



# Northern Virginia Regional Bikeway and Trail Network Study

*Final Report*



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# ACKNOWLEDGEMENTS

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Jurisdictions / Organizations participating in this study included:

- Arlington County
- City of Alexandria
- City of Falls Church
- City of Fairfax
- City of Manassas
- City of Manassas Park
- Fairfax County
- Loudoun County
- Prince William County
- Town of Herndon
- Town of Leesburg
- Town of Vienna
- National Park Service
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- Alexandria Bicycle Advisory Committee
- Arlington Bike Advisory Committee
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- Virginia Bicycling Federation
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Virginia Department of Transportation  
Northern Virginia District Office  
Transportation Planning Section  
14685 Avion Parkway, Chantilly, Virginia 20151-1104  
703-383- 2233  
TTY711

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# EXECUTIVE SUMMARY

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The Northern Virginia Regional Bike Network Study provides a coordinated and strategic approach to developing a regional transportation system for bicycling in Northern Virginia. While local jurisdictions are primarily responsible for bicycle planning in Virginia through the development of local bicycle plans and transportation plans, Virginia Department of Transportation (VDOT) plays an important role as the agency responsible for constructing and maintaining many of the primary and secondary roads, which provide Northern Virginia with regional connections between activity clusters<sup>1</sup>.

In order to further enhance Northern Virginia's non-motorized transportation network and advance bicycling as a viable mode of travel throughout the region, VDOT initiated the following study. This study coordinates local planning efforts and identifies key regional connections.

**The purpose of this study is to identify facilities and outline the steps that could be taken to develop a network of bikeways in Northern Virginia linking activity clusters throughout the region.**

The development of a regional bikeway network is supported by federal and state transportation policy goals. At the time of this report's distribution, VDOT is involved in two projects that will further support bicycling within the transportation system. One project is a review of policies and procedures to ensure that motorized and non-motorized modes of transportation receive the same consideration in the planning, design, funding, construction, operation, and maintenance of Virginia's transportation network. VDOT is also working with the state's transportation agencies on a statewide initiative to integrate planning for highways, bicycle and pedestrian accommodations, passenger rail and transit, freight rail, airports, and ports, which will produce the statewide long-range multimodal transportation plan, VTrans2025. One goal of this comprehensive approach to such planning is to move towards implementation activities that will build a balanced transportation infrastructure.

## **Regional Focus of the Study**

A considerable effort was undertaken to coordinate bikeway planning and implementation projects from a wide range of local jurisdictions in Northern Virginia. The study reflects the guidance and input of a working group of representatives from local jurisdictions including Arlington, Fairfax, Loudoun and Prince William counties; the cities of Alexandria, Falls Church, Fairfax,

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<sup>1</sup> Important regional concentrations of employment and households as identified by the Metropolitan Washington Council of Governments.

Manassas and Manassas Park; and the towns of Herndon, Leesburg, and Vienna. The regional bikeway network proposed by this study has also been closely coordinated with the adopted plan for each of these jurisdictions.

### **Bicycling - A Viable Alternative?**

This project comes at an important time for the future of bicycling, and transportation in general, in this region. With increasingly challenging requirements for better air quality in the region and traffic delays growing worse each year, there is a great deal of interest in new approaches to land use and transportation in Northern Virginia. In fact, bicycling is already becoming a more accepted alternative for Washington area commuters. The W&OD, Custis and Mount Vernon trails experience a morning rush hour, and the neighborhoods that lie along these trails have higher bike commute levels than other parts of the region. Northern Virginians are looking for alternatives to single-occupant vehicle trips.

In Northern Virginia, many bicyclists find roadway conditions to be challenging for long distance bicycle commuting. Particularly on the primary routes that lead to important destinations, bicyclists face heavy volumes of high-speed traffic on roads that lack dedicated bicycle facilities. This study continues VDOT's efforts to improve bicycling conditions in Northern Virginia and provide first-class facilities for all users of the transportation system.

### **Study Process**

The planning process for this study involved a number of different activities and outreach efforts. The process is outlined briefly below.

1. **Field Analysis**

An analysis of conditions on existing trails and roadways was conducted in the field. It included a trail facility inventory, roadway lane width measurements, and assessment of pavement conditions. Other issues such as connections to transit facilities were also examined and extensive background research and field measurements were taken to develop solutions at each of the 14 demonstration project study locations.

2. **Public Input**

Public input on the study was received through a public meeting held in centrally-located Fairfax County in July 2002 and through the project website. Electronic newsletters and regular updates to the project web page were also used to keep interested individuals and groups aware of the project progress. More than 200 emails with suggestions and comments were received from the public. In addition, several

representatives of bicycle coalitions and other groups participated in the working group meetings.

3. Jurisdiction Input/Coordination

Input was received from a working group of local representatives from the counties, cities, and towns in Northern Virginia. This input was particularly important since the study is based upon local adopted plans and planning efforts.

4. Latent Bicycle Travel Demand

The study included measuring latent bicycle travel demand, which provided information on routes that serve a high number of potential bicycling origin and destination points.

5. Demonstration Projects

Local jurisdictions recommended locations for more in-depth field analysis to demonstrate the range of various types of bikeway improvements that may be possible for different roadway corridors. Demonstration project studies completed in 14 locations throughout Northern Virginia.

6. Final Network Map and Recommendations

The final regional bikeway network map and study recommendations in this report were based on all of the input and analysis described in the steps above utilizing the locally adopted bicycle plans as guides.

## **Summary of Recommendations**

The recommendations outlined below are steps towards the creation and continued support of a regional network of bikeways in Northern Virginia. These recommendations are divided into two categories, A) Bikeway Network Recommendations and B) Planning and Policy Recommendations. In order to successfully implement these recommendations, a cooperative effort on behalf of the state and local jurisdictions will be necessary.

### **A. Bikeway Network Recommendations**

The locations of the proposed network facilities are shown on the proposed regional bikeway network maps provided in the full report. The system of facilities includes both on-road bike lanes and paved shoulders, as well as off-road shared use paths.

- **Establish a regional network of on-road bike lanes, paved shoulders and shared use paths within and between activity clusters in Northern Virginia.**

This study provides a framework for creating a more coordinated system by recommending a network of regional bikeways and trails that extends between and through all of the Metropolitan Washington Council of Government (MWCOCG)'s activity clusters in Northern Virginia, as well as connecting to activity clusters in Maryland and the District of Columbia. This network of facilities should be among the top priorities for stand-alone projects under VDOT's new policy that allows for the funding of independent bicycle facility projects.<sup>2</sup>

- **Eliminate critical gaps in the existing bikeway network.**

A number of short gaps in the existing network were identified during public meetings, through field visits, and from analysis of the network map. Future planning efforts should focus on eliminating known gaps, as well as other gaps that are identified during project development.

- **Upgrade regionally-significant trails to industry standards.**

While most of the responsibility for major commuter trails in Northern Virginia is outside of the jurisdiction of VDOT, local jurisdictions, in coordination with VDOT, should undertake a program to widen and further improve trails that do not meet national guidelines for bikeway design. A number of needed upgrades were identified during this study and are listed below:

- W&OD Trail: Widen narrow sections of the W&OD Trail to 10-foot wide minimum, 12-foot wide in areas with heavier volumes. The trail is currently less than eight feet wide in several sections. In addition, intersection safety improvements are needed at Sterling Boulevard, Church Street in Sterling, Hunter Mill Road, West Street in Falls Church, and Route 29 in Arlington.
- Mt. Vernon Trail: Widen narrow sections of the Mt. Vernon Trail to 10-foot wide minimum, 12-foot wide in areas with heavier volumes. Improve the trail alignment along the Roosevelt Island parking lot; widen pinch points, such as the sidewalk over the inlet to the Boundary Channel. Provide connections from the trail to the Washington D.C. bridges, especially the connection across the George Washington Parkway to Arlington Memorial Bridge. Also, improve connections to the Pentagon and north Crystal City.

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<sup>2</sup> Resolution of the Commonwealth Transportation Board, December 19, 2002, Section 1B.

- Accotink Trail: Widen narrow sections of the Accotink Trail to 10-foot wide minimum. The trail is 6' six feet to eight feet wide near King Arthur Road.
  - Trails along arterials: Widen narrow (defined as less than eight feet wide) shared-use paths along arterials such as Wiehle Avenue, Telegraph Road, and Lee Highway (Route 29), and others.
- **Establish a system of high quality commuter corridors that connect outlying areas directly to core urban areas.**

There are a number of key corridors that cross jurisdictional boundaries which should be considered high priority because they provide viable bicycle connections through areas that are not currently served. Two trunk routes are already in place: the W&OD Trail/Custis Trail connection and the Mt. Vernon Trail from the south. Other bicycle trunk routes that need to be developed include Route 50 (Arlington Boulevard), Braddock Road and Route 1. These routes are shown as proposed routes on the regional bikeway network map.
- **Establish a route signage system that is easily and quickly understood by bicyclists.**

A signage system should be developed to identify the regional bikeway network in Northern Virginia. Signs should be enhanced to show bikeway route numbers or names. Additional signage should also be installed to show a pictorial of the bikeway with destination and interest points.
- **Improve the mass transit system to offer seamless connections for bicycle commuters.**

Continue to improve bicycle access to transit in Northern Virginia by adding bike racks to local buses, by providing secure bike parking at transit stations and park-and-ride lots, by improving bicycle connections in the vicinity of transit stations, and by ensuring bicycle and pedestrian through transit area design.
- **Provide bicycle access across major barriers.**

There are a variety of major barriers to bicycling in Northern Virginia including major highways such as I-495, I-95 and I-66, major arterial roadways, rivers, rail lines and property sites that can force bicyclists to travel miles out of their way to cross. Providing access across these barriers should be a standard component of roadway and bridge design, including interchanges between roads.

- **Coordinate maintenance activities for bikeways to ensure a high quality, safe experience for every user of the facilities.**  
VDOT and local jurisdictions should coordinate maintenance program activities that address both regular and remedial maintenance of bicycle facilities throughout the region. One component of this may be an “Adopt-a-Trail” program.

## **B. Planning and Policy Recommendations**

The following actions are recommended to better incorporate bicycle access into standard policies and procedures of local and state government.

- **Encourage the use of context sensitive roadway design that facilitates bikeway development in all jurisdictions.**  
Flexibility should be encouraged in the VDOT Roadway Design Manual to ensure that bicycle facilities can be accommodated in corridors with constrained rights-of way.
- **Undertake comprehensive changes to land use policies to encourage bicycle mobility and discourage development that is solely oriented to automobile access.**  
In order for bicycling and walking to become comfortable and convenient transportation options, these modes must continue to be fully integrated into local land use decisions in Northern Virginia. While this is outside of VDOT’s specific area of responsibility, the department can provide assistance through land development recommendations and permitting process.
- **Augment regional planning efforts with local bikeway planning, design and encouragement/ promotional projects.**  
It will be important for local governments to continue to advance high priority regional bikeway projects through the established channels of the transportation funding process such as the VDOT Six Year Transportation Improvement Program, Secondary Road Program, Incidental and Revenue Sharing funds and local funding.
- **Identify sufficient funding sources to establish the regional bikeway network.**
- **Establish mechanisms to enable on-going coordination and public involvement in regional bicycling issues.**  
Continued coordination will be needed in the future in order to effectively implement this recommended regional bikeway network. This recommendation addresses the on-going planning, coordination, and

oversight that will be needed to advance bicycling as a viable transportation alternative in the region.

## **Conclusion**

The thirteen recommendations described above form the basis for creation of a bikeway facilities network. This will provide the option of bicycling as a practical mode of transportation to major destinations throughout the region. These recommendations are intended to support local activities and coordination between jurisdictions as these facilities, programs, and policies are put in place.

# CHAPTER 1: PURPOSE AND VISION

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The Northern Virginia Regional Bike Network Study provides a coordinated and strategic approach to developing a regional transportation system for bicycling in Northern Virginia. While local jurisdictions are primarily responsible for bicycle planning in Virginia through the development of local bicycle plans and transportation plans, VDOT plays an important role as the agency responsible for constructing and maintaining many of the primary and secondary roads, which provide Northern Virginia with regional connections.

## Study Purpose

VDOT initiated this study to help coordinate local planning efforts and to focus on forming key connections between activity clusters (areas with high concentrations of both jobs and households)<sup>3</sup> in Northern Virginia, with the purpose of promoting the advancement of bicycling as a viable alternative to travel throughout the region. This study identifies the desired future regional bikeway network based on input from the public and the local jurisdictions. The study also provides a series of recommendations that outline the necessary steps to make this network a reality.

**The purpose of this study is to identify facilities and outline the steps that may be taken to establish a Northern Virginia network of bicycle facilities.**

Further, this study supports both federal and state transportation policy goals to ensure a balanced multi-modal transportation system:

- Section 1202 of the 1998 federal law, the Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21) states that
  - *"Bicyclists and pedestrians shall be given due consideration in the comprehensive transportation plans developed by each metropolitan planning organization and State."* (Section 1202(a));
  - *"Bicycle transportation facilities and pedestrian walkways shall be considered, where appropriate, in conjunction with all new construction and reconstruction and transportation facilities, except where bicycle and pedestrian use are not permitted."* (Section 1202(a)); and
  - *"Transportation plans and projects shall provide due consideration for safety and contiguous routes for bicyclists and pedestrians."* (Section 1202(a))

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<sup>3</sup> As defined by the Metropolitan Washington Council of Governments.

- Virginia's Statewide Intermodal Long-Range Transportation Policy Plan (1995), states that the Department's policy is to *"ensure the availability of a full range of modal choices . . . and to incorporate intermodal planning, including planning for bicycle, pedestrian and telecommuting facilities, in the transportation planning efforts at the state and regional levels."*<sup>4</sup>

At the time of this report's distribution, VDOT is involved in two projects that will further support bicycling within the transportation system. One project is a review of policies and procedures to ensure that motorized and non-motorized modes of transportation receive the same consideration in the planning, design, funding, construction, operation, and maintenance of Virginia's transportation network. The results of this effort are scheduled to be presented to the Virginia Commonwealth Transportation Board (CTB) by early 2004. VDOT is also working with the state's transportation agencies on a statewide initiative to integrate planning for highways, bicycle and pedestrian accommodations, passenger rail and transit, freight rail, airports, and ports, which will produce the statewide long-range multimodal transportation plan, VTrans2025. One goal of this comprehensive approach to such planning is to move towards implementation activities that will build a balanced transportation infrastructure.

A regional bikeway network in Northern Virginia is also supported by the recommendations of the Virginia Department of Conservation and Recreation (DCR) in *The 2002 Virginia Outdoors Plan*. DCR has identified the need to provide *"transportation alternatives, specifically trails for walking, hiking and cycling and to connect people with destinations"* in its Northern Virginia Planning District. The Metropolitan Washington COG's *Bicycle Plan for the National Capital Region (1995)* provides further support for regional and local bicycle planning activities. It states: *"Bicycling...must be developed as an integral part of the transportation network...Bicycle and pedestrian transportation modes, either alone or combined with mass-transit modes, are some of the most cost effective, viable alternatives to increasing use of the automobile."*

## **Need for Regional Bicycling Improvements**

Traffic congestion and air quality have become central "quality of life" issues for Northern Virginians. The number of Code Red Air Quality Days<sup>5</sup> more than doubled between 2001 and 2002, and by some reports, area residents spend more than an average of 35 hours per year stuck in traffic, nearly 10 hours longer than

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<sup>4</sup> Virginia Statewide Intermodal Long-Range Transportation Policy Plan. 1995. Section 4.0, pp. 6-7.

<sup>5</sup> As defined by the Washington Metropolitan Council of Governments. Code Red indicates an unhealthy air quality level (index of 150 - 200). On such days, MWCOG recommends that individuals limit driving; children and elderly individuals should reduce outdoor activities; healthy individuals should limit strenuous outdoor work or exercise; individuals with heart or respiratory ailments, emphysema, asthma, or chronic bronchitis should limit their outdoor activities.

the national average<sup>6</sup>. Alternatives to single occupant vehicle trips have become a key part of the region's approach to these problems. As past experience has shown, Northern Virginians are open to alternatives as exhibited by record-breaking numbers of Virginia Railway Express (VRE) and Metrorail riders, successful HOV facilities, increased telecommuting, and well utilized long-distance bikeways.

In fact, a number of transportation surveys have reported an increase in the number of bicycle trips that are made in Northern Virginia and in the Washington DC region.

- Census data from 1990 shows increased levels of bicycling in census tracts that lie alongside major regional trails in Northern Virginia.
- MWCOG's Household Travel Survey shows a 79 percent increase in total bicycle trips between 1988 and 1999 and a 61 percent increase in home-based work trips (commuting). (See table 1.)<sup>7</sup>

**Table 1: Bicycle Trips in the Washington DC Region**

<b>Bicycle Trips</b>	<b>In 1988</b>	<b>In 1994</b>	<b>% increase between 1988 and 1994</b>	<b>In 1999</b>	<b>% increase between 1988 and 1999</b>
Total trips per day	43,000	72,000	67%	76,800	79%
Home-Based work trips <sup>8</sup> per day (commuting)	13,200	19,900	51%	21,300	61%

Source: Council of Governments Household Travel Surveys, 1988, 1994 and 1999.

By reducing the number of auto trips, bikeways can improve air quality, improve traffic congestion, and potentially reduce the need for large parking lots at transit stations, shopping centers, and employment areas. In addition to the transportation and air quality benefits of bicycling, there are other environmental, health, and recreation benefits to establishing a regional bikeway network.

<sup>6</sup> Texas Transportation Institute, 2003.

<sup>7</sup> Most of this increase is the result of an actual increase in bicycling activity. Some can be attributed to improvements in survey methodology.

<sup>8</sup> See above.

## **Regional Focus**

As a regional initiative, this study focuses on longer distance connections within Northern Virginia. The goal of this initiative is to provide a focused approach and possible mechanism to connect a wide range of activity clusters throughout the region so that bicycle travel between and within them is possible.

It is equally important to note that portions of the regional bikeway network already exist. Major regional trail corridors extend across long distances and through multiple jurisdictions. In many cases, a high level of success can be achieved by closing critical gaps in this network or by connecting an existing trail to a nearby regional activity cluster.

## **Vision for a Future Bikeway Network**

The recommendations of this study are based on a long-term vision for bicycle transportation in Northern Virginia. This vision is an important statement intended to guide the overall direction of future efforts by VDOT and local jurisdictions, as the recommendations in this study are implemented.

**Vision: Northern Virginia should become a place where people have the convenient and safe option to travel by bicycle between and within activity clusters throughout the region.**

This vision is supported by the recommendations (Chapter 5), which focus primarily on establishing the physical infrastructure needed to support bicycle travel in Northern Virginia. Achieving this vision will require a high level of commitment and a sustained funding effort on the part of local and state partners over the next 20 years. Implementation issues are discussed in Chapter 6.

## CHAPTER 2: STUDY PROCESS

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This chapter provides an overview of the planning process that was undertaken for this study, focusing on key factors that were considered during the development of the regional bikeway network.

Throughout the development of this study, VDOT actively sought the input of a wide range of stakeholders, including local citizens, bicycle advocacy groups, local bicycle advisory committees, local transportation planning agencies, local and regional parks and recreation agencies, and VDOT staff representatives from a variety of disciplines. The recommendations of this study reflect a direct relationship to the input received from these stakeholders.

### **Public Input**

Public input on the development of the Northern Virginia Regional Bikeway and Trail Network Study revealed a clear interest on the part of the local citizens to develop and improve bicycle facilities to make bicycling a more viable transportation mode. Overall, Northern Virginians expressed concerns that busy streets, fast traffic, and physical infrastructure barriers make bicycling difficult in their communities.

Public comments were received throughout the study through the project website; each question submitted to the website received an individual response. Newsletters were also sent to interested citizens in June 2001, April 2002, and August 2002. The Washington Area Bicyclist Association provided contact information for all of their Northern Virginia members (over 800 bicyclists), which enabled the newsletter to be distributed to a wide audience. In addition, Northern Virginians provided input at public informational meetings held in July 2001 and October 2003 (see Appendix C for a summary of public comments on the Draft Study Report).

The comments received through the public outreach process helped guide the recommendations of this study. Several major themes were identified in the public comments:

#### **1. Existing Bikeways**

The public comments showed that people who use established long distance trails in Northern Virginia are, on the whole, satisfied with these trails. A number of bicyclists commented that street crossings of the Washington and Old Dominion Trail are difficult in the Herndon and Falls Church areas, and suggested that some trails need to be wider to

accommodate the number of bicyclists and pedestrians using them. Access to reach the region's trails was identified as an opportunity for improvement.

## **2. New Bikeways**

Many citizens expressed a desire for continuous and high-quality bicycle routes along major highway corridors in Northern Virginia. Examples cited were I-66, Route 1, and Route 28. New trails were also requested along stream valleys and in active railroad rights-of-way, such as along active CSX rail corridors. Many citizens requested building shared-use paths, wide shoulders, or both during construction work on roadways such as the Tri-County Parkway, Loudoun County Parkway, and Belmont Ridge Road.

## **3. Access to Major Employment Centers**

Public input suggested that bicycle commuters should have better access to major employment destinations in the region. Specific locations that were mentioned include: Tyson's Corner, George Mason University, Reston, Springfield, Fairfax City, Leesburg, Ashburn, downtown Washington, the Route 1 Corridor, and government complexes such as the Pentagon and the Central Intelligence Agency.

## **4. Gaps in the Existing Bikeway Network**

Many citizens commented on gaps between existing bicycle facilities. For example, citizens recommended providing a connection between the Washington and Old Dominion Trail and the Four Mile Run Trail underneath I-395 and completing missing sections of the Fairfax County Parkway Trail to facilitate regional bicycle travel.

## **5. Bicycle Access to Transit**

Bicycle access to transit is a high priority for citizens. Some connections already exist, but bike routes should connect to all Metro stations, transit centers, and park and ride lots. Further, citizens stressed the importance of providing good bicycle parking facilities at transit stops.

## **6. Cross-connections between Major Regional Routes**

Citizens asked for additional connections between major routes. A few of the routes that residents mentioned were Duke Street in the vicinity of Telegraph Road in Alexandria, connecting the Holmes Run Trail to the Mount Vernon Trail; Prosperity Boulevard in Fairfax County, connecting the Little River Turnpike to Arlington Boulevard; and Stringfellow Road in Fairfax County, connecting VA 28 to the Fairfax County Parkway Trail.

## **7. Bridges**

Bicycle facilities on bridges and connecting to bridges were mentioned consistently. In some cases bicycle facilities on bridges do not exist at all and in other cases, they are narrow, poorly maintained or difficult to access. Many citizens requested new facilities on the bridges over the Capital Beltway and on the bridges from Fairfax County into Prince William County over Bull Run and the Occoquan River. Other suggestions were to improve access to the bridges into downtown Washington, especially Chain Bridge and Roosevelt Bridge.

## **8. Barriers**

Roadway barriers were cited many times as problems in public comments. Barriers include I-395 at Four Mile Run, Route 50 in Chantilly, the Capital Beltway throughout Fairfax County, the Dulles Toll Road, and the Fairfax County Parkway, among others.

## **9. Signage**

The need for improved informational signage was also cited frequently in public comments. Several citizens recommended developing an informational signage system along the Fairfax County Parkway Trail. Others suggested providing signs on Old Courthouse Road to show bicyclists how to connect to the Washington and Old Dominion Trail.

## **10. Maintenance**

Residents suggested making lighting improvements to all bicycle facilities, as well as regular maintenance such as sweeping, removing snow, and repairing existing trails as needed. Tree roots that are buckling the pavement were cited as a problem on several trails.

## **Local Jurisdiction Input**

A working group with representatives from each county and all municipalities in Northern Virginia was set up at the beginning of the project. This group met together and separately throughout the planning process to:

- provide existing plans and GIS data from their jurisdiction
- act as liaisons between the study team and elected officials, other government employees, and local citizens in their jurisdiction
- help VDOT answer questions from citizens that were specific to their jurisdiction
- help select the routes in their jurisdiction to be studied in the technical analysis phase
- review draft maps of bicycle facilities for accuracy

- identify locations for demonstration project studies and provided needed background information
- approve the inclusion of regional bikeway network routes in plan

Input from the working group was a fundamental aspect in the development of the recommendations herein.

## CHAPTER 3: EXISTING CONDITIONS

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This chapter describes current bicycle conditions in Northern Virginia, including descriptions of existing bikeways (both on and off-road), as well as challenges to bicycling in the region.

### Existing Bikeways

There are a number of existing bikeways in Northern Virginia that are heavily used by the region's residents and visitors. (See enclosed regional bikeway network map for locations.) The Washington and Old Dominion and Mount Vernon Trails are often cited for their high use for both transportation and recreation. Other major, heavily used trails in Northern Virginia include the Custis Trail, Four Mile Run Trail, Fairfax County Parkway Trail, and Prince William Parkway Trail, among others.

Key connections are also made with on-road bike facilities, including bike lanes on Commonwealth Avenue in Alexandria and Eads Street in Arlington. Critical bicycle connections in the region are provided by grade-separated crossings of major highways, including several bridges over Interstates 66, 395, 495 and Route 50.

The enclosed map shows the locations of existing and planned bikeways in Northern Virginia. Planned facilities that are shown on this map are limited to facilities that have been funded, either by VDOT or local jurisdictions. Only those existing and proposed bikeways that are suitable for bicycle transportation trips are shown – the map does not show locations of mountain bike trails, sidewalks or other narrow paths. This map provides a “snapshot” of the amount of activity that is already underway in each jurisdiction and the need to coordinate these activities with the goal of regional connectivity. A tally of a number of regionally significant bikeways that already exist or are fully funded in Northern Virginia includes:

- 189 miles of bike lanes, shared-use paths and trails that extend alongside roadways
- 69 miles of bicycle facilities have been planned and are funded.

In addition to bikeways that are considered regionally significant (i.e. connect across longer distances), there are also numerous local routes (i.e. shorter segments of paths, bike lanes, and shoulders). These facilities are also critical components of the bikeway system serving this region, because they provide direct access to individual neighborhoods and local destinations.

## Challenges to Bicycling in the Region

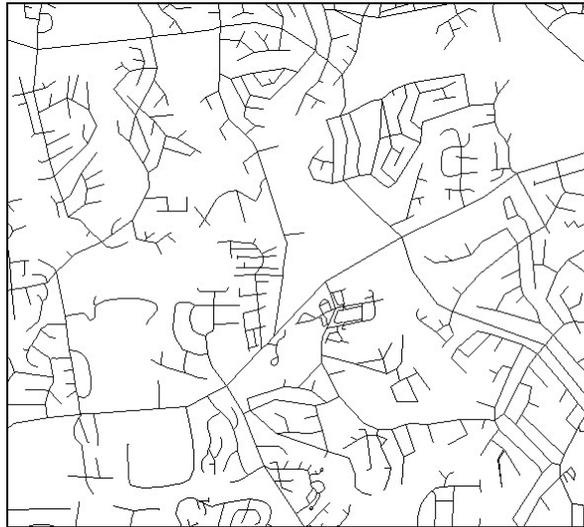
Although significant pieces of a regional bikeway system exist in Northern Virginia, there are still many routes where bicycling is inconvenient and may pose difficulties for bicyclists. The region has few bike lanes and paved shoulders outside Arlington and Alexandria, and it is difficult for many people to bicycle to major activity clusters in the region, such as Tysons Corner, Springfield, the Route 7 Technology Corridor, Manassas, Leesburg, and Woodbridge. Because many routes are heavily congested with high-speed traffic, people who would like to bicycle are often reluctant to try without the provision of bicycle facilities.

In many cases, the most direct routes between major activity clusters are the region's primary highways, such as Route 7, Route 123, Route 620, Route 1, Route 29, and Route 50. These highways have been built to accommodate large volumes of motor vehicles at high speeds, often with little or no shoulder space, creating a poor environment for bicycling. While segments of shared-use paths do exist along some of these major facilities, they do not connect to provide a continuous facility. Many gaps between segments exist and they lack signs that alert users to changes or alternatives. Outside the older sections of Arlington and Alexandria, there are few or no parallel streets that offer alternatives to these main roads (see Figures 1 and 2 below).

### Figures 1 and 2. Street Pattern Examples



**Old Town Alexandria** – street network offers many choices of alternative bicycle routes



**Dale City** – street network offers few or no alternative bicycle routes

## *Physical Barriers*

In addition to poor bicycling conditions on through routes, there are other barriers to regional bicycle travel, including major highways, rivers, rail lines and property sites that can force cyclists to travel miles out of their way to cross. Bicyclists are prohibited by state law from riding on the majority of limited access freeways and all interstates that cross through Northern Virginia. The region's expressways and multi-lane thoroughfares divide neighborhoods and separate residences from office and shopping destinations. In locations where pedestrian and bicycle bridges are not provided, the most direct bicycling route across an interstate highway is often through an interchange, which involves crossing high-speed traffic at entrance/exit ramps and riding along a heavily traveled roadway, often with little separation from vehicles. Examples of highway barriers that were identified in the public comment period include:

- I-395 at Four Mile Run
- Route 50 in Chantilly
- I-495/Capital Beltway throughout Fairfax County
- Dulles Toll Road
- Fairfax County Parkway
- I-95 in Prince William County
- I-66

In order to fully accommodate bicycling across these major thoroughfares, separate overpasses and underpasses can be constructed or interchanges can be redesigned to allow for bicycle and pedestrian access.

Major intersections also create barriers. There are many locations in Northern Virginia where two four-lane or six-lane arterial roadways meet, creating long signal phases and wide crossings in all directions that often put bicyclists in conflict with turning vehicles. Examples include the intersection of Gallows Road and Lee Highway and the intersection of Prince William Parkway and Smoketown Road.

While this study focuses on bicycle access within Northern Virginia, connections across the rivers to Maryland and Washington, D.C. are vital to connecting Northern Virginians with key destinations. Along the 70 miles of riverfront along the Potomac River, there are ten crossings that provide access to and from Northern Virginia. Four of the five bridges into Washington, D.C. have wide sidewalks to accommodate bicyclists; however, they are difficult to reach. Bicyclists must first cross the interchanges and freeways of the George Washington Parkway/ Route 110 Corridor before getting to these bridges. The Beltway bridges, the old Woodrow Wilson Bridge and the American Legion

Bridge, do not have bicycle facilities, though the reconstruction of the Wilson Bridge, which is currently underway, will provide a separated facility for bicyclists and pedestrians. In Loudoun County, White's Ferry, while not a bridge, provides a connection for bicyclists between Northern Virginia and Montgomery County, MD. It is difficult to reach because of poor bicycling conditions on Route 15 north of Leesburg. (A section of this route is being improved between Balls Bluff Road and Whites Ferry Road.) The Potomac River bridges in Loudoun County have very narrow sidewalks and are not currently designed to accommodate bicyclists. Bull Run, the Occoquan River, and Four Mile Run are also barriers to regional bicycle travel at some locations.

### *Land Use Barriers*

Land use patterns are a significant deterrent to bicycle travel in Northern Virginia. Sprawling, low-density development has created longer travel distances between origins and destinations. Housing communities are isolated from services, workplaces, and schools. For many years, residential community design in Northern Virginia has been primarily oriented to automobile access, leaving people without a convenient and/or safe alternative mode of travel. Despite a new emphasis on smart growth, many of the developed areas in Northern Virginia will require a significant retrofit in order to accommodate and encourage bicycle transportation. This applies to nearly every aspect of development: from residential communities to Metro rail stations to office parks to neighborhood shopping centers and malls.

Low density, single-use development patterns are prevalent in southern and western Fairfax County and in parts of Loudoun and Prince William counties. In some areas, such as Tysons Corner, employment density is high, but there are few residences in the immediate area. The employment core is surrounded by multi-lane roadways with high traffic volumes that discourage bicycle commuting. In cases where there is a shopping area close to a residential development, bicycle access is often inconvenient and dangerous because there are high-speed, busy roadways and wide parking lots between the homes and the store entrances.

Bicycling is more convenient in established urban areas such as downtown Alexandria, Arlington, Fairfax, Falls Church, Leesburg, and Manassas. These areas have higher building density and a greater mix of offices, stores, parks, and residences. Some new developments, such as the transit-oriented developments around the Metrorail stations in Arlington and Alexandria, are an exception to the single-use, low-density pattern. They tend to have higher densities and a variety of land uses that facilitate shorter trips that can often be made by bicycle.

### *Connections to Transit*

Bicycle mobility is an important element of the multi-modal transportation system in Northern Virginia. In August 2002, the Metrobus system began installing bicycle racks on its buses, increasing the mobility of transit users. However, there are many transit stations that are not adequately served by bicycle facilities. Virginia Railway Express rail stations and Metrorail stations in southern Fairfax County are not easily accessed by bicycle from nearby neighborhoods and destinations, and most park and ride lots and bus stops do not have bicycle parking facilities. Further, there are few signs that show bicyclists how to get from trails and roadways to nearby transit stations.

### *Maintenance Issues*

Some of the maintenance problems mentioned by the public included crumbling pavement and potholes, pavement buckled by tree roots, overgrown shrubbery, and low-hanging branches. Other maintenance problems include slippery surfaces due to snow and ice, especially on trails that are shaded in the winter, and the presence of roadway debris on shoulders and bicycle lanes. With the exception of Arlington County that maintains its own secondary roads, VDOT maintains primary and secondary roads in the counties. Local jurisdictions maintain primary and secondary roads in the cities and towns with some exceptions for cities and towns with small populations.

In conclusion, the Northern Virginia region has a mix of opportunities and challenges to bicycle transportation. Future advances in bicycle mobility will depend on the region's ability to overcome considerable barriers, as well as to capitalize on the growing number of residents who have begun to use the regional trail network to get to their workplace and other destinations. Chapter 5 presents a detailed set of recommendations to achieve these goals.

## CHAPTER 4: FUTURE BIKEWAY NETWORK

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The enclosed regional bikeway network map is the underlying framework for the recommendations of this study and is discussed in the following chapter. This map identifies the regional network of on-road bike lanes and off-road trails that will connect activity clusters in Northern Virginia. The development of the regional bikeway network involved a mix of inputs from many different plans and stakeholders. This section provides an overview of the process that was undertaken to develop the regional bikeway network map and associated recommendations.

Routes have been included in the regional bikeway network based on:

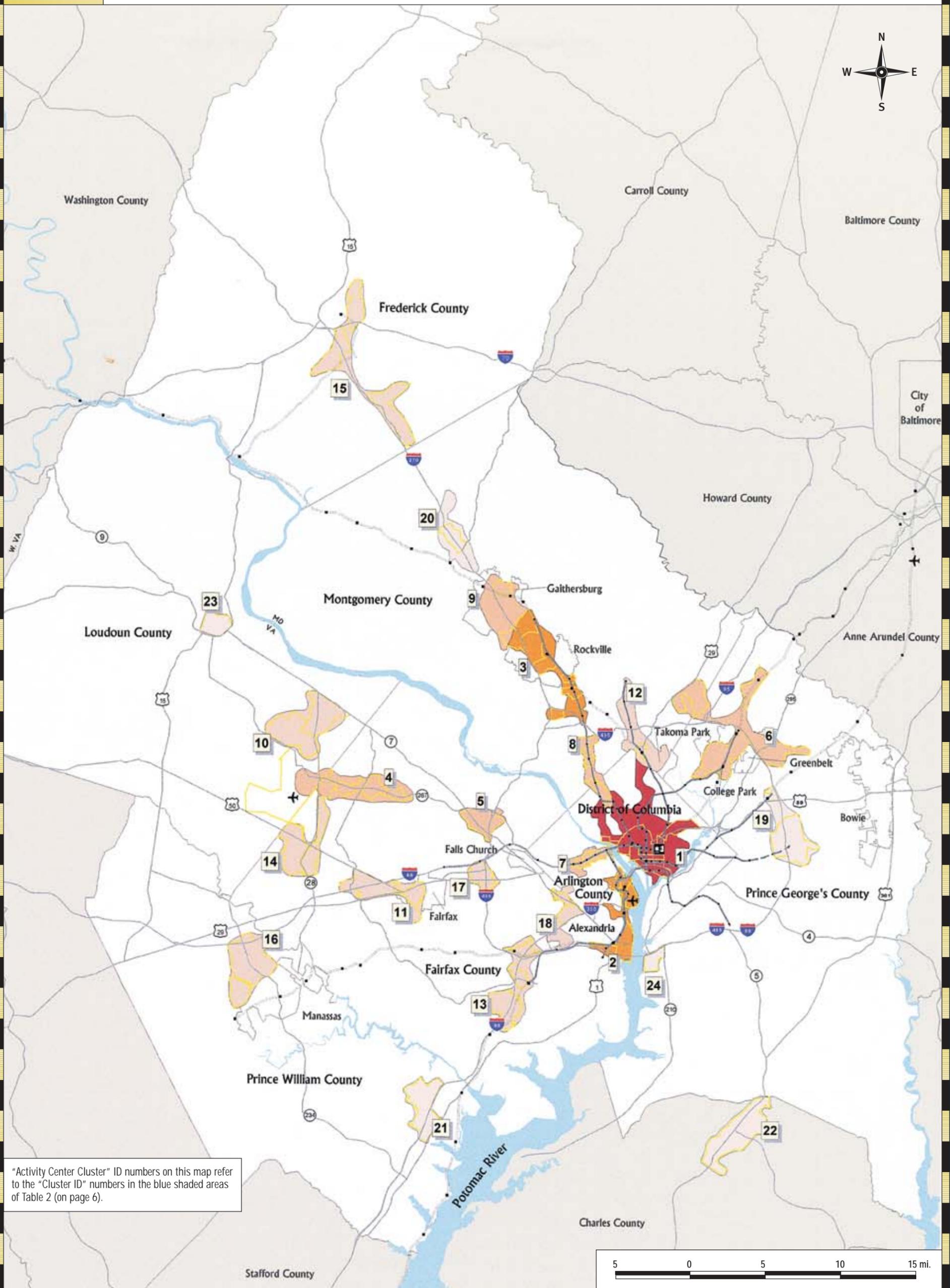
- connections to activity clusters, as established by the Metropolitan Washington Council of Governments (MWCOG) in 2002
- bike/trail/greenway plans developed by local jurisdictions (see list below)
- input from local jurisdiction and VDOT staff
- field work
- public comments
- latent demand analysis (see description below)

The proposed regional network includes a total of 828 miles of existing and proposed bikeways throughout Northern Virginia. Of this total mileage, 258 miles are either already existing or have been funded for construction. The existing and proposed network only includes facilities suitable for regional bicycle transportation trips (sidewalks, narrow bikeways, hiking trails and mountain bike trails are not included).

### **Activity Clusters**

In 2002, the Metropolitan Washington Council of Governments (MWCOG) and the National Capital Region Transportation Planning Board (TPB) unveiled an important planning and policy tool that had been under development for several years, the identification of the Metropolitan Washington Regional Activity Centers. These centers, called clusters when grouped together, refer to important regional concentrations of employment and households. The regional bikeway network seeks to improve connections within and between these clusters in Northern Virginia. A map of activity clusters is provided below.

# Regional Activity Centers and Clusters



"Activity Center Cluster" ID numbers on this map refer to the "Cluster ID" numbers in the blue shaded areas of Table 2 (on page 6).



LEGEND

ACTIVITY CLUSTERS (Employment 2025)

- 15,000 - 49,000
- 50,000 - 99,999
- 100,000 - 149,999
- 150,000 - 199,999
- 200,000 - 700,000
- Activity Center Boundaries

- Metro Stations
- ▲ Metro Stations (under construction)
- Commuter Rail Stations

- Union Station
- Airports
- Major Roads

- Metro Rail Lines
- Metro Rail Lines (under construction)
- Commuter Rail Lines



## **Bike/Trail/Greenway Plans**

The Regional Bikeway and Trail Network identified in this study utilizes a number of existing bikeways as well as those with full funding for construction. Adopted bike plans from local jurisdictions were used initially to establish the study network, and ultimately to help determine the development of the regional network map. Other data, such as informal bike route maps, proposed connections, and priority routes identified through public comments were also considered. Local plans and other sources of data used in this study include:

### *Regional Sources*

- Virginia Department of Transportation – *Northern Virginia 2020 Transportation Plan*, 1999
- Metropolitan Washington Council of Governments – geographic information system data, compiled 2001
- Alexandria Drafting Company – *Washington DC Regional Bike Map*, 1998
- public information meeting (July 31, 2001) – maps marked and comments collected from break-out groups
- project website – public comments received through the comment area on the website
- field data collection, summer 2001-2002

### Arlington/ Alexandria

- Arlington County – *Bicycle Transportation Plan*, 1994; *Arlington County Bikeways Map*, 2001
- City of Alexandria – *Alexandria Bicycle Transportation and Multi-use Trail Master Plan*, 1998; *Alexandria Recreation Facilities and Trails Map*, 2000
- *Extending the Mount Vernon Trail from Key Bridge to The American Legion Bridge (I-495): Options and Recommendations* (Washington Area Bicyclist Association and Virginia Bicycling Federation)

### Fairfax County/Falls Church

- Fairfax County – *Proposed Countywide Trails Plan Amendment Map*, 2001
- Town of Herndon – *Master Trails Plan*, 1992
- Northern Virginia Regional Commission – geographic information system data
- City of Fairfax – trails map
- City of Falls Church – *Transportation Network Plan*

### Loudoun County

- Loudoun County – *Bicycle and Pedestrian Transportation Master Plan*, 2003
- Loudoun County – *Comprehensive Transportation Plan*, 2001
- Town of Leesburg – *Pedestrian/Bicycle Trail Map*, 1993

### Prince William County

- Prince William County – *Prince William County Comprehensive Plan, 1998;*  
*Prince William County Trails and Greenways Master Plan, 1993*
- City of Manassas – *2001 Bike Trail Master Plan*
- City of Manassas Park – *Bike Route Map*

### **Input from Local Jurisdictions and VDOT Staff**

In addition to using the plans listed above from local jurisdictions, input from the working group established at the beginning of the study process was also critical to establishing the regional bikeway network. The working group was composed of representatives from each county and all municipalities in Northern Virginia as well as representatives from VDOT. This group helped select the routes in their jurisdiction to be studied in the technical analysis phase, identified locations for demonstration project studies, and approved the final recommended regional bikeway network routes. Input from the working group was a fundamental aspect in the development of the recommendations of this study.

### **Public Comments**

The public comments gathered at the public informational meetings, through the interactive website, and through community representatives who participated in the working group also played an important role in the determination of the regional bikeway network. A summary of these comments was provided in Chapter 2.

### **Latent Demand Analysis**

The routes in the Northern Virginia regional bikeway network were also selected based on their potential to serve bicycle trips. Land use patterns can help determine this potential. Routes that are more likely to be used when bicycle facilities are improved or added are those that are near high concentrations of population and close to destinations, such as offices, stores, parks, transit stops, and schools. This study used the Latent Demand Method to determine the relative potential of roadways to be used by bicyclists. A detailed description of the method is provided in Appendix B. This analysis was completed on over 1,650 miles (1,968 segments) of roadways and trails in Northern Virginia.

In conclusion, the recommended route network and study recommendations in Chapter 5 build upon previous regional and local planning activities (i.e. MWCOC's activity clusters and bicycle network plans done by local jurisdictions), as well as outreach and analysis that was conducted as a part of this current planning effort.

## CHAPTER 5: STUDY RECOMMENDATIONS

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This chapter presents the recommendations of the Northern Virginia Regional Bikeway and Trail Network Study. The recommendations are designed to achieve the vision of an interconnected network of bikeways that provide a comfortable, convenient, and safe transportation option.

While this study focuses on the physical network, there are a number of other important issues including enforcement, encouragement/promotion, education and awareness that should also be part of a comprehensive bicycle program. These are covered in detail in the *Virginia Bicycle Facility Resource Guide, 2001* and other sources and were not included in the scope of this study. This should not diminish their importance in the overall effort to promote bicycle travel.

The recommendations of this study represent a coordinated program, each part of which contributes to the success of the others. The local jurisdictions and VDOT will need to work together in order to ensure the implementation of these recommendations. The thirteen recommendations are divided into two categories bikeway network recommendations and policy/planning recommendations. Recommendations are not presented in any priority order.

- As discussed in Chapter 1, these recommendations support federal and state transportation policy goals.

### **A. Bikeway Network Recommendations**

The recommended actions described below are needed in order to develop and support a regional network of bikeways in Northern Virginia. There are a total of eight recommendations in this category.

#### **❖ Establish regional network of on-road bike lanes, paved shoulders and shared use paths within and between activity clusters in Northern Virginia.**

It will be important to avoid the piecemeal effect that could occur as bicycle accommodations are incorporated into short stretches of roadway under reconstruction. This study provides a framework for creating a more coordinated system. It recommends a network of regional bikeways that extends between and through all of the Metropolitan Washington Council of Government (MWCOC)'s activity clusters in Northern Virginia, as well as connecting to activity clusters in Maryland and the District of Columbia. The

recommended regional bikeway network was strongly supported by public comments received during the study, which stressed the importance of providing bicycle facilities to major employment centers such as Tyson's Corner, George Mason University, Reston, Springfield, Fairfax City, Leesburg, Ashburn, Arlington, downtown Washington, the Route 1 Corridor, and government complexes such as the Pentagon.

The enclosed future regional bikeway network map shows the specific locations of recommended bikeways that are included in this section of the report. The map also provides the following information:

- locations of existing on-road bike lanes and off-road shared use paths, as well as fully funded facilities in each of these categories
- locations of proposed bikeways recommended for the regional network based on the local jurisdictions' plans and input during the study process
- other notable local bicycle facilities that exist today

### *Facility Selection*

The particular type of facility –i.e. bike lane vs. parallel shared use path has not yet been determined for each route in the proposed regional network. This type of determination should be made by the local jurisdictions according to their respective adopted plans and coordination with VDOT during the project development phase. The demonstration projects in Appendix A provide examples of the type of analysis that can be done in order to determine what type of facility is feasible/appropriate given existing condition.

While this study has not determined the precise type of facility for the proposed routes, it will be essential that the regional bikeway network include both on-road bicycle facilities (such as bike lanes and paved shoulders) as well as shared-use paths in dedicated corridors and along roads. In many corridors on-road bikeways will be a more practical and cost effective accommodation, particularly where the right of way is constrained and there is little room for a pathway.

On-road bike facilities are specifically distinguished from off-road facilities by the AASHTO *Guide for the Development of Bicycle Facilities* (1999), which states that *“shared use paths should not be considered a substitute for street improvements even when the path is located adjacent to the highway, because many bicyclists will find it less convenient to ride on these paths compared with the street, particularly for utility trips.”*<sup>9</sup> Therefore, a regional bikeway network should include both on-road and off-road facilities.

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<sup>9</sup> AASHTO *Guide for the Development of Bicycle Facilities* (1999), p. 35

### ***New Construction vs. Retrofit***

In partnership with local jurisdictions, VDOT has capitalized on past opportunities to improve bicycle access during the course of major road construction and reconstruction projects. Examples include the Prince William County Parkway Trail and the Fairfax County Parkway Trail. From the outset, these four-lane highways were designed to accommodate a trail within their right of way.

A big issue for the future will be the need to retrofit roadway corridors that are already severely constrained within their right of way. In these locations, previous road widening projects have left little room for bicycle facilities, yet there is no question that these routes serve as critical connections to regional activity clusters, such as Tyson's Corner, Rosslyn, Manassas, and the office corridors near Dulles Airport in western Fairfax and eastern Loudoun Counties.

Prior to a December 2002 policy change that allows for independent bicycle facility projects, VDOT participated in the planning and implementation of several bicycle facilities but only when these facilities were part of a broader road improvement project. The new policy states, "*the Department's participation in bicycle facilities is oriented toward facilities that may be constructed either as part of a highway construction project or an independent transportation project.*" (Section 1b) While VDOT should continue to take advantage of the efficiencies of improving bicycle access during roadway improvement projects, retrofit projects should be among the top priorities for stand-alone projects under the VDOT's new policy.

In many cases, retrofit solutions will be a compromise, rather than an ideal bicycle accommodation. In some cases, accommodating safer bicycle travel will require a balance between competing interests. Compromise will be essential in order to achieve a balanced transportation system that accommodates alternative modes of travel.

### ***Demonstration Projects***

In order to provide more detailed recommendations for several key regional connections that are shown on the regional bikeway network map, demonstration project studies were completed in fourteen locations throughout Northern Virginia using federally accepted design approaches described in such documents as the AASHTO *Guide for the Development of Bicycle Facilities* (1999). Local jurisdictions were asked to submit a list of potential demonstration project study locations, and provided input on the recommendations in each report. These demonstration project studies serve several purposes:

- The demonstration projects provide innovative design recommendations that, in some cases, can be implemented in a short timeframe in order to immediately improve bicycling conditions.
- Several of the demonstration projects provide examples of solutions that are feasible, and also relatively low cost.
- The projects demonstrate retrofit solutions and offer an opportunity to review policy issues that will be inherent in these types of projects.
- The demonstration projects include on-road bike lanes, paved shoulders and off-road shared-use paths, providing an opportunity for VDOT and local jurisdictions to test a variety of different design treatments that are recommended in the AASHTO design guide.

The location of the demonstration projects is listed below and the full studies are provided in Appendix A.

#### **Arlington/Alexandria**

- Route 27 (East Cemetery Wall Connection-Joyce Street to Route 110)
- Route 50 / Arlington Boulevard (Park Drive to Glebe Road)
- VA 120 / North Glebe Road (Old Dominion Drive to Old Glebe Road)
- Route 7 / King Street (Janneys Lane to Commonwealth Avenue)
- Route 420 / Seminary Road/Janneys Lane, Route 7 / King Street, and Braddock Road (I-395 to King Street Metro and Braddock Road Metro)

#### **Fairfax County**

- Route 617 / Amherst Road / Backlick Road (one-way pair) (Highland Street to Old Keene Mill Road)
- Route 50 / Arlington Boulevard (Fairfax City Limit to Arlington County Limit)
- Route 620 / Braddock Road (Route 651 / Guinea Road to Route 613 / Lincolnia Road)
- University Drive/Old Lee Highway in Fairfax City (George Mason University to the Vienna Metro Station)
- Route 7 / Broad Street in Falls Church (Route 703 / Haycock Road to Washington and Old Dominion Trail)
- South West Street in Falls Church (Route 29 / Washington Street to Route 7 / Broad Street)
- Interstate Bicycle Route One (Fort Belvoir area)
- Gallows Road (Tysons Corner to Dunn Loring Metro)

## Prince William County

- Route 28 / Centreville Road (Liberia Avenue to Fairfax County Line)

### ❖ Eliminate critical gaps in the existing bikeway network.

Over the past 20 years, a number of long distance trails have been developed that pass through the heart of Northern Virginia activity clusters. The success of these trail facilities as transportation routes can be further enhanced by providing connections between short gaps between trails or gaps between trails and nearby destinations. Such relatively small public investments can have large benefits for bicycling in Northern Virginia and therefore should be among the highest priority improvements.

### ❖ Upgrade regionally-significant trails to industry standards.

A number of trails in Northern Virginia do not meet national guidelines and recommendations for bikeway design as set forward by the AASHTO *Guide for the Development of Bicycle Facilities* (1999), mainly due to substandard width. While most of the responsibility for major commuter trails in Northern Virginia is outside of the jurisdiction of VDOT, Northern Virginia jurisdictions should undertake a program to widen and otherwise improve these trails.

AASHTO states that, *“Under most conditions, a recommended paved width for a two-directional shared use path is 3.0 m (10 feet). In rare instances, a reduced width of 2.4 m (8 feet) can be adequate.”*<sup>10</sup> *Under certain conditions it may be necessary or desirable to increase the width of a share use path to 3.6 m (12 feet), or even 4.2 m (14 feet) due to substantial use by bicycles, joggers, skaters and pedestrians, use by large maintenance vehicles, and/or steep grades.”*<sup>11</sup> Paths of inadequate width could potentially create uncomfortable and unsafe conditions, particularly on trails that are heavily used by bicyclists, pedestrians, joggers, rollerbladers, and other users.

Sharp turns and blind curves on existing trails in Northern Virginia cause safety problems for bicyclists. In addition to addressing substandard widths, future upgrades to existing trails should also be designed to meet AASHTO guidelines for horizontal curves.

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<sup>10</sup> “ This reduced width should be used only where the following conditions prevail: (1) bicycle traffic is expected to be low, even on peak days or during peak hours, (2) pedestrian use of the facility is not expected to be more than occasional, (3) there will be good horizontal and vertical alignment providing safe and frequent passing opportunities, and (4) during normal maintenance activities the path will not be subjected to maintenance vehicle loading conditions that would cause pavement edge damage. AASHTO *Guide for the Development of Bicycle Facilities* (1999), p.36

<sup>11</sup> Ibid.

Lighting for night-time use is another issue that is important to bike commuters, particularly considering the growing number of people in Northern Virginia who commute during alternative hours to avoid rush hour traffic. Night lighting can help to make the trail system more functional for all users, including those that use trails during the winter months when the morning and evening commutes are often made in the dark. Local park authorities and trail managers should be encouraged to provide lighting for off-road paths for safety and security reasons.

Specific recommendations for upgrades to existing trails in Northern Virginia include:

- W&OD Trail: Widen narrow sections of the W&OD Trail to 10-foot wide minimum, 12-foot wide in areas with heavier volumes. The trail is currently less than eight feet wide in several sections, such as near Dry Mill Road. In addition, intersection safety improvements are needed at Sterling Boulevard, Church Street in Sterling, Hunter Mill Road, West Street in Falls Church, and Route 29 in Arlington.
- Mt. Vernon Trail: Widen narrow sections of the Mt. Vernon Trail to 10-foot wide minimum, 12-foot wide in areas with heavier volumes. Improve the trail alignment along the Roosevelt Island parking lot; widen pinch points, such as the sidewalk over the inlet to the Boundary Channel. Provide connections from the trail to the Washington D.C. bridges, especially the connection across the George Washington Parkway to Arlington Memorial Bridge.
- Accotink Trail: Widen narrow sections of the Accotink Trail to 10-foot wide minimum. The trail is 6' six feet to eight feet wide near King Arthur Road.
- Trails along arterials: Widen narrow (defined as less than eight feet wide) shared-use paths along arterials such as Wiehle Avenue, Telegraph Road, and Lee Highway (Route 29), and others.

**❖ Establish a system of high quality commuter routes that connect outlying areas directly to core urban areas.**

As described earlier, bicycle commuting in Northern Virginia has increased in recent years due to the availability of several high quality trails – primarily the Custis Trail in Arlington, the W&OD Trail, and the Mount Vernon Trail. A large part of the reason for the success of these trails is that they offer high quality, direct, and safe connections for bicycle users.

It is clear that Northern Virginia commuters are interested in alternatives to traffic congestion; however in order for more commuters to choose bicycling as an alternative, it is critical that better bicycling accommodations be provided. More on-road bike lanes and shoulders are needed throughout the region to help bicyclists reach their ultimate destination in a more efficient manner. This is particularly important for regional long distance commutes.

For these reasons, it is recommended that VDOT and local jurisdictions initially focus attention and funding on a number of key routes in the regional bikeway network that should be carefully designed with longer distance commuter bike trips in mind. These bikeways should be designed to provide high quality, direct, and safe connections for bicycle users – in effect, serving as trunk routes for bicycle travel. As such, improvements along these corridors should provide a coherent and clear path of travel for bicyclists, with as little interference from motor vehicle traffic as possible. Two trunk routes are already in place: the W&OD Trail/Custis Trail connection and the Mt. Vernon Trail from the south. The other two bicycle trunk routes that need to be developed are Route 50 (Arlington Boulevard) and Braddock Road. These routes are shown as proposed routes on the regional bikeway network map.

A distinctive and clear signage program (see the following recommendation) will be especially important to guide bicyclists along these corridors and direct them to other key bikeway connections.

**❖ Establish a route signage system that is easily and quickly understood by bicyclists.**

A signage system should be developed to identify the Northern Virginia Regional Bikeway and Trail Network. This will be particularly important for the trunk routes detailed above. Standard green bike route signs are used currently to designate facilities for bicycling. These signs should be enhanced to show the bikeway route number or name. Additional signage should also be installed to show a pictorial of the bikeway. It may be possible to design these additional signs like the Metrorail system signs, showing the trail end point, and all the destinations in the direction of that terminus. Other pertinent information such as park and ride lots and transit stations should be displayed in the background. Above all, bicyclists should be aware that they are riding on a route that is part of a continuous system of bikeways throughout Northern Virginia.

## ❖ **Improve the mass transit system to offer seamless connections for bicycle commuters.**

Bicycle access to transit is a high priority to citizens in Northern Virginia. Some recent advances in accommodating bicyclists in the region include: bike racks are being installed on all Metro and Arlington Transit buses, bicycles are allowed on Metrorail during off-peak hours, and bicycle lockers have recently been installed at several of the newly built VDOT park and ride lots (nearly 100 lockers). But in general, access to transit remains difficult for Northern Virginia commuters, and the following actions are recommended:

- add bike racks to all buses that serve Northern Virginia (CUE, DASH, Fairfax Connector, Loudoun Commuter Bus, Omniride, TAGS)
- provide high quality, secure bike parking at all Metrorail and VRE stations, and Park-and-Ride lots, per the recommendations in VDOT's NOVA District Bicycle Locker Program Assessment (2002)
- conduct a transit access study, focusing on improving connections for bicycles and pedestrians within a 1.5-mile radius of existing transit stations and large park-and-ride lots
- make bike and pedestrian access a major component in the design of all future transit stations and park-and-ride lots
- The recommended route network provides regional bike routes to all Metrorail stations and nearly all transit centers and park-and-ride lots. Connections to the Alexandria, Tyson's Corner, and Springfield Transit Centers and the Herndon/Monroe park-and-ride facilities were specifically cited in public comments.

## ❖ **Provide bicycle access across major barriers.**

There are currently many barriers to regional bicycle travel in Northern Virginia, including freeways and interchanges, rivers, and intersections of major arterial roadways (see description of these barriers under the existing conditions in Chapter 3). Gaining access across these barriers will, in many cases, carry significant costs, and should be based on a careful analysis of potential demand. A number of major highway and bridge crossings are heavily used by bicyclists, such as the W&OD Trail bridge over I-495, and the Key Bridge into Washington DC. This indicates that these types of crossings can be very successful at encouraging bicycle travel when they are located in optimum crossing locations that do not require bicyclists to make significant detours.

All new river bridges, highway bridges and interchanges should be designed from the outset to accommodate bicycle travel and prevent these facilities from creating barriers to bicyclists.

In the case of interchange design where it is necessary to cross free-flowing on and off-ramps, the suitability of at-grade crossings should be carefully weighed based on projected traffic volumes and speeds. In many cases, it will be necessary to cross ramps with grade-separated structures.

All new bridges should provide for bicycle access per the AASHTO *Guide for the Development of Bicycle Facilities* (1999). If special circumstances exist that effectively prevent the inclusion of bicycle accommodation in new bridges or highway interchanges, VDOT and the local jurisdictions should work together to identify clear alternative routes for bicyclists that minimize travel distances. VDOT and the locals should also continue to work together to provide alternative routes to overcoming existing barriers.

**❖ Coordinate maintenance activities for bikeways to ensure a high quality, safe experience for every customer.**

Bikeway maintenance is an issue that was regularly cited as a problem by citizens who submitted comments for this study. Proper maintenance of facilities is critical to the mobility of bicyclists. Due to fact that most bicycles lack suspension and have narrow wheels, they are particularly sensitive to irregularities in pavement condition caused by tree roots, weathering, snow, ice, and other surface debris. Overhanging tree branches and overgrown shrubbery also create hazards for bicyclists. In addition to improving bicycling conditions, proper maintenance and management of bikeways will also serve to reduce state and local governments' exposure to liability claims.

Currently, maintenance of bicycle facilities in Northern Virginia is shared by VDOT, local jurisdictions, federal and regional agencies. On-road bike lanes and shoulders are included as a part of regular roadway maintenance programs. Several major regional trails are maintained by federal and regional agencies: the Mount Vernon Trail is maintained by the National Park Service, and the W&OD Trail is maintained by the Northern Virginia Regional Park Authority. In general, shared-use paths that are entirely in the VDOT right-of-way are maintained by VDOT; otherwise they are the responsibility of the local jurisdiction. In some cases when the sidepath meanders in and out of the VDOT right-of-way (e.g. the Fairfax County Parkway Trail) there are agreements between the jurisdiction and VDOT to perform all maintenance.

Maintenance activities for shared-use paths include repaving (only when there are problems over a significant portion of a trail) and trimming branches. VDOT does not plow or use salt on trails in the winter, though Arlington County does this for several of their higher volume trails during winter months. Maintenance work is typically performed after problems are reported by citizens or are noted by field crews.

It is therefore recommended that VDOT and local jurisdictions coordinate both regular and remedial maintenance of bicycle facilities in the region. The program should be funded jointly by VDOT and local jurisdictions, with VDOT designating a team to proactively monitor and fix problems on the designated regional route network and local jurisdictions monitoring and maintaining on other bikeways.

This joint program would also include the following:

- Comprehensive list of all bikeways in NOVA and jurisdiction/agency responsible for maintenance. This can be included as a field in the regional GIS database that has been developed as part of this study.
- Advertisement and encouraged use of a central phone number/contact within VDOT for all remedial bikeway maintenance requests. The division formerly known as maintenance has for many years encouraged bicyclists to report problems through the highway helpline (1-800-367-ROAD or through VDOT's website at <http://www.virginiadot.org/comtravel/eoc/citizen.asp>). If the reported facility is not a VDOT facility, the request can be routed to the appropriate agency, based on the information provided in the database described above
- Training for local and state agency personnel regarding proper maintenance of on-road and off-road bicycle facilities.

Another option, in addition to this joint effort by VDOT and the local governments, is to establish an **Adopt-a-Trail program**. This program would be modeled after the Adopt-a-Highway program. It would include both in-kind contributions by adopters who would help with litter clean up and simple trail maintenance as well as monetary contributions that would help pay for repaving, plowing, and other maintenance duties performed by local jurisdictions and other agencies.

## B. Planning and Policy Recommendations

The actions described below are needed in order to incorporate bicycle access into standard policies and procedures of local and state government. There are a total of five recommendations in Category B.

### ❖ Encourage the use of context sensitive roadway design that facilitates bikeway development in all jurisdictions.

As explained in the recommendations above, *on-road* bike lanes and shoulders will be an essential part of Northern Virginia's regional bikeway network. Unfortunately, many road corridors are constrained in their rights-of-way. In some cases, widening these roads to include bike lanes would require land acquisition and relocation of expensive infrastructure such as utilities, sidewalks, and curbs.

Fortunately, on many VDOT roadways in the region, wide motor vehicle lanes will make it possible to provide bike lanes and shoulders without the need for additional pavement width. For some roadway types, the minimum lane widths in VDOT's Roadway Design Manual exceed those established by AASHTO's *Policy on the Geometric Design of Highways and Streets* (Greenbook). In fact, the 2001 edition of the Greenbook encourages design professionals to use minimum lane widths in locations where other roadway users are impacted. The guide states:

*"The intent of this policy is to provide guidance to the designer by referencing a recommended range of values for critical dimensions. It is not intended to be a detailed design manual that could supercede the need for the application of sound principles by the knowledgeable design professional. Sufficient flexibility is permitted to encourage independent designs tailored to particular situations. Minimum values are either given or implied by the lower value in a given range of values. The larger values within the ranges will normally be used where the social, economic and environmental (S.E.E.) impacts are not critical."* (emphasis added)<sup>12</sup>

Reducing lane widths can be one way of providing facilities in locations where bicycle accommodations are planned. For example, allowing 10-foot lane widths on urban roadways through developed areas with low truck volumes and low speeds would make it possible to provide for safer bicycle access in corridors with constrained rights-of-way. Several VDOT projects have already

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<sup>12</sup> AASHTO's *Policy on the Geometric Design of Highways and Streets* (2001), p. xli, fourth paragraph.

implemented narrower lane widths to improve safety, such as the 10-foot lanes recently provided on the newly resurfaced Route 9 in Loudoun County.

Bicycle accommodations are affected by other design features, such as intersection turn lane and curb radii design; signal timing and loop detector design; interchange design; and design speeds. These features should be planned with bicycle accommodation in mind.

VDOT faces continuous demands to focus on maintaining high levels of capacity throughout the roadway system and to address growing levels of traffic congestion. It will also be important to consider alternative modes of travel throughout the region, in order to alleviate traffic congestion and improve air quality. Reasonable compromises should be sought to accommodate bicycles within the existing roadway network.

**❖ Undertake comprehensive changes to land use policies to encourage bicycle mobility and discourage development that is solely oriented to automobile access.**

In order for bicycling and walking to become comfortable and convenient transportation options, these modes must be fully integrated into everyday land use decisions in Northern Virginia; such as where new schools will be located, how residential communities will be designed, and where commercial and employment centers are located. Past practices of providing segregated, low density developments have resulted in trip distances that are better suited to the automobile than to bicycle travel. Nonetheless, nationally half of all trips made in urban areas are less than three miles, a distance that can be traveled in 15 minutes on a bike.<sup>13</sup>

Changing long-standing land development policies and practices is no small task. In addition to changes in land development codes and ordinances, policy changes will require more awareness of walking and bicycling issues on the part of planning and code enforcement staff, developers, roadway designers, comprehensive planners, and others. Site layout and design decisions for developments (both large and small) should encourage bicycle and pedestrian access by providing a direct connection “to the front door” via shared use paths, bike lanes, and paved shoulders.

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<sup>13</sup> National Household Travel Survey 2001.

Bicycle parking ordinances should be adopted to ensure not only that adequate amounts of parking are provided but that the parking is located and designed correctly. Parking garages should be designed to include bike parking areas that are within sight of parking garage attendees.

Land use planning and site plan review are primarily the responsibility of local jurisdictions in Northern Virginia, however, as much as possible, VDOT should assist and encourage more bicycle compatible development through land development and site plan review.

❖ **Augment regional planning efforts with local bikeway planning, design, transportation demand management programs and encouragement/ promotional projects.**

The establishment of a regional network of bikeways in Northern Virginia will clearly require a partnership among local jurisdictions and the state. Since the majority of programmed improvements outlined in VDOT's implementation programs (such as the VDOT Six Year Transportation Improvement Program) are in response to requests made by local jurisdictions, it will be necessary for local governments to continue to advance high priority regional bikeway projects, including upgrades to substandard shared-use paths, locations for new trails and on-road bikeways (such as the commuter corridors described in the earlier recommendations), and bicycle retrofit projects during roadway resurfacing.

In addition to facility construction projects, local jurisdictions are encouraged to develop transportation demand management programs to support and promote bicycle commuting, to increase public awareness of bicycling as a mode of transportation, and to provide educational opportunities for motorists and bicyclists. Examples of the types of programs that have been implemented in Northern Virginia, and in other communities in the U.S., include:

- transportation demand management programs to encourage employers to reduce motor vehicle trips to the workplace by offering incentives to employees who choose to bicycle or walk
- elementary and middle school bicycle safety education programs such as the new Maryland Pedestrian and Bicycle Safety Education Program.
- public awareness/outreach programs that promote bicycling to transit and other health and transportation benefits of bicycling
- Bike-to-Work events, such as those already held in the Washington area each year in May

More information on these and other types of programs can be found in the *Virginia Bicycle Facility Resource Guide* and at [www.bicyclinginfo.org](http://www.bicyclinginfo.org).

❖ **Identify sufficient funding sources to establish the regional bikeway network.**

It will be critically important to establish or identify funding sources to support the construction of the regional bikeway network. More detailed information on funding and implementation is provided in Chapter 6.

❖ **Establish mechanisms to enable on-going coordination and public involvement in regional bicycling issues.**

The planning process for the Northern Virginia Regional Bikeway and Trail Network Study has been particularly helpful in bringing together adjacent jurisdictions to discuss bikeway issues. Continued coordination will be needed in the future in order to effectively implement this regional network. The following actions are therefore recommended:

- Continue the working group established for this study to form a Northern Virginia Bicycle Advisory Committee. This committee should include several members of the general public, in addition to staff from local jurisdictions.
- Regularly update/amend the regional bikeway network and GIS database developing short-term priorities and reassessing priorities as needed. The short-term priority list should serve as a recommendation to the annual VDOT Six Year Transportation Improvement Program, regional bicycle plans, and local improvement plans.
- Conduct feasibility studies for critical cross-jurisdictional routes identified in this Study, as identified in the Demonstration Projects in Appendix A.

## **Conclusion**

The thirteen recommendations described above form the basis of a network of bikeway facilities that will improve bicycle access to major destinations throughout the region for Northern Virginia residents. While these recommendations focus on a regional network, additional local activities and connections will continue to be of utmost importance.

## CHAPTER 6: IMPLEMENTATION

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Implementation of the recommendations in this regional study will require the commitment of many people and effective partnerships among many organizations. The task of building a regional bikeway network in Northern Virginia will not fall on any one single agency or jurisdiction – rather it must be shared among a variety of state, regional, and local agencies. Citizens will play a strong role in the process as well, providing support for new projects and programs at the local and regional level.

### Implementation Schedule

The recommendations in Chapter 5 suggest a critical path to achieving a successful regional network of bikeways. Some activities will need to begin immediately in order to build on the cooperation and momentum that has been generated by this study. There are other activities that will naturally follow and will be determined, in a large part, by opportunities that emerge in the future. The schedule below concentrates, on the highest priority actions that are needed in the near term.

<b>HIGH PRIORITY ACTIONS</b>	
Category A: Network Construction	Partner Organizations
1. provide facilities to fill key gaps between existing parts of the regional bikeway network	state, local transportation and public works agencies, and citizens
2. implement the improvements recommended in the demonstration project studies (see Appendix A)	state, local transportation and public works agencies, citizens
3. construct parts of the regional bikeway system in conjunction with roadway improvements in the VDOT Six Year Transportation Improvement Program	state, Local Transportation and Public Works Agencies, citizens
4. upgrade existing trails to industry standards	state, local transportation and public works agencies, NVRPA, NPS, citizens
5. develop at least one new regional trunk route and promote the route to residents	state, local transportation and public works agencies, citizen advocates
6. coordinate maintenance activities and schedule for bicycle facilities	state, local transportation and public works agencies
7. design and adopt signage system design for regional routes and sign existing parts of the network, including improved signage to transit stations	state/local jurisdictions

8. provide bicycle accommodation on transit systems	Metro, VRE, Arlington Transit, DASH (Alexandria), Fairfax Connector, CUE (Fairfax City), Loudoun County Commuter Bus, RIBS (Reston), TAGS (Springfield), Tysons Shuttle
<b>Category B: Policy and Planning Activities</b>	<b>Partner Organizations</b>
9. establish a bicycle advisory group for regional bicycling issues and to oversee implementation of the recommendations of this study	state, MWCOG, local transportation and public works agencies, NPS, NVRPA, NVRC, citizens
10. include bikeway component within local comprehensive plans, advance high priority projects	local transportation and planning agencies
11. identify and secure funding for regional bikeways, bike parking, and other necessary expenditures	state, local transportation and public works agencies
12. initiate discussions on lane width standards	state
13. adopt new site, subdivision, and land use development guidelines	local planning agencies
14. monitor and report the number of miles of the regional bikeway system that are completed each year	state
15. offer context-sensitive design training to all design professionals in the region	state, MWCOG, local transportation, planning, and public works agencies

## **APPENDICES:**

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Appendix A: Demonstration Project Studies

Bicycle Level of Service Model Summary

Summary Table of Demonstration Project Study Locations

Demonstration Project Case Studies

Summary of Additional Routes Requested by Local Jurisdictions

Appendix B: Latent Demand Method

Appendix C: Summary of Public Comment on the Draft Study Report

## **APPENDIX A:**

### **DEMONSTRATION PROJECT STUDIES**

This section of the plan presents 14 preliminary demonstration project studies and 16 paragraph summaries recommending improvements to bicycle corridors throughout Northern Virginia. The 14 demonstration project study profiles are designed to be short term projects that can be implemented relatively easily and help illustrate different types of low cost solutions to improve bicycle conditions. Each bicycle corridor study includes the following sections:

Background – significance of the corridor to the regional transportation network and the land uses and other unique characteristics of the corridor

Existing Conditions – roadway characteristics, including measurements of the cross-section, significant intersections and interchanges, parking, traffic volumes and speeds

Recommended Improvements – explanation of how the recommended bike lanes, shared use path, shoulder, or other facility would change the roadway conditions and justification for the recommendation

Bicycle Level of Service (BLOS) – comparison of bicyclist comfort under current roadway conditions and future conditions (calculated by scientifically-calibrated model)

Implementation Issues/Opportunities – discussion of issues that will need to be addressed for the recommended improvement to be implemented, such as providing alternative parking and right-of-way acquisition

### **BICYCLE LEVEL OF SERVICE MODEL SUMMARY**

The following section provides a description of the bicycle level of service model. This model was used to determine the existing and future levels of bicycling comfort for on-road facilities in a number of the demonstration project corridors.

The *Bicycle Level of Service Model (Bicycle LOS Model)* is an evaluation of bicyclist perceived safety and comfort with respect to motor vehicle traffic while traveling in a roadway corridor. It identifies the quality of service for bicyclists or pedestrians that currently exists within the roadway environment.

The statistically calibrated mathematical equation entitled the *Bicycle LOS Model*<sup>14</sup> (*Version 2.0*) is used for the evaluation of bicycling conditions in shared roadway environments. It uses the same measurable traffic and roadway factors that transportation planners and engineers use for other travel modes. With statistical precision, the *Model* clearly reflects the effect on bicycling suitability or “compatibility” due to factors such as roadway width, bike lane widths and striping combinations, traffic volume, pavement surface condition, motor vehicle speed and type, and on-street parking.

The *Bicycle Level of Service Model* is based on the proven research documented in *Transportation Research Record 1578* published by the Transportation Research Board of the National Academy of Sciences. It was developed with a background of over 150,000 miles of evaluated urban, suburban, and rural roads and streets across North America. Many urban planning agencies and state highway departments are using this established method of evaluating their roadway networks. The model has been applied by the Maryland Department of Transportation (MDOT), the Virginia Department of Transportation (VDOT), the Delaware Department of Transportation (DelDOT), Florida Department of Transportation (FDOT), New York State Department of Transportation (NYDOT), Maryland Department of Transportation (MDOT) and many others. It has been applied in regions such as Anchorage AK, Baltimore MD, Birmingham AL, Buffalo NY, Gainesville FL, Houston TX, Lexington KY, Philadelphia PA, Sacramento CA, Springfield MA, Tampa FL, Richmond, VA, Northern Virginia, and Washington, DC.

Widespread application of the original form of the *Bicycle LOS Model* has provided several refinements. Application of the *Bicycle LOS Model* in the metropolitan area of Philadelphia resulted in the final definition of the three effective width cases for evaluating roadways with on-street parking. Application of the *Bicycle LOS Model* in the rural areas surrounding the greater Buffalo region resulted in refinements to the “low traffic volume roadway width adjustment”. A 1997 statistical enhancement to the *Model* (during statewide application in Delaware) resulted in better quantification of the effects of high speed truck traffic [see the  $SP_t(1+10.38HV)^2$  term]. As a result, *Version 2.0* has the highest correlation coefficient ( $R^2 = 0.77$ ) of any form of the *Bicycle LOS Model*.

*Version 2.0* of the *Bicycle Level of Service Model* (*Bicycle LOS Model*) has been employed to evaluate conditions in several of the demonstration project corridor studies for the Northern Virginia Regional Bikeway Network and Trail Study. Its form is shown below:

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<sup>14</sup>Landis, Bruce W. et.al. “Real-Time Human Perceptions: Toward a Bicycle Level of Service” *Transportation Research Record 1578*, Transportation Research Board, Washington, DC 1997.

$$\text{Bicycle LOS} = a_1 \ln(\text{Vol}_{15}/L_n) + a_2 \text{SP}_t(1+10.38\text{HV})^2 + a_3(1/\text{PR}_5)^2 + a_4(W_e)^2 + C$$

Where:

$\text{Vol}_{15}$  = Volume of directional traffic in 15 minute time period

$$\text{Vol}_{15} = (\text{ADT} \times D \times K_d) / (4 \times \text{PHF})$$

where:

ADT = Average Daily Traffic on the segment or link

D = Directional Factor (assumed = 0.565)

$K_d$  = Peak to Daily Factor (assumed = 0.1)

PHF = Peak Hour Factor (assumed = 1.0)

$L_n$  = Total number of directional *through* lanes

$\text{SP}_t$  = Effective speed limit

$$\text{SP}_t = 1.1199 \ln(\text{SP}_p - 20) + 0.8103$$

where:

$\text{SP}_p$  = Posted speed limit (a surrogate for average running speed)

HV = percentage of heavy vehicles (as defined in the 1994 Highway Capacity Manual)

$\text{PR}_5$  = FHWA's five point pavement surface condition rating

$W_e$  = Average effective width of outside through lane:

where:

$$W_e = W_v - (10 \text{ ft} \times \% \text{ OSPA}) \text{ and } W_1 = 0$$

$$W_e = W_v + W_1(1 - 2 \times \% \text{ OSPA}) \text{ and } W_1 > 0 \ \& \ W_{ps} = 0$$

$$W_e = W_v + W_1 - 2(10 \times \% \text{ OSPA}) \text{ and } W_1 > 0 \ \& \ W_{ps} > 0$$

and a bike lane exists

where:

$W_t$  = total width of outside lane (and shoulder) pavement

OSPA = percentage of segment with occupied on-street parking

$W_1$  = width of paving between the outside lane stripe and the edge of pavement

$W_{ps}$  = width of pavement striped for on-street parking

$W_v$  = Effective width as a function of traffic volume

and:

$$W_v = W_t \quad \text{if } \text{ADT} > 4,000 \text{veh/day}$$

$$W_v = W_t (2 - 0.00025 \times \text{ADT}) \quad \text{if } \text{ADT} \leq 4,000 \text{veh/day, and if the street/road is undivided and unstriped}$$

$$a_1: 0.507 \quad a_2: 0.199 \quad a_3: 7.066 \quad a_4: -0.005 \quad C: 0.760$$

( $a_1$  -  $a_4$ ) are coefficients established by the multi-variate regression analysis.

The Bicycle LOS score resulting from the final equation is pre-stratified into service categories “A, B, C, D, E, and F”, according to the ranges shown in Table 1, reflecting users’ perception of the road segments level of service for bicycle travel. This stratification is in accordance with the linear scale established during the referenced research (i.e., the research project bicycle participants’ aggregate response to roadway and traffic stimuli). The *Model* is particularly responsive to the factors that are statistically significant. An example of its sensitivity to various roadway and traffic conditions is shown on the following page.

### Bicycle Level-of-Service Categories

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LEVEL-OF-SERVICE	Bicycle LOS Score
A	$\leq 1.5$
B	$> 1.5$ and $\leq 2.5$
C	$> 2.5$ and $\leq 3.5$
D	$> 3.5$ and $\leq 4.5$
E	$> 4.5$ and $\leq 5.5$
F	$> 5.5$

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The Bicycle LOS Model is used by planners, engineers, and designers throughout the US and Canada in a variety of planning and design applications.

Applications of the Model include:

- 1) Conducting a benefits comparison among proposed bikeway/roadway cross-sections
- 2) Identifying roadway restriping or reconfiguration opportunities to improve bicycling conditions
- 3) Prioritizing and programming roadway corridors for bicycle improvements
- 4) Creating bicycle suitability maps
- 5) Documenting improvements in corridor or system-wide bicycling conditions over time

*Bicycle LOS Model Sensitivity Analysis*

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$$\text{Bicycle LOS} = a_1 \ln(\text{Vol}_{15}/\text{Ln}) + a_2 \text{SP}_t(1+10.38\text{HV})^2 + a_3(1/\text{PR}_5)^2 + a_4 (\text{W}_e)^2 + C$$

where: a1: 0.507 a2: 0.199 a3: 7.066 a4: -0.005 C: 0.760  
T-statistics: (5.689) (3.844) (4.902) (-9.844)

Baseline inputs:

ADT = 12,000 vpd % HV = 1 L = 2 lanes  
SP<sub>p</sub> = 40 MPH W<sub>e</sub> = 12 ft PR<sub>5</sub> = 4(good pavement)

	<u>BLOS</u>	<u>% Change</u>
Baseline BLOS Score (Bicycle LOS)	3.98	N/A

Lane Width and Lane striping changes

W <sub>t</sub> = 10 ft	4.20	6% increase
W <sub>t</sub> = 11 ft	4.09	3% increase
W <sub>t</sub> = 12 ft -- (baseline average) -----	3.98 -----	no change
W <sub>t</sub> = 13 ft	3.85	3% reduction
W <sub>t</sub> = 14 ft	3.72	7% reduction
W <sub>t</sub> = 15 ft (W <sub>l</sub> = 3 ft)	3.57 (3.08)	10% (23%) reduction
W <sub>t</sub> = 16 ft (W <sub>l</sub> = 4 ft)	3.42 (2.70)	14% (32%) reduction
W <sub>t</sub> = 17 ft (W <sub>l</sub> = 5 ft)	3.25 (2.28)	18% (43%) reduction

Traffic Volume (ADT) variations

ADT = 1,000 Very Low	2.75	31% decrease
ADT = 5,000 Low	3.54	11% decrease
ADT = 12,000 Average - (baseline average) -----	3.98 -----	no change
ADT = 15,000 High	4.09	3% increase
ADT = 25,000 Very High	4.35	9% increase

Pavement Surface conditions

PR <sub>5</sub> = 2 Poor	5.30	33% increase
PR <sub>5</sub> = 3 Fair	4.32	9% reduction
PR <sub>5</sub> = 4 -- Good - (baseline average) -----	3.98 -----	no change
PR <sub>5</sub> = 5 Very Good	3.82	4% reduction

Heavy Vehicles in percentages

HV = 0 No Volume	3.80	5% decrease
HV = 1 --- Very Low - (baseline average) -----	3.98 -----	no change
HV = 2 Low	4.18	5% increase
HV = 5 Moderate	4.88	23% increase <sub>a</sub>
HV = 10 High	6.42	61% increase <sub>a</sub>
HV = 15 Very High	8.39	111% increase <sub>a</sub>

<sup>a</sup>Outside the variable's range (see Reference (1))

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## *Data Collection and Inventory Guidelines*

The following list provides a definition for each of the data fields required for the computation of the Bicycle Level of Service scores and the associated guidelines for collecting the data inputs.

Number of lanes of traffic (L) - Record the total number of through traffic lanes of the road segment and its configuration. (e.g., D = Divided, U = Undivided, OW = One-Way, S = Center Turning Lane). The programmed spreadsheet will convert these lanes into directional lanes.

Average Daily Traffic (ADT) - It is the average daily traffic volume on the segment or link. The programmed database will convert these volumes to Vol<sub>15</sub> using the Directional Factor (D), Peak to Daily Factor (K<sub>d</sub>) and Peak Hour Factor (PHF) for the road segment.

Percent Heavy Vehicles (HV) - It is the percentage of heavy vehicles (as defined in the 1994 Highway Capacity Manual).

Posted Speed Limit (S<sub>p</sub>) - Use posted speed limit unless the 85<sup>th</sup> percentile running speed is significantly different than the posted speed limit.

Width of pavement for the outside lane (W<sub>t</sub>) - It is measured from the center of the road, yellow stripe, or (in the case of a multilane configuration) the lane separation striping to the edge of pavement or to the gutter pan of the curb. When there is angled parking adjacent to the outside lane, W<sub>t</sub> is measured to the traffic-side end of the parking stall stripes.

Width of paving between the outside lane stripe and the edge of pavement (W<sub>l</sub>) - It is measured from the outside lane stripe to the edge of pavement or to the gutter pan of the curb. When there is angled parking adjacent to the outside lane, W<sub>l</sub> is measured to the traffic-side end of the parking stall stripes.

Width of pavement striped for on-street parking (W<sub>ps</sub>) - This dimension is only recorded if there is parking to the right of a striped bike lane. If there is parking on two sides on a one-way, single lane street, the combined width of striped parking is reported.

Total Pavement Width (TPW) - This is measured from center of the road or yellow stripe to the edge of pavement or to the gutter pan of the curb.

This item is only recorded when the road has four or more through lanes and has no paved shoulder or bike lane.

OSPA % (On-Street Parking) - This is an estimate on the percentage of the segment (excluding driveways) along which there is occupied on-street parking at the time of survey. Each side is recorded separately. If the parking is allowed only during off-peak periods and parking restrictions change widths and laneage, the geometric changes are indicated in the comments field. Angled parking is reported in the comments field.

Pavement Condition of Travel Lane (PC<sub>t</sub>) - Pavement condition of the motor vehicle travel lane is evaluated according to FHWA's five-point pavement surface condition rating shown in the table below.

Pavement Condition of Shoulder or Bike lane (PC<sub>l</sub>) - Pavement condition of the shoulder or bike lane is evaluated according to the FHWA's five-point pavement surface condition rating shown in the table below.

***Pavement Condition Descriptions***

<b>RATING</b>	<b>PAVEMENT CONDITION</b>
5.0 (Very Good)	Only new or nearly new pavements are likely to be smooth enough and free of cracks and patches to qualify for this category.
4.0 (Good)	Pavement, although not as smooth as described above, gives a first class ride and exhibits signs of surface deterioration
3.0 (Fair)	Riding qualities are noticeably inferior to those above; may be barely tolerable for high-speed traffic. Defects may include rutting, map cracking, and extensive patching.
2.0 (Poor)	Pavements have deteriorated to such an extent that they affect the speed of free-flow traffic. Flexible pavement has distress over 50 percent or more of the surface. Rigid pavement distress includes joint spalling, patching, etc.
1.0 (Very Poor)	Pavements that are in an extremely deteriorated condition. Distress occurs over 75 percent or more of the surface.

Source: U.S. Department of Transportation. Highway Performance Monitoring System: Field Manual. Federal Highway Administration. Washington, DC, 1987

The output of the BLOS Model is a grade that reflects the level of comfort perceived by a bicyclist riding along the roadway segment. "A" represents the highest, and "F" represents the lowest level of service.

## Summary Table of Demonstration Project Study Locations

Roadway Corridor	Limits	Recommended Bicycle Facility
<b>Arlington/Alexandria</b>		
Route 27 (East Cemetery Wall Connection)	Joyce Street to Route 110	shared use path (East Cemetery Wall Trail) on northwest side
Route 50 (Arlington Boulevard)	Park Drive to Glebe Road	shared use paths on both sides using service roads
Route 120 (North Glebe Road)	Old Dominion Drive to Old Glebe Road	bicycle lanes
Route 7 (King Street)	Janneys Lane to Commonwealth Avenue	one-way bike lane and shared auto/bike lane
Route 420 (Seminary Road/Janneys Lane), Route 7 (King Street), and Braddock Road	I-395 to King Street Metro and Braddock Road Metro	determined that X with facility Y was the best bicycle route
<b>Fairfax County</b>		
Route 617 (Amherst Road/Backlick Road (one-way pair))	Highland Street to Old Keene Mill Road	bicycle lanes
Route 50 (Arlington Boulevard)	Fairfax City Limit to Arlington County Limit	shared use paths on both sides using service roads
Route 620 (Braddock Road)	Route 651 (Guinea Road) to Route 613 (Lincolnia Road)	shared use path
University Drive/Old Lee Highway in Fairfax City	George Mason University to the Vienna Metro Station	bike lanes and shared use path
Route 7 (Broad Street) in Falls Church	Route 703 (Haycock Road) to Washington and Old Dominion Trail	bike lanes
South West Street in Falls Church	Route 29 (Washington Street) to Route 7 (Broad Street)	striped parking lane
Route 650 (Gallows Road)	Dunn-Loring Metro to Tysons Corner	Bike lanes
Interstate Bike Route 1	Fort Belvoir Area	
<b>Prince William County</b>		
Route 28 (Centreville Road)	Liberia Avenue to Fairfax County Line	shared use path and shoulders

Sixteen additional corridors were identified as key regional connections, and they are summarized in paragraphs at the end this appendix.

# Northern Virginia Regional Bikeway & Trail Network Study

## East Cemetery Wall Trail Connection

### Arlington County

Segment Length = ½ Mile

#### Background

This segment is proposed to extend from the east end of Southgate Road along the west side of Washington Boulevard (Route 27) and tie into existing and planned trails on the east side of



Route 110 north of the Pentagon.

This project is an important regional connection for several reasons. Locating a route on the west side of Route 27 is necessary given the restrictions to access and loss of public access to the trail on the east side of the road (an increased security perimeter was established around the Pentagon Fall, 2001). An existing sidepath on the east side of Route 110 (which remains open to public use) connects with a number of parks and trails that parallel the George Washington Parkway along the Potomac River and provides access to Memorial Bridge and Washington, D.C. This trail connection is identified as a high priority in the Arlington Bicycle Transportation Plan as it provides a critical link in this area.

Route 27 is a four-lane divided roadway that provides a regional connection between Columbia Pike and I-395 to the south and I-66 and Rosslyn to the north. The road serves as a primary connector for accessing the Pentagon from other major collectors and interstate highways in the region and for this reason travel through this corridor poses special security considerations.

Latent demand for bicycle travel in this corridor ranks in the highest category for this jurisdiction. The land uses along this route are primarily government and military, with park areas located just to the north and east.

#### Existing Conditions

While there appears to be right-of-way available for a trail along most of the segment, there are several areas along Route 27 where utility poles and guardrail severely restrict the space. The



Southbound Route 110 and the proposed shoulder area where a sidepath is proposed. Note narrow space limitations due to the presence of utilities and guardrail.

grass shoulders along the exit ramps from Route 110 to Route 27 vary in width from 3.5 feet to as wide as 46 feet. Mature trees and two separate 6-foot high fences (one chain link and one steel rail) separate Route 27 from the Arlington National Cemetery. The outside southbound lane of Route 27 is 16-feet and the exit ramps vary from 20 to 24 feet. The posted speed limit on Route 27 is 45 MPH and the traffic averages 70,000 vehicles per day. The purpose in constructing this segment is to reach the Route 27 bridge overpass that carries users over Route 110. There is an eight-foot paved sidewalk on the west side of this

bridge, and a protected four-foot sidewalk on the east side. Existing conditions suggest that any new trail construction utilize the west side of the bridge; however, there are significant steep slopes and a narrow passage down the west slope of this hill. There is also a very limited amount of space between the bridge abutments and the tunnel entrance for the Metrorail tracks that go underground at this location as they travel south toward the Pentagon Metrorail Station.

### **Recommended Improvements**

The recommended facility for this corridor is a 10-foot asphalt shared-use path built to AASHTO and VDOT guidelines on the west side of Route 27. This proposed trail should connect the existing 9-foot wide sidewalk on the Pentagon Access Road with the existing and planned improvements for the trail on the east side of Route 110 north of the Pentagon. This could be accomplished by narrowing the outside lane of southbound Route 27 from its current 16 feet to 12 feet and replacing the existing metal guardrail with a barrier that protects the trail within this newly created space between the utility poles and the outside lane of southbound Route 27. In



Available grass shoulder between Route 110 exit ramps and Arlington National Cemetery.

this manner, it may be possible to gain enough space to maintain a minimum of an 8-foot wide pathway through this constrained area, however a more detailed engineering analysis will be needed of this area.

### **Implementation Issues/Opportunities**

- Due to the complexity of the numerous issues impacting this corridor, a more detailed feasibility study should be undertaken. This will be particularly important to maintaining bicycle and pedestrian access through restricted areas surrounding the Pentagon, both for through-access and for potential evacuations of the Pentagon.
- The feasibility of narrowing any lanes will require a full vehicle level of service analysis and is not explored in this corridor study.
- Proposed improvements do not require movement of the existing cemetery walls or perimeter fences surrounding Arlington National Cemetery.
- Arlington County has funded improvements to the existing stone dust trail on Route 110 with construction slated to begin in 2003.
- A realignment of Route 110 to the south of the Pentagon is anticipated along with other access and roadway alterations/improvements being made in conjunction with added perimeter security measures for the Pentagon.
- The right-of-way in this area is unclear. This project will need to be coordinated with Arlington County, Arlington Cemetery, the Department of Defense and the National Park Service.



Looking north at Route 27 exit ramp to Columbia Pike. Note the fence for Arlington National Cemetery at the top of the wall.

**Northern Virginia Regional Bikeway & Trail Network Study**  
**Arlington Boulevard Trail Improvements**  
**From Glebe Road to Park Drive**  
**Arlington County**

**Segment Length = 0.6 miles**

**Background**

Arlington Boulevard provides a key regional connection between Fairfax County and Arlington, Rosslyn, and D.C. via the Memorial Bridge. Commuters from west Arlington and central Fairfax need access along Arlington Boulevard in order to connect to regional trails in this area (Four Mile Run, W&OD, and Custis trails). During a community charrette regarding Arlington Boulevard, one of the high priorities identified by local residents was connecting service roads along Arlington Boulevard with trails. Design solutions for this corridor are not obvious due to the fact that some of the service roads are one-way streets, creating a condition where bicyclists would be required to ride against traffic. Using the service roads as bike facilities is further complicated by numerous residential driveways. The preferred alternative for this route is to accommodate two-way bicycle traffic on the north side of Arlington Boulevard because this connects to a greater number of destinations and other routes including Washington Boulevard.



View of existing sidepath as it approaches the pedestrian crossing of Arlington Boulevard at the Thomas Jefferson Community Center just east of Glebe Road.

Based on the bicycle travel demand analysis conducted for this study, this corridor ranks in the highest category for latent demand due to housing densities and the proximity of bicycle destinations. The land uses along the studied portion of this route consist mostly of older residential homes, schools, parks, community centers, and churches, with some limited commercial development, a U.S. State Department training facility and the Arlington Hall military installation.

**Existing Conditions**

Bicycle facilities along Arlington Boulevard currently utilize the

existing parallel service roads. The service roads are not continuous, nor are they all suitable for two-way bicycle travel, particularly at major intersections with George Mason Drive and Glebe Road where they serve as exit ramps for Route 50. The signed bicycle routes along Arlington Boulevard are somewhat discontinuous and are difficult to follow. There are also many residential driveways and parking areas similar to those in the photograph on the following page. In some locations, trails provide connections between service roads; however, these trails are in

deteriorating condition and their width varies from six to nine feet. On the south side of the road between George Mason Drive and Glebe Road, the only existing facility is a five-foot sidewalk without buffer along the exit-entrance ramp outside lane. There is an existing grade-separated pedestrian/bike trail bridge that provides a crossing of Route 50 just east of Glebe Road and connects bike trails on both sides of the road with the community center on the south side. The posted speed limit on this section of Arlington Boulevard is 45 MPH and the annualized average daily traffic volume is 61,000 vehicles per day.



**SITE MAP**

**Recommended Improvements**

Arlington Boulevard is recommended as a key regional commuter route. (See recommendations in the Northern Virginia Regional Bikeway and Trail Network Study.) As such, bicycle facilities along Arlington Boulevard should provide a high quality, direct, and safe connection for bicycle users – in effect, serving as a principal arterial for bicycle travel. As such, improvements along this corridor should provide a coherent and clear path of



View of a typical service road paralleling Arlington Boulevard. Note the curb and gutter improvements are not present on all such roads.

travel for bicyclists, using a combination of trails, pathways, and service roads. The preferred alternative for this route is to accommodate two-way bicycle traffic on the north side of Arlington Boulevard because this connects to a greater number of destinations and other routes including Washington Boulevard. A distinctive and clear signage program will be a key to guiding bicyclists along this bikeway and directing them to key east-west bikeway connections.

One alternative for providing through-bicycle access at the Glebe Road and George Mason Drive interchanges would be to widen the existing pavement to include paved shoulders alongside the road at the underpasses. Shoulder space exists; however, a barrier on the shoulder would be needed between the trail and the adjacent traffic. Since bicyclists will enter and exit the trail at Glebe Road and George Mason Drive, there will remain a need to provide access up the ramps to the intersecting roads. These connections will be difficult due to limited ROW and the speed and volume of traffic that enter and exit Arlington Boulevard.

Several intersections may present significant barriers to through-bicycle travel, and should undergo further evaluation. A potential alternative to using the existing sidewalk on the south side of the corridor between George Mason and Glebe would be to widen this to a 10-foot shared use path, separate it from the roadway by a protective barrier, and thus allow two-way bicycle travel on the north side. Additionally, the service roads could be improved and all made one-way in each direction (paralleling the roadway direction) and striped to include bike lanes.

Note: Since the proposed solution for this corridor is primarily a separated off-road facility, Bicycle LOS, which is a measure of on-road bicycle compatibility, is not applicable as a comparative analysis. However, a higher level of service for bicyclists would be provided by providing a connected, improved trail.

Improvements to Arlington Boulevard should be coordinated with Fairfax County, as this is a proposed long distance commuter route that should extend without interruptions into Fairfax County.

### **Implementation Issues/Opportunities**

- Bikeway access through interchanges, crossing on-ramps and off-ramps, will need to be addressed.
- A clear and distinctive signage program will be needed to guide bicyclists through complex areas.
- The purchase of right-of-way may be necessary along some parts of this route.
- This facility should eventually create a seamless connection to Fairfax County.



Looking east at westbound traffic on Arlington Boulevard as it passes under Glebe Road.

Due to the complexity of the numerous issues impacting bicycle service in this corridor, this analysis is necessarily cursory in nature. In order to develop the initial design concepts described in this case study, a more detailed feasibility study should be undertaken. This will be particularly important due to the importance of Arlington Boulevard as a regional connector route for bicyclists.

**Northern Virginia Regional Bikeway & Trail Network Study**  
**North Glebe Road**  
**From Old Dominion Drive to River Street**  
**Arlington County**

**Segment Length = 2 miles**

**Background**

North Glebe Road is a four-lane divided roadway that provides an important regional link between the Chain Bridge, North Arlington and Fairfax County. This road is an essential connection for bicyclists to the C&O Canal tow-path and the Capital Crescent Trail that runs into Washington, DC and Montgomery County, Maryland. Many bicycle commuters also use North Glebe Road to access other bike routes in Arlington County such as Williamsburg Boulevard, Yorktown Boulevard and Military Road.



The land uses along this two-mile segment are primarily residential with several churches and schools mixed in. Marymont University, with approximately 3,600 undergraduate and graduate students, is located at the south end of the corridor. Glebe Road Park can be accessed from Old Glebe Road at the north end of the study corridor.

**Existing Conditions**

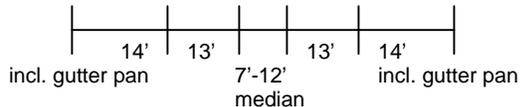
While some variation occurs, most of this corridor has 14-foot wide outside lanes, 13-foot inner lanes and concrete or grass medians that range from 7 to 12 feet. The majority of the corridor has 3 to 4-foot sidewalks and 1.5 to 2-foot buffers on both sides of the street. The posted speed limit is 35 mph, and the traffic averages 12,000 vehicles per day. The road serves as a bus route during the peak commuting period and parking is not permitted. Under existing conditions, the Bicycle LOS is D on a scale of A to F.



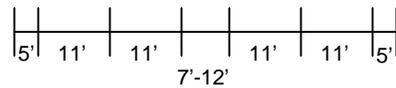
North Glebe Road

## Recommended Improvements

It is recommended that the existing travel lanes on North Glebe Road be narrowed to 11-feet in order to accommodate a 5-foot striped bike lane in each direction as shown in the cross section drawing. Further analysis will be needed at the intersections where the lane configuration changes and lane widths vary. Between Tazewell and River Street, additional pavement width is needed to accommodate bike lanes. This section has 7.5-foot wide gravel shoulders, so an additional 5 to 6 feet of pavement would be needed to continue the cross-section shown below. With these improvements, bicycling conditions would improve considerably, rising from a Bicycle LOS D to B.



**Existing Roadway Cross-Section**



**Recommended Roadway Cross-Section**

Restriping the travel lanes and providing bike lanes is a simple, low-cost improvement for bicyclists along this corridor. Another possibility for Arlington County to explore, due to the relatively low traffic volumes, would be to implement a “road diet” on North Glebe. One travel lane in each direction could be removed entirely, and a more elaborate streetscape project undertaken. This would include planting street trees, providing bike lanes, and installing a landscaped median. A streetscape project would also allow for widening the sidewalks that are too narrow to meet current AASHTO guidelines in several locations. To determine the feasibility of removing lanes from this facility, a full vehicle level of service analysis and further study is recommended.



North Glebe Road looking south near Tazewell where road narrows

## Current and Future Bicycle Level of Service Conditions

Route Name	From	To	Lanes (L)		Traffic Vol.	Pct.	Post. Spd.	Width of Pavement			Occu. Park.	Pvmt. Cond.	Bicycle LOS	
			Th #	Con.	(AADT)	(HV %)	(SPp) mph	(Wt) (ft)	(Wl) (ft)	(Wps) (ft)	(OSP) (%)	(PC <sub>5</sub> ) (5..1)	Score (1...7)	Grade (A..F)
North Glebe Road	Old Dominion Drive	River Street	4	D	12000	2	35	14.0	0.0	0	0	4.0	<b>3.66</b>	<b>D</b>
Potential Future Condition			4	D	12000	2	35	16.0	5.0	0	0	4.0	<b>2.43</b>	<b>B</b>

## Key Issues for Implementation

- This recommendation requires narrowing lanes.
- This recommendation requires some additional pavement be added.
- Additional analysis will be needed to accommodate the bike lanes at intersections along this corridor.
- At this time, the bike lanes for North Glebe Road are recommended from Old Dominion Drive to River Street. At River Street, the road becomes narrower and leads to ramps that access Military Road. Further study of this section of the corridor is recommended to determine how to best connect to Military Road and the Chain Bridge. Currently a signed alternative route exists to access Chain Bridge. This alternative route follows

Old Glebe Road parallel to North Glebe, turns north on Randolph Street and then utilizes a short section of trail to reach 41<sup>st</sup> Street and the Chain Bridge. While the trail is very steep, this route is a fairly good alternative until better bicycling connections from River Street to Military Road and the Chain Bridge can be developed on North Glebe. Currently bicycle commuters use both routes.



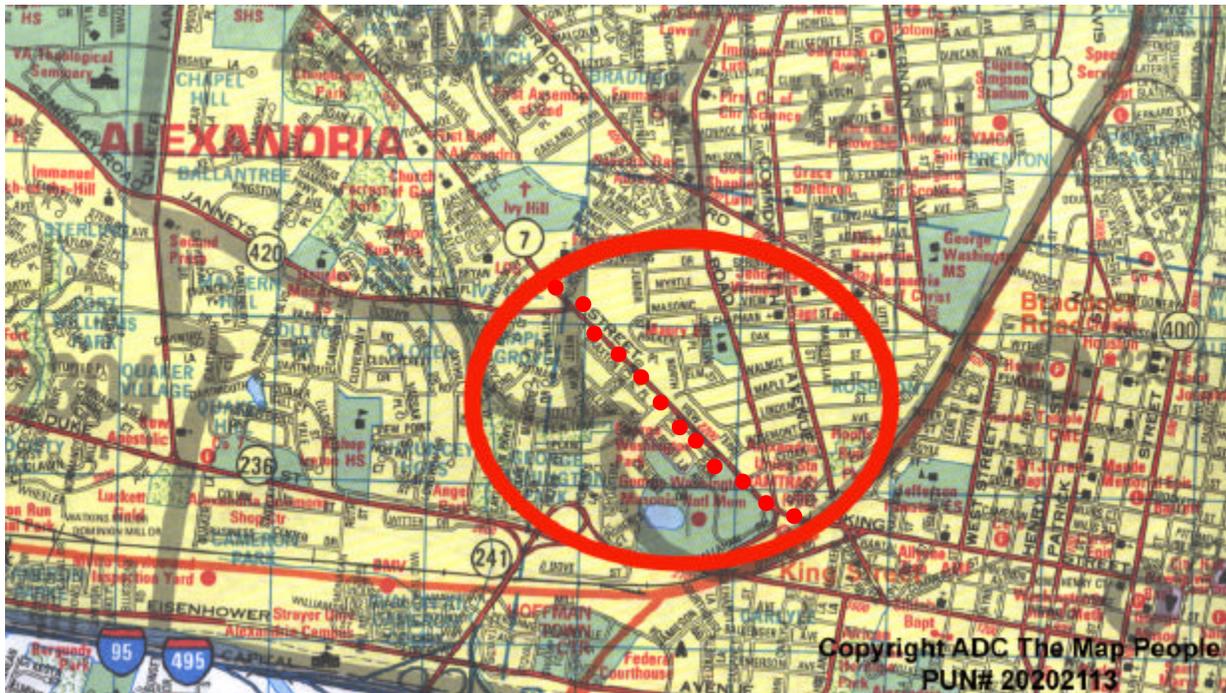
A steep section along an alternative route to the Chain Bridge

**Northern Virginia Regional Bikeway & Trail Network Study**  
**King Street**  
**From Janney's Lane to Commonwealth Ave.**  
**City of Alexandria**

**Segment Length=Approximately 1 mile**

**Background**

This corridor study focuses on a critical portion of King Street between Janney's Lane and Commonwealth Avenue. This route ranks in the highest demand category for bicycle latent demand use due to housing densities and the proximity of bicycle destinations and transit facilities. This section of King Street provides a direct regional connection between the King Street Metrorail Station/Old Town Alexandria and important destinations to the west including T.C. Williams High School, the Chinquapin Recreational Center, and the Alexandria campus of the Northern Virginia Community College. The portion of King Street west of Janney's Lane is evaluated in a separate demonstration project study that compares the alternative routes of Braddock Road, King Street and Janney's/Seminary Road. The opportunity for shoulder improvements and restriping throughout the overall corridor make this an attractive alternative to the signed Braddock Road bike route.



**Existing Conditions**

This portion of King Street is approximately .8-miles in length and is a two-lane, undivided street with a 35 mph speed limit. This segment is primarily residential; however, the eastern portion adjoins the Masonic Temple park area and changes to an urban streetscape as it passes under the Metro/Amtrak bridge and approaches Commonwealth Avenue. The predominate lane width through the corridor (including the two-foot gutter pan where it exists) is 11 feet; however,

approximately 70% of the segment is striped for an eight-foot parallel parking lane on the westbound side of the street, thus providing additional space for cyclists in that direction. There are adjoining sidewalks on both sides of the road, some of which have a narrow buffering of grass and mature trees. King Street is built into a hillside that slopes north and east down to the Potomac River, thus requiring a number of two- to four- foot retaining walls along the eastbound side of the road to allow for passage of the sidewalk. Numerous residential driveways have access to the road and steep slopes and mature trees narrow the passage for pedestrians and bicyclists in several locations. The westbound sidewalk has railings in several locations because the steep slopes drop off the north as the hill slopes away from the road. Homes along this side of the street between Russell Road and Upland Place have access and parking on North View Terrace (a parallel side street to the north) and do not appear to utilize the striped parking lane on King Street. However, the homes between Upland and West View Terrace have no such “rear access” and heavily utilize these westbound parking lanes.



King Street looking east from West View Terrace at the parked vehicles on the westbound side of the road.

The lane configurations change at intersections, where the parking lane space is used to accommodate a center-positioned left-turning lane as noted in the picture at right. Beyond the intersection with Russell Road to the east, the King Street widens to four lanes and then narrows again as it passes under the rail bridges. The posted speed limit is 35 mph along this portion of King Street. The average daily traffic volumes are approximately 15,000 vehicles per day with a three percent share of trucks.



King Street at Russell Road, with Amtrak Station in the background.

As noted above, this portion of King Street is situated on a rather steep incline, which may pose a challenge for westbound bicyclists.

### **Recommended Improvements**

This is an extremely important link in the regional network and is a severely constrained road segment as described above. Several options were considered but ultimately rejected. First, replacing the existing westbound parking lane and narrowing travel lanes in both directions to accommodate bike lanes was rejected due to likely opposition by residents, Second, construction

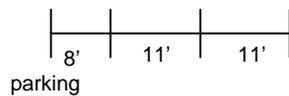
of a retaining wall and a shared-use path on the eastbound side of the road was also rejected because this would require extensive grading in front yards of residences, and removal of mature street trees. Surrounding neighborhood streets were investigated to determine the availability of a parallel route and possible locations for alternate street parking. However, no continuous alternative roads that could be utilized within this corridor, nor was a suitable location identified for relocating the existing street parking spaces.

Due to the constraints, achieving bicycle access in this corridor requires an innovative approach. Because of the downhill grade in the eastbound direction, bicyclists can generally maintain the speed limit while using the travel lane. Travel uphill in the westbound direction is more difficult. It is therefore recommended that parking be switched to the eastbound side of the street and a three-foot shoulder be provided on the westbound side of King Street to accommodate bicyclists.

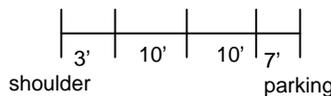


King Street looking west adjacent to the Masonic Temple. Note the presence of westbound striped parking lanes.

Eastbound bicyclists will share the travel lane in locations with occupied on-street parking. For the majority of the route, the striped parking lane is rarely occupied; therefore, bicyclists will be able to use this space as a “de-facto” bike facility (although it should not be signed as a bike lane). This solution will require that the travel lanes be narrowed, which should be acceptable given the low speeds and low truck volumes on King Street. The City may also choose to reduce the speed limit in this section of King Street, (an option which may be supported by adjacent residents). However, site engineering would be required to determine the appropriateness of this recommendation. The recommended before and after cross sections are provided below:



**Existing Roadway Cross-Section**



**Recommended Roadway Cross-Section**

Signage will be necessary to guide westbound cyclists to share the travel lane, and to discourage wrong way riding. This solution would have the added benefit of moving vehicles further away from pedestrians on the eastbound sidewalk by creating a buffer of parked cars.

**Current and Future Bicycle Level of Service Conditions**

The Bicycle LOS on King Street under existing conditions differs for each direction due to the presence of a striped parking lane on the westbound side. The current LOS is D for westbound travelers and is E the eastbound direction. Under the proposed recommendations, the future LOS will be D in both directions.

Route Name	From	To	Lanes (L)		Traffic Vol.	Pct.	Post. Spd.	Width of Pavement			Occu. Park.	Pvmt. Cond.	Bicycle LOS	
			Th #	Con.	(AADT)	(HV %)	(SPp) mph	(Wt) (ft)	(Wl) (ft)	(Wps) (ft)	(OSP) (%)	(PC <sub>5</sub> ) (5..1)	Score (1..7)	Grade (A..F)
King Street (Westbound)	West View Terrace	Russell Road/Callahan Drive	1	U	15000	3	35	19.0	8.0	0	80	5.0	<b>4.11</b>	<b>D</b>
Potential Future Condition (3' shoulder)			1	U	15000	3	35	13.0	3.0	0	0	5.0	<b>3.84</b>	<b>D</b>
King Street (Eastbound)	West View Terrace	Russell Road/Callahan Drive	1	U	15000	3	35	11.0	0.0	0	0	5.0	<b>4.51</b>	<b>E</b>
Potential Future Condition			1	U	15000	3	35	17.0	7.0	0	80	5.0	<b>4.30</b>	<b>D</b>

### Key Issues for Implementation

- If this narrow portion of King Street between Janney’s Lane and the Metrorail station can be retrofitted, this route can ultimately be extended to the 395 interchange and beyond, therefore achieving desired regional connections.
- The City of Alexandria is considering a feasibility study of potential improvements at the King Street /Russell Road / Commonwealth Avenue intersection that could include enhancements for bicycle and pedestrian facilities. It may be possible to shorten the turn lane at this location to better accommodate bicyclists.
- The City of Alexandria is considering a feasibility study of potential improvements at the King Street / Braddock Road / Quaker Lane intersection that could include enhancements for bicycle and pedestrian facilities.

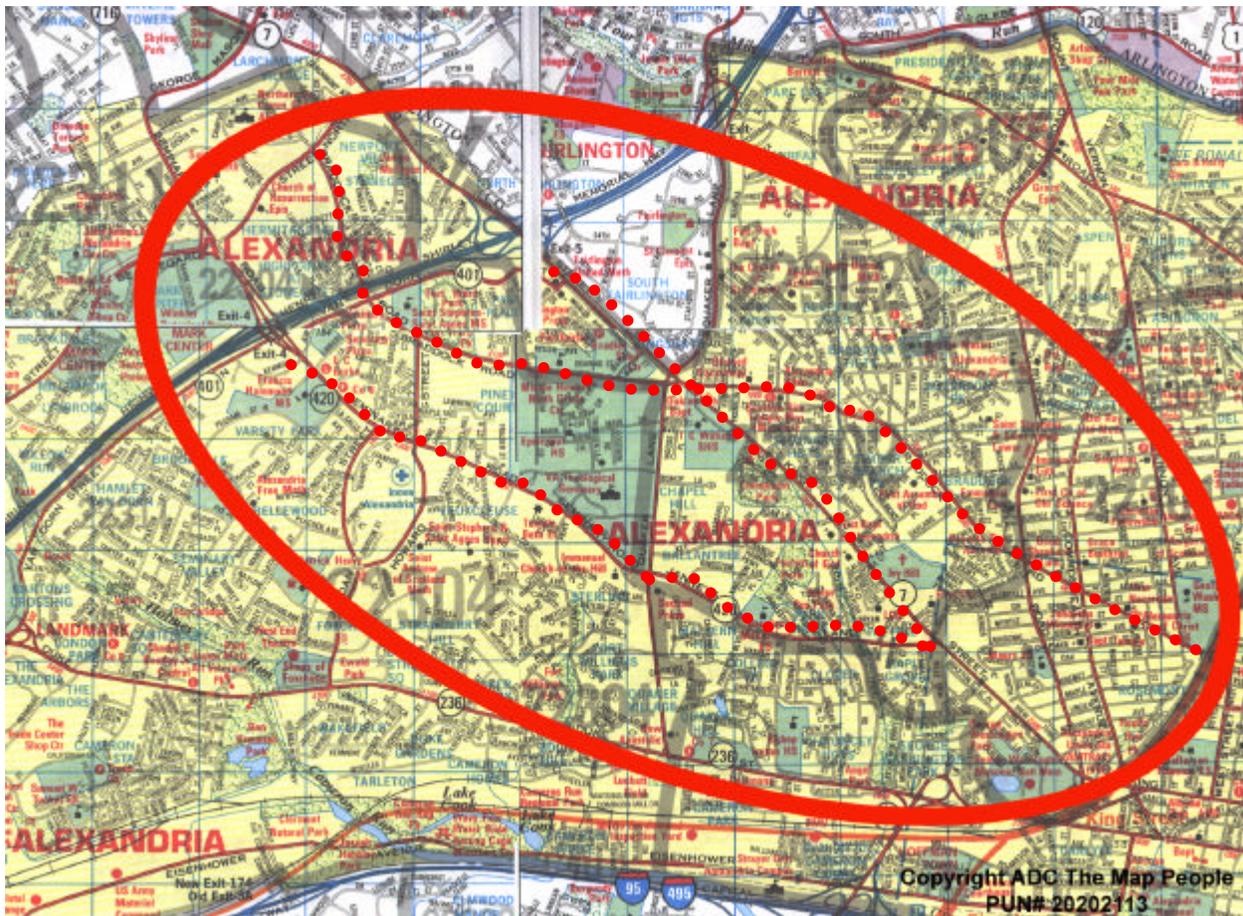


Looking west at the eastbound sidewalk, buffer area and existing retaining wall on the Masonic Temple park

**Northern Virginia Regional Bikeway & Trail Network Study**  
**Braddock Road, King Street**  
**& Janney's Lane to Seminary Road**  
**A Comparative Analysis**  
**City of Alexandria**

**Background**

The City of Alexandria is considering several bicycle routes for travel from western Alexandria into the historic district and the downtown, business, and professional centers of the city. There are three potential connections: 1) Braddock Road (which is currently signed as a bicycle route) 2) King Street, and 3) Seminary Road to Janney's Lane. These three routes were selected for analysis because each has the potential for carrying bicyclists through the City of Alexandria, and collectively they all may contribute to a comprehensive network serving both the city and the region. All three routes parallel or intersect with one another as they run roughly east - west from I-395 to the western edge of Old Town. This corridor study analyzes the various benefits and constraints of each route. The existing conditions, bicycle level of service, and implementation opportunities for each segment are analyzed and discussed, and a comparative analysis among the routes reveals which are suitable for inclusion in the regional network. This analysis will begin with an evaluation of the existing signed bicycle route on Braddock Road, followed by analyses of the Seminary Road to Janney's Lane and King Street routes.



**Existing Conditions: Braddock Road**

Braddock Road is currently signed as a bicycle route, beginning at Beauregard Street just west of I-395. It crosses, and then parallels, King Street until it reaches the Braddock Road Metrorail Station and West Street. The road geometry varies along this route. The cross section is narrowest on the eastern portion, where the road consists of two 11-foot wide lanes (undivided) along with eight-foot wide striped (and in places unstriped) parking lanes on both sides of the street. There is also a short section of road consisting of four 9.5-foot lanes between Russell Road and Ruffner Street. This segment is situated on a steep incline and has heavy vegetation that reduces visibility and further limits the space available for bicyclists. The configuration changes at the intersection with King Street, where Braddock Road becomes a four-lane divided roadway with 12-foot lanes extending west to Beauregard Street. Lane configurations change at intersections, where the parking lane space is used to accommodate center left-turn lanes. Traffic volumes are between 11,000 and 13,000 through this corridor and while the speed limit is posted at 25 MPH, actual speeds were observed to be higher. Truck volumes compose approximately three percent of the traffic volume. Fast speeds, along with the presence of on-street parking and narrow lanes make Braddock Road a less than optimal route for cyclists.

Land use along Braddock Road varies. Much of this corridor contains residential development; however, it includes large areas of commercial and mixed-use development. Several schools, parks, and churches are located along this section of Braddock Road. Latent demand for bicycling in this corridor is in the moderately high to high categories.



Braddock Road at Mt. Vernon Avenue looking east at the Metro rail bridge in the background. The narrow lanes, congested traffic and parked vehicles make bicycle travel difficult through this portion of the corridor.

**Bicycle Level of Service on Braddock Road**

The Bicycle LOS on Braddock Road varies according to the changes in roadway geometry from LOS D in the west to LOS B for a short distance east of King Street to LOS D in the eastern portions.

Route Name	From	To	Lanes (L)		Traffic Vol.	Pct.	Post. Spd.	Width of Pavement			Occu. Park.	Pvmt. Cond.	Bicycle LOS	
			Th #	Con.	(AADT)	(HV %)	(SPp) mph	(Wt) (ft)	(Wl) (ft)	(Wps) (ft)	(OSP) (%)	(PC <sub>5</sub> ) (5..1)	Score (1..7)	Grade (A..F)
Braddock Road	I-395/Van Dorn	King Street	4	D	13000	3	25	13.0	0.0	0	0	4.0	<b>3.61</b>	<b>D</b>
Braddock Road	Crest Street	Fontaine Street	2	U	11000	3	25	19.0	8.0	0	30	4.0	<b>2.26</b>	<b>B</b>
Braddock Road	Mt. Vernon Avenue	Russel Road	2	U	11000	3	25	19.0	9.5	0	75	4.0	<b>3.71</b>	<b>D</b>

### **Implementation Issues: Braddock Road**

Due to narrow lane widths, right-of-way constraints and topography, significant improvements will be needed to achieve adequate bicycling conditions on Braddock Road. It is unlikely that removal of on-street parking will be supported by the neighborhood. Therefore the most likely solution would be to purchase additional ROW and widen the road to provide space for bike lanes. This solution would be very expensive, requiring reconstruction of the sidewalk, removal of street trees, and utility relocation. Until such time as a major investment can be made to improve bicycling conditions on Braddock Road, it is recommended that alternative routes be developed. In addition, traffic calming would improve conditions for bicyclists in this corridor by lowering traffic speeds.

### **Existing Conditions: Seminary Road to Janney's Lane and Janney's Lane to King Street**

Another potential connector route in Alexandria is Seminary Road east of I-395 to Janney's Lane and Janney's Lane to King Street. Together these two roads provide an alternative route between I-395 and King Street. Seminary Road is a four-lane, undivided roadway between I-395 and Quaker Lane with outside lane widths of 11.5-feet. An existing grade-separated pedestrian and bicycle bridge is located at Seminary Road as it passes over I-395. The speed limit is 35 MPH and AADT is 16,000. The character of the road changes considerably as it becomes Janney's Lane, which is a relatively wide, two-lane residential street with striped parking on both sides. Lane widths are 20-feet. The speed limit is 25 MPH. This section has lighter traffic volumes, with an AADT of 9,700. Truck volumes along both sections are approximately 3 percent.



Janney's Lane as it approaches King Street.

Seminary Road passes through a predominantly residential area that includes Alexandria Hospital and a number of schools, including the campus of Virginia Theological Seminary and Episcopal High School. Latent demand for bicycling in this corridor is in the moderately high to high categories.

### **Bicycle Level of Service: Seminary Road to Janney's Lane**

The Bicycle LOS on Seminary Road is a D. Due to the substantial amount of traffic on this road, Bicycle LOS conditions remain a D even if travel lanes were narrowed to 10-foot wide in order to stripe a 2.5-foot wide shoulder. The Bicycle LOS for Janney's Lane is B.

Route Name			Lanes (L)		Traffic Vol. (AADT)	Pct. (HV %)	Post. Spd. (SPp) mph	Width of Pavement			Occu. Park. (OSP) (%)	Pvmt. Cond. (PC <sub>s</sub> ) (5..1)	Bicycle LOS	
			Th #	Con.				(Wt) (ft)	(Wl) (ft)	(Wps) (ft)			Score (1..7)	Grade (A..F)
Seminary Road	Pegram Street	Quaker Lane	4	U	16000	3	35	11.5	0.0	0	0	4.0	4.32	D
Potential Future Condition (2.5' shoulder)			4	U	16000	3	35	12.5	2.5	0	0	4.0	4.20	D
Janneys Lane	Quaker Lane	King Street	2	U	9700	3	25	20.0	8.0	0	30	4.0	1.97	B

**Implementation Issues: Seminary Road to Janney’s Lane**

There are some opportunities to retrofit Seminary Road by narrowing travel lanes to 10-foot wide and providing a 2.5-foot wide shoulder on the side. While this cannot be signed as a bike lane, it would serve to provide a defined area in which cyclists could ride and gives additional buffering to pedestrians on the four-foot sidewalks adjacent to the eastbound side of the road. Bicycling conditions on Janney’s Lane are already satisfactory, therefore this road could be



Seminary Road looking west from Janney’s Lane.

signed as a bike route with no further improvements. To reach the Metrorail station and downtown, this segment is necessarily dependent upon the implementation of recommended improvements to King Street east of Janney’s Lane (see separate corridor analysis). The City of Alexandria has also suggested that it may be possible to acquire right-of-way to provide a sidepath or a shoulder along the Seminary Road section of this route.

**Existing Conditions: King Street**

This analysis addresses the portion of King Street between I-395 and Janney’s Lane. King Street is a four-lane divided roadway between I-395 and Braddock Road, with gravel/grass shoulders and a center median containing mature trees. There is a two-lane service road along the south side of King Street. At the intersection with Braddock Road and Quaker Lane (all of which come together to form a major six-way intersection), King Street changes to a four-lane undivided road as it goes east towards the intersection with Janney’s Lane. Lane configurations change at intersections, where the road widens to include additional turning lanes. The speed limit for this corridor is 35 MPH, and the AADT is 19,000 vehicles per day with four percent trucks.



King Street looking east from I-395. The service road is visible on the right.

The western portion of King Street (the section with a service road) is a mixture of high-density housing and commercial strip mall development. The adjacent land use changes east of Braddock Road to a primarily residential character with a number of churches, schools and parks. Latent demand for bicycling is in the highest category for the entire length of King Street in Alexandria.

**Bicycle Level of Service: King Street**

The current Bicycle LOS on King Street is E. With the addition of six-foot wide bike lanes and a lower speed limit, the Bicycle LOS would be improved to a B.

Route Name	From	To	Lanes (L)		Traffic Vol.	Pct.	Post. Spd.	Width of Pavement			Occu. Park.	Pvmt. Cond.	Bicycle LOS	
			Th #	Con.	(AADT)	(HV %)	(SPp) mph	(Wt) (ft)	(Wl) (ft)	(Wps) (ft)	(OSP) (%)	(PC <sub>5</sub> ) (5..1)	Score (1...7)	Grade (A..F)
King Street	Menokin Drive	Quaker Lane/Braddock Road	4	D	19000	4	35	12.0	0.0	0	0	4.0	4.57	E
	Potential Future Condition		4	D	19000	4	25	18.0	6.0	0	0	4.0	1.92	B

**Implementation Issues: King Street**

The obvious choice for a bike route may appear to be the service road. However, given the recommendation to restripe King Street east of Janney’s Lane, and a desire to maintain continuity throughout the corridor, it is recommended that six-foot wide paved shoulders be added to the western portion of King Street, providing the opportunity for adding bike lanes. The right-of-way provides ample space to add a six-foot paved shoulder in each direction. Together with a lowered speed limit, improved markings and signage at the intersection of Braddock Road and a restriping of the portion of King Street from Braddock Road east to Janney’s Lane, this corridor would provide a bicycle route superior to the existing route on Braddock Road and is recommended for inclusion in the regional network. To reach the ultimate goal of Old Town, this segment is necessarily dependent upon the implementation of recommended improvements to King Street east of Janney’s Lane (see separate corridor analysis).

## **Conclusions**

After careful evaluation of each route, this comparative analysis shows King Street to be the preferred route (with implementation of the recommended improvements) for inclusion in the regional network. King Street offers the most direct route to Alexandria, while also serving higher densities of residential housing and commercial development. Latent demand on King Street was slightly higher than the other two routes. In addition, improvements to King Street would not be prohibitively expensive.

Seminary Road and Janney's Lane should also be improved: considering the opportunity to utilize the existing pedestrian/bicycle bridge on Seminary Road, the city may choose to investigate the possibility of acquiring additional right-of-way for the construction of a sidepath through this corridor.

# Northern Virginia Regional Bikeway & Trail Network Study

## Amherst Avenue / Backlick Road One-Way Pair

### From Highland Street to Old Keene Mill Road Fairfax County

Segment Length = 1 mile

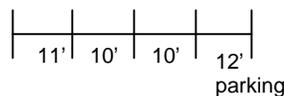
#### **Background**

The Amherst Avenue / Backlick Road one-way pair provides important access to commercial areas in the Springfield activity cluster near the intersection of interstates 95, 395, and 495. This pair connects the adjacent neighborhoods with shopping areas and job centers such as the Shirley Industrial Park and Springfield Plaza. This study was the top choice of the Fairfax County Department of Planning and Zoning. This corridor was ranked in the moderate to high category for latent demand for bicycling. This corridor is also located near the Franconia-Springfield Metro Station; however future bicycling connections will be needed to make this station accessible to bicyclists from the study corridor.

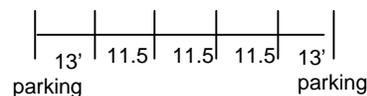


#### **Existing Conditions**

Each of these streets has three lanes in one direction with wide parking lanes. On Backlick Road, the three travel lanes are approximately 10-foot wide with an additional 12 feet striped for on-street parking on the right side of the road (1.5 feet of this is gutter pan). On Amherst Avenue, the travel lanes are approximately 11.5-foot wide and approximately 13-foot striped parking lanes are provided on both sides of the one way street. The posted speed limit is 30 MPH on both streets and observed speeds are approximately 35 MPH. Each street carries approximately 37,000 vehicles per day on average. The existing Bicycle LOS is E.



**Existing Backlick Road Cross-Section**



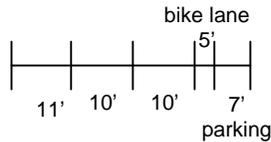
**Existing Amherst Avenue Cross-Section**

#### **Recommended Improvements**

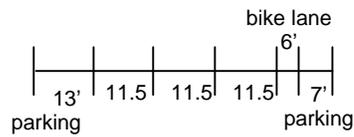
Due to the many bicycle and pedestrian connections along this corridor, it is important that future road improvement projects in this area include safe bicycle and pedestrian access. The Fairfax Countywide Trails Plan shows bike lanes and a shared use path on one side of the roadway;

however, such an improvement will require further study due to right of way constraints. This case study recommends that the following restriping be implemented to improve bicycling conditions in the interim.

Under the current lane configuration, the parking lanes are 12-foot wide on Backlick Road and 13-feet on Amherst Avenue. This width provides ample room to stripe bike lanes and maintain on-street parking. It is recommended that the parking lanes be striped seven feet from the curb to encourage drivers to park as close to the curb as possible. Bike lanes should be striped between the parking lane and the outside travel lane. On Backlick Road, the bike lane should be five-foot wide as per the AASHTO guidelines. On Amherst Avenue, the additional width allows for a six-foot wide bike lane to further enhance bicycling comfort. On both roads, the bike lanes should be placed on the right side of the street as recommended by AASHTO guidelines.



**Recommended Backlick Road Cross-Section**



**Recommended Amherst Ave. Cross-Section**

Both roads cross Old Keene Mill Road, but bicyclists are accommodated more easily by the Amherst Avenue Bridge, which has wide sidewalks on both sides. It should also be noted that Fairfax County has included on-road bicycle facilities in its plans for the rehabilitation of the Backlick Bridge. Bicycle lanes should be continued south of Old Keene Mill Road if possible, however this was not studied within the scope of this corridor analysis. Continuing the bike lanes south to the Fairfax County Parkway shared use path and bicycle / pedestrian bridge over I-95 would improve access to the Franconia Springfield Metro Station.



Amherst Avenue looking south

## Current and Future Bicycle Level of Service Conditions

Route Name	From	To	Lanes (L)		Traffic Vol.	Pct.	Post. Spd.	Width of Pavement			Occu. Park.	Pvmt. Cond.	Bicycle LOS	
			Th #	Con.	(AADT)	(HV %)	(SPp) mph	(Wt) (ft)	(Wl) (ft)	(Wps) (ft)	(OSP) (%)	(PC <sub>s</sub> ) (5..1)	Score (1...7)	Grade (A..F)
Backlick Road	Highland Street	Old Keene Mill Road	3	O	37000	4	35	22.0	12.0	0	90	3.0	<b>5.16</b>	<b>E</b>
Potential Future Condition (5' bike lane)			3	O	37000	4	35	22.0	12.0	7	90	3.0	<b>4.65</b>	<b>E</b>
Amherst Avenue	Highland Street	Old Keene Mill Road	3	O	37000	4	35	24.5	13.0	0	90	3.0	<b>4.94</b>	<b>E</b>
Potential Future Condition (6' bike lane)			3	O	37000	4	35	24.5	13.0	7	90	3.0	<b>4.03</b>	<b>D</b>

The striping of the bicycle lanes will provide an improvement in the Bicycle LOS on both roads. On Backlick Road, the LOS grade of E will remain the same, but the score will improve from 5.16 to 4.65. On Amherst Avenue, the LOS will improve from E to D. The recommended changes will have no impact on the vehicle LOS.

### Key Issues for Implementation

- Implementation of this project would require striping a 7-foot parking lane.
- The adjacent intersections will need to be designed to accommodate new bike lanes.
- Due to the short length of this segment, future connections to other facilities will be important.
- Signage will be needed to direct bicyclists to the bridge and other connections.

# Northern Virginia Bikeway & Trail Network Study

## Arlington Boulevard – Route 50

### Between Fairfax City and Arlington County

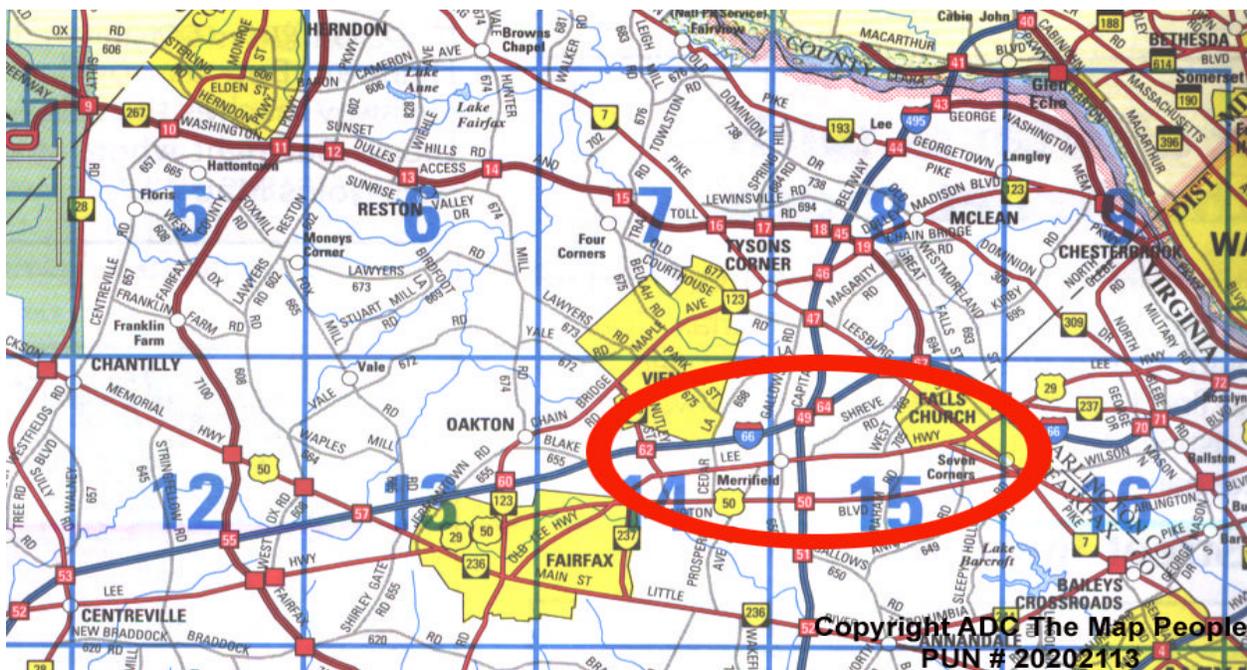
Fairfax County

Segment Length = Approximately 7 miles

#### Background

This corridor begins at the eastern edge of the City of Fairfax and extends to the Arlington County line. The corridor then continues through Arlington County as described in the Arlington County case study for Arlington Boulevard. The continuous route would serve the region by providing a direct connection between Fairfax County and the downtown areas of Arlington, Alexandria, and Washington, DC via connections to other regional bikeways in the network. This segment would also connect the Merrifield/Dunn Loring activity cluster with the Rosslyn Ballston corridor.

The *Fairfax Countywide Trails Plan* currently calls for a “major paved trail” (an asphalt shared use path of eight feet or more) along this corridor. There are no parallel facilities providing the important and needed regional east-west connections between this part of the county and the commercial/urban centers inside the Beltway. According to the latent demand model results, a high latent demand for bicycling exists in this corridor. As populations continue to grow, this access will become increasingly desirable and important. The land uses along the corridor vary widely from older residential homes, schools, and churches to new dense commercial development and office parks in the eastern portions, particularly inside the Beltway.



## **Existing Conditions**

This complex cross-section is mostly a four-lane divided highway (widening to eight lanes in certain locations) that is served by discontinuous service roads and entrance/exit ramps at major intersections such as the Capital Beltway/Gallows Road/Fairview Park Drive and Route 7 in Seven Corners interchanges as shown in the photos at right.



Route 50 approaching Gallows Road, I-495 and Fairview Park Drive interchanges

There are short sections of existing paved nine-foot sidepath and four-foot sidewalk that have been constructed by adjoining commercial and residential developments. However, many of these abruptly end at barricades.

Additionally, there are several points where stormwater culverts and associated guardrails narrow the available shoulder to as



little as three feet. The posted speed limit for much of Westbound Arlington Boulevard at Route 7 in Seven Corners. Arlington Blvd is 45 MPH and the traffic ranges from 28,000 to 44,000 vehicles per day.

## **Recommended Improvements**

Arlington Boulevard is recommended as a key regional commuter route (see recommendations in Chapter 5 of the study.) As such, bicycle facilities along Arlington Boulevard should provide a high quality, direct, and safe connection for bicycle users – in effect, serving as a principal arterial for bicycle travel. Improvements along this corridor should provide a coherent and clear path of travel for bicyclists, using a combination of trails, pathways and service roads. A distinctive and clear signage program will be key to guiding bicyclists and directing them to key east-west bikeway connections.



Existing segment of shared-use sidepath just west of Prosperity Avenue.

The wide grass and gravel shoulders on Arlington Boulevard can be used in constrained areas to gain enough space for a shared use path (suitable barriers would be needed between the trail and adjacent travel lanes.) Major grade separated crossings at Seven Corners and the Capital Beltway/Gallows Road/Fairview Park Drive are challenging, but not impassable given the provision of a separated trail facility. Shoulder space could also be used to widen existing paved surfaces and continue the bikeway lanes through major interchanges where space on the exit ramps is limited. This would also improve travel for through-users and reduce congestion at the at-grade crossings of these major intersections. Due to the complexity of the numerous issues impacting bicycle service in this corridor, a detailed feasibility study should be undertaken. This will be particularly important due to the importance of Arlington Boulevard as a regional connector route for bicyclists. Improvements to this corridor should be coordinated with Arlington County plans for continuous bicycle facilities along Route 50 as discussed in the Arlington Boulevard demonstration project study.

### **Key Issues for Implementation**

- Detailed feasibility study needed.
- Service Roads/Existing Trail Segments: A feasibility study should explore opportunities to connect the service roads with ten-foot paved trails, as shown for the north side of the highway in the Fairfax Countywide Trails Plan. In residential areas, the service roads may be utilized as bike facilities, but there are many conflicts on the eastern half of the segment (inside the Beltway) between cyclists and turning vehicles where commercial entrances use the service roads.
- Intersection/Interchange Design: A number of other intersections and interchanges along this route serve as barriers to through-bicycle travel. In addition to the interchanges referenced above, the Fairfax County Cross County Trail crossing near the eastern boundary of the City of Fairfax should be pursued.
- Signage: The feasibility study should include detailed recommendations for both directional signage as well as clearly signing connections to other existing regional trail facilities.

# Northern Virginia Regional Bikeway & Trail Network Study

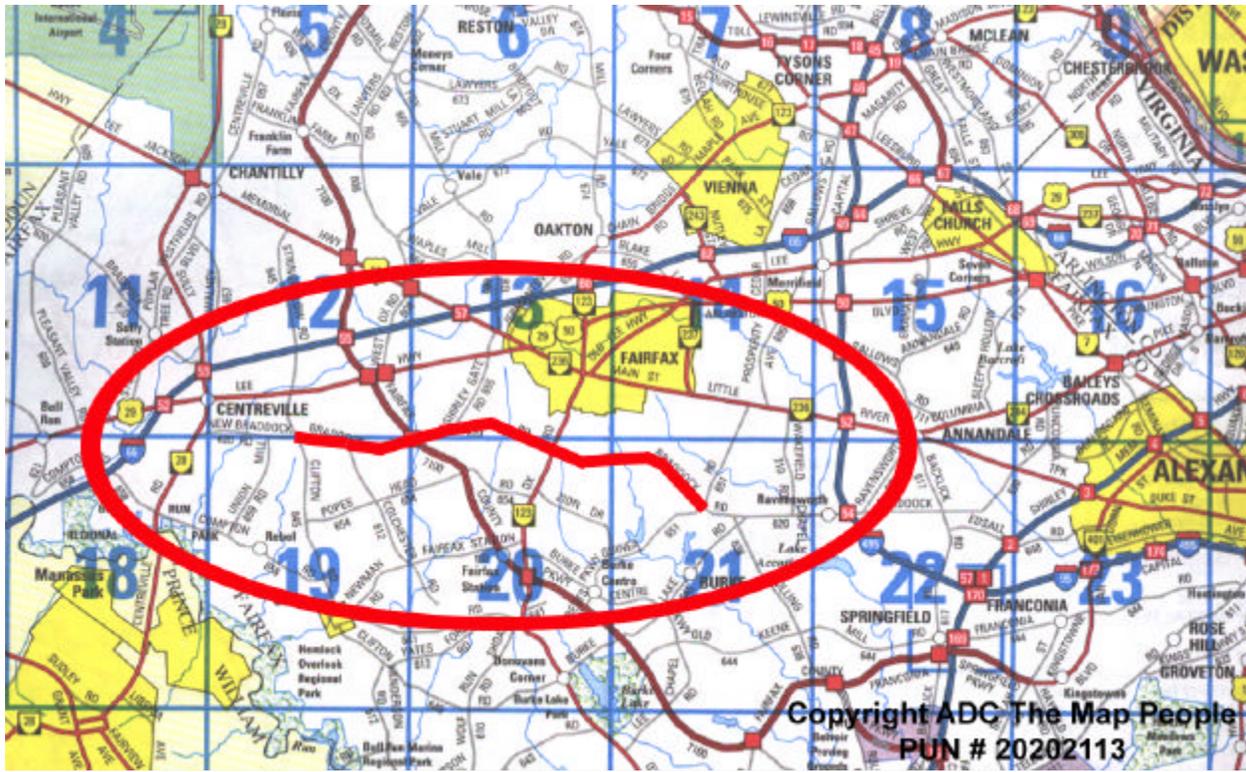
## Braddock Road

### Fairfax County

Segment length = 17 miles

### Background

This corridor analysis of the Fairfax County portion of Braddock Road (Route 620) illustrates the possibilities for a major paved trail connecting the outlying suburbs of Fairfax County with the urban centers of Alexandria and Arlington. The Fairfax County Trail Master Plan calls for a bicycle facility along this corridor to enable access from Centreville through Fairfax into the heart of Alexandria and Arlington. The land uses along this route are mostly residential neighborhoods, schools, parks, and churches, with some limited commercial development in the form of strip malls. Latent demand for bicycle travel in this corridor ranks in the highest category for this jurisdiction. This trail has the potential to provide access to the region's urban core and opportunities to cross the Potomac into Washington, D.C. Methods for providing for bicycle access through major interchanges and across numerous driveway crossings for residences and commercial areas along this route will have to be addressed.



### **Existing Conditions**

This analysis studies Braddock Road from Centreville Road to Little River Turnpike, an overall corridor length of 17 miles.

Currently, there are two sections of shared use path on the south side of Braddock Road in Fairfax County.

The first section of this trail begins at Route 28 in Centreville with a nine-foot wide asphalt sidepath and continues east for nine miles (in varying widths) until it reaches Guinea Road in Fairfax. This portion of the trail connects with the Fairfax County Parkway Trail at the intersection pictured to the right and then connects with another regional trail on Route

123. The character changes from an asphalt sidepath to a four-foot sidewalk for a short segment (0.25-mile) as it passes the University Mall and George Mason University before changing back to asphalt sidepath and continuing to its current terminus just east of Guinea Road.



The Braddock Road trail as it passes under the Fairfax County Parkway.

The other section of existing trail in this corridor picks up again just east of the Capital Beltway and continues 4.5 miles to its intersection with Route 236, however, it is discontinuous through here as well. It eventually changes from a sidepath at Backlick Road to a buffered four-foot sidewalk as it continues east to Route 236. The Fairfax County Trail Master Plan indicates this path, when finished, will continue east from Guinea Road, where there are several disconnected pieces of trail on the south side of the road (and only small segments of sidewalk on the north side) to meet this eastern section at the Capital Beltway (I-495), a distance of approximately 3.5-miles.

Outside lane widths vary on Braddock Road from between 11 and 12 feet for most of the corridor but narrow to 10 feet for the portion between Backlick Road and Route 236 (as shown in the picture at right). The posted speed limit for much of Braddock Road is 45 MPH, with some segments at 40 MPH. The traffic ranges from 24,000



Braddock Road looking west at its narrowest portion (where the lane width is only 10 feet) just east of Backlick Road. Note also that a four-foot sidewalk currently exists instead of the proposed sidepath.

vehicles per day (western end, close to Route 28) to 77,000 (near Wakefield Chapel Road) to 14,000 vehicles per day near the eastern end (Columbia Road).

### **Recommended Improvements**

The recommended trail improvements for this route include completion of the sidepath between Guinea Road and Route 236, widening to a minimum of 10 feet those portions of existing trail that do not currently meet AASHTO and VDOT guidelines, and the retrofitting of a sidepath along the narrow eastern portion of the route between Backlick Road and Route 236. Also, all major road crossings should be improved to include accessible pedestrian signals, clearly marked crosswalks, and other safe crossing measures. This is especially needed for improvements that facilitate a safe passage through the congested intersection of Port Royal Road and the crossing of I-495. It should be noted that a grade-separated pedestrian/bicycle crossing of I-495 exists in Wakefield Park (on the north side of the corridor) and may be incorporated into the route via connecting trails within the park and crossings of Braddock Road at the park entrance and again at Ravensworth Road east of the Beltway. This alternate route would avoid the congested area at the Beltway. Both of these recommendations will require more detailed study to determine the best methods for implementation. Additionally, the regional significance and length of this route warrants consideration for a signage program that provides users with direction and information regarding the many regional connections and destinations of interest.

A more detailed study will be needed to determine the best way to provide trail connections alongside this corridor, identify ways to provide bicycle access through intersections and interchanges, and to examine traffic movements from the numerous driveways along this intensely developed corridor. A more detailed future analysis should also make recommendations with respect to right-of-way and to gauge community support for changes to the roadway and streetscape.

### **Key Issues for Implementation**

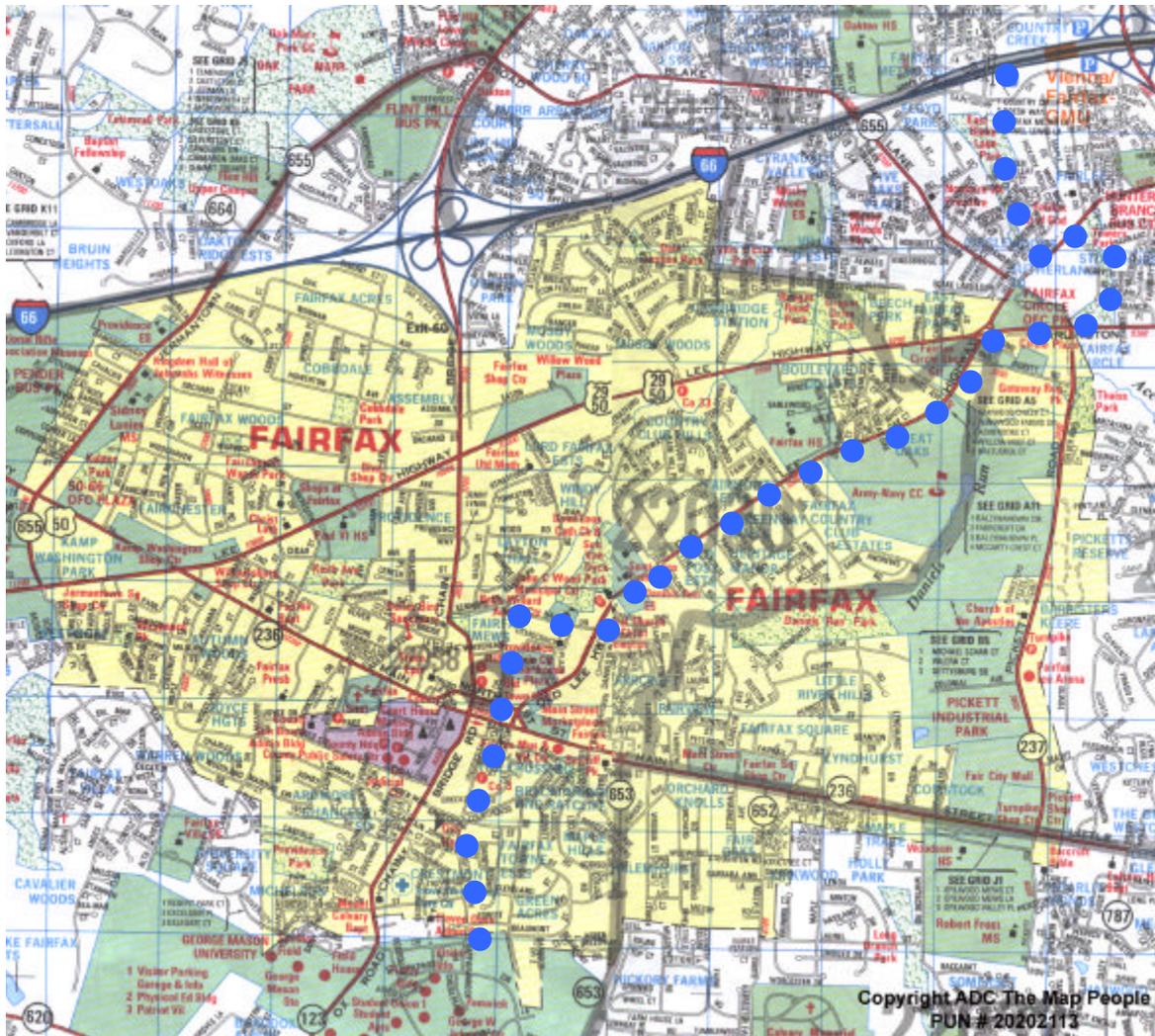
- There appears to be enough existing right-of-way on the south side of the road to construct the missing sections of sidepath; however, some acquisition may be necessary. Right-of-way issues between Braddock Road and Route 236 where the corridor narrows will need to be explored more thoroughly.
- Existing gravel shoulders may be upgraded, paved and striped to include bike lanes should acquisition be prohibitively expensive.
- The crossing of the Accotink stream valley may require using the shoulder width of the existing bridge to accommodate bicyclists.
- Space exists to widen the 4-foot sidewalk adjacent to the University Mall to a 10-foot shared use path.

Northern Virginia Regional Bikeway & Trail Network Study  
**Vienna Metro to GMU Connection**  
Via Old Lee Highway / University Drive  
Fairfax County / City of Fairfax

Segment Length = Approximately 5 miles

**Background**

This study explores the feasibility of a more direct connection for bicyclists between the Vienna Metro and George Mason University (GMU) south of the City of Fairfax. GMU is located approximately 5 miles south of the Vienna Metro. This is an easy biking distance; however, there is no clear, direct connection along the local roads that pass through Fairfax County and the City of Fairfax.



Improved bicycling facilities along this corridor would enhance the connection between regional transit and the university, which has more than 21,000 students many of whom commute. This route would also pass through the east side of the City of Fairfax, serving the Historic Downtown

and the area near Fairfax High School. This corridor was ranked in the highest category for latent demand for bicycling in this jurisdiction. The following analysis recommends the most feasible routing for this bikeway, however a more detailed study will be needed in the future in order to address several implementation issues.

### **Existing Conditions**

The City of Fairfax has suggested that the best connection between GMU and the Vienna Metro is via Old Lee Highway and University Drive. Based on the fieldwork conducted for this study, this route does appear to be the best alternative. This section therefore examines existing conditions along this proposed route.

From the Vienna Metro Station, the first portion of the route follows an existing trail segment from the west side of the Metro station through East Blake Lane Park to the edge of the city. This trail is in good condition for bicyclists.

From East Blake Lane Park, cyclists would follow Old Lee Highway between Arlington Boulevard and Layton Hall Drive. The land uses along this section are residential with schools, churches, police departments and other governmental uses. A shared use path exists along much of the northwest side of the road, however its width and condition vary considerably. At some points, the path is as narrow as four feet. In other areas, it is as wide as eight feet. The configuration of Old Lee Highway varies as well with travel lanes ranging from ten to fifteen feet. Shoulder widths vary and turn lanes are present at some intersections. Layton Hall Drive would provide the less than 0.5-mile connection to University Drive. Layton Hall Drive has 22-foot lanes and parking is permitted.



Path along Old Lee Highway near Daniels Run Elementary School



University Drive in downtown Fairfax looking south

Between Layton Hall Drive and GMU, University Drive is primarily a 4-lane undivided roadway with travel lanes ranging from ten to fourteen feet. Within the historic downtown area, the corridor is constrained by sidewalks, buildings and utilities. University Drive becomes

residential once past the downtown area and the travel lanes widen to 23 feet. On-street parking is permitted as shown in the following photo.

### **Recommended Improvements**

A combination of shared use paths and bike lanes is recommended for this route. The existing pathway along Old Lee Highway should be widened and resurfaced and the remaining gaps should be completed along Old Lee Highway to Layton Hall Road in the City of Fairfax. To connect from Old Lee Highway to University Drive, bike lanes should be installed along Layton Hall Drive. Layton Hall Drive is 44 feet wide and thus provides adequate space to accommodate parking lanes and bike lanes on both sides. A connection along Layton Hall Drive from Old Lee Highway to University Drive will provide two benefits: 1) enable bicyclists to avoid the complex intersection of North/Main and Old Lee Highway in the downtown area; and 2) provide access to the trail that runs through Van Dyck Park (beginning at the corner of Layton Hall Drive and University Drive).

From Layton Hall Drive, bike lanes should continue down University Drive through downtown Fairfax and toward GMU. A number of constraints exist along this section including constrained right-of-way, utilities, and narrow travel lanes. These constraints may necessitate a gap in the bike lanes for a couple of blocks near Main Street where bicyclists would share lanes with vehicles. If so, signage will be important to assisting bicyclists in finding where the bike lanes begin again. South of downtown to GMU, bike lanes are more feasible within the existing roadway.

Establishing a signage system for this entire route will be very important, especially on the northern end where bicyclists will need to enter the trail through the park. The goal of this signage should be to make it possible for people to bicycle between the Vienna Metro and GMU without a map.

Due to the variable roadway configuration and right-of-way constraints, a more detailed feasibility study of this corridor will be necessary to implement the recommended improvements.



University Drive near GMU

### **Current and Future Bicycle Level of Service Conditions**

A Bicycle LOS analysis was not possible for this corridor due to the wide variation in roadway cross-sections on the main roads and lack of AADT data for most sections.

### **Key Issues for Implementation**

As mentioned above, a number of issues will need to be resolved in order to implement the shared use path and bike lane recommendations. A summary of these constraints is provided below.

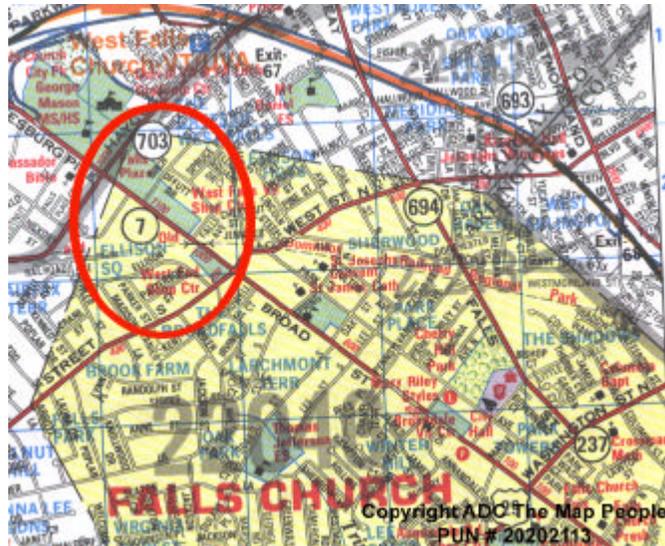
- A number of steep grades, utilities and right-of-way constraints exist along Old Lee Highway.
- Varying roadway configuration at the intersections along the route will impact bike lanes and the safety of shared use path crossings. Detailed design work will be necessary to address these issues.
- The narrow right-of-way and utilities in downtown Fairfax may limit the ability to install bike lanes for a short segment of the route.
- Clear signage will be critical to making this a user-friendly route.

**Northern Virginia Regional Bikeway & Trail Network Study**  
**Route 7 (Broad Street)**  
**From W&OD Trail to Haycock Road**  
**City of Falls Church**

**Segment Length = .5 mile**

**Background**

This .5-mile section of Route 7 (Broad Street) passes through a busy commercial district in Falls Church and provides a critical link to the Washington and Old Dominion Trail (W&OD). This corridor is also regionally significant as it has the potential to facilitate bicycle travel beyond the City of Falls Church to the Tysons Corner area. The West Falls Church Metrorail Station is located less than one-mile away and provides another potential destination that could be linked to this area in the future. This corridor ranked in the highest category for latent demand for bicyclists in this jurisdiction based on the model used for this study.

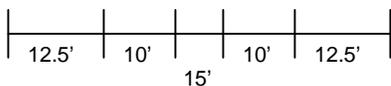


**Existing Conditions**

The current roadway configuration shown below consists of four through lanes divided by a 15-foot continuous left turn lane. The outside lanes are 12.5 feet wide (1.5 feet of which is gutter pan) and the inside lanes are 10 feet wide. Sidewalks (approximately six-foot wide) are continuous on both sides and are separated from the roadway by an eight-foot buffer planted with trees. The annual average daily traffic on this roadway is 23,000 vehicles per day with trucks composing 5 percent of this volume. The posted speed limit is 25 MPH; however vehicles are observed to travel between 30 and 35 MPH. The land uses along this route



Route 7 (Broad Street) looking northwest



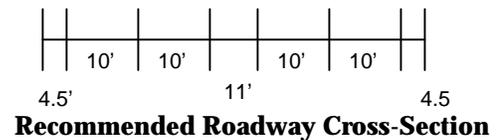
**Existing Roadway Cross-Section**

are mostly commercial strip developments set back from the roadway behind parking lots. Numerous driveways exist along the roadway to provide access to these developments. Under existing conditions, the Bicycle LOS is E on a scale of A to F.

Vehicle traffic is heavy along this corridor throughout the day and creates a challenge to improving the environment for bicycling. However, an opportunity exists to reduce the width of the continuous left turn lanes and use the gained space to provide additional space for bicyclists.

**Recommended Improvements**

It is recommended that the 15-foot center turn lane be reduced to 11 feet (the VDOT minimum is 12 feet, however the AASHTO minimum is 10 feet), the outside travel lanes reduced to 10-foot and the additional space used to create 4.5-foot bike lanes. With such improvements, the Bicycle LOS would improve to LOS D as shown below. This recommendation will require additional engineering analysis and cooperation with VDOT to ensure safety along this route. Immediately southeast of the intersection of Route 7 and Haycock Road, the continuous turn lane becomes a landscaped median. Installing a bicycle lane at this location will require additional analysis. While this segment is short, it would provide significant benefits to bicyclists accessing the commercial corridor and provides the beginning of a system of new connections such as the proposed facility on West Street (see demonstration project study).



**Current and Future Bicycle Level of Service Conditions**

Route Name	From	To	Lanes (L)		Traffic Vol. (AADT)	Pct. (HV %)	Post. Spd. (SPP) (mph)	Width of Pavement			Occu. Park. (OSP) (%)	Pvmt. Cond. (PC <sub>5</sub> ) (5..1)	Bicycle LOS	
			Th #	Con.				(Wt) (ft)	(WI) (ft)	(Wps) (ft)			Score (1...7)	Grade (A..F)
Broad Street (Route 7)	W&OD Trail	Haycock Road	4	D	23000	5	35	12.5	0.0	0	0	4.0	<b>4.81</b>	<b>E</b>
Potential Future Condition (4.5' bike lanes)			4	D	23000	5	35	14.5	4.5	0	0	4.0	<b>3.79</b>	<b>D</b>

**Key Issues for Implementation**

- This project would require narrowing lanes and VDOT approval.
- Additional analysis is needed for the intersection of Route 7 and Haycock Road.
- Signing will be important to indicate connections to the W&OD Trail and the proposed facility on West Street.



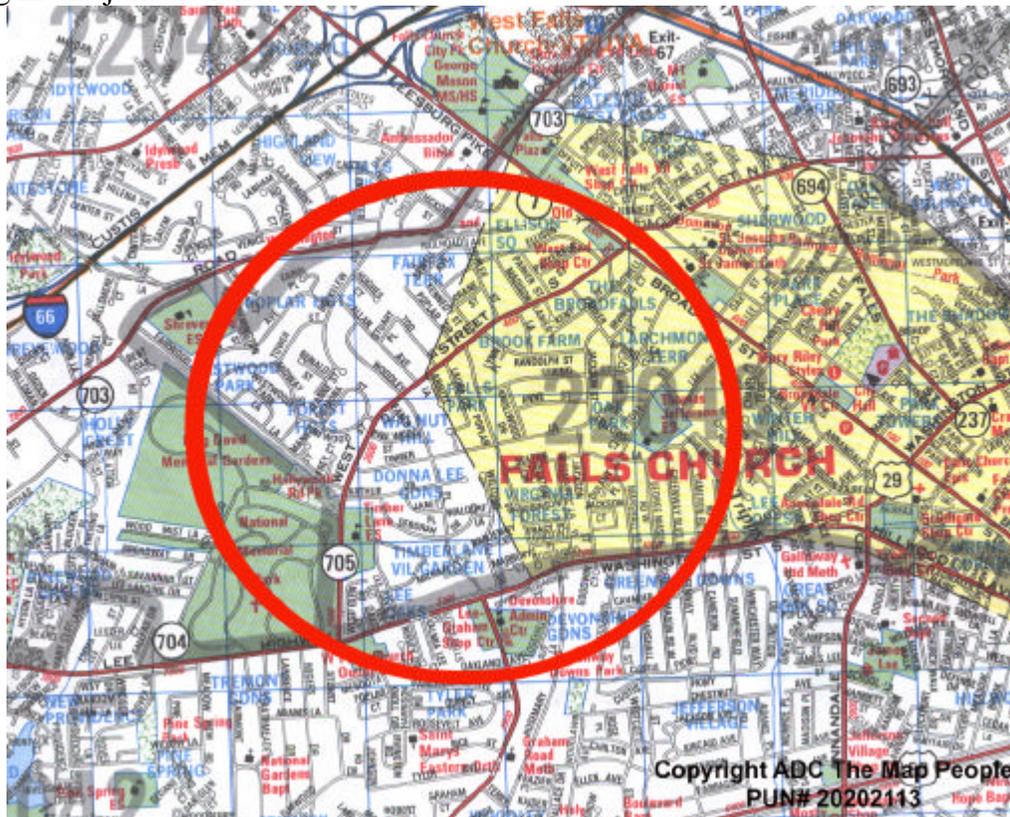
Most bicyclists currently ride on the sidewalk along Route 7 in Falls Church creating potential conflicts with pedestrians

**Northern Virginia Regional Bikeway & Trail Network Study**  
**West Street (South)**  
**From Route 29 to Route 7**  
**Fairfax County / City of Falls Church**

**Segment Length = 1.5 miles**

**Background**

The southern section of West Street connects Route 29 (Lee Highway) with the Falls Church commercial area on Route 7 (Broad Street.) This section of West Street is lightly traveled passing through residential areas, but it would provide a critical link in the regional bicycle network. Access to numerous activity centers would be improved via connections to the existing westbound facility on Route 29 (Lee Highway) and to the W&OD Trail near the intersection of West Street and Route 7. West Street was ranked in the highest category for latent demand for bicycling in this jurisdiction.



**Existing Conditions**

West Street South currently has two 20-foot wide lanes (includes a two-foot gutter), which allows space for parking on both sides of the street. The posted speed limit is 25 mph, while observed speeds averaged 30 to 35 mph. Average daily traffic volumes are approximately 5,000 vehicles per day.



**Existing Roadway Cross-Section**  
 (parking is permitted on both sides of the street)

Some sections of the west side of the street have sidewalk and bicyclists often use the continuous sidewalk on the east side of the street. The Bicycle Level of Service (BLOS) under existing conditions is LOS C on a scale of A to F.

**Recommended Improvements**

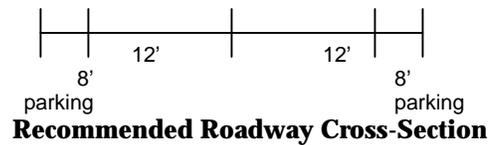
An opportunity exists to improve bicycling conditions on this street by visually narrowing the roadway to slow traffic. Wide lanes can often lead to higher speeds, and while striped bicycle lanes would be ideal on this road, there is insufficient width to accommodate them while maintaining the existing parking.

The recommended solution for West Street is an eight-foot striped parking lane along with traffic calming measures such as curb extensions, traffic calming circles and median islands to help slow vehicle speeds. The eight-foot striped parking lane would have several benefits. First, it will keep parked vehicles close to the curb and leave 12 feet of space for bicyclists and motor vehicles to share. Second, due to the low parking occupancy rates, the striped parking lane will, in effect, provide a separated area in which bicyclists can ride for the majority of the day. Finally, the striped parking lane will visually narrow the roadway and may help to slow vehicle speeds to create a more comfortable environment for bicyclists.



West Street looking north

The parking stripe can be added immediately without waiting for a repaving project. With the striped parking lane, the Bicycle LOS would improve to LOS A. If the suggested traffic calming measures are implemented in addition to the parking stripe, the LOS would be A with an even better LOS score.



**Current and Future Bicycle Level of Service Conditions**

Route Name			Lanes (L)		Traffic Vol.	Pct.	Post. Spd.	Width of Pavement			Occu. Park.	Pvmt. Cond.	Bicycle LOS	
			Th #	Con.	(AADT)	(HV %)	(SPp) mph	(Wt) (ft)	(Wl) (ft)	(Wps) (ft)	(OSP) (%)	(PC <sub>5</sub> ) (5..1)	Score (1...7)	Grade (A..F)
West Street	Route 29	Route 7	2	U	5000	2	35	20.0	0.0	0	10	4.0	2.72	C
Potential Future Condition (8' parking lanes)			2	U	5000	2	35	20.0	8.0	0	10	4.0	1.04	A

### **Key Issues for Implementation**

- West Street narrows and the parking lane ends near its intersection with Route 29. The pavement would need to be widened along this short section in order to accommodate bicyclists.
- Traffic calming measures would require additional engineering.
- Signing should indicate connections to other bicycle facilities such as the W&OD Trail and the recommended bicycle facility on Route 7 (see demonstration project study.)

**Northern Virginia Regional Bikeway & Trail Network Study**  
**Gallows Road (Route 650)**  
**Dunn Loring-Merrifield Metro to Tysons Corner**  
**Fairfax County**

**Background**

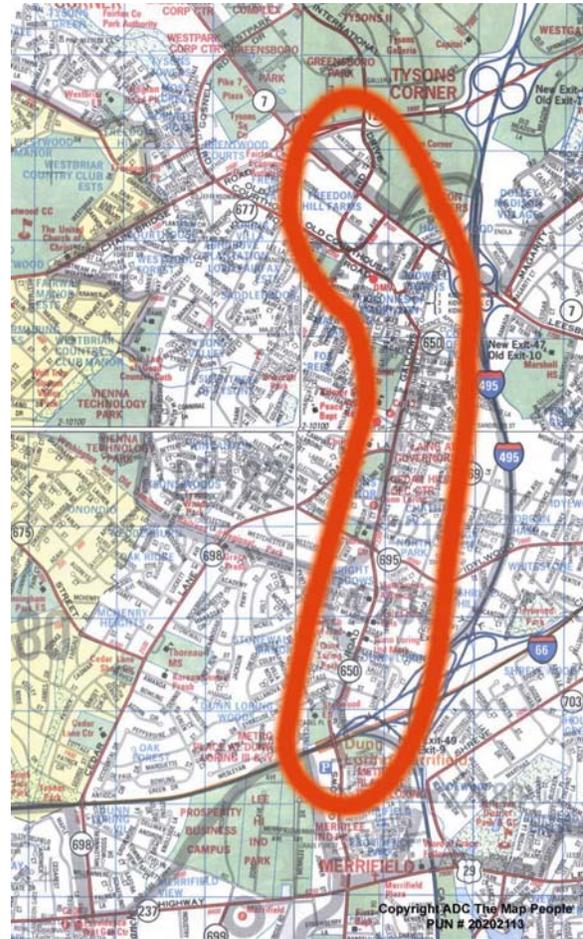
Gallows Road (Route 650) is an important component of the Northern Virginia Regional Bikeway and Trail Network Study because it acts as a “bicycle beltway” connecting Annandale and Springfield to Tysons Corner. Bicycle facilities along this corridor are also a high priority for the Fairfax County Non-Motorized Transportation Committee because of the local and regional connections this route would provide.

This case study will focus on the portion of Gallows Road between the Dunn Loring-Merrifield Metrorail Station at the south end and Tysons Corner at the north end. The provision of bicycle facilities on this portion of the road will improve access to the Washington and Old Dominion Trail (W&OD), an important regional route that passes through this corridor a half mile north of the Metrorail station.

Latent demand for bicycle travel through this corridor is projected to be high due to its proximity to the W&OD, Tysons Corner, Metro, Dunn Loring Park, and surrounding residential communities. In its current state, this segment of roadway provides a poor bicycle level of service due to high motor vehicle volumes and speeds.

This portion of Gallows Road is designated as a Type A Minor Arterial in the Fairfax County Comprehensive Transportation Plan. This designation states, “the primary function of the roadway, particularly during peak periods, is to carry through traffic” while providing “safe pedestrian and bicycle travel along and across” the facility. These roads are typically multi-lane, with divided limited access medians with no parking allowed within the roadway.

In examining alternatives for accommodating bicyclists on Gallows Road between the Dunn-Loring Metro and Tysons Corner, it is important to note that the Virginia Department of Transportation (VDOT) is currently engineering a preliminary design for upgrades to the intersection of Lee Highway (Route 29) with Gallows Road just a quarter mile south of the case



study area. The project is scoped to widen Gallows Road from four lanes to six lanes between Prosperity Avenue immediately south of the Dunn Loring Metrorail station and Route 29.

**Existing Conditions**

The segment of Gallows Road between Tysons Corner and the Dunn-Loring Metro is currently a four lane road carrying between 16,000 and 34,000 vehicles per day. The road cross section varies throughout the corridor with alternating curbed and uncurbed painted medians located in the center of the roadway as depicted in the photograph at right. There is no parking allowed along the route. There is a mixture of land uses with the southern end of the corridor predominantly residential in nature and the northern end commercial in nature.

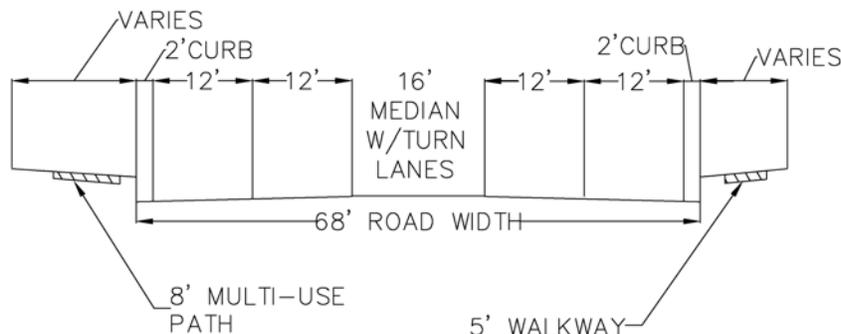


**Gallows Road with curbed median in foreground and painted median in background.**

**Existing Cross Section of Gallows Road between Tysons Corner (near Route 7) and Route 66 (near Dunn Loring Metro)**

The cross section for this section does not depict the various curb arrangements found within the road section. The purpose of the cross section is to demonstrate the average lane widths and medians along the route.

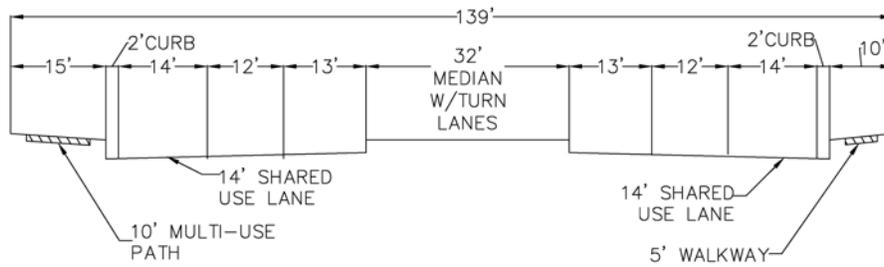
TYPICAL SECTION—GALLOWES ROAD BETWEEN ROUTE 66 AND ROUTE 7



**VDOT Proposed Cross Section of Gallows Road between Route 29 and Prosperity Avenue (south of case study area)**

Due to the importance of the proposed changes to the roadway cross section for the VDOT road widening project south of the case study area on Gallows Road between Route 29 and Prosperity Avenue, the proposed cross section is presented below.

VDOT PROPOSED SECTION FOR GALLOWES ROAD BETWEEN ROUTE 29 AND PROSPERITY AVENUE



This cross section is likely to become a template for future improvements to Gallows Road for all modes of transportation, therefore it is important to understand the impacts the current proposed cross section of the road widening project will have on bicyclists should the above bicycle improvements be applied to the case study portion of the roadway.

The current Bicycle Level of Service (LOS) along the route is poor due to the high traffic volumes and relative speeds of motor vehicles along the route. The table below summarizes the level of service conditions for the route between the I-66 overpass and Tysons Corner at Route 7 (near Dunn Loring Metro).

**GALLOWES ROAD (ROUTE 650) BICYCLE LEVEL OF SERVICE (I-66 NORTH TO ROUTE 7)**

Route Name	From	To	Lanes (L)		Traffic Vol. (ADT) (vpd)	Pct. (HV) (%)	Post. Spd. (SPp) (mph)	Width			Pvmt Cond Lane (5..1)	Pvmt Cond Shdr (5..1)	Bicycle LOS	
			Th #	Con.				Pave (Wt) (ft)	(Wl) (ft)	(Wps) (ft)			Score	Grade (A..F)
Gallows Road	Route 66 Bridge	Cottage	4	D	16,000	5	35	12.0	0.0	0	3.0	3.0	4.65	E
VDOT Proposed Cross Section 14' Outside Shared Auto/Bike Lane			4	D	16,000	5	35	14.0	0.0	0	4.0	4.0	4.06	D
Gallows Road	Cottage	W&OD Trail	4	S	16,000	5	35	12.0	0.0	0	3.0	3.0	4.86	E
VDOT Proposed Cross Section 14' Outside Shared Auto/Bike Lane			4	D	16,000	5	35	14.0	0.0	0	4.0	4.0	4.06	D
Gallows Road	W&OD Trail	Elm Place	4	D	25,000	5	35	12.0	0.0	0	4.0	4.0	4.55	E
VDOT Proposed Cross Section 14' Outside Shared Auto/Bike Lane			4	D	25,000	5	35	14.0	0.0	0	4.0	4.0	4.29	D
Gallows Road	Elm Place	Science App. Court	4	S	34,000	5	35	12.0	0.0	0	4.0	4.0	4.91	E
VDOT Proposed Cross Section 14' Outside Shared Auto/Bike Lane			4	D	34,000	5	35	14.0	0.0	0	4.0	4.0	4.44	D
Gallows Road	Science App. Court	Gallows Branch	4	D	24,000	4	35	12.0	0.0	0	3.0	3.0	4.48	D
VDOT Proposed Cross Section 14' Outside Shared Auto/Bike Lane			4	D	24,000	4	35	14.0	0.0	0	4.0	4.0	4.03	D
Gallows Road	Gallows Branch	Madrillon Road	4	S	24,000	4	35	12.0	0.0	0	3.0	3.0	4.13	D
VDOT Proposed Cross Section 14' Outside Shared Auto/Bike Lane			4	D	16,000	4	35	14.0	0.0	0	4.0	4.0	3.83	D
Gallows Road	Madrillon	Route 7	4	S	24,000	4	35	12.0	0.0	0	3.0	3.0	4.83	E
VDOT Proposed Cross Section 14' Outside Shared Auto/Bike Lane			4	D	16,000	4	35	14.0	0.0	0	4.0	4.0	3.83	D

Two rows are provided for each section. The first row displays the current BLOS. The second row displays what the Bicycle LOS will be for the segment if the bicycle improvements proposed for the road-widening project are applied to this segment of the roadway. The model

assumes no additional lanes will be added due to right of way constraints with neighboring properties, and a fully curbed median will be installed along the center of the road with appropriate turn lanes as required by AASHTO.

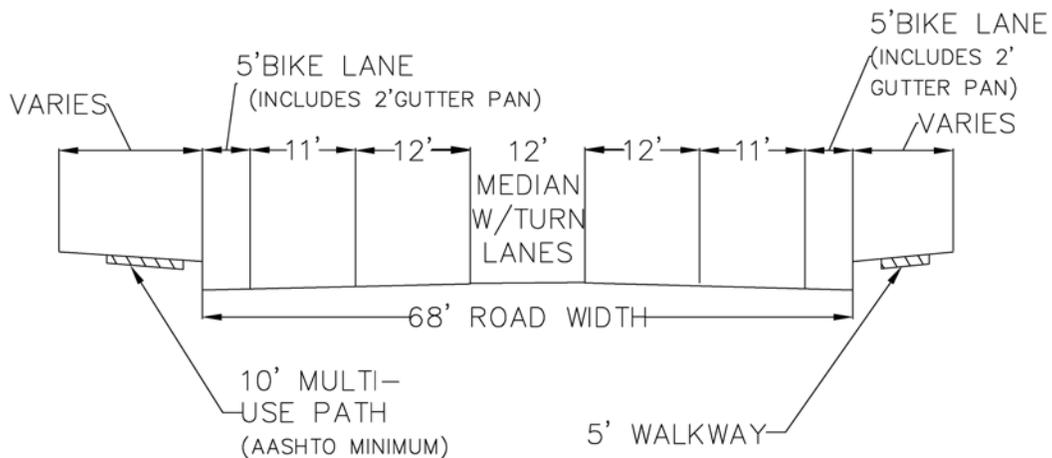
**Recommended Improvements**

As can be seen in the above analysis, if fourteen-foot shared use lanes are applied to Gallows Road, the Bicycle LOS would improve slightly but will still remain poor (“D”) for the route overall. To achieve the Fairfax County Master Plan goal of providing a safe and adequate bicycle facility, VDOT and Fairfax County should work together to incorporate changes in the road widening cross section template that could be applied to the rest of Gallows Road as future improvements are planned and implemented. The following recommendations and figures display changes that can be made to the existing right of way between the Metrorail station and Tysons Corner and they do not consider the addition of motor vehicle lanes.

The provision of bicycle lanes that measure five-feet from the curb face (as per AASHTO guidelines) on both sides of the roadway will improve the bicycle accommodation and signify the importance of this roadway segment as a part of the Northern Virginia bicycle network. The lanes define the space designated for motorists and bicyclists along this important corridor, promoting safety for both users. The bicycle lanes will also act as a buffer between automobiles and pedestrians utilizing the sidewalk and shared use path proposed for the corridor thus providing the added benefit of a higher pedestrian level of service along the corridor.

To achieve this cross section without acquiring additional right-of-way, the existing sixteen-foot median can be reduced by four feet to a twelve-foot width that is still within the AASHTO specified range of ten to sixteen feet. The outside travel lane adjacent to the bicycle lanes should be reduced to an eleven-foot width. If this portion of the road is expanded to a six-lane divided highway in the future, it is recommended that the median remain narrow enough to allow for five-foot bicycle lanes on each side of the road within the existing right-of-way.

PROPOSED SECTION—GALLOWS ROAD BETWEEN ROUTE 66 AND ROUTE 7



The Bicycle LOS of the proposed cross section is as follows. The existing Bicycle LOS is shown first.

**GALLOWES ROAD (ROUTE 650) BICYCLE LEVEL OF SERVICE (I-66 NORTH TO ROUTE 7)**

Route Name	From	To	Lanes (L) Thru #	Con.	Traffic Vol. (ADT) (vpd)	Pct. (HV) (%)	Post. Spd. (SPp) mph	Width Pave (Wt) (ft)	(Wl) (ft)	(Wps) (ft)	Pvmt Cond Lane (5..1)	Pvmt Cond Shdr (5..1)	Bicycle LOS Score	Grade (A..F)
Gallows Road	Route 66 Bridge	Cottage	4	D	16,000	5	35	12.0	0.0	0	3.0	3.0	4.65	E
11' Outside Auto w/5' Bike Lane (Bike Lane Includes 2' gutter pan)			4	D	16,000	5	35	16.0	5.0	0	4.0	4.0	2.83	C
Gallows Road	Cottage	W&OD Trail	4	S	16,000	5	35	12.0	0.0	0	3.0	3.0	4.86	E
11' Outside Auto w/5' Bike Lane (Bike Lane Includes 2' gutter pan)			4	D	16,000	5	35	16.0	5.0	0	4.0	4.0	2.83	C
Gallows Road	W&OD Trail	Elm Place	4	D	25,000	5	35	12.0	0.0	0	4.0	4.0	4.55	E
11' Outside Auto w/5' Bike Lane (Bike Lane Includes 2' gutter pan)			4	D	25,000	5	35	16.0	5.0	0	4.0	4.0	3.06	C
Gallows Road	Elm Place	Science App. Court	4	S	34,000	5	35	12.0	0.0	0	4.0	4.0	4.91	E
11' Outside Auto w/5' Bike Lane (Bike Lane Includes 2' gutter pan)			4	D	34,000	5	35	16.0	5.0	0	4.0	4.0	3.22	C
Gallows Road	Science App. Court	Gallows Branch	4	D	24,000	4	35	12.0	0.0	0	3.0	3.0	4.48	D
11' Outside Auto w/5' Bike Lane (Bike Lane Includes 2' gutter pan)			4	D	24,000	4	35	16.0	5.0	0	4.0	4.0	2.81	C
Gallows Road	Gallows Branch	Madrillon Road	4	S	24,000	4	35	12.0	0.0	0	3.0	3.0	4.13	D
11' Outside Auto w/5' Bike Lane (Bike Lane Includes 2' gutter pan)			4	D	16,000	4	35	16.0	5.0	0	4.0	4.0	2.60	C
Gallows Road	Madrillon	Route 7	4	S	24,000	4	35	12.0	0.0	0	3.0	3.0	4.83	E
11' Outside Auto w/5' Bike Lane (Bike Lane Includes 2' gutter pan)			4	D	16,000	4	35	16.0	5.0	0	4.0	4.0	2.60	C

As can be seen by the addition of the bicycle lanes, the Bicycle LOS can be improved with minor changes to the existing cross section that do not require additional land taking.

**Implementation Issues/Opportunities**

Fairfax County planners envision a boulevard atmosphere with tree lined medians and a bicycle and pedestrian friendly atmosphere; therefore it is critical that the bicycle facilities designed within this stretch of Gallows Road comply with AASHTO standards to provide a high Bicycle LOS. The cross section adopted for the road-widening project will become a template for all future improvements to the roadway. With this project currently on hold due to funding constraints, there is an opportunity for VDOT and Fairfax County to work together to modify the “template” for the Gallows Road corridor before the construction phase.

**Northern Virginia Regional Bikeway & Trail Network Study**  
**Interstate Bicycle Route 1**  
**Fort Belvoir Routing Analysis**  
**Fairfax County**

**Background**

Interstate Bicycle Route 1 (IBR 1) provides an important regional link between Woodbridge and Mount Vernon because it provides the shortest route through the Fort Belvoir military installation. With the closing of Fort Belvoir to non-military personnel, a key portion of Interstate Bicycle Route 1 through Northern Virginia was removed. This link followed Accotink Road, Woodlawn Road, and Pole Road and provided an alternative for bicyclists to riding on Richmond Highway (Route 1) through Fort Belvoir. Route 1 is currently an undesirable route because the road does not provide a consistent shoulder for bicyclists. Instead bicyclists are forced to ride in high volumes of traffic moving at greater than 45 mph. A description of the corridor and recommendations for alternatives to the closed route are provided below. Since the Interstate Bicycle Route designation is made by the American Association of State Highway and Transportation Officials (AASHTO). VDOT will need to work with this organization to have the IBR 1 officially rerouted.

**Existing Conditions**

The current official designated IBR 1 is as follows (closed portions bold) from Gunston Cove Road south of Fort Belvoir to Mount Vernon Highway north of Fort Belvoir:

- left onto Old Colchester Road, Route 611, 1.8 miles
- left onto Richmond Highway, Route 1, 0.1 miles
- right onto Telegraph Road, Route 611, 2.9 miles
- **right onto Accotink Road, Route 613, 0.4 miles [now closed]**
- **left onto Woodlawn Road, Route 618, 1.3 miles [now closed]**
- **left onto Pole Road, Route 622, 0.5 miles [now closed]**
- right onto Old Mill Road, Route 619, 0.5 miles
- right onto Richmond Highway, Route 1, 0.1 miles
- left onto Mount Vernon Highway, Route 235, 3.0 miles
- Mount Vernon Trail proceeds to Alexandria alongside Mount Vernon Highway



**Bicyclists Riding along Route 1 through Fort Belvoir**

**Existing Alternative Route:**

With the closing of Fort Belvoir, bicyclists must make a choice to either detour around the military installation entirely or to ride through it along busy Richmond Highway, the only route on which non-military personnel are allowed through Fort Belvoir. The Adventure Cycling Association directs riders along the following route to bypass Richmond Highway and the Fort Belvoir Military Installation between Telegraph Road and the Mount Vernon Trail:

- Straight at Telegraph/Beulah Intersection, Route 611/613, 3.0 miles
- Right onto South Kings Highway, Route 633, 1.5 miles
- Right onto Harrison Lane, Route 723, 0.9 miles
- Left onto Lockheed Boulevard, 0.6 miles
- Right onto Fordson Road, 0.7 miles
- Straight onto Boswell at Route 1/Fordson Intersection, 0.1 miles
- Right onto Schelhorn Road, 0.5 miles
- Right onto Sherwood Hall, 0.1 miles
- Left onto Parkers Lane, 0.5 miles
- Bear Left onto Collingwood Road, 1.3 miles
- Straight onto Mount Vernon Trail



**Lockheed Boulevard looking east.**

This detour takes a circuitous route around Fort Belvoir, adding 10.5 miles to the trip for bicyclists traveling to historic Mount Vernon and the base of the connecting trail. Additionally, portions of the route provide challenges to bicyclists due to steep grades, heavy traffic, narrow lanes, and 45 mph speed zones. The most problematic portion of the alternate route is South Kings Highway, which has multiple turn lanes, steep grades, a 45 mph speed limit, and a narrow travel way.

**IBR 1 FORT BELVOIR DETOUR BICYCLE LEVEL OF SERVICE**

Route Name	From	To	Lanes (L)		Traffic Vol. (ADT) (vpd)	Pct. (HV) (%)	Post. Spd. (SPp) (mph)	Width			Pvmt Cond Lane (5..1)	Pvmt Cond Shdr (5..1)	Bicycle LOS	
			Th #	Con.				Pave (ft)	(Wl) (ft)	(Wps) (ft)			Score	Grade (A..F)
Telegraph Road	Richmond Highway	Lockport Place	4	D	13,000	9	45	18.0	6.0	0	4.0	4.0	<b>3.44</b>	<b>C</b>
Telegraph Road	Lockport Place	Fairfax County Parkway	4	S	12,000	3	45	18.0	6.0	0	4.0	4.0	<b>1.97</b>	<b>B</b>
Telegraph Road	Fairfax County Parkway	Beulah Street	4	U	16,000	3	45	18.0	6.0	0	4.0	4.0	<b>1.56</b>	<b>B</b>
Telegraph Road	Beulah Street	Hayfield Road	4	U	16,000	3	45	12.0	0.0	0	4.0	4.0	<b>3.72</b>	<b>D</b>
Telegraph Road	Hayfield Road	South Kings Highway	4	U	19,000	3	45	12.0	0.0	0	3.0	3.0	<b>4.69</b>	<b>E</b>
South Kings Highway	South Kings Highway	Harrison Lane	4	U	11,000	6	35	12.0	0.0	0	3.0	3.0	<b>4.23</b>	<b>D</b>

Note: Remaining road network BLOS data unavailable due to lack motor vehicle statistics.

The existing conditions along the detour route around IBR 1 provided by the Adventure Cycling Association vary greatly. Telegraph Road has dedicated bicycle lanes up to Beulah Road. As

can be seen by the data shown above, the bicycle level of service (BLOS) deteriorates from a C/B to a D/E level once the bike lanes disappear from the network.

It should be noted that a June 1999 study commissioned by VDOT analyzed alternate routes to the current designated IBR 1 that would have decreased the mileage between Gunston Cove Road and Mount Vernon Highway by routing bicyclists onto Richmond Highway. The alternative routes were rejected due to the hazardous travel conditions observed along Richmond Highway between these two points. This portion of Richmond Highway has had a number of bicycling and pedestrian crashes along the highway.

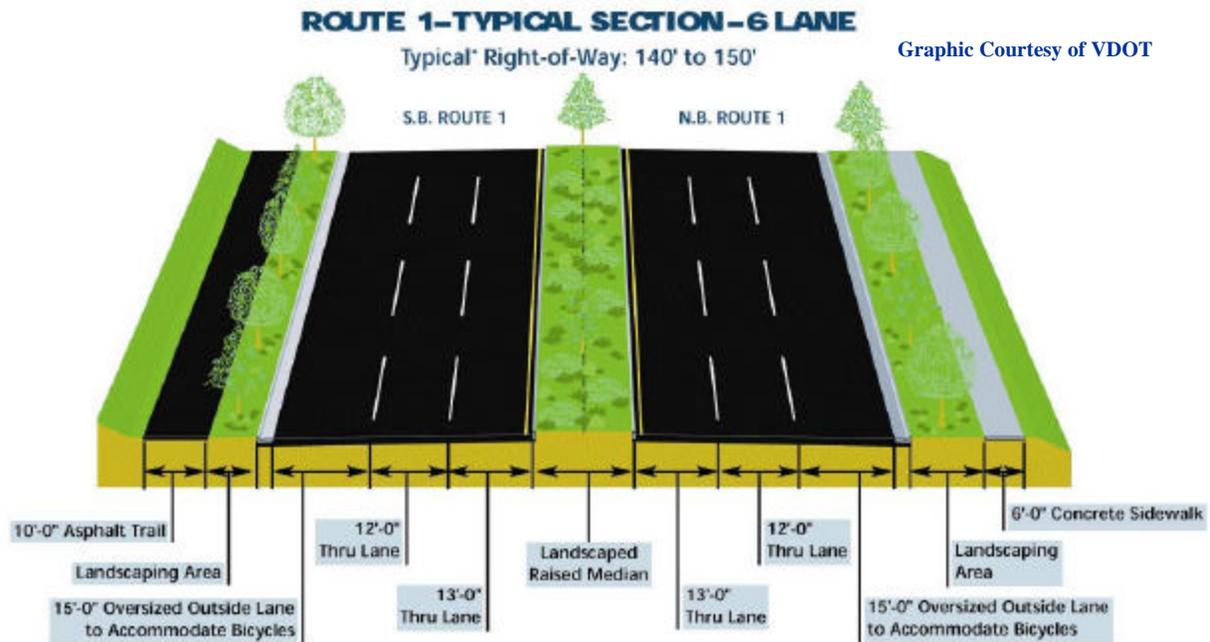
## **Recommended Improvements**

### **Richmond Highway (Route 1) Improvements**

Of the various options available, the preferred solution is to route IBR-1 along Richmond Highway in the vicinity of Fort Belvoir and provide improved accommodation for bicyclists along this route. This will provide the most direct route for bicyclists traveling through Fort Belvoir and for bicyclists traveling along IBR 1 towards Richmond or Washington, D.C.

To increase safety for roadway users and to increase carrying capacity, VDOT is currently performing a centerline study of Richmond Highway through Fairfax County to determine right of way requirements for a road-widening project. Current plans for the portion of the highway between Stafford County and the Interstate 495 interchange call for a six to eight lane divided highway, sixteen-foot median, and a ten-foot wide multi-use trail on the southbound side of the road, and fifteen-foot wide outside lanes on the north and south sides of the road to accommodate bicycles (See Figure 1).

It is expected that this project will take approximately twenty years to proceed from the right of way study to construction. Upon completion of the project, the stretch of Route 1 through Fort Belvoir should be designated IBR-1.



**FIGURE 1**

**Implementation Issues/Opportunities**

Due to the closing of Fort Belvoir to the public and the unsuitable travel conditions along Route 1, there is a need to address this issue as soon as possible. Congress had previously secured funding for a bicycle facility through Fort Belvoir (located on military property). The funding was returned to the federal government once the base was closed to the public. There is widespread political support at the local and federal level to increase travel opportunities around Fort Belvoir for all users. VDOT should work with these officials to secure funding to perform an in depth analysis of these alternatives and follow up the study with a physical improvements project.

In the long term, VDOT should work with AASHTO to designate Richmond Highway between Telegraph Road and Mount Vernon Highway as the official long-term IBR 1 to ensure that it remains an important part of the planning, design, and construction process of any future improvements to the roadway.

**Northern Virginia Regional Bikeway & Trail Network Study**  
**Centreville Road - Route 28**  
**From Manassas to Fairfax County Line**  
**Cities of Manassas and Manassas Park**  
**Prince William County**

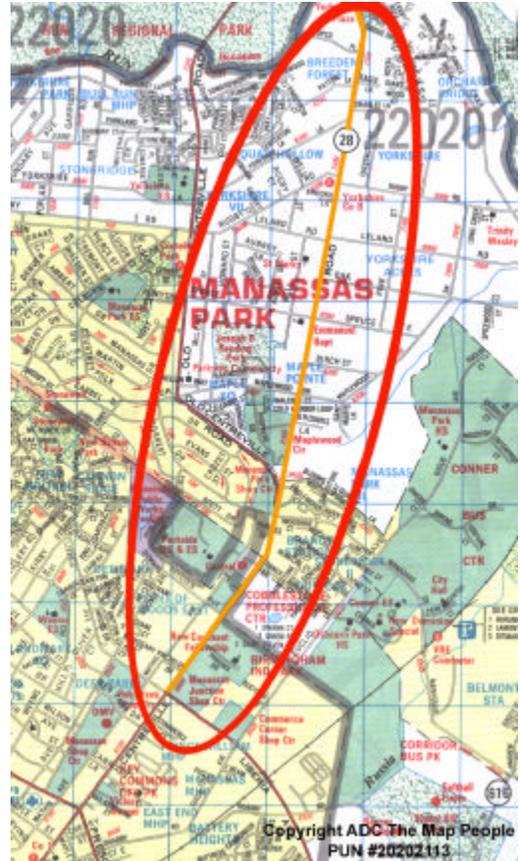
**Segment length = 3 miles**

**Background**

This route would serve the region by providing access from Manassas through the City of Manassas Park to an existing shared use path in Fairfax County. It would also serve as the major regional bikeway connection between Manassas and Centreville.

The area of Prince William County north of Manassas Park has scattered commercial establishments along Route 28 and low-density residential neighborhoods surrounding the corridor. The level of commercial development increases substantially within the city limits of Manassas Park and the adjacent area. As growth and commercial development have increased, Route 28 has been widened to meet increasing travel demand, however, pedestrian and bicycle facilities have not been regularly included in these widening projects. While limited attempts have been made to include sidewalks in the area of redevelopment, only disconnected sidewalk fragments exist on either side of the highway.

In this region, the Bull Run Creek stream valley creates a barrier between Prince William and Fairfax Counties. For bicyclists and pedestrians, the only



Centreville Road in Prince William County north of Manassas Park.

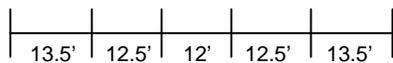
existing connection between the two jurisdictions is in the Town of Occoquan, approximately 17 miles to the southeast.

Opportunities for establishing alternative north-south regional bikeway connections are extremely limited. Other than Route 28, only two crossings exist through Bull Run: Old Centreville Road/Ordway Road (which is very narrow), and Old Yates Ford Road ten miles to the

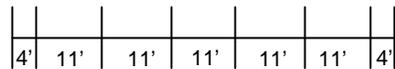
south. Bicycle facilities are not planned by either jurisdiction for these corridors.

**Existing Conditions**

This analysis addresses the three-mile section of Route 28 between Liberia Avenue and the Fairfax County line. It is predominately a four-lane highway with a 12-foot continuous center-turn lane. Approximately 70% of the corridor lacks any type of pedestrian or bicycle facility. Numerous commercial properties have parking lots that extend to the curb of the highway and contain multiple driveway entrances. In addition, several buildings on both sides of the highway are set back only a few feet from the curb. Throughout the corridor utility poles and signs crowd the road’s edge. In other areas steep grades extend from the edge of the roadway making the placement of a sidewalk or shared-use path challenging. The posted speed limit for this portion of Route 28 is 45 MPH. The average traffic volume is 42,000 vehicles per day with trucks composing a five percent share of this volume. The total width of pavement is 64 feet, containing four travel lanes of varying widths (as depicted in the existing cross section drawing below) two in each direction, separated by a continuous center-turn lane.



**Existing Roadway Cross-Section**



**Recommended Roadway Cross-Section**

The current Bicycle LOS is low E on a scale of A to F. Numerous footpaths along the corridor indicate that a number of pedestrian and bicyclists travel this route despite the lack of facilities. (See photo to the right).



Centreville Road in Manassas Park where paths are worn by pedestrian travel in the absence of sidewalks and or sidepaths.

**Recommended Improvements**

This is one of the most highly constrained corridors of all the demonstration project study locations, yet bicycle access along this corridor is very important both from a regional and local standpoint. Certainly, any future construction in this corridor (whether it is commercial or road construction) should include a minimum of 10-foot wide shared-use paths on both sides, since it is likely that bicyclists will share this space with pedestrians. (The County plans to widen the road from a four-lane to six-lane facility with 10-foot shared use path in the CLRP year 2025.) This will require a major investment due to the need for additional right-of-way and severe limitations on the amount of parking in front of businesses along the corridor.

In the meantime, bicycling conditions can be improved by restriping the existing 64 feet of pavement with 11-foot wide travel lanes and a four-foot wide shoulder on each side. This area will give bicyclists a small amount of protected area on the sides of the road, and will also

improve pedestrian conditions by increasing the distance between vehicles and pedestrians who walk along this road. The 11-foot lanes should adequately accommodate the five percent truck volumes on this facility. This shoulder should not be signed as a bike lane since it will not meet the minimum distance of five feet from the curb face established by the AASHTO Guide. The improvements could include share the road signs that would alert motorists to the presence of cyclists.

A more detailed study will be needed to determine the best way to provide trail connections alongside this congested corridor, identify ways to provide bicycle access through intersections and interchanges, and to examine traffic movements from the numerous driveways along this intensely developed corridor. A more detailed future analysis should also make recommendations with respect to right-of-way, and gauge community support for changes to the roadway and streetscape.

**Alternate Route- Euclid Avenue**

In addition to the above improvements on Route 28, an alternative route should also be provided along Euclid Avenue between Liberia Avenue and the City of Manassas Park. This route does not serve as many destinations as Route 28, but provides a more comfortable alternative for many bicyclists traveling between Manassas and Manassas Park.

**Current and Future Bicycle Level of Service Conditions**

The Bicycle LOS on this portion of Route 28 is a low E, on a scale of A to F. This is due to the high volumes of traffic, lack of shoulders or bike lanes and width of outside travel lanes. If the restriping recommended above is implemented and four-foot shoulder added, the LOS would improve from E to D for this segment of the corridor.

Route Name			Lanes (L)		Traffic Vol. (AADT)	Pct. (HV %)	Post. Spd. (SPp) mph	Width of Pavement			Occu. Park. (OSP) (%)	Pvmt. Cond. (PC <sub>5</sub> ) (5..1)	Bicycle LOS	
			Th #	Con.				(Wt) (ft)	(Wl) (ft)	(Wps) (ft)			Score (1...7)	Grade (A..F)
Route 28 (Centreville Road)	Liberia Ave.	Manassas Drive	4	S	42000	5	45	13.5	0.0	0	0	4.0	<b>5.26</b>	<b>E</b>
		Potential Future Condition	4	S	42000	5	45	15.0	4.0	0	0	4.0	<b>4.36</b>	<b>D</b>

**Key Issues for Implementation**

- Although there are no easy solutions for this corridor, it is significant given lack of alternatives.
- The ultimate improvement for this corridor will be costly and cannot be implemented in the near-term.
- Interim recommendations require narrowing travel lanes.
- A detailed feasibility study and citizen involvement will be needed.
- An opportunity exists to connect to an existing nine-foot shared-use path that extends south along the east side of Route 28 ending just north of the Prince William County line. This would need to be coordinated with Fairfax County.

## **Summary of Additional Routes Requested by Local Jurisdictions**

The 16 paragraph summaries below describe potential solutions for corridors that have not undergone a detailed field analysis. A next step is for the state and local jurisdictions to work together to determine appropriate facilities for each corridor.

### **ARLINGTON**

#### **Lee Highway (Route 29) Fort Meyer Drive to Spout Run Parkway/Kirkwood Road**

Arlington County has suggested that the vehicle travel lanes on this section of Lee Highway could be narrowed to 10 or 10.5 feet to provide space for a shoulder or designated bicycle lane. Though there has been support for narrowing lanes in the county on other collector streets, narrowing the lanes on this major 6-lane roadway running through the city may have negative impacts on traffic congestion and safety. These impacts would need to be studied in detail. In addition, bicyclists in this section of Arlington are already provided with the Custis Trail, which is a regionally significant facility running parallel to I-66. It is recommended that this project be studied at the local level.

#### **Grade separated crossing of I-395 between the Arlington View area and Army Navy Drive**

This project will connect neighborhoods in the Columbia Pike area with neighborhoods near Arlington Ridge Road and Army Navy Drive west of Pentagon City Mall and serve as a valuable I-395 crossing for long-distance riders in the region. Arlington County has been working with land owners in the area to resolve access and right-of-way issues.

### **ALEXANDRIA**

#### **Van Dorn Street from I-95 extending to Route 7 (King Street) and continuing through to connect to Army Navy Drive**

The land use along this four-lane corridor includes Landmark Mall, commercial strip centers, large apartment complexes, and industrial buildings. There are many curb cuts on the south section, so restriping the roadway lanes to provide space for bike lanes may be a feasible solution. However, there is already a shared-use path leading from the Van Dorn Street Metro into Fairfax County on the east side of the street. The Eisenhower Avenue and Duke Street interchanges would also be a major obstacle along this corridor that would require more detailed study.

## FAIRFAX COUNTY

### **Route 123 between Tyson's Corner and Vienna**

This regionally-significant connection between an established town and the major employment center of Tyson's Corner provides an opportunity for potential on-road and off-road bicycle facilities. Both types of facilities are shown on the Fairfax Countywide Trails Plan Map. One end of the Route 123 segment is at the Route 7 interchange at Tyson's Corner. The part immediately south of this interchange may have space for a shared-use path on both sides, depending on available right-of-way. The beginnings of such a path already exist on the east side of the roadway where several disconnected pieces of shared-use path have been constructed by developers. The west side of the roadway has no shared-use path, but it has a service road inside the town limits of Vienna. A potential path on the west side could perhaps utilize this service road. The lanes of the roadway itself may currently be wide enough to narrow and add bike lanes, or adding extra shoulder may be possible if the curb is moved further out.

## FAIRFAX CITY

### **GMU to Burke VRE station**

The City of Fairfax expressed interest in improving bicycle connectivity between George Mason University and the Burke Virginia Railway Express Station. A study to determine a more direct route than the current connection between the two destinations will require a large amount of field work to analyze the many different potential routes. It should also involve public participation from the local and regional bicycling community and residents of the local neighborhoods.

## FALLS CHURCH

### **Lee Highway (Route 29) through the city limits**

Providing bicycle facilities on this four-lane highway will be challenging. Much of the roadway passes by commercial establishments with heavy vehicle traffic, numerous driveway crossings, and narrow sidewalks. There is little room to add bicycle lanes, and there appear to be constraints to widening either sidewalk to create a shared-use path. However, this is a regionally significant facility that would serve as a direct connection between Fairfax County, Falls Church, and Arlington. A more detailed study will be needed to determine the best accommodation for bicyclists along this route.

## HERNDON

### **Elden Street between Van Buren Street and the Fairfax County Parkway**

Elden Street connects downtown Herndon and the Washington and Old Dominion Trail to the Fairfax County Parkway Trail and Reston. This short four-lane segment passes through a commercial area and may have the potential to support a shared-use path on the north side of the roadway. The sidewalk could be widened to 10 feet along some properties and it may be possible to add the path in other areas. There may be more restrictions to the right-of-way on the south side of the street where the town is likely to plan for a four-foot sidewalk; however the feasibility of including a shared-use path and/or on-street bike lanes should be pursued. This segment is currently a part of the VDOT East Elden Street Improvement Project, which is in the concept phase.

### **Dranesville Road from the town line to Herndon Parkway or Park Avenue**

Dranesville Road connects Route 7 in the Sterling area with Herndon. North of the Herndon town line, Dranesville Road already has bicycle lanes and a shared use path. This cross-section could be continued into Herndon, providing access to the local elementary school and surrounding neighborhoods.

### **Any additional north-south connections to complement Fairfax County Parkway trails**

North-south connections in the Herndon area are important for regional bicycle travel because of the high residential and employment density in the area and the access they would provide to the Washington and Old Dominion Trail. Currently, the Fairfax County Parkway Trail and the bike lanes on Dranesville Road serve this purpose; however, a more comprehensive set of routes could be established. A study of these routes would require a more detailed field work and should involve public participation from the local and regional bicycling community and residents of the local neighborhoods.

## VIENNA

### **Route 123 from Park Street to town Limits (on to Tyson's Corner)**

This facility would serve as an extension of the bicycle facilities that are recommended between the Vienna Town Limits and Route 7 in Tyson's Corner (See above under Fairfax County). The road is narrower and serves more dense residential and commercial areas within Vienna, so it may not be possible to continue the shared-use paths far into the town. However, the four-lane road may have room for bicycle lanes. Alternatively, a route through neighborhood streets may also be possible and may complement a residential neighborhood route that is being explored as an alternative to using Route 123 in downtown Vienna.

### **Alternative to Maple Avenue (Route 123) for bicyclists riding between Tyson's Corner and the City of Fairfax**

Though some resistance to designating bicycle routes through Vienna neighborhoods exists, this route is an important regional connection between central Fairfax County and Tyson's Corner. This connection is made more important by the constrained right-of-way and resulting resistance to providing bicycle facilities on Route 123 within downtown Vienna. A regional connection to the south of this segment may therefore need to utilize local residential streets. In choosing a route, the town has solicited feedback from the local neighborhood residents. Detailed fieldwork will also be needed to analyze the many different potential routes and input from the local and regional bicycling community.

## **LOUDOUN COUNTY**

### **Route 7/Cascades Parkway Interchange**

It appears this interchange has adequate space to accommodate a shared-use path. The north side of Route 7 may offer more opportunities for crossing the on- and off-ramps, so it is likely that the path should be added to that side. However, it will be important to consider on which side of the highway the future Route 7 trail will be constructed. Crossings from one side to the other should be facilitated with grade separations. The Cascade Parkway overpass through the interchange has a wide sidewalk on the east side of the bridge. Future shared-use paths should be connected to this sidewalk to provide north-south bicycle access through the interchange. Greater detail on improvements in this area are addressed in the Loudoun County Bicycle and Pedestrian Mobility Master Plan.

### **Proposed Interchanges at Route 7/Route 28 and Route 7/Loudoun County Parkway**

Facilities should be incorporated into the designs of these proposed intersections to allow bicyclists to travel through them conveniently and safely. The Loudoun County Bicycle and Pedestrian Mobility Master Plan includes recommendations regarding the design of these interchanges.

## **PRINCE WILLIAM COUNTY**

### **Opitz Boulevard/Smoketown Road from Prince William Parkway to Route 1**

This section of four-lane, divided roadway serves the Potomac Mills Mall area, a public high school, and several nearby neighborhoods. The eastern part of the segment goes through an interchange with I-95. Prince William County is considering a shared-use path and would like to analyze which side of the

roadway would be safer and more convenient to accommodate bicycles. There may be more roadway intersections and curb cuts on the north side of the roadway, so it may be desirable to include the path on the south side. This would also serve the high school. More analysis will be needed to determine the most appropriate alignment. This analysis should also consider roadway crossings to access the trail and the potential for having the trail switch sides and possibly use the roadway median.

## **MANASSAS/MANASSAS PARK**

### **Euclid Avenue from Liberia to Manassas Drive**

This route has regional significance because it passes a waterpark and a public high school. It has four-lanes and moderate to heavy traffic volumes. There may be enough right-of-way to provide a shared-use path on the west side of the roadway on the north half of the segment. This path could switch to the east side of the roadway at the high school before continuing south to connect to the trail on Liberia Avenue.

### **Signal Hill Road from Liberia Avenue to Signal View Drive; Signal View Drive from Signal Hill Road to Manassas Drive**

The Signal View Drive area is likely to experience a large amount of development in the future and should therefore be designed to accommodate bicycle travel. Because the adjacent properties have not been developed, shared-use paths could be constructed on both sides, depending on the number of access points (curb cuts) that are planned. If a shared-use path can only be added to one side, access to Signal Hill Park should be included in the share-use path design.

## **APPENDIX B:**

### **LATENT DEMAND METHOD**

In March 2002, a bicycle travel demand analysis for the Northern Virginia Regional Bikeway and Trail Network Study was conducted. The analysis was conducted on proposed regional bikeways, specifically measuring “latent” travel demand – or the relative amount of bicycling that would occur if riding conditions were comfortable. This involved identifying bicycle trip generators – parks, schools, high employment areas, park-and-ride lots, transit stations, shopping areas, and other high volume destinations. The analysis also included population densities. This appendix explains the basic theories of bicycle travel demand analysis, focusing on the Latent Demand Method that was employed for this study.

The Latent Demand Method provides a picture of potential demand throughout a transportation network. By contrast, traditional four step travel demand models don’t generally model non-motorized modes for a variety of reasons among them the prohibitive cost of model calibration.

In order to perform a travel demand analysis for the bicycle mode, a methodology must be employed that recognizes the unique impediments to that mode. Unlike automobile travel, bicycle travel often does not occur due to a number of impediments, one of which is relatively poor accommodation of bicyclists within the existing transportation network. Consequently, existing bicycle counts generally do not indicate the level of potential bicycle trip activity on a roadway network. Therefore, alternative or surrogate measures of assessing bicycle trip activity are needed.

#### **Methods of Assessing Bicycle Trip Activity**

There are three primary methods of assessing bicycle trip activity. The first method is documenting revealed demand. This is accomplished by simply counting the existing number of people bicycling on the roadways or off-road pathways. A second method is to identify, map, and evaluate key bicycle generators or attractors. In practice, this method tends to focus on major bicycle trip attractors. The third method is to assess the latent demand throughout the study area. Assessing latent demand considers both existing activity and pent-up bicycle demand. It also enables planners and engineers to anticipate and plan for future bicycle travel needs. The following paragraphs briefly describe each of these three methods and their advantages and disadvantages.

### **Revealed demand**

This method consists of compiling counts of existing bicycles on the roadways. Its usefulness is limited to areas that already have an extensive bicycle network that provides an overall high-quality bicycling environment. This method is not usable for the vast majority of U.S. metro area transportation networks, due to their generally poor bicycle accommodation.

### **Evaluation of Key Bicycle Trip Generators and/or Attractors**

Until recently, this method has been the most common method of estimating bicycle travel demand. However, it has two major problems: the limited number of key bicycle attractors it considers, and the fact that it generally focuses only on attractors – therefore only one end of the bicycle trip is considered.

The first problem with this method is that it tends to focus on key bicycle trip attractors such as schools, parks, and neighborhood retail centers, and thus only a fraction of the existing and potential bicycle trip attractors are represented. In fact, virtually every residence, every business, and every social and service establishment in a study area is a key bicycle trip generator or attractor. Thus this method, in practice, fails to account for that fact.

The method's second shortcoming is directly related to the first. Since the method focuses on key attractors, only one end of the bicycle trip – the destination, is quantified. This is a problem because the method does not account for the production (or supply) of trips available to that attractor. For example, a particular park may have many amenities, and hence exhibit a high trip attraction rate, but if it is in a rather remote area (i.e., the surrounding population density is very low) the actual bicycle trip activity (or interchange) between the attractor (park) and generator (population) would be low. Consequently, the method does not account for the bicycle trip interchange reality that exists among generators and attractors throughout the study area.

### **Latent Demand**

The method that quantifies both ends of the bicycling trip as well as considers all key generators and attractors in a study area for both existing and potential trips is the Latent Demand Method. The Latent Demand Method is a logical extension of the second method, and it is rapidly becoming the method of choice for metropolitan areas throughout the United States. Numerous U.S. metro areas are using this method to estimate the potential of roadway corridors to serve bicycle and/or pedestrian trip activity.

The Latent Demand Method is essentially a simplified gravity model, based upon a theory similar to that used in the prevailing four step Urban Transportation Planning System-based travel demand models throughout the

United States. The following sections outline its theory and technical application in a Geographic Information System (GIS) transportation planning environment.

### **The Latent Demand Method**

Travel patterns in a metropolitan area are well described by Newton's law of universal gravitation as applied to trip interchanges. This relationship essentially reflects that the number of trips, regardless of travel mode, between two areas is directly related to the number of trip productions (e.g. population residences) in one area and the number of trip attractions (e.g., workplaces, shopping opportunities, schools, etc.) in the other (destination) area. The relationship also shows that impedances (e.g., travel distance and/or time between the areas, conditions of the travel environment, etc.) play a significant role in reducing the amount of trips made between those areas.

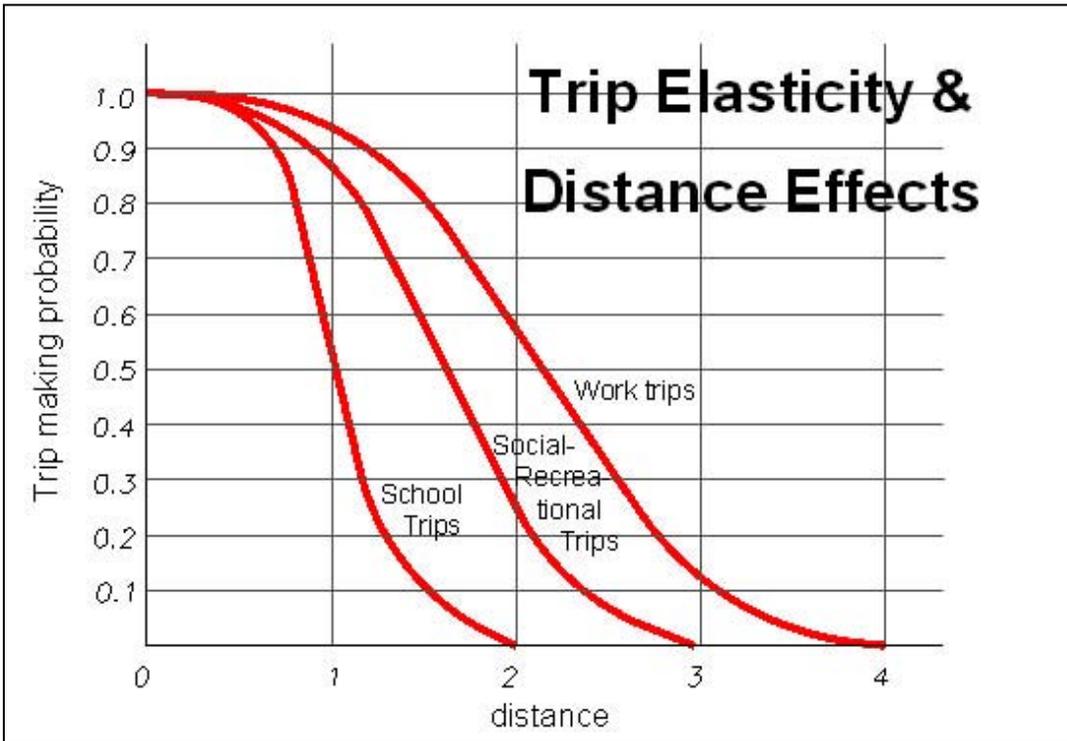
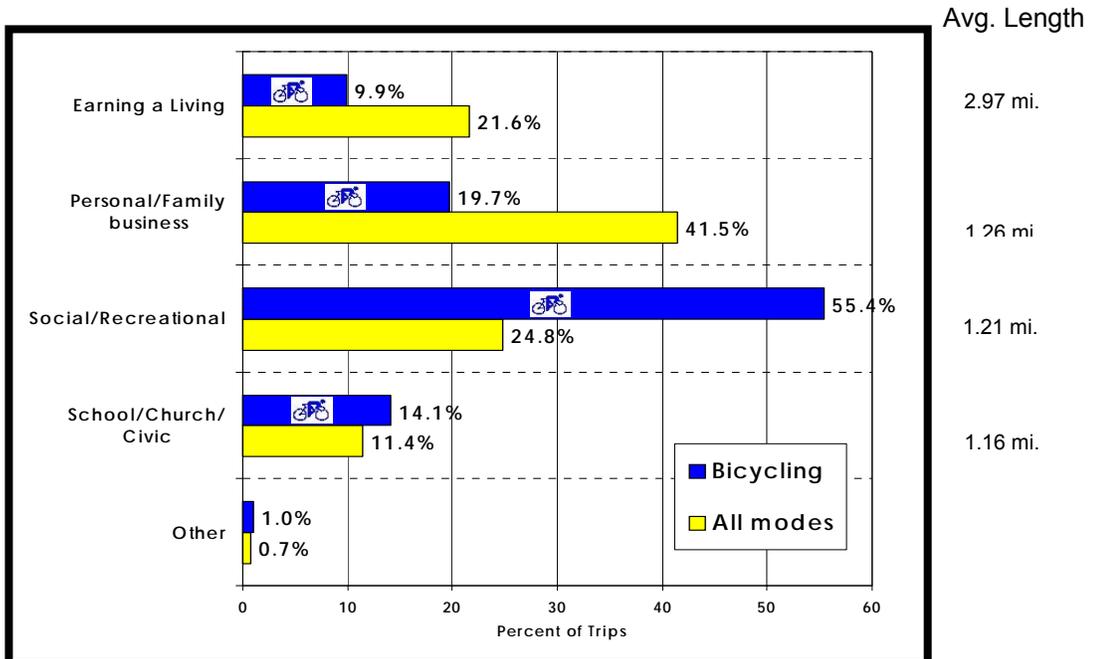


FIGURE 1 Typical Trip Making Probability (impedance effects) due to distance



Source: FINAL REPORT, The National Bicycle and Walking Study Transportation Choices for a Changing America, Publication No. FHWA-PD-94-023, National Personal Transportation

FIGURE 2 Bicycling by Trip Purpose

Bicycling activity patterns can be described by a similar relationship. However, unlike those for the automobile travel mode, the impedances to the bicycling mode play a greater role. For example, the distance between trip origins and destinations affects bicycling more dramatically than it does for automobile travel. Additionally, the condition of the bicycling environment affects whether a bicycling trip is made and how far, and what route, a person is willing to travel. Furthermore, depending on the purpose of the bicycle trip, the carrying, or “payload” capacity plays a role in not only the bicycle travel distances but also whether or not a bicycling trip is even made.

Impedances are different for different trip purposes. For example, people are typically willing to bicycle a greater distance to work than they are to simply pick up a convenience item at a neighborhood store. This phenomenon is reflected in national survey data, as depicted for three trip purposes in Figure 1. Essentially, the trip making probability varies according to the distance between origins and destinations, and it also depends on the purpose of the trip.

The Latent Demand Method accounts for the above outlined characteristics of bicycle travel in an area. While it is not a full and rigorous four-step travel demand model, it includes the trip interchange relationship in a gravity model trip distribution analysis but is conducted with a corridor focus. It models trips according to the four general utilitarian trip purposes identified in the National Personal Transportation Survey (NPTS) shown in Figure 2. The Latent Demand Method is an analysis of the entire region, using a corridor-based, geographic information system (GIS) algorithm to quantify relative potential bicycle trip activity.

The Latent Demand Method is an effective analysis tool for assessing bicycle travel demand. It can:

- include all key trip generators and attractors
- quantify the potential trip interchange between key generators and attractors
- recognize that different trip types account for differing shares of the total trips
- estimate the trip making probability of each trip type as a function of distance and
- be employed to assess the latent demand for any roadway or off-road trail network

As previously outlined the impedances to bicycling as a transportation mode play a large role in the probability of a bicycle trip occurring. One of the significant impedances, the effect of motor vehicle traffic, is assumed not to exist for the purpose of calculating non-linked, or latent trips. This assumption is

$$LDS = \sum_{n=1}^4 TTS_n \times \frac{\sum_{n=1}^4 (GA_n \times \overline{TG}_n)}{(GA_n \times \overline{TG}_n)} \times \left[ \overline{TG}_n \sum_{d=1}^I P_{nd} \times ga_n \right]$$

n = bicycle trip purpose ( e.g., work, personal/business, recreation, school)  
 TTS = trip purpose share of all bicycle trips  
 GA = number of generators or attractors per trip purpose  
 $\overline{TG}$  = average trip generation of attractor or generator  
 P = effect of travel distance on trip interchange, expressed as a probability  
 ga = number of generators or attractors within specified travel distance range  
 d = travel distance range from generator or attractor  
 LDS = Latent Demand Score

**FIGURE 3 The Basic Latent Demand Assessment Algorithm**

based on the premise that if motor vehicle traffic was not present, the “latent” bicycle trips would become “revealed” trips.

Latent bicycle travel activity is directly related to the frequency, magnitude, and proximity of trip generators and attractors to a roadway segment. The Latent Demand Method process takes these “snapshots” of the potential trip activity for all key attractors and generators throughout the study area and essentially assembles them into a composite. Figure 3 shows the basic mathematical expression of this GIS-based region-wide model.

# APPENDIX C: SUMMARY OF PUBLIC COMMENTS ON THE DRAFT STUDY REPORT

Prepared 11/10/03

Public comment period: September 29 – October 27, 2003

Three public meetings were held to review public comments on the draft study report and draft route network maps:

- **Fairfax County:**  
Thursday, October 9, 2003, 6-9 PM  
Sunrise Valley Elementary School, 10824 Cross School Road, Reston
- **Arlington County and Alexandria:** Tuesday, October 14, 6-9 PM  
Arlington County Board Room, 2100 Clarendon Blvd, #300 (Courthouse Metro)
- **Prince William and Loudoun Counties:** Thursday, October 16, 6-9 PM  
Prince William Central Library, 8601 Mathis Avenue, Manassas

In addition, exhibits of the bicycle network were displayed at the Loudoun County Government Center Building from Friday, Oct. 17-27.

## Summary Statistics

Public meeting attendance	37
Comments submitted on-line	8
Comments made on comment cards	13
Phone comments	<u>1</u>
Total:	59

## **Comments made on Comment Cards:**

- Very comprehensive with plenty of good observations and recommendations.
- I urge VDOT to adopt this plan and continue to provide the means to implement these suggestions.
- As a cyclist, I encourage the creation of well designed and high quality trails.

- Very pleased to see a regional plan for non-motorized trails from VDOT. Good report, and the final recommendations and proposed trails make good sense. The analysis seems very thorough and the consultant was a pro. As a citizen, I'd like to see more emphasis placed on this study by the state and local governments. I'd also like to approach land-use planning with people-friendly concepts as done in this report. Good job. I will promote this through my local elected representatives.
- 12 feet should be the minimum for all trails. Sharp turns and especially blind turns should be eliminated from bike paths. Bicycle access across major barriers (66, American Legion Bridge, Wilson Bridge, etc.) is critical. All bridges and roads should make bicycle use easy.
- There are some very large gaps in the proposed network: North/South along Army Navy Drive in Arlington, North/South through Alexandria, between 617 and 7 in Fairfax, both directions in McLean, most of Fairfax County, etc. There should be a trail along the G W Parkway north of Roslyn. There are way too many narrow roads in Northern Virginia. Maryland does a much better job.
- Bike lanes on roads are not needed, just roads that are wide enough. Access across and along the major barriers is the most critical need.
- Is there a separate study somewhere recommending driver education with respect to bicycles?
- There needs to be more of a focus on "errand" types of trips. Shopping centers should be required to install bike racks just as they must have handicapped parking.
- More focus needs to be made on re-stripping secondary roads to make a wider shoulder.
- VDOT should work with homeowner associations to share the cost of trail construction and maintenance.
- I'd like a way to connect the popular route along Beach Mill Road in Great Falls to the Algonkian Parkway in Loudon County.
- If it were put up to me, all natural gas pipeline and similar right-of-ways would have bike paths.

## Comments/Questions at Public Meetings:

Question: How will this be presented to local governments?

VDOT: Local Workgroup members will be responsible for taking the Study to local governments.

Comment: Let me make a pitch for having VDOT make these presentations, it carries more weight.

VDOT: We will consider your request, but still feel that our Workgroup partners should take the lead.

Comment: This would be very informational for a City Council. Would put the work done by internal departments into a regional context, and would reinforce what is being done locally.

Comment: It would be helpful to maintain statistics on how much money it takes to support a "car mile". Bikeways will save transportation money.

Question: Who originally came up with the idea for this study?

VDOT: Transportation Planning Section in the VDOT-Northern Virginia District office based on requests received from many bicyclists.

Question: From the State level, does VDOT intend under its area of influence to provide bikeways? Will VDOT adopt this plan and implement?

VDOT: We are looking at an overall policy for implementing projects with each road improvement project. This study provides added information regarding corridors that are regionally significant. However, as a Study (and not a Plan), it's not something that VDOT will adopt - rather it will help local governments choose high priority projects for implementation.

Question: If we are advocates, how can we help our local government understand this is important?

Toole Design: You can point to the many successes in the region. The study also provides some good statistics you can use.

Comment: The Tri-County Parkway should include bike facilities from the start. The problem is, we don't hear about the design process until it's over.

VDOT: It is true that the first opportunity that the public gets to see project design is at 40% completion. However, the design is guided by locally adopted plan and in consultation with local staff.

Question: Did you look at alternatives to VA 28?

VDOT/ Toole Design: Yes, we looked at alternatives, however nothing was as direct as 28, also 28 has many destinations and already experiences considerable pedestrian traffic.

Comment: You should look at Euclid as an alternative. It has 2 schools on it.

Question: What does it mean to be in a severe non-attainment area?

VDOT: (Explained Clean Air Act, and situation in metro area)

- Comment: We should look at the economics of air quality – bicycling is a quality of life issue.
- Comment: There should be a connection from the Burke Center Trail to the VRE station. Bike lockers are needed along existing trails and at the VRE station.
- VDOT: It must be within VDOT’s right of way in order for VDOT to install additional bike lockers.
- Comment: Need to improve intersection safety at 659 – Belmont Ridge Road.
- Comment: Maintenance is very important.
- Comment: Need to include bike projects in the 6-year plan.
- Question: What can be done to change statutory obstacles?
- VDOT: The policy working group is looking into this issue and will issue findings in late 2003/early 2004.
- Question: Are priorities identified in the Plan?
- VDOT: No, priorities should be identified by local governments, from the candidate routes identified in the study.
- Question: What do you (Fairfax County representative) plan to do with the results of this Plan?
- Fairfax County Representative: We have been implementing trail and restriping projects for some time now. We have a separate prioritization process, and have used it in the past to fix small gaps in the system. Funding is tighter and tighter in recent years, however. This Plan will help us work with VDOT to implement regional projects.
- Comment: Plans that build better communities are things that people will vote for. They didn’t vote for the Bond issue because it was mainly about building big roads.
- Comment: It would be helpful to present this to the FFX County Board of Supervisors.
- Question: Question about Bicycle LOS formula, its application.
- VDOT/ Toole Design: (Explained the use of Bicycle LOS, as described in the study.)
- Question: How are these gaps going to be connected to adjacent developments? Like across private land, i.e. connection between AOL and the W&OD Trail.
- VDOT: Gaps will need to be addressed one project at a time, working directly with those land owners to close the gaps. Each project is important in this respect, and contributes to the continuity of the whole network.
- Question: A few years ago, I tried to get a road restriped with bike lanes. It seemed like a foreign concept to VDOT. Is the atmosphere changing?
- VDOT: There may have been very important safety reasons for not taking your suggestions – don’t know the particulars of your particular

case. However, there is more interest within VDOT for providing facilities for bicycles whenever possible.

Question: How will this Plan be implemented?

VDOT: Local governments identify priorities in the Six Year Plan. Local jurisdictions need to identify bicycle projects, if that is a priority. In Arlington, the priorities have been bicycle and pedestrian facilities.

Question: What is the standard width of a shared use path?

VDOT/Toole Design: Currently, VDOT's standard is 10' wide, the same as AASHTO.

Question: When does the public comment period end?

VDOT: October 27, 2003

## Comments Submitted Electronically

From Dana Kauffman, Lee District Supervisor, Fairfax County Board of Supervisors  
Submitted November 13, 2003

Riding and commuting opportunities that will be provided through an interconnected and seamless network of bikeways across Northern Virginia are a welcome change for our region. I am in support of this effort.

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Comments of the Washington Area Bicyclist Association  
on the Northern Virginia Bikeways and Trails Network Study  
Submitted October 27<sup>th</sup>, 2003

Below please find the comments of the Washington Area Bicyclist Association (WABA) on the Northern Virginia Bikeways and Trails Network Study. WABA is a 501c3 safety and educational organization that represents the interests of over 6,700 cyclists in the National Capital region, 2,100 of whom live in Virginia.

WABA would like to commend the Virginia Department of Transportation (VDOT) for commissioning and completing this exhaustive study of the cycling needs of northern Virginia. By seeking to create a coherent and connected bicycle network, VDOT is embracing bicycling as a relevant transportation mode that is part of the solution to the transportation problems facing northern Virginia today.

However, while the completion of the study is a crucial step toward encouraging safe and convenient bicycling in northern Virginia, much work remains to be done. To realize the goals and recommendations of the study will require on-going communication and coordination between VDOT bicyclists, local transportation agencies and elected officials on bicycle transportation issues. The importance of such coordination is emphasized in the study's recommendations and will ensure that gaps within the network are eliminated and all roadway projects adequately and appropriately accommodate bicycling and walking. We encourage VDOT to present this document to locally elected officials and local transportation departments so that the efforts may be coordinated.

Thank you for your time and for your consideration of our comments. Congratulations on a job well done.

Sincerely,

Eric Gilliland  
Program Director  
Washington Area Bicyclist Association

\*\*\*\*\*

From Robert Brubaker  
October 22, 2003

REF: Northern Virginia Bikeway and Trail Network Study

Dear Fatemeh,

My organization supports the Safe Crossings Campaign. I had been questioned a few times by a contractor who was working on this Study but I wasn't aware that the Study had been finished. I did a quick review of the online document and would like a printed copy, if available. (If the document is larger then would fit in a small PO Box, please advise and I'll send my home address)

Notice all the Public Review & Comment milestones are 'past tense'; will there be more? Am I correct that the next stage is to secure funding?

Thank you.

Bob

(Fatemeh Allahdoust responded on October 22, 2003)

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From Dan Meier  
October 23, 2003

Hi: I am a current user of the available bikeways in Fairfax and Loudoun Counties.

One thing you need to strongly consider is the provision of BOTH bicycle and pedestrian light controlled crossings for Route 7. Currently, between Tyson's Corner and Leesburg (approximately 15 miles of a main thoroughfare) there are only TWO pedestrian crossings - Fairfax County Parkway and Algonkian Parkway overpasses. Crossing Route 7 on a bike or on foot is a suicide mission. As there are a substantial number of commercial businesses and homes on both sides of Route 7, people not in automobiles need a protected means to simply cross the road.

A second item is to not declare "bikeways" by simply painting lines in the roadway and noting them as bike lanes. Drivers do not pay close attention to bikers and in any match up, the bikers always lose. Separated bikeways running parallel to but not on the roadway are necessary - nothing else is adequate. Thanks, Dan Meier dtmeier@cox.net 703-444-2557 Phone & Fax

\*\*\*\*\*

From Pete Tenerelli  
October 10, 2003

Dear Study Group,

As a bicycle commuter and bicycle enthusiast in Northern Virginia, I would like to provide citizen feedback to the proposed routes on the study map.

- 1) Good choice: Connections on routes 50 and 29 west of the 50/29 split near city of Fairfax. These routes are not safe currently. I have traveled these routes occasionally, but rarely do because of high speed traffic (55 mph speed limit) and high speed interchanges. A connection to the trails to the west will open up many commuting/travelling opportunities (Fairfax County Parkway/Reston, West Ox Rd, Braddock Rd)
- 2) Good choice. Route 50 crossing of I-495 and connection to Arlington trails. It is impractical to get to the I495 crossings currently.
- 3) Good choice: Route 29 trail from City of Fairfax to get to the Route 29 crossing of I-495 (and destinations further east of I-495 including Arlington and Arlington trails) It is impractical to get to the I495 crossings currently.
- 4) Good choice: Access along Gallows Road along I-495. This will ease the inconvenience of the I-495 bicycle barrier with access parallel to I495

Thank you for taking my feedback into account!

Regards,  
Pete Tenerelli

\*\*\*\*\*

From Chuck Kines, Bikeways Planner, Montgomery County MD  
October 3, 2003

Jennifer:

I noticed TDG did the Northern VA Bike study. Below is the reference to Fairfax County in MoCo's Master Plan of Countywide Bikeways. Could you review and comment? Also, pass along to your contact in FC. I e-mailed this to Chris Wells a few weeks ago (minus ref to NoVA study) and never got a response. Thanks.

(Jennifer Toole reviewed and responded October 3<sup>rd</sup>, 2003)

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From Shaheer Assad, Loudoun County  
October 1, 2003

Fatemeh,  
Congratulation on the completion of the plan and for job well done. Hope the same thing for our plan. It is great accomplishment. Shaheer

\*\*\*\*\*

From Matthew Clark, Falls Church  
October 1, 2003

Dear Planners:

Good job on the study (<http://www.fhiplan.com/novabike/>).

My wife and I are nearly full-time bike commuters (Falls Church-DC) and weekend area riders.

We frankly are starved for new and safe bike routes around the Northern Virginia, particularly Fairfax and Arlington County areas. There are only so many times you can ride out and back on the W&OD trail. More scenic rides further out (Loudoun, Fauquier Counties) require a car trip for us, which is encumbered by our child care (and chauffeuring) responsibilities.

My cursory review of the executive summary and maps really delighted me. Your planned improvement will greatly enhance our ability to ride around the area without driving somewhere first or getting squashed. I am particularly pleased with all the new routes within the inner semi-circle of (cyclists') hell - the area bordered by 495 and the Potomac River. Your plans will save lives, no question - one of which could be mine.

While the executive summary did not discuss phasing and funding, I would encourage you to make physical improvements - additional trails and dedicated bike lanes - within this semi-circle first. Safety and the sheer volume of existing and potential bikers being the determining factors. All of the rest of the improvements should follow as soon as feasible.

Since I will not make it to the public meetings, please record these comments as being fully supportive of your plans, with the suggested phasing. Should all these improvements be made, Northern Virginia might just become livable (for a cyclist).

One question: What will happen to the Custis trail inside the beltway if I66 is expanded? Please do not let it be eliminated, even temporarily.

Comment to Jennifer: I need to respond to his question. Before I do however, I need to talk to our L&D folks. When I respond, I'll copy you so that you can make a note in here.

Thanks.

Matthew Clark  
1309 Tracy Place  
Falls Church, VA 22046

### **Phone Comment:**

Commuter from Dale City would like to be able to access the Mt. Vernon Trail. Stressed the need to consider commuters who work at night - the trails in parks (such as Grist Mill Park) are not lit, so they are stuck riding on high volume street corridors.

# GLOSSARY OF TERMS

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Note: Several of these definitions are adapted from the AASHTO *Guide for the Development of Bicycle Facilities*, (1999).

**Bicycle** - Every vehicle propelled solely by human power upon which any person may ride, having two tandem wheels, except scooters and similar devices. The term "bicycle" in this document also includes three and four-wheeled human-powered vehicles, but not tricycles for children.

**Bicycle facilities** - A general term denoting improvements and provisions made by public agencies to accommodate or encourage bicycling, including parking and storage facilities, and shared roadways not specifically designated for bicycle use.

**Bike lane** - A portion of a roadway that has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists. AASHTO requires that bike lanes provide five feet of space between the travel lane and parking, curb face or other roadway barrier. Four-foot bike lanes are acceptable for roadways without curb and gutter.

**Bikeway** - A generic term for any road, street, path, or way which in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.

**Local jurisdictions**- Local jurisdictions in Northern Virginia include: Arlington, Fairfax, Loudoun and Prince William counties; the cities of Alexandria, Falls Church, Fairfax, Manassas and Manassas Park; and the towns of Herndon, Leesburg, and Vienna.

**Regional bikeway network**- a system of high-quality bicycle facilities, including shared use paths that are a minimum of 10 feet, paved shoulders that are four feet or wider, and bike lanes (see acceptable widths under the definition for bike lanes). In constrained situations, wide curb lanes, with a minimum of 14 feet usable width, can also be used to accommodate bicyclists.

**Shared roadway**- A roadway that is open to both bicycle and motor vehicle travel. This may be an existing roadway, street with wide curb lanes of 14-feet to 15-feet, or road with paved shoulders.

**Shared use path** - A bikeway physically separated from motorized vehicular traffic by an open space or barrier and located either within the highway right-of-way (often termed "parallel shared use path") or within an independent right-of-way. Shared use paths may also be used by pedestrians, skaters, wheelchair users, joggers, and other non-motorized users. In some cases, such as the W&OD Trail, shared use paths also accommodate equestrians.

**Shoulder** - The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of sub-base, base, and surface courses. Paved shoulders can be used for bicycle travel as well.

**Signed shared roadway (signed bike route)** - A shared roadway that has been designated by signing as a preferred route for bicycle use with either a "Share the Road" or "Bike Route" sign.

## LIST OF ACRONYMS

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AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
BLOS	Bicycle Level of Service
CLRP	Financially Constrained Long Range Plan
CTB	Virginia Commonwealth Transportation Board
DCR	Virginia Department of Conservation and Recreation
MPO	Metropolitan Planning Organization
MWCOG	Metropolitan Washington Council of Governments
NOVA	Northern Virginia
NVTA	Northern Virginia Transportation Authority
TIP	Transportation Improvement Program
TPB	Transportation Planning Board
VDOT	Virginia Department of Transportation
W&OD Trail	Washington and Old Dominion Trail
WABA	Washington Area Bicyclist Association
WMATA	Washington Metropolitan Area Transit Authority