Loudoun County

Pedestrian and Bicycle Station Access Study

JUNE 2014

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1 Introduction

1.1 Background

Loudoun County, Virginia, has been planning for the extension of rail into the County for several decades.[1] In 2012, the Loudoun County Board of Supervisors voted to proceed with its funding participation in Phase Two of the Dulles Corridor Metrorail Project. The Phase Two extension will add three Metrorail stations in Loudoun County. The easternmost will be located at Dulles Airport and will be located on airport property. The remaining two stations, which are the subject of this study, will be located along the Dulles Greenway at Routes 606 and 772, with the station at Route 772 planned as the western terminus of the Silver Line. Completion of the work is expected in 2018.

The introduction of Metrorail stations in Loudoun County will create new travel options for residents and employees of the area. The presence of the stations is expected to attract some people from outside of Loudoun County who want to use Metrorail to access other regional destinations. The new service will contribute to a change in the travel patterns in the area as higher volumes of people seek access to the County on a daily basis by any available mode. Commuter travel will play a large role in these changing travel patterns, as residents of the immediate and surrounding areas will be able to use Metrorail to access major employment centers in downtown Washington, DC, and Tysons Corner. The project will also benefit employees who travel from neighboring jurisdictions to employment centers in Loudoun County. Occasional use of the Metrorail station for shopping, entertainment and other reasons will also be important during off peak hours. The changes in the transportation network will cause some people who live and work in Loudoun County to undertake their work trips using different routes and different modes in the future than they currently do, primarily due to the introduction of Metrorail service.

In anticipation of the extension of Metrorail into Loudoun County, the County secured funding through the Metropolitan Washington Council of Governments (MWCOG) Transportation/Land-Use Connections (TLC) Program for the development of a Loudoun County Station Pedestrian and Bicycle Station Access Study. This study features an assessment of existing pedestrian and bicycle connectivity around proposed Metro stations at Route 606 and Route 772. Using an array of tools – including geographic information systems (GIS) mapping and analysis, Pedestrian Intersection Safety Indices and Bicycle Level of Service – the project team assessed the safety and efficacy of existing pedestrian and bicycle accommodations and identified deficiencies and gaps in the network.

The project team used findings from these analyses, along with input from stakeholder meetings and interviews, to develop recommendations for pedestrian and bicycle improvements to provide a more comprehensive network and improve safety, connectivity and access in the proposed station areas. These recommendations considered policies set forth in the Loudoun County 2010 Countywide

[1] The Dulles North Area Management Plan adopted in 1985 was the first plan to consider the extension of transit in Loudoun County. DNAMP called for the extension of the Dulles Toll Road, calling for the reservation of sufficient land in the median for future transit facilities.

Transportation Plan (CTP) to provide potential actions compatible with the approach and guidance contained in that document. Recommendations were refined using a methodology developed in concert with the County for prioritizing pedestrian and bicycle improvements. For recommended new facilities and upgrades to existing facilities, the study includes a project list and construction cost estimate to guide resource allocation in implementing recommendations.

1.2 Purpose of Study

The Pedestrian and Bicycle Station Access Study assesses the existing pedestrian and bicycle facilities, identifies gaps and needs in the network, and presents a prioritized list of recommended projects to improve pedestrian and bicycle connectivity in the vicinity of the Route 772 and Route 606 Metrorail stations. The study is intended to provide guidance for the efficient allocation of resources as the County seeks to provide pedestrians and bicyclists with safe and convenient access to Metrorail facilities.

The Loudoun County CTP provides guidance on the need to address transportation needs for all users. Suburban Area Road Policy #12 states:

> *The County will continue to seek opportunities to improve the planned and existing road network including bicycle and pedestrian facilities in the Suburban Policy Area by encouraging additional connections between neighborhoods and between residential and employment areas where such connections can be made with minimal disruptions and where it can be demonstrated that such connections will ultimately reduce congestion.*[2]

Congestion and safety for all modes of transportation will be major issues in Loudoun County. This report details an array of strategies and projects that can be used to improve transportation options for residents and employees in Loudoun County. The implementation of these recommendations will help ease congestion, improve safety and increase mobility and accessibility for Metrorail passengers and local residents and employees.

1.3 Scope of Study

The Pedestrian and Bicycle Station Access Study assesses pedestrian and bicycle facilities along and across roadways within a three-mile radius of the two proposed stations. The project team conducted a detailed analysis of existing pedestrian facilities within a one-mile radius of the stations, and existing bicycle facilities within a three-mile radius of the stations. The study looked at existing conditions and limited future conditions, including scheduled bicycle and pedestrian commitments along existing roadways and ultimate roadway conditions for existing roadways. Recommendations included in the study and the GIS files created as part of the study can be used as a starting point for more detailed analysis in the future.

The study includes roadways classified as collector or higher, and considers existing facilities as well as facilities programmed in the 2010 CTP. Limited-access divided roadways – including the Dulles Greenway (VA 267) and Route 28 (Sully Road) – are not included in the analysis. Each of the study

[2] 2010 CTP, Chapter 2, Suburban Area Road Policy 12

roadways was identified as a Baseline Connecting Roadway in the 2003 Loudoun County Bicycle and Pedestrian Mobility Master Plan. These roadways were identified in the Bicycle and Pedestrian Mobility Master Plan as roads that need to serve pedestrians and bicyclists due to the connectivity they provide among employment and population centers and transit. In maintaining consistency with the Bicycle and Pedestrian Mobility Master Plan, this study adheres to multiple policies set forth in the 2010 CTP:

- Priority shall be given to providing bicycle and pedestrian accommodations and connections associated with arterial and collector roadways as identified within the *2010 CTP* and the *Loudoun County Bicycle and Pedestrian Mobility Master Plan* with emphasis on the completion of connections between existing facilities wherever it is deemed safe.[3]
- The County will establish priority bicycle and pedestrian routes and facilities along roadways as identified in the *Loudoun County Bicycle and Pedestrian Mobility Master Plan*.[4]

Special consideration is given to the W&OD Trail, a major east-west recreational and commuter route for pedestrians and bicycles that falls within the study area. The study includes several recommendations to improve connectivity between the W&OD Trail and the proposed Metrorail stations.

The study assumes that new facilities programmed in the 2010 CTP will include provision of adequate pedestrian and bicycle facilities, per the 2010 CTP:

> *While acknowledging VDOT's current design policies and standards, the County recognizes the limitations of the standard functional classification system, which emphasizes operating speed and carrying capacity. By balancing mobility with community livability and by utilizing context-sensitive design techniques, the County is committed to achieving a complete and multi-modal transportation network. Central to this commitment is the concept of the "complete street." A complete street is a road that is safe for motorists, bicyclists, transit vehicles and users, and pedestrians of all ages and abilities. The complete street focuses not just on individual roads, but on the decision-making and design process so that all users are routinely considered during the planning, designing, building and operating of all roadways.*[5]

This study examines opportunities for improved pedestrian and bicycle connectivity due to the arrival of Metrorail to eastern Loudoun County.

1.4 Relevant Resources

Loudoun County staff provided base GIS files, relevant plans and policies, and other information to understand existing conditions and planned or potential development. The information provided includes the following:

- Loudoun County GIS Shapefiles and Mapping data.
- Loudoun County 2010 Countywide Transportation Plan (CTP) (Amended 2012).

[3] 2010 CTP, Chapter 4, Pedestrian and Bicycle Facilities Policies for Roadways 3
[4] 2010 CTP, Chapter 4, Pedestrian and Bicycle Facilities Policies for Roadways 11
[5] 2010 CTP, Chapter 2, Design and Construction Standards

- Loudoun County Bicycle and Pedestrian Mobility Master Plan (2003).
- Loudoun County: Transportation Prioritization Study for the Area Surrounding the New Metrorail Stations (2013).
- Loudoun County Board of Supervisors Action Item No. 4 (15 November 2013).
- Loudoun County Board of Supervisors Action Item No. 15 (7 June 2011).
- Loudoun County Board of Supervisors Action Item No. 9b (18 November 2008).
- VDOT Northern Region Traffic Engineering Practice No. 901.1: BIKES MAY USE FULL LANE Signs and Shared Lane Markings (2012).

2 Approach and Analysis Methodology

2.1 Overview of Approach

This project was conducted over approximately a six-month period from December 2013 to June 2014. At the beginning of the project a kick-off meeting was held with County staff from the Department of Planning and the Department of Transportation and Capital Infrastructure; MWCOG, which funded the study; the Virginia Department of Transportation (VDOT); and other stakeholders. The project approach and schedule was discussed and agreed upon.

Geographic Information Systems (GIS) data was then assembled by the County to describe existing conditions on the roadway network affecting pedestrians and bicyclists. GIS was used for mapping and analysis of existing conditions affecting pedestrians and bicyclists and was an integral technology used throughout the project. GIS basemap information obtained from the County was verified with aerial photographs. Additional data needed for conducting analysis of conditions effecting pedestrians and bicyclists was also obtained and coded into GIS:

- Outside lane width
- Motor vehicle volumes (AADT)
- Posted speed limits
- Signalized intersections
- Population and population density by census block
- Pedestrian and bicycle crashes (2008-2012) by crash severity

In February 2014, field meetings were conducted with County staff; Board of Supervisors aides; a Bike Loudoun representative; and representatives from the Brambleton community, a large master planned community that is anticipated to be a major generator of pedestrian and bicycle traffic in the Route 772 station area. Information on upcoming plans and projects were shared and participants drove to key locations to observe conditions affecting pedestrians and bicyclists. Following the meeting, public input was collected by the district supervisors and provided to the County.

Based on the GIS data, analyses, district and public inputs, and other relevant documents listed in Section 1.3, preliminary recommendations were developed and presented to the stakeholder group. Feedback from that meeting was used to refine the findings and develop the study report.

2.2 Analysis Methodology

The analysis methodology for evaluating conditions for pedestrian and bicyclists was deeply rooted in GIS mapping, as information in GIS could be displayed to determine conditions that affect pedestrians and bicyclists, existing demand, and safety. In addition to GIS maps illustrating existing transportation conditions, which included facility characteristics and gaps in pedestrian and bicycle facilities, mapping was created to display population by census block (density and populations levels), locations of reported crashes (2008-2012), as well as the results of several analyses that assess the adequacy of pedestrian or bicycle facilities.

One issue that is critical to providing a continuous pedestrian and bicycle network is the adequacy of crossings. Wide crossings increase exposure for pedestrians and bicyclists to traffic and higher vehicles speeds increase the risk of a serious injury. Other conditions, such as heavy or complex turning movements also impact the desirability of walking or biking. In an effort to determine if such undesirable conditions exist in the vicinity of two planned Metrorail stations, the project team conducted an assessment of potential safety problems that would likely increase the risk to pedestrians and/or bicyclists, discourage use, or cause pedestrians and bicyclists to take alternate paths that put them into conflict with vehicular traffic. Intersections typically have the highest number of conflicts of any point along the travel path of pedestrians or bicyclists and are a good starting point for evaluating safety. Areas of highest importance can be determined through a quantitative assessment of the potential exposure of pedestrians and bicyclists to vehicular traffic. The tool that was applied to estimate the risk of crossing for pedestrians and bicyclists is the pedestrian intersection safety index (PISI). The PISI measure was developed by Zegeer et al of the Highway Safety Research Center and was published by the Federal Highway Administration (FHWA) in November 2006. The index is determined by calculating a separate value for pedestrian crash potential on each approach or crossing at an intersection. The data required to calculate this index are typically readily available, making it an easy-to-use assessment tool. Each index is based on existing conditions and is a function of traffic speed, traffic volume, roadway width, traffic control, and other intersection conditions; the existing intersection characteristics were assessed for this study to derive the PISI for each study intersection. PISI values do not serve as warrants for making improvements; rather, the index is to be used to help provide a relative assessment of safety and help prioritize the need for improvements at intersections "according to the relative likelihood of safety for pedestrians and bicyclists" (FHWA-HRT-06-125). The higher the PISI, the greater the safety concern. The PISI was used to assess the existing risk to both pedestrians and bicyclists, since, in many cases, bicyclists would be using off-road facilities and crossing with pedestrians. The index for both pedestrians and bicyclists is based on the same conditions stated above, but the bicycle ISI is more data-intensive.

To assess conditions for people biking on the road, the project team utilized the Bicycle Level of Service (BLOS) methodology consistent with the methodology used in the 2003 Loudoun County Bicycle and Pedestrian Mobility Master Plan. This measure analyzes the level of service (graded from highest "A" to lowest "F") on roadway segments; it is not applicable for off-road facilities. The BLOS model is based on users' perceptions of the roadway environment, which is a function of the following variables in order of highest to lowest importance:

- Average effective width of the outside through lane
- Motorized vehicle volumes
- Motorized vehicle speeds
- Heavy truck volumes
- Pavement condition

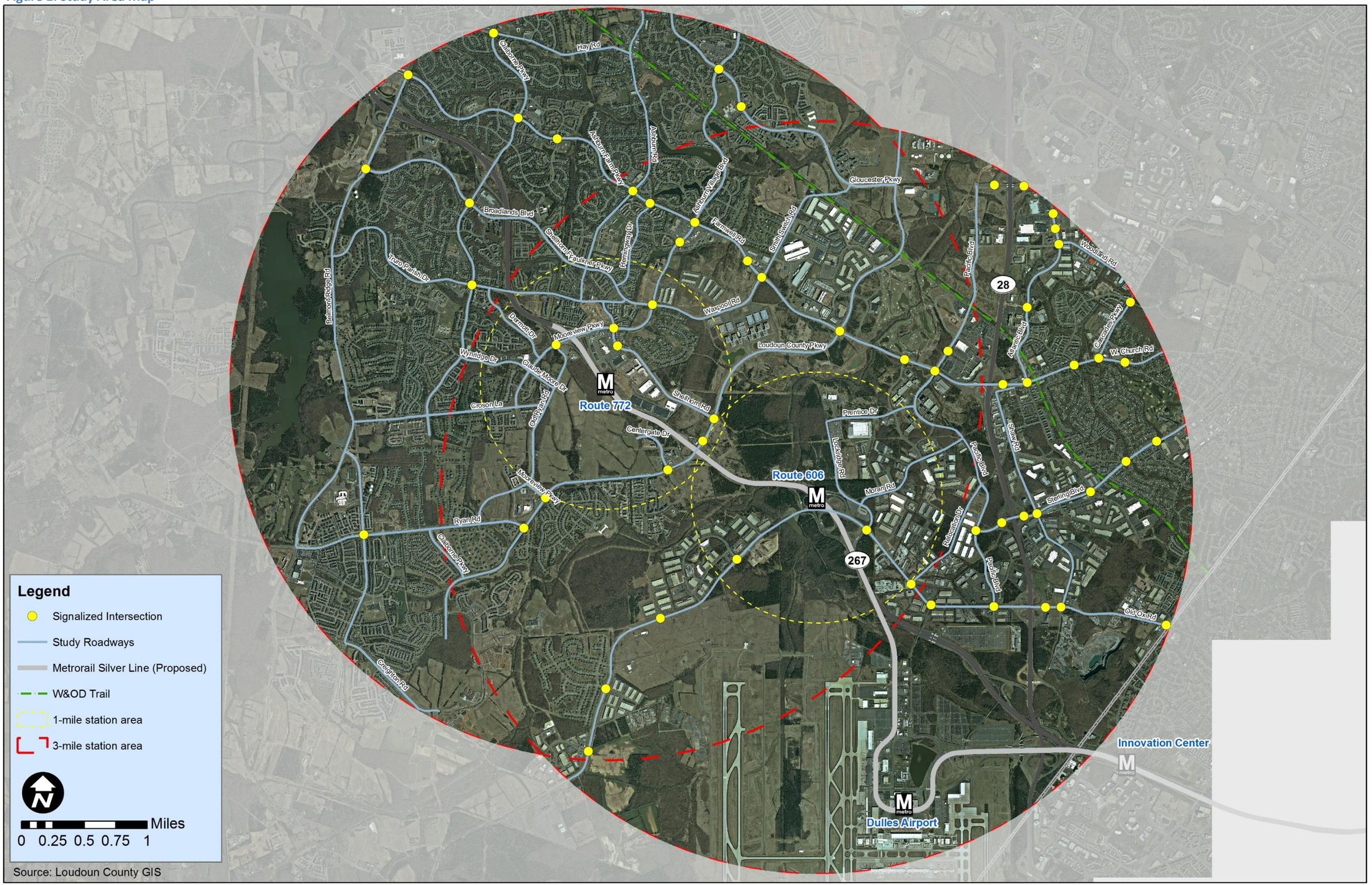
The PISI and the BLOS measures, along with identifying network gaps, resulted in an analysis of all key elements of the pedestrian and bicycle network. These two tools provided a framework from which a complete and connected network of sidewalks and paths and crossings could be developed to provide a safe and comfortable environment for pedestrians and bicyclists.

3 Existing Conditions and Analysis

3.1 Study Area Description

The study area for the Pedestrian and Bicycle Station Access Study is located in eastern Loudoun County, Virginia, and centers on proposed Metrorail Stations to be located in the median of the Dulles Greenway at Route 606 and at Route 772. For purposes of organization and to facilitate implementation efforts, the Existing Conditions, Recommendations, and Project Prioritization sections of this report are organized by station area. See Figure 1 for a map of the study area.

Figure 1: Study Area Map



The study area is comprised of a three-mile radius around each proposed Metrorail station. The area is bisected by the Dulles Greenway (VA 267), which will feature the future Metrorail Silver Line extension in its median. Route 28 (Sully Road), a major north-south artery located on the eastern side of the study area, is another limited-access divided highway that creates a barrier to pedestrian and bicycle connectivity in the area. A portion of Dulles International Airport is located in the southeastern part of the study area.

The study area features land uses typically associated with suburban development – including housing developments featuring single-family homes and townhomes and suburban-style shopping centers – with relatively low to moderate densities.

According to the 2012 American Community Survey, 1.6 percent of Loudoun County residents walk to work and 0.2 percent bike to work. The proportion of people walking to work represents a 33 percent increase since 2000; the proportion of people biking to work in Loudoun County represents a 100 percent increase since 2000.[6] The arrival of Metrorail to Loudoun County is likely to accelerate this trend. Note that in addition to work-related trips, pedestrian and bicycle activity is generated by recreational, commercial, and school-related trips.

Transportation facilities considered in the study include roadways classified as collector and above and major intersections within one mile of a station. In general, the study area is characterized by wide roadways and high vehicle speeds (see Figure 3 for a map of road classifications and posted speeds). Many roadways have been designed with future growth in mind, with several intersection approaches featuring striped-out lanes that can be activated as turn lanes or acceleration lanes relatively quickly and easily. Intersections tend to feature wide corner radii and long crossing distances. Existing roadways and intersections appear to have been designed primarily with motorized vehicle travel in mind, and generally are not conducive to high levels of safety or comfort for pedestrians and bicyclists. For example, the intersection of Ashburn Village Boulevard and Shellhorn Road is a major intersection located just 1,500 feet from the Route 772 station (Figure 2). As such, it is vital to providing connectivity to the Metro for pedestrians and bicyclists. However, the existing intersection features wide crossings and turning movements that make crossing difficult. The crossing on the east leg is approximately 160 feet, which would take a person walking at 3.5 ft/s over 45 seconds, or ¾ of a minute, to complete the crossing.[7] If someone crossing needed to cross two legs of the intersection, they may spend over a minute crossing and likely a much longer time waiting at the intersection. In addition to affecting pedestrians, the long crossings affect traffic operations. Wider crossings require more time dedicated to the pedestrian crossing phase, which affects overall traffic operations.

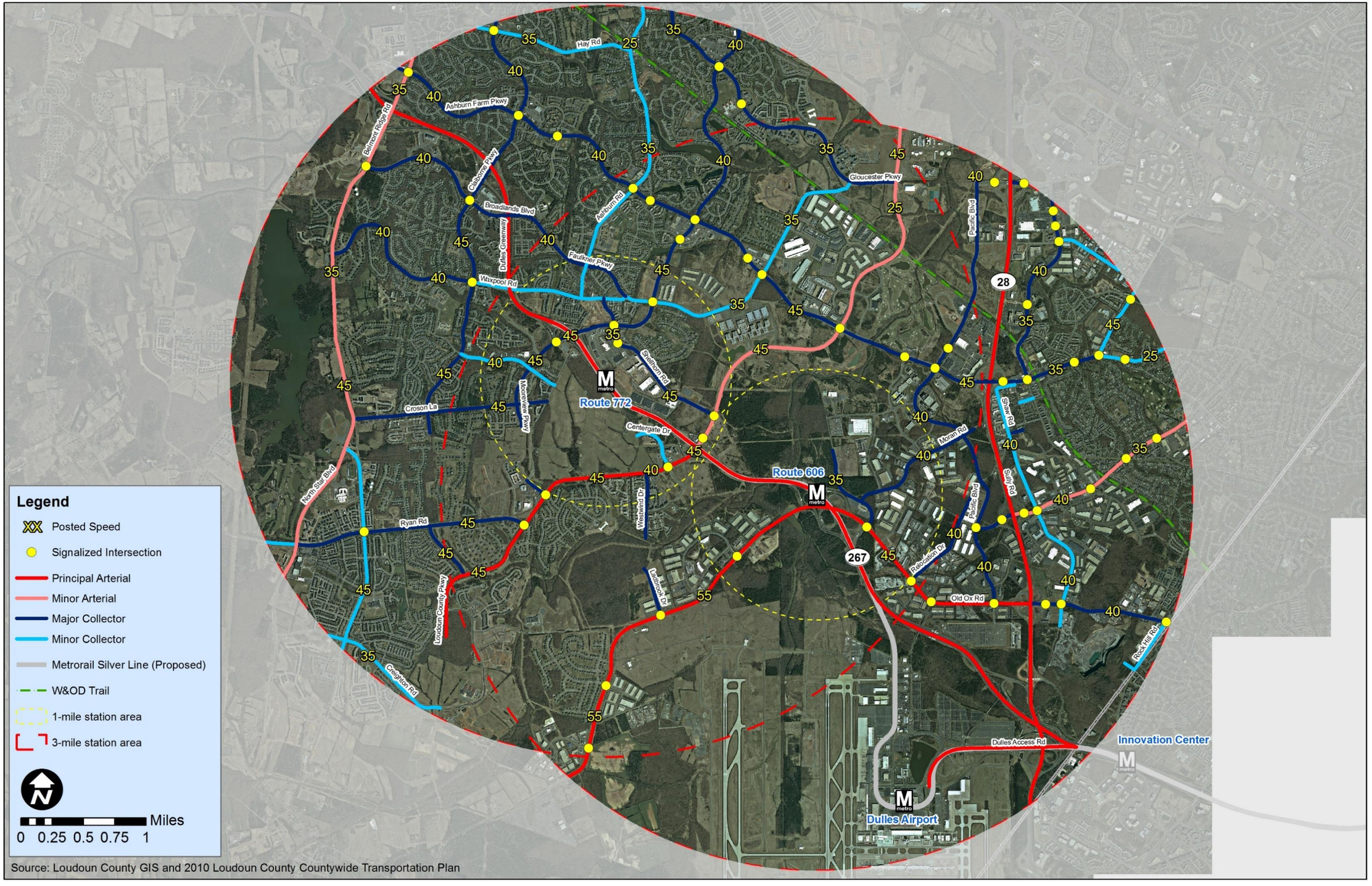
[6] 2012 American Community Survey and 2000 Census (as referenced in the 2010 CTP).

[7] 3.5 feet per second is the MUTCD walking speed used to determine the time needed for pedestrians to cross intersections.

Figure 2: Aerial view of the intersection of Ashburn Village Boulevard and Shellhorn Road

Despite some challenges, there is a considerable amount of existing pedestrian and bicycle infrastructure in the study area. The W&OD Trail, a highly-used regional recreational and commuter trail that provides connectivity to Fairfax County, Arlington County, and Washington, DC, traverses the northern and eastern edges of the study area. The W&OD Trail is a critical component of the regional pedestrian and bicycle network, and is a valuable asset for the area as Loudoun County seeks to establish and improve connections to the proposed Metrorail stations. Other shared use paths and sidewalks can be found throughout the study area. Based on the 2010 CTP, shared use paths shall be 10 feet wide; however, some shared use paths tend to be undersized (less than 10 feet wide), and there are gaps in both the trail and sidewalk networks that limit connectivity to the proposed stations at present.

Figure 3: Study Roadways by Road Classification and Posted Speed



3.2 Safety

Pedestrian and bicyclist safety conditions were evaluated at 52 intersections and along 32 roadways in the study area. This analysis included an examination of reported pedestrian/bicycle crashes,[8] and a calculation of Pedestrian Intersection Safety Index (PISI) scores at 40 study intersections.

The analysis found that, between 2008 and 2012, there were a total of 92 reported pedestrian/bicycle crashes in the study area – 66 pedestrian crashes and 26 bicycle crashes. Approximately three-fourths (76 percent) of the 66 pedestrian crashes resulted in moderate to serious injury or death, with two fatal crashes and 48 crashes resulting in moderate to serious injury. Nearly 70 percent (18 of 26) of reported bicyclist crashes resulted in moderate to serious injury. There were no bicyclist fatalities during this time period. See Figure 4 for a map of pedestrian/bicycle crashes in the study area.

The PISI analysis revealed that a majority of study intersections entail a moderate to high level of risk for pedestrian crossings. Of the 122 approaches considered across 52 intersections, 81 approaches featured a PISI score above three (3), which is the assessed midpoint of the scale. See Figure 5 for a map of PISI scores by intersection approach.

3.3 Bicycle Level of Service

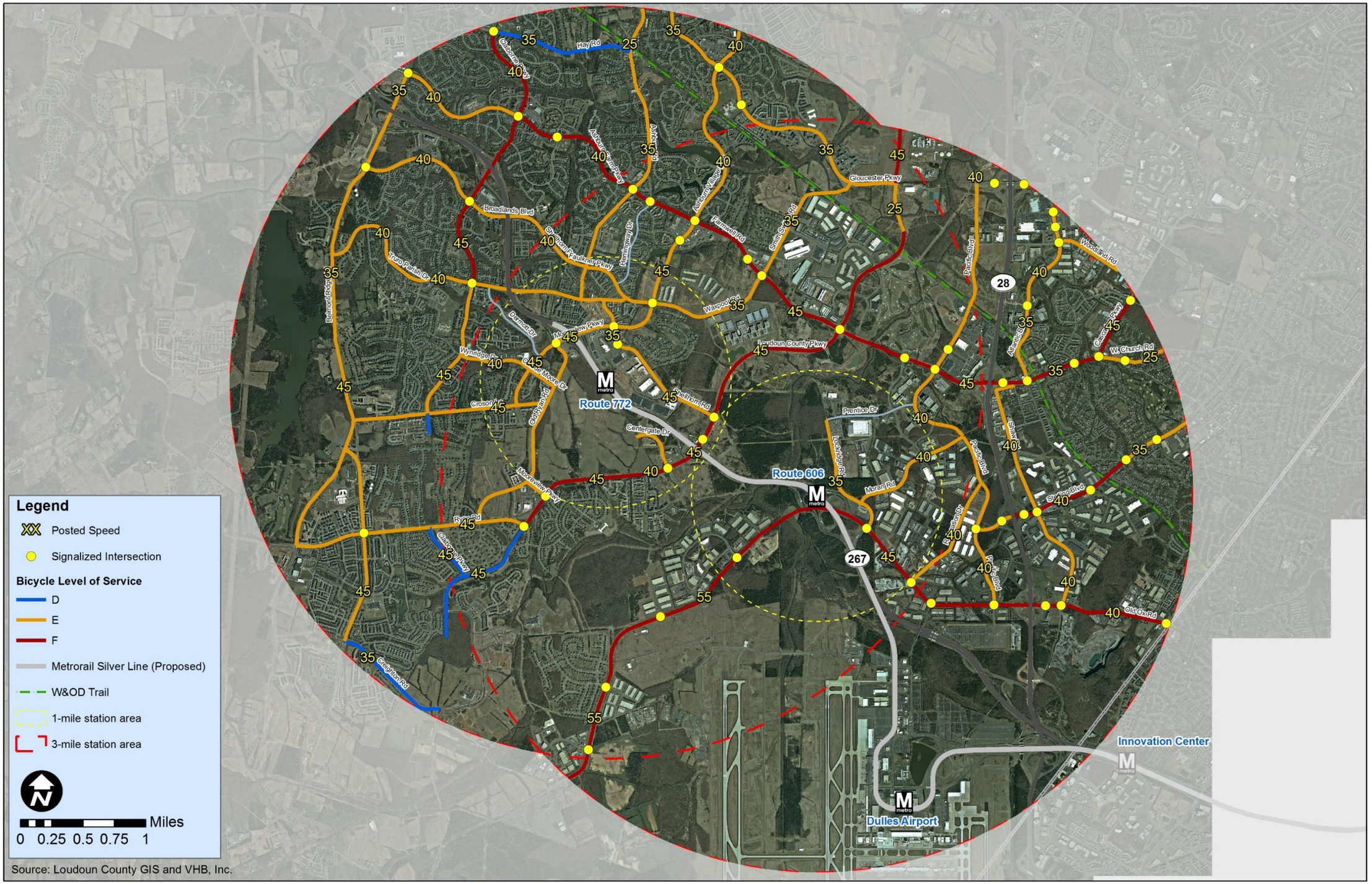
As mentioned in Section 2.2, bicycle level of service (BLOS) was analyzed, consistent with the methodology used in the 2003 Loudoun County Bicycle and Pedestrian Mobility Master Plan, to determine the compatibility of existing roadways to accommodate travel by bicycle. BLOS does not measure the compatibility of off-street facilities to accommodate bicyclists; most 10-foot wide shared use paths provide good accommodation for cyclists traveling at lower speeds. On-street facilities are important to provide options for cyclists who travel at higher speeds. The results of the BLOS analysis illustrate that the LOS in the study area ranges from LOS "D" to LOS "F" (Figure 6). Four roads in the study area had a LOS of "D": Creighton Road, Hay Road, the southern portion of Claiborne Parkway, and the southern portion of Loudoun County Parkway. With the exception of Loudoun County Parkway, these roadways either have posted speeds of 35 mph or lower, or are "stub" roadways that do not serve through traffic. All other roadways had a LOS of "E" or "F" indicating that conditions for bicyclists traveling on the roadway would be difficult. The conditions that affect the LOS (and result in a lower LOS) are vehicles speeds and volumes. Those roads with a LOS of "F" generally had posted speeds of 40 mph or higher and carried relatively higher traffic volumes. Roads with posted speeds of 35 mph or less generally had a slightly better LOS and were the best candidates for on street facilities for cyclists.

[8] Crash data provided by VDOT.

Figure 4: Pedestrian and Bicycle Crashes (2008-2012)

Figure 5: Pedestrian Intersection Safety Index (PISI)

Figure 6: Bicycle Level of Service (BLOS) on Study Roadways



3.4 Station Areas

3.4.1 Route 772 Station Area

Character and Generators

The Route 772 station area features a wide variety of land uses, including: traditional suburban residential development with single family homes, new mixed-use development adjacent to the station, vacant land approved for transit-oriented development, sprawling commercial properties that house data centers, and other undeveloped land.

The areas adjacent to the proposed station either are being or will be developed for transit-oriented development (TOD). Loudoun Station is located along Shellhorn Road to the immediate northeast of the station; portions of Phase 1 of the development are already open. The area immediately southwest of the station is presently greenfield but has been approved for the Moorefield Station TOD. When completed, both Loudoun Station and Moorefield Station will feature higher densities and a mix of uses, and will be major generators of transit users and pedestrian and bicyclist activity in the area.

The areas north and west of the Route 772 station are characterized by low- to moderate-density residential and commercial development. North of the station, major origins and destinations include residential neighborhoods; several shopping centers along Ashburn Farm Parkway, including Ashburn Farm Market Center, Ashburn Farm Village Center, Ashburn Town Square, and Pipeline Plaza; Broad Run High School; and the W&OD Trail.

To the southwest of the Route 772 station lies the Brambleton neighborhood, a master-planned community that includes moderate density residential development, and a town center. Brambleton is a major generator of pedestrian and bicycle activity in this part of the study area.

Loudoun Valley Estates is moderate-density residential development located on the south side of Loudoun County Parkway, approximately one mile south of the Route 772 station.

Transportation Facilities

Shellhorn Road lies adjacent to the northeast side of the Route 772 station, and will serve as the primary access for motorized and non-motorized users coming from the north and northeast, including the W&OD Trail. On the southwest side of the station, the planned but as-yet-unbuilt street network within the Moorefield Station TOD will provide access to the station. Existing roadways that could play critical roles in getting bicyclists and pedestrians to the station area include Croson Lane, Ryan Road, Mooreview Parkway, and Old Ryan Road.

Collectors and arterials in the Route 772 station are designed primarily to accommodate motor vehicle travel, and generally lack bicycle or pedestrian facilities, as do most intersections in the area. The station area features a number of four- or six-lane roadways with posted speeds of 45 mph: Belmont Ridge Road, Claiborne Parkway, Loudoun County Parkway, Farmwell Road/Waxpool Road, and Ashburn Village Boulevard.

The southern end of Mooreview Parkway features the County's lone location with striped bike lanes, which will extend to Croson Lane once the final section of Mooreview Parkway is completed. The Brambleton neighborhood features a relatively tight street grid and a well-connected network of sidewalks.

In addition to the W&OD Trail, the Route 772 station area features existing shared use paths on both sides of Ashburn Farm Parkway, a nearly-complete shared use path network on both sides of Claiborne Parkway, and a shared use path on most of the south side of Loudoun County Parkway.

Safety

There were a total of 53 pedestrian/bicycle crashes in the Route 772 station area between 2008 and 2012 (38 pedestrian crashes and 15 bicycle crashes). The biggest crash hot spot in the station area can be found at the intersection of Ashburn Farm Parkway and Claiborne Parkway; 11 crashes occurred within a quarter mile of the intersection between 2008 and 2012. One of the two fatal pedestrian/ bicycle crashes in the study area occurred at the intersection of Ashburn Village Boulevard and Waxpool Road, which is located just over half a mile from the Route 772 station.

Three intersections with among the highest PISI scores in the entire study area are located within one mile of the Route 772 station: Waxpool Road at Ashburn Road; Waxpool Road at Shellhorn Road; and Waxpool Road at Faulkner Parkway.

3.4.2 Route 606 Station Area

The Route 606 station area also features a wide variety of land uses, including: traditional suburban residential development with single family homes, high density residential areas in Sterling, corporate campuses, light industrial uses, and undeveloped land. A Transit-Related Employment Center (TREC) or Special Activity destination is planned north and west of the Route 606 interchange with the Dulles Greenway.

Major origins and destinations in the station area include the W&OD Trail, corporate campuses – including AOL – located along Pacific Boulevard south of Waxpool Road, large retail centers at Dulles Town Center and Dulles Crossing, and moderate- to high-density residential neighborhoods along Church Road and Sterling Boulevard.

A relatively higher density residential area is located along Rock Hill Road on the southeast edge of the study area; it is anticipated that residents of this area will use the proposed Innovation Center station in Fairfax County, as it is located closer to the residential area than the Route 606 station and is two stops closer to destinations in Tysons, Arlington, and Washington, DC.

Transportation Facilities

The Route 606 station area is bisected by both the Dulles Greenway and Route 28 (Sully Road), both of which represent major barriers to connectivity in the station area. Two high-speed roadways – Church Road/Waxpool Road and Sterling Boulevard – cross Route 28 via large interchanges.

In addition to Route 28, connectivity challenges east of the station are compounded by the lack of a traditional street grid in the immediate vicinity of the station, which limits direct access and increases travel times to the station. For instance, because Sterling Boulevard currently terminates at Pacific Boulevard, motorized and non-motorized users seeking to access the Route 606 station area from the east via Sterling Boulevard need to navigate a circuitous network of roadways to reach the station. The 2010 CTP includes an extension of Sterling Boulevard to Moran Road, just east of the Route 606 station; this future connection would significantly improve access to the Route 606 station.

The Route 606 station area is served by Lockridge Road, which runs adjacent to the proposed station facilities and will provide the primary means of vehicular access to the station; Moran Road, which connects to Pacific Boulevard to the east; and Prentice Drive, which provides connectivity to the corporate campuses northeast of the station.

Old Ox Road is a high-speed roadway that provides motor vehicle connections between the Route 606 station and US 50 to the south of the study area. A widening project on Old Ox Road is scheduled to begin in 2015 and be completed in 2017; the project will widen the roadway from two lanes to four lanes west of the Greenway, and will include pedestrian and bicycle accommodations.

The W&OD Trail is located to the north and east of the Route 606 station. The trail features a grade-separated crossing of Route 28 for pedestrians and bicyclists. In addition to the W&OD Trail, pedestrian and bicycle facilities can be found along portions of Church Road east of the W&OD Trail and along portions of Sterling Boulevard. There are sidewalks located along both of these roadways at the interchanges with Route 28; however, conditions for pedestrians are precarious in these locations due to lack of buffering, high vehicle speeds and volumes, and conflicts at ramps.

Safety

There were a total of 54 pedestrian/bicycle crashes in the Route 606 station area between 2008 and 2012 (40 pedestrian crashes and 14 bicycle crashes), including one fatality. More than half of pedestrian crashes (21 of 40) and more than two-thirds of bicycle crashes (10 of 14) resulted in moderate to serious injury or death.

The Sterling Boulevard corridor stood out as a crash hotspot, with 10 pedestrian crashes and 8 bicycle crashes from 2008 to 2012. There were five crashes – four of them bicycle crashes – at the intersection of Sterling Boulevard and the W&OD Trail during this time period.

Three intersections with relatively high PISI scores can be found along a 0.8-mile stretch of Waxpool Road (VA 625) north of the Route 606 station: Waxpool Road at Loudoun County Parkway; Waxpool Road at Broderick Drive; and Waxpool Road at Pacific Boulevard.

4 Recommendations

The areas surrounding the proposed Metrorail stations at Route 606 and Route 772 have or will have many potential origins and destinations that can be reached by walking or biking. These locations include residential neighborhoods of varying densities, schools, office buildings, retail/commercial centers and other important pedestrian and bicycle trip generators, such as the W&OD Trail, which may serve as a major arterial for bicyclists accessing the stations from the east or the west. Access to and from these locations will drive the success of these Metrorail stations and ultimately the Dulles Corridor Metrorail Project, as travelers will be more likely to use Metrorail if the trip is safe, convenient, and comfortable.

While this study deals primarily with the existing land uses, it should be noted that it considers the opportunities presented by future development that may occur in the areas closest to the stations. While most of the area surrounding the Route 772 station is approved for transit development any future development proposals around this station as well as the Route 606 Station will provide the County with a means of obtaining improvements (such as through proffers from developers). With new developments, the desire lines and available paths for non-motorized travel will change and evolve, and it is important that the list of improvements and recommendations contained in this report be re-evaluated on a regular basis to determine the changes and additions need to be made. Comparing the recommendations and list of improvements with approved but unbuilt commitments will also help to determine any changes or additions that need to be made.

Development should follow an urban footprint, where sidewalks are wide, buildings are set close to the sidewalk, there is designated space for bicyclists, and streets are narrow. This will not only encourage pedestrian and bicycle activity, but will also make the streets safer for all users by encouraging slower vehicle speeds and less exposure for pedestrians and bicyclists. The recommendations in this report do not explicitly describe pedestrian and bicycle facilities in these areas of development, rather, provide access for pedestrians and bicycles to these areas and the stations within these areas. In some cases, suggestions are provided to transform existing roads into facilities that provide balanced accommodations for all road users and fit with the evolving character of these higher density developments adjacent to the Metro.

In order to accommodate all modes accessing transit, a delicate balance between each of the modes must be established by considering the tradeoffs between specific recommendations. At times, accommodating automobile as well as bicycle and pedestrian modes of travel may entail tradeoffs. Higher levels of service for automobiles tend to result in lower BLOS and increased risks for pedestrians due to an increase in travel speeds and traffic volumes, as well as increased exposure for bicyclists and pedestrians due to the number of travel and turn lanes required for capacity. The recommendations in this report attempt to strike that balance without significant impacts to capacity.

Based on the analysis of existing conditions and consideration of a limited set of future conditions described above, improvements on or along 36 roadway segments and 31 intersections were identified. See Figure 7 for a map of recommended roadway segment improvements and Figure 8 for the location of intersections for which pedestrian and bicycle improvements have been recommended.

Figure 7: Recommended Pedestrian and Bicycle Improvements by Roadway Segment

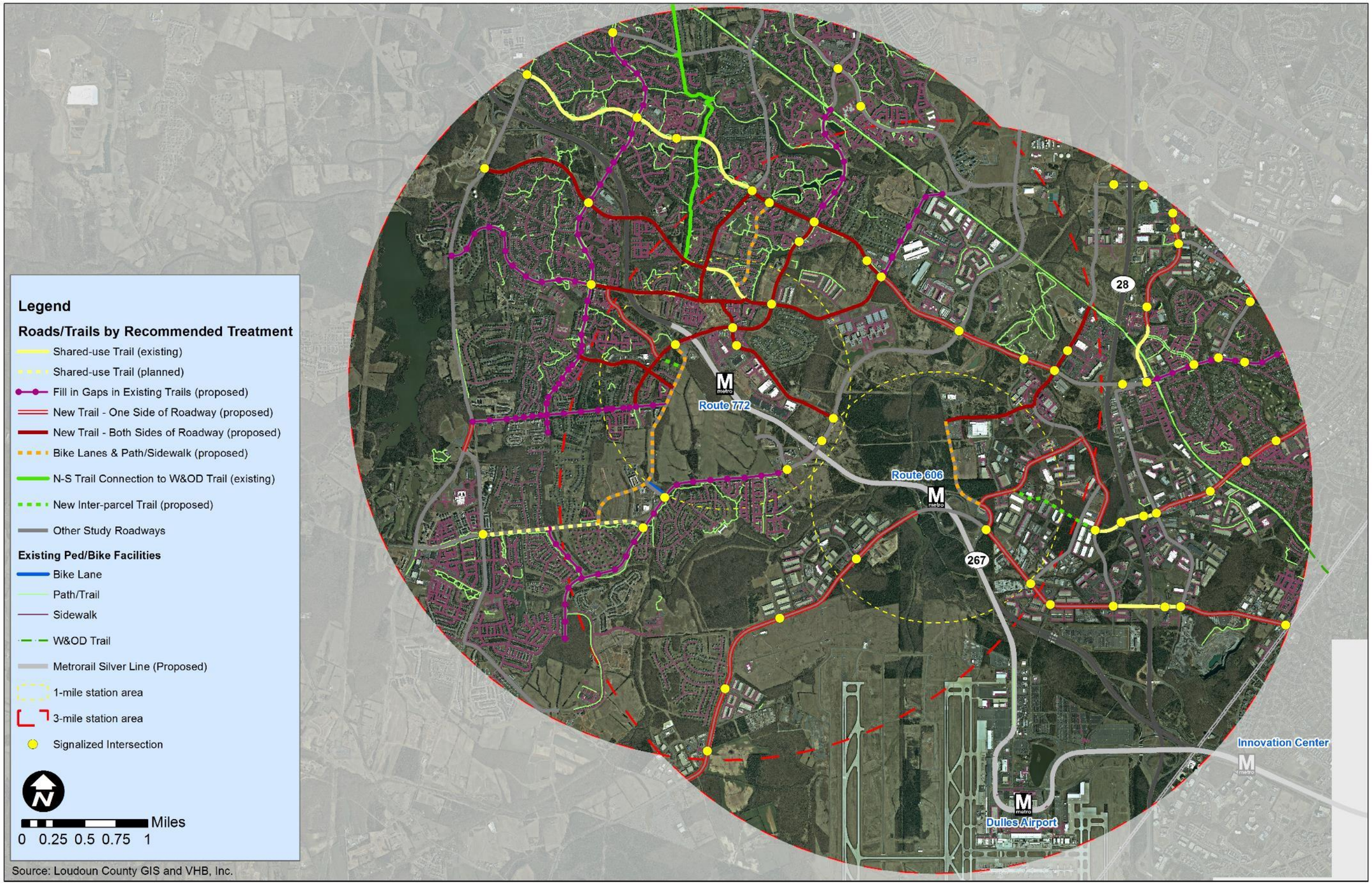
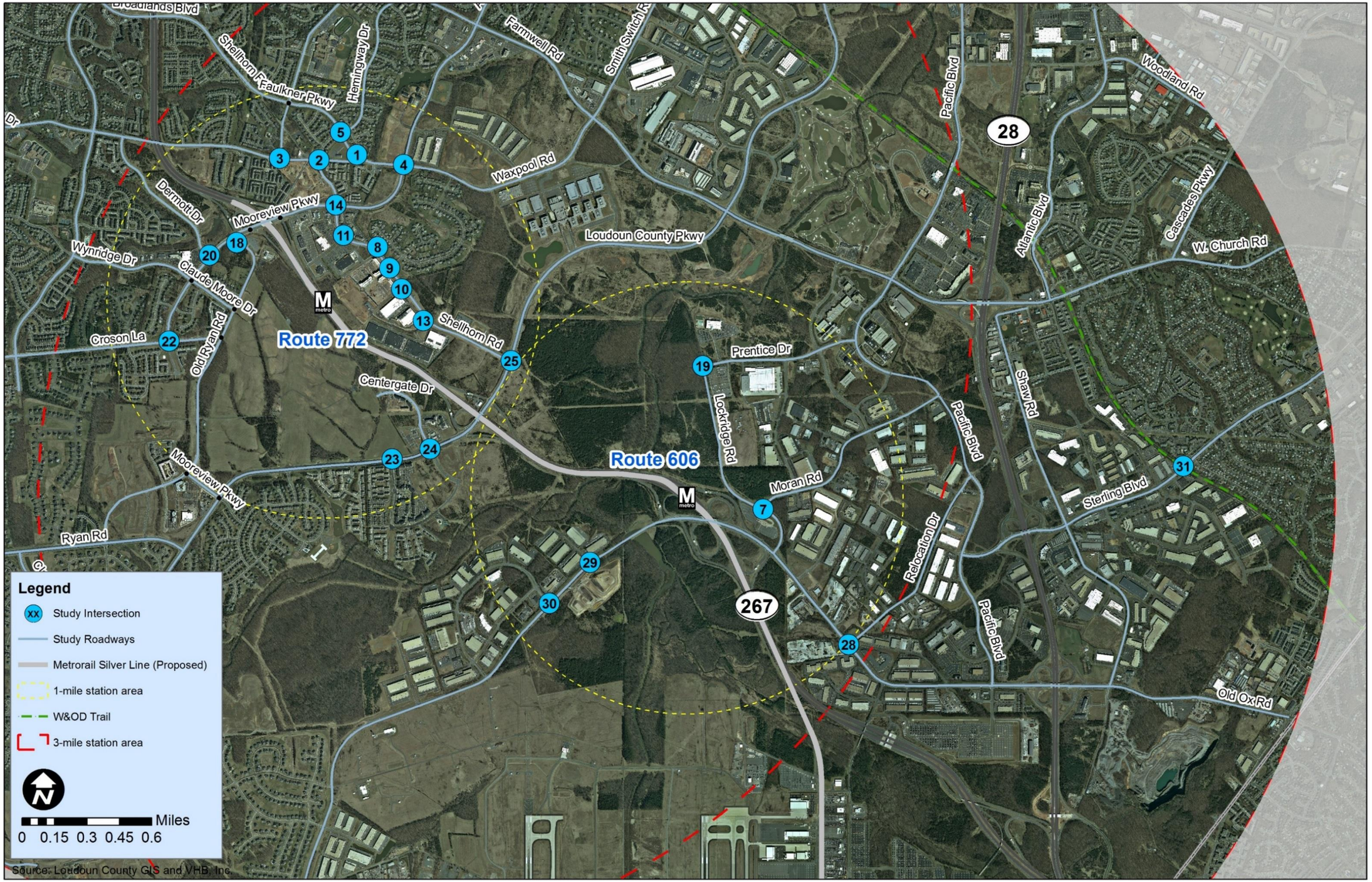


Figure 8: Locations of Recommended Intersection Improvements



In general, improvements to enhance pedestrian and bicycle safety and connectivity in the vicinity of the proposed Metrorail stations followed these guiding principles:

- Balance needs of all road users
- Consider range of users – i.e., consider varying skill and experience, age, and trip purpose
- Enhance motorist's expectancy of encountering pedestrians and bicyclists
- Address barriers to pedestrian and bicycle travel, such as
    - enhancing intersection crossings,
    - minimizing exposure of pedestrians,
    - increasing visibility of pedestrians, and
    - encouraging motorized vehicle speeds that are compatible with bicycle travel.
- Provide a more urban character to the areas immediately adjacent to the stations

To achieve these basic principles, a wide variety of modifications are proposed to the existing network. These are categorized as improvements at intersections and improvement on or along the road. Appendix B provides additional details on the different types of potential intersection improvements referenced in the recommendation tables in Chapter 4 and Chapter 6.

> *Loudoun County – a place where pedestrians and bicyclists of all abilities have a safe, secure, and convenient alternative transportation network of walkways and bikeways that enable everyone to move efficiently to and from such places as work, school, transit, shopping, libraries, parks and recreation.*
>
> - Vision Statement from 2003 Loudoun County Bicycle and Pedestrian Mobility Master Plan

In keeping with the County's approach outlined in the 2010 CTP, the improvements considered and/or recommended in this study include a broad array of treatments that have been selected to address specific conditions at a particular location, and are found both on and along roadway segments as well as at intersections. The recommendations and considerations in this study are not limited only to off-road improvements. Specifically, the CTP states the following:

> *The County recognizes that one size does not fit all when it comes to the location and design of bicycle accommodations. Accommodations for bicyclists along roadways can take various forms, such as separated, shared use paths along the roadway, bike lanes, wide curb lanes and paved shoulders. Different traffic volumes, patterns, accident statistics and roadway designs, including number of entrances/exits onto the roadway, introduce unique safety considerations when considering facility types. Design constraints due to topography, including curvatures and lines of sight, presence of historic and natural resources, proximity to existing and planned facilities and available right-of-way also are factors in facility design. Furthermore, the needs of different user groups vary from experienced bicyclists that prefer bike lanes and wide-curb lanes to the less-experienced adult or child rider who finds off-road shared use paths more conducive to comfortable travel. The complete reliance on an off-road shared use path system is not possible*

due to costs and funding constraints and is not necessarily the safest or most desirable option. Within a suburban street setting, faster-moving bicyclists greatly increase their vulnerability at intersections by riding on the sidewalk or shared use path, because motor vehicle drivers often fail to notice bicyclists in crosswalks when making right- and left-turn movements. Most motor vehicle/bicycle accidents occur at intersections: motorists rear-ending bicyclists is rare. The physical characteristics of the network should take into consideration the various needs of different user groups and provide a blend of facility alternatives specific to Loudoun County's road network, community design, and topography.[9]

The improvements recommended in this chapter adhere to the County's policy for constructing sidewalks, bike lanes and shared use paths as detailed in the 2010 CTP:

The purpose of these guidelines is to direct future developments on providing adequate bicycle and pedestrian facilities along Countywide Transportation Plan (CTP) Roads and to implement the policies of the Loudoun County Bicycle and Pedestrian Mobility Master Plan. They take into consideration general safety standards and are considered to be the minimum standards for provision of bicycle and pedestrian facilities. These guidelines do not preclude the County from asking for measures that are over and above the minimum criteria.[10]

Table 1 includes the minimum standards outlined in the 2010 CTP.

Table 1: Loudoun County Planning Guidelines for Bicycle and Pedestrian Facilities[11]

Facility Type	Minimum Standard
Eight- and Six-lane Roads	Two 10' wide Shared Use Path or amended dimensions by AASHTO in the future. If a 10' wide Shared Use Path is not feasible, a narrower shared use path may be accepted based on the *Loudoun County Pedestrian and Bicycle Design Toolkit* and AASHTO' standards and design guidelines. For on-road bicycle facilities (bike lanes) where proposed and in accordance with the Loudoun County Bicycle & Pedestrian Mobility Master Plan, refer to Loudoun County Pedestrian and Bicycle Design Toolkit for design guidelines. Pedestrian facilities need to be provided as well and designed as per the Loudoun County Bicycle & Pedestrian Mobility Master Plan.
Four-lane Roads	One 10' wide Shared Use Path over 14' wide right-of-way or public easement if required by the County. The County will make the final decision on the location of the Shared Use Path. **AND** One 6' wide sidewalk designed as per the Loudoun County Bicycle & Pedestrian Mobility Master Plan (Walkway and Sidewalk Policies) or a Shared Use Path. The County will make the final decision on the type and location of the facility. Sidewalks will not typically be provided along rural road sections with no or few adjacent housing units. **AND** On road bicycle facilities (bike lanes) in accordance with the Loudoun County Bicycle & Pedestrian Mobility Master Plan (except when determined to be infeasible according to AASHTO standards and guidelines); refer to Loudoun County Pedestrian and Bicycle Design Toolkit for design guidelines. If a 10' wide Shared Use Path is not feasible, a narrower shared use path may be accepted based on the *Loudoun County Pedestrian and Bicycle Design Toolkit* and AASHTO standards and design guidelines.

[9] 2010 CTP, Chapter 4, Bicycle Mobility.
[10] 2010 CTP, Appendix 6, Planning Guidelines for Bicycle and Pedestrian Facilities.
[11] 2010 CTP, Appendix 6, Planning Guidelines for Bicycle and Pedestrian Facilities.

Facility Type	Minimum Standard
Two-lane Roads	Two 6' wide sidewalks designed as per the Loudoun County Bicycle & Pedestrian Mobility Master Plan (Walkway and Sidewalk Policies). Such sidewalks shall be provided on both sides in Suburban Policy, Transition Policy and Joint Land Management Areas, and where feasible in Villages in the Rural Policy Area. **AND** On-road bicycle accommodations or a Shared Use Path. The County will make the final decision on the type and location of the facility. Sidewalks will not typically be provided along rural road sections with no or few adjacent housing units. For on-road bicycle facilities (bike lanes) where proposed and in accordance with the Loudoun County Bicycle & Pedestrian Mobility Master Plan, refer to Loudoun County Pedestrian and Bicycle Design Toolkit for design guidelines. Pedestrian facilities need to be provided as well and designed as per the Loudoun County Bicycle & Pedestrian Mobility Master Plan.

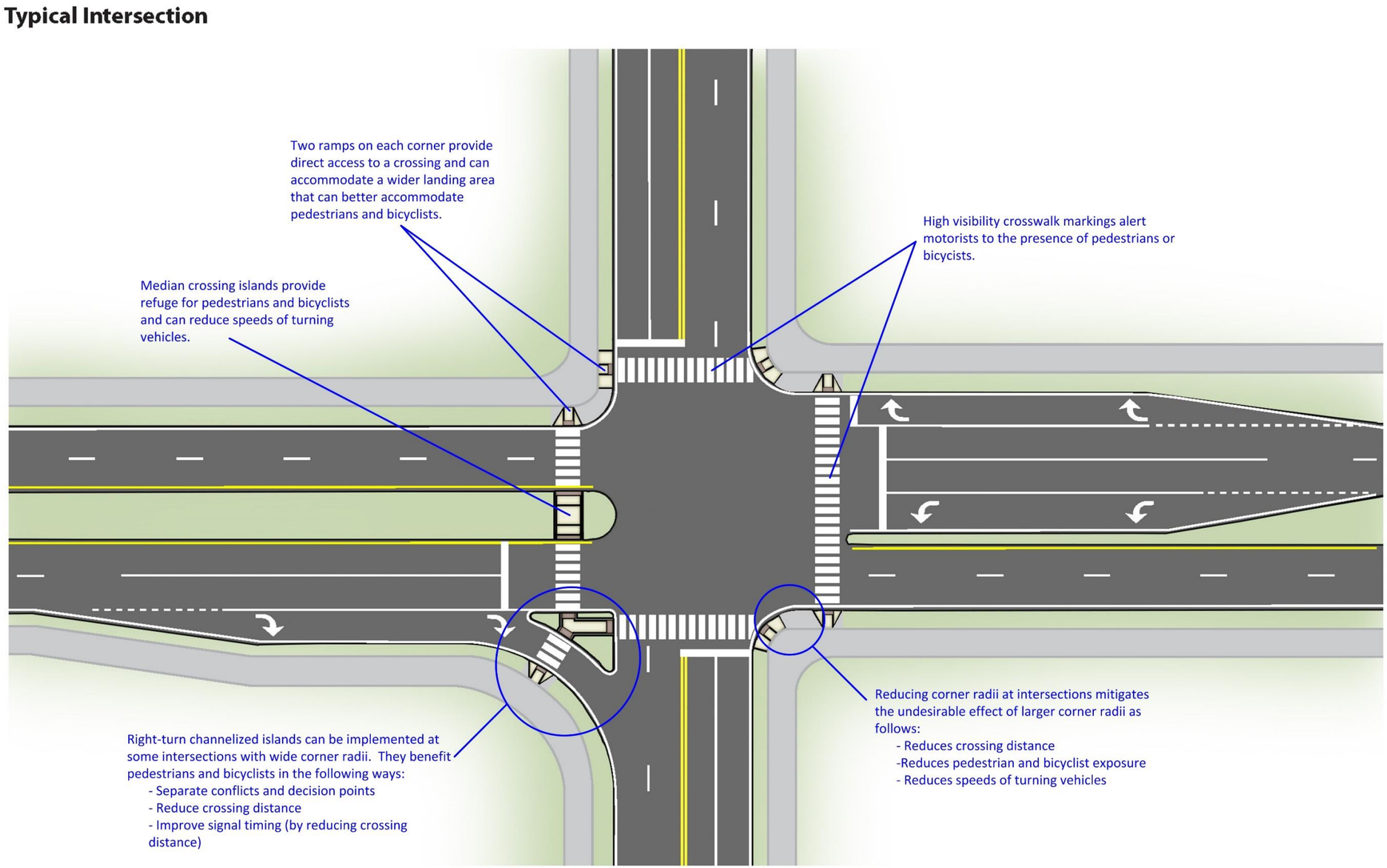
In general, recommendations in this study adhere to the standards identified for six-lane roadways (i.e. two 10-foot shared use paths). For four-lane roadways, recommendations in this study exceed the minimum identified in the CTP in order to provide a consistent network of 10-foot shared use paths throughout the station areas. This extensive network of 10-foot shared use paths will promote non-motorized modes of travel, minimize conflicts between pedestrians and bicyclists on shared use paths, and accommodate users with different mobility needs.

The recommended projects are listed by station area. It is also important to note that intersection improvements were specifically identified at intersections within a one-mile radius of the proposed stations. Improvements at intersections outside of these areas are also likely needed in that many intersections exhibit the same geometry and traffic control that may make pedestrian and bicycle travel difficult. These intersections may also be considered for improvements that are common among the intersections within the one-mile limit. These improvements may include, but are not limited to, the following:

- Measures to shorten crossing distances, such as smaller corner radii or right-turn channelized islands. Note that channelized islands must be accompanied by pedestrian signals, warning signs, and high visibility crosswalk sections between the corner radius and the island.
- Measures to enhance the conspicuity of the crossing, such as high-visibility crosswalk markings and lighting.
- Measures to improve crossing operations, such as implementing a leading pedestrian interval (LPI) and countdown pedestrian signals.
- Measures to reduce vehicle speeds by changing the overall roadway environment.

Figure 9 shows a diagram of a typical intersection featuring some of the treatments listed above. A detailed description of the measures recommended in this report are included in the appendix. All recommended improvements are consistent with treatments identified in the Loudoun County Pedestrian and Bicycle Design Toolkit.

Figure 9: Diagram of Typical Intersection with Potential Crossing Treatments



While most improvements are included in the recommendation tables in Chapter 4 and Chapter 6, others may be considered in the context of a broader, integrated plan. These include lighting, wayfinding signage, and bicycle parking. Lighting was identified by both the project team and citizen input as an issue that needs to be addressed in order to improve pedestrian and bicyclist safety in the study area. In addition to the recommended improvements detailed below for 31 intersections in the study area, the County should consider conducting a separate assessment of the lighting conditions and needs along sidewalks and shared use paths as well as at crossings. Providing good visibility for pedestrians and bicyclists crossing at each of the intersections in the study area is critical to providing a safe network of facilities for pedestrians and bicyclists. Based on the findings of that assessment, an area-wide program to address lighting needs might provide a good approach for the County to address lighting.

It also is critical that bicyclists be informed of new facilities so they can choose the most convenient route to the stations. This information should be provided in area maps showing biking facilities and the locations of bicycle racks. These maps should be updated frequently. There should also be a comprehensive plan for providing wayfinding signage to direct both pedestrians and bicyclists along routes to major destinations. Wayfinding signage will facilitate station access and heighten visibility of Metrorail.

4.1 Route 772 Station Area

The project team recommends pedestrian and bicycle improvements on 22 roadway and trail segments in the Route 772 Station Area. Among those recommendations are the installation of new shared use paths and filling in gaps in existing shared use paths, striping bike lanes on Hemingway Drive, and widening and installing bike lanes on Old Ryan Road.

Shellhorn Road lies adjacent to the northeast side of the Route 772 station, and will serve as the primary access for pedestrians and bicyclists users coming from the north and northeast, including the W&OD Trail. It is critical that safe and comfortable pedestrian and bicycle facilities be provided along and across Shellhorn Road in order to accommodate the increased pedestrian and bicycle volumes that will accompany Metrorail's arrival. With that in mind, the project team has recommended 10-foot shared use paths on both sides of the roadway. Other improvements along Shellhorn Road that would entail changes to the roadway are identified in Chapter 6 – Other Considerations.

Bicycle commuters seeking to access Metrorail from the west via the W&OD Trail likely will choose to use the terminus station at Route 772. Safe and comfortable connectivity between the W&OD Trail and the Route 772 station is therefore a key consideration in the recommendations for this station area. The project team identified Ashburn Village Boulevard as a candidate for providing a connection between the W&OD Trail and the station, and has recommended 10-foot shared use paths on both sides of the roadway to facilitate this connection. Note that Ashburn Road was also considered for designation as a critical connection to the W&OD Trail; however, because of a lack of right-of-way that results in a bottleneck at the bridge over Beaverdam Creek on Ashburn Road, the project team identified Ashburn Village Boulevard as a preferable alternative.

The project team also identified a series of existing north-south recreational trails – paralleling Beaverdam Creek between Ashburn Road and Claiborne Parkway – that can provide another off-road connection between the W&OD Trail and Faulkner Parkway, located within a mile of the Route 772 station. Additional shared use path and intersection improvements recommended in this section would provide connectivity between the end of the north-south recreational trail and the Route 772 station via Faulkner Parkway and Ashburn Village Boulevard.

Old Ryan Road, which is located adjacent to the planned higher density transit-oriented Moorefield Station development at the Route 772 station and will provide an important link for pedestrians and bicyclists from the west and the south to access the station, is currently planned to be widened from two to four lanes. With that in mind, the project team suggests studying if Old Ryan Road can be striped with two motorized through lanes and two bike lanes in lieu of four motorized vehicular through lanes. The project team also has recommended installing a 10-foot shared use path on one side and six-foot sidewalk on the other. The improved facilities on Old Ryan Road would connect to planned bike lanes on Mooreview Parkway, a planned shared use path on Ryan Road, and a planned network of pedestrian and bicycle facilities in the Moorefield Station development.

Hemingway Drive is not currently a CTP roadway, but has been identified by the Loudoun County Bicycle & Pedestrian Mobility Master Plan as a baseline connecting roadway. Due to the existing conditions of sidewalk on both sides of the roadway, a roadway width of 36 feet, a lack of any pavement markings, and low volumes, it is recommended that a striped centerline and on-road bike lanes be considered on this road to accommodate bicyclists. This road could also function in the future as an unmarked shared roadway – as it currently does – but adding markings will provide additional safety benefits by identifying clear designated spaces for all road users to travel while also altering the current “open road” feel of Hemingway Drive, which may invite speeding concerns.

See Table 2 for a detailed list of recommended roadway and trail improvements for the Route 772 station area.

Table 2: Route 772 Station Area Recommended Roadway Segment Improvements

Route No.	Road Name	From	To	Recommended Treatment	2010 CTP Appendix 6*
607	Loudoun County Pkwy	Ryan Rd	Bannister St	Fill gaps in existing shared use path on east/south side	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
625	Farmwell Rd	Ashburn Rd	Smith Switch Rd	Install 10-foot shared use path on both sides	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
640	Broadlands/ Shellhorn/ Faulkner	Belmont Ridge Rd	Ashburn Rd	Install 10-foot shared use path on both sides	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
640	Waxpool Rd	Faulkner Pkwy	Ashburn Village Blvd	Install 10-foot shared use path on both sides	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
640	Waxpool Rd	Ashburn Village Blvd	Farmwell Rd	Install 10-foot shared use path on both sides	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
641	Ashburn Rd	Ashburn Farm Pkwy	Faulkner Pkwy	Fill gaps in existing shared use path on both sides	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
641	Ashburn Rd	Faulkner Pkwy	Waxpool Rd	Install 10-foot shared use path on both sides	Two 6' sidewalks AND on-road bike accommodations or shared use path
643	Shellhorn Rd	Waxpool Rd	Loudoun County Pkwy	Install 10-foot shared use path on both sides	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
645	Croson Lane	Claiborne Pkwy	Old Ryan Rd	Fill gaps in existing shared use path on both sides	Two 6' sidewalks AND on-road bike accommodations or shared use path
645	Croson Lane	Belmont Ridge Rd	Claiborne Pkwy	Fill gaps in existing shared use path on both sides	Two 6' sidewalks AND on-road bike accommodations or shared use path
659	Belmont Ridge Rd	Northstar Blvd	Croson Ln	Install 10-foot shared use path on east side	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
772	Old Ryan Road	Mooreview Pkwy (north end)	Ryan Rd	Stripe bike lanes as part of planned widening; install sidewalk on west side and shared use path on east side	N/A (not included in CTP)
901	Claiborne Pkwy	W&OD Trail	Broadlands Blvd	Fill gaps in existing shared use paths on east side	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible

Route No.	Road Name	From	To	Recommended Treatment	2010 CTP Appendix 6*
901	Claiborne Pkwy	Broadlands Blvd	Croson Lane	Fill gaps in existing shared use paths on east side	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
1950	Smith Switch Rd	Farmwell Rd	W&OD Trail	Fill gaps in existing shared use path on west side	Two 6’ sidewalks AND on-road bike accommodations or shared use path
2020	Ashburn Village Blvd	W&OD Trail	Farmwell Rd	Fill gaps in existing shared use paths on both sides; create new connection to W&OD Trail on east side	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
2020	Ashburn Village Blvd	Farmwell Rd	Dulles Greenway bridge	Install 10-foot shared use path on both sides	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
2070	Demott Dr	Waxpool Rd	Mooreview Pkwy	Install 10-foot shared use path on north side	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
2090	Hemingway Dr	Farmwell Rd	Faulkner Pkwy	Stripe centerline and bike lanes; fill in gaps in existing sidewalk on west side	Two 6’ sidewalks AND on-road bike accommodations or shared use path
2119	Truro Parish Dr	Belmont Ridge Rd	Claiborne Pkwy	Fill gaps in existing shared use paths on south side	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
2119	Waxpool Rd	Claiborne Pkwy	Ashburn Rd	Install 10-foot shared use path on both sides	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
2119	Waxpool Rd	Ashburn Rd	Faulkner Pkwy	Install 10-foot shared use path on both sides	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
2298	Mooreview Pkwy	Dulles Greenway bridge	Croson Lane	Install 10-foot shared use path on both sides	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
2394	Wynridge Dr / Claude Moore Ave	Claiborne Pkwy	Old Ryan Rd	Install 10-foot shared use path on both sides	One 10’ shared use path AND one 6’ sidewalk AND bike lanes if feasible
n/a	Existing N-S Inter-parcel Trail	W&OD Trail	Faulkner Pkwy	Install marked trail crossing across Hay Rd	N/A (not included in CTP)

* From *2010 CTP, Appendix 6, Planning Guidelines for Bicycle and Pedestrian Facilities*.

Pedestrian and bicycle connectivity in the station area cannot be accomplished without intersection improvements to complement other roadway segment improvements such as sidewalks, shared use paths, and bike lanes. To that end, the project team has recommended pedestrian and bicycle improvements at 26 intersections in the Route 772 station area. All 26 intersections are located within

one mile of the station. These intersections were selected for their proximity to the station as well as their importance in providing connectivity to other roadway segment improvements identified in Table 2 above. See Table 3 for a list of detailed recommended improvements by intersection.

Table 3: Route 772 Station Area Recommended Intersection Improvements

Int. No.	Location	Signalized?	Recommendations
1	Waxpool Rd @ Faulkner Pkwy	No	• Check signal warrants • Consider islands or smaller corner radii • Install crosswalk with high visibility markings across W/S leg • Install crosswalk with high visibility markings across N/W leg, with median widening and other improvements • Two ramps each corner and widen landing area
2	Waxpool Rd @ Shellhorn Rd	No	• Check signal warrants • Consider islands or smaller corner radii • Install crosswalks with high visibility markings • Two ramps each corner and widen landing area
3	Waxpool Rd @ Ashburn Rd	No	• Check signal warrants • Consider islands or smaller corner radii • Install temporary/permanent curbing to reduce intersection footprint • Install crosswalks with high visibility markings • Two ramps each corner and widen landing area
4	Waxpool Rd @ Ashburn Village Blvd	Yes^	• Consider islands or smaller corner radii • Install temporary/permanent curbing to reduce intersection footprint • Add crosswalks with high visibility markings • LPI • Countdown ped signals • Modify medians for slower speed; skip marks • Two ramps each corner and landing areas (NW, SW, SE corners)
5	Faulkner Pkwy @ Hemingway Dr	No	• Reduce corner radii • Install RRFB • Shorten left-turn lanes on north and south legs • Install crosswalk across Faulkner Pkwy with high visibility markings • Reorient existing ramps and widen landing areas
6	Faulkner Pkwy @ Ashburn Rd	No	• Check signal warrants • Consider islands or smaller corner radii • Install temporary/permanent curbing to reduce intersection footprint • Add crosswalks with high visibility markings • Two ramps each corner and widen landing area
8	Shellhorn Rd @ Loudoun Station Dr	No	• Install roundabout or signal • High visibility crosswalk markings • Eliminate skew of crosswalks to reduce crossing distance (e.g. S/W leg) • Two ramps each corner and widen landing area

Int. No.	Location	Signalized?	Recommendations
9	Shellhorn Rd @ Central Station Dr	No	• Install signal or roundabout • Install crossing across Shellhorn Rd • High visibility crosswalk markings • Two ramps each corner and widen landing area
10	Shellhorn Rd @ Metro Center Dr	No	• High visibility crosswalk markings • Widen landing area
11	Shellhorn Rd @ Greenway Corporate Dr	Yes	• Consider islands or smaller corner radii • Install crosswalk on N/W leg • High visibility crosswalk markings • LPI • Countdown ped signals • Two ramps each corner and widen landing area
12	Old Ryan Rd @ Claude Moore Dr (future condition – Claude Moore extended into Mooreview Sta. development)	No	• Coordinate with proposed improvements on Old Ryan Rd (bike lanes/trail/sidewalk) • Install traffic signal • High visibility crosswalk markings on all legs • LPI • Countdown ped signals • Two ramps each corner with landing area
13	Shellhorn Rd @ Devin Shafron Dr	No	• Check signal warrants • High visibility crosswalk markings • Two ramps each corner with landing area
14	Shellhorn Rd @ Ashburn Village Blvd	Yes	• Consider islands or smaller corner radii • High visibility crosswalk markings • LPI • Countdown ped signals • Modify medians for slower speed with skip marks • Eliminate skew of crosswalks to reduce crossing distance (e.g. east leg) • Two ramps each corner and widen landing area
15	Old Ryan Rd @ Croson Ln (future condition – Croson Ln extended into Mooreview Station development)	No	• Coordinate with proposed improvements on Croson Lane (fill in trail gaps on both side) and Old Ryan Rd (bike lanes/trail/sidewalk) • Install traffic signal • High visibility crosswalk markings on all legs • LPI • Countdown ped signals • Two ramps each corner with landing area
16	Mooreview Pkwy @ west ramps	No	• Push curb out, move crosswalk closer to ramp entrance • Install post-mounted delineators on ramp to reduce vehicle speeds
17	Ashburn Village Blvd @ east ramps	No	• Install high visibility crosswalk markings on south leg • LPI on north leg • Countdown ped signals

Int. No.	Location	Signalized?	Recommendations
18	Mooreview Pkwy @ Old Ryan Rd (northern end)	Yes	• Reduce corner radii • LPI • Countdown ped signals • Eliminate skew of crosswalks to reduce crossing distance • Widen landing area
20	Mooreview Pkwy @ Demott Dr	No	• Install islands or reduce corner radii • High visibility crosswalk markings on west leg (across Demott) • Widen landing area
21	Mooreview Pkwy @ Wynridge Dr	No	• Check signal warrants • Install temporary/permanent curbing to reduce intersection footprint • High visibility crosswalk markings • Widen landing area
22	Mooreview Pkwy @ Croson Ln	No	• Check signal warrants • Reduce corner radii • Move trail crossing on south leg closer to intersection • High visibility crosswalk markings
23	Loudoun County Pkwy @ Westwind Dr (future condition – Moorefield Blvd as new north leg)	No	• Coordinate with proposed improvements on Loudoun County Pkwy (fill in trail gaps on south/east side) • Install traffic signal • Reduce corner radii on south leg • High visibility crosswalk markings on all legs with median refuge on Loudoun County Pkwy • LPI • Countdown ped signals • Two ramps each corner with landing area
24	Loudoun County Pkwy @ Centergate Dr	Yes	• High visibility crosswalk markings • LPI • Countdown ped signals
25	Shellhorn Rd @ Loudoun County Pkwy	Yes	• Tie urban design into future development in vicinity of this intersection
26	Mooreview Pkwy @ Loudoun County Pkwy	Yes	• Consider islands or smaller corner radii • High visibility crosswalk markings • Install crosswalk on south leg • Install median refuge on north and south legs • LPI • Countdown ped signals • Eliminate skew of crosswalk on north leg • Two ramps each corner and widen landing area
27	Old Ryan Rd @ Mooreview Pkwy (southern end)	No	• Assume future signal control under four-leg operation • Install temporary/permanent curbing to reduce intersection footprint • High visibility crosswalk markings • Two ramps each corner

^ Intersection to be signalized in 2014

4.2 Route 606 Station Area

The project team recommends pedestrian and bicycle improvements on 14 roadway and trail segments in the Route 606 Station Area. Among those recommendations are installation of new shared use paths and filling in gaps in existing shared use paths and an extension of Sterling Boulevard per the 2010 CTP (or, in the absence of such an extension, creating a new inter-parcel shared use path).

Two corridors were identified as critical links to the W&OD Trail in the Route 606 station area:

- Sterling Boulevard, which provides access to the Route 606 station from the east; and
- Pacific Boulevard, which provides access to both the Route 606 station and to the corporate campuses located south of Waxpool Road.

Ten-foot shared use paths have been recommended on both sides of Pacific Boulevard to facilitate the connection between the W&OD Trail, the Route 606 station, and the corporate campuses in between. For Sterling Boulevard, a 10-foot shared use path has been recommended on the south side only, as that side of the roadway was identified as the preferred route for crossing Route 28. Without an improved pedestrian/bicycle crossing of Route 28 along Sterling Boulevard, it is possible that Sterling residents will opt to use the Innovation Center station rather than navigate the existing adverse conditions at the Route 28 interchanges.

Improvements at Route 28 and Church Road/Waxpool Road interchange were not recommended, due to high traffic volumes, high posted speeds and the number of interchange ramps that need to be crossed. The W&OD Trail offers a grade-separated crossing of Route 28 just north of the interchange that can facilitate pedestrian or bicycle access to the Route 606 station. This route should be encouraged through maps illustrating pedestrian and bicycle facilities and wayfinding. Similarly, pedestrians and bicyclists should be directed to alternate paths so that they do not have to traverse the interchange of Old Ox Road and the Dulles Greenway, due to the high volumes, high speeds, the number of conflicts, and lack of driver expectancy to encounter pedestrians and bicyclists on the interchange ramps.

See Table 4 for a detailed list of recommended roadway segment improvements.

Table 4: Route 606 Station Area Recommended Roadway Segment Improvements

Route No.	Road Name	From	To	Recommended Treatment	2010 CTP Planning Guidelines*
606	Old Ox Rd (future condition – four-lane roadway)	Pebble Run Pl	1,000 feet west of Dulles Greenway bridge	Install 10-foot shared use path on north side; connect to proposed pedestrian/ bicycle bridge over VA 267 to station area	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
606	Old Ox Rd	Moran Rd	Pacific Blvd	Install 10-foot shared use path on north side	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
606	Old Ox Rd	Shaw Rd	Rock Hill Rd	Install 10-foot shared use path on north side	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
625	Waxpool Rd	Farmwell Rd	Pacific Blvd	Install 10-foot shared use path on south side	Two 10' shared use paths
625	Church Rd	W&OD Trail	1,500 feet east of Holly Ave	Install 10-foot shared use path on south side	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
634	Moran Rd	Lockridge Rd	Pacific Blvd	Install 10-foot shared use path on south side	Two 6' sidewalks AND on-road bike accommodations or shared use path
**789	Lockridge Rd	Moran Rd	Prentice Dr	Install sidewalk on east side and shared use path on west side	Two 6' sidewalks AND on-road bike accommodations or shared use path
789	Moran Rd	Old Ox Rd	Lockridge Rd	Install 10-foot shared use path on east side	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
846	Sterling Blvd	Shaw Rd	1,200 feet east of Maple Ave	Install 10-foot shared use path on south side	Two 6' sidewalks AND on-road bike accommodations or shared use path
846	Sterling Blvd	Pacific Blvd	Moran Rd	Extend Sterling Blvd to Moran Rd from its current terminus at Pacific Blvd, per the 2010 CTP	n/a
1036	Pacific Blvd	Sterling Blvd	Moran Rd	Install 10-foot shared use path on west side (check newly constructed segment of Pacific Blvd for shared use path on west side)	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible

Route No.	Road Name	From	To	Recommended Treatment	2010 CTP Planning Guidelines*
1036	Pacific Blvd	W&OD Trail	Prentice Dr	Install 10-foot shared use path on both sides	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
1902	Atlantic Blvd	Nokes Blvd	500 feet north of Magnolia Rd	Install 10-foot shared use path on east side	One 10' shared use path AND one 6' sidewalk AND bike lanes if feasible
n/a	Sterling Blvd (extended)	Pacific Blvd	Moran Rd	In the absence of a Sterling Blvd extension, install inter-parcel shared use path	n/a

* From *2010 CTP, Appendix 6, Planning Guidelines for Bicycle and Pedestrian Facilities*.

**May change due to the Board of Supervisors initiated study for Prentice Drive and Lockridge Road

The project team has recommended pedestrian and bicycle improvements at six intersections in the Route 606 station area. The W&OD Trail crossing at Sterling Boulevard is the only intersection for which improvements were recommended that is not located within one mile of a proposed Metrorail station. This location was included due to the high pedestrian and bicycle crash incidence and because the W&OD Trail serves as a major regional link: the intersection was the site of five pedestrian and bicycle crashes between 2008 and 2012. See Table 5 for a list of detailed recommended improvements by intersection.

Table 5: Route 606 Station Area Recommended Intersection Improvements

Int. No.	Location	Signalized?	Recommendations
7	Moran Rd @ Lockridge Rd	No	• Check signal warrants • Install crosswalks with high visibility markings on all legs • Consider islands or smaller corner radii • Two ramps each corner and widen landing area
19	Lockridge Rd @ Prentice Dr (future condition – Lockridge Rd extended to Loudoun County Pkwy)	No	• Coordinate with proposed improvements on Prentice Dr and Lockridge Rd • Install traffic signal • High visibility crosswalk markings on all legs • LPI • Countdown ped signals • Two ramps each corner with landing area
28	Old Ox Rd @ Relocation Dr	Yes	• Install crosswalk with high visibility markings on leg across Relocation Dr • LPI • Countdown ped signals • Install landing areas
29	Old Ox Rd @ Commerce Center Ct	No	• Install crosswalk with high visibility markings on north leg (across Commerce Center Ct) • Install median refuge on north leg • Consider islands or smaller corner radii • Install ramps and landing areas

Int. No.	Location	Signalized?	Recommendations
30	Old Ox Rd @ Mercure Cir	Yes	• Install crosswalk with high visibility markings on north leg (across Mercure Cir) • Install median refuge on north leg • LPI • Countdown ped signals • Install ramps and landing areas
31	Sterling Blvd @ W&OD Trail	No	• Enhance signage/traffic control; consider RRFB

5 Prioritization and Implementation

Each of the pedestrian and bicyclist projects recommended in this study is important in order to provide the best possible access to the proposed Metrorail stations. Prioritization of these projects is necessary as it would be impossible to construct all projects at once. Many considerations should go into the prioritization of the various recommendations to create an implementation plan that addresses the areas of highest concern first. Relevant to the development of the prioritization criteria are elements included in the Loudoun County Board of Supervisors Action Item #9b (2008), which outlined criteria to be considered for prioritizing sidewalk construction projects. Among those criteria incorporated from Action Item #9b are crash history and minimization of hazards to pedestrians and bicyclists, for which from this study the Pedestrian Intersection Safety Index (ISI) could be used as a proxy.

A list of intersections has been developed that includes each of the 31 intersections. These 31 locations could be prioritized based on the following criteria:

- **Distance to the station.** Intersections within 0.4 miles of a station should be assigned higher priority (this distance captures all intersections located adjacent to a station or adjacent to a planned TOD).
- **Pedestrian/bicyclist safety**. Intersections with a Pedestrian ISI score of 4 or higher, or which had one or more ped/bike crashes between 2008 and 2012, should be assigned higher priority.

Based on these elements, each of the recommended intersections could be assigned to priority groups.

A list of roadway segment improvements has also been developed. Roadway segment locations could be prioritized based on the following criteria:

- **Distance to the station.** Roadway segments located within one mile of a station should be assigned higher priority.
- **Connectivity to W&OD Trail.** Roadway segments that are identified as providing critical links between a station and the W&OD Trail should be assigned higher priority.
- **Connectivity to population/employment center.** Roadway segments that are identified as providing critical links between a station and a population or employment center should be assigned higher priority Priorities should also consider the phasing of future developments, as existing parcels may develop into a population or employment center.

Based on these elements, each of the recommended roadway segments could be assigned to one of three priority groups:

- Level 1 priority
    - Segments that provide connectivity to W&OD Trail.

    - Segments that are located within one mile of a station AND provide connectivity to a population or employment center.
- Level 2 priority
    - All other segments located within one mile of a station (but do not provide connectivity to the W&OD Trail or to a population or employment center).
    - Segments that are located within three miles of a station AND provide connectivity to a population or employment center.
- Level 3 priority
    - All other segments located within three miles of a station (but do not provide connectivity to the W&OD Trail or to a population or employment center).

When prioritization has been established, it is likely that some of the higher priority projects will take substantial levels of resources to complete, and may not be able to be constructed immediately. While other projects that are of a lower-level priority group may be able to be implemented quite quickly; their priority level should not prohibit this. Each of these recommended projects is important and should be completed as soon as the resources become available to do so. Prioritization simply provides guidance on where to begin.

In reality, cost plays a very important role in the actual implementation of transportation improvements as funding is typically the scarcest resource. While cost was not considered in the prioritization of projects, estimated unit costs for various types of treatments were developed based on the VDOT NOVA District Averages (see Appendix B). These cost estimates in current year dollars may be considered "conservative," meaning they are on the high side in terms of estimating construction costs. These estimates are meant to provide an order of magnitude comparison between costs for construction. Actual costs to implement projects may include these additional items:

- 15% for design costs,
- 5% contingency, and
- 20% CEI costs.

In addition to the above costs, obtaining right-of-way and relocating conflicting utilities may also be required, which could add significant time and costs to a project.

Annual budgets will also need to include monies for maintaining these facilities.

A list of roadway segment projects by station area is included in the sections to follow. These sections include some of the criteria mentioned previously that could be used to prioritize projects in the future.

5.1 Route 772 Station Area

See Table 6 for a summary of key characteristics for each roadway segment project recommended for the Route 772 station area.

Table 6: Route 772 Station Area – Key Indicators for Recommended Roadway Segment Projects

Route No.	Road Name	From	To	Distance from Station	Critical Link to W&OD Trail	Link to Pop or Emp Center	Segment Length
607	Loudoun County Pkwy	Ryan Rd	Bannister St	Within 1 mile	No	Yes	2,150 ft[&]
625	Farmwell Rd	Ashburn Rd	Smith Switch Rd	Within 3 miles	No	No	6,700 ft
640	Waxpool Rd	Faulkner Pkwy	Ashburn Village Blvd	Within 1 mile	No	Yes	1,200 ft
640	Waxpool Rd	Ashburn Village Blvd	Farmwell Rd	Within 1 mile	No	No	5,400 ft
640	Broadlands/ Shellhorn/ Faulkner	Belmont Ridge Rd	Ashburn Rd	Within 3 miles	No	Yes	11,300 ft
643	Shellhorn Rd	Waxpool Rd	Loudoun County Pkwy	Within 1 mile	No	Yes	7,400 ft
645	Croson Lane	Claiborne Pkwy	Old Ryan Rd	Within 1 mile	No	Yes	7,500 ft[&]
645	Croson Lane	Belmont Ridge Rd	Claiborne Pkwy	Within 3 miles	No	Yes	4,700 ft[&]
659	Belmont Ridge Rd	Northstar Blvd	Croson Ln	Within 3 miles	No	Yes	1,300 ft
772	Old Ryan Road	Mooreview Pkwy (north end)	Ryan Rd	Within 1 mile	No	Yes	6,250 ft
901	Claiborne Pkwy	W&OD Trail	Broadlands Blvd	Within 3 miles	No	Yes	2,300 ft[&]
901	Claiborne Pkwy	Broadlands Blvd	Croson Lane	Within 3 miles	No	Yes	4,500 ft[&]
1950	Smith Switch Rd	Farmwell Rd	W&OD Trail	Within 3 miles	No	No	2,300 ft[&]
2020	Ashburn Village Blvd	W&OD Trail	Farmwell Rd	Within 3 miles	Yes	Yes	3,550 ft[&]
2020	Ashburn Village Blvd	Farmwell Rd	Dulles Greenway bridge	Within 1 mile	Yes	Yes	4,000 ft
2070	Demott Dr	Waxpool Rd	Mooreview Pkwy	Within 1 mile	No	Yes	3,800 ft
2090	Hemingway Dr	Farmwell Rd	Faulkner Pkwy	Within 1 mile	No	Yes	4,000 ft/ 1,400 ft[&]
2119	Truro Parish Dr	Belmont Ridge Rd	Claiborne Pkwy	Within 3 miles	No	Yes	6,350 ft

Route No.	Road Name	From	To	Distance from Station	Critical Link to W&OD Trail	Link to Pop or Emp Center	Priority
2119	Waxpool Rd	Claiborne Pkwy	Ashburn Rd	Within 1 mile	No	Yes	4,650 ft
2119	Waxpool Rd	Ashburn Rd	Faulkner Pkwy	Within 1 mile	No	Yes	1,950 ft
2298	Mooreview Pkwy	Dulles Greenway bridge	Croson Lane	Within 1 mile	No	Yes	4,000 ft
n/a	Existing N-S Inter-parcel Trail	W&OD Trail	Faulkner Pkwy	Within 3 miles	Yes	Yes	65 ft

See Table 7 for a summary of key characteristics for each intersection project recommended for the Route 772 station area.

Table 7: Route 772 Station Area – Key Indicators for Recommended Intersection Projects

Int. No.	Location	Signalized?	Distance to Station	Max Ped ISI (1-6)**	Ped/Bike Crashes (2008-12)
1	Waxpool Rd @ Faulkner Pkwy	No	0.57 mi	4.68	1
2	Waxpool Rd @ Shellhorn Rd	No	0.57 mi	4.25	0
3	Waxpool Rd @ Ashburn Rd	No	0.61 mi	4.67	0
4	Waxpool Rd @ Ashburn Village Blvd	Yes^	0.61 mi	2.95	1
8	Shellhorn Rd @ Loudoun Station Dr	No	0.20 mi	n/a	0
9	Shellhorn Rd @ Central Station Dr	No	0.20 mi	n/a	0
10	Shellhorn Rd @ Metro Center Dr	No	0.20 mi	n/a	0
11	Shellhorn Rd @ Greenway Corporate Dr	Yes	0.21 mi	3.53	0
12	Old Ryan Rd @ Claude Moore Dr (future condition – Claude Moore extended into Mooreview Sta. development)	No	0.27 mi	4.19	0
13	Shellhorn Rd @ Devin Shafron Dr	No	0.27 mi	n/a	0
14	Shellhorn Rd @ Ashburn Village Blvd	Yes	0.34 mi	3.87	0
15	Old Ryan Rd @ Croson Ln (future condition – Croson Ln extended into Mooreview Station development)	No	0.36 mi	3.85	0
5	Faulkner Pkwy @ Hemingway Dr	No	0.67 mi	n/a	0
6	Faulkner Pkwy @ Ashburn Rd	No	0.85 mi	2.63	0
16	Mooreview Pkwy @ west ramps	No	0.40 mi	n/a	0
17	Ashburn Village Blvd @ east ramps	No	0.41 mi	n/a	0
18	Mooreview Pkwy @ Old Ryan Rd (northern end)	Yes	0.42 mi	3.41	0
20	Mooreview Pkwy @ Demott Dr	No	0.46 mi	n/a	0
21	Mooreview Pkwy @ Wynridge Dr	No	0.49 mi	3.05	0
22	Mooreview Pkwy @ Croson Ln	No	0.57 mi	3.852	0

Int. No.	Location	Signalized?	Distance to Station	Max Ped ISI (1-6)**	Ped/Bike Crashes (2008-12)
23	Loudoun County Pkwy @ Westwind Dr (future condition – Moorefield Blvd as new north leg)	No	0.57 mi	n/a	0
24	Loudoun County Pkwy @ Centergate Dr	Yes	0.63 mi	3.84	0
25	Shellhorn Rd @ Loudoun County Pkwy	Yes	0.67 mi	3.50	0
26	Mooreview Pkwy @ Loudoun County Pkwy	Yes	0.84 mi	3.51	0
27	Old Ryan Rd @ Mooreview Pkwy (southern end)	No	0.87 mi	n/a	0

^ Intersection to be signalized in 2014

** Pedestrian Intersection Safety Index (PISI) provides a qualitative assessment of risk to pedestrians based on vehicle speed, crossing distance, type of traffic control, and land use. Ped ISI ranges from 1 to 6, with 6 representing the highest level of risk for pedestrians.

5.2 Route 606 Station Area

See Table 8 for a summary of key characteristics for each roadway segment project recommended for the Route 606 station area.

Table 8: Route 606 Station Area – Key Indicators for Recommended Roadway Segment Projects

Route No.	Road Name	From	To	Distance from Station	Critical Link to W&OD Trail	Link to Pop or Emp Center	Segment Length
606	Old Ox Rd	Pebble Run Pl	1,000 ft west of Dulles Greenway bridge	Within 1 mile	No	No	15,950 ft
606	Old Ox Rd	Moran Rd	Pacific Blvd	Within 1 mile	No	No	6,800 ft
606	Old Ox Rd	Shaw Rd	Rock Hill Rd	Within 3 miles	No	No	4,500 ft
625	Waxpool Rd	Farmwell Rd	Pacific Blvd	Within 3 miles	No	No	8,400 ft
625	Church Rd	W&OD Trail	1,500 feet east of Holly Ave	Within 3 miles	No	Yes	5,500 ft
634	Moran Rd	Lockridge Rd	Pacific Blvd	Within 1 mile	Yes	No	5,400 ft
789	Moran Rd	Old Ox Rd	Lockridge Rd	Within 1 mile	No	No	1,300 ft
789	Lockridge Rd	Moran Rd	Prentice Dr	Within 1 mile	Yes	Yes	4,050 ft
846	Sterling Blvd	Shaw Rd	1,200 feet east of Maple Ave	Within 3 miles	Yes	Yes	7,400 ft
1036	Pacific Blvd	Sterling Blvd	Moran Rd	Within 3 miles	Yes	No	4,250 ft
1036	Pacific Blvd	W&OD Trail	Prentice Dr	Within 3 miles	Yes	Yes	5,000 ft
1071	Prentice Dr	Lockridge Rd	Pacific Blvd	Within 1 mile	Yes	Yes	3,800 ft
1902	Atlantic Blvd	Nokes Blvd	500 feet north of Magnolia Rd	Within 3 miles	No	No	5,250 ft
n/a	Sterling Blvd (extended)	Pacific Blvd	Moran Rd	Within 1 mile	Yes	Yes	3,950 ft

* May change due to the Board of Supervisors initiated study for Prentice Drive and Lockridge Road

See Table 9 for a summary of key characteristics for each intersection project recommended for the Route 606 station area.

Table 9: Route 606 Station Area – Key Indicators for Recommended Intersection Projects

Int. No.	Location	Signalized?	Distance to Station	Max Ped ISI (1-6)**	Ped/Bike Crashes (2008-12)
7	Moran Rd @ Lockridge Rd	No	0.19 mi	2.96	1
31	Sterling Blvd @ W&OD Trail	No	2.13 mi	n/a	5
19	Lockridge Rd @ Prentice Dr (future condition – Lockridge Rd extended to Loudoun County Pkwy)	No	0.46 mi	n/a	0
28	Old Ox Rd @ Relocation Dr	Yes	0.92 mi	3.51	0
29	Old Ox Rd @ Commerce Ctr Ct	No	0.57 mi	n/a	0
30	Old Ox Rd @ Mercure Cir	Yes	0.76 mi	2.65	0

6 Additional Considerations

In addition to the roadway segment and intersection recommendations included in Chapter 4, the project team considered a number of additional improvements on CTP roadways in the study area. These strategies involve changing the character of a road to enhance bicycle and pedestrian operations by altering travel or turn lanes. Because facilitating these types of improvements would require modifying CTP roads, these strategies are meant to serve as potential considerations in the future if the desire for increased bicycle and pedestrian operations is present.

One strategy proven to be an effective and relatively inexpensive method to enhance bicycle and pedestrian operations in other locations within the region as well as across the county is a road diet. Roadways with relatively low speeds and traffic volumes, proximity to the station, and connections to existing and proposed pedestrian and bicycle facilities may be good candidates for road diets. This strategy involves accommodating on-road bicycle facilities by reducing the number of motorized vehicle travel lanes.

Another consideration is roadway widening and striping bike lanes, as well as installing a 10-foot shared use path on one side of the roadway and a six-foot sidewalk on the other side. This treatment was recommended for Old Ryan Road – a non-CTP roadway – in Chapter 4, and was also considered for Lockridge Road in the Route 606 station area. Lockridge Road will serve as the primary access – vehicular, pedestrian and bicycle – to the Route 606 station due to its location adjacent to the station. Improved facilities on Lockridge Road would help provide safe and comfortable pedestrian and bicycle access to the Route 606 station. On April 2, 2014, the Board of Supervisors initiated a Comprehensive Plan Amendment for Prentice Drive and Lockridge Road, which may have result in changes to the road configuration. Due to the proximity of these roadways to both the Route 772 and Route 606 Stations any changes to these roadways should include bicycle and pedestrian accommodations.

The project team also considered shared lane markings, which are placed on roadways where on-road bike lanes cannot be placed due to limited pavement width. They are meant to be placed as an

additional indicator to drivers that bicycles could be riding in an active travel lane. Typically, these markings are limited to roadways where the speed limits and traffic volumes are such that bicyclists can ride comfortably. It is recommended that this treatment be considered in more detail as the Metro stations come on-line. Potential locations where shared lane markings may be considered on CTP roadways include: Faulkner Parkway between Ashburn Road and Waxpool Road; Ashburn Road between the W&OD Trail and Farmwell Road; Shellhorn Road between Waxpool Road and Loudoun County Parkway; and Smith Switch Road between the W&OD Trail and Farmwell Road. All four of these roadway segments generally are compatible with on-street bicycling; however, some would necessitate changes to the road that would promote slower motorized vehicle speeds and greater awareness of the presence of bicyclists. This may include eliminating unused striped-out portions of the road, reducing the length of excessively long turn lanes, or installing roundabouts. For example, the southern portion of Shellhorn Road may benefit from treatments that inform motorists to drive slowly and expect pedestrians and bicyclists. The placement of roundabouts may serve this purpose and provide the opportunity to install shared lane markings on the roadway.

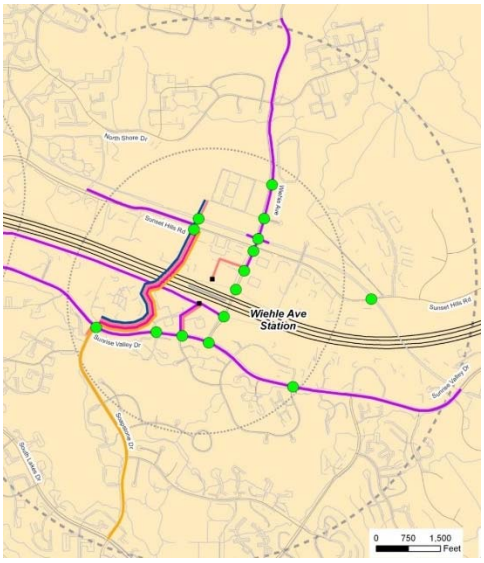
The strategies discussed in this chapter are important to providing full pedestrian and bicycle connectivity in and around the proposed Metrorail stations, and should be considered for future updates to the CTP. There also may be opportunities to pilot some of these improvements, consistent with guidance set forth in the 2003 Loudoun County Bicycle and Pedestrian Mobility Master Plan:

> *Use of emerging bicycle and pedestrian design techniques, not yet recognized in existing guidelines shall be considered on a demonstration basis as is appropriate and applicable to the particular project.*[12]

[12] 2003 Loudoun County Bicycle and Pedestrian Mobility Master Plan, Chapter 4, Transportation Project Development Policy 5.

A Local Case Study:
Providing Pedestrian and Bicycle Access to the Wiehle-Reston East Station

In 2008, Fairfax County completed a station access study for the Wiehle-Reston East and Reston Town Center Stations.[14] The report documented existing and projected transportation conditions and provided recommendations to address challenges facing access to the proposed Metro stations. With the imminent opening of the Wiehle-Reston East station, the County and the Virginia Department of Transportation have been working to enhance station access for all modes. Measures implemented are described in this case study.



Excerpt from the plans illustrating the proposed location of the road diet (yellow) in proximity to the station.

Intersection Improvements

Measures that reduce conflicts, and decrease exposure – such as reducing crossing distances – have been implemented to provide improved access for non-motorized users. These improvements are similar to treatments recommended for the Route 772 and Route 606 station areas, included in Table 3 and Table 5 of this report.

Road Diet

On-street bike lanes were proposed on several roadway segments as part of the Reston study. In multiple locations on four-lane roadways with excess capacity, bike lanes were proposed as part of a road diet. A road diet consists of the redistribution of space in an existing roadway leading to a reduction in the number of travel lanes for motor vehicles. The space remaining after the lane reduction may provide space for bike lanes, sidewalks, or medians. Road diets are considered one of FHWA's proven safety countermeasures. Safety benefits include:

- Reducing the multiple-threat crash scenario for pedestrians
- Providing space for pedestrian refuges
- Improving safety for cyclists when bike lanes are added
- Allowing for on-street parking, which can providing a buffer to pedestrians
- Reducing certain crash types
- Reducing speeding

Road diets are considered a low-cost option to providing infrastructure improvements to accommodate cyclists and pedestrians. Through proper planning of roadway maintenance, road diets can be accomplished as part of roadway overlay or restriping projects. They require no additional right-of-way acquisition or roadway widening.

Identifying roadways suitable for reconfiguration is a key to success. Roadways with travel volumes of 20,000 Average Daily Traffic (ADT) or less are good candidates. Other considerations include the

[14] http://www.fairfaxcounty.gov/fcdot/pdf/wr_sam/sam_report.pdf

number of driveways, presence of transit routes, and the quantity and layout of intersections along the roadway.[15]

One road diet recommended in the Reston study has already been implemented as part of Phase 1 of the Silver Line. Providing access to the Wiehle Avenue station for cyclists was critical, as the station is located less than a third of a mile from the W&OD trail and not far from many area neighborhoods. At the time of the study, existing facilities for pedestrians and cyclists were lacking and/or incomplete. Based on estimates of demand for walking and cycling associated with the arrival of Metrorail, a need for facilities was determined. Roadway reconfiguration was selected for roadways with excess capacity as a means to provide multimodal access within the existing roadway through low-cost improvements.

The following images illustrate how Soapstone Drive was reconfigured to provide bike lanes for residents accessing the Wiehle Avenue station from the south. The roadway was reconfigured from a four-lane facility to a two-lane facility with median turn lane and bike lanes on both sides. These improvements were completed by VDOT.

Left: Soapstone Drive prior to roadway reconfiguration. Right: Soapstone Drive after roadway reconfiguration.

Cyclist using the new bike lane on Soapstone Drive.

[15] http://safety.fhwa.dot.gov/provencountermeasures/

7 Funding Resources

Funding for the pedestrian and bicycle projects listed in this study will likely come from a variety of sources over time. Loudoun County may be responsible for funding the majority of the projects recommended through this study (estimated at between $15.2 million and $19.3 million); however, other funding sources – such as future development, federal, and state funds – may be available. Projects that do not require or only require minor construction, such as implementing a road diet, may be implemented as part of roadway resurfacing, maintenance, or other programmed projects.

Future development will offer another opportunity to implement some of the recommendations in this report, especially sidewalks and share use paths along the road. The Metrorail stations are likely to create interest in future development as increased densities near the stations become possible and profitable. As this development occurs the County may find opportunities to implement the projects as part of the development projects. Proffers from developers can include roadway expansions and improvements, construction of sidewalks and shared use paths or other projects that would improve accessibility in the station areas. The County can also use the development process to ensure that new developments match the environment around the stations that is envisioned by the community with all necessary pedestrian, bicycle and transit amenities.

Unfortunately, the opportunities during development may be limited or may be too far out to address a pressing need. Additionally, most of the area surrounding the Route 772 Station has already been approved for transit-oriented development. Other state and federal funding programs may be available.

7.1 State[16]

The Commonwealth of Virginia operates some programs that could provide additional sources of funding for projects that are recommended in this report. Access Programs provide funding for access roads to qualifying economic development sites, airports, and public recreational or historic areas. Access may require the construction of a new roadway, improvement of an existing roadway, or both. Funding is available through VDOT's Industrial, Airport, and Rail Access Fund.

The Revenue Sharing Program provides additional funding for use by a county, city, or town to construct, maintain, or improve the highway systems within such county, city, or town, with limitations on the amount of state funds authorized per locality. Locality funds are matched with state funds for qualifying projects.

7.2 Federal

Federal funds may be available for pedestrian and bicycle projects. Many Federal funding sources are administered by VDOT and have varying eligibility requirements and program goals. Potential funding sources include the following:

- Highway Safety Improvement Program (HSIP) – One Federal program that presents an opportunity is the Highway Safety Improvement Program (HSIP), which can be used for projects

[16] http://www.virginiadot.org/business/local-assistance-access-programs.asp

that specifically improve safety. HSIP can now be used for systemic improvements in addition to the site-specific data-driven improvements. HSIP applications can be created and submitted to VDOT for data or risk-driven projects. Crash data obtained for this project can be used to complete an HSIP application.

- Transportation Alternatives Program (TAP) – This replaces the Transportation Enhancement (TE) program. The TAP includes funding for bike and pedestrian facilities, safe routes to school, and recreational trails.
- Congestion Mitigation and Air Quality Improvement Program (CMAQ) – Transportation projects that contribute to congestion relief and air quality improvements.
- State and Community Traffic Safety Program (Section 402) – Reduce deaths and injuries on highways.

Other funding opportunities should also be investigated. These may include, but are not limited to, the following:

- Applicable state grants
- Private sector funding sources
- Non-profit funding sources

Additional funding sources are identified in the 2010 CTP.

Appendix A: Description of Countermeasures

Improvement Measures

Roadway Measures

		Measure	Description	Application
Signage: Regulatory		Bicycles May Use Full Lane Signs[1,5] **Cost** Low	Signs indicating that cyclists may occupy the travel lane (MUTCD R4-11).	To be used on roads where there are no bicycle lanes or usable shoulders and where marked travel lanes (should not be used on undivided, unmarked roadways) are too narrow for cyclists and motor vehicles to operate side-by-side. May be used in addition to or instead of the Shared Lane Marking.
Signage: Warning	 	Vehicular and Non-Vehicular Warning Signs[1, 5] **Cost** Low	Signs warning motorists of unexpected entries into the roadway or to alert motor vehicles that they are sharing the roadway with bicycles, pedestrians, farm equipment, and horse-drawn vehicles (multiple signs; MUTCD Figures 2C-10 and 2C-11). A fluorescent yellow-green background color may be used for pedestrian and bicycle warning signs and accompanying plaques.	To be used on sections of roadway with unexpected path, trail, or roadway intersections when driver sight distance is limited; or in sections where motor vehicles commonly share the road with other forms of transportation.
Signage: Warning		Share The Road Plaques[1,5] **Cost** Low	Signs warning motorists to share the roadway with slower forms of transportation, such as bicycles or pedestrians (MUTCD W16-1P).	To be used in combination with vehicular or non-vehicular warning signs.
Pavement Markings		Shared Lane Markings[6] **Cost** Low	A pavement marking symbol (also known as a SLM or "Sharrow") that warns motorists of the presence of cyclists and assists cyclists with lateral positioning in lanes that are too narrow for a motor vehicle and a bicycle to travel side-by-side within the same traffic lane (Section 9C.07 of the MUTCD).	Used to assist bicyclists with lateral lane positioning (should not be used on undivided, unmarked roadways); alert road users of the lateral location bicyclists within the lane; and encourage safe passing of cyclists by motorists. The SLM should not be used on roadways posted above 35 mph. The SLM may be used in addition to/instead of the Bicycles May Use Full Lane.

		Measure	Description	Application
Physical Environment		Paved Shoulders[2], 4 – 8’ **Cost** High	Dedicated space along the roadway that may accommodate bicycles, pedestrians, and stopped motor vehicles in emergency, depending upon roadway characteristics, such as cross section, speed of vehicles in adjacent travel lane, and conflicts on shoulder.	To be used in areas where pedestrian or bicycle volumes and motor vehicle volumes and speeds combine to create the need for separated space along the roadway.
		Bike Lanes[3] **Cost** *Varies	A lane in the roadway designated for bicycle use through the use of striping, signing, and pavement markings (MUTCD Chapter 9B and 9C).	To be used in areas with high volumes of bicyclists, in areas where motor vehicle speeds are more compatible with bicycle travel.
		Sidewalks and Walkways[4] **Cost** Medium to High	Pedestrian facilities that are separated from the roadway. Can be made of asphalt, concrete, or crushed stone. Sidewalks are usually paved and separated from the street by curbing. Pedestrian walkways may be separated from the roadway with a physical barrier or a landscaped strip.	To be used in areas with a high volume of pedestrians and high motor vehicle speeds or in areas where on-road bicycle/pedestrian travel is prohibited.
		Shared Use Paths[4] **Cost** Medium to High	A facility separated from motorized vehicular traffic by a landscaped space or barrier. Shared use paths may be used by cyclists, pedestrians, skaters, wheelchair users, joggers, and other non-motorized users. Such facilities are often referred to as “trails.”	To be used in areas with a high volume of pedestrians and bicyclists and high motor vehicle speeds or volumes.
Physical Environment		Roadway Illumination **Cost** Medium	Lighting directed to illuminate the roadway.	To be used on sections of roadway with a high volumes of nighttime non-motorized activity.

* Measures may vary greatly in cost. For example, some measures may be achieved through redistribution of space on the current roadway or it may require expansion of the roadway.

1. Federal Highway Administration. (2009). Manual on Uniform Traffic Control Devices. Washington, D.C.: Federal Highway Administration.

2. ITE Committee 5A-5. (1998). Design and Safety of Pedestrian Facilities. Washington, D.C.: Institute of Transportation Engineers.

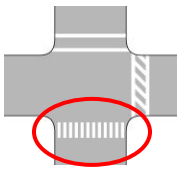
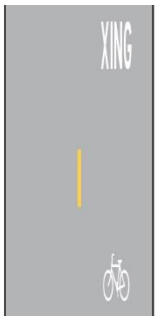
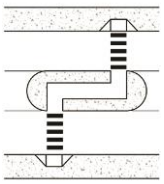
3. American Association of State Highway Safety Officials. (1999). Guide for the Development of Bicycle Facilities. Washington, D.C.: American Association of State Highway Safety Officials.

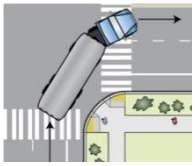
4. Federal Highway Administration. (2008). Guidance Memorandum on Consideration and Implementation of Proven Safety Countermeasures. Retrieved August 29, 2011, from Federal Highway Administration: http://safety.fhwa.dot.gov/policy/memo071008.

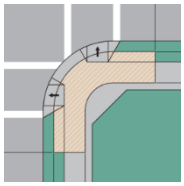
5. Overuse of signs and pavement markings may reduce their effectiveness. These devices should be used where the needs are greatest.

Crossing Measures

		Measure	Description	Application
Signage: Regulatory		Traffic Signal Pedestrian and Bicycle Actuation Signs[1] **Cost** Low	Signs directing pedestrians and bicyclists to use push buttons at signalized intersections (MUTCD Figures 2B-26 and 9B-2).	To be placed immediately above or incorporated into push button detector units.
		Yield to/Stop for Pedestrians[1,7] **Cost** Low	Signs directing drivers to yield/stop at yield (stop) lines used in advance of a marked crosswalk (R1-5a, b, and c-MUTCD Figure 2B-2).	To be used before a crosswalk on an uncontrolled, multilane approach. Stop for Pedestrian sign can only be used where the law specifically requires drivers to stop for pedestrians in a crosswalk.
		In-Street Pedestrian Crossing Signs[1,7] **Cost** Low	Signage, also known as Pedestrian Knockdown Signs, that is placed in the roadway alerting roadway users of pedestrian crossings (MUTCD R1-6 or R1-6a). If struck by a vehicle, the signs are designed to bend over and bounce back.	For use on low-speed roadways, specifically on the centerline, a lane line, or an island, at an unsignalized pedestrian crossing. Stop message can only be used where the law specifically requires drivers to stop for pedestrians in a crosswalk.
Signage: Warning		Vehicular and Non-vehicular Warning Signs[1, 7] **Cost** Low	Signs warning drivers of unexpected entries into the roadway or to alert drivers that they are sharing the roadway with bicycles, pedestrians, farm equipment, and horse-drawn vehicles (MUTCD Figures 2C-10 and 2C-11). A fluorescent yellow-green background color may be used for pedestrian and bicycle warning signs and accompanying plaques.	To be used where paths, trails, or roads intersect in unexpected locations, when the driver's sight distance is limited, or in sections where motor vehicles commonly share the road with other forms of transportation. Signs may be placed in advance,at a crossing, or both. If placed at a crossing, a diagonal downward pointing arrow (W16-7P) plaque shall be mounted below the sign (MUTCD Figure 2C-12).

		Measure	Description	Application
Pavement Markings		Crosswalks[2, 5] **Cost** Varies Low markings only Moderate markings and simple ADA landings; High significant pedestrian safety features required.	Pavement markings delineating a portion of the roadway that is designated for pedestrian or bicycle crossing. There are several types including: continental, zebra, and standard (MUTCD Section 3B.18).	To be used at intersections or midblock crossings. Crosswalks may be used in areas with lower traffic volumes, lower speeds, and a limited number of travel lanes. See Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations for additional guidance regarding when to install a marked crosswalk.[3] High visibility crosswalks (circled, at left) are preferred in order to alert motorists to the presence of pedestrians or bicyclists.
		XING Markings[1, 5] **Cost** Low	Pavement markings that provide emphasis to pedestrian and bicycle crossings (MUTCD Section 3B.20).	To be used as a supplement to regulatory and warning pedestrian and bicycle crossing signs.
		Advance Yield/Stop Lines[1,5] **Cost** Low	Pavement markings used at crosswalks as a supplement to a Yield Here to/Stop for Pedestrians sign.	To be used before a crosswalk and in combination with a Yield Here to/Stop for Pedestrian Sign. However, it should not be used in conjunction with a roundabout (MUTCD Figure 3B-17).
Physical Environment		Median Crossing Islands[3] **Cost** Medium	A raised island in the center of the roadway with a refuge area that is accessible for pedestrians of all abilities. Can also provide a refuge area for cyclists, especially at locations where a shared use path crosses a roadway. The island allows pedestrians and cyclists to cross one direction of traffic at a time.	To be used when pedestrians and cyclists have to cross high-volume, multilane roadways (MUTCD Chapter 3I).
		Staggered Median Islands[4] **Cost** Medium	A raised island located in the center of the roadway where the crosswalk is offset through the median island. The pedestrian crossing on the island is fenced and directs pedestrians to face oncoming traffic while crossing the median.	For use on high-volume or high-speed roadways so pedestrians are directed to face traffic before crossing.

		Measure	Description	Application
Physical Environment		Pedestrian Hybrid Beacons[1,5,8] **Cost** High	This device is one of the new FHWA Proven Safety Countermeasures and is used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk (MUTCD Chapter 4F). The device consists of three signal sections, with a yellow signal head centered below two horizontally aligned red signal heads.	For use at midblock crossings and intersections that do not warrant a signal.
		Rectangular Rapid Flash LED Beacons[4, 6] **Cost** Medium	A beacon that provides a warning to motorists about the presence of a crosswalk. Beacon is yellow, rectangular, and has a rapid "wig-wag" flash similar to police lights. Beacon should operate only when a pedestrian is present; utilize either push button or passive detection.	For use at midblock crossings and intersections that do not warrant a signal.
		Intersection Islands **Cost** Medium	Right-turn channelized islands at intersections are raised areas that provide refuge for pedestrians and bicyclists crossing the street. At signalized intersections the right turn operates independent of the signal.	Right-turn channelized islands are used at intersections with large footprints or complex intersections that are difficult for pedestrians and bicyclists to cross. Right turn channels benefit pedestrians and bicyclists in the following ways: - Separate conflicts and decision points. - Reduce crossing distance. - Improve signal timing (by reducing crossing distance).
		Smaller Corner Radii **Cost** Medium	Large corner radii at intersections increase crossing distance for pedestrians and bicyclists resulting in greater exposure to vehicular traffic. Larger corner radii also result in higher speed vehicle turns.	The application of this measure is at intersections with large corner radii where pedestrian and bicycle travel is desirable. Reducing corner radii at intersections mitigates the undesirable effects of larger corner radii as follows: - Reduces crossing distance for pedestrians and bicyclists. - Reduces pedestrian and bicyclist exposure to traffic. - Reduces speed of turning vehicles.
		Leading Pedestrian Interval (LPI) **Cost** Low	LPIs provide a WALK signal 3-7 seconds before the motorists are allowed to proceed through the intersection. LPIs can be programmed into traffic signals to minimize conflicts between pedestrians and bicyclists crossing a roadway and left or right turning vehicles. By giving pedestrians a head start, it is less likely that there will be conflict between pedestrians and turning vehicles.	Vehicle-pedestrian and vehicle-bicyclist conflicts often occur at intersections between pedestrians and bicyclists crossing the street during a WALK interval and turning vehicles. Leading pedestrian intervals (LPIs) give pedestrians and bicyclists time to establish their presence in the crosswalk before motorists can start turning.

		Measure	Description	Application
Physical Environment		Countdown Pedestrian Signals **Cost** Low	A countdown pedestrian signal provides a numeric display that shows how much time remains for crossing at a signalized intersection after the WALK phase is over.	Countdown pedestrian signals should be provided at all signalized intersections.
		Curb Ramps and Landing Area **Cost** Medium	Curb ramps provide a transition from the sidewalk to the street. Level landings of adequate area must be placed adjacent to curb ramps for pedestrians of all abilities.	All intersections require curb ramps that comply with the Americans with Disabilities Act (ADA). It is preferred that a curb ramp be provided for each crossing; in other words, two ramps on each corner provide direct access to a crossing and can accommodate a wider landing area that can better accommodate pedestrians and bicyclists.

* Measures may vary greatly in cost. For example, some measures may be achieved through redistribution of space on the current roadway or it may require expansion of the roadway.

1. Federal Highway Administration. (2009). Manual on Uniform Traffic Control Devices. Washington, D.C.: Federal Highway Administration.

2. ITE Committee 5A-5. (1998). Design and Safety of Pedestrian Facilities. Washington, D.C.: Institute of Transportation Engineers.

3. American Association of State Highway Safety Officials. (1999). Guide for the Development of Bicycle Facilities. Washington, D.C.: American Association of State Highway Safety Officials.

4. Federal Highway Administration. (2008). Guidance Memorandum on Consideration and Implementation of Proven Safety Countermeasures. Retrieved August 29, 2011, from Federal Highway Administration: http://safety.fhwa.dot.gov/policy/memo071008.

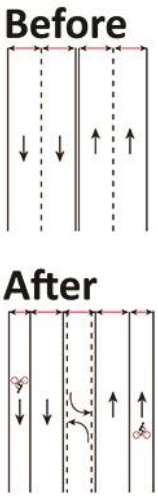
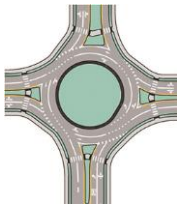
5. Hall, J. W., Brogan, J. D., & Kondreddi, M. (2004). Pedestrian Safety on Rural Highways. FHWA-SA-04-008. Washington, D.C.: Federal Highway Administration.

6. Overuse of signs and pavement markings may reduce their effectiveness. These devices should be used in locations where the needs are greatest.

7. Zegeer, C. V., Stewart, R., Huang, H., and Lagerwey, P., "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines." FHWA-RD-01-075, McLean, Va., Federal Highway Administration, (2002).

8. Fitzpatrick, K. and Park, E.S. Safety Effectiveness of the HAWK Pedestrian Crossing Treatment, FHWA-HRT-10-042, Federal Highway Administration, Washington, DC. (2010). Also published in: Fitzpatrick, K., E.S.Park, and S. Turner. "Effectiveness of the HAWK Pedestrian Crossing Treatment". ITE Journal, Vol. 82, No. 4, Washington, D.C., (2012).

Speed Reduction Measures

		Measure	Description	Application
Physical Environment		Gateways[1] **Cost** Low – High	Visual or physical markers to serve as an indicator to motorists that they are entering an urbanized area and to slow down.	For use at the entrance of a residential or commercial area.
		Curb Extensions[1] **Cost** Medium	Also known as bulb-outs or neckdowns, curb extensions are portions of the roadway where the curb extends out into the parking lane. This both visually and physically narrows the roadway to reduce vehicle speeds, it allows pedestrians and motorists to better see each other, and it provides a shorter distance for pedestrian crossings.	To be used on sections of roadway where on-street parking is provided, there are high motor vehicle speeds, and pedestrian crossings are common.
		Lane Narrowing[2] **Cost** Medium – High	The physical narrowing of lane widths. Can also be achieved through pavement markings (see above).	For use in areas with wide travel lanes and where speed is a concern.
		Road Diets[3] **Cost** Low – Medium	A redistribution of space in the roadway leading to a reduction in the number of travel lanes for motor vehicles on a roadway. The road diet is one of FHWA's Proven Safety Countermeasures and may provide space for bike lanes, sidewalk, or medians, and can help to reduce motor vehicle speed.	For use in areas with pedestrian crossings, multiple lanes of traffic, and high vehicle speeds.
		Roundabouts[4] **Cost** Low – High	A type of intersection form that is characterized by a generally circular shape, yield control on entry, and raised geometric features, including splitter islands and a center island, that together create a low-speed, efficient environment. Roundabouts are included in the FHWA Proven Safety Countermeasures.	For use at intersections where speed is a concern and/or where intersection congestion, delay or safety have worsened. Roundabouts are highly customizable, ranging from simple minis (small footprint) to complex multilane (large footprint), and can accommodate a wide range of intersection conditions.

* Measures may vary greatly in cost. For example, some measures may be achieved through redistribution of space on the current roadway or it may require expansion of the roadway.

1. Federal Highway Administration. (2009). Engineering Countermeasures for Reducing Speeds: A Desktop Reference of Potential Effectiveness. Washington, D.C.: Federal Highway Administration.

2. Federal Highway Administration. PedSAFE: Pedestrian Safety Guide and Countermeasure Selection System. Retrieved August 29, 2011, from Pedestrian and Bicycle Information Center: http://www.walkinginfo.org/pedsafe/index.cfm

3. National Center for Safe Routes to School. Safe Routes to School Guide. Retrieved August 29, 2011, from National Center for Safe Routes to School: http://guide.saferoutesinfo.org/index.cfm

4. Federal Highway Administration. Roundabouts Technical Summary. FHWA-SA-10-006.

Appendix B: Estimated Unit Cost by Treatment

Estimated Unit Costs for Roadway Segment Treatments

Treatment Type	Average NOVA Bid Price	
Shared Lane Markings	$350	EA
10-foot paved shared-use trail	$30	LF
Road Diet (restripe travel lanes – 4 lanes to 2 lanes – and stripe bike lanes)	$35	LF
Sidewalk (6 ft)	$35	LF
Stripe bike lane	$15	LF
Widen road (5 ft) and add striped bike lane	$200	LF

Estimated Unit Costs for Intersection Treatments

Treatment Type	Average NOVA Bid Price	
Install new marked crosswalk with high visibility markings	$1,700	EA
Replace existing crosswalk with new high visibility markings	$1,800	EA
Move existing crosswalk to new location	$1,800	EA
Restripe existing crosswalk to eliminate skew	$1,800	EA
Stripe skip marks through intersection	$150	EA
Install new landing area	$3,500	EA
Widen existing landing area	$4,000	EA
Install new curb ramp	$4,000	EA
Replace single curb ramp with two ramps	$7,000	EA
Install lighting at intersection	$60,000	EA
Install RRFB	$14,000	EA
Pedestrian warning sign and signpost	$150	EA
Post-mounted delineators	$90	EA
Signalize intersection (two four-lane roadways)	$250,000	EA
Install countdown pedestrian signals (one approach)	$1,500	EA
LPI- leading pedestrian interval	$500	EA
Construct one-lane roundabout	$1,000,000	EA
Construct two-lane roundabout	$1,500,000	EA
Reduce corner radius	$5,000	EA
Install island to create channelized right turn (and pedestrian refuge)	$10,000	EA
Install 5' median on existing pavement (widen and/or extend existing median)	$30	LF
Install temporary curbing to reduce intersection footprint	$2,500	EA
Install permanent curbing to reduce intersection footprint	$9,500	EA
Shorten turn lanes (paint only, do not demolish existing pavement)	$25	LF