

ALTERNATIVES TECHNICAL MEMORANDUM

for

ENVIRONMENTAL ASSESSMENT
US 460 Bypass Interchange and Southgate Drive Relocation
State Project No.: 0460-150-204, P101, R201, C501, B601; UPC 99425

Town of Blacksburg

April 1, 2013

SECTION 1 – INTRODUCTION AND BACKGROUND

1.1 Introduction..... 1
 1.2 Study Area..... 1
 1.3 Project History 4

SECTION 2 – ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

2.1 Consideration of Purpose and Need..... 7
 2.2 Alternatives Screening 7

SECTION 3 – ALTERNATIVES NOT CARRIED FORWARD FOR DETAILED STUDY

3.1 Alternatives That Would Not Meet Purpose and Need..... 8
 3.2 Interchange at Existing Intersection Location..... 8

SECTION 4 – NO-BUILD ALTERNATIVE

4.1 Elements of No-Build Alternative 10
 4.2 Ability to Meet Needs 11

SECTION 5 – BUILD ALTERNATIVE CARRIED FORWARD

5.1 Introduction..... 12
 5.2 Description 12
 5.3 Cost 12
 5.4 Ability to Meet Needs 13

LIST OF APPENDICES

Appendix A: Project History Figures..... A-1

LIST OF FIGURES

Figure 1: Traffic Analysis Area 2
 Figure 2: Study Corridor 3
 Figure 3: Alternatives Screening Process 7
 Figure 4: Build Alternative 13
 Figure A1: Project History: 1994 Virginia Tech Master Plan, Cross Campus Corridors..... A-1
 Figure A2: Project History: 2009 Virginia Tech Master Plan A-1
 Figure A3: Project History: Route 460 Connector Corridor Study..... A-2
 Figure A4: Project History: Town of Blacksburg 2006-2046 Comp Plan Road Priority Projects A-3
 Figure A5: Project History: *Blacksburg 2046* Comp Plan 2012 Update Road Priority Projects..... A-4
 Figure A6: Project History: Diverging Diamond Interchange..... A-5

LIST OF TABLES

Table 1: Alternatives Screening Criteria (Previous Study)..... 6
 Table 2: Screening of Potential Alternatives 7
 Table 3: Regional Transportation Improvements Project List..... 10
 Table 4: Queue Lengths – 2010 Existing and 2040 No-Build Conditions 11
 Table 5: Intersection LOS – 2010 Existing, 2040 No-Build, and 2040 Build Conditions 14
 Table 6: 2040 Build Alternatives – Ramp Merge and Diverge Measures of Effectiveness 14

SECTION 1

INTRODUCTION AND BACKGROUND

1.1 Introduction

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), is studying the environmental consequences of improvements along the existing signalized at-grade intersection of Southgate Drive on the US 460 Bypass in the Town of Blacksburg, Virginia. This *Alternatives Technical Memorandum* documents alternatives evaluated for the proposed improvements.

This memorandum presents the process that was used to develop and screen alternatives to determine which best meet the project purpose and need, and describes the criteria that were used to eliminate concepts from detailed evaluation. It includes discussion of alternatives that were not carried forward, as well as a description of potential alternatives to be carried forward for detailed evaluation. Previous studies are also summarized.

As a result of the screening process, one Build Alternative is carried forward for detailed evaluation. This alternative represents a set of improvements that form a stand-alone solution to the identified needs within the study limits. The Build Alternative is presented not as a specific engineering design, but, rather, as a study corridor that encompasses sufficient area to accommodate a variety of specific designs with respect to the US 460 Bypass / Southgate Drive interchange, the alignment for relocated Southgate Drive, removal of existing Southgate Drive, connections to existing roads, and other appurtenances, such as stormwater management facilities.

The no-action or No-Build Alternative is also retained for detailed study, as consistent with National Environmental Policy Act (NEPA) regulations. It serves as a baseline for comparison to build alternatives.

1.2 Study Area

The US 460 Bypass, a four-lane divided limited access highway, provides a north-south¹ connection between and around the Towns of Christiansburg and Blacksburg. It has a posted speed limit of 65 miles per hour (mph). The US 460 Bypass intersection at Southgate Drive is one of two at-grade intersections along the bypass.

Southgate Drive (Route 314), a two-lane road, provides access to Virginia Polytechnic Institute and State University (Virginia Tech), downtown Blacksburg, the Virginia Tech-Montgomery Executive Airport, and the Virginia Tech Corporate Research Center. Southgate Drive has a posted speed limit of 35 mph.

Figure 1 shows the traffic analysis area, which encompasses one existing grade-separated interchange to the north and one grade-separated interchange to the south along the US 460 Bypass, as well as areas to the east associated with connections to the existing roadway network (Duck Pond Drive and Research Center Drive). This area is located entirely within the Town of Blacksburg in Montgomery County; however, properties on both sides of the US 460 Bypass in the vicinity of the existing intersection with Southgate Drive are owned by Virginia Tech.

Figure 2 shows the study corridor for the proposed project. This area encompasses approximately 0.85 miles along US 460 Bypass and approximately 0.8 miles along Southgate Drive, as well as areas on new location for the relocation of Southgate Drive and the potential interchange area.

¹ Although US 460 generally is an east-west route across Virginia, it runs more north-south in the vicinity of the proposed project.

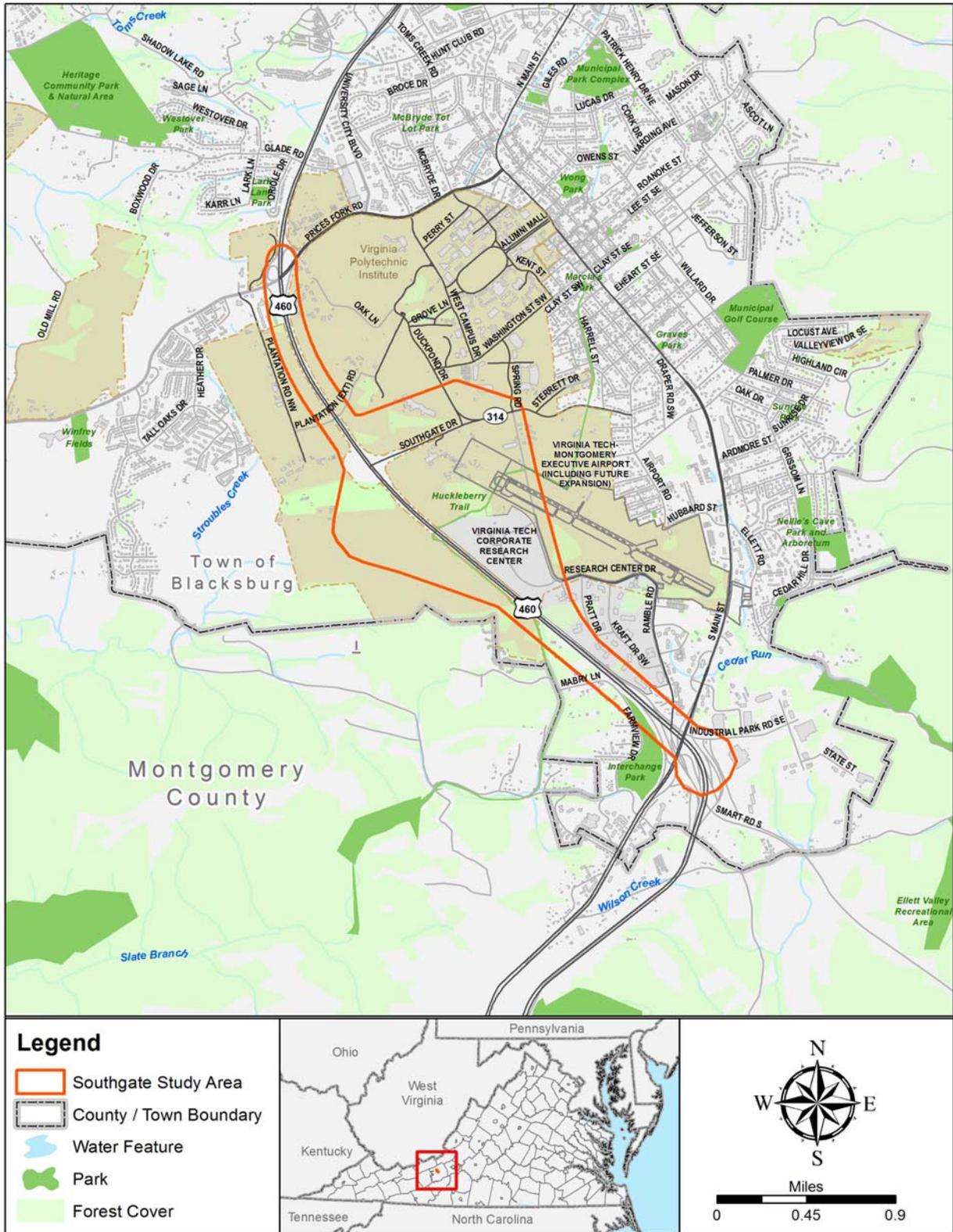


Figure 1. Traffic Analysis Area

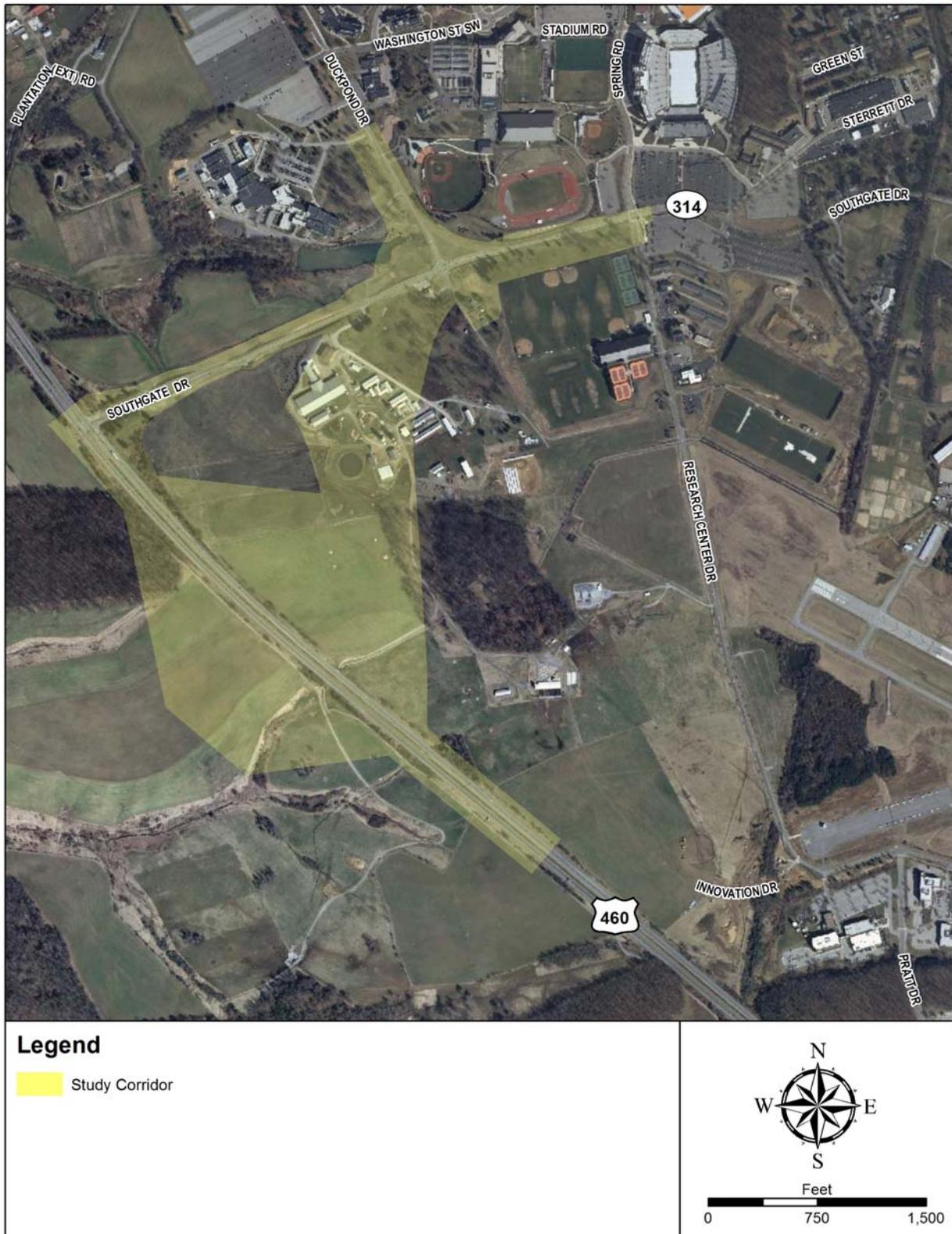


Figure 2. Study Corridor

1.3 Project History

The process of developing alternatives to address transportation needs in the vicinity of Southgate Drive has been ongoing for many years and has been documented in several studies, including: the Blacksburg-Christiansburg-Montgomery Area Metropolitan Planning Organization (MPO) long range transportation plans for both 2030 and 2035; two separate MPO studies (*Route 460 Connector Corridor Study* (2008) and the *Analysis for a New Interchange on the US 460 Bypass in the Vicinity of Southgate Drive* (2011)); the Town of Blacksburg's Comprehensive Plan, *Blacksburg 2046*; and Virginia Tech's Master Plans (1994, 2006, and 2009 updates). Based on these studies and plans, various concepts for addressing transportation needs in the vicinity of US 460 Bypass and Southgate Drive have been identified, analyzed, and screened as part of previous planning efforts in the region. These planning efforts, along with their recommendations and, where appropriate, a description of alternatives analyzed, are described in the following paragraphs (note that all figures referenced in the descriptions are contained in **Appendix A**). The MPO's financially constrained *Blacksburg/Christiansburg/Montgomery Area Year 2035 Long Range Transportation Plan (LRTP)*, available on the MPO's website, as amended June 2, 2011, identifies improvements at the at-grade intersection of US 460 Bypass and Southgate Drive to "Relocate Southgate Drive to intersect with the US 460 Bypass by constructing a new interchange approximately 2,200 feet south of the current intersection." Funding for both planning and construction are in place in the financially constrained long-range plan.

VIRGINIA TECH MASTER PLANS. As part of an overall concept for an east-west cross-campus connector, the Virginia Tech Board of Visitors adopted a resolution in 1990 that

supported the construction of a grade-separated interchange at Southgate Drive and US 460 Bypass. The concept of constructing an interchange at existing Southgate Drive was incorporated into the 1994 Master Plan. As shown in **Figure A1**, two corridors are described in the 1994 Master Plan, both of which include grade-separated interchanges on US 460 Bypass. The 2009 update to the Master Plan, which includes substantial planning efforts in the area of the Corporate Research Center (located on land between US 460 Bypass and the Virginia Tech-Montgomery Executive Airport), includes recommendations for a new grade-separated interchange south of existing Southgate Drive (labeled C on the figure) as well as the closure of existing Southgate Drive (see **Figure A2**).

ROUTE 460 CONNECTOR CORRIDOR STUDY.

This report, published in April 2008 by the MPO, documents the study of various alternatives for either extending existing Southgate Drive or relocating Southgate Drive, starting at US 460 Bypass and extending west to Prices Fork Road west of the community of Prices Fork in Montgomery County. As with the 1994 Virginia Tech Master Plan, two possible locations are identified as possible connections with US 460 Bypass; either of the two connections are planned to be grade-separated interchanges. The two possible alignments and connections to US 460 Bypass are shown in **Figure A3** as the blue and purple lines.

VIRGINIA TECH MONTGOMERY EXECUTIVE AIRPORT MASTER PLAN.

This document, published in January of 2008, includes recommendations to extend the airport runway. The runway extension would require the relocation of Research Center Drive (formerly Tech Center Drive), which provides access to the airport and the Virginia Tech Corporate Research Center from Southgate Drive. While the Airport

Master Plan does not incorporate specific recommendations for improvements to access on US 460 Bypass, the importance of increased accessibility to the airport from this major regional roadway is highlighted in the Master Plan.

TOWN OF BLACKSBURG 2006-2046

COMPREHENSIVE PLAN. The Town of Blacksburg's 2046 Comprehensive Plan, as amended in 2009 and, most recently, in December 2012, includes a grade-separated interchange on US 460 Bypass south of existing Southgate Drive as a priority project (as shown in **Figures A4 and A5**).

ANALYSIS FOR A NEW INTERCHANGE ON THE US 460 BYPASS IN THE VICINITY OF

SOUTHGATE DRIVE (2011). Adopted by the MPO's Policy Board in June 2011, this study evaluated the safety and operations of four conceptual configurations of a single Build Alternative: constructing a new grade-separated interchange south of the current intersection.

- ***Configuration 1: Standard Diamond Interchange.*** Construct a new standard diamond interchange approximately 0.4 miles south of existing US 460 Bypass/Southgate Drive intersection. This configuration includes a single ramp from and to each direction of US 460 Bypass. Signalized intersections would be located at the ramp termini.
- ***Configuration 2: Diverging Diamond Interchange.*** Construct a new diverging diamond interchange approximately 0.4 miles south of existing US 460 Bypass/Southgate Drive intersection. This alternative represents an adaptation of the standard diamond interchange design whereby the signalized intersections on either side of the bridge over the main highway include a cross-over to allow traffic to switch to the opposite side of the road, where traffic from exit ramps is able to merge without, as is otherwise typical, opposing traffic coming in the

opposite direction. With traffic on the left, left turns are conducted without conflict onto the US 460 Bypass on-ramps. Through traffic crosses back over to the right at the signalized intersection on the opposite side of the diamond. As with the standard diamond interchange, there are single ramps from and to each direction of US 460 Bypass.

- ***Configuration 3: Rotary Interchange.*** Construct a new expanded rotary interchange approximately 0.4 miles south of existing US 460 Bypass/Southgate Drive intersection. This alternative is a large oblong driving circle which provides access between the freeway and cross street without the use of any traffic signals, consequently allowing for free-flowing movements inside the rotary. As with the standard diamond and diverging diamond interchanges, there are single ramps from and to each direction of the US 460 Bypass.
- ***Configuration 4: Partial Cloverleaf Interchange.*** Construct a new partial cloverleaf interchange approximately 0.4 miles south of existing US 460 Bypass/Southgate Drive intersection. This alternative is a combination of a standard diamond interchange and a cloverleaf interchange. The concept provides unsignalized access to and from eastbound US 460 Bypass, along with a signalized treatment and a smaller footprint for ramps associated with westbound US 460 Bypass. There are single ramps from and to the westbound US 460 Bypass, but multiple access points onto eastbound US 460 Bypass would need to be addressed with a collector-distributor road.

The study included forecasts and analysis for a design year of 2040, and included input on alternatives from federal, state, and local stakeholders as well as review by citizens at

general public meetings. As part of a comprehensive alternatives development and screening process, **Table 1** presents the

criteria that were used in the study to identify which concepts to eliminate, modify, or retain.

Table 1. Alternatives Screening Criteria (Previous Study)

Purpose and Need Criteria	<ol style="list-style-type: none"> 1. Conforms to regional and local plans. 2. Accommodates projected multi-modal travel demands. 3. Supports accessibility to employment centers and supports regional economic development. 4. Enhances travel by multiple travel modes and supports connectivity and interoperability between modes. 5. Enhances safety for the traveling public. 6. Improves regional transportation deficiencies.
Traffic Operations and Engineering Criteria	<ol style="list-style-type: none"> 7. Connects to existing roads or land uses at desirable locations; intersection patterns acceptable; constructible without excessive disruption of traffic flow. 8. Minimizes travel time and delays through the study area. 9. Enhances safety for all modes of travel, reduces overall exposure to crashes. 10. Supports travel by transit, bicycling, and walking, as well as automotive travel. 11. Provides maximum support for campus evacuation and emergency vehicle access during possible emergencies. 12. Standards for engineering features (curvature, grades) can be met; amount of earthwork not excessive; access to properties can be acceptably maintained.
Community Criterion	13. Minimizes intrusion into or through neighborhoods and community facilities.
Historic Property Criterion	14. Minimizes impacts to historic properties.
Recreational Facilities Criterion	15. Minimizes impacts to recreational facilities and trails; enhances such facilities where possible.
Other Environmental Issues Criterion	16. Minimizes impacts to farmland and farming operations, streams and wetlands, and floodplains.
Citizen Recommendations and Concerns Criterion	17. Reflects input and recommendations from stakeholders and the general public.

Each of the four concepts was found to have a generally similar footprint with regard to potential environmental impacts, though the footprint of the diverging diamond would be the smallest and the partial cloverleaf the largest. The study also found that, in general, each of the alternatives provides adequate levels of service and would improve congestion; however, the diverging diamond provides the least overall amount of travel time for all vehicles and serves the two heaviest movements between US 460 Bypass and Southgate Drive with the least amount of delay. The queue estimates showed that while some lengthy queues would form, the queue on the new ramps would not affect freeway operations on US 460 Bypass for all scenarios. Of the concepts, the diverging diamond would produce some of the shortest overall queues.

Based on stakeholder and public input, operations, safety, ability to serve transit and pedestrian/bicycle operations, cost, the final study recommendation was to construct an interchange with a diverging diamond configuration (see **Figure A6**) south of existing Southgate Drive and tying into relocated Southgate Drive and relocated Research Center Drive. The diverging diamond concept was shown to be one of the safest interchange configurations based on the fact that it would spread out the conflict points, provide better sight distance and shorter pedestrian crossings, and allow for the ability to incorporate traffic calming features. One important factor supporting the new location for the Southgate Drive connection was the ability to maintain traffic to US 460 Bypass and Southgate Drive while a new connection is constructed.

SECTION 2

ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

2.1 Consideration of Purpose and Need

While the planning study and the MPO’s inclusion of the project in the regional transportation plan, referenced above, have framed the consideration of alternatives, additional study has been conducted for purposes of the EA to ensure that the latest available information has been taken into account. The EA analysis identified three components of the purpose and need:

Traffic Congestion. Need to improve traffic operations for vehicles that pass through the intersection of US 460 Bypass and Southgate Drive, and the associated local roadway network, including special events at Virginia Tech.

Safety. Need to address safety concerns resulting from having an at-grade intersection along a predominantly limited-access highway, which can adversely affect travel speeds, queue lengths, and driver expectation.

Accessibility and Mobility. Need to continue to improve the accessibility to existing regional activity and employment centers to support the region’s economy.

2.2 Alternatives Screening

Figure 3 illustrates the step-by-step process used to identify and screen alternatives. This process considers a full range of alternatives, including those considered in previous studies, which could potentially meet the identified transportation needs, and narrows the options to one Build Alternative for further consideration in this EA.

With the exception of the No-Build Alternative, alternatives that would not meet the stated purpose and need are not considered reasonable and were not carried forward for detailed evaluation. The screening of potential Alternatives is shown in **Table 2**, and further described in Section 3.

Figure 3. Alternatives Screening Process

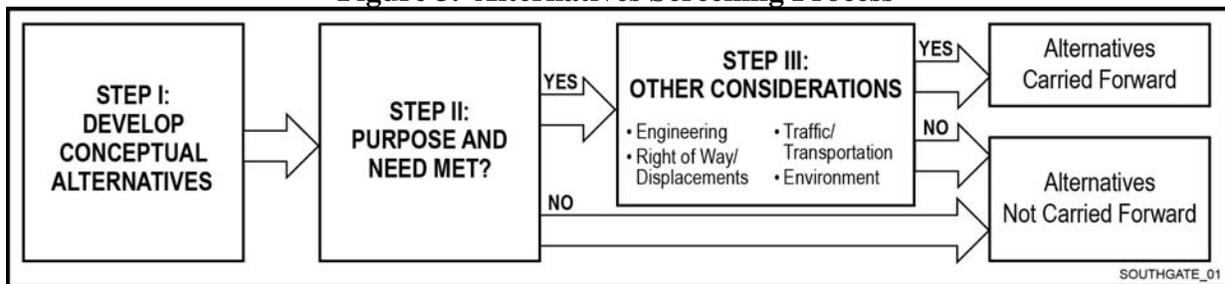


Table 2. Screening of Potential Alternatives

Potential Alternative:	Would Purpose and Need Be Met?		
	Traffic Congestion	Safety	Accessibility & Mobility
Mass Transit Alternative	No	No	No
Transportation System Management Alternative	No	No	No
Upgrade Existing At-grade Intersection	No	No	No
Interchange at Existing Intersection Location	Yes	Yes	Yes
Interchange at Relocated Intersection Location	Yes	Yes	Yes

ALTERNATIVES NOT CARRIED FORWARD FOR DETAILED STUDY

3.1 Alternatives That Would Not Meet Purpose and Need

Through the alternatives screening process, several concepts were not carried forward for detailed consideration and not carried forward in the EA for detailed evaluation.

Three potential alternatives were not carried forward due to their inability to address the project purpose and need:

- *Mass Transit Alternative.* Blacksburg Transit (BT) provides transit service for the region, and such service is particularly important within the study area in terms of serving students and faculty/staff going to and from the Virginia Tech campus as well as serving the heavy transportation demands of major events such as Virginia Tech football games. BT continues to expand to meet transit needs within the region, and improvements to the US 460 Bypass/Southgate Drive intersection will allow BT buses to serve transit needs more efficiently (BT buses are currently not routed through the existing intersection in one direction because of high levels of delay). While increasing transit use and expanding transit service is an important component of any regional transportation system, this alternative was determined to have limited ability as a stand-alone solution to reduce congestion, improve safety, and improve access and mobility because it would not address the primary basis for these needs, which is the at-grade intersection.
- *Transportation System Management (TSM) Alternative.* TSM generally includes implementation of relatively low-cost actions to improve the efficiency of existing transportation systems. Some examples include traffic

controls, signal synchronization, turn lanes, parking management, access management, operational modifications, flexible work hours, van pools, transit scheduling, bicycle and pedestrian improvements, modifying driver behavior with incentives, pricing, or restrictions. Although such actions are critical elements of the region's overall transportation system and are implemented by Virginia Tech, the Town of Blacksburg, and the region as a whole, there are none that would meet the identified needs for this study. This alternative would have limited ability as a stand-alone solution to reduce congestion, improve safety, and improve access and mobility because it would not address the primary basis for these needs, which is the at-grade intersection.

- *Upgrade existing at-grade intersection.* Many of the transportation needs in the project area relate to the at-grade aspect of this junction (including safety, access, and mobility). This alternative would maintain an at-grade intersection on the primarily grade-separated US 460 Bypass, and would therefore not meet these needs.

3.2 Interchange at Existing Intersection Location

The alternative consisting of an interchange at the existing at-grade intersection location was not carried forward for further evaluation for the following reasons:

- In order to construct an interchange at the existing location, Southgate Drive would have to be closed to traffic during construction, or a temporary access road would have to be constructed and maintained for the duration of interchange construction. Closing the intersection during construction would

eliminate the access provided by the existing road to Virginia Tech, downtown Blacksburg, the Virginia Tech-Montgomery Executive Airport, and the Virginia Tech Corporate Research Center. Constructing temporary access would not be cost-effective when compared to constructing an interchange at a new location, allowing the existing intersection to remain open during construction. The construction of an interchange at a new location affords maintenance of traffic through the existing intersection and facilitates construction relatively free of traffic conflicts.

- The existing intersection location conflicts with Virginia Tech's campus access plans, as outlined in the 2009 Master Plan Amendment². These plans include a "new interchange/flyover south of Southgate Drive on the Route 460 Bypass" as part of a roadway concept to replace existing Southgate Drive to accommodate the airport runway expansion.
- As described in Section 1.3, the location of a new interchange to the south of the existing intersection location is consistent with the MPO's planning and programming in its long range transportation plan; an interchange at the existing intersection is not.

² The Virginia Tech Master Plan Amendment 2009, Land Use.

SECTION 4
NO-BUILD ALTERNATIVE

4.1 Elements of No-Build Alternative

The no-action or No-Build Alternative serves as a baseline for comparing build alternatives. The elements of the No-Build Alternative include the following:

- Southgate Drive would remain on its existing alignment.
- The intersection of Southgate Drive and US 460 Bypass would remain a signalized at-grade intersection.

It is assumed that all transportation improvements (with the exception of the Southgate Drive improvements) that are funded for construction in the MPO’s financially constrained long range transportation plan (*Year 2035 LRTP* adopted November 4, 2010 and amended June 2, 2011) and in VDOT’s current Six-year Improvement Program would be implemented by the design year 2040. These projects are listed in **Table 3**.

Table 3. Regional Transportation Improvements Project List

Plan	Route	Project Location	Project Description
2035 Plan	VA 314	Duck Pond Drive over Stroubles Creek (South)	Upgrade bridge.
2035 Plan	VA 314	Duck Pond Drive over Stroubles Creek (North)	Upgrade bridge.
2035 Plan	VA 314	Research Center Drive at Southgate Drive	Realign Research Center Drive to intersect with the relocated Southgate Drive. Part of the airport runway extension project.
2035 Plan	US 460 Bypass	US 460 Bypass at US 460 Business (North Main Street)	Perform study to identify specific safety concerns.
2035 Plan		Progress Street and Givens Lane	Widen Givens Lane to include bike lanes and sidewalks. Extend Progress Street to Givens Lane.
2035 Plan		Construct multi-modal transfer facility on Perry Street	Construct new facility (on Virginia Tech Campus).
2035 Plan and SY2012-2017	US 460 Bypass	Ramble Road at Industrial Park Drive	Upgrade intersection.
SY2012-2017	Huckleberry Trail	Miller Street to Energy Drive	Rebuild section.
SY2012-2017	US 460 Bypass	US 460 Bypass/Pandapas Pond Road to US 460 Business (N. Main Street)	Install safety and warning equipment.
SY2012-2017	N. Main Street	Giles Road to Tabor Road	Reconstruction; preliminary engineering only.
SY2012-2017	N. Main Street	N. Main Street and Red Maple Drive	Improve sight distance.
SY2012-2017	N. Main Street	Just north of intersection with Kabrich Street to just south of intersection with College Avenue	Safety and traffic operations.
SY2012-2017	Progress Street	Just south of Ashford Court/Givens Lane to just east N. Main Street/north of Cherokee Drive	Extend Progress Street
SY2012-2017	Prices Fork Road	Prices Fork Road to Plantation Road	Upgrade traffic signals.

Note: Projects associated with the Build Alternative are not included in this table.

As discussed in Section 1, the No-Build Alternative is not consistent with local land use plans, including the MPO’s official policy decisions regarding the Southgate Drive improvements, the Virginia Tech Master Plan, and the planned expansion of the Virginia Tech-Montgomery County Executive Airport. Furthermore, the No-Build Alternative would not meet the identified project needs, as described below.

4.2 Ability to Meet Needs

Traffic Congestion. By 2040, traffic forecasts show increases in travel demand of almost 84% (to 64,300 vehicles) in weekday traffic that would pass through the intersection at Southgate Drive and US 460 Bypass. As shown in Table 5 in Section 5, the LOS at the intersection of Southgate Drive and US 460 Bypass would deteriorate from existing LOS B and D to 2040 No-Build LOS D and F in the AM and PM peak hours, respectively. FHWA design criteria require LOS C on this section of US 460 Bypass. The associated delays at this intersection would approximately triple in both peak hours. The intersections of Southgate Drive with Duck Pond Drive and Spring Road would deteriorate in the AM peak hour from existing LOS A and B, respectively, to 2040 No-Build LOS E.

Safety. Existing safety issues associated with variations of travel speeds, queue

lengths, and driver expectations are anticipated to worsen as higher traffic volumes (almost 84% increase in weekday traffic through the intersection of Southgate Drive and US 460 Bypass) would pass through the at-grade intersection along the mainly limited-access bypass. The increase in travel delays and congestion also would result in longer queues, as shown in **Table 4**. The movement of most concern with respect to safety is the left-turn traffic from eastbound US 460 Bypass onto Southgate Drive, in which case the stopped traffic in turning queues would spill back into the through lanes carrying higher-speed traffic. Queue lengths on eastbound US 460 Bypass are projected to increase more than 200% in both the AM and PM peak hours by 2040.

Accessibility and Mobility. As traffic demand increases, continued accessibility to regional activity and employment centers will be needed to support the region’s economy. These centers include the Town of Blacksburg, the expanded Virginia Tech-Montgomery Executive Airport, the campus of Virginia Tech, and the expanded Corporate Research Center, which is anticipated to double in size to house an additional 3,000 employees. For the region as a whole, the MPO estimates more than 30% increase in population and 45% increase in employment by 2035.

Table 4. Queue Lengths – 2010 Existing and 2040 No-Build Conditions

Movement	AM (feet)			PM (feet)		
	2010 Existing	2040 No-Build	% Increase	2010 Existing	2040 No-Build	% Increase
US 460 Bypass						
Eastbound Left Turn to Southgate Drive	210	725	245%	160	345	115%
Eastbound Through	125	385	208%	565	1,730	206%
Westbound Through	345	490	42%	890	2,370	166%
Southgate Drive						
Westbound Left Turn to EB 460	35	60	71%	280	895	220%
Westbound Right Turn to WB 460	60	60	-	320	920	188%

Source: Traffic and Transportation Memorandum, prepared in support of the EA.

SECTION 5

BUILD ALTERNATIVE CARRIED FORWARD

5.1 Introduction

The screening process resulted in one Build Alternative being carried forward for detailed evaluation: a grade-separated interchange on new location south of existing Southgate Drive, relocation of Southgate Drive to connect to the new interchange, and closure and demolition of existing Southgate Drive and its intersection with US 460 Bypass.

Although several preliminary designs were tested for purposes of the previously published *Analysis for a New Interchange on the US Route 460 Bypass in the Vicinity of Southgate Drive* (as summarized in Section 1.3), those designs were not based on engineering surveys and do not represent actual final designs for elements of the project. Notwithstanding, those preliminary designs were used to inform the size of area needed to implement an interchange and its associated ramps. Accordingly, the Build Alternative is represented as a study corridor that encompasses sufficient area to accommodate several design variations. This approach provides a worst-case assessment of the potential impacts while providing flexibility during final design with respect to specific alignment and design features.

5.2 Description

As shown in **Figure 4**, the elements of the Build Alternative include the following:

1. Construction of a new interchange, located between approximately 0.3 and 0.4 miles south of the existing at-grade intersection of Southgate Drive and US 460 Bypass.
2. Relocation of Southgate Drive to connect with the new interchange on the west end and with existing Southgate

Drive on the east end in the vicinity of Duck Pond Drive.

3. Removal of the existing Southgate Drive and US 460 Bypass intersection and existing Southgate Drive between US 460 Bypass and Duck Pond Drive.

Construction of the Build Alternative would also include geometric improvements to the existing Huckleberry Trail underpass of US 460 Bypass to eliminate sharp curves and poor sight distance as well as reduce the approach grades to the underpass. Other ancillary improvements would include drainage, stormwater management facilities, and connections to existing Duck Pond Drive and Spring Road. All elements of the Build Alternative would accommodate connection with the relocated Research Center Drive and relocated crossings with the Huckleberry Trail that are associated with the airport expansion.

5.3 Cost

The estimated cost for the new interchange and associated roadway improvements is \$46.7 million (2035 *Long Range Transportation Plan, Amendment 1*).

5.4 Ability to Meet Needs

Traffic Congestion. The Build Alternative would relieve congestion on both US 460 Bypass and Southgate Drive, as shown in **Table 5**. Additionally, all new ramp merge and diverge connections (shown in **Table 6**) with relocated Southgate Drive would operate at reasonable LOS. Refer to the *Traffic and Transportation Memorandum* for details on traffic operations.

Safety. The Build Alternative would improve safety by providing a grade separation that would remove much of the traffic conflict that occurs today with the at-grade intersection.

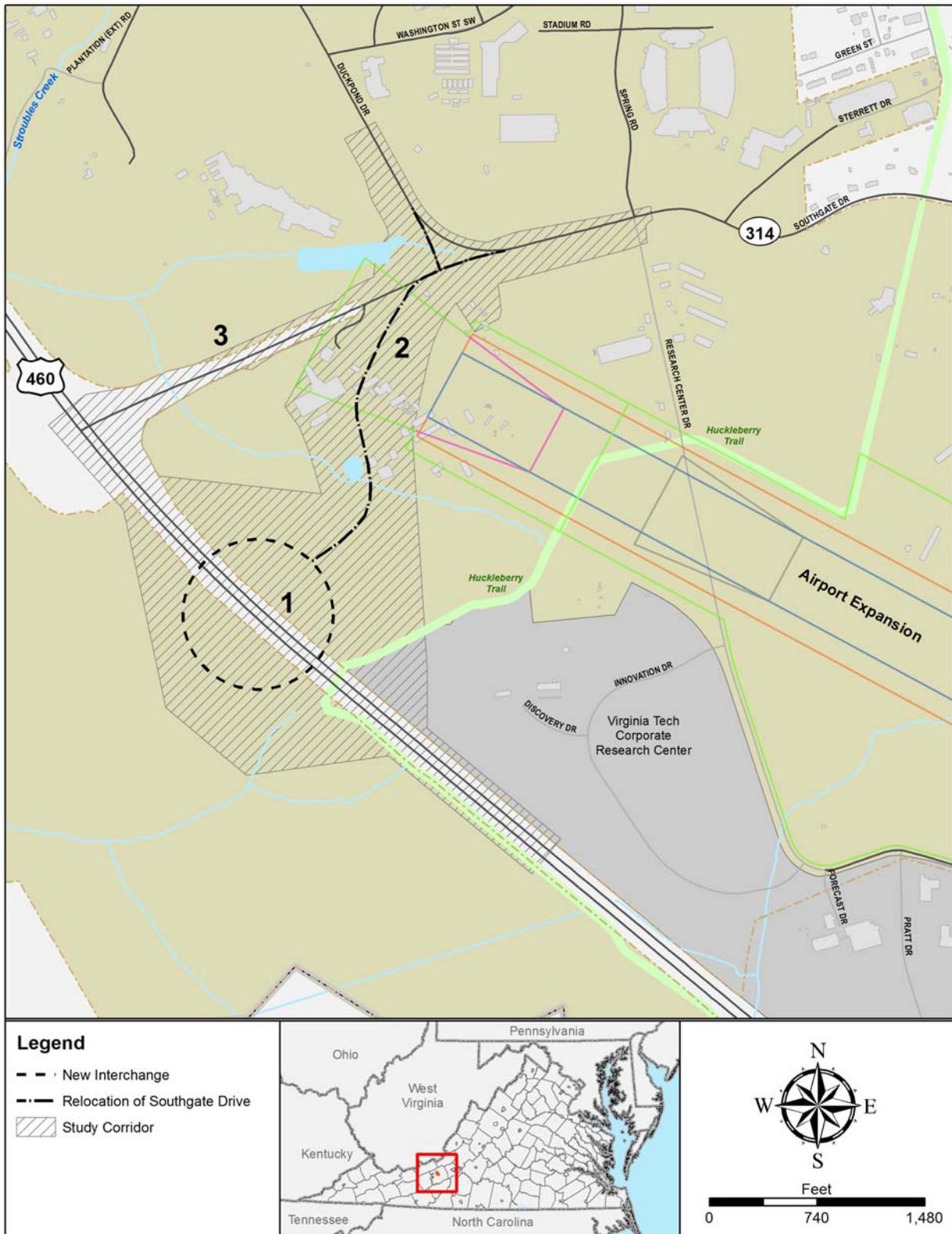


Figure 4. Build Alternative

Table 5. Intersection LOS – 2010 Existing, 2040 No-Build, and 2040 Build Conditions

Intersection		2010 Existing		2040 No-Build		2040 Build	
		AM	PM	AM	PM	AM	PM
Southgate Drive at US 460 Bypass	LOS	B	D	D	F	A	B
	Delay (sec)	11.9	35.9	42.2	139.3	9.8	12.5
Southgate Drive at Duck Pond Drive	LOS	A	B	E	B	A	B
	Delay (sec)	6.6	16.4	59.8	15.9	3.4	13.1
Southgate Drive at Spring Road	LOS	B	F	E	F	D	D
	Delay (sec)	16	262.4	70.7	300.6	36.8	46.0

Table 6. 2040 Build Alternative – Ramp Merges and Diverges Measures of Effectiveness

Direction and Ramp		AM		PM	
		Speed (mph)	LOS	Speed (mph)	LOS
EB US 460 Bypass	Off-ramp to Southgate Drive	53.3	C	54.5	C
	On-ramp from Southgate Drive	56.0	C	57.0	C
WB US 460 Bypass	Off-ramp to Southgate Drive	52.7	C	54.8	C
	On-ramp from Southgate Drive	56.0	C	56.0	C

The new grade-separated interchange would be located between adjacent interchanges that are also grade-separated, which would reduce unexpected conditions for drivers and unsafe variation of driving speeds by maintaining the grade-separated operational characteristics along the US 460 Bypass.

The potential safety hazard of turning queues spilling back into the through lanes carrying higher-speed traffic on US 460 Bypass would be eliminated as analysis shows that queues at the intersection of the ramps with relocated Southgate Drive would be less than 50 feet (refer to the *Traffic and Transportation Memorandum* for details).

Accessibility and Mobility. By reducing congestion and providing a more efficient connection between US 460 Bypass and Southgate Drive, the Build Alternative would enhance accessibility to and mobility between the area’s activity centers, including Virginia Tech, downtown Blacksburg, the Virginia Tech Corporate Research Center, and the Virginia Tech-Montgomery Executive Airport.

APPENDIX A
PROJECT HISTORY FIGURES



Figure A1. Project History: 1994 Virginia Tech Master Plan, Cross Campus Corridors



Figure A2. Project History: 2009 Virginia Tech Master Plan

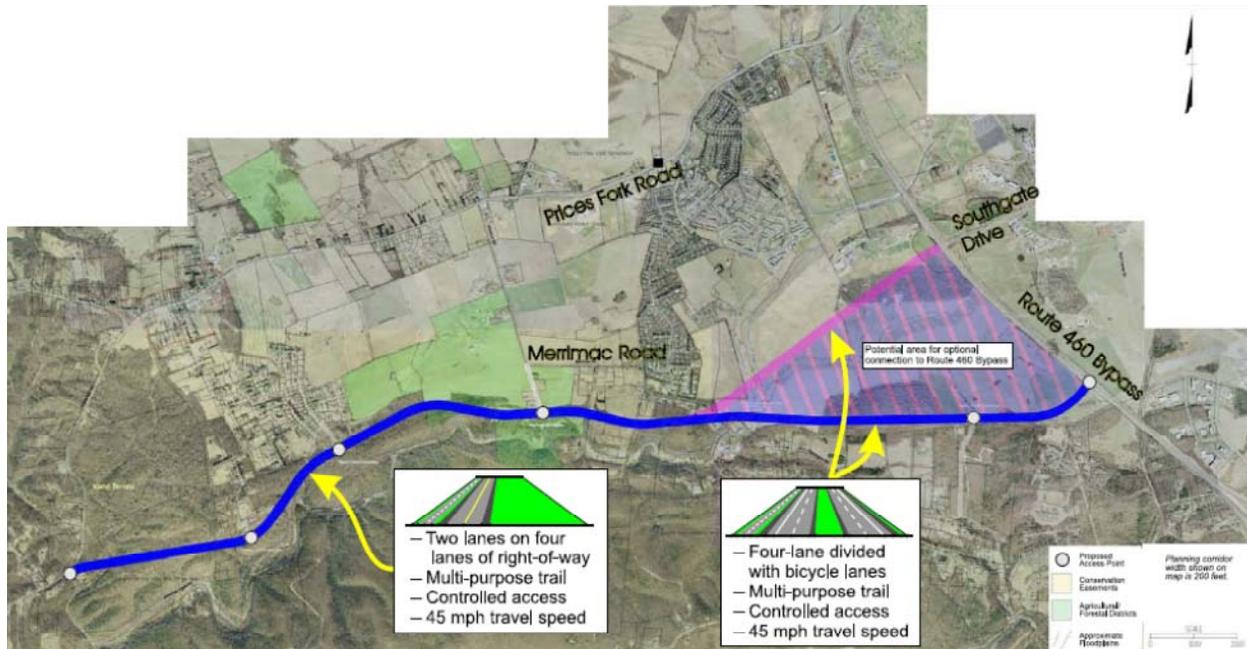


Figure A3. Project History: Route 460 Connector Corridor Study

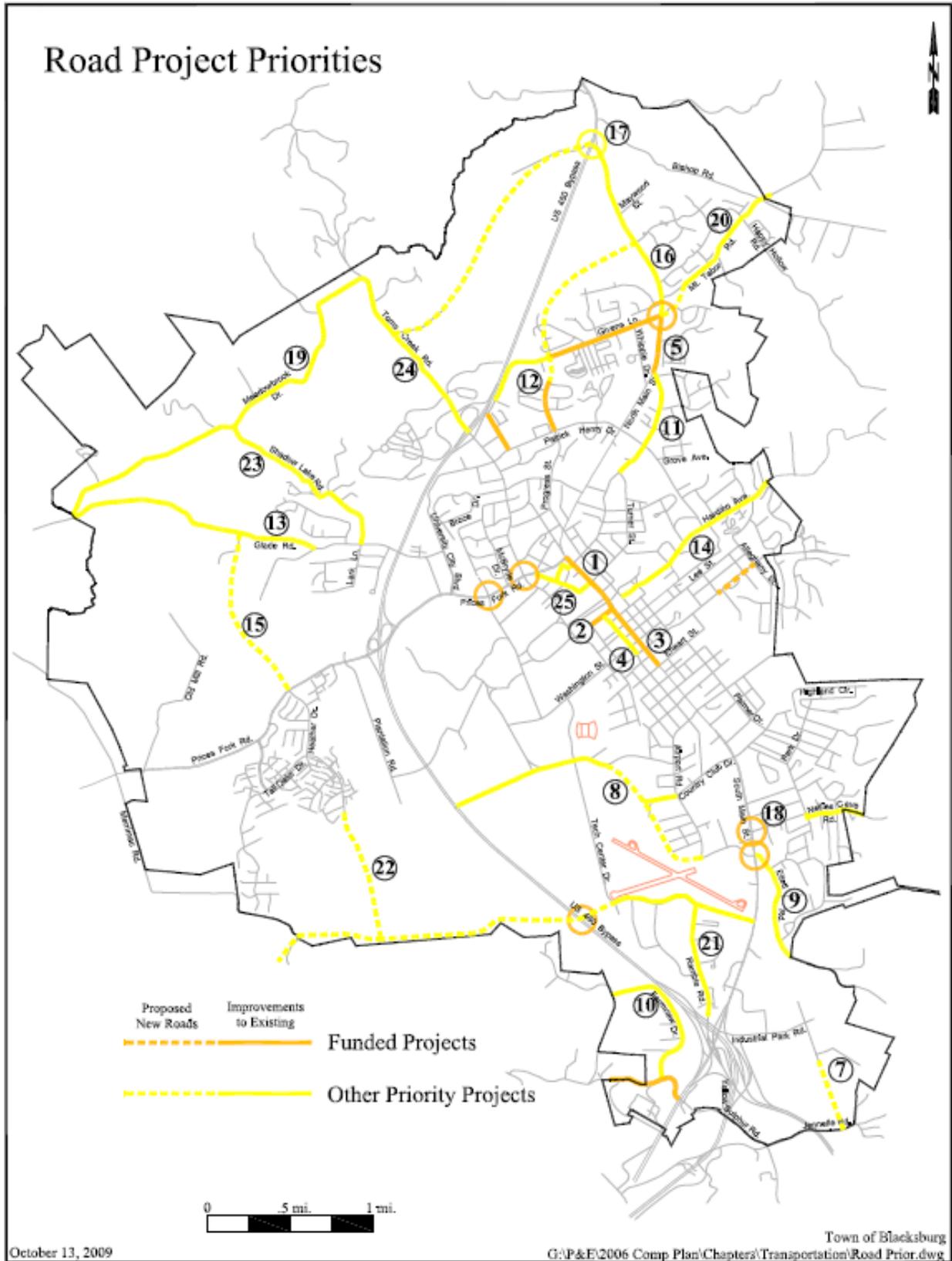
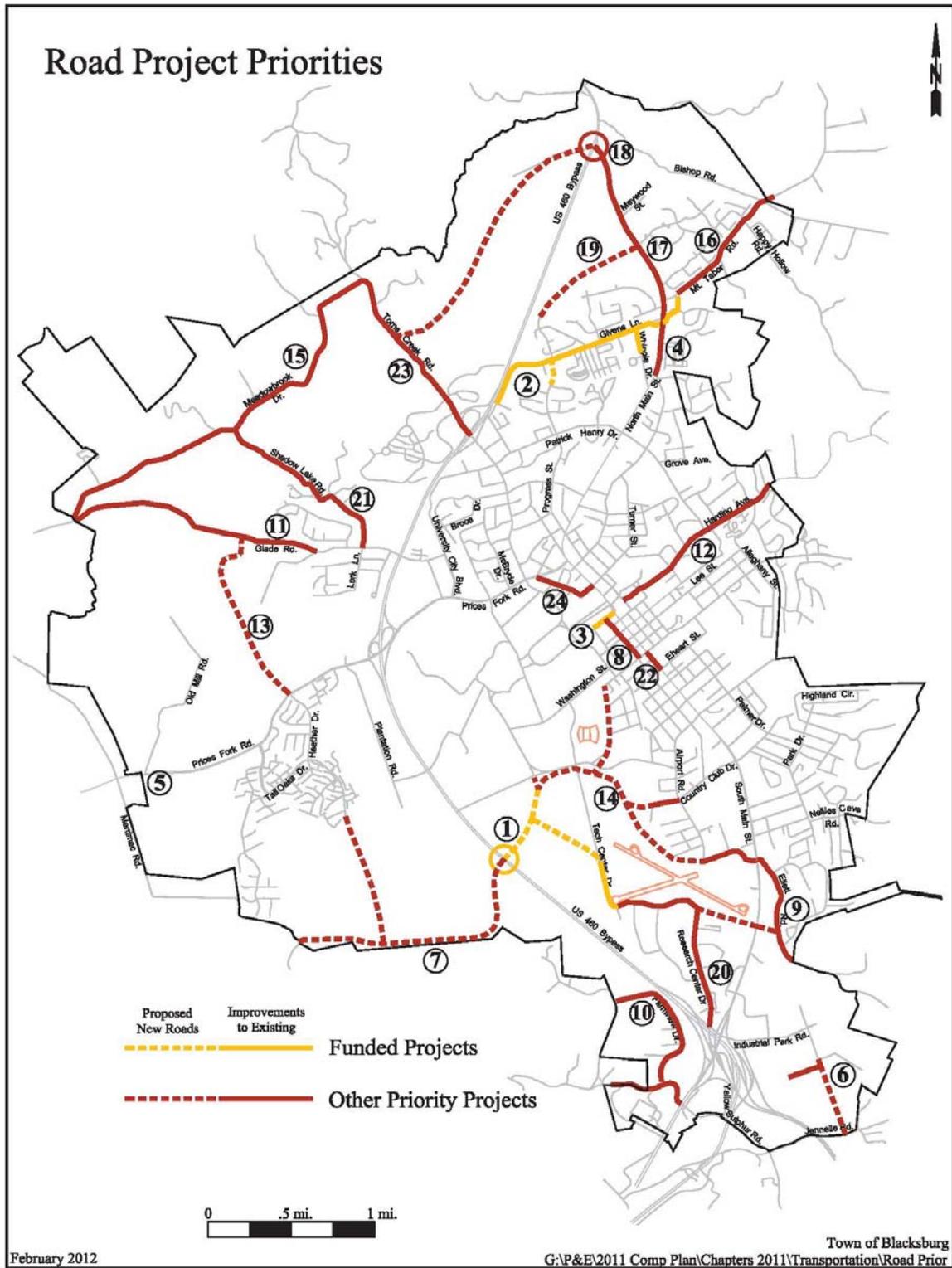


Figure A4. Project History: Town of Blacksburg 2006-2046 Comprehensive Plan Road Priority Projects



**Figure A5. Project History: Blacksburg 2046 Comp Plan 2012 Update
 Road Priority Projects**

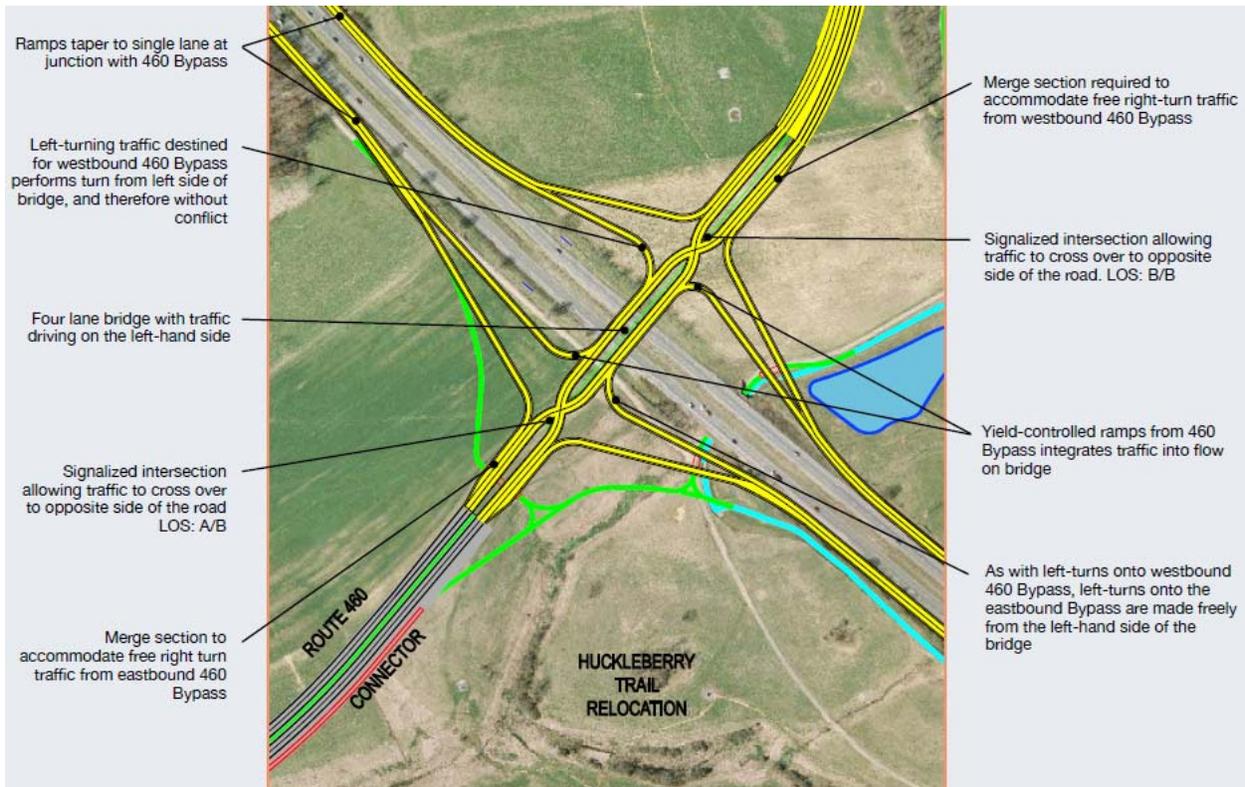


Figure A6. Project History: Diverging Diamond Interchange