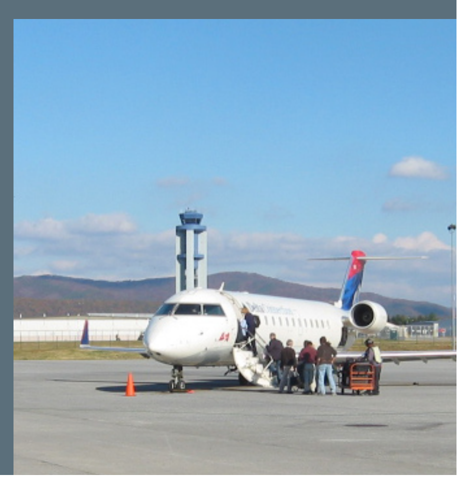
Roanoke Regional Airport

Airport Master Plan Update
Appendices

June 2008



HNTB

LIST OF APPENDICES

APPENDIX A

Obstruction Study

DRAFT

OBSTRUCTION STUDY

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

Prepared for: HNTB Corporation

At the request of

THE ROANOKE REGIONAL AIRPORT COMMISSION

By:

DELTA AIRPORT CONSULTANTS

February 2007

Delta Project No. VA 04095

TABLE OF CONTENTS

ITEM **PAGE**

Exhibits

Appendices

INTRODUCTION

This report summarizes existing and future obstructions on, or in the vicinity of the Roanoke Regional Airport (ROA), in Roanoke, Virginia. This report is intended to be included in the master plan update which provides a planning and programming direction for long term development of the airport.

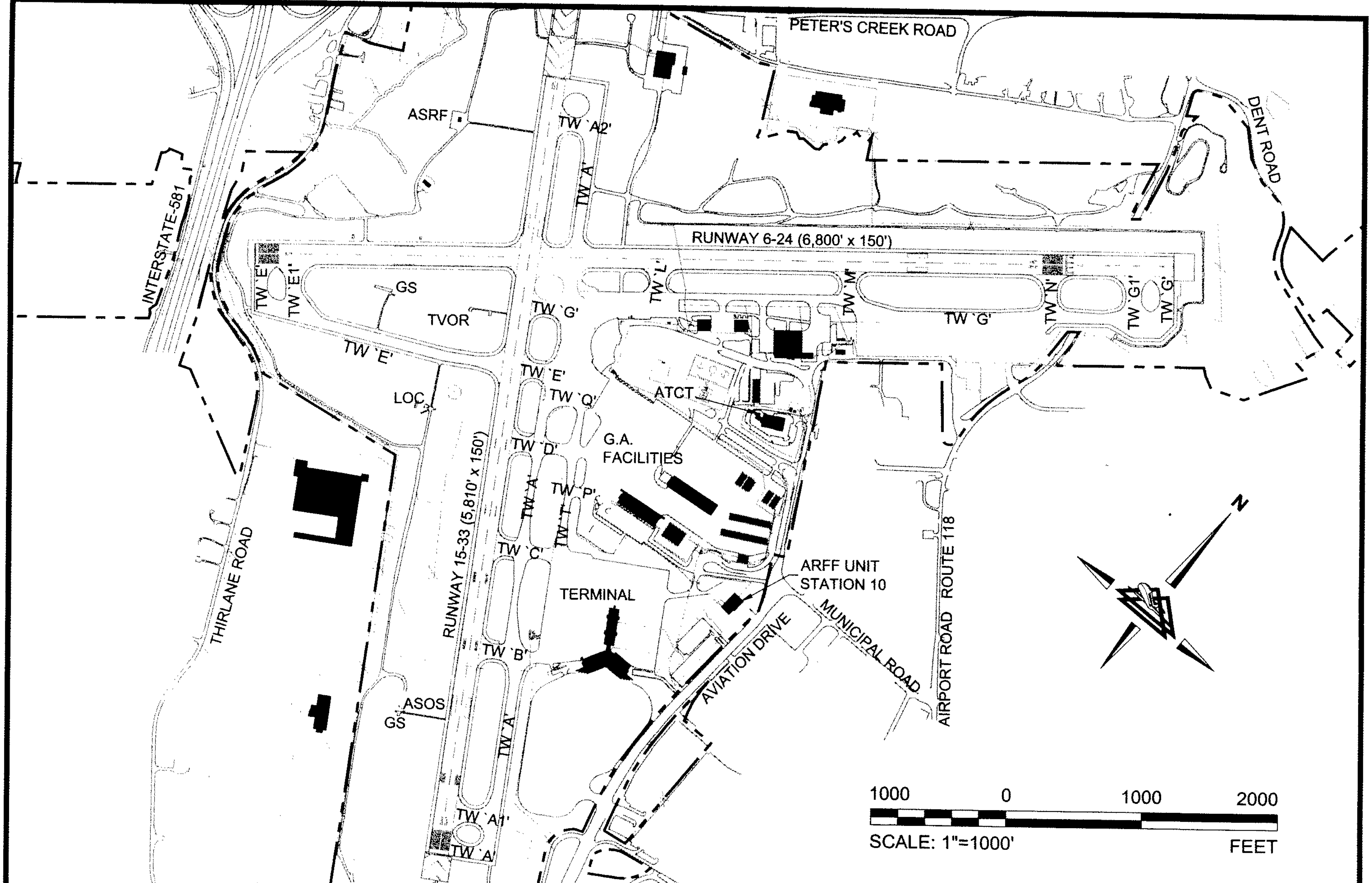
SITE INFORMATION

Roanoke Regional Airport (ROA) is a primary, non-hub, commercial service airport located in Roanoke, Virginia and serves both air carrier and general aviation traffic. The airport is owned and operated by the Roanoke Regional Airport Commission. This report summarizes existing and future obstructions on, or in the vicinity of the airport.

The Airport has two (2) intersecting runways, as shown on **Exhibit A**, Airport Layout. Runway 6-24 (6,800' x 150') is the primary runway, and presently has a displaced landing threshold on the Runway 24 end. Runway 6 has an offset localizer (LDA) with glide slope. Runway 24 has a non-precision instrument approach.

Runway 15-33 is 5,810' in length by 150' in width. Runway 33 supports a precision, Category I Instrument Landing System (ILS) approach. Runway 15 is a visual, daytime only approach.

DRAWING: 04095 AIRPORT LAYOUT.dwg LAYOUT: L1



AIRPORT LAYOUT
ROANOKE REGIONAL AIRPORT

www.deltaairport.com

DRAWN BY: PJW	CHECKED BY: JKB	SCALE: 1"=1000'	DATE: FEBRUARY 2007

EXHIBIT A

GUIDANCE AND STANDARDS FOR OBSTRUCTION DETERMINATIONS

Three (3) FAA documents were utilized to determine and identify obstructions at Roanoke Regional Airport. These documents are listed and briefly described below. Excerpts from each document are included as Appendices A through C.

A. <u>14 CFR Part 77 – "Objects Affecting Navigable Airspace"</u>

This document describes the imaginary surface requirements for civil and military airfields. These imaginary surfaces are comprised of several components of varying slopes and dimensions, and include the Primary Surface, Approach Surface, Transitional Surface, Horizontal Surface, and the Conical Surface. The surfaces are based on the types of aircraft utilizing a runway and the runway approaches at a particular airport. Anything which penetrates these surfaces is considered an airspace obstruction, although it may not necessarily be a hazard to navigation. An airspace study (via FAA Form 7460) is required to make hazard determinations. Obstructions to Part 77 must be removed, lowered, or lighted; otherwise instrument approaches may be eliminated, or their minima may be adjusted upwards to accommodate the obstruction. Increased minima reduce the all-weather capability for the airport. A graphical depiction of Part 77 Surfaces can be found at **Exhibit B**.

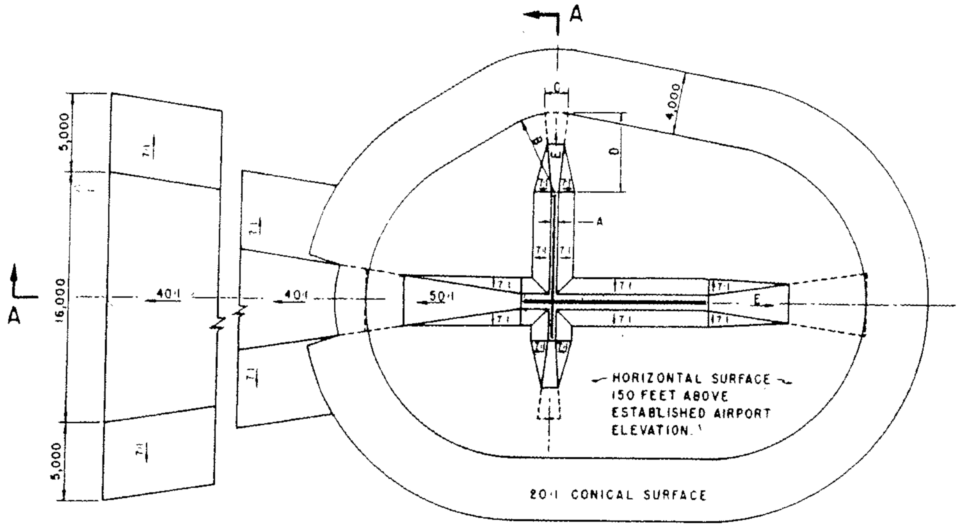
B. <u>FAA Advisory Circular 150/5300-13, App. 2 – "Threshold Siting Requirements"</u>

This document contains guidance on locating runway thresholds to meet approach obstacle clearance requirements. If there are objects which penetrate the threshold siting obstacle clearance surface, they must be removed or lowered; otherwise the obstruction must be accommodated by displacing the threshold, reducing visibility minima, or prohibiting night operations. A graphical depiction of the Threshold Siting Obstacle Clearance Surfaces can be found at **Exhibit C**.

C. <u>FAA AC 150/5340-30A – "Design of Airport Visual Aids"</u>

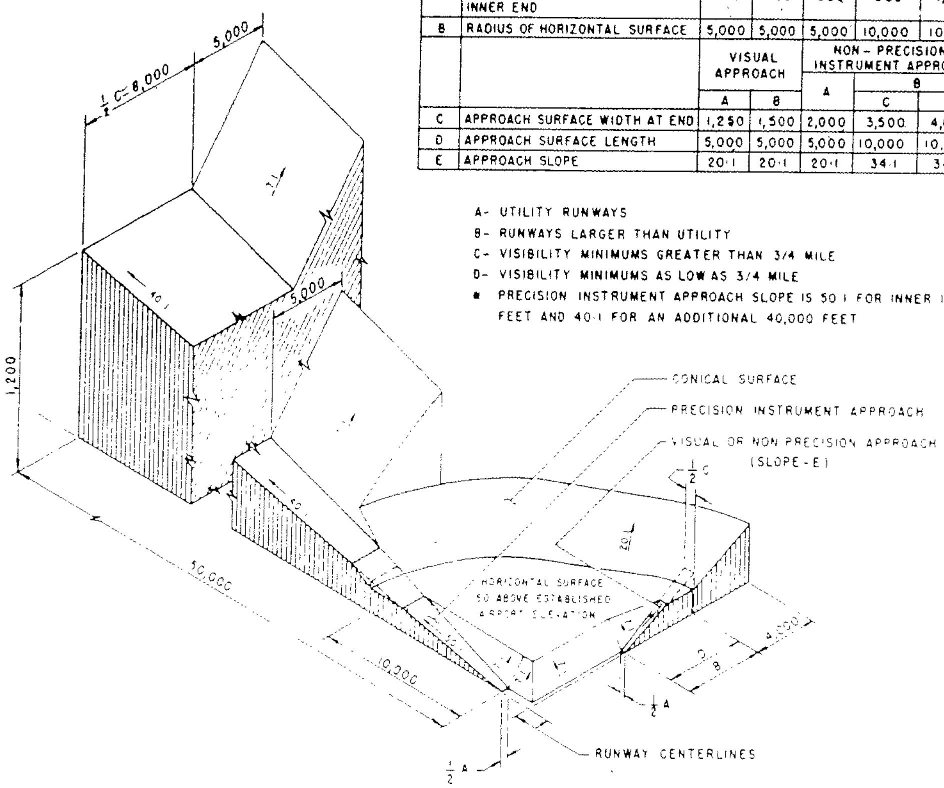
These documents include guidance on the Obstacle Clearance Surface that must be maintained to provide a pilot with minimum clearance over obstacles while utilizing a PAPI for visual approach guidance. If there is an obstacle to this surface which cannot be removed, then the glide path angle for the PAPI must be changed, or the PAPI system moved further from the threshold, thereby reducing the amount of runway length available for landing when utilizing a PAPI. A graphical depiction of the PAPI Obstacle Clearance Surfaces can be found at **Exhibit D**.

UTILITY RUNWAY - A/C 12,500 lbs or LESS



DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B C	B D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B C	B D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A- UTILITY RUNWAYS
B- RUNWAYS LARGER THAN UTILITY
C- VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D- VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET



ISOMETRIC VIEW OF SECTION A-A

§ 77.25 CIVIL AIRPORT IMAGINARY SURFACES

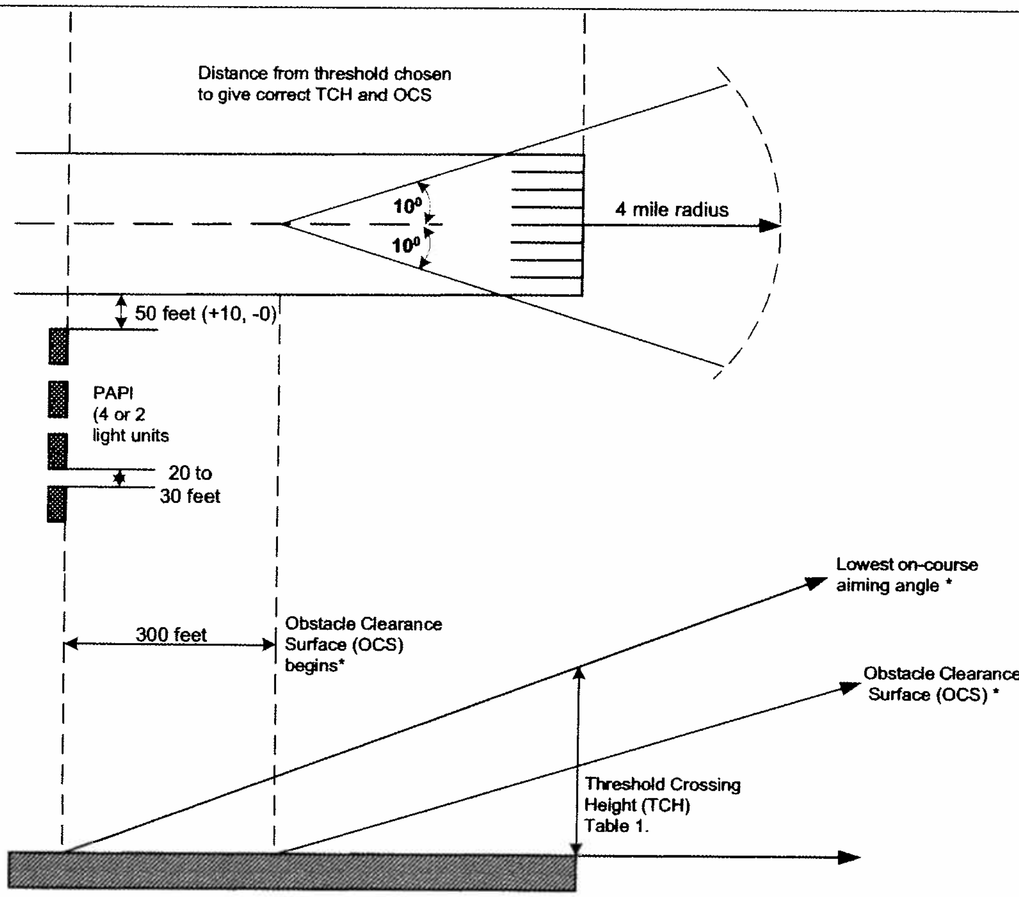
Table A2-1. Approach/Departure Requirements Table

	Runway Type	DIMENSIONAL STANDARDS* Feet					Slope
		A	B	C	D	E	
1	Approach end of runways expected to serve small airplanes with approach speeds less than 50 knots. (Visual runways only, day/night)	0	60	150	500	2,500	15:1
2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more. (Visual runways only, day/night)	0	125	350	2,250	2,750	20:1
3	Approach end of runways expected to serve large airplanes (Visual day/night); or instrument minimums ≥ 1 statute mile (day only).	0	200	500	1,500	8,500	20:1
4	Approach end of runways expected to support instrument night circling. [1]	200	200	1,700	10,000	0	20:1
5	Approach end of runways expected to support instrument straight in night operations, serving approach category A and B aircraft only. [1]	200	200	1,900	10,000 [2]	0	20:1
6	Approach end of runways expected to support instrument straight in night operations serving greater than approach category B aircraft. [1]	200	400	1,900	10,000 [2]	0	20:1
7	Approach end of runways expected to accommodate instrument approaches having visibility minimums ≥ 3/4 but < 1 statute mile, day or night.	200	400	1,900	10,000 [2]	0	20:1
8	Approach end of runways expected to accommodate instrument approaches having visibility minimums < 3/4 statute mile or precision approach (ILS, GLS, or MLS), day or night.	200	400	1,900	10,000 [2]	0	34:1
9	Approach runway ends having Category II approach minimums or greater.	The criteria are set forth in TERPS, Order 8260.3.					
10	Departure runway ends for all instrument operations	0 [5]	See Figure A2-3				40:1 [3]
11	Departure runway ends supporting Air Carrier operations. [4]	0 [5]	See Figure A2-4				62.5:1

* The letters are keyed to those shown in figure A2-1.

Notes:

1. Lighting of obstacle penetrations to this surface or the use of a VGSI, as defined by the TERPS order, may avoid displacing the threshold.
2. 10,000 feet is a nominal value for planning purposes. The actual length of these areas is dependent upon the visual descent point position of the instrument approach procedure.
3. ≤ 35-foot obstacles are permitted through the surface without requiring actions found in paragraph 4; however, they could have an impact on departure visibilities or departure procedures.
4. Information concerning penetrations to this surface is provided for information only and does not take effect until January 1, 2008.
5. Dimension A is measured from the departure end of the TODA as determined by the DER or clearway.



PAPI OCS angle = Lowest on-course aiming angle - 1 degree

NOTES

1. The visual glide path angle is the center of the on-course zone, and is a nominal 3 degrees when measured from the horizontal surface of the runway.
   a. For non-jet runways, the glide path may be raised to 4 degrees maximum to provide obstacle clearance.
   b. If the PAPI glide path is changed to a higher angle from the nominal 3 degrees, it must be communicated in a Notice to Airmen (NOTAM) and published in the Airport Facility Directory.
2. PAPI Obstacle Clearance Surface (OCS).
   a. The PAPI OCS provides the pilot with a minimum approach clearance.
   b. The PAPI must be positioned and aimed so no obstacles penetrate this surface.
      (1) The OCS begins 300 feet (90 m) in front of the PAPI system.
      (2) The OCS is projected into the approach zone 1 degree less than the aiming angle of the third light unit from the runway for an L-880 system, or the outside light unit for an L-881 system.
   c. **Example:** For an L-880 PAPI system with a 3 degree glide path and 20 feet of separation between light units, the third light unit from the runway would be aimed at:
      3 degrees - 10 minutes = 2 degrees, 50 minutes elevation
      (1) The 10 minutes correction was obtained from Table 7.2.
      (2) The OCS angle would be:
      2 degrees 50 minutes - 1 degree = 1 degree 50 minutes.
   d. The OCS is 10 degrees either side of the extended runway centerline and projects 4 statute miles from its point of origin.
   e. If a site survey determines there is an obstacle penetrating the OCS then:
      (1) Remove the obstacle if possible.
      (2) Increase the PAPI approach path angle.
      (3) Move the PAPI toward the threshold to provide an increased TCH equal to the obstacle penetration height.

Figure 78 PAPI Obstacle Clearance Surface

RUNWAY SCENARIOS

Obstructions at Roanoke Regional Airport were analyzed for following four existing and proposed/considered scenarios for each runway end. The assumptions for each are noted below:

1. **Runway 6**

   a. Part 77 – Non-Precision, 34:1; visibility minimums as low as ¾ mile

   b. Threshold Siting Surface - Instrument straight in night operations; ≥ ¾ mile but < 1 mile, (Table A2-1, #7) – 20:1 clearance surface

   c. Visual Aids – VASI, MALSR, REILS

   d. Proposed changes – Precision approach, ½ mile visibility minimums; 50:1 Part 77; 34:1 Threshold Siting Surface (Table A2-1 #8)

2. **Runway 24**

   a. Part 77 – Non-Precision, 34:1; visibility minimums > 3/4 mile

   b. Threshold Siting Surface - Instrument straight in night operations (Table A2-1, #6) – 20:1 clearance surface

   c. Visual Aids – REILS

   d. Proposed changes - Install PAPI; Apply GPS Threshold Siting Surface 30:1

3. **Runway 15**

   a. Part 77 – Visual, large aircraft

   b. Threshold Siting Surface – Day operations serving large aircraft (Table A2-1, #3) – 20:1 clearance surface

   c. Visual Aids – None

   d. Proposed changes – 500' extension and raise runway end. Maintain current landing threshold location.

4. Runway 33

a. Part 77 – Precision, 50:1, ILS

b. Threshold Siting Surface – Precision Approach operations (Table A2-1, #8) – 34:1 clearance surface

c. Visual Aids – PAPI, MALSR

d. Proposed changes - None

OBSTRUCTION ANALYSIS AND RESULTS

All four runways were evaluated based on aerial surveys of objects on and in the vicinity of the airport. These aerial surveys were originally completed as part of the Master Plan update effort, by Mercado Engineers and Potomac Aerial Surveys. These aerial surveys may need to be supplemented and/or reconfirmed by ground survey in critical areas to complete detailed design for obstruction removal.

Based on the limits of the existing surveys, obstructions were identified within an area that extends approximately 3,000' beyond each runway end, and 1,600' to each side of the runway. Areas beyond this were evaluated for obstructions; through a review of the Master Plan, USGS quad maps, and the Cincinnati Sectional Aeronautical Chart. The quad maps show that terrain beyond the limits of the survey does penetrate the airspace surfaces for the airport. The terrain surrounding the airport restricts approach and departure procedures.

A 10 foot buffer between the surfaces and the surveyed elevations was factored in during the analysis. Penetrations within 10' of the surface are designated as "buffer" obstruction.

For railroads and roads, assumed vehicle heights were included to estimate the actual heights of objects on the road or railroad in accordance with Part 77 guidance.

MITIGATION/REMOVAL OF OBSTRUCTIONS

Several options for near and long-term mitigation of the identified obstructions are available. These options are listed below.

- Remove the object
- Lower the object
- Light the object with approved FAA obstruction lights
- Displace the applicable runway threshold
- Adjust the applicable approach (increase minima or prohibit night operations)

There is high terrain in proximity to the airport. Where significant, locations are identified on the attached USGS quad maps for obstruction lights that would assist pilots in locating surrounding terrain during night operations.

The recommendations are presented in table format at Sheet 6, which is a comprehensive Obstruction Chart for all evaluated scenarios. The recommendations are also described in general terms below.

OBSTRUCTION ANALYSIS

Obstructions were identified using aerial surveys. Areas beyond the survey limits were evaluated using USGS quad maps and the February 2003 NOAA Obstruction Chart for the Roanoke Regional Airport.

For all four runway scenarios, the study revealed a number of obstructions to the various imaginary surfaces that the airport owner/operator should protect under 14 CFR Part 77. As shown on Sheet 6, Obstruction Chart, most of these obstructions are trees identified on the Runway 6 approach sheet.

The result of the obstruction analysis and recommendations are shown on Sheets 2 through 5, and is discussed in detail for each runway end below. Full size (24" x 36") copies are included in the back of this report at Appendix D, and reduced size (11" x 17") copies follow this section.

RESULTS AND RECOMMENDATIONS

Runway 6 End

On-Airport Property

As depicted on Sheet 2, there are some minor tree obstructions to the current Threshold Siting and Part 77 Approach Surfaces, as well as some buffer obstructions to both surfaces.

These obstructions become even more pronounced with the proposed changes to the Part 77 Approach Surface (50:1) for a Precision Approach.

Off- Airport Property

To the west of I-581 in the vicinity of Sioux Ridge Road and Cheraw Lake Road, there are also some minor tree obstructions penetrating the Part 77 Approach and future Threshold Siting Surfaces, as well as a few buffer obstructions to these surfaces. These are Sheets 2 and 6.

As shown on Sheets 7 and 10, Poor and Twelve O'clock Knob Mountains are significant terrain which lies beneath the approach surface to Runway 6 and are obstructions to the proposed 50:1 Approach Surface.

Mitigation/Removal of Obstructions

On-airport tree obstructions should be removed as soon as possible. To minimize community impact off-airport , it is recommended that select tree removal be completed as opposed to wholesale clearing and grubbing. Only those trees which are penetrations, or 10' buffer penetrations, to the existing surfaces should be removed. In the future when the surfaces are revised, then another survey should be conducted and at that time property acquisition should be pursued and tree obstructions removed. Property information for those parcels within existing easements is included in Appendix F

For off-airport terrain penetrations, it is recommended that obstruction lights be placed in strategic locations identified on Sheets 7 and 10.

Runway 24 End

On-Airport Property

There are a few (5) tree/shrub obstructions to the Part 77 Surfaces as shown on Sheet 3, Runway 24 Obstruction Layout. Other minor obstructions penetrating the Part 77 Primary and Transitional Surfaces are the Air Traffic Control Tower, Hangars 2, 3 and 4 and the chain link fence adjacent to these buildings.

Off-Airport Property

There are no obstructions to the current airspace surfaces to Runway 24; however Tinker Mountain which lies approximately four (4) nautical miles from the airport is a terrain obstruction to the Obstacle Clearance Surface (OCS) for the proposed PAPI.

Mitigation/Removal of Obstructions

The on-airport obstructions are being removed. The ACTC and Hangar 4 are lighted.

Tinker Mountain is the only off-airport terrain penetration, and that is to the future PAPI OCS, it is recommended that obstruction lights be placed in strategic locations on Tinker Mountain as identified on Sheets 7 and 9.

Runway 15

On-Airport Property

Beside a single tree/shrub obstruction in the Part 77 Primary Surface off the western side of the Runway 15 centerline, the only other obstructions are a few obstructions to the Threshold Siting Surface.

Off-Airport Property

Immediately outside the northern boundary of the airport property are a few minor tree obstructions to the Part 77 Surface to Runway 15. These are shown on Sheet 4, Runway 15 Obstruction Layout and described on Sheet 6, Obstruction Chart.

Mitigation/Removal of Obstructions

It is recommended that the Airport continue to clear the Runway 15 approach area both on and off airport property.

Runway 33

There are no known obstructions to the imaginary surfaces to Runway 33.

APPENDIX "A"

Part 77—Objects Affecting Navigable Airspace

Contents

Contents—Continued

Adoption of Revised Part 77

Adopted: February 3, 1965 **Effective: May 1, 1965**

(Published in 30 F.R. 1837, February 10, 1965)

This revision of Part 77 of the Federal Aviation Regulations relaxes and simplifies the requirements for notice to the Agency of certain proposed structures, consolidates obstruction standards for use in the several Agency programs, and streamlines the Agency procedures for determining the effect of proposed structures on air navigation.

The proposed revision was published in the Federal Register (28 F.R. 7788–7795) on July 31, 1963. Extensive comments were received from aeronautical and nonaeronautical sources which endorsed generally the changes under consideration. These comments were very constructive in nature and the Agency appreciates the cooperative spirit in which they were submitted. Since the discussion here must necessarily be a limited review and explanation of the principal actions being taken, the Agency is unable to give specific recognition to each comment. However, each person who participated may be assured that full consideration was given to his recommendations.

The first noteworthy departure in this amendment from the revisions originally proposed relates to the statement in Subpart A—General on the lack of application of Subparts B, D, and E to construction work begun before July 15, 1961. This has been deleted as unnecessary and possibly misleading. The extensive amendments made by this revision to all portions of Part 77 will take effect at the effective date provided herein. Notices received after this date will be processed under the provisions of Part 77 as revised. Aeronautical studies begun prior to this effective date will be continued under the new provisions.

Public reaction to the proposed revisions of the notice requirements disclosed a need for several adjustments. The first of these involves the requirement for notice to the Agency of any proposed structure which would pierce an imaginary slope of 100 to 1 extending from the property line of an airport listed in the "Airport Directory" of the *Airman's Information Manual.* The property line was selected as a point of beginning because of its greater availability to the public. This feature appears to be an inadequate substitute for the most appropriate point of beginning, that is, the nearest point of the runway nearest to the site of the proposed structure. The use of this point also fixes the elevation of the beginning of the pertinent imaginary slope at the elevation of that nearest point. In addition, the scope of the notice requirement has been substantially reduced. The horizontal distance of the 100 to 1 slope has been restricted to 20,000 feet and will now be applied only to airports with the longest runway more than 3,200 feet in length. For airports with the longest runway 3,200 feet or shorter, a 50 to 1 slope is prescribed for a horizontal distance of 10,000 feet. The FAA "Directory" furnishes the length of the longest runway at each airport. The notice requirement for helicopters now has a horizontal slope of 25 to 1 extending for 5,000 feet.

These notice requirements are made applicable for airports which are either listed in the "Directory" or are operated by a Federal military agency. We have determined that military airports need not be included in the "Directory" in view of their listing in military publications and the fact that their presence is generally well known to people living or owning property in their vicinity. In those cases where the boundaries of a runway of an airport, including a seaplane base, are not designated, the notice requirement of section 77.13(a)(2) will, obviously, not be applicable. However, the notice requirement would apply to those airports which have large sod, or other unpaved areas designated for the takeoff and landing of aircraft. Those areas constitute the runways from which the notice slope is computed. Also, the "Directory" will not list those airports constructed after December 31, 1958, which were the subject of a determination by the Agency that their establishment was not acceptable and would have an adverse effect on the efficient use of airspace and the safety of aircraft.

While this amendment simplifies the current notice requirements, it is recognized that many construction proponents may nevertheless experience difficulty in ascertaining whether they are required to notify the Agency of their proposed structures. The Airspace Utilization Branch in each FAA regional office is staffed with technicians who are available to inform any interested person of the effect of these notice requirements on a specific construction proposal. These technicians will also describe the airspace assignments and aeronautical operations in the area of the construction site so that the proponent may make an informed decision on the feasibility of the site and the availability of other areas which may serve his purpose equally and without derogation of air safety.

The substantial number of comments on the shielding provision of section 77.15 which excuses certain construction and alteration proposals from the notice requirements indicates a further explanation would be in order. The shielding provision adopted here is more restrictive than the one previously employed. This limitation was found necessary because of the unjustified extension of the earlier provision by certain construction proponents. As adopted, the shielding exemption is applicable only in the congested areas of cities, towns, and settlements, and then only to structures so shielded that they could not possibly derogate the safety of air navigation. It should be emphasized that this provision does not represent the Agency shielding criteria. It only relates to the exception from the notice requirements. Upon receiving the required notice, the Agency conducts an appropriate aeronautical study of the proposed structure and, in the course of that study, determines whether it would be, in fact, shielded.

The provisions describing the Agency acknowledgment of notices of construction proposals have been further simplified. The acknowledgment will advise each construction sponsor on two subjects, the possible application of the Agency marking and lighting standards, and whether the proposed structure may be a hazard to air navigation. On the first, the acknowledgment advises whether the construction proposal would be of a type included under the provisions of the FAA Manual on "Obstruction Marking and Lighting" and, if so, how the structure should be marked and lighted. On the hazard question, the acknowledgment will generally state whether the construction or alteration would exceed any of the obstruction standards of Subpart C and will either include a determination on whether the structure would be a hazard to air navigation or advise that further study is required to resolve the question. In the relatively few cases where the structure would exceed an obstruction standard and, in addition, would be located within a runway clear zone or the part of the primary surface extending beyond the end of a runway, the acknowledgment advises that the structure would be a hazard to air navigation. As indicated by this discussion, we have determined not to substitute the phrase "adverse effect on air navigation" for "hazard to air navigation." The Agency review of this portion of the proposal and the comments received with respect to it have disclosed that the "hazard" terminology is preferable.

The obstruction standards adopted here differ in many respects from those originally proposed. Upon review of the comments, the Agency has determined that the obstruction criteria most appropriate for promulgation at this time for civil airports, including joint-use airports, should be drawn more directly from the existing Technical Standard Order TSO–N18, "Criteria for Determining Obstruction to Air Navigation." In view of the substantial length of time that the TSO–N18 criteria have been employed for civil aviation purposes, the adoption of these criteria as the consolidated Agency criteria for use in the performance of the statutory functions authorized by the Federal Aviation Act and the Federal Airport Act should result in the least possible disruption of the performance of those functions.

The obstruction standards now presented in Subpart C are less stringent than those contained in the notice of Proposed Rule Making. The 200-foot limiting height of section 77.23(a) is now to be applied only within three statute miles of an airport with its longest runway more than 3,200 feet in length, rather than the proposed five statute miles. While there is an additional limiting height, beginning at 100 feet within instrument approach areas within three miles of the end of the runway and increasing to a maximum of 250 feet within ten miles from the runway end, this height is largely duplicative of other limiting heights or surfaces and does not constitute a substantial addition to the standard previously considered. We might note, in explanation of the use of the term "runway" here, that this term is now used, exclusively throughout the Part, and the term "landing strip" has been deleted to eliminate a possible ambiguity.

In sections 77.25 and 77.27, criteria are provided for all civil airports, including those constructed to "VFR Airports" standards. These standards are currently contained in the Advisory Circular 150/5300–1, "VFR Airports," and are prescribed for airports constructed to serve only aircraft operating under the Visual Flight Rules. The horizontal and conical airport imaginary surfaces provided in section 77.25 with respect to airport reference points are classified for (1) "VFR Airports," and (2) other airports in accordance with the planned length of the longest runway at each such airport.

The airport imaginary surfaces prescribed in section 77.27 based on runways, except those for "VFR Airports," have been reclassified so that their sizes depend upon whether the runway is equipped with a precision landing aid, such as an instrument Landing System. Runways having instrument approach procedures based upon such facilities as a VOR, ADF, ASR, low frequency range, or TACAN are now provided with the same type surfaces as runways used only for VFR operations, except those on "VFR Airports."

The Department of Defense has forwarded obstruction criteria which differ from those applied here for civil airports. The Department has requested that the criteria be incorporated into Part 77 for application at military airports, except heliports, controlled by components of the Department of Defense, where the longest runway exceeds 5,000 feet. The Department advises that these separate criteria are required at military airports because of the operating characteristics of certain military aircraft, the necessity for low-altitude maneuvering and formation takeoffs, the more stringent aircrew training, and the armament and ordnance-carrying requirements of the military. Accordingly, these criteria are stated herein in section

77.28. The Department is developing criteria for application at military airports with shorter runways than 5,000 feet; and until these criteria are developed, civil airport criteria will apply at such military airports. Also, pending development of these criteria, the military standards for the 2,000-foot width of primary surface will apply only to runways longer than 5,000 feet. The Agency will study the military criteria to determine their potential adaptability to civil airports and their appropriate consolidation with the civil criteria.

The presence of two sets of criteria, applicable to civil and military airports, will not result in inconsistent conclusions in the aeronautical studies on whether a proposed structure would be a hazard to air navigation. These determinations are not controlled by the extent to which such a structure may exceed a civil or military obstruction standard but, rather, upon the possible hazardous effect of the structure on air navigation. A "hazard" or "no hazard" determination is reached after a review of the VFR and IFR operations and procedures involved, both present and prospective. Each study not only includes a review to determine whether the construction proposal might be so altered in location or height that it would not exceed an obstruction standard but, also, a review to ascertain if the structure could be accommodated by adjustment of the aeronautical procedures. Thus, there may be a substantial difference between a construction proposal which would exceed an obstruction standard and one which is determined, as the result of the aeronautical study, to be a hazard to air navigation.

The airport imaginary surfaces proposed for helicopters have been substantially revised for compatibility with the current "Heliport Design Guide." The primary surfaces coincide in size and shape with the takeoff and landing area of each heliport. The designated approach clearance surfaces begin at the edge(s) of the primary surface and extend outward and upward at a slope of 8 to 1. The approach surface is a trapezoid whose inner width is coincident with' the width of the primary surface and which extends to the minimum enroute altitude where its width is 500 feet. Transitional surfaces extend outward and upward at a slope of 2 to 1 from the lateral boundaries of each primary surface and approach surface for a horizontal distance of 250 feet from the centerline of these surfaces.

One of the minor revisions of the obstruction standards made here might also be mentioned. The proposed addition of a 17-foot height to a highway prior to the application of the obstruction criteria evoked several protests. The 17-foot clearance was proposed as a compatible measure with current Federal policy for interstate highways. To avoid an unnecessary extension of this policy, the standard here has been adjusted to permit application of the current 15-foot figure to highways which will not be used by the higher vehicles. In addition, we have added a provision which removes the requirement for the addition of any figure, 15 feet or 17 feet, to a traverse way which is under the coordinated traffic control of the airport management or the air traffic control tower.

We might conclude this brief reference to some of the salient features of the obstruction standards of Subpart C by emphasizing this Subpart may be applied with respect to air navigation facilities planned for future installation or alteration and to planned uses of the navigable airspace by aircraft if that application would result in a lower limiting height or surface. This point is of particular significance in regard to an airport since it includes all runway extensions and other improvements which may be contained in the approved airport layout plan.

The revisions in the procedures for the conduct of aeronautical studies, public hearings on the effect of proposed structures on the navigable airspace, and the establishment of antenna farm areas have been adopted substantially as proposed. Section 77.37 has been broadened to make available a review by the Administrator of each decision by a Regional Director on the effect of a proposed structure on air navigation, including "no hazard" determinations made without notice to any possible interested aeronautical source. While decisions of this type are only made in cases where the available evidence clearly indicates that air safety would not be affected by the construction, this review procedure is nevertheless provided to insure against possible error. The effective period fixed in section 77.39 for a determination of no hazard has been extended in recognition of the time necessary for the processing by the Federal Communications Commission of an application for a construction permit and the issuance of that permit. Appropriate safeguards for the protection of air navigation have been attached to this extension of time.

The comments in response to the Notice of Proposed Rule Making included a number of recommendations for Agency action beyond the authority contained in the Federal Aviation Act of 1958. That Act does not contain a basis for the mandatory marking and lighting of structures to warn pilots of aircraft of those structures. Neither does it contain specific authorization for regulations which would limit the heights of structures. To date, no judicial decision has been issued on the extent to which ground structures may constitute an unlawful interference with the public right of freedom of transit through the navigable airspace recognized in Section 104 of the Act. Until authoritative guidance is received on that point or express legislative authority is conferred, the Agency measures in the field of ground hazards to air navigation will be limited to the areas presently covered in Part 77.

In consideration of the foregoing, Part 77 of Chapter I of Title 14 of the Code of Federal Regulations is revised, effective May 1, 1965, to read as hereinafter set forth.

This amendment is made under the authority of Sections 104, 307, 313, 1001, and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1304, 1348, 1354, 1481, 1501).

Amendment 77–1 *

Miscellaneous Amendments

Adopted: May 11, 1965 **Effective: May 11, 1965**

(Published in 30 F.R. 6713, May 18, 1965)

The purpose of this amendment is to make certain minor clarifying amendments to Part 77 of the Federal Aviation Regulations, which became effective on May 1, 1965.

Section 77.19, by reference to section 77.28(b) in the last paragraph, provides for application of the dimensions of clear zones for runways at civil airports to runways at all military airports. This was not intended. As currently written, section 77.28(b)(1) states that the primary surface for military airports is "the same elevation as the centerline of the runway." The section is being revised to make it clear that the primary surface undulates with the underlying surface.

In the interest of timely correction of these discrepancies, in view of the May 1, 1965, effective date of revised Part 77, and since these amendments are clarifying in nature, I find that notice and public procedure are impracticable and contrary to the public interest and that this amendment may therefore be made effective immediately.

In consideration of the foregoing, Part 77 is amended, effective immediately, as follows.

This amendment is made under the authority of Sections 307, 313, and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354, and 1510), and Executive Order 10854 (24 F.R. 9565).

Amendment 77–2

Form and Time of Notice

Adopted: July 6, 1966 **Effective: July 12, 1966**

(Published in 31 F.R. 9448, July 12, 1966)

The purpose of this amendment is to establish an Agency policy applicable to proposals filed under section 77.13 of the Federal Aviation Regulations for any construction or alteration in excess of 2,000 feet aboveground. This amendment is a general statement of policy anti is procedural in nature. Therefore notice and public procedure hereon are unnecessary and the amendment may be made effective in less than 30 days after publication.

The Federal Aviation Agency has analyzed the recent trend of competitively taller television antenna towers to determine its effect on safety in air navigation. It has long been recognized by this Agency that antenna towers of adequate height are necessary to serve the public interest in a nation-wide broadcasting system. However, there has been a proliferation of antenna towers accompanied by a progressive increase in heights over 1,000 feet above the ground that now presents hazardous conditions to the safety of air navigation. The Agency is of the firm belief that the reasonable interests of the communications industry and the aviation community be accommodated concurrently. To this end, the Federal Communications Commission recently declared in Public Notice FCC 65–455 that "the public interest in broadcast service, may in some instances call for an antenna tower higher than any particular maximum imposed." However, the FCC was "nevertheless convinced that the public interest requires a specific ceiling to halt the upward trend in antenna tower heights, and that 2,000 feet above ground is both realistic and appropriate."

The Federal Aviation Agency, within the limits of its jurisdiction, has attempted to find a remedy for air safety problems inherent in the conflicting demands for a fair and reasonable sharing of airspace by tall towers and aircraft. Part 77 of the Federal Aviation Regulations established procedures for reporting

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* Included in the publication of Part 77.

to the Agency proposed construction that may constitute potential obstructions or hazards to safe air navigation as determined by the application of criteria stated therein. Under these regulations, the FAA advises the construction proponent whether his proposal would constitute a hazard to air navigation. During the time the regulation has been in effect, hundreds of proposed television and radio towers have been considered. Procedures permitting such analysis by the Agency have been of considerable value to the aviation community and to the broadcasting industry in eliminating both geographic and airspace conflicts created by their competing requirements.

In spite of steps already taken to ensure the accommodation of these competing interests, it has been determined that the cumulative effect of heights and locations of towers, both actual and proposed, have created a situation that is hazardous to safe air navigation.

On February 18–19, 1965 the Agency made the following statement to the House Committee on Interstate and Foreign Commerce concerning H.J. Res. 261, which would limit the height of certain radio and television towers:

> The FCC has allocated the TV channels of the Nation on the basis of maximum power television broadcasting at a height of 2,000 feet. Whenever a television tower exceeds this 2,000-foot limitation in most areas (it is 1,000 feet for VHF TV stations in the eastern part of the United States) the power must be reduced to compensate for the increased height.
>
> Therefore, there is no compelling need for any tower to be in excess of 2,000 feet. Although there may be a need for 2,000-foot television towers, under some conditions we would be derelict in our duty as the allocator of the airspace if we permitted all towers to be constructed to a height of 2,000 feet wherever the broadcaster desired.
>
> The 2,000-foot tower with its problems of visibility is inherently hazardous to air navigation.

The Agency therefore considers that it is necessary to take steps to minimize the construction of any antenna tower to a height of more than 2,000 feet aboveground unless it is fully justified in accordance with this Part. This action applies equally to any other structure whose height is proposed to exceed 2,000 feet aboveground, even though the most pressing current problem relates to antenna towers. It is expected that this action will encourage proponents of tower or other type construction to formulate realistic plans, thereby avoiding unnecessary and costly proceedings before the Federal Aviation Agency. In addition, the regulation will be flexible enough to accommodate a proposal for a tower or other type construction more than 2,000 feet high in the event the proponent can demonstrate that it would not be a present or reasonably foreseeable hazard to safe air navigation.

It is of course recognized that towers or other structures with heights of *less* than 2,000 feet above the ground may be hazardous to air navigation, especially where they are located near airports, Federal airways or VFR routes. However, the problems engendered by these situations are totally different from the potential hazards precipitated by the taller towers. Proposed tall towers and other type structures of less than 2,000 feet will continue to be studied carefully on an individual basis to determine whether they present any adverse effects on safe air navigation or cause an inefficient utilization of navigable airspace. The Agency is convinced that from an air safety standpoint the designation of a specific ceiling is needed to halt the upward trend in heights of various type structures. As a general policy, this Agency considered 2,000 feet above the ground to be the maximum height of structures that may be acceptable for maintaining safe navigation. Any structure proposed in excess of 2,000 feet above the ground will be considered to be, inherently, a hazard to air navigation and an inefficient utilization of the airspace. It will be incumbent upon the proponent to overcome this technical assumption by demonstrating to the Agency that such a proposal will not create an inefficient use of airspace or constitute a hazard to air navigation.

In consideration of the foregoing, Part 77 of the Federal Aviation Regulations is amended, effective July 12, 1966.

This amendment is made under the authority of Sections 307, 313, and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354, and 1510).

Amendment 77–3

Alteration of Discretionary Review

Adopted: May 1, 1967

Effective: June 5, 1967

(Published in 32 F.R. 6970, May 6, 1967)

The purpose of this amendment is to exclude determinations of no hazard made under § 77.19(c)(1) from the applicability of discretionary review provided in § 77.37.

The FAA published a notice of proposed rule making in the Federal Register on August 23, 1966 (31 F.R. 11155), circulated as Notice 66–34, proposing to exclude no hazard determinations relating to those structures for which a notice must be filed under § 77.13 but which would not exceed any standard of Subpart C of Part 77, and therefore would be neither an obstruction nor a hazard. Under the FAA's published criteria the proponent of a structure in this category could be given only a no hazard determination. However, under § 77.37 the proponent should wait 30 days to allow any interested party the opportunity to petition for a discretionary review that could only result in a substantiation of the no hazard determination.

Comments received in response to the notice indicated a general understanding of the unneeded delay of 30 days preceding finality of the determination and generally endorsed the proposal. Objections were received to the proposal that were directed to procedural delays encountered in disseminating information concerning the proposed structure to airspace users.

The Air Line Pilots Association objected, stating that local authority would not have an opportunity to study a proposed construction with regard to local zoning ordinances, and to assess the "effects" of the proposal on aviation in that location. A proponent must, of course, obtain any necessary approval from local government authorities prior to construction, including zoning approval if any, which would consider the effects on local property interests. Elimination of the provision for discretionary review by the FAA would have no effect on any requirement local authorities may impose on the proponent.

The Department of the Air Force objected, stating that the elimination of a 30-day delay would not permit proper treatment of aviation considerations because of the length of time involved in obtaining and assessing the effect of the proposal. Particularly, the Air Force is concerned with training flights at very low levels for which a structure of moderate height could be a hazard, and which may be erected before the Air Force representatives would be aware of its existence. Part 77 was never intended to provide protection for very low level military training operations. If every structure that may be an obstruction to flights of this nature should be called a hazard, the public would be overburdened, and a hazard determination would be meaningless. The portion of the comment relating to the delay in obtaining information is pertinent, and coincidentally is similar to a comment received from the Department of the Navy in concurring with the proposal. The FAA will review its procedures to insure appropriate coordination and timely dissemination of information to appropriate parties, including military representatives.

Some comments, conceding that a delay of 30 days may be burdensome in particular circumstances, suggested that a provision be promulgated to waive the 30-day period in circumstances of hardship, or that the 30-day period be retained when an interested party specifically requests its retention to permit time for filing a petition for review. One comment suggested eliminating acknowledgments issued under § 77.19(c)(1). Retention of the 30-day period under normal circumstances while waiving it in cases of hardship would base the decision for discretionary review upon the circumstances of the proponent rather than the effect upon aeronautical operations. If under the standards of Part 77 a structure could be neither an obstruction nor a hazard, periods of delay and additional reviews could not alter the determination. Moreover, issuing waivers would be time-consuming and administratively inefficient where the necessity of review is nonexistent.

In consideration of the foregoing, § 77.37 of the Federal Aviation Regulations is amended, effective June 5, 1967.

This amendment is made under the authority of Secs. 307, 313, and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354, and 1501).

Amendment 77–4

Standards for Determining Obstructions

Adopted: September 6, 1967 **Effective: November 12, 1967**

(Published in 32 F.R. 12997, September 13, 1967)

The purpose of this amendment is to eliminate the requirement that the FAA must find any structure exceeding the applicable obstruction standard and located within an airport runway clear zone or the portion of a primary surface extending beyond the end of a runway to be a hazard to air navigation, regardless of any mitigating factor.

The FAA published a Notice of Proposed Rule Making in the Federal Register on March 9, 1967 (32 F.R. 3887), circulated as Notice No. 67–7 proposing the elimination of the mandatory finding of hazard, thereby permitting the FAA to study all factors involved and make a finding based on the particular situation. The response to the notice indicated a general endorsement of the proposal. Due consideration was given to all comments received.

The Air Line Pilots Association withheld endorsement because the FAA had not indicated what factors it presently considers before granting an exemption to a proposal for an obstruction in a clear zone. It stated it had difficulty in visualizing any mitigating factor relative to an obstruction within a clear zone, and making it easier to allow an obstruction would undoubtedly increase the number of obstructions and decrease the safety margin.

Under the present regulation, we have granted exemptions in cases, there among other matters, the proposed construction, though in a clear zone, was shielded from aircraft flight paths; or where the structure was of a temporary nature such as construction machinery or rigs used in constructing a public water system and erected for use only during daylight hours under VFR conditions.

With the deletion of § 77.19(c)(4), the FAA could subject any construction proposal within a clear zone that exceeded the applicable obstruction standards to an aeronautical study in accordance with § 77.19(c)(3). The study, which may be reviewed by all interested persons, would determine whether the proposed construction could be a hazard. Pending such a determination the construction would be presumed to be a hazard as provided in that section.

This amendment will not reduce the protection to runway approach areas presently afforded by § 77.19(c)(4), but would retain that protection through the application of § 77.19(c)(3). It is not the intent of this amendment to make it easier for obstructions to be based in approach areas or to relax the position of the FAA with regard to such obstructions. This amendment will permit the FAA to exercise its discretionary authority in determining whether the obstruction will in fact be a hazard after reviewing all of the relevant factors. In so doing, the public will be made more aware of the proposed obstruction through circularization and notice, and will be given an opportunity to present relevant comments. Additionally, it will make unnecessary the present practice of granting exemptions from the notice requirements of Part 77 through a procedure recognized as time consuming and inefficient.

In consideration of the foregoing, Part 77 of the Federal Aviation Regulations is amended, effective November 12, 1967.

These amendments are made under the authority of §§ 307, 313, and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354, 1501).

Amendment 77–5

Miscellaneous Amendments

Adopted: March 25, 1968 **Effective: May 2, 1968**

(Published in 33 F.R. 5255, April 2, 1968)

The purpose of these amendments is to make minor substantive changes and editorial corrections to Part 77.

The FAA published a notice of proposed rule making in the Federal Register on July 14, 1967 (32 F.R. 10373), circulated as Notice No. 67–29 which proposed a number of minor substantive amendments and editorial corrections to Part 77 that would clarify the intent or would make the part consistent with the FAA's current practice or organization.

Comments received to the notice indicated a general endorsement of the proposal. A number of comments suggested changes or improvements that have been incorporated herein. Due consideration was given to all comments received.

One comment raised a question on whether this proposal would increase the protection for airports with at least one runway of 3,200 feet. The proposed revision of § 77.13(a)(2) (i) and (ii) would make no change to the current notice requirement criteria. It would merely add the term "actual length" to clarify the intent that the runway length referred to in that section is the actual and not the "corrected" runway length. The actual runway length is selected because this is the measurement provided in the FAA Airport Directory, the Alaska and the Pacific Airman's Guides and Chart Supplements and is the length that the construction sponsor would see on the airport. The general public would have no means of readily determining a corrected runway length, as referred to in the proposed revision of § 77.23(a)(8), and which is used by the FAA in applying its standards for determining obstructions.

The notice proposed to revoke § 77.13(a)(5) which requires a notice, when requested by FAA, for any construction proposal that would be in an instrument approach area and available information indicates that it may be an obstruction to air navigation. Information from the FAA's regional offices indicates that this provision has been used in a number of cases to obtain specific data on height and location after general information on the construction became available. This provision is therefore retained but is redesignated as § 77.13(a)(4).

A new § 77.2, *Definition of terms,* is included to clarify the meaning of certain terms used in this amendment.

Several comments objected to § 77.13(a)(5)(ii) as redesignated herein, which included a planned or proposed airport within the category of airports for which the notice criteria applies, pointing out that frequently sponsors would have no way of ascertaining the sites of planned airports without an inquiry to the FAA each time, or consulting a currently maintained list of planned or proposed airports. There is merit to these comments and the amendment to that section has been revised to include only those airports under construction. Sponsors will be able to see work in progress on airports near the proposed construction and the benefits of this part will be available to those airports.

Some comments suggested that proposed § 77.15(c) should be revised to clarify the phrase "approved by the Administrator" and to list the facilities to which that paragraph applies. The amendment has been revised to reflect the intent that the types of facilities and devices that have been approved by the Administrator are the subject of the reference. "Air Navigation facility" is defined in section 101(8) of the Federal Aviation Act of 1958. Therefore, it is unnecessary to again list those facilities to which the notice requirements do not apply.

The Air Line Pilots Association objected to exempting any object or structure from the notice requirements and obstruction standards. It is recognized that some of the structures exempted from the notice requirement may be obstructions to air navigation. However, these exemptions are based on the need to provide a reasonable notice that can be applied and complied with by a construction proponent. A notice requirement similar to the obstruction criteria of Subpart C of this part would be impracticable in application. The exemption of certain structures, e.g. antenna structures of 20 feet or less in height, and airport or FAA navigational aids, has been found advantageous to both the FAA and industry. Therefore, certain necessary structures, although they may be obstructions, are exempted because of their utility or the relative absence of any hazard associated therewith.

Editorial changes have been made to § 77.17 to reflect the current procedure of sending notices of proposed construction to the appropriate area office instead of a regional office. The identity and address of the appropriate FAA area or regional office may be obtained from any FAA facility, therefore a listing of the respective jurisdictions and addresses is omitted.

Editorial changes have been made to § 77.17(d) including the redesignation of paragraph (d) as paragraph (e), because of the intervening effectiveness of another amendment subsequent to the circularization of Notice No. 67–29.

Sections § 77.11(b)(3) and § 77.19 have been amended to refer to the current designation of the FAA advisory circular on "Obstruction Marking and Lighting".

The wording of § 77.21(a) has been rearranged for readability without making any substantive change. One comment made the same objection to § 77.21(c)(2) as to the notice criteria under § 77.13(a)(5)(ii) that the public would be unable to comply with that section since it could not be aware of airports existing only in the planning stage. This comment is not valid since the standards thereunder are applied by FAA specialists to whom this data would be available.

In consideration of the foregoing, Part 77 is amended, effective May 2, 1968, as hereinafter set forth.

(Secs 307, 313, 1101, Federal Aviation Act of 1958; 49 U.S.C. 1348, 1354, 1501)

Amendment 77–6

Objects Interfering With Air Navigation Facilities

Adopted: July 25, 1968 **Effective: August 31, 1968**

(Published in 33 F.R. 10842, July 31, 1968)

The purpose of this amendment to Part 77 of the Federal Aviation Regulations is to permit the Administrator to consider the effect a proposed construction or alteration would have upon the operation of an air navigation facility.

The substance of this amendment was published as a Notice of Proposed Rule Making in the Federal Register on December 21, 1967, (32 F.R. 20658) as NPRM 67–54. Many comments were received in response to the Notice. Generally, the comments were favorable and recommended adoption of the amendment as proposed.

Part 77 of the Federal Aviation Regulations establishes standards for determining obstructions in navigable airspace, sets forth the notice requirements of certain proposed construction or alteration, provides for aeronautical studies of obstructions to determine their effect on the safe and efficient use of airspace and provides for public hearings on the hazardous effect of proposed construction or alteration. In accordance with previous interpretations and practice, this part applies to the physical effect of an obstruction on the flight of aircraft through the navigable airspace.

The Federal Aviation Administration is encountering with increasing frequency, situations where construction or alteration has a deleterious effect on the operation of air navigation facilities without being a physical hazard in the flight path of aircraft. These situations have ranged from construction which partially blocked the view from an airport air traffic control tower of runways, taxi, and parking areas, to obstructions which blocked or reflected electromagnetic radiation in the vicinity of navigational aids like radio or radar installations. In some instances, the navigational aid could be moved to an interference-free location. In other situations, however, no interference-free locations were available, or the cost of razing and relocating facilities, because of their size or number, was exorbitant.

It appears desirable that when an aeronautical study is made, the Administrator should include in that study the effect that construction or alteration may have on the operation of air navigation facilities. It would be an unreasonable burden on the public to require a proponent to consider this effect because the public may not be aware of the existence or operational characteristics of an air navigation facility, and any effect thereon may not easily be ascertained by the proponent. Accordingly, the Administrator should have the authority of including in an aeronautical study the physical or electromagnetic effect of proposed construction on air navigation facilities. The study may enable the Administrator to recommend changes in the design, location, or construction material that would eliminate or reduce interference with the operation of the air navigation facility. A reduction or elimination of interference may permit the retention of existing approach minimums, use of existing runways or facility structures or avoid costly relocation expenses to the airport or the FAA.

All of the parties that submitted comments concurred in or endorsed the proposed amendment, except the Airport Operators Council International, the Department of Aviation, City of Atlanta, Georgia, and the Air Transport Association of America.

The Airport Operators Council International stated that it strongly opposed the proposed amendment primarily for the following reasons:

(1) The FAA already has sufficient authority to minimize critical encroachment upon airport control tower sight lines through its ability to NOTAM and therefore needs no additional authority.

(2) It is undesirable to use the proposed amendment to protect off-airport navaids from the deleterious effect on their operation by construction proposals over which the airport has no control.

Regarding the first comment, the FAA's present authority allows it to issue a Notice to Airmen to advise them concerning areas on an airport in which ground control of traffic cannot be maintained due to blocking of line-of-sight from the airport control tower. When such a condition exists, the derogation of air traffic control has already taken place and a NOTAM merely advises of that condition. The purpose of this rule is to prevent the condition from arising in the first place.

As far as the second comment is concerned, this amendment intends to include consideration of the physical or electromagnetic effect on the operation of air navigation facilities of any construction proposal for which a notice is required under Section 77.13(a), and would exceed any standard of Subpart C, regardless of whether the facilities are located on or off an airport.

The Department of Aviation, City of Atlanta, Georgia, opposed the proposed amendment primarily on the ground that it felt that this amendment would allow the location and functioning of an FAA air navigation facility to control all other airport development prospects. The Department also stated that it felt that the present Federal Aviation Regulations were adequate to handle obstructions to airport control towers and air navigation facilities.

The aeronautical study may enable the FAA to recommend changes in the design, location or construction material that may eliminate or reduce interference with the operation of the air navigation facility. These recommendations would be made to the construction sponsor and not to the airport operator unless the construction proposal was one over which the airport operator exercised control. Proposed construction or alteration subject to an aeronautical study under the proposed amendment would be limited to those proposals for which notice to the Administrator is now required under Section 77.13(a) of Part 77, FAR, and the proposal would exceed any standard of Subpart C. Proposed construction or alteration of airports that would not require notice under Section 77.13(a) would not come within the scope of the proposed amendment even though there may be a possibility that the proposed construction or alteration might adversely affect the operation of a nearby air navigation facility.

It is not the purpose of the proposed amendment to institute control over any aspect of airport development but (1) to consider the physical and electromagnetic effects of any proposed construction or alteration on air navigation facilities, during an aeronautical study; (2) to inform the construction sponsor, if necessary, of possible interference and how to avoid it; and (3) where the construction proposal would have a substantial adverse effect upon the operation of any air navigation facility to issue a determination of hazard. Current Federal Aviation Regulations do not provide the FAA with authority to study proposed construction or alteration for the purpose of determining their physical and electromagnetic effect on the operation of air navigation facilities.

The Air Transport Association (ATA) did not oppose the proposed amendment, but made several suggestions. Among them ATA commented that FAA has published few guidelines for construction facilities on or near airports and such guidelines should be published by FAA prior to amending Part 77 as proposed.

In addition, ATA felt it should be made clear that airport control towers are not air navigation facilities in the sense of the proposed rule. ATA comments are under careful consideration and the FAA at the present time is engaged in a project to develop new criteria to determine whether proposed construction would affect the operation of air navigation facilities. The intent of the amendment to Part 77, however, is not to revise or develop criteria but to provide the authority to consider possible interference with the operation of air navigation facilities during the aeronautical study of construction proposals. At such time as new criteria have been developed a determination will be made as to their adequacy and whether they should be incorporated in the regulation.

In consideration of the foregoing, Part 77 (§§ 77.31 and 77.35) of the Federal Aviation Regulations is amended effective August 31, 1968.

This amendment is made under the authority of sections 307, 313, and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354, 1501).

Amendment 77–7

Utility Airports

Adopted: October 25, 1968 **Effective: November 30, 1968**

(Published in 33 F.R. 16056, November 1, 1968)

The purpose of this amendment is to include in Part 77 of the Federal Aviation Regulations a reference to "Utility Airports," as appropriate, with each reference to "VFR Airports" standards.

Subpart C of Part 77 contains several references to airports constructed to "VFR Airports" standards. The "VFR Airports" standards and the Advisory Circular in which they were contained were canceled and replaced with Advisory Circular 150/5300–4, "Utility Airports—Design Criteria and Dimensional Standards." Since those airports built to VFR Airports standards continue in existence, Subpart C must be revised to refer to both VFR and Utility Airports.

Since this amendment merely includes in Part 77 a reference to publications and standards currently in use, I find that notice and public procedure hereon are unnecessary.

In consideration of the foregoing, Part 77 (§§ 77.25 (a)(1) and (b)(1) and 77.27 (a)(1) and (c)(2)(i)) of the Federal Aviation Regulations is amended, effective November 30, 1968.

These amendments are made under the authority of Sections 307, 313, and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354, and 1510).

Amendment 77–8

Revision of Notice Form

Adopted: December 11, 1968 **Effective: February 1, 1969**

(Published in 33 F.R. 18614, December 17, 1968)

The purpose of this amendment to Part 77 of the Federal Aviation Regulations is to revise the reference to the form on which notices of proposed construction or alteration are filed to reflect the new form number that has been adopted and to correct an editorial error.

The FAA is adopting Form 7460–1 entitled, "Notice of Proposed Construction or Alteration" to replace Form 177. This form more adequately reflects informational requirements concerning proposed construction or alteration of objects which might affect navigable airspace. Reference is made to FAA Form 117 in several places throughout Subpart B of Part 77. Therefore, an amendment is required to revise the references to this notice form.

Amendment 77–6, effective May 2, 1968, to § 77.11 erroneously identified FAA Advisory Circular AC 70/7460–1 as AC 70/7460. Therefore, this section is being changed to reflect the correct advisory circular number.

In consideration of the foregoing, Subpart B of Part 77 (§§ 77.11(b)(3) and 77.17 (a) and (d)) of the Federal Aviation Regulations is amended, effective February 1, 1969.

This amendment is made under the authority of §§ 307, 313 and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354, 1501), and of § 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)).

Amendment 77–9

Standards for Determining Obstructions to Air Navigation

Adopted: March 25, 1971 **Effective: May 16, 1971**

(Published in 36 F.R. 5968, April 1, 1971)

The purpose of these amendments to the Federal Aviation Regulations is to change the standards for determining obstructions to air navigation.

These amendments were proposed in Notice 70–11 and published in the Federal Register on March 14, 1970 (35 F.R. 4554).

Twenty-five public comments were received in response to the Notice. A substantial number of comments were directed to the application of the obstruction standards and to suggestions for improving notice requirements. Since the subjects of these comments were not part of Notice 70–11, they were not considered in the formulation of the rule. However, they will be given full consideration by the FAA in its continuing efforts to improve Part 77.

Numerous comments were received in response to the FAA's request for public comment on two possible future changes to § 77.25 which were not made part of the Notice. These two possible changes would revise § 77.25 to specify (1) that the approach surface would begin 200 feet beyond the end of the landing threshold, and (2) that the slope of the transitional surfaces extending outward and upward from the edges of the primary surface would be 4:1 instead of 7:1. The comments reflected many viewpoints pro and contra. Several commentators stated that the approach surface to a runway should be related to the end of the runway, or to the displaced threshold if the landing threshold had been relocated, without applying the current 200-foot buffer zone between the landing threshold and the beginning of the approach surface. Others felt that the beginning of the approach surface should not be moved to relate to a displaced threshold unless the displacement was the result of some irrevocably fixed obstruction. Some opposition was expressed to changing the slope of the primary surface related transitional surfaces from 7:1 to 4:1. It was felt that no factual data or rationale had been presented to justify such a change. Further, it was suggested that such a change would result in unsafe structures near runways and might also affect CAT II missed approach requirements. On the other hand, some commentators suggested that the relaxation of the transitional surface slope would have certain advantages for locating airport parking gates for large airplanes; would be practical and desirable; and would be more realistic in view of current land use concepts. All of these comments will be given careful consideration by the FAA in determining its future action in this area.

While some revision of the proposal was effected in the light of the comments received, the amendment as adopted follows the general form of the Notice.

Several commentators proposed modifications for the definitions of the several categories of runways. Concern was expressed as to the use of the phrase "or any other FAA or military planning document" in the proposed definition of a visual runway; that an airport operator might be obligated or under control of a document to which he does not have access. In response. to these comments, the definition of a visual runway has been changed to clarify reference to a military approved airport layout plan as a plan for military airports only, and to amend the phrase referring to "any other FAA or military planning document" to specify any planning document submitted to the FAA by competent authority. This will include an airport layout plan or planning document submitted to the FAA by or through a state or local government.

Consideration was given to suggestions by commentators to include a variety of other definitions in § 77.2. However, since the suggested terms have common dictionary definitions or are otherwise defined in the Federal Aviation Regulations, it was determined not to include these terms in § 77.2. However, minor changes in the language of the proposed definitions in § 77.2 have been made to state more clearly their purpose and use.

One comment concerning the proposed change to § 77.13(a)(3) suggested that the railroad height adjustment should be modified so that the "highest possible or intended" object is considered, and that this should include all roads so that plans would not be based upon heights that are impractical. The FAA considers that the height adjustments prescribed are needed for guidance when applying the notice requirement criteria, and should have limited flexibility. It should be noted that 23 feet is the highest tunnel clearance required for railroads in the United States, and this height would be in consonance with the requirements of the various states.

Several commentators objected to the proposed changes in § 77.15(c) that would exclude from the notice requirement of § 77.13 any air navigation facility, airport visual approach or landing aid, aircraft arresting device, or meteorological device, the location and height of which is fixed by its functional purpose, if a type approved by "an appropriate military service." After careful consideration of the objections, the FAA decided that type approval of devices and equipment on civil airports should remain with the Administrator. Therefore, the change to § 77.15(c) as proposed, has been modified to exclude from the notice requirement of § 77.13 any air navigation facility, airport visual approach or landing aid, aircraft arresting device, or meteorological device given type approval by an appropriate military service only when such facilities, aids, or devices would be located on a military airport.

Several isolated comments directed attention to the intention of the FAA to use the applicable MOCA instead of the established MEA as the basis for determining obstructions within an en route obstacle clearance area of a Federal airway or approved off-on airway route.

Even though some individuals or groups may consider this concept to be a new one, it is based on the rationale that through use of the MOCA alone and selectively applying the terms obstacle and obstruction to it, the application of the standards of Part 77 will be simplified and will result in bringing the entire system into conformity with international standards. In simplified terms, a MOCA is that minimum safe altitude that will permit an aircraft to traverse a designated area of airspace clear of obstacles below. Generally, the height of the highest or controlling obstacle in that airspace segment provides the imaginary obstacle reference line. The appropriate FAA personnel, applying established and specified standards then supply an additional amount of airspace above the obstacle reference line that forms the MOCA altitude level for that segment of flight.

In applying the standards of Part 77 to this airspace formulation, any proposed structure that does not exceed the obstacle reference line will be classified as an obstacle. However, if the proposed structure would penetrate this airspace above the obstacle reference line, it would be classified as an obstruction. Once a proposal is classified as an obstruction, under the procedures provided for in Part 77, it will be studied to determine whether it will or will not constitute a hazard to air navigation.

Accordingly, new § 77.23(a)(4) establishes that the MOCA instead of the MEA will be the basis for determining whether any object within any en route obstacle clearance area, including turn and termination areas, of any Federal airway or approved off-airway route will be classified as an obstruction to air navigation.

One comment was received concerning the proposed new § 77.21(b). The new paragraph was added to ensure proper application of the imaginary surfaces outlined in § 77.25 at airports that have defined landing and takeoff strips, or pathways that are designated as runways but do not have specially prepared hard surfaces, or have a defined landing and takeoff area with no defined landing and takeoff strips or pathways designated as runways. For the purpose of Part 77, any clearly defined strip, pathway or lane designated by appropriate authority for the landing and takeoff of aircraft is considered to be a runway, even though its surface consists of water, turf, dirt or similar unprepared surface.

The application of new § 77.21(b) is based upon the philosophy that, at the thousands of airports having runways of various lateral dimensions without specially prepared hard surfaces, a factor common to each runway and its related primary surface is the centerline. This common factor permits application of the primary surface and the related transitional surfaces because the primary surface is longitudinally centered on the runway and the transitional surfaces extend outward and upward from the sides of the primary surface. Since the width of any primary surface is prescribed in § 77.25(c), the width of that portion of any runway over which its primary surface is superimposed is limited by the width of the related primary surface, regardless of the runway width; the length of the primary surface, however, in this case, is the same as the length of the runway. In applying § 77.21(b) to those airports, excluding seaplane bases, where the defined landing and takeoff area does not have any defined runways for the landing and takeoff of aircraft, the agency would, applying the standards of the regulation, make a determination as to which portions of the area were being regularly used by aircraft as runways for landing and take off. The appropriate primary surface prescribed in § 77.25(c) will then be centered on each portion of the landing and takeoff area determined to be used as a runway, with each end of the primary surface coinciding with the corresponding end of the determined runway.

Many commentators objected to the proposed amendment of § 77.23(a)(2). After careful consideration of all objections to the proposed change, the FAA is convinced that with one exception the proposed revision should not be made. That exception is, that nautical miles will be used in lieu of statute miles in § 77.23(a)(2) to conform to the units of horizontal measurement currently used in en route and terminal airspace configurations, and instrument procedures both nationally and internationally. Further study will be given to the need for relating the height of objects to the airport elevation where the terrain on which those objects are located exceeds the surfaces prescribed in § 77.25 or the heights prescribed in § 77.23(a)(2).

The Notice proposed new § 77.23(a) (3) and (4) to replace § 77.23(a) (4), (5), (6), and (7). Comments on this proposal were generally favorable. Two commentators requested clarification of an en route obstacle clearance area and suggested that definitions of en route and terminal obstacle clearance be included in the regulation. Since we have already discussed in some detail the en route obstacle clearance area that falls within the scope of § 77.23(a)(4), it only remains necessary to provide a brief explanation as to how obstacles and obstructions will relate to the terminal obstacle clearance area portion of the regulation provided for in § 77.23(a)(3) of this amendment.

All approved procedures for instrument approach and departure of aircraft to and from airports that are conducted within specified terminal obstacle clearance and departure areas are established in conformity to the applicable criteria set forth either in the United States Standard for Terminal Instrument Procedures (TERPS) or the FAA Handbook 8260.19, Flight Procedures and Airspace. In the establishment of these instrument approach and departure criteria, the involvement of existing obstacles on the type of instrument procedure proposed for adoption, is one of the primary considerations. Accordingly, the standards of Part 77 applicable in any terminal instrument procedure area must also be based on the same obstacle concept that was used to formulate the applicable criteria of TERPS and FAA Handbook 8260.19. A brief explanation of the interrelationship of obstacles and obstructions to this concept should aid materially in understanding the provisions of § 77.23(a)(3).

In the development of all types of instrument approach procedures under TERPS and departure procedures under FAA Handbook 8260.19, the method of establishing each such procedure is basically the same. The existing obstacles, including objects that are manmade, the terrain features, and the navigational facilities involving a particular approach or departure area are carefully analyzed, after which a prescribed plane, which is commonly referred to as an obstacle clearance plane, is established for that particular phase of flight. In order to insure maximum safety to all aircraft operators who may use that particular terminal instrument procedure, applicable FAA criteria is then applied to provide an additional layer of airspace above the prescribed obstacle clearance plane.

In applying the standards of Part 77 to this type of airspace structure, any object that does not exceed the obstacle clearance plane will be classified as an obstacle; but any object that penetrates the prescribed obstacle clearance plane will be classified as an obstruction, and subject to aeronautical study to determine whether or not it is a hazard to air transportation or air commerce.

Stated in another but in a more sophisticated way, any object that is located within an obstacle clearance area, including an initial approach segment, a circling approach area, or a departure area, is an obstruction to air navigation under the standards of Part 77, if it is of such height that the vertical distance between any point on it and any minimum instrument flight altitude established for any authorized instrument procedure within that area, is less than the obstacle clearance specified for that instrument procedure.

Several commentators addressed the proposed revision of § 77.23. One commentator suggested that runways on air carrier airports be categorized as "air carrier" and provided with equal protection at both ends. The FAA feels that the rationale for the new categorization of runways has been explained adequately previously, therefore, this suggestion was not adopted.

Concern was expressed by some commentators as to the availability of information regarding the category of each approach to each end of each runway of any airport under consideration. The FAA agrees that the success of this concept is dependent upon definite information concerning the category of each approach to each runway end being available to the agency and to the public. This information will be available from FAA regional area offices, and from agency computer readouts.

In response to the suggestion of one commentator, § 77.25(c) will be changed to include the words "or planned hard surface" after the words "has specially prepared hard surface." The FAA believes that this addition helps to clarify the intent of the section and does not modify the meaning.

Other minor changes of an editorial and technically clarifying nature have been made to the amendment. A minor change to the addresses under § 77.17 has been included.

Interested persons have been afforded an opportunity to participate in the making of these amendments. Due consideration has been given to all matter presented. In other respects, for the reasons stated in the preamble to the notice, the rule is adopted as prescribed herein.

In consideration of the foregoing, Part 77 of the Federal Aviation Regulations is amended, effective May 16, 1971.

Sections 307, 313 and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354, and 1501), and Section 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)).

Amendment 77–10

Miscellaneous Amendments

Adopted: February 28, 1972 **Effective: March 4, 1972**

(Published in 37 F.R. 4705, March 4, 1972)

The purpose of this amendment is to make certain minor editorial changes to Part 77 of the Federal Aviation Regulations.

Section 77.11(b) contains a reference to the sale of Advisory Circular 70/7460–1 entitled "Obstruction Marking and Lighting." Effective January 1, 1972, a revised edition of this Advisory Circular has become available free of charge from the Department of Transportation. Section 77.11(b) is revised to reflect this change.

Throughout Subpart B of Part 77 there are several references to FAA area offices and personnel. Since all area offices were eliminated April 2, 1971, and reference to them is deleted and replaced with reference to the appropriate regional office or personnel.

Section 77.73 provides for the establishment of antenna farm areas under the procedural requirements of Section 4 of the Administrative Procedure Act. This citation is no longer accurate since the recodification of the Act, and appropriate language is substituted therefor.

Since these amendments are minor and editorial in nature and no substantive change is effected, notice and public procedure thereon are not necessary and good cause exists for making them effective on less than 30 days notice.

In consideration of the foregoing, Part 77 of the Federal Aviation Regulations is amended, effective March 4, 1972.

This amendment is issued under the authority of sections 313 and 1101 of the Federal Aviation Act of 1958 (49 U.S.C. 1354, 1501), and section 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)).

Amendment 77–11

Organizational Changes and Delegations of Authority

Adopted: September 15, 1989 **Effective: October 25, 1989**

(Published in 54 F.R. 39288, September 25, 1989)

SUMMARY: This amendment adopts changes to office titles and certain terminology in the regulations that were affected by a recent agencywide reorganization. These changes are being made to reflect delegations of authority that were changed, as well as offices that were renamed or abolished and replaced with new office designations. These changes are necessary to make the regulations consistent with the current agency structure.

FOR FURTHER INFORMATION CONTACT: Jean Casciano, Office of Rulemaking (ARM–1), Federal Aviation Administration, 800 Independence Ave., SW., Washington, DC 20591; Telephone (202) 267–9683.

SUPPLEMENTARY INFORMATION

Background

On July 1, 1988, the FAA underwent a far-reaching reorganization that affected both headquarters and regional offices. The most significant change is that certain Regional Divisions and Offices, which formerly reported to the Regional Director, are now under "straight line" authority, meaning that these units within each Regional Office report to the appropriate Associate Administrator (or Chief Counsel) in charge of the function performed by that unit.

Within Part 11 of the Federal Aviation Regulations (FAR), various elements of the FAA have been delegated rulemaking authority by the Administrator. These delegations need to be updated. In addition, throughout the Federal Aviation Regulations references are made to offices that have been renamed or are no longer in existence as a result of reorganization.

Title 14 of the Code of Federal Regulations must therefore be amended to reflect the reorganizations and changes that have taken place.

Paperwork Reduction Act

The paperwork requirements in sections being amended by this document have already been approved. There will be no increase or decrease in paperwork requirements as a result of these amendments, since the changes are completely editorial in nature.

Good Cause Justification for Immediate Adoption

This amendment is needed to avoid possible confusion about the FAA reorganization and to hasten the effective implementation of the reorganization. In view of the need to expedite these changes, and because the amendment is editorial in nature and would impose no additional burden on the public, I find that notice and opportunity for public comment before adopting this amendment is unnecessary.

Federalism Implications

The regulations adopted herein will not have substantial direct effects on the states, on the relationship between the National government and the states, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this final rule does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

The FAA has determined that this document involves an amendment that imposes no additional burden on any person. Accordingly, it has been determined that: 'The action does not involve a major rule under Executive Order 12291; it is not significant under DOT Regulatory Policies and Procedures

(44 FR 11034; February 26, 1979); and because it is of editorial nature, no impact is expected to result and a full regulatory evaluation is not required. In addition, the FAA certifies that this amendment will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

The Rule

In consideration of the foregoing, the Federal Aviation Administration amends the Federal Aviation Regulations (14 CFR Chapter I) effective October 25, 1989.

The authority citation for Part 77 is revised to read as follows:

Authority: 49 U.S.C. 1304, 1348, 1354, 1421 through 1430, 1431, 1501, 49 U.S.C. 106(g) (Revised Pub. L. 97–449, January 12, 1983), (Revised Pub. L. 100–223, December 30, 1987).

PART 77—OBJECTS AFFECTING NAVIGABLE AIRSPACE
Subpart A—General

Source: Docket No. 1882 (30 FR 1839, 2/10/65) effective 5/1/65, for each subpart, unless otherwise noted.

§ 77.1 Scope.

This part:

(a) Establishes standards for determining obstructions in navigable airspace;

(b) Sets forth the requirements for notice to the Administrator of certain proposed construction or alteration;

(c) Provides for aeronautical studies of obstructions to air navigation, to determine their effect on the safe and efficient use of airspace;

(d) Provides for public hearings on the hazardous effect of proposed construction or alteration on air navigation; and

(e) Provides for establishing antenna farm areas.

§ 77.2 Definition of terms.

For the purpose of this part:

Airport available for public use means an airport that is open to the general public with or without a prior request to use the airport.

A seaplane base is considered to be an airport only if its sea lanes are outlined by visual markers.

Nonprecision instrument runway means a runway having an existing instrument approach procedure utilizing air navigation facilities with only horizontal guidance, or area type navigation equipment, for which a straight-in nonprecision instrument approach procedure has been approved, or planned, and for which no precision approach facilities are planned, or indicated on an FAA planning document or military service military airport planning document.

Precision instrument runway means a runway having an existing instrument approach procedure utilizing an Instrument Landing System (ILS), or a Precision Approach Radar (PAR). It also means a runway for which a precision approach system is planned and is so indicated by an FAA approved airport layout plan; a military service approved military airport layout plan; any other FAA planning document, or military service military airport planning document.

Utility runway means a runway that is constructed for and intended to be used by propeller driven aircraft of 12,500 pounds maximum gross weight and less.

Visual runway means a runway intended solely for the operation of aircraft using visual approach procedures, with no straight-in instrument approach procedure and no instrument designation indicated on an FAA approved airport layout plan, a military service approved military airport layout plan, or by any planning document submitted to the FAA by competent authority.

(Amdt. 77–5, Eff. 5/2/68); (Amdt. 77–9, Eff. 5/16/71)

§ 77.3 Standards.

(a) The standards established in this part for determining obstructions to air navigation are used by the Administrator in:

(1) Administering the Federal-aid Airport Program and the Surplus Airport Program;

(2) Transferring property of the United States under section 16 of the Federal Airport Act;

(3) Developing technical standards and guidance in the design and construction of airports; and

(4) Imposing requirements for public notice of the construction or alteration of any structure where notice will promote air safety.

(b) The standards used by the Administrator in the establishment of flight procedures and aircraft operational limitations are not set forth in this part but are contained in other publications of the Administrator.

(Amdt. 77–9, Eff. 5/16/71)

§ 77.5 Kinds of objects affected.

This part applies to:

(a) Any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment or materials used therein, and apparatus of a permanent or temporary character; and

(b) Alteration of any permanent or temporary existing structure by a change in its height (including appurtenances), or lateral dimensions, including equipment or materials used therein.

Subpart B—Notice of Construction or Alteration

§ 77.11 Scope.

(a) This subpart requires each person proposing any kind of construction or alteration described in § 77.13(a) to give adequate notice to the Administrator. It specifies the locations and dimensions of the construction or alteration for which notice is required and prescribes the form and manner of the notice. It also requires supplemental notices 48 hours before the start and upon the completion of certain construction or alteration that was the subject of a notice under § 77.13(a).

(b) Notices received under this subpart provide a basis for:

(1) Evaluating the effect of the construction or alteration on operational procedures and proposed operational procedures;

(2) Determinations of the possible hazardous effect of the proposed construction or alteration on air navigation;

(3) Recommendations for identifying the construction or alteration in accordance with the current Federal Aviation Administration Advisory Circular AC 70/7460–1 entitled "Obstruction Marking and Lighting," which is available without charge from the Department of Transportation, Distribution Unit, TAD 484.3, Washington, DC 20590.

(4) Determining other appropriate measures to be applied for continued safety of air navigation; and

(5) Charting and other notification to airmen of the construction or alteration.

(Amdt. 77–8, Eff. 2/1/69); (Amdt. 77–10, Eff. 3/4/72)

§ 77.13 Construction or alteration requiring notice.

(a) Except as provided in § 77.15, each sponsor who proposes any of the following construction or alteration shall notify the Administrator in the form and manner prescribed in § 77.17:

(1) Any construction or alteration of more than 200 feet in height above the ground level at its site.

(2) Any construction or alteration of greater height than an imaginary surface extending outward and upward at one of the following slopes:

(i) 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) of this section with at least one runway more than 3,200 feet in actual length, excluding heliports.

(ii) 50 to 1 for a horizontal distance of 10,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) of this section with its longest runway no more than 3,200 feet in actual length, excluding heliports.

(iii) 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff area of each heliport specified in paragraph (a)(5) of this section.

(3) Any highway, railroad, or other traverse way for mobile objects, of a height which, if adjusted upward 17 feet for an Interstate Highway that is part of the National System of Military and Interstate Highways where overcrossings are designed for a minimum of 17 feet vertical distance, 15 feet for any other public roadway, 10 feet or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road, 23 feet for a railroad, and for a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it, would exceed a standard of paragraph (a) (1) or (2) of this section.

(4) When requested by the FAA, any construction or alteration that would be in an instrument approach area (defined in the FAA standards governing instrument approach procedures) and available information indicates it might exceed a standard of subpart C of this part.

(5) Any construction or alteration on any of the following airports (including heliports):

(i) An airport that is available for public use and is listed in the Airport Directory of the current Airman's Information Manual or in either the Alaska or Pacific Airman's Guide and Chart Supplement.

(ii) An airport under construction, that is the subject of a notice or proposal on file with the Federal Aviation Administration, and, except for military airports, it is clearly indicated that that airport will be available for public use.

(iii) An airport that is operated by an armed force of the United States.

(b) Each sponsor who proposes construction or alteration that is the subject of a notice under paragraph (a) of this section and is advised by an FAA regional office that a supplemental notice is required shall submit that notice on a prescribed form to be received by the FAA regional office at least 48 hours before the start of the construction or alteration.

(c) Each sponsor who undertakes construction or alteration that is the subject of a notice under paragraph (a) of this section shall, within 5 days after that construction or alteration reaches its greatest height, submit a supplemental notice on a prescribed form to the FAA regional office having jurisdiction over the region involved, if—

(1) The construction or alteration is more than 200 feet above the surface level of its site; or

(2) An FAA regional office advises him that submission of the form is required.

(Amdt. 77–5, Eff. 5/2/68); (Amdt. 77–9, Eff. 5/16/71); (Amdt. 77–10, Eff. 3/4/72)

§ 77.15 Construction or alteration not requiring notice.

No person is required to notify the Administrator for any of the following construction or alteration:

(a) Any object that would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, and would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded will not adversely affect safety in air navigation.

(b) Any antenna structure of 20 feet or less in height except one that would increase the height of another antenna structure.

(c) Any air navigation facility, airport visual approach or landing aid, aircraft arresting device, or meteorological device, of a type approved by the Administrator, or an appropriate military service on military airports, the location and height of which is fixed by its functional purpose.

(d) Any construction or alteration for which notice is required by any other FAA regulation.

(Amdt. 77–5, Eff. 5/2/68); (Amdt. 77–9, Eff. 5/16/71)

§ 77.17 Form and time of notice.

(a) Each person who is required to notify the Administrator under § 77.13(a) shall send one executed form set (four copies) of FAA Form 7460–1, Notice of Proposed Construction or Alteration, to the Manager, Air Traffic Division, FAA Regional Office having jurisdiction over the area within which the construction or alteration will be located. Copies of FAA Form 7460–1 may be obtained from the headquarters of the Federal Aviation Administration and the regional offices.

(b) The notice required under § 77.13(a) (1) through (4) must be submitted at least 30 days before the earlier of the following dates:

(1) The date the proposed construction or alteration is to begin.

(2) The date an application for a construction permit is to be filed.

However, a notice relating to proposed construction or alteration that is subject to the licensing requirements of the Federal Communications Act may be sent to FAA at the same time the application for construction is filed with the Federal Communications Commission, or at any time before that filing.

(c) A proposed structure or an alteration to an existing structure that exceeds 2,000 feet in height above the ground will be presumed to be a hazard to air navigation and to result in an inefficient utilization of airspace and the applicant has the burden of overcoming that presumption. Each notice submitted under the pertinent provisions of this part 77 proposing a structure in excess of 2,000 feet above ground, or an alteration that will make an existing structure exceed that height, must contain a detailed showing, directed to meeting this burden. Only in exceptional cases, where the FAA concludes that a clear and compelling showing has been made that it would not result in an inefficient utilization of the airspace and would not result in a hazard to air navigation, will a determination of no hazard be issued.

(d) In the case of an emergency involving essential public services, public health, or public safety that requires immediate construction or alteration, the 30-day requirement in paragraph (b) of this section does not apply and the notice may be sent by telephone, telegraph, or other expeditious means, with an executed FAA Form 7460–1 submitted within 5 days thereafter. Outside normal business hours, emergency notices by telephone or telegraph may be submitted to the nearest FAA Flight Service Station.

(e) Each person who is required to notify the Administrator by paragraph (b) or (c) of § 77.13, or both, shall send an executed copy of FAA Form 117–1, Notice of Progress of Construction or Alteration, to the Manager, Air Traffic Division, FAA Regional Office having jurisdiction over the area involved.

(Amdt. 77–2, Eff. 7/12/66); (Amdt. 77–5, Eff. 5/2/68); (Amdt. 77–8, Eff. 2/1/69); (Amdt. 77–9, Eff. 5/16/71); (Amdt. 77–10, Eff. 3/4/72); (Amdt. 77–11, Eff. 10/25/89)

§ 77.19 Acknowledgment of notice.

(a) The FAA acknowledges in writing the receipt of each notice submitted under § 77.13(a).

(b) If the construction or alteration proposed in a notice is one for which lighting or marking standards are prescribed in the FAA Advisory Circular AC 70/7460–1, entitled "Obstruction Marking and Lighting," the acknowledgment contains a statement to that effect and information on how the structure should be marked and lighted in accordance with the manual.

(c) The acknowledgment states that an aeronautical study of the proposed construction or alteration has resulted in a determination that the construction or alteration:

(1) Would not exceed any standard of subpart C and would not be a hazard to air navigation;

(2) Would exceed a standard of subpart C but would not be a hazard to air navigation; or

(3) Would exceed a standard of subpart C and further aeronautical study is necessary to determine whether it would be a hazard to air navigation, that the sponsor may request within 30 days that further study, and that, pending completion of any further study, it is presumed the construction or alteration would be a hazard to air navigation.

(Amdt. 77–1, Eff. 5/11/65); (Amdt. 77–4, Eff. 11/12/67); (Amdt. 77–5, Eff. 5/2/68)

Subpart C—Obstruction Standards

§ 77.21 Scope.

(a) This subpart establishes standards for determining obstructions to air navigation. It applies to existing and proposed manmade objects, objects of natural growth, and terrain. The standards apply to the use of navigable airspace by aircraft and to existing air navigation facilities, such as an air navigation aid, airport, Federal airway, instrument approach or departure procedure, or approved off-airway route. Additionally, they apply to a planned facility or use, or a change in an existing facility or use, if a proposal therefor is on file with the Federal Aviation Administration or an appropriate military service on the date the notice required by § 77.13(a) is filed.

(b) At those airports having defined runways with specially prepared hard surfaces, the primary surface for each such runway extends 200 feet beyond each end of the runway. At those airports having defined strips or pathways that are used regularly for the taking off and landing of aircraft and have been designated by appropriate authority as runways, but do not have specially prepared hard surfaces, each end of the primary surface for each such runway shall coincide with the corresponding end of the runway. At those airports, excluding seaplane bases, having a defined landing and takeoff area with no defined pathways for the landing and taking off of aircraft, a determination shall be made as to which portions of the landing and takeoff area are regularly used as landing and takeoff pathways. Those pathways so determined shall be considered runways and an appropriate primary surface as defined in § 77.25(c) will be considered as being longitudinally centered on each runway so determined, and each end of that primary surface shall coincide with the corresponding end of that runway.

(c) The standards in this subpart apply to the effect of construction or alteration proposals upon an airport if, at the time of filing of the notice required by § 77.13(a), that airport is—

(1) Available for public use and is listed in the Airport Directory of the current Airman's Information Manual or in either the Alaska or Pacific Airman's Guide and Chart Supplement; or

(2) A planned or proposed airport or an airport under construction, that is the subject of a notice or proposal on file with the Federal Aviation Administration, and, except for military airports, it is clearly indicated that that airport will be available for public use; or,

(3) An airport that is operated by an armed force of the United States.

(Amdt. 77–5, Eff. 5/2/68); (Amdt. 77–9, Eff. 5/16/71)

§ 77.23 Standards for determining obstructions.

(a) An existing object, including a mobile object, is, and a future object would be, an obstruction to air navigation if it is of greater height than any of the following heights or surfaces:

(1) A height of 500 feet above ground level at the site of the object.

(2) A height that is 200 feet above ground level or above the established airport elevation, whichever is higher, within 3 nautical miles of the established reference point of an airport, excluding heliports, with its longest runway more than 3,200 feet in actual length, and that height increases in the proportion of 100 feet for each additional nautical mile of distance from the airport up to a maximum of 500 feet.

(3) A height within a terminal obstacle clearance area, including an initial approach segment, a departure area, and a circling approach area, which would result in the vertical distance between any point on the object and an established minimum instrument flight altitude within that area or segment to be less than the required obstacle clearance.

(4) A height within an en route obstacle clearance area, including turn and termination areas, of a Federal airway or approved off-airway route, that would increase the minimum obstacle clearance altitude.

(5) The surface of a takeoff and landing area of an airport or any imaginary surface established under § 77.25, § 77.28, or § 77.29. However, no

part of the take-off or landing area itself will be considered an obstruction.

(b) Except for traverse ways on or near an airport with an operative ground traffic control service, furnished by an air traffic control tower or by the airport management and coordinated with the air traffic control service, the standards of paragraph (a) of this section apply to traverse ways used or to be used for the passage of mobile objects only after the heights of these traverse ways are increased by:

(1) Seventeen feet for an Interstate Highway that is part of the National System of Military and Interstate Highways where overcrossings are designed for a minimum of 17 feet vertical distance.

(2) Fifteen feet for any other public roadway.

(3) Ten feet or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road.

(4) Twenty-three feet for a railroad, and,

(5) For a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it.

(Amdt. 77–5, Eff. 5/2/68); (Amdt. 77–9, Eff. 5/16/71)

§ 77.25 Civil airport imaginary surfaces.

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

(a) *Horizontal surface.* A horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway of each airport and connecting the adjacent arcs by lines tangent to those arcs. The radius of each arc is:

(1) 5,000 feet for all runways designated as utility or visual;

(2) 10,000 feet for all other runways. The radius of the arc specified for each end of a runway will have the same arithmetical value. That value will be the highest determined for either end of the runway. When a 5,000-foot arc is encompassed by tangents connecting two adjacent 10,000-foot arcs, the 5,000-foot arc shall be disregarded on the construction of the perimeter of the horizontal surface.

(b) *Conical surface.* A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

(c) *Primary surface.* A surface longitudinally centered on a runway. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond each end of that runway; but when the runway has no specially prepared hard surface, or planned hard surface, the primary surface ends at each end of that runway. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. The width of a primary surface is:

(1) 250 feet for utility runways having only visual approaches.

(2) 500 feet for utility runways having nonprecision instrument approaches.

(3) For other than utility runways the width is:

(i) 500 feet for visual runways having only visual approaches.

(ii) 500 feet for nonprecision instrument runways having visibility minimums greater than three-fourths statute mile.

(iii) 1,000 feet for a nonprecision instrument runway having a nonprecision instrument approach with visibility minimums as low as three-fourths of a statute mile, and for precision instrument runways.

The width of the primary surface of a runway will be that width prescribed in this section for the most precise approach existing or planned for either end of that runway.

(d) *Approach surface.* A surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface. An approach surface is applied to each end of each runway based upon the type of approach available or planned for that runway end.

(1) The inner edge of the approach surface is the same width as the primary surface and it expands uniformly to a width of:

(i) 1,250 feet for that end of a utility runway with only visual approaches;

(ii) 1,500 feet for that end of a runway other than a utility runway with only visual approaches;

(iii) 2,000 feet for that end of a utility runway with a nonprecision instrument approach;

(iv) 3,500 feet for that end of a nonprecision instrument runway other than utility, having visibility minimums greater than three-fourths of a statute mile;

(v) 4,000 feet for that end of a nonprecision instrument runway, other than utility, having a nonprecision instrument approach with visibility minimums as low as three-fourths statute mile; and

(vi) 16,000 feet for precision instrument runways.

(2) The approach surface extends for a horizontal distance of:

(i) 5,000 feet at a slope of 20 to 1 for all utility and visual runways;

(ii) 10,000 feet at a slope of 34 to 1 for all nonprecision instrument runways other than utility; and,

(iii) 10,000 feet at a slope of 50 to 1 with an additional 40,000 feet at a slope of 40 to 1 for all precision instrument runways.

(3) The outer width of an approach surface to an end of a runway will be that width prescribed in this subsection for the most precise approach existing or planned for that runway end.

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

(Amdt. 77–7, Eff. 11/30/68); (Amdt. 77–9, Eff. 5/16/71)

§ 77.27 [Reserved]

(Amdt. 77–5, Eff. 5/2/68); (Amdt. 77–7, Eff. 11/30/68); (Amdt. 77–9, Eff. 5/16/71)

§ 77.28 Military airport imaginary surfaces.

(a) *Related to airport reference points.* These surfaces apply to all military airports. For the purposes of this section a military airport is any airport operated by an armed force of the United States.

(1) *Inner horizontal surface.* A plane is oval in shape at a height of 150 feet above the established airfield elevation. The plane is constructed by scribing an arc with a radius of 7,500 feet about the centerline at the end of each runway and interconnecting these arcs with tangents.

(2) *Conical surface.* A surface extending from the periphery of the inner horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation.

(3) *Outer horizontal surface.* A plane, located 500 feet above the established airfield elevation, extending outward from the outer periphery of the conical surface for a horizontal distance of 30,000 feet.

(b) *Related to runways.* These surfaces apply to all military airports.

(1) *Primary surface.* A surface located on the ground or water longitudinally centered on each runway with the same length as the runway. The width of the primary surface for runways is 2,000 feet. However, at established bases where substantial construction has taken place in accordance with a previous lateral clearance criteria, the 2,000-foot width may be reduced to the former criteria.

(2) *Clear zone surface.* A surface located on the ground or water at each end of the primary surface, with a length of 1,000 feet and the same width as the primary surface.

(3) *Approach clearance surface.* An inclined plane, symmetrical about the runway centerline extended, beginning 200 feet beyond each end of the primary surface at the centerline elevation of the runway end and extending for 50,000 feet. The slope of the approach clearance surface is 50 to 1 along the runway centerline extended until it reaches an elevation of 500 feet above the established airport elevation. It then continues horizontally at this elevation to a point 50,000 feet from the point of beginning. The width of this surface at the runway end is the same as the primary surface, it flares uniformly, and the width at 50,000 is 16,000 feet.

(4) *Transitional surfaces.* These surfaces connect the primary surfaces, the first 200 feet of the clear zone surfaces, and the approach clearance surfaces to the inner horizontal surface, conical surface, outer horizontal surface or other transitional surfaces. The slope of the transitional surface is 7 to 1 outward and upward at right angles to the runway centerline.

(Amdt. 77–1, Eff. 5/11/65); (Amdt. 77–9, Eff. 5/16/71)

§ 77.29 Airport imaginary surfaces for heliports.

(a) *Heliport primary surface.* The area of the primary surface coincides in size and shape with the designated take-off and landing area of a heliport. This surface is a horizontal plane at the elevation of the established heliport elevation.

(b) *Heliport approach surface.* The approach surface begins at each end of the heliport primary surface with the same width as the primary surface, and extends outward and upward for a horizontal distance of 4,000 feet where its width is 500 feet. The slope of the approach surface is 8 to 1 for civil heliports and 10 to 1 for military heliports.

(c) *Heliport transitional surfaces.* These surfaces extend outward and upward from the lateral boundaries of the heliport primary surface and from the approach surfaces at a slope of 2 to 1 for a distance of 250 feet measured horizontally from the centerline of the primary and approach surfaces.

(Amdt. 77–9, Eff. 5/16/71)

Subpart D—Aeronautical Studies of Effect of Proposed Construction on Navigable Airspace

§ 77.31 Scope.

(a) This subpart applies to the conduct of aeronautical studies of the effect of proposed construction or alteration on the use of air navigation facilities or navigable airspace by aircraft. In the aeronautical studies, present and future IFR and VFR aeronautical operations and procedures are reviewed and any possible changes in those operations and procedures and in the construction proposal that would eliminate or alleviate the conflicting demands are ascertained.

(b) The conclusion of a study made under this subpart is normally a determination as to whether the specific proposal studied would be a hazard to air navigation.

(Amdt. 77–6, Eff. 8/31/68)

§ 77.33 Initiation of studies.

(a) An aeronautical study is conducted by the FAA:

(1) Upon the request of the sponsor or any construction or alteration for which a notice is submitted under subpart B of this part, unless that construction or alteration would be located within an antenna farm area established under subpart F of this part; or

(2) Whenever the FAA determines it appropriate.

(Amdt. 77–4, Eff. 11/12/67)

§ 77.35 Aeronautical studies.

(a) The Regional Manager, Air Traffic Division of the region in which the proposed construction or alteration would be located, or his designee, conducts the aeronautical study of the effect of the proposal upon the operation of air navigation facilities and the safe and efficient utilization of the navigable airspace. This study may include the physical and electromagnetic radiation effect the proposal may have on the operation of an air navigation facility.

(b) To the extent considered necessary, the Regional Manager, Air Traffic Division or his designee:

(1) Solicits comments from all interested persons;

(2) Explores objections to the proposal and attempts to develop recommendations for adjustment of aviation requirements that would accommodate the proposed construction or alteration;

(3) Examines possible revisions of the proposal that would eliminate the exceeding of the standards in subpart C of this part; and

(4) Convenes a meeting with all interested persons for the purpose of gathering all facts relevant to the effect of the proposed construction or alteration on the safe and efficient utilization of the navigable airspace.

(c) The Regional Manager, Air Traffic Division or his designee issues a determination as to whether the proposed construction or alteration would be a hazard to air navigation and sends copies to all known interested persons. This determination is final unless a petition for review is granted under § 77.37.

(d) If the sponsor revises his proposal to eliminate exceeding of the standards of subpart C of this part, or withdraws it, the Regional Manager, Air Traffic Division, or his designee, terminates the study and notifies all known interested persons.

(Amdt. 77–6, Eff. 8/31/68); (Amdt. 77–11, Eff. 10/25/89)

§ 77.37 Discretionary review.

(a) The sponsor of any proposed construction or alteration or any person who stated a substantial aeronautical objection to it in an aeronautical study, or any person who has a substantial aeronautical objection to it but was not given an opportunity to state it, may petition the Administrator, within 30 days after issuance of the determination under § 77.19 or § 77.35 or revision or extension of the determination under § 77.39(c), for a review of the determination, revision, or extension. This paragraph does not apply to any acknowledgment issued under § 77.19(c)(1).

(b) The petition must be in triplicate and contain a full statement of the basis upon which it is made.

(c) The Administrator examines each petition and decides whether a review will be made and, if so, whether it will be:

(1) A review on the basis of written materials, including study of a report by the Regional Manager, Air Traffic Division of the aeronautical study, briefs, and related submissions by any interested party, and other relevant facts, with the Administrator affirming, revising, or reversing the determination issued under § 77.19, § 77.35 or § 77.39(c); or

(2) A review on the basis of a public hearing, conducted in accordance with the procedures prescribed in subpart E of this part.

(Amdt. 77–3, Eff. 6/5/67); (Amdt. 77–11, Eff. 10/25/89)

§ 77.39 Effective period of determination of no hazard.

(a) Unless it is otherwise extended, revised, or terminated, each final determination of no hazard made under this subpart or subpart B or E of this part expires 18 months after its effective date, regardless of whether the proposed construction or alteration has been started, or on the date the proposed construction or alteration is abandoned, whichever is earlier.

(b) In any case, including a determination to which paragraph (d) of this section applies, where the proposed construction or alteration has not been started during the applicable period by actual structural work, such as the laying of a foundation, but not including excavation, any interested person may, at least 15 days before the date the final determination expires, petition the FAA official who issued the determination to:

(1) Revise the determination based on new facts that change the basis on which it was made; or

(2) Extend its effective period.

(c) The FAA official who issued the determination reviews each petition presented under paragraph (b) of this section, and revises, extends, or affirms the determination as indicated by his findings.

(d) In any case in which a final determination made under this subpart or subpart B or E of this part relates to proposed construction or alteration that may not be started unless the Federal Communications Commission issues an appropriate construction permit, the effective period of each final determination includes—

(1) The time required to apply to the Commission for a construction permit, but not more than 6 months after the effective date of the determination; and

(2) The time necessary for the Commission to process the application except in a case where the Administrator determines a shorter effective period is required by the circumstances.

(e) If the Commission issues a construction permit, the final determination is effective until the date prescribed for completion of the construction. If the Commission refuses to issue a construction permit, the final determination expires on the date of its refusal.

(Amdt. 77–5, Eff. 5/2/68)

Subpart E—Rules of Practice for Hearings Under Subpart D

§ 77.41 Scope.

This subpart applies to hearings held by the FAA under titles I, III, and X of the Federal Aviation Act of 1958 (49 U.S.C. subchapters I, III, and X), on proposed construction or alteration that affects the use of navigable airspace.

§ 77.43 Nature of hearing.

Sections 4, 5, 7, and 8 of the Administrative Procedure Act (5 U.S.C. 1003, 1004, 1006, and 1007) do not apply to hearings held on proposed construction or alteration to determine its effect on the safety of aircraft and the efficient use of navigable airspace because those hearings are factfinding in nature. As a factfinding procedure, each hearing is nonadversary and there are no formal pleadings or adverse parties.

§ 77.45 Presiding officer.

(a) If, under § 79.37, the Administrator grants a public hearing on any proposed construction or alteration covered by this part, the Director, Air Traffic Operations Service designates an FAA employee to be the presiding officer at the hearing.

(b) The presiding officer may:

(1) Give notice of the date and location of the hearing and any prehearing conference that may be held;

(2) Administer oaths and affirmations;

(3) Examine witnesses;

(4) Issue subpoenas and take depositions or have them taken;

(5) Obtain, in the form of a public record, all pertinent and relevant facts relating to the subject matter of the hearing;

(6) Rule, with the assistance of the legal officer, upon the admissibility of evidence;

(7) Regulate the course and conduct of the hearing; and

(8) Designate parties to the hearing and revoke those designations.

(Amdt. 77–11, Eff. 10/25/89)

§ 77.47 Legal officer.

The Chief Counsel designates a member of his staff to serve as legal officer at each hearing under this subpart. The legal officer may examine witnesses and assist and advise the presiding officer on questions of evidence or other legal questions arising during the hearing.

§ 77.49 Notice of hearing.

In designating a time and place for a hearing under this subpart the presiding officer considers the needs of the FAA and the convenience of the parties and witnesses. The time and place of each hearing is published in the "Notices" section of the FEDERAL REGISTER before the date of the hearing, unless the notice is impractical or unnecessary.

§ 77.51 Parties to the hearing.

The presiding officer designates the following as parties to the hearing—

(a) The proponent of the proposed construction or alteration.

(b) Those persons whose activities would be substantially affected by the proposed construction or alteration.

§ 77.53 Prehearing conference.

(a) The presiding officer may, in his discretion, hold a prehearing conference with the parties to the hearing and the legal officer before the hearing.

(b) At the direction of the presiding officer, each party to a prehearing conference shall submit a brief written statement of the evidence he intends to provide through his witnesses and by questioning other witnesses at the hearing, and shall provide enough copies of the statement so that the presiding officer may keep three for the FAA and give one to each other party.

(c) At the prehearing conference, the presiding officer reduces and simplifies the subject matter of the hearing so far as possible and advises the parties of the probable order of presenting the evidence.

§ 77.55 Examination of witnesses.

(a) Each witness at a hearing under this subpart shall, after being sworn by the presiding officer, give his testimony under oath.

(b) The party for whom a witness, other than an employee of the FAA, is testifying shall examine that witness. After that examination, other parties to the hearing may examine the witness, in the order fixed by the presiding officer. The presiding officer and the legal officer may then examine the witness. The presiding officer may grant any party an additional opportunity to examine any witness, if that party adequately justifies the additional examination.

(c) The legal officer examines each FAA employee who is a witness, before the other parties examine him. After that examination, the order prescribed in paragraph (b) of this section applies. An FAA employee may testify only as to facts within his personal knowledge and the application of FAA regulations, standards, and policies.

§ 77.57 Evidence.

(a) The presiding officer receives all testimony and exhibits that are relevant to the issues of the hearing. So far as possible, each party shall submit enough copies of his exhibits that the presiding officer may keep three copies for the FAA and give one to each other party.

(b) The presiding officer excludes any testimony that is irrelevant, unduly repetitious, or consists of statements made during an aeronautical study in an effort to reconcile or compromise aviation or construction or alteration requirements. A party to the hearing may object to the admission of evidence only on the ground that it is irrelevant.

§ 77.59 Subpoenas of witnesses and exhibits.

(a) The presiding officer of a hearing may issue subpoenas for any witness or exhibit that he determines may be material and relevant to the issues of the hearing. So far as possible, each party to the hearing shall provide the witnesses and exhibits that he intends to present at the hearing.

(b) If any party to the hearing is unable to provide his necessary witnesses and exhibits, he shall advise the presiding officer far enough in advance that the presiding officer can determine whether he should issue subpoenas for the desired witnesses or exhibits.

§ 77.61 Revision of construction or alteration proposal.

(a) The sponsor of any proposed construction or alteration covered by this part may revise his proposal at any time before or during the hearing. If he revises it, the presiding officer decides whether the revision affects the proposal to the extent that he should send it to the Administrator for a redetermination of the need for a hearing.

(b) If the presiding officer decides that it does not need to be resubmitted to the Administrator, he advises the parties of the revised proposal and takes the action necessary to allow all parties to effectively participate in the hearing on the revised proposal. Without limiting his discretion, the presiding officer may recess and reconvene the hearing, or hold another prehearing conference.

§ 77.63 Record of hearing.

(a) Each hearing is recorded verbatim by an official reporter under an FAA contract. The transcript, and all exhibits, become a part of the record of the hearing.

(b) Any person may buy a copy of the transcript of the hearing from the reporter at the price fixed for it.

(c) The presiding officer may allow any party to withdraw an original document if he submits authenticated copies of it.

(d) Any person may buy, from the FAA, photostatic copies of any exhibit by paying the copying costs.

(e) A change in the official transcript of a hearing may be made only if it involves an error of substance. Any recommendation to correct the transcript must be filed with the presiding officer within 5 days after the hearing closes. The presiding officer reviews each request for a correction to the extent he considers appropriate and shall make any revisions that he finds appropriate as a result of that review.

§ 77.65 Recommendations by parties.

Within 20 days after the mailing of the record of hearing by the official reporter, or as otherwise directed by the presiding officer, each party may submit to the presiding officer five copies of his recommendations for a final decision to be made by the Administrator.

§ 77.67 Final decision of the Administrator.

After reviewing the evidence relevant to the questions of fact in a hearing, including the official transcript and the exhibits, The Administrator resolves all these questions, based on the weight of evidence, and makes his determination, stating the basis and reasons for it. He then issues an appropriate order to be served on each of the parties.

§ 77.69 Limitations on appearance and representation.

(a) A former officer or employee of the FAA may not appear on behalf of, or represent, any party before the FAA in connection with any matter to which this part applies, if he considered or passed on that matter while he was an officer or employee of the FAA.

(b) A person appearing before the FAA on any matter to which this part applies may not, in connection with that appearance, knowingly accept assistance from, or share fees with, any person who is prohibited by paragraph (a) of this section, from appearing himself on that matter.

(c) A former official or employee of the FAA may not, within 6 months after he ceases to be such an officer or employee, appear before the FAA on behalf of, or represent, any party in connection with any proceeding that was pending under this part while he was an officer or employee of the FAA, unless he obtains written consent from an appropriate officer of the FAA, based on a verified showing that he did not personally consider the matter concerned or gain particular knowledge of it while he was an officer or employee of the FAA.

Subpart F—Establishment of Antenna Farm Areas

§ 77.71 Scope.

(a) This subpart establishes antenna farm areas in which antenna structures may be grouped to localize their effect on the use of navigable airspace.

(b) It is the policy of the FAA to encourage the use of antenna farms and the single structure-multiple antenna concept for radio and television towers whenever possible. In considering proposals for establishing antenna farm areas, it considers as far as possible the revision of aeronautical procedures and operations to accommodate antenna structures that will fulfill broadcasting requirements.

§ 77.73 General provisions.

(a) An antenna farm area consists of a specified geographical location with established dimensions of area and height, where antenna towers with a common impact on aviation may be grouped. Each such area is established by appropriate rule making action.

(b) Each proposal for an antenna farm area is evaluated on the basis of its effect on the use of navigable airspace. The views of the Federal Communications Commission are requested on the effect that each establishment of an antenna farm area would have on its statutory responsibilities. Any views submitted by it are fully considered before the antenna farm concerned is established. If the Commission advises that the establishment of any proposed antenna farm area would interfere with its statutory responsibility, the proposed area is not established.

(c) The establishment of an antenna farm area is considered whenever it is proposed by:

(1) The FAA;

(2) The Federal Communications Commission;

(3) The sponsor of a proposed antenna tower; or

(4) Any other person having a substantial interest in a proposed antenna tower.

(Amdt. 77–10, Eff. 3/4/72)

§ 77.75 Establishment of antenna farm areas.

The airspace areas described in the following sections of this subpart are established as antenna farm areas.

Note: Sections 77.77 through 77.1100 reserved for descriptions of antenna farm areas.

*U.S. Government Printing Office: 1993 — 343-120/85837

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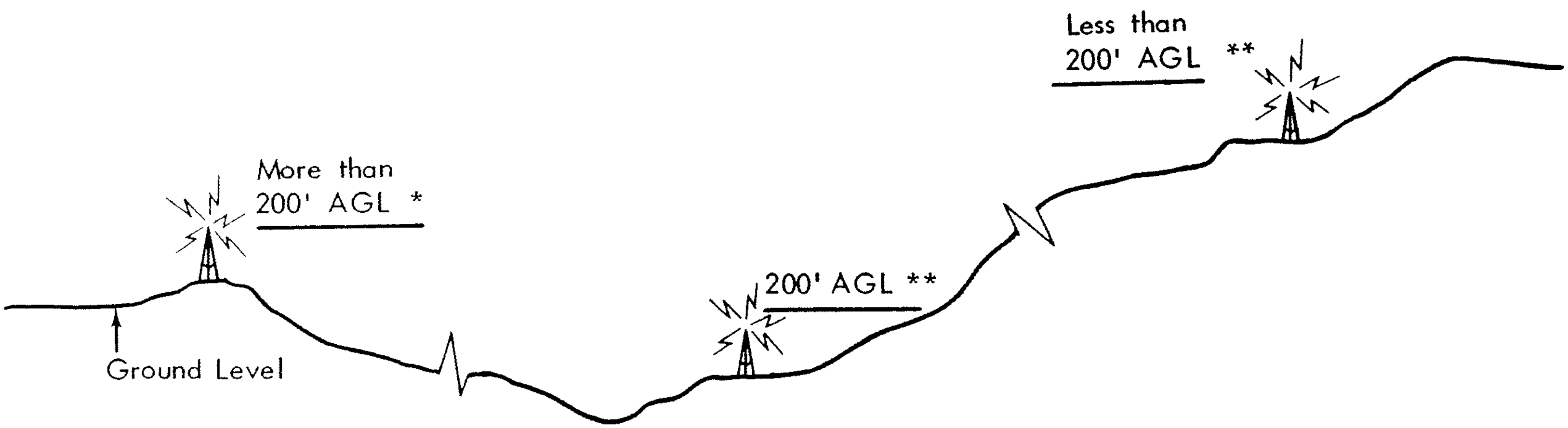
§77.13(a)(1) - Notice Requirement Anywhere

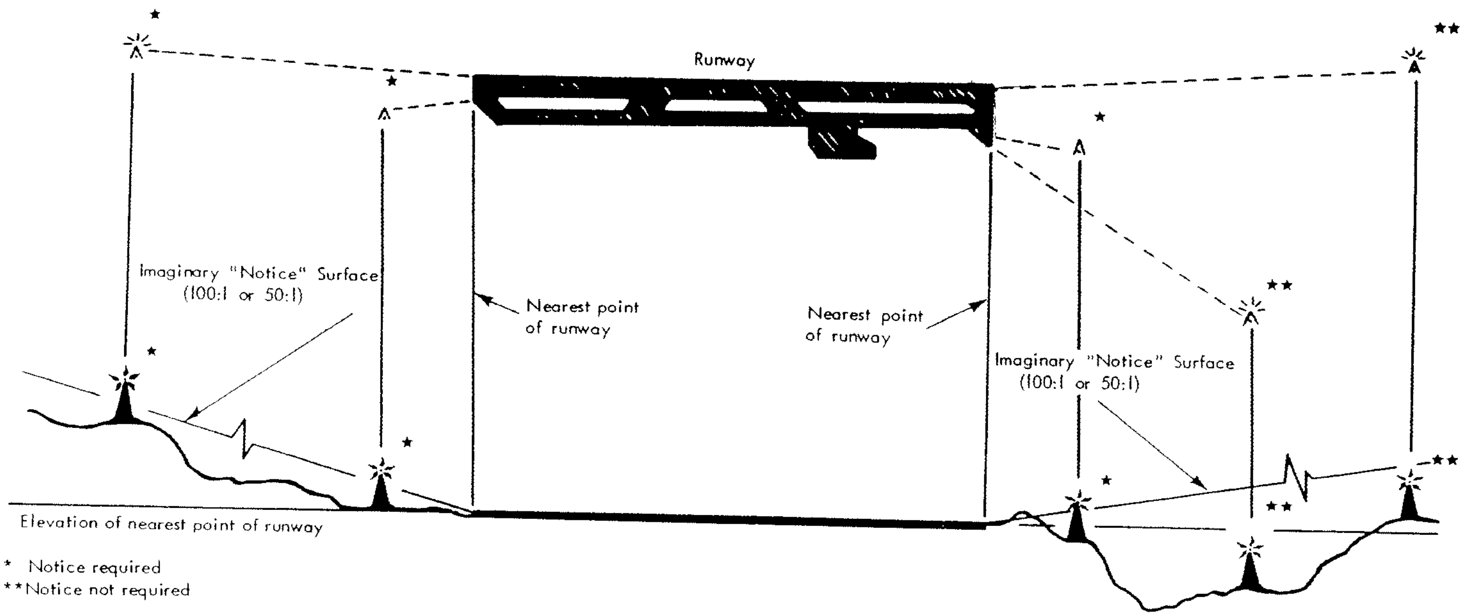


* Notice Required
** Notice Not Required

SUBPART B - NOTICE OF CONSTRUCTION OR ALTERATION

§77.13(a)(1) - A notice is required for any proposed construction or alteration that would be more than 200 feet in height above the ground level at its site.

§ 77.13(a)(2) - NOTICE REQUIREMENT RELATED TO AIRPORTS



* Notice required
**Notice not required

Note: Each airport must be available for public use and listed in the Airport Directory of the current Airman's Information Manual, or in either the Alaska or Pacific Airman's Guide and Chart Supplement; under construction and the subject of a notice or proposal on file with FAA, and except for Military airports, it is clearly indicated that that airport will be available for public use, or operated by an armed force of the United States. (Heliports and seaplane bases without specified boundaries are excluded.)

SUBPART B - NOTICE OF CONSTRUCTION OR ALTERATION

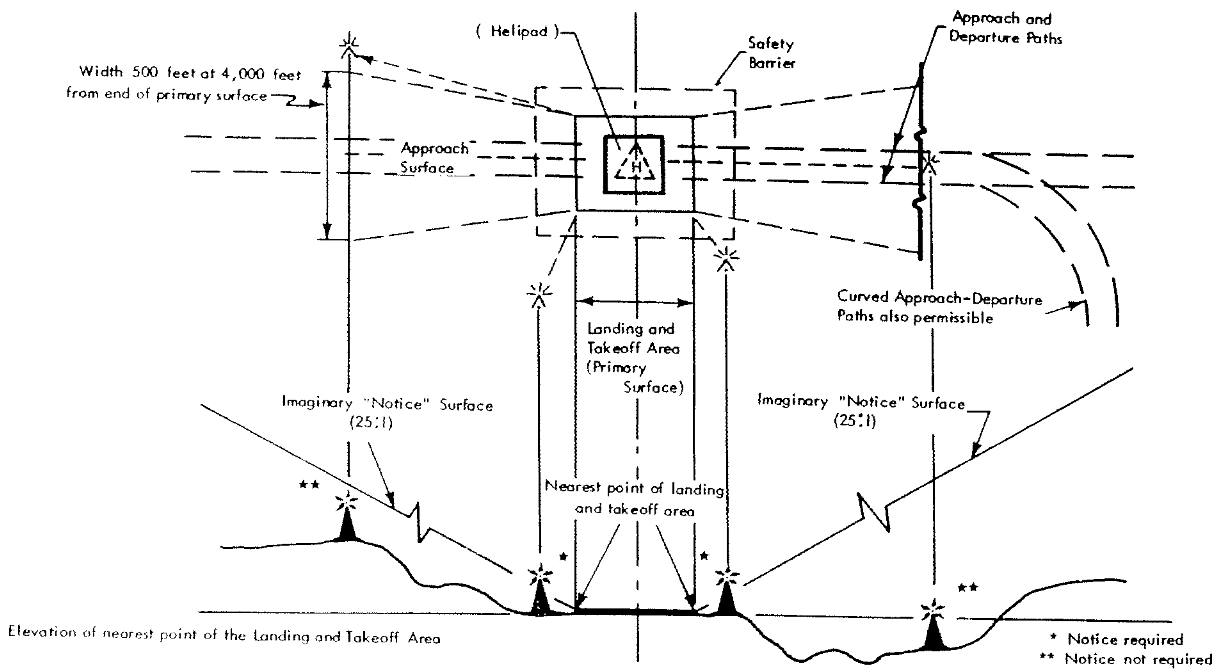
§77.13(a)(2) - A notice is required for any proposed construction or alteration that would be of greater height than an imaginary surface extending outward and upward at one of the following slopes -

(i) 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport with at least one runway more than 3,200 feet in actual length.

(ii) 50 to 1 for a horizontal distance of 10,000 feet from the nearest point of the nearest runway of each each airport with its longest runway no more than 3,200 feet in actual length.

(Note: §77.13(a)(5) requires notice of any proposed construction or alteration on each airport, including heliports)

§ 77.13(a)(2) - NOTICE REQUIREMENT RELATED TO HELIPORTS

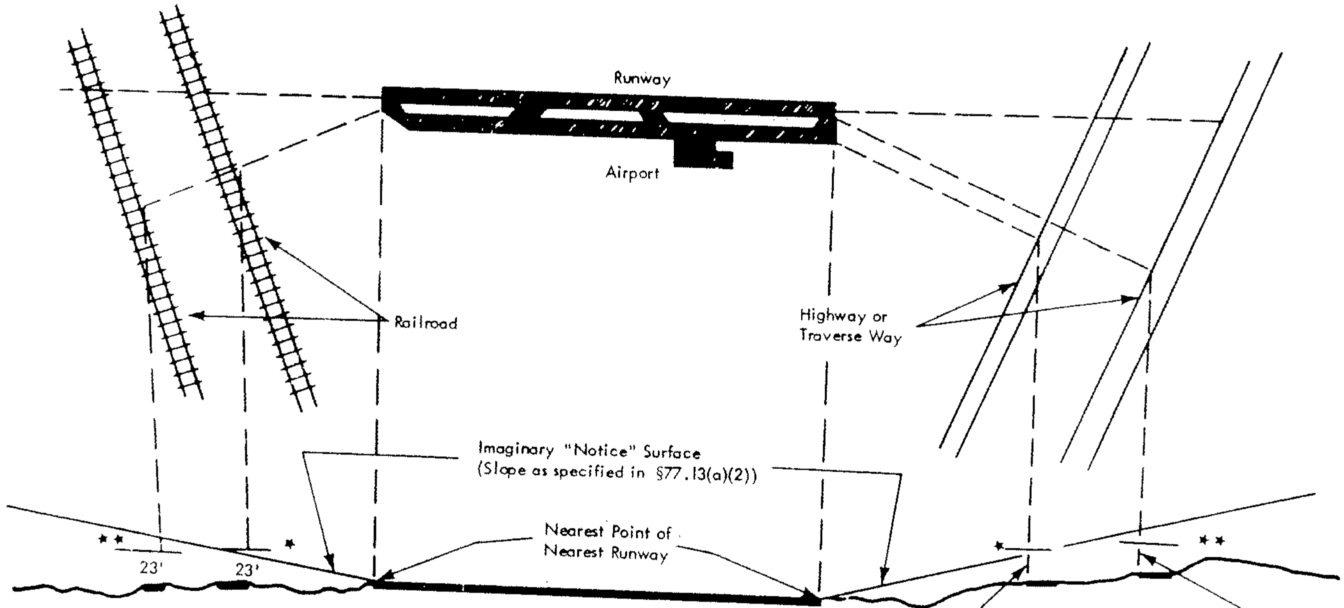


SUBPART B - NOTICE OF CONSTRUCTION OR ALTERATION

§77.13 (a)(2)-A notice is required for any proposed construction or alteration that would be of greater height than an imaginary surface extending outward and upward at the following slope:

(iii) 25 to 1 for a horizontal distance of 5,000 feet from the nearest landing and takeoff area of each heliport, available for public use and listed in the Airport Directory of the current Airman's Information Manual or in either the Alaska or Pacific Airman's Guide and Chart Supplement; is under construction and is the subject of a notice or proposal on file with the FAA and except for military heliports, it is clearly indicated that that heliport will be available for public use, or operated by a Federal Military agency.

§ 77.13(a)(3) - NOTICE REQUIREMENT RELATED TO TRAVERSE WAYS



SUBPART B - NOTICE OF CONSTRUCTION OR ALTERATION

§77.13(a)(3) - Notice is required for any proposed construction or alteration of any highway, railroad, or other traverse way for mobile objects if of greater height than the standards of §77.13(a)(1) or (2) after their height has been adjusted upward by one of the following:

17 feet for an Interstate highway that is part of the National System of Military and Interstate Highways,

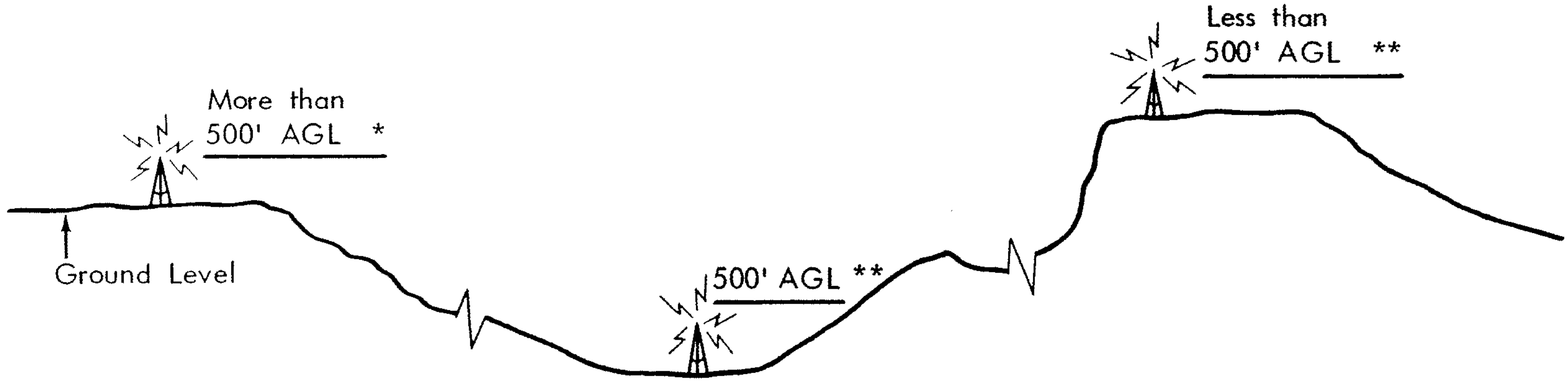
15 feet for any other public roadway

10 feet or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road,

23 feet for a railroad

For a waterway or any other traverse way, an amount equal to the height of the highest mobile object that would normally use it.

§77.23(a)(l) - Anywhere



* Obstruction to Air Navigation
** Not an Obstruction to Air Navigation

SUBPART C - OBSTRUCTION STANDARDS

§77.23(a)(l) - An object would be an obstruction to air navigation if of greater height than 500 feet above ground level at its site.

§ 77. 23(a)(2) - NEAR AIRPORTS

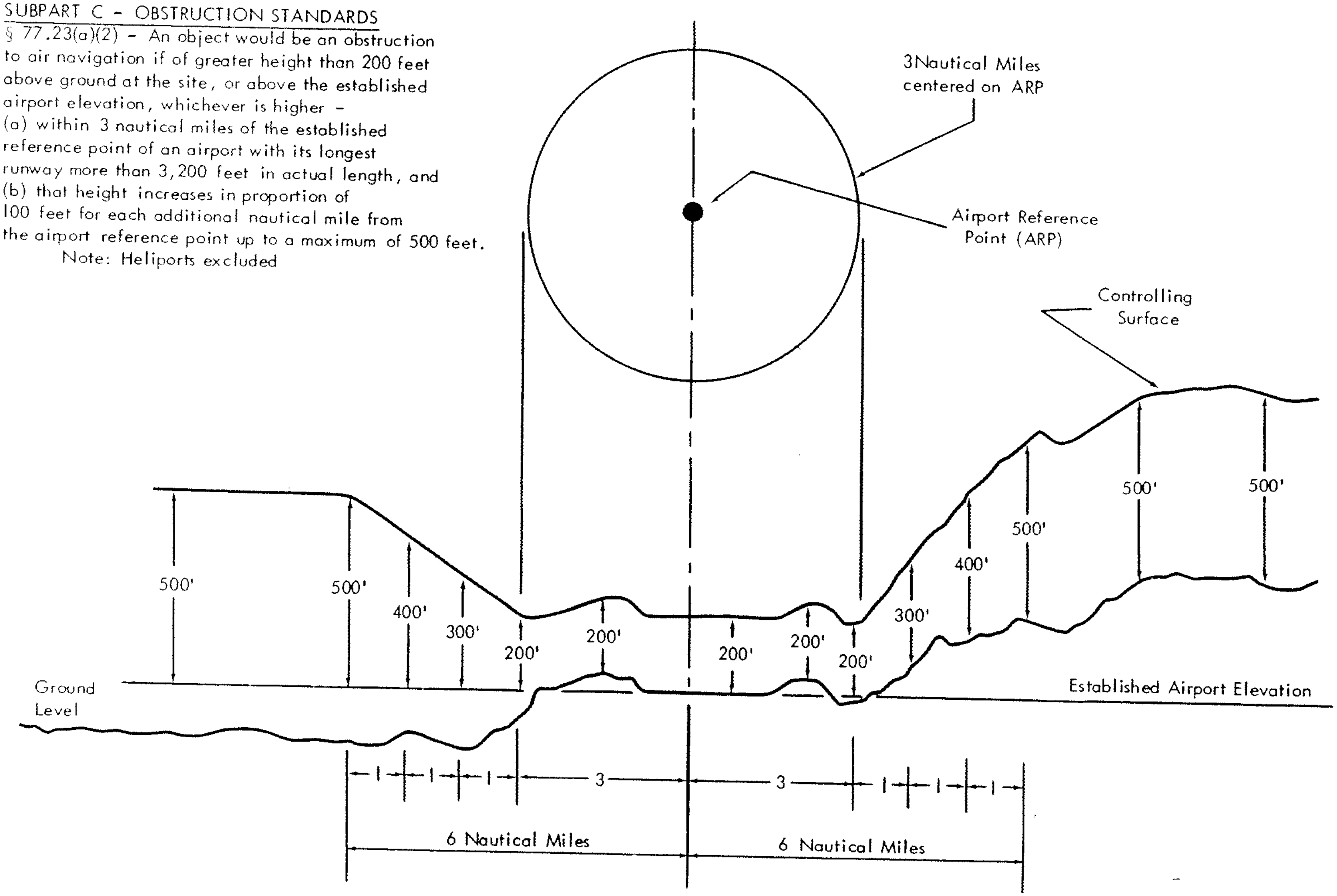
SUBPART C - OBSTRUCTION STANDARDS

§ 77.23(a)(2) - An object would be an obstruction to air navigation if of greater height than 200 feet above ground at the site, or above the established airport elevation, whichever is higher -

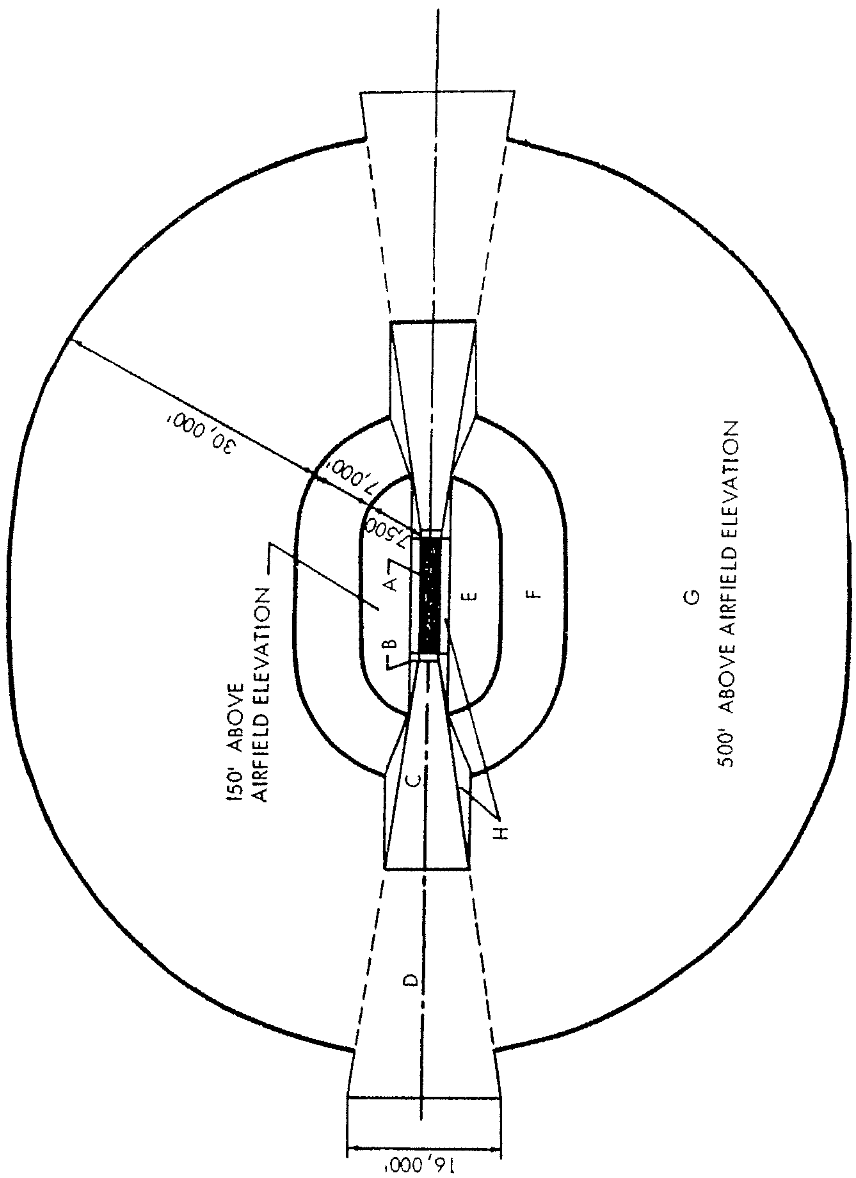
(a) within 3 nautical miles of the established reference point of an airport with its longest runway more than 3,200 feet in actual length, and

(b) that height increases in proportion of 100 feet for each additional nautical mile from the airport reference point up to a maximum of 500 feet.

Note: Heliports excluded

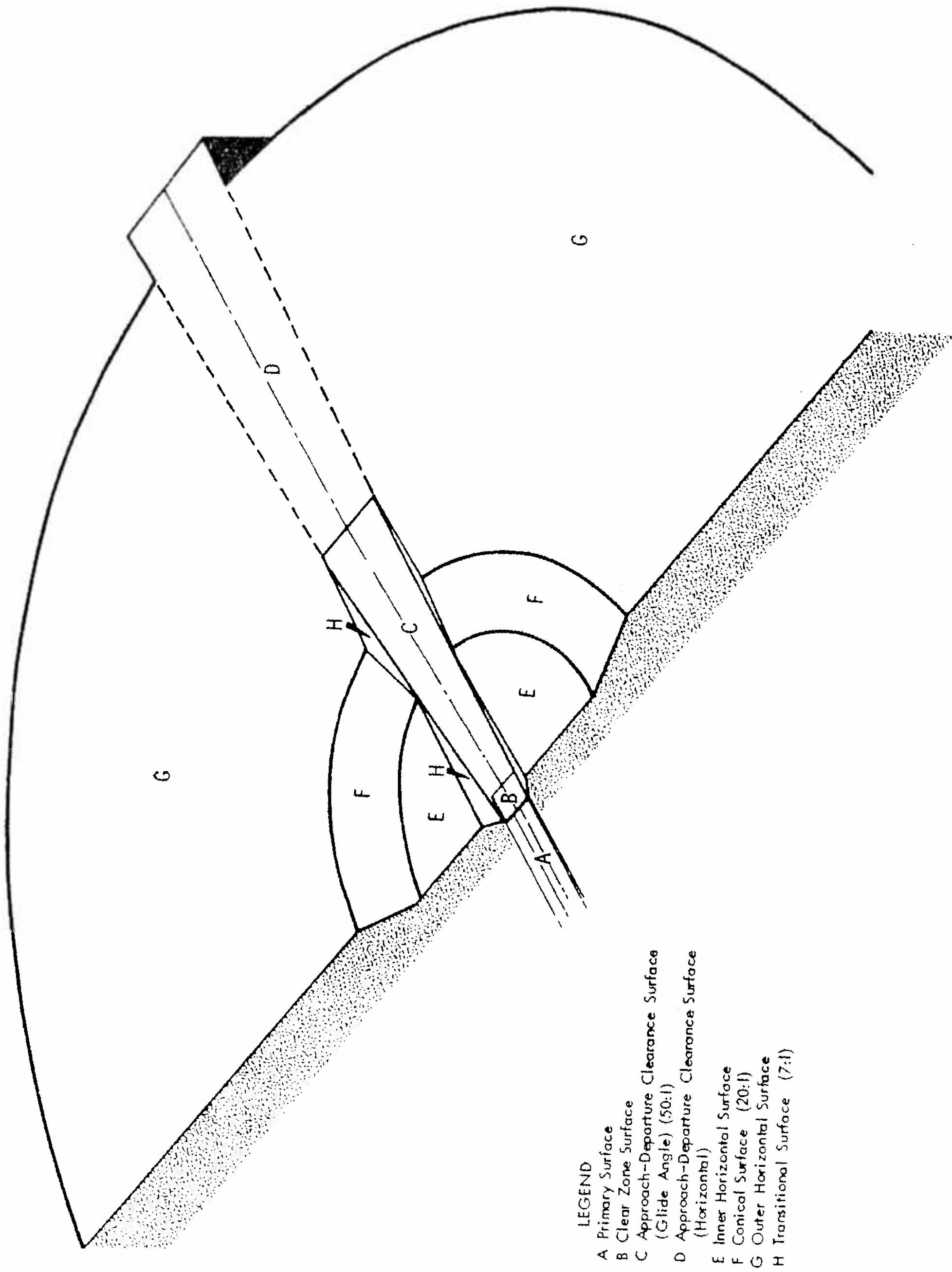


§ 77.28 - MILITARY AIRPORT IMAGINARY SURFACES



LEGEND

- A Primary Surface
- B Clear Zone Surface
- C Approach-Departure Clearance Surface (Glide Angle)
- D Approach-Departure Clearance Surface (Horizontal)
- E Inner Horizontal Surface
- F Conical Surface
- G Outer Horizontal Surface
- H Transitional Surface



§77.28 - MILITARY AIRPORT IMAGINARY SURFACES

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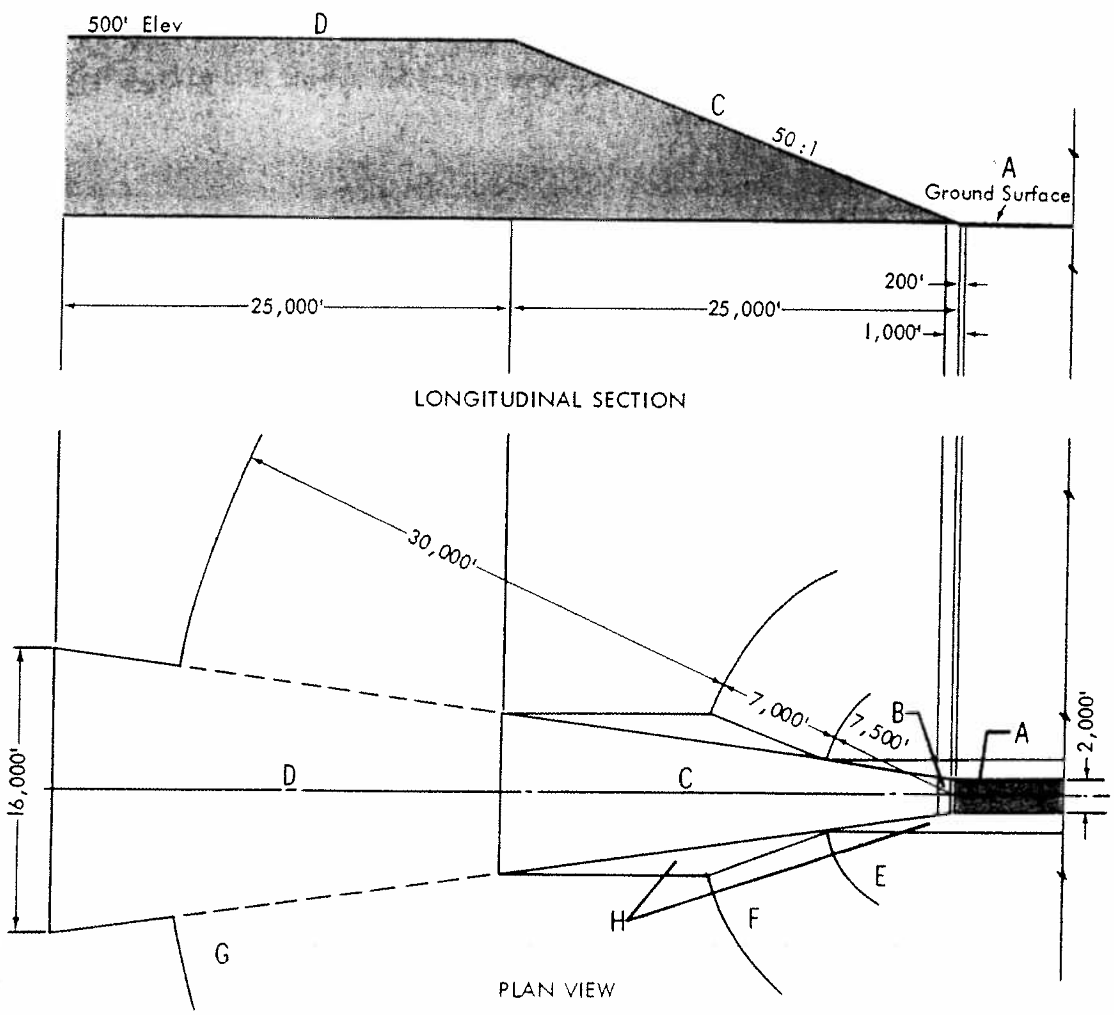
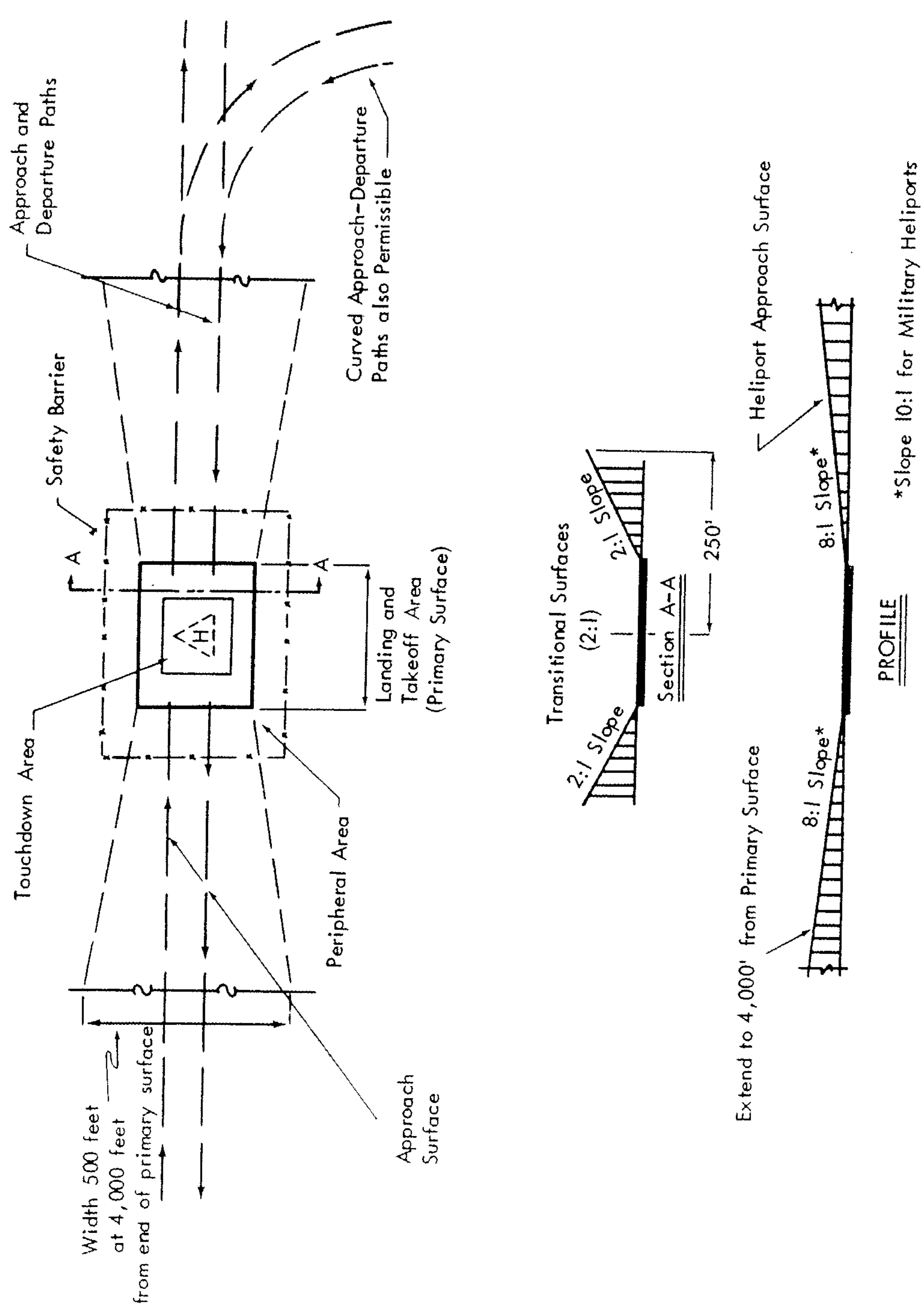


LEGEND

A Primary Surface
B Clear Zone Surface
C Approach-Departure Clearance Surface (Glide Angle)
D Approach-Departure Clearance Surface (Horizontal)
E Inner Horizontal Surface
F Conical Surface
G Outer Horizontal Surface
H Transitional Surface

§ 77.29 - AIRPORT IMAGINARY SURFACES FOR HELIPORTS



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APPENDIX "B"

Appendix 2. RUNWAY END SITING REQUIREMENTS

1. PURPOSE. This appendix contains guidance on siting thresholds to meet approach obstacle clearance requirements and departure obstacle clearance requirements.

2. APPLICATION.

a. The threshold should be located at the beginning of the full-strength runway pavement or runway surface. However, displacement of the threshold may be required when an object that obstructs the airspace required for landing and/or departing airplanes is beyond the airport owner's power to remove, relocate, or lower. Thresholds may also be displaced for environmental considerations, such as noise abatement, or to provide the standard RSA and ROFA lengths.

b. When a hazard to air navigation exists, the amount of displacement of the threshold or reduction of the TODA should be based on the operational requirements of the most demanding airplanes. The standards in this appendix minimize the loss of operational use of the established runway and reflect the FAA policy of maximum utilization and retention of existing paved areas on airports.

c. Displacement of a threshold reduces the length of runway available for landings. Depending on the reason for displacement of the threshold, the portion of the runway behind a displaced threshold may be available for takeoffs in either direction and landings from the opposite direction. Refer to Appendix 14, Declared Distances, for additional information.

d. Where specifically noted, the Glidepath Angle (GPA) and Threshold Crossing Height (TCH) of a vertically guided approach may be altered (usually increased) rather than displacing the threshold. Examples of approaches with positive vertical guidance include Instrument Landing System (ILS), Microwave Landing System (MLS), Localizer Performance with Vertical Guidance (LPV), Lateral Navigation/Vertical Navigation (LNAV/VNAV), and required navigation performance (RNP). Alternatively, a combination of threshold displacement and altering of the Glidepath Angle/Threshold Crossing Height (GPA/TCH) may also be accomplished. Guidelines for maximum and minimum values of TCH and GPA are contained in FAA Order 8260.3, *United States Standard for Terminal Instrument Procedures (TERPS)*. The tradeoff between threshold displacement, TCH, and GPA is complex, but can be analyzed by applying formula contained in the order. Contact the appropriate FAA Airports Regional or District Office for assistance on the specific requirements and effects of GPA and TCH changes.

3. LIMITATIONS.

a. These standards should not be interpreted as an FAA blanket endorsement of the alternative to displace or relocate a runway threshold. Threshold displacement or relocation should be undertaken only after a full evaluation reveals that displacement or relocation is the only practical alternative.

b. The standards in this appendix are not applicable for identifying objects affecting navigable airspace. See Title 14 Code of Federal Regulations Part 77, Objects Affecting Navigable Airspace.

4. EVALUATION CONSIDERATIONS.

a. Possible Actions. When a penetration to a threshold siting surface defined in paragraph 5 exists, one or more of the following actions are required:

(1) Approach Surfaces.

(a) The object is removed or lowered to preclude penetration of applicable threshold siting surfaces;

(b) The threshold is displaced to preclude object penetration of applicable threshold siting surfaces, with a resulting shorter landing distance; or

(c) The GPA and/or TCH is/are modified, or a combination of threshold displacement and GPA/TCH increase is accomplished.

(d) Visibility minimums are raised.

(e) Night operations are prohibited unless the obstruction is lighted or an approved Visual Glide Slope Indicator (VGSI) is used.

(2) Departure Surfaces for Designated Runways. The applicability of the surface defined in Table A2-1 is dependant on the designation of primary runway(s) for departure. The Airport Sponsor, through the Airports District Office to the Regional Airspace Procedures Team (RAPT), will identify runway end(s) intended primarily for instrument departures. The determination of primary runway(s) for departure does not prohibit or negate the use of other runways. It only identifies the applicability of the surface in Table A2-1 to the runway end(s).

(a) Remove, relocate, or lower (or both relocate and lower) the object to preclude penetration of applicable siting surfaces unless it is fixed by function and/or designated impracticable. Within 6000' of the Table A2-1 surface origin, objects less than or equal to an elevation determined by application of the formula below are allowable.

E + (0.025 x D)

Where:
E = DER elevation
D = Distance from OCS origin to object in feet

(b) Decrease the Takeoff Distance Available (TODA) to preclude object penetration of applicable siting surfaces, with a resulting shorter takeoff distance (the Departure End of the Runway (DER) is coincident with the end of the TODA where a clearway is not in effect); or

(c) Modify instrument departures. Contact the Flight Procedures Office (FPO) for guidance. Objects penetrating by ≤ 35 feet may not require actions (a) or (b); however, they will impact departure minimums/climb gradients or departure procedures.

b. Relevant Factors for Evaluation.

(1) Types of airplanes that will use the runway and their performance characteristics.

(2) Operational disadvantages associated with accepting higher landing/ takeoff minimums.

(3) Cost of removing, relocating, or lowering the object.

(4) Effect of the reduced available landing/takeoff length when the runway is wet or icy.

(5) Cost of extending the runway if insufficient runway length would remain as a result of displacing the threshold. The environmental aspects of a runway extension need to also be evaluated under this consideration.

(6) Cost and feasibility of relocating visual and electronic approach aids, such as threshold lights, visual glide slope indicator, runway end identification lights, localizer, glide slope (to provide a threshold crossing height of not more than 60 feet (18 m)), approach lighting system, and runway markings.

(7) Effect of the threshold change on noise abatement.

5. CLEARANCE REQUIREMENTS. The standard shape, dimensions, and slope of the surface used for locating a threshold are dependent upon the type of aircraft operations currently conducted or forecasted, the landing visibility minimums desired, and the types of instrumentation available or planned for that runway end.

a. Approaches with Positive Vertical Guidance. Table A2-1 and Figure A2-1 describe the clearance surfaces required for instrument approach procedures with vertical guidance.

The Glidepath Qualification Surface (GQS) limits the height of obstructions between Decision Altitude (DA) and runway threshold (RWT). When obstructions exceed the height of the GQS, an approach procedure with positive vertical guidance is not authorized. Further information can be found in the appropriate TERPS criterion.

b. Instrument Approach Procedures Aligned with the Runway Centerline. Table A2-1 and Figure A2-1 describe the minimum clearance surfaces required for instrument approach procedures aligned with the runway centerline.

c. Procedures Not Aligned with the Runway Centerline. To accommodate for offset procedures, increase the lateral width at threshold by multiplying the width specified in the appropriate paragraph by 2 (offset side only). The outside offset boundary splays from this point at an angle equal to the amount of angular divergence between the final approach course and runway centerline + 10 degrees. Extend the outside offset boundary out to the distance specified in the applicable paragraph and connect it to runway centerline with an arc of the same radius. On the side opposite the offset, construct the area aligned with runway centerline as indicated (non-offset side only). The surface slope is as specified in the applicable paragraph, according to Table A2-1. Figure A2-2 is an example of the offset procedure.

d. Locating or Determining the DER. The standard shape, dimensions, and slope of the departure surface used for determining the DER, as defined in TERPS, is only dependent upon whether or not instrument departures are being used or planned for that runway end. See Table A2-1 and Figures A2-1 and A2-2 for dimensions.

Subparagraph 5d(2) applies only to runways supporting Air Carrier departures and is not to be considered a clearance surface.

(1) For Departure Ends at Designated Runways.

(a) No object should penetrate a surface beginning at the elevation of the runway at the DER or end of clearway, and slopes at 40:1. Penetrations by existing obstacles of 35 feet or less would not require TODA reduction or other mitigations found in paragraph 4; however, they may affect new or existing departure procedures.

(2) Departure Runway Ends Supporting Air Carrier Operations.

(a) Objects should be identified that penetrate a one-engine inoperative (OEI) obstacle identification surface (OIS) starting at the DER and at the elevation of the runway at that point, and slopes upward at 62.5:1. See Figure A2-4.

Note: This surface is provided for information only and does not take effect until January 1, 2008.

Table A2-1. Approach/Departure Requirements Table

	Runway Type	DIMENSIONAL STANDARDS* Feet					Slope/ OCS
		A	B	C	D	E	
1	Approach end of runways expected to serve small airplanes with approach speeds less than 50 knots. (Visual runways only, day/night)	0	60	150	500	2,500	15:1
2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more. (Visual runways only, day/night)	0	125	350	2,250	2,750	20:1
3	Approach end of runways expected to serve large airplanes (Visual day/night); or instrument minimums ≥ 1 statute mile (day only).	0	200	500	1,500	8,500	20:1
4	Approach end of runways expected to support instrument night circling. [1]	200	200	1,700	10,000	0	20:1
5	Approach end of runways expected to support instrument straight in night operations, serving approach category A and B aircraft only. [1]	200	200	1,900	10,000 [2]	0	20:1
6	Approach end of runways expected to support instrument straight in night operations serving greater than approach category B aircraft. [1]	200	400	1,900	10,000 [2]	0	20:1
7 [3, 6, 7, 8]	Approach end of runways expected to accommodate approaches with positive vertical guidance (GQS).	0	½ width runway + 100	760	10,000 [2]	0	30:1
8	Approach end of runways expected to accommodate instrument approaches having visibility minimums ≥ 3/4 but < 1 statute mile, day or night.	200	400	1,900	10,000 [2]	0	20:1
9	Approach end of runways expected to accommodate instrument approaches having visibility minimums < 3/4 statute mile or precision approach (ILS, GLS, or MLS), day or night.	200	400	1,900	10,000 [2]	0	34:1
10	Approach runway ends having Category II approach minimums or greater.	The criteria are set forth in TERPS, Order 8260.3.					
11	Departure runway ends for all instrument operations.	0 [4]	See Figure A2-3				40:1
12	Departure runway ends supporting Air Carrier operations. [5]	0 [4]	See Figure A2-4				62.5:1

* The letters are keyed to those shown in Figure A2-1.

Notes:

1. Lighting of obstacle penetrations to this surface or the use of a VGSI, as defined by the TERPS order, may avoid displacing the threshold.
2. 10,000 feet is a nominal value for planning purposes. The actual length of these areas is dependent upon the visual descent point position for 20:1 and 34:1 and Decision Altitude point for the 30:1.
3. Any penetration to this surface will limit the runway end to nonprecision approaches. No vertical approaches will be authorized until the penetration(s) is/are removed except obstacles fixed by function and/or allowable grading.
4. Dimension A is measured relative to Departure End of Runway (DER) or TODA (to include clearway).
5. Data Collected regarding penetrations to this surface are provided for information and use by the air carriers operating from the airport. These requirements do not take effect until January 1, 2008.
6. Surface dimensions/Obstacle Clearance Surface (OCS) slope represent a nominal approach with 3 degree GPA, 50'

TCH, < 500' HAT. For specific cases refer to TERPS. The Obstacle Clearance Surface slope (30:1) represents a nominal approach of 3 degrees (also known as the Glide Path Angle). This assumes a threshold crossing height of 50 feet. Three degrees is commonly used for ILS systems and VGSI aiming angles. This approximates a 30:1 approach angle that is between the 34:1 and the 20:1 notice surfaces of Part 77. Surfaces cleared to 34:1 should accommodate a 30:1 approach without any obstacle clearance problems.

7. For runways with vertically guided approaches the criteria in Row 7 is in addition to the basic criteria established within the table, to ensure the protection of the Glidepath Qualification Surface.
8. For planning purposes, sponsors and consultants determine a tentative Decision Altitude based on a 3° Glidepath angle and a 50-foot Threshold Crossing Height.

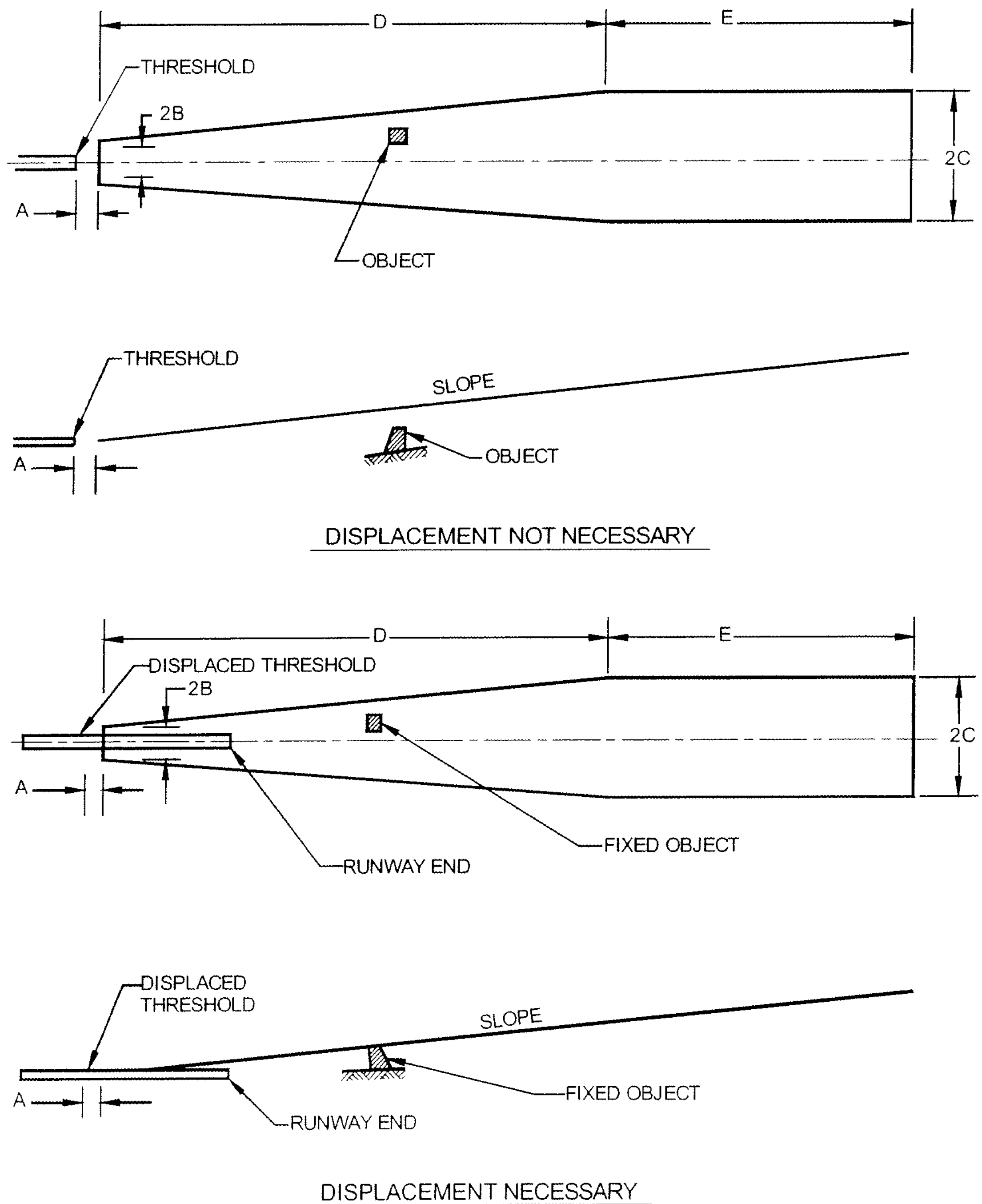


Figure A2-1. Approach slopes

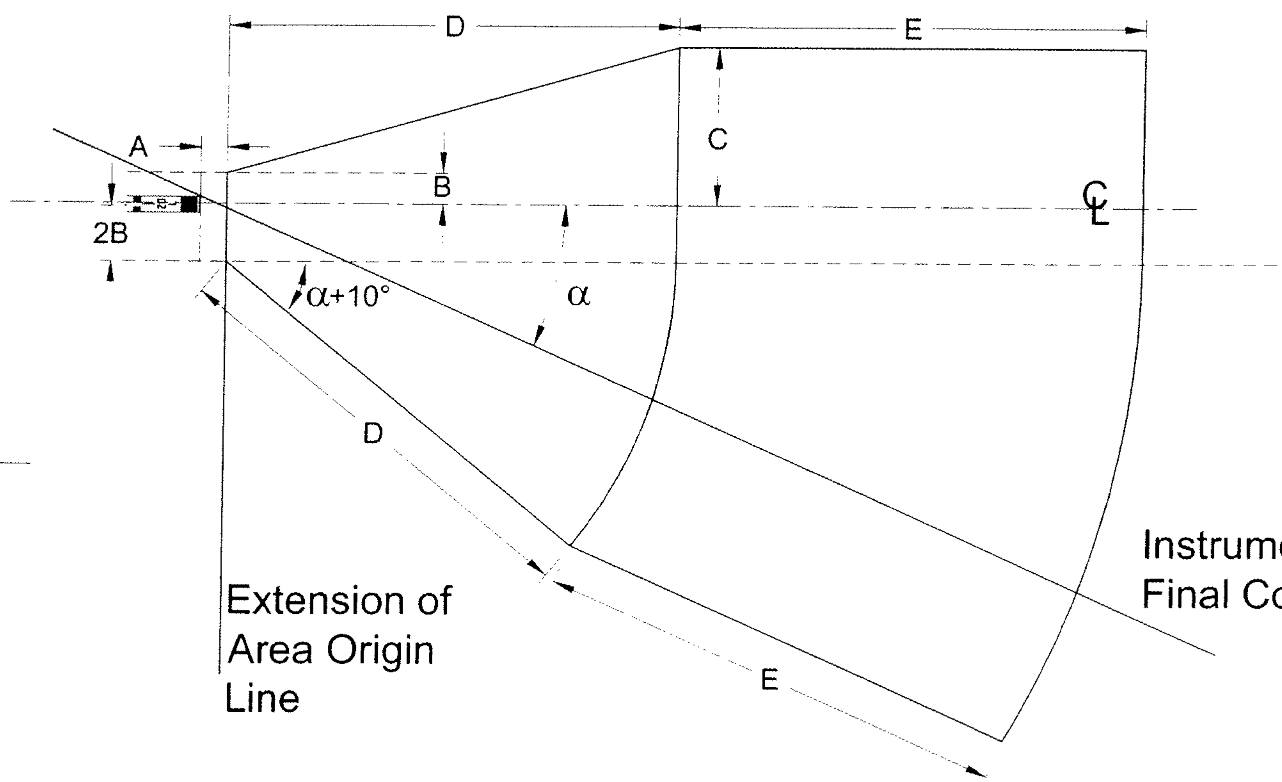


Figure A2-2. Approach Slopes—With Offset Approach Course

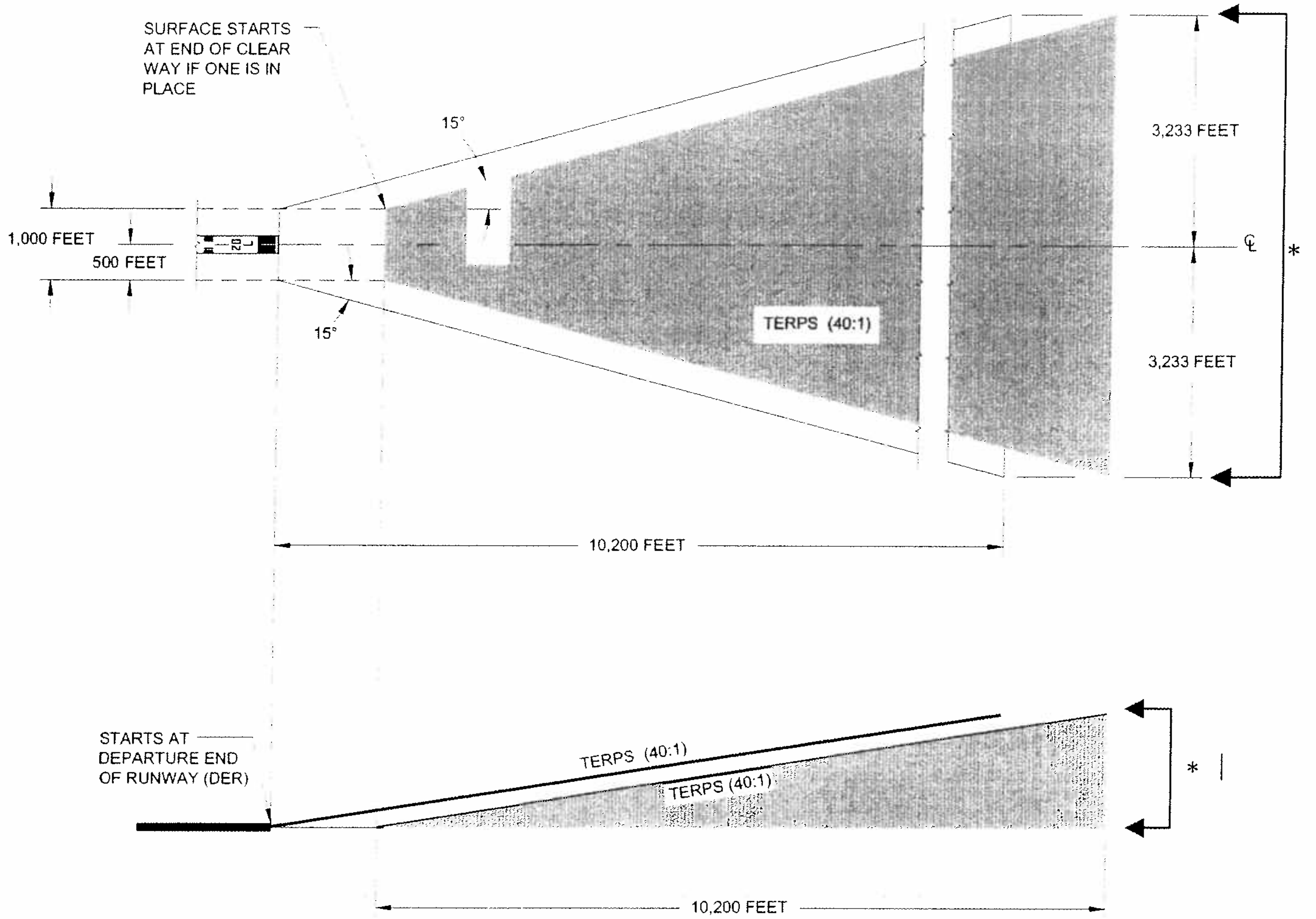


Figure A2-3. Departure surface for Instrument Runways TERPS (40:1)

* This is an interpretation of the application of the TERPS surface associated with a clearway.

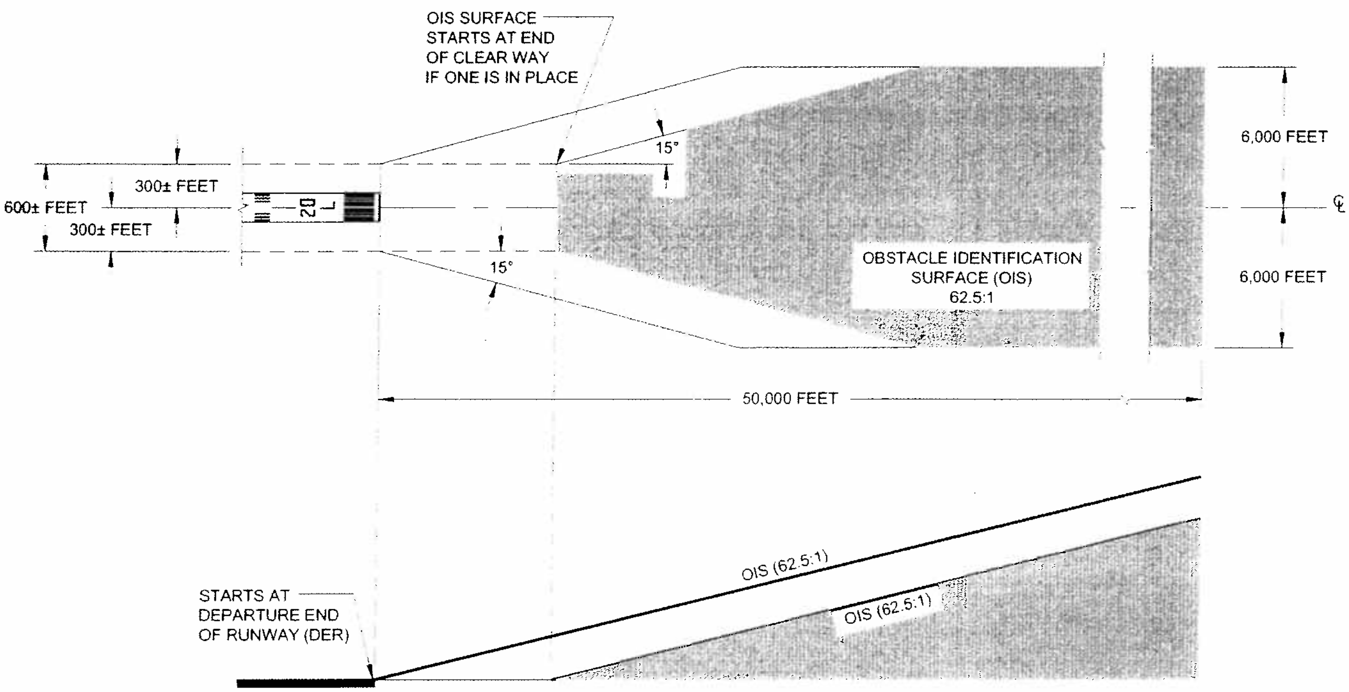


Figure A2-4. One-Engine Inoperative (OEI) Obstacle Identification Surface (62.5:1)

APPENDIX "C"

U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: DESIGN AND INSTALLATION DETAILS FOR AIRPORT VISUAL AIDS

Date: 4/11/05
Initiated by: AAS-100

AC No.: 150/5340-30A
Change:

1. PURPOSE. This advisory circular (AC) provides guidance and recommendations on the installation of airport visual aids.

2. EFFECTIVE DATES. The standards contained herein are effective for all new construction. Upgrades for all future lighting systems should use this standard.

3. CANCELLATION. AC 150/5340-30, *Design and Installation Details for Airport Visual Aids*, dated April 30, 2004, is cancelled.

4. APPLICATION. This AC recommends installation methods and techniques for airport visual aids. The standards contained herein are standards the Federal Aviation Administration (FAA) in all applications involving airport development of this nature. These standards must be met where lighting systems are required for FAA-developed procedures. Installations should conform to the National Electrical Code (NEC) and local codes.

5. PRINCIPAL CHANGES. The following declared distance drawings are incorporated:

a. Normal Runway with a Taxiway.
b. Lighting for Runway with Displaced Threshold.
c. Lighting for Runway with Displaced Threshold/Usable Pavement.
d. Lighting for Runway with Displaced Threshold Not Coinciding with Opposite Runway End.
e. Lighting for Runway with Stopway.
f. Lighting for Runway with Displaced Threshold and Stopway.
g. Runway with End Taxiway.
h. Lighting for Runway with End Taxiway and Shortened ASDA.
i. Lighting for Runway with End Taxiway and Displaced Threshold Not Coinciding with Opposite Runway End.

6. METRICS. To promote an orderly transition to metric units, this AC contains both English and metric dimensions. The metric conversions may not be exact metric equivalents, and, until there is an official changeover to the metric system, the English dimensions will govern.

7. COMMENTS OR SUGGESTIONS for improvements to this AC should be sent to:

Manager, Airport Engineering Division
Federal Aviation Administration
ATTN: AAS-100
800 Independence Avenue, S.W.
Washington D.C. 20591

8. COPIES OF THIS AC. The Office of Airport Safety and Standards is in the process of making ACs available to the public through the Internet. These ACs may be found through the Federal Aviation Administration (FAA)

CHAPTER 7. ECONOMY APPROACH AIDS.

7.1 INTRODUCTION.

a. The economy approach lighting aids were developed to make visual aids available to airports at a low cost. The design and installation requirements are flexible to permit the equipment to be installed and operated with minimal changes to the power distribution system at the airport.

b. The drawings required to plan and install a system are described and referenced throughout this chapter. These are drawings of typical installations. Local applications may require variations from the drawings, but no variations in the layout, spacing, and tolerances are permitted. Although it is possible to plan an installation from the drawings, various characteristics affecting the systems and their design, equipment, and installation deserve special consideration.

7.2 TYPES OF ECONOMY APPROACH LIGHTING AIDS.

a. Medium Intensity Approach Lighting System With or Without Sequenced Flashing Lights (MALSF or MALS). If medium intensity approach lights are to be installed without sequenced flashing lights, apply only the applicable portions of the paragraphs for MALSF.

b. Runway End Identifier Lights (REIL).

c. Precision Approach Path Indicator (PAPI).

7.3 SELECTION CONSIDERATIONS.

Select a particular system on the basis of an operational requirement for light signals in addition to runway edge lights. Consider the following when selecting an economy approach lighting aid:

a. The airport's current operations and forecasts for three years indicate that the airport will not meet the criteria under the FAA's planning standards for the installation of an instrument landing system/approach lighting system (ILS/ALS), REIL or PAPI system. See the paragraphs below for a listing of FAA-owned approach lighting systems. (Configurations and design details pertaining to these systems are contained in FAA Order 6850.2, *Visual Guidance Lighting Systems*.)

b. The runway to be served has at least a medium intensity runway lighting system.

c. If MALSF is to be installed, the airport should have assigned, or have the potential for, an instrument approach procedure other than instrument landing system/precision approach radar (ILS/PAR).

d. MALSF and REIL are not installed on the same end of a runway. If required, install the PAPI with either MALSF or REIL on the same end of a runway.

e. MALSFs are not installed at locations where in-pavement approach light fixtures are required.

f. Prior to the selection of a particular lighting aid, discuss with regional airport FAA personnel operations and environmental needs of the individual site. In addition, make an individual site evaluation to determine which aid will best serve in reducing the deficiency(s) in a particular area. Reduction to instrument approach minimums may be made in accordance with the U.S. Standard for Terminal Instrument Procedures. Use the following information as a guide for selecting a particular system.

(1) MALS/MALSF. This system provides early runway lineup and lead-in guidance, runway end identification and, to a degree, roll guidance. The lights are helpful during some periods of restricted visibility. The MALS is beneficial where extraneous lighting prevents the pilot from lining up with the runway centerline or where the surrounding terrain is devoid of lighting and does not provide the cues

necessary for proper aircraft attitude control. At locations where approach area identification is difficult at night due to surrounding lights, MALSF installed at the three outermost bars should resolve this problem. See FAA Order 6850.2 for details on Medium-intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR).

(2) REIL. These lights aid in early identification of the runway and runway end. They are more beneficial in areas having a large concentration of lights and in areas of featureless terrain. These lights must be installed where there is only a circling approach or a circling and non-precision straight-in approach. The omnidirectional REIL provides good circling guidance and is the preferred system. The unidirectional REIL must be installed where environmental conditions require that the area affected by the flash from the REIL be greatly limited.

(3) PAPI. This system provides visual approach slope guidance. On runways not provided with electronic guidance, the light signals are beneficial in aiding the pilot of an aircraft to determine the correct glide slope. The presence of objects in the approach area may present a serious hazard if an aircraft descends below the normal path. This is especially true where sources of visual reference information are lacking or deceptive: i.e., hilltops, valleys, terrain grades, and remote-type airports. The PAPI assists the pilot in maintaining a safe distance above hazardous objects. The visual aiming point obtained with the PAPI reduces the probability of undershoots or overshoots. The 2-box PAPI system is normally installed on runways that are not provided with electronic guidance, on non-Part 139 airports, or when there is a serious hazard where the aircraft descends below the normal approach path angle. The system can be expanded to a 4-box system when jet aircraft operations are introduced at a future time.

7.4 CONFIGURATIONS.

a. MALSF.

(1) Provide a configuration of steady-burning and flashing lights arranged symmetrically about and along the extended runway centerline as shown in Figure 76. Begin the system approximately 200 feet from the runway threshold and extend it to an approximate 1400 foot overall length. (See Figure 76 for tolerances.)

(2) Use seven light stations with five steady-burning lights at each station. Provide one flashing light at each of the three outermost stations. At the station 1,000 feet from the runway threshold, use two additional bars (one of each side of the centerline bar) each with five steady-burning lights.

(3) All lights in the system emit white light. Provide intensity control for steady-burning lights. Flashing lights have no intensity control.

b. REIL. Provide two flashing lights near the end of the runway as shown in Figure 77. The optimum location of the lights is 40 feet from the runway edge and in line with the existing runway threshold lights. You may locate the light units is laterally up to 75 feet from the runway edge and longitudinally 40 feet downwind or 90 feet upwind from the runway threshold. When possible, install the two light units equidistant from the runway centerline. When location adjustments are necessary, the difference in the distance of the two lights to the centerline may not exceed 10 feet. Each light unit must be a minimum of 40 feet from the edge of taxiways and runways. The elevation of both units must be within 3 feet of a horizontal plane through the runway centerline, with the maximum height above ground limited to 3 feet. When the centerline elevation varies, the centerline point in line with the two units must be used to measure the centerline elevation. Orient the beam axis of an unbaffled unit 15 degrees outward from a line parallel to the runway and inclined at an angle 10 degrees above the horizontal. If this standard setting is operationally objectionable, provide optical baffles and orient the beam axis of the unit 10 degrees outward from a line parallel to the runway centerline and inclined at an angle of 3 degrees above the horizontal. Details pertaining to baffles are contained in AC 150/5345-51, *Specification for Discharge-Type Flasher Equipment*, Type L-849. The REILs emit white light and have no intensity control.

c. PAPI. Provide light units located 50 feet from the left runway edge when the optical system is viewed from the approach zone. The light units are installed in a line perpendicular to the runway edge. Each light unit emits a two-color (red and white) light beam. When the light units are properly aimed, the optical system provides visual approach slope information. When airport paved surfaces prevent the normal left side installation, or when significant cost reduction can be realized, install the system on the right side of the runway and publish this fact in the Aeronautical Information Manual. See Figure 78 for aiming criteria. See Figure 79 for PAPI signal presentation as seen from the approaching aircraft.

7.5 DESIGN.

a. MALSF.

(1) Electrical Systems. The design of the electrical system is identified by the method used to control the on/off operation of the lights. The controls available are remote, radio, and control from the runway edge lighting circuit. Select the type of control best suited for the airport's operation.

(a) Remote Control. A typical remotely controlled system consists of on/off and brightness switches, control relays, distribution transformers, MALSF equipment, and interconnecting wires. See Figure 81 for a typical wiring diagram. Normally the initial installation cost for remote controls is more than that for a system with radio controls or controls from the runway lighting circuit.

(b) Radio Control. Use the system wiring diagram shown in Figure 81 with the exceptions listed below. Select radio controls if the lights are needed for short duration (less than 15 minutes at a time).

1. Locate the AC 150/5345-49 Specification L-854 receiver near the MALSF to eliminate costly underground cables.

2. Substitute the L-854 radio controls for the on/off switch shown in Figure 81 and use a control relay with a coil compatible with the output of the L-854 receiver.

3. Use a photoelectric device in lieu of the high/low switch shown in Figure 81.

(c) Runway Lighting Circuit Control. See Figure 82 for a typical system controlled from the runway edge lighting circuit. Use components such as an isolation transformer, a series control device, and a distribution transformer in conjunction with the MALSF equipment to assure proper on/off operation. Select the brightness control as specified in FAA Order 6850.2.

(d) Power Supply and Wiring. Use a distribution transformer with a center tap to obtain the 120-volt and 60-volt input to the MALS PAR 38 spotlights. As an alternate, use two distribution transformers with the necessary switching equipment to connect these transformers alternately in series and parallel to obtain 120 volts and 60 volts across the MALS PAR 38, 120-watt spotlights. Obtain the high setting of the MALS lamp with the 120 volts and the low setting with the 60 volts.

1. Transformer Rating. Obtain a transformer with a minimum rating of 10 kilowatts at 120 volts, 60 hz. Use this power to supply the lamp load and field wiring shown in Figure 83. Select a transformer designed to carry the rated load continuously under expected environmental conditions.

2. Field Wire Sizes. Calculate the minimum wire sizes for each installation. If the field wiring is similar to the typical layout shown in Figure 83, use a No. 4 AWG wire (maximum) for power circuits and a No. 19 AWG wire (minimum) for sequenced flashing lights timing circuits. Provide not less than 114 volts, 60 hz; nor more than 126 volts, 60 hz at all steady-burning and flashing MALSF lamps.

(2) Structures.

(a) Where possible, mount all lights in the inner 1,000 foot section of the MALSF on frangible structures, meeting the RSA standards of AC 150/5300-13.

(b) Use semi-frangible structures at all light stations of the MALSF where the distance from ground level to lamp center is over 40 feet. Semi-frangible structures have the upper 20-foot portion frangible and the remaining portion rigid.

(c) Structure must be in accordance with FAA-E-2702, *Specification for Low Impact Resistant Structures*.

b. REIL.

(1) Electrical Systems. Design the system to permit operation of the light units within the rated tolerances of the equipment. Select light units that operate in a multiple circuit or series circuit. Light units will conform to AC 150/5345-51, *Specification for Discharge-Type Flasher Equipment,* Type L-849.

(a) Controls. Control the operation of the light units with one of the methods listed below:

1. Remote Controls. Provide an on/off switch as shown in Figure 85 at a remote location. Use this switch to control the input power to the light unit. Select a switch rated to carry continuously the required rated load.

2. Radio Controls. Use the L-854 receiver in conjunction with a pilot relay to control the light units. Select a relay with contacts rated to carry continuously the required rated load.

3. Runway Regulator Controls. See Figure 86 for a typical installation of REILs in a series circuit. Provide a selector switch to permit the independent control of the REILs even though the REILS share a common power source with the runway edge lights.

(b) Power Supply and Wiring. Use a source capable of producing 120 volts ± 6 volts, 60 hz volts or 240 volts ± 12 volts, 60 HZ at the terminal of a 1.3 kilowatt inductive load. Calculate the wire size used to connect the multiple light units to the source voltage. See Figure 85 for a typical example. Use 5 kilovolt (KV) cables for connecting REILs into series circuits.

(2) Structures. Install in accordance with manufacturer's requirements. Use a 2.197 inch or 2.375 inch (outside diameter) pipe support to secure the light unit.

c. PAPI.

(1) Siting Considerations.

(a) The PAPI system should be located at the approach end of the runway on the left side.

(b) The PAPI must be sited and aimed so it defines an approach path with sufficient clearance over obstacles and a minimum threshold crossing height per Table 7.1.

(c) For proper aiming procedure for the light units, see manufacturer's installation manual.

(d) Other PAPI alignment tolerances and considerations common to installations are in paragraph 7.5.h.

(2) Siting PAPI on a Runway With an ILS Glide Path. When siting PAPI on a runway with an ILS system, the PAPI visual approach path must coincide with the ILS glide path. The PAPI must be

placed at the same distance from the threshold as the touchdown point of the ILS glide path with a tolerance of ±30 feet (±10 m). If the PAPI is installed on an ILS runway primarily used by aircraft in height group 4 (see Table 7.1), the PAPI distance from the threshold must equal the distance to the ILS glide path touchdown point plus an additional 300 feet +50, -0 (90 m +15, -0) from the runway threshold.

(3) Siting PAPI on a Runway Without an ILS Glide Path. When a runway is not ILS equipped, the position and aiming for the PAPI must be aligned to produce the required threshold crossing height and obstacle clearance for the runway approach path.

(4) Threshold Crossing Height (TCH). The TCH is the height of the lowest on-course signal at a point directly above the intersection of the runway centerline and the threshold.

(a) The minimum TCH varies with the height group of aircraft that primarily use the runway.

(b) The PAPI approach path must provide the proper TCH for the most demanding height group using the runway per Table 7.1.

(5) PAPI AIMING. The standard aiming angles for Type L-880 and Type L-881 systems are shown in Tables 7.2 and 7.3.

Table 7.1 - Threshold Crossing Heights

Representative aircraft type	**Approximate glide path-to-wheel height**	**Recommended TCH**	**Remarks**
Height Group 1 General aviation Small commuters Corporate turbo jets	10 feet or less	40 feet (+5, -20) 12 m. (+2, -6)	Many runways less than 6,000 feet long with reduced widths and/or restricted weight bearing that would normally prohibit landings by larger aircraft.
Height Group 2 F-28, CV-340/440/580 A-737, DC-9, DC-8	15 feet	45 feet (+5, -20) 14 m. (+2, -6)	Regional airport with limited air carrier service
Height Group 3 B-727/707/720/757	20 feet	50 feet (+5,-15) 15 m. (+2, -6)	Primary runways not normally used by aircraft with ILS glide-path-to-wheel heights exceeding 20 feet.
Height group 4 B-747/767, L-1011, DC-10 A-300	Over 25 feet	75 feet (+5, -15) 23 m. (+2, -4)	Most primary runways at major airports.

Table 7.2. Aiming of Type L-880 (4 Box) PAPI Relative to Pre-selected Glide Path

Light Unit	Aiming Angle (in minutes of arc) Standard installation	Ht group 4 aircraft. on runway with ILS
Unit nearest runway	30' above glide path	35' above glide path
Next adjacent unit	10' above glide path	15' above glide path
Next adjacent unit	10' below glide path	15' below glide path
Next adjacent Unit	30' below glide path	35' below glide path

Table 7.3. Aiming of Type L-881 (2 Box) PAPI Relative to Pre-selected Glide Path

Light Unit	Aiming angle (in minutes of arc)
Unit nearest runway	15' above glide path
Unit farthest from runway	15' below glide path

(6) OTHER SITING DIMENSIONS AND TOLERANCES.

(a) Distance from Runway Edge:

1. The inboard light unit must be not be less than 50 feet, +10, -0, (15 m, +3, -0) from the runway edge or to other runways or taxiways, except as in the following paragraph.

2. The distance may be reduced to 30 feet (10 m) for small general aviation runways used by non-jet aircraft.

(b) Separation Between Light Units:

1. The PAPI light units must have a lateral separation of:

a. Between 20 and 30 feet (6 to 9 m) for L-880 systems.

b. For the L-880, the distance between light units may not vary by more than 1 foot (0.3 m).

(c) Azimuth Aiming. Each light unit must be aimed outward into the approach zone on a line parallel to the runway centerline within a tolerance of ±1/2 degree.

(d) Mounting Height Tolerances.

1. The beam centers of all light units must be within ±1 inch of a horizontal plane.

2. The PAPI horizontal plane must be within ±1 foot (0.3 m) of the elevation of the runway centerline at the intercept point of the visual glide path with the runway (except for the siting conditions in subparagraph g below).

(e) Tolerance Along Line Perpendicular to Runway. The front face of each light unit in a bar must be located on a line perpendicular to the runway centerline within +6 inches (+152 millimeters).

(f) Correction for Runway Longitudinal Gradient.

1. On runways where there is a difference in elevation between the runway threshold and the PAPI, it may be necessary to adjust the location of the light units with respect to the threshold to meet the required obstacle clearance and TCH.

2. When an elevation difference exists, the following steps (reference Figure 80) must be used to compute the change in the distance from the threshold required and preserve the proper geometry.

   a. Obtain the runway longitudinal gradient (RWY) from "as-built" drawings or airport obstruction charts.

   NOTE: *If the information cannot be obtained from the above sources, a survey must be performed to obtain RWY.*

   b. Determine the ideal (D1, zero gradient) PAPI distance from the runway threshold (T).

   c. Assume a level reference plane at the runway threshold elevation. Plot the location determined in (2) above.

   d. Plot the runway longitudinal gradient (RWY).

   e. Project the visual glide path angle (θ) to its intersection with the runway longitudinal gradient (RWY).

   f. Solve for the adjusted distance from threshold (d) either mathematically or graphically.

   g. Double-check to see that the calculated location gives the desired TCH.

(g) Additional Siting Considerations.

1. If the terrain drops off rapidly near the approach threshold and severe turbulence is experienced, then PAPI must be located farther from the threshold to keep the aircraft at the maximum possible threshold crossing height.

2. For short runways, the PAPI must be as near the threshold as possible to provide the maximum amount of runway for braking after landing.

3. At locations where snow is likely to obscure the light beams, the light units may be installed so the top of the unit is a maximum of 6 feet (2 m) above ground level.

   NOTES:

   - *Increasing the height of the PAPI light units will also raise the threshold crossing height for the glide path.*
   - *This may also require locating the light units farther from the runway edge to ensure adequate clearance for aircraft.*
   - *The location for the light units (closer to the runway threshold) must be recalculated to* maintain the correct TCH and Obstacle Clear Surface (OCS).

(7) Electrical Systems. Select equipment and connect the light units for continuous operation, series operation. See Figure 87 and Figure 88 for typical wiring diagrams.

(a) Continuous Operation. Provide a continuous power source to permit the PAPI to be energized at all times. Use a commercial photoelectric device to change the light intensity from a high to a low position for day and nighttime, respectively.

(b) Series Operation. Use isolation transformers in conjunction with the light unit to connect the PAPI into the 4.8-6.6-ampere circuit. Do not connect the 2-box PAPI in a circuit that has nominal intensity settings less than 4.8-amperes. The on/off operation and the brightness of the light units vary with the current in the series circuit. Select a series circuit capable of accepting an additional load for each installation. Provide a selector switch as shown in Figure 88 to permit independent control of the PAPI. At an existing runway lighting installation, the 2-box PAPI may be connected into the series runway lighting circuit; however, it would be necessary to burn the runway edge lights at top brightness if approach slope information is needed during daytime conditions.

(c) Multiple Operation. Use the light boxes with accessories provided for the specification to permit operation from a 2 Kw, 120-volt ±5 volt, 60hz source or a 240 volt ± 12 volt, 60hz source. Control the on/off operation of the light units with a remote switch or with radio controls. Provide pilot relays with contacts rated to operate the 2-kilowatt load on a continuous basis.

(d) Wire. Use No. 8 AWG wires to connect light units in series circuits. Make connections to multiple circuits with wire insulated for 600 volts minimum.

(8) Foundation. See Figure 89 for design details for the light unit's foundation.

(9) Feeder Circuit. The PAPI may be specified to operate from a standard utility voltage (Style A) or from a constant current power supply (Style B).

(a) The power cable must be in accordance with FAA Type L-824 per AC 150/5345-7, Specification for L-624 Underground Electrical Cable for Airport Lighting Circuit, or equivalent.

(b) Lightning arresters for both power and control lines must be provided per AC/150-5345-28, Precision Approach Path Indicator (PAPI) Systems.

NOTE: *the output power lines for an L-828 regulator used for Style B systems already have integral lightning protection).*

(c) All fuses or circuit breakers must be within the equipment ratings.

(10) Style A PAPI Systems.

(a) Input Voltage. Although PAPI systems may be designed to operate from any standard utility voltage,

1. The site designer must ensure the PAPI will operate from the airfield service voltage available and avoid installing a transformer for the system operating voltage.

2. The site designer must determine if there is any fluctuation in the utility line voltage exceeding the PAPI power design limits that will cause reduced lamp life.

   a. If the line voltage variations exceed the PAPI power regulation limits, then a voltage regulator must be provided to ensure the PAPI provides its specified lamp brightness.

3. The power distribution cabling to individual light units must be sized so any voltage drop does not exceed the PAPI power design limits.

(b) Location of the Power and Control Unit (PCU).

1. The PCU must be located as far from the runway as possible for a minimum obstruction to aircraft.

2. If the PCU is integral with a light unit, it must be placed farthest from the runway.

3. If the PCU is a separate unit, it must be mounted at the minimum possible height, and located outside the runway safety area.

4. If the PCU cannot be located outside the runway safety area, it must be mounted with frangible couplings and breakaway cabling.

(11) Style B PAPI System.

(a) PAPI systems that operate from a constant current source must use several types of FAA equipment:

(b) The system power source is an L-828 constant current regulator (AC 150/5345-10, *Specification for Constant Current Regulators and Regulator Monitors)*, with an output current of 6.6 amps. The regulator automatically compensates for up to ±10 percent deviation from its nominal voltage, and may be ordered with three or five brightness steps.

1. The five-step regulator is recommended, since field tests have shown that the lowest brightness step on a three-step regulator may be too bright for some rural PAPI installations.

(c) The output voltage of the regulator powers L-830 isolation transformers (specified in AC 150/5345-47, *Isolation Transformers for Airport Lighting Systems.* The isolation transformer wattage must be chosen for PAPI maximum load.

(12) Wiring the PAPI Light Units.

(a) For Style A systems, the cable used to deliver the power to the individual light units must be a gage large enough to minimize any voltage drop.

(b) Ensure all PAPI light boxes are properly grounded to the connection point provided by the manufacturer.

(c) All wiring entering the PAPI light unit must be through plugs and receptacles that will separate if the box is struck by an aircraft. The receptacles are located and secured at the frangible couplings.

(d) A length of flexible watertight conduit conveys the PAPI wiring between the frangible coupling and the PAPI light box. The flexible conduit is required so the PAPI box has sufficient movement for proper aiming.

(e) All underground connections must be made with either splices or plugs and receptacles per AC 150/5345-26, *Specification for L-823, Plug and Receptacle, Cable Connectors.*

(13) PAPI Lamp Brightness Control.

(a) Style A Systems.

1. The Style A PAPI system automatically selects day or night intensity settings with a photocell.

2. There are two night intensity settings (one time manual configuration), approximately 5 and 20 percent of full intensity, when the PAPI is in night mode.

(b) Style B Systems. The lamp intensity of style B systems is controlled by the tap settings on an L-828 regulator. See AC 150/5345-10.

1. We recommend that the PAPI not be powered from a runway edge lighting circuit, as this will require the edge lights to be at full intensity during day operations.

2. A dedicated L-828 constant current regulator with five current steps (2.8 to 6.6A) is the preferred method of powering the PAPI. The regulator current steps may be controlled either manually or automatically via a photocell.

3. The photoelectric control must be configured to reduce the regulator current step when the ambient lighting decreases to 25-35 foot-candles (night).

4. The photoelectric control must increase the regulator step setting to restore full PAPI lamp intensity when the ambient lighting reaches 50-60 foot-candles (daylight).

5. The photoelectric control must use a time delay of at least 30 seconds to prevent false PAPI day/night switching from stray light or temporary shadows.

(14) PAPI Power Control. The PAPI may be turned on and off by a number of different methods.

(a) For Style A systems, a contactor is provided in the PCU, allowing the system to be turned on and off via control signals.

(b) For Style B systems, the PAPI is turned on and off by the L-828 regulator control circuitry.

(c) The remote control that activates either Style A or B systems may be located in the control tower, flight service station, or other attended facility.

(d) Alternatively, the PAPI power control lines may be activated by an L-854 radio control receiver (AC 150/5345-49, *Specification L-854, Radio Control Equipment*. The L-854 allows the PAPI to be energized by either a pilot on approach, or by an airport ground control station.

(15) Other PAPI Power Control Configurations.

(a) PAPIs On Both Runway Ends.

1. It is desirable to independently control PAPIs for each runway end, energizing only the PAPI that serves the active runway end.

2. Turning off both systems when the runway is inactive will conserve energy.

(b) Interlock Relay.

1. During the night, it is desirable that the PAPI be energized only when the runway lights are on.

2. To provide this feature, an interlock relay must be installed in series with the night intensity contacts on the photocell controller.

a. The normally open contacts of the interlock relay are closed only when:

- It is night
- The runway edge lights are on.

b. Daylight PAPI operation must not be affected.

(16) Style B PAPI Lamp Bypass. Constant current regulators will increase the output current as the number of isolation transformers with an open secondary (caused by burned-out lamps) increases. The increased current will cause more lamp failures, increasing the regulator current. This situation is particularly critical when the connected load is small (less than 50 percent) compared to the regulator rating. A lamp bypass device prevents the runaway effect by shorting the secondary of the isolating transformer and simulating the resistance of a lamp. Lamp bypass devices are an optional feature, and are recommenced for all Style B PAPIs powered by resonant-type constant current regulators.

7.6 EQUIPMENT AND MATERIAL.

a. Specifications and Standards.

(1) Equipment and material covered by specifications are referred to by specification number.

(2) Use distribution transformers, oil switches, cutouts, relays, terminal blocks, transfer relays, circuit breakers, photoelectric controls, and all other commercial items of electrical equipment not covered by FAA specifications that conform to the applicable rulings and standards of the electrical industry.

b. Shelter. If power supplies and accessories are not designed for outdoor service, enclose them in the prefabricated metal housing or other outdoor enclosure conforming with industry standards.

c. Wires. Use No. 12 to No. 4 AWG wires in accordance with AC 150/5345-7. Use No. 19 AWG wires in accordance with ANSI/ICEA S-85-625, *Telecommunications Cable Air Core, Polyolefin Insulated, Copper Conductor, Technical Requirements*.

d. Concrete. Use concrete and reinforcing steel conforming with AC 150/5370-l0, Item P-610.

e. Radio Controls. Select radio controls in accordance with Chapter 8.

f. Isolation transformer. If control is provided from the runway lighting circuit, select an isolation transformer conforming with FAA Order 6850.2 to obtain a sensing current from the circuit.

g. MALSF.

(1) Equipment. Select equipment in accordance with the requirements of FAA-E-2325, *Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights*. See paragraph 7.5.a(2) for typical structural installation details.

(2) Aiming Device. Obtain a device for aiming the light units from the equipment manufacturer.

h. REIL.

(1) Light Unit. Only select condenser discharge lights and accessories in accordance with the requirements of AC 150/5345-51. Obtain L-869 fittings to permit the installation of the light unit on a 2.197 inch or 2.375 inch diameter frangible vertical support.

(2) Aiming Device. Obtain a device for aiming the REIL unit from the equipment manufacturer.

i. PAPI.

(1) Light Unit. Select light units in accordance with the requirements of AC 150/5345-28. Those items not covered in the specification are provided by the installation contractor.

(2) Aiming Device. Obtain a device for aiming the PAPI light unit from the equipment manufacturer.

See Chapter 12, Equipment and Material, for additional information.

7.7 INSTALLATION.

Install the economy approach lighting aid in accordance with AC 150/5370-10. Additional details are contained in the following paragraphs:

a. Wiring. Install underground cable in accordance with the requirements of AC 150/5370-10, Item L-108. Make installations of wiring in vaults or prefabricated metal housings in accordance with AC 150/5370-10, Item L-109.

b. Duct. Install underground electrical duct in accordance with the requirements of AC 150/5370-10, Item L-110.

c. Equipment. Assemble the lighting equipment in accordance with the manufacturer's instructions.

d. MALSF.

(1) Approach Light Plane. Define the approach light plane as an imaginary plane. This plane passes through the beam center of the steady-burning lights in the system. The plane is rectangular in shape, 400 feet wide, and centered on the MALS centerline. It originates at the landing threshold and extends 200 feet beyond the last light bar at the approach end of the MALSF. You may consider elevated lights in station 2 + 00, at runway elevation even though they project several inches above it.

(2) Clearance. Permit no objects above the approach light plane. For approach light plane clearance purposes, consider all roads, highways, vehicle parking areas, and railroads as vertical solid objects. Make the clearance required above interstate highways 17 feet, for railroads 23 feet, and for all other roads, highways, and vehicle parking areas 15 feet. Measure the clearance for roads and highways from the crown and edges of the road and make measurements for railroads from the top of rails. Make measurements for vehicle parking areas' clearances from the grade in the vicinity of the highest point. Airport service roads, where vehicular traffic is controlled in any manner that would preclude blocking the view of the approach lights by landing aircraft, are not considered as obstructions in determining the approach light plane.

(3) Location and Orientation. Install all light bars perpendicular to the vertical plane containing the MALSF centerline.

(4) Visibility. Provide a clear line of sight to all lights of the system from any point on a surface, 1/2-degree below a 3-degree glide path, intersecting the runway 1,000 feet from the landing threshold. This line of sight applies to 250 feet each side of the entire length of the MALSF and extends up to 1,600 feet in advance of the outermost light in the system. See Figure 76 for details.

(5) Slope Gradient. Keep the slope gradient as small as possible and do not exceed 2 percent for a positive slope or 1 percent for a negative slope. For additional guidance, see FAA Order 6850.2.

(6) Frangible Structures. Install frangible MALS structures as shown in Figure 84.

(7) Equipment. Assemble the lighting equipment in accordance with the manufacturer's instructions.

e. REIL.

(1) Location. Locate the REIL units and aim them as shown in Figure 77.

(2) Structures. See Figure 90 for typical installation details.

f. PAPI.

(1) Location. Locate the PAPI and aim the light units as shown in Figure 78.

(2) Structures. Install light units on supports and concrete foundations as shown in Figure 89.

(3) Foundations.

(a) Foundations for mounting light boxes must be made of concrete (or comparable material) and designed to prevent frost heave or other displacement.

(b) The foundation should extend at least 1 foot (0.3 m) below the frost line.

(c) A column may be provided under each mounting leg for attachment of the mounting flanges, or a pad with appropriate reinforcement may be used.

(d) The pad or surface stabilization must extend at least 1 foot (0.3 m) beyond the light boxes, to minimize damage from mowers, and should not be more than 1 inch (25 mm) above grade.

(e) All PAPI light boxes will be frangibly mounted to the foundation.

(f) For Style B systems, a transformer housing may be installed in the pad below grade to provide both a convenient and protected location for the isolation transformer (see AC 150/5345-47, *Isolation Transformers for Airport Lighting Systems*.

(4) Interfering Airport Lighting. Because PAPI system is dependent upon the pilot seeing a red and/or white signal from the light units, care should be taken to assure that no other lights are located close enough to the system to interfere with the signal presentation.

(5) Electrical. The PAPI installation must conform to the National Electrical Code and any local codes.

(a) All electrical connections to the light unit must be made with plugs and receptacles designed to separate in the event of an aircraft strike.

(b) Extra control circuitry must be housed in an enclosure for protection from the airport environment.

(c) All underground cable must be installed in accordance with item L-108 of AC 150/5370-10, *Standards for Specifying Construction of Airports*.

(6) COMMISSIONING NOTICE TO AIRMEN (NOTAM).

(a) The Flight Service Station (FSS) has jurisdiction over the airport where the PAPI is installed and must be notified when the system is ready to be commissioned.

(b) The FSS must be requested to issue a commissioning NOTAM, and to forward copies of this NOTAM to the National Flight Data Center, the local Air Traffic Control Tower, the Air Route Traffic Control Center, and the FAA Regional Office. This will ensure that the new PAPI system will be included in the Airport Facility Directory.

(c) The following items must be reported to the FSS:

1. Airport name and location.

2. Runway number and location of PAPI (left or right side of runway).

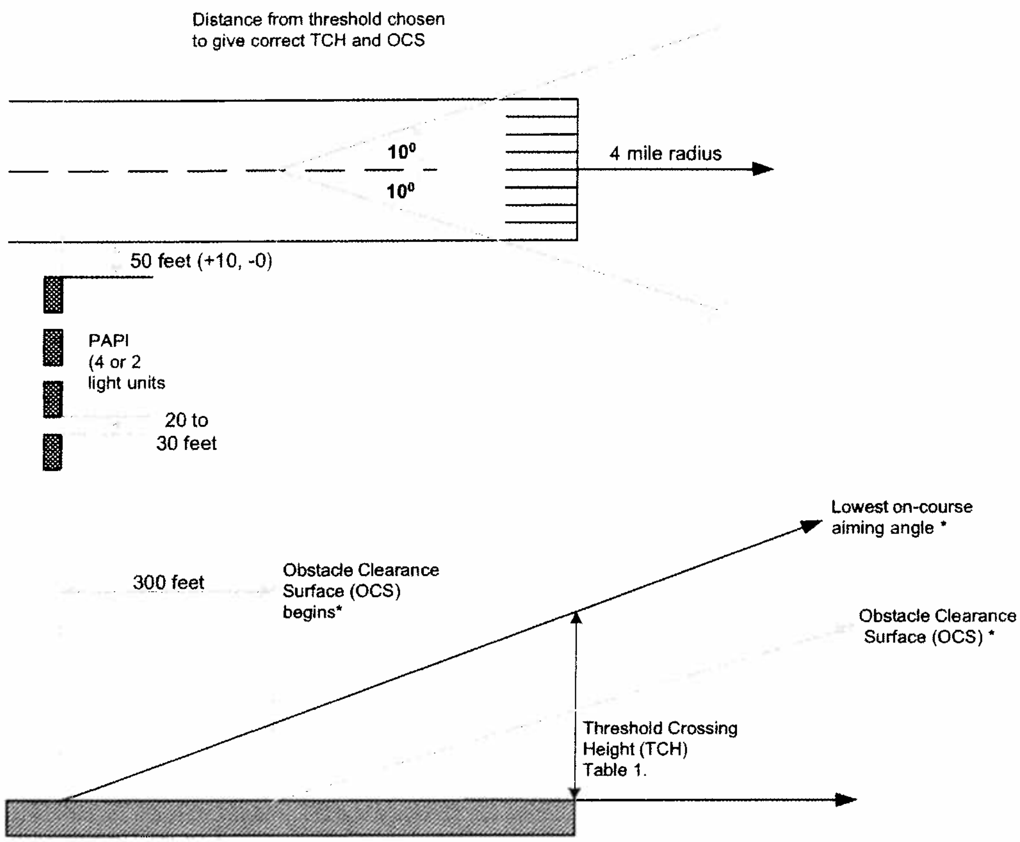
3. Type of PAPI (L-880 or L-881).

4. Glide path angle.

5. Runway threshold crossing height (TCH).

6. Date of commissioning.

g. Alternate Installation Details. Use details contained in FAA Order 6850.2 for guidance to obtain alternate methods of installing economy approach lighting aids.

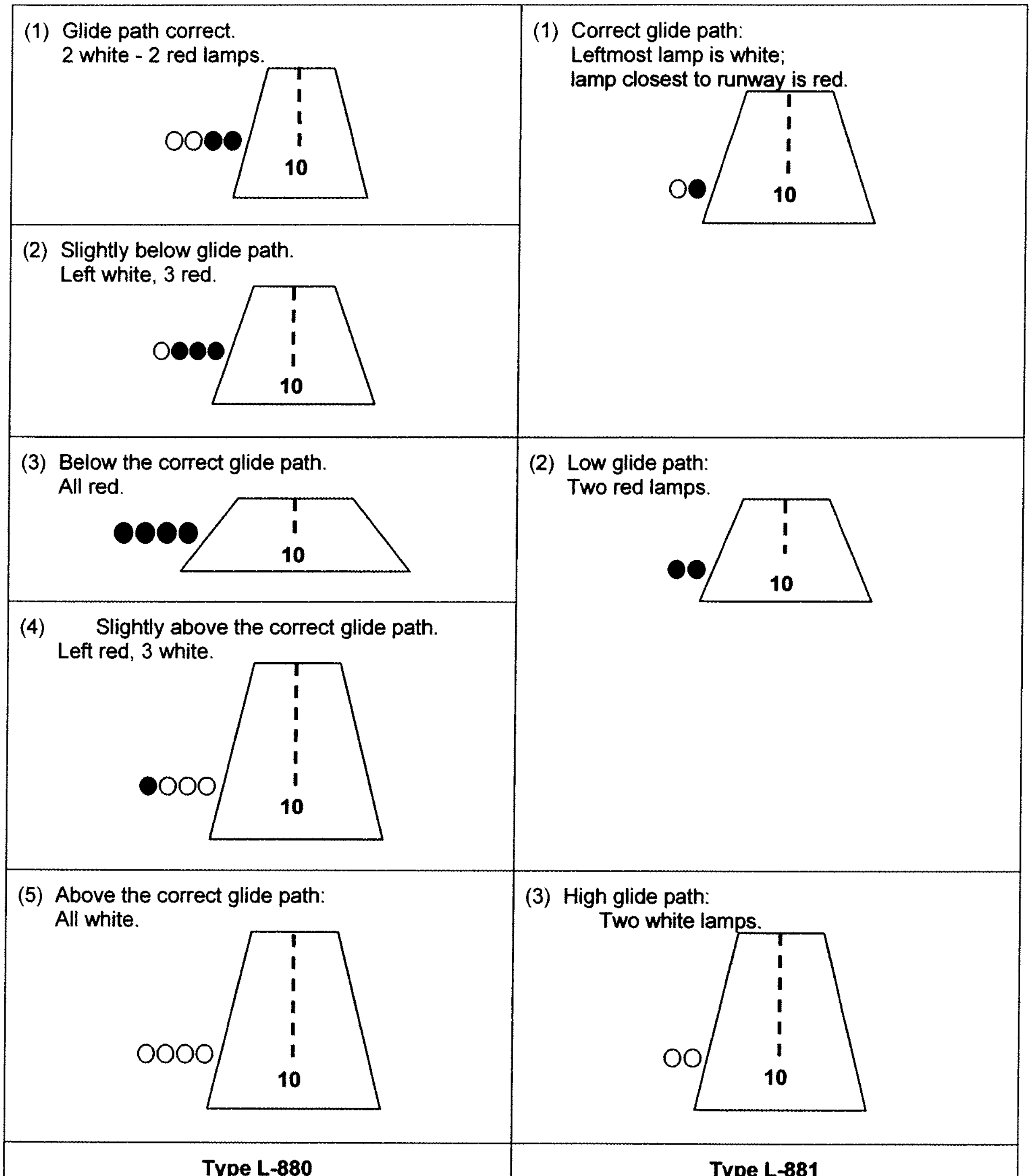


PAPI OCS angle = Lowest on-course aiming angle - 1 degree

NOTES

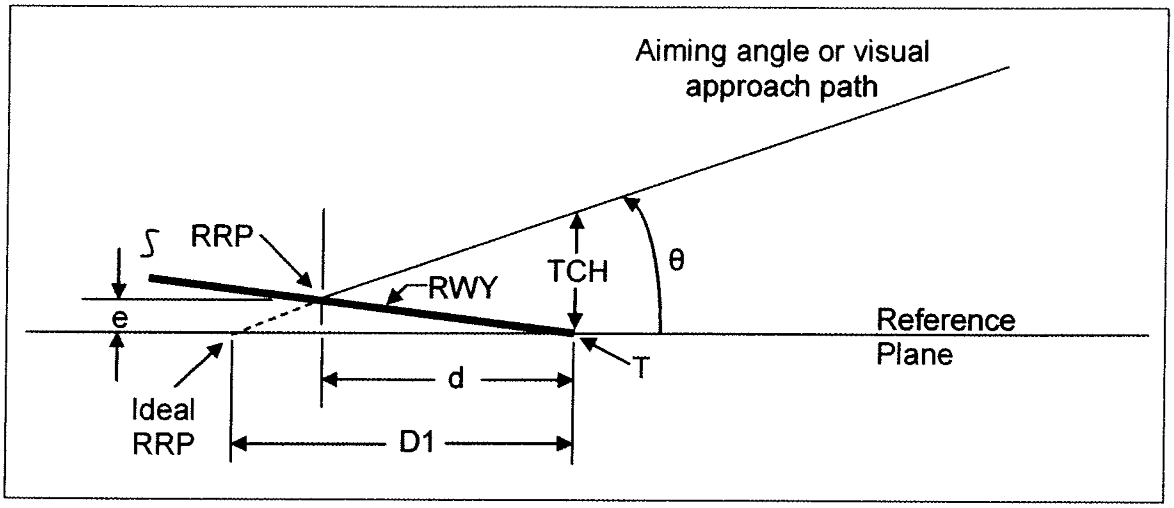
1. The visual glide path angle is the center of the on-course zone, and is a nominal 3 degrees when measured from the horizontal surface of the runway.
   a. For non-jet runways, the glide path may be raised to 4 degrees maximum to provide obstacle clearance.
   b. If the PAPI glide path is changed to a higher angle from the nominal 3 degrees, it must be communicated in a Notice to Airmen (NOTAM) and published in the Airport Facility Directory.
2. PAPI Obstacle Clearance Surface (OCS).
   a. The PAPI OCS provides the pilot with a minimum approach clearance.
   b. The PAPI must be positioned and aimed so no obstacles penetrate this surface.
      (1) The OCS begins 300 feet (90 m) in front of the PAPI system.
      (2) The OCS is projected into the approach zone 1 degree less than the aiming angle of the third light unit from the runway for an L-880 system, or the outside light unit for an L-881 system.
   c. **Example:** For an L-880 PAPI system with a 3 degree glide path and 20 feet of separation between light units, the third light unit from the runway would be aimed at:
      3 degrees - 10 minutes = 2 degrees, 50 minutes elevation
      (1) The 10 minutes correction was obtained from Table 7.2.
      (2) The OCS angle would be:
          2 degrees 50 minutes - 1 degree = 1 degree 50 minutes.
   d. The OCS is 10 degrees either side of the extended runway centerline and projects 4 statute miles from its point of origin.
   e. If a site survey determines there is an obstacle penetrating the OCS then:
      (1) Remove the obstacle if possible.
      (2) Increase the PAPI approach path angle.
      (3) Move the PAPI toward the threshold to provide an increased TCH equal to the obstacle penetration height.

Figure 78 PAPI Obstacle Clearance Surface

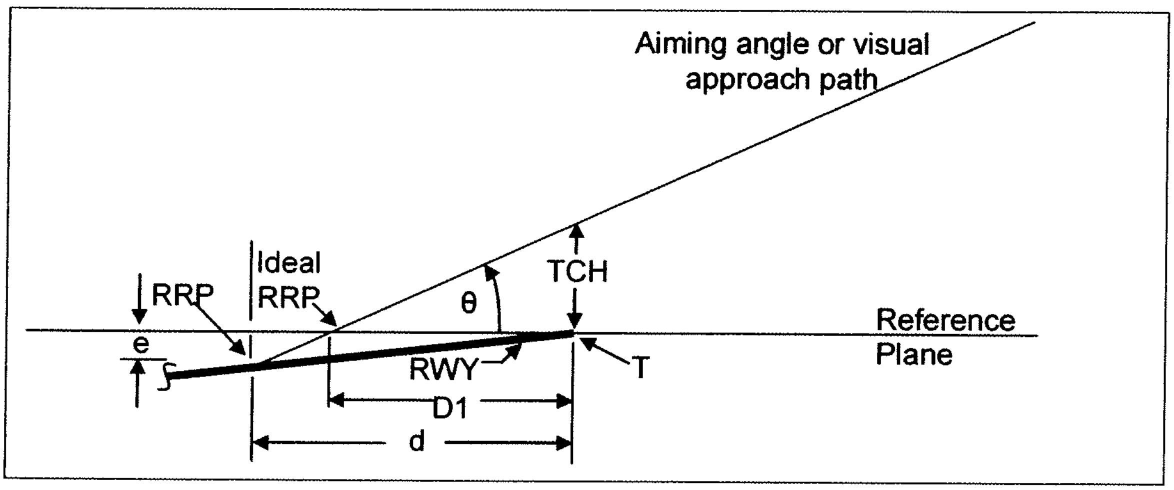


NOTE: *The PAPI is a system of either four or two identical light units placed on the left of the runway in a line perpendicular to the centerline. The boxes are positioned and aimed to produce the visual signal shown above.*

Figure 79 PAPI Signal Presentation



Siting station displaced towards threshold



Siting station displaced from threshold

Symbols:

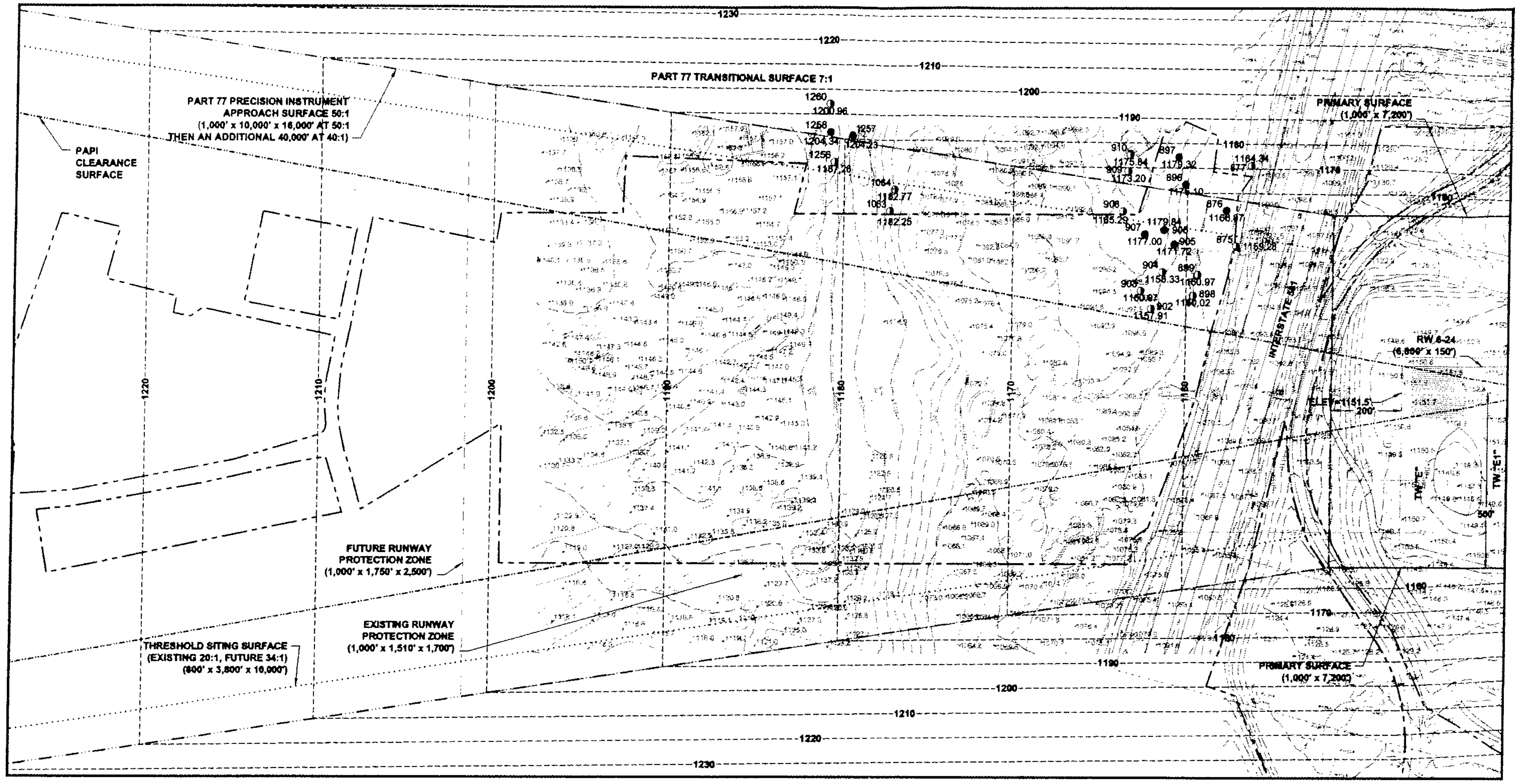
DI = ideal (zero gradient) distance from threshold
RWY = runway longitudinal gradient
TCH = threshold crossing height
T = threshold
e = elevation difference between threshold and RRP
RRP = runway reference point (where aiming angle or visual approach path intersects runway profile)
d = adjusted distance from threshold
Q = aiming angle

Figure 80 Correction for Runway Longitudinal Gradient

Appendix D

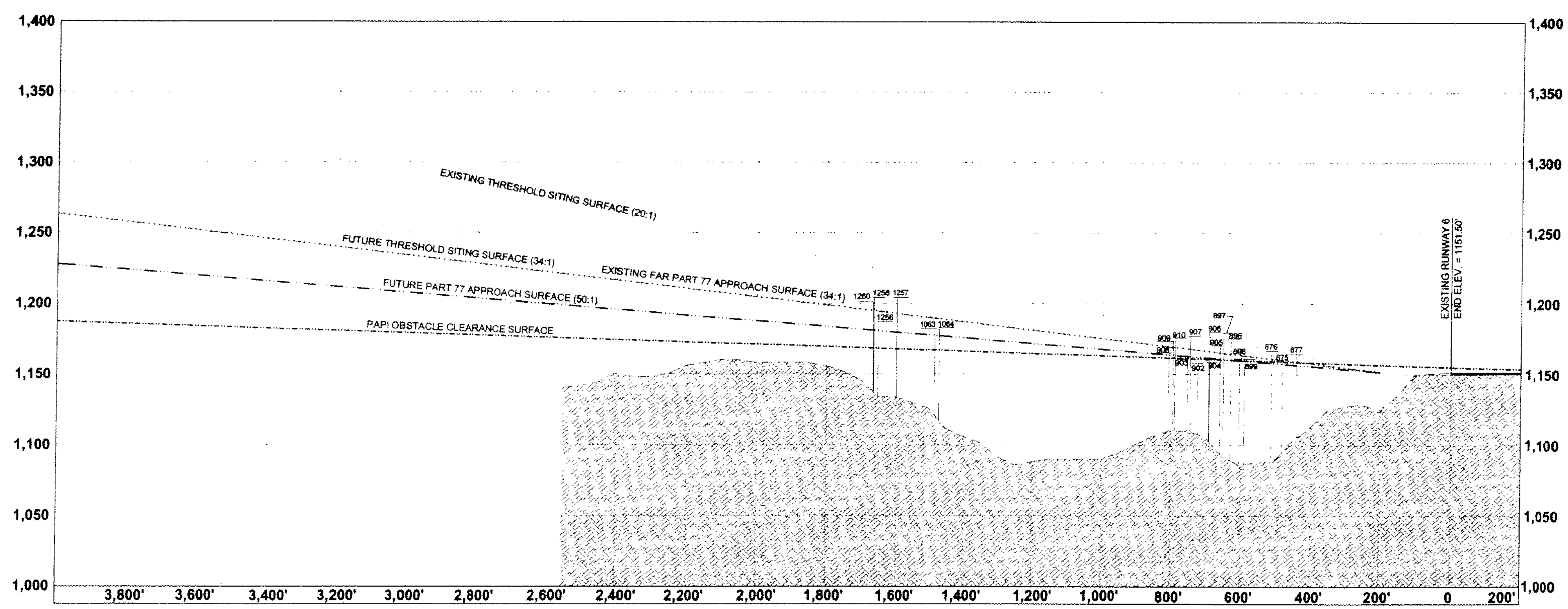
Obstruction Sheets

1 of 11



RUNWAY 6 APPROACH - PLAN VIEW

SCALE: 1" = 200' (HORIZ)



RUNWAY 6 APPROACH - PROFILE VIEW

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

2 3

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
- EXISTING GROUND ELEVATION
- MALSR TOWERS/FIXTURES

200 0 200 400
SCALE: 1"=200' FEET

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

RW 6 OBSTRUCTION LAYOUT

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	PJW	SCALE:	AS SHOWN	SHEET 2 OF 11
CHECKED BY:	MWK	DATE:	FEBRUARY 2007	

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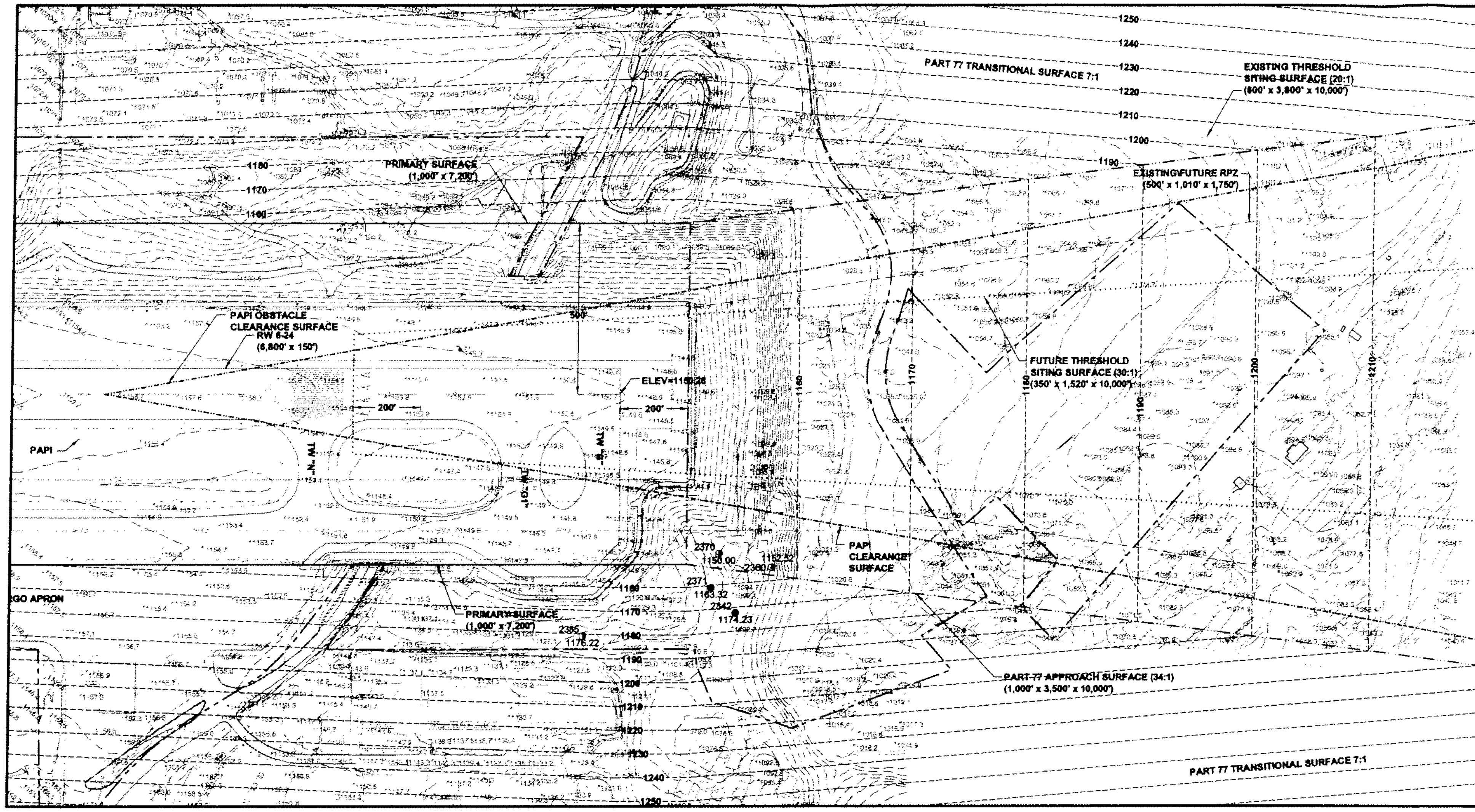
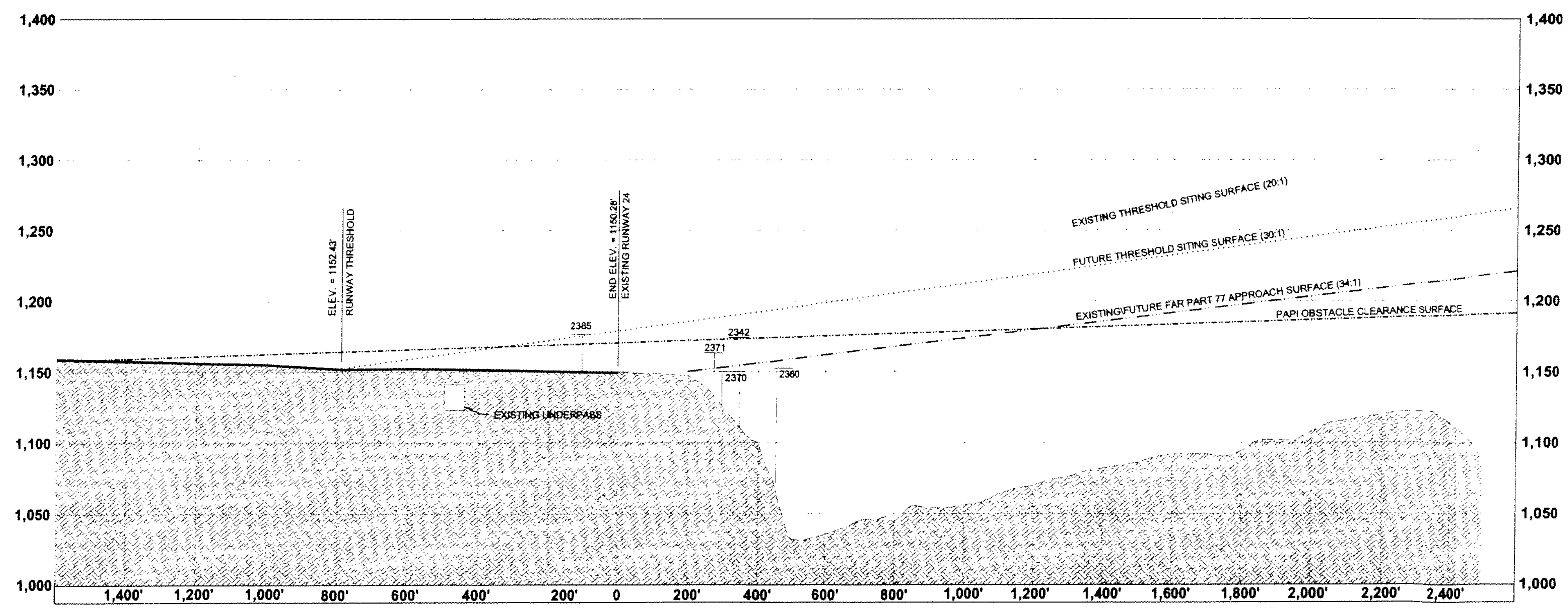
XREFS: 0503Sheet.dwg 04095-bgs.dwg BASE.S



RUNWAY 24 APPROACH - PLAN VIEW

SCALE: 1" = 200' (HORIZ)



RUNWAY 24 APPROACH - PROFILE VIEW

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

2

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
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- 1250.91 BUFFER OBSTRUCTION OBJECT (WITHIN 10'
- EXISTING GROUND ELEVATION
- MALSR TOWERS/FIXTURES

SCALE: 1"=200' FEET

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

RW 24 OBSTRUCTION LAYOUT

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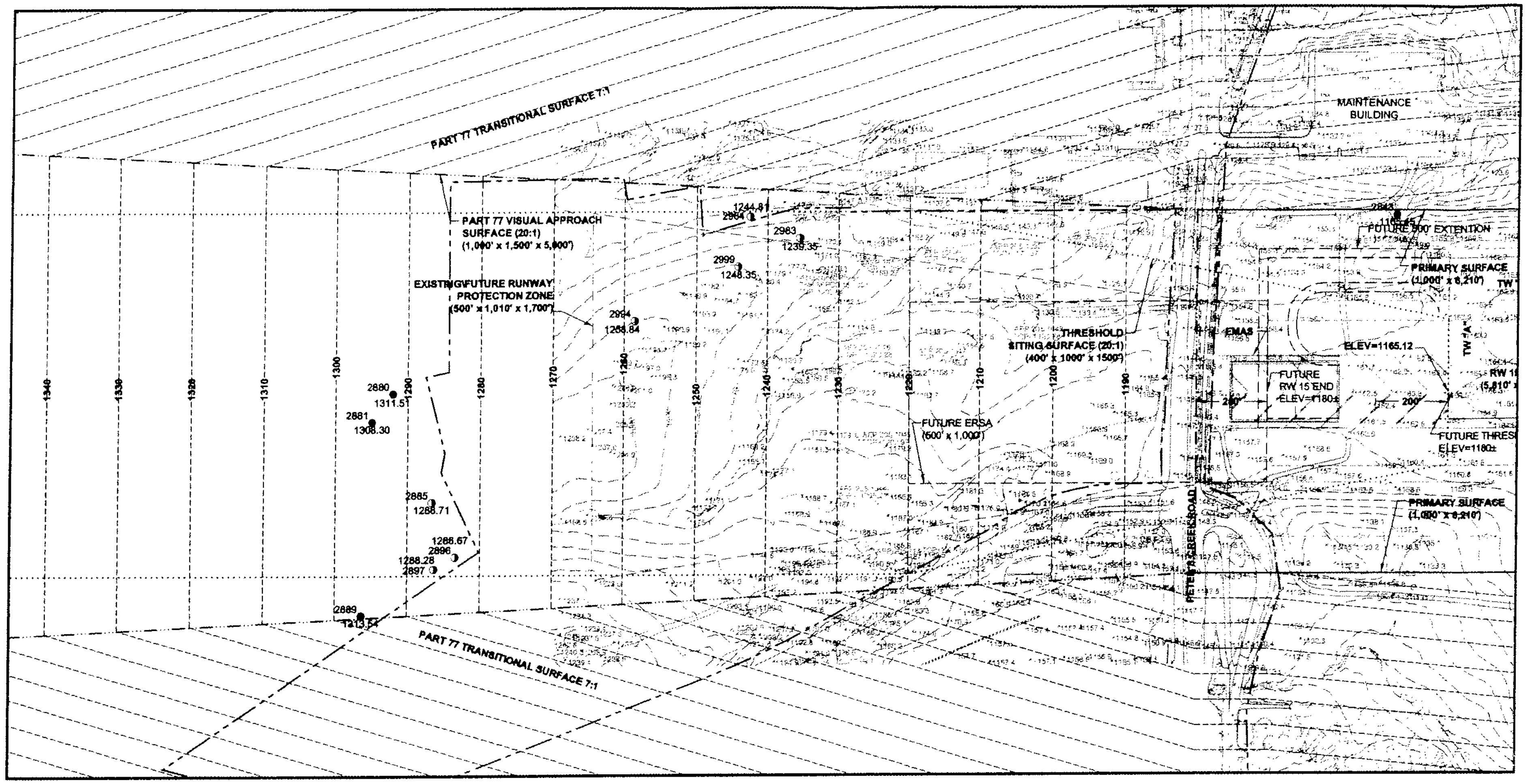
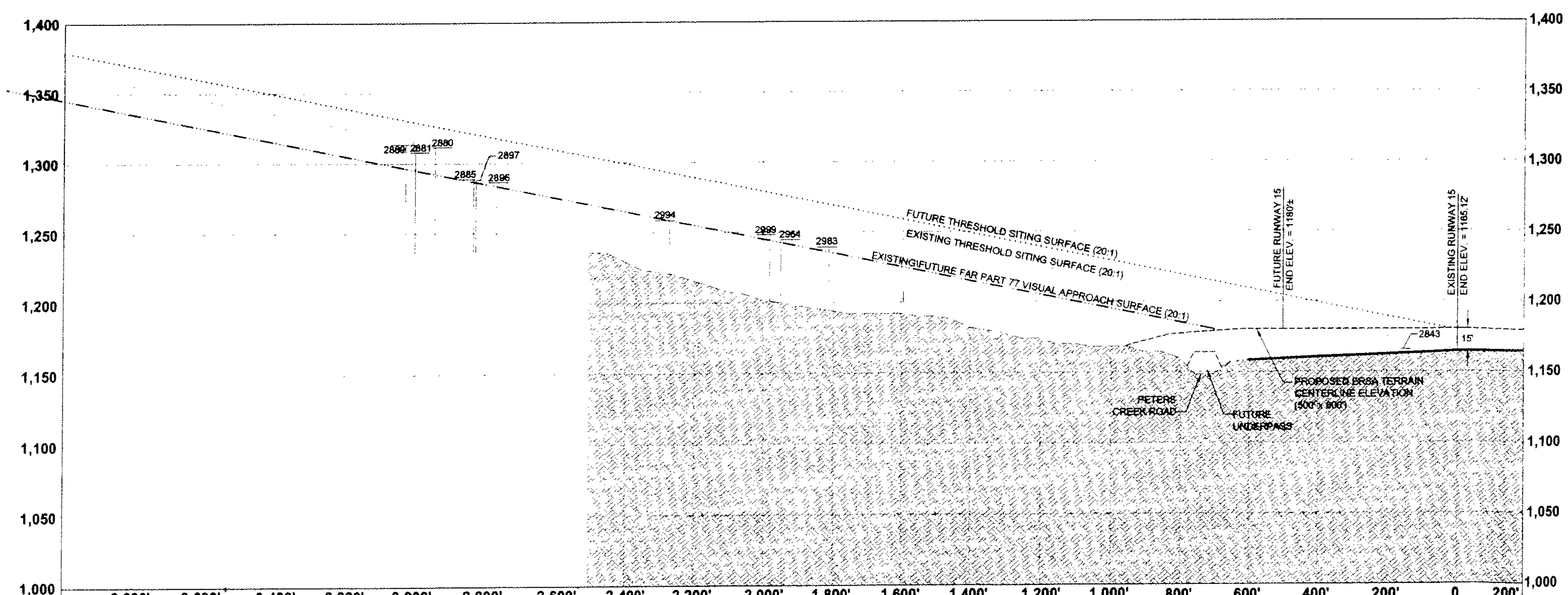
CHECKED BY:	MWK	DATE:	FEBRUARY 2007	



RUNWAY 15 APPROACH - PLAN VIEW

SCALE: 1" = 200' (HORIZ)



RUNWAY 15 APPROACH - PROFILE VIEW

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

5

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
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- 1260.23 OBSTRUCTION OBJECT
- 1250.91 BUFFER OBSTRUCTION OBJECT (WITHIN 10')
- EXISTING GROUND ELEVATION
- MALSR TOWERS/FIXTURES

200 0 200 400
SCALE: 1"=200' FEET

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

RW 15 OBSTRUCTION LAYOUT

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

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CHECKED BY:	MWK	DATE:	FEBRUARY 2007	

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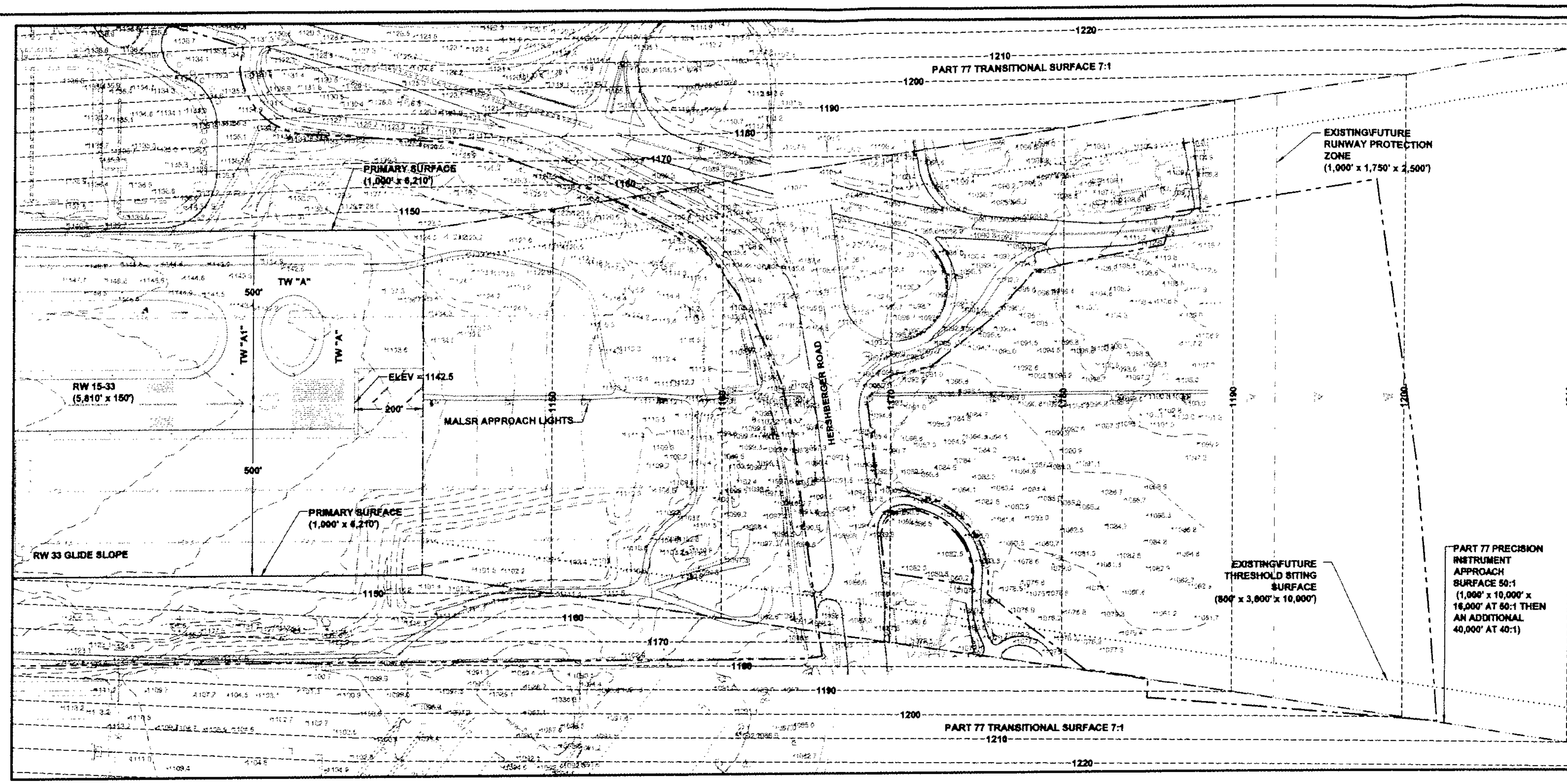
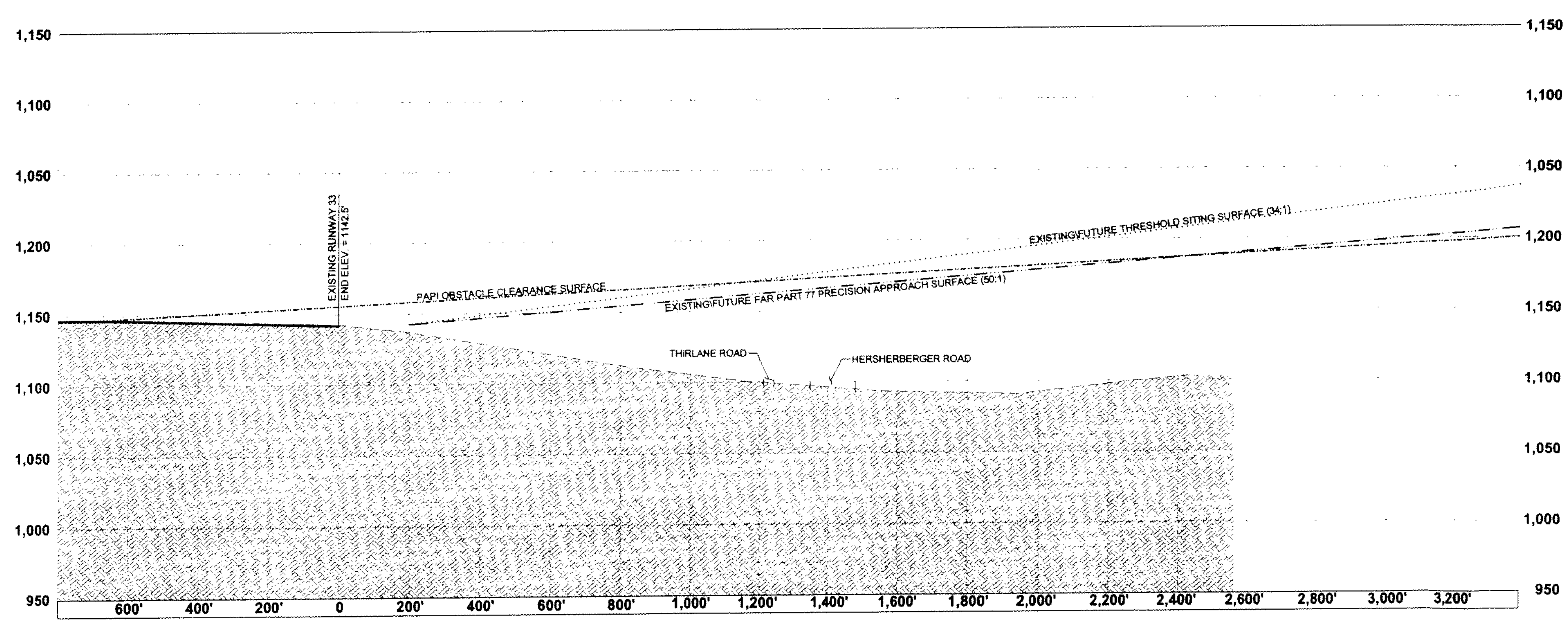


RUNWAY 33 APPROACH - PLAN VIEW

SCALE: 1" = 200' (HORIZ)



RUNWAY 33 APPROACH - PROFILE VIEW

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

4

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
- EXISTING GROUND ELEVATION
- MALSR TOWERS/FIXTURES

200 0 200 400
SCALE: 1"=200' FEET

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

RW 33 OBSTRUCTION LAYOUT

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	PJW	SCALE:	AS SHOWN	SHEET 5
CHECKED BY:	MWK	DATE:	FEBRUARY 2007	OF 11

DRAWING: 04095 OBS.dwg LAYOUT: L4
XREFS: 06033sheet.dwg; 04095-vega.dwg IMAGES:

RUNWAY 6 OBSTRUCTION CHART

OBJECT			PART 77 SURFACE	SURFACE ELEVATION		PENETRATION		ACTION
NO.	DESCRIPTION	ELEV.		EXISTING	FUTURE	EXISTING	FUTURE	
875	OBST. TREE	1159'	50:1 APPROACH	1157'	SAME	2'	0'	REMOVE
876	OBST. TREE	1167'	50:1 APPROACH	1157'	SAME	10'	0'	REMOVE
877	OBST. TREE	1164'	7:1 TRANSITIONAL	1170'	SAME	- 6'	0'	REMOVE
896	OBST. TREE	1175'	7:1 TRANSITIONAL	1165'	SAME	10'	0'	REMOVE
897	OBST. TREE	1179'	7:1 TRANSITIONAL	1175'	SAME	4'	0'	REMOVE
898	OBST. TREE	1160'	50:1 APPROACH	1159'	SAME	- 1'	0'	REMOVE
899	OBST. TREE	1161'	50:1 APPROACH	1159'	SAME	- 2'	0'	REMOVE
902	OBST. TREE	1158'	50:1 APPROACH	1162'	SAME	- 4'	0'	REMOVE
903	OBST. TREE	1161'	50:1 APPROACH	1162'	SAME	- 1'	0'	REMOVE
904	OBST. TREE	1158'	50:1 APPROACH	1161'	SAME	- 3'	0'	REMOVE
905	OBST. TREE	1172'	50:1 APPROACH	1161'	SAME	11'	0'	REMOVE
906	OBST. TREE	1180'	50:1 APPROACH	1161'	SAME	19'	0'	REMOVE
907	OBST. TREE	1177'	50:1 APPROACH	1162'	SAME	5'	0'	REMOVE
908	OBST. TREE	1165'	50:1 APPROACH	1164'	SAME	1'	0'	REMOVE
909	OBST. TREE	1173'	7:1 TRANSITIONAL	1168'	SAME	- 8'	0'	REMOVE
910	OBST. TREE	1176'	7:1 TRANSITIONAL	1175'	SAME	1'	0'	REMOVE
1063	OBST. TREE	1182'	50:1 APPROACH	1177'	SAME	5'	0'	REMOVE
1064	OBST. TREE	1183'	50:1 APPROACH	1177'	SAME	6'	0'	REMOVE
1256	OBST. TREE	1187'	50:1 APPROACH	1181'	SAME	6'	0'	REMOVE
1257	OBST. TREE	1204'	7:1 TRANSITIONAL	1180'	SAME	24'	0'	REMOVE
1258	OBST. TREE	1204'	7:1 TRANSITIONAL	1182'	SAME	22'	0'	REMOVE
1260	OBST. TREE	1201'	7:1 TRANSITIONAL	1195'	SAME	6'	0'	REMOVE
	POOR MOUNTAIN	2100'	50:1 APPROACH	2040'	SAME	60'	60'	LIGHT
	POOR MOUNTAIN	2560'	50:1 APPROACH	2087'	SAME	473'	473'	LIGHT
	TWELVE O'CLOCK KN.	2683'	50:1 APPROACH	2117'	SAME	566'	566'	LIGHT
	LONG MOUNTAIN	2607'	50:1 APPROACH	2162'	SAME	445'	445'	LIGHT
	POOR MOUNTAIN	2460'	50:1 APPROACH	2291'	SAME	169'	169'	LIGHT
	POOR MOUNTAIN	2684'	50:1 APPROACH	2340'	SAME	344'	344'	LIGHT

PROPOSED OBSTRUCTION LIGHT ON SIGNIFICANT TERRAIN OFF RUNWAY 6:

POOR MOUNTAIN, ELEV = 3093'

RUNWAY 24 OBSTRUCTION CHART

OBJECT			PART 77 SURFACE	SURFACE ELEVATION		PENETRATION		ACTION
NO.	DESCRIPTION	ELEV.		EXISTING	FUTURE	EXISTING	FUTURE	
2342	OBST. TREE	1174'	7:1 TRANSITIONAL	1172'	SAME	2"	0'	REMOVE
2360	OBST. TREE	1153'	34:1 APPROACH	1158'	SAME	- 5'	0'	REMOVE
2370	OBST. TREE	1150'	34:1 APPROACH	1153'	SAME	- 3'	0'	REMOVE
2371	OBST. TREE	1163'	7:1 TRANSITIONAL	1160'	SAME	3'	0'	REMOVE
2385	OBST. TREE	1176'	7:1 TRANSITIONAL	1180'	SAME	- 4'	0'	REMOVE
2	HANGAR	1190'	PRIMARY	1168'	SAME	22'	0'	REMOVE
3	HANGAR	1195'	PRIMARY	1167'	SAME	28'	0'	REMOVE
4	HANGAR	1227'	7:1 TRANSITIONAL	1170'	SAME	57'	0'	REMOVE
35	ATCT	1372'	7:1 TRANSITIONAL	1260'	SAME	112'	112'	LIGHT
	8' CHAIN FENCE	1178'	PRIMARY	1170'	SAME	8'	0'	REMOVE
	8' CHAIN FENCE	1177'	7:1 TRANSITIONAL	1174'	SAME	3'	0'	REMOVE
	TINKER MOUNTAIN	2228'	PAPI CLEARANCE	1312'	SAME	916'	916'	LIGHT

PROPOSED OBSTRUCTION LIGHTS ON SIGNIFICANT TERRAIN OFF RUNWAY 24:

READ MOUNTAIN, ELEV = 2060'
READ MOUNTAIN, ELEV = 2353'
TINKER MOUNTAIN, ELEV = 2274'
COYNER MOUNTAIN, ELEV = 2080'
FULLHART KNOB, ELEV = 2291'
JEFFERSON NATIONAL FOREST, ELEV = 2670'

RUNWAY 15 OBSTRUCTION CHART

OBJECT			PART 77 SURFACE	SURFACE ELEVATION		PENETRATION		ACTION
NO.	DESCRIPTION	ELEV.		EXISTING	FUTURE	EXISTING	FUTURE	
2843	OBST. TREE	1165'	PRIMARY	?	SAME	7'	0'	REMOVE
2880	OBST. TREE	1311'	20:1 APPROACH	1302'	SAME	9'	0'	REMOVE
2881	OBST. TREE	1308'	20:1 APPROACH	1305'	SAME	3'	0'	REMOVE
2885	OBST. TREE	1288'	20:1 APPROACH	1297'	SAME	- 9'	0'	REMOVE
2889	OBST. TREE	1313'	20:1 APPROACH	1304'	SAME	11'	0'	REMOVE
2896	OBST. TREE	1286'	20:1 APPROACH	1294'	SAME	- 8'	0'	REMOVE
2897	OBST. TREE	1288'	20:1 APPROACH	1296'	SAME	- 8'	0'	REMOVE
2964	OBST. TREE	1244'	20:1 APPROACH	1242'	SAME	- 2'	0'	REMOVE
2983	OBST. TREE	1239'	20:1 APPROACH	1236'	SAME	3'	0'	REMOVE
2994	OBST. TREE	1258'	20:1 APPROACH	1259'	SAME	-1'	0'	REMOVE
2999	OBST. TREE	1248'	20:1 APPROACH	1244'	SAME	4'	0'	REMOVE

NOTES:

1. ALL ELEVATIONS ARE IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS. SPOT ELEVATIONS AND GROUND CONTOURS ARE DERIVED FROM AERIAL PHOTOGRAMMETRY AND ARE APPROXIMATE. GROUND SURVEYS ARE REQUIRED TO VERIFY ACCURACY OF OBSTRUCTIONS.
2. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
3. GROUND CONTOURS, RUNWAY END AND OBSTRUCTION ELEVATIONS ARE BASED UPON AERIAL PHOTOGRAPHY PREPARED BY:
   POTOMAC AERIAL SURVEYS, INC.
   FREDERICK COUNTY AIRPORT
   1819 BUCHELMER ROAD
   FREDERICK, MARYLAND 21701
4. ALL POTENTIAL OBSTRUCTIONS ARE WITHIN 10 FEET OF FAR PART 77 SURFACE AND SHOULD BE FIELD VERIFIED.
5. FAR PART 77 REQUIRES THE FOLLOWING CLEARANCES:
   10 FEET ABOVE PRIVATE ROADS
   15 FEET ABOVE PUBLIC ROADS
   17 FEET ABOVE INTERSTATE HIGHWAYS
   23 FEET ABOVE RAILROADS
   ELEVATION = ACTUAL ROADWAY ELEVATION + FAR PART 77 CLEARANCE.

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

OBSTRUCTION CHARTS

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	PJW	SCALE:	NONE	SHEET 6
CHECKED BY:	MWK	DATE:	FEBRUARY 2007	OF 11

DRAWING: 04066 CHT.dwg LAYOUT: L1
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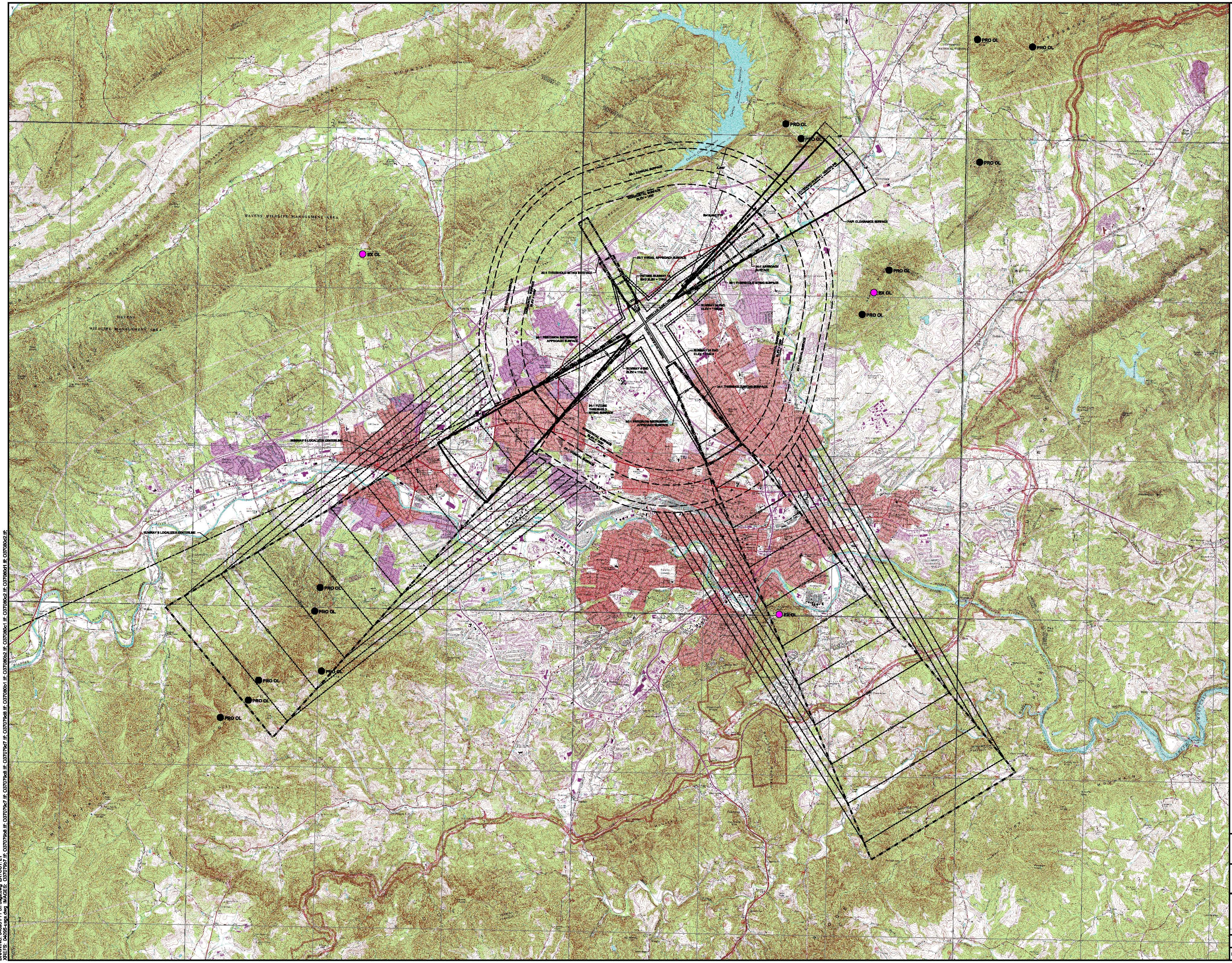

N

8 9 10 11

LEGEND

EX OL — EXISTING OBSTRUCTION LIGHT

PRO OL — PROPOSED OBSTRUCTION LIGHT

NOTE:

1. ELEVATIONS ARE GIVEN IN FEET ABOVE MEAN SEA LEVEL.

4000 0 4000 8000

SCALE: 1"=4000' FEET

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

PART 77 AIRSPACE SURFACES

ROANOKE REGIONAL AIRPORT ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	PJW	SCALE:	1"=4000'
CHECKED BY:	MWK	DATE:	FEBRUARY 2007

SHEET 7 OF 11

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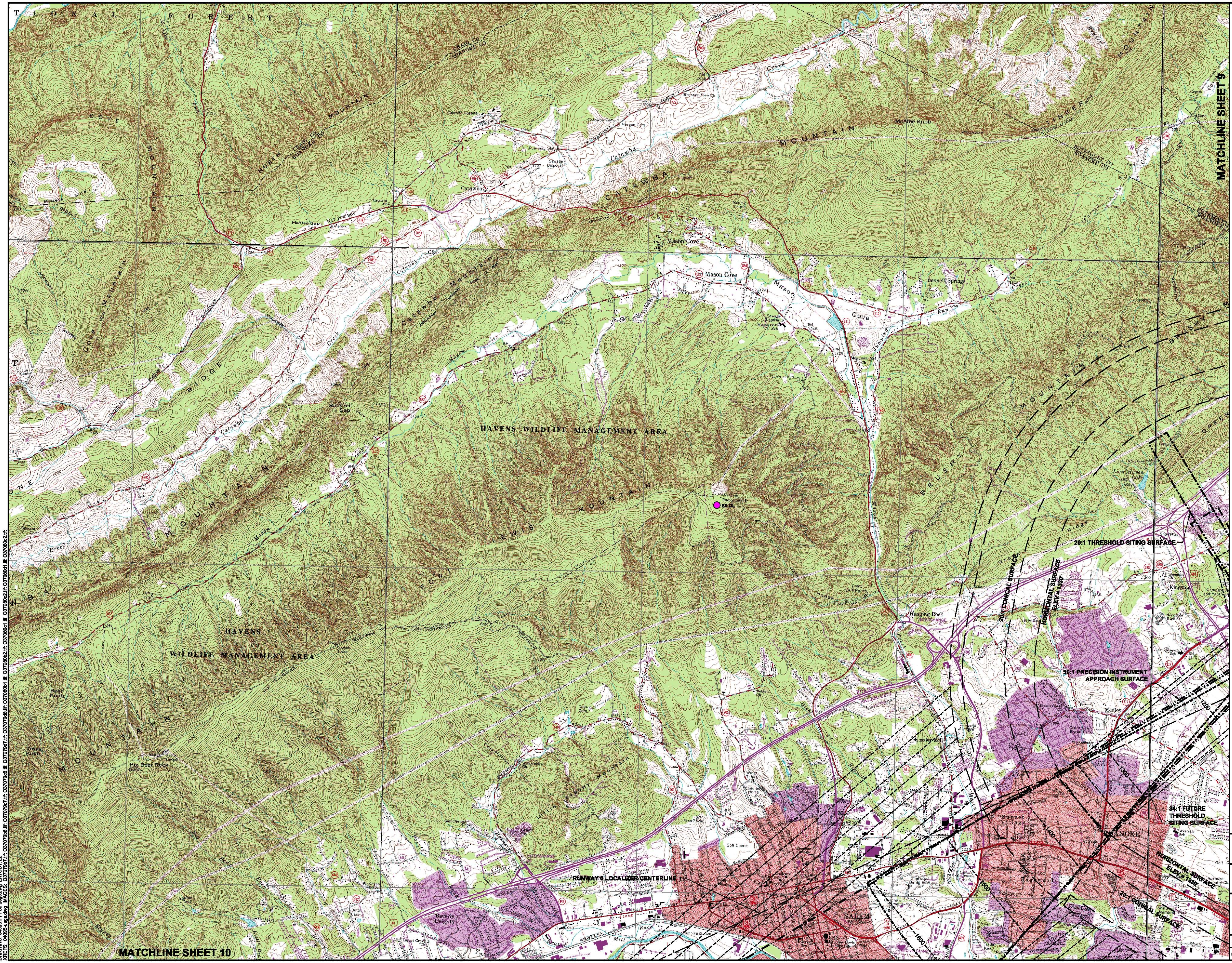

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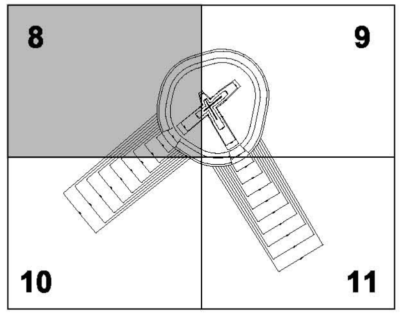

LEGEND

EX OL — EXISTING OBSTRUCTION LIGHT

PRO OL — PROPOSED OBSTRUCTION LIGHT

NOTE:

1. ELEVATIONS ARE GIVEN IN FEET ABOVE MEAN SEA LEVEL.

2000 0 2000 4000 FEET

SCALE: 1"=2000'

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

PART 77 AIRSPACE SURFACES

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
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DRAWN BY:	PJW	SCALE:	1"=2000'
CHECKED BY:	MWK	DATE:	FEBRUARY 2007

SHEET 8 OF 11

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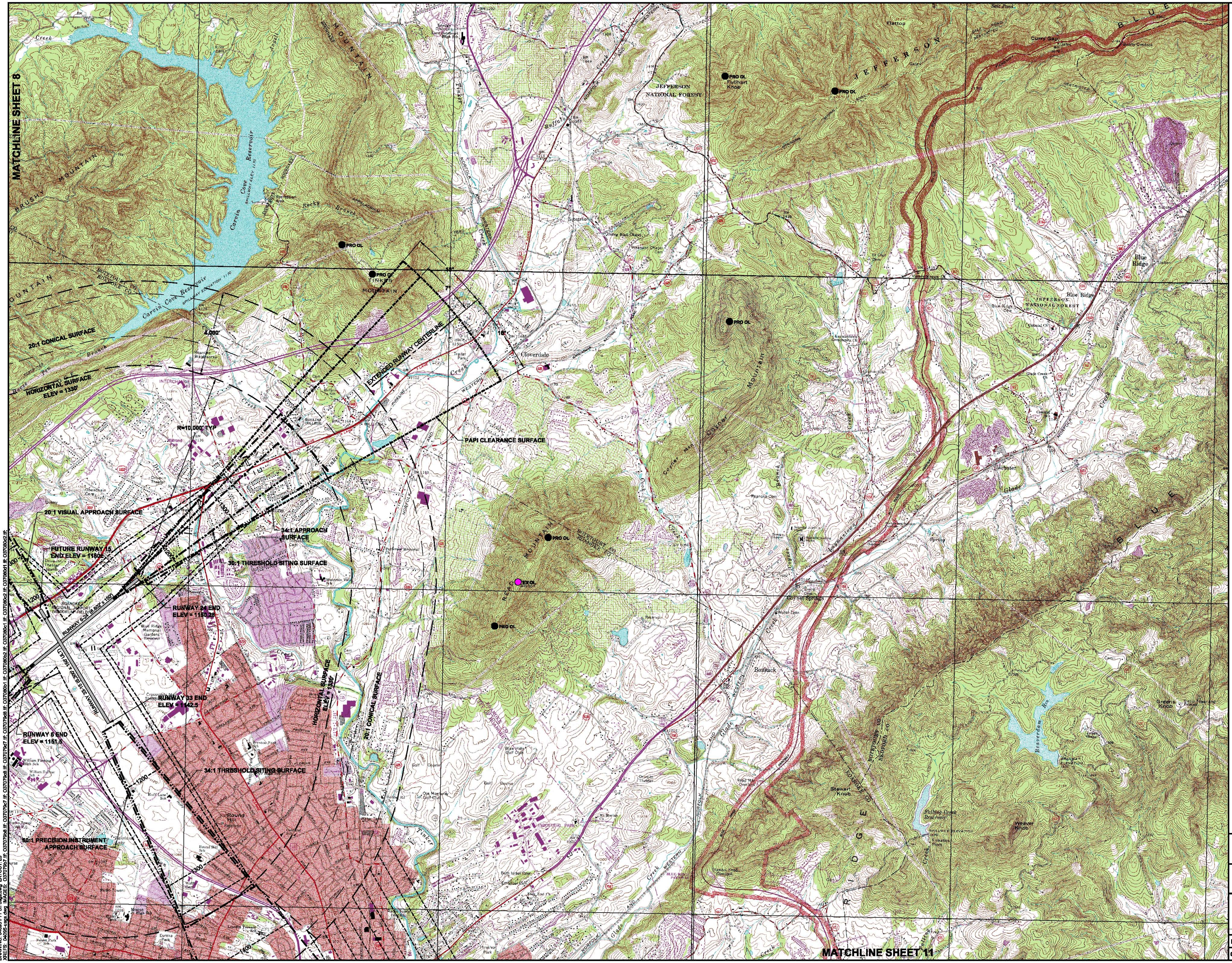

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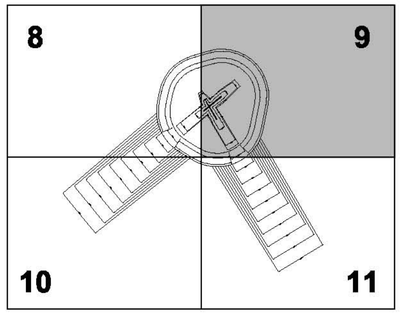


LEGEND

EX OL — EXISTING OBSTRUCTION LIGHT

PRO OL — PROPOSED OBSTRUCTION LIGHT

NOTE:

1. ELEVATIONS ARE GIVEN IN FEET ABOVE MEAN SEA LEVEL.

2000 0 2000 4000

SCALE: 1"=2000' FEET

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

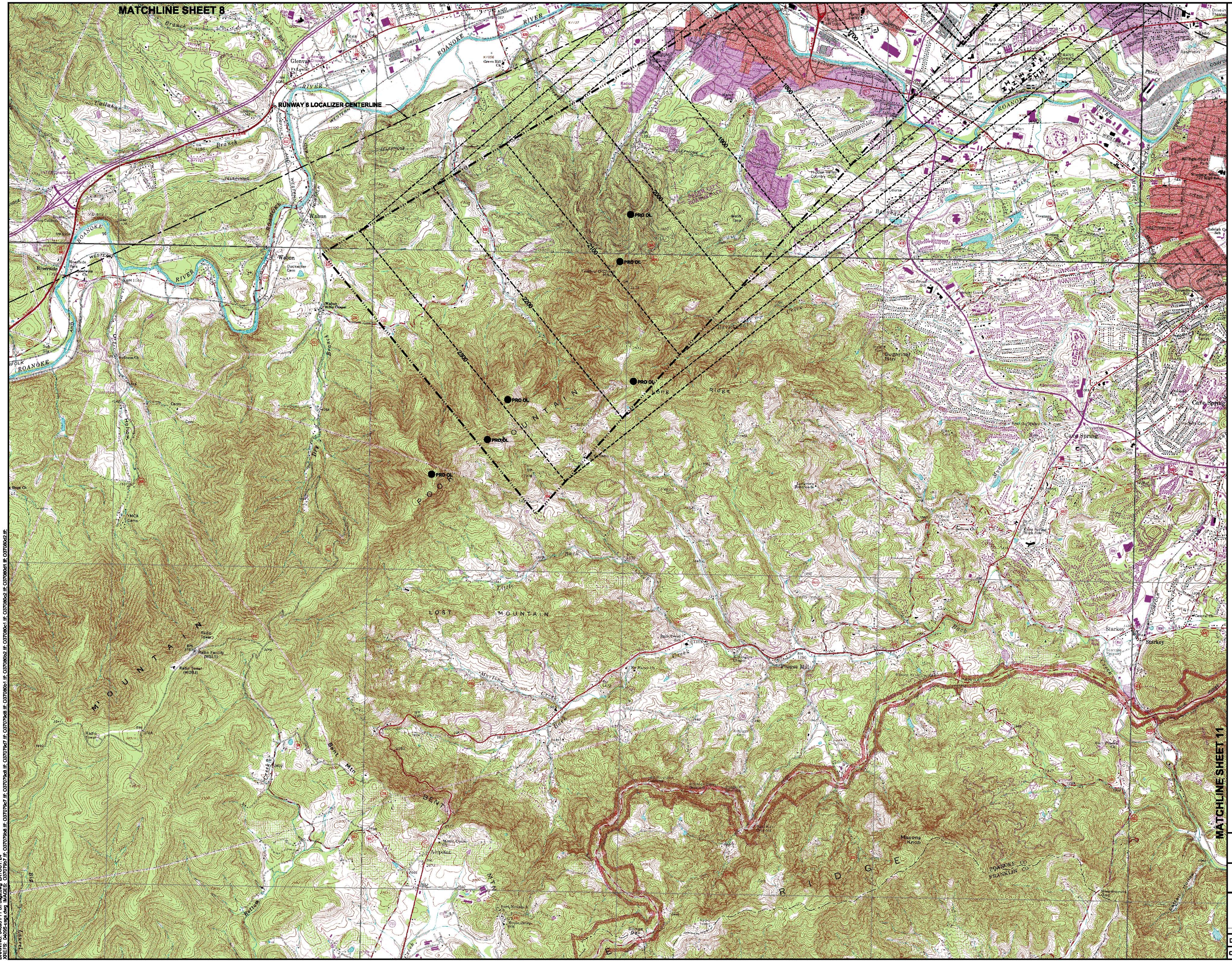
PART 77 AIRSPACE SURFACES

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	PJW	SCALE:	1"=2000'
CHECKED BY:	MWK	DATE:	FEBRUARY 2007

SHEET 9 OF 11



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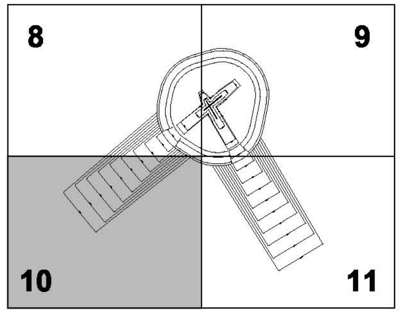

LEGEND

EX OL — EXISTING OBSTRUCTION LIGHT

PRO OL — PROPOSED OBSTRUCTION LIGHT

NOTE:

1. ELEVATIONS ARE GIVEN IN FEET ABOVE MEAN SEA LEVEL.

2000 0 2000 4000
SCALE: 1"=2000' FEET

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

PART 77 AIRSPACE SURFACES

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	PJW	SCALE:	1"=2000'	SHEET 10 OF 11
CHECKED BY:	MWK	DATE:	FEBRUARY 2007	

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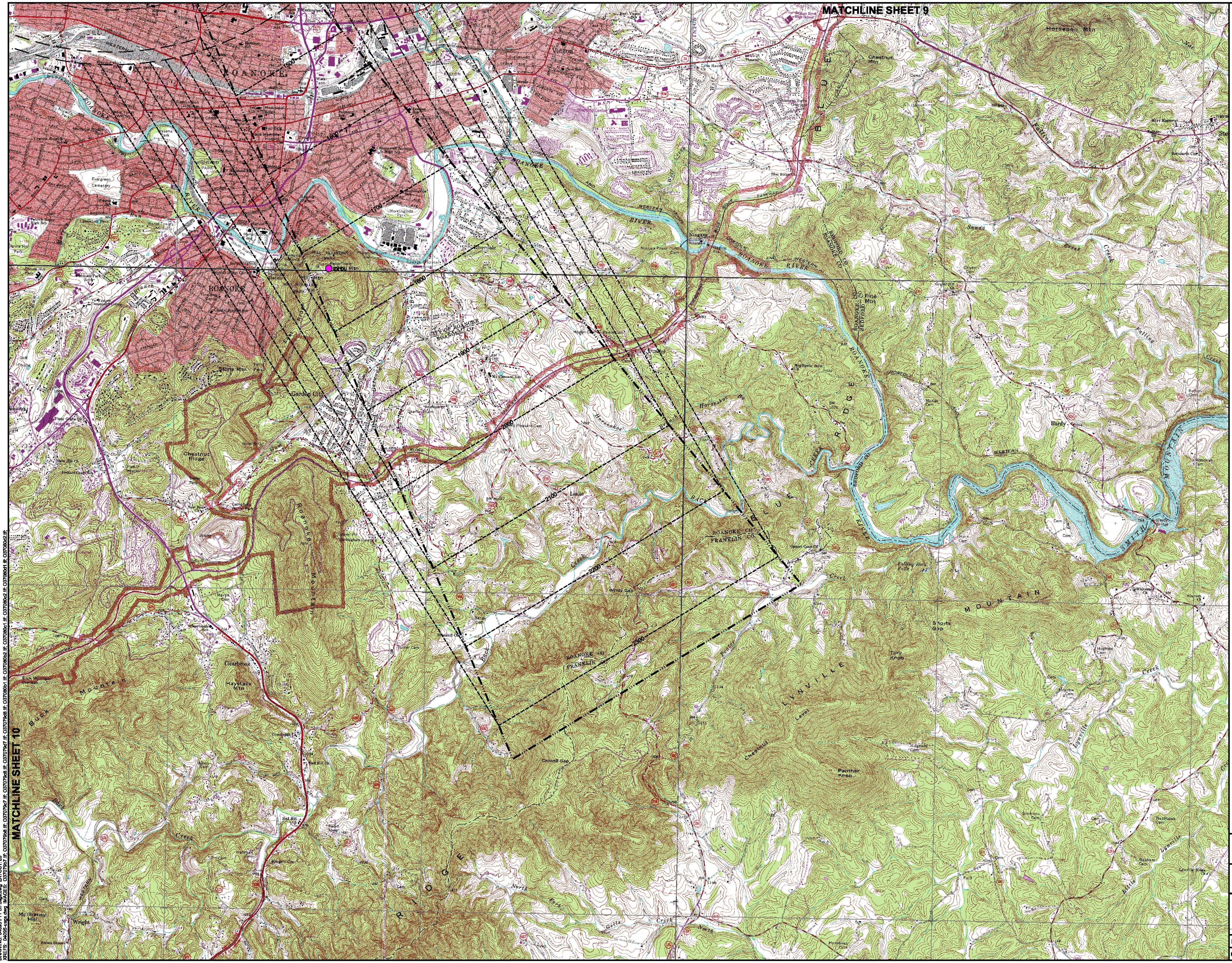

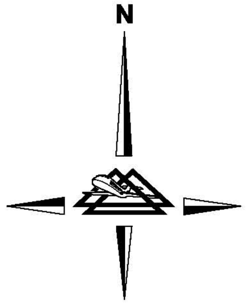

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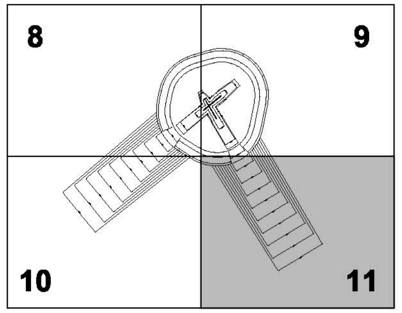

LEGEND

EX OL	EXISTING OBSTRUCTION LIGHT
PRO OL	PROPOSED OBSTRUCTION LIGHT

NOTE:

1. ELEVATIONS ARE GIVEN IN FEET ABOVE MEAN SEA LEVEL.

2000 0 2000 4000
SCALE: 1"=2000' FEET

PRELIMINARY - DO NOT USE FOR CONSTRUCTION

PART 77 AIRSPACE SURFACES

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	PJW	SCALE:	1"=2000'	SHEET 11
CHECKED BY:	MWK	DATE:	FEBRUARY 2007	OF 11

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APPENDIX "E"

06215

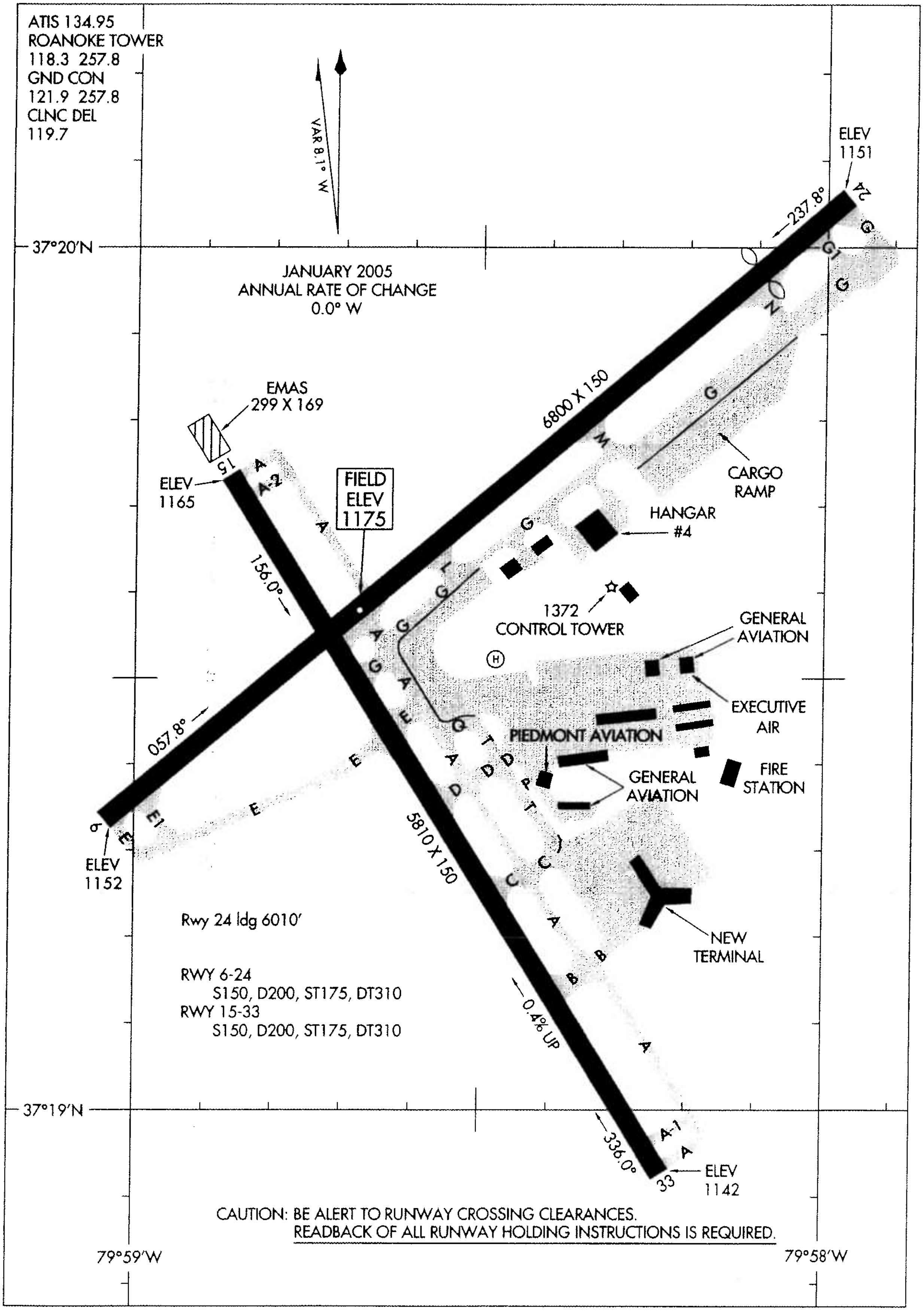
AIRPORT DIAGRAM

AL-349 (FAA)

ROANOKE REGIONAL/WOODRUM FIELD (ROA)

ROANOKE, VIRGINIA

NE-3, 18 JAN 2007 to 15 FEB 2007



NE-3, 18 JAN 2007 to 15 FEB 2007

AIRPORT DIAGRAM

ROANOKE, VIRGINIA

ROANOKE REGIONAL/WOODRUM FIELD (ROA)

06215

LOC I-ROA	APP CRS	Rwy ldg	5810
109.7	**334°**	TDZE	**1160**
		Apt Elev	**1176**

ILS RWY 33
ROANOKE REGIONAL/WOODRUM FIELD (ROA)

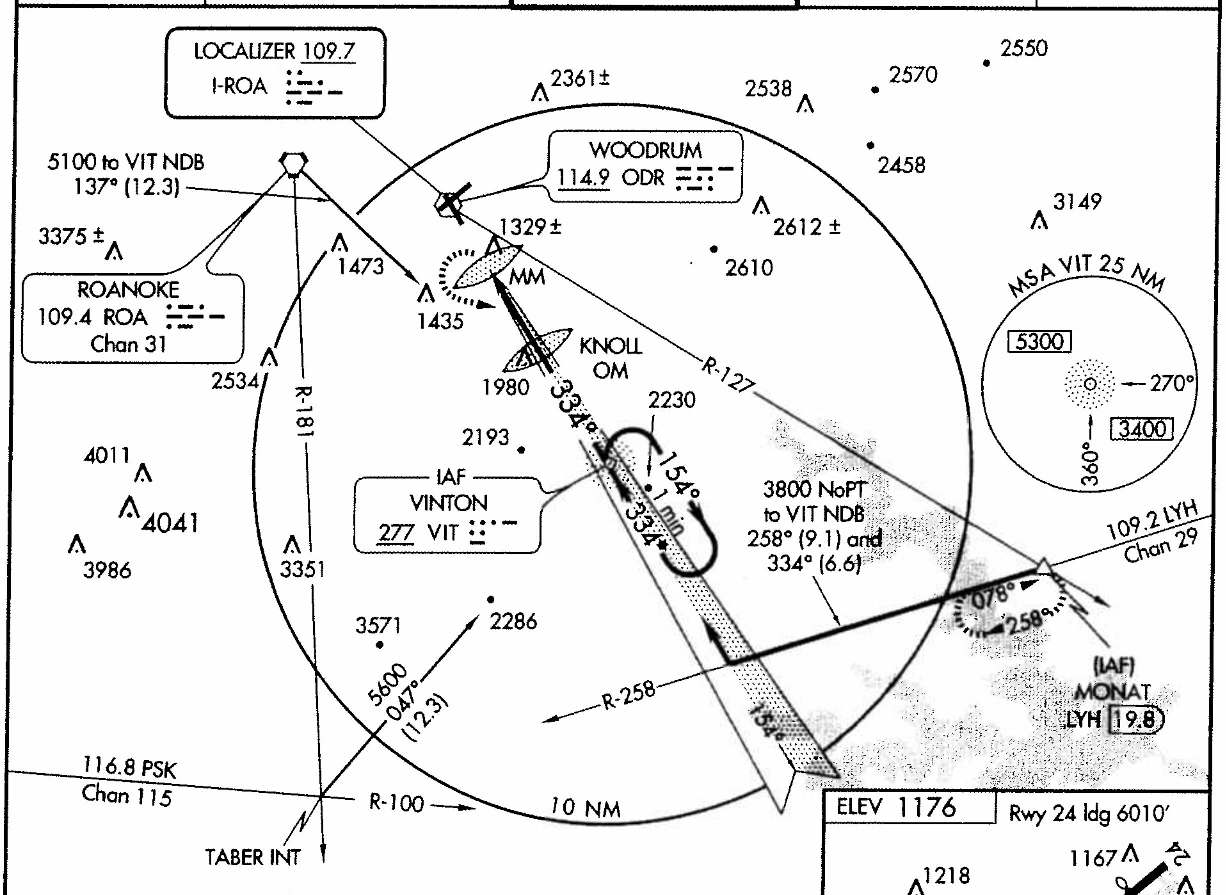
Circling NA northwest of Rwy 6-24. Circling to Rwy 15 is NA.
All CATs S-ILS-33 visibility increased ½ mile for inoperative MALSR. DH not increased for inoperative MM. Inoperative table does not apply to CATs A and B S-LOC-33. Mountainous terrain higher than airport in all quadrants.
*ADF required for S-LOC 33 minimums.

ASR

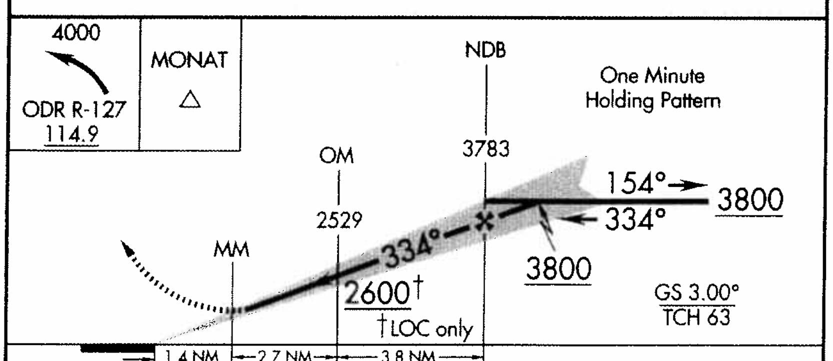
MALSR

MISSED APPROACH: Climbing left turn to 4000 via ODR R-127 to MONAT Int and hold.

ATIS	ROANOKE APP CON	ROANOKE TOWER	GND CON	CLNC DEL
134.95	**126.9 339.8**	**118.3 257.8**	**121.9 257.8**	**119.7**



NE-3, 18 JAN 2007 to 15 FEB 2007



REIL Rwys 6 and 24
HIRL Rwys 6-24 and 15-33

CATEGORY	A	B	C	D
S-ILS 33	1660-1¼ 500 (500-1¼)			1780-1½ 620 (700-1½)
S-LOC 33*	1940-1¼ 780 (800-1¼)		1940-1¾ 780 (800-1¾)	1940-2 780 (800-2)
CIRCLING	1940-1¾ 764 (800-1¾)		1940-2¼ 764 (800-2¼)	1940-2½ 764 (800-2½)

FAF to MAP 6.5 NM

Knots	60	90	120	150	180
Min:Sec	6:30	4:20	3:15	2:36	2:10

NE-3, 18 JAN 2007 to 15 FEB 2007

RNAV (GPS) RWY 6

ROANOKE REGIONAL/WOODRUM FIELD (ROA)

APP CRS	Rwy ldg	6800
070°	TDZE	1176
	Apt Elev	1176

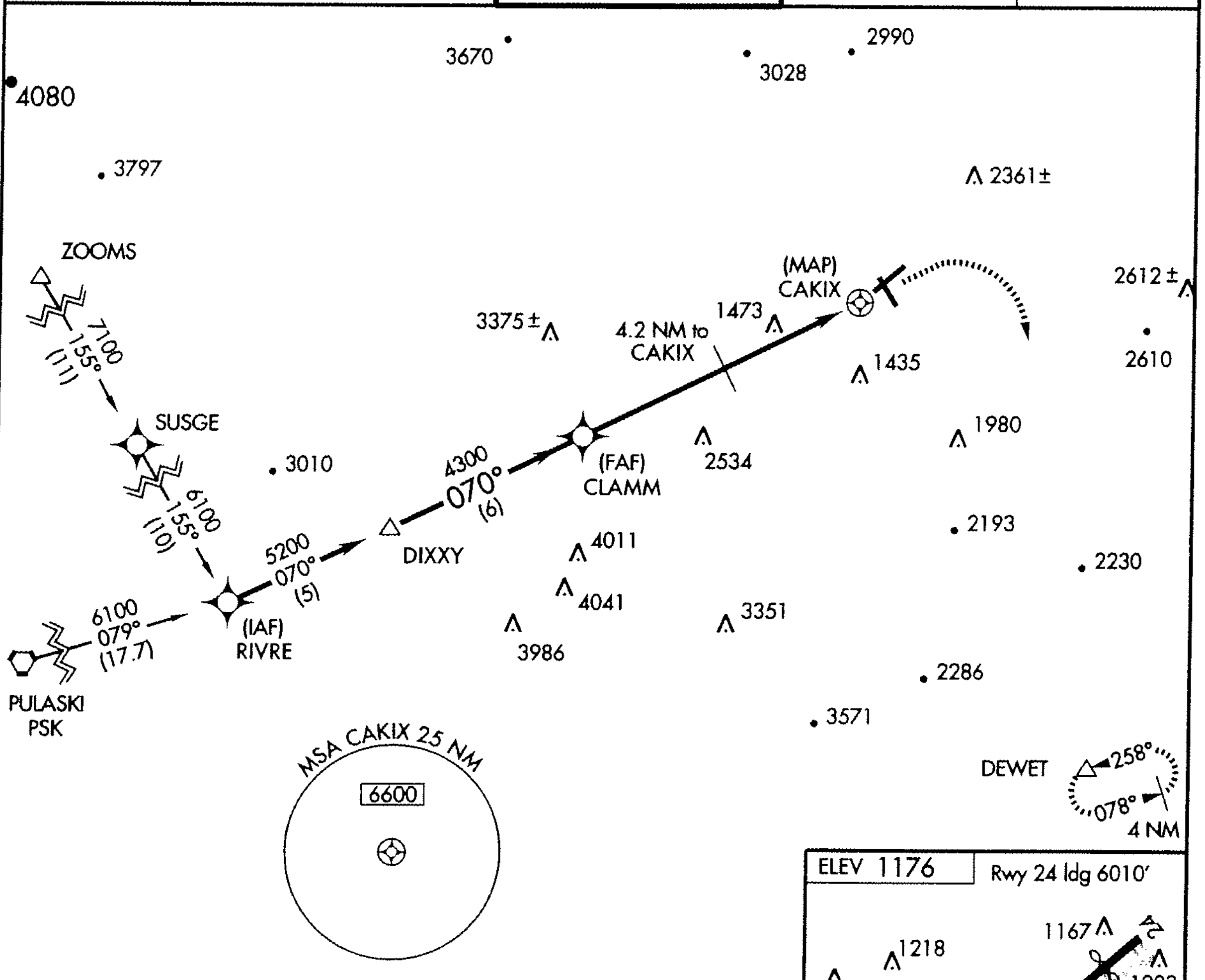
Circling to Rwy 15 is NA. Circling NA northwest Rwy 6-24.
NA ASR: For inoperative MALSR, increase LNAV MDA Cat A and B visibility to 1 mile. GPS or RNP-0.3 required. DME/DME RNP-0.3 NA.

MALSR

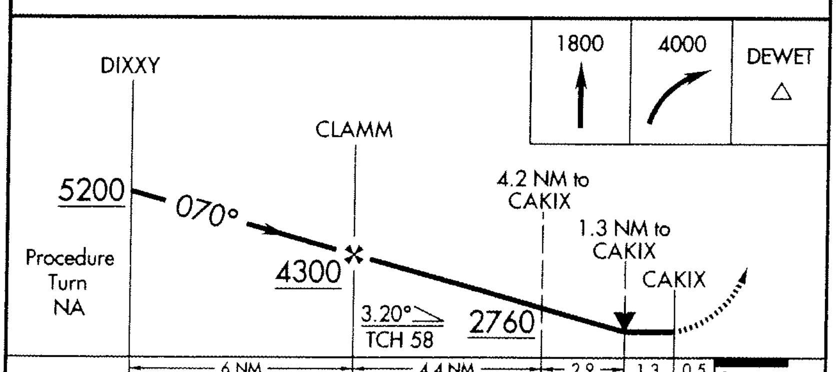
MISSED APPROACH: Climb to 1800, then climbing right turn to 4000 direct DEWET Int and hold.

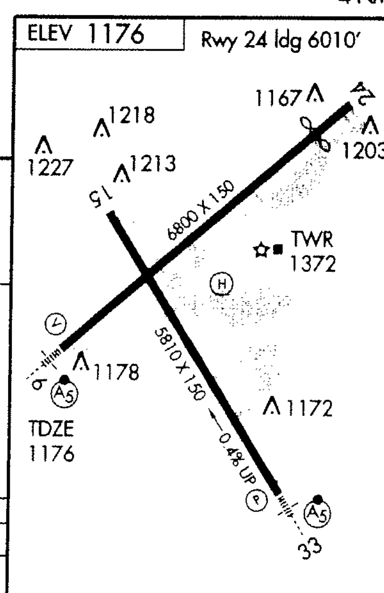
ATIS	ROANOKE APP CON	ROANOKE TOWER	GND CON	CLNC DEL
134.95	126.9 339.8	118.3 257.8	121.9 257.8	119.7

NE-3, 18 JAN 2007 to 15 FEB 2007



NE-3, 18 JAN 2007 to 15 FEB 2007





CATEGORY	A	B	C	D
LNAV MDA	1780-¾ 604 (700-¾)		1780-1¼ 604 (700-1¼)	1780-2 604 (700-2)
CIRCLING	1780-1 604 (700-1)		1780-1¾ 604 (700-1¾)	1840-2 664 (700-2)

REIL Rwys 6 and 24
HIRL Rwys 6-24 and 15-33

RNAV (GPS) RWY 33
ROANOKE REGIONAL/WOODRUM FIELD (ROA)

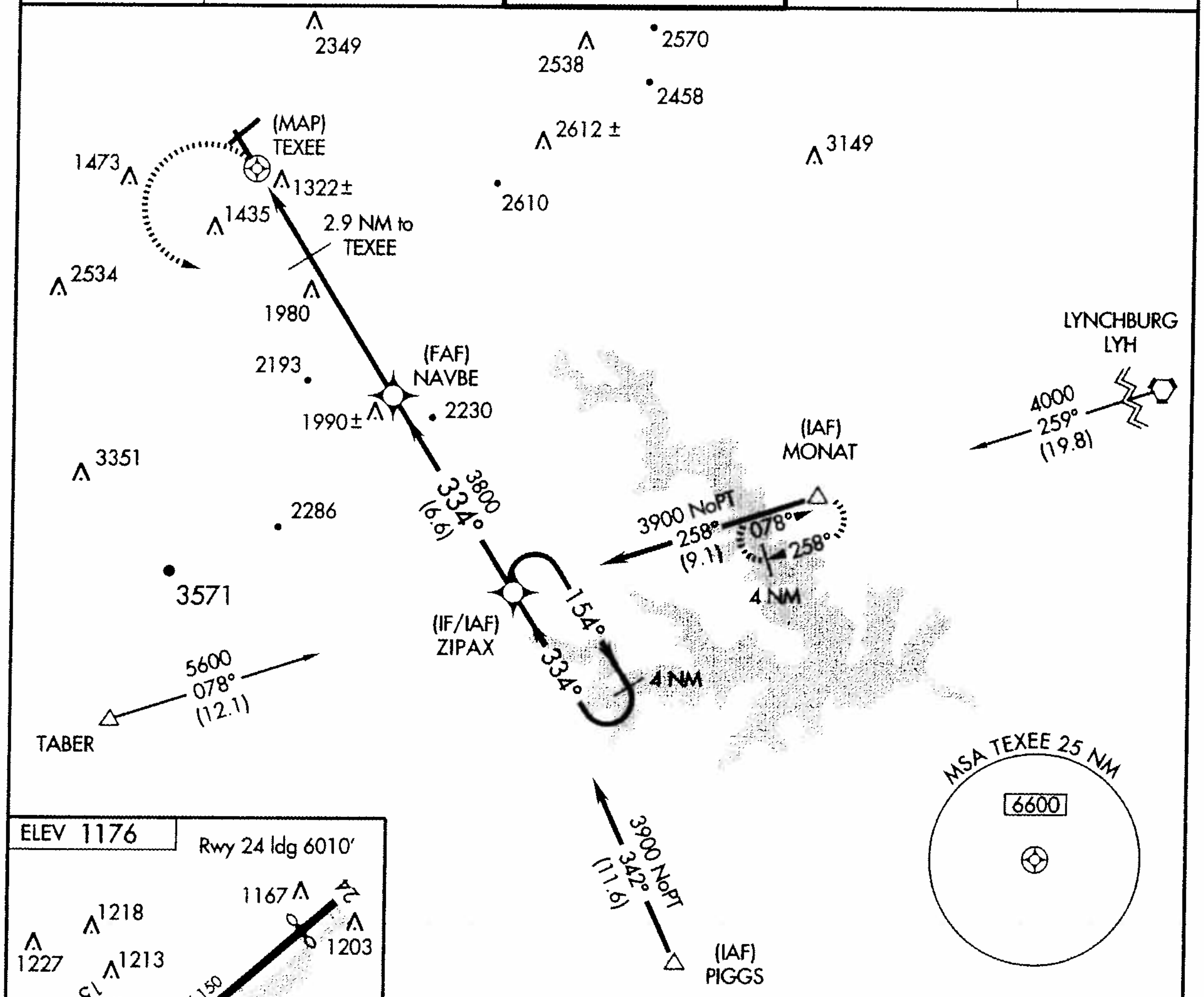
APP CRS		
334°	Rwy ldg	5800
	TDZE	1160
	Apt Elev	1176

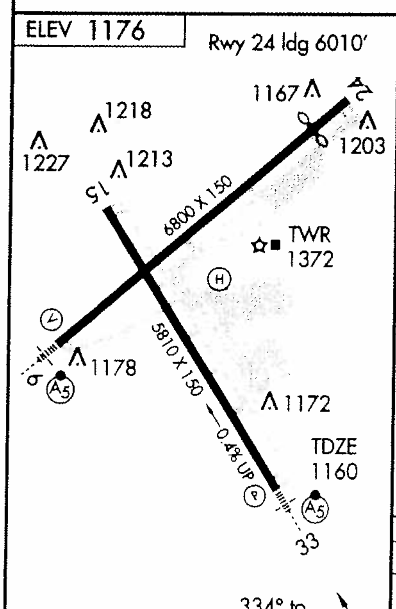
GPS or RNP-0.3 required. DME/DME RNP-0.3 NA.
NA ASR: For inoperative MALSR, increase LNAV MDA Cat D visibility to 1¼ miles. Circling NA NW of Rwy 6-24. Circling to Rwy 15 NA.

MALSR

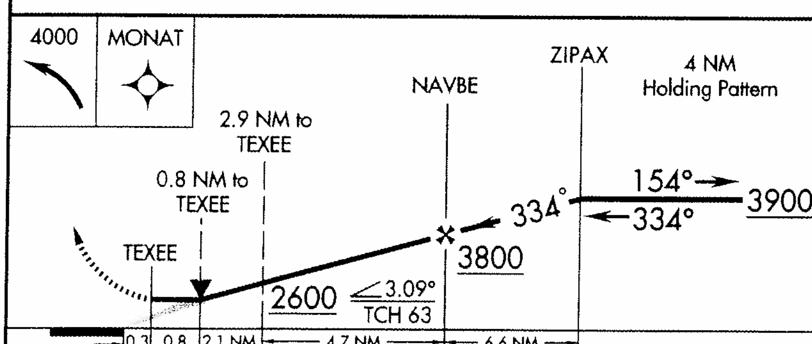
MISSED APPROACH: Climbing left turn to 4000 direct MONAT WP and hold.

ATIS	ROANOKE APP CON	ROANOKE TOWER	GND CON	CLNC DEL
134.95	126.9 339.8	118.3 257.8	121.9 257.8	119.7





REIL Rwys 6 and 24
HIRL Rwys 6-24 and 15-33



CATEGORY	A	B	C	D
LNAV MDA	1580-½ 420 (500-½)		1580-¾ 420 (500-¾)	1580-1 420 (500-1)
CIRCLING	1640-1 464 (500-1)		1700-1½ 524 (600-1½)	1840-2 664 (700-2)

NE-3, 18 JAN 2007 to 15 FEB 2007

NE-3, 18 JAN 2007 to 15 FEB 2007

LOC/DME I-SZK	APP CRS	Rwy ldg 6800
111.1 Chan **48**	**070°**	TDZE **1175** Apt Elev **1175**

LDA RWY 6
ROANOKE REGIONAL/WOODRUM FIELD (ROA)

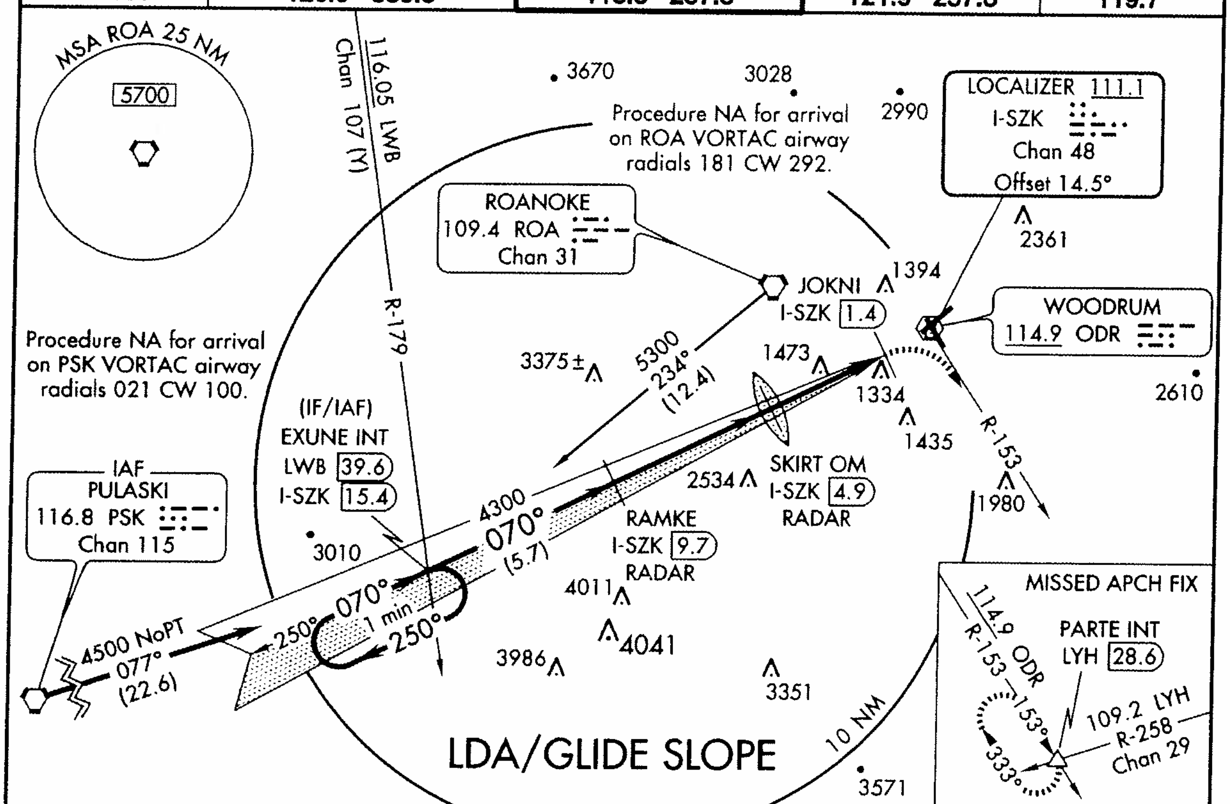
Circling NA NW of Rwy 6-24. Circling NA to Rwy 15. RADAR or DME REQUIRED. Inoperative table does not apply to S-LDA-6. SKIRT MINIMUMS: For inoperative MALSR increase S-LDA-6 Cats A and B to 1½ and Cat C visibility to 1¾. When VGSI inop, straight-in/circling Rwy 6 procedure NA at night.

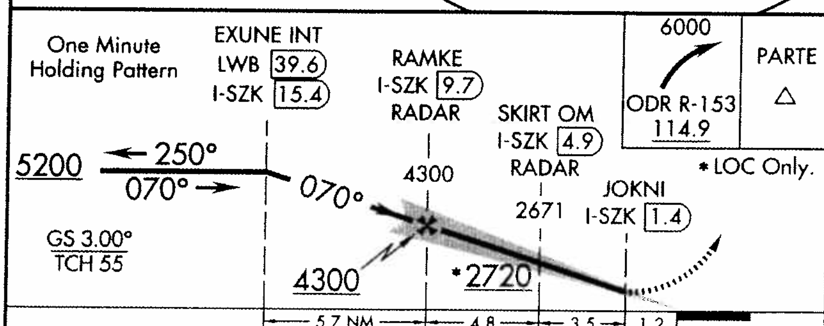
ASR

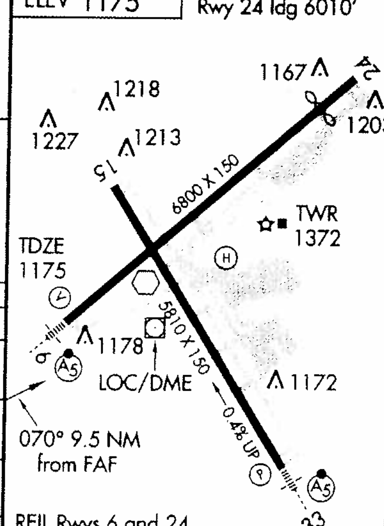
MALSR

MISSED APPROACH: Climbing right turn to 6000 via ODR R-153 to PARTE Int/LYH 28.6 DME and hold.

ATIS	ROANOKE APP CON	ROANOKE TOWER	GND CON	CLNC DEL
134.95	126.9 339.8	118.3 257.8	121.9 257.8	119.7







CATEGORY	A	B	C	D
S-LDA/GS 6	1580-1 405 (500-1)			
S-LDA 6	2720-1½ 1545 (1600-1½)		2720-3 1545 (1600-3)	
CIRCLING	2720-1½ 1545 (1600-1½)		2720-3 1545 (1600-3)	
SKIRT OM/DME/RADAR				
S-LDA 6	1780-1 605 (700-1)		1780-1¼ 605 (700-1¼)	1780-1½ 605 (700-1½)
CIRCLING	1780-1½ 605 (700-1½)		1780-1¾ 605 (700-1¾)	1780-2 605 (700-2)

FAF to MAP 8.3 NM

Knots	60	90	120	150	180
Min:Sec	8:18	5:32	4:09	3:19	2:46

NE-3, 18 JAN 2007 to 15 FEB 2007
NE-3, 18 JAN 2007 to 15 FEB 2007

VOR/DME-A
ROANOKE REGIONAL/WOODRUM FIELD (ROA)

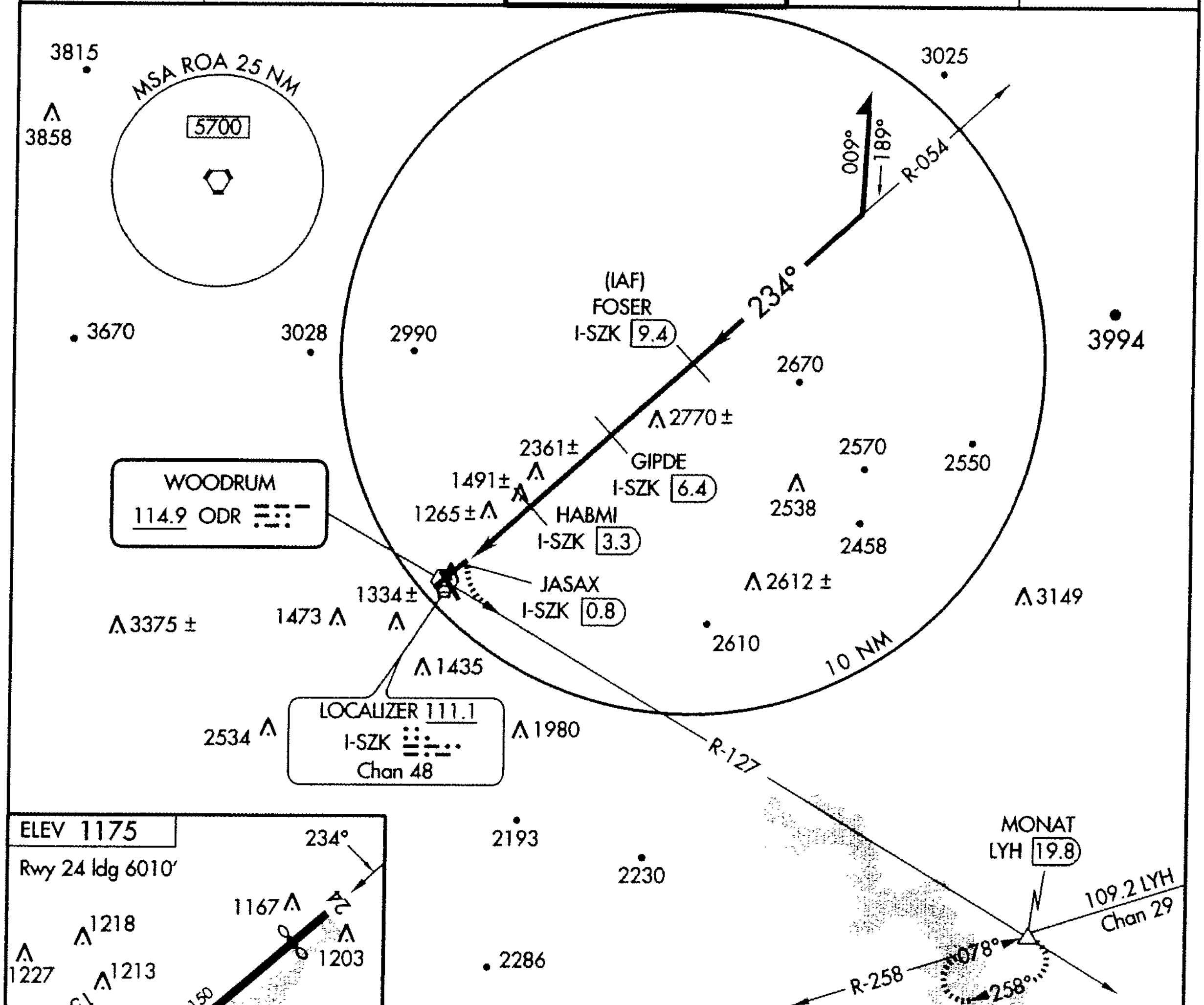
VOR ODR	APP CRS	Rwy ldg	N/A
114.9	234°	TDZE	N/A
		Apt Elev	1175

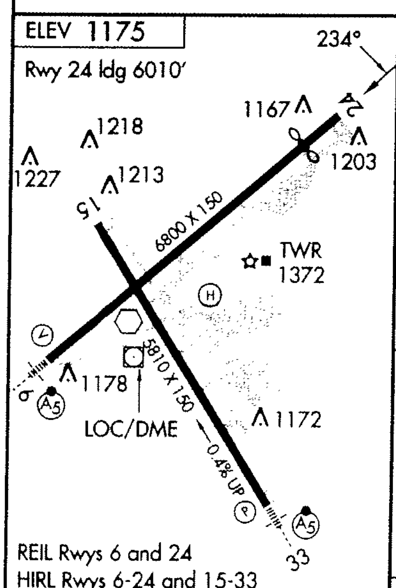
ASR — Simultaneous reception of ODR VOR and I-SZK DME required. DME from I-SZK LDA. Circling NA northwest of Rwy 6-24. Circling to Rwy 15 NA.

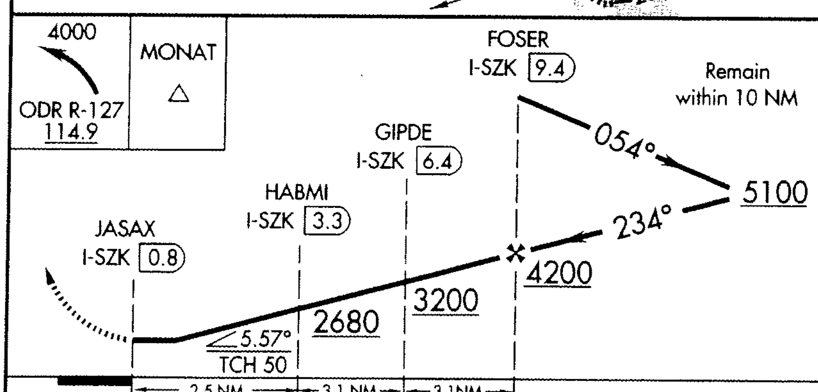
MISSED APPROACH: Climbing left turn to 4000 via ODR R-127 to MONAT Int/LYH 19.8 DME and hold.

ATIS	ROANOKE APP CON	ROANOKE TOWER	GND CON	CLNC DEL
134.95	126.9 339.8	118.3 257.8	121.9 257.8	119.7

NE-3, 18 JAN 2007 to 15 FEB 2007







Knots	60	90	120	150	180
Min:Sec					

CATEGORY	A	B	C	D
CIRCLING	1700-1 525 (600-1)		1700-1½ 525 (600-1½)	1780-2 605 (700-2)

NE-3, 18 JAN 2007 to 15 FEB 2007

VOR ODR	APP CRS	Rwy ldg 5810
114.9	333°	TDZE 1159 Apt Elev 1175

VOR/NDB RWY 33
ROANOKE REGIONAL/WOODRUM FIELD (ROA)

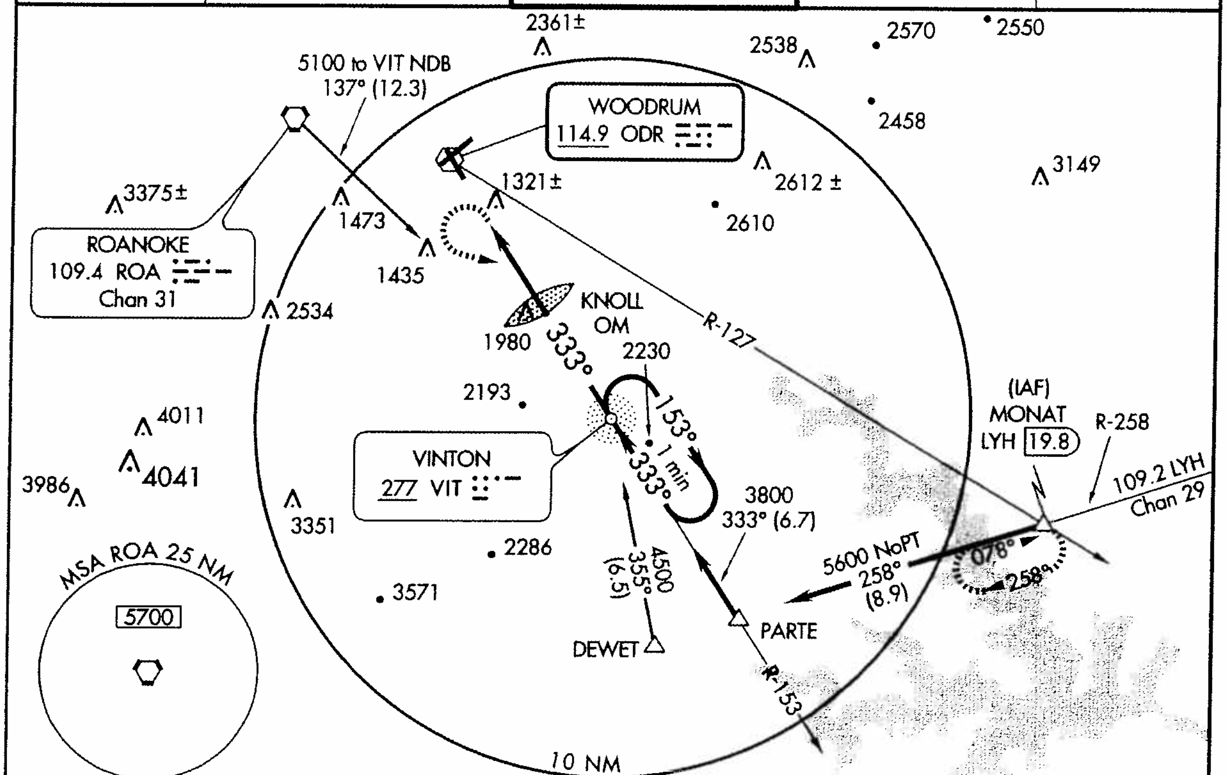
T A ASR

Circling NA Northwest of Rwy 6-24.
Circling to Rwy 15 NA.

MALSR (A5)

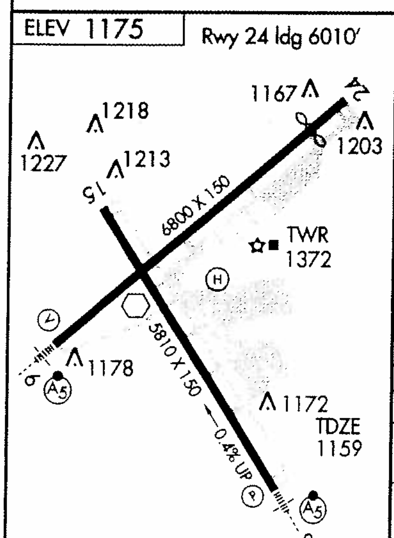
MISSED APPROACH: Climbing left turn to 4000 via ODR R-127 to MONAT Int/LYH 19.8 and hold.

ATIS	ROANOKE APP CON	ROANOKE TOWER	GND CON	CLNC DEL
134.95	126.9 339.8	118.3 257.8	121.9 257.8	119.7

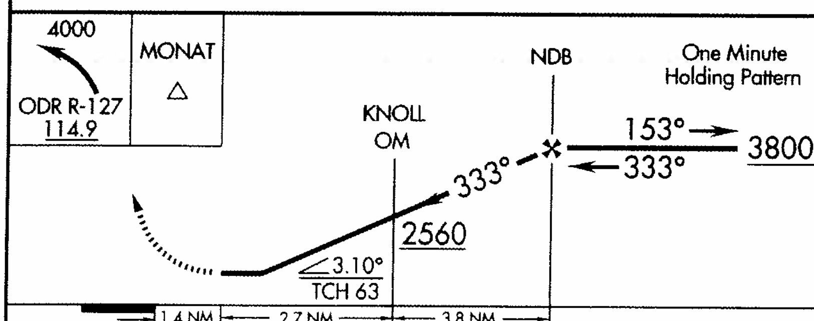


Procedure NA for arrival at PARTE on V470 Northeast bound and at DEWET on V258 Southeast bound.

NE-3, 18 JAN 2007 to 15 FEB 2007



REIL Rwys 6 and 24
HIRL Rwys 6-24 and 15-33



FAF to MAP 6.5 NM					
Knots	60	90	120	150	180
Min:Sec	6:30	4:20	3:15	2:36	2:10

CATEGORY	A	B	C	D
S-33	2560-1¼ 1401 (1400-1¼)		2560-2½ 1401 (1400-2½)	
CIRCLING	2560-1¾ 1385 (1400-1¾)		2560-3 1385 (1400-3)	
KNOLL OM MINIMA				
S-33	1700-1¼ 541 (600-1¼)			
CIRCLING	1700-1¾ 525 (600-1¾)			1780-2 605 (700-2)

APP CRS	Rwy ldg	6010
236°	TDZE	1170
	Apt Elev	1176

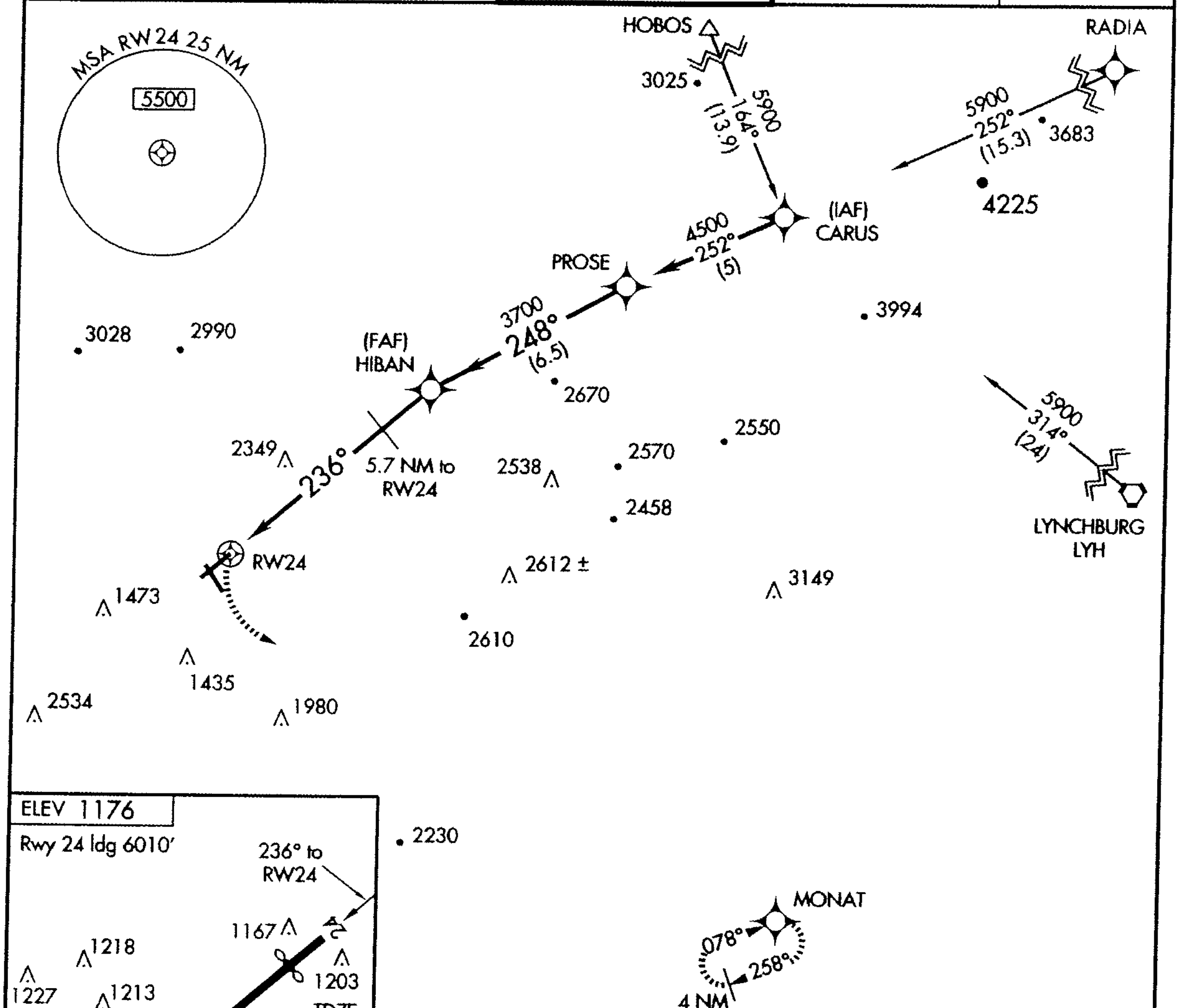
RNAV (GPS) RWY 24
ROANOKE REGIONAL/WOODRUM FIELD (ROA)

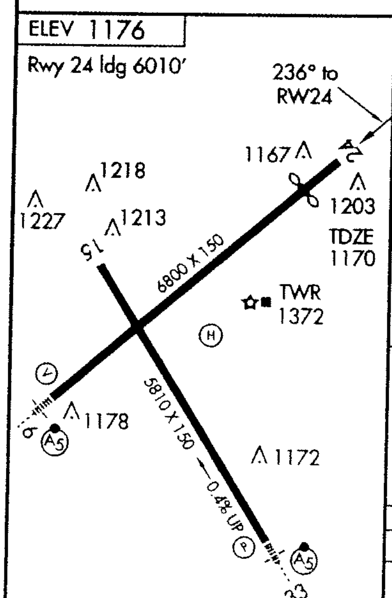
T
A NA
ASR

GPS or RNP-0.3 required. DME/DME RNP-0.3 NA.
Circling NA northwest of Rwy 6-24. Circling to Rwy 15 is NA.

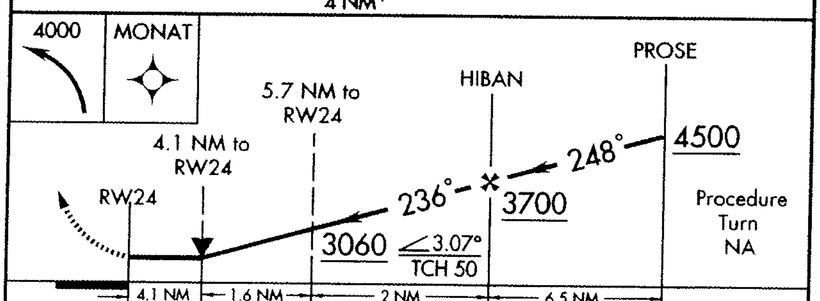
MISSED APPROACH: Climbing left turn to 4000 direct MONAT WP and hold.

ATIS	ROANOKE APP CON	ROANOKE TOWER	GND CON	CLNC DEL
134.95	126.9 339.8	118.3 257.8	121.9 257.8	119.7





REIL Rwys 6 and 24
HIRL Rwys 6-24 and 15-33



CATEGORY	A	B	C	D
LNAV MDA	2580-1¼ 1410 (1500-1¼)	2580-1½ 1410 (1500-1½)	2580-3 1410 (1500-3)	
CIRCLING	2580-1¼ 1404 (1500-1¼)	2580-1½ 1404 (1500-1½)	2580-3 1404 (1500-3)	

NE-3, 18 JAN 2007 to 15 FEB 2007

NAME	ALTERNATE MINIMUMS

LEESBURG, VA

LEESBURG EXECUTIVE .. **RNAV (GPS) Rwy 17**
LPV, Category D, 700-2.

LYNCHBURG, VA

LYNCHBURG REGIONAL/PRESTON GLENN FIELD .... **ILS Rwy 4**[1,2]
VOR/DME Rwy 22[3]
VOR or GPS Rwy 4[4,5]

[1]NA when control tower closed.
[2]ILS,Categories A,B, 900-2;Category C,900-2½, Category D, 900-2¾. LOC,Category C,900-2½, Category D, 900-2¾.
[3]Categories A,B, 900-2; Category C, 900-2½, Category D, 900-2¾.
[4]Category C, 900-2½; Category D, 900-2¾.
[5]NA when control zone not in effect except for operators with approved weather reporting service.

MANASSAS, VA

MANASSAS REGIONAL/HARRY P DAVIS FIELD .... **ILS Rwy 16L**
RNAV (GPS) Rwy 16L
NA when control tower closed.

MARION/WYTHEVILLE, VA

MOUNTAIN EMPIRE .... **RNAV (GPS) Rwy 26**
NA when local weather not available.
Category C, 800-2¼.

NEWPORT NEWS, VA

NEWPORT NEWS/WILLIAMSBURG INTL .... **ILS Rwy 7**
ILS or LOC Rwy 25
NA when control tower closed.

OCEAN CITY, MD

OCEAN CITY MUNI .... **RNAV (GPS) Rwy 2**[1]
VOR-A[2]
[1]NA when local weather not available.
[2]Categories A, B, 900-2; Category C, 900-2½; Category D, 900-2¾.

RICHLANDS, VA

TAZEWELL COUNTY .... **RNAV (GPS) Rwy 25**
NA when local weather not available.

NAME	ALTERNATE MINIMUMS

RICHMOND, VA

RICHMOND INTL .... **ILS Rwy 16**
ILS, Categories A,B, 900-2, Category C, 900-2¾, Category D, 900-3.
LOC, Categories A,B, 900-2, Category C, 900-2¾, Category D, 900-3.

RICHMOND/ASHLAND, VA

HANOVER COUNTY MUNI .... **VOR Rwy 16**
Category C, 800-2¼, Category D, 800-2½.

ROANOKE, VA

ROANOKE REGIONAL/WOODRUM FIELD .... **ILS Rwy 33**[1,2]
LDA Rwy 6[3]
VOR/NDB Rwy 33[4]

[1]ILS, Categories A,B, 800-2; Category C, 800-2½; Category D, 1400-3. LOC, Category C, 800-2½; Category D, 1400-3.
[2]NA when control tower closed.
[3]Categories A,B, 1600-2; Categories C,D, 1600-3.
[4]Categories A,B, 1400-2; Categories C,D, 1400-3.

SALISBURY, MD

SALISBURY-OCEAN CITY WICOMICO REGIONAL .... **VOR Rwy 23**
Category D, 800-2¼.

STAUNTON-WAYNESBORO-HARRISONBURG, VA

SHENANDOAH VALLEY REGIONAL .... **ILS Rwy 5**
NDB or GPS Rwy 5
NA when control zone not in effect.

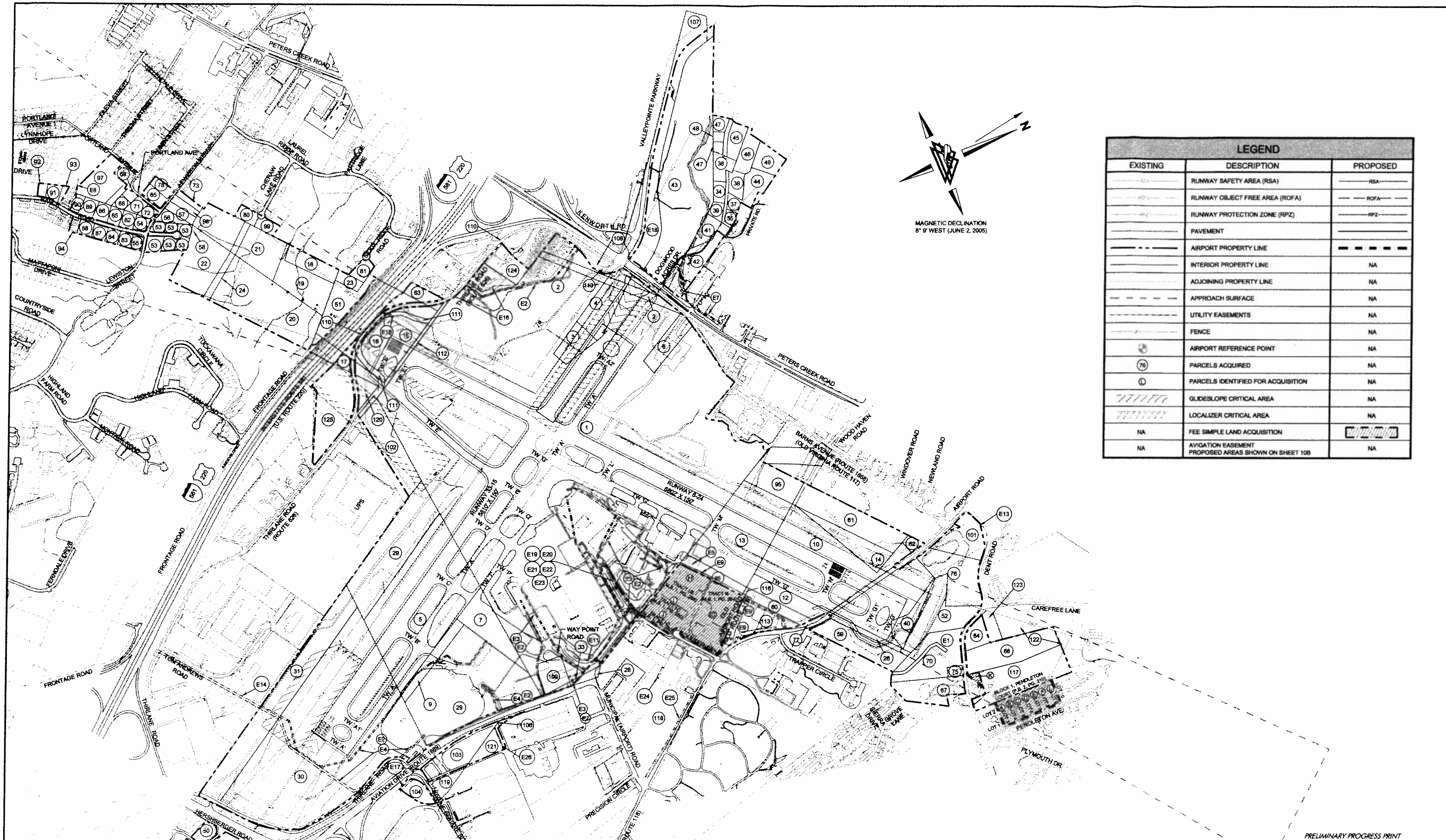
SUFFOLK, VA

SUFFOLK EXECUTIVE .... **RNAV (GPS) Rwy 4**
RNAV (GPS) Rwy 7
NA when local weather not available.

WALLOPS ISLAND, VA

WALLOPS FLIGHT FACILITY .... **VOR/DME or TACAN Rwy 10**
Categories A,B, 900-2; Category C, 900-2½; Category D, 900-2¾.

APPENDIX “F”



LEGEND

EXISTING	DESCRIPTION	PROPOSED
	RUNWAY SAFETY AREA (RSA)	RSA
	RUNWAY OBJECT FREE AREA (ROFA)	ROFA
	RUNWAY PROTECTION ZONE (RPZ)	RPZ
	PAVEMENT	
	AIRPORT PROPERTY LINE	
	INTERIOR PROPERTY LINE	NA
	ADJOINING PROPERTY LINE	NA
	APPROACH SURFACE	NA
	UTILITY EASEMENTS	NA
	FENCE	NA
	AIRPORT REFERENCE POINT	NA
76	PARCELS ACQUIRED	NA
L	PARCELS IDENTIFIED FOR ACQUISITION	NA
	GLIDESLOPE CRITICAL AREA	NA
	LOCALIZER CRITICAL AREA	NA
NA	FEE SIMPLE LAND ACQUISITION	
NA	AVIGATION EASEMENT PROPOSED AREAS SHOWN ON SHEET 10B	NA

PRELIMINARY PROGRESS PRINT
DO NOT USE FOR CONSTRUCTION

AIRPORT PROPERTY MAP

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

EXHIBIT **10A**

DRAWN BY:	RWW/MLH	SCALE:	1" = 500'
CHECKED BY:	MJD	DATE:	JULY 2005

NO.	REVISIONS	BY	APP.	DATE

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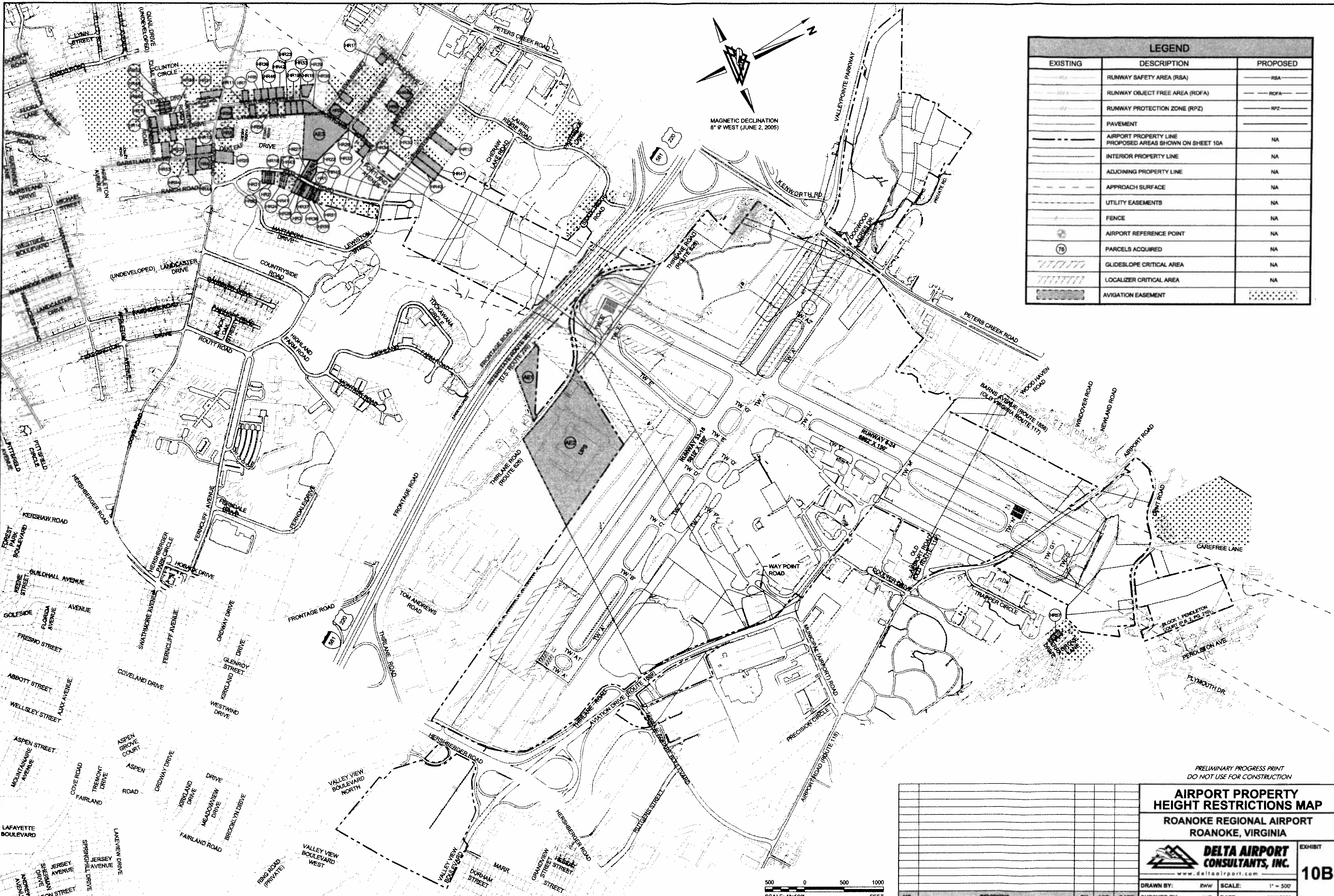

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PROPERTY TRANSACTIONS AT ROANOKE REGIONAL AIRPORT

FEE SIMPLE ACQUISITIONS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	DATE	DEED BOOK PAGE NO.	ACREAGE PARCEL	ACREAGE TOTAL	REMARKS
1	F	A.A. CANNADAY ESTATE	D	7-13-34	224, 540	319.36	319.36	#1363 - D
2	F	VALLEY R.R. CO.	D	11-10-39	271, 216	3.25	322.61	OLD R.R. EASEMENT
3	F	JOHN W. SNYDER	D	09-20-40	278, 315	3.00	325.61	#3316
4	F	WILKERSON, ET. AL.	D	09-20-40	279, 380	6.00	331.61	#3316
5	F	ROANOKE ORCHARD CO. INC.	D	10-28-40	279, 485	23.56	355.17	#3316 - 1
6	F	K. G. & ETHEL SWAIN	D	05-01-42	279, 230	3.41	358.58	#3316 - D
7	F	ROANOKE ORCHARD CO. INC.	D	09-19-44	316, 75	4.97	363.55	#3316 - 1
8		INTENTIONALLY LEFT BLANK					363.55	
9	F	ROANOKE ORCHARD CO. INC.	D	04-15-48	390, 290	1.865	365.415	#3316 - 1
10	F	LYLE CLAY & JAMES W. BUSHONG	D	07-30-54	510, 556	34.372	399.787	#4066
11		INTENTIONALLY LEFT BLANK					399.787	
12	F	BESSIE INEZ NININGER, ET. AL.	D	06-15-56	554, 519	7.666	407.453	#4066 - 3
13	F	MARY ELVA COULTER	D	07-03-56	566, 231	19.853	427.306	#4066 - 1
14	F	DANIEL H. SHEPERD	D	07-03-56	555, 452	3.732	431.038	#4066 - 2
15	F	STELLA FEAZELL	D	09-25-57	582, 587	5.41	436.448	#4240 - A
16	F	J.H. GARST	D	09-30-57	584, 171	16.76	453.208	#4240 - B
17	F	J.H. GARST	D	09-30-57	584, 171	2.54	455.748	#4240 - C
18	F	ROY C. GARST, ET. UX.	D	09-30-57	584, 171	1.56	457.308	#4240 - E
19	F	FLOYD R. MASON, ET. UX.	D	09-30-57	584, 171	5.09	462.398	#4240 - F
20	F	ROY C. KINSEY, ET. UX.	D	09-30-57	584, 171	18.76	481.158	#4240 - G
21	F	ROY C. KINSEY, ET. UX.	D	09-30-57	584, 171	9.37	490.528	#4240 - G1
22	F	M. S. HUDGIN, ET. UX.	D	09-30-57	584, 171	6.23	496.758	#4240 - H
23	F	HILDA L. McGRADY	D	10-02-57	582, 596	0.61	497.368	#4240 - D
24	F	ROY C. KINSEY, ET. UX.	D	11-01-57	584, 171	1.16	498.528	#4240 - G 50' EASEMENT
25		INTENTIONALLY LEFT BLANK					498.528	
26	F	BESSIE I. NININGER (HEIRS)	D	03-25-58	594, 377	0.12, 0.48	499.128	#4284 - B 0.12 AC. DEDICATED FOR ROUTE 118
27		INTENTIONALLY LEFT BLANK					499.128	
28	F	COULTER	D	03-06-62	686, 373	0.0667	499.195	#4066 0.0667 AC. DEDICATED FOR RIGHT OF WAY
29	F	ROANOKE ORCHARD CO. INC.	D	01-09-64	733, 132	34.29,12.58	546.065	#4738 - 2 0.52 AC. DEDICATED FOR PROPOSED ROAD
30	F	J.B. ANDREWS (HEIRS)	D	03-06-64	737, 91	92.31	638.375	#4738 - 3A
31	F	J.B. ANDREWS (HEIRS)	D	03-06-64	737, 91	17.45	655.825	#4738 - 5
32		INTENTIONALLY LEFT BLANK					655.825	
33	F	ASSOCIATED TRANSPORT INC.	D	06-09-64	745, 248	2.98	658.805	#4738 - 1 2.52 AC. DEDICATED FOR PROPOSED ROAD
34	F	WILLIAM E. & GROCER MILLS	D	01-14-65	761, 473	0.53	659.335	FAAP-C615 PARCEL
35	F	JOSEPH C. & MARGARET R. BROWN	D	04-20-65	768, 559	0.525	659.860	FAAP-C615 PARCEL B
36	F	BILLY N. & PHYLLIS T. WITT	D	06-01-65	773, 44	1.11, 0.56	661.530	FAAP-C615 PARCEL C
37	F	STERLING W. & NANCY M. WINN	D	07-06-65	776, 143	1.142	662.672	FAAP-C615 PARCEL E
38	F	CHARLES E. & LOIS C. CARTER	D	10-13-65	786, 124	1.09	663.762	FAAP-C615 PARCEL D
39	F	MARGARETTE T. SYNDER	D	10-19-65	787, 173	0.61	664.372	FAAP-C615 PARCEL F
40	F	PRESTON R. PAYNE	D	04-04-66	796, 407	2.63	667.002	FAAP-C616 PARCEL
41	F	HERMAN E. & KATHLEEN L. MAXWELL	D	04-20-66	800, 31	1.45	668.452	FAAP-C615 PARCEL G
42	F	ROBERT L. & LOTTIE S. HAWKINS	D	10-04-66	813, 360	4.4	672.852	FAAP-C615 PARCEL A
43	F	CHURCH OF GOD TRUSTEES	D	10-17-66	814, 539	44.70	717.552	FAAP-C616 PARCEL
44	F	MARION E. & CARRIE C. LYON	D	06-29-67	838, 295	1.536	719.088	FAAP-C615 PARCEL H
45	F	ROBERT W. COOPER	D	11-13-67	846, 380	2.079	721.167	FAAP-C615 PARCEL J
46	F	DELLA W. DOWNING	D	11-13-67	847, 405	2.38	723.547	FAPP-C615 PARCEL K
47	F	ANNIE E. POINDEXTER ESTATE	D	11-20-67	846, 515	0.94, 0.37	724.857	FAAP-C615 PARCEL M
48	F	EMILY L. SMITH	D	11-20-67	847, 409	0.46	725.317	FAAP-C615 PARCEL N
49	F	LINCOLN D. & MARY F. BARRETT	D	12-04-67	846, 520	2.37	727.687	FAAP-C615 PARCEL L
50	F	FIRST NATIONAL EXCHANGE BANK, ET. AL.	D	02-12-68	1232, 75	52.63	780.317	FAAP-C616 A,B, 6.32 AC. TO VDH&T, 1.67 AC. TO STREET
51	W	COMMONWEALTH OF VIRGINIA	D	05-07-68	871, 036	-7.43	772.887	ROUTE 581 RIGHT OF WAY #4728
52	F	PRESTON R. PAYNE ESTATE	D	03-12-69	871, 777	7.84	780.727	#5160
53	F	BUILDERS INVESTMENT GROUP	D	05-19-77	1401, 800	3.55	784.277	ADAP-07 PARCEL
54	F	BUILDERS INVESTMENT GROUP	D	05-19-77	1401, 800	0.560	784.837	ADAP-07 PARCEL
55	F	BUILDERS INVESTMENT GROUP	D	05-19-77	1401, 800	0.620	785.457	ADAP-07 PARCEL
56	F	SAMUEL MOORE, ET. UX.	D	07-20-77	1406, 12	0.530	785.987	ADAP-07 PARCEL
57	F	SAMUEL MOORE, ET. UX.	D	07-20-77	1406, 12	0.800	786.787	ADAP-07 PARCEL
58	F	BUILDERS INVESTMENT GROUP	D	02-10-78	1425, 257	0.153	786.940	ADAP-07 PARCEL
59	F	BESSIE I. NININGER	D	11-14-79	1448, 1465	5.084	792.024	ADAP-08 PARCEL F
60	F	McDOWALL & WOOD INC.	D	12-14-79	1449, 722	2.213	794.237	ADAP-08 PARCEL B
61	F	JESSE N. & MARY H. JONES	D	04-01-80	1450, 1305	6.421	800.658	ADAP-08 PARCEL C
62	F	CHARLES H. BURTON	D	05-01-80	1453, 1077	0.96	801.618	ADAP-08 PARCEL D
63	F	J.M. RAMSEY, J.E. GUYNN & J.B. MARSHALL	D	10-01-80	1452, 989	2.54	804.158	ADAP-08 PARCEL E
64	F	WINGFIELD & MARSHALL	D	02-02-82	1181, 897	2.02	806.178	ADAP-09 PARCEL 2
65	F	TED G. SHINAULT, ET. UX.	D	02-08-82	1474, 138	0.830	807.008	ADAP-12 PARCEL P NOISE
66	F	WILLIAM E. GATES	D	03-02-82	1181, 1067	7.55	814.558	AIP-03 PARCEL 3 NOISE
67	F	RALPH E. AYERS	D	03-11-82	1181, 1418	6.0	820.558	AIP-03 PARCEL 1 NOISE
68	F	HOMER E. WADE, ET UX.	D	03-25-82	1475, 315	0.480	821.038	ADAP-12 PARCEL M NOISE
69	F	HOMER E. WADE, ET. UX.	D	03-25-82	1475, 315	0.520	821.558	ADAP-12 PARCEL N NOISE
70	F	KESSLER'S	D	03-27-82	1183, 826	7.80	829.358	ADAP-13 PARCEL 5
71	F	S.D. WITHERS, ET. UX.	D	05-17-82	1476, 1250	0.540	829.898	ADAP-12 PARCEL O NOISE
72	F	S.D. WITHERS, ET. UX.	D	05-17-82	1476, 1250	0.660	830.558	ADAP-12 PARCEL O NOISE
73	F	DORIS S. CUNDIFF	D	05-18-82	1476, 1218	0.750	831.308	ADAP-12 PARCEL Q NOISE
74		INTENTIONALLY LEFT BLANK					831.308	
75	F	NORMA LETSON ESTATES	D	06-10-82	1185, 841	0.66	831.968	AIP-03 PARCEL 2 NOISE
76	F	FRIENDSHIP MANOR APT. VILLAGE	D	10-12-82	1480, 1523	8.644	840.612	ADAP-13 PARCEL 4
77	F	McDOWALL & WOOD INC.	D	11-01-82	1481, 596	0.024	840.636	
78	F	CLIFFORD E. SMITH, ET. UX.	D	11-09-82	1481, 1158	0.820	841.456	ADAP-12 PARCEL Y NOISE
79		INTENTIONALLY LEFT BLANK					841.456	
80	F	WILLIE H. ENGLISH, ET. UX.	D	12-21-82	1482, 1704	0.930	842.386	ADAP-12 NOISE
81	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.980	843.366	ADAP-12 NOISE
82	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.550	843.916	ADAP-12 PARCEL G NOISE
83	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.570	844.486	ADAP-12 NOISE
84	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.520	845.006	ADAP-12 PARCEL NOISE
85	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.520	845.526	ADAP-12 PARCEL F NOISE
86	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.520	846.046	ADAP-12 PARCEL E NOISE
87	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.520	846.566	ADAP-12 PARCEL NOISE
88	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.520	847.086	ADAP-12 PARCEL NOISE
89	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.520	847.606	ADAP-12 PARCEL D NOISE
90	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.500	848.106	ADAP-12 PARCEL NOISE
91	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.740	848.846	ADAP-12 PARCEL NOISE
92	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.560	849.406	ADAP-12 PARCEL NOISE
93	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.057	849.463	ADAP-12 PARCEL NOISE

FEE SIMPLE ACQUISITIONS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	DATE	DEED BOOK PAGE NO.	ACREAGE PARCEL	ACREAGE TOTAL	REMARKS
94	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.140	849.603	ADAP-12 PARCEL NOISE
95	F	MARY ELVA COULTER	D	01-10-83	1483, 914	3.05, 2.288	854.941	ADAP-08 PARCEL A-1,A-2
96		INTENTIONALLY LEFT BLANK					854.941	
97	F	J. WILEY SHEPARD, ET. UX.	D	02-07-83	1484, 484	4.823	859.764	ADAP-12 PARCEL NOISE
98	F	HOWARD J. SIZEMORE, ET. UX.	D	06-16-83	1488, 1814	0.750	860.514	ADAP-12 PARCEL R NOISE
99	F	LEE C. HARTMAN SR., ET. UX.	D	08-23-83	1492, 66	0.790	861.304	ADAP-12 PARCEL NOISE
100		INTENTIONALLY LEFT BLANK					861.304	
101	F	WILLIAM H. PRICE (BARN DINNER THEATRE)	D	11-14-85	1528, 1437	2.95	864.254	AIP 3-51-0045-06
102	F	ROANOKE COUNTY BOARD OF SUPERVISORS	D	08-08-86	1587, 294	8.0	872.254	AIP 3-51-0045-06
103	F	CITY OF ROANOKE	D	06-30-87	1564, 668	6.989	879.243	AIP 3-51-0045-06
104	F	CITY OF ROANOKE	D	06-30-87	1564, 668	1.578	880.821	AIP 3-51-0045-06
105		INTENTIONALLY LEFT BLANK						INTENTIONALLY LEFT BLANK
106	F	CALVIN W. & MARY C. POWERS	D	09-06-89	1611, 525	0.20	881.021	AIP-3-51-0045-06
107	W	ROANOKE COUNTY	D	01-16-89	M.B. 1290, 789	-7.9	873.121	PROPERTY RELEASE FOR RIGHT-OF-WAY
108	T	PUBLIC RIGHT-OF-WAY	D	01-24-90	M.B. 1, 921	-0.631	872.490	PROPERTY RELEASE FOR RIGHT-OF-WAY
109	F	CITY OF ROANOKE	D	07-08-05	050010650, 365	2.670	875.160	FIRE STATION
110	T	PUBLIC RIGHT-OF-WAY	SD	05-11-90	M.B.1,948-950	-1.845	873.315	PROPERTY RELEASE FOR RIGHT-OF-WAY
111	F	PUBLIC RIGHT-OF-WAY	SD	05-11-90	M.B.1,948-950	1.648	874.963	ABANDONED PUBLIC RIGHT-OF-WAY
112	F	PUBLIC RIGHT-OF-WAY	SD	06-02-87	M.B.1,618-628	0.595	875.558	ABANDONED PUBLIC RIGHT-OF-WAY
113	F	P & H AFFILIATED PARTNERSHIP	D	11-18-93	1698, 1492	4.045	879.603	AIP 3-51-0045-10
114	F	CITY OF ROANOKE	D	08-23-91	1644, 1017	0.502	880.105	ADJOINING E. I-581 R/W, 1.3 MI. S. OF HERSHBERGER
115	F	CITY OF ROANOKE	D	08-15-94	1454, 1966	0.23	880.335	S. SIDE OF ROUTE 11 5.8 MI. W. OF SALEM POST OFFICE
116	F	COMMONWEALTH OF VIRGINIA	D	02-10-97	1786, 344	0.110	880.445	PORTION OF OLD RTE. 118
117	F	CHARLES H. & MARY S. BURTON	D	12-22-86	1252, 3	10.12	890.565	
118	F	MURRAY K. COULTER ESTATE	D	09-24-01	INST. 10014123	11.902	902.467	WILL SEEK AIP REIMBURSEMENT
119	T	WAL-MART PROPERTIES, INC.	D	05-03-02	020010269, 361	-1.802	900.665	RELINQUISHED FOR ACQUISITION OF #121
120	F	B.T. PROPERTY, LLC	D	07-12-02	020012852, 358	1.055	901.720	AIP-3-51-0045-026
121	F	SAM'S REAL ESTATE BUSINESS TRUST	D	05-03-02	020010269, 361	1.441	903.161	ACQUIRED FOR RELINQUISHMENT OF #119
122	F	FRIENDSHIP MANOR APARTMENT VILLAGES TRUST	D	02-12-02	200204548, 22	2.389	905.550	WILL SEEK AIP REIMBURSEMENT
123	F	FRIENDSHIP MANOR APARTMENT VILLAGES TRUST	D	02-12-02	200204548, 22	1.182	906.732	WILL SEEK AIP REIMBURSEMENT
124	F	DOROTHY F. LACKEY	D	09-05-03	030017415, 332	2.711	909.443	
125	F	B. T. PROPERTY, LLC	D	05-07-04	040007520, 365	8.450	917.893	AIP-3-51-0045-031

UTILITY AND LANDSCAPE EASEMENTS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	DATE	DEED BOOK PAGE NO.	REMARKS
E1	T	ROANOKE BUSINESS CONDOMINIUMS	E	08-30-88	1586, 1534	PRIVATE 35' STORM DRAIN EASEMENT
E2	T	CITY OF ROANOKE	E	05-12-88	M.B. 1, 899	VARIOUS WATER, SANITARY & STORM DRAIN EASEMENTS
E3	T	CITY OF ROANOKE	E	06-04-90	1632, 1204	SANITARY SEWER & WATER LINE EASEMENT
E4	T	CITY OF ROANOKE	E	06-06-90	1632, 1207	SANITARY SEWER, WATER LINE & STORM DRAIN EASEMENTS
E5	T	APPALACHIAN POWER COMPANY	E	02-24-95	1744, 1825	EASEMENT FOR UNDERGROUND & OVERHEAD ELECTRIC LINES
E6	F	HERSCH ASSOCIATES & SHAKERS RESTAURANT	E	12-18-95	1762, 370	30' ACCESS EASEMENT
E7	T	BILLY H. BRANCH & MICHAEL M. BRANCH	E	05-08-96	1510, 74	STORM DRAIN EASEMENT
E8	T	GARY L. & DIANE E. JOHNS	E	12-29-99	980014794, 292	SANITARY SEWER EASEMENT
E9	T	CITY OF ROANOKE	E	12-29-99	000000018, 74	WATER LINE EASEMENT
		INTENTIONALLY LEFT BLANK				
E11	T	APPALACHIAN POWER COMPANY	E	01-14-98	980008676, 34	EASEMENT FOR UNDERGROUND & OVERHEAD ELECTRIC LINES
		INTENTIONALLY LEFT BLANK				
E13	T	APPALACHIAN POWER COMPANY	E	04-05-89	N/A	ELECTRIC LINE EASEMENT
E14	F	J.B. ANDREWS (HEIRS)	E	03-06-64	737, 91	DRAINAGE EASEMENT
		INTENTIONALLY LEFT BLANK				
E16	T	CITY OF ROANOKE	E	05-11-90	M.B. 1, 948-950	DRAINAGE EASEMENT
E17	T	CITY OF ROANOKE	E	03-16-87	M.B. 1, 589	DRAINAGE EASEMENT
E18	T	ROANOKE COUNTY BOARD OF SUPERVISORS	E	08-06-88	M.B. 1290, 789	LANDSCAPE EASEMENT (P.B. 11, PG 121)
E19	T	VERIZON VIRGINIA, INC.	E	04-25-01	010007512, 1	15' COMMUNICATION EASEMENT
E20	T	APPALACHIAN POWER COMPANY	E	05-21-01	010007399, 443	15' ELECTRIC EASEMENT
E21	T	ROANOKE GAS COMPANY	E	04-24-01	010008977, 136	10' GAS EASEMENT
E22	T	CITY OF ROANOKE	E	06-01-01	010008953, 245	15' SEWER EASEMENT
E23	T	CITY OF ROANOKE	E	06-01-01	010008954, 254	15' WATERLINE EASEMENT
E24	T	CITY OF ROANOKE	E	10-22-79	M.B. 1, 264	20' DRAINAGE EASEMENT
E25	T	CITY OF ROANOKE	E	02-25-77	M.B. 1, 243	15' PUBLIC UTILITY EASEMENT
E26	T	CITY OF ROANOKE	E	03-16-87	M.B. 1, 591	20' PUBLIC UTILITY EASEMENT

FUTURE PROPERTY ACQUISITIONS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	DATE	DEED BOOK PAGE NO.	ACREAGE	REMARKS
A	PENDING	FRANK N. PERKINSON, JR. ET AL	PENDING		1310, 693	0.66	PENDING
B	PENDING	FRANK N. PERKINSON, JR. ET AL	PENDING		1310, 693	0.66	PENDING
C	PENDING	RONALD L. FERGUSON, ET UX	PENDING		1166, 314	0.66	PENDING
D	PENDING	DAVID L. DECK, ET UX	PENDING		1336, 199	0.66	PENDING
E	PENDING	STEPHEN E. & RUTH M. LUCIA	PENDING		2, 210	0.66	PENDING
F	PENDING	STEPHEN E. & RUTH M. LUCIA	PENDING		2, 210	0.66	PENDING
G	PENDING	MOORE INVESTMENT CORP.	PENDING		1665, 837	7.97	PENDING
H	PENDING	INDUSTRIAL DEVEL. AUTH. CITY OF ROANOKE	PENDING		1471, 379	4.066	PENDING
I	PENDING	FIRST VIRGINIA BANKS, INC.	PENDING		1550, 1099	2.127	PENDING
J	PENDING	FIRST VIRGINIA BANKS, INC.	PENDING		1550, 1099	1.963	PENDING
K	PENDING	GILBERT E. TWILLY, ET UX	PENDING		1091, 335	1.00	PENDING
L	PENDING	EDWARD S. & RUTH B. HOPKINS	PENDING		1091, 335	0.66	PENDING

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AIRPORT PROPERTY MAP TRANSACTION CHARTS

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

EXHIBIT **11A**

DRAWN BY:	RWW	SCALE:	1" = 500'
CHECKED BY:	MJD	DATE:	JULY 2005

PROPERTY TRANSACTIONS AT ROANOKE REGIONAL AIRPORT

AVIGATIONAL EASEMENTS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	DATE	DEED BOOK PAGE NO.	REMARKS
AE1	F	JERRY H. GARST (B. T. PROPERTIES, LLC)	E	10-21-80	1460, PG 485	AVIGATIONAL AIR EASEMENT
AE2	F	COVA CORPORATION (UPS FACILITY)	E	02-26-90	1619, PG 249	CLEAR ZONE AND ADJACENT TRANSITION ZONE EASEMENT
AE3	F	GARY L. & DIANE E. JOHNS	E	09-30-98	980014793, PG 285	AVIGATIONAL AND HAZARD EASEMENT

HEIGHT RESTRICTIONS EASEMENTS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	DATE	DEED BOOK PAGE NO.	ADDRESS	TAX MAP NO.	REMARKS
HR1	F	TURNER, JERINE	E	5-4-04	50006911, 436	2319 RANCH RD., NW	6431110	NOISE EASEMENT
HR2	F	GETGOOD, CALVERT D. & NORMA A.	E	7-7-04	40011234, 228	2223 RANCH RD. NW	6431123	NOISE EASEMENT
HR3	F	HOLLAND, WILLIAM M., JR.	E	7-7-04	40011255, 234	2307 RANCH RD. NW	6431114	NOISE EASEMENT
HR4	F	FICKENS, SUSAN	E	7-7-04	40011236, 240	2217 GARSTLAND DR., NW	6400615	NOISE EASEMENT
HR5	F	HASH, MARVIN P L. & EDITH R.	E	7-7-04	40011234, 246	2506 PORTLAND AV NW	6420701	NOISE EASEMENT
HR6	F	GATES, LONN W. & DOROTHY H.	E	8-12-04	40045585, 162	2340 PORTLAND AVE. NW	6410128	NOISE EASEMENT
HR7	F	COX, RICHARD L. & VICTORIA L.	E	8-12-04	40043566, 168	2326 PORTLAND AVE. NW	6410130	NOISE EASEMENT
HR8	F	MOSER, TYREE I., JR., & CHERYL D.	E	8-12-04	40043567, 174	4323 COVE RD. NW	6410219	NOISE EASEMENT
HR9	F	WATSON, JAMES G.	E	8-12-04	40013568, 180	4436 BEN STREET NW	6420610	NOISE EASEMENT
HR10	F	CLAYBORNE, JOHN & MARY	E	9-28-04	40016497, 386	2218 GARSTLAND DR. NW	6400312	NOISE EASEMENT
HR11	F	LEMOINE, JOHANN HENRI & DORIT S.	E	10-28-04	40018120, 126	2331 PORTLAND AVE. NW	6410208	NOISE EASEMENT
HR12	F	GARREN, E. LA VERNE	E	10-28-04	40018121, 130	4456 LEWISTON ST. NW	6421124	NOISE EASEMENT
HR13	F	LOGAN, JAMES & HELEN	E	11-4-04	40048662, 356	2104 LYNNHOPE DR. NW	6400205	NOISE EASEMENT
HR14	F	WARREN, BEVERLY & MARZENNIA	E	11-4-04	40018614, 217	2103 LYNNHOPE DR. NW	6400301	NOISE EASEMENT
HR15	F	ROSBOROUGH, VALERIE L.	E	12-15-04	40020852, 222	2312 RANCH RD. NW	6431007	NOISE EASEMENT
HR16	F	MULL, DOUGLAS N. & JUDITH E.	E	12-15-04	40020853, 226	2430 PORTLAND AVE. NW	6410121	NOISE EASEMENT
HR17	F	DANIEL, GARY	E	12-15-04	40020854, 230	2513 HILLENDALE DR. NW	6420502	NOISE EASEMENT
HR18	F	WILSON, CARL DAVID	E	12-15-04	40020855, 236	2227 RANCH RD. NW	6431125	NOISE EASEMENT
HR19	F	SHROADES, CONRAD V. & WYNNIEFREDA	E	12-15-04	40020898, 442	2415 PORTLAND AVE. NW	6410214	NOISE EASEMENT
HR20	F	BROWN, WILLIAM	E	12-30-04	40021751, 150	2121 LYNNHOPE DR. NW	6400304	NOISE EASEMENT
HR21	F	DULANEY, JACK ALLEN ILONKA B.	E	12-30-04	40021752, 156	4428 COVE RD.	6370117	NOISE EASEMENT
HR22	F	JACKSON, DOUGLAS	E	12-30-04	40021753, 160	2308 RANCH RD. NW	6431009	NOISE EASEMENT
HR23	F	EDMONDSON, JOYCE DARLENE	E	2-16-05	50002391, 341	2409 PORTLAND AVE	6410213	NOISE EASEMENT
HR24	F	HALL, HAROLD G. & SUSAN L.	E	2-16-05	50002392, 345	2237 RANCH RD. NW	6431120	NOISE EASEMENT
HR25	F	WILLIAMS, BRENDA	E	2-16-05	50002393, 349	4237 COVE RD. NW	6430301	NOISE EASEMENT
HR26	F	JENNINGS, LILLIAN G. & JOHN RAY	E	2-18-05	50002473, 35	2520 PORTLAND AVE	6420709	NOISE EASEMENT
HR27	F	McGHEE, LEON & GINGER	E	3-2-05	50003123, 279	2304 RANCH RD., NW	6431011	NOISE EASEMENT
HR28	F	McQUEEN, CHARLES W., JR.	E	3-2-05	40016496, 392	2303 RANCH RD. NW	6431116	NOISE EASEMENT
HR29	F	MAJORS, WILLIAM H & MILDRED A.	E	3-15-05	50003861, 164	2439 PORTLAND AVE	6410216	NOISE EASEMENT
HR30	F	GRAY, MATILDA	E	3-15-05	50003860, 180	4439 BEN STREET	6420905	NOISE EASEMENT
HR31	F	SPAULDING, RICHARD & CAROLYN	E	3-17-05	50004062, 287	2231 RANCH RD. NW	6431127	NOISE EASEMENT
HR32	F	LOVELACE, ROLAND T. & ROBIN W.	E	3-21-05	50004249, 546	2602 PORTLAND AVE. NW	6420807	NOISE EASEMENT
HR33	F	MORGAN, HARRY & MARY T.	E	5-20-05	5007721, 3	2421 PORTLAND AVE. NW	6410215	NOISE EASEMENT
HR34	F	MITCHELL, KENTON L & DENISE D.	E	5-23-05	50007831, 129	2621 PORTLAND AVE NW	6410218	NOISE EASEMENT
HR35	F	PRESTON, JOHNNY & CORNETTA	E	5-25-05	50007940, 1	4417 OLEVA ST. NW	6420510	NOISE EASEMENT
HR36	F	BOARDWINE, BETSY	E	5-31-05	50008195, 57	2317 RANCH RD. NW	6431111	NOISE EASEMENT
HR37	F	JONES, ARLENE	E	6-9-05	5000688, 82	2313 RANCH RD	6431112	NOISE EASEMENT
HR38	F	ROSE, ERMA	E	6-14-05	50009077, 1	2122 LYNNHOPE DR. NW	6400202	NOISE EASEMENT
HR39	F	TOOMER, PHILLIP	E	6-22-05	50009568, 3	2346 PORTLAND AVE. NW	6410127	NOISE EASEMENT
HR40	F	MULDREW, SEAN	E	6-23-05	50009668, 99	4433 LEWISTON AVE	6421120	NOISE EASEMENT
HR41	F	ABBOTT, GRACE	E	6-30-05	50010137, 1	2255 RANCH RD. NW	6431132	NOISE EASEMENT
HR42	F	SHELTON-TILLEY, MARIE ELAINE & RUTH MAXINE	E	7-28-05	50011887, 423	2402 PORTLAND AVE. NW	6410125	NOISE EASEMENT
HR43	F	LONG, DONNA	E	9-30-05	50015947, 80	2241 RANCH RD. NW	6431118	NOISE EASEMENT
HR44	F	BARTON III, JAMES C.	E	10-27-05	50017562, 189	2205 GARSTLAND DR. NW	6400614	NOISE EASEMENT
HR45	F	COFFMAN, GEORGIA L.	E	10-27-05	50017563, 195	2110 LYNNHOPE DR. NW	6400204	NOISE EASEMENT
HR46	F	WILLIAMS, NATASHA L.	E	11-16-05	50018881, 302	2354 PORTLAND AVE. NW	6410126	NOISE EASEMENT
HR47	F	RIPPEY III, JOHN W.	E	11-23-05	50019313, 222	4437 LEWISTON ST. NW	6421121	NOISE EASEMENT
HR48	F	PENNIX, SHERMAN L. & SHERRITA A.	E	1-19-06	60000897, 238	2112 TEMPLE ST. NW	6370803	NOISE EASEMENT
HR49	F	HELMS, CAMILLE LEGANS	E	2-6-06	60001888, 186	4460 BEN ST. NW	6420806	NOISE EASEMENT
HR50	F	LOWE, FRANCES C.	E	2-27-06	60003011, 433	2225 RANCH RD. NW	6431124	NOISE EASEMENT
HR51	F	TAYLOR, JAMES C.	E	3-14-06	60003914, 454	2325 RANCH RD. NW	6431107	NOISE EASEMENT
HR52	F	COOK, JAMES & ERICKA	E	3-27-06	60004544, 72	2116 TEMPLE DR. NW	6370604	NOISE EASEMENT
HR53	F	HACKLEY, THEODORE & SHARON	E	4-25-06	60006275, 153	2114 GARSTLAND DR. NW	6400316	NOISE EASEMENT
HR54	F	PAXTON, MARY L.	E	5-10-06	60007334, 277	2206 GARSTLAND DR. NW	6400313	NOISE EASEMENT
HR55	F	MARKELL, JOHN	E	6-20-06	60009769, 440	2323 RANCH RD. NW	6431108	NOISE EASEMENT
HR56	F	LEMOINE, HENRY C. & CINA M.	E	6-28-06	60014141, 324	2353 PORTLAND DR. NW	6410211	NOISE EASEMENT
HR57	F	BAILEY, JOHN E. & PATRICIA	E	8-24-06	200606107, 181	6011 SIERA DR. NW	38.05-2-11	NOISE EASEMENT
HR58	F	PHAN, CHAU GIA & NGUYEN, TY	E	9-15-06	60015233, 72	2303 PORTLAND DR. NW	6410204	NOISE EASEMENT

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AIRPORT PROPERTY MAP
TRANSACTION CHARTS

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

EXHIBIT **11B**

DRAWN BY: RWW	SCALE: 1" = 500'
CHECKED BY: MJD	DATE: JULY 2005

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APPENDIX B

Verbatim Passenger Survey Comments

Airline Service and Employees

- Would like to see more improved air service in and out of ROA.
- I would be happier if student airfares were offered later in the day. Also, a direct flight to/from St. Louis on the weekends would be incredible.
- You need to do something to lower the cost US Air flights out of Roanoke. Many people from the Roanoke area go to Greensboro, NC because of better flights rates. We saved over $300 on a trip to West Hartford, Connecticut just in the past two weeks.
- Love to see AirTran here.
- Please get some discount airlines in Roanoke! When flying on our dime, we must drive to other airports like Raleigh to get a cheaper flight. My family will do this in 2 weeks for holiday travel.
- I know this is the airline, not the airport, but I hate flying in these small old planes. Thank You!
- We would like a low cost carrier at the Roanoke Airport. We could and would travel more if this was available. Thank you.
- Would have been nice if DL used an "URGENT" transfer tag on luggage due to quick turn around in ATL. Other airlines do this.
- Often fly from Greensboro as the flights are much cheaper. Also drive to Dulles which is inconvenient but more reasonable in cost for overseas flights.
- We are hoping to see additional carriers in the future and more competitive prices. A low cost carrier would be a great addition (Independence, SW, etc.).
- Please encourage a low-cost carrier to come here as well as keeping US AIR. I work for VA Tech and it would very difficult for us if there were no nearby commercial airport.
- If this were not frequent flyer miles we would have gone from another airport because the fares from Roanoke are far too high. I once did not get a position I applied for because of the expense.
- You need better airfares - we lose way too many people flying out of Greensboro rather than ROA. Even my work requires us to leave from Greensboro because of cheaper flights.
- Our US Airways flight was delayed leaving Roanoke because of inadequate in-flight personnel. This caused us to miss our Charlotte connection, and therefore we had to switch to Northwest Airlines. This delayed our return home by 5 hours. This posed a significant inconvenience as our young children had to stay with a babysitter much longer than planned. Potentially if our current flight on NWA is delayed we may not get home until tomorrow.
- People that work at the airport (US Airways and Roanoke city employees and TSA) have always been courteous and friendly.
- Direct to CVG to MSN (Delta) DTW to MSN (Northwest) not available in LYH.
- I love Maggie - Flight Attendant on US#2757!
- Very pleasant personnel at check in and security.
- The personnel are very courteous and helpful at the rental car booth, the airline and TSA employees.

- Polite employees. Kelly with US Air was actually concerned about her passengers, which is nice to see.

Airport Facilities/Layout

- Should have an escalator to go to the airplane instead of stairs at gate 5/6.
- Airport is getting shabby. Bathrooms are in poor shape and a bad example to visitor. Move the airport to create an International airport for jets and promote business and prosperity in this community. It was a terrible decision not to do this 20 years ago. Now's the time to correct that mistake and bring convenient air travel, with fewer connections to Roanoke and stop the lugging of carry on up and down the stairs.
- Entrance by way of stairs is a hindrance for handicapped people. DFW was a much easier way to access prop planes. If you must use this method, assistance would be helpful. Thanks, KMD.
- 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.
- I looked for Northwest shared "world club", but I really didn't expect one here.
- Need a cut-thru to get to National Car Rental area. Have to go up and down that curb - make it a walk thru like the rest of the walk to the rental car farthest areas.
- Two Individuals stated that they liked the internet! Said it was great.
- The pickup/drop-off section is designed very well.
- The current terminal is a big improvement.
- Rocking chairs are nice, Art work, local displays of aircraft and exhibits attractions, crooked road, Mill Mountain Coffee House.
- Appreciate the free wireless.
- Easy Access.
- Roanoke is convenient and easy to get through.
- ROA is a comfortable, easy to use /navigate airport.
- I like the small personal aspect of Roanoke Airport. Easy to get in / get out. Not crowded. Personal and friendly. Would rather fly from here than a larger metro airport providing fares are competitive.
- I love the small airport very clean and quiet! Please do not add hanging TVs that talk loudly to no one in particular and do not make for relaxed passengers. Noise Pollution- Argh!
- Nice to have complimentary high speed internet.
- The airport is clean, well organized, friendly and attractive.
- Great having wireless access - I was at the airport for 5 hours - I was pleasantly surprised to find internet access here - fantastic!
- Easy to get around airport, clean restrooms, very nice kind service.

Concessions

- A nice facility to fly to/from but some of the service people can be incompetent - I fly out of here approximately 18 times annually. The restaurant and snack bar personnel are consistently poor. Stood in the restaurant for 5 minutes this morning, no one to help me get a cup of coffee!! Go to the snack bar in terminals and it has "closed, will be back in a while".

- It could use a good restaurant.
- The restaurant facility is clean, but the food was bland and not up to par with the other airports. Need more variety.
- I think $1.75 is quite expensive for a cup of tea, and $2 for bottled water is twice as much as what other airport charge. Check the prices for food at airports like JFK - much more reasonable.

General

- For the last 2 years we have flown down about once a month to see our family in Blacksburg. Airport is easy to get in and out of.
- This is a way clean and convenient airport.
- Very nice airport.
- I only consider ROA. It is my preferred option. I check no other rates or airports.
- Have flown out of Roanoke since 1985. It has been a positive experience over the many years to fly in and out of ROA. Please keep up the good work.
- I fly into and out of ROA over a dozen times a year. I find it quick and convenient.
- Periodically use Roanoke Transportation Service to get to ROA from home at Smith Mountain Lake or from airport to home - good service and appreciated.
- Nice airport. Check in and screenings are fast.
- I have used various amenities before and all is well.
- Airport is clean and nice.
- This is a fantastic airport!! Airport staff was very friendly.
- Nice Airport - very clean.
- This is a wonderful airport. It's usually clean and the people friendly. Please do everything that you can to keep it open.
- Nice little airport.
- We love this airport! Nice and clean with friendly helpful people.
- Roanoke Regional Airport is nearest to the conference site. I commented earlier today on the warm and friendly treatment I always get at this airport. Without exception, it is the customer- friendliest airport I've ever visited. That quality has been consistent through the years. I will later today visit Detroit and SEATAC. I have quite different feelings about these two airports, and am often disappointed by the treatment I get there.

Parking

- For supposedly so few air passengers in Roanoke, the airport parking lots sure do stay full!
- Need more parking spaces.
- Rental car parking could be moved to a lot across the street which would allow more parking for patrons who leave their cares while traveling. As a traveler who has many early flights and late returns to the airport it would help.

Signage

- I had a very hard time finding the airport on my return. As I drove on 581 N - there were 3 exits showing for the airport. I tried the first and got lost. Went way out of the way - ended up on 81 N and had to turn around. Hershberger Rd is probably the most direct exit - not being from the area I wasn't sure it was dark - very frustrating.
- When I arrived 3 days ago, I considered using the Smart bus. People told me it picked up at the north end of the terminal, but there was no sign or indication of a bus stop (that I could see), so I ended up not using it. It would have been nice to have a sign or some instructions on how to use the bus in addition to the schedule on the wall. I was not sure if it ran every time shown, or whether I needed to call to have it stop.

APPENDIX C

Detailed Scheduled Passenger Enplanement Forecasts

APPENDIX C: DETAILED SCHEDULED PASSENGER ENPLANEMENT FORECASTS

This appendix provides a detailed description of the approach to the scheduled passenger enplanement forecasts. The development of the forecasting equation for domestic passenger originations is described, along with estimates of the input variables and the translation of domestic originations to total enplanements.

Domestic passenger originations are revenue passengers that begin the flight portion of their trip at ROA. Non-revenue passengers, international originations, and connecting passengers are excluded from the domestic origination numbers. Historically, domestic originations at ROA have closely tracked schedule passenger enplanements.

An attempt was made to develop a forecast equation for total enplanements rather than domestic originations, but the statistical results were much weaker (see below). Also, using the US DOT's OD1A data base for originations provides a consistent data source for domestic originations, and air fares at ROA and competing airports. Although international O&D data is fairly complete for ROA, this is not true at competing airports such as CLT which has service by foreign-flag carriers that are not required to file the data.

C.1 FORECAST EQUATION

Regression analysis was used to determine the factors that have historically affected domestic O&D passengers at ROA. Regression analysis is a statistical method of generating an equation (or model) which best explains the historical relationship among selected variables, such as passengers and real income. If it is assumed that the model that best explains historical activity will continue to hold into the future, this equation can be used as a forecasting equation. Using historical (1990-2003) data, several passenger forecasting models were tested. The potential driving factors tested included socioeconomic variables, aviation industry variables, and instrument variables (also called dummy variables). The socioeconomic variables included population, employment, income, and per capita income for the Roanoke MSA and the primary catchment area (see Section 4.2). The aviation industry variables included fares and yields for ROA and for competing airports within several hours driving distance. Dummy variables representing the first Gulf War, and the September 11 attacks and ensuing industry recovery were also tested. Domestic originations and total enplanements were both tested as dependent variables. The model was tested in both linear and logarithmic formulations.

Several of the equations that were calculated showed strong correlations with passenger originations. The model that produced the best results, from both a theoretical and statistical standpoint, was a logarithmic formulation, which specified ROA O&D passengers as a function of primary catchment area income, average fares (including taxes and fees) at ROA, average yield at CLT and RDU, and a dummy variable representing the continuing effects of the 9/11 attacks as independent variables. The regression equation took the following form:

$O\&D = (10^{-1.58439}) \times INCPCA^{1.19958} \times ROAFARE^{-.88507} \times CLTRDUYLD^{.60636} \times D2001$

Where:

O&D = annual domestic O&D passengers at ROA

INCPCA = income in the Roanoke primary catchment area (in thousands of 2004 dollars).

ROAFARE = ROA air fare adjusted for taxes and fees in 2004 dollars.

CLTRDUYLD = average of CLT and RDU yields adjusted for taxes and fees in 2004 dollars.

D2001 = Dummy variable for 9/11 impacts which is equal to 1.0 prior to 2001 and is equal to $10^{-.09074}$ in 2001 and thereafter.

R^2 = .858
F-statistic = 12.085
Durbin-Watson = 1.696
t-statistics:
Intercept = -0.60
INCPCA = 2.76
ROAFARE = -2.30
CLTRDUYLD = 2.07
D2001 = -5.44

The model's projections for 2005 were compared with preliminary numbers for 2005 and the results suggested a further recovery or "snap-back" from the 9/11 impacts in 2005. Based on the difference between the forecast results and actual numbers, the value of this imputed dummy variable is $10^{.024432}$. The combined value of the 2001 and imputed 2005 dummy variables is (-.09074 + .024432) or -.066308. This indicates that, at the end of 2005, the net impact of 9/11 on passenger demand was -14.2 percent. This negative impact was carried through the forecast period. Essentially, this means that all other factors being equal, passenger enplanements at ROA have been, and will continue to be, 14.2 percent lower than if the 9/11 attacks had never occurred. The negative impact incorporates several factors, including the increased waiting time and inconvenience associated with security requirements, post-9/11 service cutbacks (meals, etc.) by the airlines, and increased fear of terrorism. Similar negative impacts have been observed at all other airports studied by HNTB.

The primary catchment area income variable represents the size of the market, and the ROA fare variable represents the cost of the service. The average CLT/RDU yield variable represents the cost of competing service. Since the forecasting model has a logarithmic formulation, each of the exponents associated with the input variables is an elasticity. With small changes in the input variables, the forecasting model can be interpreted as indicating that every 1.0 percent increase in catchment area income will increase O&D passengers by approximately 1.20 percent and that every 1.0 percent decrease in ROA fares will increase O&D passengers by approximately 0.89 percent. Since the average CLT/RDU yield variable represents the cost of service at competing airports, the impact is the opposite of the ROA fare variable. Therefore, for example, a 1.0 percent decrease in CLT/RDU yields reduces ROA O&D traffic by 0.61 percent because the reduction in yields at CLT and RDU attracts passengers away from ROA.

The cost of air service at GSO would also be expected to affect O&D traffic, especially since according to the passenger survey, GSO was the alternate airport most likely to be considered by ROA passengers. It was not possible, however, to statistically identify this influence, most likely because there were too many similarities between fare patterns at ROA and GSO. This does not mean that GSO fares have no impact on ROA passengers; instead it means that it was not possible to identify this relationship with the available data.

C.2 PROJECTED FARES AND YIELDS

The forecasting equation specifies domestic O&D passengers as a function of income, yields and fares. Consequently, forecasts of the income, fare and yield variables are required to use the forecasting equation. Income projections are provided in Section 4.2. Projections of future fares and yields are discussed in this section.

The cost of air travel has dropped markedly at many airports, including competitors such as RDU (see Table 4.11). ROA, however, has not shared substantially in these decreases. The principal obstacle to low-fare service at ROA is illustrated in **Table C.1**. On an available seat mile (ASM) basis, the operating costs of regional jets are significantly higher than those of mainline jets. As shown, when compared to a Boeing 737-700, the per seat operating cost of an Embraer 145 or a CRJ-700 is almost twice as high, and the operating cost of a CRJ-200 is almost three times as high. The only way that airlines could substantially reduce fares at ROA is by flying larger aircraft. Because of the limited size of the Roanoke market, however, airlines would have to reduce frequencies to achieve break-even load factors on their aircraft. They would then be vulnerable to losing higher yield business travelers to other airlines offering higher frequencies on regional jets.

Table C.2 presents historical and projected fares and yields for ROA, CLT and RDU. Projected real fares for the three airports were calculated from the FAA's projections of real yield (weighted average air carrier and regional carrier yields) and average trip distance and include estimated taxes and fees.[1] Since the FAA projects average trip distance to increase, fares are not projected to decline as quickly as yields.

Although ROA fares are higher than the national average, they are unlikely to decline significantly because of the airline need to offset the higher regional jet operating costs. The new service announced by Allegiant Air does not provide the frequencies that are likely to induce a competitive fare response among the other airlines. Hence, the new service is unlikely to significantly reduce average fares and yields at ROA. Yields and fares at CLT are also currently higher than the U.S. average. It is anticipated that low cost carriers, such as AirTran, will provide some downward pressure on yields and fares, but that the high-cost structure of most carriers operating at CLT will prevent yields and fares from falling at a faster rate than the national average. In the case of RDU, the need for Southwest Airlines to cover fuel costs after its fuel hedges expire will limit its ability to further reduce fares

[1] (FAA Aerospace Forecasts: Fiscal Years 2006-2017).

Table C.1

Average Aircraft Operating Costs (Cents Per Available Seat Mile (ASM))
Twleve Months Ending September 2005

	Fuel Cost (per ASM)	Crew Cost (per ASM)	Total Operating Cost (per ASM)
Boeing 737-700	1.665	1.116	3.947
Canadair CRJ-200	4.372	1.907	11.707
Canadair CRJ-700	2.936	1.249	6.834
Embraer 145	2.221	1.275	7.317

Sources: USDOT Form 41 data as compiled by BACK Aviation Solutions and HNTB analysis.

Table C.2

Historical and Projected Average Domestic Fares and Yields including Airline Fees and Taxes at ROA, RDU and CLT (1)

	Roanoke		Raleigh-Durham		Charlotte		Average of RDU and CLT	
Year	**Fare**	**Yield**	**Fare**	**Yield**	**Fare**	**Yield**	**Fare**	**Yield**
1990	217.23	28.24	237.42	29.92	230.66	33.10	234.04	31.51
1991	221.81	28.93	241.21	29.97	237.67	34.06	239.44	32.02
1992	206.72	26.51	226.11	27.44	232.94	32.34	229.52	29.89
1993	224.81	27.21	247.03	29.57	239.05	33.54	243.04	31.56
1994	197.56	23.00	212.91	24.43	205.50	26.86	209.21	25.65
1995	222.61	26.59	208.22	24.57	242.97	31.89	225.59	28.23
1996	229.80	26.68	198.49	23.03	235.09	30.49	216.79	26.76
1997	240.92	28.10	209.80	23.69	232.53	31.64	221.17	27.67
1998	252.53	29.12	217.22	25.11	253.53	32.04	235.38	28.57
1999	246.51	28.90	182.94	20.68	249.08	29.88	216.01	25.28
2000	241.68	26.42	171.71	18.96	260.30	31.13	216.00	25.04
2001	221.06	23.77	151.03	16.04	244.56	28.93	197.80	22.48
2002	208.87	22.45	140.83	14.64	219.63	24.63	180.23	19.64
2003	203.72	22.15	154.27	15.34	216.17	24.20	185.22	19.77
2004	203.08	21.42	143.49	14.66	200.36	21.71	171.93	18.18
2005	197.74	20.35	139.73	14.59	183.37	20.77	161.55	17.68
2010	197.72	19.81	139.14	14.14	182.33	20.10	160.73	17.12
2015	195.75	18.97	137.77	13.54	180.46	19.24	159.12	16.39
2020	193.24	18.14	136.03	12.95	178.07	18.40	157.05	15.68
2025	188.55	17.30	132.78	12.36	173.61	17.53	153.19	14.94

(1) Historical data from Table 4.11. Forecast projections assume yields grow at FAA national projections for domestic yields and that fees and taxes increase at the same rate as inflation.

Sources: As noted and HNTB analysis.

from their existing low levels. As shown in Table C.2, real fares (including taxes and fees) at the three airports are expected to decline slightly over the forecast period.

C.3 DOMESTIC PASSENGER O&D FORECAST

Table C.3 shows the forecast of scheduled passenger originations using the equation presented in Section C.1 and the income, yield and fare forecasts. As shown, total scheduled ROA domestic O&D passengers are projected to rise from 579,700 in 2005 to 856,300 in 2025, an average annual increase of 1.99 percent.

In addition to the assumptions in Section 4.4, there are several assumptions implicit in the passenger origination forecasts:

- The historical relationship between originations, income and fares and yields will continue throughout the forecast period. Forces that could disrupt this relationship, such as a return to regulation, severe congestion at destination airports, or the wide-scale use of teleconferencing as a travel alternative, could alter this relationship.

- In accordance with FAA assumptions, fuel prices will increase in 2006 but then level off over the remainder of the forecast period, allowing real yields to continue to decline slightly as a result of more efficient aircraft and more productive airline labor and management.

- Real income in the Roanoke primary catchment area will grow at the rate projected in Table 4.4.

- The population's distribution of income through the forecast period will be similar to what it is today.

- As a percentage of income, taxes and medical expenses, which are the principle budget items over which households have little control, will not increase sufficiently to affect household or business budgets devoted to air travel.

C.4 PROJECTED PASSENGER ENPLANEMENTS

Table C.4 shows the projection of scheduled passenger enplanements at ROA. Enplanements were projected by using the ratio of enplanements to domestic O&D passengers. As shown, the ratio of enplanements to domestic originations has averaged slightly above 1.00 with no discernable long-term trend.[2] Therefore, the future ratio of enplanements to domestic originations was assumed to be the same as the average for the 2001-2005 period.

As shown in Table C.4, scheduled passenger enplanements are projected to increase from 324,590 in 2005 to 481,182 in 2025, an average annual increase of 1.99 percent.

[2] The difference between enplanements and domestic originations consists mostly of international originations and non-revenue domestic originations, neither of which is included in the USDOT's domestic origin-destination survey.

Table C.3

Forecast of Domestic Origin/Destination Traffic at ROA

Year	Roanoke Primary Catchment Area Real Income ($000s) (1)		ROA Average Fare (2)	RDU/CLT Average Yield (2)	O&D Passengers (3)
1990	$	12,382,058	217.23	31.51	612,580
1991	$	12,258,973	221.81	32.02	559,640
1992	$	12,543,568	206.72	29.89	589,980
1993	$	12,752,908	224.81	31.56	584,310
1994	$	13,161,404	197.56	25.65	602,740
1995	$	13,590,773	222.61	28.23	578,450
1996	$	14,028,100	229.80	26.76	573,970
1997	$	14,570,752	240.92	27.67	593,990
1998	$	15,287,371	252.53	28.57	609,270
1999	$	15,713,586	246.51	25.28	621,570
2000	$	16,163,414	241.68	25.04	635,250
2001	$	16,582,225	221.06	22.48	537,960
2002	$	16,771,658	208.87	19.64	526,640
2003	$	16,862,579	203.72	19.77	528,910
2004	n/a		203.08	18.18	547,630
2005	n/a		197.74	17.68	576,860
2010	$	19,223,653	197.72	17.12	634,835
2015	$	21,116,230	195.75	16.39	698,186
2020	$	23,205,967	193.24	15.68	769,690
2025	$	25,517,786	188.55	14.94	856,282
			Average Annual Growth Rate		
(2005-2015)			-0.24%	-0.84%	1.99%

(1) Table 4.4.
(2) Table C.2.
(3) See text for forecasting equation.

Sources: As noted and HNTB analysis.

Table C.4

Forecast Of Scheduled Passenger Enplanements

Year	Domestic O&D Passengers (1)	Domestic Originations (2)	Ratio of Enplanements to Originations (3)	Scheduled Enplanements (4)
1990	612,580	305,800	1.17	358,054
1991	559,640	276,930	1.11	306,321
1992	589,980	293,510	1.10	323,530
1993	584,310	292,330	1.11	325,213
1994	602,740	300,270	1.22	366,166
1995	578,450	287,250	1.11	319,256
1996	573,970	286,170	1.10	314,371
1997	593,990	296,670	1.09	323,836
1998	609,270	302,270	1.12	339,010
1999	621,570	307,360	1.11	341,852
2000	635,250	315,710	1.13	357,581
2001	537,960	268,910	1.12	300,951
2002	526,640	263,420	1.12	295,232
2003	528,910	261,390	1.09	286,034
2004	547,630	269,030	1.14	306,655
2005	576,860	283,390	1.15	324,590
2010	634,835	317,418	1.12	355,036
2015	698,186	349,093	1.12	392,341
2020	769,690	384,845	1.12	432,522
2025	856,282	428,141	1.12	481,182
		Average Annual Growth Rate		
(2005-2015)	1.99%	2.08%	-0.09%	1.99%

(1) Table C.3.

(2) USDOT Origin-Destination Survey for historical. Total O&D divided by 2 for forecast.

(3) Historical ratio calculated by dividing historical enplanements by historical originations. Future ratio assumed to remain constant at average for most recent five years.

(4) Table 4.6 for historical data. Originations multiplied by ratio of enplanements to originations for forecast.

Sources: As noted and HNTB analysis.

APPENDIX D

Forecast Scenarios

Table D.1

Scenario 1: Low Economic Growth

Year	2005	2010	2015	2020	2025	Average Annual Increase
Enplanements						
Scheduled Enplanements	324,590	329,044	345,427	362,613	385,029	0.9%
Charter Enplanements	2,680	3,638	3,638	3,638	3,638	1.5%
Total Enplanements	327,270	332,682	349,065	366,251	388,667	0.9%
Total Cargo Tonnage	15,802	14,436	14,976	15,529	16,103	0.1%
Operations						
Scheduled Passenger Carrier	23,706	21,068	21,115	21,579	21,973	-0.4%
Charter Passenger Carrier	48	64	64	64	64	1.4%
All-Cargo Carrier	2,241	1,702	1,724	1,710	1,802	-1.1%
Air Taxi	9,606	11,512	14,051	16,327	19,328	3.6%
General Aviation	48,892	47,470	46,793	45,955	45,172	-0.4%
Military	1,401	1,374	1,374	1,374	1,374	-0.1%
Total	85,894	83,191	85,121	87,009	89,714	0.2%
Based Aircraft	125	124	122	122	121	-0.2%

Source: HNTB analysis.

Table D.2

Scenario 2: Moderate Economic Growth

Year	2005	2010	2015	2020	2025	Average Annual Increase
Enplanements						
Scheduled Enplanements	324,590	368,153	416,160	468,216	530,533	2.5%
Charter Enplanements	2,680	3,638	3,638	3,638	3,638	1.5%
Total Enplanements	327,270	371,790	419,798	471,854	534,170	2.5%
Total Cargo Tonnage	15,802	17,836	20,077	22,589	25,415	2.4%
Operations						
Scheduled Passenger Carrier	23,706	23,515	25,177	27,156	29,378	1.1%
Charter Passenger Carrier	48	64	64	64	64	1.4%
All-Cargo Carrier	2,241	2,045	2,127	2,414	2,606	0.8%
Air Taxi	9,606	12,280	15,944	19,627	24,528	4.8%
General Aviation	48,892	50,150	53,313	54,618	57,118	0.8%
Military	1,401	1,374	1,374	1,374	1,374	-0.1%
Total	85,894	89,428	97,999	105,254	115,069	1.5%
Based Aircraft	125	131	139	145	153	1.0%

Source: HNTB analysis.

Table D.3

Scenario 3: Fuel Shock and Recession

Year	2005	2010	2015	2020	2025	Average Annual Increase
Enplanements						
Scheduled Enplanements	324,590	336,758	364,054	396,125	434,426	1.5%
Charter Enplanements	2,680	3,638	3,638	3,638	3,638	1.5%
Total Enplanements	327,270	340,396	367,691	399,763	438,064	1.5%
Total Cargo Tonnage	15,802	15,517	15,823	16,195	16,554	0.2%
Operations						
Scheduled Passenger Carrier	23,706	21,255	22,089	23,092	24,696	0.2%
Charter Passenger Carrier	48	64	64	64	64	1.4%
All-Cargo Carrier	2,241	1,784	1,738	1,730	1,765	-1.2%
Air Taxi	9,606	10,474	12,795	14,996	17,883	3.2%
General Aviation	48,892	48,236	47,943	46,708	45,919	-0.3%
Military	1,401	1,374	1,374	1,374	1,374	-0.1%
Total	85,894	83,187	86,003	87,964	91,701	0.3%
Based Aircraft	125	126	125	124	123	-0.1%

Source: HNTB analysis.

Table D.4

Scenario 4: GSO Low Fares

Year	2005	2010	2015	2020	2025	Average Annual Increase
Enplanements						
Scheduled Enplanements	324,590	316,147	349,422	385,290	428,812	1.4%
Charter Enplanements	2,680	3,638	3,638	3,638	3,638	1.5%
Total Enplanements	327,270	319,784	353,060	388,927	432,450	1.4%
Total Cargo Tonnage	15,802	16,438	17,053	17,683	18,336	0.7%
Operations						
Scheduled Passenger Carrier	23,706	19,929	20,885	22,420	23,873	0.0%
Charter Passenger Carrier	48	64	64	64	64	1.4%
All-Cargo Carrier	2,241	1,906	1,862	1,923	2,013	-0.5%
Air Taxi	9,606	12,029	15,325	18,548	22,828	4.4%
General Aviation	48,892	49,384	51,012	51,982	53,012	0.4%
Military	1,401	1,374	1,374	1,374	1,374	-0.1%
Total	85,894	84,686	90,523	96,311	103,165	0.9%
Based Aircraft	125	129	133	138	142	0.6%

Source: HNTB analysis.

Table D.5

Scenario 5: Reduced Fares at ROA

Year	2005	2010	2015	2020	2025	Average Annual Increase
Enplanements						
Scheduled Enplanements	324,590	433,675	479,243	528,324	587,762	3.0%
Charter Enplanements	2,680	3,638	3,638	3,638	3,638	1.5%
Total Enplanements	327,270	437,313	482,881	531,962	591,400	3.0%
Total Cargo Tonnage	15,802	16,438	17,053	17,683	18,336	0.7%
Operations						
Scheduled Passenger Carrier	23,706	25,941	26,796	28,718	30,161	1.2%
Charter Passenger Carrier	48	64	64	64	64	1.4%
All-Cargo Carrier	2,241	1,900	1,855	1,910	2,008	-0.5%
Air Taxi	9,606	12,029	15,325	18,548	22,828	4.4%
General Aviation	48,892	49,384	51,012	51,982	53,012	0.4%
Military	1,401	1,374	1,374	1,374	1,374	-0.1%
Total	85,894	90,693	96,426	102,595	109,448	1.2%
Based Aircraft	125	129	133	138	142	0.6%

Source: HNTB analysis.

Table D.6

Scenario 6: Airline Consolidation

Year	2005	2010	2015	2020	2025	Average Annual Increase
Enplanements						
Scheduled Enplanements	324,590	342,988	368,740	412,936	462,762	1.8%
Charter Enplanements	2,680	3,638	3,638	3,638	3,638	1.5%
Total Enplanements	327,270	346,625	372,378	416,574	466,400	1.8%
Total Cargo Tonnage	15,802	16,438	17,053	17,683	18,336	0.7%
Operations						
Scheduled Passenger Carrier	23,706	16,209	16,858	16,891	18,271	-1.3%
Charter Passenger Carrier	48	64	64	64	64	1.4%
All-Cargo Carrier	2,241	1,905	1,861	1,920	2,012	-0.5%
Air Taxi	9,606	12,029	15,325	18,548	22,828	4.4%
General Aviation	48,892	49,384	51,012	51,982	53,012	0.4%
Military	1,401	1,374	1,374	1,374	1,374	-0.1%
Total	85,894	80,965	86,494	90,778	97,561	0.6%
Based Aircraft	125	129	133	138	142	0.6%

Source: HNTB analysis.

APPENDIX E

Approach Minimums Analysis

Roanoke Regional Airport
Master Plan Update
February 19, 2007

Chapter 5 Facility Requirements, Design Criteria - Approach Minimums Analysis

The primary purpose of this analysis was to determine the feasibility of lowering instrument approach minimums for instrument flight rule (IFR) operations at the Roanoke Regional Airport (ROA). The main focus of this study was on lowering the decision heights (DHs) for the approach procedures. For potential improvements to visibility minimums, in general a lower decision height will also lower visibility minimums, as visibility minimums are a function of the distance needed to see the runway from the missed approach point. Thus, the intent was on researching the various possible terminal instrument procedure (TERPS) approach types for ways to achieve lower DHs. In general, the finding from this effort is that it appears that the FAA's procedure development process has been thorough and accurate in utilizing standard navigation facilities and technology to keep ROA minimums as low as possible.

Essentially, the situation at ROA that precludes the lowest possible Category I weather minimums of 200-½ is the surrounding high terrain. Table 1 lists the current ROA decision heights and visibility minimums. Note that none of the procedures afford ROA the lowest possible Category I weather minimums of 200-½. To achieve 200-½, an obstacle-free precision instrument approach procedure is needed, which can be achieved through either an instrument landing system (ILS) or aircraft-equipped with GPS.

Table 1

Runway	Approach Category				Approach Aid	GPA	TCH
	A	B	C	D			
6	405-1				S-LDA/GS 6	3.00	55
	605-1		605-1 1/4	605-1 1/2	S-LDA 6	3.00	55
	604-3/4		604-1 1/4	604-2	LNAV MDA	3.20	58
24	1410-1 1/4	1410-1 1/2	1410-3		LNAV MDA	3.07	50
33	585-1 1/2			660-1 3/4	S-ILS 33*	3.00	56
	781-1/2	781-3/4	781-1 3/4	781-2	S-LOC 33*		
	420-1/2		420-3/4	420-1	LNAV MDA	3.09	63
	541-1 1/4				VOR/NDB 33	3.10	63
VOR/DME-A	525-1		525-1 1/2	605-2	CIRCLING	5.57	50

* New Amdt 12 minima

At ROA, the minimums are principally a function of the application of missed approach obstacle clearance requirements, rather than the more typical obstacle clearance problems in the final approach segment. The challenge is that the missed approach obstacle clearance requirements are much greater (i.e., both horizontally and vertically) for that phase of flight than for a pilot established on a stabilized final approach descent, whether utilizing ILS or GPS approach aids. As a result, and especially because at ROA turning missed approaches are needed due to high terrain, improvements appear possible only if very advanced GPS technologies are employed. There are such advanced procedures, which are special types of Required Navigation Performance procedures (see further explanation below), but currently they are not available for public use. However, if developed these advanced procedures will likely necessitate initiation by the airlines, due to the required higher-end avionics and specialized training. Examples of these procedures are further detailed in the following sections.

Runway 6

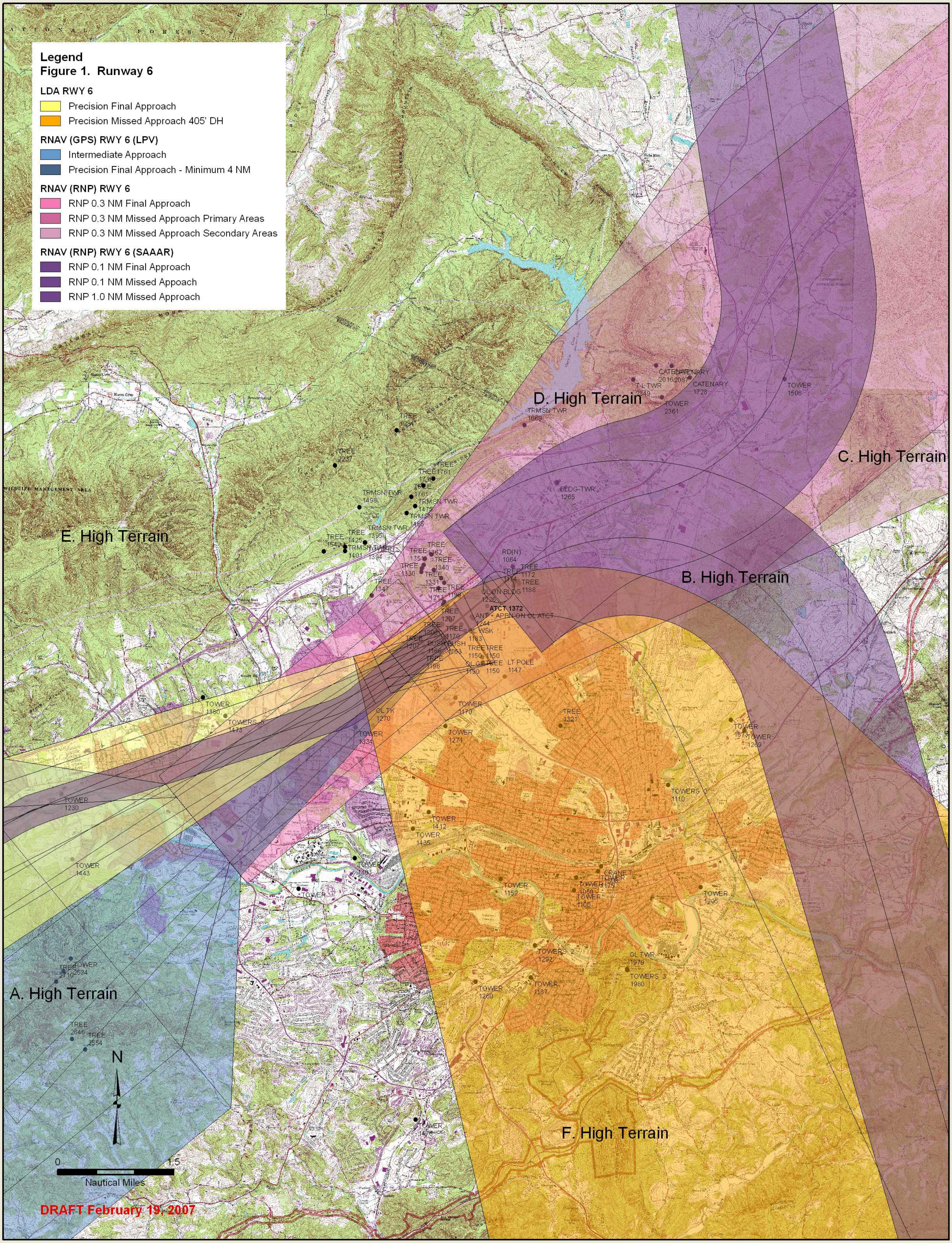
As shown in Table 1, the lowest possible decision height minimums at ROA are for the localizer-type directional aid (LDA) procedure to Runway 6, with a DH of 405'. The LDA procedure is offset from the final approach course by 14.5 degrees to provide a final approach course through the valley and north of the high terrain in the straight-in final approach area (see Figure 1, point A. High Terrain). Note also in Figure 1 the example showing both straight-in intermediate and final approach segments for a precision approach aligned with Runway 6. In this case, the required obstacle clearance over the high terrain for the intermediate segment would place an aircraft at too high an altitude to intercept a standard glide slope at the minimum distance from runway. Thus, this is the reason for the angled LDA approach.

Therefore, even though the LDA has vertical guidance, which is provided by a standard glide slope (GS), and so has the equipment to qualify for a precision approach, the final approach course is offset more than 3.0 degrees from the runway, which is a precision approach requirement. Thus, only the lowest non-precision minimum of 250' is allowed, and in this case was raised to 405' to accommodate a missed approach procedure that avoids high terrain (see Figure 1, point B. High Terrain).

The same requirement of a straight-in final approach applies to any precision approach, whether navigation guidance is provided by an ILS or Area Navigation (RNAV) GPS. Therefore, a precision GPS procedure, such as the current RNAV GPS Lateral Precision Performance with Vertical Guidance (LPV) procedures, won't be possible. However, new GPS procedures have been developed called Required Navigation Performance procedures, or RNP. The RNP criteria allow for GPS-based course navigation with more flexible routings based on a series of GPS waypoints. Fundamentally, what is different about GPS RNP from standard GPS is that obstacles are evaluated within a set distance left or right of course centerline, which is therefore constant along any given segment of flight. Such a parallel object evaluation area (OEA) differs from the traditional trapezoid-shaped OEAs that require a widening obstacle clearance area as distance from the land-based NAVAID signal source increases.

Thus, Figure 1 shows two examples of potential RNP procedures. The first example is of an RNP 0.3 NM approach procedure, which is the standard public-use RNP procedure type. The OEAs for RNP 0.3 NM procedures have a primary surface that is 4x the 0.3 NM actual navigation performance (ANP) requirement (i.e., pilots' actual navigation performance is +/- 0.3 NM from course), or 1.2 NM wide total. There is also 7:1 sloping secondary OEA that is 1x RNP wide. Yet, the design of the final approach segment for these basic public-use RNP procedures is still limited to a straight-in segment, which is precluded by the high-terrain, so still is not a possible procedure for Runway 6.

However, there are RNP procedures that are more advance than the public-use RNP 0.3 procedures. These advanced RNP procedures allow ANP values as low as 0.1 NM left or right of course, which is approximately +/- 600' of centerline. Procedure development for such a high-level of navigation performance stipulates special aircraft and aircrew authorization requirements, thus referred to as RNP SAAARs, or "specials". Increasingly, more airlines are going to the expense of equipping and training aircrew for the procedures in order obtain the advantages that lower minimums can provide for certain airports where poor weather curtails access.



Legend
Figure 1. Runway 6
LDA RWY 6
Precision Final Approach
Precision Missed Approach 405' DH
RNAV (GPS) RWY 6 (LPV)
Intermediate Approach
Precision Final Approach - Minimum 4 NM
RNAV (RNP) RWY 6
RNP 0.3 NM Final Approach
RNP 0.3 NM Missed Approach Primary Areas
RNP 0.3 NM Missed Approach Secondary Areas
RNAV (RNP) RWY 6 (SAAAR)
RNP 0.1 NM Final Approach
RNP 0.1 NM Missed Approach
RNP 1.0 NM Missed Approach
A. High Terrain
B. High Terrain
C. High Terrain
D. High Terrain
E. High Terrain
F. High Terrain
N
0
1.5
Nautical Miles
DRAFT February 19, 2007

Therefore, Figure 1 also shows a potential RNP SAAAR procedure of 0.1 NM for both the final approach segment and the relatively short initial missed approach segment. Thereafter, the minimum missed approach RNP is 1.0 NM. The procedures as shown also incorporate an allowable arc segments, called a radius-to fix leg (RF), which can be used both the final and missed approach segments.

In addition to arc-based course alignments, RNP SAAARs will allow non-standard climb gradients (i.e., greater than the standard 200'/NM), which are not currently possible for standard public-use procedures. As such, even with the depicted missed approach turn to the east, which would otherwise be precluded by the high terrain, it is possible with current RNP (SAAAR) criteria to allow non-standard missed approach climb gradients up to 425'/NM, which will clear the terrain in this case. Preferable to a required climb gradient though, is the example RNP SAAAR course to the north. This route appears to circumnavigate the high terrain between points C and D, although a slight climb gradient, e.g. 250'/NM, may still be required to clear the high terrain near point D and/or the tall antenna towers located there.

Runway 33

Amendment 12 to the ILS RWY 33 procedure was published in October 2007. The new DH minima will increase the DH from the current 500' to 585' for approach category A thru C aircraft. For category D aircraft, it will increase to from the current 620' to 660'.

Figure 2 shows three critical high terrain points for Runway 33 procedures, which are points E, A, and F. These points appear in the figure in a counter-clockwise direction surrounding the outer boundaries of the missed approach procedures, and as such are what determine the minimum DH for Runway 33 approaches.

Any missed approach obstacle clearance area is based on turn radius geometry (i.e. approach speed category C aircraft require smaller areas to complete turns). Accordingly, for the ILS procedures, category A-C aircraft are limited to a DH of 585' because of the turning missed approach requirement. These aircraft need to turn between the points E and H high terrain, to the northwest and southwest, respectively, and then to climb clear of the point F high terrain to the south, where they enter the missed approach holding pattern. For category D aircraft, because the turn radius is larger, point A high terrain is critical and requires a further increase in DH from 585' to 660'.

Interestingly, the RNAV (GPS) lateral navigation (LNAV) procedure to Runway 33, which does not afford any vertical guidance for the final approach, has even lower minimums than the ILS. The difference likely results from a combination of two factors. First, the start of a missed approach for any vertically-guided procedure assumes an additional 50' of height loss after reaching the missed approach point, so the missed approach point is farther from the landing threshold and at a higher decision altitude. Laterally-guided procedures do not have such a requirement. Second, application of new Adverse Assumption Obstacle (AAO) clearance criteria require assuming a 200' object may exist. This is because the FAA's notification requirement does not mandate reporting new construction or alteration 200' or less above ground where more than 20,000 feet from the runways. Application of this new criterion appears to be the reason the upcoming minimums increase for the ILS procedure.

A preliminary RNP (SAAAR) 0.1 NM procedure was also developed for Runway 33. It seems possible to achieve the lowest DH of 250', but will require the maximum allowable RNP climb gradient of 425'/NM. A lower climb gradient can be used, but will require a DH adjustment.

Runway 24

The RNAV (GPS) approach to Runway 24 is also a LNAV approach without vertical guidance. As with Runway 6, the high terrain on the northern side of the final approach (see Figure 3, point D) precludes a precision approach. A precision final approach analysis of the penetration to the obstacle clearance transitional surfaces by the high terrain resulted in a DH similar to the current DH of 1410'. So, as with Runways 6 and 33, it appears the only feasible solution is to seek development of an advanced RNP SAAAR procedure in order to avoid the terrain in the final approach segment.

VOR/DME-A

Circling MDH is 525 and for categories A thru C aircraft and 605 for category D aircraft, with visibility minimums of; 1 mile for categories A and B aircraft, 1½ mile for category C aircraft, and 2 miles for category D aircraft. The procedure was not analyzed for further improvements.

Visibility Minimums

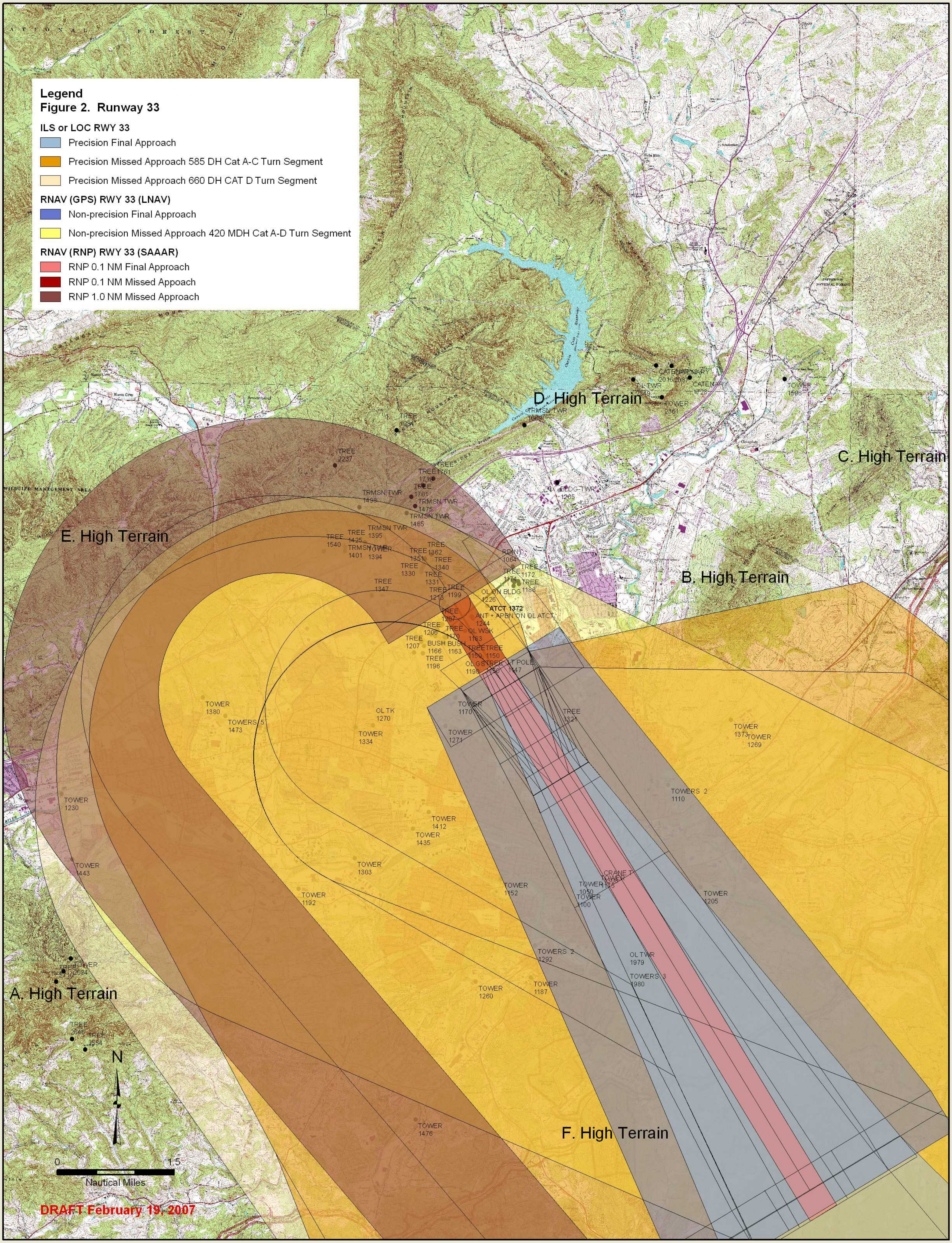
ROA has approach visibility as low as ½ mile. If lower DH minimums result from development of an advanced RNP SAAAR procedure then the appropriate visibility minimums will also be determined. In general, the lower the DH the lower the visibility will also be. However, the visibility reduction also depends on satisfying threshold siting surface requirements.

Approach visibility minimums are a function of the pilot's height above touchdown and distance from runway end at the missed approach point. The higher the missed approach altitude means the farther away from the end the pilot will be when descending to the minimum cloud ceiling. In order to descend below the cloud ceiling, the pilot must have visual reference to either the runway or runway lights/lighting system. Thus, visibility is a function of the pilot's altitude along a constant angle of descent.

Approach visibility minimums can be reduced in one of two ways. The first is by lowering the cloud ceiling minimums so that the pilot can descend lower and closer to the runway before visual sighting is required. The other is to install an approach lighting system, which serves to extend the runway environment closer to the pilot in poor visibility conditions (i.e. as much as a ½ mile for a 2400' MALSR system).

Conclusion

It appears that the FAA has been attentive to developing approach procedures with the lowest possible minimums. The recent more advance procedures that are now possible will require the cooperation of interested air carriers, since they are responsible for the required avionics and training. At this point, therefore, inquiry to desirability of such further development appears the next course of action. Close and continued coordination with the FAA is also encouraged as new procedure types and criteria continue to evolve in the direction of higher precision and accuracy, which may prove beneficial for future ROA instrument operations.


Legend
Figure 2. Runway 33
ILS or LOC RWY 33
Precision Final Approach
Precision Missed Approach 585 DH Cat A-C Turn Segment
Precision Missed Approach 660 DH CAT D Turn Segment
RNAV (GPS) RWY 33 (LNAV)
Non-precision Final Approach
Non-precision Missed Approach 420 MDH Cat A-D Turn Segment
RNAV (RNP) RWY 33 (SAAAR)
RNP 0.1 NM Final Approach
RNP 0.1 NM Missed Approach
RNP 1.0 NM Missed Approach
D. High Terrain
C. High Terrain
E. High Terrain
B. High Terrain
A. High Terrain
F. High Terrain
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N
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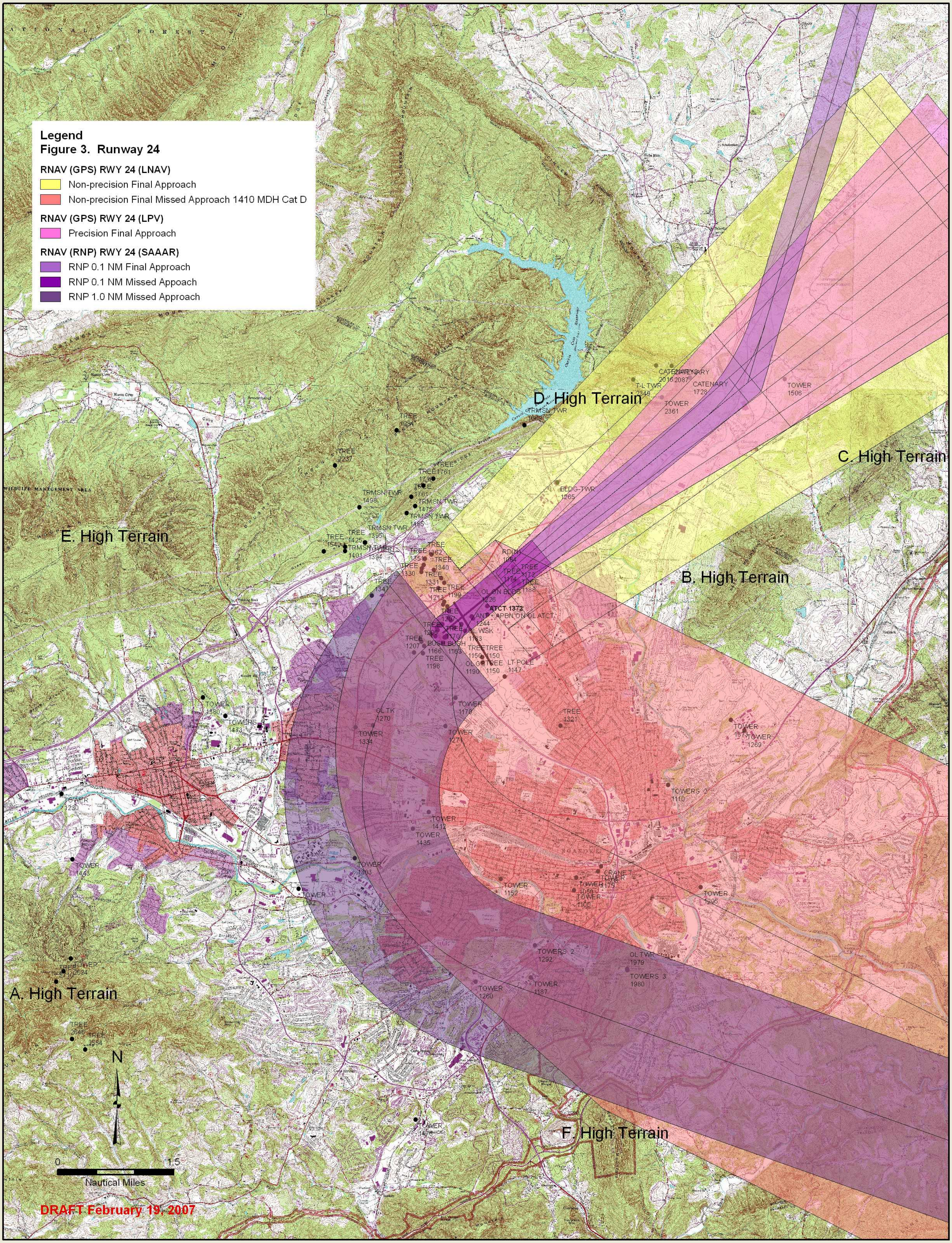
DRAFT February 19, 2007


Legend
Figure 3. Runway 24
RNAV (GPS) RWY 24 (LNAV)
Non-precision Final Approach
Non-precision Final Missed Approach 1410 MDH Cat D
RNAV (GPS) RWY 24 (LPV)
Precision Final Approach
RNAV (RNP) RWY 24 (SAAAR)
RNP 0.1 NM Final Approach
RNP 0.1 NM Missed Approach
RNP 1.0 NM Missed Approach
A. High Terrain
B. High Terrain
C. High Terrain
D. High Terrain
E. High Terrain
F. High Terrain
N
0
1.5
Nautical Miles
DRAFT February 19, 2007

APPENDIX F

Review of Proposed Intersection Configuration for Airport Entrance

HNTB

ROANOKE REGIONAL AIRPORT

MASTER PLAN UPDATE

Technical Memorandum

Review of Proposed Intersection
Configuration for Airport Entrance

February 22, 2007

HNTB

Background

HNTB Corporation is assisting the Roanoke Regional Airport Commission to develop an update to the Roanoke Regional Airport (RRA) master plan. As part of this study, it was learned that the City of Roanoke is developing a design for intersection improvements at Aviation Drive, Towne Square Boulevard, and Thirlane Road that would directly impact access to the Airport's passenger terminal. The idea behind the City's proposal is that improved access to and egress from the retail area served by Towne Square Boulevard requires a signal at Aviation Drive. To minimize impacts on and improve the adjacent airport entrance, and to help reduce wrong-turn movements into Thirlane Road by drivers believing that Thirlane is the entrance to the Airport, the City proposed a single signalized intersection of Aviation/Towne Square/Airport entrance/Thirlane Road, in which Thirlane and the Airport entrance would be the shared west leg. Airport staff requested that HNTB analyze the proposed intersection improvements to identify impacts to Airport customers. The full scope of HNTB's assignment is presented in Appendix 1.

This memorandum presents the results of traffic simulation and geometric analysis of the City's proposed configuration and suggests a refinement of the configuration.

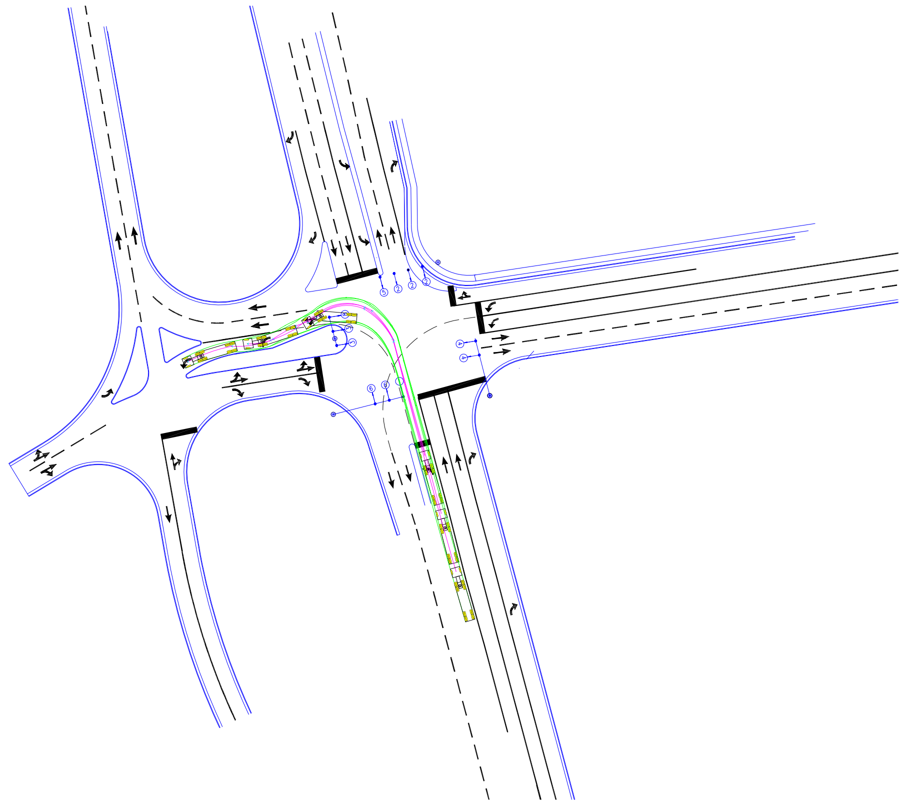
Findings

HNTB reviewed the City's proposal from a number of perspectives of interest and importance to the Airport. Our findings were:

1. **Level of service of traffic operations:** HNTB simulated the traffic operations of the proposed intersection using VISSIM microsimulation software. Both queue lengths and average vehicle delay were examined. In the City's proposed configuration, depicted in Figure 1, the intersection as a whole and the northbound left-turn movement into the airport operate with acceptable level of service.

2. **Encroachment into lanes:** HNTB reviewed the swept path of trucks that would make the northbound left into the airport followed by a left turn onto Thirlane Road. All turning trucks of wheelbase WB-40 or longer would encroach in the southbound right-turn lane into the airport, largely due to the length of the nose of the median on the west leg of the intersection. In the event three trucks make the northbound left turn sequentially and get delayed at the subsequent left turn onto Thirlane Road, one of the airport entrance lanes will become blocked. Such an event would be expected to occur only infrequently.

Figure 1: Aviation Drive at Towne Square Boulevard – City of Roanoke Proposal



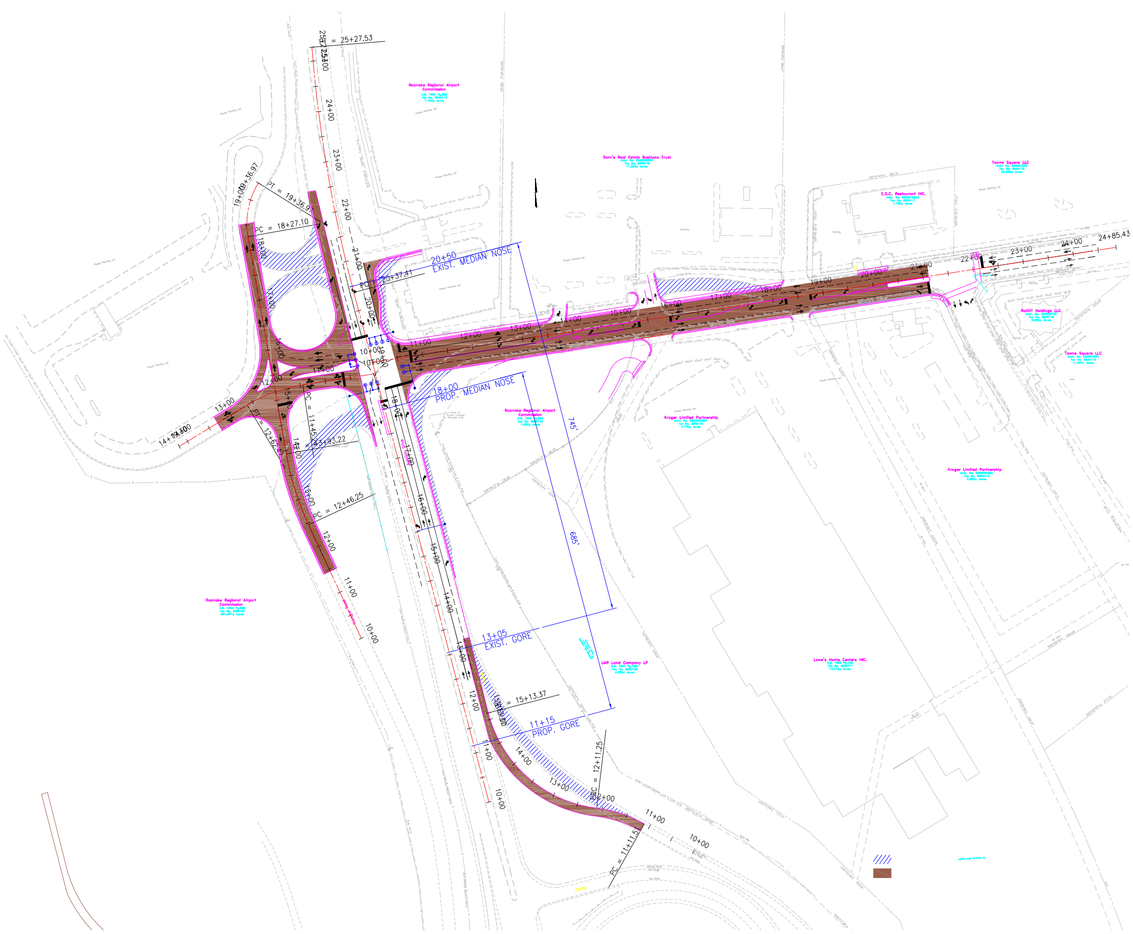
3. **Wayfinding:** HNTB considered the wayfinding implications of the proposal for airport-bound traffic. The issue today is the potential for airport-bound traffic to mistakenly turn left into Thirlane Road at the left-turn bay prior to the airport entrance. With a merged entrance as per the City's proposal, a single left-turn bay feeds both Thirlane Road and airport traffic. How to sign this left turn to inform the driver that immediately after turning left, he would have to choose between a left turn to Thirlane or a right turn to the airport is problematic. Some downstream signing, internal to the airport, is necessary to continue to provide positive guidance to the driver bound for the airport. However, large vehicles, especially trucks, would tend to block the view of drivers who may be following closely (as is true of most signalized left turns, the headway between vehicles is short). This further makes it difficult to sort Thirlane traffic from airport traffic, raising the possibility of wrong turns again.

4. **Weaving distance on Aviation Drive:** When traffic is busy on northbound Aviation Drive today, it can be challenging for drivers coming from the flyover ramp from eastbound Hershberger Road to weave across Aviation Drive to get in the left lane for the turn into the Airport. With the proposed new signalized

intersection located further south, any weaving issue could be aggravated. Recognizing this, the City's proposal was to reconstruct the merge point of the flyover ramp to move it southward, keeping as much of the weaving distance on Aviation as possible. As well, with tighter geometry on this ramp, traffic coming from the ramp would be at a lower speed than it is today. Figure 2 shows the current and proposed distances for making this movement between the flyover ramp and the Airport entrance. While no decrease is desirable from the perspective of ease of movement for traffic inbound to the Airport, the difference is a proposed decrease of approximately 60 feet, or less than 10 percent of the currently available distance.

Our conclusion based on these findings was that as proposed, the intersection had a few issues which needed to be addressed in order for the proposed project to achieve its objectives.

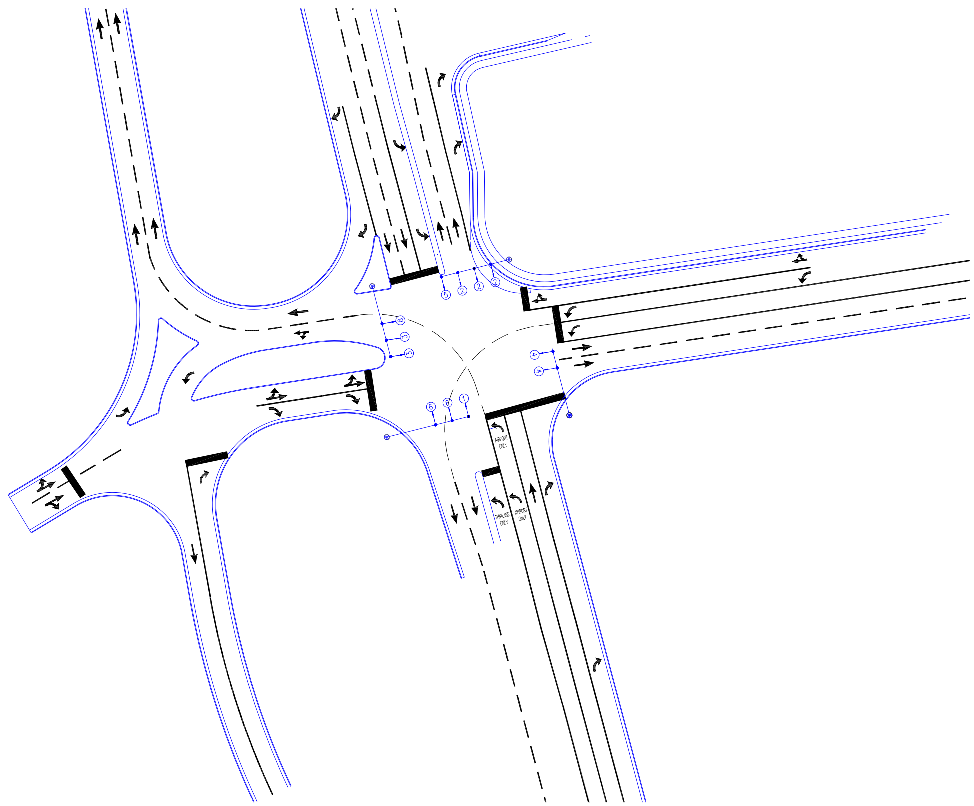
Figure 2. Proposed Change in Weaving Distance on Aviation Drive



Proposed Alternative Configuration

HNTB examined an alternative configuration to the intersection that would address potential vehicle blocking, motorist wayfinding concerns, and implications of the decrease in the weaving distance. This alternative is depicted in Figure 3.

Figure 3. Aviation Drive at Towne Square Boulevard – HNTB Alternative



The suggested changes shown in this plan are:

- Convert the left-most northbound through lane on Aviation Drive to a left-turn lane. Northbound volumes do not require two through lanes. Of the two left-turn lanes, the leftmost lane would be indicated with an overhead sign "Thirlane Road Only" and the second from left lane would be indicated "Airport Only." The two turning paths would be separated by cat-track pavement markings.
- Have two receiving lanes on the airport entrance. The right lane would continue onto the airport ring road. The left lane would be for left turns onto Thirlane Road but would also permit a driver to continue onto the airport ring road. Thus, even if a driver bound for the airport were to be in the incorrect lane, he could still correct for that after turning left off of Aviation Drive.

- Trim back the nose of the raised median of the airport entrance road such that left-turning trucks going to Thirlane Road do not encroach on the lane for traffic into the airport.
- Place a stop bar pavement marking, a "Stop Here on Red" (R10-6), and a "Do Not Block Intersection" (R10-7) sign on the outbound airport roadway just west of Thirlane Road.
- Construct a raised concrete island to prohibit northbound Thirlane Road through movement into the airport. The utility of this movement in the City's plan is not clear, and the anticipated tiny volume of traffic desiring to reach the terminal from Thirlane does not warrant the accommodation of this movement.
- If the intersection project is undertaken, at the Commission and the City should monitor the operation of the access/egress of the overflow lot relative to the influence thereon of the new adjacent signalized intersection.

With the dual left-turn lanes and overhead signs designating their usage, it is anticipated that the majority of airport-bound traffic would use the rightmost left-turn lane and be unimpeded by left-turning traffic onto Thirlane Road. Those airport-bound vehicles that get into the far left turn lane and are delayed by Thirlane-bound vehicles still would be able to continue in the same lane into the airport once the blockage clears. If outbound vehicles heed the "Do Not Block Intersection" sign, vehicles bound for Thirlane Road should rarely be delayed.

Relative to the weaving issue, the HNTB alternative configuration reduces the number of lanes across which a driver would have to weave to get into the Airport from the Hershberger flyover ramp. In the City's proposal, that movement would continue to be across two lanes of Aviation Drive. Under this alternate, there is only the need to weave across one lane, which takes a shorter distance to accomplish safely and easily, thus more than offsetting the impact of the loss of 60 feet of weaving distance.

Summary of Changes and Recommendation

If the City moves forward with the project and adopts the recommended alternatives presented in this memo, there will be three significant improvements from today's conditions:

- There will be no separate entrance to Thirlane Road from Aviation Drive to confuse anyone looking for the airport or to induce drivers to make sudden, last minute lane changes when they realize their mistake.
- The weaving is improved since Airport traffic would only have to weave left two lanes, one lane less than they do now. Given the modest decrease in the weaving length, the weave into the Airport would be better than today.

- There will be a signal at the Airport entrance which will improve the ability to deal with traffic volumes on Aviation which will, in general, be higher over time.

Our recommendation is that the Airport support the project with the proposed changes recommended herein for the following reasons:

- The City's original proposal overall was problematic relative to a few factors, which we have identified.
- The HNTB proposed revision to the City's plan addresses the concerns we have with the City's proposal:
    - It eliminates lane encroachment for left turns by trucks into the Airport and into Thirlane.
    - It improves the weave for Airport traffic (as noted above).
    - It operates as well or better than the City's proposal from a traffic operations perspective, and better from a safety and wayfinding perspective.
    - It offers an alternative for the possible improvement for movements out of Overflow Parking.
- With the recommended changes to the City's proposal, access to the Airport will be improved incrementally. One key aspect of our recommendation would be that there be an overhead sign structure (spanning the four northbound lanes of Aviation) set south of the northbound stop bar just far enough to not block driver's views of the traffic signals. This sign structure would flag the intended use of each lane with arrows and messages, to wit:
    - Right lane: Shopping Center Only (right turn arrow)
    - Second lane: Aviation Drive Through Traffic (thru arrow)
    - Third lane: Airport (left turn arrow)
    - Leftmost lane: Thirlane Road (left-turn arrow or a modified one which is almost a u-turn arrow)

Appendix 1.
Roanoke Regional Airport Master Plan Update
Supplemental Services Scope of Work

HNTB Corporation is assisting the Roanoke Regional Airport Commission to develop an update to the Roanoke Regional Airport master plan. As part of this study, it was learned that the City of Roanoke is developing a design for intersection improvements at Aviation Drive, Towne Square Boulevard, and Thirlane Road that would directly impact access to the Airport's passenger terminal. Airport staff has requested that HNTB Corporation analyze the proposed intersection improvements to identify impacts to Airport customers.

HNTB Corporation proposes the following scope of work.

Task 1: Collect and Collate Data
HNTB will acquire the following information from the City of Roanoke and its consultant that is designing the intersection improvements:

- turning movement volumes at the subject intersection
- vehicle classification
- origin and destination information through the intersection
- signal timing
- base mapping showing the currently proposed intersection configuration.

Task 2: Build Base Case Model
HNTB will build a VISSIM microsimulation model of the base case scenario – that is, the intersection configuration being developed by the City of Roanoke. This task will encompass laying out links, adding priority rules and signal controls, coding vehicle paths, checking model operations, refining and rechecking the model, and documentation of assumptions and methods. This model will use vehicle volumes for one time period, presumably the peak volumes for the intersection as a whole, as supplied by the City of Roanoke.

Additional service: Incorporate a second time period into the model.

Task 3: Run Base Case Model
Once the base case model has been built, HNTB will run the microsimulation model using 5 random number seeds. HNTB will extract and collate the data outputs from the model runs and report the following measures of effectiveness:

- average delay per vehicle at the intersection
- average travel times for vehicles destined for the Airport.

These model runs will be for the one time period described in Task 2.

Additional service: Run the model an additional 5 times for a second time period.

Task 4: Develop Alternatives
HNTB will evaluate the model results and identify deficiencies with the existing design. HNTB will then develop an alternative intersection configuration to address the deficiencies.

Task 5: Build Alternative Case Model
HNTB will build a VISSIM microsimulation model of the alternative case scenario – that is, the intersection configuration developed in Task 4. This task will encompass laying out links, adding priority rules and signal controls, coding vehicle paths, checking model operations, refining and rechecking the model, and documentation of assumptions and methods. This model will use vehicle volumes for one time period, presumably the peak volumes for the intersection as a whole, as supplied by the City of Roanoke.

Additional service: Incorporate a second time period into the model.

Task 6: Run Alternative Case Model
Once the alternative case model has been built, HNTB will run the microsimulation model using 5 random number seeds. HNTB will extract and collate the data outputs from the model runs and report the following measures of effectiveness:

- average delay per vehicle at the intersection
- average travel times for vehicles destined for the Airport.

These model runs will be for the one time period described in Task 2.

Additional service: Run the model an additional 5 times for a second time period.

Task 7: Final Documentation
HNTB will write a brief technical memorandum summarizing:

- methods and assumptions
- results of the base case modeling
- description of the alternative intersection configuration
- results of the alternative case modeling
- recommended course of action.

One hard copy and one electronic copy of the technical memorandum will be submitted to Roanoke Regional Airport staff.

APPENDIX G

Performance Analysis for Short/ Long Term Parking Lot Lighting System

PERFORMANCE ANALYSIS

For

ROANOKE REGIONAL AIRPORT
SHORT/LONG TERM PARKING LOT LIGHTING SYSTEM
ROANOKE, VIRGINIA

Prepared by:

HNTB

Arlington, Virginia
December 2006

TABLE OF CONTENTS

INTRODUCTION

This analysis is part of a larger project to develop the most efficient and economical solution for lighting of the short and long term parking lots at the Roanoke Regional Airport. The task order consists of a field survey for evaluating the existing lighting system, a lighting analysis of the existing lighting system and a preliminary design of a recommended lighting system. The report describes the details and results of the study, and examines the replacement of all existing luminaries excluding the pedestrian luminaries for the entire parking lot area. The mission of the proposed lighting system is to enhance parking lot safety. In the process, goals ensure a balanced approach to resolving lighting issues by assigning equal importance to safety, visual continuity, total cost, and minimization of light pollution.

Goal 1: to provide sufficient levels of illumination to ensure pedestrians, drivers and other users can travel safely at night.

Goal 2: to establish a system that provides unity and continuity for which enhances the character of the airport’s architecture and the surrounding landscape.

Goal 3: to balance energy efficiency, construction cost, illumination control and uniformity.

Field Survey of Existing Lighting System

The parking lot is currently being illuminated by conventional offset low-level lighting. There are three types of light poles in the parking lots (see Fig. 1.). Luminaire Type S: rectangular 400 Watt Metal Halide luminaries, HUBBELL#: RCM-0400M-IF5-X-F5, with sharp cutoff - medium type III distribution, mounted on Type A poles. Luminaire Type S1: 175 Watt Metal Halide luminaries, HUBBELL#: RCS-OMSH-IP5-X-F5, with sharp cut-off – medium type III distribution, mounted on Type B poles. Luminaire Type S2: 175 Watt Metal Halide Glow Dome walkway luminaries, Gardco#: CPG 1811-277, 175MH-WP-10 AF-NA, with Anodized Brushed Aluminum Type C poles.

Tested Area	Reading Number	Reading under the Luminaire (Fc)	Reading Coverage Area of the Luminaire (Fc)	Reading Coverage Area of the Luminaire (Fc)	Reading Coverage Area of the Luminaire (Fc)
PL Access Road	1	0.27	0.1		
PL Access Road	2	0.4	0.38		
PL Access Road	3	0.27	0.1		
Parking Lot	1	1.28	0.21	0.21	0.04
Parking Lot	2	1.28	0.9	0.9	0.04
Parking Lot	3		0.21	0.33	
Pedestrain Path	1	3.05	1.33		
Pedestrain Path	2	3.05	1.33		
Pedestrain Path	3	2.11	0.4		

Table 1: Test data collected during the field survey

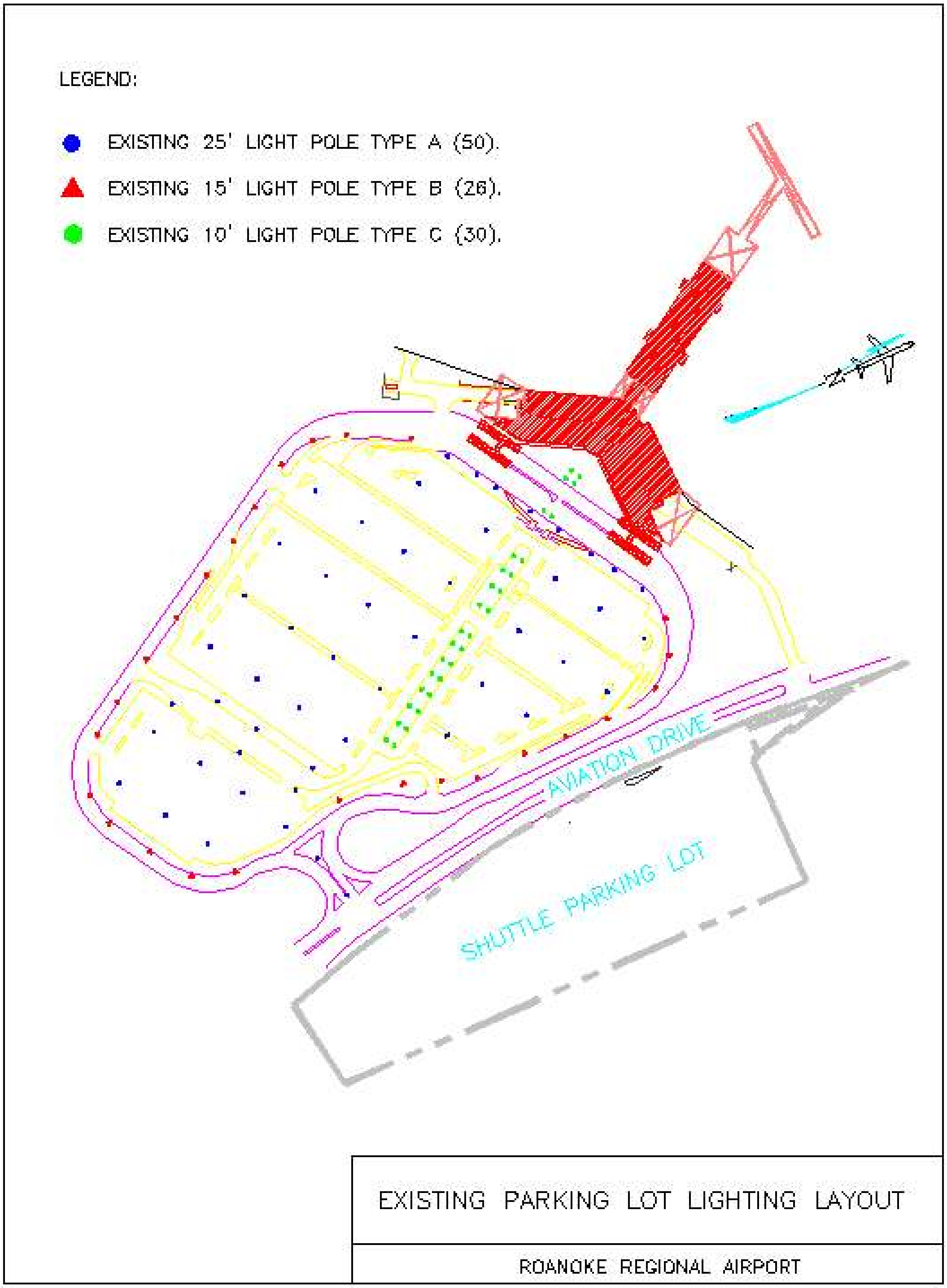
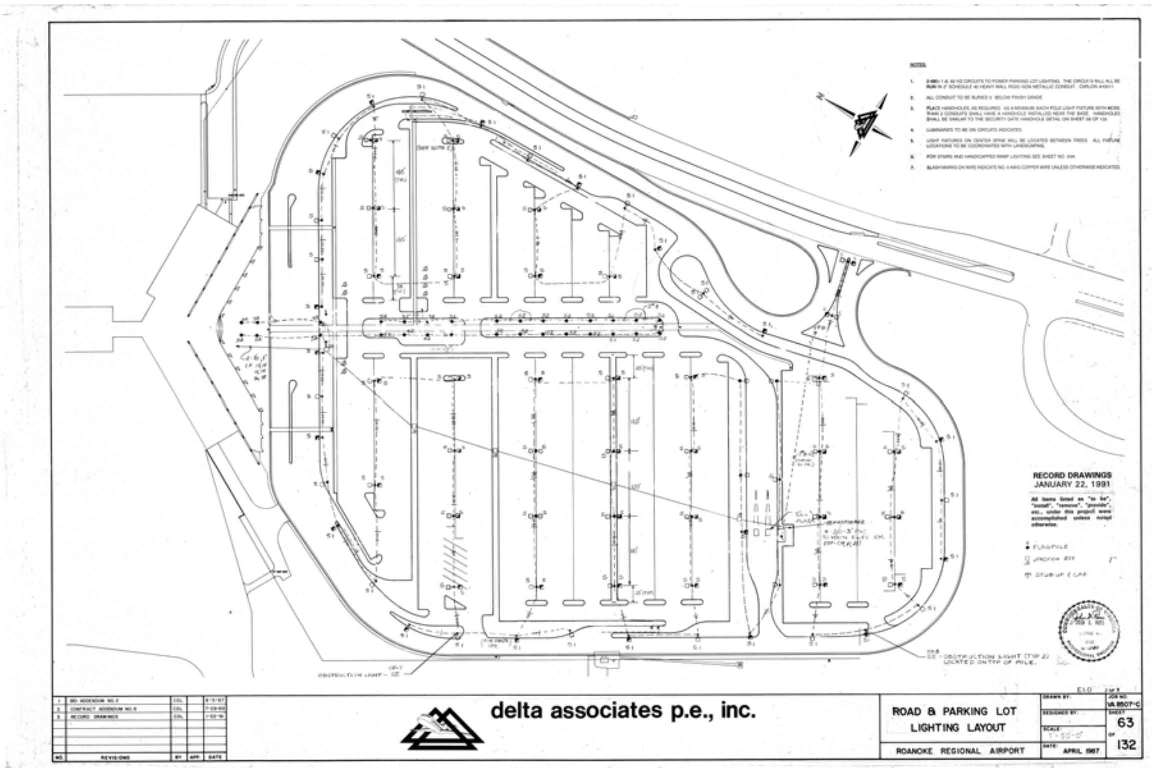


Figure 1. Existing Lighting Layout



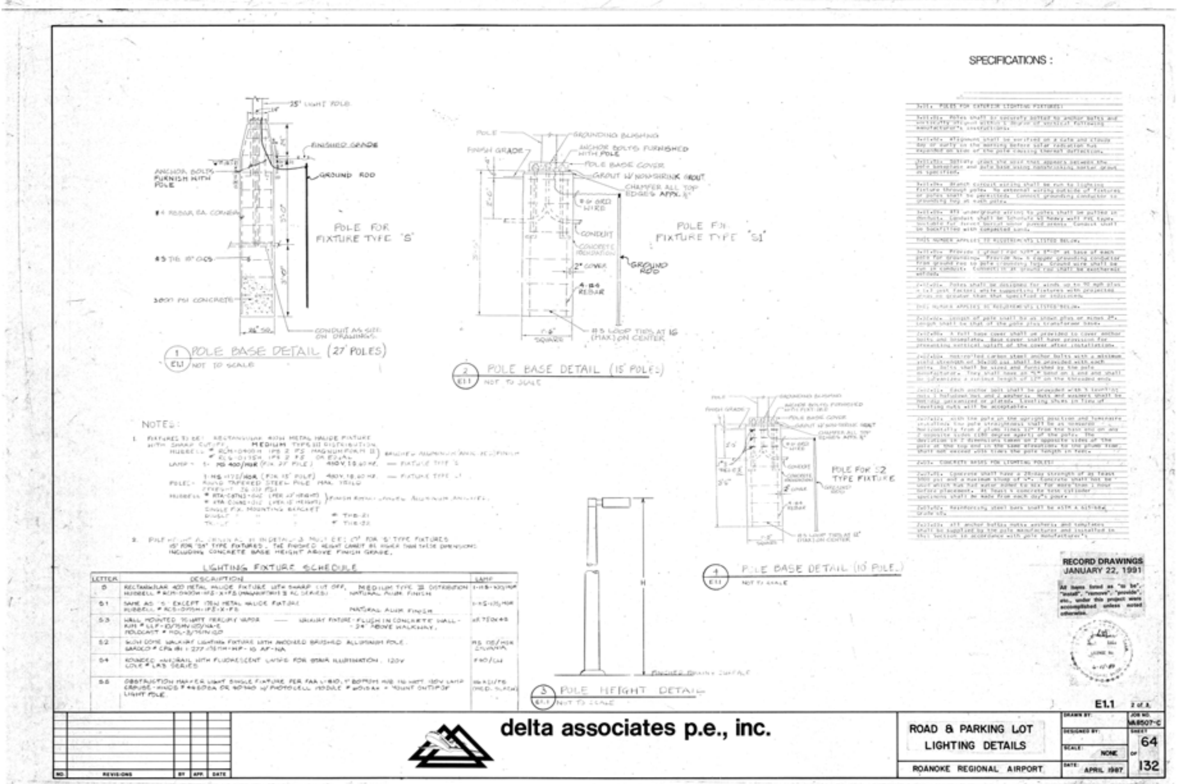


Figure 2. Existing Lighting Design Drawings

Proposed Lighting System

DESIGN CRITERIA

The following criteria are based on the IESNA Recommended Practice with airport parking area (RP-17-87).

- Level of Illumination (average maintained horizontal illumination)

  1 to 2 footcandles

- Minimum Horizontal Illuminance

  0.2 to 0.5 footcandles

- Uniformity Ratio (Maximum to Minimum)

  20:1 to 15:1

PROPOSED SYSTEM

- Light Source: Metal Halide
- Lamps:

  a) New 250 watt M.H. luminaries on existing light poles at existing locations.

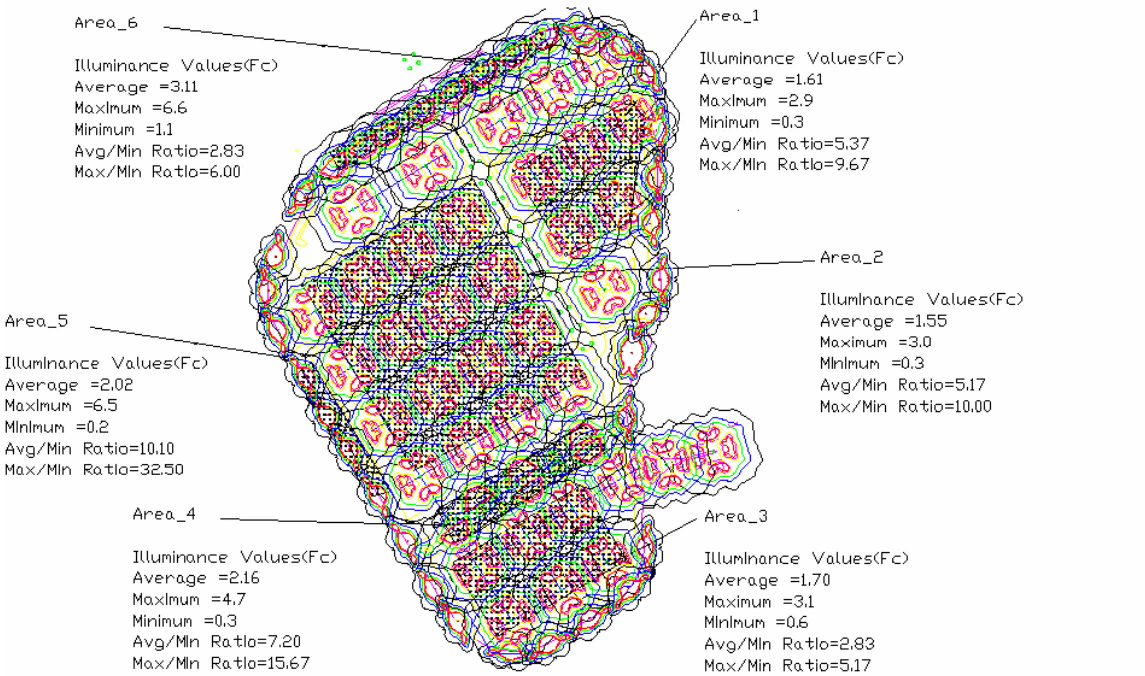
  b) New 175 watt M.H. luminaries on existing light poles at existing locations.

  c) Existing pedestrian path lighting system to remain.

- Mounting Heights (remain the same as the existing mounting heights):

  a) Parking lot --- 27'; b) Access road --- 15'; c) Pedestrian walkway (typical) --- 10'

Photometric Calculations



Statistical Area Summary							
Label	**CalcType**	**Units**	**Avg**	**Max**	**Min**	**Avg/Min**	**Max/Min**
Area_1	Illuminance	Fc	1.61	2.90	0.30	5.37	9.67
Area_2	Illuminance	Fc	1.55	3.00	0.30	5.17	10.00
Area_3	Illuminance	Fc	1.70	3.10	0.60	2.83	5.17
Area_4	Illuminance	Fc	2.16	4.70	0.30	7.20	15.67
Area_5	Illuminance	Fc	2.02	6.50	0.20	10.10	32.50
Area_6	Illuminance	Fc	3.11	6.60	1.10	2.83	6.00

Conclusion

To achieve an optimum lighting system the light poles for the parking lots and access road would require redesign and reinstallation. However, considering most of the lighting system elements are of good condition, our conclusion is that a retrofit of the existing lighting system is more feasible for reasons of efficiency and performance. We have concluded that the existing luminaries in the parking lots and access road will improve the overall existing lighting conditions by:

- Reduction of illumination glare and improved illumination uniformity. Such enhancements will improve night time visual perception; therefore providing significant improvements to night time driving as well as pedestrian and security conditions.

- Controlling light pollution. By applying cut-off illumination optics, vertical and horizontal illumination spillage from the parking lots and access road will be eliminated. Only a visual perception of the illumination will be detectable outside of the limits of the parking lots and access road.

- Reduction of energy consumption. The proposed luminaries operate more efficiently than the existing luminaries.

Recommendation

Retrofit the existing lighting system:

1. Replace the existing luminaries in the parking lots and access road.

2. Retain existing lighting system elements such as: light pole foundations, light poles, lighting system electrical service and circuits.

3. Retain all elements of the pedestrian walkway lighting system.

4. Additional improvements to the existing lighting system can be obtained by adding more access road light poles and luminaries and by modifying the light pole spacing and luminaire mounting heights in the parking lots.

APPENDIX H

Northwest Quadrant Development Analysis

DELTA AIRPORT
CONSULTANTS, INC.

January 12, 2007

Mr. Jeffrey S. Mishler
Associate Vice President
HNTB
2900 South Quincy Street, Suite 200
Arlington, Virginia 22206

RE: Northwest Quadrant Development
Update Airport Master Plan
Roanoke Regional Airport
Roanoke, Virginia
AIP Project No. 3-51-0045-Pending
Delta Project No. VA 04095

Dear Mr. Mishler:

Please find enclosed the draft report of an analysis of the development of the Northwest Quadrant at the Roanoke Regional Airport. This report identifies the anticipated development to accommodate conceptual cargo and fixed base operator facilities. It also identifies proposed land acquisition, construction, environmental impacts, residential displacement and order of magnitude costs for developing that site.

In the report, Delta Airport Consultants, Inc. assessed the site work required to accommodate the conceptual layout provided by HNTB. Please note that slight modifications were made to the layout due to the site constraints.

The report does not relay opinion on feasibility or make recommendations on proceeding. The report and estimates are preliminary and based on limited topographical and geographical study of the airport vicinity.

We appreciate the opportunity to assist in this effort for the Roanoke Regional Airport. If you should have any questions regarding this matter, please do not hesitate to contact our office.

Sincerely,

Jeffrey K. Brown, P.E.

JKB:blg

Encl: Northwest Quadrant Analysis Report

cc: Joe Navarette, HNTB w/encl.

VA04095C003

9711 Farrar Court, Suite 100 • Richmond, Virginia 23236
phone: (804) 275-8301 • fax: (804) 275-8371 • www.deltaairport.com

NORTHWEST QUADRANT DEVELOPMENT ANALYSIS

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

Prepared for: HNTB Corporation

At the request of

THE ROANOKE REGIONAL AIRPORT COMMISSION

By

Delta Airport Consultants

January 12, 2007

Delta Project No. VA 04095

CONTENTS

I. Introduction

The Roanoke Regional Airport Commission has requested study of conceptual development for aviation facilities in the undeveloped northwest quadrant of the airport shown at Exhibit 1. Delta is providing preliminary estimates for the site work and building facilities.

Purpose

The purpose of this preliminary study is to estimate the costs and scope of work for the conceptual layout prepared by HNTB. The layout depicts cargo operations and a fixed based operator (FBO) in the northwest quadrant of the airport.

II. Current FAA Design Standards

Layout meets ARC D-IV, 400' Taxiway – Runway separation, 500' setback to apron, Part 77 airspace clearance – assuming both runways are served by precision approaches

III. Existing Conditions

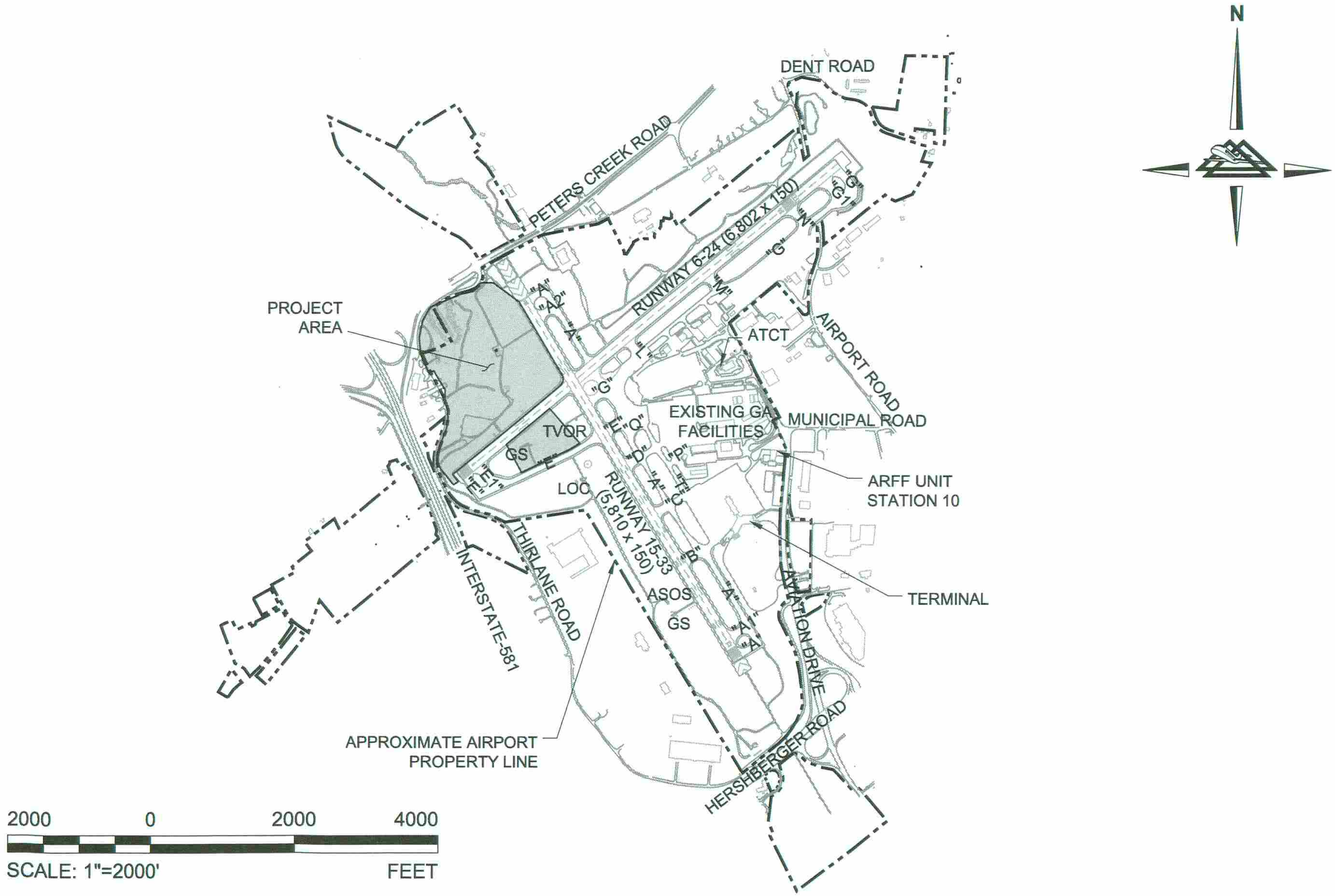
As shown on Exhibit 2, the northwest quadrant is an undeveloped area located on airport property. The site is occupied by an FAA maintenance building, an Airport Surveillance Radar (ASR) and a mobile home park which is partly on Airport property.

The proposed site is bisected by approximately twenty-five hundred linear feet (2,500') of a regulated intermittent stream, whose entire length is classified as a wetland. A small portion of the site has been used as a construction staging area and may contain construction waste, such as excavated soils, asphalt and concrete pipes.

In addition to air carrier operations, the Airport has significant general and corporate aviation traffic. At least four (4) air cargo aircraft are based at the Airport and several other freight, charter, and non-scheduled cargo aircraft operate at the Airport on a continuous basis.

Due to the limited area of the Airport, space is limited to expand existing facilities in the midfield area south and east of the runway intersection. The study of the feasibility to develop the Northwest Quadrant is in the long term interest of the Airport to serve growing aviation demand especially for business aviation and air cargo. Growth of the air carrier terminal facilities could displace some general aviation facilities further increasing potential development of the Northwest Quadrant.

DRAWING: 04095 NW Quadrant Airport Layout.dwg LAYOUT: L1



NORTHWEST QUANDRANT PROJECT AREA

ROANOKE REGIONAL AIRPORT

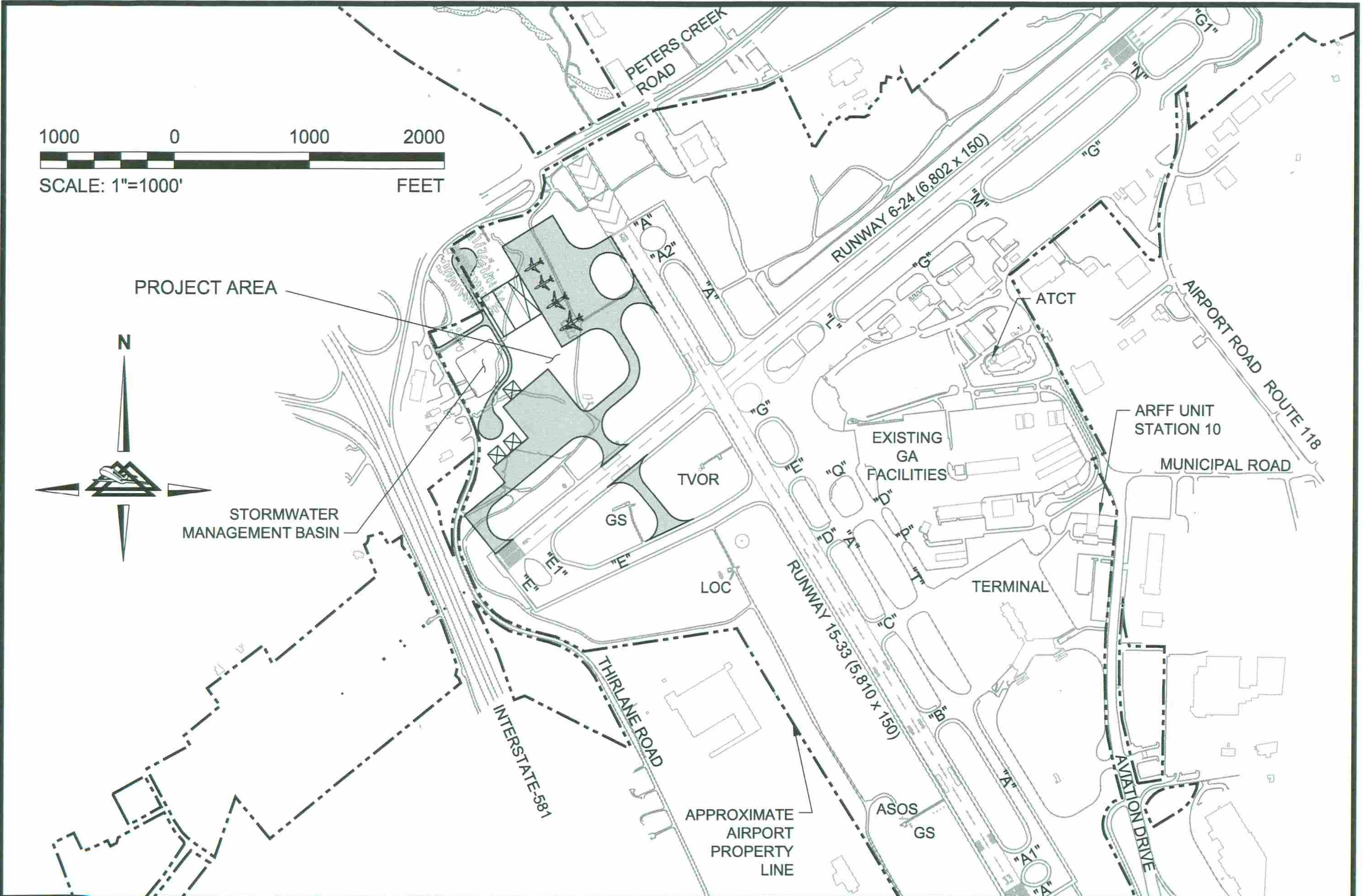
www.deltaairport.com

DRAWN BY:	PJW	CHECKED BY:	TSS	SCALE:	1"=2000'	DATE:	JANUARY 2007

EXHIBIT 1

X:\2004proj\04095\exhibits\NW Quadrant Development\04095 NW Quadrant Airport Layout.dwg, L1, 1/12/2007 2:52:01 PM, pjw

DRAWING: 04095 NW Quadrant Project Area.dwg LAYOUT: L1



www.deltaairport.com

NORTHWEST QUANDRANT PROJECT AREA
ROANOKE REGIONAL AIRPORT

EXHIBIT
2

DRAWN BY: PJW	CHECKED BY: TSS	SCALE: 1"=1000'	DATE: JANUARY 2007

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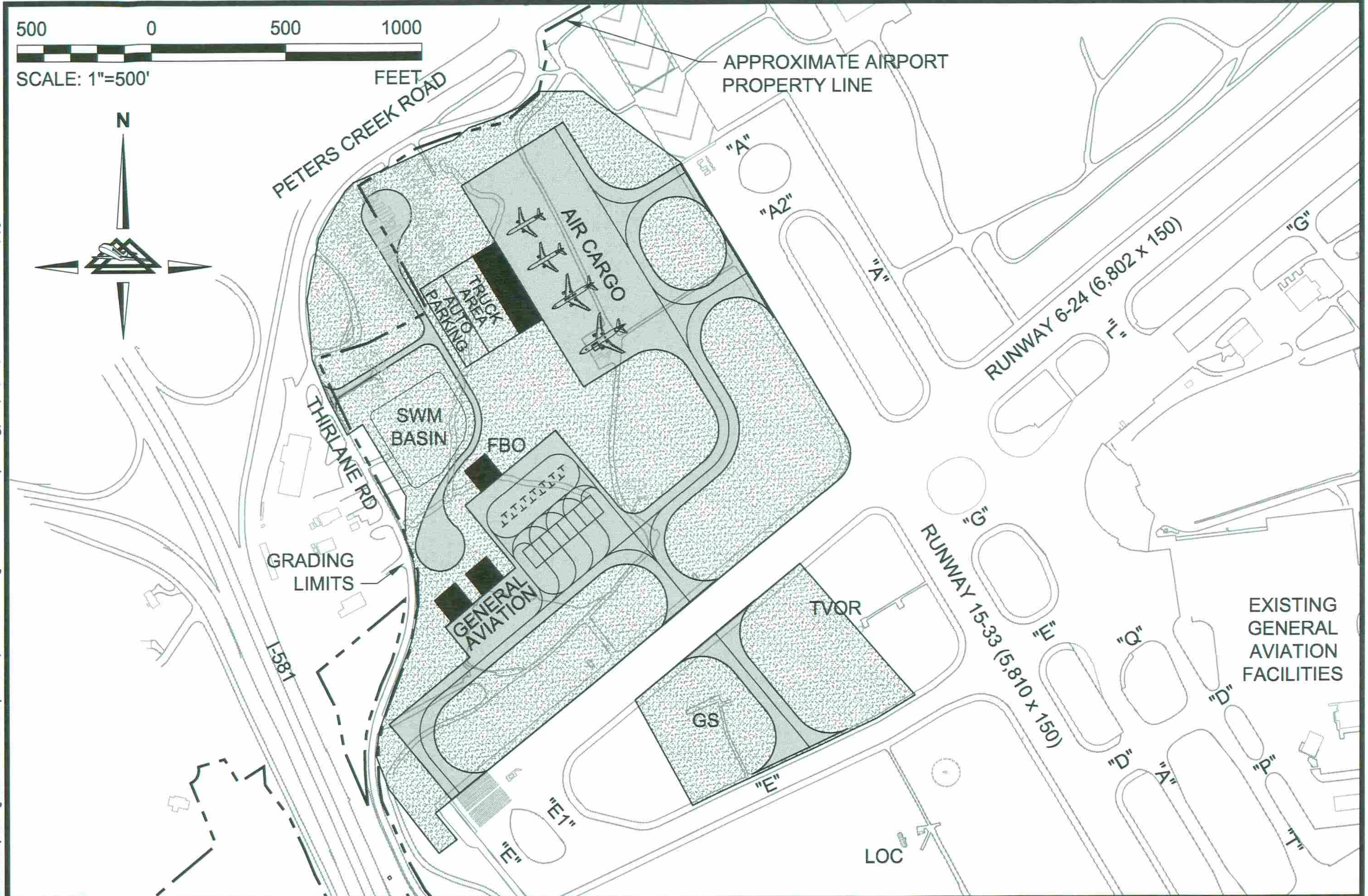
DRAWING: 04095 NW Quadrant Concept.dwg LAYOUT: L1



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NORTHWEST QUANDRANT DEVELOPMENT
ROANOKE REGIONAL AIRPORT

DRAWN BY: PJW	CHECKED BY: TSS	SCALE: 1"=500'	DATE: JANUARY 2007

EXHIBIT 3A

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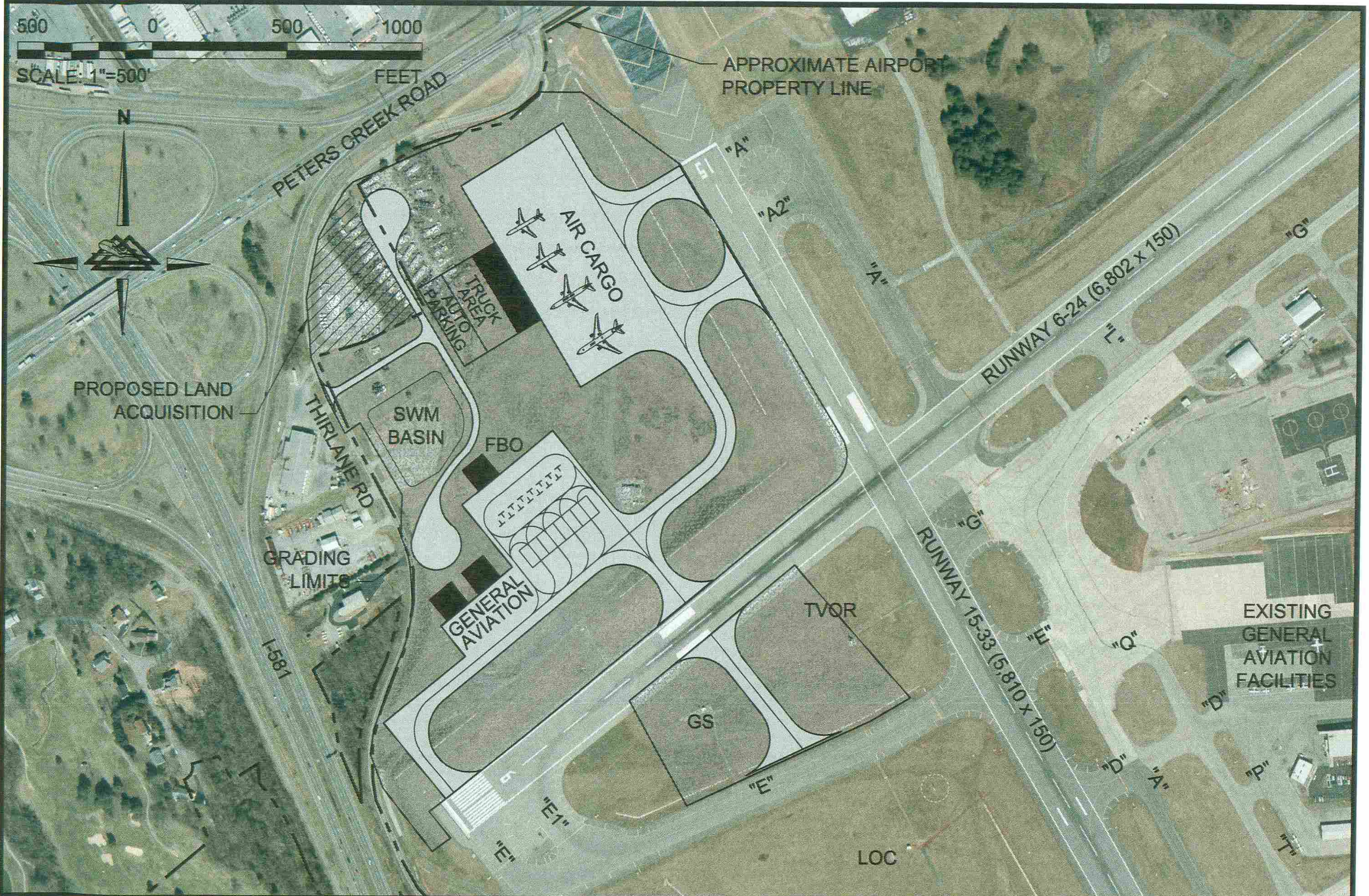
DRAWING: 04095 NW Quadrant Concept.dwg LAYOUT: PHOTO



www.deltaairport.com

NORTHWEST QUANDRANT DEVELOPMENT
ROANOKE REGIONAL AIRPORT

EXHIBIT 3B

DRAWN BY: PJW	CHECKED BY: TSS	SCALE: 1"=500'	DATE: JANUARY 2007

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Northwest Quadrant Development

1. Property Impacts

As shown at Exhibit 2 approximately 66.5 acres of existing airport property will be required for the proposed development of the Northwest Quadrant. In addition, development should include acquisition of remaining property inside Thirlane Road and the portion of the mobile home park not currently on airport property, approximately four (4) acres. This would result in the displacement of approximately 45 dwellings and the closure of the mobile home park.

It is assumed that the existing FAA maintenance building and airport surveillance radar will be relocated separately and prior to this development.

2. Construction

To develop the northwest quadrant as proposed, approximately one point seven (1.7) million cubic yards of earthwork, primarily clean fill, material would be required with associated grading, drainage, site work, grade changes and pavement in the development area.

To mitigate the impacted wetland it is assumed that water quality enhancement measures would be required. However alternate mitigating methods could be investigated to compensate for this impact such as contribution to a wetland bank, or watershed improvements.

3. Environmental

Environmental impacts to existing wetlands are anticipated and would need to be investigated with some level of permitting required. Environmental study would likely be satisfied by completion of an FAA Form C. In addition to existing wetlands, the considerable construction grading, drainage, and vegetation impacts would also result from this project. The anticipated project impacts appear to be able to be mitigated by reasonable measures.

4. Estimated Cost

Based on updated planning cost figures, the cost for the development of the northwest quadrant is estimated to be $100 million. The estimate details are shown in Appendix 1. The estimate includes the costs of the new buildings, paving and utility improvements. The costs do not include furniture, fixtures and equipment (FF & E) by tenants for use.

5. AIP Eligible Costs

A significant portion of the NW Quadrant improvements would be considered AIP eligible since they would be part of the public use infrastructure. AIP eligible components include the taxiway pavements, apron pavements, associated electrical and drainages improvements; and some portions of the landside access facilities. As shown in Appendix 1 it is estimated that approximately $60 million of the development costs are eligible for AIP funding.

SUMMARY CHART – Northwest Quadrant

Item	Scope of Work	Operational Impact (Airport)	Environmental Impact	Estimated Cost
1. Northwest Quadrant Project Area	1.7 MCY earthwork. Paving Electrical include lighting vault FBO and Cargo Buildings	Limited runway closures. - for connector taxiway tie-in	Wetland Impact,– Minimal Mobile Home Park – potential resident displacement and relocation	$100 million

APPENDIX 1

COST ESTIMATE

NORTHWEST QUADRANT DEVELOPMENT STUDY

ROANOKE REGIONAL AIRPORT
ROANOKE, VA

DELTA PROJECT NO: VA 04095

DATE: January 12, 2007

CONSTRUCTION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT	AIP Percentage	AIP Contibution
1	MOBILIZATION	LS	1	$4,100,000	$4,100,000	50%	$2,050,000
2	BUILDING DEMOLITION	LS	1	$50,000	$50,000	100%	$50,000
3	DRAINAGE	LS	1	$2,400,000	$2,400,000	75%	$1,800,000
4	EROSION AND SEDIMENT CONTROL	LS	1	$500,000	$500,000	75%	$375,000
5	EXCAVATION	CY	210,000	$10	$2,100,000	50%	$1,050,000
6	EMBANKMENT	CY	1,760,000	$15	$26,400,000	75%	$19,800,000
7	BUILDINGS	SF	110,000	$125	$13,750,000	0%	$0
8	PAVING	SY	130,000	$150	$19,500,000	80%	$15,600,000
9	ELECTRICAL	LS	1	$3,000,000	$3,000,000	50%	$1,500,000
10	MISCELLANEOUS (15%)	LS	1	$10,155,000	$10,155,000	50%	$5,077,500

	Construction Costs	AIP Contribution
TOTAL:	$81,955,000	$47,302,500
20% Engineering, Constr. Admin, EA, etc.	$16,391,000	$9,460,500
Construction Sub- Total	$98,346,000	$56,763,000
Use	**$100,000,000**	**$60,000,000**

J:\PROJECT\2004proj\04095\RW 15 Ext. Study\04095 NW Quadrant estimate.xls

APPENDIX I

Runway Length Analysis

Runway Extension Alternatives to Meet Master Plan Recommended 7,700-foot Length White Paper

Introduction

The Master Plan Update recommends an ultimate runway length of 7,700 feet for Roanoke Regional Airport (ROA). This recommendation is based on a preliminary analysis of anticipated air service in the future.[1] This analysis suggests that, toward the end of the 20-year forecast horizon, nonstop service to Dallas-Ft. Worth (DFW) and/or Houston (IAH) is possible. Due to the relatively long stage length and low demand levels of these markets, it is anticipated that these markets would be served by regional jets. For planning purposes, therefore, runway length requirements were determined using the 50-seat Embraer EMB-145 regional jet, currently, the most common regional jet used for these two markets.

Potential Benefit of a 7,700-foot Runway

A general, order-of-magnitude analysis was undertaken to determine whether a runway-lengthening project would be economically feasible. The results are shown in **Table 1**. The economic benefit of the runway-lengthening project was limited to benefits accrued by commercial passenger airlines.[2] Since the current length is sufficient for existing service, a lengthened runway would not begin to provide a measurable economic benefit until the airlines introduced service to new markets where operational payloads would be restricted by runway length.

The primary benefit of a 7,700-foot runway would be the greater payload-carrying capacity (expressed in terms of additional revenue) of commercial flights. As noted previously, the most likely passenger markets that could benefit from having a longer runway would be DFW and IAH, both of which are approximately 1,000 statute miles from Roanoke. The maximum payload capacity of the EMB-145 is 12,771 pounds.[3] A full 50-passenger load would therefore leave 1,771 pounds available for cargo. The economic benefit calculations, therefore, assumed 1,771 pounds of cargo and measured the additional benefit in terms of added revenue from being able to carry more passengers due to the longer runway.[4]

[1] See draft of Chapter 5, Section 5.4.2, Roanoke Regional Airport Master Plan Update (2006) for a discussion of this analysis.
[2] Based on the analysis in Section 5.4.2 of the Master Plan Update, the short stage lengths to existing cargo hubs do not indicate an economic benefit from a longer runway.
[3] EMB-145-LR airport planning manual.
[4] Revenue for belly cargo carried is difficult to obtain; therefore, the benefit calculations were determined based on additional passengers carried.

Table 1

ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

Comparison of Order-of-magnitude Benefit and Cost
for Providing 7,700 Feet of Runway (1)

	6,800 Feet (2)	7,700 Feet		Difference
BENEFIT				
Max. Takeoff Wt. (lbs.) (3)	44,864	47,508		2,644
Oper. Empty Weight (lbs.)	26,694	26,694		-
Fuel + Reserves (lbs.)	7,470	8,043		573
Avail. Payload (lbs.)	10,700	12,771 (4)		2,071
Cargo (lbs.) (5)	1,771	1,771		-
Passengers (6)	40	50		10
Passenger Load Factor	80.0%	100.0%		
Avg. One-way Fare (7)				
Dallas-Ft. Worth			$	193.33
Houston			$	202.25
Annual Departures				
Dallas-Ft. Worth (8)				1,095
Houston (8)				1,095
Additional Revenue				
Dallas-Ft. Worth			$	2,116,964
Houston			$	2,214,638
Total			$	4,331,601
TOTAL ANNUAL BENEFIT				
DFW Service Only			$	2,116,964
DFW + IAH Service			$	4,331,601
COST				
Costruction Cost				
Lengthen East End of Runway 6-24			$	250,000,000
Lengthen North End of Runway 15-33			$	90,000,000
TOTAL ANNUAL COST (9)				
Lengthen East End of Runway 6-24			$	20,000,000
Lengthen North End of Runway 15-33			$	7,200,000
DIFFERENCE BETWEEN ANNUAL BENEFIT AND COST				
Lengthen East End of Runway 6-24				
DFW Service Only			$	(17,883,037)
DFW + IAH Service			$	(15,668,399)
Lengthen Northwest End of Runway 15-33				
DFW Service Only			$	(5,083,037)
DFW + IAH Service			$	(2,868,399)

Note: (1) Assumes no obtacle limitations.
(2) Existing length of longest runway.
(3) At mean maxium summer temperature (85 deg. F).
(4) Maximum payload for EMB-145 LR version.
(5) Maximum cargo assuming full 50-passenger load.
(6) Assumes 220 pounds per passenger.
(7) Average one-way fare (CY2005), from US DOT.
(8) Assumes 3 daily departures x 365 days; all departures at 85 deg. F.
(9) Does not include O&M.

Source: EMB145 Airport Planning Manual; USDOT T100 data; HNTB analysis.

At the current 6,800-foot runway length, an EMB-145-LR regional jet traveling to either DFW or IAH would be limited to about 40 passengers and 1,771 pounds of cargo for flights departing at the mean maximum temperature. It is recognized that, in practice, airlines would likely reduce the amount of cargo on-board 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 had to be calculated in terms of additional passengers. 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 annual benefit was estimated for two scenarios—three daily departures to DFW only and three daily departures to both DFW and IAH (for a total of six daily departures). In addition, to present the best case for potential benefits, it was assumed that each departure occurred at 85 degrees throughout the year. With nonstop service to DFW only, the annual benefit is estimated to be approximately $2.1 million. Assuming six daily non-stops, the annual benefit is estimated to be $4.3 million. This suggests that the amortized (annual) cost of the extension would have to be equal to or less than these amounts in order to make it cost-justifiable. Based on current financing costs, a benefit of $2.1 million could support a project capital cost of between $23 million to $27 million, while a benefit of $4.3 million could support a project capital cost of between $48 million and $55 million.

Cost of Longer Runway

The cost of the lengthened runway would be its construction cost and costs for planning, engineering, land acquisition, materials, labor and environmental mitigation. Once the extension became operational, there would also be an incremental increase in operating and maintenance (O&M) cost.

Cost of Extending Runway 6-24 to 7,700 Feet

As part of a separate analysis, options for extending the primary runway at ROA (Runway 10-28) to a length of 10,000 feet were examined. The results of this analysis indicated that the least expensive option for providing this length was extending the runway to the east, as a westward extension would require spanning I-581. The initial cost estimate for this 3,200-foot extension was $490 million. Although a specific cost estimate was not undertaken for a 900-foot extension (i.e., the additional length needed to provide the Master Plan-recommended 7,700 feet), it would likely exceed $250 million; this cost was assumed for providing 7,700 feet on Runway 6-24.

Extending Runway 15-33 to 7,700 Feet

Extending Runway 15-33 was also examined as part of the Master Plan Update effort. Extending the runway to the southeast would have a significant impact on Hershberger Road and its interchange with Aviation Drive, as well as other impacts, and was therefore not considered in greater detail. However, an extension toward the northwest (i.e., 15 end) was examined (see **Figure 1**). Because air carrier departures would generally be limited to the southeast direction (due to terrain), it is possible that the full benefit of extending this runway would not be realized; however, to present a best case for this option, it was assumed that the 7,700-foot length could be used when needed.[5]

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 safety area, and for obstruction mitigation. Approximately one million cubic yards of earthwork would be required to provide adequate grading and drainage and clearance of Peter's Creek Road. It also would require an overpass to be constructed over Peter's 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 result of the preliminary cost estimate for lengthening Runway 15-33 to 7,700 feet to the northeast indicates a construction cost of $90 million.

Order-of-magnitude Comparison between Benefit and Cost

Lengthening Runway 15-33 to the northwest appears to be the least expensive option for providing the Master Plan Update-recommended 7,700 feet of runway; however, it does not appear to be practical from a cost justification perspective during the 20-year planning horizon. As shown in Table 1, the annual benefit would be between $2.1 million and $4.3 million while its annual cost would be approximately $7.2 million.

Recommendation

Although the runway lengthening project does not appear to be cost-justifiable during the 20-year planning horizon of the Master Plan Update, as demand continues to increase and as aircraft become more efficient, the benefit of a longer runway would, at some point, justify its implementation. Prudent planning therefore suggests that sufficient land beyond the northwest end of Runway 15-33 be acquired by the Airport and preserved to ensure that the project could be undertaken.

[5] Terrain would limit the landing length to 5,800 feet when landing on Runway 15.

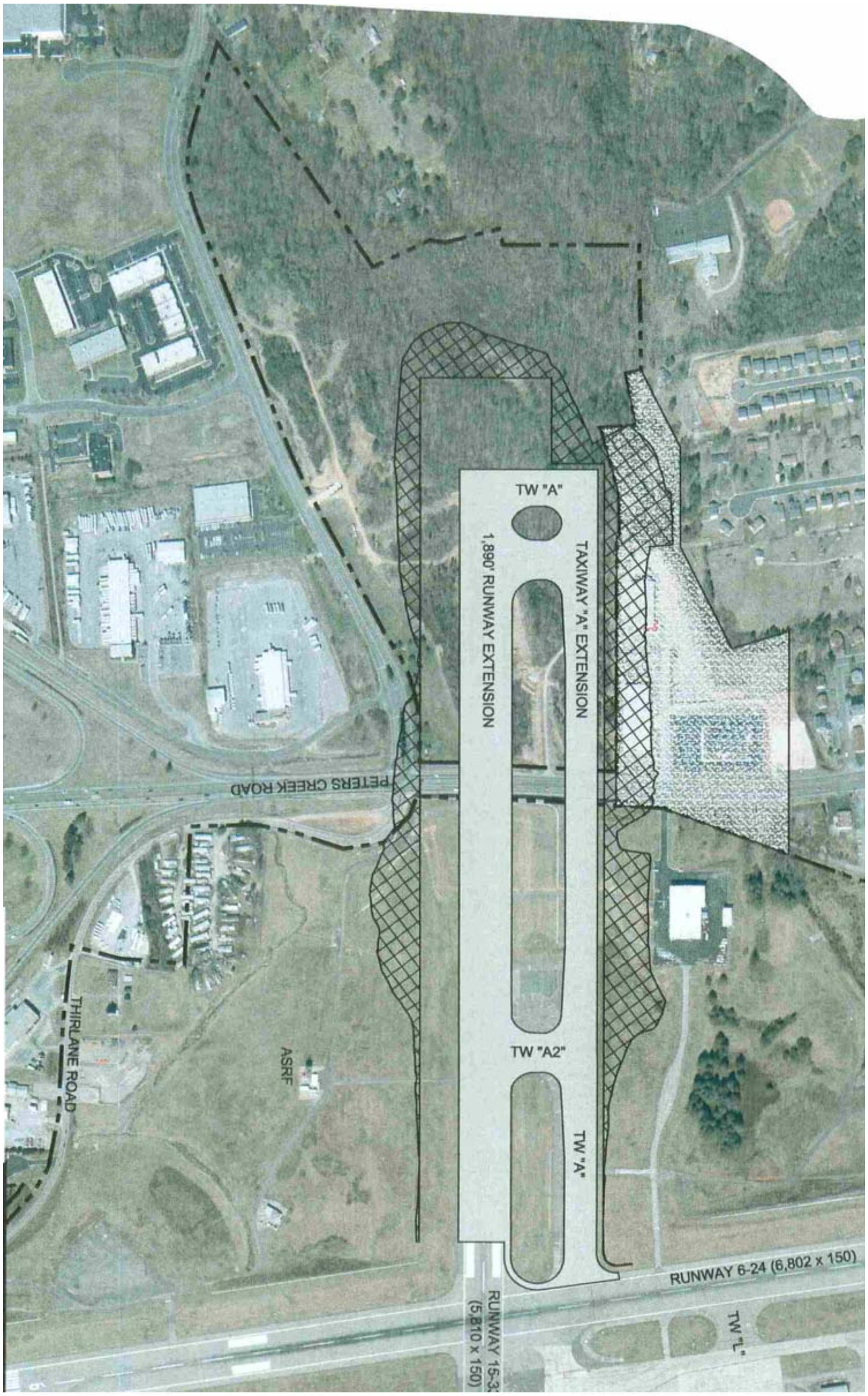


Figure 1—*Northwest Extension to Runway 15-33*

RUNWAY EXTENSION ANALYSIS

RUNWAY 15

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

Prepared for: HNTB Corporation

At the request of

THE ROANOKE REGIONAL AIRPORT COMMISSION

By

Delta Airport Consultants

December 8, 2006

Delta Project No. VA 04095

CONTENTS

I. Introduction

The Roanoke Regional Airport Commission has requested an analysis of factors related to extending Runway 15–33 per the requirements of the FAA design standards. As shown in Exhibit 1, Runway 15 -33 is 5,810 feet long by 150' wide. Runway 33 serves as the Airport's primary instrument arrival runway and is equipped with an ILS. Runway 15 serves as an instrument departure runway. Runway 15-33 has a bituminous surface and is the shorter of the two runways at the Airport. Steep rising terrain at the Runway 33 end restricts approaches to Runway 15 and departures from Runway 33 to day VFR only.

Purpose

The purpose of this preliminary study is to prepare a layout diagram for increasing the take-off length of Runway 15 to 7,700 feet; and to estimate order of magnitude cost for planning, design and construction. Previous studies of improving Runway 6-24 found that extending its length significantly would be cost and environmentally prohibitive. Therefore, this report studies the most feasible extension alternative.

II. Current FAA Design Standards

Standards for Airport Runway Design are described in FAA Advisory Circular (A.C.) 150/5300-13. In this A.C. the FAA describes the conditions and recommendations for runway design. Due to terrain restrictions, the extension of Runway 15 will utilize Declared Distance criteria.

III. Existing Conditions

As shown on Exhibit 1, Runway 15-33 is 5,810 feet long and serves as an instrument and visual arrival runway. Due to existing terrain limitations and the relative short runway length, Runway 15-33 is used primarily for arrival traffic, while the longer Runway 6-24 is used as the primary departure runway and is 6,800 feet long. Both runways have terrain restrictions.

In addition to air carrier operations, the Airport has significant general and corporate aviation traffic. At least four (4) air cargo aircraft are based at the Airport and several other freight, charter, and non-scheduled cargo aircraft operate at the Airport on a continuous basis.

The extent of the Airport's medium to large jet air carrier aircraft and increased operations of regional jet aircraft, require at least the available 6,800 feet of runway available at Roanoke. Analysis of performance data shows that these aircraft are limited in range and payload by the current runway length, especially in the summer.

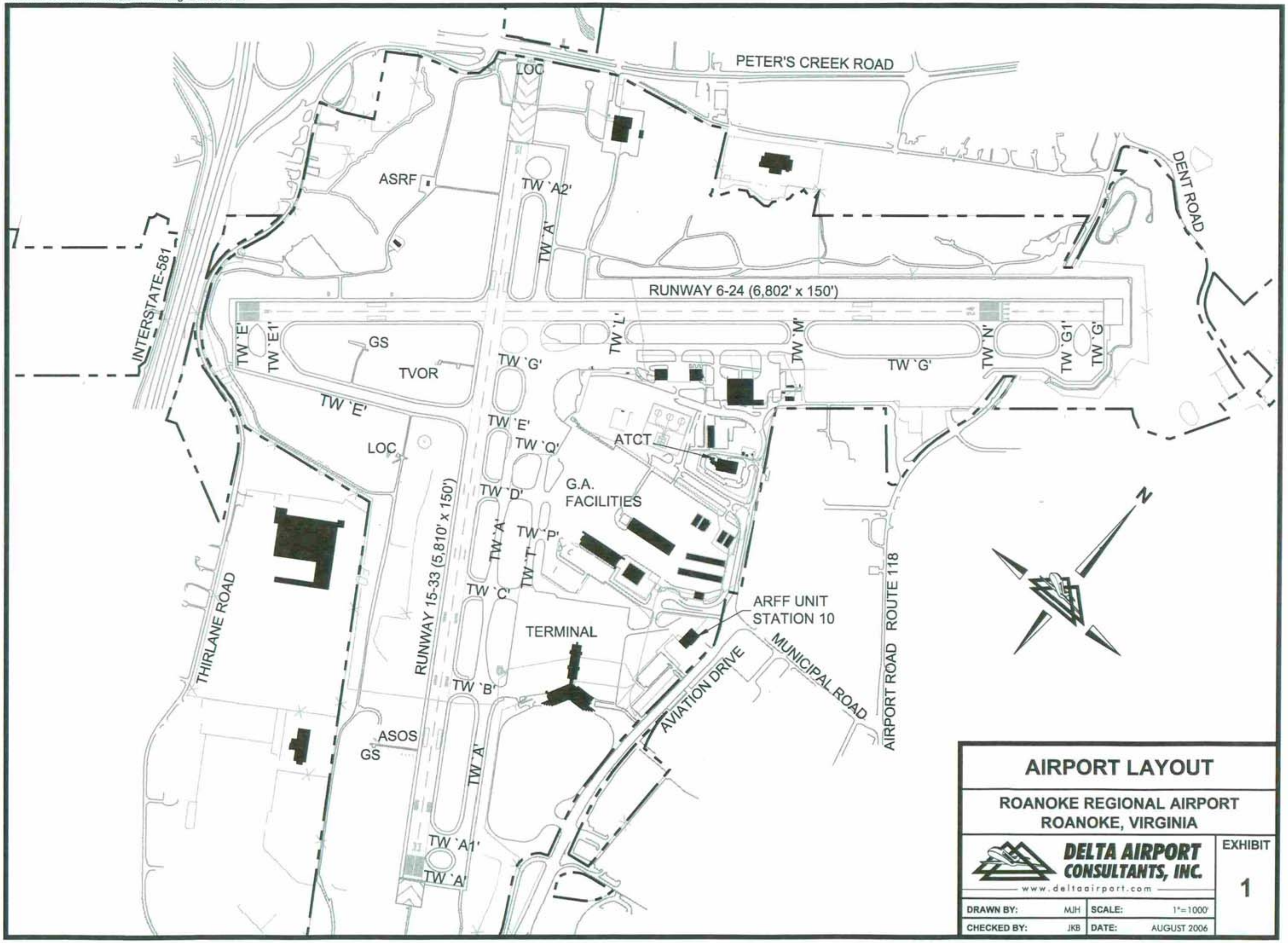
IV. Alternatives

Operational and market analysis has determined that air carrier service expansion to hubs and major cities in Texas and west will require a minimum runway length of 7,700 feet. Previous studies of Runway 6-24 have shown that extension of Runway 6-24 to this length is cost prohibitive.

As shown on Exhibit 2A and 2B, the extension of Runway 15-33 to 7,700 feet is feasible and can be accomplished for the most part on Airport property. Increasing the take-off length of the runway from 5,810 feet to 7,700 feet can only be accomplished by an extension of the Runway 15 end. Due to terrain, the runway extension is a "one way" extension and will utilize declared distances as shown in the report and exhibits.

The proposed extended runway configuration and declares distances are shown at Exhibits 3A and 3B. While the declared distance procedure is described in FAA A.C. 150/5300-13 Airport Design, the FAA may require a Modification of Standard Determination to utilize this runway configuration.

DRAWING: ROA Extension Ex 1.dwg LAYOUT: L1



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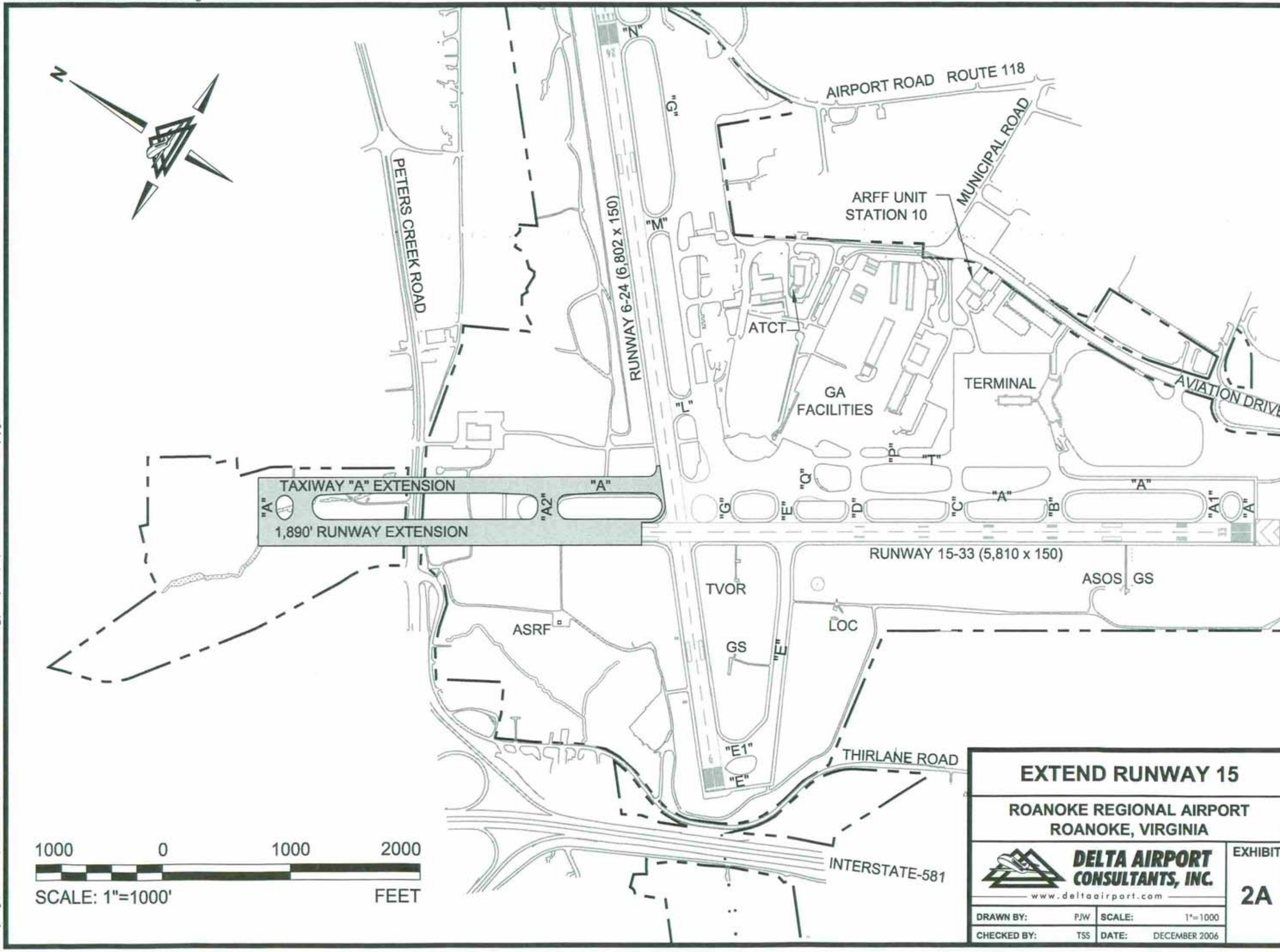

EXTEND RUNWAY 15			
ROANOKE REGIONAL AIRPORT ROANOKE, VIRGINIA			
DELTA AIRPORT CONSULTANTS, INC. www.deltaairport.com			EXHIBIT 2A
DRAWN BY: PJW	SCALE: 1"=1000		
CHECKED BY: TSS	DATE: DECEMBER 2006		

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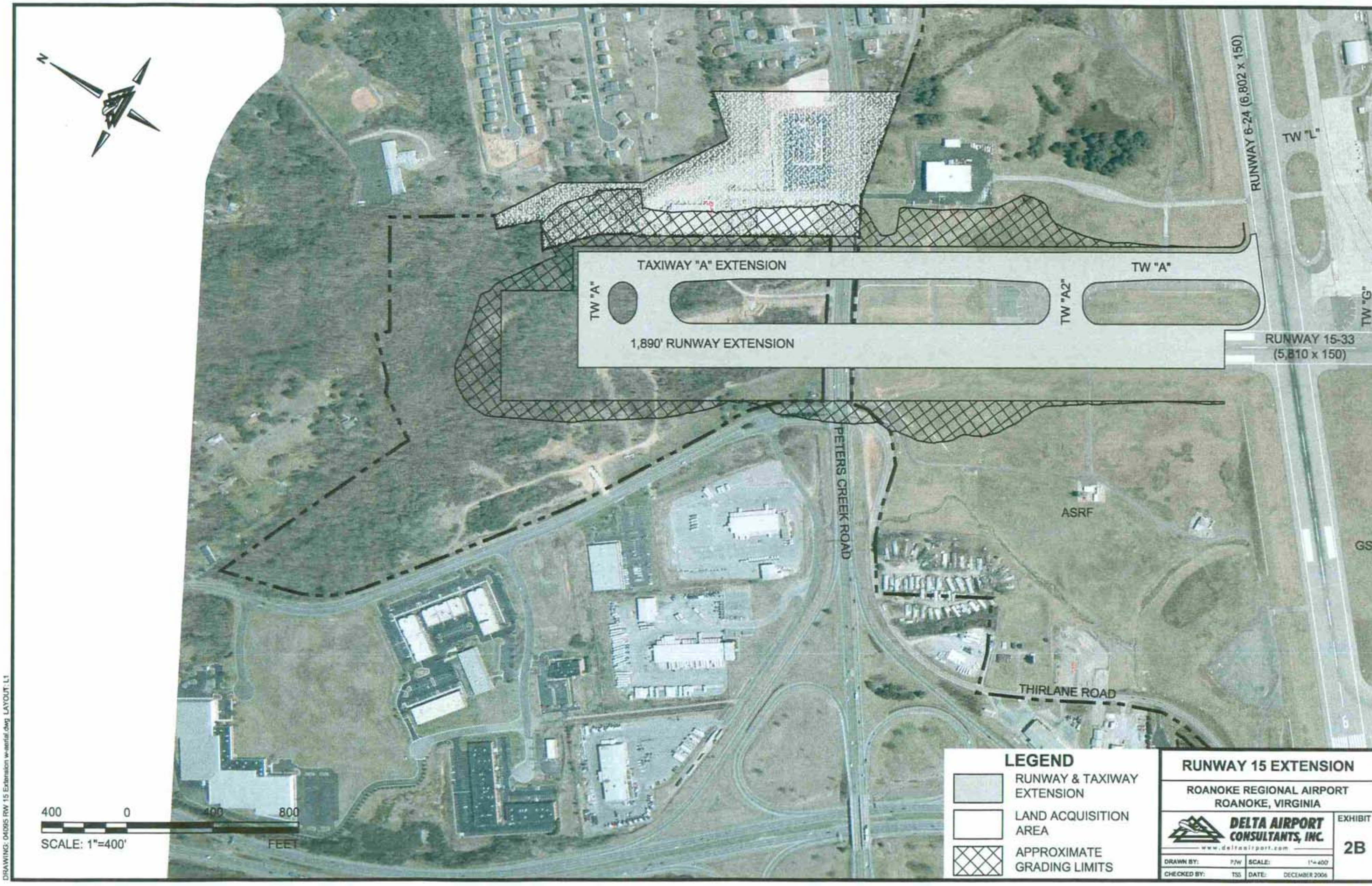

DRAWING: 04095 RW 15 Extension w-aerial.dwg LAYOUT: L1

DRAWING: 04095 RW 15 Extension Declared Distances.dwg LAYOUT: L1

DECLARED DISTANCE DATA

EXISTING CONDITIONS				
	ASDA	TORA	TODA	LDA
RUNWAY 15	5,810	5,810	5,810	5,810
RUNWAY 33	5,810	5,810	5,810	5,810

PROPOSED CONDITIONS				
	ASDA	TORA	TODA	LDA
RUNWAY 15	7,700	7,700	7,700	5,810
RUNWAY 33*	6,000	6,000	6,000	6,900±

ASDA = Accelerate-stop Distance Available

TORA = Take Off Run Available

TODA = Take Off Distance Available

LDA = Landing Distance Available

* = Proposed Runway 33 Dimensions Dependent Upon Terrain Obstacles and Grading Beyond Runway End

DECLARED DISTANCE DATA	
ROANOKE REGIONAL AIRPORT ROANOKE, VIRGINIA	
DELTA AIRPORT CONSULTANTS, INC. www.deltaairport.com	EXHIBIT 3A
DRAWN BY: PJW	SCALE: NONE	
CHECKED BY: TSS	DATE: DECEMBER 2006	

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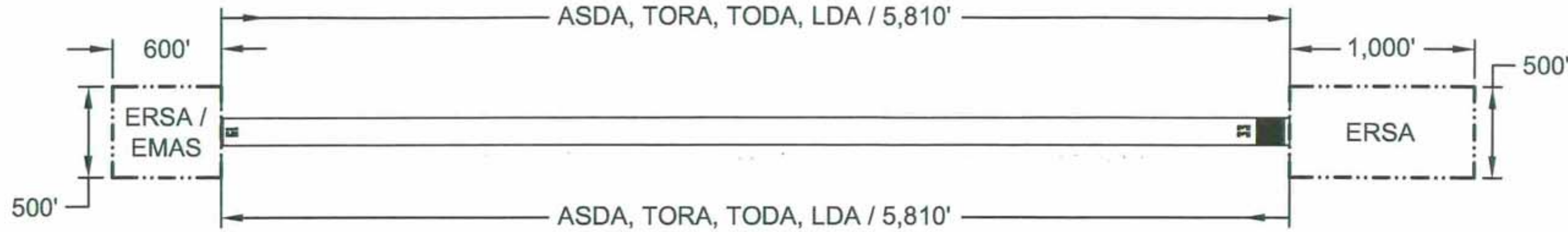
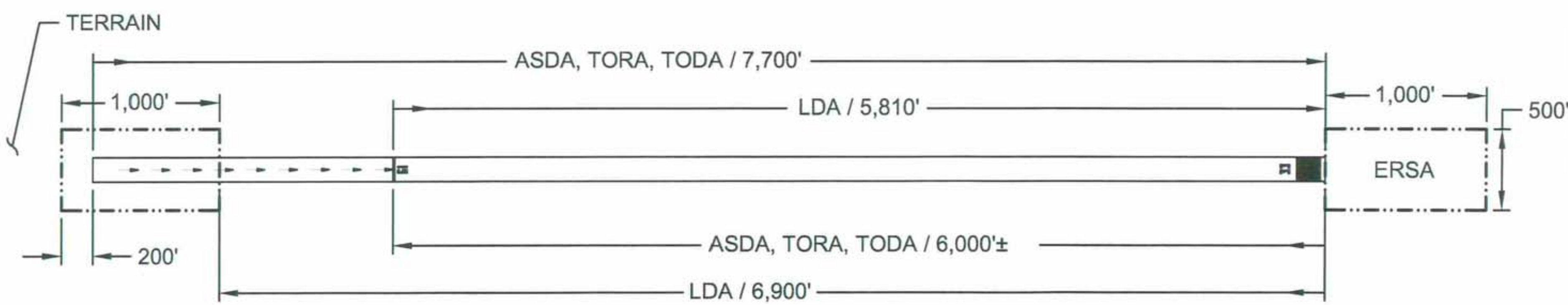
DRAWING: 04095 RW 15 Extension Declared Distances.dwg LAYOUT: L2



EXISTING (5,810' x 150')



PROPOSED (7,700' x 150')

DECLARED DISTANCES

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	PJW	SCALE:	NONE	EXHIBIT 3B
CHECKED BY:	TSS	DATE:	DECEMBER 2006	

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Runway 15 Extension

1. Land

As shown at Exhibits 2A and 2B approximately 15 acres of land will be required for acquisition for airfield construction, runway safety area and obstruction removal to provide a fully compliant runway extension. The acquired land will be inclusive of existing and known future commercial business

2. Construction

To construct a fully compliant extension to Runway 15, approximately one (1) million cubic yards of earthwork material would be required with associated grading, drainage, site work and grade changes to Runway 15 to provide adequate clearance for the runway and taxiway overpass structure over Peter's Creek Road. In addition to the relocation of airfield, related items such as the lights, NAVAIDs, and perimeter fencing, significant road and highway impacts would be required as shown at Exhibits 2A and 2B. The end of Runway 15 is approximately 600 feet south of Peter's Creek Road. Peter's Creek Road is a four lane state road. Since the extension to Runway 15 would extend over Peter's Creek Road, this would require an underpass/tunnel to be constructed accommodating a future six to eight lane Peter's Creek Road. Since most of the proposed extension would be on property already owned by the Airport, limited property acquisition is required. Only two existing and one planned commercial property would be impacted by direct acquisition and relocation.

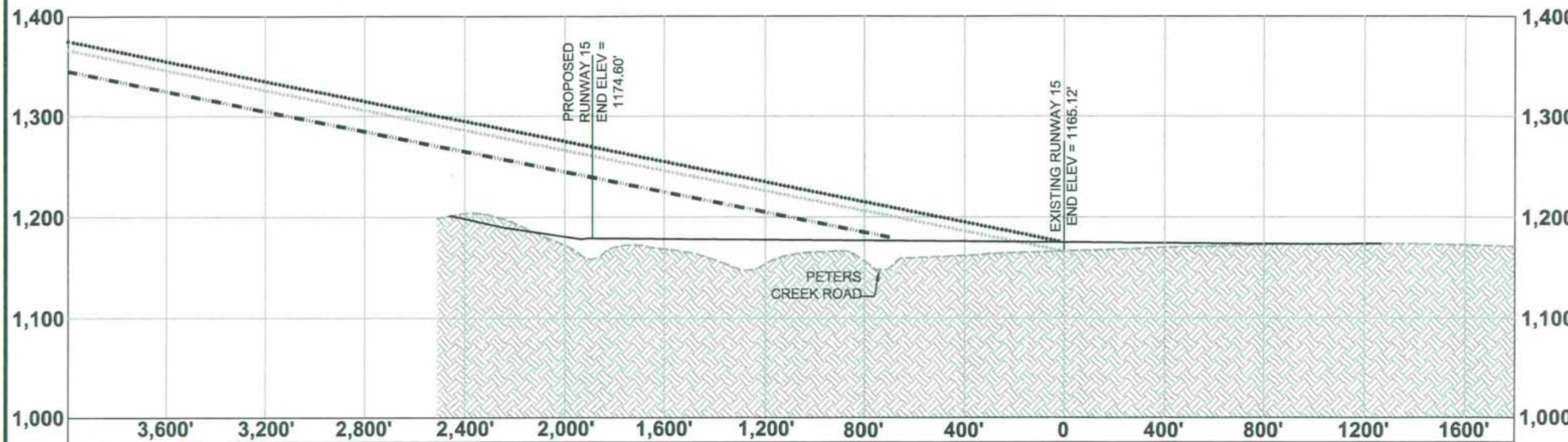
Grade changes will be necessary for the existing portion of Runway 15-33 north of Runway 6-24 to provide adequate clearance over Peter's Creek Road as shown on Exhibit 4.

3. Environmental

Environmental impacts are not anticipated to be significant but would need to be studied in a formal Environmental Assessment (EA). In addition to existing wetlands, the considerable construction grading, drainage, and vegetation impacts, the road and highway relocations would require emissions, noise, social, and energy impact study. Minor commerce impact may also be realized by the business impacts due to the road relocations. The anticipated project impacts appear to be able to be mitigated by reasonable measures.

4. Estimated Cost

Based on updated planning cost figures, the cost for the construction of a fully compliant Runway 15 extension is estimated to be $90 million. The estimate details are shown in Appendix 1. The estimate includes the costs of the Runway 15 extension, bridge structure over Peter's Creek Road, and property acquisitions.



RUNWAY 15 APPROACH - PROFILE VIEW

SCALE: 1"=100' (VERT)
SCALE: 1"=400' (HORIZ)

LEGEND

- EXISTING GRADE
- PROPOSED GRADE
- EXISTING\FUTURE FAR PART 77 VISUAL APPROACH SURFACE (20:1)
- EXISTING THRESHOLD SITING SURFACE (20:1)
- FUTURE THRESHOLD SITING SURFACE (20:1)

RW 15 EXTENSION PROFILE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
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EXHIBIT 4

DRAWN BY:	PJW	SCALE:	1"=400'
CHECKED BY:	TSS	DATE:	DECEMBER 2006

DRAWING: 04095 RW 15 Extension Profile.dwg LAYOUT: L1

APPENDIX 1

SUMMARY CHART – RUNWAY 15-33 EXTENSION

Item	Scope of Work	Operational Impact (Airport)	Environmental Impact	Estimated Cost
1. RWY 15 EXTENSION	1.0 MCY earthwork Bridge /Tunnel over Peter's Creek Road. Commercial Property Acquisition Wetland Impact Mitigation ILS – Localizer Relocation	Limited runway closures and threshold displacement Runway 15-33 restricted to approximately 4,000 for approximately 1 year. Runway 33 ILS out of service for 1-2 years.	Wetland Impact, property acquisition, noise, traffic, social impacts – Formal EA required	$90 million

COST ESTIMATE

RUNWAY 15 EXTENSION STUDY

ROANOKE REGIONAL AIRPORT
ROANOKE, VA

DELTA PROJECT NO: VA 04095

DATE: NOVEMBER 21, 2006

CONSTRUCTION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$5,713,735	$5,713,735
2	BUILDING DEMOLITION	LS	1	$35,000	$35,000
3	PAVEMENT DEMOLITION	LS	1	$296,000	$296,000
4	DRAINAGE	LS	1	$2,066,000	$2,066,000
5	EROSION AND SEDIMENT CONTROL	LS	1	$500,000	$500,000
6	EXCAVATION	CY	111,140	$15	$1,667,100
7	EMBANKMENT	CY	1,068,086	$18	$19,225,548
8	PETER'S CREEK ROAD BRIDGES	SF	106,500	$120	$12,780,000
9	PAVING	SY	123,500	$90	$11,115,000
10	ELECTRICAL/NAVAIDS	LS	1	$2,000,000	$2,000,000
11	MISCELLANEOUS (15%)	LS	1	$7,452,697	$7,452,697

TOTAL: $62,851,080

20% Engineering, Constr. Admin, EA, etc. $12,570,216

Construction Sub- Total $75,421,296

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	LAND ACQUISITION - UNDEVELOPED	AC	15	$250,000	$3,750,000
2	BUSINESS RELOCATION	EA	2	$4,000,000	$8,000,000
3	ADMINISTRATION (15%)	LS	1	$1,762,500	$1,762,500

TOTAL: $13,512,500

Land Sub- Total $13,512,500

Total **$88,933,796**

Use **$90,000,000**

APPENDIX 2

Appendix 8. RUNWAY DESIGN RATIONALE

1. SEPARATIONS. Dimensions shown in tables 2-1, 2-2, 3-1, 3-2, and 3-3 may vary slightly due to rounding off.

a. **Runway to holdline separation** is derived from landing and takeoff flight path profiles and the physical characteristics of airplanes. The runway to holdline standard satisfies the requirement that no part of an airplane (nose, wingtip, tail, etc.) holding at a holdline penetrates the obstacle free zone (OFZ). Additionally, the holdline standard keeps the nose of the airplane outside the runway safety area (RSA) when holding prior to entering the runway. When the airplane exiting the runway is beyond the standard holdline, the tail of the airplane is also clear of the RSA. Additional holdlines may be required to prevent airplane, from interfering with the ILS localizer and glide slope operations.

b. **Runway to parallel taxiway/taxilane separation** is determined by the landing and takeoff flight path profiles and physical characteristics of airplanes. The runway to parallel taxiway/taxilane standard precludes any part of an airplane (tail, wingtip, nose, etc.) on a parallel taxiway/taxilane centerline from being within the runway safety area or penetrating the OFZ.

c. **Runway to airplane parking areas** is determined by the landing and takeoff flight path profiles and physical characteristics of airplanes. The runway to parking area standard precludes any part of a parked airplane (tail, wingtip, nose, etc.) from being within the runway object free area or penetrating the OFZ.

2. OBSTACLE FREE ZONE (OFZ). The portion of the OFZ within 200 feet (60 m) of the runway centerline is required for departure clearance. The additional OFZ, beyond 200 feet (60 m) from runway centerline, is required to provide an acceptable accumulative target level of safety without having to adjust minimums. The level of safety for precision instrument operations is determined by the collision risk model. The collision risk model is a computer program developed from observed approaches and missed approaches. It provides the probability of an airplane passing through any given area along the flight path of the airplane. To obtain an acceptable accumulative target level of safety with objects in the OFZ, operating minimums may have to be adjusted.

3. RUNWAY SAFETY AREA.

a. **Historical Development.** In the early years of aviation, all airplanes operated from relatively unimproved airfields. As aviation developed, the alignment of takeoff and landing paths centered on a well defined area known as a landing strip. Thereafter, the requirements of more advanced airplanes necessitated improving or paving the center portion of the landing strip. The term "landing strip" was retained to describe the graded area surrounding and upon which the runway or improved surface was constructed. The primary role of the landing strip changed to that of a safety area surrounding the runway. This area had to be capable, under normal (dry) conditions, of supporting airplanes without causing structural damage to the airplanes or injury to their occupants. Later, the designation of the area was changed to "runway safety area," to reflect its functional role. The runway safety area enhances the safety of airplanes which undershoot, overrun, or veer off the runway, and it provides greater accessibility for firefighting and rescue equipment during such incidents. Figure A8-1 depicts the approximate percentage of airplanes undershooting and overrunning the runway which stay within a specified distance from the runway end. The runway safety area is depicted in figure 3-1 and its dimensions are given in tables 3-1, 3-2, and 3-3.

b. **Recent Changes.** FAA recognizes that incremental improvements inside standard RSA dimensions can enhance the margin of safety for aircraft. This is a significant change from the earlier concept where the RSA was deemed to end at the point it was no longer graded and constructed to standards. Previously, a modification to standards could be issued if the actual, graded and constructed RSA did not meet dimensional standards as long as an acceptable level of safety was provided. Today, modifications to standards no longer apply to runway safety areas. (See paragraph 6) Instead, FAA airport regional division offices are required to maintain a written determination of the best practicable alternative for improving non-standard RSAs. They must continually analyze the non-standard RSA with respect to operational, environmental, and technological changes and revise the determination as appropriate. Incremental improvements are included in the determination if they are practicable and they will enhance the margin of safety.

4. RUNWAY OBJECT FREE AREA (ROFA). The ROFA is a result of an agreement that a minimum 400-foot (120 m) separation from runway centerline is required for equipment shelters, other than localizer equipment shelters. The aircraft parking limit line no longer exists as a separate design standard. Instead, the separations required for parked aircraft and the building restriction line from the runway centerline are determined by object clearing criteria.

5. RUNWAY SHOULDERS AND BLAST PADS. Chapter 8 contains the design considerations for runway shoulders and blast pads.

6. CLEARWAY. The use of a clearway for takeoff computations requires compliance with the clearway definition of 14 CFR Part 1.

7. STOPWAY. The use of a stopway for takeoff computations requires compliance with the stopway definition of 14 CFR Part 1.

8. RUNWAY PROTECTION ZONE (RPZ). Approach protection zones were originally established to define land areas underneath aircraft approach paths in which control by the airport operator was highly desirable to prevent the creation of airport hazards. Subsequently, a 1952 report by the President's Airport Commission (chaired by James Doolittle), entitled "The Airport and Its Neighbors," recommended the establishment of clear areas beyond runway ends. Provision of these clear areas was not only to preclude obstructions potentially hazardous to aircraft, but also to control building construction as a protection from nuisance and hazard to people on the ground. The Department of Commerce concurred with the recommendation on the basis that this area was "primarily for the purpose of safety and convenience to people on the ground." The FAA adopted "Clear Zones" with dimensional standards to implement the Doolittle Commission's recommendation. Guidelines were developed recommending that clear zones be kept free of structures and any development which would create a place of public assembly.

In conjunction with the introduction of the RPZ as a replacement term for clear zone, the RPZ was divided into "object free" and "controlled activity" areas. The RPZ function is to enhance the protection of people and property on the ground. Where practical, airport owners should own the property under the runway approach and departure areas to at least the limits of the RPZ. It is desirable to clear the entire RPZ of all aboveground objects. Where this is impractical, airport owners, as a minimum, shall maintain the RPZ clear of all facilities supporting incompatible activities. Incompatible activities include, but are not limited to, those which lead to an assembly of people.

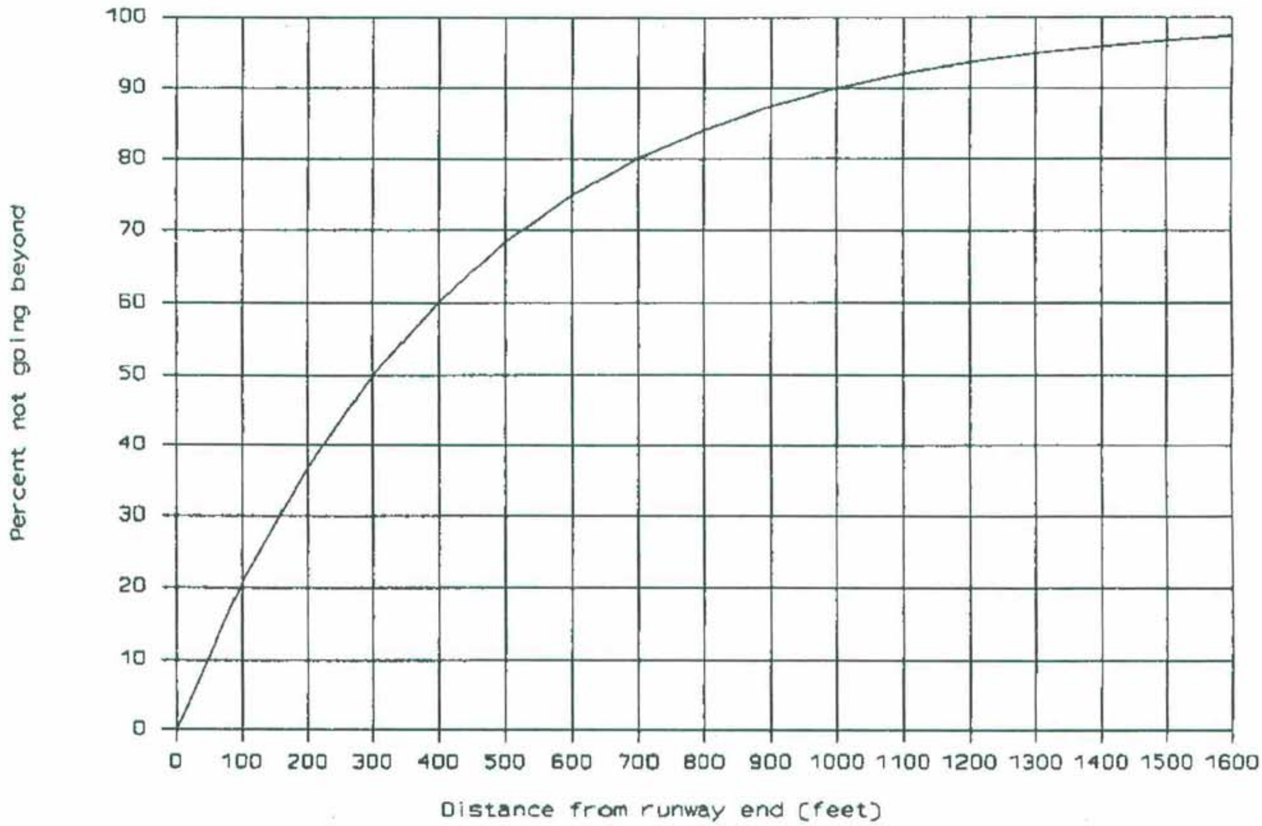

Figure A8-1. Approximate distance airplanes undershoot and overrun the runway end

DELTA AIRPORT CONSULTANTS, INC.

August 10, 2006

Mr. Jeffrey S. Mishler
Associate Vice President
HNTB
2900 South Quincy Street, Suite 200
Arlington, Virginia 22206

RE: Runway Extension Analysis: Runway 6-24
Inventory and Obstruction Surveys
Update Airport Master Plan
Roanoke Regional Airport
Roanoke, Virginia
AIP Project No. 3-51-0045-Pending
Delta Project No. VA 04095

Dear Mr. Mishler:

Please find enclosed a draft report for your review of our preliminary analysis of an extension of Runway 6-24 at the Roanoke Regional Airport. As discussed at our meeting on June 7, 2006, this report identifies the anticipated land acquisition, construction, environmental and order of magnitude costs of an extension of Runway 6-24 to a length of 10,000 feet. We understand that this information will be provided to the Airport Commission staff to address inquiries regarding significant upgrade in the Airport's level of service.

In the report, Delta assessed the extension of the Runway 6 end to the southwest approximately 3,200 feet, the extension of the Runway 24 end and in limited form the extension of both ends approximately 1,600 feet. In all cases the scope of work and cost are considerable with the least cost alternative expected to exceed $420 million dollars to complete.

The report does not relay opinion on feasibility or make recommendations on proceeding. The report and estimates are preliminary and based on limited topographical and geographical study of the Airport vicinity.

We understand that this information is to be presented for review to the Commission staff. Delta will address comments and prepare a final report upon receipt of HNTB's consolidated comments subsequent to meeting with the Commission.

9711 Farrar Court, Suite 100 • Richmond, Virginia 23236
phone: (804) 275-8301 • fax: (804) 275-8371 • www.deltaairport.com

We appreciate the opportunity to assist in this effort for the Roanoke Regional Airport. This study highlights the challenges of providing significant additional runway length for the Airport. If you should have any questions regarding this matter, please do not hesitate to contact our office.

Sincerely,

Jeffrey K. Brown, P. E.

JKB:drs

Encl: Runway Extension Analysis Report

cc: Joe Navarette, HNTB w/encl.

VA 04095 C025

RUNWAY EXTENSION ANALYSIS

RUNWAY 6 – 24

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

Prepared for: HNTB Corporation

At the request of

The ROANOKE REGIONAL AIRPORT Commission

By

Delta Airport Consultants

August 9, 2006

Delta Project No. VA 04095.02

CONTENTS

I. Introduction

The Roanoke Regional Airport Commission has requested an analysis of factors related to extending Runway 6–24 per the requirements of the FAA design standards. As shown in Exhibit 1, Runway 6-24 is 6,802 feet long and serves as the Airport's primary instrument air carrier runway. Runway 6-24 has a bituminous surface and is the longest runway at the Airport.

Purpose

The purpose of this preliminary study is to prepare a layout diagram for increasing the length of Runway 6–24 to 10, 000 feet total length, and to estimate order of magnitude cost for construction of the required extension.

II. Current FAA Design Standards

Standards for Airport Runway Design are described in FAA Advisory Circular (A/C) 150/5300-13. In this A.C. the FAA describes the conditions and recommendations for runway design.

III. Existing Conditions

Runway 6-24 is 6,802 feet long and serves as the Airport's primary instrument air carrier runway. Runway 6-24 provides the lowest instrument approach minimums. At times, low weather conditions can create a condition in which aircraft can only arrive on Runway 6 and depart on Runway 24.

Additionally, the Airport has significant general and corporate aviation traffic. At least four (4) air cargo aircraft are based at the Airport and several other freight, charter, and non-scheduled cargo aircraft operate at the Airport on a continuous basis.

The extent of the Airport's medium to large jet air carrier aircraft, over 3,000 annual operations, and increased operations of regional jet aircraft, require at least the available 6,802 feet of runway available at Roanoke. Analysis of performance data shows that these aircraft are limited in range and payload by the current runway length, especially in the summer

IV. Alternatives

The preliminary study has found that increasing the length of the runway from 6,802 feet to 10,000 feet can be accomplished by an extension at either end, or by extending both ends. However, a combination of physical and budgetary constraints may make this prohibitive to accomplish. The three alternatives to extend Runway 6-24 are shown at Exhibits 2, 3 and 4.

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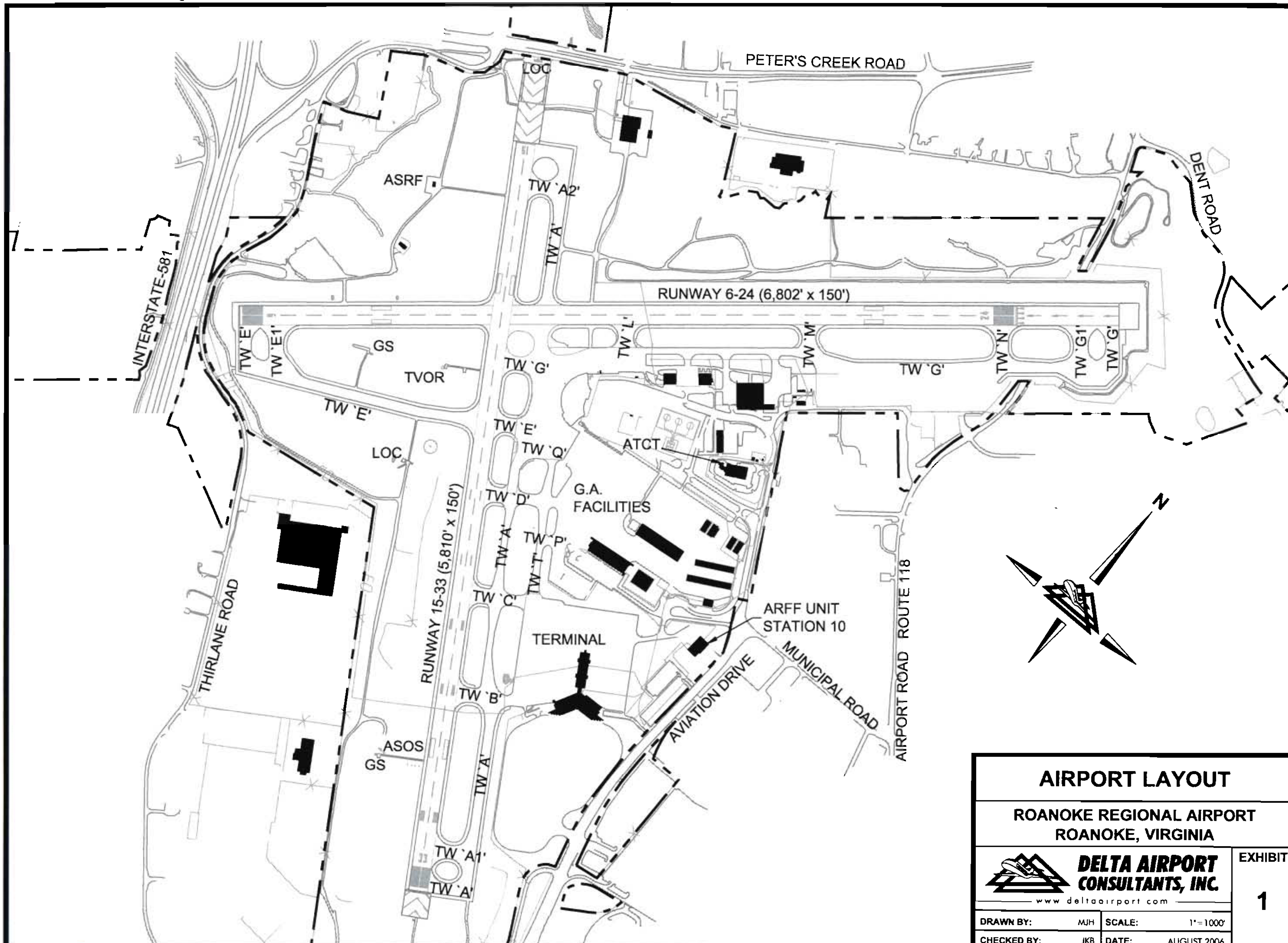


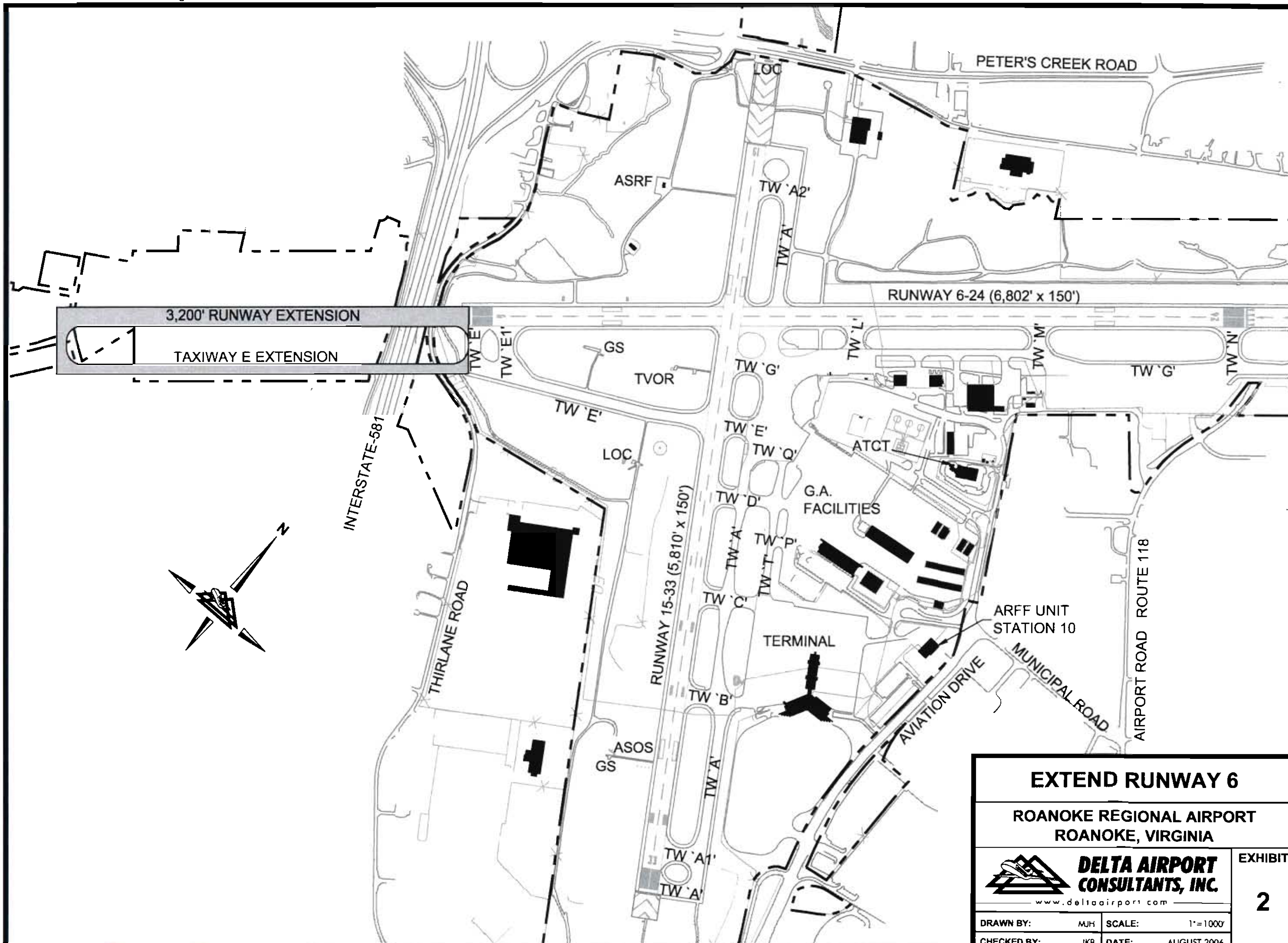
AIRPORT LAYOUT

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	MJH	SCALE:	1" = 1000'	EXHIBIT
CHECKED BY:	JKB	DATE:	AUGUST 2006	1

DRAWING: ROA Extension Ex 2.dwg LAYOUT. L1



EXTEND RUNWAY 6

ROANOKE REGIONAL AIRPORT
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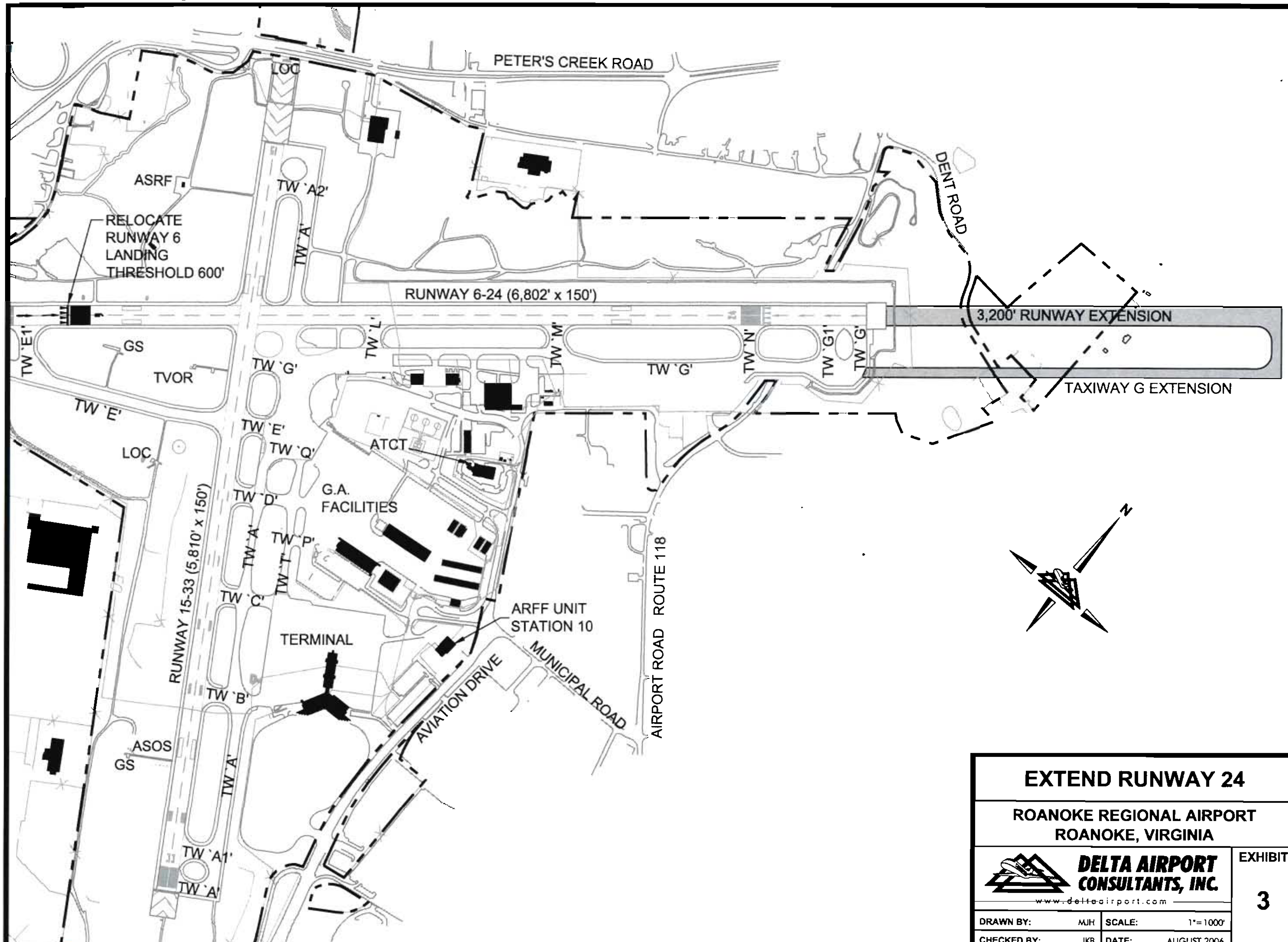
DRAWN BY:	MJH	SCALE:	1"=1000'
CHECKED BY:	JKB	DATE:	AUGUST 2006

EXHIBIT

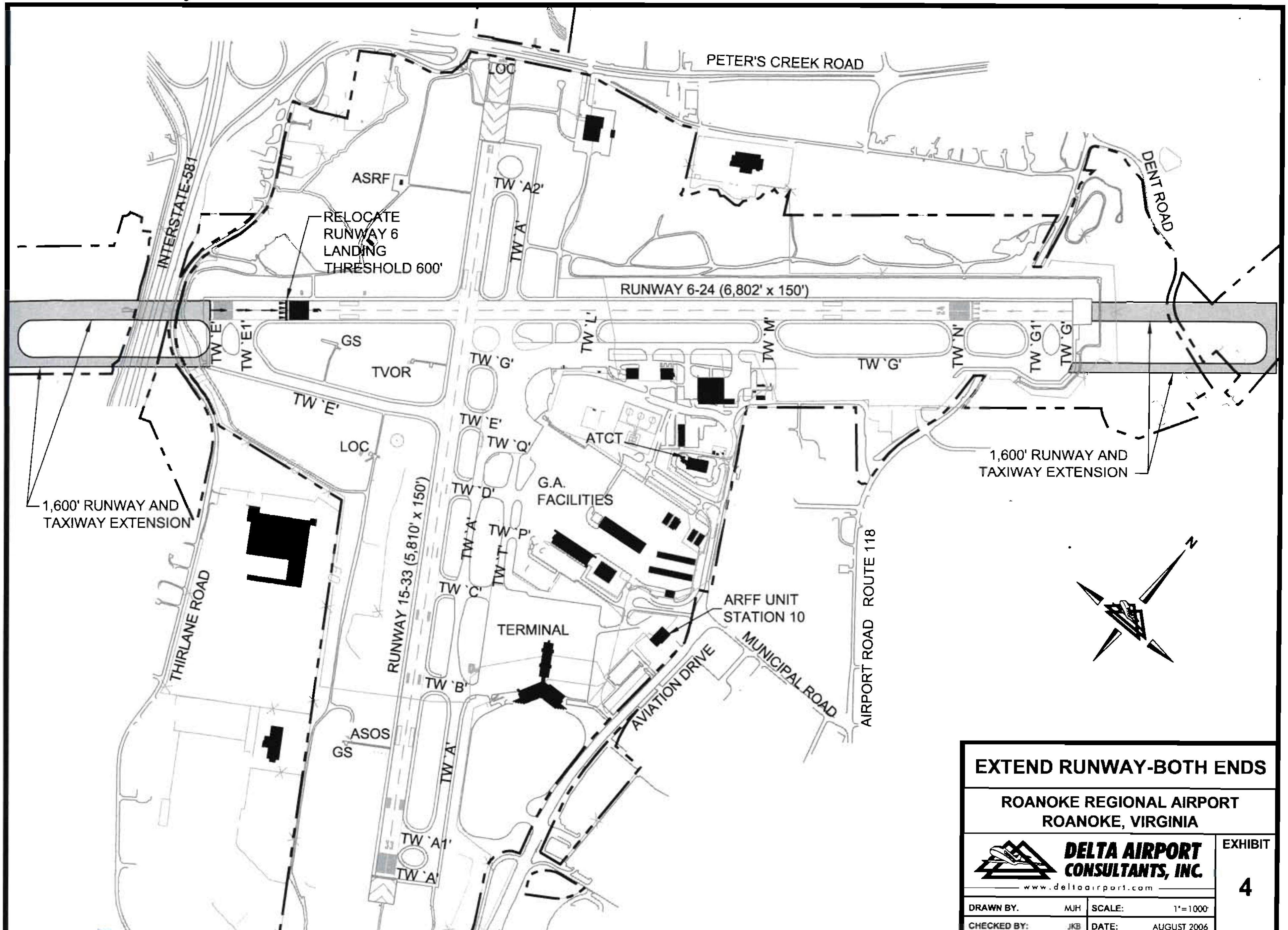
2

DRAWING: ROA Extension Ex 3.dwg LAYOUT: L1



EXTEND RUNWAY 24			
ROANOKE REGIONAL AIRPORT ROANOKE, VIRGINIA			
DELTA AIRPORT CONSULTANTS, INC. www.deltaairport.com			EXHIBIT 3
DRAWN BY: MJH	SCALE: 1"= 1000'		
CHECKED BY: JKB	DATE: AUGUST 2006		

DRAWING: ROA Extension Ex 4.dwg LAYOUT. L1



EXTEND RUNWAY-BOTH ENDS

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ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
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EXHIBIT 4

DRAWN BY.	MJH	SCALE:	1"=1000'
CHECKED BY:	JKB	DATE:	AUGUST 2006

A. Runway 6 Extension

1. Land

As shown at Exhibit 5 approximately 300 acres of land will be required for acquisition for airfield construction, runway safety area and obstruction removal to provide a fully compliant runway extension. The acquired land will be inclusive of residential, commercial and recreational properties.

2. Construction

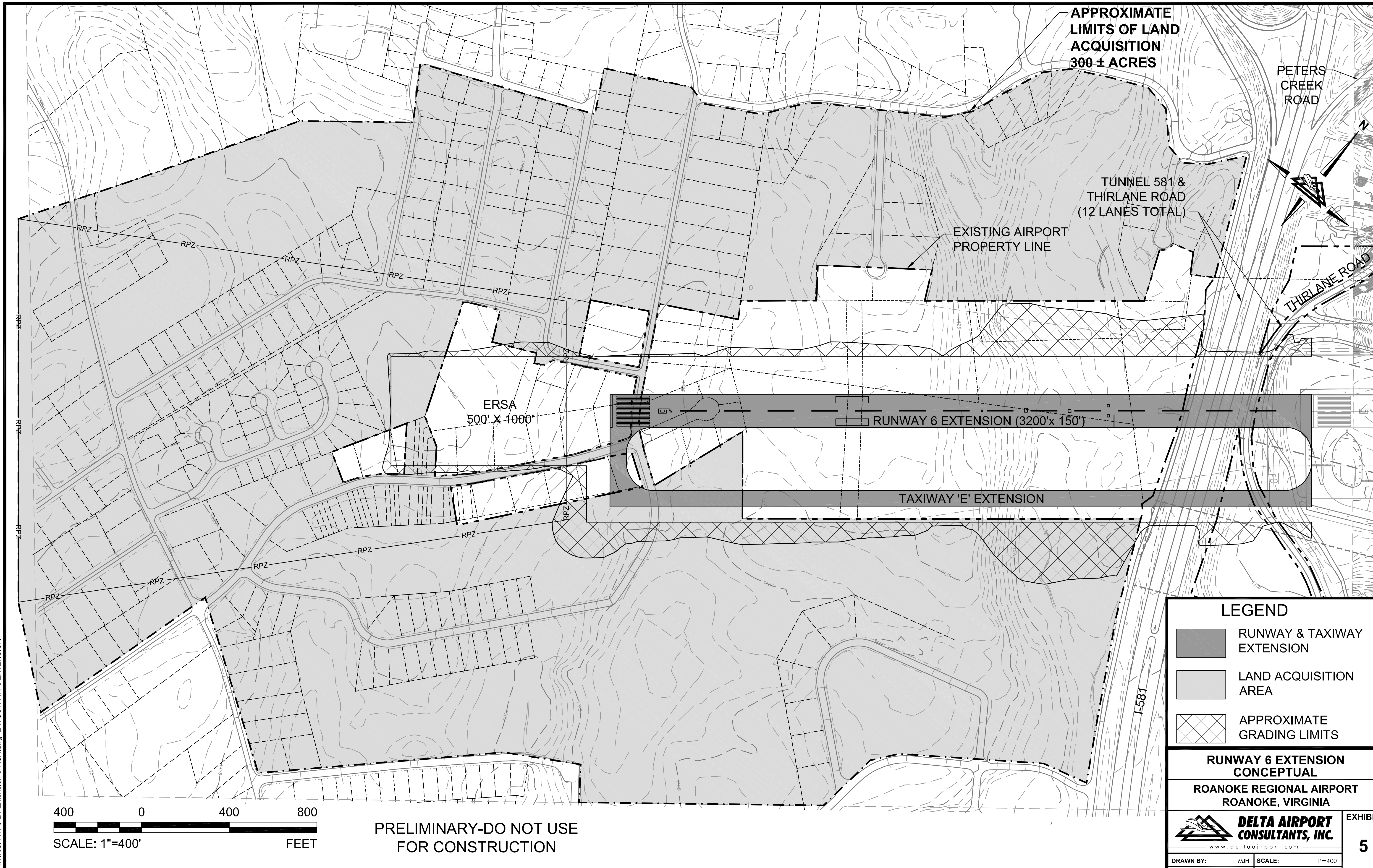
To construct a fully compliant extension to Runway 6, approximately three (3) million cubic yards of earthen fill material would be required with associated grading, drainage and site work. In addition to the relocation of Airport, related items such as the approach lights, NAVAIDs, and perimeter fencing, significant road and highway impacts would be required as shown at Exhibit 5. The end of Runway 6 is approximately 300 feet east of Thirlane Road and 400 feet west of Interstate 581. Thirlane Road is a two lane local collector with shoulders and approximate 45 mph curve design. Interstate 581 is a six to eight lane regional divided highway. Corridor studies are underway to consider improving the highway to provide a new major north-south commerce route. Due to the highway's location and its role as a central arterial route, this would likely entail ten (10) to twelve (12) lanes of traffic. Since the extension to Runway 6 would extend over Thirlane Road and I-581, this would require an underpass/tunnel to be constructed incorporating future expansion of I-581. Additionally, significant drainage work would be required to accommodate the upper drainage for Lick Run. Extensive property, residence, and business acquisition and relocation would also be required. Over 300 acres, 200 residences, and businesses would be impacted by direct acquisition and relocation.

3. Environmental

Environmental impacts related to this work would potentially be significant and would need to be studied in a formal Environmental Assessment (EA). In addition to the considerable construction grading, drainage, and vegetation impacts, the road and highway relocations would require extensive emissions, noise, social, and energy impact study. Significant community and commerce impact may also be realized by the business and residence impacts due to the road relocations. The cost and scope of mitigation efforts for environmental and community impacts would likely be significant.

4. Estimated Cost

Based on updated planning cost figures, the cost for the construction of a fully compliant Runway 6 extension is estimated to be $560 million. The estimate details are shown in Appendix 1. The estimate includes the costs of the Runway 6 extension, bridge structure for I-581and Thirlane Road, and property acquisitions.



RUNWAY 6 EXTENSION CONCEPTUAL

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
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EXHIBIT 5

DRAWN BY:	MJH	SCALE:	1"=400'
CHECKED BY:	JKB	DATE:	AUGUST 2006

DRAWING: RW 6-24 Extension & RSA.dwg LAYOUT: RW 6 EXTENSION

B. Runway 24 Extension

1. Land

As shown at Exhibit 6, approximately 300 acres of land will be required for acquisition for airfield construction, runway safety area and obstruction removal to provide a fully compliant runway extension. The acquired land will be inclusive of residential, commercial and recreational properties.

2. Construction

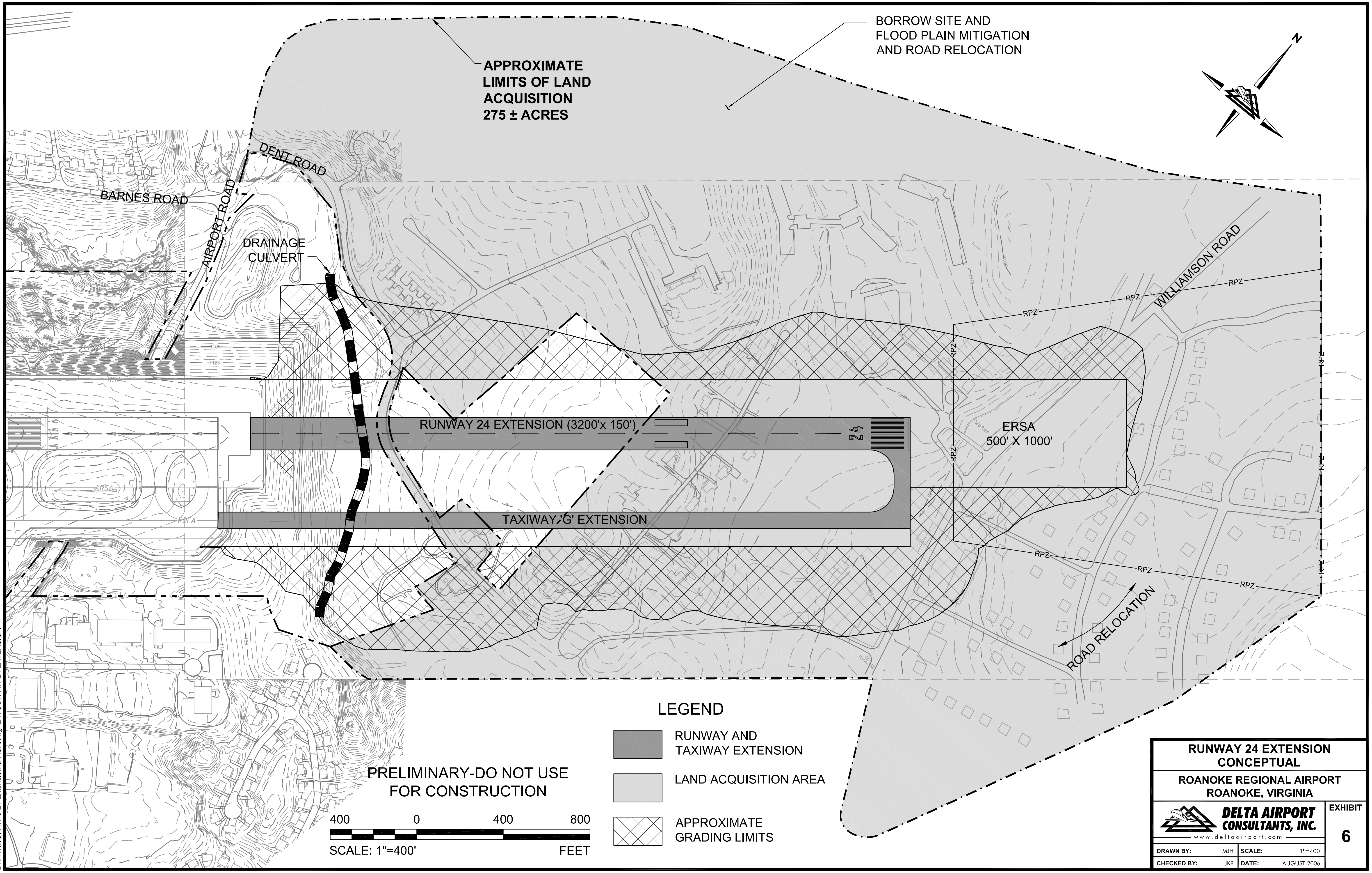
To construct a fully compliant extension to Runway 24, approximately ten (10) million cubic yards of earthen fill material would be required with associated grading, drainage and site work. In addition to the relocation of Airport related items such as the approach lights, NAVAIDs, and perimeter fencing, significant road and highway impacts would be required as shown at Exhibits 6. There are a number of major state highways and local roads located within the footprint of the Runway 24 extension, the extensive grading and stream relocation required would likely require relocation of approximately 2 miles of state highway and local road and extensive property and residence acquisition and relocation. The project would require the relocation of approximately 3,000 linear feet of intermittent stream, acquisition of 300 acres, 100 single family residences, and 50 multiple family residence buildings, and 50 commercial properties. The extent of the Runway 24 extension project is shown at Exhibit 6.

3. Environmental

The extension of the Runway 24 would have significant environmental issues that would require study under a formal Environmental Assessment. Extensive construction, drainage and land acquisition impacts would be realized. Additionally it is estimated that residents of approximately 100 households would be displaced. The runway extension would project into a stream with over six (6) square miles of watershed. The grading and filling would require relocation of an intermittent stream and extensive grading to mitigate flood plain impacts. It is likely that wetland, habitat, and other natural resource impacts would also require extensive analysis and/or mitigation.

4. Estimated Cost

Based on updated planning cost figures, the cost for the construction of a fully compliant Runway 24 extension is estimated to be $420 million. The estimate details are shown in Appendix 1. The estimate includes the costs of the Runway 6 extension, road relocation, box culvert/drainage structure for existing stream, wetland mitigation and property acquisitions.



APPROXIMATE
LIMITS OF LAND
ACQUISITION
275 ± ACRES
BORROW SITE AND
FLOOD PLAIN MITIGATION
AND ROAD RELOCATION
N
DENT ROAD
BARNES ROAD
AIRPORT ROAD
DRAINAGE
CULVERT
WILLIAMSON ROAD
RPZ
RUNWAY 24 EXTENSION (3200'x 150')
24
ERSA
500' X 1000'
TAXIWAY 'G' EXTENSION
ROAD RELOCATION
LEGEND
RUNWAY AND
TAXIWAY EXTENSION
LAND ACQUISITION AREA
APPROXIMATE
GRADING LIMITS
PRELIMINARY-DO NOT USE
FOR CONSTRUCTION
400
0
400
800
SCALE: 1"=400'
FEET
RUNWAY 24 EXTENSION
CONCEPTUAL
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA
DELTA AIRPORT
CONSULTANTS, INC.
www.deltaairport.com
EXHIBIT
6
DRAWN BY: MJH
SCALE: 1"=400'
CHECKED BY: JKB
DATE: AUGUST 2006
DRAWING: RW 6-24 Extension & RSA.dwg LAYOUT: RW 24 EXTENSION

C. Extension of both ends (1,600 feet)

1. Land

Land acquisition would be required at both runway ends and in total would be of similar magnitude to the other alternatives. Approximately 250 acres of land will be required for acquisition for airfield construction, runway safety area and obstruction removal to provide a fully complaint extension at both ends of Runway 6 - 24. The acquired land will be inclusive of residential, recreational and commercial, and environmental mitigation.

2. Construction:

The extension to both ends of Runway 6 - 24 would require approximately 4 million cubic yards of earthen fill material for associated grading, drainage and site work. In addition to the adjustment of Airport related items such as the approach lights, NAVAIDs, and perimeter fencing, significant road and highway impacts would be required as shown at Exhibit 4.

There are a number of local, state and inter-state highways located within the foot-print at both ends of the Runway 24 extension. The extension at the Runway 6 end would extend over Thirlane Road and I-581 and would require a bridge structure over both Thirlane Road and I-581. At the Runway 24 end the extension would extend over the existing Dent Road which would require relocation as well as the construction of a deep box culvert drainage structure to accommodate the existing intermittent stream.

3. Environmental Issues

Environmental impacts related to this work would potentially be significant and would need to be studied in a formal Environmental Assessment (EA). In addition to the considerable construction grading, drainage, and vegetation impacts, the road and highway relocations would require extensive emissions, noise, social, and energy impact study. Significant community and commerce impact may also be realized by the business and residence impacts due to the road relocations. The cost and scope of mitigation efforts for environmental and community impacts would likely be significant.

Additionally it is estimated that a number residential households would be displaced, primarily at the Runway 24 end of the project. The extension would project into a stream with over six (6) square miles of watershed. The grading and filling for the extension would require relocation of an intermittent stream and extensive grading to mitigate flood plain impacts. It is likely that wetland, habitat, and other natural resource impacts would also require extensive analysis and/or mitigation.

4. Estimated Cost

The extension of both ends of Runway 6 - 24 is expected to cost approximately $610 million.

SUMMARY CHART - NON STANDARD CONDITIONS

	Item	Scope of Work	Operational Impact (Airport)	Environmental Impact	Estimated Cost
1.	RWY 6 EXTENSION	1.8 MCY fill Bridge /Tunnel over I-581 and Thirlane Road. Property Acquisition	Limited runway closures and threshold displacement	Possibly significant: Road relocations, property acquisition, relocations, noise, traffic, social impacts	$560 million
2.	RWY 24 EXTENSION	10.4 MCY fill, Relocate stream and road. Property Acquisition	Limited runway closures and threshold displacement	Possibly significant: Stream relocation, property and residence relocations, habitat, social impacts	$420 million
3.	RWY 6 – 24 Both Ends	5.0 MCY fill Bridge/Tunnel over I-581 and Thirlane Road. Relocate stream and roads. Property Acquisition	Limited runway closures and threshold displacement	Possibly significant and similar to options 1 and 2.	$610 million

COST ESTIMATE

RUNWAY 6 EXTENSION STUDY

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

CONSTRUCTION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$22,205,925	$22,205,925
2	BUILDING DEMOLITION	LS	1	$10,000,000	$10,000,000
3	DRAINAGE	LS	1	$2,500,000	$2,500,000
4	EROSION AND SEDIMENT CONTROL	LS	1	$1,500,000	$1,500,000
5	EXCAVATION	CY	210,000	$10	$2,100,000
6	EMBANKMENT	CY	3,010,000	$15	$45,150,000
7	I-581/THIRLANE ROAD TUNNEL	LS	1	$200,000,000	$200,000,000
8	PAVING	SY	84,000	$150	$12,600,000
9	ELECTRICAL	LS	1	$2,000,000	$2,000,000
10	MISCELLANEOUS (15%)	LS	1	$41,377,500	$41,377,500

TOTAL:	$339,433,425
20% Engineering, Constr. Admin, etc.	$67,886,685
Construction Sub- Total	$407,320,110

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	LAND ACQUISITION - UNDEVELOPED	AC	100	$250,000	$25,000,000
2	RESIDENTIAL RELOCATION	EA	200	$300,000	$60,000,000
3	BUSINESS RELOCATION (SMALL)	EA	70	$500,000	$35,000,000
4	CHURCH/INSTITUTIONAL RELOCATION	EA	3	$4,000,000	$12,000,000
5	ADMINISTRATION (15%)	LS	1	$19,800,000	$19,800,000

TOTAL:	$151,800,000
Land Sub- Total	$151,800,000
Total	**$559,120,110**
Use	**$560,000,000**

COST ESTIMATE

RUNWAY 24 EXTENSION STUDY

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$10,161,900	$10,161,900
2	BUILDING DEMOLITION	LS	1	$15,000,000	$15,000,000
3	DRAINAGE - AIRFIELD	LS	1	$2,500,000	$2,500,000
4	EROSION AND SEDIMENT CONTROL	LS	1	$1,500,000	$1,500,000
5	EXCAVATION	CY	2,000	$10	$20,000
6	EMBANKMENT	CY	10,400,000	$10	$104,000,000
7	CREEK RELOCATION/TUNNEL	LS	1	$10,000,000	$10,000,000
8	DENT ROAD RELOCATION (VA 623)	LS	1	$5,000,000	$5,000,000
9	WILLIAMSON ROAD RELOCATION	LS	1	$10,000,000	$10,000,000
10	RUNWAY PAVING	SY	81,000	$150	$12,150,000
10	AIRPORT ELECTRICAL	LS	1	$2,000,000	$2,000,000
11	ENVIRONMENTAL MITIGATION	LS	1	$5,000,000	$5,000,000
12	MISCELLANEOUS (15%)	LS	1	$25,075,500	$25,075,500
				TOTAL:	$202,407,400

20% Engineering, Constr. Admin, etc. $40,481,480

Construction Sub- Total $240,000,000

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	LAND ACQUISITION - UNDEVELOPED	AC	200	$250,000	$50,000,000
2	RESIDENTIAL ACQUISITION & RELOCATION (SINGLE FAMILY)	EA	200	$250,000	$50,000,000
3	RESIDENTIAL ACQUISITION & RELOCATION (MULTI FAMILY)	EA	50	$350,000	$17,500,000
4	BUSINESS ACQUISITION & RELOCATION	EA	50	$800,000	$40,000,000
5	INSTITUTIONAL ACQUISITION & RELOCATION	EA	1	$5,000,000	$5,000,000
6	ADMINISTRATION (15%)	LS	1	$16,875,000	$16,875,000
				TOTAL:	$179,375,000

Land Sub- Total $179,375,000

Total **$419,375,000**

Use **$420,000,000**

COST ESTIMATE

RUNWAY 6-24 EXTENSION STUDY- BOTH ENDS

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$20,731,900	$20,731,900
2	BUILDING DEMOLITION	LS	1	$10,000,000	$10,000,000
3	DRAINAGE - AIRFIELD	LS	1	$2,500,000	$2,500,000
4	EROSION AND SEDIMENT CONTROL	LS	1	$1,500,000	$1,500,000
5	EXCAVATION	CY	2,000	$10	$20,000
6	EMBANKMENT	CY	5,000,000	$10	$50,000,000
7	CREEK RELOCATION/TUNNEL	LS	1	$10,000,000	$10,000,000
8	DENT ROAD RELOCATION (VA 623)	LS	1	$5,000,000	$5,000,000
9	RUNWAY PAVING	SY	81,000	$150	$12,150,000
10	AIRPORT ELECTRICAL	LS	1	$2,000,000	$2,000,000
11	ENVIRONMENTAL MITIGATION	LS	1	$3,000,000	$3,000,000
11	I-581/THIRLANE ROAD TUNNEL	LS	1	$200,000,000	$200,000,000
12	MISCELLANEOUS (15%)	LS	1	$47,535,285	$47,535,285
				TOTAL:	$364,437,185

20% Engineering, Constr. Admin, etc. $72,887,437

Construction Sub- Total $440,000,000

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	LAND ACQUISITION - UNDEVELOPED	AC	250	$250,000	$62,500,000
2	RESIDENTIAL ACQUISITION & RELOCATION (SINGLE FAMILY	EA	100	$250,000	$25,000,000
3	RESIDENTIAL ACQUISITION & RELOCATION (MULTI FAMILY)	EA	30	$350,000	$10,500,000
4	BUSINESS ACQUISITION & RELOCATION	EA	30	$800,000	$24,000,000
5	INSTITUTIONAL ACQUISITION & RELOCATION	EA	1	$5,000,000	$5,000,000
6	BUSINESS RELOCATION (SMALL)	EA	70	$500,000	$35,000,000
7	ADMINISTRATION (10%)	LS	1	$3,500,000	$3,500,000
				TOTAL:	$165,500,000

Land Sub- Total $165,500,000

Total $605,500,000

Use $610,000,000

APPENDIX 2

Appendix 8. RUNWAY DESIGN RATIONALE

1. SEPARATIONS. Dimensions shown in tables 2-1, 2-2, 3-1, 3-2, and 3-3 may vary slightly due to rounding off.

a. Runway to holdline separation is derived from landing and takeoff flight path profiles and the physical characteristics of airplanes. The runway to holdline standard satisfies the requirement that no part of an airplane (nose, wingtip, tail, etc.) holding at a holdline penetrates the obstacle free zone (OFZ). Additionally, the holdline standard keeps the nose of the airplane outside the runway safety area (RSA) when holding prior to entering the runway. When the airplane exiting the runway is beyond the standard holdline, the tail of the airplane is also clear of the RSA. Additional holdlines may be required to prevent airplane, from interfering with the ILS localizer and glide slope operations.

b. Runway to parallel taxiway/taxilane separation is determined by the landing and takeoff flight path profiles and physical characteristics of airplanes. The runway to parallel taxiway/taxilane standard precludes any part of an airplane (tail, wingtip, nose, etc.) on a parallel taxiway/taxilane centerline from being within the runway safety area or penetrating the OFZ.

c. Runway to airplane parking areas is determined by the landing and takeoff flight path profiles and physical characteristics of airplanes. The runway to parking area standard precludes any part of a parked airplane (tail, wingtip, nose, etc.) from being within the runway object free area or penetrating the OFZ.

2. OBSTACLE FREE ZONE (OFZ). The portion of the OFZ within 200 feet (60 m) of the runway centerline is required for departure clearance. The additional OFZ, beyond 200 feet (60 m) from runway centerline, is required to provide an acceptable accumulative target level of safety without having to adjust minimums. The level of safety for precision instrument operations is determined by the collision risk model. The collision risk model is a computer program developed from observed approaches and missed approaches. It provides the probability of an airplane passing through any given area along the flight path of the airplane. To obtain an acceptable accumulative target level of safety with objects in the OFZ, operating minimums may have to be adjusted.

3. RUNWAY SAFETY AREA. In the early years of aviation, all airplanes operated from relatively unimproved airfields. As aviation developed, the alignment of takeoff and landing paths centered on a well defined area known as a landing strip. Thereafter, the requirements of more advanced airplanes necessitated improving or paving the center portion of the landing strip. The term "landing strip" was retained to describe the graded area surrounding and upon which the runway or improved surface was constructed. The primary role of the landing strip changed to that of a safety area surrounding the runway. This area had to be capable, under normal (dry) conditions, of supporting airplanes without causing structural damage to the airplanes or injury to their occupants. Later, the designation of the area was changed to "runway safety area," to reflect its functional role. The runway safety area enhances the safety of airplanes which undershoot, overrun, or veer off the runway, and it provides greater accessibility for firefighting and rescue equipment during such incidents. Figure A8-1 depicts the approximate percentage of airplanes undershooting and overrunning the runway which stay within a specified distance from the runway end. The runway safety area is depicted in figure 3-1 and its dimensions are given in tables 3-1, 3-2, and 3-3.

4. RUNWAY OBJECT FREE AREA (ROFA). The ROFA is a result of an agreement that a minimum 400-foot (120 m) separation from runway centerline is required for equipment shelters, other than localizer equipment shelters. The aircraft parking limit line no longer exists as a separate design standard. Instead, the separations required for parked aircraft and the building restriction line from the runway centerline are determined by object clearing criteria.

5. RUNWAY SHOULDERS AND BLAST PADS. Chapter 8 contains the design considerations for runway shoulders and blast pads.

6. CLEARWAY. The use of a clearway for takeoff computations requires compliance with the clearway definition of FAR Part 1.

7. STOPWAY. The use of a stopway for takeoff computations requires compliance with the stopway definition of FAR Part 1.

8. RUNWAY PROTECTION ZONE (RPZ). Approach protection zones were originally established to define land areas underneath aircraft approach paths in which control by the airport operator was highly desirable to prevent the creation of airport hazards. Subsequently, a 1952 report by the President's Airport Commission (chaired by James Doolittle), entitled "The Airport and Its Neighbors," recommended the establishment of clear areas beyond runway ends. Provision of these clear areas was not only to preclude obstructions potentially hazardous to aircraft, but also to control building construction as a protection from nuisance and hazard to people on the ground. The Department of Commerce concurred with the recommendation on the basis that this area was "primarily for the purpose of safety and convenience to people on the ground." The FAA adopted "Clear Zones" with dimensional standards to implement the Doolittle Commission's recommendation. Guidelines were developed recommending that clear zones be kept free of structures and any development which would create a place of public assembly.

In conjunction with the introduction of the RPZ as a replacement term for clear zone, the RPZ was divided into "object free" and "controlled activity" areas. The RPZ function is to enhance the protection of people and property on the ground. Where practical, airport owners should own the property under the runway approach and departure areas to at least the limits of the RPZ. It is desirable to clear the entire RPZ of all aboveground objects. Where this is impractical, airport owners, as a minimum, shall maintain the RPZ clear of all facilities supporting incompatible activities. Incompatible activities include, but are not limited to, those which lead to an assembly of people.

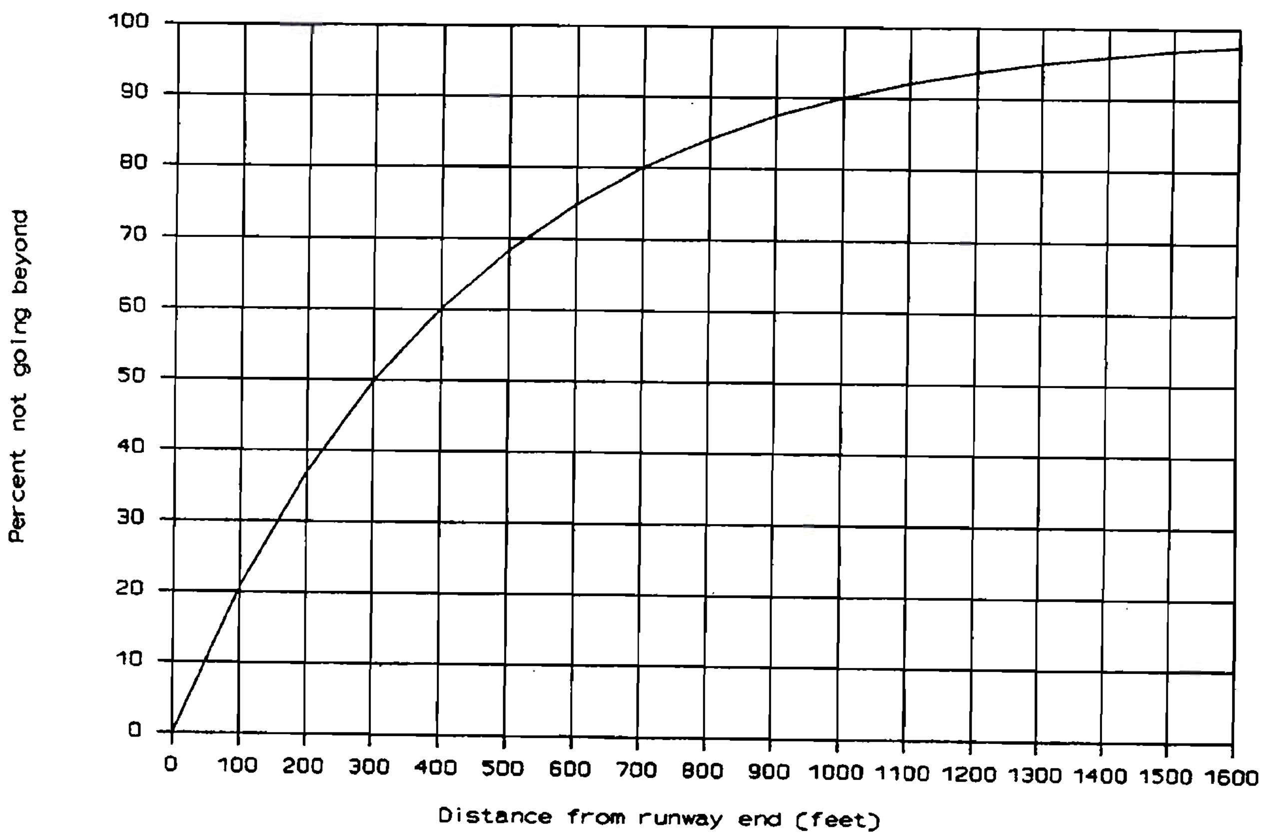


Figure A8-1. Approximate distance airplanes undershoot and overrun the runway end

C. Extension of both ends (1,600 feet)

1. Land

Land acquisition would be required at both runway ends and in total would be of similar magnitude to the other alternatives. Approximately 250 acres of land will be required for acquisition for airfield construction, runway safety area and obstruction removal to provide a fully complaint extension at both ends of Runway 6 - 24. The acquired land will be inclusive of residential, recreational and commercial, and environmental mitigation.

2. Construction:

The extension to both ends of Runway 6 - 24 would require approximately 4 million cubic yards of earthen fill material for associated grading, drainage and site work. In addition to the adjustment of Airport related items such as the approach lights, NAVAIDs, and perimeter fencing, significant road and highway impacts would be required as shown at Exhibit 4.

There are a number of local, state and inter-state highways located within the foot-print at both ends of the Runway 24 extension. The extension at the Runway 6 end would extend over Thirlane Road and I-581 and would require a bridge structure over both Thirlane Road and I-581. At the Runway 24 end the extension would extend over the existing Dent Road which would require relocation as well as the construction of a deep box culvert drainage structure to accommodate the existing intermittent stream.

3. Environmental Issues

Environmental impacts related to this work would potentially be significant and would need to be studied in a formal Environmental Assessment (EA). In addition to the considerable construction grading, drainage, and vegetation impacts, the road and highway relocations would require extensive emissions, noise, social, and energy impact study. Significant community and commerce impact may also be realized by the business and residence impacts due to the road relocations. The cost and scope of mitigation efforts for environmental and community impacts would likely be significant.

Additionally it is estimated that a number residential households would be displaced, primarily at the Runway 24 end of the project. The extension would project into a stream with over six (6) square miles of watershed. The grading and filling for the extension would require relocation of an intermittent stream and extensive grading to mitigate flood plain impacts. It is likely that wetland, habitat, and other natural resource impacts would also require extensive analysis and/or mitigation.

4. Estimated Cost

The extension of both ends of Runway 6 - 24 is expected to cost approximately $610 million.

SUMMARY CHART - NON STANDARD CONDITIONS

	Item	Scope of Work	Operational Impact (Airport)	Environmental Impact	Estimated Cost
1.	RWY 6 EXTENSION	1.8 MCY fill Bridge /Tunnel over I-581 and Thirlane Road. Property Acquisition	Limited runway closures and threshold displacement	Possibly significant: Road relocations, property acquisition, relocations, noise, traffic, social impacts	$560 million
2.	RWY 24 EXTENSION	10.4 MCY fill, Relocate stream and road. Property Acquisition	Limited runway closures and threshold displacement	Possibly significant: Stream relocation, property and residence relocations, habitat, social impacts	$420 million
3.	RWY 6 – 24 Both Ends	5.0 MCY fill Bridge/Tunnel over I-581 and Thirlane Road. Relocate stream and roads. Property Acquisition	Limited runway closures and threshold displacement	Possibly significant and similar to options 1 and 2.	$610 million

COST ESTIMATE

RUNWAY 6 EXTENSION STUDY

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

CONSTRUCTION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$22,205,925	$22,205,925
2	BUILDING DEMOLITION	LS	1	$10,000,000	$10,000,000
3	DRAINAGE	LS	1	$2,500,000	$2,500,000
4	EROSION AND SEDIMENT CONTROL	LS	1	$1,500,000	$1,500,000
5	EXCAVATION	CY	210,000	$10	$2,100,000
6	EMBANKMENT	CY	3,010,000	$15	$45,150,000
7	I-581/THIRLANE ROAD TUNNEL	LS	1	$200,000,000	$200,000,000
8	PAVING	SY	84,000	$150	$12,600,000
9	ELECTRICAL	LS	1	$2,000,000	$2,000,000
10	MISCELLANEOUS (15%)	LS	1	$41,377,500	$41,377,500

TOTAL: $339,433,425

20% Engineering, Constr. Admin, etc. $67,886,685

Construction Sub- Total $407,320,110

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	LAND ACQUISITION - UNDEVELOPED	AC	100	$250,000	$25,000,000
2	RESIDENTIAL RELOCATION	EA	200	$300,000	$60,000,000
3	BUSINESS RELOCATION (SMALL)	EA	70	$500,000	$35,000,000
4	CHURCH/INSTITUTIONAL RELOCATION	EA	3	$4,000,000	$12,000,000
5	ADMINISTRATION (15%)	LS	1	$19,800,000	$19,800,000

TOTAL: $151,800,000

Land Sub- Total $151,800,000

Total $559,120,110

Use $560,000,000

COST ESTIMATE

RUNWAY 24 EXTENSION STUDY

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$10,161,900	$10,161,900
2	BUILDING DEMOLITION	LS	1	$15,000,000	$15,000,000
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7	CREEK RELOCATION/TUNNEL	LS	1	$10,000,000	$10,000,000
8	DENT ROAD RELOCATION (VA 623)	LS	1	$5,000,000	$5,000,000
9	WILLIAMSON ROAD RELOCATION	LS	1	$10,000,000	$10,000,000
10	RUNWAY PAVING	SY	81,000	$150	$12,150,000
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12	MISCELLANEOUS (15%)	LS	1	$25,075,500	$25,075,500
				TOTAL:	$202,407,400

20% Engineering, Constr. Admin, etc. $40,481,480

Construction Sub- Total $240,000,000

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
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5	INSTITUTIONAL ACQUISITION & RELOCATION	EA	1	$5,000,000	$5,000,000
6	ADMINISTRATION (15%)	LS	1	$16,875,000	$16,875,000
				TOTAL:	$179,375,000

Land Sub- Total $179,375,000

Total **$419,375,000**

Use **$420,000,000**

COST ESTIMATE

RUNWAY 6-24 EXTENSION STUDY- BOTH ENDS

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

LAND ACQUISITION

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$20,731,900	$20,731,900
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				TOTAL:	$165,500,000

Land Sub- Total $165,500,000

Total $605,500,000

Use $610,000,000

APPENDIX 2

Appendix 8. RUNWAY DESIGN RATIONALE

1. SEPARATIONS. Dimensions shown in tables 2-1, 2-2, 3-1, 3-2, and 3-3 may vary slightly due to rounding off.

a. Runway to holdline separation is derived from landing and takeoff flight path profiles and the physical characteristics of airplanes. The runway to holdline standard satisfies the requirement that no part of an airplane (nose, wingtip, tail, etc.) holding at a holdline penetrates the obstacle free zone (OFZ). Additionally, the holdline standard keeps the nose of the airplane outside the runway safety area (RSA) when holding prior to entering the runway. When the airplane exiting the runway is beyond the standard holdline, the tail of the airplane is also clear of the RSA. Additional holdlines may be required to prevent airplane, from interfering with the ILS localizer and glide slope operations.

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4. RUNWAY OBJECT FREE AREA (ROFA). The ROFA is a result of an agreement that a minimum 400-foot (120 m) separation from runway centerline is required for equipment shelters, other than localizer equipment shelters. The aircraft parking limit line no longer exists as a separate design standard. Instead, the separations required for parked aircraft and the building restriction line from the runway centerline are determined by object clearing criteria.

5. RUNWAY SHOULDERS AND BLAST PADS. Chapter 8 contains the design considerations for runway shoulders and blast pads.

6. CLEARWAY. The use of a clearway for takeoff computations requires compliance with the clearway definition of FAR Part 1.

7. STOPWAY. The use of a stopway for takeoff computations requires compliance with the stopway definition of FAR Part 1.

8. RUNWAY PROTECTION ZONE (RPZ). Approach protection zones were originally established to define land areas underneath aircraft approach paths in which control by the airport operator was highly desirable to prevent the creation of airport hazards. Subsequently, a 1952 report by the President's Airport Commission (chaired by James Doolittle), entitled "The Airport and Its Neighbors," recommended the establishment of clear areas beyond runway ends. Provision of these clear areas was not only to preclude obstructions potentially hazardous to aircraft, but also to control building construction as a protection from nuisance and hazard to people on the ground. The Department of Commerce concurred with the recommendation on the basis that this area was "primarily for the purpose of safety and convenience to people on the ground." The FAA adopted "Clear Zones" with dimensional standards to implement the Doolittle Commission's recommendation. Guidelines were developed recommending that clear zones be kept free of structures and any development which would create a place of public assembly.

In conjunction with the introduction of the RPZ as a replacement term for clear zone, the RPZ was divided into "object free" and "controlled activity" areas. The RPZ function is to enhance the protection of people and property on the ground. Where practical, airport owners should own the property under the runway approach and departure areas to at least the limits of the RPZ. It is desirable to clear the entire RPZ of all aboveground objects. Where this is impractical, airport owners, as a minimum, shall maintain the RPZ clear of all facilities supporting incompatible activities. Incompatible activities include, but are not limited to, those which lead to an assembly of people.

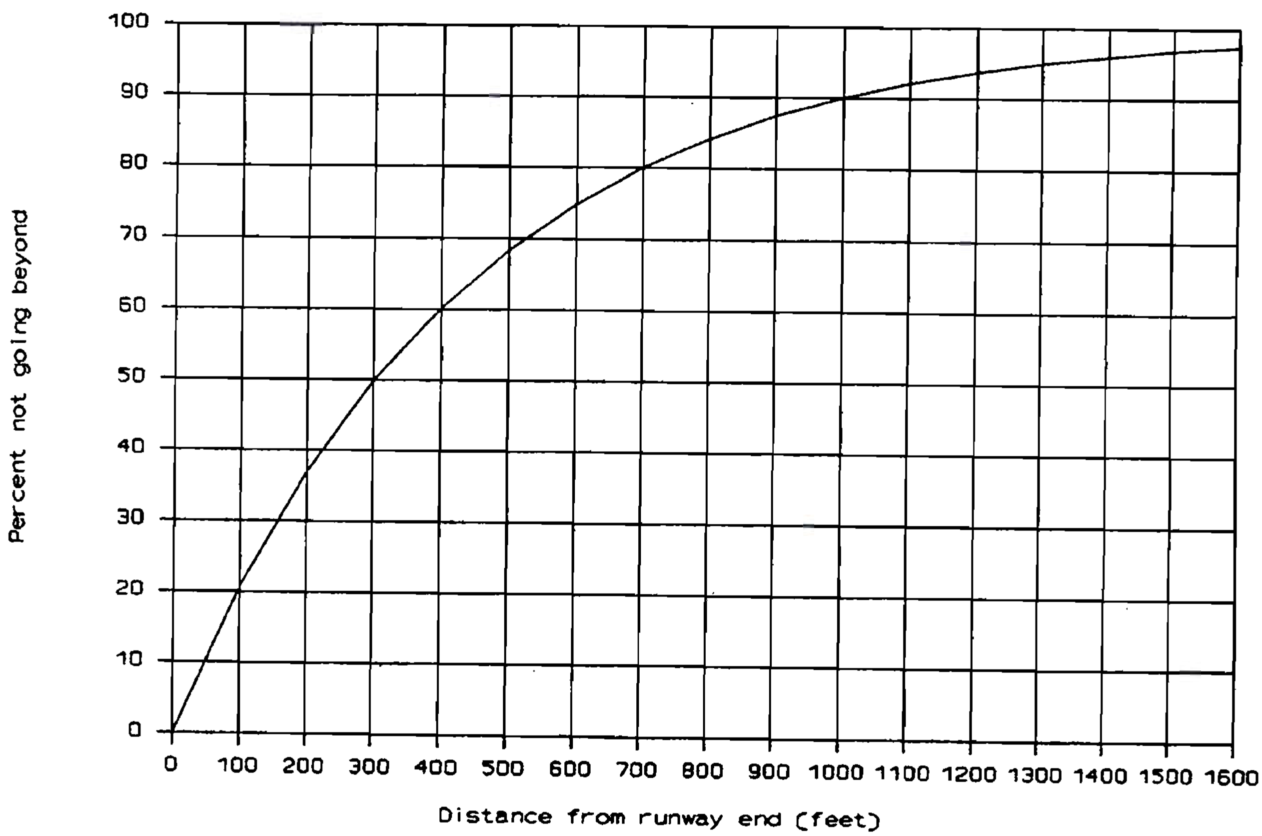

Figure A8-1. Approximate distance airplanes undershoot and overrun the runway end

APPENDIX J

Runway Safety Area Analysis
Runway 6-24

DELTA AIRPORT CONSULTANTS, INC.

August 10, 2006

Mr. Jeffrey S. Mishler
Associate Vice President
HNTB
2900 South Quincy Street, Suite 200
Arlington, Virginia 22206

RE: Runway Safety Area Analysis Report
Inventory and Obstruction Surveys
Update Airport Master Plan
Roanoke Regional Airport
Roanoke, Virginia
AIP Project No. 3-51-0045-Pending
Delta Project No. VA 04095

Dear Mr. Mishler:

Please find enclosed a draft Runway Safety Area Analysis Report for improving Runway 6-24 at the Roanoke Regional Airport. As discussed at our meeting on June 7, 2006, this report assesses the scope of work and estimated cost of the options to improve the Runway 6-24 Extended Runway Safety Areas (ERSAs).

The options assessed were as follows:

A. Full Standard 500' wide by 1,000' long standard graded ERSAs beyond each runway end.

B. Full EMAS: 500' wide by 1,000' long graded area beyond each runway with approximately 200' wide by 400' long EMAS for both runway ends.

C. Minimum Performance EMAS: 500' wide by approximately 250' long graded area beyond each runway end with approximately 200' wide by 200' long EMAS set back at least 35' from each runway end.

In each alternative, maintenance of existing runway length of 6,802 feet was assumed with no change in landing threshold location. As shown in the report summary, provision of Full Standard ERSA's or Full EMAS at each runway end are nearly equivalent in magnitude requiring significant a construction scope of work and costs in excess of $300 million dollars. The installation of the Minimum Performance EMAS appears to be feasible and can be accomplished

9711 Farrar Court, Suite 100 • Richmond, Virginia 23236
phone: (804) 275-8301 • fax: (804) 275-8371 • www.deltaairport.com

essentially within current Airport property at a significantly less cost. The installation of the Minimum Performing EMAS is estimated to cost approximately $25 million for both runway ends.

We understand this information is to be presented to the Airport Commission as information for consideration of improving the ERSA's to the maximum extent feasible. We look forward to your review and comment on the report and will provide a final report upon receipt of your comments subsequent to consultation with the Airport staff.

We appreciate the opportunity to assist HNTB with this effort. If you should have any questions regarding this matter, please do not hesitate to contact our office.

Sincerely,

Matthew W. Kundrot, P. E.

MWK:drs

Encl: Runway Safety Area Analysis Report

cc: Joe Navarette, HNTB w/encl.

VA 04095 C024

DRAFT

RUNWAY SAFETY AREA ANALYSIS

RUNWAY 6-24

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

Prepared For:

HNTB Corporation

At the Request of
The Roanoke Regional Airport Commission

By

Delta Airport Consultants, Inc.

August 9, 2006

Delta Project No. VA 04095

TABLE OF CONTENTS

I. Introduction

The Roanoke Regional Airport Commission has requested an analysis of the Runway 6 – 24 safety area per the requirements of the FAA design standards. As shown in Exhibit 1, Runway 6-24 is 6,802 feet long and serves as the Airport's primary instrument air carrier runway. Runway 6-24 has a bituminous surface and is the longest runway at the Airport

The FAA has made improvement of Runway Safety Areas (RSAs) a high priority for Airport Improvement Program (AIP) funded projects. This includes the areas at the ends of the runways called Extended Runway Safety Areas (ERSAs) which provide a smooth graded, obstacle free areas for aircraft which overrun or undershoot the paved runway surface to come to a stop without major damage. A number of aircraft accidents in recent years were made much more severe due to the lack of full standard safety areas for the incident runway.

At the Roanoke Regional Airport, the 6,802 foot long Runway 6-24 has an area approximately 90' long at the Runway 6 (west) end and 200' long at the Runway 24 (east) end that meets the current standards. This is well under the 1,000' long design standard shown at Exhibit 1. To this point improvement of the ERSA condition has not been considered feasible due to steep terrain and barriers at each end such as I-581 to the west and a creek to the east. Improved technology and increased emphasis for significant funding of safety area improvements may provide for some level of improvement of the ERSAs for Runway 6-24.

This report assesses the current alternatives to provide safety area improvements to Runway 6-24 assuming no reduction in the current runway length of 6,802 feet.

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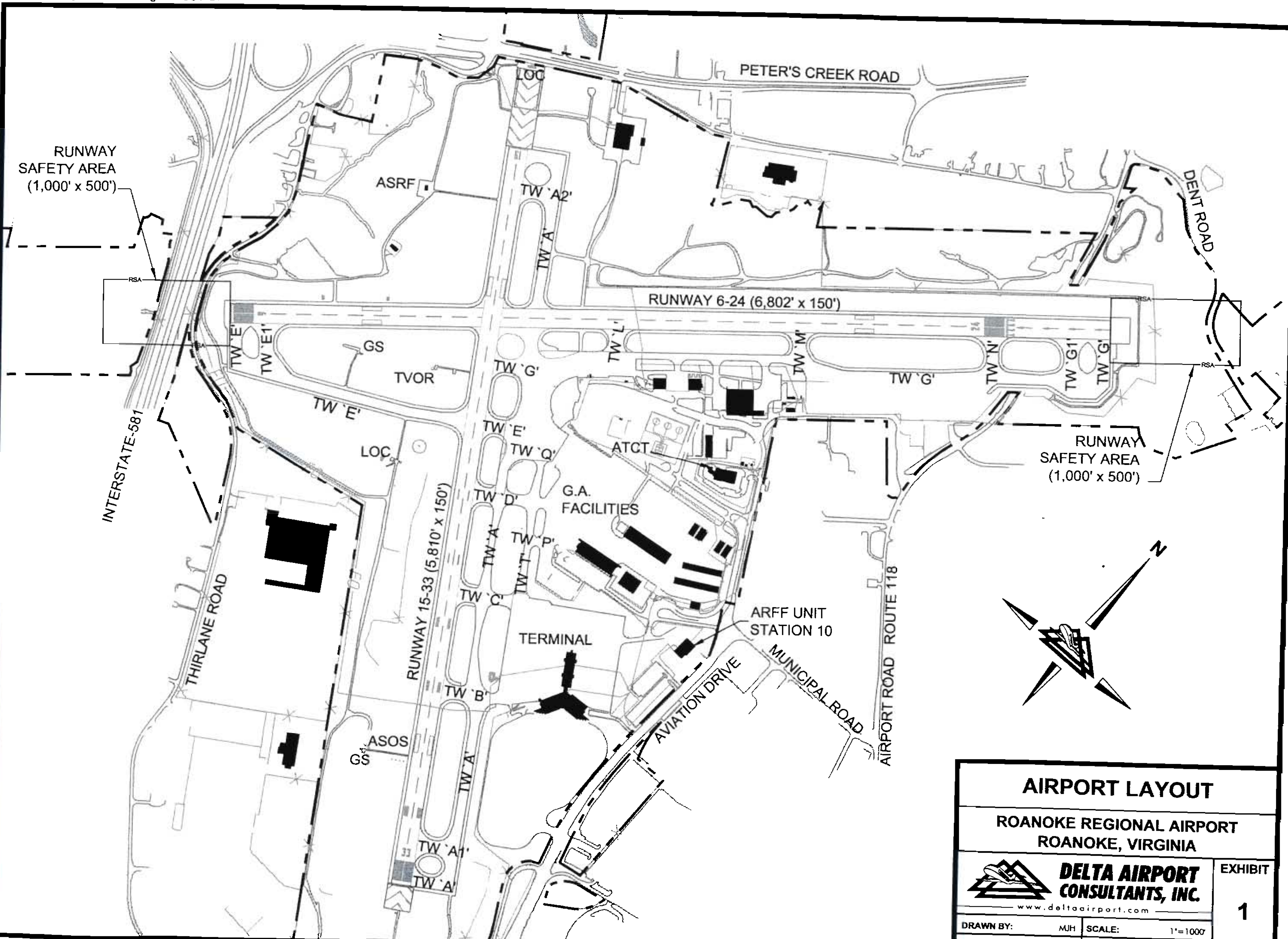

AIRPORT LAYOUT

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
www.deltaairport.com

DRAWN BY:	MJH	SCALE:	1"=1000'	EXHIBIT 1
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II. Current FAA Design Standards

Standards for Airport runway safety area (RSA) and Engineered Materials Arresting Systems (EMAS) are described in FAA Advisory Circulars (A/C) 150/5300-13 and A/C 150/5220-22A respectively. In these A/C's the FAA describes the following design parameters.

1. Extended Runway Safety Areas (ERSA)

   Standard: FAA A.C. 150/5300-13, Chg 6, Table 3-3. Runway Safety Area length beyond runway end for Approach Category C & D, Airplane Design Group III and IV is 1,000 feet. Runway Safety Area width is 500 feet.

2. Runway Safety Areas (RSA)

   Standard: FAA A.C. 150/5300-13, Chg 4, paragraph 305. Safety areas are to be cleared and graded to remove surface variations and capable of supporting aircraft and vehicle traffic without causing damage to the aircraft. No items other than those required by function shall be in the RSA and no objects shall be of a height greater than three (3) inches unless they are frangible. RSA width of 500 feet required.

3. Engineered Materials Arresting System (EMAS)

   Standard: FAA A.C. 150/5220-22A. A standard EMAS provides a level of safety that is generally equivalent to a full RSA built to the dimensional standards in A.C. 15/5300-13, *Airport Design.* It also provides an acceptable level of safety for undershoots.

III. Existing Conditions

A. ERSAs

The Runway 6-24 environment exhibits the following non-standard ERSA conditions.

1. Runway 6 ERSA less than standard dimensions of length (1,000 feet). Existing length: Less than 100 feet. Existing width 500 feet.

2. Runway 24 ERSA less than standard dimension. Existing length: 200 +/- feet. Existing width: 500 feet.

IV. Alternatives

This preliminary study of the scope impacts and estimated costs for improving the ERSAs at the Roanoke Regional Airport are being conducted to provide a basis of a feasibility study for follow on planning and engineering design. It is anticipated that some level of safety area enhancement would be mandated and the significant costs will likely have to be compared to the risk associated with the lack of full standard ERSAs.

The extent of the Airport's medium to large jet air carrier aircraft, and increased operations of regional jet aircraft require at least the available 6,800 feet of runway available at Roanoke. Analysis of performance data shows that these aircraft are limited in range and payload by the current runway length, especially in the summer. Therefore in the following analysis, reducing runway length to achieve compliant extended runway safety area length was not considered.

Three alternatives are analyzed in this report to provide a basis for comparing the factors in determining the ultimate feasibility of improving the ERSAs for Runway 6-24. The following alternatives are assessed in this report.

A. Full Standard ERSA - Graded area 500' wide by 1,000' long beyond each runway end.

B. Full Standard EMAS – Graded area 500' wide by 600' long beyond each runway end to allow installation of 70 knot entry EMAS of approximately 200' wide by 400' long set back approximately 200' from the runway end.

C. Minimum Performance EMAS without undershoot protection consisting of a 500' wide by approximately 250' long graded area to allow a 200' by 200' EMAS installation set back a minimum of 35' from each runway end.

Each alternative is analyzed in regards the following factors:

1. Land Acquisition beyond existing Airport Property Limits. This includes acquisition and relocation of occupied parcels.

2. Construction magnitude to include grading, drainage, road way and other infrastructure work.

3. Environmental considerations to include wetlands, habitat, floodplain, socioeconomic or other significant environmental factors requiring extensive assessment and or mitigation.

4. Estimated Cost to be used as a basis of overall comparison.

A. Full Standard RSA

1. Land

As shown at Exhibits 2 and 4, approximately 50 acres of land will be required for acquisition for construction and related impacts to improve the ERSAs to the full standard for Runway 6-24. At least 30 occupied parcels would be displaced and require relocation. While the ERSA improvements will not alter the Runway Protection Zone, Noise impact or airspace protection property requirements, the extensive grading and associated impacts to the road relocations, stream channel and flood plain requirements will require extensive additional property acquisition beyond just the 500' by 1,000' (11.5 acres) ERSA.

While the Roanoke Airport Commission has been undergoing a consistent program of land acquisition to mitigate and prevent encroachment, there are still significant occupied residential and business parcels impacted. The costs associated with acquisition and relocation of these occupied parcels are significant and are described in further detail below. In addition, the acquisition and relocation of occupied parcels will require extensive environmental assessment for induced socio-economic impacts to the locality and region.

Land acquisition and associated impacts are a considerable factor in consideration of the feasibility of alternatives to improve the ERSAs.

2. Construction

As shown at Exhibits 2 through 5, the grading, drainage and infrastructure improvements for improvement of the ERSAs is considerable. Fill depths exceeding averaging 50 to 70 feet will be required on each runway end and there are special considerations at each runway end requiring additional cost premiums to the basic earthwork.

For the Runway 6 end, the embankment for the ERSA will extend over Interstate 581 which is currently 6 lanes and anticipated to be widened to 10 to 12 lanes due to the proximity of the Peters Creek interchange and traffic growth. Relocation of I-581 will require considerably more land acquisition due to major business parcel impacts along I-581 between the Peters Creek Road and Hershberger Road interchanges. Therefore, an underpass of I-581 would be the least costly solution for accommodating the highway and overtopping ERSA embankment. This would also be the least construction impact versus a relocation of the highway. Grading requirements for the Runway 6 end are estimated at approximately 1.8 million cubic yards with a significant cost also required for the highway underpass structure and roadway. There have been several recent major airport highway underpass structures installed recently at Atlanta and St. Louis which provide a basis of cost for such significant structures.

For the Runway 24 end, the stream channel located approximately 400 feet from the runway end would require relocation or enclosure in a culvert structure. Due the requirement for extensive earthen fill material, relocation of the stream is the most likely course of action versus the culvert as it will provide a more natural watercourse and maintain flood plain area and volume. The need for excavation of earthen fill material and relocation of the stream is the main reason for the more extensive property acquisition on the Runway 24 end. Earthwork estimates for improvement of the Runway 24 end are estimated at over 2 million cubic yards.

3. Environmental

Environmental considerations for the improvement of the ERSAs at ROA in a standard manner are significant and require formal assessment and coordination but appear to be mitigatable and do not alter the airport operations or service to the extent to require a regional assessment. Most significant considerations for environmental factors are as follows:

Runway 6 end: There would be considerable work require to maintain traffic while the highway underpass structure was constructed. Temporary lane relocations and construction impacts would be costly and require several construction seasons. Induced socio economic impacts and other impacts such as drainage course, wetlands, or other habitat or occupied parcels would be minimal and temporary and with good construction practices not likely be significant.

Runway 24 end: Extensive grading and water course relocation is required on the Runway 24 end to accommodate the full ERSA. At the runway end the upstream drainage area is at least 6 square miles and thus extensive flood plain study would be required. There are likely to be some wetlands impacted by the grading and the FAA policy of not replacing or mitigating wetlands within 10,000 feet of the Airport may increase the complexity of obtaining a permit for the extension work. The extension grading and stream relocation will also require acquisition of a number of occupied residential and business parcels along Dent Road. These include a number of multi-family residential units. Environmental impacts appear to be mitigatable to an not significant impact but will require extensive time, effort and cost to complete prior to the start of construction.

4. Cost

The construction of standard ERSAs at each end of Runway 6-24 is considerable. Due to the cost of the physical construction such as the large volume of earthwork, the premium specialty construction items such as the I-581 underpass and stream relocation, and occupied land acquisition, the estimated cost to improve the Runway 6 ERSA is $230 million and the Runway 24 ERSA is $80 million for a total cost of $310 million.

The estimates are shown at Appendix 1.

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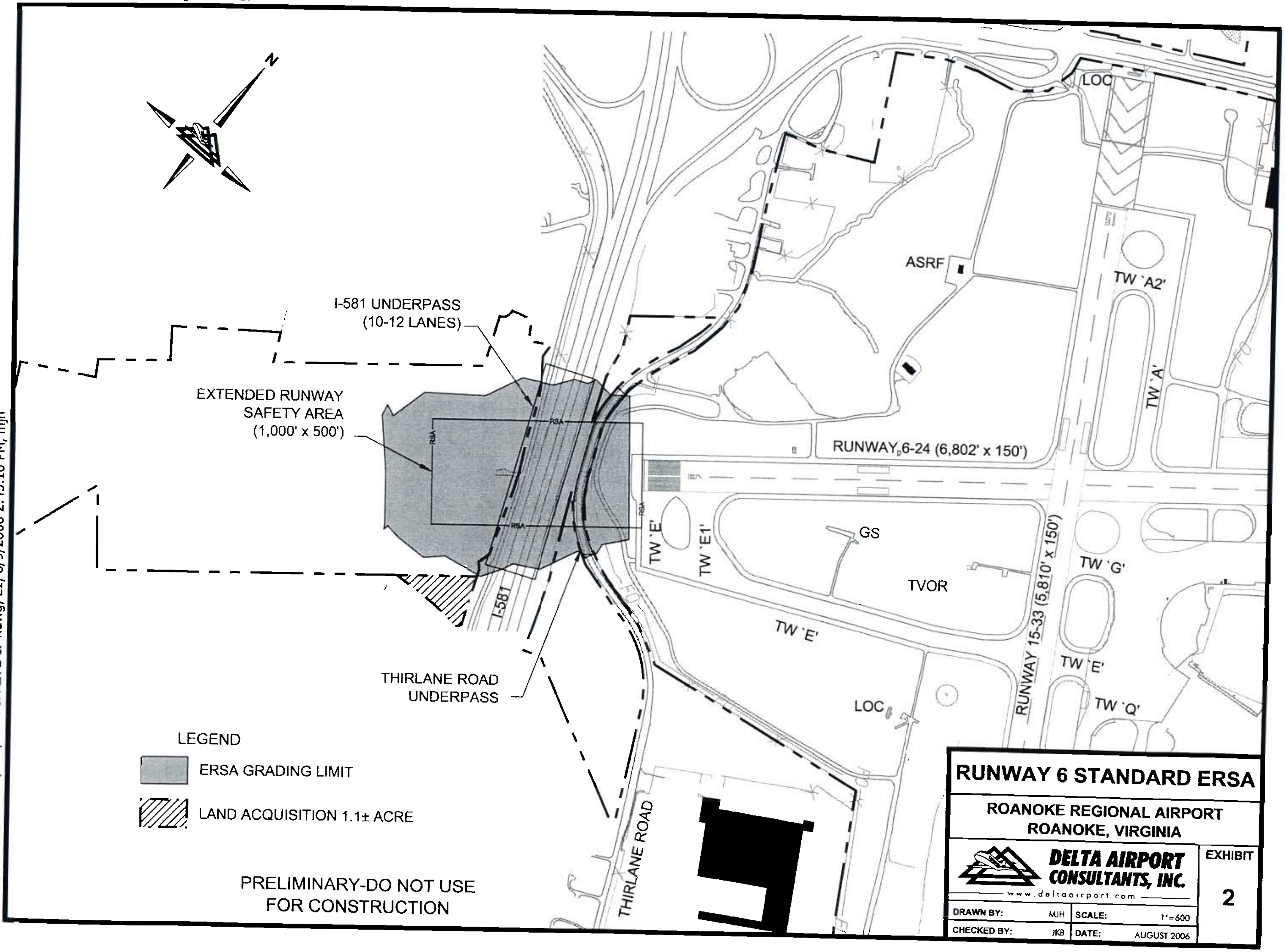

RUNWAY 6 STANDARD ERSA

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC
www.deltaairport.com

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EXHIBIT 2

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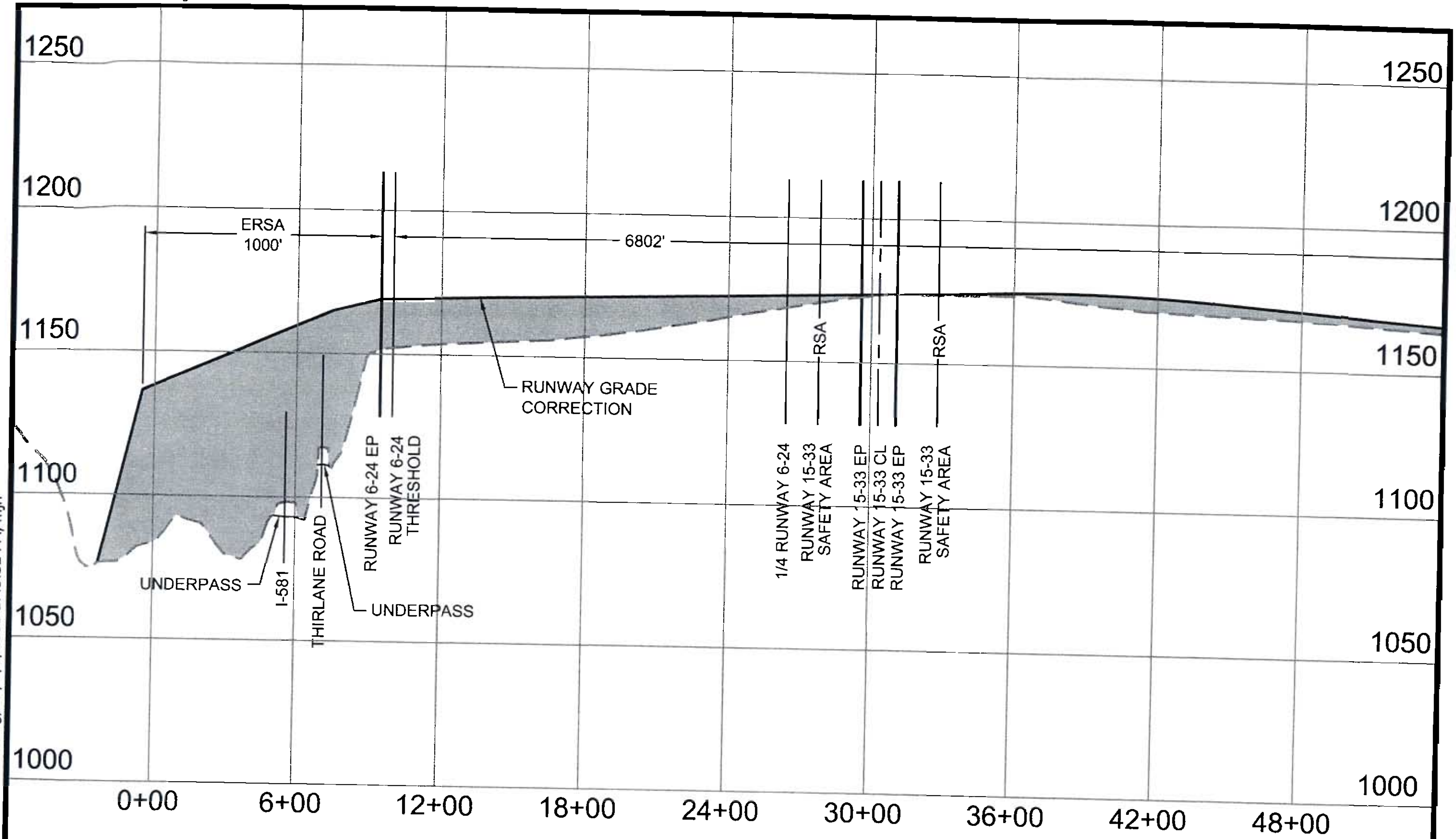

LEGEND

PROPOSED GROUND

EXISTING GROUND

FILL

PRELIMINARY-DO NOT USE
FOR CONSTRUCTION

SCALE: 600 — 0 — 600 — 1200 FEET

RUNWAY 6 ERSA-PROFILE	
ROANOKE REGIONAL AIRPORT ROANOKE, VIRGINIA	
DELTA AIRPORT CONSULTANTS, INC www.deltaairport.com	EXHIBIT 3
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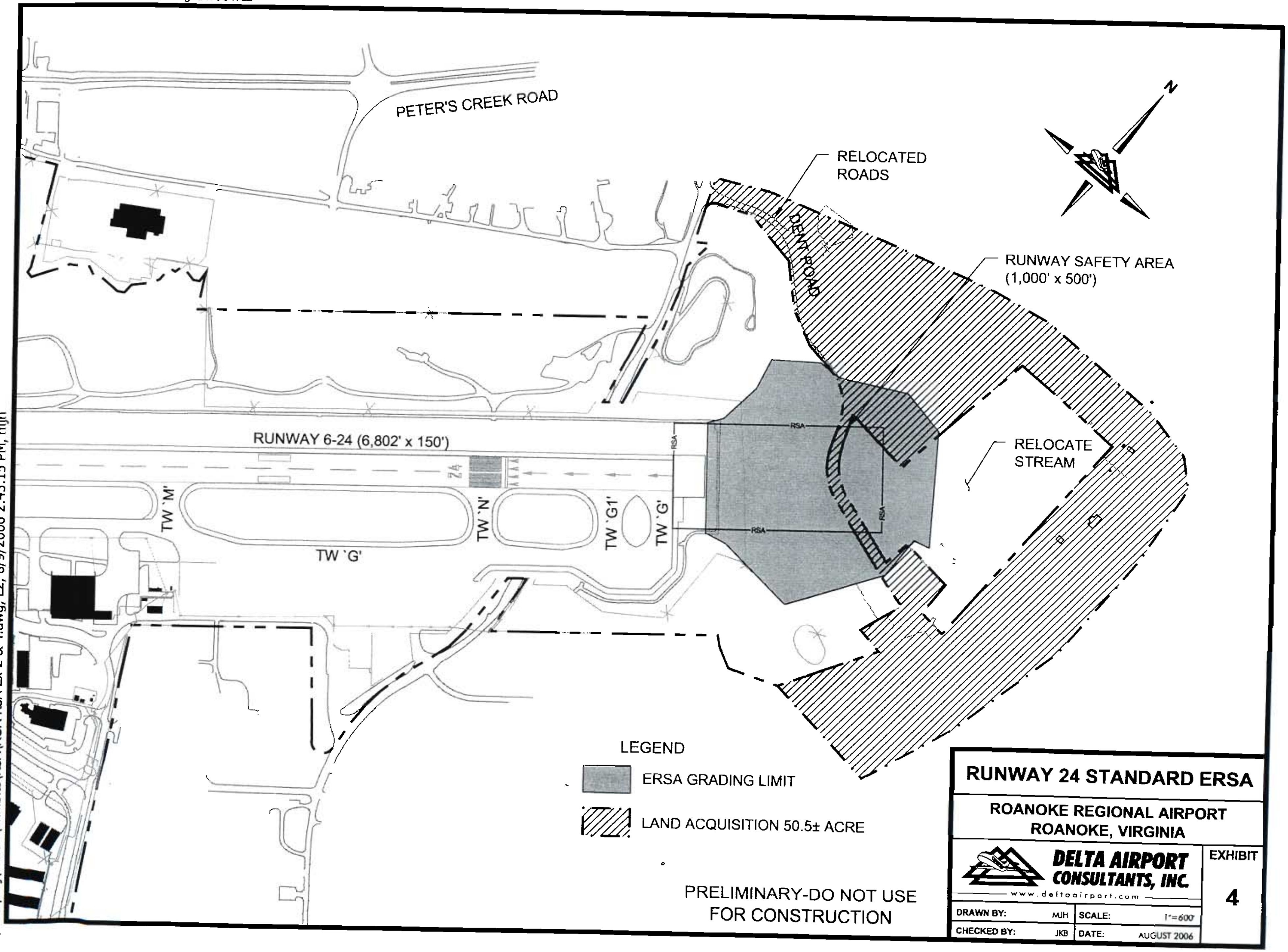

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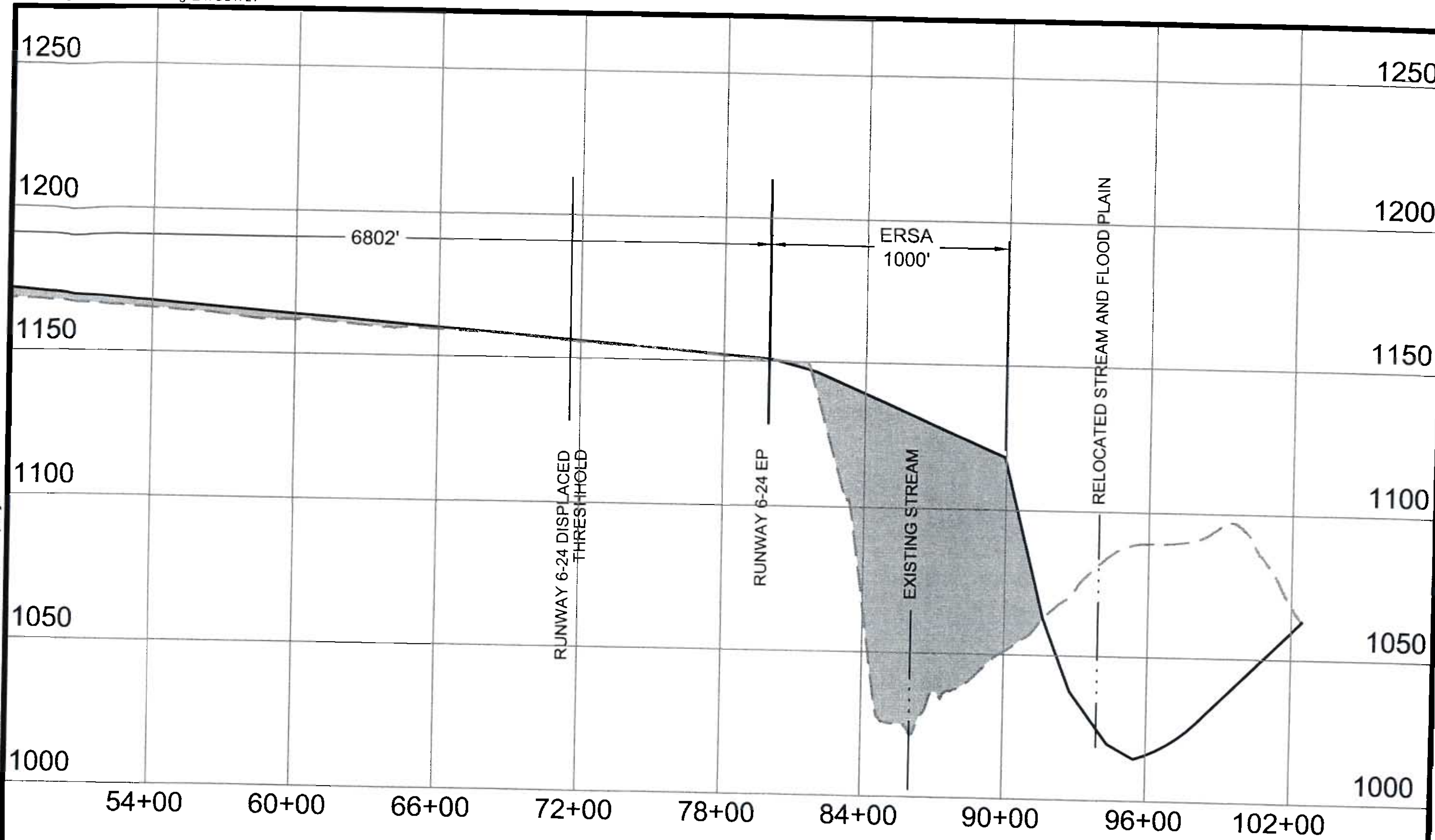

LEGEND

- PROPOSED GROUND
- EXISTING GROUND
- FILL

PRELIMINARY-DO NOT USE
FOR CONSTRUCTION

SCALE 600 0 600 1200 FEET

RUNWAY 24 ERSA-PROFILE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC.
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EXHIBIT 5

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B. Full Standard EMAS

As an alternative to the full standard 500' wide by 1,000' long ERSA, a potentially lesser cost alternative is to construct a smaller graded area of 500' width and 600' length at each runway end to accommodate an EMAS bed of approximately 200 foot width and 400 length as shown at Exhibits 6 and 7. It is set back from the runway end approximately 200 feet to provide undershoot protection and minimize jet blast erosion of the EMAS blocks. The smaller graded area, (6.9 acres) should cost less and may be more feasible to construct and thus offset the additional cost of the EMAS. A full standard EMAS which is designed to arrest the design aircraft at an approximate 70 knot entry speed is considered equivalent to a full standard ERSA.

For ROA, the runway end conditions are extreme and the benefit of construction of a lesser graded area for the full EMAS does not realize the cost savings to make a significant distinction in cost between the full standard ERSA and the full EMAS since the high cost construction elements are still required for even the smaller graded area at each runway end as shown in Exhibits .

1. Land

The land impacts are similar to the full standard ERSA in that significant grading is still required at each runway end. The additional land area is slightly reduced to an estimated total of 51 acres required for mainly grading and drainage construction.

2. Construction

The construction scope is nearly the same although somewhat less due lesser amounts of earth embankment for a 400' shorter length which equates to about a 30% reduction in earthwork. Although, the graded area will still extend over I-581 on the Runway 6 end and will require stream relocation on the Runway 24 end. The elements of construction are essentially as the standard ERSA but costs would be somewhat reduced by a reduction in earthwork.

3. Environmental

The Environmental factors are similar again to the full standard ERSA. Slightly less land acquisition will be required but there will still be considerable acquisition and associated relocation of occupied parcels. Extensive formal assessment, coordination of natural and socio-economic factors will be required prior to design and construction.

4. Cost

The cost would be somewhat less due to the lesser amount of earthwork for the graded area. The cost of each EMAS would have to be added which is currently approximately $6 million. The order of magnitude cost for the standard EMAS is similar to the full standard graded ERSA.

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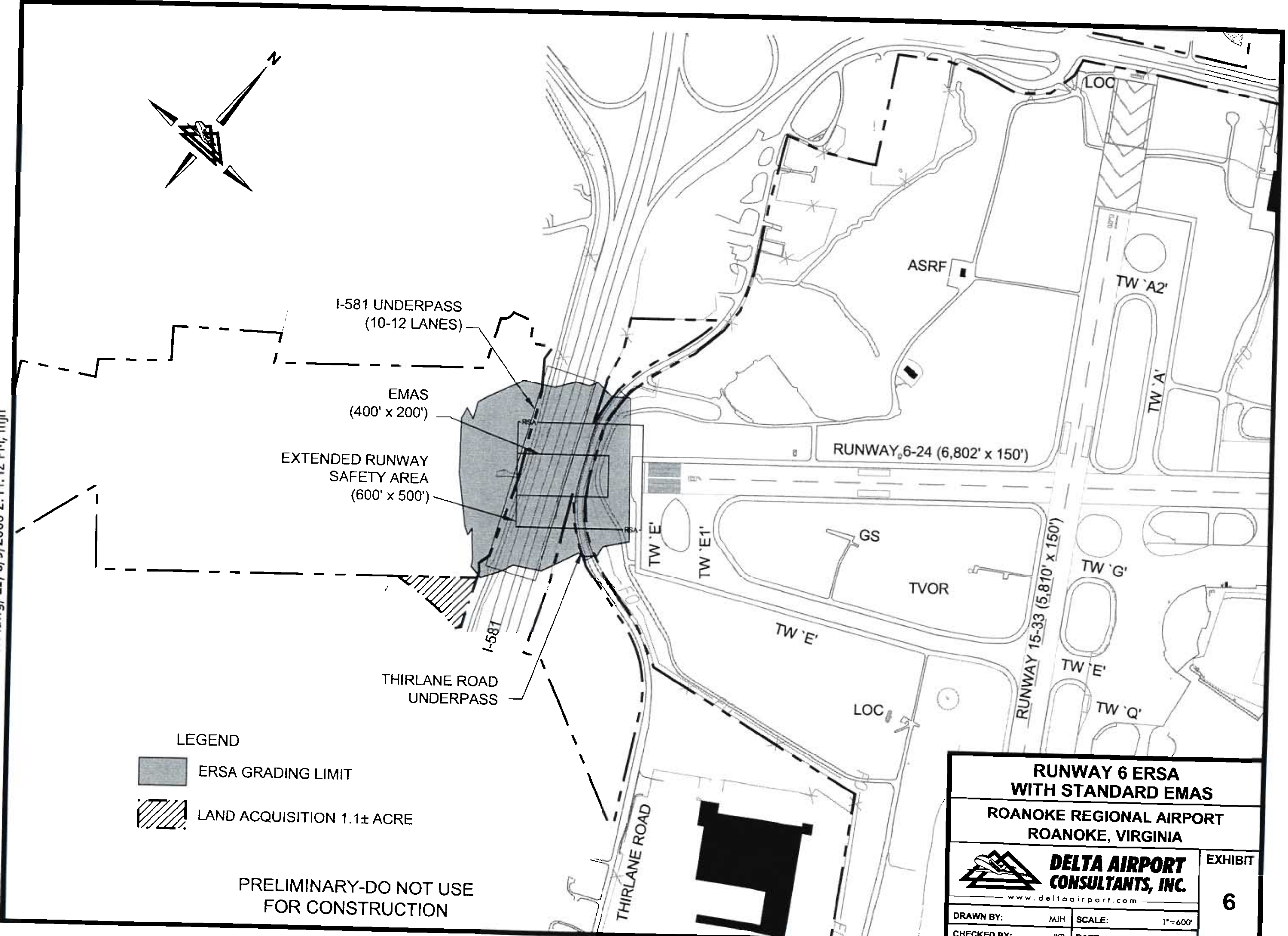

RUNWAY 6 ERSA WITH STANDARD EMAS			
ROANOKE REGIONAL AIRPORT ROANOKE, VIRGINIA			
DELTA AIRPORT CONSULTANTS, INC. www.deltaairport.com			EXHIBIT 6
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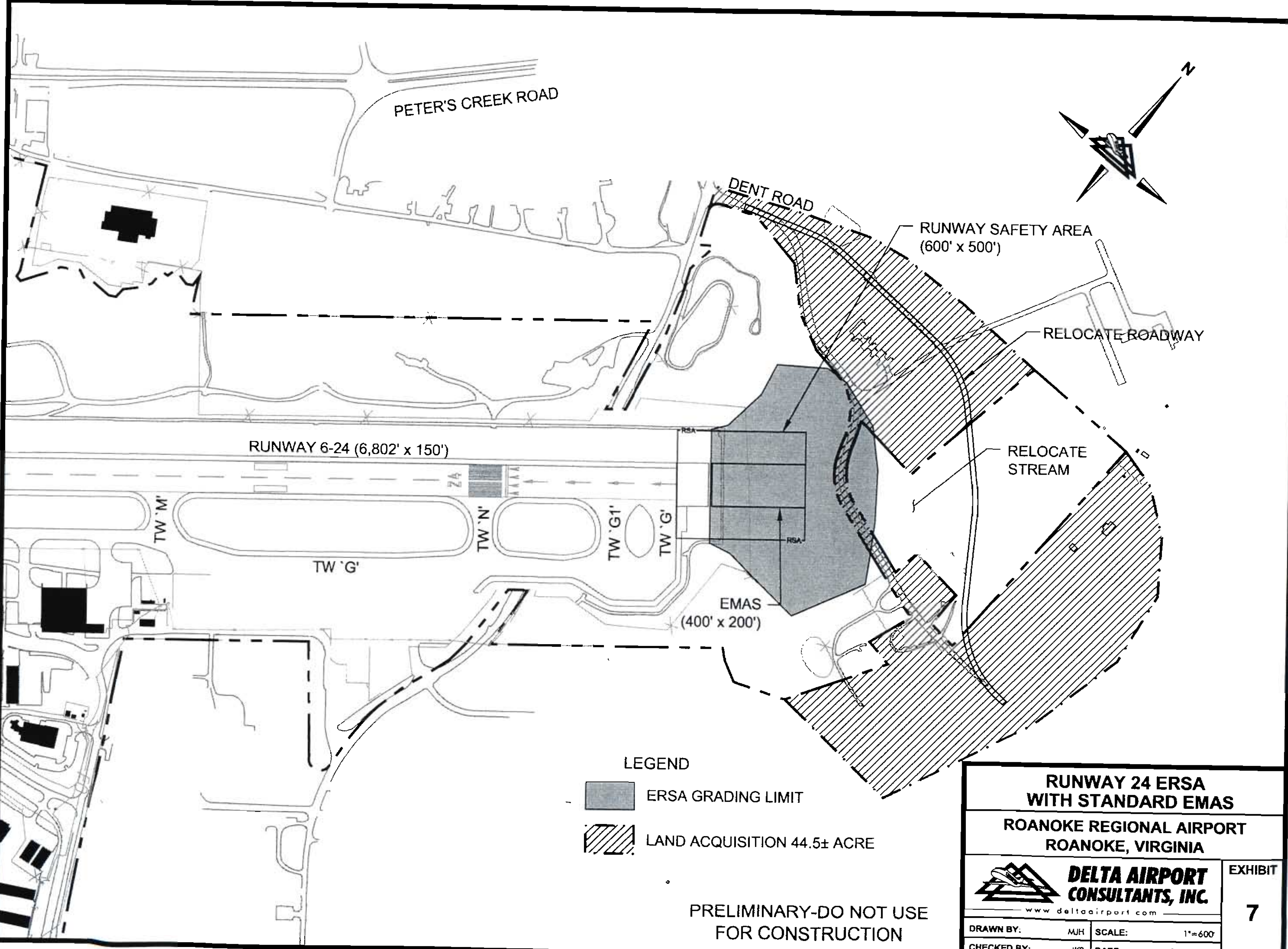

RUNWAY 24 ERSA WITH STANDARD EMAS

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DELTA AIRPORT CONSULTANTS, INC
www.deltaairport.com

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C. Minimum Performing EMAS

As described above the construction of a full standard ERSA or full EMAS at each runway end will require extensive work and cost. These costs may provide a determination of non-feasibility to install either measure to provide compliant ERSAs for Runway 6-24. For these situations, consideration should be given to the installation of an EMAS to the maximum extent practical with the minimum performance EMAS being an approximately 200' long by 200' wide bed at a minimum of 35' from the runway end as shown at Exhibits 8 and 9. Thus, a graded area of approximately 250' long by 500' wide would need to be constructed at each runway end. The minimum performance EMAS provides the potential for arresting of an aircraft at an approximately 40 knot entry speed.

This alternative if considered to be acceptable, appears to much more feasible in that the impacts and scope of work are much less than the standard alternatives described above. The Minimum Performance EMAS alternatives are shown at Exhibits 8 and 9.

1. Land

The Minimum Performance EMAS appears to constructable within the current Airport property limits although some right of way and easement coordination will be required with VDOT and the City of Roanoke to shift Thirlane Road and construct retaining walls. Actual land or easement acquisition appears to be insignificant and no occupied parcels are impacted.

2. Construction

The confined areas available for construction of the 250' long by 500' wide graded area at each runway end will require significant structural measures such as retaining walls and reinforced slopes. The earthwork for these embankments is a fraction of the standard ERSA or full EMAS and materials are available on Airport property. Construction could be accomplished with minimal traffic disruption and no impact I-581. Impact to the stream area would be temporary and only during actual work to construct the reinforced slope or wall at the Runway 24 end.

3. Environmental

No significant environmental issues are associated with this alternative as the work is on existing Airport property, does not require occupied parcel relocation or impact the natural watercourses or habitat. There is also only temporary impact to Airport operations but no change in the nature of traffic or flight patterns.

4. Cost

The cost for providing the Minimum Performance EMAS at both ends of Runway 6-24 is significantly less, and is estimated at $25 million. This is because grading is significantly reduced, bridge structure across I-581 and Thirlane Road is not required and environmental impact/mitigation is minimized.

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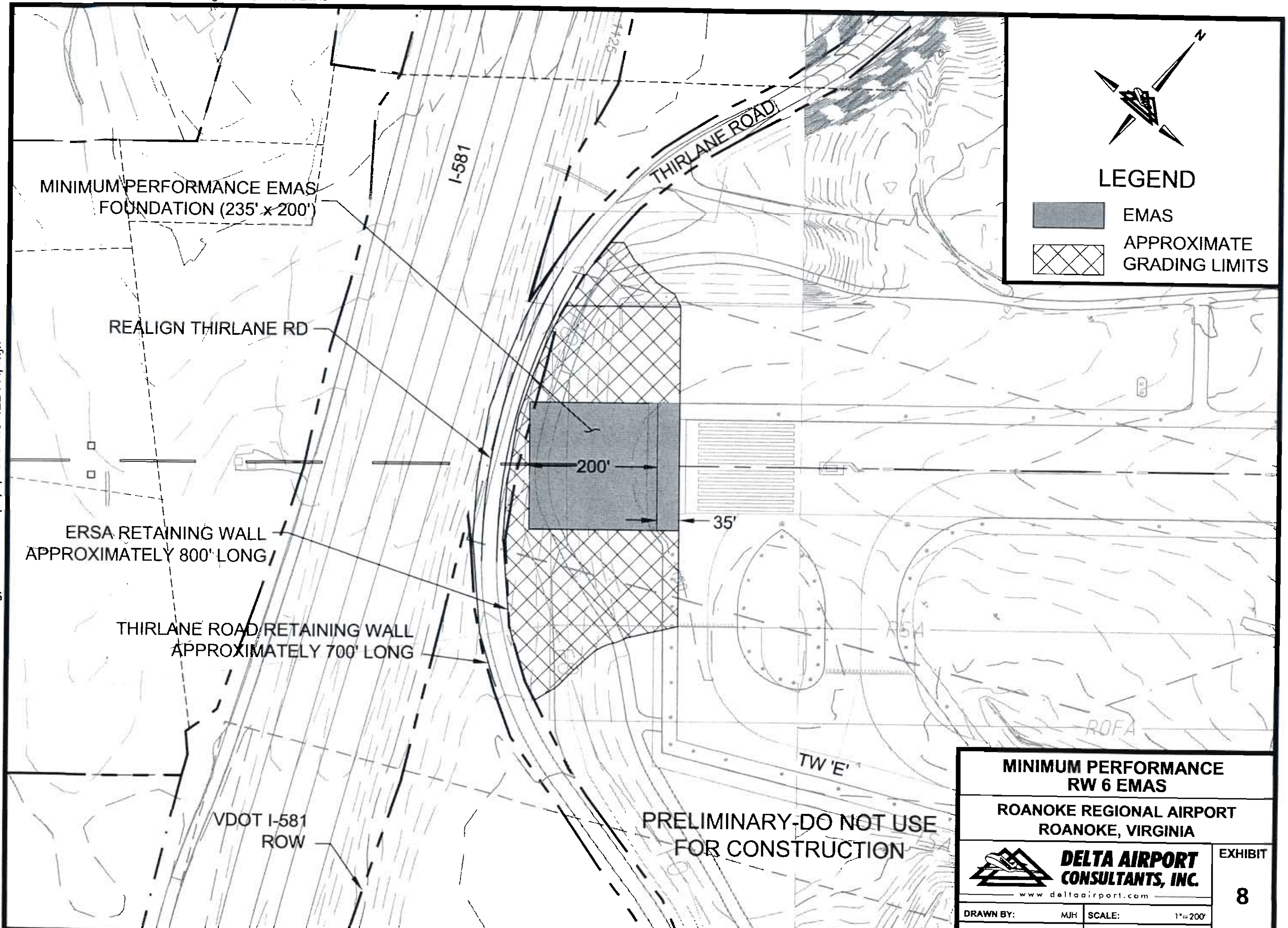

MINIMUM PERFORMANCE RW 6 EMAS			
ROANOKE REGIONAL AIRPORT ROANOKE, VIRGINIA			
DELTA AIRPORT CONSULTANTS, INC. www.deltaairport.com			EXHIBIT 8
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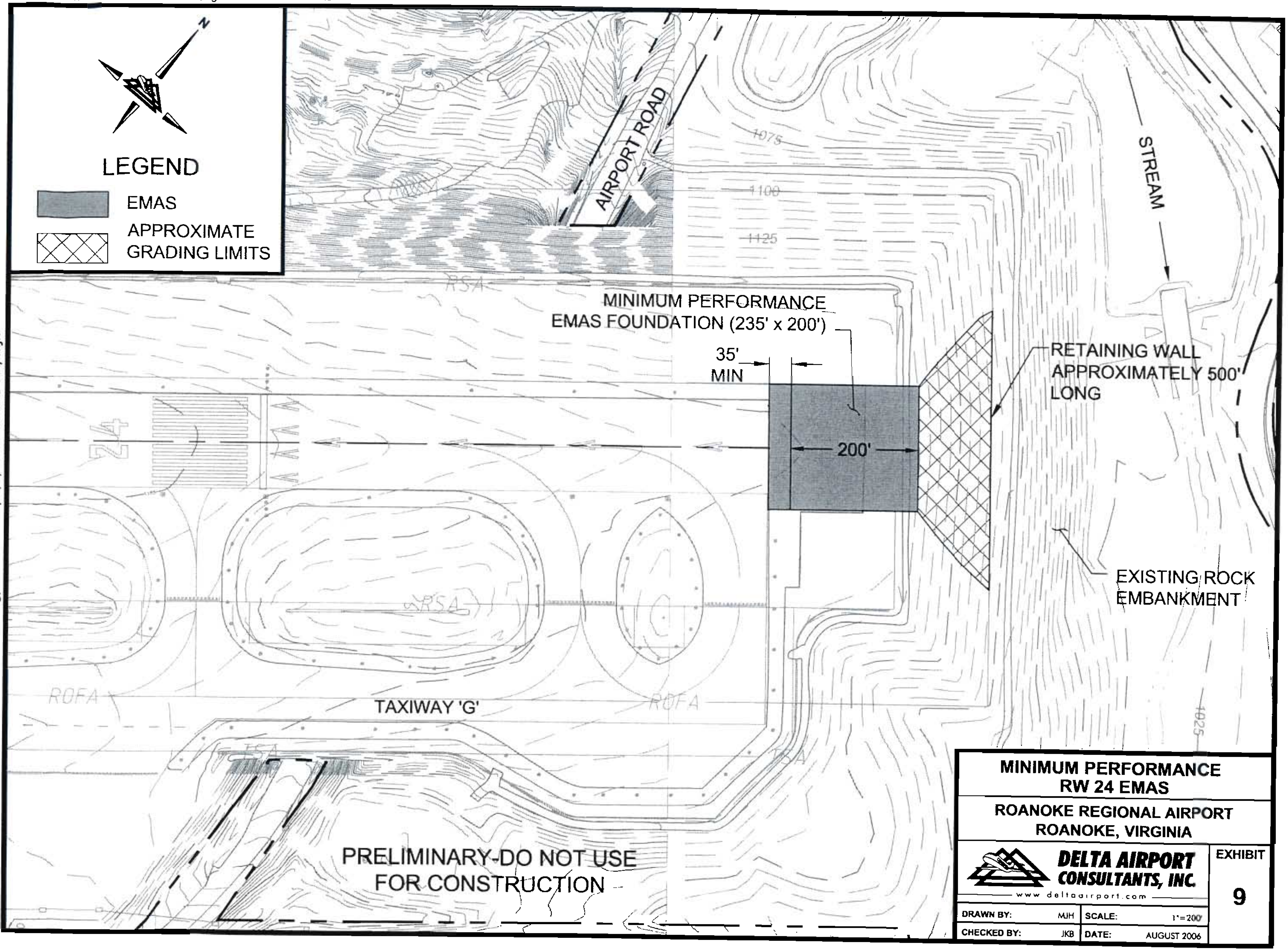

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SUMMARY CHART - NON STANDARD CONDITIONS

Item	Scope of Work	Operational Impact (Airport)	Environmental Impact	Estimated Cost
RWY 6 RSA	1.8 MCY fill Bridge/Tunnel across Interstate and Local road, Property Acquisition	Limited runway closures and threshold displacement	Possibly significant: Road relocations, property acquisition, relocations, noise, traffic, social impacts	$230 million
RWY 24 RSA	2.0 MCY fill, Relocate stream and road. Property Acquisition	Limited runway closures and threshold displacement	Possibly significant: Stream relocation, property and residence relocations, habitat, social impacts	$80 million
RWY 6 - Standard EMAS	1.3 MCY fill Bridge/Tunnel across Interstate and Local road, Property Acquisition	Limited runway closures and threshold displacement	Possibly significant: Road relocations, property acquisition, relocations, noise, traffic, social impacts	$230 million
RWY 24 - Standard EMAS	1.4 MCY fill, Relocate stream and road. Property Acquisition	Limited runway closures and threshold displacement	Possibly significant: Road relocations, property acquisition, relocations, noise, traffic, social impacts	$56 million
RWY 6 - Minimum EMAS	0.1 MCY fill, grading and retaining wall	Limited runway closures	No significant environmental impact	$17 million
RWY 6 - Minimum EMAS	0.1 MCY fill, grading and retaining wall	Limited runway closures	No significant environmental impact	$8 million

APPENDIX 1

COST ESTIMATE

RUNWAY 6 RUNWAY SAFETY AREA - FULL STANDARD

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	Mobilization	LS	1	$10,791,550	$10,791,550
2	Embankment	CY	1,800,000	$15	$27,000,000
3	Drainage	LS	1	$2,000,000	$2,000,000
4	I-581/Thirlane RoadTtunnel	LS	1	$125,000,000	$125,000,000
5	Land Acquisition	AC	1.1	$150,000	$165,000
6	MISCELLANEOUS (15%)	LS	1	$24,743,483	$24,743,483

Estimated Total:	$189,700,033
20% Engineering, Constr. Admin, etc.	$37,940,007
Total	$227,640,039
Use	**$230,000,000**

COST ESTIMATE

RUNWAY 24 RUNWAY SAFETY AREA - FULL STANDARD

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	Mobilization	LS	1	$ 1,925,000	$ 1,925,000
2	Embankment	CY	2,000,000	$ 12	$ 24,000,000
3	Drainage	LS	1	$ 2,000,000	$ 2,000,000
4	Stream Relocation	LF	3,000	$ 500	$ 1,500,000
5	Dent Road Relocation (VA 623)	LF	3,000	$ 200	$ 600,000
6	Land Acquisition - Undeveloped	AC	50	$ 200,000	$ 10,000,000
7	Residential Acquisition & Relocation (Single Family)	EA	10	$ 250,000	$ 2,500,000
8	Residential Acquisition & Relocation (Multi Family)	EA	20	$ 150,000	$ 3,000,000
9	Business Acquisition & Relocation	EA	10	$ 500,000	$ 5,000,000
10	Institutional Acquisition & Relocation	EA	1	$ 2,000,000	$ 2,000,000
11	Building Demolition	LS	1	$ 1,000,000	$ 1,000,000
12	Miscellaneous (15%)	LS	1	$ 8,028,750	$ 8,028,750

Estimated Total:	$61,553,750
20% Engineering, Constr. Admin, etc.	$12,310,750
Total	**$73,864,500**
Use	**$80,000,000**

COST ESTIMATE

RUNWAY 6 FULL STANDARD EMAS

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$8,400,000	$8,400,000
2	LAND ACQUISITION	AC	1	$150,000	$165,000
3	DRAINAGE	LS	1	$1,000,000	$1,000,000
4	EROSION AND SEDIMENT CONTROL	LS	1	$1,500,000	$1,500,000
5	EMBANKMENT	CY	1,300,000	$15	$19,500,000
6	I-581/THIRLANE ROAD TUNNEL	LS	1	$125,000,000	$125,000,000
7	ELECTRICAL	LS	1	$2,000,000	$2,000,000
8	EMAS STRUCTURE and Foundation	LS	1	$7,000,000	$7,000,000
9	MISCELLANEOUS (15%)	LS	1	$23,634,750	$23,634,750

TOTAL:	$188,199,750
20% Engineering, Constr. Admin, etc.	$37,639,950
Total	**$225,839,700**
Use	**$230,000,000**

COST ESTIMATE

RUNWAY 24 FULL STANDARD EMAS

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	Mobilization	LS	1	$ 2,205,000	$ 2,205,000
2	Embankment	CY	1,400,000	$ 10	$ 14,000,000
3	Drainage	LS	1	$ 2,000,000	$ 2,000,000
4	Stream Relocation	LF	3,000	$ 500	$ 1,500,000
5	Dent Road Relocation (VA 623)	LF	3,000	$ 200	$ 600,000
6	Land Acquisition	AC	50	$ 30,000	$ 1,500,000
7	Residential Acquisition & Relocation (Single Family)	EA	10	$ 250,000	$ 2,500,000
8	Residential Acquisition & Relocation (Multi Family)	EA	20	$ 150,000	$ 3,000,000
9	Business Acquisition & Relocation	EA	10	$ 500,000	$ 5,000,000
10	School Acquisition & Relocation	EA	1	$ 2,000,000	$ 2,000,000
11	Building Demolition	LS	1	$ 1,000,000	$ 1,000,000
12	EMAS STRUCTURE and Foundation	LS	1	$7,000,000	$7,000,000
13	Miscellaneous (15%)	LS	1	$ 5,295,750	$ 5,295,750

Estimated Total:	$47,600,750
20% Engineering, Constr. Admin, etc.	$9,520,150
Total	**$57,120,900**
Use	**$58,000,000**

COST ESTIMATE

RUNWAY 6 MINIMUM PERFORMING EMAS

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$593,250	$593,250
2	DRAINAGE - AIRFIELD	LS	1	$500,000	$500,000
3	EROSION AND SEDIMENT CONTROL	LS	1	$200,000	$200,000
4	EMBANKMENT	CY	75,000	$15	$1,125,000
5	THIRLANE ROAD REALIGNMENT	LS	1	$2,000,000	$2,000,000
6	THIRLANE ROAD RETAINING WALL	S. F	28,000	$90	$2,520,000
7	ERSA RETAINING WALL	S. F	28,000	$90	$2,520,000
8	EMAS STRUCTURE	LS	1	$3,000,000	$3,000,000
9	MISCELLANEOUS (15%)	LS	1	$1,418,738	$1,418,738
				TOTAL:	$13,876,988
				20% Engineering, Constr. Admin, etc.	$2,775,398
				Total	**$16,652,385**
				Use	**$17,000,000**

COST ESTIMATE

RUNWAY 24 MINIMUM PERFORMING EMAS

ROANOKE REGIONAL AIRPORT
ROANOKE, VA
DELTA PROJECT: VA 04095

ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION	LS	1	$266,250	$266,250
2	DRAINAGE	LS	1	$500,000	$500,000
3	EROSION AND SEDIMENT CONTROL	LS	1	$200,000	$200,000
4	EMBANKMENT	CY	65,000	$25	$1,625,000
5	EMAS STRUCTURE	LS	1	$3,000,000	$3,000,000
6	MISCELLANEOUS (15%)	LS	1	$388,688	$388,688
				TOTAL:	$5,979,938
				20% Engineering, Constr. Admin, etc.	$1,195,988
				Total	**$7,175,925**
				Use	**$8,000,000**

APPENDIX 2

Table 3-3. Runway design standards for aircraft approach categories C & D (Refer also to Appendix 16 for the establishment of new approaches)

ITEM	DIM[1]	AIRPLANE DESIGN GROUP					
		I	II	III	IV	V	VI
Runway Length	A	- Refer to paragraph 301 -					
Runway Width	B	100 ft 30 m	100 ft 30 m	100 ft 30 m	150 ft 45 m	150 ft 45 m	200 ft 60 m
Runway Shoulder Width[3]		10 ft 3 m	10 ft 3 m	20 ft 6 m	25 ft 7.5 m	35 ft 10.5 m	40 ft 12 m
Runway Blast Pad Width		120 ft 36 m	120 ft 36 m	140 ft 42 m	200 ft 60 m	220 ft 66 m	280 ft 84 m
Runway Blast Pad length		100 ft 30 m	150 ft 45 m	200 ft 60 m	200 ft 60 m	400 ft 120 m	400 ft 120 m
Runway Safety Area Width[4]	C	500 ft 150 m	500 ft 150 m	500 ft 150 m	500 ft 150 m	500 ft 150 m	500 ft 150 m
Runway Safety Area Length Prior to Landing Threshold		600 ft 180 m	600 ft 180 m	600 ft 180 m	600 ft 180 m	600 ft 180 m	600 ft 180 m
Runway Safety Area Length Beyond RW End[5]	P	1,000 ft 300 m	1,000 ft 300 m	1,000 ft 300 m	1,000 ft 300 m	1,000 ft 300 m	1,000 ft 300 m
Obstacle Free Zone Width and length	- Refer to paragraph 306 -						
Runway Object Free Area Width	Q	800 ft 240 m	800 ft 240 m	800 ft 240 m	800 ft 240 m	800 ft 240 m	800 ft 240 m
Runway Object Free Area Length Beyond RW End[5]	R	1000 ft 300 m	1000 ft 300 m	1000 ft 300 m	1000 ft 300 m	1,000 ft 300 m	1000 ft 300 m

1/ Letters correspond to the dimensions on figures 2-1 and 2-3.

2/ For Airplane Design Group III serving airplanes with maximum certificated takeoff weight greater than 150,000 pounds (68 100 kg), the standard runway width is 150 feet (45 m), the shoulder width is 25 feet (7.5 m), and the runway blast pad width is 200 feet (60 m).

3/ Design Groups V and VI normally require stabilized or paved shoulder surfaces.

4/ For Airport Reference Code C-I and C-II, a runway safety area width of 400 feet (120 m) is permissible.

5/ The runway safety area and runway object free area lengths begin at each runway end when stopway is not provided. When stopway is provided, these lengths begin at the stopway end. The runway safety area length and the object free area length are the same for each runway end. Use the table (3-1 or 3-2) that results in the longest dimension. RSA length beyond the runway end standards may be met by provision of an Engineered Materials Arresting System or other FAA approved arresting system providing the ability to stop the critical aircraft using the runway exiting the end of the runway at 70 knots. See AC 150/5220-22.

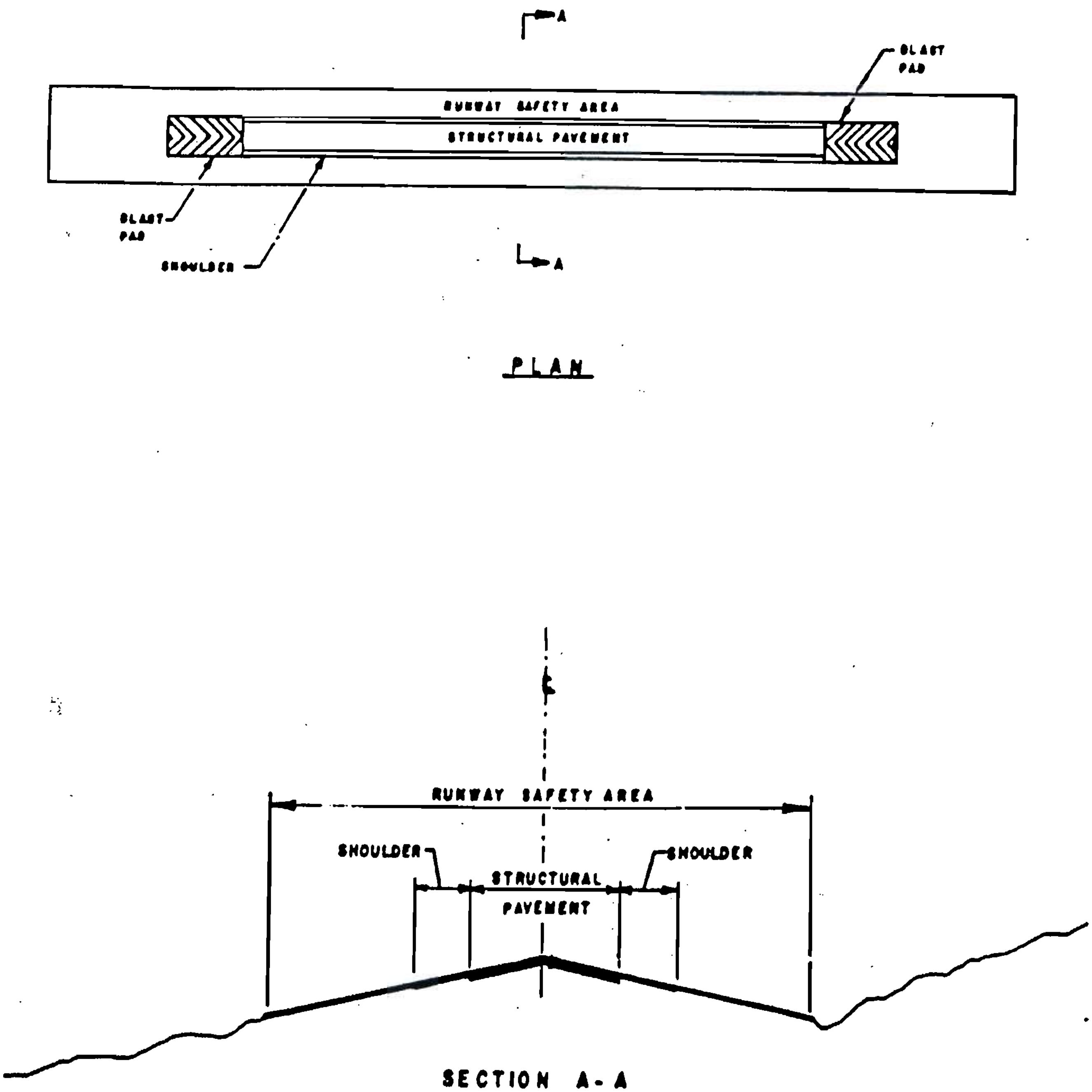


Figure 3-1. Runway safety area

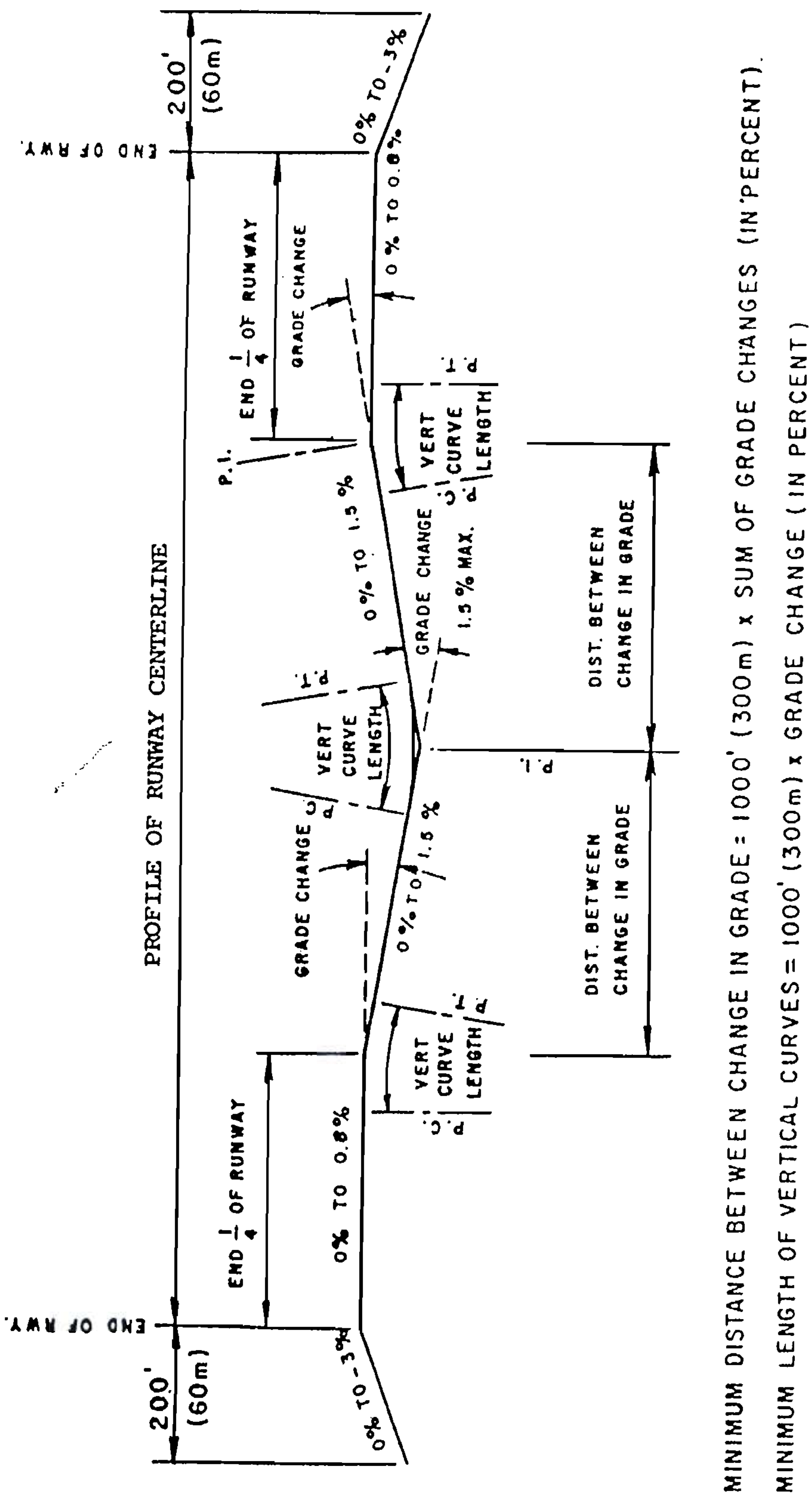
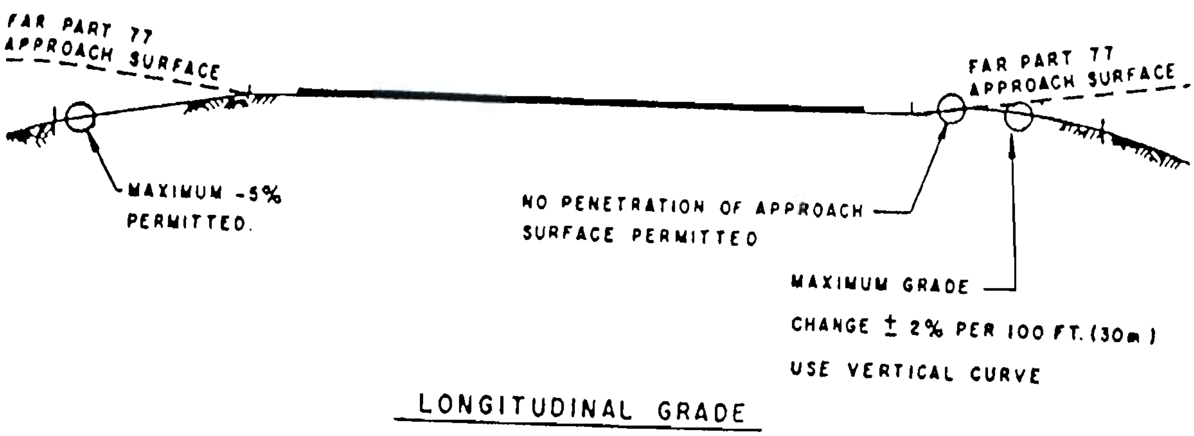


Figure 5-3. Longitudinal grade limitations for aircraft approach categories C & D



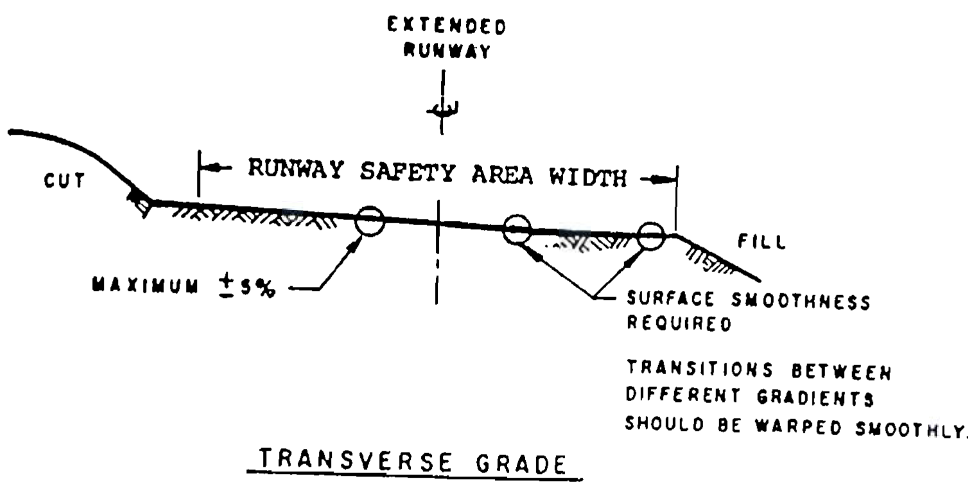
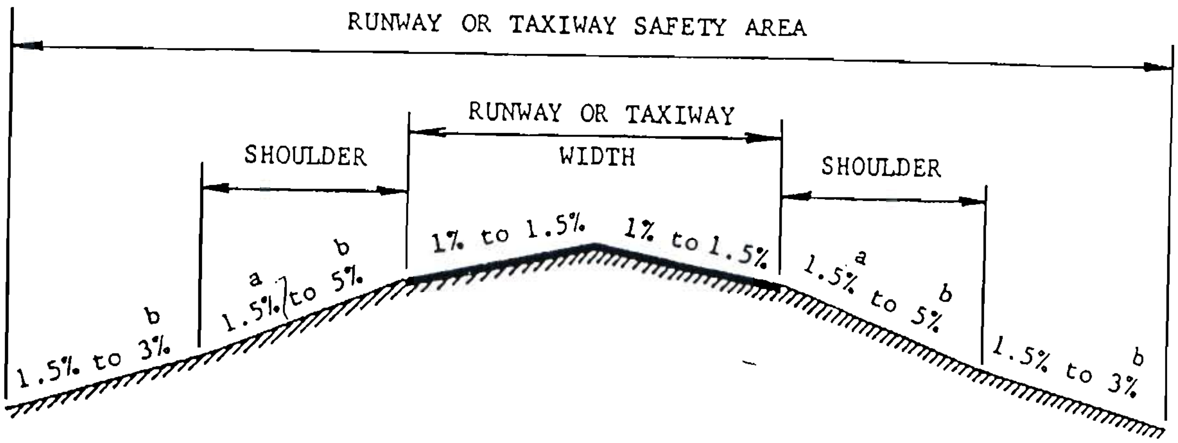


Figure 5-5. Runway safety area grade limitations beyond 200 feet (60 m) from the runway end



a. 3% MINIMUM REQUIRED FOR TURF

b. A slope of 5% is recommended for a 10-foot (3 m) width adjacent to the pavement edges to promote drainage.

GENERAL NOTES:

1. A 1.5 inch (3.8 cm) drop from paved to unpaved surfaces is recommended.

2. Drainage ditches may not be located within the safety area.

Figure 5-4. Transverse grade limitations for aircraft approach categories C & D

Appendix 8. RUNWAY DESIGN RATIONALE

1. **SEPARATIONS.** Dimensions shown in tables 2-1, 2-2, 3-1, 3-2, and 3-3 may vary slightly due to rounding off.

a. **Runway to holdline separation** is derived from landing and takeoff flight path profiles and the physical characteristics of airplanes. The runway to holdline standard satisfies the requirement that no part of an airplane (nose, wingtip, tail, etc.) holding at a holdline penetrates the obstacle free zone (OFZ). Additionally, the holdline standard keeps the nose of the airplane outside the runway safety area (RSA) when holding prior to entering the runway. When the airplane exiting the runway is beyond the standard holdline, the tail of the airplane is also clear of the RSA. Additional holdlines may be required to prevent airplane, from interfering with the ILS localizer and glide slope operations.

b. **Runway to parallel taxiway/taxilane separation** is determined by the landing and takeoff flight path profiles and physical characteristics of airplanes. The runway to parallel taxiway/taxilane standard precludes any part of an airplane (tail, wingtip, nose, etc.) on a parallel taxiway/taxilane centerline from being within the runway safety area or penetrating the OFZ.

c. **Runway to airplane parking areas** is determined by the landing and takeoff flight path profiles and physical characteristics of airplanes. The runway to parking area standard precludes any part of a parked airplane (tail, wingtip, nose, etc.) from being within the runway object free area or penetrating the OFZ.

2. **OBSTACLE FREE ZONE (OFZ).** The portion of the OFZ within 200 feet (60 m) of the runway centerline is required for departure clearance. The additional OFZ, beyond 200 feet (60 m) from runway centerline, is required to provide an acceptable accumulative target level of safety without having to adjust minimums. The level of safety for precision instrument operations is determined by the collision risk model. The collision risk model is a computer program developed from observed approaches and missed approaches. It provides the probability of an airplane passing through any given area along the flight path of the airplane. To obtain an acceptable accumulative target level of safety with objects in the OFZ, operating minimums may have to be adjusted.

3. **RUNWAY SAFETY AREA.**

a. **Historical Development.** In the early years of aviation, all airplanes operated from relatively unimproved airfields. As aviation developed, the alignment of takeoff and landing paths centered on a well defined area known as a landing strip. Thereafter, the requirements of more advanced airplanes necessitated improving or paving the center portion of the landing strip. The term "landing strip" was retained to describe the graded area surrounding and upon which the runway or improved surface was constructed. The primary role of the landing strip changed to that of a safety area surrounding the runway. This area had to be capable, under normal (dry) conditions, of supporting airplanes without causing structural damage to the airplanes or injury to their occupants. Later, the designation of the area was changed to "runway safety area," to reflect its functional role. The runway safety area enhances the safety of airplanes which undershoot, overrun, or veer off the runway, and it provides greater accessibility for firefighting and rescue equipment during such incidents. Figure A8-1 depicts the approximate percentage of airplanes undershooting and overrunning the runway which stay within a specified distance from the runway end. The runway safety area is depicted in figure 3-1 and its dimensions are given in tables 3-1, 3-2, and 3-3.

b. **Recent Changes.** FAA recognizes that incremental improvements inside standard RSA dimensions can enhance the margin of safety for aircraft. This is a significant change from the earlier concept where the RSA was deemed to end at the point it was no longer graded and constructed to standards. Previously, a modification to standards could be issued if the actual, graded and constructed RSA did not meet dimensional standards as long as an acceptable level of safety was provided. Today, modifications to standards no longer apply to runway safety areas. (See paragraph 6) Instead, FAA airport regional division offices are required to maintain a written determination of the best practicable alternative for improving non-standard RSAs. They must continually analyze the non-standard RSA with respect to operational, environmental, and technological changes and revise the determination as appropriate. Incremental improvements are included in the determination if they are practicable and they will enhance the margin of safety.

4. **RUNWAY OBJECT FREE AREA (ROFA).** The ROFA is a result of an agreement that a minimum 400-foot (120 m) separation from runway centerline is required for equipment shelters, other than localizer equipment shelters. The aircraft parking limit line no longer exists as a separate design standard. Instead, the separations required for parked aircraft and the building restriction line from the runway centerline are determined by object clearing criteria.

5. RUNWAY SHOULDERS AND BLAST PADS. Chapter 8 contains the design considerations for runway shoulders and blast pads.

6. CLEARWAY. The use of a clearway for takeoff computations requires compliance with the clearway definition of 14 CFR Part 1.

7. STOPWAY. The use of a stopway for takeoff computations requires compliance with the stopway definition of 14 CFR Part 1.

8. RUNWAY PROTECTION ZONE (RPZ). Approach protection zones were originally established to define land areas underneath aircraft approach paths in which control by the airport operator was highly desirable to prevent the creation of airport hazards. Subsequently, a 1952 report by the President's Airport Commission (chaired by James Doolittle), entitled "The Airport and Its Neighbors," recommended the establishment of clear areas beyond runway ends. Provision of these clear areas was not only to preclude obstructions potentially hazardous to aircraft, but also to control building construction as a protection from nuisance and hazard to people on the ground. The Department of Commerce concurred with the recommendation on the basis that this area was "primarily for the purpose of safety and convenience to people on the ground." The FAA adopted "Clear Zones" with dimensional standards to implement the Doolittle Commission's recommendation. Guidelines were developed recommending that clear zones be kept free of structures and any development which would create a place of public assembly.

In conjunction with the introduction of the RPZ as a replacement term for clear zone, the RPZ was divided into "object free" and "controlled activity" areas. The RPZ function is to enhance the protection of people and property on the ground. Where practical, airport owners should own the property under the runway approach and departure areas to at least the limits of the RPZ. It is desirable to clear the entire RPZ of all aboveground objects. Where this is impractical, airport owners, as a minimum, shall maintain the RPZ clear of all facilities supporting incompatible activities. Incompatible activities include, but are not limited to, those which lead to an assembly of people.

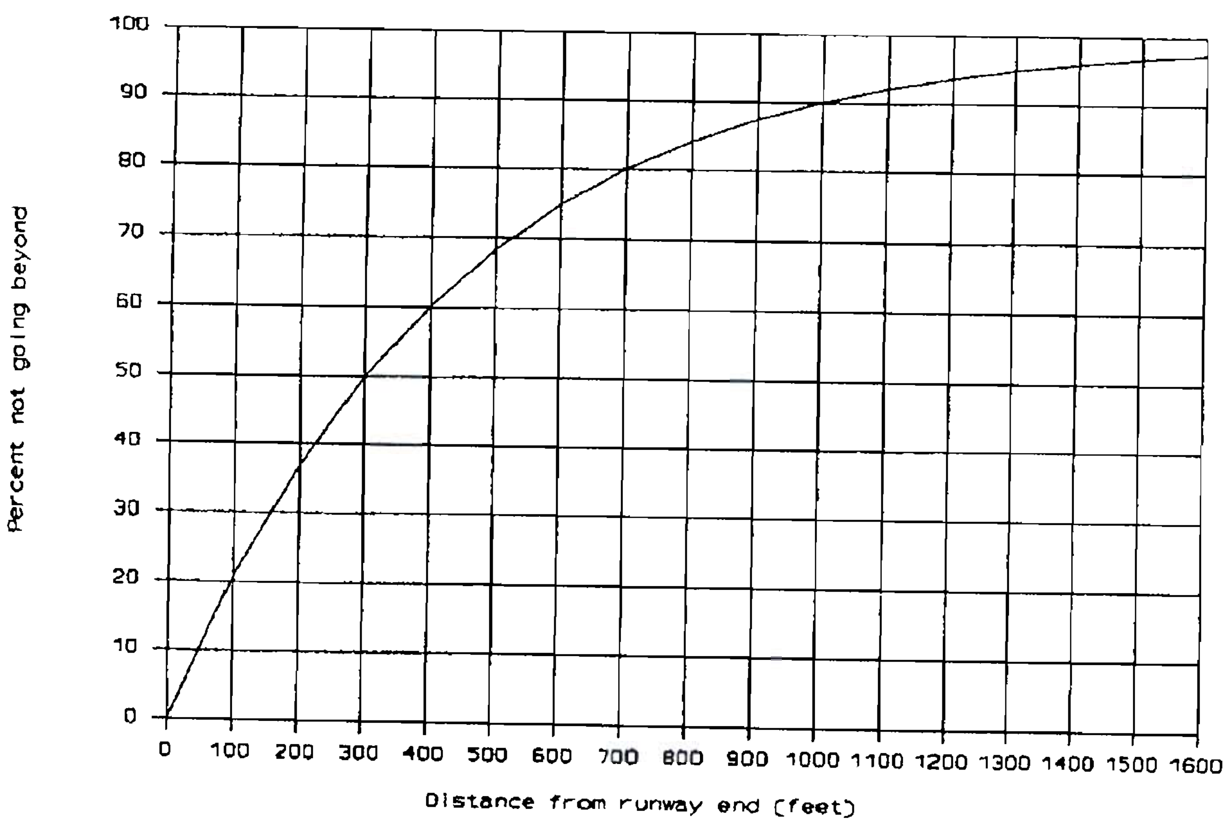


Figure A8-1. Approximate distance airplanes undershoot and overrun the runway end

U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject: Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns

Date: 9/30/2005 **AC No:** 150/5220-22A
Initiated by: AAS-100 **Change:**

1. PURPOSE. This advisory circular (AC) contains standards for the planning, design, installation, and maintenance of Engineered Materials Arresting Systems (EMAS) in runway safety areas (RSA). Engineered Materials means high energy absorbing materials of selected strength, which will reliably and predictably crush under the weight of an aircraft.

2. CANCELLATION. This AC cancels AC 150/5220-22, *Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns*, dated August 28, 1998.

3. BACKGROUND. Aircraft can and do overrun the ends of runways, sometimes with devastating results. An overrun occurs when an aircraft passes beyond the end of a runway during an aborted takeoff or while landing. Data on aircraft overruns over a 12-year period (1975 to 1987) indicate that approximately 90% of all overruns occur at exit speeds of 70 knots or less (Reference 7, Appendix 4) and most come to rest between the extended runway edges within 1000 feet of the runway end (Reference 6, Appendix 4).

To minimize the hazards of overruns, the Federal Aviation Administration (FAA) incorporated the concept of a safety area beyond the runway end into airport design standards. To meet the standards, the safety area must be capable, under normal (dry) conditions, of supporting the occasional passage of aircraft that overrun the runway without causing structural damage to the aircraft or injury to its occupants. The safety area also provides greater accessibility for emergency equipment after an overrun incident. There are many runways, particularly those constructed prior to the adoption of the safety area standards, where natural obstacles, local development, and/or environmental constraints, make the construction of a standard safety area impracticable. There have been accidents at some of these airports where the ability to stop an overrunning aircraft within the runway safety area would have prevented major damage to aircraft and/or injuries to passengers.

Recognizing the difficulties associated with achieving a standard safety area at all airports, the FAA undertook research programs on the use of various materials for arresting systems. These research programs, as well as, evaluation of actual aircraft overruns into an EMAS have demonstrated its effectiveness in arresting aircraft overruns.

4. APPLICATION. Runway safety area standards cannot be modified or waived. The standards remain in effect regardless of the presence of natural or man-made objects or surface conditions that might create a hazard to aircraft that overrun the end of a runway. A continuous evaluation of all practicable alternatives for improving each sub-standard RSA is required. FAA Order 5200.8, *Runway Safety Area Program*, explains the evaluation process.

FAA Order 5200.9, *Financial Feasibility and Equivalency of Runway Safety Area Improvements and Engineered Material Arresting Systems*, is used in connection with FAA Order 5200.8 to determine the best practicable and financially feasible alternative for an RSA improvement.

The FAA does not require an airport sponsor to reduce the length of a runway or declare its length to be less than the actual pavement length to meet runway safety area standards if there is an operational impact to the airport. An example of an operational impact would be an airport's inability to accommodate its current or planned aircraft fleet. Under these circumstances, installing an EMAS is another way of enhancing safety.

A standard EMAS provides a level of safety that is generally equivalent to a full RSA built to the dimensional standards in AC 150/5300-13, *Airport Design*. It also provides an acceptable level of safety for undershoots.

The FAA recommends the guidelines and standards in this AC for the design of EMAS. In general, this AC is not mandatory and does not constitute a regulation. It is issued for guidance purposes and to outline a method of compliance. However, use of these guidelines is mandatory for an airport sponsor installing an EMAS funded under Federal grant assistance programs or on an airport certificated under Title 14 Code of Federal Regulations (CFR) Part 139, *Certification of Airports*. Mandatory terms such as "shall" or "must" used herein apply only to those who seek to demonstrate compliance by use of the specific method described by this AC.

If an airport sponsor elects to follow an alternate method, the alternate method must have been determined by the FAA to be an acceptable means of complying with this AC, the runway safety area standards in AC 150/5300-13, and 14 CFR Part 139.

5. RELATED READING MATERIAL. Appendix 4, Related Reading Material, contains a list of documents with supplemental material relating to EMAS. These documents contain information on materials evaluated, as well as design, construction, and testing procedures utilized. Testing and data generated under these FAA studies may be used as input to an EMAS design without additional justification.

6. PLANNING CHARTS. The figures included in Appendix 2, Planning Charts, are for planning purposes only. They are intended as a preliminary screening tool and are not sufficient for final design. Final design must be customized for each installation. The figures illustrate estimated EMAS stopping distance capabilities for various aircraft types. The design used in each chart is optimized specifically for the aircraft noted on the chart. Charts are based on standard design conditions, i.e. 75-foot set-back, no reverse thrust, and poor braking (0.25 braking friction coefficient).

a. Example 1. Assume a runway with a DC-9 (or similar) as the design aircraft. Figure A2-1 shows that an EMAS 400 feet in length (including a 75-foot set-back) is capable of stopping a DC-9 within the confines of the system at runway exit speeds of up to 75 knots.

b. Example 2. Assume the same runway, but assume the design aircraft is a DC-10 (or similar). Figure A2-2 shows an EMAS of the same length, but designed for larger aircraft, can stop the DC-10 within the confines of the system at runway exit speeds of up to 62 knots.

7. PRELIMINARY PLANNING. Follow the guidance in FAA Orders 5200.8 and 5200.9 to determine practicable, financially feasible alternatives for RSA improvements. Additional cost and performance information for EMAS options to consider in the analysis can be obtained from the EMAS manufacturer.

8. SYSTEM DESIGN REQUIREMENTS. For purposes of design, the EMAS can be considered fixed by its function and frangible since it is designed to fail at a specified impact load. An aircraft arresting system such as EMAS is exempt from the requirements of 14 CFR Part 77, *Objects Affecting Navigable Airspace*. When EMAS is the selected option to upgrade a runway safety area, it is considered to meet the safety area requirements of 14 CFR Part 139. The following system design requirements must prevail for all EMAS installations:

a. Concept. An EMAS is designed to stop an overrunning aircraft by exerting predictable deceleration forces on its landing gear as the EMAS material crushes. It must be designed to minimize the potential for structural damage to aircraft, since such damage could result in injuries to passengers and/or affect the predictability of deceleration forces. An EMAS should be design for a 20-year service life.

b. Location. An EMAS is located beyond the end of the runway and centered on the extended runway centerline. It will usually begin at some setback distance from the end of the runway to avoid damage due to jet blast and undershoots (Figure A1-2, Appendix 1). This distance will vary depending on the available area and the EMAS materials. Where the area available is longer than required for installation of a standard EMAS designed to stop the design aircraft at an exit speed of 70 knots, the EMAS should be placed as far from the runway end as practicable. Such placement decreases the possibility of damage to the system from short overruns or undershoots and results in a more economical system by considering the deceleration capabilities of the existing runway safety area.

The resulting runway safety area must provide adequate protection for aircraft that touch down prior to the runway threshold (undershoot). Adequate protection is provided by either: (1) providing at least 600 feet (or the length of the standard runway safety area, whichever is less) between the runway threshold and the far end of the EMAS bed if the approach end of the runway has vertical guidance or (2) providing the full length standard runway safety area when no vertical guidance is provided.

An EMAS is not intended to meet the definition of a stopway as provided in AC 150/5300-13. The runway safety area and runway object free area lengths begin at a runway end when a stopway is not provided. When a stopway is provided, these lengths begin at the stopway end (AC 150/5300-13).

The airport sponsor, EMAS manufacturer, and the appropriate FAA Regional Airports Division/Airport District Office (ADO) should consult regarding the EMAS location to determine the appropriate location beyond the end of the runway for the EMAS installation for a specific runway.

c. Design Method. An EMAS design must be supported by a validated design method that can predict the performance of the system. The design (or critical) aircraft is defined as that aircraft using the associated runway that imposes the greatest demand upon the EMAS. This is usually, but not always, the heaviest/largest aircraft that regularly uses the runway. EMAS performance is dependent not only on aircraft weight, but landing gear configuration and tire pressure. In general, use the maximum take-off weight (MTOW) for the design aircraft. However, there may be instances where less than the MTOW will require a longer EMAS. All configurations should be considered in optimizing the EMAS design. To the extent practicable, however, the EMAS design should consider both the aircraft that imposes the greatest demand upon the EMAS and the range of aircraft expected to operate on the runway. In some instances, this composite design aircraft may be preferable to optimizing the EMAS for a single design aircraft. Other factors unique to a particular airport, such as available RSA and air cargo operations, should also be considered in the final design. The airport sponsor, EMAS manufacturer, and the appropriate FAA Regional Airports Division/ADO should consult regarding the selection of the design aircraft that will optimize the EMAS for a specific airport.

The design method must be derived from field or laboratory tests. Testing may be based either on passage of an actual aircraft or an equivalent single wheel load through a test bed. The design must consider multiple aircraft parameters, including but not limited to allowable aircraft gear loads, gear configuration, tire contact pressure, aircraft center of gravity, and aircraft speed. The model must calculate imposed aircraft gear loads, g-forces on aircraft occupants, deceleration rates, and stopping distances within the arresting system. Any rebound of the crushed material that may lessen its effectiveness must also be considered.

d. Operation. The EMAS must be a passive system.

e. Width. The minimum width of the EMAS must be the width of the runway (plus any sloped area as necessary—see 8 (h) below).

f. Base. The EMAS must be constructed on a paved surface capable of supporting the occasional passage of the critical design aircraft using the runway and fully loaded Aircraft Rescue and Fire Fighting (ARFF) vehicles without deformation of the base surface or structural damage to the aircraft or vehicles. It must be designed to perform satisfactorily under all local weather, temperature, and soil conditions. It must provide sufficient support to facilitate removal of the aircraft from the EMAS. Full strength runway pavement is not required. Pavement suitable for shoulders and blast pads is suitable as an EMAS base. AC 150/5300-13 provides recommendations on pavement for shoulders and blast pads. State highway specifications may also be used.

g. Entrance Speed. To the maximum extent possible, the EMAS must be designed to decelerate the design aircraft expected to use the runway at exit speeds of 70 knots (approach category C and D aircraft) without imposing loads that exceed the aircraft's design limits, causing major structural damage to the aircraft or imposing excessive forces on its occupants. Contact the FAA's Airport Engineering Division (AAS-100) at 202-267-7669 for guidance when other than approach category C and D aircraft is proposed for the EMAS design. Standard design conditions are no reverse thrust and poor braking (0.25 braking friction coefficient).

Generally, when there is insufficient RSA available for a standard EMAS, the EMAS must be designed to achieve the maximum deceleration of the design aircraft within the available runway safety area. However, a 40-knot minimum exit speed should be used for the design of a non-standard EMAS. For design purposes, assume the aircraft has all of its landing gear in full contact with the runway and is traveling within the confines of the runway and parallel to the runway centerline upon overrunning the runway end.

The airport sponsor, EMAS manufacturer, and the appropriate FAA Regional Airports Division/ADO should consult regarding the selection of the appropriate design entrance speed for the EMAS installation.

Note that current EMAS models are not as accurate for aircraft with a maximum take-off weight less than 25,000 pounds.

h. Aircraft Evacuation. The EMAS must be designed to enable safe ingress and egress as well as movement of ARFF equipment (not necessarily without damage to the EMAS) operating during an emergency. If the EMAS is to be built above existing grade, sloped areas sufficient to allow the entrance of ARFF vehicles from the front and sides must be provided. Provision for access from the back of the EMAS may be provided if desirable. Maximum slopes must be based on the EMAS material and performance characteristics of the airport's ARFF equipment.

i. Maintenance Access. The EMAS must be capable of supporting regular pedestrian traffic for the purposes of maintenance of the arresting material and co-located navigation aids without damage to the surface of the EMAS bed. An EMAS is not intended to support vehicular traffic for maintenance purposes.

j. Undershoots. The EMAS must not cause control problems for aircraft undershoots which touch down in the EMAS bed. Fulfillment of this requirement may be based exclusively on flight simulator tests. The tests will establish the minimum material strength and density that does not cause aircraft control problems during an undershoot. Materials whose density and strength exceeds these minimums will be deemed acceptable.

k. Navigation Aids. The EMAS must be constructed to accommodate approach lighting structures and other approved facilities within its boundaries. It must not cause visual or electronic interference with any air navigation aids. All navigation aids within the EMAS must be frangible as required by 14 CFR Part 139. To meet the intent of this regulation, approach light standards must be designed to fail at two points. The first point of frangibility must be three inches or less above the top of the EMAS bed. The second point of frangibility must be three inches or less above the expected residual depth of the EMAS bed after passage of the design aircraft. As a part of the EMAS design, the EMAS manufacturer must provide the expected residual depth to allow the determination of this second frangibility point.

l. Drainage. The EMAS must be designed to prevent water from accumulating on the surface of the EMAS bed, the runway or the runway safety area. The removal and disposal of water, which may hinder any activity necessary for the safe and efficient operation of the airport, must be in accordance with AC 150/5320-5, *Airport Drainage.*

The EMAS design must consider ice accumulation and/or snow removal limitations/requirements dictated by the project locale. Requirements/limitations must be addressed in the approved inspection and maintenance program discussed in paragraph 14 and Appendix 3.

m. Jet Blast. The EMAS must be designed and constructed so that it will not be damaged by expected jet blast.

n. Repair. The EMAS must be designed for repair to a usable condition within 45 days of an overrun by the design aircraft at the design entrance speed. Note that this is a design requirement only.

An EMAS bed damaged due to an incident (overrun/undershoot, etc.) must be repaired in a timely manner. The undamaged areas of the EMAS bed must be protected from further damage until the bed is repaired.

9. MATERIAL QUALIFICATION. The material comprising the EMAS must have the following requirements and characteristics:

a. Material Strength and Deformation Requirements. Materials must meet a force vs. deformation profile within limits having been shown to assure uniform crushing characteristics, and therefore, predictable response to an aircraft entering the arresting system.

b. Material Characteristics. The materials comprising the EMAS must:

(1) Be water-resistant to the extent that the presence of water does not affect system performance.

(2) Not attract vermin, birds, wildlife or other creatures.

(3) Be non-sparking.

(4) Be non-flammable.

(5) Not promote combustion.

(6) Not emit toxic or malodorous fumes in a fire environment after installation.

(7) Not support unintended plant growth with proper application of herbicides.

(8) Exhibit constant strength and density characteristics during all climatic conditions within a temperature range appropriate for the locale.

(9) Be resistant to deterioration due to:

(a) Salt.

(b) Approved aircraft and runway deicing fluids.

(c) Aircraft fuels, hydraulic fluids, and lubricating oils.

(d) UV resistant.

(e) Water.

(f) Freeze/thaw.

(g) Blowing sand and snow.

(h) Paint.

10. Material Conformance Requirements. An EMAS manufacturer must establish a material sampling and testing program to verify that all materials are in conformance with the initial approved material force versus deformation profile established under paragraph 9.a. Materials failing to meet these requirements must not be used.

The initial sampling and testing program must be submitted to and approved by the FAA, Office of Airport Safety and Standards for each design method found by the FAA to be an acceptable means of complying with this AC. Once approved, the program may be used for subsequent projects.

11. DESIGN PROPOSAL SUBMITTAL. The EMAS design must be prepared by the design engineer and the EMAS manufacturer for the airport sponsor. The airport sponsor must submit the EMAS design through the responsible FAA Airports Region/District Office, to the FAA, Office of Airport Safety and Standards, for review and approval. The EMAS design must be certified as meeting all the requirements of this AC and the submittal must include all design assumptions and data utilized in its development as well as proposed construction procedures and techniques. The EMAS design must be submitted at least 45 days prior to the bid opening date for the project.

12. QUALITY ASSURANCE (QA) PROGRAM. A construction quality assurance program must be implemented to ensure that installation/construction is in accordance with the approved EMAS design. The construction contractor and EMAS manufacturer prepare the construction QA program for the airport sponsor. The airport sponsor must submit the construction QA program to the responsible FAA Airports Region/District Office for approval 14 days prior to the project notice to proceed.

13. MARKING. An EMAS must be marked with yellow chevrons as an area unusable for landing, takeoff, and taxiing in accordance with AC 150/5340-1, *Standards for Airport Markings*. Paint application should be in accordance with the EMAS manufacturers' recommendations for the EMAS system.

14. INSPECTION AND MAINTENANCE. The EMAS manufacturer must prepare an inspection and maintenance program for the airport sponsor for each EMAS installation. The airport sponsor must submit the program to the responsible FAA Airports Region/District Office for approval prior to final project acceptance. The airport sponsor must implement the approved inspection and maintenance program. The program must include any necessary procedures for inspection, preventive maintenance and unscheduled repairs, particularly to weatherproofing layers. Procedures must be sufficiently detailed to allow maintenance/repair of the EMAS bed with the airport sponsor's staff. The program must include appropriate records to verify that all required inspections and maintenance have been performed by the airport sponsor and/or EMAS manufacturer. These records must be made available to the FAA upon request. Appendix 3, Inspection and Maintenance Program, outlines the basic requirements of an EMAS inspection and maintenance program.

Airport personnel must be notified that the EMAS is designed to fail under load and that precautions should be taken when activities require personnel to be on, or vehicles and personnel to be near, the EMAS.

15. AIRCRAFT RESCUE AND FIRE FIGHTING (ARFF).

a. Access. As required by paragraph 8 (h), an EMAS is designed to allow movement of typical ARFF equipment operating during an emergency. However, as the sides of the system are typically steeply sloped, and the system will be severely rutted after an aircraft arrestment, ARFF vehicles so equipped should be shifted into all-wheel-drive prior to entering and maneuvering upon an EMAS.

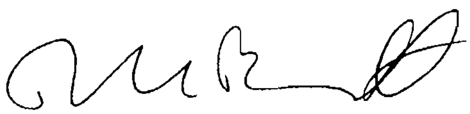
b. Tactics. Any fire present after the arrestment of an aircraft will be three-dimensional due to the rutting and breakup of the EMAS material. A dual-agent attack and/or other tactics appropriate to this type of fire should be employed.

16. NOTIFICATION. Upon installation of an EMAS, its length, width, and location must be included as a remark in the Airport/Facility Directory (AFD). To assure timely publication, the airport sponsor must forward the required information to the FAA Aeronautical Information Services (AIS) as soon as possible, but not later than the "cut-off" dates listed in the AFD, for publication on the desired effective date. (The AIS address and cut-off dates are listed on the inside front cover of the AFD.) The airport sponsor must also notify the appropriate FAA Regional Airports Division/ADO.

The following is an example of a typical entry:

- "Engineered Materials Arresting System, 400'L x 150'W, located at departure end of runway 16."

When an EMAS is damaged due to an overrun or determined to be less than fully serviceable, a Notice to Airmen (NOTAM) must be issued to alert airport users of the reduced performance of the EMAS.



DAVID L. BENNETT
Director of Airport Safety and Standards

APPENDIX 1. STANDARD EMAS AND TYPICAL SECTIONS.

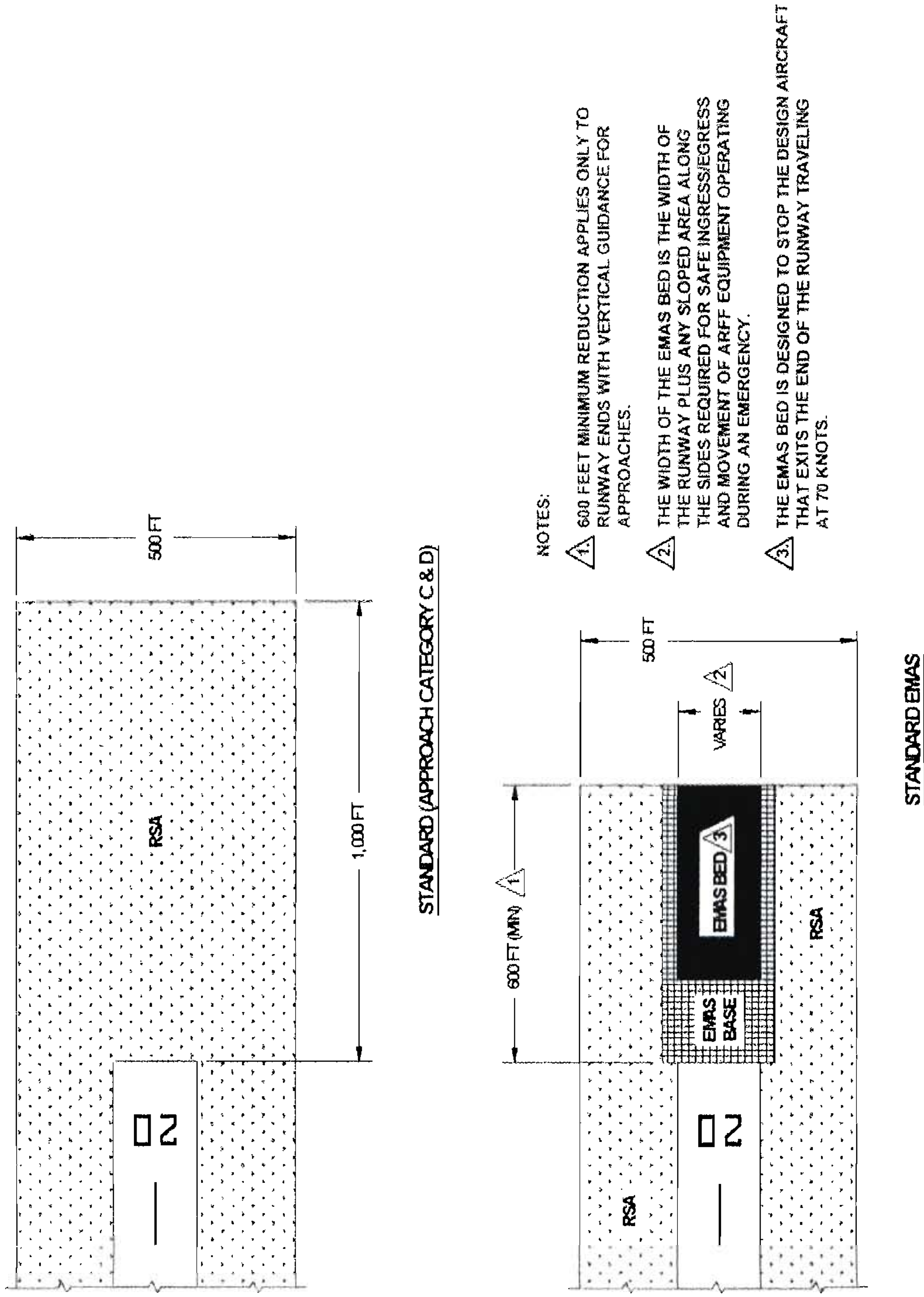


FIGURE A1-1. STANDARD EMAS INSTALLATION PROVIDES A LEVEL OF SAFETY THAT IS GENERALLY EQUIVALENT

TO A STANDARD RUNWAY SAFETY AREA (RSA).

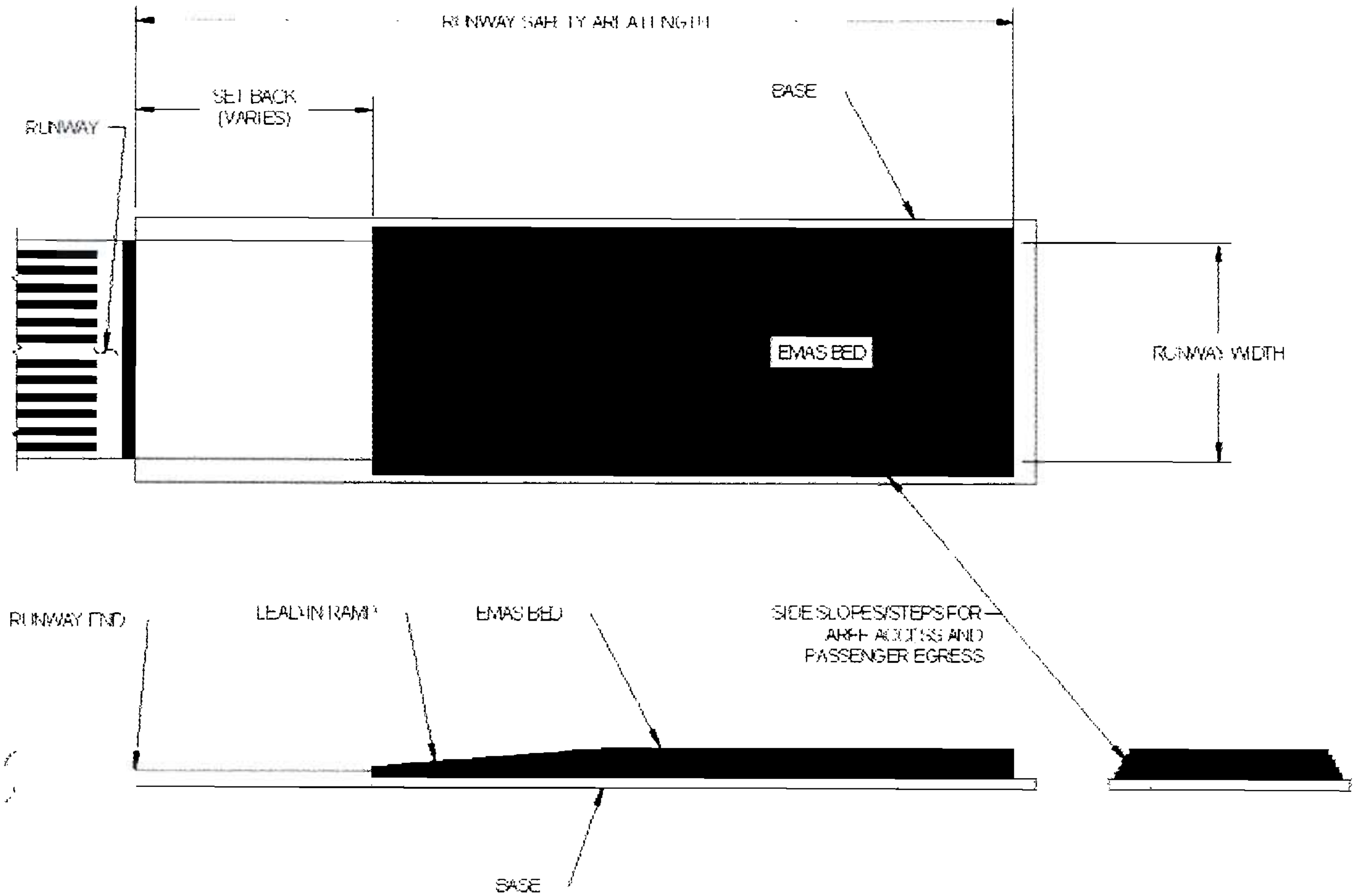
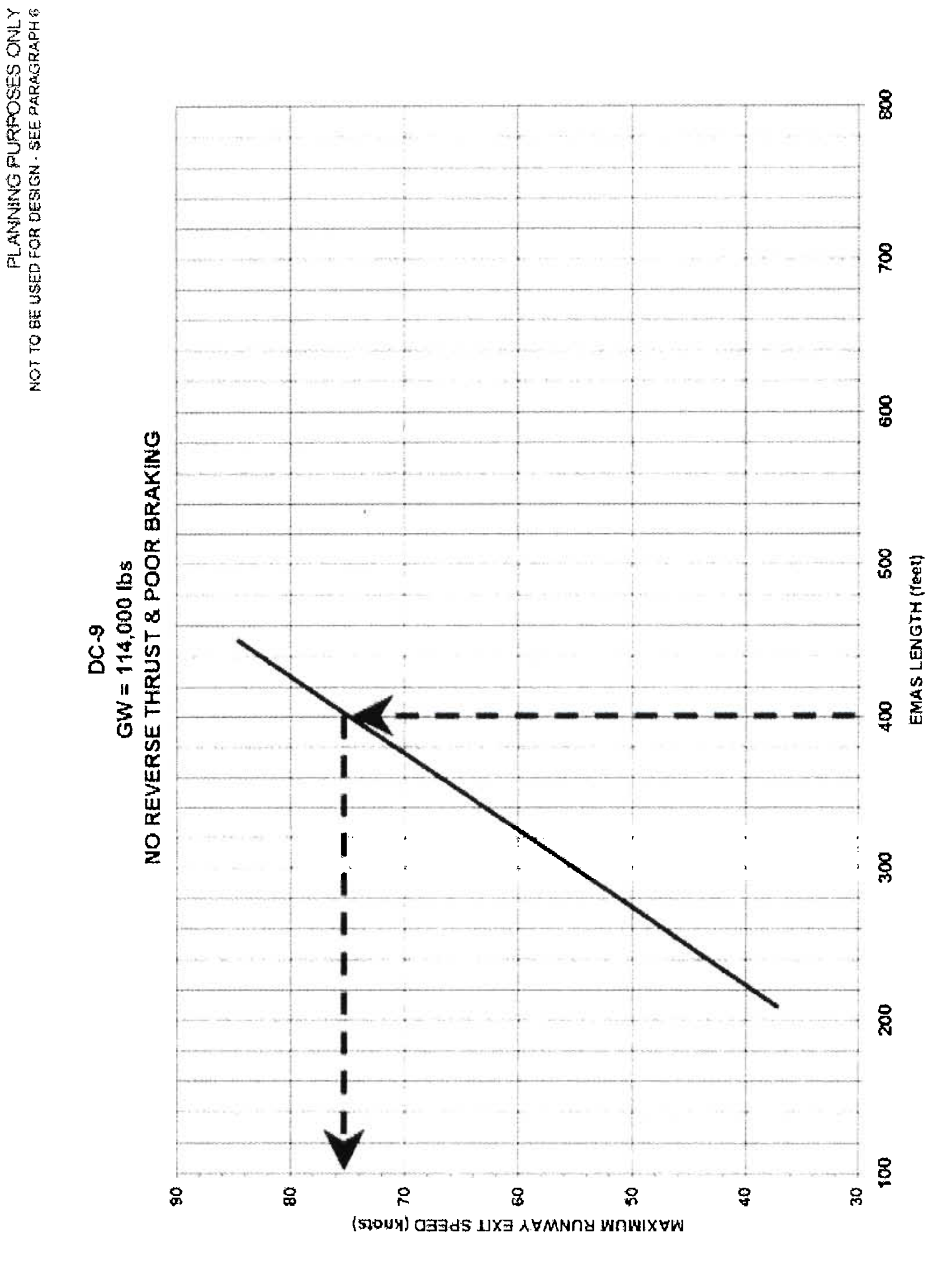


FIGURE A1-2. EMAS TYPICAL SECTION.

APPENDIX 2. PLANNING CHARTS.

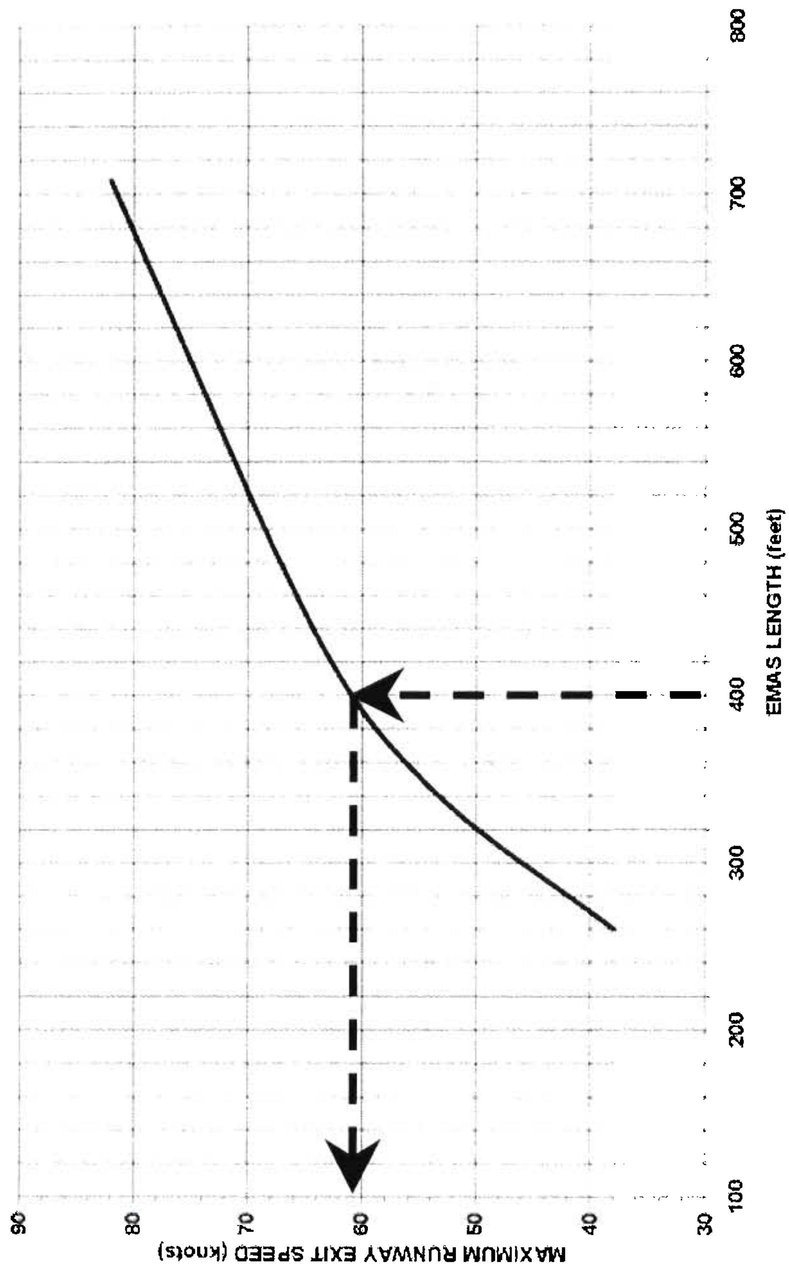


Notes
1 Arrestor includes a 75 ft paved lead-in rigid ramp. A 35 ft setback can be used to improve performance for short safety areas
2 Poor braking simulated using 0.25 braking friction coefficient

FIGURE A2-1.

PLANNING PURPOSES ONLY
NOT TO BE USED FOR DESIGN - SEE PARAGRAPH 6

DC-10
GW = 455,000 lbs.
NO REVERSE THRUST & POOR BRAKING

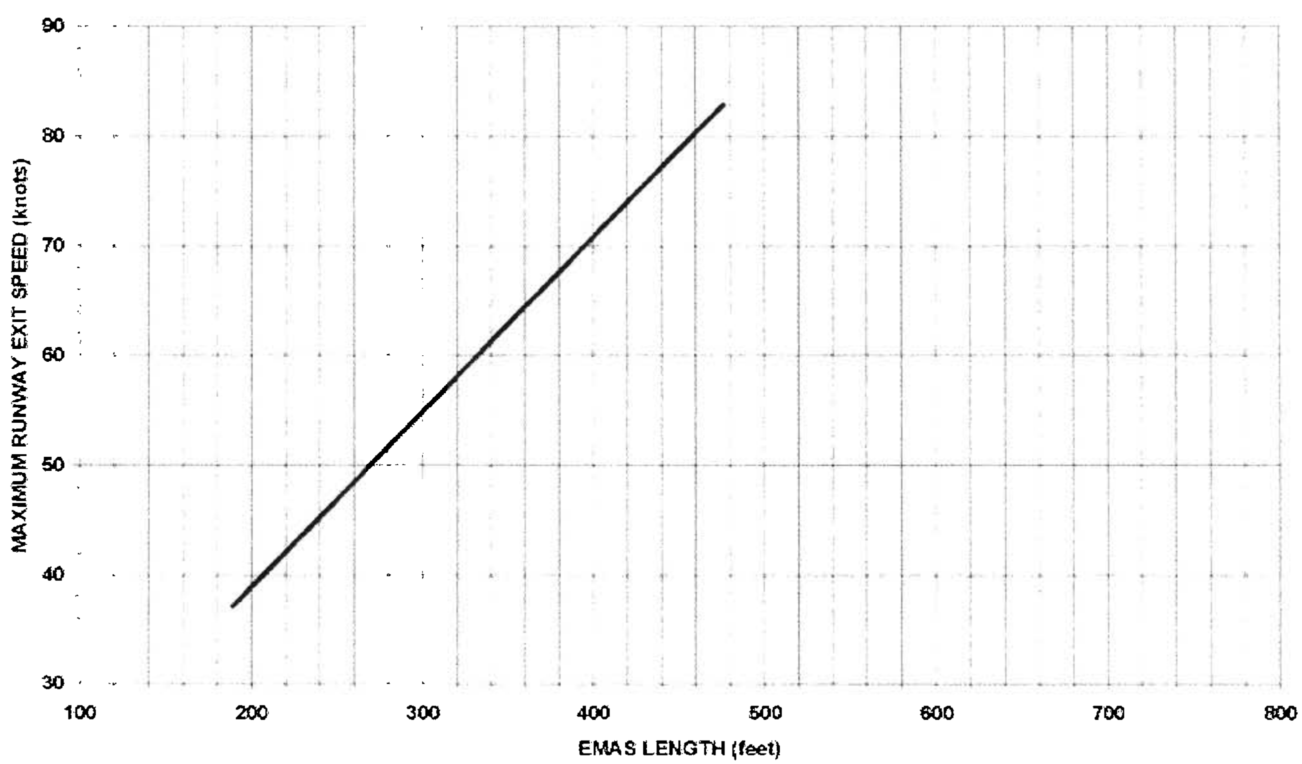


Notes
1 Arrestor includes a 75 ft paved lead-in rigid ramp. A 35 ft setback can be used to improve performance for short safety areas.
2 Poor braking simulated using 0 25 braking friction coefficient.

FIGURE A2-2.

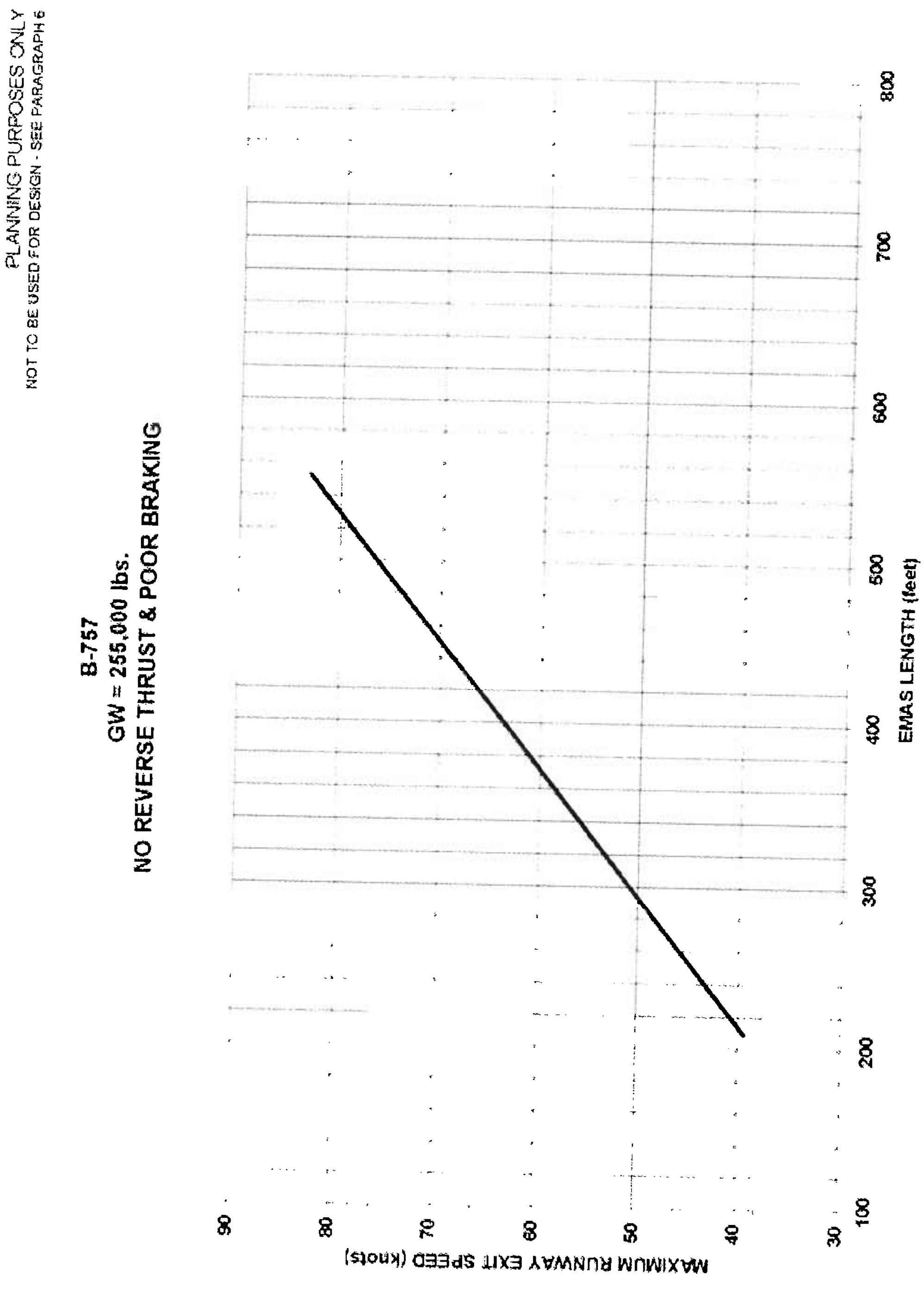
PLANNING PURPOSES ONLY
NOT TO BE USED FOR DESIGN - SEE PARAGRAPH 6

B-737-400
GW = 150,000 lbs.
NO REVERSE THRUST & POOR BRAKING



Notes:
1. Arrestor includes a 75 ft paved lead-in rigid ramp. A 35 ft setback can be used to improve performance for short safety areas
2. Poor braking simulated using 0.25 braking friction coefficient

FIGURE A2-3.

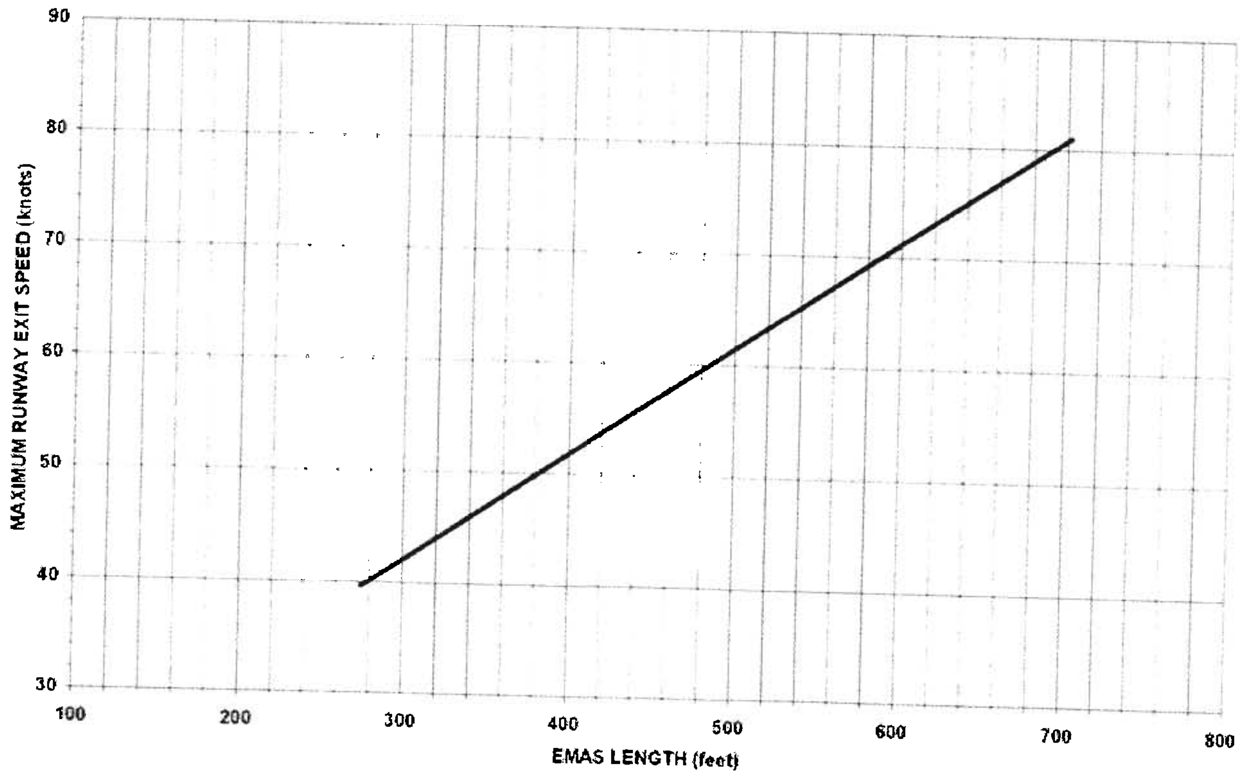


Notes
1 Arrestor includes a 75 ft paved lead-in rigid ramp. A 35 ft setback can be used to improve performance for short safety areas
2 Poor braking simulated using 0.25 braking friction coefficient

FIGURE A2-4.

PLANNING PURPOSES ONLY
NOT TO BE USED FOR DESIGN - SEE PARAGRAPH 6

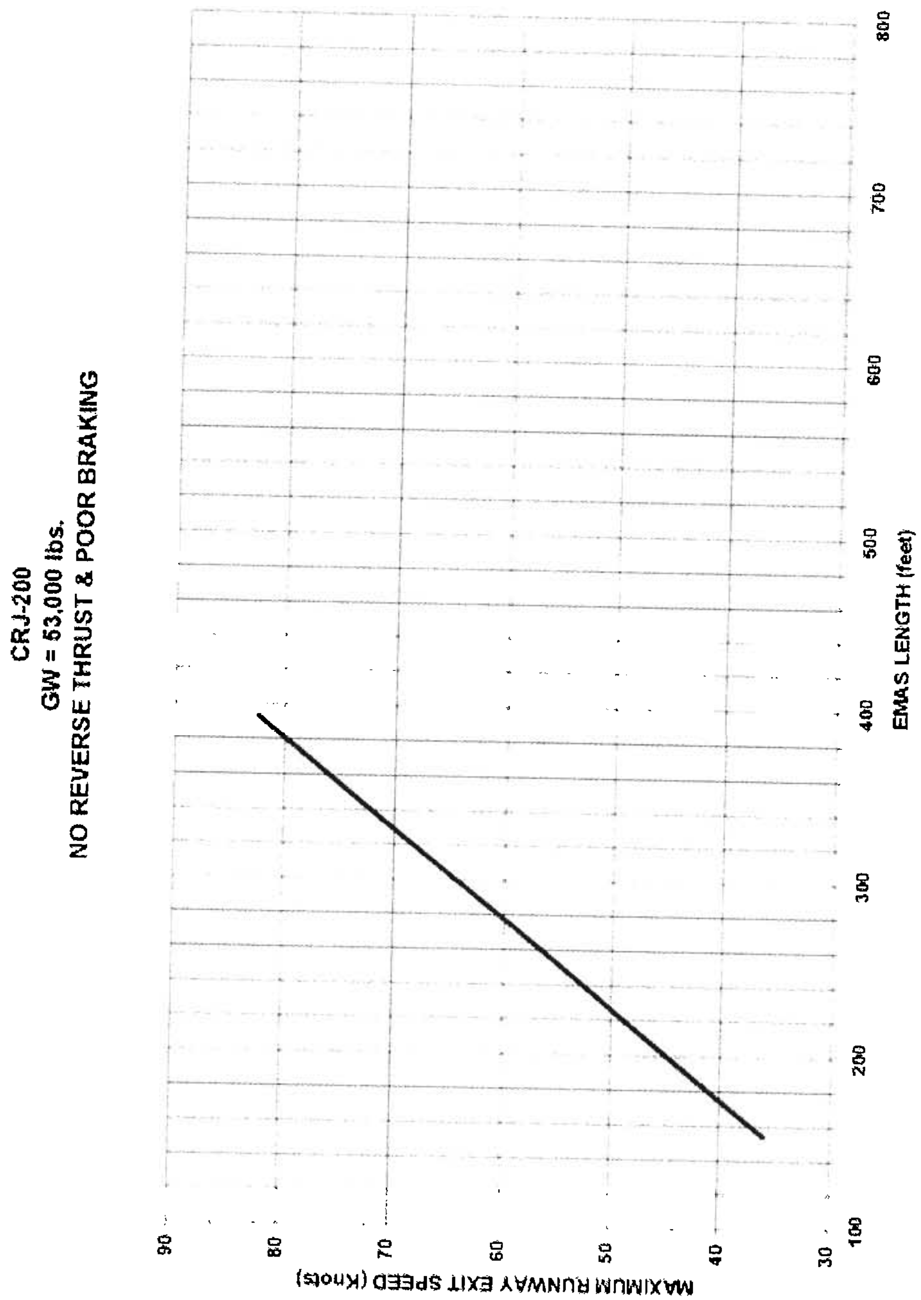
B-747
GW = 875,000 lbs.
NO REVERSE THRUST & POOR BRAKING



Notes
1. Arrestor includes a 75 ft paved lead-in rigid ramp A 35 ft setback can be used to improve performance for short safety areas
2. Poor braking simulated using 0 25 braking friction coefficient.

FIGURE A2-5.

PLANNING PURPOSES ONLY
NOT TO BE USED FOR DESIGN - SEE PARAGRAPH 6

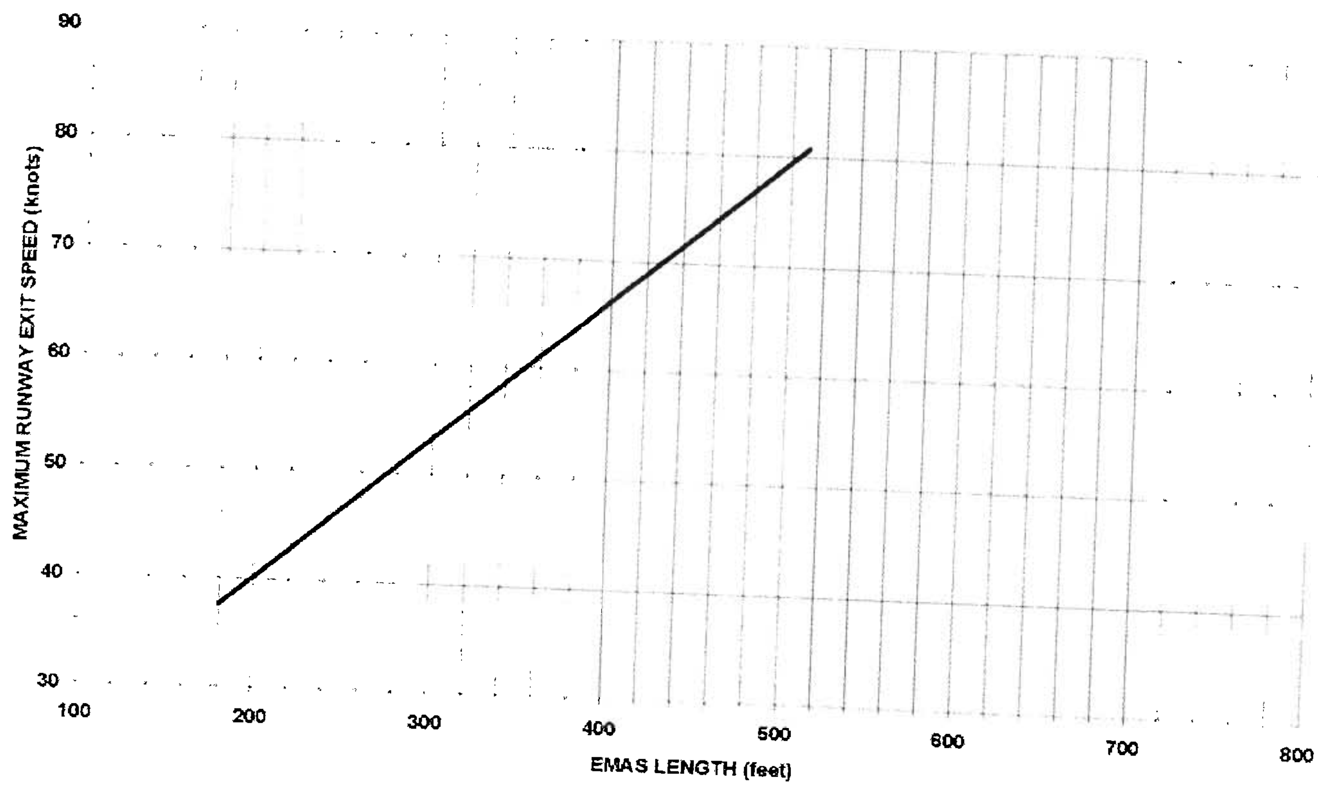


Notes
1. Arrestor includes a 75 ft paved lead-in rigid ramp. A 35 ft setback can be used to improve performance for short safety areas
2. Poor braking simulated using 0.25 braking friction coefficient

FIGURE A2-6.

PLANNING PURPOSES ONLY
NOT TO BE USED FOR DESIGN - SEE PARAGRAPH 6

G-III
GW = 69,700 lbs.
NO REVERSE THRUST & POOR BRAKING



Notes
1 Arrestor includes a 75 ft paved lead-in rigid ramp A 35 ft setback can be used to improve performance for short safety areas
2 Poor braking simulated using 0.25 braking friction coefficient

FIGURE A2-7.

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APPENDIX 3. INSPECTION AND MAINTENACE PROGRAM.

An inspection and maintenance program, prepared by the EMAS manufacturer, will be submitted to and approved by the FAA Regional/Airports District Office. The Airport sponsor must implement the approved inspection and maintenance program. As a minimum, a basic EMAS inspection and maintenance program must address the following areas:

1. General information on the EMAS bed including
   - A description of the EMAS bed
   - Material description
   - Contact information for the EMAS manufacturer
2. Inspection requirements including:
   - Type and frequency of required inspections
   - Training of personnel
   - Instructions on how to conduct each inspection
   - List of typical problems and possible solutions
   - Required documentation for inspections
   - Inspection forms
3. Maintenance and repair procedures including:
   - List of approved materials and tools
   - Description of repair procedures for typical damage to an EMAS bed such as repairing depressions/holes, abrasion damage, replacing a damaged block, repairing coatings, caulking/joint repair, etc.
4. Any unique requirements due to location such as snow removal requirements and methods. Identify compatible deicing agents. Specify snow removal equipment that is compatible with the EMAS bed and recommended clearing procedures and/or limitations.
5. Warranty information

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APPENDIX 4. RELATED READING MATERIAL.

This appendix contains a listing of documents with supplemental material relating to the subject of EMAS. These documents contain certain information on materials evaluated as well as design, construction, and testing procedures utilized to date. These publications may be obtained from the National Technical Information Service (NTIS), Springfield, VA 22151.

1. DOT/FAA/PM-87/27, *Soft Ground Arresting Systems*, Final Report, Sept. 1986–Aug. 1987, published Aug. 1987 by R.F. Cook, Universal Energy Systems, Inc., Dayton, OH.

2. 2. DOT/FAA/CT-93/4, *Soft Ground Arresting Systems for Commercial Aircraft,* Interim Report, Feb. 1993 by Robert Cook.

3. DOT/FAA/CT-93/80, *Soft Ground Arresting Systems for Airports*, Final Report, Dec. 1993 by Jim White, Satish K. Agrawal, and Robert Cook.

4. DOT/FAA/AOV 90-1, *Location of Commercial Aircraft Accidents/Incidents Relative to Runways*, July 1990.

5. UDR-TR-88-07, *Evaluation of a Foam Arrestor Bed for Aircraft Safety Overrun Areas*, 1988 by Cook, R.F., University of Dayton Research Institute, Dayton, OH.

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APPENDIX K

Recommended Terminal Improvements

Recommended Terminal Improvements

Introduction

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 hold bag screening functions. Finally, the Master Plan Update provides an opportunity to upgrade passenger services and amenities. This white paper describes the recommended terminal improvements needed to accommodate future demand.

First Floor Improvements

This section outlines the recommended key improvements to the first level of the terminal including, hold bag screening 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 hold bag screening activity which was implemented in response to the 9/11 terrorist attacks. The Transportation Security Administration (TSA) installed explosive trace detection equipment (ETD) and inspection space for the checked baggage in the ticket queue area of the terminal. This has significantly reduced queue and circulation space in the ticket lobby, and creates crowded conditions and a low level of costumer service.

The recommended solution is to relocate the baggage screening process to a separate HBS area behind the airline ticket office area, as shown in **Figure 1**. All bags would be collected along the ticket counter with the existing take away conveyor system and conveyed to a single high throughput in-line system and EDS device such as a CTX 9000 or an L3 Examiner 6500 with throughput rates of more than 384 bags per hour. Indexing queue belts would be provided for any peak ten minute surge of baggage in the system.

Suspect bags would be screened in a secondary “level three” ETD screening. Once the bags are fully screened and cleared, 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.

The recommended checked baggage screening plan would be implemented in phases in order to keep all airline baggage make-up operations functioning during the construction of the new system. When the in-line checked bag screening system is constructed, baggage make–up areas which are currently not used can be used for the new screening

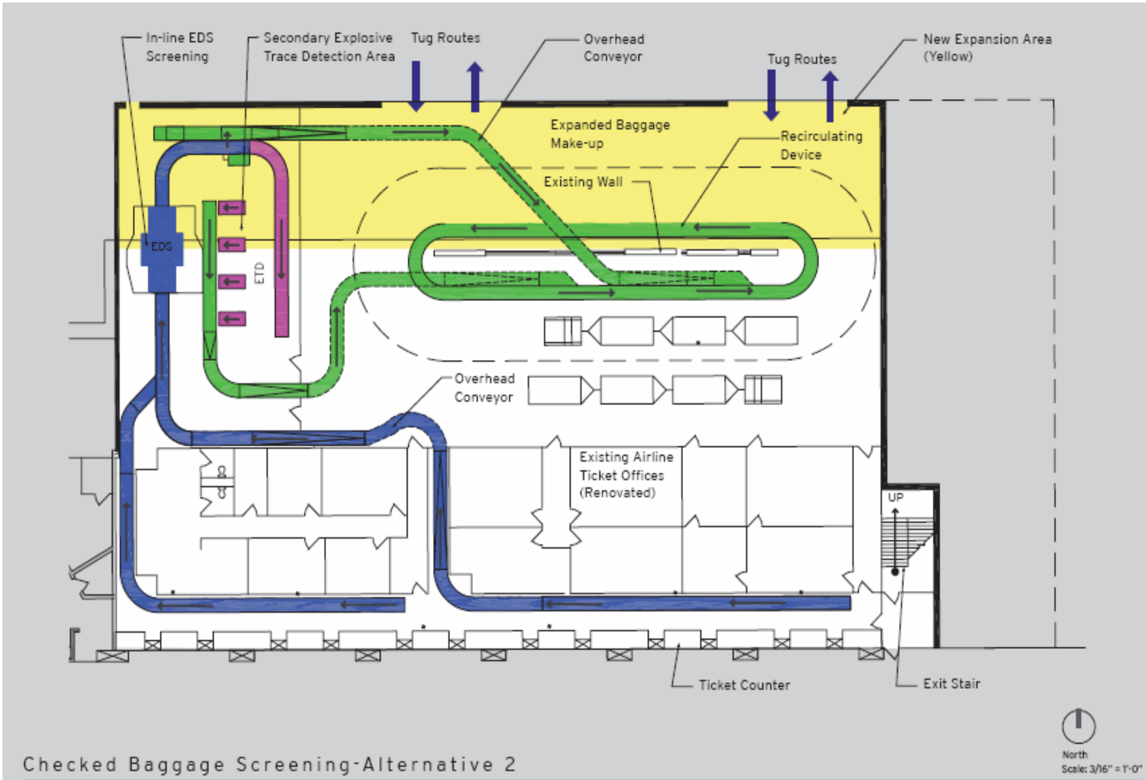

Figure 1—Recommended Hold Bag Screening Option

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. This scheme provides for flexibility and changes in airline market share, and as airlines come and go the facility stays the same.

Additional improvements include expanding the outbound baggage room outward from the back end of the building approximately 25 feet along the entire ticketing wing length. The existing slot drain would have to be relocated northward to accommodate the expansion and the grades for site drainage.

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. (See **Figure 2**.) This is an excellent location near the main entrance to capture both departing and arriving passengers and produce significant non-airline revenues for the airport.

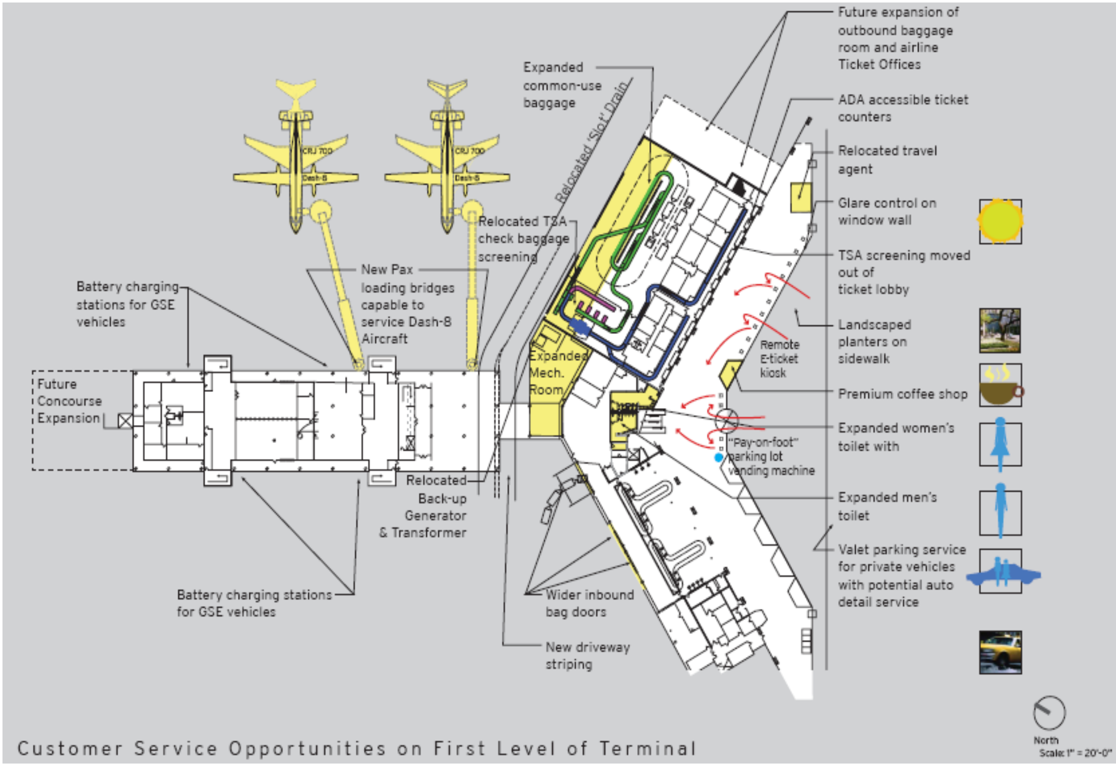

Figure 2—Customer Service Improvement Opportunities

First Floor Restroom Improvements

The recommended plan provides expanding/improved first floor restrooms which 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 new plan increases the amount of women's fixtures to provide restroom "parity" by providing an appropriate level of service equal to the men's facilities. **Figure 3** shows the recommended expansion.

Level One Support Space Improvements

The recommended terminal plan expands the mechanical room space for added chiller and boiler capacity as the terminal spaces increase in the future.

To create the mechanical space, the emergency generator and substation transformer will have to be relocated. The new location keeps the two units close to the current underground electrical utility feed and circuits to the emergency power next to the expanded mechanical room.

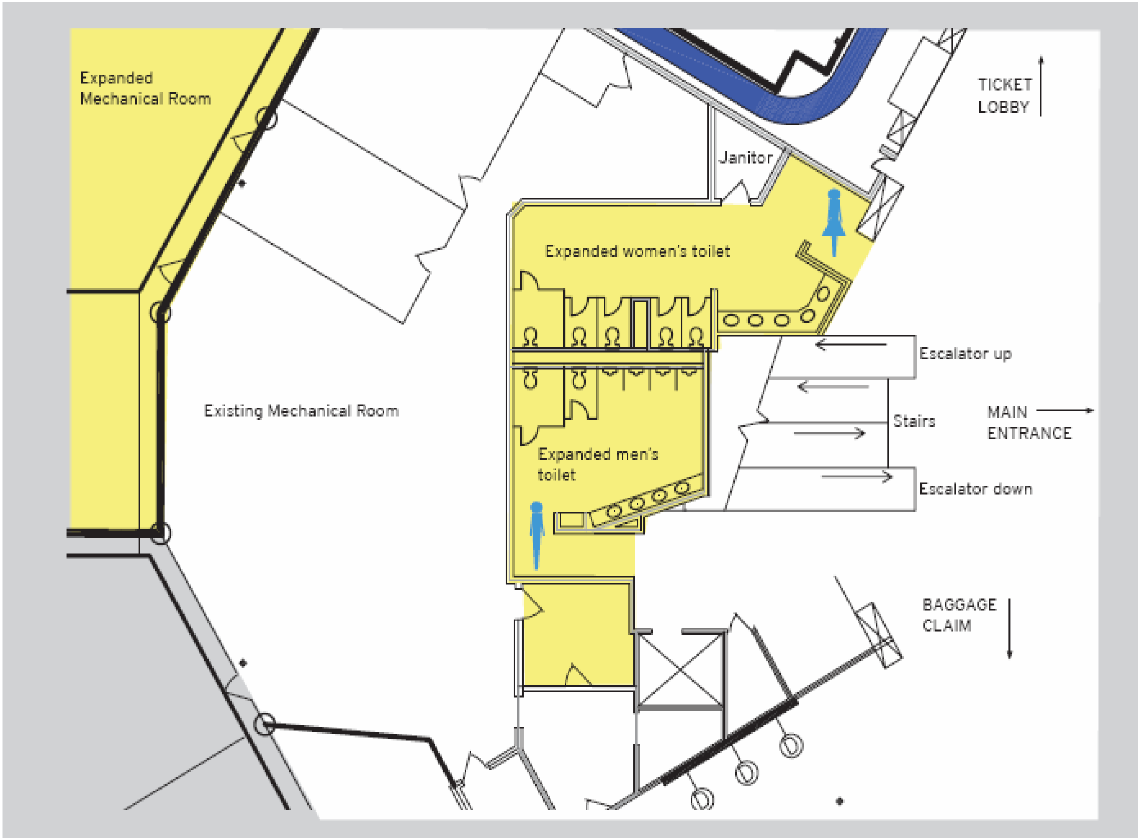

Figure 3—Level One Restroom Expansion

The ground service vehicle roadway underneath the terminal will have to shift northward to accommodate the mechanical room expansion. This is easily accomplished, as there is ample open space below the concourse at this location.

The entrances and exits to the inbound baggage layout area are to be enlarged in the recommended plan. The north end of the inbound bag lay down area will be expanded northward and widened to facilitate easier access to the first baggage claim device. This augmentation should eliminate any potential for tug damage to doors and walls in the area. The south entries and exits will also be widened.

Battery charging stations are recommended to 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.

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. The recommended plan provides several important improvements that greatly enhance the level of passenger service at the departure level.

Passenger Security Screening Checkpoint

In its existing configuration, the passenger security screening checkpoint has insufficient area for all the functions, especially at peak periods as passengers queue for screening in the main central area. It is recommended that an additional building structural bay be added towards the north 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.

The recommended plan is shown in **Figure 4.** As shown, a second security checkpoint lane with a magnetometer and X-ray devices is provided. Additional secondary screening areas and a private search room have also been provided. The area designated for queuing has been increased significantly, and TSA and Airport office space is added in the building expansion at this level.

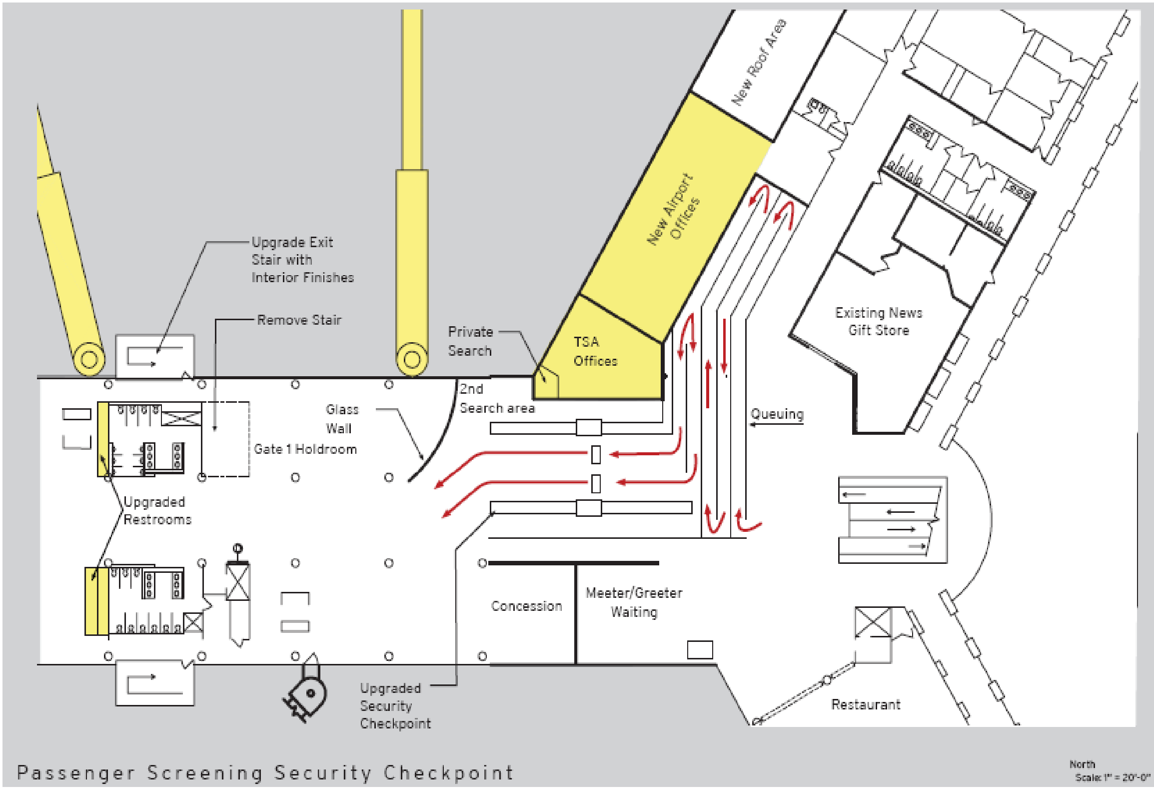

Figure 4—Expanded Security Checkpoint

The outbound baggage expansion area roof will 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 & 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 has become dated. 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 space coupled with an updated menu would increase the revenue potential of the facility.

Secure Concourse Area Recommendations

This section focuses on concession improvements, passenger amenities, passenger holdrooms and boarding bridges, restrooms, and other improvements to the secure concourse area.

<u>Concessions on the Departure Concourse</u>

Concessions areas on the concourse would benefit with more visual exposure to the main concourse circulation. Over time, as activity levels increase, additional area is warranted for food & beverage and retail concessions. **Figure 5** shows the recommended concession improvements.

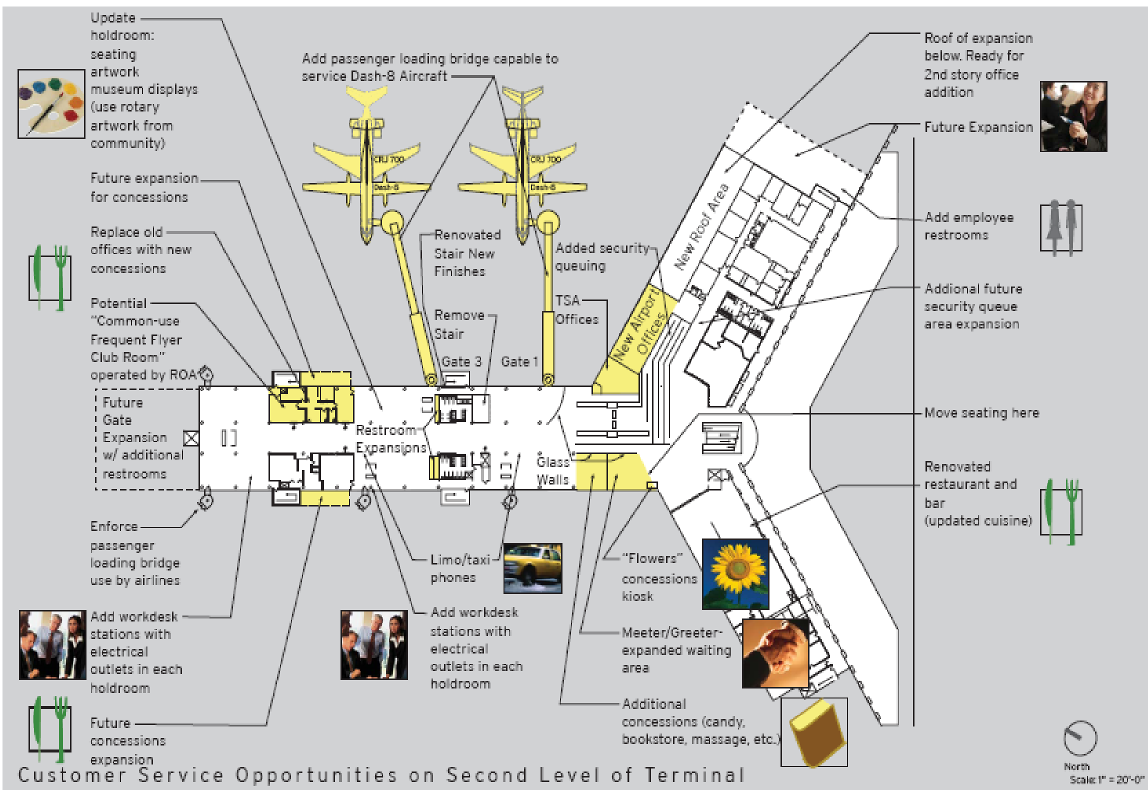

Figure 5—Second Level Concession Level Improvements

Additional concessions should 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. Suggestions from successful new concession ideas in the airport industry include:

- Premium coffee kiosks
- Flowers
- Candy
- Massage services
- 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 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,
- Pay phones with TDD capability for the hearing impaired,
- Community art work displays along the concourse,
- Airport TV (e.g., CNN), and
- A common-use club room for premium frequent flyer passengers and membership passengers provided by ROA Airport.

Passenger Departure Holdrooms

Gate 1 should be reactivated as a useable gate by moving TSA activity and the unused commuter stair. 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. 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 gate and holdrooms could be created by extending the concourse northwestward.

Passenger Boarding Bridges

Although several of the gates are equipped with loading bridges, the 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 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 to be improved. Currently, the stairs used are utilitarian exit stairs. They should be upgraded with better finishes, signage, lighting, and 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 enforced through lease terms and conditions to encourage frequent use, 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 should be expanded into the Gate 3 and 4 holdrooms 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 can also be added. This is illustrated in the plan showing an extension to the end of the concourse.

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,
- Electrical charging stations for electrical GSE equipment,
- Recycling center in terminal, and
- Recycled building materials on site work and building projects.

Charter Aircraft Operations

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 level of service, 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 level of service, 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.

APPENDIX L

Secondary Air Charter Staging Facility Concept

Secondary Air Charter Staging Facility Concept White Paper

Introduction

Roanoke Regional Airport (ROA) accomodates numerous charter flights during a typical year. These charters include those using the passenger terminal and those staged at the cargo apron. (Some charters which use small regional aircraft occasionally operate from the FBO.)

Because charters operate under FAR Part 135, checked baggage does not have to be inspected, therefore making it more attractive to handle some charters (typically those associated with university-related travel) at the cargo apron because these operations frequently have a large amount of oversized luggage (e.g., sporting equipment, band instruments, etc.). In order to improve the processing of these charter operations, an analysis was undertaken to select a preferred secondary charter processing concept.

Current Charter Processing at the Cargo Apron

At ROA, charter aircraft handling is provided by the FBO and several airlines, and charter operators frequently compare the costs and services offered by each provider when making their selection. To gain a better understanding of current charter practices, representatives of Landmark Aviation (the current FBO operator) and Comair (a carrier who handles the majority of charter flights) were contacted.

According to the Comair station manager at ROA, the schools chartering aircraft prefer to pull their buses right up to the aircraft. Typically, Delta's charter division contracts with a third party to provide aircraft handling and passenger screening. Frequently, this six- or seven-person team arrives onboard the chartered aircraft. Comair will notify TSA about the operation, and occasionally a local TSA representative will monitor passenger screening.

While the charters can be processed anywhere along the cargo apron, they are usually accommodated at the west end, near the blast fence. Based on discussions with the local FBO the buses are marshaled onto the apron through Gate 20, adjacent to the east apron of Piedmont Airlines' maintenance facility. According to Airport staff, buses occasionally have wandered onto other areas of the airfield, creating a safety hazard.

There is no shelter for passenger security screening resulting in both passengers and security personnel frequently being exposed to inclement weather.

Planning Parameters

For planning purposes, the following parameters were established as goals for development of a secondary charter staging facility.

- Identify a dedicated site for charter aircraft processing;
- Accommodate up to B757 aircraft;
- Provide structure for passenger processing (minimally) and possibly passenger holding;
- Provide flexibility to respond to changing TSA security protocols;
- Minimize opportunity for hazardous aircraft-vehicle interaction;
- Minimize disruption to surrounding aviation operations; and
- Minimize cost.

Development Options

Two concepts were considered: 1) Provide improved secondary charter processing at current site (cargo ramp), and 2) Provide secondary charter processing at future FBO site.

Improved Secondary Charter Processing Site at Cargo Apron

Under this operating scenario, a portion of the cargo apron would become a dedicated location for secondary charter processing. The site would be developed in such a manner as to meet the goals outlined above as follows:

- Designate the west portion (out to 400 feet beyond the blast fence intersection) of the cargo apron as the secondary charter facility;
- Construct a bus loading/unloading zone along Old Airport Road, which runs parallel to the cargo apron;
- Construct a building that is sized to accommodate passenger screening at a minimum (about 1,000 square feet), and possibly, screening and passenger holding (about 3,000 square feet);
- Shift security fence to keep bus staging outside secure area.

Figure 1 shows the charter facility at the cargo layout.

It is recommended that the building needs be met through the construction of an inexpensive semi-permanent building (e.g., a stressed membrane structure, similar to the FedEx cargo building currently located at the ROA cargo apron). An example is shown below.


NEW SEMI-PERMANENT PASSENGER
PROCESSING FACILITY
NEW FENCE LINE
BUS LOADING/UNLOADING
SERVICE ROAD
EXISTING
AIR CARGO
FACILITIES
0
150
300
SCALE IN FEET
HNTB
2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210
Charter Option 1
Air Cargo Apron Site
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA
DATE:
Apr 09, 2007
Figure 1
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Example of Fabric Structure Building

The cargo apron and adjoining taxiway (Taxiway G) are designed for modified ADG-IV aircraft, requiring minimal infrastructure improvements. In addition, as numerous charter operations have occurred here through the years, the operation has been demonstrated to be a workable option.

The cargo apron can accommodate both the charter facility and future cargo activity; however, as the number of cargo aircraft parked at the apron increased, they would have to be pushed back from their parking positions instead of powering out. Should the charter aircraft be required to stay at ROA for an extended period, it could remain at the cargo apron.

In the future, should the Airport acquire the adjoining Nordt property, the apron could be made deeper, and a new cargo building could likely be built without having to move the charter building. If, however, the cargo building did have to be relocated, the cost would be relatively low.

A general, order-of-magnitude development cost for providing a dedicated secondary charter facility at the cargo apron would range from a low of approximately $150,000 for a bus loading/unloading zone and a small building to handle passenger screening to $250,000 for a larger facility to accommodate screening and passenger holding.

Secondary Charter Processing at the New FBO Site

As noted previously, some smaller charter flights operate from the current FBO. Under this option, secondary charter aircraft processing would be shifted to the relocated FBO site (at the location of the old terminal parking lot) as shown in **Figure 2**.

It should be noted that, unlike the cargo facilities at ROA, the design aircraft for the FBO area include a modified ADG-II (60-foot wingspan) with provisions for an ADG-III taxilane for occasional larger jets, as shown in Figure 3. Assuming a B757 charter operation, the aircraft would have approximately 18 feet of wingtip clearance as it taxis past parked aircraft, about two feet less than recommended planning parameters as specified in AC 150/5300-13. While the aircraft was loading and unloading passengers, it would block aircraft circulation into and out of the hangar area. Should the aircraft be required to stay at ROA for an extended period, it would have to be tugged to the proposed secondary deicing pad which would require ground staff; the aircraft would also have to be tugged back to the FBO apron to re-board passengers.

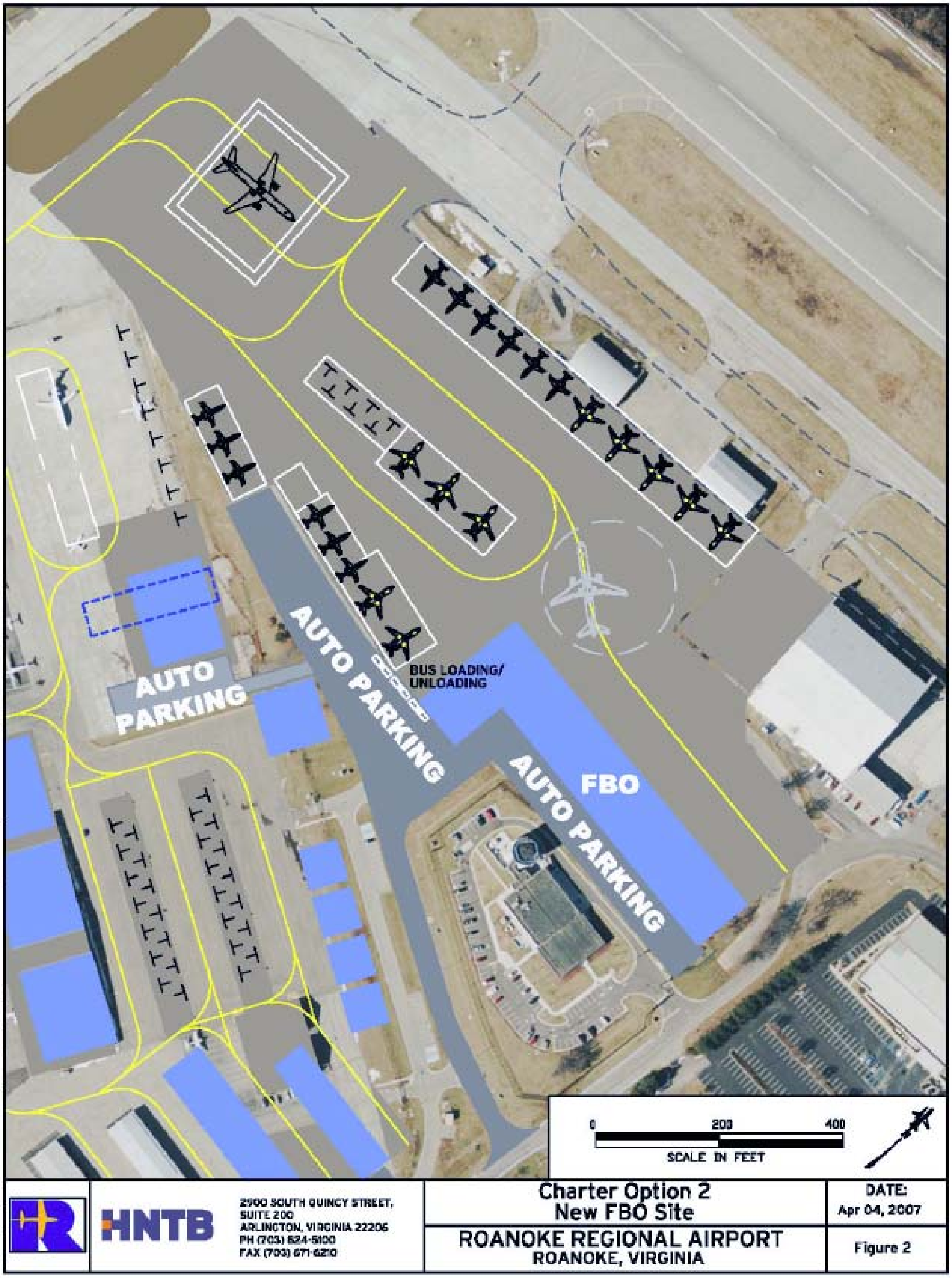
Recognizing one of the goals of this analysis is to provide an enclosed passenger screening area, the facility would have to be accommodated within the FBO building, as there would not be sufficient space for a stand-alone screening area.

It is also anticipated that there will be considerably more aircraft operations occurring in the FBO during charter boarding and deplaning which could be considered undesirable from a safety perspective.

Recommendation

The analysis above suggests that providing improved charter-related facilities at the cargo apron is the most effective way to meet the goals specified above. In summary,

- The cargo area is already designed to handle large air carrier aircraft;
- Charters are already accommodated at that site demonstrating its feasibility;
- The aircraft could remain for extended periods without having to be repositioned;
- Interaction with other aviation activity would be minimal; and
- Landside and passenger-related facilities, such as a bus loading/unloading zone and small structure for passenger processing could be provided with minimal cost.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HNTB
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SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210
Charter Option 2
New FBO Site
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA
DATE:
Apr 04, 2007
Figure 2

In contrast, relocating secondary charter aircraft processing to the proposed FBO site is not recommended for the following reasons:

- Charter operations would impact FBO activity by constraining/blocking aircraft circulation;
- Charter aircraft staying at ROA for an extended period would have to be tugged to a remote location (likely the proposed secondary deicing pad) and tugged again to the FBO for passenger re-boarding; and
- The FBO terminal would have to include design features that would permit the screening of passengers.

For these reasons, it is recommended that, should the Airport desire a permanent site for charter processing, the site should be at the air cargo apron.

APPENDIX M

Air Cargo Development Concept

ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

Air Cargo Development Concept
White Paper

Introduction

Air cargo activity at ROA is primarily centered the Airport's air cargo facility in the northeast portion of the Airport. This facility consists of a large 32,000 square yard apron, a FedEx cargo building and some ancillary support structures.

Air cargo activity at Roanoke Regional Airport (ROA) peaked in 1995 at 27,200 tons. From this level, cargo activity dropped steadily, reaching a low of 13,100 tons in 2002. Since 2002, cargo activity has shown a slow but steady increase, reaching 15,800 tons in 2005. The FAA-approved Master Plan Update forecasts show a continued slow increase in air cargo activity, reaching 18,300 tons by 2025 under the base case forecast. This slow growth translates into a moderate increase in cargo building requirements from 28,400 square feet in 2005 to approximately 33,000 square feet by 2025. (It should be noted that Building 5, which is partially used for cargo activity, will likely be removed to accommodate other development.)

The majority of air cargo is transported by all-cargo aircraft (versus belly cargo in passenger aircraft). There were slightly more than 2,000 all-cargo operations in 2005. This level is forecast to remain fairly constant over the next 20 years as it is assumed that cargo airlines will see higher load factors and use larger aircraft to accommodate higher demand. The Master Plan Update indicates a current peak period requirement for four (4) cargo aircraft parking positions (two narrow-body positions, one B757 position, and one wide-body position). By 2025, the Master Plan Update anticipates the parking position requirement to remain at four; however, the average size of each position would increase to two B757 positions and two wide-body positions.

At a typical air cargo facility, the apron should be of sufficient length and depth to accommodate the perpendicular side-by-side parking of the number and mix of aircraft anticipated to use the facility during the peak period, a taxi lane, a two-lane service road, and at least 50 feet of marshaling area between the nose of the aircraft and the building to stage the transfer of cargo as it is loaded and offloaded from aircraft.

Although the cargo apron at ROA is of sufficient length to accommodate future activity, it is not deep enough to allow aircraft to park perpendicularly to the support buildings and still provide room for a service road and adequate marshaling area. Moreover, the depth of the entire site is inadequate to provide room for truck docks on the non-secure side of the building and other activities.

Air Cargo Development Options

Although the current air cargo operators have not indicated that current layout deficiencies hamper their day-to-day activities, prudent planning recognizes the need to provide a more efficient layout in the future if possible.

There are two general options for accommodating future air cargo growth. The first is to continue to meet future needs at the existing site. The second option is to move cargo operations to a new location.

Continued Air Cargo Development at Existing Site

In order to adequately accommodate future demand, the depth of the current cargo apron and of the overall site would have to be increased. To meet 2025 requirements, the northern half of the Nordt property would have to be acquired at a minimum. If property acquisition were held to this amount, existing activity at the Nordt factory could remain relatively undisturbed. The estimated cost for acquiring the northern half of the Nordt property is approximately $0.5 million.

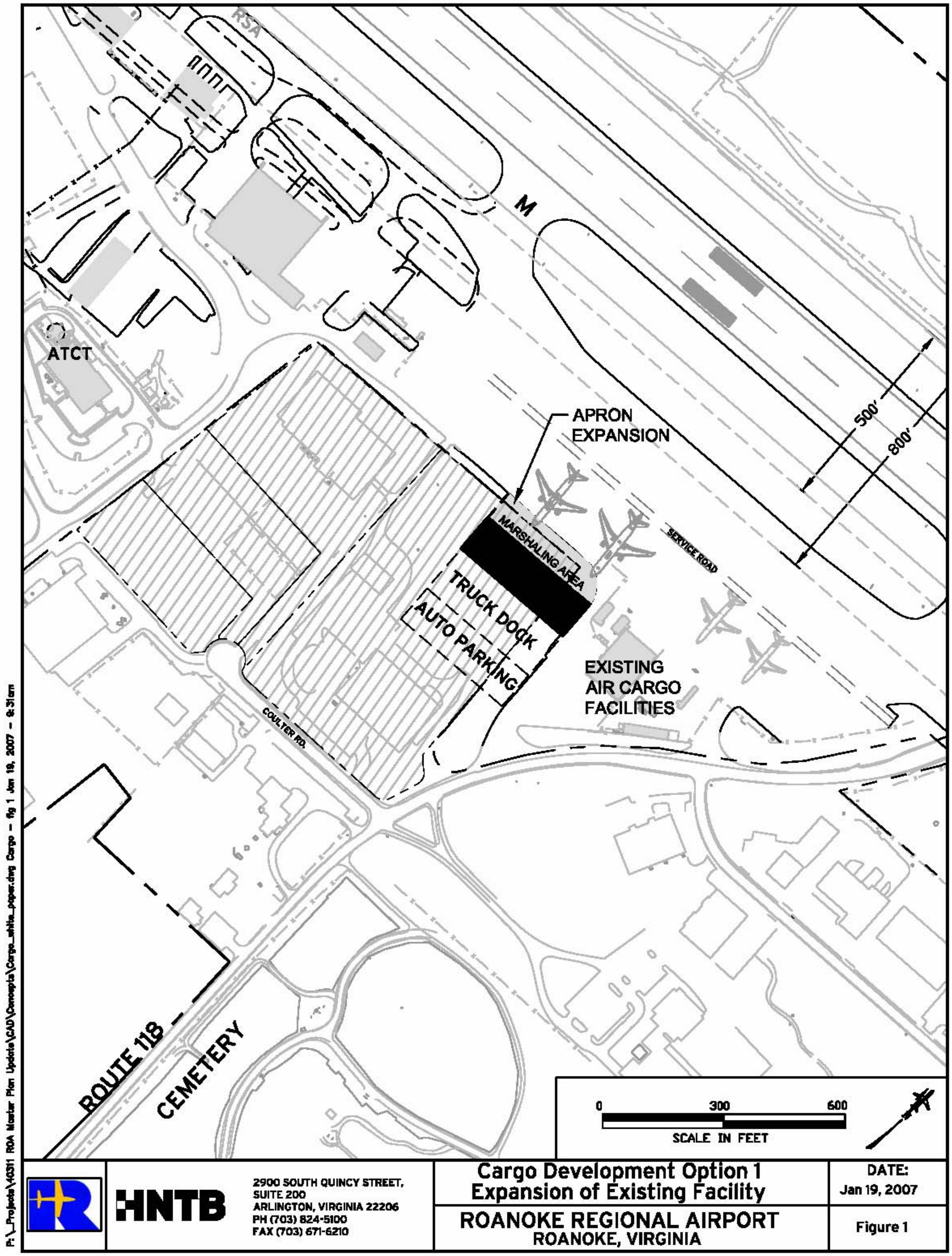
Figure 1 shows a general concept for this expansion. The benefits of this option include its relatively low development cost (which would range from a minimum of $8 million to a high of $12 million depending on the amount of land desired) and its reasonable proximity to the airline terminal to permit the ground movement of belly cargo between the two facilities. The primary disadvantage of this site is the uncertainty of when (or even if) the required land parcels could be acquired when needed.

Relocate Air Cargo Facilities to New Site

To meet long-term cargo needs, a 15-acre site is required. The number of alternative sites for relocating air cargo facilities at ROA is limited. There are no available sites in the southeast quadrant area bordered by Runway 15-33 and Runway 6-24. The northeast quadrant is either too narrow or has very steep grades making this area unsuitable. The southwest quadrant is also too narrow and has grade issues.

The only remaining area that has sufficient acreage to accommodate the Airport's long-term cargo needs is the Northwest Quadrant. This area, however, has significant terrain issues, would require infrastructure improvements, would result in the relocation of existing FAA facilities, and would require the removal of a mobile home park.

Figure 2 shows a possible air cargo layout at this site. A taxiway system would be constructed to connect the site with the west end of Runway 6-24 and north end of Runway 15-33. Landside access would be provided directly from Thirlane Road. The advantages of this site include its ability to be expanded beyond the 2025 requirements, its direct access to Thirlane Road and its proximity to the Peter's Creek/I-581 interchange. The primary disadvantage of this site is its development cost. A second, smaller disadvantage is its distance from the passenger terminal, which would make the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HNTB
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SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210
Cargo Development Option 1
Expansion of Existing Facility
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA
DATE:
Jan 19, 2007
Figure 1
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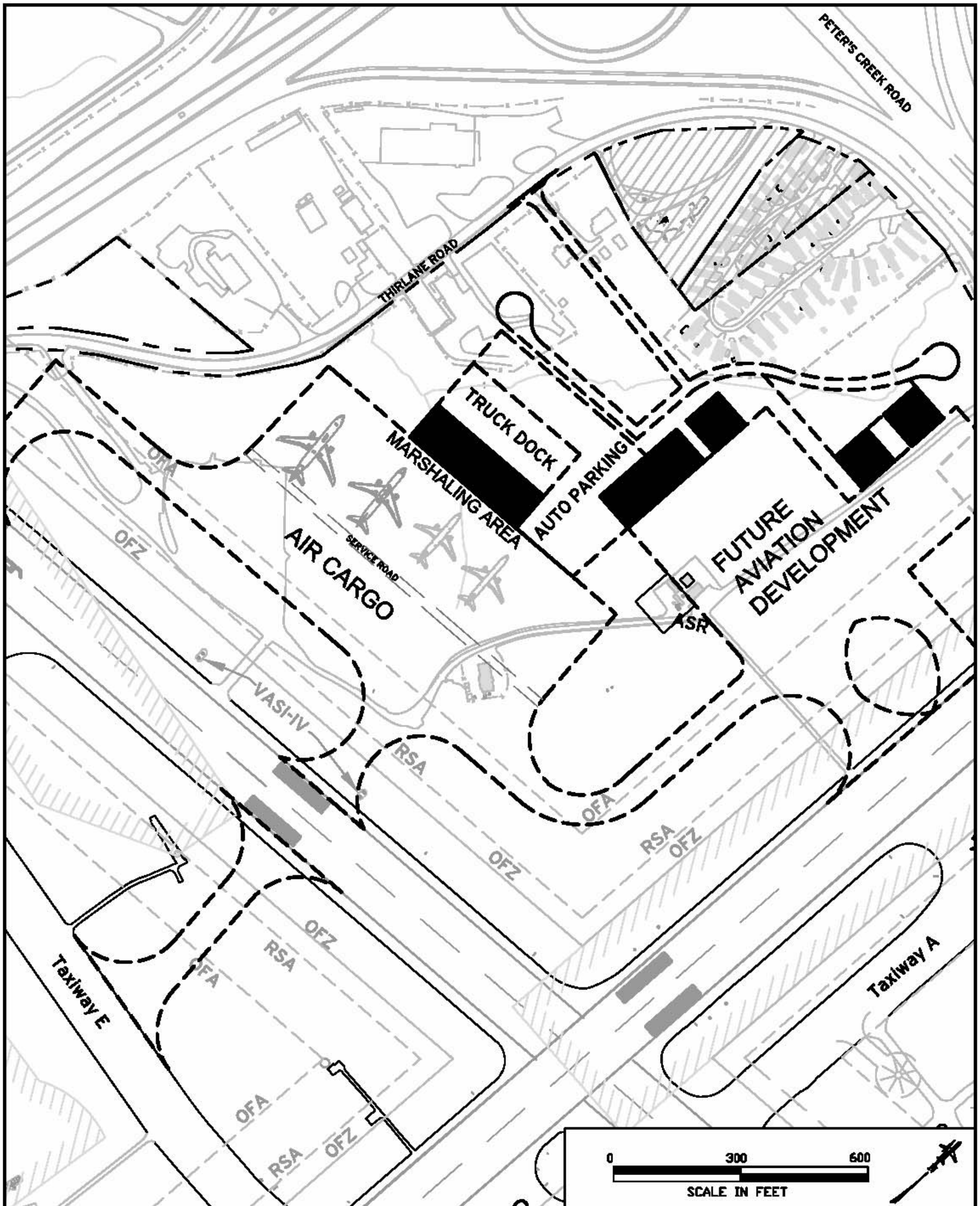


HNTB	2900 SOUTH QUINCY STREET, SUITE 200 ARLINGTON, VIRGINIA 22206 PH (703) 824-5100 FAX (703) 671-6210	**Cargo Development Option 2 Northwest Quadrant**	DATE: Jan 17, 2007
		ROANOKE REGIONAL AIRPORT ROANOKE, VIRGINIA	Figure 2

P:_Projects\40311 ROA Master Plan Update\CAD\Concepts\Cargo_white_paper.dwg Cargo -- fig 2 Jan 17, 2007 - 2:26pm transfer of cargo between the terminal and the new cargo site less efficient. (It should be noted, however, that less than one percent of ROA's air cargo is transported as belly cargo.) Based on a general order-of-magnitude cost estimate which includes removing the mobile home park, relocating FAA facilities, drainage, erosion/sediment control, grading, electrical, paving, and buildings, the cost to develop this site is at least $65 million.

Recommendation

The existing cargo facility is currently accommodating most of the Airport's cargo activity, and, based on the analysis above, can be upgraded to meet the Airport's long-term cargo requirements with little additional investment. Conversely, relocating cargo functions to the Northwest Quadrant would involve a considerable expenditure for site preparation and facility development. For these reasons, the preferred cargo development option is continued expansion at the existing cargo site. However, recognizing the possibility that the additional land to be acquired adjacent to the existing site may not be available when needed, it is also recommended that preliminary site preparation in the Northwest Quadrant be initiated over the next several years as funding becomes available to provide an alternative location for cargo activity.

APPENDIX N

General Aviation Development Concept Update

ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

General Aviation Development Concept Update White Paper

Introduction

Although the forecasts approved by the FAA as part of the Roanoke Regional Airport (ROA) Master Plan Update show modest growth in the General Aviation (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.

Table 1 shows the facility requirements needed to accommodate the forecast GA demand.[1] These facilities include the Fixed Base Operator (FBO) terminal, maintenance hangars, storage hangars (including T-hangars and conventional hangars), tie downs for based and transient aircraft, and complementing landside facilities.

Existing GA Layout

Currently, the majority of GA facilities (including the FBO, conventional hangars, T-hangars, and tie-downs) are consolidated in a 34-acre site to the northeast of the terminal. Two additional hangars (Buildings 2 and 3) are adjacent to Taxiway G and are scheduled to be removed as part of the taxiway relocation project.

Overall 20-Year GA Development Strategy

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. Recognizing ROA's role as a commercial service airport, the planning strategy was to prioritize commercial aviation facilities (including passenger and cargo) followed by GA activity. In addition, 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

[1] From Table 5.20 of Chapter 5 of Roanoke Regional Airport Master Plan Update (Draft).

- Taxiway/taxilane separation standards.

The current preliminary development 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. (See corresponding white paper.)

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.

There are also several development constraints:

- The Runway Visibility Zone (RVZ) requires structures/buildings to be located within the eastern two-thirds of the site;
- There is a significant 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 air traffic control tower facility constrains a portion of the area; and
- The shifting of Taxiway G to the southeast reduces the amount of developable area.

The proposed GA development plan, therefore, strives to balance meeting FAA design criteria, addressing the anticipated shift toward the use of larger, more complex aircraft, the Airport's desire of providing higher level of customer service, and providing a realistic development plan in terms of cost.

20-Year GA Development Concept

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.

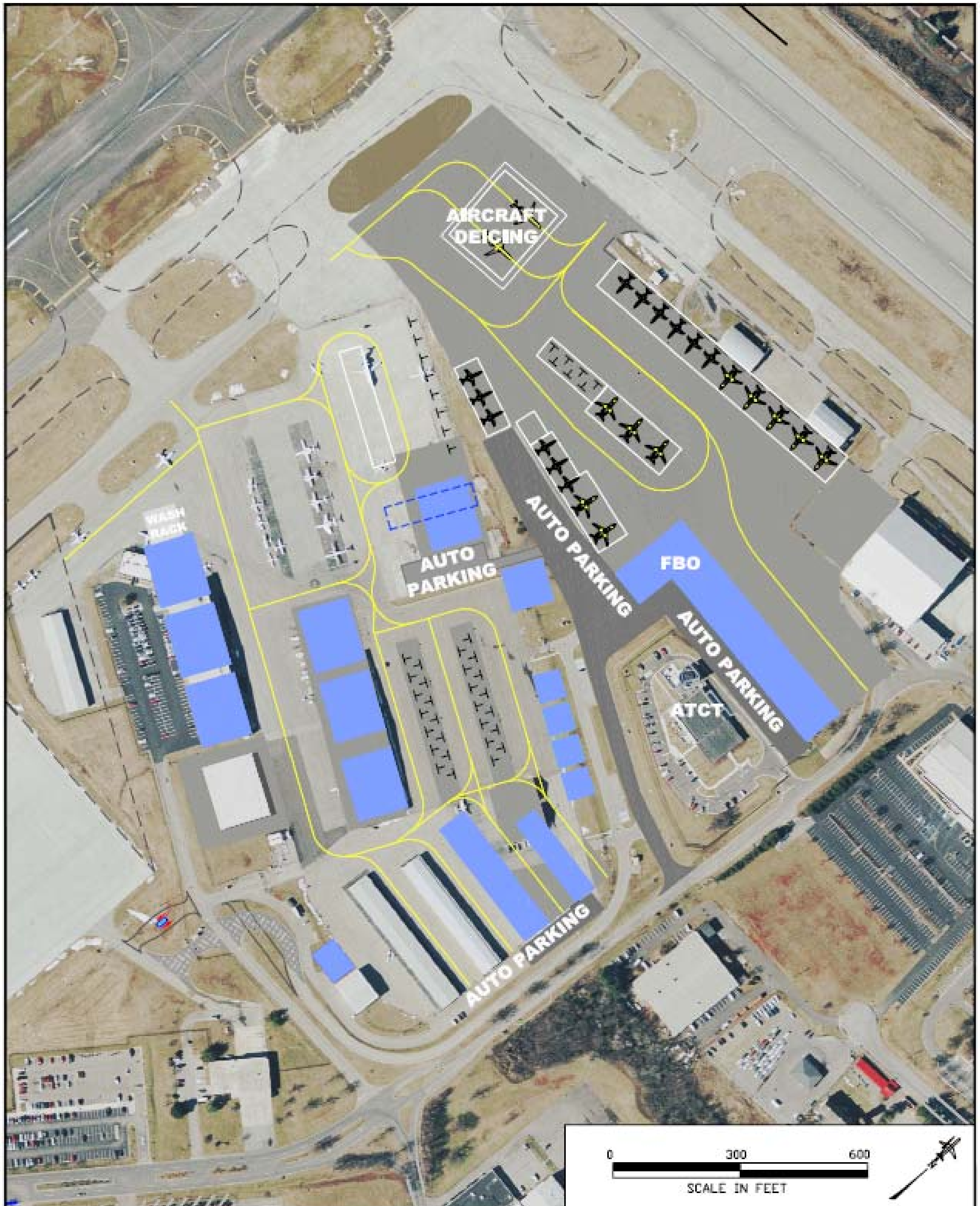
As shown in **Figure 1,** the plan features a new, large-scale FBO/GA terminal at the site of Building 5 (cargo building). The building would house a new up-scale FBO and hangar space for storing/maintaining high-end GA aircraft. The apron to the east of the new FBO building provides sufficient parking 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 (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.

Conclusion

The recommended 20-year development plan to meet GA requirements at ROA balances the desire to provide a good level of customer service with the need to be fiscally realistic. Recognizing that at least $20-$30 million would be required for site preparation work before the Northwest Quadrant could be developed, the recommended concept strove to accommodate 20-year GA requirements within the existing midfield area and by increasing overall customer service as much as feasible. Toward the end of the planning horizon, it is likely that work on preparing the Northwest Quadrant for aviation development may be necessary to meet long-term demand.



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Phase III

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Mar 12, 2007

Figure 3

APPENDIX O

Airport Rescue and Fire Fighting Station Site Recommendation

Airport Rescue and Fire Fighting Station Site Recommendation White Paper

Introduction

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 National Fire Protection Association (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.[1] In

[1] 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.

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.

Site Selection Criteria

FAA AC 150/5210-15, *Airport Rescue and Firefighting Station Building Design* lists the site requirements for an ARFF station.

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 1** shows their location.

Table 1 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.

Figure 1

Potential ARFF Station Locations

Site 1—FBO Site

Site 2—Northeast Quadrant

Site 3—Northwest Quadrant

Site 4—Southwest Quadrant

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.

Recommendation

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.

APPENDIX P

Secondary Deicing Facility
Site Selection

ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

Secondary Deicing Facility Site Selection
White Paper

Introduction

Commercial aircraft deicing at Roanoke International Airport (ROA) occurs at the gate and at a remote deicing area on the west end of the cargo apron. This remote location permits deicing away from the gate and also reduces the time between application of a deicing agent and an aircraft's departure. As the number of cargo aircraft using the apron increases, however, a new site for a new secondary deicing pad may be needed. This white paper identifies and evaluates a potential site for a secondary remote deicing pad should the current site at the cargo apron become infeasible.

Planning Parameters

The overall size for a deicing pad is determined by considering peak hour commercial aircraft departures and the types of aircraft anticipated to operate during that period. At ROA, 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 (ADG-III) air carrier aircraft.

The primary consideration for choosing a location for the secondary deicing pad is taxi times to each runway end relative to holdover times (i.e., the time between the final application of an anti-icing agent to the wing and the time when the agent is no longer effective in preventing the accumulation of frozen precipitation). Additional considerations include:

- The predominant users of the secondary deicing pad will be passenger commercial aircraft;
- The predominant runway end used for departures is Runway 24, although Runway 6 and Runway 15 would also be occasionally used, suggesting a more centralized location on the airfield;
- Runway crossings by either aircraft or ground vehicles should be minimized;
- Consideration for collecting the spent glycol in an environmentally responsible manner;
- Impacts on either current or future aviation development should be minimized; and
- Expandability.

Preliminary Secondary Deicing Pad Site Selection

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 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 1**). 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.

Aircraft travel 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: 3.1 minutes
- Runway 24: 3.8 minutes
- Runway 15: 2.6 minutes
- Runway 33: 3.9 minutes

The generic holdover times for Type II anti-icing fluids were obtained from Table 2 of FAA's publication entitled, *Holdover Time Tables Ice Pellet Allowance Time Heavy Snow Procedures, Winter 2006-2007*. According to the table, holdover times for a 75 percent concentration of Type II fluid during a snow event with air temperatures between seven degrees and 27 degrees range from 15 minutes to 25 minutes, indicating that the proposed site would provide acceptable taxi times and would allow aircraft to take on several minutes of delay before having to return for a reapplication of anti-icing agents.

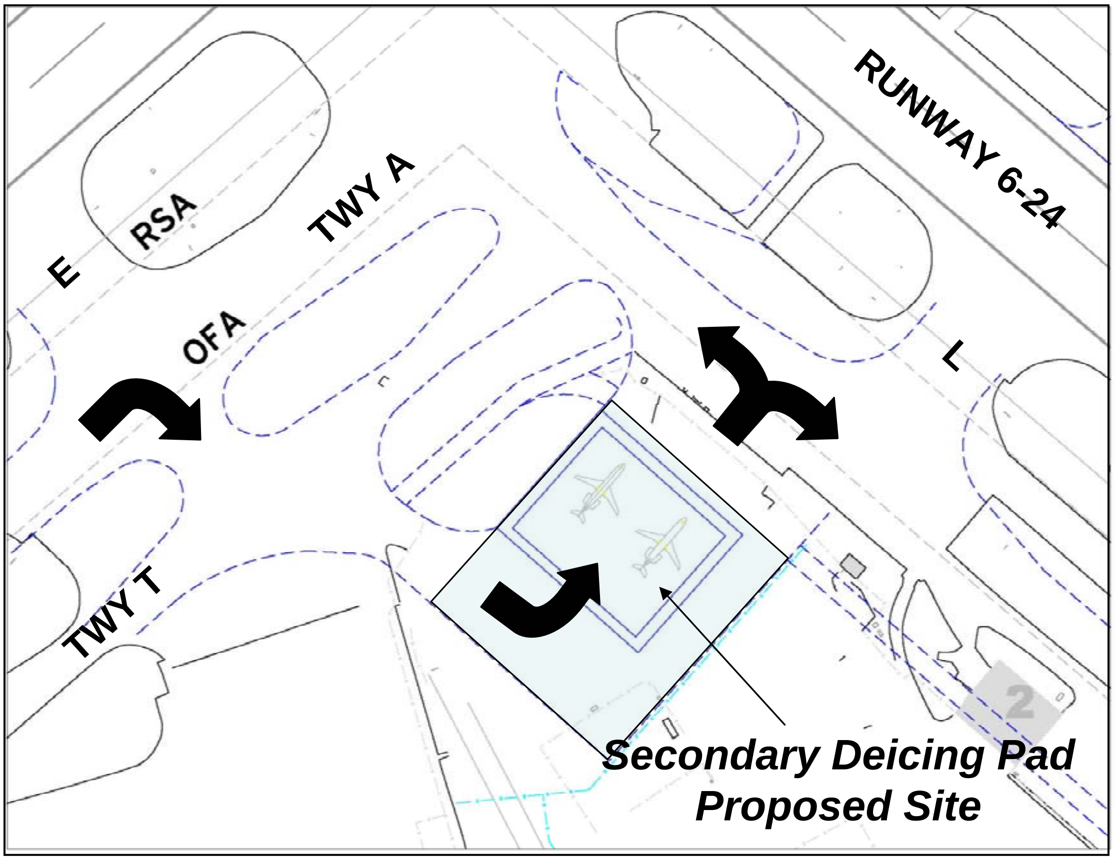


Figure 1—Secondary Deicing Pad, Proposed Site

Recommendation

The forecasts of cargo activity prepared for the Master Plan Update suggest that southwestern portion of the cargo apron should remain available as a secondary deicing site through the 20-year planning horizon. Nevertheless, recognizing the level of uncertainty associated with any long-term aviation forecast, an alternate site should be identified and preserved. The analysis described above indicates that an alternative preferred site for a secondary deicing pad should be in the midfield area opposite Taxiway L, at the site of the old terminal building. The site provides taxi times to each runway end that are well within the holdover times for Type II fluids and is readily developable. It is recommended that any interim development in this area be of a nature that would enable the site to be converted to a deicing facility (for example, an aircraft tie-down area).

APPENDIX Q

Fuel Farm Development Concept

ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

Fuel Farm Development Concept
White Paper

Introduction

The current fuel farm is located off Waypoint Drive, directly east of the new Landmark Aviation corporate hangar (Building 32) and occupies approximately 5,000 square feet. The Master Plan Update projects a 40 percent increase in tank storage capacity over the planning horizon, requiring the expansion of the fuel farm. In addition a spokesperson from Landmark Aviation (the FBO operating the fuel farm) has indicated that near-term expansion is needed. Finally, current fuel farm operational procedures could be improved. This white paper summarizes the analysis that was undertaken to develop a recommended fuel farm development concept.

Current Operation

The existing fuel farm consists of two 20,000-gallon above-ground tanks and one 12,000-gallon below-ground tank storing Jet-A fuel, for a combined 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.

Landmark Aviation, the primary FBO at the Airport, currently operates the fuel farm. According to their general manager, about 80 tanker deliveries are made per month. On a busy day, between three to five delivery 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, 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 in 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.

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 National Fire Protection Association (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 five feet from building on same property and 20 feet from property line that can be build 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 Options

Several options for providing long-term fuel storage capacity were considered:

- Meet 20-year requirements by expanding existing site;
- Replace existing fuel farm with a new, expanded facility near the proposed relocated FBO site;
- Operate two fuel farms—the existing facility to serve airline operations and a new fuel farm near proposed relocated FBO site; and
- Build new, replacement fuel farm at another location.

Figure 1 shows the location of these development options. A qualitative analysis was then undertaken to select a preferred option.

Expand Existing Fuel Farm Site

Although expansion options at the existing fuel farm are somewhat limited by the nearby large Landmark Aviation aircraft storage hangar and the adjoining GA apron, there are opportunities for expansion to the south and east. **Figure 2** shows how the area around the existing fuel farm could be expanded to meet the planning parameters and design considerations outlined above.

Figure 1—Potential Fuel Farm Sites

As shown if Figure 2, the tug road would be closed[1] and 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 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

This fuel farm expansion option clearly meets the planning parameters described above:

- The site provides room for ARFF vehicle circulation, meets general NFPA safety requirements, and can provide for fuel spill containment, both at the tank storage facility as well as the transfer area;
- The site provides for fuel truck delivery maneuvering without encroaching on the GA apron;

[1] Based on discussions with Airport staff, the tug road is not used; non-licensed vehicles can use Aviation Drive north of the existing ARFF station.

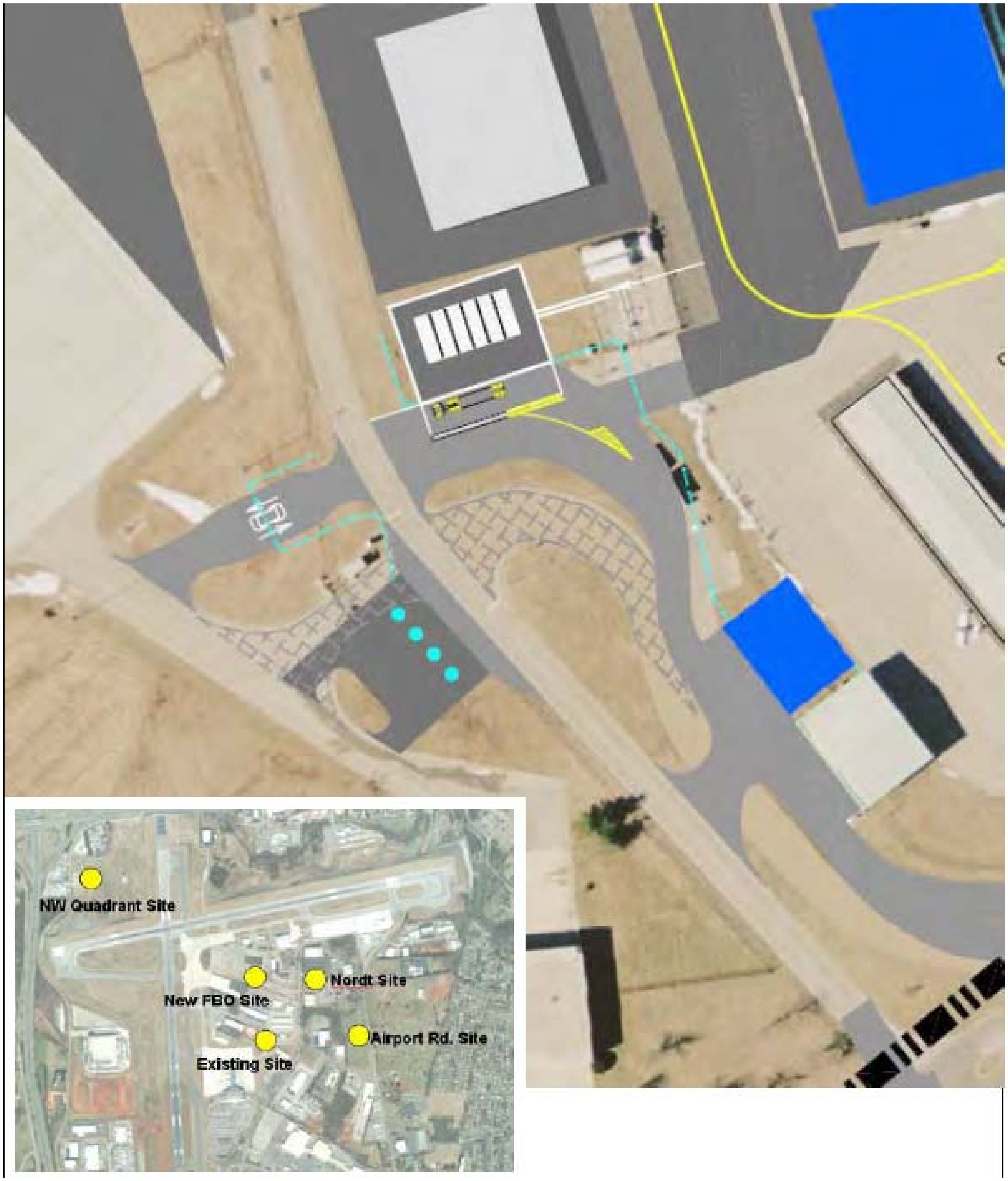


Figure 2—Recommended Fuel Farm Expansion Layout

- Fuel trucks serving commercial aircraft would have a short and direct route to the terminal apron; however, fuel trucks serving GA aircraft at the proposed new FBO site would need to use Aviation Drive;

- There is room for expansion beyond 2025 requirements, if needed;

- Development costs would not be significant.

The disadvantages of expansion at this site include the fact that, there would be an increase in drive times for fuel trucks serving the FBO; in addition, the FBO's ability to monitor activity at the fuel farm would be reduced, assuming it is moved to the midfield area. (This latter impact could be mitigated by installing closed-circuit television.)

Build Replacement Fuel Farm at Proposed New FBO Site

This option would relocate all fuel farm storage and delivery facilities to the midfield area of the Airport, in the vicinity of the proposed new FBO location.

The advantages of this option include its being closer to the FBO site, which would provide a more efficient operation, since most fuel calls are to GA aircraft. Secondly, it would enable better monitoring of the fuel farm by the FBO, should they continue to be the primary operators of the facility.

The disadvantages of this option would be a higher development cost and difficulty in 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. (A one-acre site is the minimum required for providing room for storage tanks, a containment berm, a truck maneuvering area, a buffer from other structures and for ARFF circulation—additional land would also have to preserved for post-2025 expansion.) This last impact could also likely force a move to develop the Northwest Quadrant earlier than necessary.

Operate Two Fuel Farms

Under this option, 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 option include having one farm in proximity to the terminal area (to serve commercial flights) and a second farm in proximity to the proposed new FBO site to serve GA operations.

The disadvantage of this option include having to monitor two different locations, having to coordinate tanker deliveries between the two sites, and 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 future aviation activity there (toward the end of the planning horizon), there would ultimately be a total of three fuel farms. This is considered to be inefficient and impractical from an operational standpoint.

Build Replacement Fuel Farm at Other Location

In this option, 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);
- On the Nordt property across Aviation Drive, behind the air cargo facility (this land would have to be acquired); or
- In the Northwest Quadrant

Airport Road Site—This site, located southwest of Blue Ridge Memorial Gardens on Airport Road, is owned by the Airport. A one- to two-acre portion of the property could be developed as a fuel farm. The site would permit a well-laid-out facility; however, it would require a significant amount of coordination for fuel deliveries and would require airport fuel trucks to travel on public roads. This location is therefore not considered to be a good site for a fuel farm.

Aviation Drive Site—A second location for a fuel farm would be on the Nordt property directly behind the air cargo apron. The advantage of this site is its proximity to the future proposed GA FBO location and its ability to accommodate a well laid-out fuel farm site. In addition, airport fuel trucks would have easy access as that portion of Aviation Drive is accessible to non-licensed vehicles. The disadvantage of the site is that it is currently not owned by the Airport. For this reason, this option was not considered to be appropriate because it would not meet near-term needs.

Northwest Quadrant—Under this option, near-term and long-term fuel storage requirements would be met by building a new fuel farm in the Northwest Quadrant of the Airport. The advantages of this option include the fact that sufficient land could be provided for a well laid-out site and that, eventually, a fuel farm would likely be needed in this area over the long term as the Northwest Quadrant is developed for aviation activity. The disadvantage of building a fuel farm in the Northwest Quadrant in the near future is its significant road distance from current aviation activity and the difficulty in getting aircraft fuel trucks to the site. While it is acknowledged that a fuel farm would likely be needed in the Northwest Quadrant at some point, it would not be a suitable option for meeting near-term requirements. For this reason, developing a fuel farm in the Northwest Quadrant was not considered to be a viable option to meet 20-year needs.

Recommendation

Based on the analysis described above, it is recommended that a single fuel farm be provided and that the preferred option should be expanding at the existing site, since it meets the desired fuel farm requirements. Furthermore, to eliminate the need for delivery tankers to maneuver on the airfield, the surrounding area should be redeveloped to provide a fuel truck circulation roadway system as shown in Figure 2.

APPENDIX R

Ground run-up Enclosure
Primary Site Selection

ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

Ground Run-up Enclosure Preliminary Site Selection White Paper

Introduction

This white paper summarizes a preliminary site selection analysis of providing a ground run-up enclosure (GRE) facility at Roanoke Regional Airport (ROA). The analysis was undertaken because airline maintenance activity which regularly occurs at the Airport requires that engine run-ups be performed to test aircraft power plants. In order to ensure aircraft are ready for scheduled service the next morning, it is desirable for engine run-ups to be performed at night—a period of increased community sensitivity to noise.

The white paper summarizes current run-up activity and restrictions, describes ground run-up enclosures, conducts a preliminary evaluation of possible sites for a GRE, and provides a general order-of-magnitude cost for a GRE.

Current Run-up Activity

In response to previous noise complaints from local residents, the Commission has designated the intersection of Taxiway A and Taxiway A-2 as the preferred location for engine run-ups and has prohibited run-ups between 10 PM and 6 AM. The restriction limits the amount of time available to conduct engine testing which could result in scheduled aircraft departure delays. Based on discussions with an airline maintenance base representative, eight run-ups are usually performed on a typical day. Currently, the Dash-8 is the only commercial airliner serviced at the base.

There is no standard noise level for determining impacts from ground run-ups. For conservative purposes, the Lmax 55 noise contour generated from a five-minute run-up at takeoff thrust was used for this study. **Figure 1** shows the Lmax 55 noise contour generated from a five-minute engine run-up of a Dash-8 at the designated run-up location. As shown the Lmax 55 extends into the residential area north of the Airport off Peter's Creek Road and into the trailer park northwest of the airfield. Several of these homes are less than ¼ mile from the designated run-up location.

Ground Run-up Enclosure

A GRE is a large, three-sided structure designed to absorb engine noise. (See **Figure 2** for an example.) A typical facility consists of a concrete pad upon which a GRE is installed, an apron in front of the facility for aircraft maneuvering, and a connecting taxilane. The GRE itself consists of a blast deflector, vented sidewalls, and sound-absorbent panels. Because the enclosure restricts airflow to the engines, GREs must be


Dash 8 - 55dB $L_{A\,max}$ (5 min)
0
200
400
SCALE IN FEET
HNTB
2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210
Dash 8 Run-up Contours
at Current Location
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA
DATE:
Dec 20, 2006
Figure 1

oriented with the open end aligned into the prevailing wind as much as feasible to maximize its benefit. The overall size of the site is approximately 1.5 acres.

At many larger airports, where a significant number of run-ups are performed, GREs have been constructed and have produced significant benefits to both communities and maintenance operations to the point where run-ups can be performed on an unlimited basis at night.

Figure 2—*Example of Ground Run-up Enclosure*

A general layout for a GRE at ROA capable of containing a regional jet or medium-sized narrow body jet is shown in **Figure 3**. The dimensions permit a regional jet to taxi into the facility or a narrow body to be backed in using a tug.

At ROA, a GRE could allow unrestricted engine run-ups for the current Dash 8 fleet and possibly for jet aircraft, increasing the attractiveness of the Airport for additional airline maintenance activity, depending on the selected site.

Preliminary ROA GRE Site Recommendation

A process was then initiated to identify possible locations for a GRE at ROA. The siting analysis considered existing and future Airport development, control tower line-of-site, runway visibility zone, Part 77 surfaces, proximity to existing airline maintenance operations, land availability, and, most importantly, the potential benefit on surrounding noise-sensitive land uses. To ensure greater flexibility, contours for both the existing Dash 8 fleet and for regional jets (in this case an EMB-145) were considered.


Taxiway G
Runway Visibility Zone
0 200 400
SCALE IN FEET
HNTB
2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210
Ground Run-up Enclosure
at Maintenance Base
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA
DATE:
Dec 20, 2006
Figure 3

Figure 4 shows two possible locations for a GRE at the Airport and the general size of the noise contours that would be generated for a Dash 8 and an EMB-145.[1] The first general location would be in the midfield area; the second is in the Northwest Quadrant.

Midfield Location

The benefits of locating a GRE in the midfield area include proximity to current airline maintenance operations and reducing engine run-up noise exposure for communities off Peter's Creek Road. Constraints to siting a GRE in the midfield area include aligning the open end of the GRE into prevailing winds, remaining clear of the runway visibility zone and tower line-of-site, and minimizing the site's impact on both current facilities and the limited remaining areas that could be developed for other aviation-related uses. Consideration was also given to possible impacts to ATCT operations from noise and vibration; however, preliminary discussions with Roanoke ATCT staff suggest that these impacts would not be significant.

Two sites within the midfield area that could accommodate a GRE include the area between the air traffic control tower and the current maintenance facility, where Building 5 is currently located (shown in Figure 3), and the area west of the control tower at the site currently striped as a helipad. Airfield access to the Building 5 site would be provided by a taxilane extending southeast from Taxiway G, past an enlarged Piedmont maintenance apron. This site would both provide convenient and direct access to the most frequent users of the GRE (Piedmont maintenance) and would leave the greatest amount of remaining development area within the midfield site.

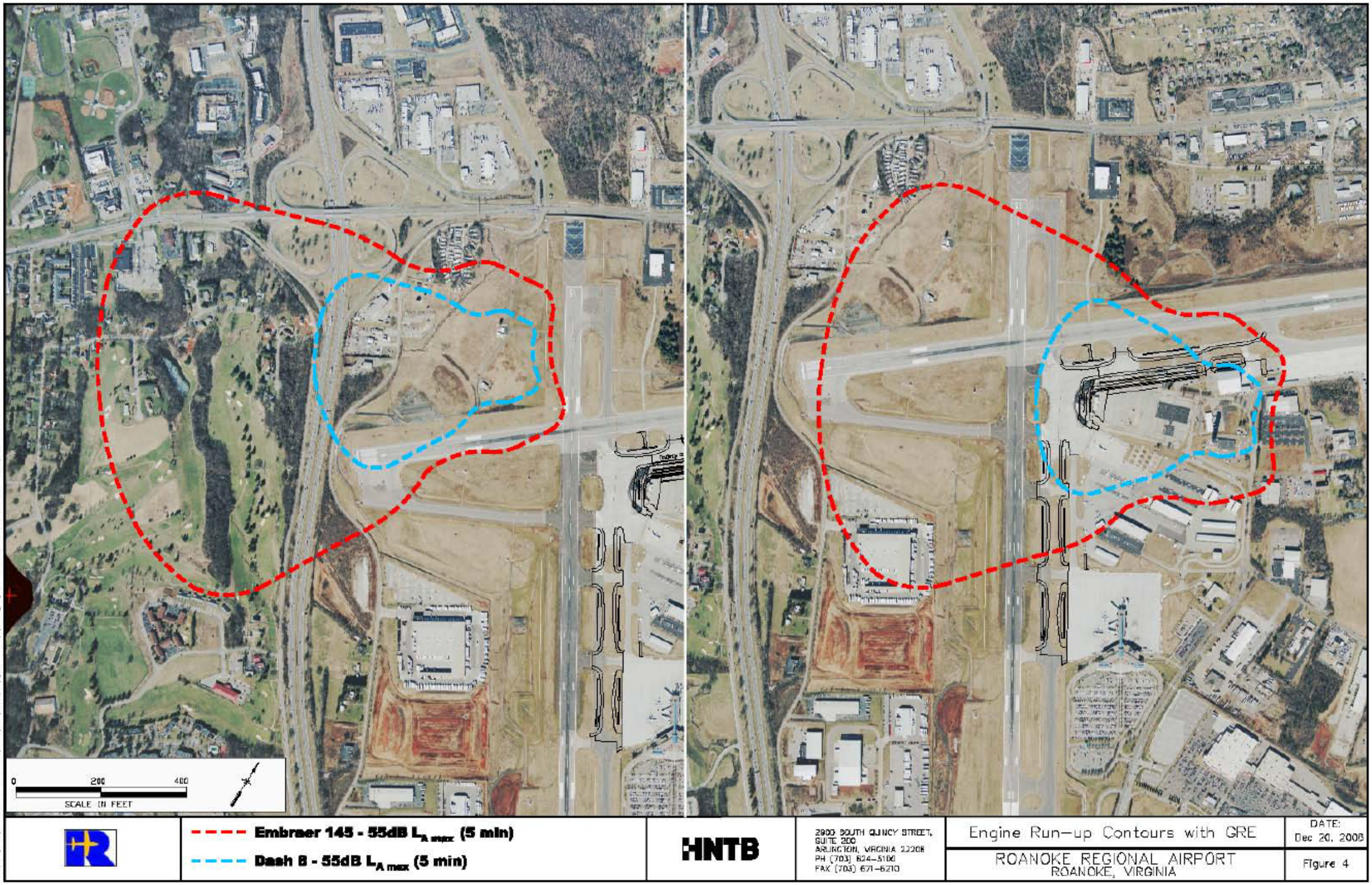
If it was the desire to preserve Building 5, a GRE could be built on the helipad; however, access from the maintenance base would be less convenient and development flexibility for the rest of the midfield area would be reduced.

Of the two sites, the former appears to be more favorable primarily because it would minimize impacts to future midfield area development opportunities. While this location would require the demolition and possible relocation of Building 5, it should be noted that this structure is 46 years old, is currently considered to be in only fair condition, and is only partially occupied by BAX Global (formerly Burlington Air Express).

Northwest Quadrant Location

The second location considered for this analysis is the Northwest Quadrant. While this site would have the benefit of allowing the midfield area to be developed for other uses, the GRE would be farther from the airline maintenance base and would require significant investment to make the site developable. Most importantly, however, it would increase noise exposure for residents west of the Airport, most likely impacting residences adjacent to the golf course.

[1] The contours shown were developed based on a limited number of data points provided by a GRE manufacturer and not by modeling. Contour is for illustrative purposes only.



0
200
400
SCALE IN FEET
Embraer 145 - 55dB $L_{A\,max}$ (5 min)
Dash 8 - 55dB $L_{A\,max}$ (5 min)
HNTB
2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210
Engine Run-up Contours with GRE
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA
DATE:
Dec 20, 2006
Figure 4

Preliminary Site Recommendation

Based on this initial analysis, it appears that siting a GRE in the midfield area on the site of Building 5 would provide the most direct access to the facility by its most frequent users, would maximize the remaining land area within the midfield site for other aviation-related development, and would provide the best level of noise reduction on surrounding communities.

Order-of-Magnitude Cost and Financial Feasibility

GREs require a significant investment. Based on a review of several GRE installations, it is anticipated that a GRE for ROA would cost between $3 million and $4 million. An additional $1 million to $2 million would likely be required to construct the pad, adjoining apron, and connecting taxilane, bringing the total cost to between $4 million and $6 million.

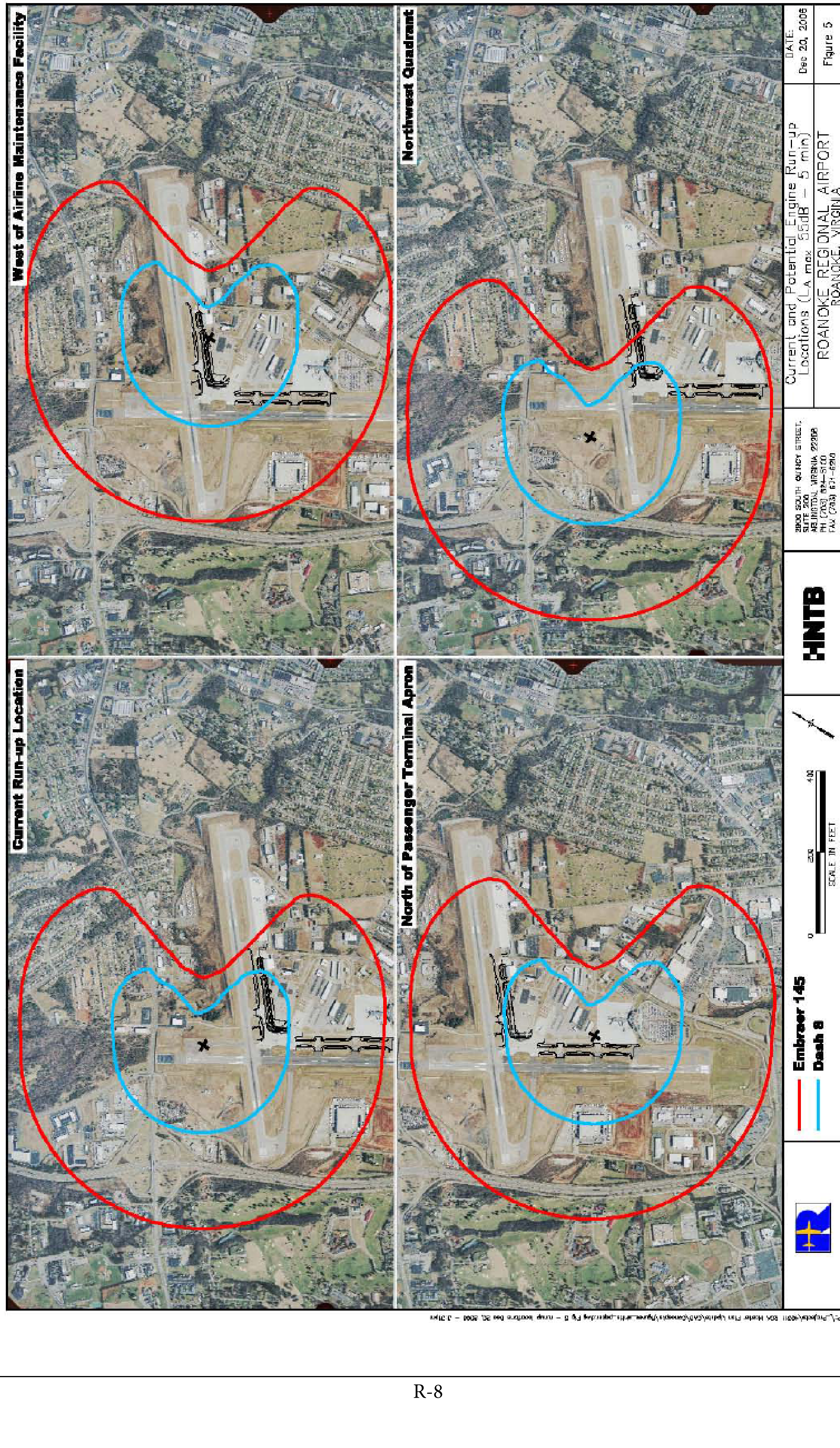
Other site specific costs would also be required. If the GRE were developed on the Building 5 site, an additional $1.5 million would be needed to relocate Building 5 should the Airport choose to maintain a facility for BAX Express on-airport. If the second site (Northwest Quadrant) is selected, several million dollars would be required for grading and preparing the site.

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. In addition, the GRE would have to be available to any user.

Additional investment may also be needed to construct new facilities to attract new airline maintenance activity (for example, a new hangar and expanded apron area). It is also likely that the community would have to offer financial incentives to attract an airline maintenance operation.

Interim Engine Run-up Measures

A possible option that may allow some nighttime run-ups of Dash 8s for the short term would be to identify a new site for engine run-ups that would place this activity farther from the surrounding population. **Figure 5** shows the current site for run-ups and three additional sites where run-ups could be performed (the Dash 8 run-up contour is shown in blue, while the EMB-145 contour is shown in red). By relocating the run-up location to the west of the maintenance hangar, there would be no homes within the Dash 8 noise contour. A second potential location would be at the northwest corner of the terminal apron. No homes would be within the Dash 8 contour at this site. A final site could be on an apron in the Northwest Quadrant. No homes are within the Dash 8 contour at this location; however, it does move the contour closer to homes in the vicinity of the golf course. In addition, a significant investment would be required to develop this site.


West of Airline Maintenance Facility
Northwest Quadrant
Current Run-up Location
North of Passenger Terminal Apron
Embraer 145
Dash 8
0
200
400
SCALE IN FEET
HNTB
2900 SOUTH QUINCY STREET,
SUITE 200,
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210
Current and Potential Engine Run-up
Locations (LA max 55dB – 5 min)
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA
DATE:
Dec 20, 2006
Figure 5

As shown, a run-up location at either the west side of the existing maintenance base or at the northwest corner of the terminal apron would provide the most benefit, as the contours are furthest from local residences at these sites.

It appears that relocating the engine run-up site would not allow run-ups of jet aircraft (such as the EMB-145) at either location because the contours generated by this aircraft overlap residential land uses at each location.

Site Selection Summary

Based on the preliminary analysis above, 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. Because a GRE at this location 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.

APPENDIX S

Compass Calibration Pad Additional Analysis

ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

Compass Calibration Pad
Additional Analysis
White Paper

Introduction

The aircraft and airline maintenance community has expressed a desire to have a compass calibration pad at the Airport. As part of the Master Plan Update process, three sites were tested to determine if they would be an appropriate location for a compass calibration pad. A white paper, documenting the findings of a field magnetic survey of three potential sites was provided to Airport staff in March 2007. The white paper noted that the best site for a compass calibration pad would be centered 500 to 600 feet northwest of the Taxiway A-Runway 6-24 intersection.

For the purposes of this study, a distinction is made between a *compass calibration pad* and a *compass rose site*. A compass calibration pad should be designed to meet the standards specified in Appendix 4 of FAA Advisory Circular 150/5300-13, *Airport Design*.

A compass rose site, for the purposes of this study, is an area of pavement upon which a compass rose is painted. Its markings are aligned with local magnetic north; however, the rose is not certified to be within calibration pad tolerances.

This white paper summarizes the findings of the survey and provides additional information provided by the two primary companies performing aircraft compass calibration.

Review of Initial Compass Calibration Pad Site Identification and Field Survey Results and Recommendations

Three sites were initially identified for surveying based on the following:

- Compass calibration pad site requirements as specified in AC 150/5300-13,
- Current calibration practices by airline maintenance personnel,
- Availability of land

Compass Calibration Pad Site Requirements

Appendix Four of AC 150/5300-13 provides guidance on locating compass calibration pads. The guidelines are designed to help screen out unsuitable sites prior to conducting field surveys. Following are the key requirements:

- The pad must be located off the side of a taxiway or runway and outside all runway and taxiway clearances and Navaid critical areas;
- The pad should be at least 300 feet from potential disturbances (e.g., power and communication cables, and other aircraft);
- The pad should be at least 600 feet from large magnetic objects such as buildings, railroad tracks, high voltage transmission lines, or cables carrying direct current;
- The pavement and materials used to construct the pad cannot contain metallic materials;
- The pad must be certified to a tolerance of 0.5 degrees within a space between two feet and 10 feet above the pad, extending over an area within a 250-foot radius from the center of the pad.
- The compass calibration pad should be resurveyed at regular intervals of five years or less, and additional surveys should be performed after major construction of utility lines, buildings, or any other structures within 600 feet of the center of the pad.

Based on these criteria, there is no site within the already developed area of the Airport (i.e., the southeast portion), with the possible exception of the run-up pad for Runway 24. This site was included in the field survey as Site 3, as shown in **Figure 1**.

The southwest portion of the Airport is constrained as a location for a compass calibration pad due to terrain issues, the Runway 33 ILS glide slope critical area, the proximity to the UPS sort facility, and the Runway 6 offset localizer critical area. The only location in this area was southeast of the end of Taxiway E. (This location was included in the field survey as Site 1 in Figure 1.)

The northeast portion of the Airport is relatively clear of development; however, there are significant topography issues. The current Airport Layout Plan (ALP) shows a proposed compass calibration pad development site located in this area. In addition, as this area is the general site for a future ARFF station, it is possible that the cost of the overall area's site preparation work could be split between the two projects. Therefore, this location was also included in the field survey as Site 2 in Figure 1.

The Northwest Quadrant has significant terrain issues. In addition, the Airport's ASR is located in this area (the ASR critical area extends 1,500 feet around the facility) which would likely require the relocation of the ASR.

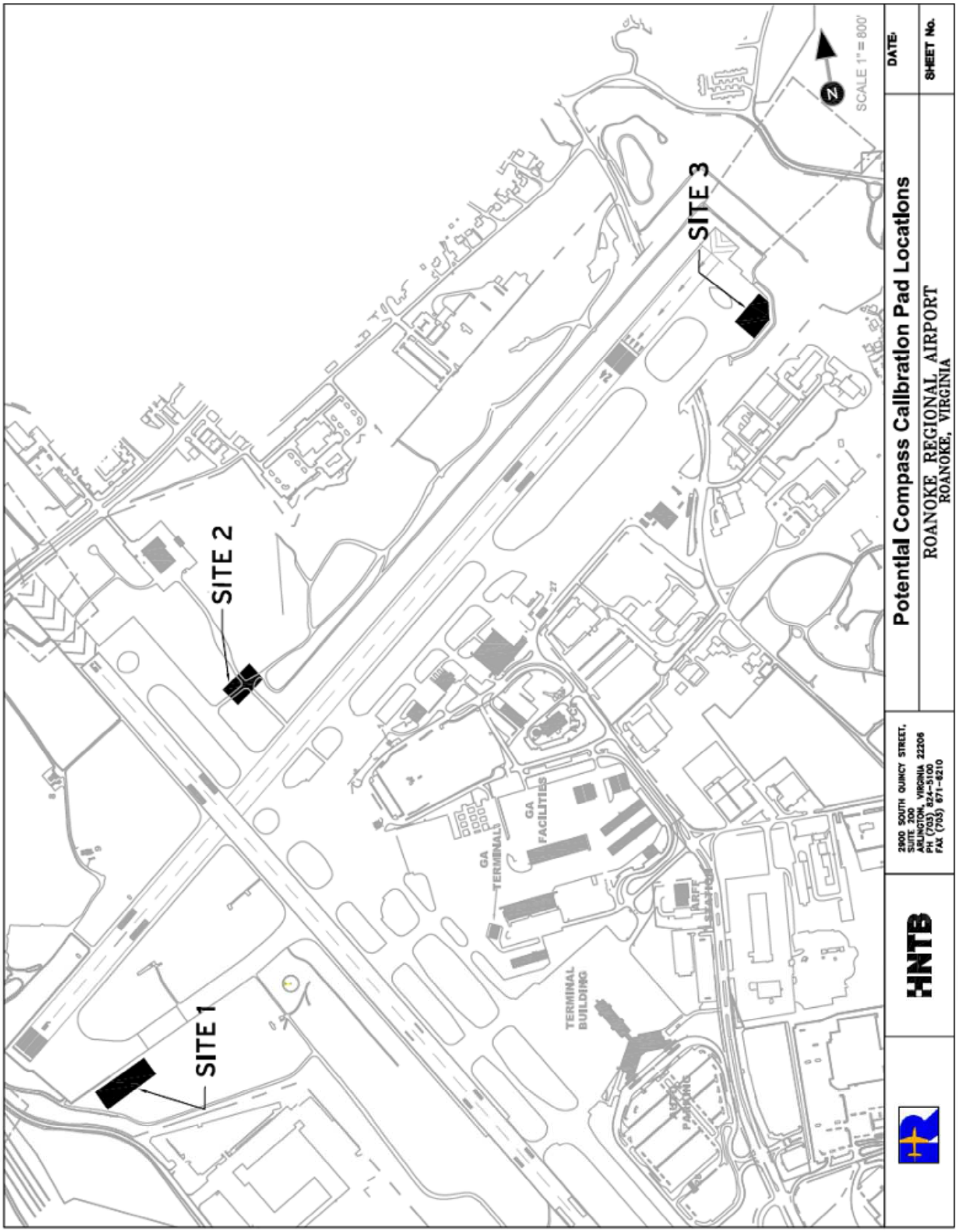


Figure 1—Compass Calibration Pad Test Sites

Results of Magnetic Field Survey

As noted previously, a summary report documenting the results and recommendations of a magnetic field survey was provided to Airport staff in March 2007. The survey indicated that the Airport is considered to be a "very active area". The survey indicates that, in order of suitability from a compass calibration pad viability standpoint, the preferred location is Site 2, followed by Site 3, and lastly, Site 1.

Site 2—Even though this is the best site, some remediation work would be required depending on the specific location selected. This remediation would include removal of a steel gate and posts currently located 50 feet south of the service road intersection, the excavation of buried ferrous materials to a depth of four to eight feet, and shifting an eight-foot high steel fence which lies north of the site by at least 300 feet.

Site 3—Based on the field survey, Site 3 is considered to be "marginal" as a candidate for a compass calibration pad. The survey showed manhole covers, taxiway lights, steel drains, a fence, and other objects that would have to be moved or replaced with non-metallic fixtures. In addition, the compass calibration pad would be located on the runup pad for Runway 24 which would limit its use to periods when aircraft were not using the runway. (FAA may not provide funding for a pad at that location.)

Site 1—Readings at Site 1 were well beyond the tolerances required for a compass calibration pad, suggesting that a significant amount of remediation work would be required to make the site feasible. There are two large areas with magnetic anomalies which indicate buried ferrous material. There are also two areas where magnetic material is on the surface. Finally, the area has a poor overall magnetic strength.

Additional Information Regarding Need for Compass Calibration Pad at ROA

ROA is a site-constrained facility due to surrounding development and topography. These site constraints may make it difficult to locate some desired facilities without incurring significant development costs. In addition, based on the field magnetic survey, the terrain upon which the airfield lies has numerous magnetic anomalies and disturbances. Finally, because the optimal site for a calibration pad appears to impact the recommended site for a new ARFF facility, phone conversations were held with representatives from Landmark Aviation and Piedmont Airlines to confirm their compass calibration pad requirements.

Discussion with Landmark Aviation

A phone conversation was held with Karen Roberts, Vice President and General Manager of Landmark's ROA operation and Jim Wright, Avionics Supervisor for Landmark in late March 2007 to discuss the need for a compass calibration pad.

Mr. Wright noted that a compass calibration pad is not required for their maintenance activity and suggested that, perhaps, their desire for a pad was "overstated" to the Airport.

When they calibrate an aircraft's primary compass, they use the aircraft's standby compass. This procedure typically involves placing the aircraft in a clear, open area, taking the standby compass to a point about 20 to 30 feet from the aircraft's nose (for typical GA aircraft) and conducting the calibration procedures to provide an accuracy range to within three degrees, which is the typical range expressed in most aircraft owner's manuals.

Mr. Wright also said that a calibrated standby compass kit can be used. This process is "a little more difficult" but appears to provide more accurate results. A compass calibration pad is not needed to use the kit. According to company literature, the standby compass calibrator eliminates the need for physically rotating the aircraft, reduces the number of technicians for the calibration process, and reduces overall calibration time.

Mr. Wright noted that, although their operation did not require a compass calibration pad, he did express a desire to have a designated area to perform the calibration process. For safety concerns, he would prefer that the pad be located at a site that would not require his maintenance staff to cross taxiways and runways as they traveled between their hangar and the site.

Discussion with Piedmont Airlines Maintenance

A phone conversation was held in early April 2007 with staff from the Piedmont Airlines maintenance base, including Dwayne Devinney, Maintenance Manager and Harry Abels, Avionics Supervisor.

Piedmont Airlines performs about two or three calibrations per month. According to Piedmont, there are very few certified compass calibration pads on the East Coast.

Because there is no certified compass calibration pad at ROA, Piedmont did an "in-house stability test" using the guidelines outlined by the compass manufacturer and selected a site at the west end of Taxiway E, between E and E1 for their calibration process. Initially, Piedmont had difficulty getting the local FSDO to accept their calibration procedure, as it did not occur on a certified calibration pad; however, recognizing that no pad was available and that there were few airports on the East Coast that had a pad, the FAA conditionally approved Piedmont's procedure.

In summary, Mr. Devinney noted that, although it would be desirable to have a compass calibration pad, it was not necessary for their operation at this point and would not likely affect the long-term viability of their ROA facility.

Further Action

Based on the field survey, Site 2 is the preferred location for a compass calibration pad. It should be noted, however, that the Site 2 location is in the vicinity of the proposed ARFF station site. To minimize the possibility of magnetic interference, the ARFF station should be at least 400 feet to 450 feet from the center of the pad which could increase response times or increase development cost. The Master Plan Team will work with Airport Staff to establish development priorities for these two facilities and identify their optimal locations.

APPENDIX T

Transient Airship Mooring Site

White Paper

ROANOKE REGIONAL AIRPORT
MASTER PLAN UPDATE

Transient Airship Mooring Site White Paper

Introduction

Due to its proximity to Virginia Polytechnic Institute and State University (Virginia Tech), commercial airships occasionally desire to moor at Roanoke Regional Airport (ROA) to cover sporting events. For this reason, the existing airfield was examined to determine if an adequate airship mooring site could be identified.

Airship Landing Facility Planning Parameters

There are no FAA standard design criteria for airship landing sites. The planning parameters used in this effort were based a review airship dimensions and discussions with the current manager (and a former chief pilot) for a major airship operator.[1]

For any particular airship flight, the selection of a landing area is ultimately left to the pilot-in-charge. Typically, however, 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. Based on the dimensions of the largest airships typically used and the information provided by the airship operations manager, the following planning criteria were assumed:

- Airship dimensions—Length: 192 feet, height: approx. 60 feet
- Airship height when moored (assuming 5-ft. ground clearance): Approx. 65 feet
- Mooring mast height: Approx. 35 feet.
- Airship would approach airport in standard traffic pattern.
- Airship operator desires 35-acre area for maneuvering and mooring. This translates into either a circular site with a 700-foot radius or a rectangular site with four sides 1,235 feet long. (Operator acknowledges that most sites cannot provide this large an area.)
- Require minimum 300-foot radius of clear area around mast with relatively level ground and no terrain undulation.
- Airship could land and depart on active runway.
- Airship would taxi to mooring site.
- Moored airship must remain clear of object free areas, NAVAID critical areas, and Part 77 surfaces.

[1] Telephone discussion with Dr. Jim Maloney, manager of airship operations for the Goodyear Tire and Rubber Company, January 12, 2007.

- Airship mooring site should not result in extended operational impact for other Airport facilities.

Figure 1 shows the Goodyear Airship Facility at Pompano Beach, Florida, while **Figure 2** shows the Goodyear Airship Facility at Carson, California which is their smallest facility.

Figure 1—Goodyear Airship Facility, Pompano Beach, FL (Google Earth)

Figure 2*—Goodyear Airship Landing Facility, Carson, CA (Google Earth)*

Screening ROA for Potential Airship Mooring Sites

The existing Airport layout was examined to see if any site could be identified that would meet the criteria listed above. The development within the southeast quadrant of the Airport (terminal area, general aviation facilities, airline maintenance, and air cargo) precludes mooring an airship in this area. The land in the northeast portion of the Airport has significant grade issues and is too narrow in most locations to serve as a temporary mooring site. Similar issues apply to the southwest quadrant. While the Northwest Quadrant is large enough to accommodate an airship, the site has grading issues. An airship in this area could also interfere with the FAA's ASR installation.

The preliminary review above indicates there are no sites on-airport that could accommodate an airship mooring site without impacting daily operations.

Recommendation

The current Airport property does not provide a location suitable for occasional airship use without resulting in a closure of a portion of the airfield. (For example, based on our contact's recollection, the airship was moored at ROA several years ago in a location that required the closing of the crosswind 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 that could accommodate an airship but also serve as a buffer between the Airport and competing land uses.

APPENDIX U

Property Acquisition

Property Acquisition

The Master Plan Update recommends that the Commission acquire approximately 220 acres of land in the vicinity of the Airport. The identification of particular parcels was based on meeting the Airport's goals and objectives, outlined in Chapter 1 of the Master Plan Update Technical Report—in particular, developing a Plan that:

- Ensures the Airport is safe and reliable (Goal 1);
- Meets security requirements (Goal 2);
- Meets the region's future aviation needs (Goal 3);
- Is flexible and adaptable to changing conditions (Goal 5); and
- Supports local and regional economic goals and plans without constraining long-term Airport development (Goal 7).

Figure 1 illustrates the recommended parcels to be acquired. Following is a discussion of the Master Plan Update land acquisition strategy.

1.1 Safety Related Property Acquisition

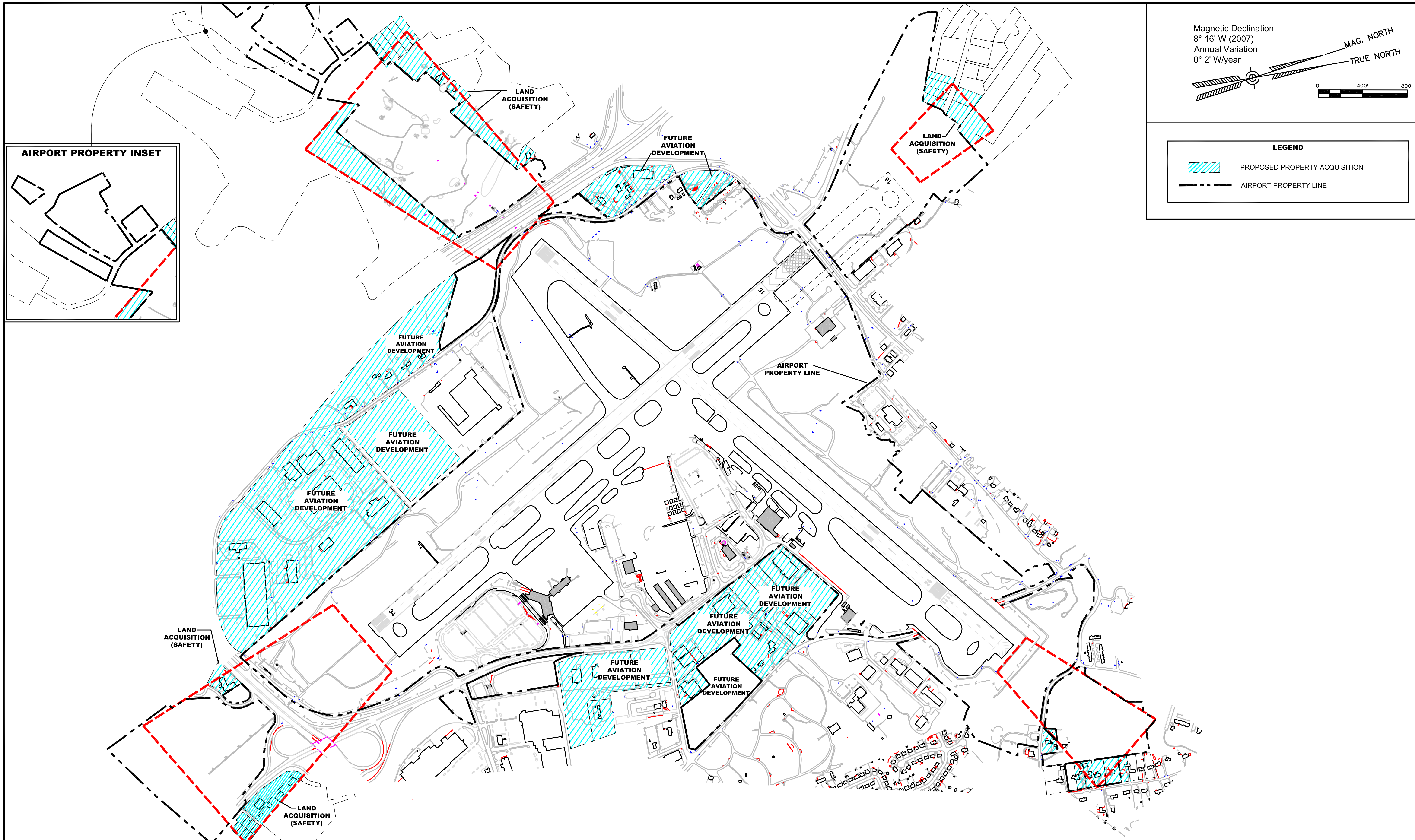
FAA Advisory Circular 150/5300-13, *Airport Design*, recommends that airport sponsors control the land within Runway Protection Zones (RPZs), either through outright ownership or by easement.

To comply with this guidance, the Master Plan Update recommends that the Commission acquire 16 acres of land along the Runway 33 RPZ, about five acres along the Runway 24 RPZ, and approximately 23 acres along the Runway 6 RPZ.

The 16 acres along the Runway 33 RPZ is owned and occupied by multiple private residential owners, a motel, a Boy Scout facility, and a 10.4-acre multi-family residential development. The total assessed value of these parcels is approximately $13.8 million.[1] It is possible that only a portion of the multi-family development could be acquired—that portion within the RPZ, lowering the overall cost; however, for planning purposes, the cost of acquiring the entire property was assumed.

The five acres along the Runway 24 RPZ consists of private residences. The assessed value of the land is approximately $0.8 million.

[1] Assessed values were obtained from the City and County GIS sites over a period of several months and are used as order-of-magnitude land acquisition costs. Actual purchase price would be based on market conditions at the time of sale and through negotiation. Costs for managing the property acquisition, surveys, appraisals, inspections, legal fees, and property management after the transfer are not included.



P:_Projects\40311 RDA Master Plan Update\Report\MP Final\Appendices\APP U-PROP ACQ FIGURE 1.dwg Figure 1 Property Acquisition Jun 27, 2008 - 9:43am

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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

PROPOSED PROPERTY ACQUISITION

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Jun 27, 2008

FIGURE
1

The 23 acres along the Runway 6 RPZ includes 17 acres land owned by the City of Roanoke (operated as a golf course) and six acres of residential land. The assessed value of the residential land is approximately $1.3 million. In addition, the Airport will be releasing 17 acres beyond the RPZ in the near future.

Recognizing that ownership of these parcels will provide better control of development within RPZs, the Master Plan Update recommends that the Commission place a high priority on acquiring these properties as they become available.

1.2 Properties to be Acquired for Development

Developable areas around the Airport are limited due to surrounding topography and existing development. To provide additional land for future aviation development, the Master Plan Update recommends acquiring 179 acres in Northwest, Southwest, and Southeast Quadrants.

1.2.1 Northwest Quadrant

The Northwest Quadrant of the Airport has long been identified as a location for future aviation development, and the Airport already owns much of the land bounded by the airfield and Thirlane Road, including about half of the area occupied by a trailer park. To maximize development flexibility, the Master Plan Update recommends acquiring the rest of the trailer park land as well as several acres between Thirlane Road and the I-581 right-of-way, for a total of about 12 additional acres.

The Master Plan recommends placing a high priority on acquiring this additional land as it will enable the Commission to begin grading the site as dirt fill becomes available. The assessed value of this land is approximately $2.3 million.

Although providing additional runway length does not prove to be cost-effective during the planning horizon, prudent planning suggests that the Airport provide the opportunity to lengthen one of its runways at some point beyond this 20-year period. As lengthening Runway 15-33 to the northwest was determined to be the least expensive option, the Master Plan Update recommends acquiring approximately six acres of land where the future Runway 15 RPZ would be relocated, assuming a 1,900-foot extension. The cost for this additional land is approximately $330,000. Because the lengthening of this runway is not cost-justifiable within the planning horizon, this acquisition of this land should currently be given a low priority.

1.2.2 Southwest Quadrant

BT Properties owns the 47-acre parcel currently occupied by the UPS ground sort facility. An 18-acre portion of this land, southeast of the UPS facility has remained undeveloped and should be acquired by the Airport. In the near term, the acquisition of this land would enable the Commission to control development, and ultimately, the parcel could be developed for aviation use. For this reason, the Master Plan Update recommends placing a high priority on acquiring this land. The approximate assessed value for this southeastern portion of the BT Properties land is approximately $1.4 million.

The Master Plan Update also recommends acquiring the remaining 89 acres of land in the Southwest Quadrant bounded by I-581 and the airfield. Most of this land is zoned commercial. As with the UPS property, the acquisition of this land would enable the Commission to better ensure compatible development and ultimately would provide land for future aviation development. Recognizing the significant acquisition cost ($20.3 million), overall complexity of acquiring these properties, and the very long term nature of future aviation development on these parcels, the Master Plan Update recommends assigning this area a low level of priority.

1.2.3 Southeast Quadrant

The land bordering the southeast quadrant of the Airport has seen significant commercial development over the last several years. The Master Plan Update has identified several land parcels in this area that should be acquired by the Airport.

The acquisition of approximately 47 acres of commercial/industrial land either directly adjacent to the cargo apron or along Aviation Drive would serve to control development in the vicinity of the Airport in the near term and ultimately would provide needed land for future aviation development beyond the 20-year planning horizon. The assessed value of this land is approximately $11.1 million. Because of this land's adjacency to existing aviation development, the Master Plan Update recommends placing a high priority on the acquisition of these parcels.

An additional seven acres of commercial/industrial land along Municipal Drive and Airport Road is also recommended to be acquired; however, because the land is not immediately adjacent to existing aviation development, the Master Plan Update recommends that the acquisition be given a low priority. The assessed value of this land is about $1.9 million.

1.3 Summary

Consistent with the Commission's operating policy, the Master Plan Update recommends the Airport continue to assess the value of acquiring properties in the Airport vicinity as they become available for purchase. The analysis provides initial guidance on merits of various properties surrounding the Airport. However, recognizing the dynamic nature of the real estate industry, the Commission should periodically reevaluate their property acquisition priorities.

APPENDIX V

Airport Layout Plan

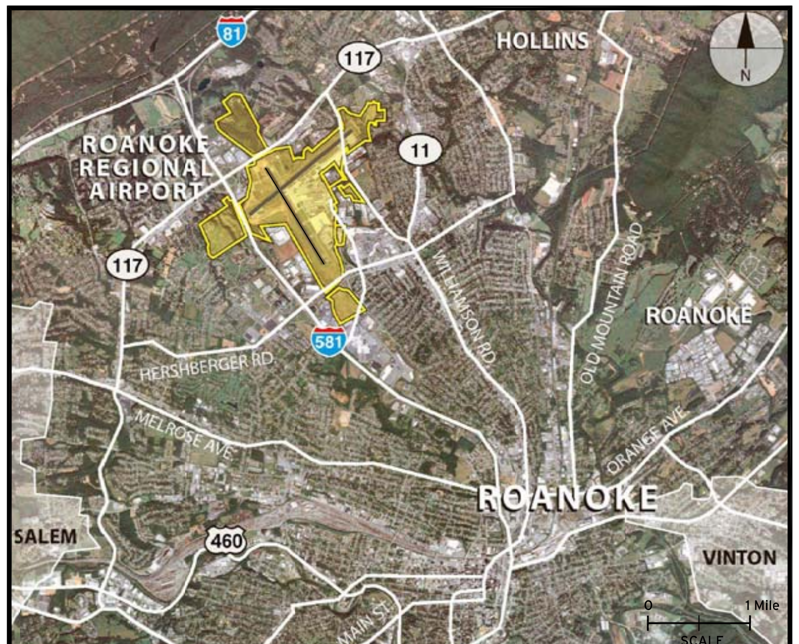
Reduced Size Set

ROANOKE REGIONAL AIRPORT

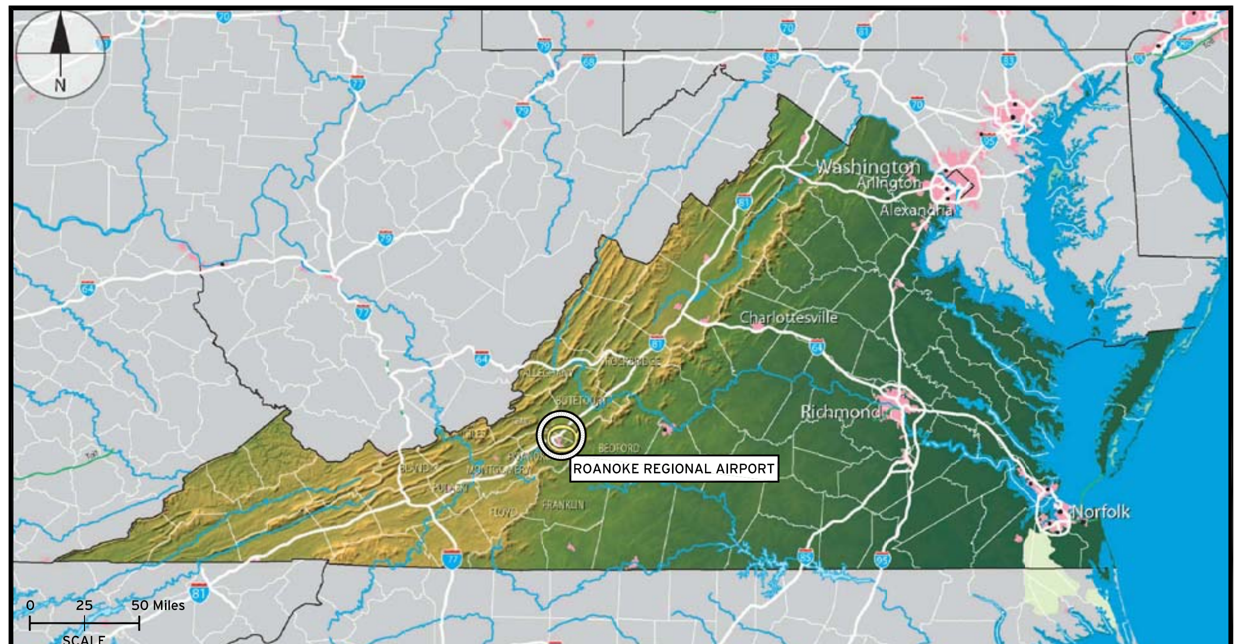
AIRPORT MASTER PLAN UPDATE

PROJECT # 40311 **AIP#: 3-51-0045-39**

APRIL 2009



VICINITY MAP



REGIONAL LOCATION MAP

Airport Layout Plan Sheet List	
1	COVER SHEET
2	EXISTING AIRPORT LAYOUT
3	PROPOSED AIRPORT LAYOUT
4	DATA SHEET
5	TERMINAL AREA PLAN
6	GENERAL AVIATION AND CARGO AREA PLAN
7	PART 77 AIRSPACE SURFACES
8	PART 77 CONICAL SURFACE
9	20 YEAR NOISE CONTOUR/OFF-AIRPORT LAND USE
10	RUNWAY 6 APPROACH AND PROFILE
11	RUNWAY 24 APPROACH AND PROFILE
12	RUNWAY 16 APPROACH AND PROFILE
13	RUNWAY 34 APPROACH AND PROFILE
14	RUNWAY OBSTRUCTION CHART
15	ON-AIRPORT LAND USE
16	AIRPORT PROPERTY MAP
17	AIRPORT PROPERTY MAP DATA SHEET
18	AVIGATION EASEMENT MAP
19	AVIGATION EASEMENT MAP DATA SHEET

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
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COVER SHEET

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

SHEET No. 1

LEGEND

	EXISTING
Object Free Area	ROFA
Runway Safety Area	RSA
Obstacle Free Zone	OFZ
Runway Visibility Zone	RVZ
Building Restriction Line*	BRL
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	
Hold Lines	

(#) AIRPORT BUILDINGS

BLDG. NO.	DESCRIPTION	ELEV. MSL	ELEV. AGL	Notes
4	Maintenance Hangar	1190'	23'	Ult. to be rem.
5	Cargo Building	1186'	16'	To be rem. Ph. II
6	Remote Demarcation Point	1178'	7'	
7	ATCT Facility	1372'	200'	
8	Storage Building - FAA	1182'	15'	To be rem. Ph. II
9	Storage Building - FAA	1180'	13'	To be rem. Ph. II
16	T-hangar	1182'	14'	
17	Storage Hangar	1183'	16'	To be rem. Ph. I
18	Storage Hangar & Office	1183'	16'	To be rem. Ph. I
19	Storage Hangar	1185'	16'	To be rem. Ph. I
20	Storage Hangar	1186'	17'	To be rem. Ph. I
21	ARFF Facility	1186'	20'	
22	FBO Maintenance Hangar	1187'	29'	To be rem. Ph. II
23	GA Terminal Building	1176'	18'	To be rem. Ph. II
24	FBO T-hangar	1168'	13'	Ult. to be rem.
25	FBO Maintenance Hangar	1189'	23'	To be rem. Ph. III
26	FBO T-hangar	1182'	14'	
27	Electrical Vault	1179'	12'	
28	Parking Exit Toll Building	1152'	15'	
29	FBO Hangar	1197.5'	34.5'	
30	Terminal Building	1185'	32'	
31	Airfield Maintenance Bldg.	1163'	30'	
32	Corp. Storage Hangar	1188'	21'	
33	Parking Lot Booth	1157'	19'	
A	FedEx Trailer	1168'	10'	Ult. to be rem.
B	FedEx Trailer	1168'	10'	Ult. to be rem.
C	FedEx Cargo Building	1202'	44'	Ult. to be rem.
D	Trailer	1168'	10'	Ult. to be rem.
E	UPS Trailer	1170'	12'	Ult. to be rem.
F	Trailer	1154'	12'	Ult. to be rem.

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

MAG. NORTH
TRUE NORTH

0' 400' 800'

NOTE: NO OFZ PENETRATION

*BUILDING RESTRICTION LINE BASED ON FAR PART 77 OBSTRUCTION CLEARANCE AND ASSUMES 35 FOOT BUILDING HEIGHT

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
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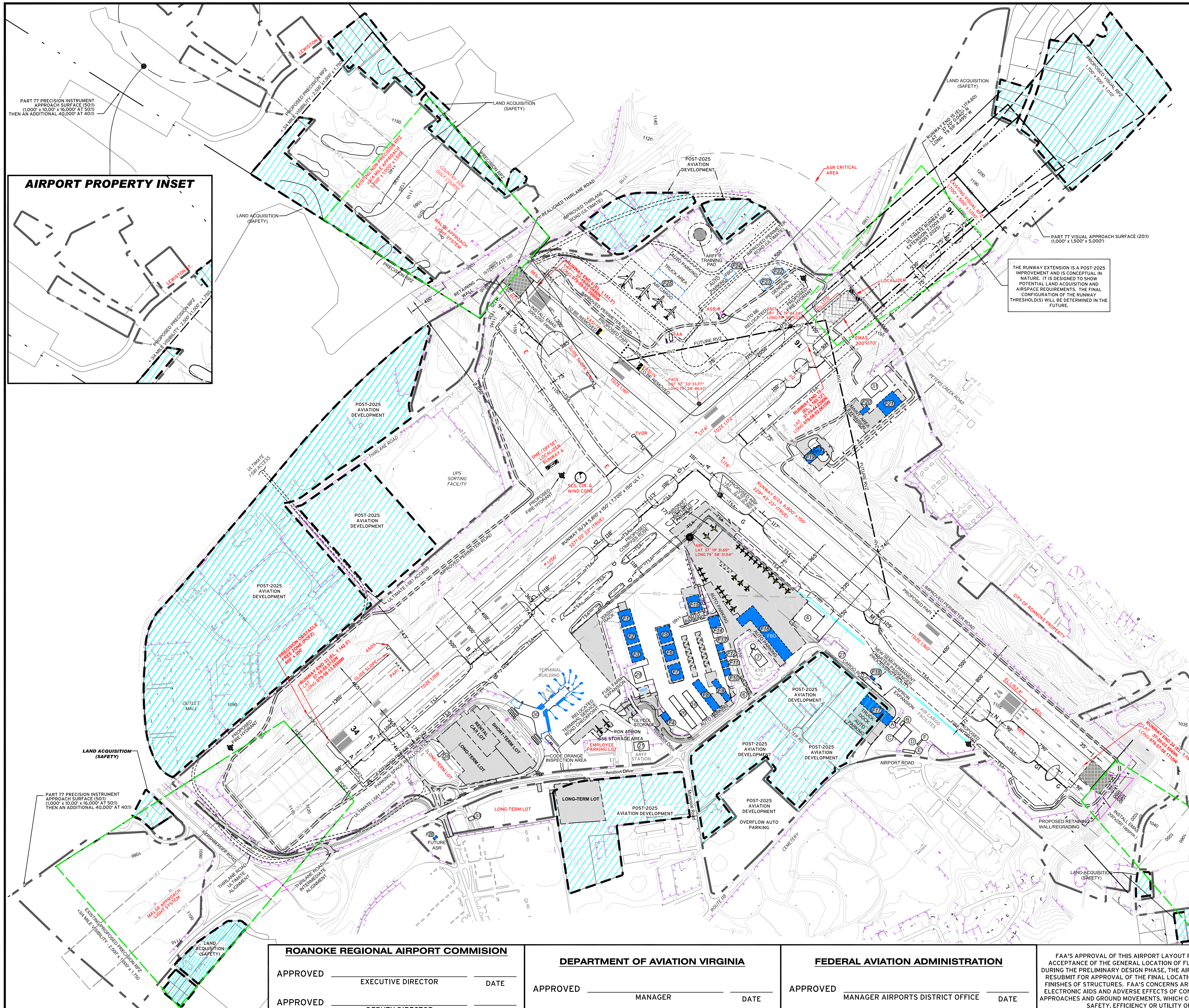
EXISTING AIRPORT LAYOUT

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Jun 29, 2009

SHEET No.
2



LEGEND

	EXISTING	FUTURE
Object Free Area	ROFA	ROFA
Runway Safety Area	RSA	RSA
Obstacle Free Zone	OFZ	OFZ
Runway Visibility Zone	RVZ	RVZ
Taxiway Safety Area	TSA	TSA
Building Restriction Line*	BRL	BRL
Roads/Landside Pavement		
Airfield Pavement		
Ultimate Airfield Development	N/A	
Demolition	N/A	
Runway Protection Zone		
On-Airport Property Buildings		
Ultimate On-Airport Buildings	N/A	
Off-Airport Property Buildings		
Property Line		
Fence Line		
Hold Lines		

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

MAG. NORTH
TRUE NORTH

0' 500' 1000'

NOTE: NO OFZ PENETRATIONS

*BUILDING RESTRICTION LINE BASED ON FAR PART 77 OBSTRUCTION CLEARANCE AND ASSUMES 35 FOOT BUILDING HEIGHT

THE ATCT IS CURRENTLY OPERATIONAL 24 HOURS A DAY, SEVEN DAYS A WEEK. SHOULD THESE HOURS BE REDUCED, A NOTAM WOULD NEED TO BE ISSUED FOR PERIODS WHEN THE TOWER IS NOT OPERATIONAL REQUIRING THE CLOSURE OF ONE RUNWAY.

AIRPORT BUILDINGS

BLDG. NO.	DESCRIPTION	ELEV. MSL	ELEV. AGL	Notes
4	Maintenance Hangar	1190'	23'	Ult. to be rem.
5	Cargo Building	1186'	16'	To be rem. Ph. II
6	Remote Demarcation Point	1178'	7'	
7	ATCT Facility	1372'	200'	
8	Storage Building - FAA	1182'	15'	To be rem. Ph. II
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16	T-hangar	1182'	14'	
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B	FedEx Trailer	1168'	10'	Ult. to be rem.
C	FedEx Cargo Building	1202'	44'	Ult. to be rem.
D	Trailer	1168'	10'	Ult. to be rem.
E	UPS Trailer	1170'	12'	Ult. to be rem.
F	Trailer	1154'	12'	Ult. to be rem.

FUTURE BUILDINGS

BDG. NO.	DESCRIPTION	ELEV. MSL	ELEV. AGL	Construction Phase
F1	Conventional Hangar	1200'	40'	Phase II
F2	Conventional Hangar	1200'	40'	Phase II
F3	Conventional Hangar	1200'	40'	Phase II
F4	Conventional Hangar	1175'	15'	Phase II
F5	Conventional Hangar	1200'	40'	Phase III
F6	Conventional Hangar	1200'	40'	Phase III
F7	Conventional Hangar	1200'	40'	Phase III
F8	T-Hangars	1175'	15'	Phase I
F9	T-Hangars	1175'	15'	Phase II
F10	Small Conventional Hangar	1175'	15'	Phase I
F11	Small Conventional Hangar	1175'	15'	Phase I
F12	Small Conventional Hangar	1175'	15'	Phase I
F13	Small Conventional Hangar	1175'	15'	Phase I
F14	Conventional Hangar	1190'	30'	Phase II
F15	Conventional Hangar	1200'	40'	Phase III
F16	FBO Building	1190'	30'	Phase II
F17	Air Cargo	1190'	30'	Phase III
F18	Charter Facility	1180'	20'	Phase II
F19	ARFF (Relocated)	1174'	20'	Phase I
F20	Maintenance Storage	1185'	20'	Phase II
F21	Maintenance Building	1195'	30'	Phase II
F22	Conventional Hangar	1180'	15'	Post 2025
F23	Conventional Hangar	1180'	15'	Post 2025
F24	GA FBO Building	1180'	20'	Post 2025
F25	Air Cargo	1190'	30'	Post 2025
F26	ASR (Relocated)	1190'	60'	TBD

PHASE I: 2008 - 2012
PHASE II: 2013 - 2017
PHASE III: 2018 - 2025
(ACTUAL TIMING OF CONSTRUCTION DEPENDENT ON NEED, MARKET CONDITIONS, AND FUNDING AVAILABILITY.)

ROANOKE REGIONAL AIRPORT COMMISION

APPROVED ______ EXECUTIVE DIRECTOR ______ DATE

APPROVED ______ DEPUTY DIRECTOR ______ DATE

DEPARTMENT OF AVIATION VIRGINIA

APPROVED ______ MANAGER ______ DATE

FEDERAL AVIATION ADMINISTRATION

APPROVED ______ MANAGER AIRPORTS DISTRICT OFFICE ______ DATE

FAA'S APPROVAL OF THIS AIRPORT LAYOUT PLAN (ALP) REPRESENTS ACCEPTANCE OF THE GENERAL LOCATION OF FUTURE FACILITIES DEPICTED. DURING THE PRELIMINARY DESIGN PHASE, THE AIRPORT OWNER IS REQUIRED TO RESUBMIT FOR APPROVAL OF THE FINAL LOCATIONS, HEIGHTS AND EXTERIOR FINISHES OF STRUCTURES. FAA'S CONCERNS ARE OBSTRUCTIONS, IMPACT ON ELECTRONIC AIDS AND ADVERSE EFFECTS OF CONTROLLER VIEW OF AIRCRAFT APPROACHES AND GROUND MOVEMENTS, WHICH COULD ADVERSELY AFFECT THE SAFETY, EFFICIENCY OR UTILITY OF THE AIRPORT.

NO.	BY	DATE	REVISIONS

NOTES

ROANOKE REGIONAL AIRPORT MASTER PLAN UPDATE: AIP#: 3-51-0045-39

HNTB

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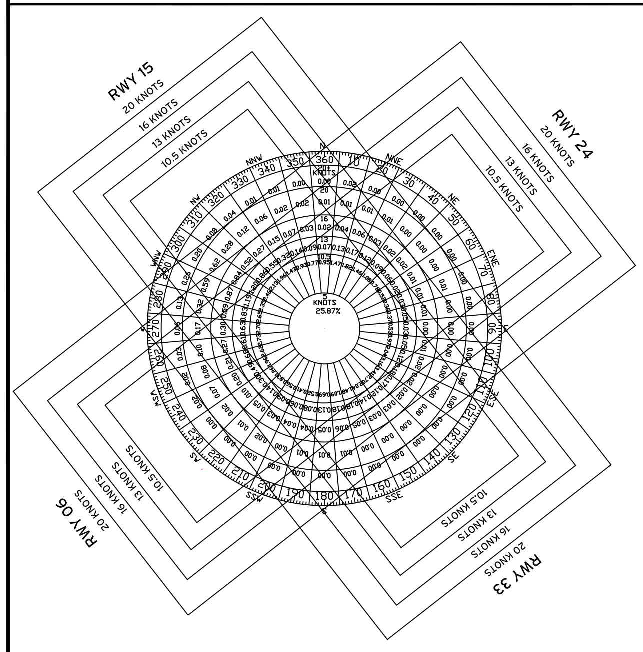
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

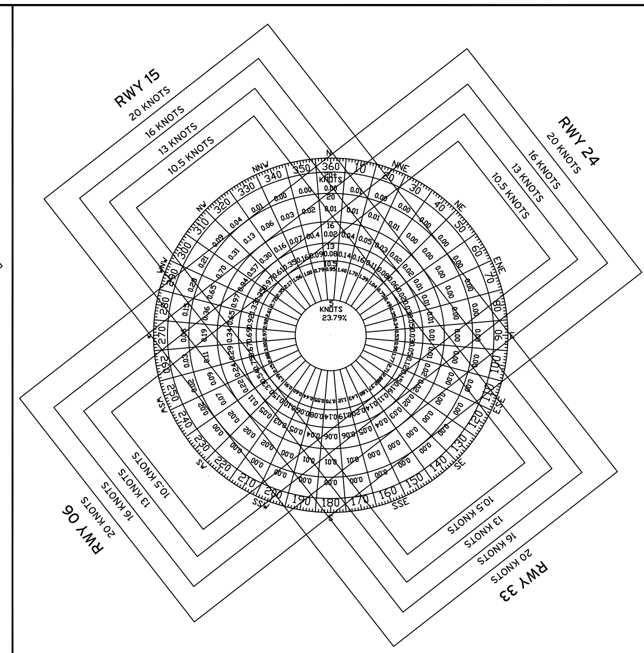
PROPOSED AIRPORT LAYOUT

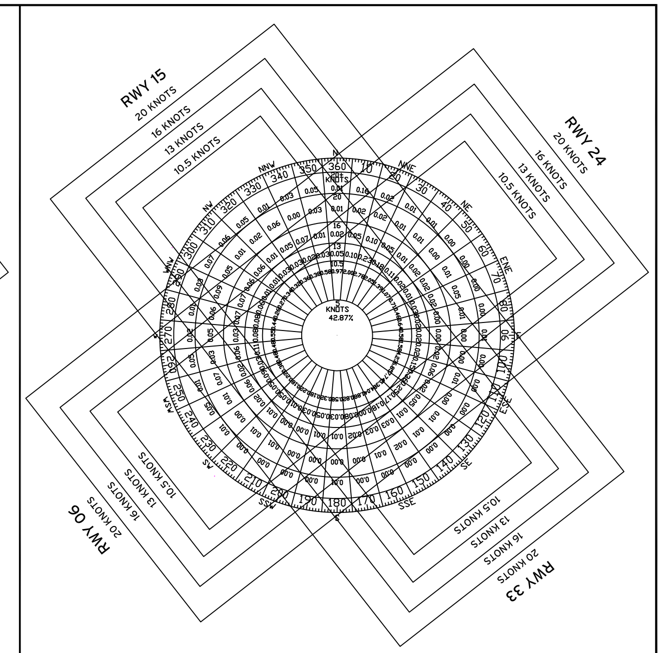
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

SHEET No. 3







All-Weather Runway Wind Coverage

Condition	06-24	15-33	Combined
10.5-knot	89.1%	94.1%	98.1%
13.0-knot	95.0%	97.9%	99.4%
16.0-knot	98.0%	99.3%	99.9%
20.0-knot	99.6%	99.9%	100.0%

Visual Flight Rule Runway Wind Coverage

Condition	06-24	15-33	Combined
10.5-knot	88.1%	93.6%	97.9%
13.0-knot	94.5%	97.7%	99.3%
16.0-knot	97.9%	99.3%	99.9%
20.0-knot	99.6%	99.1%	100.0%

Instrument Flight Rule Runway Wind Coverage

Condition	06-24	15-33	Combined
10.5-knot	97.2%	98.0%	99.4%
13.0-knot	98.7%	99.0%	99.7%
16.0-knot	99.3%	99.4%	99.9%
20.0-knot	99.7%	99.8%	100.0%

Station: KROA
Period: 1996 - 2005
Observations: 84,427
Source: National Climatic Data Center (1996-2005); HNTB analysis.

AIRPORT DATA		EXISTING	FUTURE
Airport Elevation		1,174.5' (MSL)	1,174.6' (MSL)
Airport Reference Point (NAD 83)			
	Lat	N 37° 19' 31.69"	37° 19' 34.38"
	Long	W 79° 58' 31.54"	79° 58' 35.79"
Mean Max. Temperature of Hottest Month		85.3	SAME
Airport Terminal Area NAVAIDS		ILS, VOR, LOC, ASOS	SAME
Magnetic Variation		8° 16' W (2007) ANNUAL VAR. 0° 2' W/YR	
Airport Reference Code		C-IV	SAME
Design Aircraft		A300	SAME
NPIAS/VATSP Service Role		COMMERCIAL	SAME

RUNWAY DATA	EXISTING		FUTURE	
	06-24	15-33	06-24	16-34
Airport Reference Code (ARC)	C-IV	C-IV	SAME	SAME
Runway Length/Width	6,800' x 150'	5,810' x 150'	6,800' x 150'	7,700' x 150'
Threshold Displacement	0 - 790'	NONE	0 - 790'	NONE
Runway Bearing (true)	049 - 229	148 - 328	SAME	SAME
Effective Runway Gradient (Percent)	0.36 -0.36	0.5 - 0.5	SAME	SAME
Runway End Elevation (AMSL)	1151.5' - 1150.3'	1165.1' - 1142.5'	SAME	1174.60' - SAME
Displaced Threshold Elevation (AMSL)	N/A - 1,152.4'	N/A	N/A	TBD - N/A
Pavement Strength (Pounds)	SW-150,000/DW-200,000/DT-310,000		SAME	
Pavement Material	GROOVED BITUM.	GROOVED BITUM.	SAME	SAME
Runway Approach Surfaces	34:1 - 34:1	20:1 - 50:1	50:1 - 34:1	SAME
Visiblity Minimums (1)(miles)	3/4 - 1	N/A - 1/2	≤3/4 - SAME	SAME - SAME
Visual Aids	VASI, REIL - REIL	NONE - PAPI	SAME +PAPI - SAME +PAPI	SAME
Instrument Approach Aids	LOC (LDA/DME) - NONE	NONE - ILS		
Runway Marking	NON-PRECISION	BASIC - PRECISION	SAME	SAME
Approach Lighting	MALSR - NONE	NONE - MALSR	SAME	SAME
Runway/Taxiway Lighting	HIRL/MITL	HIRL/MITL	SAME	SAME
RSA (Length/Width)	7,150' x 500'	7,410 x 500' (2)	SAME w EMAS INSTALLATIONS	SAME
Required RSA (Length/Width)	8,802' x 500'	7,810 x 500'	SAME	SAME
ROFA (Length/Width)	8,802' x 800'	7,810 x 800'	SAME	SAME
Required ROFA (Length/Width)	8,802' x 800'	7,810 x 800'	SAME	SAME
OFZ Penetrations	NONE	NONE	NONE	NONE
Threshold Siting Surface Object Penetrations	NONE	NONE	NONE	NONE
Critical Aircraft for Runway Length	EMB-145 @ 1,000 mile stage length (ult.)			

Sources: ROA Administration, FAA 5010 Data, HNTB Analysis.
Notes: SW = Single Wheel, DW = Dual Wheel
(1) Lowest published for slowest approach speed category. Consult approach plates for latest information.
(2) Runway 15-33 meets FAA RSA design standards with 1000-foot safety area on Runway 33 and EMAS on Runway 15

Modifications to FAA Standards

	Existing Condition	FAA Standard	Proposed Action	Date Approved
1	RWY to TWY separation of "A" from RWY 15 to TWY "G" is non-standard 330'	400' RWY to TWY separation	Permanent Modification	2/10/1999
2	147 foot taxiway safety area	171 foot taxiway safety area	Permanent Modification	2/10/1999
3	Max transverse grades in TSA exceed 1-1.5 percent slope	1-1.5 percent slope in taxiway safety area	Permanent Modification	2/10/1999
4	RWY to TWY separation of "A" from RWY 33 to TWY "B" is non-standard 365'	400' RWY to TWY separation	Permanent Modification	10/24/2006
5	RWY to TWY separation of "G" from TWY "A" to TWY "M" is non-standard 280'	400' RWY to TWY separation	Relocate TWY " G " to 365' where feasible.	10/24/2006
6	RWY 6/24 to TWY G separation is 330' (portion between TWY M and L)	400' RWY to TWY separation	Realign TWY to 365' once Bldg 4 reaches end of useful life	10/24/2006
7	Minimum Vertical Curve length on TWY C, D, L, and M	Min. 100' curve length per 1% grade change	Permanent Modification	10/24/2006
8	Required RSA of 1,000' at RWY Ends 6/24 are not available.	500' by 1000' RSA	Install 200x200' EMAS pads on both ends of RWY 6/24	To be submitted
9	Residential Buildings in RWY 24 and 34 End Runway Protection Zone	Residential prohibited within RPZ	Acquire property	To be submitted

Source: ROA, FAA

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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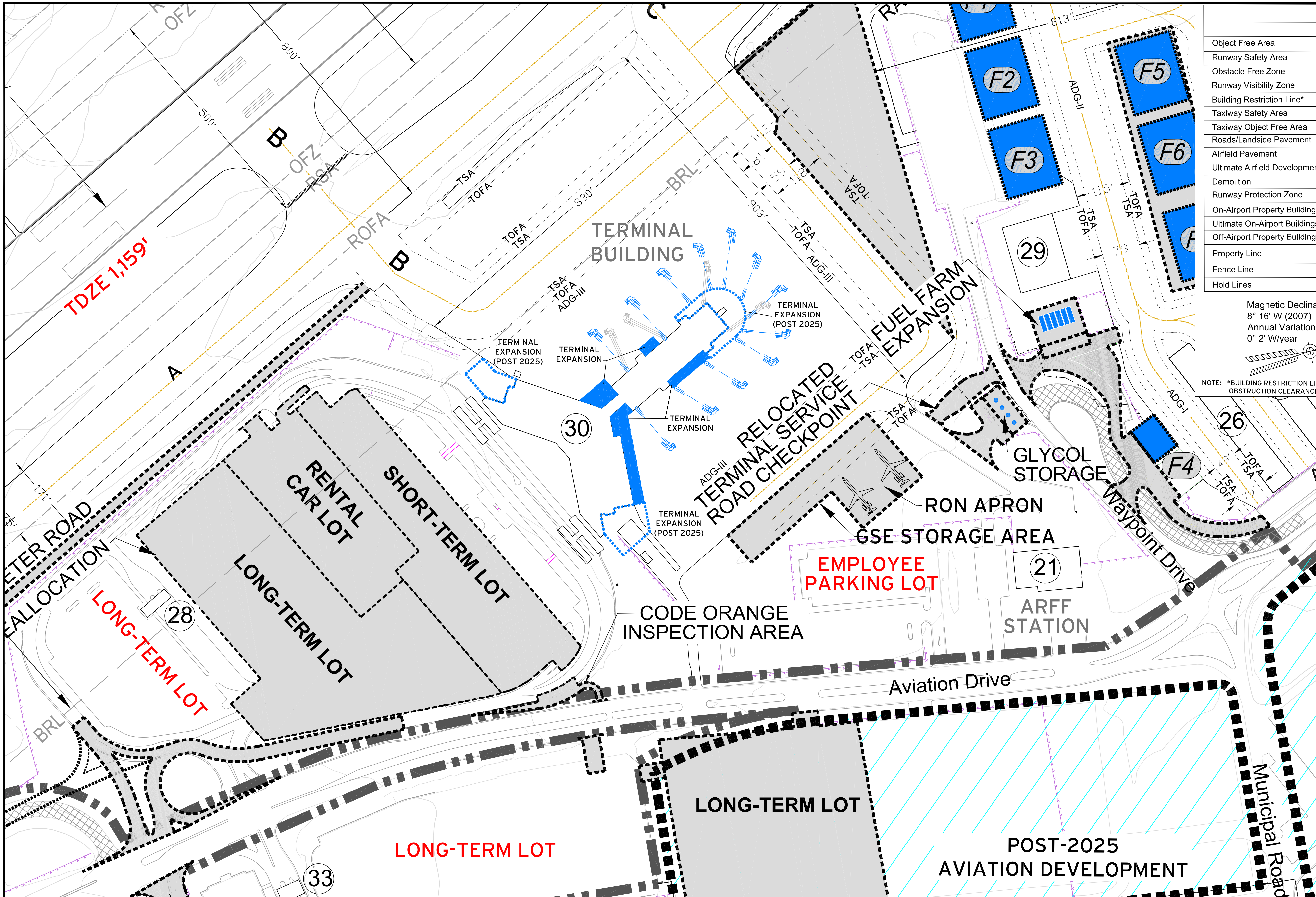
FAX (703) 671-6210

DATA SHEET

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Apr 29, 2009

SHEET No. 4



LEGEND

	EXISTING	FUTURE
Object Free Area		
Runway Safety Area		
Obstacle Free Zone		
Runway Visibility Zone		
Building Restriction Line*		
Taxiway Safety Area		
Taxiway Object Free Area		
Roads/Landside Pavement		
Airfield Pavement		
Ultimate Airfield Development	N/A	
Demolition	N/A	
Runway Protection Zone		
On-Airport Property Buildings		
Ultimate On-Airport Buildings	N/A	
Off-Airport Property Buildings		
Property Line		
Fence Line		
Hold Lines		

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

MAG. NORTH
TRUE NORTH

0' 100' 200'

NOTE: *BUILDING RESTRICTION LINE BASED ON FAR PART 77 OBSTRUCTION CLEARANCE AND ASSUMES 35 FOOT BUILDING HEIGHT

(#) AIRPORT BUILDINGS

BLDG. NO.	DESCRIPTION	ELEV. MSL	ELEV. AGL	Notes
4	Maintenance Hangar	1190'	23'	Ult. to be rem.
5	Cargo Building	1186'	16'	To be rem. Ph. II
6	Remote Demarcation Point	1178'	7'	
7	ATCT Facility	1372'	200'	
8	Storage Building - FAA	1182'	15'	To be rem. Ph. II
9	Storage Building - FAA	1180'	13'	To be rem. Ph. II
16	T-hangar	1182'	14'	
17	Storage Hangar	1183'	16'	To be rem. Ph. I
18	Storage Hangar & Office	1183'	16'	To be rem. Ph. I
19	Storage Hangar	1185'	16'	To be rem. Ph. I
20	Storage Hangar	1186'	17'	To be rem. Ph. I
21	ARFF Facility	1186'	20'	
22	FBO Maintenance Hangar	1187'	29'	To be rem. Ph. II
23	GA Terminal Building	1176'	18'	To be rem. Ph. II
24	FBO T-hangar	1168'	13'	Ult. to be rem.
25	FBO Maintenance Hangar	1189'	23'	To be rem. Ph. III
26	FBO T-hangar	1182'	14'	
27	Electrical Vault	1179'	12'	
28	Parking Exit Toll Building	1152'	15'	
29	FBO Hangar	1197.5'	34.5'	
30	Terminal Building	1185'	32'	
31	Airfield Maintenance Bldg.	1163'	30'	
32	Corp. Storage Hangar	1188'	21'	
33	Parking Lot Booth	1157'	19'	
A	FedEx Trailer	1168'	10'	Ult. to be rem.
B	FedEx Trailer	1168'	10'	Ult. to be rem.
C	FedEx Cargo Building	1202'	44'	Ult. to be rem.
D	Trailer	1168'	10'	Ult. to be rem.
E	UPS Trailer	1170'	12'	Ult. to be rem.
F	Trailer	1154'	12'	Ult. to be rem.

(F#) FUTURE BUILDINGS

BDG. NO.	DESCRIPTION	ELEV. MSL	ELEV. AGL	Construction Phase
F1	Conventional Hangar	1200'	40'	Phase II
F2	Conventional Hangar	1200'	40'	Phase II
F3	Conventional Hangar	1200'	40'	Phase II
F4	Conventional Hangar	1175'	15'	Phase II
F5	Conventional Hangar	1200'	40'	Phase III
F6	Conventional Hangar	1200'	40'	Phase III
F7	Conventional Hangar	1200'	40'	Phase III
F8	T-Hangars	1175'	15'	Phase I
F9	T-Hangars	1175'	15'	Phase II
F10	Small Conventional Hangar	1175'	15'	Phase I
F11	Small Conventional Hangar	1175'	15'	Phase I
F12	Small Conventional Hangar	1175'	15'	Phase I
F13	Small Conventional Hangar	1175'	15'	Phase I
F14	Conventional Hangar	1190'	30'	Phase II
F15	Conventional Hangar	1200'	40'	Phase III
F16	FBO Building	1190'	30'	Phase II
F17	Air Cargo	1190'	30'	Phase III
F18	Charter Facility	1180'	20'	Phase II
F19	ARFF (Relocated)	1174'	20'	Phase I
F20	Maintenance Storage	1185'	20'	Phase II
F21	Maintenance Building	1195'	30'	Phase II
F22	Conventional Hangar	1180'	15'	Post 2025
F23	Conventional Hangar	1180'	15'	Post 2025
F24	GA FBO Building	1180'	20'	Post 2025
F25	Air Cargo	1190'	30'	Post 2025
F26	ASR (Relocated)	1190'	60'	TBD

NO.	BY	DATE	REVISIONS	NOTES

HNTB

2900 SOUTH QUINCY STREET,
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TERMINAL AREA PLAN

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

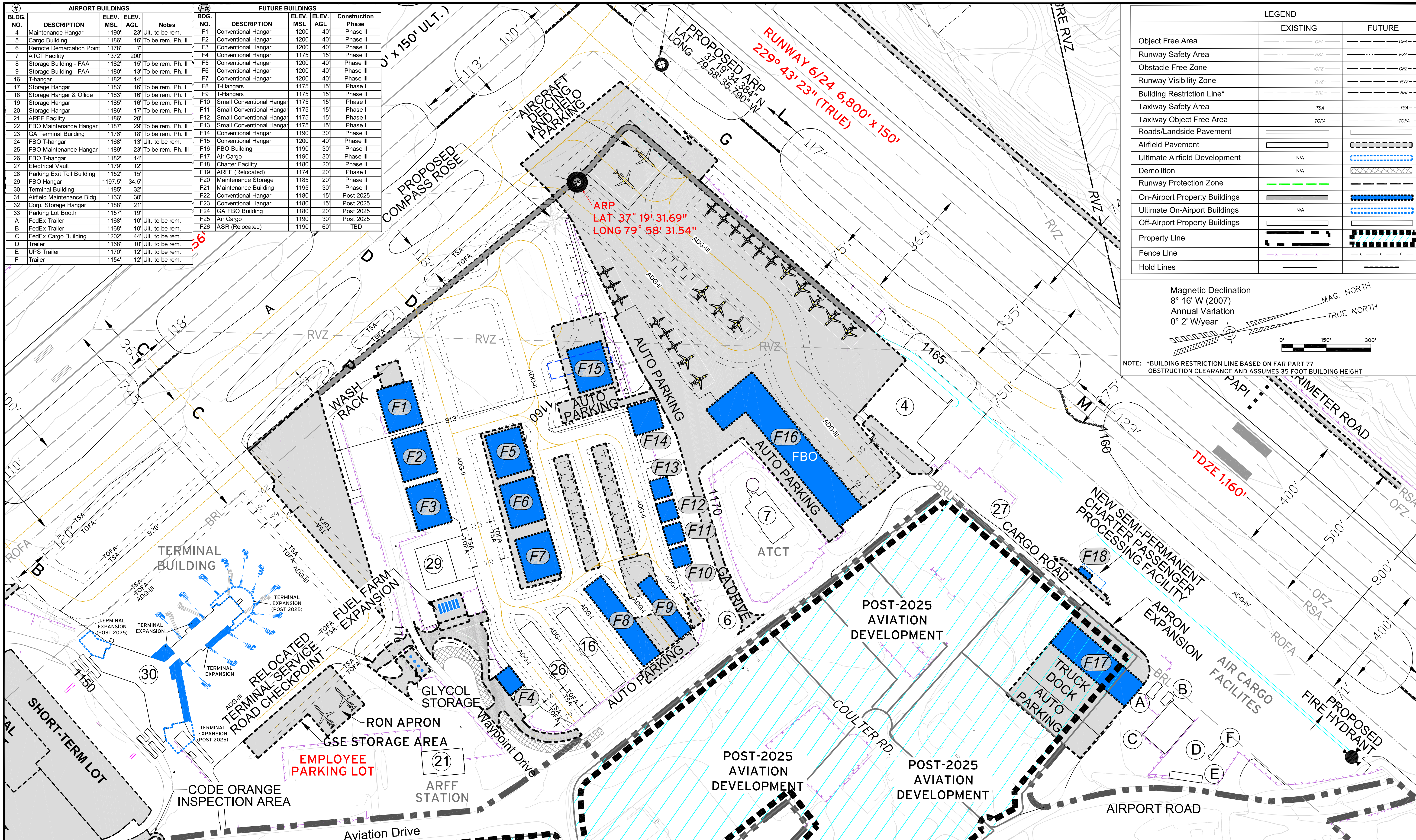
SHEET No. 5

AIRPORT BUILDINGS

BLDG. NO.	DESCRIPTION	ELEV. MSL	ELEV. AGL	Notes
4	Maintenance Hangar	1190'	23'	Ult. to be rem.
5	Cargo Building	1186'	16'	To be rem. Ph. II
6	Remote Demarcation Point	1178'	7'	
7	ATCT Facility	1372'	200'	
8	Storage Building - FAA	1182'	15'	To be rem. Ph. II
9	Storage Building - FAA	1180'	13'	To be rem. Ph. II
16	T-hangar	1182'	14'	
17	Storage Hangar	1183'	16'	To be rem. Ph. I
18	Storage Hangar & Office	1183'	16'	To be rem. Ph. I
19	Storage Hangar	1185'	16'	To be rem. Ph. I
20	Storage Hangar	1186'	17'	To be rem. Ph. I
21	ARFF Facility	1186'	20'	
22	FBO Maintenance Hangar	1187'	29'	To be rem. Ph. II
23	GA Terminal Building	1176'	18'	To be rem. Ph. II
24	FBO T-hangar	1168'	13'	Ult. to be rem.
25	FBO Maintenance Hangar	1189'	23'	To be rem. Ph. III
26	FBO T-hangar	1182'	14'	
27	Electrical Vault	1179'	12'	
28	Parking Exit Toll Building	1152'	15'	
29	FBO Hangar	1197.5'	34.5'	
30	Terminal Building	1185'	32'	
31	Airfield Maintenance Bldg.	1163'	30'	
32	Corp. Storage Hangar	1188'	21'	
33	Parking Lot Booth	1157'	19'	
A	FedEx Trailer	1168'	10'	Ult. to be rem.
B	FedEx Trailer	1168'	10'	Ult. to be rem.
C	FedEx Cargo Building	1202'	44'	Ult. to be rem.
D	Trailer	1168'	10'	Ult. to be rem.
E	UPS Trailer	1170'	12'	Ult. to be rem.
F	Trailer	1154'	12'	Ult. to be rem.

FUTURE BUILDINGS

BDG. NO.	DESCRIPTION	ELEV. MSL	ELEV. AGL	Construction Phase
F1	Conventional Hangar	1200'	40'	Phase II
F2	Conventional Hangar	1200'	40'	Phase II
F3	Conventional Hangar	1200'	40'	Phase II
F4	Conventional Hangar	1175'	15'	Phase II
F5	Conventional Hangar	1200'	40'	Phase III
F6	Conventional Hangar	1200'	40'	Phase III
F7	Conventional Hangar	1200'	40'	Phase III
F8	T-Hangars	1175'	15'	Phase I
F9	T-Hangars	1175'	15'	Phase II
F10	Small Conventional Hangar	1175'	15'	Phase I
F11	Small Conventional Hangar	1175'	15'	Phase I
F12	Small Conventional Hangar	1175'	15'	Phase I
F13	Small Conventional Hangar	1175'	15'	Phase I
F14	Conventional Hangar	1190'	30'	Phase II
F15	Conventional Hangar	1200'	40'	Phase III
F16	FBO Building	1190'	30'	Phase II
F17	Air Cargo	1190'	30'	Phase III
F18	Charter Facility	1180'	20'	Phase II
F19	ARFF (Relocated)	1174'	20'	Phase I
F20	Maintenance Storage	1185'	20'	Phase II
F21	Maintenance Building	1195'	30'	Phase II
F22	Conventional Hangar	1180'	15'	Post 2025
F23	Conventional Hangar	1180'	15'	Post 2025
F24	GA FBO Building	1180'	20'	Post 2025
F25	Air Cargo	1190'	30'	Post 2025
F26	ASR (Relocated)	1190'	60'	TBD



NO.	BY	DATE	REVISIONS	NOTES

HNTB

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

GENERAL AVIATION AND CARGO AREA PLAN

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

SHEET No. 6

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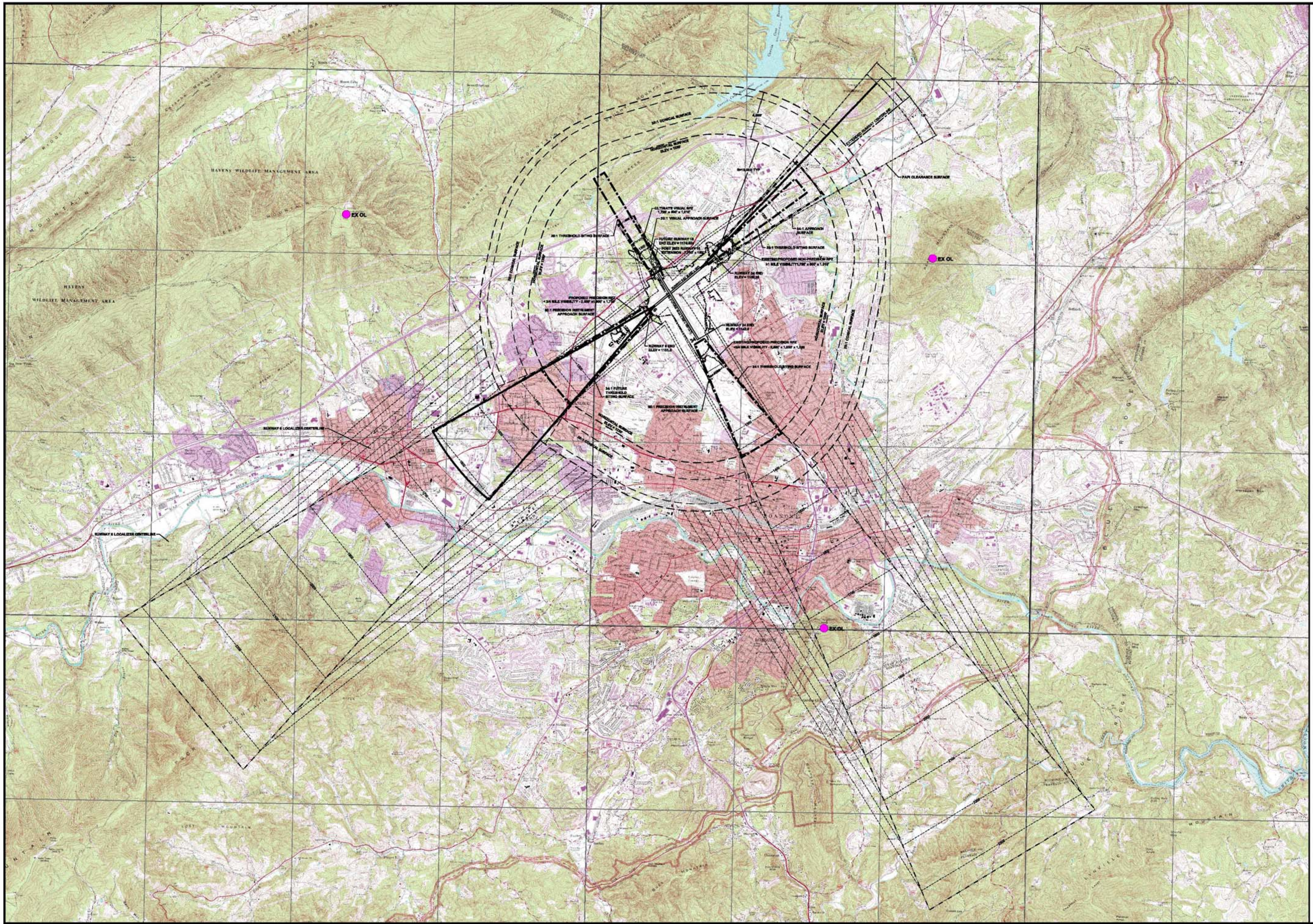

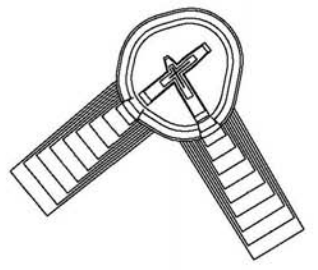

LEGEND

EX OL	EXISTING OBSTRUCTION LIGHT
	APPROACH SURFACE
	CONICAL SURFACE
	PROPERTY LINE
	THRESHOLD SITING SURFACE

NOTE:

1. ELEVATIONS ARE GIVEN IN FEET ABOVE MEAN SEA LEVEL.
2. SEE SECTION 36.2-234 OF THE CITY OF ROANOKE'S ZONING ORDINANCE FOR A DESCRIPTION OF THE AIRPORT NAVIGATION OVERLAY DISTRICT WHICH REGULATES THE HEIGHT AND LOCATION OF DEVELOPMENT IN THE VICINITY OF THE AIRPORT.

4000' 0' 4000' 8000'

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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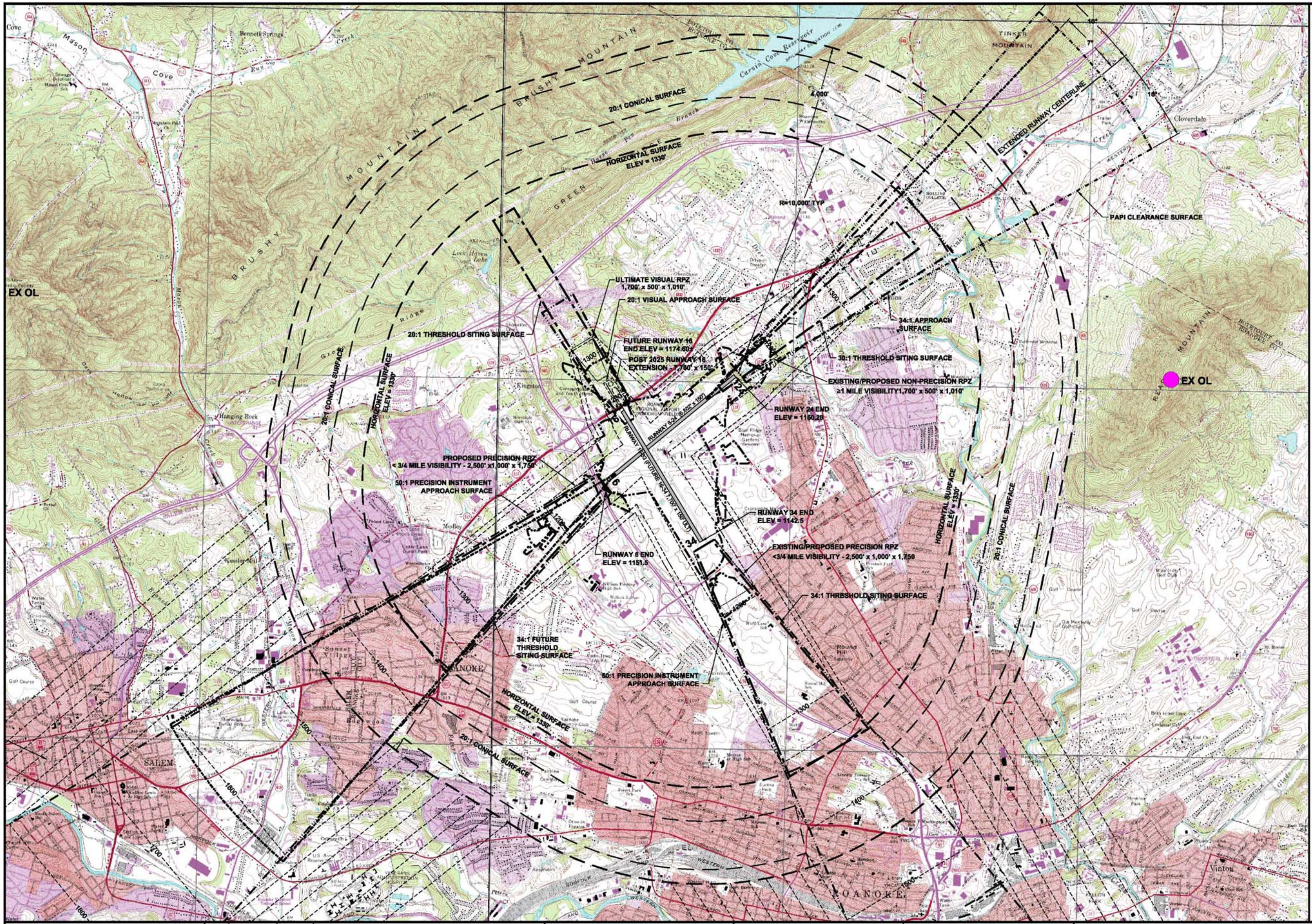
PART 77 AIRSPACE SURFACES

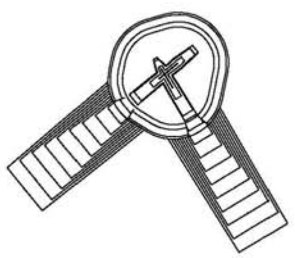
ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Jun 29, 2009

SHEET No.
7

P:_Projects\40311 ROA Master Plan Update\CAD\ALP SET\SHT-7_8 PART 77.dwg S7 Jun 29, 2009 - 1:36pm





LEGEND

- EX OL — EXISTING OBSTRUCTION LIGHT
- APPROACH SURFACE
- CONICAL SURFACE
- PROPERTY LINE
- THRESHOLD SITING SURFACE

NOTE:

1. ELEVATIONS ARE GIVEN IN FEET ABOVE MEAN SEA LEVEL.
2. SEE SECTION 36.2-234 OF THE CITY OF ROANOKE'S ZONING ORDINANCE FOR A DESCRIPTION OF THE AIRPORT NAVIGATION OVERLAY DISTRICT WHICH REGULATES THE HEIGHT AND LOCATION OF DEVELOPMENT IN THE VICINITY OF THE AIRPORT.

2000' 0' 2000' 4000'

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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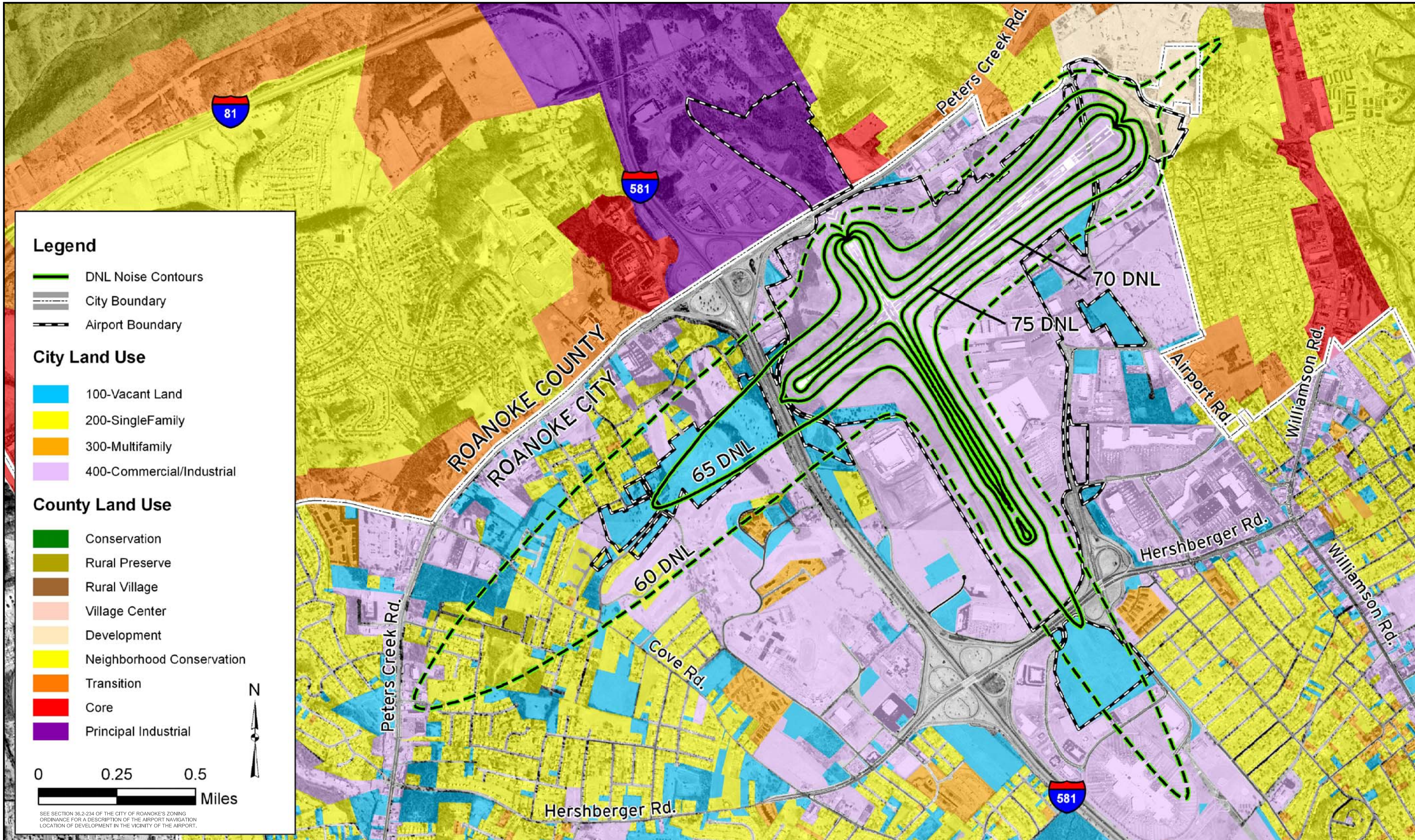
PART 77 CONICAL SURFACE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

SHEET No. 9



NO.	BY	DATE	REVISIONS	APPROVED

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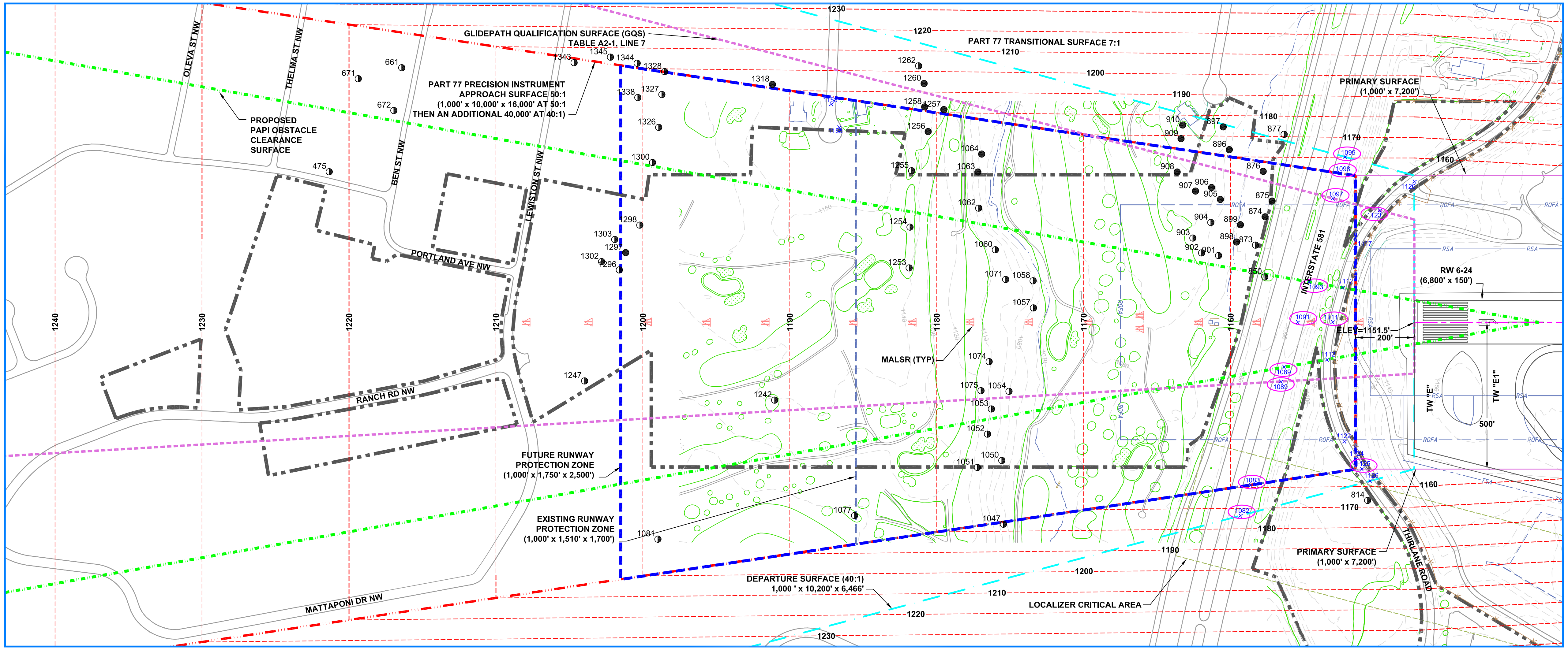
20 YEAR NOISE CONTOUR - OFF-AIRPORT LAND USE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

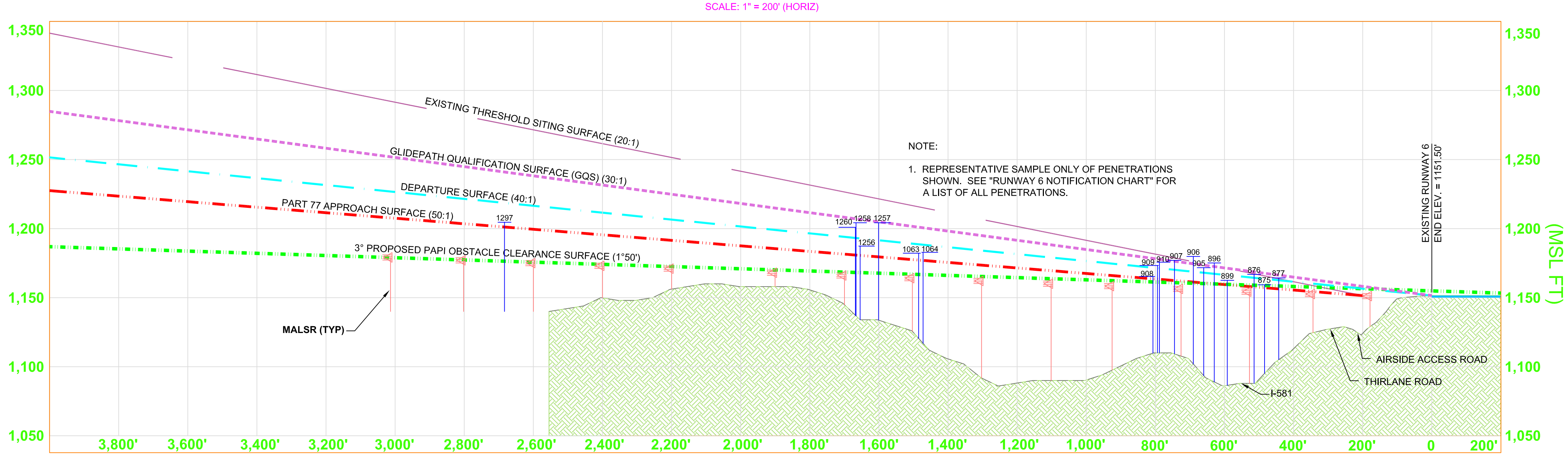
SHEET No. 9

P:_Projects\40311 ROA Master Plan Update\CAD\ALP SET\SHT-9 OFF-AIRPORT LAND-USE_NOISE CONTOURS.dwg S9 Jun 29, 2009 – 1:01pm



RUNWAY 6 APPROACH - PLAN VIEW

SCALE: 1" = 200' (HORIZ)



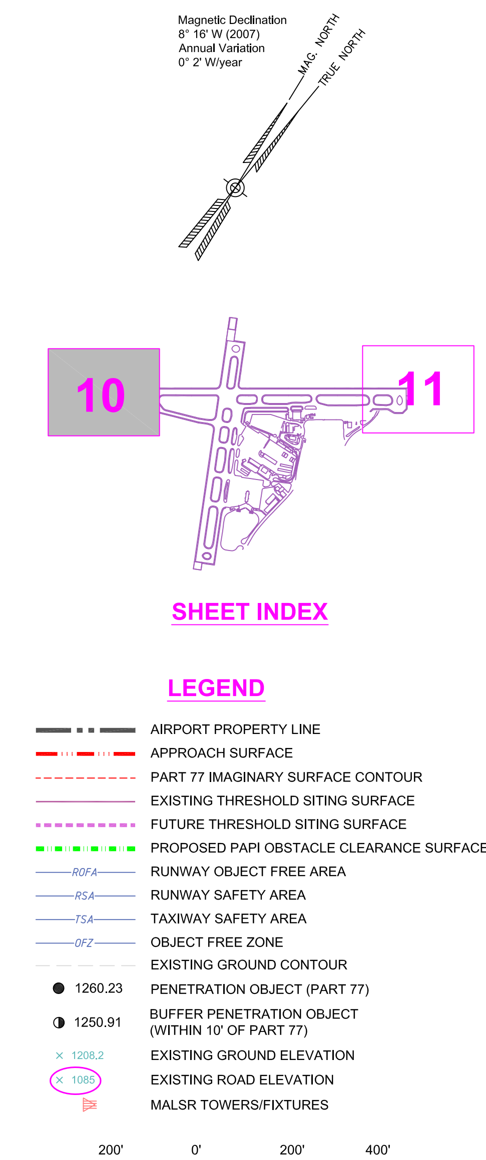
NOTE:

1. REPRESENTATIVE SAMPLE ONLY OF PENETRATIONS SHOWN. SEE "RUNWAY 6 NOTIFICATION CHART" FOR A LIST OF ALL PENETRATIONS.

RUNWAY 6 APPROACH - PROFILE VIEW

SCALE: 1"=50' (VERT)

SCALE: 1"=200' (HORIZ)



Note: Obstruction Study conducted by Delta Airport Consultants.

NO.	BY	DATE	REVISIONS	APPROVED

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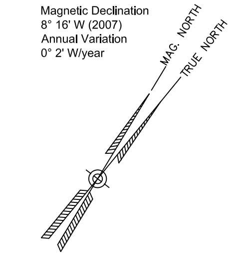
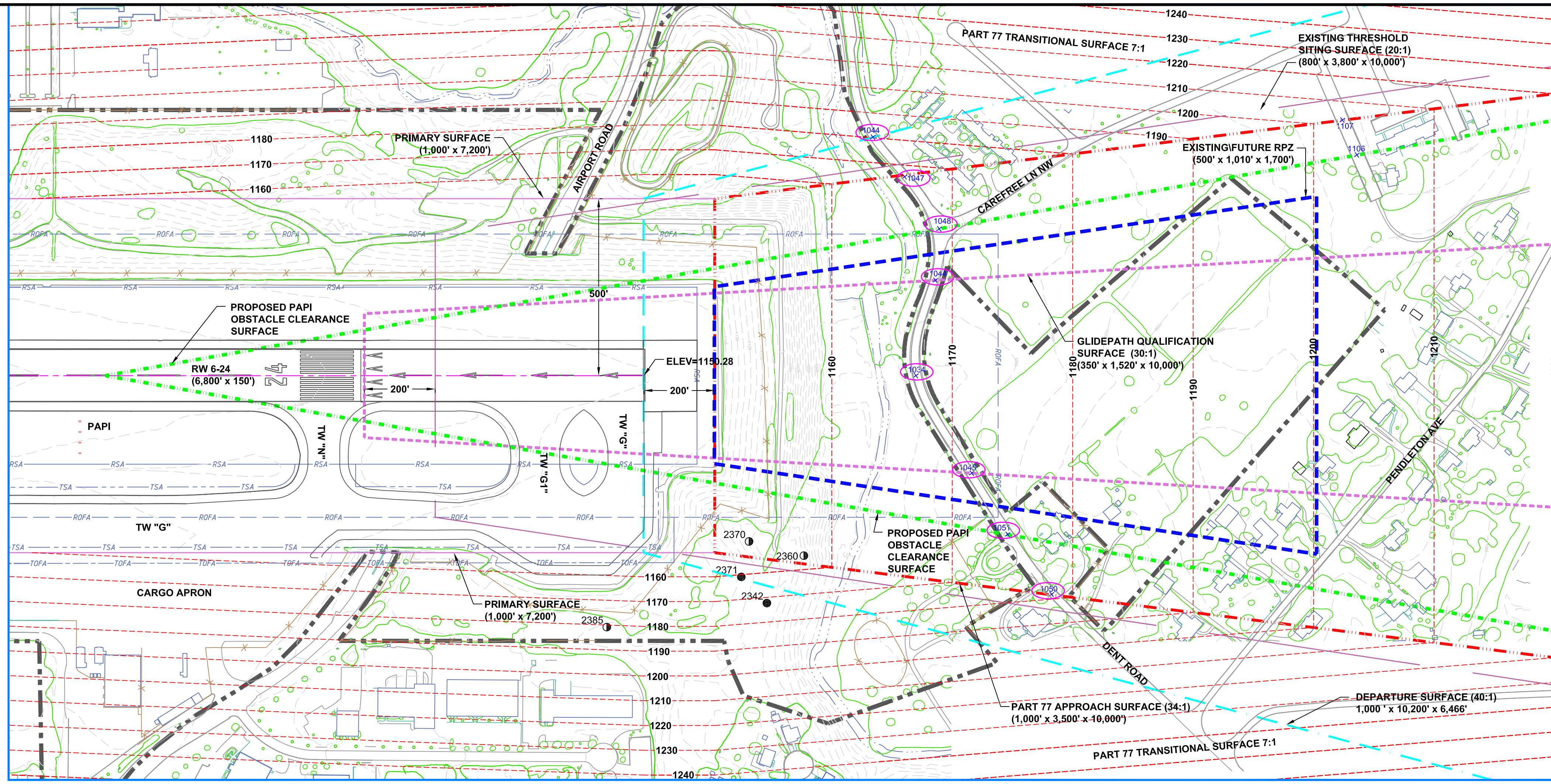
RUNWAY 6 APPROACH AND PROFILE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

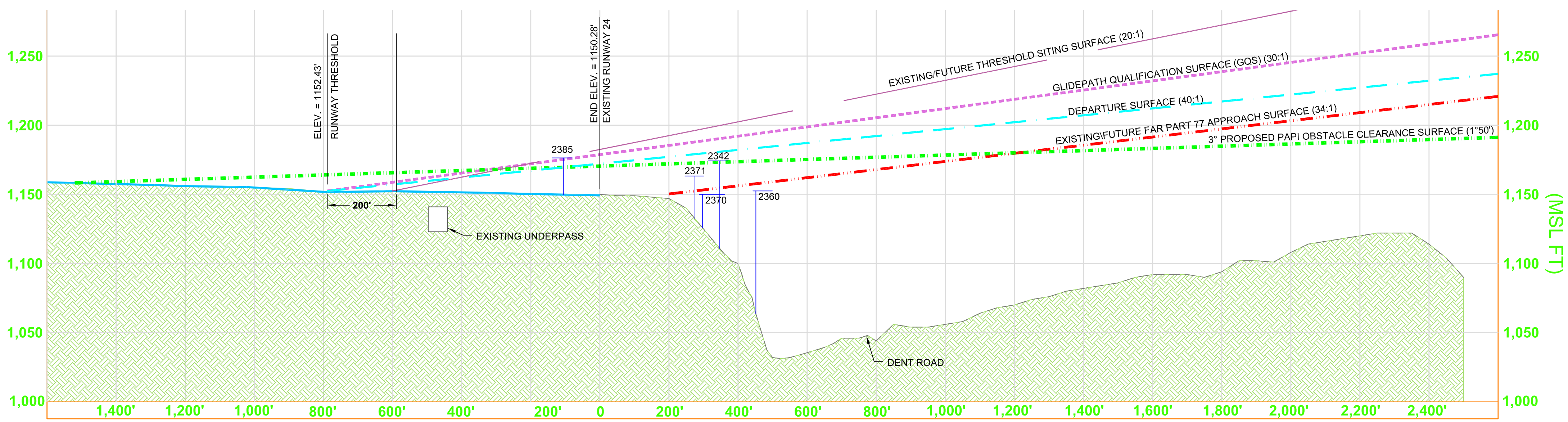
SHEET No. 10





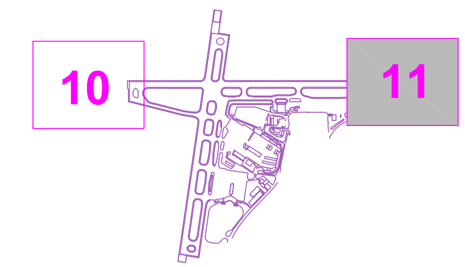
RUNWAY 24 APPROACH - PLAN VIEW

SCALE: 1" = 200' (HORIZ)



RUNWAY 24 APPROACH - PROFILE VIEW

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



SHEET INDEX

LEGEND

- AIRPORT PROPERTY LINE
- APPROACH SURFACE
- PART 77 IMAGINARY SURFACE CONTOUR
- EXISTING THRESHOLD SITING SURFACE
- FUTURE THRESHOLD SITING SURFACE
- PROPOSED PAPI OBSTACLE CLEARANCE SURFACE
- ROFA — RUNWAY OBJECT FREE AREA
- RSA — RUNWAY SAFETY AREA
- TSA — TAXIWAY SAFETY AREA
- OFZ — OBJECT FREE ZONE
- EXISTING GROUND CONTOUR
- 1260.23 — PENETRATION OBJECT (PART 77)
- 1250.91 — BUFFER PENETRATION OBJECT (WITHIN 10' OF PART 77)
- 1208.2 — EXISTING GROUND ELEVATION
- 1085 — EXISTING ROAD ELEVATION
- MALSR TOWERS/FIXTURES

200' 0' 200' 400'

Note: Obstruction Study conducted by Delta Airport Consultants.

NO.	BY	DATE	REVISIONS	APPROVED

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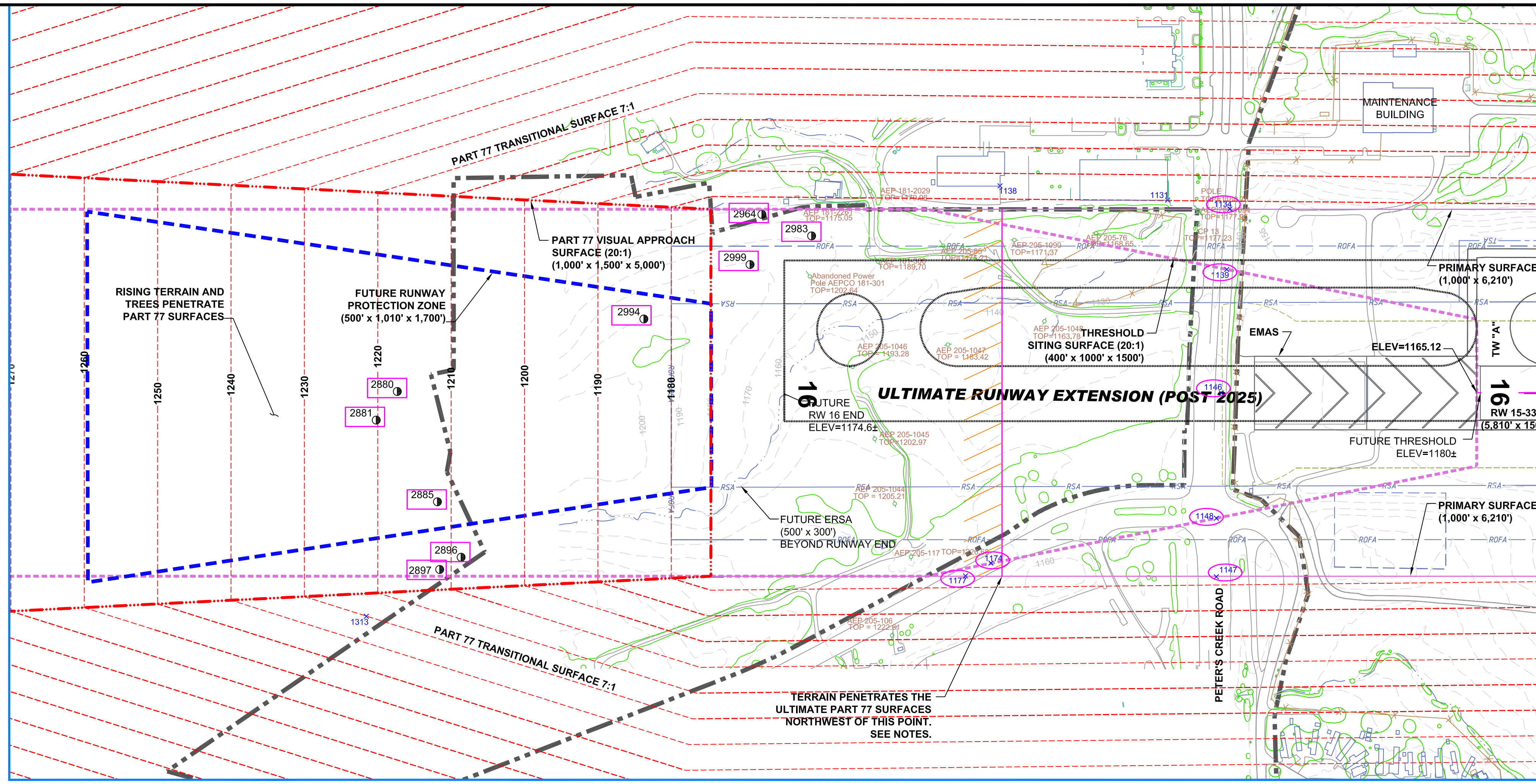
RUNWAY 24 APPROACH AND PROFILE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

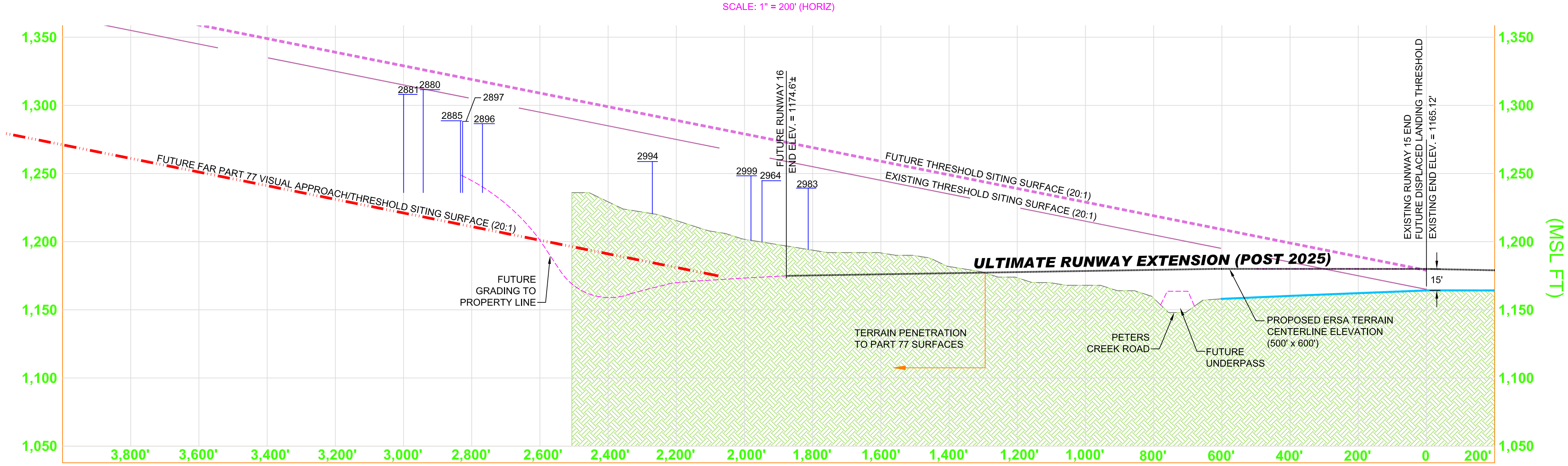
SHEET No. 11

P:_Projects\40311 ROA Master Plan Update\CAD\ALP SET\SHT 10-14.dwg L2 Jun 29, 2009 - 1:04pm



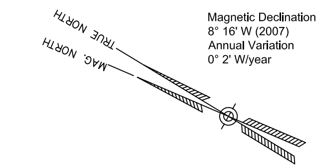
RUNWAY 16 APPROACH - PLAN VIEW

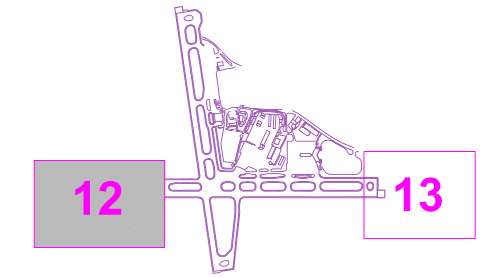
SCALE: 1" = 200' (HORIZ)



RUNWAY 16 APPROACH - PROFILE VIEW

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





SHEET INDEX

LEGEND

- AIRPORT PROPERTY LINE
- APPROACH SURFACE
- PART 77 IMAGINARY SURFACE CONTOUR
- EXISTING THRESHOLD SITING SURFACE
- FUTURE THRESHOLD SITING SURFACE
- PROPOSED PAPI OBSTACLE CLEARANCE SURFACE
- 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
- 1085 — EXISTING ROAD ELEVATION
- MALSR TOWERS/FIXTURES

200' 0' 200' 400'

Note: Obstruction Study conducted by Delta Airport Consultants.

NOTES:

1. THERE IS NO DEPARTURE SURFACE FOR RUNWAY 34 TAKEOFF (RUNWAY 16 END) DUE TO TERRAIN OBSTRUCTIONS.
2. ITEMS SHOWN ON PLAN AND PROFILE ARE REFERENCED TO EXISTING THRESHOLD SITING SURFACE (20:1). PART 77 SURFACE (ULTIMATE) IS PENETRATED BY TERRAIN AND TREES.

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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SUITE 200
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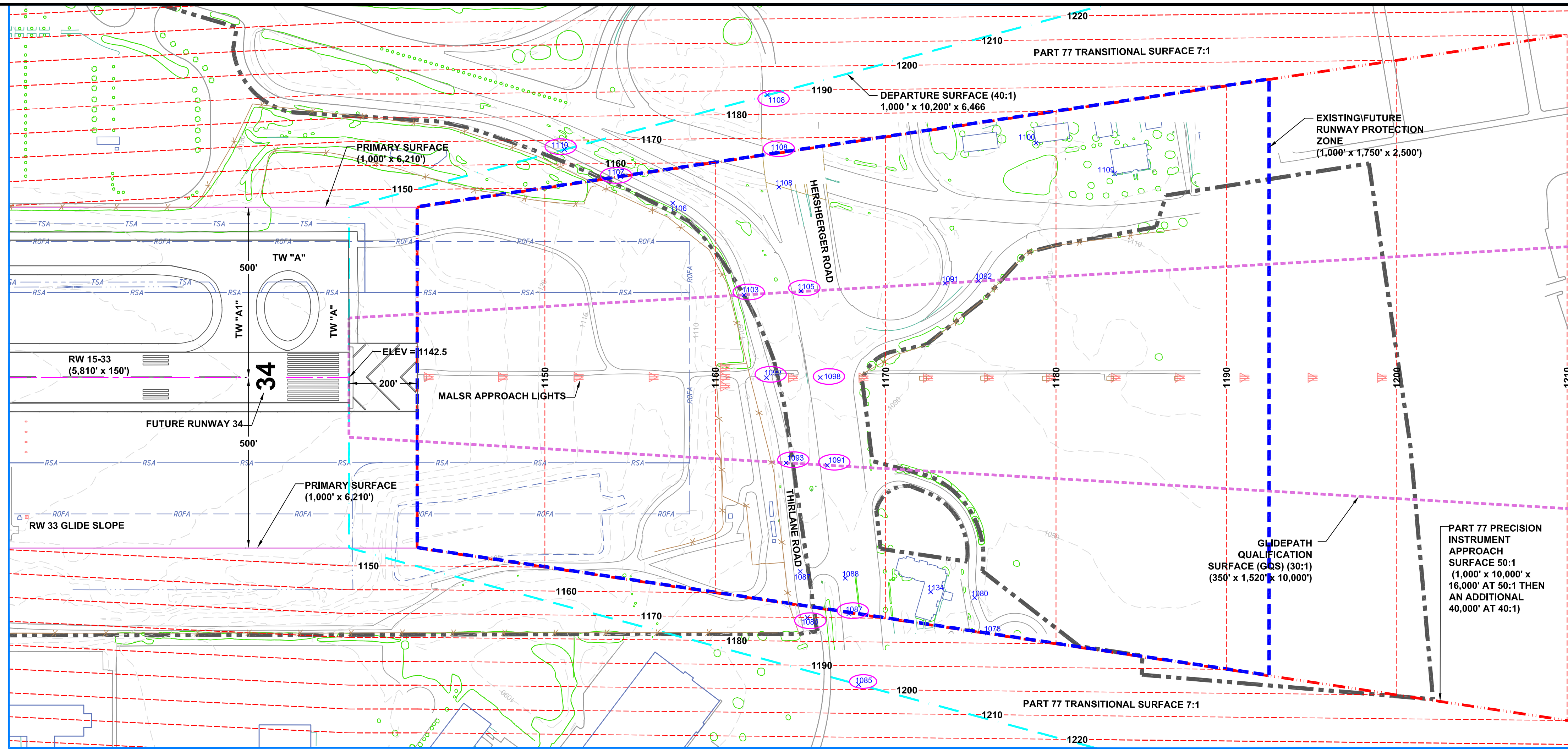
RUNWAY 16 APPROACH AND PROFILE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

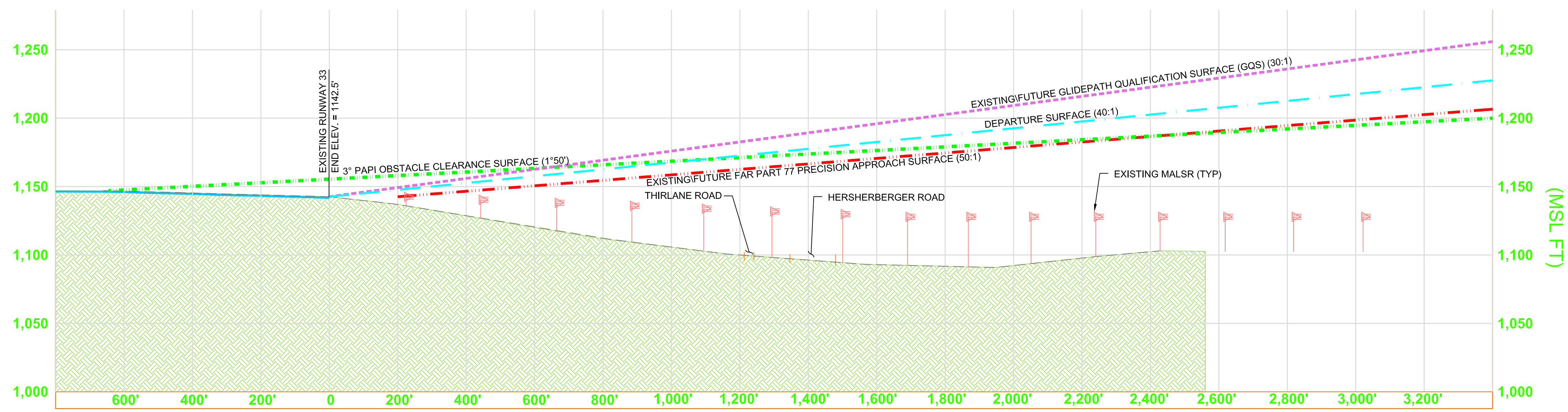
DATE: Jun 29, 2009

SHEET No. 12



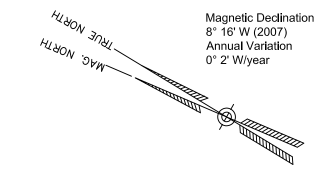
RUNWAY 34 - PLAN VIEW

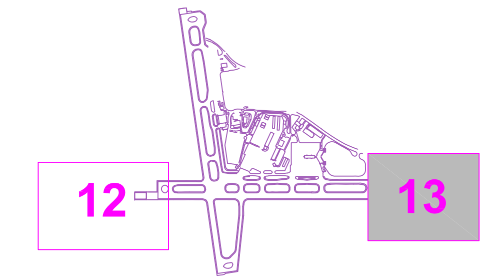
SCALE: 1" = 200' (HORIZ)



RUNWAY 34 - PROFILE VIEW

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





SHEET INDEX

LEGEND

- AIRPORT PROPERTY LINE
- APPROACH SURFACE
- PART 77 IMAGINARY SURFACE CONTOUR
- EXISTING THRESHOLD SITING SURFACE
- FUTURE THRESHOLD SITING SURFACE
- PROPOSED PAPI OBSTACLE CLEARANCE SURFACE
- ROFA — RUNWAY OBJECT FREE AREA
- RSA — RUNWAY SAFETY AREA
- TSA — TAXIWAY SAFETY AREA
- OFZ — OBJECT FREE ZONE
- EXISTING GROUND CONTOUR
- 1260.23 — PENETRATION OBJECT (PART 77)
- 1250.91 — BUFFER PENETRATION OBJECT (WITHIN 10' OF PART 77)
- 1208.2 — EXISTING GROUND ELEVATION
- 1085 — EXISTING ROAD 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 34 APPROACH AND PROFILE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

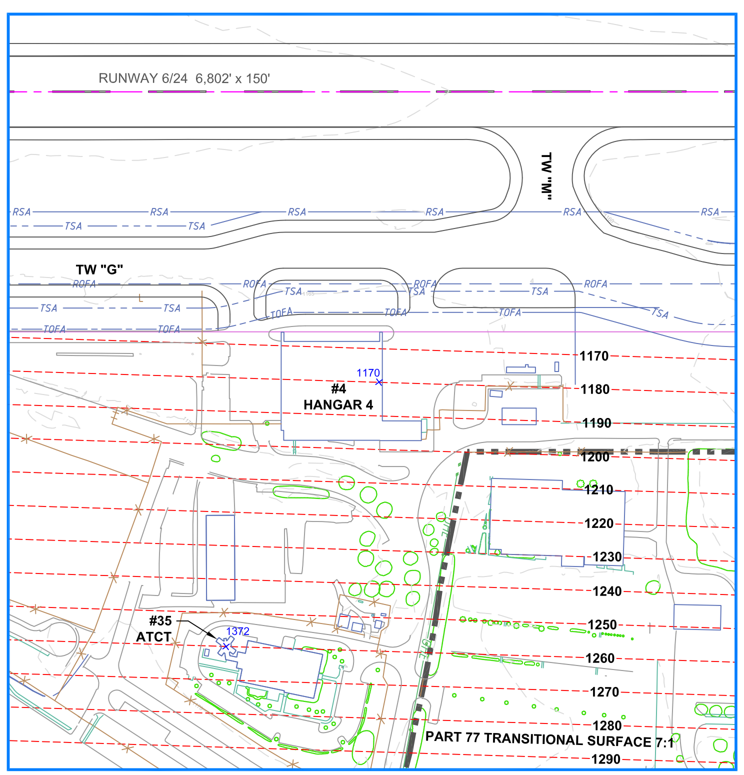
DATE: Jun 29, 2009

SHEET No. 13

P:_Projects\40311 ROA Master Plan Update\CAD\ALP SET\SHT 10-14.dwg L4 Jun 29, 2009 - 1:07pm

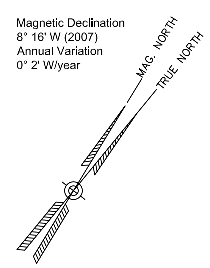
NOTES:

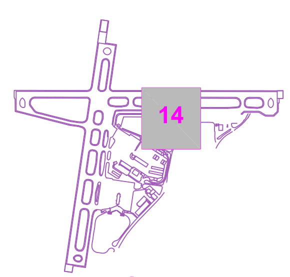
1. OBSTRUCTION STUDY CONDUCTED BY DELTA AIRPORT CONSULTANTS, INC.
2. ALL ELEVATIONS ARE IN ACCORDANCE WITH NATIONAL MAP ACCURACY STANDARDS. SPOT ELEVATIONS AND GROUND CONTOURS ARE DERIVED FROM AERIAL PHOTOGRAMMETRY AND ARE APPROXIMATE. GROUND SURVEYS ARE REQUIRED TO VERIFY ACCURACY OF OBSTRUCTIONS.
3. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
4. GROUND CONTOURS, RUNWAY END AND OBSTRUCTION ELEVATIONS ARE BASED UPON AERIAL PHOTOGRAPHY PREPARED BY:
   POTOMAC AERIAL SURVEYS, INC.
   FREDERICK COUNTY AIRPORT
   1819 BUCHELMER ROAD
   FREDERICK, MARYLAND 21701
5. ALL NOTIFICATION ITEMS ARE WITHIN 10 FEET OF FAR PART 77 SURFACE AND SHOULD BE FIELD VERIFIED.
6. FAR PART 77 APPLIES THE FOLLOWING CLEARANCES:
   10 FEET ABOVE PRIVATE ROADS
   15 FEET ABOVE PUBLIC ROADS
   17 FEET ABOVE INTERSTATE HIGHWAYS
   23 FEET ABOVE RAILROADS
   ELEVATION = ACTUAL ROADWAY ELEVATION + FAR PART 77 CLEARANCE.



HANGAR 4 & ATCT LOCATION DIAGRAM

SCALE: 1"=200'





SHEET INDEX

RUNWAY 6 NOTIFICATION CHART

OBJECT			PART 77 SURFACE	SURFACE ELEVATION	PENETRATION	ACTION
NO.	DESCRIPTION	ELEV.		FUTURE	FUTURE	
475	TREE	1213	50:1 APPROACH	1221	-8	MONITOR
661	TREE	1216	50:1 APPROACH	1216	-1	MONITOR
671	TREE	1216	50:1 APPROACH	1219	-4	MONITOR
672	TREE	1210	50:1 APPROACH	1217	-7	MONITOR
814	TREE	1157	7:1 TRANSITIONAL	1167	-10	MONITOR
850	TREE	1149	50:1 APPROACH	1158	-9	MONITOR
873	TREE	1150	50:1 APPROACH	1158	-8	MONITOR
874	TREE	1159	50:1 APPROACH	1158	1	REMOVE - ON AIRPORT
875	TREE	1159	50:1 APPROACH	1157	2	REMOVE - ON AIRPORT
876	TREE	1167	50:1 APPROACH	1158	9	REMOVE - ON AIRPORT
877	TREE	1164	7:1 TRANSITIONAL	1171	-7	MONITOR
896	TREE	1175	7:1 TRANSITIONAL	1164	12	REMOVE - ON AIRPORT
897	TREE	1179	7:1 TRANSITIONAL	1175	5	REMOVE - ON AIRPORT
898	TREE	1160	50:1 APPROACH	1160	0	REMOVE - ON AIRPORT
899	TREE	1161	50:1 APPROACH	1159	2	REMOVE - ON AIRPORT
901	TREE	1156	50:1 APPROACH	1161	-5	MONITOR
902	TREE	1158	50:1 APPROACH	1162	-4	MONITOR
903	TREE	1161	50:1 APPROACH	1163	-2	MONITOR
904	TREE	1158	50:1 APPROACH	1161	-3	MONITOR
905	TREE	1172	50:1 APPROACH	1161	11	REMOVE - DEP SURFACE PENETRATION
906	TREE	1180	50:1 APPROACH	1161	19	REMOVE - GQS SURFACE PENETRATION
907	TREE	1177	50:1 APPROACH	1162	15	REMOVE - DEP SURFACE PENETRATION
908	TREE	1165	50:1 APPROACH	1164	2	ACQUIRE AND REMOVE
909	TREE	1173	7:1 TRANSITIONAL	1169	5	ACQUIRE AND REMOVE
910	TREE	1176	7:1 TRANSITIONAL	1175	1	ACQUIRE AND REMOVE
1047	TREE	1167	7:1 TRANSITIONAL	1176	-9	MONITOR
1050	TREE	1168	50:1 APPROACH	1176	-7	MONITOR
1051	TREE	1168	50:1 APPROACH	1177	-9	MONITOR
1052	TREE	1176	50:1 APPROACH	1177	-1	MONITOR
1053	TREE	1173	50:1 APPROACH	1176	-3	MONITOR
1054	TREE	1172	50:1 APPROACH	1175	-3	MONITOR
1057	TREE	1164	50:1 APPROACH	1173	-9	MONITOR
1058	TREE	1169	50:1 APPROACH	1173	-4	MONITOR
1060	TREE	1172	50:1 APPROACH	1176	-4	MONITOR
1062	TREE	1177	50:1 APPROACH	1177	0	REMOVE - ON AIRPORT
1063	TREE	1182	50:1 APPROACH	1177	5	ACQUIRE AND REMOVE
1064	TREE	1183	50:1 APPROACH	1177	6	ACQUIRE AND REMOVE
1071	TREE	1169	50:1 APPROACH	1175	-6	MONITOR
1074	TREE	1167	50:1 APPROACH	1176	-10	MONITOR
1075	TREE	1168	50:1 APPROACH	1177	-9	MONITOR
1077	TREE	1184	50:1 APPROACH	1186	-2	MONITOR
1081	TREE	1192	50:1 APPROACH	1199	-7	MONITOR
1242	TREE	1182	50:1 APPROACH	1191	-9	MONITOR
1247	TREE	1198	50:1 APPROACH	1204	-6	MONITOR
1253	TREE	1177	50:1 APPROACH	1182	-5	MONITOR
1254	TREE	1177	50:1 APPROACH	1182	-5	MONITOR
1255	TREE	1178	50:1 APPROACH	1182	-4	MONITOR
1256	TREE	1187	50:1 APPROACH	1181	7	ACQUIRE AND REMOVE
1257	TREE	1204	7:1 TRANSITIONAL	1182	23	ACQUIRE AND REMOVE
1258	TREE	1204	7:1 TRANSITIONAL	1183	21	ACQUIRE AND REMOVE
1260	TREE	1201	7:1 TRANSITIONAL	1194	7	ACQUIRE AND REMOVE
1262	TREE	1201	7:1 TRANSITIONAL	1203	-2	MONITOR
1296	TREE	1198	50:1 APPROACH	1202	-4	MONITOR
1297	TREE	1205	50:1 APPROACH	1201	3	REMOVE - ON AIRPORT
1298	TREE	1200	50:1 APPROACH	1200	0	REMOVE - ON AIRPORT
1300	TREE	1195	50:1 APPROACH	1199	-4	MONITOR
1302	TREE	1198	50:1 APPROACH	1203	-5	MONITOR
1303	TREE	1195	50:1 APPROACH	1202	-7	MONITOR
1318	TREE	1199	7:1 TRANSITIONAL	1193	6	ACQUIRE AND REMOVE
1326	TREE	1192	50:1 APPROACH	1199	-7	MONITOR
1327	TREE	1196	50:1 APPROACH	1199	-2	MONITOR
1328	TREE	1198	7:1 TRANSITIONAL	1199	-1	MONITOR
1338	TREE	1193	50:1 APPROACH	1200	-8	MONITOR
1343	TREE	1198	50:1 APPROACH	1205	-7	MONITOR
1344	TREE	1196	7:1 TRANSITIONAL	1203	-7	MONITOR
1345	TREE	1199	7:1 TRANSITIONAL	1206	-7	MONITOR

RUNWAY 15 (16) NOTIFICATION CHART

OBJECT			THRESHOLD SITING SURFACE	SURFACE ELEVATION	PENETRATION	ACTION
NO.	DESCRIPTION	ELEV.		EXISTING	EXISTING	
2880	TREE	1311'	20:1	1312'	- 1'	MONITOR
2881	TREE	1308'	20:1	1315'	- 7'	MONITOR
2885	TREE	1288'	20:1	1306'	- 18'	MONITOR
2896	TREE	1286'	20:1	1303'	- 17'	MONITOR
2897	TREE	1288'	20:1	1306'	- 18'	MONITOR
2964	TREE	1244'	20:1	1262'	- 18'	REMOVE
2983	TREE	1239'	20:1	1255'	-16'	REMOVE
2994	TREE	1258'	20:1	1278'	- 20'	REMOVE
2999	TREE	1248'	20:1	1264'	- 16'	REMOVE

NOTE: DUE TO SIGNIFICANT TERRAIN PENETRATION TO FUTURE RUNWAY 16 PART 77 SURFACES, ASSESSMENT IS BASED ON CURRENT THRESHOLD SITING CRITERIA, 20:1.

RUNWAY 24 NOTIFICATION CHART

OBJECT			PART 77 SURFACE	SURFACE ELEVATION	PENETRATION	ACTION
NO.	DESCRIPTION	ELEV.		EXISTING/FUTURE	EXISTING/FUTURE	
2342	TREE	1174'	7:1 TRANSITIONAL	1172'	2'	REMOVE
2360	TREE	1153'	34:1 APPROACH	1158'	- 5'	MONITOR
2370	TREE	1150'	34:1 APPROACH	1153'	- 3'	MONITOR
2371	TREE	1163'	7:1 TRANSITIONAL	1160'	3'	REMOVE
2385	TREE	1176'	7:1 TRANSITIONAL	1180'	- 4'	REMOVE
4	HANGAR	1227'	7:1 TRANSITIONAL	1170'	57'	LIGHTED
35	ATCT	1372'	7:1 TRANSITIONAL	1260'	112'	LIGHTED

NOTE: OBJECT NUMBERS 4 AND 35 ARE DEPICTED ON THE INSET ON THE BOTTOM LEFT CORNER OF THIS SHEET.

RUNWAY 33 (34) NOTIFICATION CHART

OBJECT			PART 77 SURFACE	SURFACE ELEVATION	PENETRATION	ACTION
NO.	DESCRIPTION	ELEV.		EXISTING	EXISTING	
	NO OBJECTS FOUND					

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

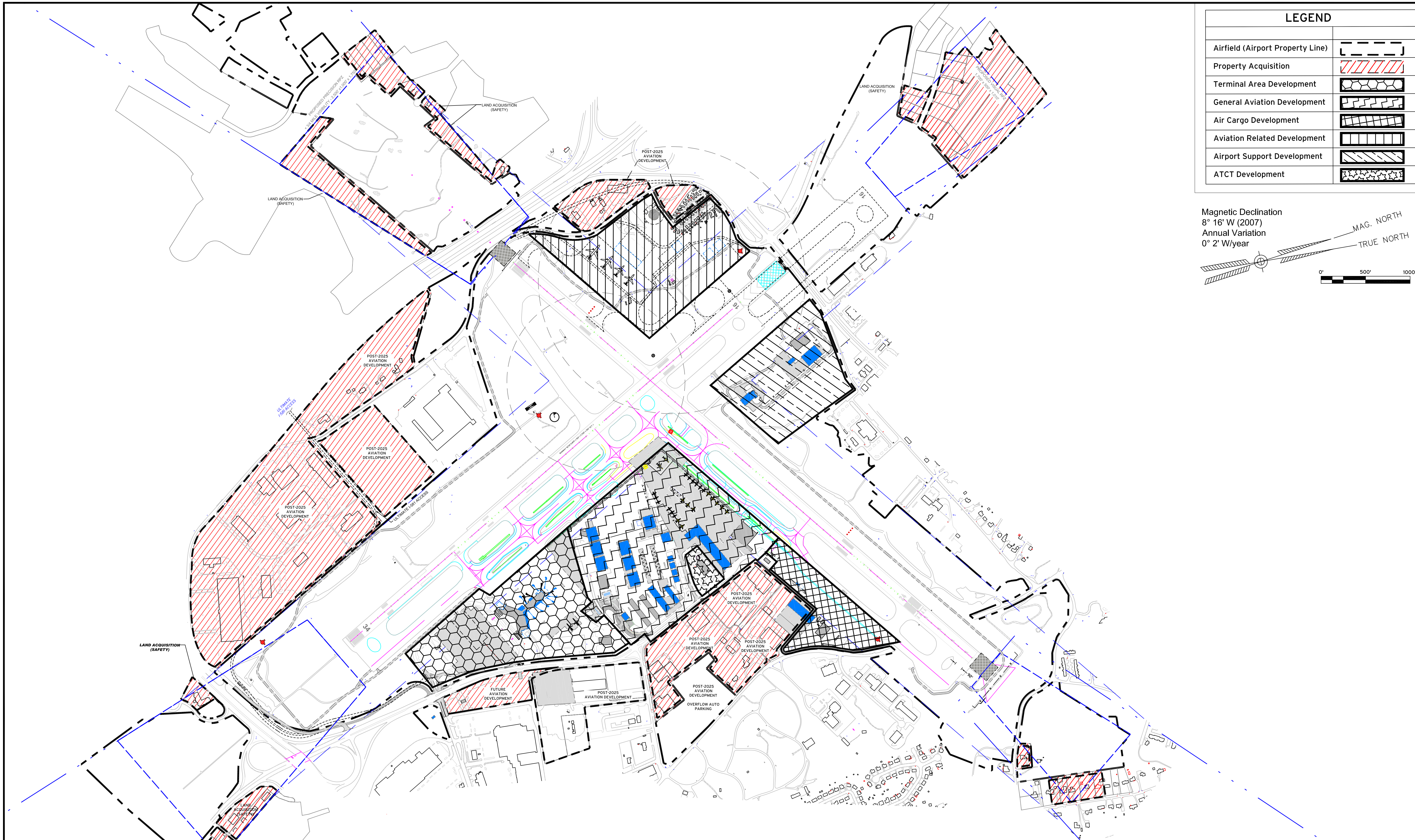
2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

RUNWAY PART 77 NOTIFICATION CHARTS

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

SHEET No. 14



NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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

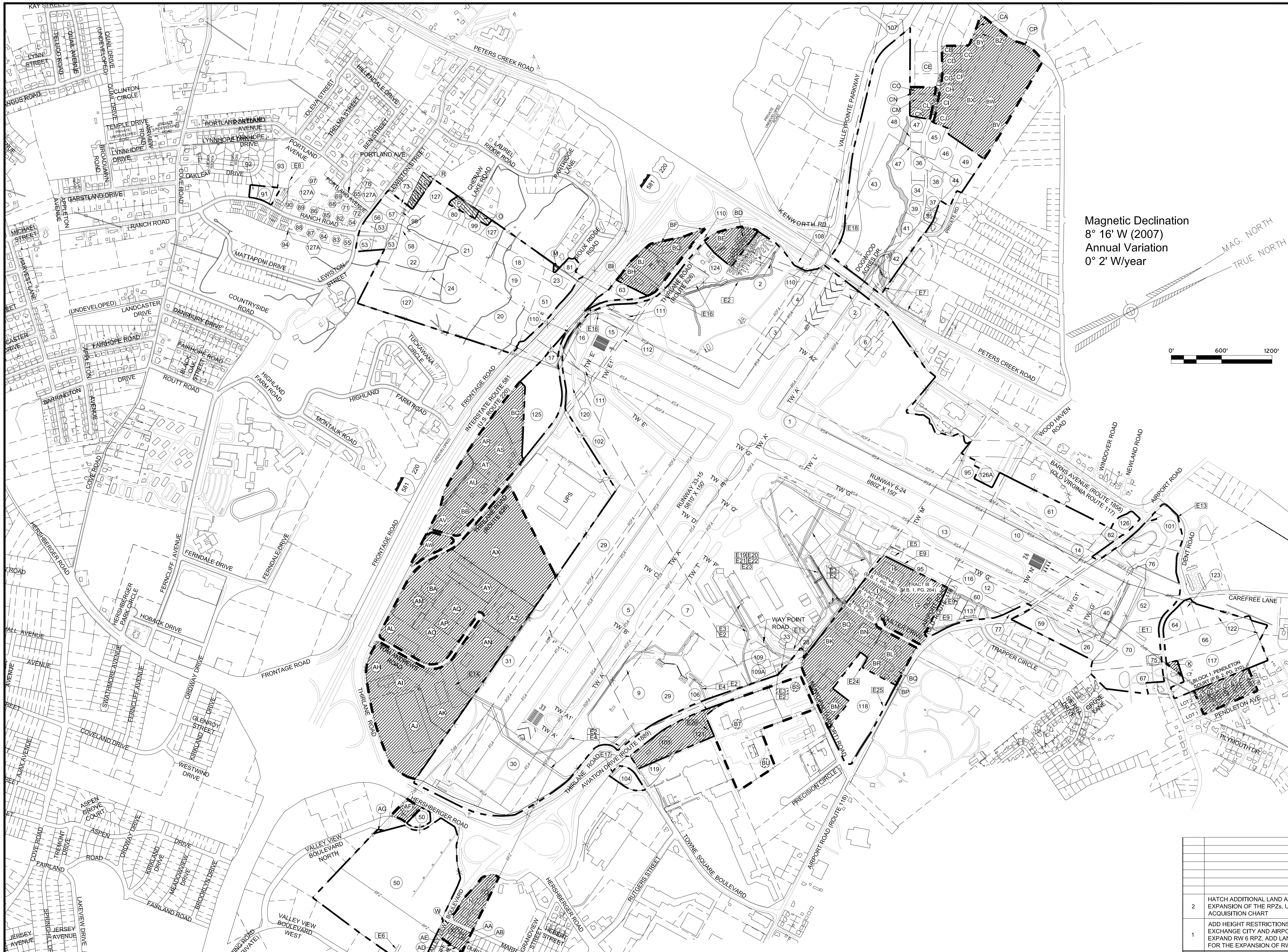
ON-AIRPORT LAND-USE

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Jun 29, 2009

SHEET No.
15

P:_Projects\40311 ROA Master Plan Update\CAD\ALP SET\SHT-15 On-Airport Land-Use_REV1.dwg S15 Jun 29, 2009 - 1:11pm



LEGEND		
EXISTING	DESCRIPTION	PROPOSED
RSA	RUNWAY SAFETY AREA (RSA)	RSA
ROFA	RUNWAY OBJECT FREE AREA (ROFA)	ROFA
RPZ	RUNWAY PROTECTION ZONE (RPZ)	
	PAVEMENT	
	AIRPORT PROPERTY LINE	
	INTERIOR PROPERTY LINE	NA
	ADJOINING PROPERTY LINE	NA
	APPROACH SURFACE	NA
	UTILITY EASEMENTS	NA
	FENCE	NA
	AIRPORT REFERENCE POINT	NA
76	PARCELS ACQUIRED	NA
L	PARCELS IDENTIFIED FOR ACQUISITION	NA
65	LAND RELINQUISHED	NA
E23	UTILITY/ LANDSCAPE EASEMENTS	NA
NA	FEE SIMPLE LAND ACQUISITION	
NA	AVIGATION EASEMENT (SHOWN ON SHEET 10B)	NA

NO.	REVISIONS	BY	APP.	DATE
2	HATCH ADDITIONAL LAND ACQUISTION FOR THE EXPANSION OF THE RPZs, UPDATE FUTURE PROPERTY ACQUISITION CHART	RWW	MWK	05/15/09
1	ADD HEIGHT RESTRICTIONS PHASE 2 EASEMENTS, EXCHANGE CITY AND AIRPORT PROPERTIES TO EXPAND RW 6 RPZ, ADD LAND ACQUISITION HATCH FOR THE EXPANSION OF RW 33 RPZ	RWW	MWK	04/20/09

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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

AIRPORT PROPERTY MAP

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Jun 29, 2009

SHEET No.
16

P:_Projects\40311 ROA Master Plan Update\CAD\ALP SET\SHT-16_17 PROPERTY MAP.dwg S16 Jun 29, 2009 - 1:16pm

PROPERTY TRANSACTIONS AT ROANOKE REGIONAL AIRPORT

FEE SIMPLE ACQUISITIONS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	RECORDED DATE	DEED BOOK PAGE NO.	ACREAGE PARCEL	ACREAGE TOTAL	REMARKS
1	F	A.A. CANNADAY ESTATE	D	7-13-34	224, 540	319.36	319.36	#1363 - D
2	F	VALLEY R.R. CO.	D	11-10-39	271, 215	3.25	322.61	OLD R.R. EASEMENT
3	F	JOHN W. SNYDER	D	09-20-40	278, 315	3.00	325.61	#3316
4	F	WILKERSON, ET. AL.	D	09-20-40	279, 380	6.00	331.61	#3316
5	F	ROANOKE ORCHARD CO. INC.	D	10-28-40	279, 465	23.56	355.17	#3316 - 1
6	F	K. G. & ETHEL SWAIN	D	05-01-42	279, 230	3.41	358.58	#3316 - D
7	F	ROANOKE ORCHARD CO. INC.	D	09-19-44	316, 75	4.97	363.55	#3316 - 1
8		INTENTIONALLY LEFT BLANK					363.55	
9	F	ROANOKE ORCHARD CO. INC.	D	04-15-48	390, 290	1.865	365.415	#3316 - 1
10	F	LYLE CLAY & JAMES W. BUSHONG	D	07-30-54	510, 556	34.372	399.787	#4066
11		INTENTIONALLY LEFT BLANK					399.787	
12	F	BESSIE INEZ NININGER, ET. AL.	D	06-15-56	554, 519	7.666	407.453	#4066 - 3
13	F	MARY ELVA COULTER	D	07-03-56	566, 231	19.853	427.306	#4066 - 1
14	F	DANIEL H. SHEPERD	D	07-03-56	555, 452	3.732	431.038	#4066 - 2
15	F	STELLA FEAZELL	D	09-25-57	582, 587	5.41	436.448	#4240 - A
16	F	J.H. GARST	D	09-30-57	584, 171	16.76	453.208	#4240 - B
17	F	J.H. GARST	D	09-30-57	584, 171	2.54	455.748	#4240 - C
18	F	ROY C. GARST, ET. UX.	D	09-30-57	584, 171	1.56	457.308	#4240 - E
19	F	FLOYD R. MASON, ET. UX.	D	09-30-57	584, 171	5.09	462.398	#4240 - F
20	F	ROY C. KINSEY, ET. UX.	D	09-30-57	584, 171	18.76	481.158	#4240 - G
21	F	ROY C. KINSEY, ET. UX.	D	09-30-57	584, 171	9.37	490.528	#4240 - G1
22	F	M. S. HUDGIN, ET. UX.	D	09-30-57	584, 171	6.23	496.758	#4240 - H
23	F	HILDA L. McGRADY	D	10-02-57	582, 596	0.61	497.368	#4240 - D
24	F	ROY C. KINSEY, ET. UX.	D	11-01-57	584, 171	1.16	498.528	#4240 - G 50' EASEMENT
25		INTENTIONALLY LEFT BLANK					498.528	
26	F	BESSIE I. NININGER (HEIRS)	D	03-25-58	594, 377	0.12, 0.48	499.128	#4284 - B 0.12 AC. DEDICATED FOR ROUTE 118
27		INTENTIONALLY LEFT BLANK					499.128	
28	F	COULTER	D	03-06-62	686, 373	0.0667	499.195	#4066 0.0667 AC. DEDICATED FOR RIGHT OF WAY
29	F	ROANOKE ORCHARD CO. INC.	D	01-09-64	733, 132	34.29,12.58	546.065	#4738 - 2 0.52 AC. DEDICATED FOR PROPOSED ROAD
30	F	J.B. ANDREWS (HEIRS)	D	03-06-64	737, 91	92.31	638.375	#4738 - 3A
31	F	J.B. ANDREWS (HEIRS)	D	03-06-64	737, 91	17.45	655.825	#4738 - 5
32		INTENTIONALLY LEFT BLANK					655.825	
33	F	ASSOCIATED TRANSPORT INC.	D	06-09-64	745, 248	2.98	658.805	#4738 - 1 2.52 AC. DEDICATED FOR PROPOSED ROAD
34	F	WILLIAM E. & GROCER MILLS	D	01-14-65	761, 473	0.53	659.335	FAAP-C615 PARCEL
35	F	JOSEPH C. & MARGARET R. BROWN	D	04-20-65	768, 559	0.525	659.860	FAAP-C615 PARCEL B
36	F	BILLY N. & PHYLLIS T. WITT	D	06-01-65	773, 44	1.11, 0.56	661.530	FAAP-C615 PARCEL C
37	F	STERLING W. & NANCY M. WINN	D	07-06-65	776, 143	1.142	662.672	FAAP-C615 PARCEL E
38	F	CHARLES E. & LOIS C. CARTER	D	10-13-65	786, 124	1.09	663.762	FAAP-C615 PARCEL D
39	F	MARGARETTE T. SYNDER	D	10-19-65	787, 173	0.61	664.372	FAAP-C615 PARCEL F
40	F	PRESTON R. PAYNE	D	04-04-66	798, 407	2.63	667.002	FAAP-C616 PARCEL
41	F	HERMAN E. & KATHLEEN L. MAXWELL	D	04-20-66	800, 31	1.45	668.452	FAAP-C615 PARCEL G
42	F	ROBERT L. & LOTTIE S. HAWKINS	D	10-04-66	813, 360	4.4	672.852	FAAP-C615 PARCEL A
43	F	CHURCH OF GOD TRUSTEES	D	10-17-66	814, 539	44.70	717.552	FAAP-C616 PARCEL
44	F	MARION E. & CARRIE C. LYON	D	08-29-67	838, 295	1.536	719.088	FAAP-C615 PARCEL H
45	F	ROBERT W. COOPER	D	11-13-67	846, 380	2.079	721.167	FAAP-C615 PARCEL J
46	F	DELLA W. DOWNING	D	11-13-67	847, 405	2.38	723.547	FAPP-C615 PARCEL K
47	F	ANNIE E. POINDEXTER ESTATE	D	11-20-67	846, 515	0.94, 0.37	724.857	FAAP-C615 PARCEL M
48	F	EMILY L. SMITH	D	11-20-67	847, 409	0.46	725.317	FAAP-C615 PARCEL N
49	F	LINCOLN D. & MARY F. BARRETT	D	12-04-67	846, 520	2.37	727.687	FAAP-C615 PARCEL L
50	F	FIRST NATIONAL EXCHANGE BANK, ET. AL.	D	02-12-68	1232, 75	52.63	780.317	FAAP-C616 A,B, 6.32 AC. TO VDH&T, 1.67 AC. TO STREET
51	W	COMMONWEALTH OF VIRGINIA	D	05-07-68	871, 035	-7.43	772.887	ROUTE 581 RIGHT OF WAY #4728
52	F	PRESTON R. PAYNE ESTATE	D	03-12-69	871, 777	7.84	780.727	#5160
53	F	BUILDERS INVESTMENT GROUP	D	05-19-77	1401, 800	3.55	784.277	ADAP-07 PARCEL
54	F	BUILDERS INVESTMENT GROUP	D	05-19-77	1401, 800	(-0.560)	783.717	ADAP-07 PARCEL, SEE PARCEL 128 REMARKS
55	F	BUILDERS INVESTMENT GROUP	D	05-19-77	1401, 800	(-0.620)	783.097	ADAP-07 PARCEL, SEE PARCEL 128 REMARKS
56	F	SAMUEL MOORE, ET. UX.	D	07-20-77	1406, 12	0.530	783.627	ADAP-07 PARCEL
57	F	SAMUEL MOORE, ET. UX.	D	07-20-77	1406, 12	0.800	784.424	ADAP-07 PARCEL
58	F	BUILDERS INVESTMENT GROUP	D	02-10-78	1425, 257	0.153	784.577	ADAP-07 PARCEL
59	F	BESSIR I. NININGER	D	11-14-79	1448, 1455	5.084	789.661	ADAP-08 PARCEL F
60	F	McDOWALL & WOOD INC.	D	12-14-79	1449, 722	2.213	791.874	ADAP-08 PARCEL B
61	F	JESSE N. & MARY H. JONES	D	04-01-80	1450, 1305	6.421	798.295	ADAP-08 PARCEL C
62	F	CHARLES H. BURTON	D	05-01-80	1453, 1077	0.96	799.255	ADAP-08 PARCEL D
63	F	J.M. RAMSEY, J.E. GUYNN & J.B. MARSHALL	D	10-01-80	1452, 969	2.54	801.795	ADAP-08 PARCEL E
64	F	WINGFIELD & MARSHALL	D	02-02-82	1181, 897	2.02	803.815	ADAP-09 PARCEL 2
65	F	TED G. SHINAULT, ET. UX.	D	02-08-82	1474, 138	(-0.830)	802.985	ADAP-12 PARCEL P NOISE, SEE PARCEL 128 REMARKS
66	F	WILLIAM E. GATES	D	03-02-82	1181, 1067	7.55	810.535	AIP-03 PARCEL 3 NOISE
67	F	RALPH E. AYERS	D	03-11-82	1181, 1418	6.0	816.535	AIP-03 PARCEL 1 NOISE
68	F	HOMER E. WADE, ET UX.	D	03-25-82	1475, 315	(-0.480)	816.055	ADAP-12 PARCEL M NOISE, SEE PARCEL 128 REMARKS
69	F	HOMER E. WADE, ET. UX.	D	03-25-82	1475, 315	(-0.520)	815.535	ADAP-12 PARCEL N NOISE, SEE PARCEL 128 REMARKS
70	F	KESSLER'S	D	03-27-82	1183, 826	7.80	823.335	ADAP-13 PARCEL 5
71	F	S.D. WITHERS, ET. UX.	D	05-17-82	1476, 1250	(-0.540)	822.795	ADAP-12 PARCEL O NOISE, SEE PARCEL 128 REMARKS
72	F	S.D. WITHERS, ET. UX.	D	05-17-82	1476, 1250	(-0.660)	822.135	ADAP-12 PARCEL O NOISE, SEE PARCEL 128 REMARKS
73	F	DORIS S. CUNDIFF	D	05-18-82	1476, 1218	0.750	822.885	ADAP-12 PARCEL Q NOISE
74		INTENTIONALLY LEFT BLANK					822.885	
75	F	NORMA LETSON ESTATES	D	08-10-82	1185, 841	0.66	823.545	AIP-03 PARCEL 2 NOISE
76	F	FRIENDSHIP MANOR APT. VILLAGE	D	10-12-82	1480, 1523	8.644	832.189	ADAP-13 PARCEL 4
77	F	McDOWALL & WOOD INC.	D	11-01-82	1481, 596	0.024	832.189	
78	F	CLIFFORD E. SMITH, ET. UX.	D	11-09-82	1481, 1158	(-0.820)	831.393	ADAP-12 PARCEL Y NOISE, SEE PARCEL 128 REMARKS
79		INTENTIONALLY LEFT BLANK					831.393	
80	F	WILLIE H. ENGLISH, ET. UX.	D	12-21-82	1482, 1704	0.930	832.323	ADAP-12 NOISE
81	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.980	833.303	ADAP-12 NOISE
82	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.550	833.853	ADAP-12 PARCEL G NOISE, SEE PARCEL 128 REMARKS
83	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.570)	833.283	ADAP-12 NOISE, SEE PARCEL 128 REMARKS
84	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.520)	832.763	ADAP-12 PARCEL NOISE, SEE PARCEL 128 REMARKS
85	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.520)	832.243	ADAP-12 PARCEL F NOISE, SEE PARCEL 128 REMARKS
86	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.520)	831.723	ADAP-12 PARCEL E NOISE, SEE PARCEL 128 REMARKS
87	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.520)	831.203	ADAP-12 PARCEL NOISE, SEE PARCEL 128 REMARKS
88	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.520)	830.683	ADAP-12 PARCEL NOISE, SEE PARCEL 128 REMARKS
89	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.520)	830.163	ADAP-12 PARCEL D NOISE, SEE PARCEL 128 REMARKS
90	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.500)	829.663	ADAP-12 PARCEL NOISE, SEE PARCEL 128 REMARKS
91	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.740	830.403	ADAP-12 PARCEL NOISE
92	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.560	830.963	ADAP-12 PARCEL NOISE
93	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	0.057	831.020	ADAP-12 PARCEL NOISE
94	F	BUILDERS INVESTMENT GROUP	D	12-27-82	1482, 1704	(-0.071)	830.949	ADAP-12 PARCEL NOISE, SEE PARCEL 128 REMARKS
95	F	MARY ELVA COULTER	D	01-10-83	1483, 914	3.05, 2.288	836.287	ADAP-08 PARCEL A-1,A-2
96		INTENTIONALLY LEFT BLANK					836.287	INTENTIONALLY LEFT BLANK
97	F	J. WILEY SHEPARD, ET. UX.	D	02-07-83	1484, 484	(-4.823)	831.464	ADAP-12 PARCEL NOISE, SEE PARCEL 128 REMARKS
98	F	HOWARD J. SIZEMORE, ET. UX.	D	06-16-83	1488, 1814	0.750	832.214	ADAP-12 PARCEL R NOISE
99	F	LEE C. HARTMAN SR., ET. UX.	D	08-23-83	1492, 65	0.790	833.004	ADAP-12 PARCEL NOISE
100		INTENTIONALLY LEFT BLANK					833.004	INTENTIONALLY LEFT BLANK
101	F	WILLIAM H. PRICE (BARN DINNER THEATRE)	D	11-14-85	1528, 1437	2.95	835.954	AIP 3-51-0045-05
102	F	ROANOKE COUNTY BOARD OF SUPERVISORS	D	08-08-88	1587, 294	8.0	843.954	AIP 3-51-0045-05
103	F	CITY OF ROANOKE	D	06-30-87	1564, 668	6.989	850.943	AIP 3-51-0045-06
104	F	CITY OF ROANOKE	D	06-30-87	1564, 668	1.578	852.521	AIP 3-51-0045-06
105		INTENTIONALLY LEFT BLANK					852.521	INTENTIONALLY LEFT BLANK

FEE SIMPLE ACQUISITIONS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	RECORDED DATE	DEED BOOK PAGE NO.	ACREAGE PARCEL	ACREAGE TOTAL	REMARKS
106	F	CALVIN W. & MARY C. POWERS	D	09-06-89	1611, 525	0.200	852.721	AIP-3-51-0045-06
107	W	ROANOKE COUNTY	D	01-16-89	M.B. 1290, 769	(-7.900)	844.821	PROPERTY RELEASE FOR RIGHT-OF-WAY
108	T	PUBLIC RIGHT-OF-WAY	D	01-24-90	M.B. 1, 921	(-0.631)	844.190	PROPERTY RELEASE FOR RIGHT-OF-WAY
109	T	CITY OF ROANOKE	D	07-10-87	1565, 770	(-2.670)	841.520	FIRE STATION REMAIN CITY PROPERTY
109A	F	CITY OF ROANOKE	D	07-08-05	050010650, 365	2.670	844.190	FIRE STATION, CITY RELINQUISH PROPERTY
110	T	PUBLIC RIGHT-OF-WAY	SD	05-11-90	M.B.1,948-950	(-1.845)	842.345	PROPERTY RELEASE FOR RIGHT-OF-WAY
111	F	PUBLIC RIGHT-OF-WAY	SD	05-11-90	M.B.1,948-950	1.648	843.993	ABANDONED PUBLIC RIGHT-OF-WAY
112	F	PUBLIC RIGHT-OF-WAY	SD	06-02-87	M.B.1,618-626	0.595	844.588	ABANDONED PUBLIC RIGHT-OF-WAY
113	F	P & H AFFILIATED PARTNERSHIP	D	11-16-93	1698, 1492	4.045	848.633	AIP 3-51-0045-10
114	F	CITY OF ROANOKE	D	08-23-91	1644, 1017	0.502	849.135	ADJOINING E. I-581 R/W, 1.3 Mi. S. OF HERSHBERGER
115	F	CITY OF ROANOKE	D	08-15-94	1454, 1968	0.23	849.365	S. SIDE OF ROUTE 11 5.8 Mi. W. OF SALEM POST OFFICE
116	F	COMMONWEALTH OF VIRGINIA	D	02-10-97	1786, 344	0.110	849.475	PORTION OF OLD RTE. 118
117	F	CHARLES H. & MARY S. BURTON	D	12-22-86	1252, 3	10.12	859.595	
118	F	MURRAY K. COULTER ESTATE	D	09-24-01	INST. 10014123	11.902	871.497	WILL SEEK AIP REIMBURSEMENT
119	T	WAL-MART PROPERTIES, INC.	D	05-03-02	020010269, 361	(-1.802)	869.695	RELINQUISHED FOR ACQUISITION OF #121
120	F	B.T. PROPERTY, LLC	D	07-12-02	020012852, 358	1.055	870.750	AIP 3-51-0045-026
121	F	SAM'S REAL ESTATE BUSINESS TRUST	D	05-03-02	020010269, 361	1.441	872.191	ACQUIRED FOR RELINQUISHMENT OF #119
122	F	FRIENDSHIP MANOR APARTMENT VILLAGES TRUST	D	02-12-02	200204548, 22	2.389	874.580	AIP 3-51-0045-033
123	F	FRIENDSHIP MANOR APARTMENT VILLAGES TRUST	D	02-12-02	200204548, 22	1.182	875.762	AIP 3-51-0045-033
124	F	DOROTHY F. LACKEY	D	09-05-03	030017415, 332	2.711	878.473	
125	F	B. T. PROPERTY, LLC	D	05-07-04	040007520, 365	8.450	886.923	AIP 3-51-0045-031, TAX NUMBER 6510101 (PARITAL TO 6510108)
126	T	CITY OF ROANOKE	D	10-31-07	070016931, 60	1.20	888.123	ACQUIRED FOR RELINQUISHMENT OF #126A, (PREVIOUSLY OLD PARCEL M)
126A	F	ROANOKE REGIONAL AIRPORT COMMISSION (RRAC)	D	10-31-07	070016931, 60	(-1.20)	886.923	RELINQUISHED FOR ACQUISITION OF #126, (PREVIOUSLY OLD PARCEL N)
127	T	CITY OF ROANOKE	D	12-18-08	080015401, 117	17.104	904.027	CONVEY CITY PARCELS 1, 2, & 3; EXPAND RUNWAY 6, RUNWAY PROTECTION ZONE (RPZ), RESOLUTION #34-111308 DATED 11-13-08, ORDINANCE # 38320-121508 DATED 12-15-08
127A	F	ROANOKE REGIONAL AIRPORT COMMISSION (RRAC)	D	12-18-08	080015401, 117	(-14.887)	889.140	EXCHANGE AIRPORT PARCELS 2, 3 & 4 FOR CITY PARCELS 1, 2, & 3; EXPAND RUNWAY 6, RUNWAY PROTECTION ZONE (RPZ), RESOLUTION #34-111308 DATED 11-13-08, ORDINANCE # 38320-121508 DATED 12-15-08

UTILITY AND LANDSCAPE EASEMENTS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	RECORDED DATE	DEED BOOK PAGE NO.	REMARKS
E1	T	ROANOKE BUSINESS CONDOMINIUMS	E	06-30-88	1586, 1534	PRIVATE 35' STORM DRAIN EASEMENT
E2	T	CITY OF ROANOKE	E	05-12-88	M.B. 1, 899	VARIOUS WATER, SANITARY & STORM DRAIN EASEMENTS
E3	T	CITY OF ROANOKE	E	06-04-90	1632, 1204	SANITARY SEWER & WATER LINE EASEMENT
E4	T	CITY OF ROANOKE	E	06-06-90	1632, 1207	SANITARY SEWER, WATER LINE & STORM DRAIN EASEMENTS
E5	T	APPALACHIAN POWER COMPANY	E	02-24-95	1744, 1825	EASEMENT FOR UNDERGROUND & OVERHEAD ELECTRIC LINES
E6	F	HERSCH ASSOCIATES & SHAKERS RESTAURANT	E	12-18-95	1762, 370	30' ACCESS EASEMENT
E7	T	BILLY H. BRANCH & MICHAEL M. BRANCH	E	05-08-96	1510, 74	STORM DRAIN EASEMENT
E8	T	GARY L. & DIANE E. JOHNS	E	12-29-99	980014794, 292	SANITARY SEWER EASEMENT
E9	T	CITY OF ROANOKE	E	12-29-99	000000018, 74	WATER LINE EASEMENT
		INTENTIONALLY LEFT BLANK				INTENTIONALLY LEFT BLANK
E11	T	APPALACHIAN POWER COMPANY	E	01-14-98	980008876, 34	EASEMENT FOR UNDERGROUND & OVERHEAD ELECTRIC LINES
		INTENTIONALLY LEFT BLANK				INTENTIONALLY LEFT BLANK
E13	T	APPALACHIAN POWER COMPANY	E	04-05-89	N/A	ELECTRIC LINE EASEMENT
E14	F	J.B. ANDREWS (HEIRS)	E	03-06-64	737, 91	DRAINAGE EASEMENT
		INTENTIONALLY LEFT BLANK				INTENTIONALLY LEFT BLANK
E16	T	CITY OF ROANOKE	E	05-11-90	M.B. 1, 948-950	DRAINAGE EASEMENT
E17	T	CITY OF ROANOKE	E	03-16-87	M.B. 1, 589	DRAINAGE EASEMENT
E18	T	ROANOKE COUNTY BOARD OF SUPERVISORS	E	08-08-88	M.B. 1290, 769	LANDSCAPE EASEMENT (P.B. 11, PG 121)
E19	T	VERIZON VIRGINIA, INC.	E	04-25-01	010007512, 1	15' COMMUNICATION EASEMENT
E20	T	APPALACHIAN POWER COMPANY	E	05-21-01	010007399, 443	15' ELECTRIC EASEMENT
E21	T	ROANOKE GAS COMPANY	E	04-24-01	010008977, 135	10' GAS EASEMENT
E22	T	CITY OF ROANOKE	E	06-01-01	010008953, 245	15' SEWER EASEMENT
E23	T	CITY OF ROANOKE	E	06-01-01	010008954, 254	15' WATERLINE EASEMENT
E24	T	CITY OF ROANOKE	E	10-22-79	M.B. 1, 264	20' DRAINAGE EASEMENT
E25	T	CITY OF ROANOKE	E	02-25-77	M.B. 1, 243	15' PUBLIC UTILITY EASEMENT
E26	T	CITY OF ROANOKE	E	03-16-87	M.B. 1, 591	20' PUBLIC UTILITY EASEMENT

FUTURE PROPERTY ACQUISITIONS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	RECORDED DATE	DEED BOOK PAGE NO.	ACREAGE	REMARKS
A	PENDING	FRANK N. PERKINSON, JR. ET AL		PENDING	1310, 693	0.66	PENDING
B	PENDING	FRANK N. PERKINSON, JR. ET AL		PENDING	1310, 693	0.66	PENDING
C	PENDING	RONALD L. FERGUSON, ET UX		PENDING	1168, 314	0.66	PENDING
D	PENDING	DAVID L. DECK, ET UX		PENDING	1336, 199	0.66	PENDING
E	PENDING	STEPHEN E. & RUTH M. LUCIA		PENDING	2, 210	0.66	PENDING
F	PENDING	STEPHEN E. & RUTH M. LUCIA		PENDING	2, 210	0.66	PENDING
G	PENDING	MOORE INVESTMENT CORP.		PENDING	1665, 837	7.97	PENDING
H	PENDING	INDUSTRIAL DEVELOPMENT AUTHORITY CITY OF ROANOKE		PENDING	1471, 379	4.066	PENDING
I	PENDING	FIRST VIRGINIA BANKS, INC.		PENDING	1550, 1099	2.127	PENDING
J	PENDING	FIRST VIRGINIA BANKS, INC.		PENDING	1550, 1099	1.953	PENDING
K	PENDING	GILBERT E. TWILLY, ET UX		PENDING	1091, 335	1.00	PENDING
L	PENDING	EDWARD S. & RUTH B. HOPKINS		PENDING	1091, 335	0.66	PENDING
M	PENDING	KENNETH L. & LORI C. DENSON		PENDING	02000, 0040	0.10	PENDING, TAX NUMBER 6490405
N	PENDING	BLUE RIDGE MOUNTAINS COUNCIL, INC., BOY SCOUTS		PENDING	1574, 1409	2.05	PENDING, TAX NUMBER 2270222
O	PENDING	BOBBY LEE & DOROTHY C. LAVENDER		PENDING	1596, 695	0.40	PENDING, TAX NUMBER 6490703
P	PENDING	A. BYRON SMITH		PENDING	WB33, 738	1.00	PENDING, TAX NUMBER 6490706
Q	PENDING	PARK TOWNE, LLC.		PENDING	03001, 6925	1.61	PENDING, TAX NUMBER 2270208
R	PENDING	JEROME D. RICHARDSON & CAROL B. ROSLYN		PENDING	050002795	0.17	PENDING, TAX NUMBER 6421124
S	PENDING	SECURITY FINANCIAL ENTERPRISES		PENDING	050021304	0.30	PENDING, TAX NUMBER 6421123
T	PENDING	AL W. & MARY R. HOLLAND		PENDING	0619901260	0.27	PENDING, TAX NUMBER 6421122
U	PENDING	BRYAN J. & MELISSA B. THORNHILL		PENDING	050019555	0.23	PENDING, TAX NUMBER 6421121
V	PENDING	JOSEPH M. KISER		PENDING	070008651	0.20	PENDING, TAX NUMBER 6421120
W	PENDING	CITY OF ROANOKE		PENDING	1564, 668	0.24	PENDING, TAX NUMBER 2380113, REMAINING PROPERTY NOT TRANSFERRED TO AIRPORT FROM TAX MAP 2380101
X	PENDING	BROSHIA & JAMES DANCY, SR.		PENDING	05001, 7588	0.21	PENDING, TAX NUMBER 2270247
Y	PENDING	DAISY MAE MANNS		PENDING	0990014567	0.17	PENDING, TAX NUMBER 2270246
Z	PENDING	MICHAEL JUSTUS		PENDING	06001, 6676	0.17	PENDING, TAX NUMBER 2270245
AA	PENDING	CHENG YUAN HSU & MIAU MA YU		PENDING	06001, 1517	0.14	PENDING, TAX NUMBER 2270244
AB	PENDING	JAMIE L. WHITT & CHRISTOPHER L. HODGES		PENDING	07001, 5037	0.13	PENDING, TAX NUMBER 2270313
AC	PENDING	WESLEY T. & SHELLEY CRUTE		PENDING	020020203	0.16	PENDING, TAX NUMBER 2270314
AD	PENDING	TIMOTHY A. RUMFELT		PENDING	040010506	0.15	PENDING, TAX NUMBER 2270315
AE	PENDING	LAWRENCE A. & KATHLEEN F. PERFATER		PENDING	873, 14	0.14	PENDING, TAX NUMBER 2270316
AF	PENDING	INN AT VALLEY VIEW BOULEVARD, LLC.		PENDING	00001, 1491	1.17	PENDING, TAX NUMBER 2490122
AG	PENDING	EYE VIEW, LLC.		PENDING	0000000800	0.05	PENDING, TAX NUMBER 2490118
AH	PENDING	A & M ENTERPRISES, LP.		PENDING	060013709	4.58	PENDING, TAX NUMBER 6530104
AI	PENDING	ELBERRY NABIL		PENDING	060007645	2.52	PENDING, TAX NUMBER 6530102
AJ	PENDING	A. B. MAR VALLEY COURT, LP.		PENDING	0173001895	13.71	PENDING, TAX NUMBER 6530103
AK	PENDING	ROANOKE AIRPARK, LLC.		PENDING	0020010271	4.93	PENDING, TAX NUMBER 6530105
AL	PENDING	S. L. L. LIMITED COMPANY		PENDING	0180100431	5.14	PENDING, TAX NUMBER 6530110
AM	PENDING	DATASAFE REAL ESTATE, LLC.		PENDING	0010013660	3.01	PENDING, TAX NUMBER 6530101
AN	PENDING	GK 1993 ROANOKE. LLC.		PENDING	0020009805	10.0	PENDING, TAX NUMBER 6530106
AO	PENDING	MONMOUTH REAL ESTATE INVESTMENT		PENDING	060020460	2.30	PENDING, TAX NUMBER 6530109
AP	PENDING	MONMOUTH REAL ESTATE INVESTMENT		PENDING	060020460	2.01	PENDING, TAX NUMBER 6530108
AQ	PENDING	MONMOUTH REAL ESTATE INVESTMENT		PENDING	060020460	4.68	PENDING, TAX NUMBER 6530107
AR	PENDING	CALVIN W. & MARY C. POWERS		PENDING	0000010347	5.47	PENDING, TAX NUMBER 6520101
AS	PENDING	AYERS PROPERTIES, LLC.		PENDING	070006723	2.36	PENDING, TAX NUMBER 6520102
AT	PENDING	AYERS PROPERTIES, LLC.		PENDING	070006723	1.79	PENDING, TAX NUMBER 6520103
AU	PENDING	CLIVE E. & BETTY ANN RICE		PENDING	0171401851	3.31	PENDING, TAX NUMBER 6520104
AV	PENDING	CRAWFORD DEVELOPMENT CO., LLC.		PENDING	0000010635	1.86	PENDING, TAX NUMBER 6520105 (PARTIAL TO 6520111)
AW	PENDING	FARMERS WAREHOUSE, INC.		PENDING	070018708	1.70	PENDING, TAX NUMBER 6520106
AX	PENDING	B. T. PROPERTY, LLC		PENDING	090014022	46.65	PENDING, TAX NUMBER 6520107
AY	PENDING	SUNTRUST BANK TRUSTEE UNDER WILL OF EDWIN WILSON		PENDING	0178300939	5.18	PENDING, TAX NUMBER 6520108
AZ	PENDING	GK 1993 ROANOKE. LLC.		PENDING	0020009805	5.35	PENDING, TAX NUMBER 6520109
BA	PENDING	J. R. S. A. PROPERTIES, LLC.		PENDING	0970021440	3.49	PENDING, TAX NUMBER 6520110
BB	PENDING	CRAWFORD DEVELOPMENT CO., LLC.		PENDING	0000010635	1.61	PENDING, TAX NUMBER 6520111 (FROM 6520105)
BC	PENDING	B. T. PROPERTY, LLC		PENDING	0990014022	3.70	PENDING, TAX NUMBER 6510108 (FROM 6510101)
BD	PENDING	CIRCLE T. PROPERTIES, LLC.		PENDING	030021302	1.56	PENDING, TAX NUMBER 6500101
BE	PENDING	INERGY PROPANE, LLC.		PENDING	050009842	2.11	PENDING, TAX NUMBER 6500102
BF	PENDING	WESTERN BRANCH DIESEL, INC.		PENDING	1438, 1910	0.09	PENDING, TAX NUMBER 6500105
BG	PENDING	WESTERN BRANCH DIESEL, INC.		PENDING	1413, 1913	2.74	PENDING, TAX NUMBER 6500106
BH	PENDING	DODSON BROS. EXTERMINATING		PENDING	0970021854	1.70	PENDING, TAX NUMBER 6500107
BI	PENDING	DODSON BROS. EXTERMINATING		PENDING	0970021854	0.41	PENDING, TAX NUMBER 6500108
BJ	PENDING	VIRGINIA HIGHWAY DEPARTMENT		PENDING	PENDING	2.76	PENDING, TAX NUMBER 6500109
BK	PENDING	P. D. J. ASSOCIATES		PENDING	016300222	7.73	PENDING, TAX NUMBER 6630102
BL	PENDING	WILDWOOD PARK, LLC.		PENDING	070003430	2.24	PENDING, TAX NUMBER 6630105
BM	PENDING	N & W INVESTMENTS, LLC.		PENDING	0020014857	1.99	PENDING, TAX NUMBER 6630106
BN	PENDING	MIDWEST CAR CORPORATION		PENDING	0010013358	2.02	PENDING, TAX NUMBER 6630108
BO	PENDING	RICHARD C. BISHOP		PENDING	0172800630	2.54	PENDING, TAX NUMBER 6630112
BP	PENDING	STOKES W. N., LLC.		PENDING	0000015698	0.52	PENDING, TAX NUMBER 6630113
BQ	PENDING	MICHAEL T. & JOYCE B. FRANCISCO		PENDING	0166800169	0.52	PENDING, TAX NUMBER 6630114
BR	PENDING	GARY L. & GLENNA J. BANNISTER		PENDING	070003429	2.03	PENDING, TAX NUMBER 6630115
BS	PENDING	GEOFFREY M. OTTAWAY		PENDING	0157301128	3.66	PENDING, TAX NUMBER 6640101
BT	PENDING	CALVIN W. & MARY C. POWERS		PENDING	0155101366	12.50	PENDING, TAX NUMBER 6640102
BU	PENDING	HART INVESTMENTS, IV, LLC.		PENDING	060021324	2.62	PENDING, TAX NUMBER 6640122

FUTURE PROPERTY ACQUISITIONS

PARCEL	TO / FROM	NAME OF PREVIOUS OWNER	INST.	RECORDED DATE	DEED BOOK PAGE NO.	ACREAGE	REMARKS
BV	PENDING	PURCELL L. & MATHEW A. BARRETT		PENDING	016040451	8.01	PENDING, TAX NUMBER 026.19-01-27.00
BW	PENDING	ENGLISH CONSTRUCTION COMPANY, INC.		PENDING	200617709	4.97	PENDING, TAX NUMBER 026.19-01-28.00
BX	PENDING	ADAMS CONSTRUCTION CO.		PENDING	016311024	6.56	PENDING, TAX NUMBER 026.19-01-29.00
BY	PENDING	CHESTER A. MOORE, JR.		PENDING	016061592	1.96	PENDING, TAX NUMBER 026.19-01-30.00
BZ	PENDING	POINDEXTER CEMETERY		PENDING	093300142	1.00	PENDING, TAX NUMBER 026.19-01-30.01
CA	PENDING	ROY A. LEWIS		PENDING	200718166	0.05	PENDING, TAX NUMBER 026.19-01-31.00
CB	PENDING	ROLAND H. MALONE, SR.		PENDING	013070194	0.50	PENDING, TAX NUMBER 026.19-01-35.00
CC	PENDING	CHESTER A. MOORE, JR.		PENDING	000481292 (WILL)	1.03	PENDING, TAX NUMBER 026.19-01-36.00
CD	PENDING	ROLAND H. MALONE		PENDING	011560506	1.00	PENDING, TAX NUMBER 026.19-01-37.00
CE	PENDING	FRANKLIN & LOUISE B. STYLES		PENDING	009530392	0.09	PENDING, TAX NUMBER 026.19-01-38.00
CF	PENDING	FRANKLIN & LOUISE B. STYLES		PENDING	009530392	0.50	PENDING, TAX NUMBER 026.19-01-39.00
CG	PENDING	FRANKLIN R. & LOUISE B. STYLES		PENDING	009330140	0.50	PENDING, TAX NUMBER 026.19-01-40.00
CH	PENDING	FRANKLIN R. & LOUISE B. STYLES		PENDING	093900309	1.00	PENDING, TAX NUMBER 026.19-01-41.00
CI	PENDING	FRANKLIN R. & LOUISE B. STYLES		PENDING	009720508	1.00	PENDING, TAX NUMBER 026.19-01-42.00
CJ	PENDING	THOMAS & GEORGIE CROSON		PENDING	058400479	1.00	PENDING, TAX NUMBER 026.19-01-43.00
CK	PENDING	LESLEY H. & CHARLOTTE L. JOHNSON		PENDING	011970591	058	PENDING, TAX NUMBER 026.19-01-44.00
CL	PENDING	LESLEY H. & CHARLOTTE L. JOHNSON		PENDING	011970592	0.50	PENDING, TAX NUMBER 026.19-01-45.00
CM	PENDING	PAUL E. JOHNSON		PENDING	00800334 (WILL)	0.56	PENDING, TAX NUMBER 026.19-01-46.00
CN	PENDING	PAUL E. JOHNSON		PENDING	00800334 (WILL)	1.00	PENDING, TAX NUMBER 026.19-01-47.00
CO	PENDING	PAUL E. JOHNSON		PENDING	00800334 (PLAT)	0.50	PENDING, TAX NUMBER 026.19-01-48.00
CP	PENDING	PURCELL L. & GAIL BERNA BARRETT		PENDING	016191230	0.18	PENDING, TAX NUMBER 026.19-01-03.01

NO.	REVISIONS	BY	APP.	DATE
2	HATCH ADDITIONAL LAND ACQUISITION FOR THE EXPANSION OF THE RPZs, UPDATE FUTURE PROPERTY ACQUISITION CHART	RWW	MWK	05/15/09
1	ADD HEIGHT RESTRICTIONS PHASE 2 EASEMENTS, EXCHANGE CITY AND AIRPORT PROPERTIES TO EXPAND RW 6 RPZ, ADD LAND ACQUISITION HATCH FOR THE EXPANSION OF RW 33 RPZ	RWW	MWK	04/20/09

NO.	BY	DATE	REVISIONS	APPROVED

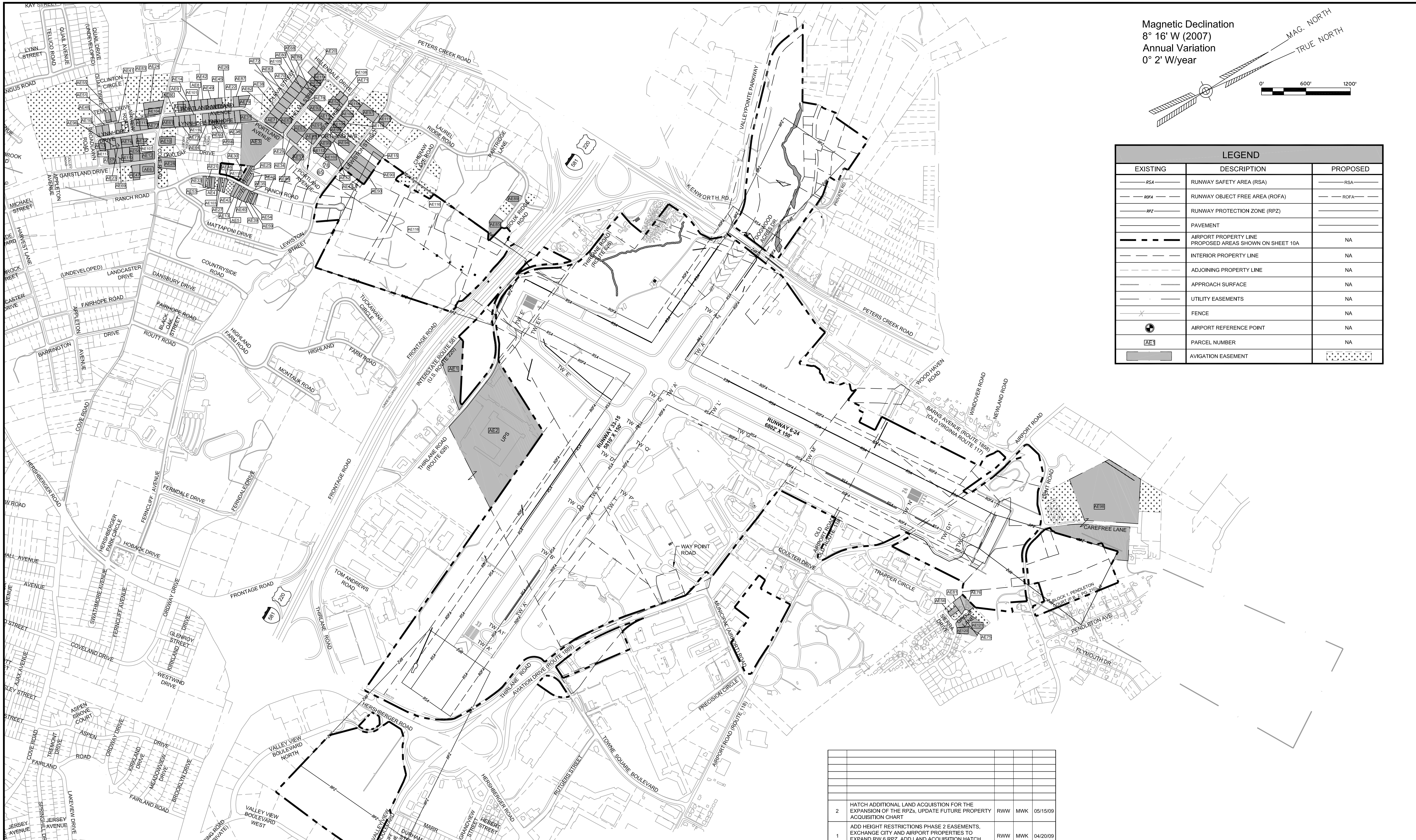
HNTB
2900 SOUTH QUINCY STREET,
SUITE 200
ARLINGTON, VIRGINIA 22206
PH (703) 824-5100
FAX (703) 671-6210

AIRPORT PROPERTY MAP DATA SHEET

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE:
Jun 29, 2009

SHEET No.
17



LEGEND

EXISTING	DESCRIPTION	PROPOSED
——RSA——	RUNWAY SAFETY AREA (RSA)	——RSA——
—— ROFA ——	RUNWAY OBJECT FREE AREA (ROFA)	—— ROFA ——
——RPZ——	RUNWAY PROTECTION ZONE (RPZ)	————
————	PAVEMENT	————
— · — · —	AIRPORT PROPERTY LINE PROPOSED AREAS SHOWN ON SHEET 10A	NA
— — — —	INTERIOR PROPERTY LINE	NA
- - - -	ADJOINING PROPERTY LINE	NA
————	APPROACH SURFACE	NA
————	UTILITY EASEMENTS	NA
——x——	FENCE	NA
⊕	AIRPORT REFERENCE POINT	NA
AE1	PARCEL NUMBER	NA
(shaded)	AVIGATION EASEMENT	(dotted)

NO.	REVISIONS	BY		DATE
2	HATCH ADDITIONAL LAND ACQUISTION FOR THE EXPANSION OF THE RPZs, UPDATE FUTURE PROPERTY ACQUISITION CHART	RWW	MWK	05/15/09
1	ADD HEIGHT RESTRICTIONS PHASE 2 EASEMENTS, EXCHANGE CITY AND AIRPORT PROPERTIES TO EXPAND RW 6 RPZ, ADD LAND ACQUISITION HATCH FOR THE EXPANSION OF RW 33 RPZ	RWW	MWK	04/20/09

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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

AVIGATION EASEMENT MAP

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

SHEET No. 18

P:_Projects\40311 ROA Master Plan Update\CAD\ALP SET\SHT-18_19 AVIGATION EASEMENT MAP.dwg S18 Jun 29, 2009 - 1:21pm

AVIGATION EASEMENTS TRANSACTIONS AT ROANOKE REGIONAL AIRPORT

AVIGATION EASEMENTS

PARCEL	TO / FROM	NAME OF OWNER	INST.	RECORDED DATE	DEED BOOK PAGE NO.	ADDRESS	TAX MAP NO.	REMARKS
AE1	F	B. T. PROPERTIES, LLC, (JERRY R. GARST)	E	10-21-80	1460, 465	THIRLANE RD. NW	6510108	PARCEL 1-B
AE2	F	B. T. PROPERTIES, LLC, (COVA CORPORATION)	E	2-26-90	1619, 249	3941 THIRLANE RD. NW	6520107	CLEAR ZONE & ADJACENT TRANSITION ZONE EASEMENT
AE3	F	TRUSTEES OF HOUSE OF PRAYER, (GARY & DIANE JOHNS)	E	9-30-98	980014793, 285	2521 PORTLAND AVE. NW	6410231	AVIGATION & HAZARD EASEMENT
AE4	F	GETGOOD, CALVERT D. & NORMA A.	E	7-7-04	040011234, 228	2223 RANCH RD. NW	6431123	AIP 3-15-0045-028
AE5	F	HOLLAND, WILLIAM M., JR.	E	7-7-04	040011235, 234	2307 RANCH RD. NW	6431114	AIP 3-15-0045-028
AE6	F	FICKENS, SUSAN	E	7-7-04	040011236, 240	2217 GARSTLAND DR. NW	6400615	AIP 3-15-0045-028
AE7	F	HASH, MARVIN P. L. & EDITH R.	E	7-7-04	040011237, 246	2506 PORTLAND AVE. NW	6420701	AIP 3-15-0045-028
AE8	F	GATES, LONN W. & DOROTHY H.	E	8-12-04	040013565, 162	2340 PORTLAND AVE. NW	6410128	AIP 3-15-0045-028
AE9	F	COX, RICHARD L. & VICTORIA L.	E	8-12-04	040013566, 168	2326 PORTLAND AVE. NW	6410130	AIP 3-15-0045-028
AE10	F	MOSER, TYREE I., JR., & CHERYL D.	E	8-12-04	040013567, 174	4323 COVE RD. NW	6410219	AIP 3-15-0045-028
AE11	F	WATSON, JAMES G.	E	8-12-04	040013568, 180	4436 BEN ST. NW	6420810	AIP 3-15-0045-028
AE12	F	CLAYBORNE, JOHN D. & MARY T.	E	9-28-04	040016497, 386	2218 GARSTLAND DR. NW	6400312	AIP 3-15-0045-028
AE13	F	McQUEEN, CHARLES W., JR.	E	9-28-04	040016498, 392	2303 RANCH RD. NW	6431116	AIP 3-15-0045-028
AE14	F	LEMOINE, JOHANN HENRI & DORIT S.	E	10-28-04	040018120, 126	2331 PORTLAND AVE. NW	6410208	AIP 3-15-0045-028
AE15	F	GARREN, E. LA VERNE	E	10-28-04	040018121, 130	4455 LEWISTON ST. NW	6421124	AIP 3-15-0045-028
AE16	F	LOGAN, JAMES N. & HELEN A.	E	11-4-04	040018662, 356	2104 LYNNHOPE DR. NW	6400205	AIP 3-15-0045-028
AE17	F	WARREN, BEVERLY E. & MARZENNIA G.	E	11-4-04	040018614, 217	2103 LYNNHOPE DR. NW	6400301	AIP 3-15-0045-028
AE18	F	ROSBOROUGH, VALERIE L.	E	12-15-04	040020852, 222	2312 RANCH RD. NW	6431007	AIP 3-15-0045-028
AE19	F	MULL, DOUGLAS N. & JUDITH E.	E	12-15-04	040020853, 226	2430 PORTLAND AVE. NW	6410121	AIP 3-15-0045-028
AE20	F	DANIEL, GARY A.	E	12-15-04	040020854, 230	2513 HILLENDALE DR. NW	6420502	AIP 3-15-0045-028
AE21	F	WILSON, CARL DAVID	E	12-15-04	040020855, 236	2227 RANCH RD. NW	6431125	AIP 3-15-0045-028
AE22	F	SHROADES, CONRAD V. & WYNNIEFREDA	E	12-15-04	040020898, 442	2415 PORTLAND AVE. NW	6410214	AIP 3-15-0045-028
AE23	F	BROWN, WILLIAM J.	E	12-30-04	040021751, 150	2121 LYNNHOPE DR. NW	6400304	AIP 3-15-0045-028
AE24	F	DULANEY, JACK ALLEN ILONKA B.	E	12-30-04	040021782, 156	4428 COVE RD.	6370117	AIP 3-15-0045-028
AE25	F	JACKSON, DOUGLAS E.	E	12-30-04	040021753, 160	2308 RANCH RD. NW	6431009	AIP 3-15-0045-028
AE26	F	EDMONDSON, JOYCE DARLIENE	E	2-16-05	050002391, 341	2409 PORTLAND AVE.	6410213	AIP 3-15-0045-028
AE27	F	HALL, HAROLD G. & SUSAN L.	E	2-16-05	050002392, 345	2237 RANCH RD. NW	6431120	AIP 3-15-0045-028
AE28	F	WILLIAMS, BRENDA J.	E	2-16-05	050002393, 349	4237 COVE RD. NW	6430301	AIP 3-15-0045-028
AE29	F	JENNINGS, LILLIAN G. & JOHN RAY	E	2-18-05	050002473, 35	2520 PORTLAND AVE.	6420709	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE30	F	McGHEE, LEON & GINGER	E	3-2-05	050003123, 279	2304 RANCH RD. NW	6431011	AIP 3-15-0045-028
AE31	F	MAJORS, WILLIAM H. & MILDRED A.	E	3-15-05	050003861, 164	2439 PORTLAND AVE.	6410216	AIP 3-15-0045-028
AE32	F	GRAY, MATILDA A.	E	3-15-05	050003860, 160	4439 BEN ST.	6420905	AIP 3-15-0045-028
AE33	F	SPAULDING, RICHARD S., JR., & CAROLYN P.	E	3-17-05	050004062, 287	2231 RANCH RD. NW	6431127	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE34	F	LOVELACE, ROLAND T. & ROBBIN W.	E	3-21-05	050004249, 546	2602 PORTLAND AVE. NW	6420807	AIP 3-15-0045-028
AE35	F	TURNER, JERINE A.	E	5-4-05	050006911, 436	2319 RANCH RD. NW	6431110	AIP 3-15-0045-032
AE36	F	MORGAN, HARRY L. & MARY T.	E	5-20-05	050007721, 3	2421 PORTLAND AVE. NW	6410215	AIP 3-15-0045-034, PURCHASE ASSURANCE
AE37	F	MITCHELL, KENTON L. & DENISE D.	E	5-23-05	050007831, 129	2621 PORTLAND AVE NW	6410218	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE38	F	PRESTON, JOHNNY OTIS & CORNETTA H.	E	5-25-05	050007940, 1	4417 OLEVA ST. NW	6420510	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE39	F	BOARDWINE, BETSY	E	5-31-05	050008195, 57	2317 RANCH RD. NW	6431111	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE40	F	JONES, ARLENE S.	E	6-9-05	050008883, 82	2313 RANCH RD.	6431112	AIP 3-15-0045-028
AE41	F	ROSE, ERMA L.	E	6-14-05	050009077, 1	2122 LYNNHOPE DR. NW	6400202	AIP 3-15-0045-028
AE42	F	TOOMER, PHILLIP	E	6-22-05	050009568, 3	2346 PORTLAND AVE. NW	6410127	AIP 3-15-0045-028
AE43	F	MULDREW, SEAN F.	E	6-23-05	050009668, 99	4433 LEWISTON AVE.	6421120	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE44	F	ABBOTT, GRACE	E	6-30-05	050010137, 1	2255 RANCH RD. NW	6431132	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE45	F	SHELTON-TILLEY, MARIE ELAINE & RUTH MAXINE	E	7-28-05	050011887, 423	2402 PORTLAND AVE. NW	6410125	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE46	F	LONG, DONNA M.	E	9-30-05	050015947, 80	2241 RANCH RD. NW	6431118	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE47	F	BARTON III, JAMES C.	E	10-27-05	050017562, 189	2205 GARSTLAND DR. NW	6400614	AIP 3-15-0045-028
AE48	F	COFFMAN, CLARENCE E. & GEORGIA L.	E	10-27-05	050017563, 195	2110 LYNNHOPE DR. NW	6400204	AIP 3-15-0045-028
AE49	F	WILLIAMS, NATASHA L.	E	11-16-05	050018881, 302	2354 PORTLAND AVE. NW	6410126	AIP 3-15-0045-028
AE50	F	RIPPEY III, JOHN W.	E	11-23-05	050019313, 222	4437 LEWISTON ST. NW	6421121	AIP 3-15-0045-028, PURCHASE ASSURANCE
AE51	F	PENNIX, SHERMAN L. & SHERRITA A.	E	1-19-06	060000897, 238	2112 TEMPLE ST. NW	6370803	AIP 3-15-0045-032
AE52	F	HELMS, CAMILLE LEGANS	E	2-6-06	060001886, 186	4460 BEN ST. NW	6420808	AIP 3-15-0045-032
AE53	F	LOWE, FRANCES C.	E	2-27-06	060003011, 433	2225 RANCH RD. NW	6431124	AIP 3-15-0045-032
AE54	F	TAYLOR, JAMES C.	E	3-14-06	060003914, 454	2325 RANCH RD. NW	6431107	AIP 3-15-0045-032
AE55	F	COOK, JAMES & ERICKA	E	3-27-06	060004544, 72	2116 TEMPLE DR. NW	6370804	AIP 3-15-0045-032, PURCHASE ASSURANCE
AE56	F	BAILEY, JOHN E. & PATRICIA	E	4-21-06	200606107, 181	6011 SIERA DR. NW	038.05-02-11.00	AIP 3-15-0045-032
AE57	F	HACKLEY, THEODORE & SHARON	E	4-25-06	060006275, 153	2114 GARSTLAND DR. NW	6400316	AIP 3-15-0045-032
AE58	F	PAXTON, MARY L.	E	5-10-06	060007334, 277	2206 GARSTLAND DR. NW	6400313	AIP 3-15-0045-032
AE59	F	MARKELL, JOHN	E	6-20-06	060009769, 438	2323 RANCH RD. NW	6431108	AIP 3-15-0045-032
AE60	F	LEMOINE, HENRY C. & CINA M.	E	8-28-06	060014140, 319	2353 PORTLAND DR. NW	6410211	AIP 3-15-0045-032
AE61	F	PHAN, CHAU GIA & NGUYEN, TY	E	9-15-06	060015233, 72	2303 PORTLAND DR. NW	6410204	AIP 3-15-0045-032
AE62	F	AYTON, RUDULPH H.	E	1-26-07	070001351, 305	4409 OLEVA ST. NW	6420511	AIP 3-15-0045-032, SOUND PHASE 1A
AE63	F	BARRETT, CAROLYN H.	E	1-26-07	070001352, 311	4410 THELMA ST. NW	6420708	AIP 3-15-0045-032, SOUND PHASE 1A
AE64	F	BOWENS, MICHAEL L. & RUTH C.	E	1-26-07	070001353, 317	2345 PORTLAND AVE. NW	6410210	AIP 3-15-0045-032, SOUND PHASE 1A
AE65	F	BROCK, ALBERT E.	E	1-26-07	070001354, 323	4456 THELMA ST. NW	6420703	AIP 3-15-0045-032, SOUND PHASE 1A
AE66	F	CARTER, BEVERLY JEAN & JAMES	E	1-26-07	070001355, 329	2401 PORTLAND DR. NW	6410212	AIP 3-15-0045-032, SOUND PHASE 1A
AE67	F	CECIL, R. L. & LOIS M.	E	1-26-07	070001356, 335	4409 THELMA ST. NW	6420806	AIP 3-15-0045-032, SOUND PHASE 1A
AE68	F	COUSER, CAROLYN C.	E	1-26-07	070001357, 341	4457 OLEVA ST. NW	6420505	AIP 3-15-0045-032, SOUND PHASE 1A
AE69	F	CRUMP, ROLAND L. & BRENDA W.	E	1-26-07	070001358, 347	2122 GARSTLAND DR. NW	6400315	AIP 3-15-0045-032, SOUND PHASE 1A
AE70	F	DICKERSON DONALD J. SR., & BOBBIE J.	E	1-26-07	070001359, 353	4441 OLEVA ST. NW	6420507	AIP 3-15-0045-032, SOUND PHASE 1A
AE71	F	GRAVERLY, WILLIAM GRAY	E	1-26-07	070001360, 359	2633 HILLENDALE DR. NW	6420301	AIP 3-15-0045-032, SOUND PHASE 1A
AE72	F	HALE, DANIEL M., JR.	E	1-26-07	070001361, 365	4425 OLEVA ST. NW	6420509	AIP 3-15-0045-032, SOUND PHASE 1A
AE73	F	HAMM, NEILA BARNETT	E	1-26-07	070001362, 371	2319 PORTLAND DR. NW	6410206	AIP 3-15-0045-032, SOUND PHASE 1A
AE74	F	HILL, AUDLEY & VALERIA	E	1-26-07	070001363, 376	2133 LYNNHOPE DR. NW	6400306	AIP 3-15-0045-032, SOUND PHASE 1A
AE75	F	HOLLINGSWORTH, SAMUEL & PARTICAI	E	1-26-07	200701212, 8	920 GROVE LN. NW	038.05-02-05.00	AIP 3-15-0045-032, SOUND PHASE 1A
AE76	F	MARTIN, DOUGLAS G. & VIRGIE I.	E	1-26-07	200701213, 14	905 GROVE LN. NW	038.05-02-08.00	AIP 3-15-0045-032, SOUND PHASE 1A
AE77	F	PRESTON, ARTHUR L.	E	1-26-07	070001364, 382	4404 COVE RD. NW	6400102	AIP 3-15-0045-032, SOUND PHASE 1A
AE78	F	REED, ROBERT W.	E	1-26-07	070001365, 388	4440 THELMA ST. NW	6420705	AIP 3-15-0045-032, SOUND PHASE 1A
AE79	F	RICHARDSON, TERRI A.	E	1-26-07	070001366, 394	2209 LYNNHOPE DR. NW	6400308	AIP 3-15-0045-032, SOUND PHASE 1A
AE80	F	ROWE, EMOGENE S.	E	1-26-07	070001367, 400	4450 THELMA ST. NW	6420704	AIP 3-15-0045-032, SOUND PHASE 1A
AE81	F	RUSSO, KENNETH A. & DIANA J.	E	1-26-07	200701214, 20	913 GROVE LN. NW	038.05-02-09.00	AIP 3-15-0045-032, SOUND PHASE 1A
AE82	F	THOMPSON, IVA J. S.	E	1-26-07	070001368, 406	4433 OLEVA ST. NW	6420508	AIP 3-15-0045-032, SOUND PHASE 1A
AE83	F	BROADY, ULAS M. & DELOIS C.	E	8-10-07	070012548, 18	2204 LYNNHOPE DR. NW	6400104	AIP 3-15-0045-034, SOUND PHASE 1B
AE84	F	CRAWLEY, FRANCES S.	E	8-10-07	070012553, 47	4460 THELMA ST. NW	6420702	AIP 3-15-0045-034, SOUND PHASE 1B
AE85	F	DENSON, LEON & LORI	E	8-10-07	070012562, 119	3837 SIOUX RIDGE RD. NW	6490405	AIP 3-15-0045-034, SOUND PHASE 1B
AE86	F	ENGLISH, KELLY M. & PATRICIA H.	E	8-10-07	070012564, 131	2313 PORTLAND DR. NW	6410205	AIP 3-15-0045-034, SOUND PHASE 1B
AE87	F	GRANT, OLIVER & LILLETHE J.	E	8-10-07	070012547, 11	2422 PORTLAND DR. NW	6410122	AIP 3-15-0045-034, SOUND PHASE 1B
AE88	F	HACKNEY, BESSIE L.	E	8-10-07	070012551, 35	2615 PORTLAND DR. NW	6410217	AIP 3-15-0045-034, SOUND PHASE 1B
AE89	F	HAMM, GARY & CAROLYN L.	E	8-10-07	070012559, 101	3807 SIOUX RIDGE RD. NW	6490402	AIP 3-15-0045-034, SOUND PHASE 1B

AVIGATION EASEMENTS

PARCEL	TO / FROM	NAME OF OWNER	INST.	RECORDED DATE	DEED BOOK PAGE NO.	ADDRESS	TAX MAP NO.	REMARKS
AE90	F	HOLLARD, AL W. & MARY R.	E	8-10-07	070012561, 113	4443 LEWISTON ST. NW	6421122	AIP 3-15-0045-034, SOUND PHASE 1B
AE91	F	MANNS, WARREN J. & NETTIE M.	E	8-10-07	070012552, 41	4426 BEN ST. NW	6420811	AIP 3-15-0045-034, SOUND PHASE 1B
AE92	F	MANNING, THELMA M.	E	8-10-07	070012550, 29	4439 THELMA ST. NW	6420803	AIP 3-15-0045-034, SOUND PHASE 1B
AE93	F	PINKARD, ROBERT M.	E	8-10-07	070012554, 53	4410 BEN ST. NW	6420814	AIP 3-15-0045-034, SOUND PHASE 1B
AE94	F	TAYLOR, SHERMAN M. & EVA MAE	E	8-10-07	070012560, 107	4440 LEWISTON ST. NW	6421110	AIP 3-15-0045-034, SOUND PHASE 1B
AE95	F	WALKER, WOODROW, JR., & VIOLA H.	E	8-10-07	070012549, 23	4449 BEN ST. NW	6420904	AIP 3-15-0045-034, SOUND PHASE 1B
AE96	F	WATTS, DELORES S.	E	8-10-07	070012565, 137	2115 LYNNHOPE DR. NW	6400303	AIP 3-15-0045-034, SOUND PHASE 1B
AE97	F	WILSON, CAROL M.	E	8-10-07	070012563, 125	4502 LEWISTON ST. NW	6421106	AIP 3-15-0045-034, SOUND PHASE 1B
AE98	F	VILLAGE GREEN OF VIRGINIA, LLC	E	11-5-07	200717207, 248	CAREFREE LANE	027.17-04-13.3 027.17-04-13.6	AIP 3-15-0045-042, SOUND PHASE 2 (FORMERLY FRIENDSHIP MANOR APARTMENT)
AE99	F	ALSTON-TERRY, LORETTA K.	E	4-28-08	080005543, 555	4429 BEN ST. NW	6420906	AIP 3-15-0045-042, SOUND PHASE 2
AE100	F	ANDERSON, MICHAEL ANTHONY	E	4-28-08	080005544, 561	2320 PORTLAND AVE. NW	6410131	AIP 3-15-0045-042, SOUND PHASE 2
AE101	F	BUCKNER, HAROLD JR., & SANDRA L.	E	4-28-08	080005545, 567	2332 PORTLAND AVE. NW	6410129	AIP 3-15-0045-042, SOUND PHASE 2
AE102	F	DAVIS, BILLIE E.	E	4-28-08	080005546, 573	4420 LEWISTON ST. NW	6421112	AIP 3-15-0045-042, SOUND PHASE 2
AE103	F	DAVIS, DIANE	E	4-28-08	080005547, 580	2235 RANCH RD. NW	6431121	AIP 3-15-0045-042, SOUND PHASE 2
AE104	F	DULANEY, RUSSELL	E	4-28-08	080005548, 585	4418 COVE RD. NW	6370118	AIP 3-15-0045-042, SOUND PHASE 2
AE105	F	ENGLISH SAMUEL R. & TANYA M.	E	4-28-08	080005549, 591	4449 OLEVA ST. NW	6420506	AIP 3-15-0045-042, SOUND PHASE 2
AE106	F	HALE, LESLIE	E	4-28-08	080005533, 495	4457 BEN ST. NW	6420903	AIP 3-15-0045-042, SOUND PHASE 2
AE107	F	HOBSON, PEGGY L.	E	4-28-08	080005550, 597	2203 LYNNHOPE DR. NW	6400307	AIP 3-15-0045-042, SOUND PHASE 2
AE108	F	KERR, STEPHEN P.	E	4-28-08	080005551, 603	2627 HILLENDALE DR. NW	6420302	AIP 3-15-0045-042, SOUND PHASE 2
AE109	F	KING, JAMES H.	E	4-28-08	080005552, 609	4473 BEN ST. NW	6420901	AIP 3-15-0045-042, SOUND PHASE 2
AE110	F	LAWSON, ANTHONY L. & CAROL L.	E	4-28-08	080005534, 501	2130 GARSTLAND DR. NW	6400314	AIP 3-15-0045-042, SOUND PHASE 2
AE111	F	LONG, LLOYD	E	4-28-08	080005535, 507	3507 LAUREL RIDGE RD. NW	6490601	AIP 3-15-0045-042, SOUND PHASE 2
AE112	F	MAYO, JOESPH & LINDA	E	4-28-08	080005536, 513	4419 BEN ST. NW	6420907	AIP 3-15-0045-042, SOUND PHASE 2
AE113	F	PARSON, LEROY C. JR., & TERESA O.	E	4-28-08	080005537, 519	2214 LYNNHOPE DR. NW	6400103	AIP 3-15-0045-042, SOUND PHASE 2
AE114	F	SAUNDERS, JEFFREY R. & NORMA B.	E	4-28-08	080005538, 525	2525 HILLENDALE DR. NW	6420501	AIP 3-15-0045-042, SOUND PHASE 2
AE115	F	SINGLETON, MARCUS	E	4-28-08	080005539, 531	2327 PORTLAND AVE. NW	6410207	AIP 3-15-0045-042, SOUND PHASE 2
AE116	F	SWEETENBERG, CAROL V.	E	4-28-08	080005540, 537	2306 RANCH RD. NW	6431010	AIP 3-15-0045-042, SOUND PHASE 2
AE117	F	THOMPSON, CAMELLIA CASEY	E	4-28-08	080005441, 543	2109 LYNNHOPE DR. NW	6400302	AIP 3-15-0045-042, SOUND PHASE 2
AE118	F	WATTS, ROBERT B.	E	4-28-08	080005532, 489	4483 BEN ST. NW	6420103	AIP 3-15-0045-042, SOUND PHASE 2
AE119	F	WILLIAMS II, JAMES A.	E	4-28-08	080005542, 549	4465 BEN ST. NW	6420902	AIP 3-15-0045-042, SOUND PHASE 2
AE120	F	WILLIAMS, TYRON G.	E	5-1-08	200806108, 514	5969 SIERRA DR.	038.05-02-04.00	AIP 3-15-0045-042, SOUND PHASE 2
AE121	F	SMITH, ROY M. & KATHLEEN C.	E	5-1-08	200806109, 520	912 GROVE LN.	038.05-02-06.00	AIP 3-15-0045-042, SOUND PHASE 2

NO.	REVISIONS	BY	APP.	DATE
2	HATCH ADDITIONAL LAND ACQUISTION FOR THE EXPANSION OF THE RPZs, UPDATE FUTURE PROPERTY ACQUISITION CHART	RWW	MWK	05/15/09
1	ADD HEIGHT RESTRICTIONS PHASE 2 EASEMENTS, EXCHANGE CITY AND AIRPORT PROPERTIES TO EXPAND RW 6 RPZ, ADD LAND ACQUISITION HATCH FOR THE EXPANSION OF RW 33 RPZ	RWW	MWK	04/20/09

NO.	BY	DATE	REVISIONS	APPROVED

HNTB

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

AVIATION EASEMENT TRANSACTION DATA SHEET

ROANOKE REGIONAL AIRPORT
ROANOKE, VIRGINIA

DATE: Jun 29, 2009

SHEET No. 19

APPENDIX W

Detailed Financial Analysis

Table W.1

Pro Forma Cash Flow Analysis

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Inflation Factor (a)	1.025	1.051	1.077	1.104	1.131	1.160	1.189	1.218	1.249	1.280	1.312	1.345	1.379	1.413	1.448	1.485	1.522	1.560
Bond Term (b)	25																	
Bond Interest Rate (c)	5.0%																	
Bond Financing Cost (d)	5.0%																	
Capital Costs (e)																		
Airfield	-	6,086,000	-	4,497,000	565,000	-	8,834,000	20,970,000	6,465,000	3,865,000	-	-	-	-	-	-	-	-
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
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	-	-
Air Cargo	-	-	-	-	-	-	-	-	-	-	654,000	8,193,000	715,000	-	-	-	-	-
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	-	-	-
Airfield/Airline Maintenance/Support	-	-	5,322,000	923,000	-	2,888,000	1,226,000	6,184,000	-	-	-	-	-	-	-	453,000	-	-
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
Miscellaneous	1,944,000	4,210,000	1,078,000	-	-	-	-	-	3,092,000	-	-	1,265,000	3,386,000	-	-	-	-	-
Subtotal	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 Funds																		
AIP Eligible Capital Costs (f)	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	-	-
Entitlements (g)	2,788,096	2,921,136	2,688,924	2,740,505	2,793,845	2,831,494	2,869,896	2,909,066	2,949,019	2,989,287	3,029,868	3,071,241	3,113,421	3,156,425	3,202,379	3,251,386	3,301,441	2,503,940
Non-Master Plan AIP Expenditures (h)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Net Entitlements (i)	2,688,096	2,821,136	2,588,924	2,640,505	2,693,845	2,731,494	2,769,896	2,809,066	2,849,019	2,889,287	2,929,868	2,971,241	3,013,421	3,056,425	3,102,379	3,151,386	3,201,441	2,403,940
Available Entitlements (j)	2,688,096	2,859,232	2,627,075	4,717,580	2,881,530	5,076,274	6,158,470	2,991,146	3,031,099	3,025,386	3,065,967	5,415,908	7,227,579	6,388,054	9,490,433	12,641,819	12,911,631	12,259,146
Expended Entitlements (k)	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	-	-	-	-	-
Remaining Potential Entitlements (l)	38,096	38,151	2,077,075	187,685	2,344,780	3,388,574	182,080	182,080	136,099	136,099	2,444,667	4,214,158	3,331,629	6,388,054	9,490,433	12,641,819	12,911,631	12,259,146
Discretionary Expenditures (m)	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	-	-	-	-	-	-	-	-
Eligible Costs Unfunded by AIP (n)	2,180,050	2,460,419	4,353,100	4,084,730	1,250,900	5,828,340	5,119,945	5,874,800	1,486,150	297,350	768,550	-	1,125,750	-	-	1,291,050	-	-
PFC Funds																		
PFC Eligible Capital Costs (o)	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
PFC Eligible Less AIP Funded (p)	2,914,000	4,694,169	8,882,100	5,908,850	1,450,250	10,946,450	18,600,079	15,992,500	6,372,850	4,265,250	12,789,700	725,250	8,163,050	-	5,255,000	11,510,000	9,643,000	10,402,000
PFC Collections (q)	1,437,742	1,955,930	2,031,526	2,072,129	2,113,544	2,155,787	2,198,874	2,242,822	2,286,597	2,331,226	2,376,726	2,423,114	2,470,408	2,523,223	2,577,167	2,632,265	2,688,540	2,746,018
Encumbered PFC Funds (r)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Available PFC Funds (sa)	1,437,742	1,955,930	3,001,256	3,137,285	2,113,829	4,269,616	3,115,490	2,839,639	2,578,236	2,675,462	4,089,588	4,077,702	6,415,710	3,338,933	5,916,100	4,193,365	3,031,905	5,777,923
PFC Expenditures (sb)	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
Airport Costs Reimbursable by PFCs (u)	33,058	2,015,000	4,014,500	2,952,000	497,000	3,747,653	13,392,128	11,537,500	2,045,840	1,306,300	8,413,000	8,193,000	43,000	-	-	7,374,000	1,928,600	4,313,000
Cummulative PFC Reimbursables (ua)	-	2,015,000	6,029,500	8,981,500	9,478,500	13,226,153	26,618,282	38,155,782	40,201,622	41,507,922	49,920,922	58,113,922	58,156,922	58,156,922	58,156,922	65,530,922	67,459,522	71,772,522
Remaining PFC Funds (sc)	-	969,730	1,065,156	285	2,113,829	916,616	596,817	291,639	344,236	1,712,862	1,654,588	3,945,302	815,710	3,338,933	1,561,100	343,365	3,031,905	296,123
Remaining PFC Eligible Costs (t)	1,476,258	3,707,969	6,946,000	2,771,850	1,450,250	7,593,450	16,081,406	13,444,500	-	3,302,650	10,354,700	592,850	2,563,050	-	900,000	7,660,000	9,643,000	4,920,200

Table W.1 cont'd

Pro Forma Cash Flow Analysis

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
State Funds																		
State Eligible Capital Costs (x)	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
State Entitlements (y)	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Non-Master Plan State Expenditures (z)	-	-	-	-	-	-	-	-	-	-								
Net State Entitlements (aa)	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Available State Entitlements (ab)	5,620,000	6,176,800	4,481,831	3,550,331	4,858,481	5,905,231	3,581,434	2,005,830	2,098,830	2,005,820	2,009,470	2,067,770	3,474,920	2,954,870	4,954,870	6,054,870	7,768,870	2,054,470
Expended State Entitlements (ac)	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
Discretionary Expenditures (ac)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remaining State Entitlements (ad)	4,176,800	2,481,831	1,550,331	2,858,481	3,905,231	1,581,434	5,830	98,830	5,820	9,470	67,770	1,474,920	954,870	2,954,870	4,054,870	5,768,870	54,470	1,447,270
Grant and PFC Summary																		
Total Costs (ae)	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
Ineligible Costs (ae)	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	-	-	-
Eligible Costs (ae)	7,364,000	15,441,000	14,488,000	12,916,000	3,987,000	15,340,000	34,490,000	35,914,000	18,656,000	7,937,000	13,411,000	10,120,000	12,059,000	-	5,255,000	11,510,000	9,643,000	10,402,000
Available Funds(af)	11,545,838	16,915,712	15,166,062	13,010,451	11,853,840	17,478,971	21,882,598	24,949,049	17,096,315	8,489,131								
Eligible Expenditures (ag)	7,330,942	13,426,000	10,473,500	9,964,000	3,490,000	11,592,347	21,097,872	24,376,500	16,610,160	6,630,700	4,998,000	1,927,000	12,016,000	-	5,255,000	4,136,000	7,714,400	6,089,000
Remaining Costs (ah)	1,829,058	2,054,000	4,958,500	2,952,000	1,485,000	6,635,653	14,441,128	24,004,500	2,045,840	13,958,300	8,413,000	8,193,000	43,000	11,691,000	3,987,000	7,374,000	1,928,600	4,313,000
Other Expenditures (ai)	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	-	-	-
Airport Estimated Costs (aj)	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
Airfield Cost Center (ak)	-	13,000	-	-	-	-	441,700	125,000	-	77,300	-	-	-	-	-	-	-	-
Terminal Cost Center (al)	17,400	39,000	3,216,500	-	-	78,000	3,923,000	2,446,500	-	-	-	-	-	-	-	-	-	4,313,000
Airport Master Plan Expenditures (am)	16,529	1,043,529	3,034,250	3,483,250	1,724,500	1,544,827	6,254,391	10,726,814	6,791,670	1,676,070	653,150	-	21,500	21,500	-	3,687,000	4,651,300	3,120,800
Bond Issues									-									
Bond Issue #1																		
Bond Size (ao)							28,666,082											
Bond Proceeds (ap)							27,232,778											
Debt Service (aq)	$0	$0	$0	$0	$0	$0			$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
Interest Earnings (ar)	-	-	-	-	-	-	-	753,710	297,454	-	-	-	-	-	-	-	-	-
Reserve (as)	-	-	-	-	-	-	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	2,135,625	2,135,625
Capitalized Interest (at)								1,433,304	942,138									
Available Funds (au)	-	-	-	-	-	-	25,097,153	18,163,168	6,791,670	-	-	-	-	-	-	-	-	-
Expenditures from Proceeds (av)	-	-	-	-	-	-	6,254,391	10,726,814	6,791,670		-	-	-	-	-	-	-	-
Remaining Funds (aw)	-	-	-	-	-	-	18,842,762	7,436,354	-	-	-	-	-	-	-	-	-	-

Table W.1 cont'd

Pro Forma Cash Flow Analysis

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Existing Debt Service (ba)																		
Revenue Bonds and Loans																		
Principal	552,165	578,420	604,951	631,768	663,886	691,317	724,075	192,174	200,630	209,458	218,674	228,296	238,341	119,060	124,299	-	-	-
Interest	259,021	234,071	207,628	179,763	150,202	118,779	85,431	64,102	55,646	46,818	37,602	27,980	17,935	9,078	3,839	-	-	-
Total Existing	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	-	-	-
Total Existing Plus New Debt Service (bb)	811,186	812,491	812,579	811,531	814,089	810,096	809,506	256,276	2,391,901	2,391,901	2,391,901	2,391,901	2,391,901	2,263,763	2,263,763	2,135,625	2,135,625	2,135,625
Debt Service for Airline Calculations	811,186	812,491	812,579	811,531	814,089	810,096	809,506	256,276	796,480	796,480	796,480	796,480	796,480	668,342	668,342	540,204	540,204	540,204
Operating Expenses																		
Allocable Expenses (bc)																		
Personal Services (bd)	1,292,400	1,343,600	1,396,500	1,451,300	1,507,900	1,566,400	1,626,900	1,689,500	1,753,900	1,820,600	1,890,000	1,961,900	2,036,700	2,122,700	2,212,500	2,306,000	2,403,400	2,505,000
Other Operating (be)	755,500	785,400	816,400	848,400	881,500	915,700	951,100	987,700	1,025,300	1,064,300	1,104,800	1,146,900	1,190,600	1,240,900	1,293,400	1,348,000	1,405,000	1,464,400
Reallocation of Op. Expenses (bf)	(2,047,900)	(2,129,000)	(2,212,900)	(2,299,700)	(2,389,400)	(2,482,100)	(2,578,000)	(2,677,200)	(2,779,200)	(2,884,900)	(2,994,800)	(3,108,800)	(3,227,300)	(3,363,600)	(3,505,900)	(3,654,000)	(3,808,400)	(3,969,400)
Non-Operating (bg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Projects (bh)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital (bi)	27,700	28,800	29,900	31,100	32,300	33,500	34,800	36,200	37,500	39,000	40,400	42,000	43,600	45,400	47,400	49,400	51,400	53,600
Reallocation of Non-Op Expenses (bj)	(27,700)	(28,800)	(29,900)	(31,100)	(32,300)	(33,500)	(34,800)	(36,200)	(37,500)	(39,000)	(40,400)	(42,000)	(43,600)	(45,400)	(47,400)	(49,400)	(51,400)	(53,600)
Subtotal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Public Aircraft Facilities																		
Personal Services (bk)	594,900	612,300	630,300	654,400	679,300	705,200	732,100	760,100	788,000	817,000	847,100	878,300	910,800	947,000	984,600	1,023,800	1,064,500	1,106,600
Other Operating (bl)	865,400	890,800	916,900	928,000	951,200	974,900	999,300	1,024,300	1,049,900	1,076,100	1,103,100	1,130,600	1,158,900	1,187,900	1,217,600	1,248,000	1,279,200	1,311,200
Reallocation of Op. Expenses (bm)	486,991	506,276	526,228	546,869	568,200	590,244	613,049	636,638	660,894	686,029	712,164	739,273	767,452	799,864	833,703	868,922	905,638	943,924
Non-Operating (bn)																		
Debt Service	40,811	40,876	40,881	40,828	40,957	40,756	40,726	12,893	40,071	40,071	40,071	40,071	40,071	33,624	33,624	27,178	27,178	27,178
Amortized Airport Capital Costs (bw)	-	-	1,000	1,000	1,000	1,000	1,000	33,900	43,200	43,200	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000
Other Projects (bo)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Capital (bp)	41,300	42,500	43,700	45,400	47,100	48,900	50,800	52,700	54,700	56,700	58,800	60,900	63,200	65,700	68,300	71,000	73,800	76,800
Reallocation of Non-Op Expenses (bq)	6,600	6,800	7,100	7,400	7,700	8,000	8,300	8,600	8,900	9,300	9,600	10,000	10,400	10,800	11,300	11,700	12,200	12,700
Subtotal	2,036,002	2,099,553	2,166,109	2,223,897	2,295,456	2,369,000	2,445,275	2,529,132	2,645,665	2,728,400	2,819,835	2,908,144	2,999,823	3,093,889	3,198,128	3,299,599	3,411,516	3,527,401
Terminal Complex																		
Personal Services (bs)	1,268,000	1,299,700	1,370,700	1,405,000	1,440,100	1,476,100	1,513,000	1,700,900	1,752,700	1,803,900	1,849,000	1,895,200	1,942,600	1,991,200	2,040,900	2,092,000	2,144,300	2,254,200
Other Operating (bt)	600,200	615,200	648,900	665,100	681,700	698,800	716,200	805,200	829,700	853,900	875,300	897,200	919,600	942,600	966,100	990,300	1,015,100	1,067,100
Reallocation of Op. Expenses (bu)	677,241	704,061	731,807	760,511	790,175	820,831	852,545	885,351	919,082	954,037	990,381	1,028,081	1,067,269	1,112,343	1,159,402	1,208,379	1,259,439	1,312,681
Non-Operating (bv)																		
Debt Service	534,408	535,268	535,326	534,636	536,321	533,690	533,302	168,834	524,720	524,720	524,720	524,720	524,720	440,303	440,303	355,886	355,886	355,886
Amortized Airport Capital Costs (bw)	-	1,300	4,200	244,000	244,000	244,000	249,800	542,300	724,700	724,700	724,700	724,700	724,700	724,700	724,700	724,700	724,700	724,700
Other Projects (bx)	6,400	6,600	6,900	7,100	7,300	7,500	7,600	8,600	8,800	9,100	9,300	9,600	9,800	10,100	10,300	10,600	10,800	11,400
Capital (by)	8,700	8,900	9,400	9,600	9,900	10,100	10,400	11,700	12,000	12,400	12,700	13,000	13,300	13,700	14,000	14,400	14,700	15,500
Reallocation of Non-Op Expenses (bz)	9,200	9,500	9,900	10,300	10,700	11,100	11,500	12,000	12,400	12,900	13,400	13,900	14,400	15,000	15,700	16,300	17,000	17,700
Subtotal	3,104,149	3,180,529	3,317,132	3,636,247	3,720,196	3,802,121	3,894,347	4,134,885	4,784,102	4,895,657	4,999,501	5,106,401	5,216,389	5,249,946	5,371,405	5,412,564	5,541,925	5,759,167

Table W.1 cont'd

Pro Forma Cash Flow Analysis

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Other Direct Cost Centers																		
Personal Services (ca)	607,000	631,000	655,900	681,600	708,200	735,700	764,100	793,500	823,800	855,100	887,700	921,500	956,600	997,000	1,039,100	1,083,100	1,128,800	1,176,600
Other Operating (cb)	619,100	643,600	668,900	695,200	722,300	750,300	779,300	809,300	840,100	872,100	905,300	939,800	975,600	1,016,800	1,059,800	1,104,600	1,151,300	1,199,900
Reallocation of Op. Expenses (cc)	883,668	918,663	954,866	992,320	1,031,025	1,071,025	1,112,406	1,155,211	1,199,224	1,244,833	1,292,255	1,341,446	1,392,579	1,451,392	1,512,795	1,576,700	1,643,323	1,712,795
Non-Operating (cd)																		
Debt Service	235,968	236,347	236,373	236,068	236,812	235,651	235,479	74,549	231,690	231,690	231,690	231,690	231,690	194,416	194,416	157,141	157,141	157,141
New Debt Service (ce)	-	-	-	-	-	-	-	-	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
Other Projects (cea)	57,500	58,900	62,200	63,700	65,300	66,900	68,600	77,100	79,500	81,800	83,800	85,900	88,100	90,300	92,600	94,900	97,200	102,200
Capital (cf)	67,700	70,400	73,100	76,000	79,000	82,000	85,200	88,500	91,900	95,400	99,000	102,800	106,700	111,200	115,900	120,800	125,900	131,200
Reallocation of Non-Op Expenses (cg)	12,000	12,400	12,900	13,400	13,900	14,500	15,000	15,600	16,200	16,800	17,400	18,100	18,800	19,600	20,500	21,300	22,200	23,100
Subtotal	2,482,936	2,571,310	2,664,239	2,758,288	2,856,538	2,956,076	3,060,085	3,013,760	5,418,039	5,533,349	5,652,771	5,776,862	5,905,694	6,016,333	6,170,736	6,294,167	6,461,490	6,638,562
Operating Cost Summary																		
Salaries & Fringe Benefits (ch)	3,762,300	3,886,600	4,053,400	4,192,300	4,335,500	4,483,400	4,636,100	4,944,000	5,118,400	5,296,600	5,473,800	5,656,900	5,846,700	6,057,900	6,277,100	6,504,900	6,741,000	7,042,400
Operating Expenses (ci)	2,840,200	2,935,000	3,051,100	3,136,700	3,236,700	3,339,700	3,445,900	3,626,500	3,745,000	3,866,400	3,988,500	4,114,500	4,244,700	4,388,200	4,536,900	4,690,900	4,850,600	5,042,600
City services																		
Other Projects (cj)	63,900	65,500	69,100	70,800	72,600	74,400	76,200	85,700	88,300	90,900	93,100	95,500	97,900	100,400	102,900	105,500	108,000	113,600
Total O&M Expenses	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-Operating Costs																		
Debt Service (ck)	811,186	812,491	812,579	811,531	814,089	810,096	809,506	256,276	2,391,901	2,391,901	2,391,901	2,391,901	2,391,901	2,263,763	2,263,763	2,135,625	2,135,625	2,135,625
Interest expense	259,021	234,071	207,628	179,763	150,202	118,779	85,431	64,102	55,646	46,818	37,602	27,980	17,935	9,078	3,839	-	-	-
Depreciation																		
Capital Purchases (cl)	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
Total Costs (cn)	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
Revenues																		
Airfield Revenue																		
Signatory Landed Weight (cp)	651,000	677,600	675,800	680,400	685,000	689,600	694,300	699,000	707,300	715,700	724,200	732,800	741,500	750,700	760,000	769,500	779,000	788,700
Total Landed Weight	651,000	677,600	675,800	680,400	685,000	689,600	694,300	699,000	707,300	715,700	724,200	732,800	741,500	750,700	760,000	769,500	779,000	788,700
Signatory Cost Prior to Adjustment (cr)	2,036,002	2,099,553	2,166,109	2,223,897	2,295,456	2,369,000	2,445,275	2,529,132	2,645,665	2,728,400	2,819,835	2,908,144	2,999,823	3,093,889	3,198,128	3,299,599	3,411,516	3,527,401
Less: Commission Adjustment (cs)	520,694	556,971	586,181	600,372	616,939	637,836	657,842	679,225	702,965	738,226	756,266	784,156	807,115	833,229	859,051	888,849	916,085	948,264
Airfield Cost Applied to Signatories (ct)	1,515,308	1,542,582	1,579,928	1,623,525	1,678,517	1,731,163	1,787,433	1,849,907	1,942,700	1,990,174	2,063,568	2,123,988	2,192,708	2,260,660	2,339,077	2,410,750	2,495,431	2,579,138
Signatory Landing Fee (cu)	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
Total Airfield Revenue	1,465,713	1,542,582	1,579,928	1,623,525	1,678,517	1,731,163	1,787,433	1,849,907	1,942,700	1,990,174	2,063,568	2,123,988	2,192,708	2,260,660	2,339,077	2,410,750	2,495,431	2,579,138
Landing Fee in 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
Terminal Revenue																		
Terminal Cost (da)	3,104,149	3,180,529	3,317,132	3,636,247	3,720,196	3,802,121	3,894,347	4,134,885	4,784,102	4,895,657	4,999,501	5,106,401	5,216,389	5,249,946	5,371,405	5,412,564	5,541,925	5,759,167
Airline Share (db)	1,292,955	1,326,556	1,385,397	1,520,723	1,557,929	1,594,384	1,635,260	1,738,605	2,014,295	2,064,044	2,110,667	2,158,705	2,208,175	2,225,377	2,279,932	2,300,500	2,358,658	2,454,423
Average Rental Rate (dc)	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
Airline Rental Revenue (dd)	1,292,955	1,326,556	1,385,397	1,520,723	1,557,929	1,594,384	1,635,260	1,738,605	2,014,295	2,064,044	2,110,667	2,158,705	2,208,175	2,225,377	2,279,932	2,300,500	2,358,658	2,454,423
Aircraft Apron Revenue (de)	169,841	174,254	181,984	199,760	204,647	209,436	214,805	228,381	264,595	271,130	277,254	283,564	290,063	292,322	299,489	302,190	309,830	322,409
Loading Bridge Revenue (df)	52,595	53,962	56,356	61,861	63,374	64,857	66,520	70,724	81,938	83,962	85,859	87,813	89,825	90,525	92,744	93,581	95,946	99,842
Baggage Make-Up Conveyor Rev. (dg)	8,793	9,022	9,422	10,342	10,595	10,843	11,121	11,824	13,699	14,038	14,355	14,681	15,018	15,135	15,506	15,646	16,041	16,693
Baggage Claim Revenue (dh)	9,579	9,828	10,264	11,267	11,542	11,812	12,115	12,881	14,923	15,292	15,637	15,993	16,360	16,487	16,891	17,044	17,475	18,184
Lease and Concession Revenues (di)	1,745,826	1,893,503	2,024,199	2,274,405	2,385,086	2,498,550	2,623,134	2,929,784	3,474,533	3,644,441	3,814,788	3,993,765	4,181,782	4,313,901	4,524,047	4,672,681	4,903,967	5,223,607
Parking Lot Revenues (dj)	1,931,382	2,016,345	2,105,045	2,197,647	2,294,322	2,395,250	2,500,618	2,871,684	2,998,011	3,129,894	3,267,580	3,411,322	3,561,388	3,718,055	3,881,614	4,052,368	4,230,633	4,416,741
Total Terminal Revenue	5,210,973	5,483,470	5,772,666	6,276,003	6,527,496	6,785,133	7,063,575	7,863,882	8,861,995	9,222,800	9,586,140	9,965,844	10,362,611	10,671,802	11,110,222	11,454,010	11,932,551	12,551,898
	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

Table W.1 cont'd

Pro Forma Cash Flow Analysis

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
General Aviation																		
Building and Hangar Rental (dk)	353,632	377,700	387,900	416,200	429,400	460,700	475,300	490,400	555,000	571,000	646,200	664,900	684,000	703,800	796,600	901,700	927,800	954,900
Fuel & Oil Sales (dl)	21,000	21,600	22,200	22,900	23,600	24,300	25,100	25,900	29,300	30,100	34,100	35,100	36,100	37,100	42,000	47,500	48,900	50,300
Landing Fees (dm)	16,800	17,300	17,800	18,400	19,000	19,600	20,200	20,800	22,500	23,200	25,100	25,800	26,500	27,300	29,500	31,900	32,800	33,800
Ramp & Tie Down Fees (dn)	15,750	16,200	16,600	17,100	17,600	18,200	18,800	19,400	20,000	20,600	21,200	21,800	22,400	23,000	23,700	24,400	25,100	25,800
Total General Aviation	407,182	432,800	444,500	474,600	489,600	522,800	539,400	556,500	626,800	644,900	726,600	747,600	769,000	791,200	891,800	1,005,500	1,034,600	1,064,800
Other Revenues																		
Other Building & Hangar Rentals (do)	278,242	285,200	292,300	299,600	307,100	314,800	322,700	330,800	339,100	347,600	356,300	365,200	430,500	441,300	452,300	463,600	475,200	487,100
LEO Services - TSA	167,577	170,090	172,641	175,231	177,860	180,527	183,235	185,984	188,774	191,605	194,479	197,397	200,358	203,363	206,413	209,510	212,652	215,842
Non-Aviation Land Rentals (dr)	16,379	16,800	17,200	17,600	18,000	18,500	19,000	19,500	20,000	20,500	21,000	21,500	22,000	22,600	23,200	23,800	24,400	25,000
Other Fees (ds)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Other	462,197	472,090	482,141	492,431	502,960	513,827	524,935	536,284	547,874	559,705	571,779	584,097	652,858	667,263	681,913	696,910	712,252	727,942
Total Operating Revenues	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
Non-Operating Revenues (Other Revenues)																		
Passenger Facility Charge	1,437,742	1,955,930	2,031,526	2,072,129	2,113,544	2,155,787	2,198,874	2,242,822	2,286,597	2,331,226	2,376,726	2,423,114	2,470,408	2,523,223	2,577,167	2,632,265	2,688,540	2,746,018
Capital Grants	5,893,200	12,439,800	8,537,400	6,827,000	3,490,000	8,239,347	18,579,199	21,828,500	14,376,160	5,668,100	2,563,000	1,794,600	6,416,000	-	900,000	286,000	7,714,400	607,200
Noncapital Grants	164,900	169,000	173,200	177,500	181,900	186,400	191,100	195,900	200,800	205,800	210,900	216,200	221,600	227,100	232,800	238,600	244,600	250,700
Interest Income (du)	490,902	506,801	488,561	392,212	288,296	253,703	228,891	268,704	351,069	386,116	360,666	383,979	440,516	507,461	584,103	674,754	632,667	558,291
Net appreciation (depr) in fair value of investments	(51,300)	(52,600)	(53,900)	(55,200)	(56,600)	(58,000)	(59,500)	(61,000)	(62,500)	(64,100)	(65,700)	(67,300)	(69,000)	(70,700)	(72,500)	(74,300)	(76,200)	(78,100)
Total Revenues (dx)	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
Total Costs (dy)	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
Master Plan Outlays (ea)	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 (ec)	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 Estimate																		
Total Revenues (dx)	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
Total Operating Costs (ed)	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
Remaining Revenue (ee)	1,370,567	1,550,643	1,594,197	1,858,971	1,842,068	1,909,127	1,986,035	2,504,503	3,464,163	3,635,221	3,838,779	4,024,032	4,313,817	4,437,311	4,775,640	5,026,048	5,193,325	5,368,894
Debt Service (ef)	811,186	812,491	812,579	811,531	814,089	810,096	809,506	256,276	2,391,901	2,391,901	2,391,901	2,391,901	2,391,901	2,263,763	2,263,763	2,135,625	2,135,625	2,135,625
Coverage Ratio (eg)	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

Sources: Roanoke Airport Commission, HNTB Analysis.

Notes to Table W.1

Pro Forma Cash Flow Analysis

(a) Assumes increase of 2.5 percent per year.
(b) Assumes 25 year bond term.
(c) Assumes 5.0 percent annual interest rate for revenue bond.
(d) Assumes that financing, insurance, legal and other issuance costs account for 5 percent of the bond costs.
(e) Table 9.5.
(f) Table 9.5.
(g) Table 9.4.
(h) Assumes $100,000 in entitlements per year are allocated to non-Master Plan projects when not required for Master Plan projects.
(i) Entitlements less non-Master Plan AIP expenditures.
(j) Current year net entitlements plus unspent portions of previous years' entitlements. Assumes maximum carryover of three years. Also assumes potential use of entitlements from two upcoming years through multiyear grants.
(k) Entitlement funds spent on master plan capital projects during referenced year.
(l) Available potential entitlements less expended entitlements.
(m) Table 9.6.
(n) AIP eligible capital costs less expended entitlements and discretionary expenditures.
(o) Table 9.5.
(p) PFC eligible capital costs less those costs funded by AIP entitlements.
(g) Table 9.4.
(r) PFCs encumbered to reimburse existing projects.
(sa) Remaining PFC funds from previous year plus PFC collections less encumbered PFCs.
(sb) Table 9.6. PFC funds spent on master plan capital projects during referenced year.
(sc) Available PFC funds less PFC expenditures. Figure can be negative, as PFC projects can sometimes be implemented by advancing State funds.
(t) PFC eligible costs less AIP funded less PFC expenditures.
(u) PFC eligible capital costs funded by Airport funds.
(ua) Sum of accumulated PFC eligible costs funded by Airport funds.
(x) Table 9.5.
(y) Increases as a function of sales tax revenue. Assumed to increase at same rate as real State income plus inflation (4.9 percent per year).
(z) $200,000 per year assumed to be spent on non-Master Plan projects.
(aa) State entitlements less non-Master Plan State expenditures.
(ab) Remaining State entitlements from previous year plus net State entitlements. Assumes potential carry-over of up to five years. Entering FY 2008, the Airport had a positive balance of State entitlements equal to $3,620,000.
(ac) Table 9.6.
(ad) Available State entitlements less expended State entitlements.
(ae) Table 9.5.
(af) Total available funds from FAA, State and PFC sources.
(ag) Master Plan projects funded by FAA, State or PFC sources.
(ah) Available funds less eligible expenditures.
(ai) Table 9.6.
(aj) Remaining costs less private expenditures.
(ak) Airport funded Master Plan costs allocated to Airfield cost center. Does not include costs refunded by PFCs.
(al) Airport funded Master Plan costs allocated to Terminal cost center. Does not include costs refunded by PFCs.
(am) Airport capital costs presented on fiscal year basis. Assumed to equal 50 % of each calendar year comprising fiscal year.
(ao) Assumed size of bond issue.
(ap) Bond proceeds net of estimated financing cost.
(aq) Debt service at stated bond term (25 years) and interest rate (5.0 percent).
(ar) Interest earnings from unexpended bond proceeds. Earnings rate of 4 percent assumed.
(as) Debt service reserve assumed to equal one year's debt service.
(at) Capitalized interest until date of beneficial occupancy.
(au) Bond proceeds less reserve, capitalized interest, and previous year's expenditures from bond proceeds plus interest earnings
(av) Bond proceeds spent on master plan capital projects in referenced year.
(aw) Available funds less expenditures from proceeds.
(ba) Roanoke Regional Airport.
(bb) Existing debt service plus new debt service from Master Plan projects.
(bc) Indirect expenses later allocated to direct cost centers.
(bd) Assumed to increase at same rate as Airport activity (as measured by index representing 50% passenger growth and 50% aircraft operations growth) and adjusted for inflation.
(be) Assumed to increase at same rate as Airport activity (as measured by passenger/aircraft operations index) and adjusted for inflation.
(bf) Allocable expenses allocated to direct cost centers.
(bg) Consistent with existing expenditures, no non-operating expenses allocated to allocable expenses.
(bh) Consistent with existing expenditures, no other projects expenses allocated to allocable expenses.
(bi) Assumed to increase at same rate as Airport activity (as measured by passenger/aircraft operations index) and adjusted for inflation.
(bj) Allocable expenses allocated to direct cost centers.
(bk) Assumed to increase at same rate as inflation.

Notes to Table W.1

Pro Forma Cash Flow Analysis

(bl) Assumed to increase at same rate as Airport aircraft operations and adjusted for inflation.
(bm) Allocable expenses assumed to be allocated to public aircraft facilities cost center according to estimated FY 2007 proportions.
(bn) Share of existing principal and interest costs assumed to be the same as in FY 2007.
(bo) Cost of other projects assumed to continue at estimated FY 2007 levels.
(bp) Assumed to increase at same rate as Airport aircraft operations and adjusted for inflation.
(bq) Allocable non-operating expenses assumed to be allocated to public aircraft facilities cost center according to estimated FY 2007 proportions.
(bs) Assumed to increase at same rate as total terminal building square feet adjusted for inflation.
(bt) Assumed to increase at same rate as total terminal building square feet adjusted for inflation.
(bu) Allocable expenses assumed to be allocated to terminal complex cost center according to estimated FY 2007 proportions.
(bv) Share of existing principal and interest costs assumed to be the same as in FY 2007.
(bw) Terminal capital costs assumed to be amortized at 5.5 percent interest over 25 years based on Airport direction.
(bx) Assumed to increase at same rate as total terminal building square feet adjusted for inflation.
(by) Assumed to increase at same rate as total terminal building square feet adjusted for inflation.
(bz) Allocable non-operating expenses assumed to be allocated to terminal complex cost center according to estimated FY 2007 proportions.
(ca) Assumed to increase at same rate as Airport activity (as measured by passenger/aircraft operations index) and adjusted for inflation.
(cb) Assumed to increase at same rate as Airport activity (as measured by passenger/aircraft operations index) and adjusted for inflation.
(cc) Allocable expenses assumed to be allocated to other direct cost centers according to estimated FY 2007 proportions.
(cd) Share of existing principal and interest costs assumed to be the same as in FY 2007.
(ce) Debt service from 2014 GARB issue.
(cea) Assumed to remain at FY 2007 levels.
(cf) Assumed to increase at same rate as Airport activity (as measured by passenger/aircraft operations index) and adjusted for inflation.
(cg) Allocable non-operating expenses assumed to be allocated to other direct cost centers according to estimated FY 2007 proportions.
(ch) Sum of personnel expenses for allocable expenses, public aircraft facilities, terminal complex and other cost centers.
(ci) Sum of other operating expenses for allocable expenses, public aircraft facilities, terminal complex and other cost centers.
(cj) Sum of other projects expenses for allocable expenses, public aircraft facilities, terminal complex and other cost centers.
(ck) Sum of existing and new debt service. See Note (bb).
(cl) Sum of non-amortized capital expenses for allocable expenses, public aircraft facilities, terminal complex and other cost centers.
(cn) Sum of operating and non-operating costs.
(cp) Growth in landed weight based on master plan update forecast fleet mix.
(cr) Total Public Aircraft Facilities cost multiplied by signatory share of landed weight.
(cs) 38 percent of net revenue in previous fiscal year.
(ct) Signatory cost prior to adjustment less 38 percent of prior years revenues.
(cu) Airfield cost applied to signatories divided by signatory landed weight.
(da) Total annual terminal complex costs.
(db) Airline share of total terminal complex costs assumed to continue at FY 2007 levels.
(dc) Airline share of costs divided by airline space.
(dd) Airline space multiplied by average airline rental rate.
(de) Assumed to increase at same rate as total annual terminal complex costs.
(df) Assumed to increase at same rate as total annual terminal complex costs.
(dg) Assumed to increase at same rate as total annual terminal complex costs.
(dh) Assumed to increase at same rate as total annual terminal complex costs.
(di) Assumed to increase at same rate as enplaned passengers adjusted for inflation.
(dj) Assumed to increase at same rate as enplaned passengers adjusted for inflation. One-time increases in real rates assumed after construction of parking improvements
(dk) Existing rental revenue assumed to increase with inflation. One-time increases assumed in accordance with new capital projects.
(dl) Assumed to increase at same rate as projected general aviation operations, adjusted for inflation.
(dm) Assumed to increase at same rate as projected general aviation operations, adjusted for inflation.
(dn) Assumed to increase at same rate as projected general aviation operations, adjusted for inflation.
(do) Assumed to increase at same rate as inflation. Incremental rental revenue associated with Building 5 replacement and US Airways maintenance hangar rehab assumed be to sufficient to offset amortized capital costs of those two projects. Revenues reduced $75,000 after 2001 to account for loss of ATCT rental revenue.
(dr) Assumed to increase at same rate as inflation.
(ds) Assumed to continue at FY 2007 levels.
(dt) One time adjustment for estimated FY 2007 total revenues to reflect revised revenue estimate.
(du) Interest income associated with change in CIP reserve balance assumed to be 4 percent.
(dx) Sum of operating and non-operating revenues.
(dy) Total operating and non-operating costs.
(ea) Airport capital costs (fiscal year) not funded by bond issue.
(ec) CIP Reserve Balance at end of Fiscal Year. Calculated as equal to previous year's CIP Reserve Balance plus net revenue less Master Plan outlays.
(ed) Total O&M expenses. See Notes (ch), (ci), and (cj).
(ee) Total revenues less total operating costs.
(ef) Existing plus new debt service. See Note (bb).
(eg) Remaining Revenue divided by debt service.

Sources: As noted and HNTB analysis.