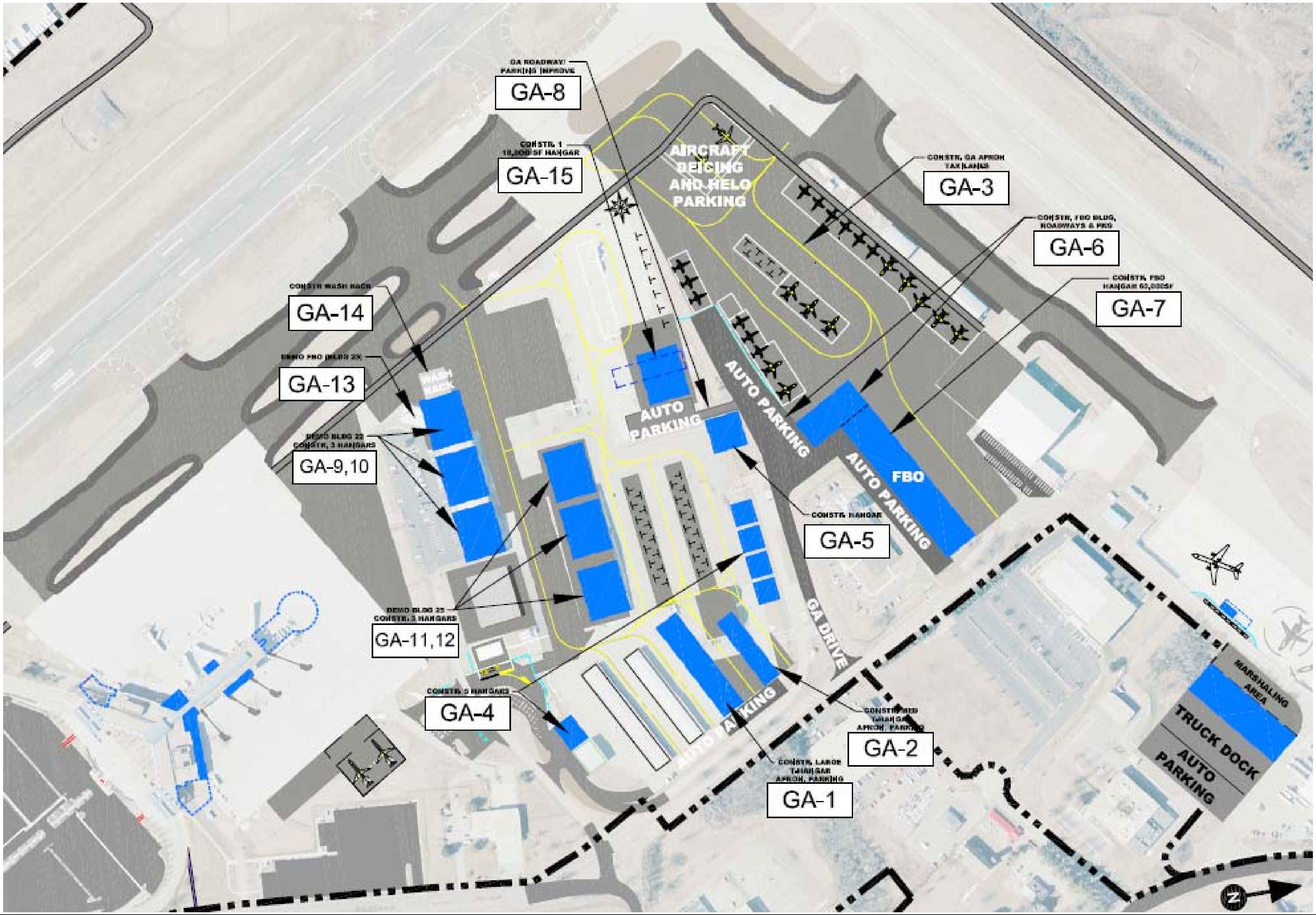
FIGURE 8-8



ROANOKE REGIONAL AIRPORT

Cargo Projects

FIGURE 8-9

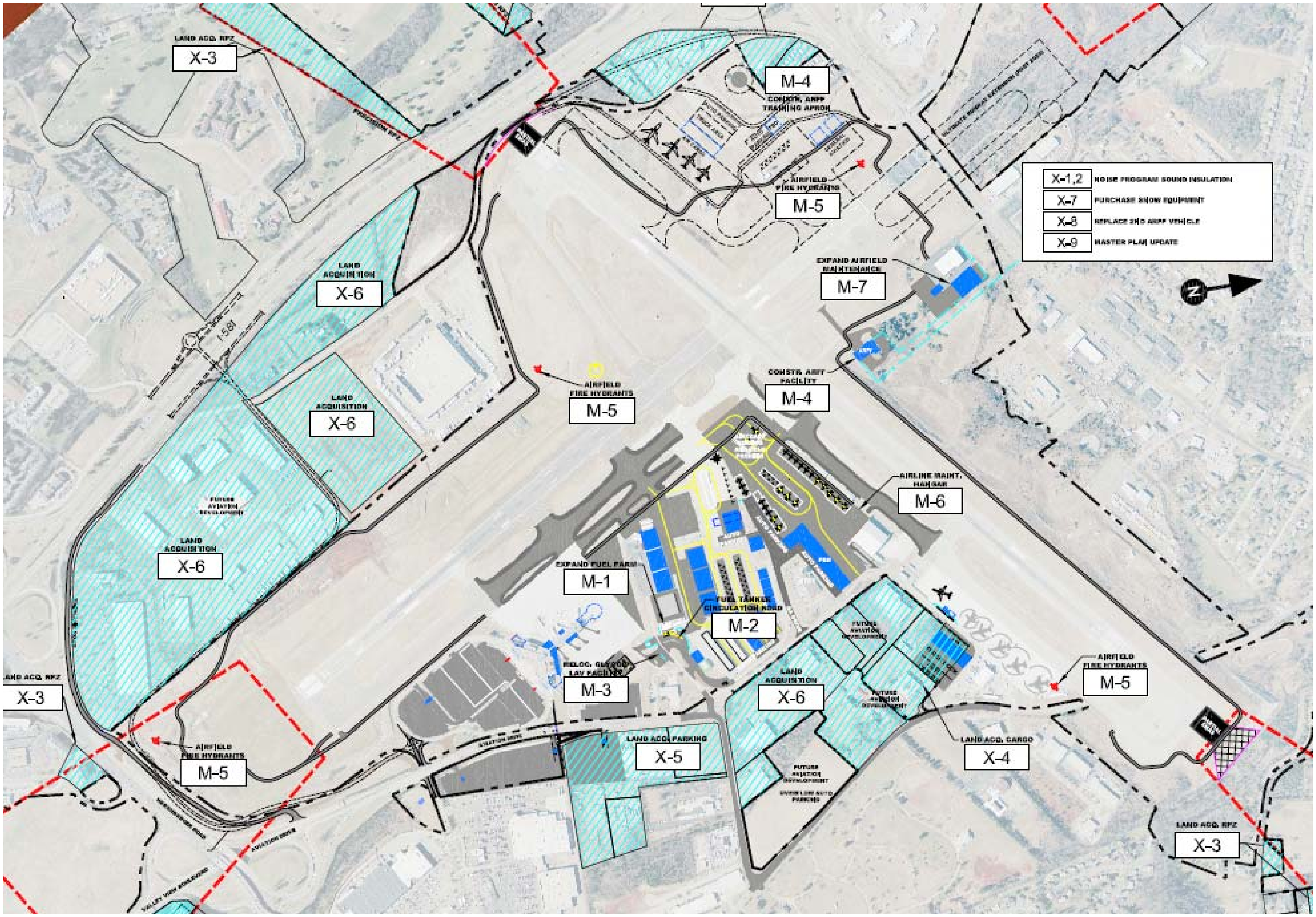


ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE

ROANOKE REGIONAL AIRPORT

General Aviation Projects

FIGURE 8-10



R O A N O K E R E G I O N A L A I R P O R T M A S T E R P L A N U P D A T E

ROANOKE REGIONAL AIRPORT

Support Facility Projects

FIGURE 8-11

Key terminal projects include completion of the hold bag screening facility (T-11) ($0.6 million), reconfiguration of the gate areas to increase the number of aircraft parking positions (T-19) ($1.2 million), providing additional concession space in the concourse (T-20) ($0.7 million), and expansion of Airport administration space (T-23) ($1.3 million). Also scheduled for Phase II is the construction of a semi-permanent charter passenger facility on the west end of the air cargo apron (T-25) ($0.4 million).

Phase II landside improvements include expansion of the terminal parking lots (L-9), providing improvements to the secondary access route (L-10), and the rehabilitation of Tug Road, Waypoint Drive, and the employee parking lot (L-8). The total construction cost for landside-related projects in Phase II is approximately $6.9 million.

A significant portion of Phase II costs is associated with expansion and redevelopment of the Airport's GA facilities. Key GA-related projects in Phase II include the construction of a new FBO terminal and adjoining storage/maintenance hangar (GA-7 and GA-8), continued reconfiguration of the midfield area for GA transient parking and taxilanes (GA-3), constructing T-hangars (GA-2) and several large hangars (GA-5, GA-6, and GA-11), and relocating the wash rack (GA-15). The total cost of GA construction in Phase II is approximately $23.2 million.

The remaining major construction projects in Phase II are improvements to support facilities, including expanding the existing fuel farm (M-1), expanding the Airport's airfield maintenance facility (M-8), expanding the airline maintenance base apron (M-7), and providing water hydrants (M-6) at key locations of the airfield. The total construction cost for these support facility-related projects is $6.9 million.

The total construction cost for Phase II is approximately $67.7 million.

In Phase II it is also anticipated that additional land will be acquired to accommodate future expansion of the cargo facility (LA-2) and future long-term Airport development (LA-4). The approximate cost of these acquisitions is approximately $17.6 million.

Finally, the CIP includes $2.5 million for the purchase of snow removal equipment (X-3) and $1.0 million for updating the Airport's Master Plan (X-5).

The total cost for Phase II, including contingencies, administration, engineering, and testing is approximately $105.8 million.

8.6.3 Phase III (2018-2025)

Long-term projects recommended by the Master Plan Update include expansion of the terminal passenger concourse to provide additional aircraft gate positions (T-24); improving air cargo facilities by expanding the apron, providing a permanent cargo building and improved landside facilities (C-1, C-2, and C-3); adding several hangars for GA aircraft storage (GA-13 and GA-16); and relocating the lavatory disposal facility (M-4). The total construction cost for these projects is approximately $21.8 million.

Land acquisition costs in Phase III are estimated to total approximately $29.7 million (LA-4). This land acquisition is for parcels currently adjoining the Airport that should be acquired for long-range (i.e., beyond 2025) development and to act as a buffer around the Airport.

Finally, $2.5 million is allocated for purchasing snow removal equipment (X-3).

The total cost of Phase III, including contingencies, administration, engineering, and testing is approximately $59.5 million.

Chapter Nine
Financial Plan

9.1 INTRODUCTION

The purpose of this chapter is to demonstrate the Commission's ability to finance the projects recommended in the Master Plan Update. Much of the emphasis is placed on the first phase of the program, where realistic projections can provide the most meaningful analysis. This emphasis is not intended to determine the feasibility of bond issuance, which would require a more extensive analysis. Rather, it is intended to show whether there are sufficient sources of capital – Airport Improvement Program (AIP) grants, etc. – available to fund the projects recommended in the planning period, or if not, what changes to the Master Plan might be made to ensure such feasibility.

This chapter is divided into the following sections:

- Existing Airport Financial Structure
- Recommended Capital Program
- Available Funding Sources
- Proposed Capital Program and Funding
- Financial Analysis
- Conclusions

9.2 EXISTING AIRPORT FINANCIAL STRUCTURE

The Roanoke Regional Airport Commission is an independent subdivision of the State, which was established by the State legislature to own and operate the Airport. The Commission, in turn, is governed by the Commissioners, which consist of five members. Three of these commissioners are appointed by the City, and two are appointed by the County. Day-to-day management is executed by the Executive Director and a staff of approximately 66 employees.

The Airport functions with 30-day airline use/permit agreements and maintains a concessions policy which requires that most concessionaires pay fees based on a percentage of gross receipts against minimum annual guarantees (MAGs). Rental car concessions agreements have five-year terms, beginning July 1, 2005, which were awarded to The Hertz Corporation, Avis Rent-A-Car Systems, Budget Rent A Car, National Car Rental, and Enterprise Rent-A-Car. The MAGs from the Rental Car Agreements are projected to total $994,000 million in Year Three (FY 2008) of the five-year term.

The Airport utilizes a management agreement with Standard Parking Corporation for the operation of its parking facilities. This agreement expires in 2011.

Under the agreement, the Commission pays all payroll, fringe benefits, maintenance and operating expenses. After consideration of these expenses, a monthly management fee of the greater of $1,800/month or 2.95 percent of net operating revenue is paid.

Terminal concessions are primarily provided by Creative Host Services (Creative Host) for food/beverage and Hudson Group for news/gift and retail. Creative Host pays rent equal to the greater of a MAG or 10 percent of gross sales, and Hudson pays the greater of a MAG or 12 percent of gross sales.

Recently, total operating revenues at the Airport have grown to historical highs, reaching an estimated $7.5 million in FY 2008. The following components constitute Airport operating revenues based on the FY 2008 budget:

- Airfield 19.4%
- Parking 25.6%
- Lease & Concession 23.1%
- Other Terminal (Airline) 20.4%
- General Aviation 5.4%
- Other 6.1%

Airport expenses consist primarily of Operating and Maintenance (O&M) expenses and debt service. In FY 2008, O&M expenses were budgeted to be $7.3 million, excluding depreciation. Existing debt service is presently in excess of $800,000 annually. The annual debt service requirement consists of payments towards the Series 1998 Bonds, the 2005 VARF loan and the 2008 VARF loan.[1]

9.3 RECOMMENDED CAPITAL PROGRAM

In determining project financial feasibility, the critical elements to analyze are project costs, project priority, funding sources, and the ability of the Airport to leverage funding sources by issuing bonds. These elements manifest themselves in the year-by-year phasing of construction expenditures.

Delaying a project can provide time to accumulate funding and allow the Airport to exploit additional bonding capacity in future years. However, project costs tend to increase with delays, and delaying expansion may constrain an airport from generating the revenues it needs to finance the expansion. Delays may also adversely affect the safety and capacity of the Airport.

The phasing of the projects contained herein has been determined by need and demand. In some cases, however, the phasing of some projects has been delayed because of financial constraints. If additional funds, such as Federal or State discretionary funds, became available, the timing of these projects could be advanced.

Tables 9.1 and 9.2 present the recommended capital program, first in constant 2007 dollars, and then in inflated dollars using the forecast consumer price

[1] A VARF loan, of the same size and with the same terms as the 2005 VARF loan, is expected to be in place by very early 2008. It was therefore considered to be an existing debt service instrument.

Table 9.1

Master Plan Update Capital Improvement Program

Project Number/Description		Cost in 2007 Dollars										Cost in 2007 Dollars								
		2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total**
Airfield/NAVAIDS																				
AN-1	Rehab Taxiway T & GA Taxilane (Proj. No. 29)	-	4,616,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,616,000
AN-2	Install Fencing Around Rwy 33 RPZ (Proj. No. 52)	-	-	-	-	400,000	-	-	-	-	-	-	-	-	-	-	-	-	-	400,000
AN-3	Construct Min. Performance EMAS Rwy 24	-	-	-	-	-	-	5,980,000	-	-	-	-	-	-	-	-	-	-	-	5,980,000
AN-4	Construct Min. Performance EMAS Rwy 6	-	-	-	-	-	-	-	13,877,000	-	-	-	-	-	-	-	-	-	-	13,877,000
AN-5	Construct Secondary Deicing Pad	-	-	-	3,259,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,259,000
AN-6	Stripe Compass Rose	-	10,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10,000
AN-7	Airfield Perimeter Road Improvements	-	-	-	-	-	-	-	-	-	2,444,000	-	-	-	-	-	-	-	-	2,444,000
AN-8	Terminal Apron Rehab.	-	-	-	-	-	-	-	-	4,182,000	-	-	-	-	-	-	-	-	-	4,182,000
	Subtotal	$ -	$ 4,626,000	$ -	$ 3,259,000	$ 400,000	$ -	$ 5,980,000	$ 13,877,000	$ 4,182,000	$ 2,444,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 34,768,000
Terminal																				
T-1	Replace Slats in Bag Claim Belts (Proj. No. 24)	68,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68,000
T-2	Plaza Area Security Improvements (Proj. No. 25)	569,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	569,000
T-3	Upgrade FIDS/Intercom System (Proj. No. 26)	425,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	425,000
T-4	Replace Concourse Roof (Proj. No. 40)	-	-	500,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500,000
T-5	Replace Terminal Gate Seating (Proj. No. 41)	-	-	250,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	250,000
T-6	Replace Terminal Carpeting & Flooring (Proj. No. 43)	-	-	750,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	750,000
T-7	1st Floor Prem. Coffee Concession Space	-	30,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30,000
T-8	E-ticket Kiosk Project	-	-	-	-	-	54,000	-	-	-	-	-	-	-	-	-	-	-	-	54,000
T-9	Hold Bag Screening Project Phase I	-	1,250,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,250,000
T-10	Hold Bag Screening Project Phase II	-	-	-	-	1,450,000	-	-	-	-	-	-	-	-	-	-	-	-	-	1,450,000
T-11	Hold Bag Screening Project Phase III	-	-	-	-	-	-	-	570,000	-	-	-	-	-	-	-	-	-	-	570,000
T-12	Second Floor Restroom Renovation	-	-	200,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200,000
T-13	First Floor Restroom Expansion	-	340,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	340,000
T-14	Central Term'l Improv. (Mech., Sec. Chkpt, Inbnd Bag)	-	-	2,940,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,940,000
T-15	Add Loading Bridge Gate 1	-	-	-	290,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	290,000
T-16	Add Loading Bridge Gate 3	-	-	-	290,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	290,000
T-17	Concourse Restroom Expansion	-	-	150,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150,000
T-18	Gate 1 Area Expansion	-	-	210,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	210,000
T-19	Gate Reconfiguration	-	-	-	-	-	-	1,170,000	-	-	-	-	-	-	-	-	-	-	-	1,170,000
T-20	Additional Concourse Concession Space	-	-	-	-	-	-	710,000	-	-	-	-	-	-	-	-	-	-	-	710,000
T-21	Energy-savings Projects	-	-	-	300,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300,000
T-22	Front Façade Sun Screening	300,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300,000
T-23	Airport Administration Office Expansion	-	-	-	-	-	-	-	1,250,000	-	-	-	-	-	-	-	-	-	-	1,250,000
T-24	Concourse Holdroom Expansion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,750,000	3,750,000
T-25	New Secondary Pax Charter Facility	-	-	-	-	-	-	-	-	400,000	-	-	-	-	-	-	-	-	-	400,000
T-26	Expand Ticketing & Outbound Bag Room	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,333,000	1,333,000
T-27	Construct Consolidated GSE Storage Area	-	-	-	-	-	-	100,000	-	-	-	-	-	-	-	-	-	-	-	100,000
	Subtotal	$ 1,362,000	$ 1,620,000	$ 5,000,000	$ 880,000	$ 1,450,000	$ 54,000	$ 1,980,000	$ 1,820,000	$ 400,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,083,000	$ 19,649,000
Landside (Ground Access/Parking)																				
L-1	Tunnel Rehab (Proj. No. 28)	500,000	-	-	-	-	500,000	-	-	-	-	500,000	-	-	-	-	500,000	-	-	2,000,000
L-2	Rehab Terminal Roadway Entrance (Proj. No. 36)	-	800,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800,000
L-3	Term'l Loop Road Rehab & Drainage Imp (Proj. No. 42)	-	-	1,000,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,000,000
L-4	Public Parking Lot Rehab. (Primary) (1)	-	1,522,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,522,000
L-5	Waypoint Dr./SIDA Access Gate Intersection Reconfig.	-	-	-	1,500,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,500,000
L-6	Rehab. Tug Road, Waypoint Dr., and Employee Lot	-	-	-	-	-	452,000	-	-	-	-	-	-	-	-	-	-	-	-	452,000
L-7	Parking System Expansion/Reorg.	-	-	-	-	-	-	3,500,000	-	-	-	-	-	-	-	-	-	-	-	3,500,000
L-8	Secondary Access Route Improvements	-	-	-	-	-	-	-	-	2,400,000	-	-	-	-	-	-	-	-	-	2,400,000
	Subtotal	$ 500,000	$ 2,322,000	$ 1,000,000	$ 1,500,000	$ -	$ 952,000	$ 3,500,000	$ -	$ 2,400,000	$ -	$ 500,000	$ -	$ -	$ -	$ -	$ 500,000	$ -	$ -	$ 13,174,000
Air Cargo																				
C-1	Widen Portion of Air Cargo Apron	-	-	-	-	-	-	-	-	-	-	404,000	-	-	-	-	-	-	-	404,000
C-2	Construct Air Cargo Building	-	-	-	-	-	-	-	-	-	-	-	4,950,000	-	-	-	-	-	-	4,950,000
C-3	Expand Truck Dock and Auto Parking	-	-	-	-	-	-	-	-	-	-	-	-	422,000	-	-	-	-	-	422,000
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 404,000	$ 4,950,000	$ 422,000	$ -	$ -	$ -	$ -	$ -	$ 5,776,000

Table 9.1 cont'd

Master Plan Update Capital Improvement Program

		Cost in 2007 Dollars									Cost in 2007 Dollars									
Project Number/Description		**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total**
General Aviation																				
GA-1	Construct Large T-hangar Bdg, Apron, & Auto Pkg	-	-	-	632,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	632,000
GA-2	Construct Medium T-hangar Bdg, Apron, & Auto Pkg	-	-	-	-	-	331,000	-	-	-	-	-	-	-	-	-	-	-	-	331,000
GA-3	Construct GA Apron/Taxilanes in Midfield Area	-	-	-	-	3,824,000	3,824,000	-	-	-	-	-	-	-	-	-	-	-	-	7,648,000
GA-4	Construct Four 4,800-SF Conventional Hangars	1,400,000	-	700,000	-	700,000	-	-	-	-	-	-	-	-	-	-	-	-	-	2,800,000
GA-5	Construct One 4,800-SF Conventional Hangar	-	-	-	-	-	-	-	700,000	-	-	-	-	-	-	-	-	-	-	700,000
GA-6	Construct One 10,000-SF Conventional Hangar	-	-	-	-	-	-	-	-	-	1,250,000	-	-	-	-	-	-	-	-	1,250,000
GA-7	Construct New FBO Bdg, Roadways, & Parking	-	-	-	-	-	-	1,865,000	-	-	-	-	-	-	-	-	-	-	-	1,865,000
GA-8	Construct New 60,000-SF FBO Hangar	-	-	-	-	-	-	-	7,550,000	-	-	-	-	-	-	-	-	-	-	7,550,000
GA-9	Other GA-area Roadway/Pkg Improvements	-	-	-	-	-	-	-	-	-	98,000	-	-	-	-	-	-	-	-	98,000
GA-10	Demolish Building 22	-	-	-	-	-	-	-	-	620,000	-	-	-	-	-	-	-	-	-	620,000
GA-11	Construct Three 18,000-SF Conventional Hangars	-	-	-	-	-	-	-	-	-	6,750,000	-	-	-	-	-	-	-	-	6,750,000
GA-12	Demolish Building 25	-	-	-	-	-	-	-	-	-	-	-	-	700,000	-	-	-	-	-	700,000
GA-13	Construct Three 18,000-SF Conventional Hangars	-	-	-	-	-	-	-	-	-	-	-	-	-	6,750,000	-	-	-	-	6,750,000
GA-14	Demolish Current FBO (Bdg 23)	-	-	-	-	-	-	-	-	90,000	-	-	-	-	-	-	-	-	-	90,000
GA-15	Construct New Wash Rack	-	-	-	-	-	-	-	-	-	100,000	-	-	-	-	-	-	-	-	100,000
GA-16	Construct One 18,000-SF Conventional Hangar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,250,000	-	-	-	2,250,000
	Subtotal	$ 1,400,000	$ -	$ 700,000	$ 632,000	$ 4,524,000	$ 4,155,000	$ 1,865,000	$ 8,250,000	$ 710,000	$ 8,198,000	$ -	$ -	$ 700,000	$ 6,750,000	$ 2,250,000	$ -	$ -	$ -	$ 40,134,000
Airfield/Airline Maintenance/Support Facilities																				
M-1	Expand Fuel Farm	-	-	-	-	-	2,000,000	-	-	-	-	-	-	-	-	-	-	-	-	2,000,000
M-2	Construct Tanker Circulation Road	-	-	-	419,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	419,000
M-3	Relocate Glycol Storage Facility	-	-	-	250,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	250,000
M-4	Relocate Lavatory Disposal Facility (Inc. Proj. 51)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	250,000	-	-	250,000
M-5	Construct ARFF and Training Facility	-	-	3,948,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,948,000
M-6	Airfield Fire Hydrants	-	-	-	-	-	-	830,000	-	-	-	-	-	-	-	-	-	-	-	830,000
M-7	Airline Maintenance Hangar Apron	-	-	-	-	-	-	-	536,000	-	-	-	-	-	-	-	-	-	-	536,000
M-8	Expand Airfield Maintenance Facility	-	-	-	-	-	-	-	3,556,000	-	-	-	-	-	-	-	-	-	-	3,556,000
	Subtotal	$ -	$ -	$ 3,948,000	$ 669,000	$ -	$ 2,000,000	$ 830,000	$ 4,092,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,000	$ -	$ -	$ 11,789,000
Construction Subtotal		$ 3,262,000	$ 8,568,000	$ 10,648,000	$ 6,940,000	$ 6,374,000	$ 7,161,000	$ 14,155,000	$ 28,039,000	$ 7,692,000	$ 10,642,000	$ 904,000	$ 4,950,000	$ 1,122,000	$ 6,750,000	$ 2,250,000	$ 750,000	$ -	$ 5,083,000	$ 125,290,000
Contingencies @ 10%		$ 326,200	$ 856,800	$ 1,064,800	$ 694,000	$ 637,400	$ 716,100	$ 1,415,500	$ 2,803,900	$ 769,200	$ 1,064,200	$ 90,400	$ 495,000	$ 112,200	$ 675,000	$ 225,000	$ 75,000	$ -	$ 508,300	$ 12,529,000
Administration, Engineering, & Testing @ 15%		$ 489,300	$ 1,285,200	$ 1,597,200	$ 1,041,000	$ 956,100	$ 1,074,150	$ 2,123,250	$ 4,205,850	$ 1,153,800	$ 1,596,300	$ 135,600	$ 742,500	$ 168,300	$ 1,012,500	$ 337,500	$ 112,500	$ -	$ 762,450	$ 18,793,500
Construction Total		$ 4,077,500	$ 10,710,000	$ 13,310,000	$ 8,675,000	$ 7,967,500	$ 8,951,250	$ 17,693,750	$ 35,048,750	$ 9,615,000	$ 13,302,500	$ 1,130,000	$ 6,187,500	$ 1,402,500	$ 8,437,500	$ 2,812,500	$ 937,500	$ -	$ 6,353,750	$ 156,612,500
Land Acquisition																				
LA-1	Land Acquisition (Rwy Protection Zones)	3,173,800	3,173,800	3,173,800	3,173,800	3,173,800	-	-	-	-	-	-	-	-	-	-	-	-	-	15,869,000
LA-2	Land Acquisition (Cargo-related)	-	-	-	-	-	-	-	-	-	2,794,000	-	-	-	-	-	-	-	-	2,794,000
LA-3	Land Acquisition (Term'l Auto Pkg-related)	-	-	-	-	2,969,000	-	-	-	-	-	-	-	-	-	-	-	-	-	2,969,000
LA-4	Land Acquisition (Other)	-	-	-	-	-	1,000,000	2,941,000	4,971,000	2,971,000	2,971,000	6,500,000	500,000	5,000,000	-	3,707,000	7,000,000	6,500,000	500,000	44,561,000
	Subtotal	$ 3,173,800	$ 3,173,800	$ 3,173,800	$ 3,173,800	$ 6,142,800	$ 1,000,000	$ 2,941,000	$ 4,971,000	$ 2,971,000	$ 5,765,000	$ 6,500,000	$ 500,000	$ 5,000,000	$ -	$ 3,707,000	$ 7,000,000	$ 6,500,000	$ 500,000	$ 66,193,000
Miscellaneous																				
X-1	Noise Program--Sound Insulation (Proj. No. 30)	1,895,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,895,000
X-2	Noise Program--Sound Insulation (Proj. No. 38)	-	4,000,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,000,000
X-3	Purchase Snow Removal Equipment	-	-	-	-	-	-	-	-	2,500,000	-	-	-	2,500,000	-	-	-	-	-	5,000,000
X-4	Replace 2nd ARFF Vehicle (Proj. No. 47)	-	-	1,000,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,000,000
X-5	Master Plan Update	-	-	-	-	-	-	-	-	-	1,000,000	-	-	-	-	-	-	-	-	1,000,000
	Subtotal	$ 1,895,000	$ 4,000,000	$ 1,000,000	$ -	$ -	$ -	$ -	$ -	$ 2,500,000	$ 1,000,000	$ -	$ -	$ 2,500,000	$ -	$ -	$ -	$ -	$ -	$ 12,895,000
GRAND TOTAL		$ 9,146,300	$ 17,883,800	$ 17,483,800	$ 11,848,800	$ 14,110,300	$ 9,951,250	$ 20,634,750	$ 40,019,750	$ 15,086,000	$ 20,067,500	$ 7,630,000	$ 6,687,500	$ 8,902,500	$ 8,437,500	$ 6,519,500	$ 7,937,500	$ 6,500,000	$ 6,853,750	$ 235,700,500

Sources: Roanoke Airport Commission, compiled by HNTB Corporation.

Table 9.2

Capital Costs Including Contingencies, A&E Fees and Cost Escalation

		Cost in Escalated Dollars																		
Project Description		**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total**
Airfield/NAVAIDS																				
AN-1	Rehab Taxiway T & GA Taxilane (Proj. No. 29)	-	6,073,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,073,000
AN-2	Install Fencing Around Rwy 33 RPZ (Proj. No. 52)	-	-	-	-	565,000	-	-	-	-	-	-	-	-	-	-	-	-	-	565,000
AN-3	Construct Min. Performance EMAS Rwy 24	-	-	-	-	-	-	8,834,000	-	-	-	-	-	-	-	-	-	-	-	8,834,000
AN-4	Construct Min. Performance EMAS Rwy 6	-	-	-	-	-	-	-	20,970,000	-	-	-	-	-	-	-	-	-	-	20,970,000
AN-5	Construct Secondary Deicing Pad	-	-	-	4,497,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,497,000
AN-6	Stripe Compass Rose	-	13,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13,000
AN-7	Airfield Perimeter Road Improvements	-	-	-	-	-	-	-	-	-	3,865,000	-	-	-	-	-	-	-	-	3,865,000
AN-8	Terminal Apron Rehab.	-	-	-	-	-	-	-	-	6,465,000	-	-	-	-	-	-	-	-	-	6,465,000
	Subtotal	-	6,086,000	-	4,497,000	565,000	-	8,834,000	20,970,000	6,465,000	3,865,000	-	-	-	-	-	-	-	-	51,282,000
Terminal																				
T-1	Replace Slats in Bag Claim Belts (Proj. No. 24)	87,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87,000
T-2	Plaza Area Security Improvements (Proj. No. 25)	730,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	730,000
T-3	Upgrade FIDS/Intercom System (Proj. No. 26)	545,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	545,000
T-4	Replace Concourse Roof (Proj. No. 40)	-	-	674,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	674,000
T-5	Replace Terminal Gate Seating (Proj. No. 41)	-	-	337,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	337,000
T-6	Replace Terminal Carpeting & Flooring (Proj. No. 43)	-	-	1,011,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,011,000
T-7	1st Floor Prem. Coffee Concession Space	-	39,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39,000
T-8	E-ticket Kiosk Project	-	-	-	-	-	78,000	-	-	-	-	-	-	-	-	-	-	-	-	78,000
T-9	Hold Bag Screening Project Phase I	-	1,644,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,644,000
T-10	Hold Bag Screening Project Phase II	-	-	-	-	2,047,000	-	-	-	-	-	-	-	-	-	-	-	-	-	2,047,000
T-11	Hold Bag Screening Project Phase III	-	-	-	-	-	-	-	861,000	-	-	-	-	-	-	-	-	-	-	861,000
T-12	Second Floor Restroom Renovation	-	-	270,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	270,000
T-13	First Floor Restroom Expansion	-	447,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	447,000
T-14	Central Term'l Improv. (inc. Mech., Sec. Chkpt, & Inbnd Bag)	-	-	3,963,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,963,000
T-15	Add Loading Bridge Gate 1	-	-	-	400,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400,000
T-16	Add Loading Bridge Gate 3	-	-	-	400,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400,000
T-17	Concourse Restroom Expansion	-	-	202,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	202,000
T-18	Gate 1 Area Expansion	-	-	283,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	283,000
T-19	Gate Reconfiguration	-	-	-	-	-	-	1,728,000	-	-	-	-	-	-	-	-	-	-	-	1,728,000
T-20	Additional Concourse Concession Space	-	-	-	-	-	-	1,049,000	-	-	-	-	-	-	-	-	-	-	-	1,049,000
T-21	Energy-savings Projects	-	-	-	414,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	414,000
T-22	Front Façade Sun Screening	385,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	385,000
T-23	Airport Administration Office Expansion	-	-	-	-	-	-	-	1,889,000	-	-	-	-	-	-	-	-	-	-	1,889,000
T-24	Concourse Holdroom Expansion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,114,000	7,114,000
T-25	New Secondary Pax Charter Facility	-	-	-	-	-	-	-	-	618,000	-	-	-	-	-	-	-	-	-	618,000
T-26	Expand Ticketing & Outbound Bag Room	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,529,000	2,529,000
T-27	Construct Consolidated GSE Storage Area	-	-	-	-	-	-	148,000	-	-	-	-	-	-	-	-	-	-	-	148,000
	Subtotal	1,747,000	2,130,000	6,740,000	1,214,000	2,047,000	78,000	2,925,000	2,750,000	618,000	-	-	-	-	-	-	-	-	9,643,000	29,892,000
Landside (Ground Access/Parking)																				
L-1	Tunnel Rehab (Proj. No. 28)	641,000	-	-	-	-	722,000	-	-	-	-	809,000	-	-	-	-	906,000	-	-	3,078,000
L-2	Rehab Terminal Roadway Entrance (Proj. No. 36)	-	1,052,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,052,000
L-3	Term'l Loop Road Rehab & Drainage Imp (Proj. No. 42)	-	-	1,348,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,348,000
L-4	Public Parking Lot Rehab. (Primary) (1)	-	2,002,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,002,000
L-5	Waypoint Dr./SIDA Access Gate Intersection Reconfig.	-	-	-	2,070,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,070,000
L-6	Rehab. Tug Road, Waypoint Dr., and Employee Lot	-	-	-	-	-	653,000	-	-	-	-	-	-	-	-	-	-	-	-	653,000
L-7	Parking System Expansion/Reorg.	-	-	-	-	-	-	5,170,000	-	-	-	-	-	-	-	-	-	-	-	5,170,000
L-8	Secondary Access Route Improvements	-	-	-	-	-	-	-	-	3,710,000	-	-	-	-	-	-	-	-	-	3,710,000
	Subtotal	641,000	3,054,000	1,348,000	2,070,000	-	1,375,000	5,170,000	-	3,710,000	-	809,000	-	-	-	-	906,000	-	-	19,083,000

Table 9.2 cont'd

Capital Costs Including Contingencies, A&E Fees and Cost Escalation

		Cost in Escalated Dollars																		
Project Description		**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total**
Air Cargo																				
C-1	Widen Portion of Air Cargo Apron	-	-	-	-	-	-	-	-	-	-	654,000	-	-	-	-	-	-	-	654,000
C-2	Construct Air Cargo Building	-	-	-	-	-	-	-	-	-	-	-	8,193,000	-	-	-	-	-	-	8,193,000
C-3	Expand Truck Dock and Auto Parking	-	-	-	-	-	-	-	-	-	-	-	-	715,000	-	-	-	-	-	715,000
	Subtotal	-	-	-	-	-	-	-	-	-	-	654,000	8,193,000	715,000	-	-	-	-	-	9,562,000
General Aviation																				
GA-1	Construct Large T-hangar Bdg, Apron, & Auto Pkg	-	-	-	872,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	872,000
GA-2	Construct Medium T-hangar Bdg, Apron, & Auto Pkg	-	-	-	-	-	478,000	-	-	-	-	-	-	-	-	-	-	-	-	478,000
GA-3	Construct GA Apron/Taxilanes in Midfield Area	-	-	-	-	5,398,000	5,522,000	-	-	-	-	-	-	-	-	-	-	-	-	10,920,000
GA-4	Construct Four 4,800-SF Conventional Hangars	1,796,000	-	944,000	-	988,000	-	-	-	-	-	-	-	-	-	-	-	-	-	3,728,000
GA-5	Construct One 4,800-SF Conventional Hangar	-	-	-	-	-	-	-	1,058,000	-	-	-	-	-	-	-	-	-	-	1,058,000
GA-6	Construct One 10,000-SF Conventional Hangar	-	-	-	-	-	-	-	-	-	1,977,000	-	-	-	-	-	-	-	-	1,977,000
GA-7	Construct New FBO Bdg, Roadways, & Parking	-	-	-	-	-	-	2,755,000	-	-	-	-	-	-	-	-	-	-	-	2,755,000
GA-8	Construct New 60,000-SF FBO Hangar	-	-	-	-	-	-	-	11,409,000	-	-	-	-	-	-	-	-	-	-	11,409,000
GA-9	Other GA-area Roadway/Pkg Improvements	-	-	-	-	-	-	-	-	-	155,000	-	-	-	-	-	-	-	-	155,000
GA-10	Demolish Building 22	-	-	-	-	-	-	-	-	958,000	-	-	-	-	-	-	-	-	-	958,000
GA-11	Construct Three 18,000-SF Conventional Hangars	-	-	-	-	-	-	-	-	-	10,675,000	-	-	-	-	-	-	-	-	10,675,000
GA-12	Demolish Building 25	-	-	-	-	-	-	-	-	-	-	-	-	1,185,000	-	-	-	-	-	1,185,000
GA-13	Construct Three 18,000-SF Conventional Hangars	-	-	-	-	-	-	-	-	-	-	-	-	-	11,691,000	-	-	-	-	11,691,000
GA-14	Demolish Current FBO (Bdg 23)	-	-	-	-	-	-	-	-	139,000	-	-	-	-	-	-	-	-	-	139,000
GA-15	Construct New Wash Rack	-	-	-	-	-	-	-	-	-	158,000	-	-	-	-	-	-	-	-	158,000
GA-16	Construct One 18,000-SF Conventional Hangar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,987,000	-	-	-	3,987,000
	Subtotal	1,796,000	-	944,000	872,000	6,386,000	6,000,000	2,755,000	12,467,000	1,097,000	12,965,000	-	-	1,185,000	11,691,000	3,987,000	-	-	-	62,145,000
Airfield/Airline Maintenance/Support Facilities																				
M-1	Expand Fuel Farm	-	-	-	-	-	2,888,000	-	-	-	-	-	-	-	-	-	-	-	-	2,888,000
M-2	Construct Tanker Circulation Road	-	-	-	578,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	578,000
M-3	Relocate Glycol Storage Facility	-	-	-	345,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	345,000
M-4	Relocate Lavatory Disposal Facility (Inc. Proj. 51)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	453,000	-	-	453,000
M-5	Construct ARFF and Training Facility	-	-	5,322,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,322,000
M-6	Airfield Fire Hydrants	-	-	-	-	-	-	1,226,000	-	-	-	-	-	-	-	-	-	-	-	1,226,000
M-7	Airline Maintenance Hangar Apron	-	-	-	-	-	-	-	810,000	-	-	-	-	-	-	-	-	-	-	810,000
M-8	Expand Airfield Maintenance Facility	-	-	-	-	-	-	-	5,374,000	-	-	-	-	-	-	-	-	-	-	5,374,000
	Subtotal	-	-	5,322,000	923,000	-	2,888,000	1,226,000	6,184,000	-	-	-	-	-	-	-	453,000	-	-	16,996,000
Land Acquisition																				
LA-1	Land Acquisition (Rwy Protection Zones)	3,257,000	3,340,000	3,422,000	3,503,000	3,584,000	-	-	-	-	-	-	-	-	-	-	-	-	-	17,106,000
LA-2	Land Acquisition (Cargo-related)	-	-	-	-	-	-	-	-	-	3,535,000	-	-	-	-	-	-	-	-	3,535,000
LA-3	Land Acquisition (Term'l Auto Pkg-related)	-	-	-	-	3,353,000	-	-	-	-	-	-	-	-	-	-	-	-	-	3,353,000
LA-4	Land Acquisition (Other)	-	-	-	-	-	1,155,000	3,476,000	6,010,000	3,674,000	3,759,000	8,413,000	662,000	6,773,000	-	5,255,000	10,151,000	9,643,000	759,000	59,730,000
	Subtotal	3,257,000	3,340,000	3,422,000	3,503,000	6,937,000	1,155,000	3,476,000	6,010,000	3,674,000	7,294,000	8,413,000	662,000	6,773,000	-	5,255,000	10,151,000	9,643,000	759,000	83,724,000
Miscellaneous																				
X-1	Noise Program--Sound Insulation (Proj. No. 30)	1,944,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,944,000
X-2	Noise Program--Sound Insulation (Proj. No. 38)	-	4,210,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,210,000
X-3	Purchase Snow Removal Equipment	-	-	-	-	-	-	-	-	3,092,000	-	-	-	3,386,000	-	-	-	-	-	6,478,000
X-4	Replace 2nd ARFF Vehicle (Proj. No. 47)	-	-	1,078,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,078,000
X-5	Master Plan Update	-	-	-	-	-	-	-	-	-	1,265,000	-	-	-	-	-	-	-	-	1,265,000
	Subtotal	1,944,000	4,210,000	1,078,000	-	-	-	-	-	3,092,000	1,265,000	-	-	3,386,000	-	-	-	-	-	14,975,000
GRAND TOTAL		$ 9,385,000	$ 18,820,000	$ 18,854,000	$ 13,079,000	$ 15,935,000	$ 11,496,000	$ 24,386,000	$ 48,381,000	$ 18,656,000	$ 25,389,000	$ 9,876,000	$ 8,855,000	$ 12,059,000	$ 11,691,000	$ 9,242,000	$ 11,510,000	$ 9,643,000	$ 10,402,000	287,659,000

Source: HNTB Corporation.

index (CPI) as an inflation factor. Both tables present projects fully-loaded with contingencies and fees for architecture, engineering, and planning.

It is important to note that these two tables present the expected capital requirements in the years required if projects are phased according to when they should be implemented in order to meet demand. At this stage in the analysis, no revisions to the program have been made to facilitate their implementation.

9.4 AVAILABLE FUNDING SOURCES

The Commission has five potential sources of funding for capital projects at this time:

- Passenger Facility Charges
- AIP funds
- Commonwealth of Virginia Grants
- Third-Party sources (private, etc.)
- Airport revenues

Projected PFC, AIP, and Commonwealth of Virginia grant funds are based on the previous forecast of enplaned passengers and are provided in **Table 9.3**.

9.4.1 Passenger Facility Charges

The most desirable source of capital funding for airports is the PFC. The FAA currently authorizes the collection of $4.50 per passenger enplanement to fund certain approved projects at ROA for a defined collection period. It is expected that the federal government will increase the PFC cap from $4.50 to $6.00 in the near future. This analysis assumes that ROA will be able to amend its application and begin collecting at the $6.00 level on January 1, 2009.

Eligible projects for PFC use include those projects which preserve or enhance safety, security, or capacity; reduce or mitigate noise; and/or enhance competition among air carriers. It is projected that ROA will collect over $41 million in PFCs between FY 2008 and FY 2025 to assist in paying for project costs. Collections will range from $1.44 million to $2.75 million annually based on projected passenger enplanements during this time period. The Commission's primary use of PFCs is to pay for terminal and land acquisition projects that cannot use AIP grant funding, as well as for capital-intensive projects that cannot be implemented using only grants and airport surplus revenues.

9.4.2 AIP Funds

Funding is also provided to airports through the AIP as awarded by the FAA. AIP funds are divided into two categories: discretionary funds and entitlement funds. Discretionary funds are awarded at the discretion of the FAA based on certain eligibility criteria, while entitlement funds are distributed to airports on a per enplanement basis using the formula below:

- $7.80/enplanement for the first 50,000
- $5.20/enplanement for the next 50,000
- $2.60/enplanement for the next 400,000
- $0.65/enplanement for the next 500,000
- $0.50/enplanement thereafter

Table 9.3

Estimated Available Passenger Facilitity Charges and FAA Entitlement Funds

Calendar Year	Enplane-ments (a)	Estimated PFC Collec-tions (b)	Fiscal Year (c)	FAA Entitlements Passenger (d)	Cargo	Total (e)	Commonwealth Entitlements (f)
2006	326,214	1,384,191	2008	2,275,859	130,105	2,405,964	2,000,000
2007	332,464	1,410,713	2009	3,040,122	130,105	3,170,227	2,000,000
2008	338,834	1,437,742	2010	2,541,940	130,105	2,672,045	2,000,000
2009	345,327	1,955,930	2011	2,575,698	130,105	2,705,803	2,000,000
2010	358,673	2,031,526	2012	2,645,102	130,105	2,775,207	2,000,000
2011	365,842	2,072,129	2013	2,682,378	130,105	2,812,483	2,000,000
2012	373,154	2,113,544	2014	2,720,400	130,105	2,850,505	2,000,000
2013	380,612	2,155,787	2015	2,759,182	130,105	2,889,287	2,000,000
2014	388,219	2,198,874	2016	2,798,740	130,105	2,928,845	2,000,000
2015	395,978	2,242,822	2017	2,839,088	130,105	2,969,193	2,000,000
2016	403,707	2,286,597	2018	2,879,276	130,105	3,009,381	2,000,000
2017	411,586	2,331,226	2019	2,920,250	130,105	3,050,355	2,000,000
2018	419,620	2,376,726	2020	2,962,022	130,105	3,092,127	2,000,000
2019	427,810	2,423,114	2021	3,004,610	130,105	3,134,715	2,000,000
2020	436,160	2,470,408	2022	3,048,030	130,105	3,178,135	2,000,000
2021	445,484	2,523,223	2023	3,096,518	130,105	3,226,623	2,000,000
2022	455,008	2,577,167	2024	3,146,044	130,105	3,276,149	2,000,000
2023	464,736	2,632,265	2025	3,196,628	130,105	3,326,733	2,000,000
2024	474,672	2,688,540					
2025	484,820	2,746,018					

(a) Table 4.32, interpolated for intermediate years.
(b) Assumes collection of $4.50 per enplaned passenger, at 96 percent collection rate less 8 cents administration fee to airlines. Also assumes a rate increase to $6.00 per enplaned passenger, at a 96 percent collection rate less 10 cent administration fee to airlines, effective January 1, 2009. Assumes application is extended, or a new one is in effect, throughout the planning period.
(c) Federal fiscal year ending September 30.
(d) Assumes existing passenger entitlement formula continues through the forecast period, including a doubling of entitlements in any fiscal year in which the total AIP appropriation is $3.2 billion or greater. It is assumed that this level will be met or exceeded in every year of the planning period.
(e) Passenger plus cargo entitlements.
(f) Per Commonwealth of Virginia formula, it was assumed that ROA would receive entitlements at the annual maximum of $2 million.

Sources: As noted and HNTB analysis.

Beginning in 2003, in accordance with federal law, the figure resulting from this formula has been doubled in any year where the total national AIP appropriation has been at least $3.2 billion. The total appropriation has been at least this large since 2003, and it is expected to be in the future.

Recently, federal entitlements for ROA have averaged approximately $2.0-$2.5 million per year. This level consists of passenger and cargo entitlements. Available AIP entitlement funds are expected to total nearly $53.5 million through FY 2025.

The Airport has received discretionary funding in the past, and it expects to obtain similar levels in the future. However, the FAA has notified the Commission that no discretionary funding will be available until at least FY 2011. In recent years, ROA has obtained discretionary funding in the amount of slightly more than $5 million annually. This analysis assumes a total of nearly $55 million between 2008 and 2025, which equates to approximately $3.1 million annually.[2] As discussed later, discretionary funding is assumed for projects likely to be deemed a high priority, such as noise mitigation, RPZ land acquisition, and critical airfield projects.

[2] Though the FAA has indicated a lack of discretionary funding through FY 2011, this analysis assumed the presence of discretionary funding in earlier years if the project had already been indicated by FAA as one to receive discretionary funding, which includes, among others, the two sound insulation projects and the ARFF project.

9.4.3 Virginia Department of Aviation

Funds are available from the Commonwealth to cover the Airport's project costs. The Commonwealth will match all or part of the local share of AIP-funded projects depending upon the type (entitlement or discretionary) of state grant funds used. If a project is funded with federal money, the Airport may use Commonwealth funds to cover 100 percent of the non-federal portion.

Recently, the Airport has received Commonwealth entitlements of approximately $2.0 million annually. For the planning period, it was assumed that the Airport would receive $2.0 million in Commonwealth entitlements in 2008, and that this figure would continue through 2025. In the event that the Airport's entitlement funds are completely obligated, state discretionary funding may be available, though this analysis does not assume the presence of any State discretionary funding during the planning period. Using these funds, the Commonwealth is targeted to cover approximately $38.2 million in project costs through FY 2025.

9.4.4 Third-Party Sources

Third-party sources, such as tenant-funded projects, were factored into the financial plan for many of the new hangar projects, and for land acquisition beyond 2015. It is projected that tenants will directly finance more than $56 million of the master plan projects between FY 2008 and FY 2025.

9.4.5 Airport Revenues

After exhausting all present sources of external funding, it is assumed that the Commission will use Airport revenues to fund the remaining project costs. This creates some funding challenges for Commission, as it strives to keep airline rates as low as possible while providing superior customer service, enhancing facilities, and complying with Department of Homeland Security (DHS) requirements.

As will be discussed below, the Commission will ultimately be responsible for approximately $50.6 million of capital improvements if the federal, Commonwealth, PFC, and private funding assumptions described previously come to pass.

9.5 PROPOSED CAPITAL PROGRAM AND FUNDING

Tables 9.4, 9.5, and 9.6 summarize the master plan program by funding source eligibility and assumed funding source. The eligibility assumptions are based on the eligibility criteria for the alternative funding sources and comments from Airport officials.

Projects eligible for AIP entitlement, PFC, or State entitlement funds were assumed to be financed from these sources to the extent that funds are available. Carryover options are more limited for AIP entitlements than PFC funds, and in turn more limited for PFC funds than State entitlements, except in the frequent cases where the Airport is collecting the PFC after the project has been funded from other sources. Therefore, it was assumed that in any given year, a project would draw from potential funding sources to the extent available in the following order: AIP entitlement, PFC, and State entitlement. In the event projects are funded before sufficient PCFs are collected, this order may change to: AIP, State entitlement, and PFC.

Airfield projects that have a strong safety justification, such as runway and taxiway rehabilitation or RPZ land acquisition, were assumed to be able to obtain AIP discretionary funding. Noise mitigation projects also were assumed to qualify for discretionary funding.

In the course of determining funding sources, it became necessary to adjust the phasing of certain projects in order to take advantage of funding availability, or to avoid issuing more debt. It also became apparent that some long-term land acquisition projects would not be affordable if the financial projections come to pass. As such, the phasing reflected in Table 9.4 is slightly different than that shown in Tables 9.1 and 9.2. The adjustments made were:

- Project T-10, Hold Bag Screening Phase II, was moved from 2012 to 2014;
- Project GA-3, Construct GA Apron/Taxilanes in Midfield Area, was moved from 2012-2013 to 2013-2014;
- Project LA-1, Land Acquisition for RPZs, was re-phased such that the part of the project necessary for the Runway 6 RPZ is still accomplished in 2008, but the remaining parcels occur from 2011 through 2014, rather than from 2009-2012 as originally phased;

Table 9.4

Projects by Estimated Funding Source (Preliminary): Base Case
(Costs include Escalation for Inflation, Contingencies @ 10 Percent, and Administration, Engineering and Testing @ 15 Percent)

Project	Year of Construction (a)	Total Cost (a)	Eligibility (b) AIP	Eligibility (b) PFCe	Eligibility (b) State	Ineligible Costs (c)	Estimated Funding (d) AIP Entitlement	AIP Discretionary	PFC	State Entitlements	State Discretionary	Third Party	Airport
Land Acquisition (Rwy Protection Zones) - Part I	2008	3,032,000	2,880,400	3,032,000	2,425,600		2,650,000	-	231,542	134,800	-	-	15,658
# Noise Program--Sound Insulation (Proj. No. 30)	2008	1,944,000	1,846,800	1,944,000	1,555,200	-	-	1,800,000	-	144,000	-	-	-
Construct Four 4,800-SF Conventional Hangars - Part I	2008	1,796,000	-	-	-	1,796,000	-	-	-	-	-	1,796,000	-
Plaza Area Security Improvements (Proj. No. 25)	2008	730,000	693,500	730,000	584,000		-	-	584,000	146,000	-	-	-
Tunnel Rehab (Proj. No. 28) - Part I	2008	641,000	608,950	641,000	512,800		-	-	128,200	512,800	-	-	-
Upgrade FIDS/Intercom System (Proj. No. 26)	2008	545,000	517,750	545,000	436,000		-	-	109,000	436,000	-	-	-
Front Façade Sun Screening	2008	385,000	-	385,000	-	-	-	-	385,000	-	-	-	-
Replace Slats in Bag Claim Belts (Proj. No. 24)	2008	87,000	82,650	87,000	69,600	-	-	-	-	69,600	-	-	17,400
Rehab Taxiway T & GA Taxilane (Proj. No. 29)	2009	6,073,000	5,769,350	6,073,000	4,858,400	-	2,821,081	1,924,250	-	1,327,669	-	-	-
Noise Program--Sound Insulation (Proj. No. 38)	2009	4,210,000	3,999,500	4,210,000	3,368,000	-	-	3,999,500	-	210,500	-	-	-
Public Parking Lot Rehab. (Primary) (1)	2009	2,002,000	-	-	-	-	-	-	-	-	-	-	2,002,000
Hold Bag Screening Project Phase I	2009	1,644,000	-	1,644,000	1,315,200		-	-	328,800	1,315,200	-	-	-
Rehab Terminal Roadway Entrance (Proj. No. 36)	2009	1,052,000	999,400	1,052,000	841,600	-	-	-	210,400	841,600		-	-
First Floor Restroom Expansion	2009	447,000	424,650	447,000	357,600		-	-	447,000	-	-	-	-
1st Floor Prem. Coffee Concession Space	2009	39,000	-	-	-	39,000	-	-	-	-	-	-	39,000
Stripe Compass Rose	2009	13,000	12,350	13,000	10,400	-	-	-	-	-	-	-	13,000
Construct ARFF and Training Facility	2010	5,322,000	5,055,900	5,322,000	4,257,600		-	5,055,900	266,100	-	-	-	-
Central Term'l Improv. (inc. Mech., Sec. Chkpt, & Inbnd Bag)	2010	3,963,000	1,981,500	3,963,000	3,170,400		-	-	1,400,000	-	-	-	2,563,000
Term'l Loop Road Rehab & Drainage Imp (Proj. No. 42)	2010	1,348,000	1,280,600	1,348,000	1,078,400	-	550,000	-	-	-		-	798,000
Replace 2nd ARFF Vehicle (Proj. No. 47)	2010	1,078,000	1,024,100	1,078,000	862,400	-	-	-	-	1,078,000	-	-	-
Replace Terminal Carpeting & Flooring (Proj. No. 43)	2010	1,011,000	-	1,011,000	808,800		-	-	-	1,011,000	-	-	-
Construct Four 4,800-SF Conventional Hangars - Part II	2010	944,000	-	-	-	944,000	-	-	-	-	-	944,000	-
Replace Concourse Roof (Proj. No. 40)	2010	674,000	-	674,000	539,200		-	-	-	674,000	-	-	-
Replace Terminal Gate Seating (Proj. No. 41)	2010	337,000	168,500	337,000	269,600		-	-	-	168,500	-	-	168,500
Gate 1 Area Expansion	2010	283,000	-	283,000	-	-	-	-	-		-	-	283,000
Second Floor Restroom Renovation	2010	270,000	256,500	270,000	216,000		-	-	270,000	-	-	-	-
Concourse Restroom Expansion	2010	202,000	191,900	202,000	161,600	-	-	-	-	-	-	-	202,000
Construct Secondary Deicing Pad	2011	4,497,000	4,272,150	4,497,000	3,597,600	-	2,666,895	1,605,255	-	224,850	-	-	-
Land Acquisition (Rwy Protection Zones) - Part II	2011	3,340,000	3,173,000	3,340,000	2,672,000		-	-	1,000,000	260,000	-	-	2,080,000
Waypoint Dr./SIDA Access Gate Intersection Reconfig.	2011	2,070,000	1,863,000	2,070,000	1,656,000	-	1,863,000	-	-	207,000	-	-	-
Construct Large T-hangar Bdg, Apron, & Auto Pkg	2011	872,000	34,880	-	31,004	-	-	-	-	-	-	-	872,000
Construct Tanker Circulation Road	2011	578,000	549,100	578,000	462,400		-	-	578,000	-	-	-	-
Energy-savings Projects	2011	414,000	-	414,000	-	-	-	-	414,000	-	-	-	-
Add Loading Bridge Gate 1	2011	400,000	-	400,000	-		-	-	400,000	-	-	-	-
Add Loading Bridge Gate 3	2011	400,000	-	400,000	-		-	-	400,000	-	-	-	-
Relocate Glycol Storage Facility	2011	345,000	327,750	345,000	276,000		-	-	345,000	-	-	-	-
Land Acquisition (Rwy Protection Zones) - Part III	2012	3,422,000	3,250,900	3,422,000	2,737,600		-	2,000,000	-	925,000	-	-	497,000
Construct Four 4,800-SF Conventional Hangars - Part III	2012	988,000	-	-	-	988,000	-	-	-	-	-	988,000	-
Install Fencing Around Rwy 33 RPZ (Proj. No. 52)	2012	565,000	536,750	565,000	452,000	-	536,750	-	-	28,250	-	-	-
Construct GA Apron/Taxilanes in Midfield Area - Part I	2013	5,398,000	5,128,100	5,398,000	4,318,400		-	-		3,493,000	-	-	1,905,000
Land Acquisition (Rwy Protection Zones) - Part IV	2013	3,503,000	3,327,850	3,503,000	2,802,400		1,100,000	2,227,850	-	175,150	-	-	-
Land Acquisition (Term'l Auto Pkg-related)	2013	3,353,000	-	3,353,000	2,682,400		-	-	3,353,000	-	-	-	-
Expand Fuel Farm	2013	2,888,000	-	-	-	2,888,000	-	-	-	-		2,888,000	-
Land Acquisition (Other) - Part I (Unfunded)	*2013	1,155,000	-	1,155,000	924,000		-	-	-	-	-	-	-
Tunnel Rehab (Proj. No. 28) - Part II	2013	722,000	685,900	722,000	577,600					577,600			144,400
Rehab. Tug Road, Waypoint Dr., and Employee Lot	2013	653,000	587,700	653,000	522,400	-	587,700	-	-	65,300	-	-	-
Construct Medium T-hangar Bdg, Apron, & Auto Pkg	2013	478,000	14,340	-	12,747		-	-	-	12,747	-	-	465,253
E-ticket Kiosk Project	2013	78,000	-	78,000	-		-	-	-	-	-	-	78,000

Table 9.4 cont'd

Projects by Estimated Funding Source (Preliminary): Base Case
(Costs include Escalation for Inflation, Contingencies @ 10 Percent, and Administration, Engineering and Testing @ 15 Percent)

Project	Year of Construc-tion (a)	Total Cost (a)	Eligibility (b) AIP	Eligibility (b) PFCe	Eligibility (b) State	Ineligible Costs (c)	Estimated Funding (d) AIP Entitle-ment	AIP Dis-cretion-ary	PFC	State Entitle-ments	State Discre-tionary	Third Party	Airport
Construct Min. Performance EMAS Rwy 24	2014	8,834,000	8,392,300	8,834,000	7,067,200	-	2,769,896	5,622,404	-	-	-	-	441,700
Construct GA Apron/Taxilanes in Midfield Area - Part II	2014	5,522,000	5,245,900	5,522,000	4,417,600		3,206,494	-	-	1,330,405	-	-	985,101
Parking System Expansion/Reorg.	2014	5,170,000	-	5,170,000	4,136,000	-	-	-	650,000	840,000	-		3,680,000
Land Acquisition (Rwy Protection Zones) - Part V	2014	3,584,000	3,404,800	3,584,000	2,867,200		-	3,404,800	-	179,200	-	-	-
Land Acquisition (Other) - Part II (Unfunded)	**2014*	3,476,000	-	3,476,000	2,780,800		-	-	-	-	-	-	-
Construct New FBO Bdg, Roadways, & Parking	2014	2,755,000	1,775,239	1,868,673	1,494,938		-	-	1,868,673	-	-	-	886,327
Hold Bag Screening Project Phase II	2014	2,047,000	-	2,047,000	1,637,600		-	-	-	-	-	-	2,047,000
Gate Reconfiguration	2014	1,728,000	-	1,728,000	-	-	-	-	-	-	-	-	1,728,000
Airfield Fire Hydrants	2014	1,226,000	1,164,700	1,226,000	980,800		-	-	-	1,226,000		-	-
Additional Concourse Concession Space	2014	1,049,000	-	-	-	1,049,000	-	-	-	-	-	1,049,000	-
Construct Consolidated GSE Storage Area	2014	148,000	140,600	148,000	118,400	-	-	-	-	-	-	-	148,000
Construct Min. Performance EMAS Rwy 6	2015	20,970,000	19,921,500	20,970,000	16,776,000	-	2,809,066	17,112,434	-	923,500	-	-	125,000
Construct New 60,000-SF FBO Hangar	2015	11,409,000	-	-	-	11,409,000	-	-	-	-	-	11,409,000	-
Land Acquisition (Other) - Part III	2015	6,010,000	-	6,010,000	4,808,000		-	-	-	680,000	-	-	5,330,000
Expand Airfield Maintenance Facility	2015	5,374,000	5,105,300	5,374,000	4,299,200		-	-	2,000,000	-		-	3,374,000
Airport Administration Office Expansion	2015	1,889,000	-	1,889,000	-		-	-	-	-		-	1,889,000
Construct One 4,800-SF Conventional Hangar	2015	1,058,000	-	-	-	1,058,000	-	-	-	-	-	1,058,000	-
Hold Bag Screening Project Phase III	2015	861,000	-	861,000	688,800		-	-	-	303,500	-	-	557,500
Airline Maintenance Hangar Apron	2015	810,000	769,500	810,000	648,000		-	-	548,000	-	-	-	262,000
Terminal Apron Rehab.	2016	6,465,000	6,141,750	6,465,000	5,172,000	-	-	6,141,750	-	323,250	-	-	-
Secondary Access Route Improvements	2016	3,710,000	3,339,000	3,710,000	2,968,000	-	2,895,000	-	-	815,000		-	-
Land Acquisition (Other) - Part IV	2016	3,674,000	-	3,674,000	2,939,200		-	-	2,095,000	-	-	-	1,579,000
Purchase Snow Removal Equipment - Part I	2016	3,092,000	2,937,400	3,092,000	2,473,600	-	-	2,937,400	-	92,760	-	-	61,840
Demolish Building 22	2016	958,000	910,100	958,000	766,400		-	-	-	553,000	-	-	405,000
New Secondary Pax Charter Facility	2016	618,000	309,000	618,000	309,000		-	309,000	-	309,000	-	-	-
Demolish Current FBO (Bdg 23)	2016	139,000	132,050	139,000	111,200	-	-	-	139,000	-	-	-	-
Construct Three 18,000-SF Conventional Hangars	2017	10,675,000	-	-	-	10,675,000	-	-	-	-	-	10,675,000	-
Airfield Perimeter Road Improvements	2017	3,865,000	3,671,750	3,865,000	3,092,000	-	2,889,287	782,463	-	115,950	-	-	77,300
Land Acquisition (Other) - Part V	2017	3,759,000	-	3,759,000	3,007,200		-	-	900,000	1,630,000	-	-	1,229,000
Construct One 10,000-SF Conventional Hangar	2017	1,977,000	-	-	-	1,977,000	-	-	-	-	-	1,977,000	-
Construct New Wash Rack	2017	158,000	150,100	158,000	126,400	-	-	-	31,600	126,400	-	-	-
Other GA-area Roadway/Pkg Improvements	2017	155,000	147,250	155,000	124,000		-	-	31,000	124,000	-	-	-
Land Acquisition (Other) - Part VI (Unfunded)	**2018*	8,413,000	-	8,413,000	6,730,400		-	-	-	-	-	-	-
Land Acquisition (Cargo-related)	2018	3,535,000	-	3,535,000	2,828,000		-	-	2,435,000	1,100,000	-	-	-
Tunnel Rehab (Proj. No. 28) - Part III	2018	809,000	768,550	809,000	647,200		-	-	-	809,000		-	-
Widen Portion of Air Cargo Apron	2018	654,000	621,300	654,000	32,700		621,300	-	-	32,700	-	-	-
Construct Air Cargo Building	2019	8,193,000	-	-	-		-	-	-	-	-	8,193,000	-
Master Plan Update	2019	1,265,000	1,201,750	1,265,000	1,012,000	-	1,201,750	-	-	63,250	-	-	-
Land Acquisition (Other) - Part VII	2019	662,000	-	662,000	529,600		-	-	132,400	529,600	-	-	-
Land Acquisition (Other) - Part VIII	2020	6,773,000	-	6,773,000	5,418,400		-	-	5,600,000	1,130,000	-	-	43,000
Purchase Snow Removal Equipment - Part II	2020	3,386,000	3,216,700	3,386,000	2,708,800		3,216,700	-	-	169,300	-	-	-
Demolish Building 25	2020	1,185,000	1,125,750	1,185,000	948,000		-	-	-	1,185,000	-	-	-
Expand Truck Dock and Auto Parking	2020	715,000	679,250	715,000	35,750		679,250	-	-	35,750	-	-	-
Construct Three 18,000-SF Conventional Hangars	2021	11,691,000	-	-	-	11,691,000	-	-	-	-	-	11,691,000	-
Land Acquisition (Other) - Part IX	2022	5,255,000	-	5,255,000	4,204,000		-	-	4,355,000	900,000	-	-	-
Construct One 18,000-SF Conventional Hangar	2022	3,987,000	-	-	-	3,987,000	-	-	-	-	-	3,987,000	-
Land Acquisition (Other) - Part X	2023	10,151,000	-	10,151,000	8,120,800		-	-	3,850,000	-	-	-	6,301,000
Tunnel Rehab (Proj. No. 28) - Part IV	2023	906,000	860,700	906,000	724,800		-	-	-	-	-	-	906,000
Relocate Lavatory Disposal Facility (Inc. Proj. 51)	2023	453,000	430,350	453,000	362,400		-	-	-	286,000	-	-	167,000
Land Acquisition (Other) - Part XI	2024	9,643,000	-	9,643,000	7,714,400		-	-	-	7,714,400	-	-	1,928,600
Concourse Holdroom Expansion	2025	7,114,000	-	7,114,000	-	-	-	-	5,330,000	-		-	1,784,000
Expand Ticketing & Outbound Bag Room	2025	2,529,000	-	2,529,000	-	-	-	-	-	-	-	-	2,529,000
Land Acquisition (Other) - Part XII	2025	759,000	-	759,000	607,200		-	-	151,800	607,200	-	-	-
Grand Total (excludes unfunded projects)		274,390,000	124,108,309	213,457,673	157,421,739	48,501,000	33,064,169	54,923,006	40,967,515	38,172,730	-	56,655,000	50,607,580

(a) Table 9.2.
(b) Amount of project eligible for AIP, PFC or State funding. Eligiblity for funding does not assure funding. State funding represents the maximum amount possible, though participation would be less if federal funding is discretionary in nature.
(c) Costs not eligible for any AIP, PFC or State funding.
(d) Estimated funding source(s) for each project.
(e) State eligibility for land acquisition costs is calculated under the assumption that there is no federal participation - therefore, the Commonwealth may participate at a rate up to 80 percent of project costs with its own funds.

Sources: As noted and HNTB analysis.

Table 9.5

Summary of Capital Costs by Project Eligibility

Project Description	Cost in Escalated Dollars																		
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Total Capital Costs (a)																			
Airfield	-	6,086,000	-	4,497,000	565,000	-	8,834,000	20,970,000	6,465,000	3,865,000	-	-	-	-	-	-	-	-	51,282,000
Terminal Area	1,747,000	2,130,000	6,740,000	1,214,000	-	78,000	4,972,000	2,750,000	618,000	-	-	-	-	-	-	-	-	9,643,000	29,892,000
Landside	641,000	3,054,000	1,348,000	2,070,000	-	1,375,000	5,170,000	-	3,710,000	-	809,000	-	-	-	-	906,000	-	-	19,083,000
Air Cargo	-	-	-	-	-	-	-	-	-	-	654,000	8,193,000	715,000	-	-	-	-	-	9,562,000
General Aviation	1,796,000	-	944,000	872,000	988,000	5,876,000	8,277,000	12,467,000	1,097,000	12,965,000	-	-	1,185,000	11,691,000	3,987,000	-	-	-	62,145,000
Airfield/Airline Maintenance/Support	-	-	5,322,000	923,000	-	2,888,000	1,226,000	6,184,000	-	-	-	-	-	-	-	453,000	-	-	16,996,000
Land Acquisition	3,032,000	-	-	3,340,000	3,422,000	8,011,000	7,060,000	6,010,000	3,674,000	3,759,000	11,948,000	662,000	6,773,000	-	5,255,000	10,151,000	9,643,000	759,000	83,499,000
Miscellaneous	1,944,000	4,210,000	1,078,000	-	-	-	-	-	3,092,000	-	-	1,265,000	3,386,000	-	-	-	-	-	14,975,000
Total	9,160,000	15,480,000	15,432,000	12,916,000	4,975,000	18,228,000	35,539,000	48,381,000	18,656,000	20,589,000	13,411,000	10,120,000	12,059,000	11,691,000	9,242,000	11,510,000	9,643,000	10,402,000	287,434,000
AIP Eligible Capital Costs (b)																			
Airfield	-	5,781,700	-	4,272,150	536,750	-	8,392,300	19,921,500	6,141,750	3,671,750	-	-	-	-	-	-	-	-	48,717,900
Terminal Area	1,293,900	424,650	2,598,400	-	-	-	140,600	-	309,000	-	-	-	-	-	-	-	-	-	4,766,550
Landside	608,950	999,400	1,280,600	1,863,000	-	1,273,600	-	-	3,339,000	-	768,550	-	-	-	-	860,700	-	-	10,993,800
Air Cargo	-	-	-	-	-	-	-	-	-	-	621,300	-	679,250	-	-	-	-	-	1,300,550
General Aviation	-	-	-	34,880	-	5,142,440	7,021,139	-	1,042,150	297,350	-	-	1,125,750	-	-	-	-	-	14,663,709
Airfield/Airline Maintenance/Support	-	-	5,055,900	876,850	-	-	1,164,700	5,874,800	-	-	-	-	-	-	-	430,350	-	-	13,402,600
Land Acquisition	2,880,400	-	-	3,173,000	3,250,900	3,327,850	3,404,800	-	-	-	-	-	-	-	-	-	-	-	16,036,950
Miscellaneous	1,846,800	3,999,500	1,024,100	-	-	-	-	-	2,937,400	-	-	1,201,750	3,216,700	-	-	-	-	-	14,226,250
Total	6,630,050	11,205,250	9,959,000	10,219,880	3,787,650	9,743,890	20,123,539	25,796,300	13,769,300	3,969,100	1,389,850	1,201,750	5,021,700	-	-	1,291,050	-	-	124,108,309
PFC Eligible Capital Costs (c)																			
Airfield	-	6,086,000	-	4,497,000	565,000	-	8,834,000	20,970,000	6,465,000	3,865,000	-	-	-	-	-	-	-	-	51,282,000
Terminal Area	1,747,000	2,091,000	6,740,000	1,214,000	-	78,000	3,923,000	2,750,000	618,000	-	-	-	-	-	-	-	-	9,643,000	28,804,000
Landside	641,000	1,052,000	1,348,000	2,070,000	-	1,375,000	5,170,000	-	3,710,000	-	809,000	-	-	-	-	906,000	-	-	17,081,000
Air Cargo	-	-	-	-	-	-	-	-	-	-	654,000	-	715,000	-	-	-	-	-	1,369,000
General Aviation	-	-	-	-	-	5,398,000	7,390,673	-	1,097,000	313,000	-	-	1,185,000	-	-	-	-	-	15,383,673
Airfield/Airline Maintenance/Support	-	-	5,322,000	923,000	-	-	1,226,000	6,184,000	-	-	-	-	-	-	-	453,000	-	-	14,108,000
Land Acquisition	3,032,000	-	-	3,340,000	3,422,000	8,011,000	7,060,000	6,010,000	3,674,000	3,759,000	11,948,000	662,000	6,773,000	-	5,255,000	10,151,000	9,643,000	759,000	83,499,000
Miscellaneous	1,944,000	4,210,000	1,078,000	-	-	-	-	-	3,092,000	-	-	1,265,000	3,386,000	-	-	-	-	-	14,975,000
Total	7,364,000	13,439,000	14,488,000	12,044,000	3,987,000	14,862,000	33,603,673	35,914,000	18,656,000	7,937,000	13,411,000	1,927,000	12,059,000	-	5,255,000	11,510,000	9,643,000	10,402,000	226,501,673
State Eligible Capital Costs (d)																			
Airfield	-	4,868,800	-	3,597,600	452,000	-	7,067,200	16,776,000	5,172,000	3,092,000	-	-	-	-	-	-	-	-	41,025,600
Terminal Area	1,089,600	1,672,800	5,165,600	-	-	-	1,756,000	688,800	309,000	-	-	-	-	-	-	-	-	-	10,681,800
Landside	512,800	841,600	1,078,400	1,656,000	-	1,100,000	4,136,000	-	2,968,000	-	647,200	-	-	-	-	724,800	-	-	13,664,800
Air Cargo	-	-	-	-	-	-	-	-	-	-	32,700	-	35,750	-	-	-	-	-	68,450
General Aviation	-	-	-	31,004	-	4,331,147	5,912,538	-	877,600	250,400	-	-	948,000	-	-	-	-	-	12,350,689
Airfield/Airline Maintenance/Support	-	-	4,257,600	738,400	-	-	980,800	4,947,200	-	-	-	-	-	-	-	362,400	-	-	11,286,400
Land Acquisition	2,425,600	-	-	2,672,000	2,737,600	6,408,800	5,648,000	4,808,000	2,939,200	3,007,200	9,558,400	529,600	5,418,400	-	4,204,000	8,120,800	7,714,400	607,200	66,799,200
Miscellaneous	1,555,200	3,368,000	862,400	-	-	-	-	-	2,473,600	-	-	1,012,000	2,708,800	-	-	-	-	-	11,980,000
Total	4,028,000	7,383,200	10,501,600	8,695,004	3,189,600	11,839,947	25,500,538	27,220,000	12,265,800	6,349,600	10,238,300	529,600	6,402,150	-	4,204,000	9,208,000	7,714,400	607,200	167,856,939
Capital Costs Ineligible for Federal or State Grants (e)																			
Airfield	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terminal Area	-	39,000	-	-	-	-	1,049,000	-	-	-	-	-	-	-	-	-	-	-	1,088,000
Landside	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Air Cargo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General Aviation	1,796,000	-	944,000	-	988,000	-	-	12,467,000	-	12,652,000	-	-	-	11,691,000	3,987,000	-	-	-	44,525,000
Airfield/Airline Maintenance/Support	-	-	-	-	-	2,888,000	-	-	-	-	-	-	-	-	-	-	-	-	2,888,000
Land Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,796,000	39,000	944,000	-	988,000	2,888,000	1,049,000	12,467,000	-	12,652,000	-	-	-	11,691,000	3,987,000	-	-	-	48,501,000

(a) Table 9.2.
(b) Table 9.4. Many FAA eligible costs are alse eligible for PFC and State funding.
(c) Table 9.4. Many PFC eligible costs are also eligible for FAA AIP and State funding.
(d) Table 9.4. Many State eligible costs are also eligible for PFC and FAA AIP funding.
(e) Table 9.4.

Sources: As noted and HNTB analysis.

Table 9.6

Summary of Capital Costs by Estimated Funding Source

	Cost in Escalated Dollars																		
Project Description	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**Total**
Total Project Costs																			
Airfield	-	6,086,000	-	4,497,000	565,000	-	8,834,000	20,970,000	6,465,000	3,865,000	-	-	-	-	-	-	-	-	51,282,000
Terminal Area	1,747,000	2,130,000	6,740,000	1,214,000	-	78,000	4,972,000	2,750,000	618,000	-	-	-	-	-	-	-	-	9,643,000	29,892,000
Landside	641,000	3,054,000	1,348,000	2,070,000	-	1,375,000	5,170,000	-	3,710,000	-	809,000	-	-	-	-	906,000	-	-	19,083,000
Air Cargo	-	-	-	-	-	-	-	-	-	-	654,000	8,193,000	715,000	-	-	-	-	-	9,562,000
General Aviation	1,796,000	-	944,000	872,000	988,000	5,876,000	8,277,000	12,467,000	1,097,000	12,965,000	-	-	1,185,000	11,691,000	3,987,000	-	-	-	62,145,000
Airfield/Airline Maintenance/Support	-	-	5,322,000	923,000	-	2,888,000	1,226,000	6,184,000	-	-	-	-	-	-	-	453,000	-	-	16,996,000
Land Acquisition	3,032,000	-	-	3,340,000	3,422,000	8,011,000	7,060,000	6,010,000	3,674,000	3,759,000	11,948,000	662,000	6,773,000	-	5,255,000	10,151,000	9,643,000	759,000	83,499,000
Miscellaneous	1,944,000	4,210,000	1,078,000	-	-	-	-	-	3,092,000	-	-	1,265,000	3,386,000	-	-	-	-	-	14,975,000
Total	9,160,000	15,480,000	15,432,000	12,916,000	4,975,000	18,228,000	35,539,000	48,381,000	18,656,000	20,589,000	13,411,000	10,120,000	12,059,000	11,691,000	9,242,000	11,510,000	9,643,000	10,402,000	287,434,000
AIP Entitlements																			
Airfield	-	2,821,081	-	2,666,895	536,750	-	2,769,896	2,809,066	-	2,889,287	-	-	-	-	-	-	-	-	14,492,975
Terminal Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Landside	-	-	550,000	1,863,000	-	587,700	-	-	2,895,000	-	-	-	-	-	-	-	-	-	5,895,700
Air Cargo	-	-	-	-	-	-	-	-	-	-	621,300	-	679,250	-	-	-	-	-	1,300,550
General Aviation	-	-	-	-	-	-	3,206,494	-	-	-	-	-	-	-	-	-	-	-	3,206,494
Airfield/Airline Maintenance/Support	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land Acquisition	2,650,000	-	-	-	-	1,100,000	-	-	-	-	-	-	-	-	-	-	-	-	3,750,000
Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	1,201,750	3,216,700	-	-	-	-	-	4,418,450
Total	2,650,000	2,821,081	550,000	4,529,895	536,750	1,687,700	5,976,390	2,809,066	2,895,000	2,889,287	621,300	1,201,750	3,895,950	-	-	-	-	-	33,064,169
AIP Discretionary																			
Airfield	-	1,924,250	-	1,605,255	-	-	5,622,404	17,112,434	6,141,750	782,463	-	-	-	-	-	-	-	-	33,188,556
Terminal Area	-	-	-	-	-	-	-	-	309,000	-	-	-	-	-	-	-	-	-	309,000
Landside	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Air Cargo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General Aviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Airfield/Airline Maintenance/Support	-	-	5,055,900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,055,900
Land Acquisition	-	-	-	-	2,000,000	2,227,850	3,404,800	-	-	-	-	-	-	-	-	-	-	-	7,632,650
Miscellaneous	1,800,000	3,999,500	-	-	-	-	-	-	2,937,400	-	-	-	-	-	-	-	-	-	8,736,900
Total	1,800,000	5,923,750	5,055,900	1,605,255	2,000,000	2,227,850	9,027,204	17,112,434	9,388,150	782,463	-	-	-	-	-	-	-	-	54,923,006
PFC Funds																			
Airfield	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terminal Area	1,078,000	775,800	1,670,000	1,214,000	-	-	-	-	-	-	-	-	-	-	-	-	-	5,330,000	10,067,800
Landside	128,200	210,400	-	-	-	-	650,000	-	-	-	-	-	-	-	-	-	-	-	988,600
Air Cargo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General Aviation	-	-	-	-	-	-	1,868,673	-	139,000	62,600	-	-	-	-	-	-	-	-	2,070,273
Airfield/Airline Maintenance/Support	-	-	266,100	923,000	-	-	-	2,548,000	-	-	-	-	-	-	-	-	-	-	3,737,100
Land Acquisition	231,542	-	-	1,000,000	-	3,353,000	-	-	2,095,000	900,000	2,435,000	132,400	5,600,000	-	4,355,000	3,850,000	-	151,800	24,103,742
Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,437,742	986,200	1,936,100	3,137,000	-	3,353,000	2,518,673	2,548,000	2,234,000	962,600	2,435,000	132,400	5,600,000	-	4,355,000	3,850,000	-	5,481,800	40,967,515
State Entitlements																			
Airfield	-	1,327,669	-	224,850	28,250	-	-	923,500	323,250	115,950	-	-	-	-	-	-	-	-	2,943,469
Terminal Area	651,600	1,315,200	1,853,500	-	-	-	-	303,500	309,000	-	-	-	-	-	-	-	-	-	
Landside	512,800	841,600	-	207,000	-	642,900	840,000	-	815,000	-	809,000	-	-	-	-	-	-	-	
Air Cargo	-	-	-	-	-	-	-	-	-	-	32,700	-	35,750	-	-	-	-	-	68,450
General Aviation	-	-	-	-	-	3,505,747	1,330,405	-	553,000	250,400	-	-	1,185,000	-	-	-	-	-	6,824,551
Airfield/Airline Maintenance/Support	-	-	-	-	-	-	1,226,000	-	-	-	-	-	-	-	-	286,000	-	-	1,512,000
Land Acquisition	134,800	-	-	260,000	925,000	175,150	179,200	680,000	-	1,630,000	1,100,000	529,600	1,130,000	-	900,000	-	7,714,400	607,200	15,965,350
Miscellaneous	144,000	210,500	1,078,000	-	-	-	-	-	92,760	-	-	63,250	169,300	-	-	-	-	-	1,757,810
Total	1,443,200	3,694,969	2,931,500	691,850	953,250	4,323,797	3,575,605	1,907,000	2,093,010	1,996,350	1,941,700	592,850	2,520,050	-	900,000	286,000	7,714,400	607,200	29,071,630
State Discretionary																			
Airfield	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terminal Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Landside	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Air Cargo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General Aviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Airfield/Airline Maintenance/Support	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other																			
Airfield	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terminal Area	-	-	-	-	-	-	1,049,000	-	-	-	-	-	-	-	-	-	-	-	1,049,000
Landside	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Air Cargo	-	-	-	-	-	-	-	-	-	-	-	8,193,000	-	-	-	-	-	-	8,193,000
General Aviation	1,796,000	-	944,000	-	988,000	-	-	12,467,000	-	12,652,000	-	-	-	11,691,000	3,987,000	-	-	-	44,525,000
Airfield/Airline Maintenance/Support	-	-	-	-	-	2,888,000	-	-	-	-	-	-	-	-	-	-	-	-	2,888,000
Land Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,796,000	-	944,000	-	988,000	2,888,000	1,049,000	12,467,000	-	12,652,000	-	8,193,000	-	11,691,000	3,987,000	-	-	-	56,655,000
Airport																			
Airfield	-	13,000	-	-	-	-	441,700	125,000	-	77,300	-	-	-	-	-	-	-	-	657,000
Terminal Area	17,400	39,000	3,216,500	-	-	78,000	3,923,000	2,446,500	-	-	-	-	-	-	-	-	-	4,313,000	14,033,400
Landside	-	2,002,000	798,000	-	-	144,400	3,680,000	-	-	-	-	-	-	-	-	906,000	-	-	7,530,400
Air Cargo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General Aviation	-	-	-	872,000	-	2,370,253	1,871,428	-	405,000	-	-	-	-	-	-	-	-	-	5,518,682
Airfield/Airline Maintenance/Support	-	-	-	-	-	-	-	3,636,000	-	-	-	-	-	-	-	167,000	-	-	3,803,000
Land Acquisition	15,658	-	-	2,080,000	497,000	-	-	5,330,000	1,579,000	1,229,000	-	-	43,000	-	-	6,301,000	1,928,600	-	19,003,258
Miscellaneous	-	-	-	-	-	-	-	-	61,840	-	-	-	-	-	-	-	-	-	61,840
Total	33,058	2,054,000	4,014,500	2,952,000	497,000	2,592,653	9,916,128	11,537,500	2,045,840	1,306,300	-	-	43,000	-	-	7,374,000	1,928,600	4,313,000	50,607,580

Sources: Table 9.4 and HNTB analysis.

- Projects LA-2 and LA-3, land acquisition projects for cargo and terminal auto parking uses, are each shifted out one year, to 2018 and 2013, respectively;
- Project X-5, Master Plan Update, was moved from 2017 to 2019; and
- Three elements of the land acquisition projects are projected to be unfunded. These elements include various parcels that were originally scheduled for 2013, 2014, and 2018. These elements are not critical to the safety and efficiency of the Airport, but may be required to create additional buffer space between the Airport and the surrounding community, or for long-term development not identified in this master plan. Note that in Table 9.4 these projects are noted as "(*Unfunded*)" and that the funding columns are zeroed out.

The projected total estimated cost of the master plan projects was estimated to exceed $287 million for the period FY 2008 through 2025 (inflated dollars). AIP entitlement and discretionary funds are expected to fund approximately $88.0 million of the total costs. Commonwealth grants are expected to exceed $38 million. PFCs will be used for more than $40.9 million of the costs. Tenants and other third parties will provide more than $56.6 million in direct funding. The Commission will be responsible for $50.6 million, and would need to issue new debt in the form of a $28.7 million bond issue. Finally, there will be approximately $13.0 million of the program that would go un-funded under this plan. This amount, when deducted from the total program of $287.4 million presented previously, yields the total of $274.4 million presented in Table 9.4.

9.6 FINANCIAL ANALYSIS

Table 9.7 presents the estimated Airport cash flow analysis during the project construction period. The analysis includes projections of project funding, revenue bond issues, Airport revenues, operating and maintenance and capital costs, airline rates and charges, and net Airport revenue. The analysis follows the Airport's accounting and rates and charges procedures to the extent practical. Additional detail regarding these analyses is provided in **Appendix W**.

9.6.1 Operating Revenue Projections

In fiscal year 2008, operating revenues were budgeted at approximately $7.5 million. The dominant categories of revenue are Airfield (19.4 percent), lease and concessions (23.1 percent), parking (25.6 percent), other Terminal (20.4 percent), GA (5.4 percent), and Other (6.1 percent). As shown in Tables 9.7, operating revenue is projected to more than double to $16.9 million by 2025.

The following assumptions were used to develop the estimates of operating revenue:

The current methodology for calculating landing fee revenue was assumed to continue. Landing fees are set to cover a proportionate share of airfield costs, and are typically reduced to the extent possible in order to keep airline rates competitive with other regional airports. The reduction is not set by formula, but instead reflects a share of the Airport's

Table 9.7

Summary of Cash Flow Analysis

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Capital Costs and Grants (Calendar Year)																		
Total Costs	9,160,000	15,480,000	15,432,000	12,916,000	4,975,000	18,228,000	35,539,000	48,381,000	18,656,000	20,589,000	13,411,000	10,120,000	12,059,000	11,691,000	9,242,000	11,510,000	9,643,000	10,402,000
AIP Entitlements	2,650,000	2,821,081	550,000	4,529,895	536,750	1,687,700	5,976,390	2,809,066	2,895,000	2,889,287	621,300	1,201,750	3,895,950	-	-	-	-	-
AIP Discretionary	1,800,000	5,923,750	5,055,900	1,605,255	2,000,000	2,227,850	9,027,204	17,112,434	9,388,150	782,463	-	-	-	-	-	-	-	-
FAA F&E Funds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Part 150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PFCs (b)	1,437,742	986,200	1,936,100	3,137,000	-	3,353,000	2,518,673	2,548,000	2,234,000	962,600	2,435,000	132,400	5,600,000	-	4,355,000	3,850,000	-	5,481,800
State Entitlement	1,443,200	3,694,969	2,931,500	691,850	953,250	4,323,797	3,575,605	1,907,000	2,093,010	1,996,350	1,941,700	592,850	2,520,050	-	900,000	286,000	7,714,400	607,200
State Discretionary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Airport	33,058	2,054,000	4,014,500	2,952,000	497,000	2,592,653	9,916,128	11,537,500	2,045,840	1,306,300	-	-	43,000	-	-	7,374,000	1,928,600	4,313,000
Cash Flow (Fiscal Year)																		
Bond Issue	-	-	-	-	-	-	28,666,082	-	-	-	-	-	-	-	-	-	-	-
Revenues																		
Operating	7,546,064	7,930,942	8,279,235	8,866,559	9,198,572	9,552,924	9,915,343	10,806,573	11,979,369	12,417,580	12,948,088	13,421,528	13,977,176	14,390,925	15,023,013	15,567,169	16,174,834	16,923,778
Interest	490,902	506,801	488,561	392,212	288,296	253,703	228,891	354,129	436,494	471,541	446,091	469,404	525,941	592,886	669,528	760,179	718,092	643,716
Gain on Asset Disposition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Revenues	8,036,967	8,437,743	8,767,797	9,258,771	9,486,868	9,806,627	10,144,235	11,160,703	12,415,863	12,889,121	13,394,179	13,890,932	14,503,117	14,983,811	15,692,540	16,327,348	16,892,925	17,567,494
Costs																		
Operating	6,666,400	6,887,100	7,173,600	7,399,800	7,644,800	7,897,500	8,158,200	8,656,200	8,951,700	9,253,900	9,555,400	9,866,900	10,189,300	10,546,500	10,916,900	11,301,300	11,699,600	12,198,600
Non-Master Plan Capital Expense	145,400	150,600	156,100	162,100	168,300	174,500	181,200	189,100	196,100	203,500	210,900	218,700	226,800	236,000	245,600	255,600	265,800	277,100
Existing Debt Service	811,186	812,491	812,579	811,531	814,089	810,096	809,506	256,276	256,276	256,276	256,276	256,276	256,276	128,138	128,138	-	-	-
New Debt Service	-	-	-	-	-	-	-	-	2,135,625	2,135,625	2,135,625	2,135,625	2,135,625	2,135,625	2,135,625	2,135,625	2,135,625	2,135,625
Total Costs	7,622,986	7,850,191	8,142,279	8,373,431	8,627,189	8,882,096	9,148,906	9,101,576	11,539,701	11,849,301	12,158,201	12,477,501	12,808,001	13,046,263	13,426,263	13,692,525	14,101,025	14,611,325
Net Revenue	413,981	587,552	625,518	885,340	859,680	924,531	995,329	2,059,127	876,162	1,039,819	1,235,977	1,413,431	1,695,116	1,937,547	2,266,277	2,634,823	2,791,900	2,956,168
Airport Master Plan Costs (a)																		
From Bond Proceeds (b)							6,254,391	10,726,814	6,791,670									
From CIP Reserve/Cash Flow	16,529	1,043,529	3,034,250	3,483,250	1,724,500	1,544,827				1,676,070	653,150	-	21,500	21,500	-	3,687,000	4,651,300	3,120,800
CIP Reserve Balance	7,997,452	7,541,474	5,132,743	2,534,833	1,670,012	1,049,717	2,045,045	4,104,172	4,980,334	4,344,083	4,926,910	6,340,341	8,013,957	9,930,005	12,196,282	11,144,104	9,284,704	9,120,072
Debt Service Coverage	1.69	1.91	1.96	2.29	2.26	2.36	2.45	9.77	1.45	1.52	1.60	1.68	1.80	1.96	2.11	2.35	2.43	2.51
Rates and Charges																		
Terminal Rent	45.01	46.18	43.95	48.24	49.43	50.58	51.88	55.16	63.90	65.48	66.96	68.48	70.05	70.60	72.33	72.98	74.83	71.47
Terminal Rent (2007$)	43.91	43.95	40.81	43.71	43.68	43.62	43.64	45.27	51.17	51.15	51.03	50.92	50.82	49.97	49.94	49.16	49.18	45.83
Signatory Landing Fee	2.33	2.28	2.34	2.39	2.45	2.51	2.57	2.65	2.75	2.78	2.85	2.90	2.96	3.01	3.08	3.13	3.20	3.27
Signatory Landing Fee (2007$)	2.27	2.17	2.17	2.16	2.17	2.16	2.17	2.17	2.20	2.17	2.17	2.16	2.15	2.13	2.13	2.11	2.11	2.10

(a) Airport capital costs presented on fiscal year basis. Assumed to equal 50 % of each calendar year comprising fiscal year.
(b) Actual expenditures may not coincide with calendar years. Projected expenditures from bond proceeds may differ depending on project phasing.

Sources: Table V.1 and HNTB analysis.

projected operating surplus for the year. For this analysis, forecasted landing fees are expected to remain relatively constant when measured in 2007 dollars.

- The current methodology for airline terminal building rental rates was assumed to continue. Airline rates are calculated to offset terminal building operating costs and local capital costs. For this analysis, the forecasted terminal rental rate is expected to remain relatively constant when measured in 2007 dollars.

- It was assumed that concession revenue per passenger would remain constant for existing concessions, except for an inflation factor. Additional increases were assumed to follow concessions improvement projects.

- It was assumed that parking revenue per enplaned passenger would remain constant, except for an inflation factor.

- Other building and hangar rental revenue was assumed to grow with inflation, with corresponding increases to account for the development of new and improved facilities throughout the planning period.

9.6.2 Operating Expense Projections

O&M expenses are allocated among four cost centers: allocable expenses (overhead expenses which are allocated to other cost centers), Airfield, Terminal, and Other direct cost centers. Prior to reallocation, allocable expenses are expected to account for approximately 34 percent of O&M and capital expenses in fiscal year 2008. After reallocation, Airfield is expected to account for 29.2 percent, Terminal for 38.3 percent, and Other direct cost centers for 32.5 percent of O&M and capital costs in FY 2008. As shown in Table 9.7, O&M costs are projected to increase from $6.7 million in FY 2008 to $12.2 million in FY 2025.

The following assumptions were used in developing the O&M cost estimates:

- Operating and maintenance costs per square foot for the Terminal were assumed to remain constant after adjustment for inflation. Total terminal building O&M costs were increased to reflect the additional building space under the various expansion projects.

- Airfield O&M expenses were assumed to grow at essentially the same rate as inflation.

- Other direct cost center O&M expenses were assumed to increase at the same rate as general Airport activity plus inflation. General Airport activity was assumed to be represented by an index comprised of 50 percent increase in passenger activity and 50 percent increase in aircraft operations activity.

9.6.3 Bond Issues

One bond issue is assumed necessary in this analysis. The issue, a $28.7 million general airport revenue bond (GARB) projected for 2014, would assist in paying for several projects, most notably including several land acquisitions. A 25-year repayment period and an interest rate of 5.0 percent are assumed. In addition, it is assumed that five percent of the issue amount would go towards financing costs such as insurance, and financial and legal counsel. The timing of this issue is such that the first year of complete principal and interest payments occurs after the 1998 bonds are paid off. The resulting debt service coverage ratios never fall below 1.45.

It is important to note that this bond issue is only required because the phasing program places several land acquisition projects in a time frame where airport revenues and PFCs will not provide enough funding capacity. The Airport may elect to postpone some of these projects if it believes a new debt issue is not the best solution at the time.

9.6.4 Total Revenues and Expenses

Based on the projections of operating revenue, O&M costs, and debt service, net revenue is projected to rise consistently until 2015, when the additional debt service is incurred. It is then projected to rise again through the forecast period until it reaches more than $2.9 million by 2025. Net revenue is projected to be positive in all years.

The CIP reserve balance is projected to be drawn down from its existing level of $7.6 million because of projected capital spending requirements in the early years of the planning period. Based on the cash flow analysis, it is expected to reach a low of approximately $1.05 million in 2013 before increasing to healthier levels. Between 2015 and 2025, the balance is not expected to fall below $4.1 million.

9.7 CONCLUSIONS

The analyses presented in this chapter highlight the financial challenges faced by Commission and most other U.S. airports in these times of new, greater Security requirements and difficult airline economics. The findings of these analyses are summarized as follows:

- Generally, the development program is financially feasible. The most critical projects can be implemented when demand warrants.

- The feasibility of the program depends on the availability of federal and Commonwealth grant funding; however, this feasibility exists while assuming that, on average, the Commission receives less discretionary funding during the planning period than it has recently. Still, should discretionary funding become more difficult to obtain, the Commission may need to re-phase or postpone projects in the future.

- One debt issue is required to make the entire program feasible. It was assumed to have a 25-year term and an interest rate of 5.0 percent. It was possible to schedule this new debt to coincide with the elimination of debt service on the 1998 bonds.

- PFCs were assumed to fund a substantial portion of the program. It was assumed that the federal cap on PFCs would be increased to $6.00 and that the Commission would collect at that level beginning January 1, 2009. If the cap is not raised, the program would only be feasible if some projects were cancelled and/or postponed.

- It was assumed that the Commission would develop many of the more expensive general aviation and corporate facilities through agreements with private developers. This greatly reduced the Commission's capital requirement for these projects, but also resulted in reduced revenue to the Commission from these projects.

- The Commission will need to draw upon its CIP reserve in the early years of the planning period to fund its share of a number of projects. From its current level of $7.6 million, it will decrease until it reaches approximately $1.05 million in 2013. Beyond 2013, it is expected to grow quickly.

- The assumed inflation rate is 2.5 percent per year. A lower inflation rate would slightly reduce the nominal costs of capital projects.

- Many of the land acquisition projects in the program, while not "optional," are projects that are not warranted by demand. That is, they are not required in a particular year. This flexibility made it possible to label four land acquisition elements as "unfundable." By excluding these from the financial model, the program becomes feasible. Should the Commission find itself with additional available funds in the latter years of the planning period, these projects should be pursued.