Chapter V
Transportation Concept Alternatives

Three (3) fundamentally different approaches to meeting vehicular travel needs in the corridor were considered. One approach is to leave the road as it is today. Another is to use traditional engineering concepts to address congestion and safety issues. A third is to use a traffic calming approach that slows traffic and makes entry into the roadway safer. Each approach was compared to the following transportation concept plan objectives:

1. Safety: Create a safe and attractive corridor for residents and for drivers passing through

2. Preservation: Hunter Mill Road must remain a 2-lane roadway. No 4-lane road sections, or two (2) through lanes per approach at signalized intersections are considered. The significant historic and scenic attributes of the corridor shall be promoted and protected, thus creating the atmosphere of a scenic and historic byway.

3. Capacity: The roadway should accommodate existing volumes and future Near Term Traffic Volumes (10% increase).

4. Functional capability: The multifunctional purposes – arterial for through traffic access to connecting collector roads and a direct access to adjacent residences are met.

5. Non-motorized transportation: Design the roadway to enhance safety, comfort, and convenience for pedestrians, cyclists, and equestrians using the corridor.

Alternative 1: Status Quo Concept

Some adjoining residents prefer that no improvements are made to Hunter Mill Road thereby constraining traffic growth. People often mention this approach when the topic of replacing the 1-lane Colvin Run Bridge arises, but they also mention it in other circumstances.

Table 3 summarizes projected levels of service at the thirteen (13) previous analyzed locations assuming existing roadway geometrics and near term traffic volumes. Approximately half the intersections will experience an unacceptable “E” or “F” LOS on a typical day, a near 20 percent (20%) increase over existing conditions.

Traffic delay and congestion on the entire length of Hunter Mill Road will worsen as traffic volumes grow. Increasing traffic volumes will lengthen vehicle queues at congested intersections and may cause several other intersections to fail. Capacity limitations at saturated intersections may result in added delays to drivers wishing to enter and leave Hunter Mill Road at many side streets or private driveways. Vehicle crashes will increase, as will injuries and, potentially, deaths. The ability of the road to meet its functional purpose as an arterial and local access will be degraded. Noise and air pollution will increase.

Table 3
Status Quo Concept

INTERSECTION	LEVEL OF SERVICE	
	AM Peak	PM Peak
Baron Cameron Avenue	C	C
Hunting Crest Lane	C	C
Crowell Road	F	F
Sunset Hills Road	C	B
Dulles Toll Westbound Ramps	D	D
Dulles Toll Eastbound Ramps	D	D
Sunrise Valley Road	E	D
Hunt Race Way / Clovermeadow Drive (W/E) *	F/F	C/E
Hunter Station Road / W&OD Trail	F	F
Lawyers Road	F	F
Vale Road (North)	B	B
Vale Road (South)	C	B
Chain Bridge Road	F	F

*Note: * (W/E) indicates directional West and East, therefore "F/F" in AM Peak column means "F" LOS west traffic, and "F" LOS east traffic. Same for the PM Peak column.*

The status quo concept fails to meet safety, capacity, functional capabilities, and non-motorized transportation objectives.

Alternative 2: Traditional Engineering Concept

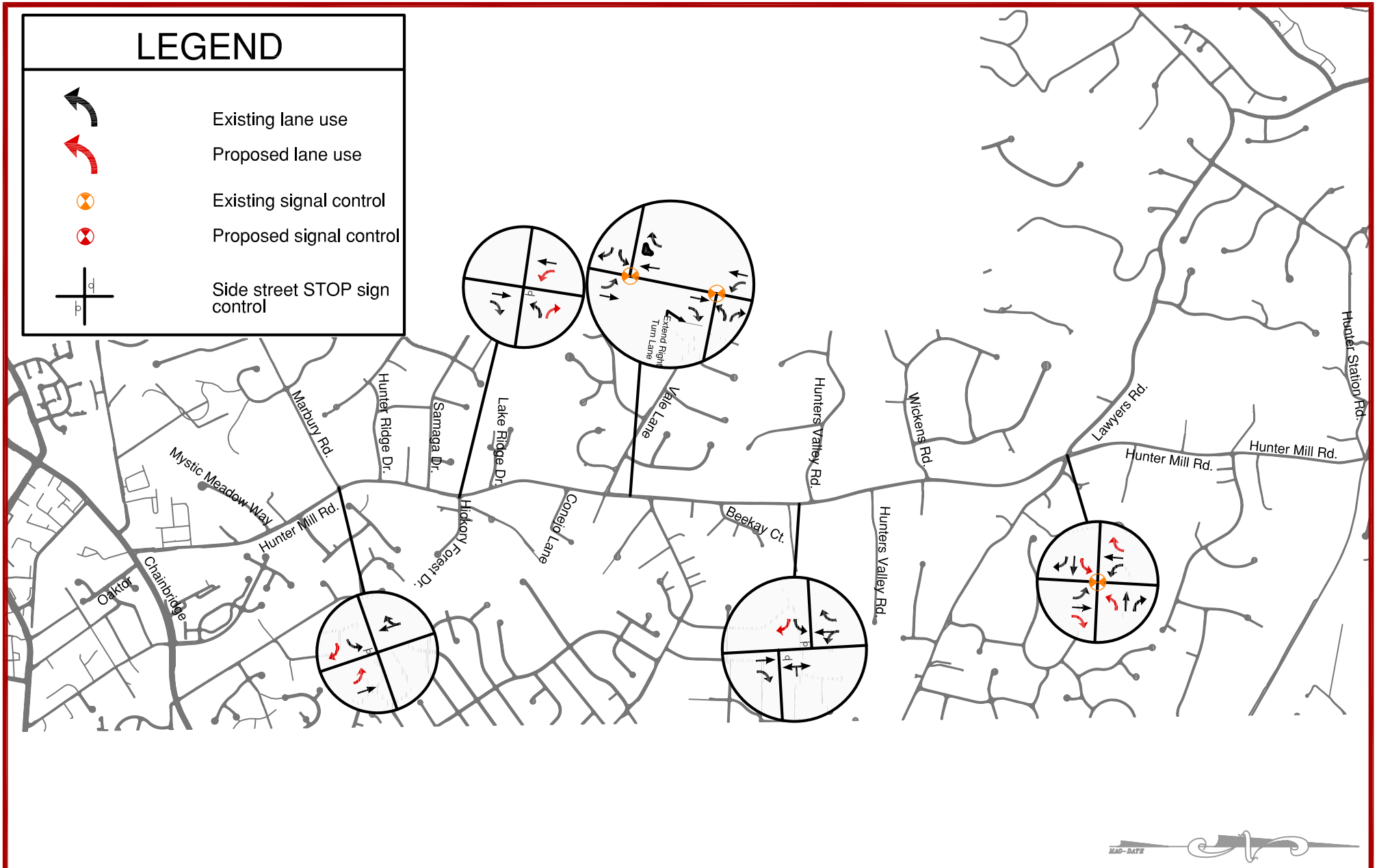
Traditional engineering approach follows historic practices used to upgrade a 2-lane roadway in Northern Virginia, which include:

1. Substandard horizontal and vertical roadway curves are straightened;
2. Turning lanes are added at intersections as volumes increase;
3. Traffic signal control is provided at higher volume intersections where signal warrants[1] are met; and
4. Paved or gravel shoulders are added.

Figures 13 and **14** show possible improvements at nine (9) intersections, typically involving adding left and right turn lanes, if absent on both Hunter Mill Road and its cross street. No additional through lanes are assumed. Several comments are pertinent:

1. The current all-way STOP Crowell Road intersection is assumed to be signalized with turning lanes on all approaches (**Figure 15**).
2. The Lawyers Road intersection (**Figure 16**) assumes an additional lane on all approaches.
3. There are no improvements assumed at the Dulles Toll Road/Hunter Mill Road signalized ramps. Additional turning lanes cannot be cost effectively added. There have been preliminary plans developed which would replace the existing interchange, but at a cost in the tens of millions of dollars.

[1] Signal warrants are criteria established by the Manual on Uniform Traffic Control Devices. Warrants establish the minimum number of vehicles that must be served before a signal is justified.



TRADITIONAL PLAN CONCEPT

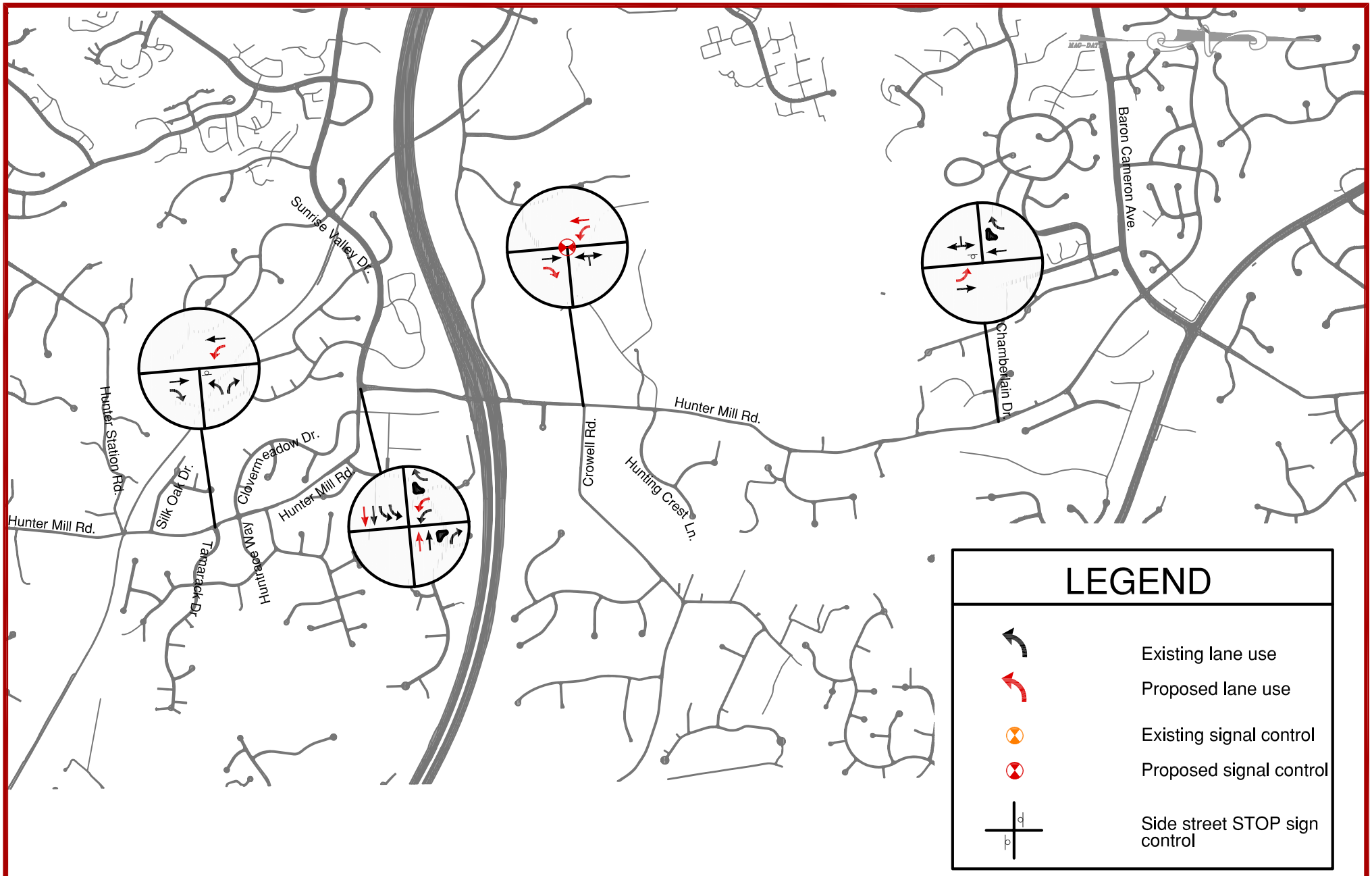
Hunter Mill Road Traffic Calming Study

Fairfax County, Virginia

FIGURE 13

nvrc Northern Virginia Regional Commission

Alternate Street Design, P.A. | Draper Aden Associates



TRADITIONAL PLAN CONCEPT

Hunter Mill Road Traffic Calming Study

Fairfax County, Virginia

nvrc Northern Virginia Regional Commission

Alternate Street Design, P.A. | Draper Aden Associates

FIGURE

14

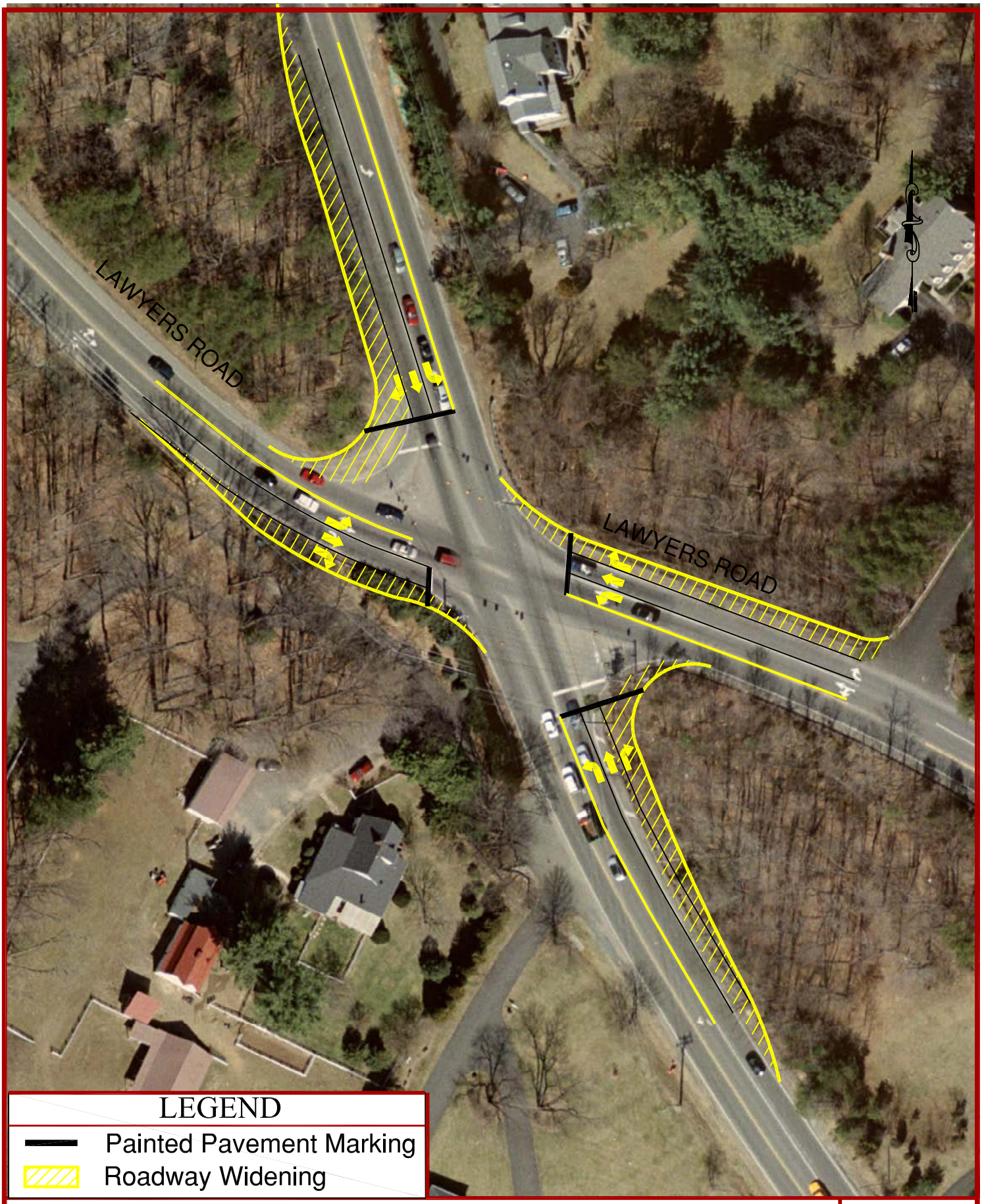
CROWELL ROAD INTERSECTION

Hunter Mill Road Traffic Calming Study

Fairfax County, Virginia

FIGURE 15

Draper Aden Associates
Engineering + Surveying + Environmental Services
8090 Villa Park Drive
Richmond, VA 23228
804-264-2228 Fax: 804-264-8773
Blacksburg, VA
Charlottesville, VA
Hampton Roads, VA



LAWYERS ROAD INTERSECTION

Hunter Mill Road Traffic Calming Study

Fairfax County, Virginia

FIGURE 16

Draper Aden Associates
Engineering • Surveying • Environmental Services
8090 Villa Park Drive
Richmond, VA 23228
804-264-2228 Fax: 804-264-8773
Blacksburg, VA
Charlottesville, VA
Hampton Roads, VA

4. No evaluation of the intersections at the corridor termini, Chain Bridge Road and Baron Cameron Avenue, were prepared since there are two (2) crossing arterials with multi-lane approaches and traffic signal control. Any capacity upgrading of significance of either intersection would be a major right-of-way and construction expense.

Table 4 summarizes the estimated LOS for each of the Traditional Plan intersection concepts. Note the Crowell Road intersection, with turning lanes and traffic signal control, improves to an acceptable "B" level. A number of intersections still will have unacceptable levels of service, but there is improvement over the Status Quo option.

Traffic signal LOS analyses are based on delay at the intersection, including vehicles that queue up during a red signal indication. Sometimes vehicle queues in a turn lane will overflow and block a through lane, which will adversely impact intersection operation. Additional lanes or longer turn lanes are required to mitigate this situation.

Crosswalks can be provided at these intersections, but pedestrian crossing distance would be lengthened due to increased pavement width. Pedestrians may be adversely impacted if turning radii are wide, as is customary in a traditional engineering approach. Wide turning radii increase crossing distances and allow drivers to turn at higher speeds.

In a traditional engineering approach, the number and width of vehicle lanes are increased to accommodate larger trucks and faster travel speeds, and any other impediments to faster traffic flow are removed. For example, the Virginia Department of Transportation developed preliminary plans to widen the one-lane bridge at Colvin Run to a 58 foot wide, two (2) travel plus lanes bridge. Widening the bridge would increase capacity in this section of Hunter Mill Road and Dulles Toll Road and Baron Cameron Avenue. A wider bridge would also allow drivers to travel faster through this section of Hunter Mill Road during the off-peak periods. Residents trying to exit their driveways near the bridge would encounter vehicles that would most likely be speeding

Table 4
Traditional Plan Concept

INTERSECTION	LEVEL OF SERVICE	
	AM Peak	PM Peak
Baron Cameron Avenue	C	C
Hunting Crest Lane	C	C
Crowell Road	B	B
Sunset Hills Road	C	B
Dulles Toll Westbound Ramps	D	D
Dulles Toll Eastbound Ramps	D	D
Sunrise Valley Road	C	B
Hunt Race Way / Clovermeadow Drive (W/E) *	F/F	C/E
Hunter Station Road / W&OD Trail	F	F
Lawyers Road	E	E
Vale Road (North)	B	B
Vale Road (South)	C	B
Chain Bridge Road	F	F

*Note: * (W/E) indicates directional West and East, therefore "F/F" in AM Peak column means "F" LOS west traffic, and "F" LOS east traffic. Same for the PM Peak column.*

In a traditional engineering approach, trees and other obstacles are removed alongside the road to provide recovery space for errant drivers. Existing landscape may be removed and replaced with a paved or gravel shoulder.

This concept partially meets capacity and functional capability objectives. However, preservation objectives are not met. Some safety improvements would be achieved, but increased speeds may offset those improvements. In addition, as noted previously in this report, crashes are currently concentrated at signalized and major STOP-controlled side streets intersections. This pattern is likely to continue under the traditional engineering concept. Cycling is enhanced by widened shoulders, but the higher speed environment does not favor pedestrians or equestrians.

Alternative 3: Traffic Calming Concept

The term *traffic calming* as used in this report describes treatments added to the roadway to require drivers to slow down to negotiate through the feature. The primary treatments in this report feature *horizontal deflection*, which are designs that require drivers to slow to steer around a treatment. In general, more deflection equates to slower speeds. Treatments such as speed humps, which require *vertical deflection,* are not suitable for arterials roads because speeds and volumes are high and emergency access would be restricted on a primary response route.

On arterial roads, traffic calming treatments are typically placed in areas of conflict, such as intersections, and at selected mid-block locations. Potential treatments are listed below and discussed in greater depth on the following pages.

- Minimal road widths, short vertical curves and tight horizontal curves;
- Raised medians, medians around curves, and pedestrian crossing islands;
- Landscaping signage and entranceway treatments; and
- Roundabouts.

Road Width and Curves

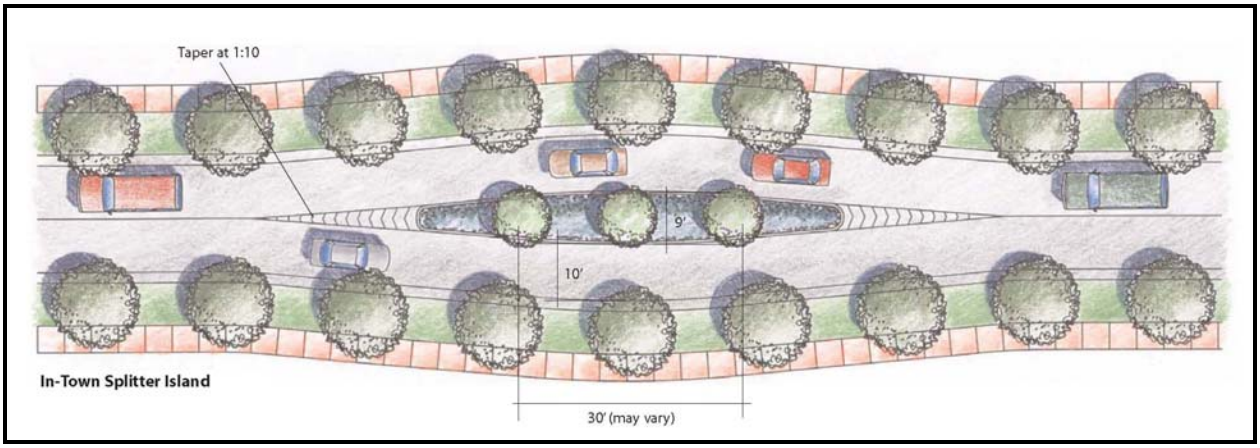
Traffic calming concepts include designing narrow travel lanes and tight turning radii to discourage high speeds. Vehicle speeds on Hunter Mill Road are currently constrained by the tight horizontal and shorter vertical curves. In the traffic calming concept, these constraints are preserved, while still maintaining 2-lane roadway capacity.

Raised Medians/Splitters

The effectiveness of raised medians on straight roads sections is dependent upon the degree of deflection encountered by the approaching driver. Rectangular medians are most useful on curves, where they slow traffic and prevent drivers from crossing over the centerline to travel faster. Oval medians have a greater degree of deflection than rectangular medians. Both types of raised medians can be used as gateways or as an intermediate treatment between two widely spaced roundabouts. Splitter islands are raised medians similar to oval medians, but the

ends of the islands are elongated. Splitter islands can be used at low volume intersections to help slow traffic and provide pockets where left-turning vehicles can wait for a gap in oncoming traffic.

Rectangular Median



Splitter

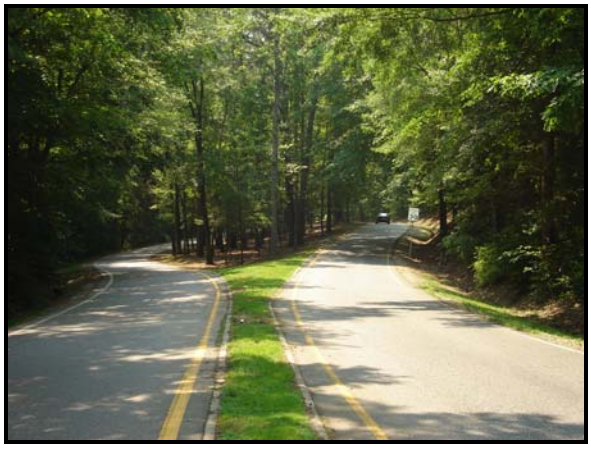
Rectangular or oval raised medians can be used at pedestrian or trail crossings to create space where pedestrians, bicyclists or equestrians can wait for a gap in traffic after crossing one half of the road. Shorter gaps are needed to cross one-half of the road, which increases crossing opportunities and reduces delay. The island provides a safe place to wait to determine if drivers are going to yield. The crossing area within the median can also be offset or angled to direct attention toward oncoming traffic.

Landscaping

Traffic calming treatments such as medians and roundabouts are landscaped to enhance visibility and improve aesthetics. Large canopy trees in medians or along roads help create a sense of enclosure that may prompt some drivers to lower their speeds, although definitive research is not available. Removal of trees creates the opposite effect, so in a traffic calming

2-Lane Roundabout

approach, existing trees are retained and additional trees added at strategic locations. Trees placed outside of a properly applied clear zone[2] provide drivers with physical and visual guidance that may cause drivers to slow and actually reduce accidents. The most effective strategy is for the canopy to reach over the road to create a tunnel effect.



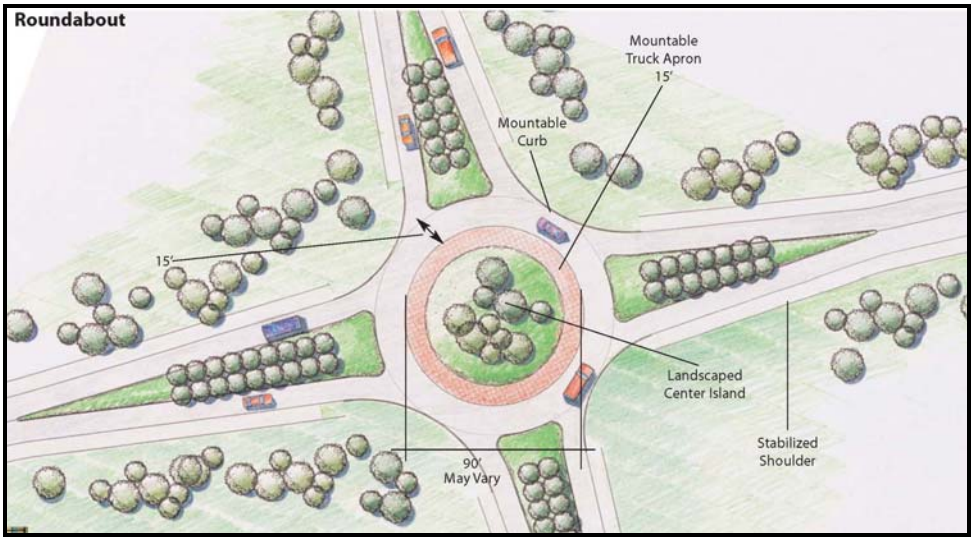
2-Lane Splitter

Roundabouts

Trees, narrow vehicle lanes, and raised medians reduce the speed of some drivers, but the most effective method of reducing driver speed is deflection. This is especially true during the

[2] A Policy on Geometric Design of Highways and Streets, 2004, American Association of State Highway and Transportation Officials

off-peak hours, when traffic volumes are lower. Roundabouts can be designed with ample deflection, making them very effective treatments for slowing traffic, controlling intersections, and reducing crashes.



Roundabouts are circular intersections with channelized approaches. The geometry of the entry point requires drivers to slow to 15 to 20 mph as they approach, but there are no stop or signal controls. Entering traffic must yield to circulating traffic. This action is similar to waiting for a gap in traffic to turn right from a side street or driveway. Traffic circulates around the center island at speeds of 15 to 20 mph. Low circulating speeds are the result of the tight curve drivers must negotiate. A truck apron facilitates the movement for larger vehicles. Center islands are usually landscaped.

All roundabouts are substantially smaller than large traffic circles often seen on the United States east coast. Traffic circles give priority to entering traffic and often use signals to control entering traffic. Unlike roundabouts, large traffic circles often operate at high speeds.

Crash rates at modern roundabouts are typically about 3.5 to 6 times lower than traffic circles[3]. Left turn and right angle crashes, the two most common crashes at signalized intersections, are virtually eliminated at roundabouts. Studies show roundabouts reduce overall crashes by 39 percent, injury crashes by 76 percent and fatal crashes by 96 percent[4]. The few fatal crashes in roundabouts found in the United States have been single vehicle crashes involving drivers under the influence of alcohol who were driving at excessively high speeds.

The lowered speed of through traffic at roundabouts improves access into and out of side streets. Drivers entering the main street from side streets do not have to wait for a gap in two directions at roundabouts, which increases the number of opportunities to enter the intersection. Drivers wishing to turn left onto a side street have the right-of-way as they drive around the center island to turn right at the side street. This eliminates waiting for a gap in oncoming traffic.

[3] University of Maine, Professor Per Gardner
[4] Insurance Institute for Highway Safety, May 2000

Where roundabouts are installed in a series, travel time along the road decreases. Drivers slow down at every roundabout, but the cumulative delay is typically less than stopping at one or more traffic signals. Delay and vehicle queues at roundabouts are typically less than half the delay or queue length at signalized intersections.

Levels of Service

Level of Service was calculated for primary intersections in the Hunter Mill Road corridor where roundabouts were considered feasible. The engineering software aaSIDRA was used for the analyses in **Table 5. Table 6** provides a more detailed description as well as projected LOS for the assumed traffic calming concept, consisting of roundabouts at all intersections except the Hunter Station Road/W&OD Trail Crossing where a splitter "T" intersection with a left turn lane is assumed. The LOS for Near Term traffic volumes produces excellent "A" and "B" LOS. The exception is the splitter intersection at Hunter Station Road which would have "F" service levels for the Hunter Station left-turn onto Hunter Mill Road. Since this turning volume is relatively low, this is not considered unacceptable, because Hunter Mill traffic would be free flow (i.e. "A" LOS).

Overall, these LOS would be a significant improvement over current LOS, as well as the two (2) other concepts considered. Implicit in these excellent LOS is a reduction in accident frequency.

Other Roundabout Features

Considerable discussion at the May 24, 2006 public meeting focused on the availability of gaps in Hunter Mill Road traffic for citizens exiting their driveways. Appendix F and Appendix G contain more in depth information of roundabout gap characteristics as well as other roundabout characteristics.

Pedestrians, Equestrians, and Cyclists

A primary purpose of traffic calming is to create a safer environment for all users, including vehicle occupants, cyclists, pedestrians, and equestrians. Slower speeds reduce crashes and provide an environment that is more comfortable for people who are not inside

Table 5
Traffic Calming Concept

INTERSECTION	LEVEL OF SERVICE	
	AM Peak	PM Peak
Baron Cameron Avenue	---	---
Hunting Crest Lane	A	A
Crowell Road	A	B
Sunset Hills Road	B	A
Dulles Toll Westbound Ramps	A	B
Dulles Toll Eastbound Ramps	A	A
Sunrise Valley Road	B	B
Hunt Race Way / Clovermeadow Drive	A	A
Hunter Station Road / W&OD Trail	A	A
Lawyers Road	B	B
Vale Road (North)	A	A
Vale Road (South)	B	A
Chain Bridge Road	---	---

Table 6
Traffic Calming Concept

INTERSECTION	TYPE CONTROL	LEVEL OF SERVICE	
		AM Peak	PM Peak
Crowell Road	One lane roundabout	A	B
Sunset Hills Road /Dulles Toll Westbound Ramps	Combined mixed lane Roundabout	A	B
Dulles Toll Eastbound Ramps	Mixed lane roundabout	A	A
Sunrise Valley Drive	Two lane Roundabout plus a right turn lane	B	B
Clovermeadow Drive	One lane roundabout	A	A
Hunt Race Way/Clovermeadow Dr	One lane roundabout	A	A
Hunter Station Road / W&OD Trail (W/E) *	Splitter with left-turn lane	F/A	F/A
Lawyers Road	Two lane Roundabout	B	B
Vale Road (North)	One lane roundabout with 3 turn lanes	A	A
Vale Road (South)	One lane roundabout with 3 turn lanes	B	A

*Note: * (W/E) indicates directional West and East, therefore "F/F" in AM Peak column means "F" LOS west traffic, and "F" LOS east traffic. Same for the PM Peak column.*

vehicles. Studies show that walking and bicycling safety improve as frequency increases,[5] although not all motorists slow down when pedestrians and bicyclists are present. Pedestrians, cyclists, and equestrians benefit from the reduction in vehicle noise, an increase in driver yield rates at crosswalks, and a reduction in pollution when signals are replaced by roundabouts.

Trails separated from the roadway by a landscaped area create comfortable space for bicyclists, pedestrians, and equestrians. A minimum of five (5) feet of separation from the roadway is needed, but additional separation adds to the comfort of trail users. Minimum width for an off-street trail where bicyclists and pedestrian will share space is ten (10) feet.[6] Additional, unpaved, space and separation are required for equestrians.

Many cyclists, particularly those with more experience, prefer to ride on the road, rather than on trails. This is because on the road they can travel faster and need not stop at minor side streets unless the vehicles are also required to stop.

Crossing travel lanes is the most challenging task for non-motorized users. Crossing at intersections does always provide convenient access. Midblock crossings using the traffic calming median treatments previously discussed can also be used.

Overpasses and underpasses eliminate crossing conflicts between vehicles and pedestrians, bicyclists, and equestrians. They enhance usability of the trail by reducing disruptions. Large vehicles require approximately 17 feet of clearance under an overpass. The gentle grade needed on ramps to the overpass results in ramps of up to a quarter mile long, which are expensive and visually unappealing. In addition, providing an underpass at trails such as W&OD Trail crossing, often involved disturbing underground utilities, which can be costly. An alternative is to lower the trail half way and raise the road the other half to provide the necessary clearance. Crossing pedestrians, bikes and equestrians under the slightly elevated roadway requires less clearance than large vehicles, so ramps are substantially shorter. The combined under/overpass must be wide and well-lit, with good visibility to enhance security. An example of an underpass in another location is shown below.

[5] Safety in Numbers: More Walkers and Bicyclists; Safer Walking and Bicycling. P.L. Jaconsen, BMJ Publishing Group, ip.bmjjournals.com

[6] Guide for the Development of Bicycle Facilities, 1999. American Association of State Highway and Transportation Officials.

Summary

The Status Quo Concept has the obvious advantage of no direct improvement costs, but clearly fails to achieve traffic capacity, environmental (noise and air pollution) and safety goals. The Traditional Engineering Concept provides some benefit regarding safety, capacity, and environmental goals, but does not achieve preservation goals nor would concerns of residents and their vision be met.

Table 7 provides a LOS summary and comparison of the three (3) concepts. The Traffic Calming Concept clearly provides significantly better LOS than the other two (2) concepts. This also suggests a safe operating condition but does not achieve preserving the historic attributes and resources in the Hunter Mill Road corridor.

The Traffic Calming Concept meets safety, preservation, capacity, and functional capability criteria. The traffic calming treatments help create a corridor that will be safe and comfortable for pedestrians, cyclists, and equestrians.

Table 7
All Concepts / Level of Service Comparison

Intersection	Current		Status Quo		Traditional Plan		Traffic Calming	
	AM	PM	AM	PM	AM	PM	AM	PM
Baron Cameron Avenue	C	C	C	C	C	C	---	---
Hunting Crest Lane	C	C	C	C	C	C	A	A
Crowell Road	F	F	F	F	B	B	A	B
Sunset Hills Road	C	B	C	B	C	B	B	A
Dulles Toll Westbound Ramps	C	D	D	D	D	D	A	B
Dulles Toll Eastbound Ramps	C	C	D	D	D	D	A	A
Sunrise Valley Road	D	D	E	D	C	B	B	B
Hunt Race Way / Clovermeadow Drive (W/E)*	F/F	C/D	F/F	C/E	F/F	C/E	A	A
Hunter Station Road / W&OD Trail	F	F	F	F	F	F	F/A	F/A
Lawyers Road	E	E	F	F	E	E	B	B
Vale Road (North)	B	B	B	B	B	B	A	A
Vale Road (South)	C	B	C	B	C	B	B	A
Chain Bridge Road	F	F	F	F	F	F	---	---

*Note: * (W/E) indicates directional West and East, therefore "F/F" in AM Peak column means "F" LOS west traffic, and "F" LOS east traffic. Same for the PM Peak column.*