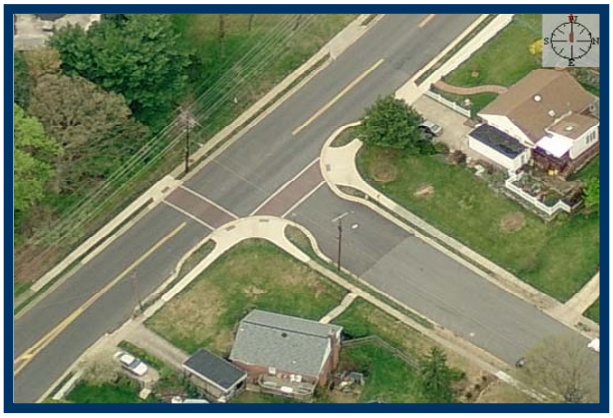
ARLINGTON
VIRGINIA

Neighborhood Traffic Calming Program

Process, Criteria & Measures



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November 2008

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NEIGHBORHOOD TRAFFIC CALMING

SUMMARY

In March, 2000, the Arlington County Board adopted a Neighborhood Traffic Calming ("NTC") Program in recognition of the growing desire of residents within many neighborhoods in the County to address speeding on residential streets. To implement the program, the Board created a citizen advisory committee, the Neighborhood Traffic Calming Committee ("NTCC"), which participates in and oversees the program.

The NTC Program adopted by the County Board established policies and procedures for determining whether and in what order streets should be selected for traffic calming, the process by which an NTC plan is established for those streets that are selected, and the criteria for determining whether those NTC plans should be approved. The NTC procedure is a "problem-oriented" procedure aimed at finding the most appropriate measures for each situation. Streets are determined to be eligible for traffic calming on a "worst first" basis, based on specified objective criteria that are applied uniformly for all streets that are submitted to the NTCC for assessment.

Under this program, the NTCC selects a series of "project streets" to develop traffic calming plans in association with the County's NTC Staff and residents in the "area of impact" as discussed in detail on pages 4-7. A "working group", composed of residents of the area of impact, NTC staff, and others develops a traffic calming plan, and subsequently conduct a County-prepared petition to determine if the proposed plan has the requisite level of support to be considered for County Board approval and funding. If a plan does receive the requisite level of support within the area of impact, the NTCC votes at a public funding meeting whether to recommend the plan to the County Board for approval and funding. Upon County Board approval the project undergoes final design and construction.

After each project is constructed, the NTCC and NTC staff evaluate the success of the project using objective data. The NTCC evaluates these data, as well as other information provided by citizens affected by its work, to identify any needed changes to the program.

CHAPTER I:
MISSION STATEMENT, PROGRAM GOALS, OBJECTIVES AND STRATEGIES

NTCC MISSION STATEMENT

The NTCC supports the County Board's vision of an urban village by reducing the adverse impact of speeding on residential streets. Traffic calming is intended to improve safety for pedestrians, bicyclists and motorists, and raise the quality of life in residential neighborhoods.

TRAFFIC CALMING GOALS, OBJECTIVES AND STRATEGIES

A goal of the NTC Program is to *promote safety and livability within residential areas of the County.* The program promotes the orderly development of traffic calming projects in the County using a uniform set of criteria for identifying residential streets in need of traffic calming and working with residents on those streets to develop consensus plans for dealing with traffic problems.

The County Board established the NTCC in 1999. The NTCC has eleven members; five are at-large representatives, and six are representatives of other County advisory groups: the Transportation Commission, the Neighborhood Conservation Advisory Committee (2), the Civic Federation, the Bicycle Advisory Committee and the Pedestrian Advisory Committee. The NTCC meets periodically, in open session, and individual NTCC members also participate in planning meetings with residents to develop proposed traffic calming projects.

Since the inception of the program, the NTCC has received requests for traffic calming on hundreds of streets. Speeding, and associated noise and traffic volume, endangers pedestrians, bicyclists and other motorists. Speeding degrades the residential character of neighborhoods by making it unpleasant to be outdoors. The NTC Program *seeks to promote a culture of "people first," rather than cars first.* Many streets in Arlington were designed to facilitate vehicle traffic, with only incidental consideration of pedestrian and bicycle use. The NTC Program seeks to balance more appropriately the various uses of residential streets among cars, bikes and people.

Pedestrian safety is a key objective of traffic calming. Approximately 5000 pedestrians are killed and over 80,000 are injured on the nation's streets every year. Fifty-five percent of pedestrian deaths occur on neighborhood streets, rather than on major roadways. Bicyclist fatalities average approximately 800 per year and the injury rate is approximately 583,000 per year. Thirty-four percent of bicycle fatalities occur on neighborhood streets, rather than on major roadways.

The speed limit on most neighborhood streets in Arlington is 25 miles per hour. Studies have shown a correlation between increased vehicle speeds and the likelihood of pedestrian deaths. Several studies have shown that about five percent of pedestrians would die when struck by a vehicle traveling 20 miles per hour. When struck by a vehicle traveling 30 miles per hour, the likelihood of death rises to 40 percent. Research indicates that the likelihood of a pedestrian accident increases at higher speeds because motorists are less likely to see and react to a pedestrian in time.

Another goal of the NTC Program is to *promote compliance with traffic laws while minimizing reliance on police resources*. The posted speed limit on residential streets for the most part is 25 miles per hour. Drivers are legally obligated to observe the posted speed limit. However, the NTC Program's data, collected over the past seven years, show that drivers frequently do not comply with those speed limits in residential neighborhoods. A premise of the NTC program is that the use of Arlington's police alone to address this problem would likely be extremely costly, impractical and unreasonable. The Program's approach is that appropriate roadway modifications or physical changes that persuade motorists to observe speed limits are often the most cost-effective way to control traffic speeds.

Consistent with the civic participation tradition of Arlington County, the NTC Program *involves the community in addressing traffic problems*. Each project undertaken by the NTCC includes resident participation and leadership. When the NTCC selects a street for traffic calming, a working group is formed, comprised of local residents, NTCC members and County Staff to work together in developing a calming project. The NTC Program *encourages constructive dialogue and discussion within neighborhoods* regarding their traffic problems, and gives residents ownership of the solutions.

The NTCC *approaches residential traffic problems in a fair, consistent and comprehensive manner*. The NTCC developed a numerical point formula, adopted by the County Board, to ensure that all streets are assessed for traffic calming on a uniform and objective basis. The NTCC ranks all streets that qualify for traffic calming based on this formula, dealing with the streets with the worst problems and highest numerical scores first.

The NTC Program *functions consistently with and as a complement to the other County transportation programs and policies* to slow traffic and promote appropriate uses of residential streets. The NTC Program *embraces the integrated nature of the street networks and does not promote blocking streets or diverting traffic*. For the most part, the *traffic calming measures that are employed in the program are designed only to control traffic speeds.*

The NTC Program is *limited to streets classified by Arlington's Master Transportation (MTP) as non-arterial* (neighborhood-principal, neighborhood-minor, urban-center local).

The NTCC *promotes the availability of the program to interested residents, and informs the broader community of its activities.* This program manual is part of that effort. The County Staff maintains a web page in which it reports on the projects under consideration by the NTCC, as well as those approved to date.

The NTC Program *evaluates the effectiveness of traffic calming measures and procedures.* As of mid-2007, the NTCC has successfully implemented traffic calming projects on approximately 75 streets. Many streets that have qualified for traffic calming but for which projects have not yet been developed continue to await traffic calming. The NTCC is continually learning from and using knowledge gained from prior calming projects. Over the eight years the current program has operated, the NTCC and the County Staff have monitored the construction of the traffic calming measures and evaluated the effectiveness of projects, principally by comparing before and after speed and traffic volume. In addition, the NTCC *continuously re-examines the effectiveness of its procedures* to ensure that the objectives of resident involvement and dialogue are being met.

Mindful of the need to manage resources carefully and effectively, the NTCC seeks to *use the most cost-effective traffic calming measures appropriate to the traffic problems identified*. The NTC Program seeks to *limit any adverse aesthetic impacts* from traffic calming, but ultimately the purpose of this program is not beautification, but *reduced traffic speeds*. Thus, it is important that the measures adopted in any particular traffic project must be designed to reduce speeds in the professional judgment of the County Staff.

The NTC Program also *seeks and receives guidance from the County Board* on the program and how well it is working. The NTCC accomplishes this objective through twice-a-year project recommendations for to the Board, periodic dialogue with the County Board liaison and County Staff in various departments that have responsibilities relevant to the NTC Program.

Citizens can comment and propose NTC program changes to the NTCC at the committee's monthly meeting during the public comment period or by writing to NTC Staff or the NTCC Chairman at Division of Transportation, Neighborhood Traffic Calming Section, 2100 Clarendon Boulevard, Suite 900, Arlington, VA 22201 or email at des@arlingtonva.us.

CHAPTER II:
NEIGHBORHOOD TRAFFIC CALMING PROCESS

The neighborhood traffic calming process is based on citizen involvement, both in problem identification and problem solving. The process is intended to provide residents who live on the street/street segment with an opportunity to participate in a working group that will develop a plan to address speeding and other traffic problems on that street/street segment. The process is also intended to be flexible. Each street and neighborhood is unique, and will present its own set of circumstances.

The NTC process is generally expected to produce a traffic calming plan and obtain at least 60% support (70% support for speed tables, speed cushions and raised crosswalks) of the households in the area of impact within approximately a twelve-week period. If the 60% support (70% support for speed tables, speed cushions and raised crosswalks) is achieved, the project will be presented to the NTCC, which will decide whether to recommend the project to the County Board for funding. If the NTCC recommends funding for one or more projects, they will be presented to the County Board for approval at a public meeting.

NTC tools may be included as part of a more comprehensive infrastructure program, such as a Neighborhood Conservation ("NC") plan. Furthermore, NTC projects may be funded under any of several different County programs (such as NC) and initiatives such as Safe Routes to School. Regardless of the program under which an NTC plan is developed or the source of funding for an NTC plan, all NTC tools must meet the same substantive criteria and procedural requirements. Thus, the County will consider funding traffic calming only for streets that meet the NTC eligibility criteria in this Program Manual. Moreover, the input and approval requirements of the process for traffic calming discussed below must be satisfied as well.

PROCESS STEPS

Requesting Traffic Calming. Requests for neighborhood traffic calming typically come from a resident or group of residents on the streets or blocks[1] where a perceived problem exists. However, requests can come from civic associations, businesses, as a result of development proposals, County Staff or the County Board. Requests to NTC Staff can be made in writing, including e-mail, or by phone. The requester should identify the specific location(s) where the perceived problem is occurring. Specific details, including any special factors (such as locations where pedestrians are frequently present), are helpful in thorough analysis.

Evaluating Traffic Calming Requests. NTC Staff evaluates each request by first taking speed and volume measurements. NTC Staff takes these measurements using standard traffic engineering measurement equipment, and standard industry techniques. The traffic counting devices record individual vehicle speeds in tenths of a mile per hour, but will report it in whole numbers.

If the street meets the speed threshold, NTC Staff performs further analysis of the street to assign the street a score based on problem-severity ranking criteria (See Appendix 3). This

[1] For ease of reference, this program guide will refer generally to "streets" when discussing projects. However, because many streets are not contiguous or uniform in width and geometric configuration, a project may be confined to one or several blocks of a street.

analysis may include, as appropriate, field observations, review of neighborhood conservation plans, accident reports, land-use maps and other reference documents. As part of that analysis, Staff identifies sources of pedestrian and traffic volume. The NTC Staff assigns points for excessive speed, with additional points based on the severity of the problem.

Upon completion of the full evaluation, NTC Staff will assign a problem severity ranking score to each street. Once a street has received a score and ranking among other streets, Staff contacts the requester, the NCAC representative, and the relevant civic association, providing the results of the speed and volume measurements as well as the ranking score. The NTC Staff maintains a list of all streets that have qualified for traffic calming, ranked in order by score from highest to lowest. Thus, streets with the highest score (generally those with the highest speeds and volumes) are at the top of the list for calming consideration.

Selecting Project Streets. The NTCC will usually select a group of streets for project development twice annually. Absent special considerations, such as an impending Neighborhood Conservation project or other imminent construction that could affect traffic speeds, the NTCC generally selects streets at the top of the list. The number of streets selected will vary based on resource availability and the perceived scope of the project. NTCC project streets selected for a funding round will proceed concurrently.

Before the NTCC selects a street from the severity ranking list for traffic calming assistance, if the data for that street are more than two years old, new data will be collected to determine if the speeding problem continues to exist. The new data do not affect the street's position on the severity ranking list, but are used only to confirm that the speeding problem continues to exist on the street.

If the new data show that the street no longer meets the speed threshold for neighborhood traffic calming (an 85th percentile speed of 30 mph or higher), that street is no longer eligible for the program and is removed from the severity ranking list. NTC Staff will contact the requester and report the result. NTC Staff will also transmit the result to the civic association(s) in which the street is located and the NCAC representative. Residents on that street can request new measurements and evaluation after a two-year waiting period.

Forming a Working Group. After a street has been selected, the NTC Staff prepares a letter informing the requester of the NTCC selection. NTC Staff also prepares a flyer announcing the first planning meeting to start the project process, and distributes or mails it to the residents in the preliminarily-identified area of impact, the NCAC representative, and a representative of the civic association.

At the first meeting, the NTC Staff will (1) explain the process, (2) review the data and additional results of Staff's analysis of the project street, (3) determine, with meeting attendees, the limits of the proposed project and extent of the "area of impact" and (4) establish a schedule for the development of a traffic calming plan. The meeting participants will usually form a working group.

The "area of impact" is an important element in the planning process. This is the area that must be polled to determine whether a traffic calming plan has the required level of support; residents in this area are most directly affected by the speeding problem and the possible traffic

calming measures. The "area of impact" consists of (1) residences that directly front on the street segment where the traffic calming measures will be installed; (2) residences on cul-de-sacs or courts directly connected to that street segment; and (3) nearby residences on side streets directly connected to that street segment. The NTCC and County Staff may have to exercise judgment in determining the area of impact for any given project, depending in part on street layout.

NTCC members assigned to the project will seek to ensure that the resident participants fully understand the program and the process. The assigned NTCC members will also identify any issues that appear to require guidance from the full NTCC and discuss possible alternative traffic calming approaches. A Working Group will generally be comprised of people from the following: residents of the project street and the area of impact, representatives of businesses or facilities in the area of impact, a representative for the relevant civic association(s), the NCAC representative, NTC Staff and assigned NTCC members.

The Working Group will usually hold further meetings to develop a traffic calming plan. The Working Group will decide on the number of meetings needed to develop a plan; there is no pre-set number of meetings. The purpose of the meetings is to develop a consensus plan that addresses the traffic concerns of the residents of the street, including any problems that may not have been identified in the NTC Staff analysis. The number of meetings will likely be a function of how easy or difficult it is to form a consensus plan. It is anticipated that the assigned NTCC members will participate in those meetings.

Developing a Traffic Calming Plan. The outcome of the community problem-solving process should be a proposed traffic calming plan for the project street. The Working Group should design a traffic calming plan that will effectively address traffic problems identified by (1) the NTC Staff's measurement and analysis and (2) resident input through the discussion in Working Group. The traffic calming measures available in the County are discussed in the next chapter. NTC Staff will review the measures appropriate for the problems that have been identified and make recommendations as necessary. Due to the variety of street configurations and geometrics, among other things, certain measures may not be effective or even possible in some situations.

The assigned NTCC members will participate in these meetings as necessary to facilitate discussions and address questions regarding the program. At the regularly scheduled meetings of the NTCC, the NTC Staff and assigned NTCC members will report on the progress and status of the individual plans. The NTCC will discuss and offer guidance to NTC Staff and the assigned NTCC members as appropriate. If the Working Group cannot decide on a consensus traffic calming plan, the NTCC will vote on whether to end the project process. If a working group project process is terminated, the NTCC will invoke its policy not reconsider the project street for another three years.

Obtaining Project Support. In addition to developing the traffic calming plan, the Working Group will be responsible for securing the necessary level of support for the plan among the households within the area of impact. It is important, therefore, for the resident participants on the Working Group to disseminate project information and justification to residents in the area of impact on a regular basis.

The level of community support required for a traffic calming plan can vary depending in part on the types of measures used in the plan. Speeding solutions must be supported by 60%, or 70% of the households in the Area of Impact (see Chapter 3), depending on the traffic calming measures used in the plan. Projects containing speed tables, speed cushions, raised intersections and raised crosswalks must obtain support from 70% of households. See the Traffic Calming Toolbox (See Appendix 7) for additional specifics. In some cases, it may be prudent to expand the area of impact (affected area) to include other streets, which might be affected by the proposed plan.

Once the Working Group has developed a plan, it will hold an Open House at which residents in the area of impact can review the Working Group's plan. The Working Group and NTC Staff will prepare a letter to all households within the area of impact announcing an Open House. The letter will contain information about the Open House, information on the proposed plan and staff contact information. A post card will be enclosed that residents can use to mail-in their vote on the project. Maps, diagrams and examples of traffic calming measures will be on display at this meeting. At this point in the process, the plan is considered largely final. The purpose of the Open House is to provide information that residents will need to consider in voting on whether to support the proposed project.

If any households within the area of impact do not return the postcard mailed with the proposed plan information by the deadline set in the mailing, the Working Group participants are responsible for petitioning those households. NTC Staff compose and print the petition, which may be available for signature at the Open House. The NTC Staff will also provide written materials and maps setting forth the details of the plan for the petition carriers to share with residents.

The petition carriers are responsible for contacting all households in the area of impact which have not used the postcard response. The function of petition carriers is simply to explain the project and record a household's vote. The petition carriers are expected to objectively describe traffic problems, the proposed calming project and proposed measures. Petition carriers are to be respectful and not argue with residents. If residents feel uncomfortable signing the petition in the presence of the petition carrier, they may request the staff prepared post card to register their opinion of the project. As with the open house, by this point, the plan is considered final although later, detailed project design may result in minor adjustments.

Support of the civic association(s) and local PTA(s) is not required, but is strongly encouraged, because it can enhance the project funding score.

If the overall response does not reach the required level of support for the plan, the NTCC will recommend either that the problem be referred back to the Working Group, or that it be closed out as irreconcilable. If a project is referred back to the Working Group, the NTCC may recommend alternative approaches more likely to obtain the necessary support in the area of impact.

In the case of projects failing to receive the minimum support needed and being closed out, the project street may be re-evaluated by Staff after three years. (See Appendix 5: Citizen Appeals for more information.)

NTCC Recommendation to the County Board. After the Working Group has successfully met the requirement of obtaining the necessary level of support for the proposed project, the NTCC will hold a special public "funding" session to formally vote on its recommendation to the County Board for the group of projects under consideration. In advance of that meeting, the Staff will assign funding points for each plan based on the NTC Project Ranking Funding Guidelines. (See Appendix 4.) The funding rankings provide the NTCC with an objective method for making funding recommendations to the County Board. The Project Ranking Funding Guidelines give priority to speeding and volume, and assign points for every reported accident within the last three years. Additional points are given to projects on streets that are bike routes; are transit routes; have facilities that generate substantial amounts of pedestrian traffic; and have street conditions that may lead to increased hazards. Points are also given to projects that demonstrate high levels of community support, such as letters of support received from local schools, PTAs, and civic associations, for example.

Other factors being equal, projects with higher points will be recommended by the NTCC for funding before projects with lower points.

Prior to the funding session, the NTC Staff will review eligible projects, their estimated costs and their funding rankings with the NTCC at its monthly meeting prior to the funding session. Prior to the NTCC funding session, NTCC members are expected to visit the eligible sites.

The purpose of the funding session is for the NTCC to formally review the eligible traffic calming plans, receive public comment and recommendations on the plans, and prepare and vote on recommendations to the County Board to approve and fund the individual project plans.

At the funding session, NTC Staff describes each project, with input from NTCC Working Group members. The opportunity for public comment follows, subject to time limits and ground rules that permit all of the projects to be considered at the meeting. Following the public speakers, the NTCC members discuss among themselves any issues, out of which comes the NTCC recommendation, on a project-by–project basis, for the County Board. The Board acts upon the NTCC recommendation at one of its future, regularly scheduled public meetings.

Any projects that the NTCC does not recommend for funding may remain on either the problem-severity or funding lists, depending on circumstances, until the next funding session. Any elements of approved projects that are not recommended for funding may be eligible for other funding sources, such as the Neighborhood Conservation Program, WALKArlington, or other County programs, and will be referred back to the community.

Implementing the Project. Once the County Board has approved the project, County Staff implements the project plan. This implementation can include: (1) determination of the scope of work, (2) performance of a site topographic survey, (3) development of detailed construction drawings, (4) acquisition of any necessary rights of way and easements, (5) development of a construction schedule, (6) notification to affected residents of the construction schedule, (7) arranging and supervising construction, and (8) planning any needed landscaping treatments and maintenance requirements with affected residents.

During project implementation, the Working Group remains the liaison between NTC Staff and the residents in the area of impact. The Working Group is expected to assist NTC Staff

and residents on maintenance agreements for the landscaping plan, speed table or cushion locations (if not previously agreed upon), and other requests as needed.

Evaluating the Effectiveness of the NTC Project. Following construction of the project, the NTC Staff evaluates whether the project has been effective in calming traffic on the project street. Staff collects "after" data, normally within one year after project completion, using the same measurement parameters as in developing the original data identifying and analyzing the problems following the original request for traffic calming on the street. Staff tracks changes in traffic patterns (for example, additional data collection to measure diversion) and performs any additional study deemed necessary.

The NTC Staff analyzes data and prepares an Evaluation Report for each project that compares the "before" and "after" data, determining whether the traffic calming measures have accomplished the desired objectives. This analysis may indicate that due to some deficiency in implementation, corrective measures are needed. The Evaluation Report is shared with the NTCC, the residents in the area of impact and other Working Group members (the civic association representative, for example). NTC Staff works with residents with regard to any remaining issues, problems, or concerns. The project is then formally closed-out.

CHAPTER III:
TRAFFIC CALMING CONSIDERATIONS

Neighborhood traffic calming involves a combination of mainly physical measures to improve safety and livability of neighborhood streets by (1) reducing the negative effects of motor vehicle use, including excessive vehicle speed by altering driver behavior, and (2) addressing other safety-related neighborhood traffic concerns. The following definitions, measures and considerations govern the NTC process. This chapter discusses in very general terms the measures used in the County's NTC Program, and the criteria considered in determining which measures are appropriate in a given circumstance.

DEFINITIONS

Speeding. A speeding problem exists when the 85th percentile speed on the affected street/s or street segment is 5 mph or more over the posted speed limit. The 85th percentile speed, and the reasons for its use, are explained in Appendix 6.

Area of Impact. The "area of impact" which must be polled to determine whether a traffic calming plan has the required level of support. The area of impact consists of (1) residences that directly front on the street segment where the traffic calming measures will be installed; (2) residences on cul-de-sacs or courts directly connected to that street segment; and (3) nearby residences on side streets directly connected to that street segment. The NTCC and County Staff may have to exercise judgment in determining this area, which should include the residences most directly affected by the speeding problem and the traffic calming measures.

TRAFFIC CALMING MEASURES

The Traffic Calming Toolbox (See Appendix 7) identifies and briefly defines NTC measures that the County Board has approved for use in developing traffic calming plans. Depending on the characteristics of the project street(s), or whether the street is an emergency response or bus route, the NTC Staff may determine that certain measures are not appropriate in a particular plan.

Some measures are available for implementation under authority of the County Manager, such as: roadway markings, mid-block crosswalks, multi-way stop signs, $200 warning signs for speeding, placement of a speed display trailer, arterial direction signs, marking of bike lanes, changes in parking restrictions, vegetation trimming, additional speed limit or "Stop Ahead" signs and education programs.

Stop signs and multi-way stop signs are not traffic calming measures, but traffic control devices used to assign the right of way or improve safety at intersections. They are not installed to control speeding. There is a separate administrative process and specific standards for evaluating the placement of multi-way stop signs that does not fall under the NTC Program. These are provided in Appendix 9.

CONSIDERATIONS IN SELECTING TRAFFIC CALMING MEASURES

Traffic calming measures, set forth in the "Traffic Calming Toolbox" Matrix (see Appendix 7), are available for use in addressing traffic problems on neighborhood streets in residential neighborhoods. Some of these measures address the same types of problems. However, the selection of the specific measure or combination of measures to include in a traffic calming plan will involve a number of considerations specific to the particular problem on that street(s). The Working Group should weigh the following considerations when selecting a measure (or combination of measures) for a project street. The list is not arranged in any particular order of importance or preference.

A. Effectiveness: Whether the measure or combination of measures would be expected to solve the identified problem, based on past experience in Arlington or elsewhere.

B. Best Traffic Engineering Practices: The measure must be appropriate to the physical layout and geometrics of the street, within the range of traffic management guidelines based on best engineering practices as applied by the County Staff. Street width, intersection size, and topography may lead to the exclusion or selection of certain measures. For example, some intersections may not be wide enough to safely accommodate a traffic circle.

C. Existence of transit route, major school bus route or Emergency Medical Service Response Route: Additional approval and evaluation may be needed depending on the measure desired.

D. Schools: The presence of schools near a location increases the need for controlled vehicular traffic but may influence the particular traffic calming measures utilized.

E. Traffic Management Guidance: As relevant to a given project, The Manual on Uniform Traffic Control Devices and other relevant professional traffic engineering publications may provide guidance on the selection and use of traffic control devices.

F. Other Neighborhood Traffic-Related Issues: Other considerations in determining appropriate traffic calming measures could include, among other things, lack of appropriate crosswalks, lack of sidewalks, hazards for bicyclists, and excessive noise from vehicles, motor vehicles and trucks. Safety for pedestrians may have particular significance near schools, community centers, elderly living centers, playgrounds and other pedestrian traffic generators.

APPENDICES

Appendix 1

NEIGHBORHOOD TRAFFIC CALMING AND PEDESTRIAN SAFETY

Neighborhood traffic calming is intended to reduce the speed of traffic to levels appropriate for a residential neighborhood, as a means to promote traffic safety and active street life. Pedestrian safety is an important objective of traffic calming.

Nationally, approximately 5,000 pedestrians are killed and about 80,000 injured in accidents with automobiles annually. Fifty-five percent of these pedestrian deaths occur on neighborhood streets.[2] Bicyclist fatalities average approximately 800 per year, with an injury rate of approximately 583,000 per year.[3] Thirty-four percent of bicycle fatalities occurred on local--as opposed to major--roads.[4] Children ages 5 to 14 account for nearly 30 percent of the fatalities and more than 60 percent of the injuries.[5]

According to the most recent data reviewed by the Metropolitan Washington Area Council of Governments, pedestrian fatality and injury rates in the greater Washington, DC region are typical for a major urbanized area, but still high in proportion to the number of pedestrian trips. A pedestrian is killed in the Washington region every 4.4 days, and an average of 5.6 pedestrians are injured every day. Approximately 2300 pedestrians are injured every year in the Washington region, and eighty-four are killed. Pedestrian fatalities accounted for one fifth of the total traffic fatalities in the District of Columbia, suburban Maryland and northern Virginia from 2002-2006.

The speed limit on most of Arlington's neighborhood streets is 25 miles per hour. Studies reviewed by the National Highway Traffic Safety Administration of the Department of Transportation[6] indicate a consistent correlation between increased vehicle speed and likelihood of death in pedestrian accidents. Several studies have shown that approximately five percent of pedestrians would die when struck by a vehicle traveling 20 mph. That fatality percentage jumps to 40 percent for vehicles traveling 30 mph, which is the defined threshold for a speeding problem under the Arlington County NTC Program. Research by the Federal Highway Administration indicates that the likelihood of a pedestrian accident increases at higher speeds, because motorists are less likely to see and react to a pedestrian in time.

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[2] *Mean Streets: Pedestrian Safety and Reform of the Nation's Transportation Law*. Surface Transportation Policy Project and Environmental Working Group. Web site: http://www.transact.org/Reports/Mean/for.htm.

[3] *Fatality Facts: Pedestrians.* Insurance Institute of Highway Safety, 1999. Web site: http://www.highwaysafety.org/safety_facts/fatality_facts/peds.htm.

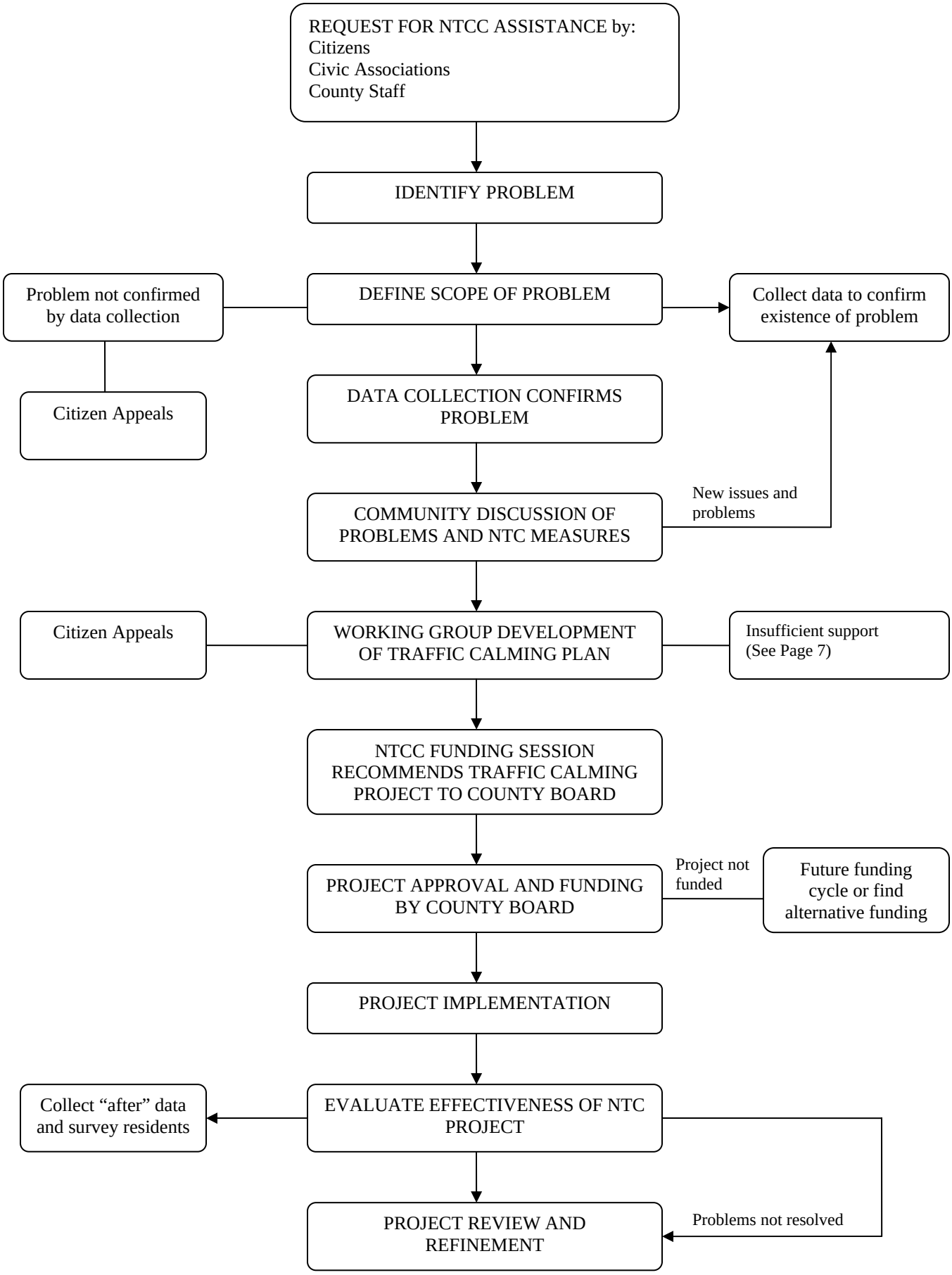
[4] *Fatality Facts: Bicycles.* Insurance Institute of Highway Safety, 1999. Web site: http://www.highwaysafety.org/safety_facts/fatality_facts/bikes.htm.

[5] *What's New at DOT?* New York City Department of Transportation, September 27, 1999. Web site: http://www.nhtsa.dot.gov/people/ncsa/tsf-1998.pdf.

[6] "Literature Review on Vehicle Travel Speeds and Pedestrian Injuries," U. S. Department of Transportation, National Highway Traffic Safety Administration, DOT HS 809 021 October 1999 -Final Report.

APPENDIX 2

NEIGHBORHOOD TRAFFIC CALMING PROCESS FLOW CHART



APPENDIX 3

PROBLEM SEVERITY RANKING GUIDELINES

Measure	Definition	Points
Speeding	Average daily percentage of vehicles traveling 5 mph or more over the speed limit at the point on the project street with the highest speed. One point for each percentage point over 5 MPH and a second point for each percentage point over 10 MPH.	0 - 40
Volume	Average daily traffic volume, at the point on the project street with the highest average volume, divided by 100.	0 - 30
Accidents	Number of reported correctable accidents on the project street in the last three years.	5 each
Bike/Transit Routes	Street designated as Official or Unofficial Bicycle Routes on the Arlington County Bikeway Map, or used as a regular transit route by Metro Bus or ART bus.	5 each
Pedestrian Generators	Public or private facilities on or near the project street, such as schools, parks, community houses, senior housing, etc., which generate a substantial amount of pedestrian traffic.	5 each
Dangerous Conditions	Conditions on the project street which lead to increased hazards, such as the absence of a sidewalk on either side of the street or inadequate, uncorrectable site distance problems.	5 each
Existing Traffic Calming Measures	Are there existing traffic calming measures on the street?	- 5 (yes) 0 (no)

APPENDIX 4

FUNDING RANKING GUIDELINES

Measure	Definition	Points
Speeding	Average daily percentage of vehicles traveling 5 mph and over the speed limit, at the point on the project street with the highest speed. One point for each percentage point over 5 MPH, and a second point for each percentage point over 10 MPH.	0-40
Volume	Average daily traffic volume, at the point on the project street with the highest average volume, divided by 100.	0-30
Accidents	Number of reported, correctable accidents on the project street in the last three years.	5 each
Bike/Transit Routes	Street designated as Official or Unofficial Bicycle Route on the Arlington County Bikeways Map, or used as a regular transit route by Metro Bus.	5 each
Pedestrian Generators	Public and private facilities on or near the project street, such as schools, parks, community houses, senior housing, etc., which generate a substantial amount of pedestrian traffic.	5 each
Dangerous Conditions	Conditions on the project street which lead to increased hazards, such as the absence of a sidewalk on either side of the street or inadequate, uncorrectable site distance problems.	5 each
Community Support	Support from civic association, local PTA, etc; each ten percentage points above required 60%/70% on qualifying petitions.	5 each

APPENDIX 5

CITIZEN APPEALS

The NTCC meets monthly throughout the year. The NTCC's meetings are open to the public, and there is a public comment period at the beginning of each meeting during which citizens may express their views concerning the NTC Program generally or specific NTCC projects.

In addition, citizens who disagree with an action of the NTCC or a Working Group can request the opportunity to present the reasons for their disagreement to the NTCC during one of the regular monthly meetings. Citizens could appeal, for example, a determination that a street did qualify for traffic calming, the ranking score assigned to a qualifying street, a decision not to select a particular street in a particular funding round, or a Working Group's determination of the "affected area" for purposes of the petitioning process. Citizens should contact the Staff to determine the NTCC's meeting schedule and allow the NTCC members a sufficient opportunity to review any information relevant to the appeal, including a visit to the street in question, prior to the meeting. The NTCC will consider the appeal based on whether the determination was made in accordance with the adopted policies and procedures of the NTC program as established by the County Board. The NTCC members will endeavor to communicate clearly to appellants the basis for their decisions. Any appellant who remains dissatisfied may appeal the NTC's decision to the County Board.

Citizens who disagree with the Program itself, or elements of the Program should recognize that the NTCC is an advisory group and cannot modify the NTC Program without County Board approval. The NTCC nonetheless welcomes comments about the NTC Program, and may be able to help clarify the underlying reasons for the operation of aspects of the NTC Program.

APPENDIX 6

85TH PERCENTILE SPEED

Definition: The speed at which, or below 85 percent of all traffic travels, and above which 15 percent of the traffic travel.

What is the 85th percentile speed and why do we use it?

In general, an accepted principle of traffic planning is that the majority of drivers on a roadway select safe and proper speeds based on roadway and traffic conditions. Traffic engineers use the 85th percentile speed to determine whether a specific roadway has a speeding hazard, because that speed approximates the high end of the "normal" speeds traveled by motorists on a roadway.

The 85th percentile speed statistic is of particular interest for planning because the 85th percentile speed is often located at the upper end of a range of speeds that includes the majority of motorists who select "safe and proper speeds". Typically, recorded speeds above the 85th percentile speed tend to occur much less frequently than speeds below it. This is usually because the highest speeds recorded in a study may be erroneous readings or because relatively few motorists are irresponsible or unperceptive of roadway conditions.

How does the 85th percentile speed relate to Speed Limits?

A generally accepted traffic engineering practice is that, for traffic flow efficiency, speed limits should be set at the nearest 5 mph increment to the 85th percentile speed. For instance, if the 85th percentile speed on a road were measured at 27 mph, then the speed limit on the road would typically be set at 25 mph. However, other considerations such as accidents and real dangers not perceivable by drivers may suggest a need for a lower speed limit. Since speed limits are generally set using the 85th percentile speed, it is *expected* that 15 percent of the vehicles will exceed the speed limit on a regular basis. On the other hand, traffic department administrators and/or elected officials may decide to set speed limits reflecting adjacent land use. For example, non-arterial streets in residential neighborhoods should be posted 25 mph.

How does the 85th percentile speed relate to speeding problems?

Frequently, County engineering studies show that the 85th percentile speed exceeds the speed limit of 25 mph established by the State code. If the 85th percentile speed falls within a range of 25-29 mph, it is not considered a speeding problem under Arlington County's NTC Program, since the traffic speed is reasonably close to the posted speed limit on neighborhood streets. However, once the 85th percentile speed is equal to or greater than 30 mph, the situation is considered to be a speeding problem under the policies and procedures of the NTCC Program.

APPENDIX 7

TRAFFIC CALMING TOOLBOX

EDUCATION – TRAFFIC ENGINEERING - ADMINISTRATIVE

NTC MEASURE	DEFINITION	CRITERIA	MINIMUM SUPPORT NEEDED
Arterial Direction Signs	A passive device used to guide and advise motorists of major destinations and to reach those locations using arterial streets. The signs are not regulatory in nature and have no enforcement status.	Manual of Uniform Traffic Control Devices*	Civic association support
Roadway Markings	Markings on crosswalks, stop bars at stop signs and traffic signals, delineated bicycle and parking lanes, cross-hatchings at lane narrowing points and curb lines.	Manual of Uniform Traffic Control Devices*	Staff judgment
$200 Fine Speed Warning Sign	A warning sign generally placed below a speed limit sign to inform of maximum fines for speeding	Used at locations with long-term speeding problem	Civic association support
Pedestrian Crossing Sign	A regulatory sign that provides the right of way to pedestrians and indicates the range of fines for violation	Major pedestrian crossing MUTCD	Staff judgment
Speed Display	A Smart set (Speed Monitoring Awareness Radar Trailer) is a portable, self-contained speed display unit.	None	Citizen request
Truck Restrictions	Prohibition of use of certain streets by trucks (registered gross weight exceeding 7500 pounds), except for receiving loads or making deliveries. Requires County Board to amend County Code.	Excessive truck volume (5% of total traffic volume)	Civic association support

* The MUTCD defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.

SPEED REDUCTION - MEASURES

NTC MEASURE	DEFINITION	CRITERIA	MINIMUM SUPPORT NEEDED
Chicane	Slow points created by curb extensions to create a serpentine movement.	Excessive speed (85th percentile speed 30 mph or higher)	60% of households in area of impact
Flat-Top Speed Cushion	A speed table (see below) modified with slots to permit passage of emergency vehicles.	Same criteria as speed tables (85th percentile speed 32 mph or higher); used on streets that have been designated as emergency response routes	70% of households in area of impact
Gateway	Narrowing of the roadway at or near the entrance to a neighborhood, intended to cause drivers to slow and to foster recognition that they are entering a residential area.	Excessive speed (85th percentile speed 30 mph or higher)	60% of households in area of impact
Intersection Geometry Changes	Introduce traffic modification and control through channeling, re-direction, and tightening turning radii.	Excessive speed (85th percentile speed 30 mph or higher), possibly combined with excessive volume	60% of households in area of impact
Median	Islands, either raised or flush with the street level, along the roadway cross section, intended to narrow the roadway, channel traffic, control turning movement, and provide pedestrians with a mid-road safe refuge.	Excessive speed (85th percentile speed 30 mph or higher)	60% of households in area of impact
Nubs (curb extensions, chokers)	Nubs can be installed at intersections or mid-block, to shorten pedestrian crossing distances and slow traffic.	Excessive speed (85th percentile speed 30 mph or higher)	60% of households in area of impact
Raised Crosswalk	Designed in a manner similar to Speed Tables but with certain design features and markings to indicate a pedestrian crossing.	Excessive speed (85th percentile speed 32 mph or higher)	70% of households in area of impact
Raised Intersection	Flat raised areas covering entire intersections, with ramps on all approaches and often with brick or other textured materials on the flat section.	Excessive speed (85th percentile speed 32 mph or higher)	70% of households in area of impact

NTC MEASURE	DEFINITION	CRITERIA	MINIMUM SUPPORT NEEDED
Slow Points	Small islands placed at intersections or mid-block to slow vehicles and improve pedestrian safety. Two-lane angled slow points are created by staggered, triangular curb extensions that alter the traffic movement on a street from straight through to curving, thereby slowing travel speeds.	Excessive speed (85th percentile speed 30 mph or higher)	60% of households in area of impact
Permanent Speed Display	A SMART set (Speed Monitoring Awareness Radar Trailer) is a self-contained speed display unit that electronically displays a digital readout of vehicle speeds visible to the driver.	Excessive speed (85th percentile speed 30 mph or higher)	60% of households in area of impact
Speed Table (also called flat-top speed humps)	A short, raised street section that extends across the roadway. The maximum height is 3.5 inches; the length is 22 feet.	Excessive speed (85th percentile speed 32 mph or higher)	70% of households in area of impact
Street Narrowing	General narrowing of the street cross-section.	Excessive speed (85th percentile speed 30 mph or higher)	60% of households in area of impact
Traffic Circle	A small circular island, usually landscaped, placed in the middle of an intersection.	Excessive speed (85th percentile speed 30 mph or higher); cannot be used for three-way or offset intersections.	60% of households in area of impact

ARTERIAL DIRECTIONAL SIGNS

Description: Arterial Directional Signs are used to guide and advise motorists of major destinations and how to reach these locations using arterial streets, reducing travel on local residential streets. This type of device is most effective in areas where there are alternative arterial routes. This measure serves as a directional/guide signs, not as a regulatory sign and has no enforcement status.

Wilson Boulevard in Clarendon

Wilson Boulevard at North Irving Street

Advantages	Disadvantages	Criteria
• May reduce excessive traffic by encouraging use of arterial roadway	• Not as effective as regulatory measure • May add to sign clutter	• Manual on Uniform Traffic Control Devices • Civic association approval

Arlington locations where Arterial Directional Signs are installed:

Wilson Boulevard in Clarendon adjacent to Lyon Village; Lee Highway near I-66 (eastbound).

ROADWAY MARKINGS

Description: Roadway markings are a relatively inexpensive method to promote traffic safety and traffic calming. Recommended markings include, but are not limited to, crosswalks, stop bars at stop signs, and traffic signals, delineated bicycle and parking lanes, cross-hatchings at lane narrowing, centerlines and curb lines. Street markings are visual cues to drivers to moderate their speeds.

North Barton Street at Fairfax Drive

Advantages	Disadvantages	Criteria
• Inexpensive means to narrow travel lanes and to delineate other roadway users space • Can be used in conjunction with other measures	• Not self-enforcing • Need to maintain (repaint in time)	• MUTCD, staff discretion

Arlington locations where roadway markings are installed: Numerous

$200 FINE SPEED WARNING SIGNS

Description: A warning sign installed under a speed limit sign to indicate what the potential maximum fine could be if cited for speeding. Most times, motorists cited for speeding can pre-pay the fine and not go to court. However, if the motorist wants to contest the citation, he can appear in court, but should he lose, he may be charged up to $200 plus after costs.

16th Street North, between North Glebe Road and North George Mason Drive

Advantages	Disadvantages	Criteria
• Informs public of potential fine for speeding	• May not be very effective	• Used where chronic excessive speeding problems exist Approval of civic association

Arlington locations where "$200 Fine Speed Warning" signs are installed:

16th Street North, between North Glebe Road and North George Mason Drive

PEDESTRIAN CROSSING SIGN WITH FINE SIGN

Description: A regulatory sign which assigns the right of way to pedestrians at specific crossing locations, and indicates the range of fines if a citation is written.

Washington Boulevard at North Buchanan Street

Advantages	Disadvantages	Criteria
• Clearly assigns the right of way to pedestrians at specific crossing location	• Not self-enforcing	• MUTCD, staff discretion

Arlington locations where "Pedestrian Crossing" signs are installed: Numerous.

SPEED DISPLAY

Description: A SMART set (Speed Monitoring Awareness Radar Trailer) is a portable, self-contained speed display unit. This unit operates on batteries that are charged by either a 110-volt power source or attached solar cells. A fully charged unit, without available sunlight, may be used for up to three days depending on traffic volume.

Advantages	Disadvantages	Criteria
• Makes motorists aware of the speed they are traveling and the posted speed limit • Self enforcing where compliance is voluntary • Highly visible • Does not require a police officer to be present	• Cost of equipment and maintenance • Requires towing, set-up and storage • Possible target of vandalism • Temporary effectiveness	• Citizen request and schedule

Arlington locations where speed displays are installed: Various locations as requested.

TRUCK RESTRICTIONS

Description: On streets under the County's jurisdiction, the County Board has authority under Virginia Code to prohibit the use of trucks except for the purpose of receiving loads or making deliveries. Additionally, the County Code would have to be amended each time a new street is added to the list of affected streets and before signs can be posted and enforced. Under the County Code, a truck is defined as "every motor vehicle designated to transport property on its own structure independent of any other vehicle and having a registered gross weight in excess of 7500 pounds." This would include certain pickup or panel trucks, tractor trucks and trailers.

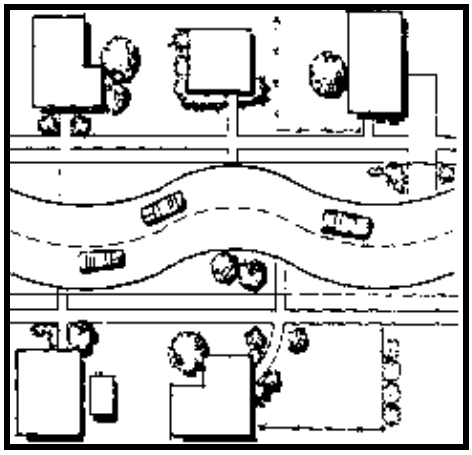
North Highland Street at Lee Highway

Advantages	Disadvantages	Criteria
• Reroutes trucks to arterial roadways • Does not affect access to property	• Not self-enforcing	• 5% of total traffic and an Alternative Arterial nearby • Civic Association Approval • County Board Approval to amend County Code

Arlington locations where truck restrictions are installed: North Highland Street between 13th Street North and Lee Highway; South Columbus Street between Columbia Pike and South George Mason Drive.

CHICANE

Description: A chicane is a two-lane angled slow point created by staggered, triangular curb extensions that alter the traffic movement on a street from straight through to curving, thus slowing travel speeds. Particularly when landscaped, the curb extensions also visually narrow the street, which typically results in slower speeds.



Chicane treatment in Seattle, WA

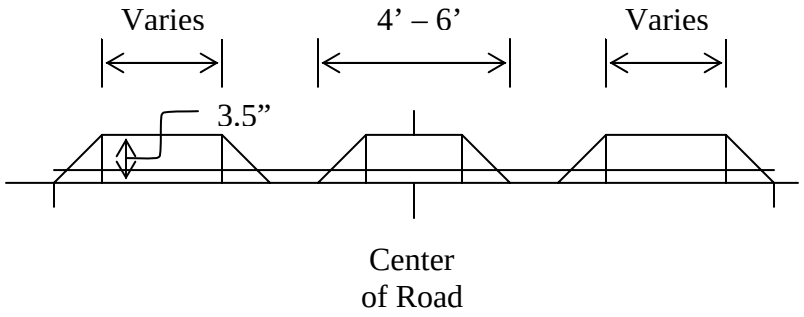
Advantages	Disadvantages	Criteria
• Reduces vehicle speed • Most effective when used in a series • Regulates parking with curb extensions • Increases pedestrian safety by reducing crossing distances • Increases pedestrian and bicyclist safety by reducing vehicle speeds • Provides areas for landscaping	• Reduces on-street parking • Reduces the space for motor vehicles to safely pass • Requires wide right of way, or pavement width	• 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected area must support

Arlington locations where chicanes are installed: None today. Previously tested in Arlington but removed because of sight distance concerns.

FLAT-TOP SPEED CUSHIONS

Description: A speed cushion is a short, raised street section that extends across the roadway. It is basically the same design as a speed table; usually 22 feet long and 3.5 inches high. There are three sections to the speed cushion, which allows emergency vehicles to drive through the center section without affecting response time or jolting patients in an ambulance. As with speed table, speed cushions have little effect on a vehicle driving the posted speed limit, but produce discomfort when the speed limit is exceeded. The speed cushions are designed to allow snow plows to smoothly traverse them with no significant impedance. It is not necessary to prohibit parking at or on the speed cushion, unless the roadway is narrow and then parking may be eliminated near the cushions. Speed cushions are most effective if used in a series; spaced 300 to 500 feet apart.

Speed cushion on North Fillmore Street



Speed Cushion Profile

Advantages	Disadvantages	Criteria
• Reduces speeds, 3-7 mph • Increases pedestrian safety • Self enforcing • Relatively inexpensive • Does not delay emergency vehicles • Parking may be allowed on cushion	• May generate minor noise at cushion when traversed by large trucks or buses • Some discomfort for short wheel-based vehicles	• 85th percentile speed is 32 mph, or greater • 70% of households in affected area must support • Spacing of 300 – 500 feet

Arlington locations where speed cushions are installed: 26th Street North, between North Ohio Street and North Lexington Street; South Kenmore Street, between Walter Reed Drive and 22nd Street South; South Columbus Street, between South Chesterfield Road and George Mason Drive; North Fillmore Street, between Pershing Drive and Arlington Boulevard.

GATEWAY TREATMENT

Description: Gateway treatments are usually located at the entrances of a neighborhood and are intended to discourage excessive traffic and reduce speed. They also provide a sense of neighborhood cohesion and pride. A gateway treatment may include changes in street appearance (street width, and paving material(s) and landscaping (signage, plantings) to signal the demarcation between a major street and an adjacent residential area, or between areas of residential and commercial usage.

Gateway treatment on South Columbus Street at George Mason Drive

Advantages	Disadvantages	Criteria
• Positive indication of a change in environment to a residential street • May reduce entry speeds • Opportunity for landscape and signage • Reduces pedestrian crossing distance • Aesthetically pleasing • May reduce excessive traffic	• Limited nature of physical impediment may not be effective for excessive traffic • Reduction of speed of traffic turning onto residential street could hinder arterial road flow and decrease safety for turning vehicles • Maintenance responsibility	• 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected area must support

Arlington locations where gateway treatments are installed: North Highland and North Danville Streets at Lee Highway; North Lexington Street at Lee Highway; South Kenmore Street at Walter Reed Drive; South Columbus Street at George Mason Drive.

INTERSECTION GEOMETRY CHANGES

Description: Intersection geometry changes introduce traffic modification and control through channeling, re-direction, and tightening turning radii. Proper design can reduce aggressive driver action and promote calmer traffic. Intersection geometry changes may incorporate several other measures to achieve the requested result.

North Frederick Street at North George Mason Drive

Advantages	Disadvantages	Criteria
• Reduce aggressive driver incident/accident potential • Improve pedestrian safety • Can be used to narrow excessively wide intersections • Slows turning traffic	• May reduce on-street parking • Can be expensive if utility work is required	• 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected area must support

Arlington locations where intersection geometry changes are installed: North Frederick Street @ North George Mason Drive; 4th Street North @ Pershing Drive

MEDIAN

Description: Medians are islands, which are raised or flush with the pavement level, along the roadway cross section. Their purpose is to: narrow the roadway, channelize vehicular traffic, passively control turning movement, provide pedestrian mid-road safe refuge, and create landscape/streetscape enhancement. Normally the width for a raised median is 10 feet minimum with landscaping, and the width of the pedestrian refuge area is four feet.

Median on Patrick Henry Drive, between
16th Street North and North Harrison Street

Advantages	Disadvantages	Criteria
• Allow pedestrians to cross half of the street at a time (pedestrian refuge) • Make pedestrian crossing points more visible to drivers • Channelize traffic and inhibit prohibited turning movement • Prevent vehicles from passing turning vehicles • May result in geometric improvement • Improve streetscape through landscaping • Slower traffic	• Potential loss of curb-side parking • Some inconveniences to residents by raised median in reaching their driveways	• 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected area must support

Arlington locations where medians are installed: North Patrick Henry Drive, between North George Mason Drive and 16th Street North; 6th Street South east of Walter Reed Drive; North Woodrow Street, between Lee Highway and North Glebe Road.

NUBS (CURB EXTENSIONS, CHOKERS)

Description: Nubs (curb extensions, chokers) are installed within the roadway cross section. These curb modifications can be installed at intersections or mid-block. Nubs increase pedestrian safety, by both reducing the crossing distance and improving the line-of-sight between pedestrian and vehicle operator. Additionally, they create a visual narrowing of the roadway, which typically results in vehicle speed reductions. Pedestrian safety is enhanced when nubs are used in conjunction with other measures.

North Lexington Street and 22nd Street North

7th Road South & South Dinwiddie Street

Advantages	Disadvantages	Criteria
• Reduce pedestrian crossing distance and interval • Make pedestrian crossing points more visible to drivers • Prevent vehicles from passing vehicles • Enhance the street through landscaping	• May not reduce speeds without other measures • Reduces on-street parking	• 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected area must support

Arlington locations where nubs (curb extensions) are installed: 7th Road South and South Dinwiddie Street; North Lexington Street between Lee Highway and 18th Street North; North Jefferson Street between Wilson Boulevard and 4th Street North.

RAISED CROSSWALK

Description: Raised crosswalks are essentially flat-top speed tables which are installed across the roadway to prompt drivers to exercise caution (slow down) in a recognized and designated pedestrian crossing area. Raised crosswalks also provide pedestrian a sense of place to safely cross the roadway.

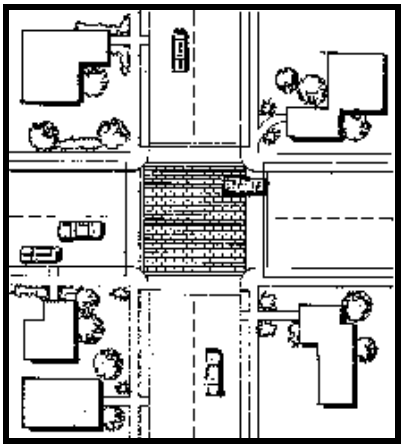
16th Street North at Virginia Hospital Center

Advantages	Disadvantages	Criteria
• Slows traffic • Increases pedestrian visibility • Clearly designates the crosswalk	• May cause vehicle deceleration and acceleration noises	• 85th percentile speed is 32 mph, or greater • 70% of households in affected area must support

Arlington locations where raised crosswalks are installed: 16th Street North, between North Glebe Road and North George Mason Drive; 8th Street South at South Randolph Street.

RAISED INTERSECTION

Description: Raised intersections are flat raised areas covering entire intersections, with ramps on all approaches and often with brick or other textured materials on the flat section. They usually rise to the sidewalk level or slightly below to provide a "lip" for the visually impaired. Raised intersections are particularly useful in dense urban areas, where the loss of on-street parking associated with other traffic calming measures is considered unacceptable.



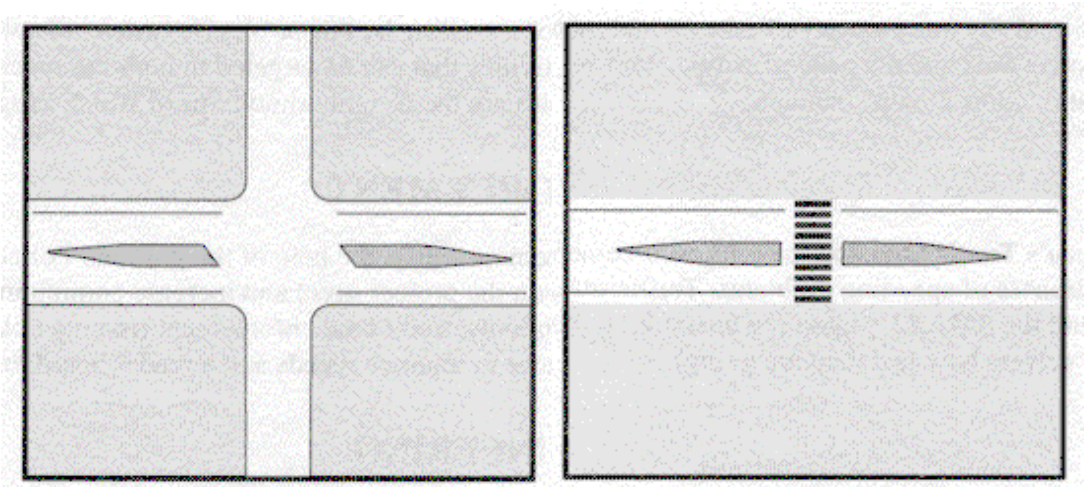
Raised intersection in Sarasota, FL

Advantages	Disadvantages	Criteria
• Slows vehicles in the most critical area and helps to make conflict avoidance easier • Highlights intersection • Excellent pedestrian safety treatment	• Increased maintenance • Expensive to build and maintain	• 85th percentile speed is 32 mph, or greater • 70% of households in affected area must support

Arlington locations where raised intersection are installed: None today.

SLOW POINTS

Description: Slow points are small islands placed at intersections or mid block with the intent of slowing vehicles, and of improving pedestrian safety. Slow points should be at least four feet wide to accommodate pedestrian safely, and wider (8 to 10 feet) if landscaping is included.



Intersection Slow Point Mid Block Slow Point

Advantages	Disadvantages	Criteria
• Slows traffic in the vicinity of the slow point • Allows pedestrians to cross half of the street at a time • May provide some landscaping opportunities	• May result in additional congestion as cars cannot pass stopped, left-turning vehicles • Reduces the space for motor vehicles to pass bicycles	• Adequate pavement width • 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected area must support

Arlington locations where slow points are installed: None today.

PERMANENT SPEED DISPLAY UNIT

Description: A permanent electronic radar display device that displays the travel speeds of each vehicle approaching the device.

16th Street North, between North Glebe Road to North George Mason Drive

Advantages	Disadvantages	Criteria
• Can be quickly installed with little construction • Shown to be effective at reducing travel speeds	• May lose effectiveness over time • Maintenance and energy requirements	• 85th percentile speed is 5 mph above the speed limit, or greater • Civic association approval

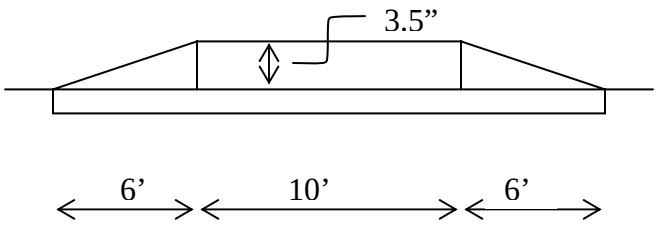
Arlington locations where permanent speed display units are installed:

16th Street North, between North Glebe Road and North George Mason Drive; Lorcom Lane, between Military Road and 23rd Street North

SPEED TABLE (Flat-top Speed Hump)

Description: A speed table is a short, raised street section that extends across the roadway. Speed tables are gradual changes in the roadway surface usually 22 feet long and 3.5 inches high. Speed tables have little effect on a vehicle driving the posted speed limit or slower, but can produce discomfort when the speed limit is exceeded. Speed tables are designed to allow snow plows to smoothly traverse them with no significant impedance. It is not necessary to prohibit parking at or on the table, although adjacent residents may feel uncomfortable parking on the table. Speed tables are most effective if used in a series; spaced 300 to 500 feet apart.

27th Street North
Between N. Greenbrier Street and North Harrison Street



Speed Table Profile

Advantages	Disadvantages	Criteria
• Reduces speeds, 3-7 mph • Increases pedestrian safety • Self enforcing • Relatively inexpensive • Parking allowed on table • Does not affect drainage	• May increase response time for emergency vehicles • May generate minor noise at table when traversed by large trucks or buses • Some discomfort for short wheel-based vehicles	• 85th percentile speed is 32 mph, or greater • 70% of households in affected area must support

Arlington locations where speed tables are installed: North Vermont Street, between Wilson Boulevard and North Carlin Springs Road; 27th Street North, between North Ohio Street and North Lexington Street; 6th Street South, between South Glebe Road and South Quincy Street; South Cleveland Street, between Columbia Pike and 13th Street South.

STREET NARROWING

Description: Narrower cross sections on neighborhood streets may help to prevent speeding problems from arising and reduce speeding where it already exists inside residential neighborhoods. Narrow street cross sections create visible narrowing that typically results in vehicle speed reduction. The narrower street pavements will provide increased green space for landscaping that may also slow traffic and will improve neighborhoods' appearance and space for sidewalks that will increase pedestrian safety.

North Powhatan Street, between Williamsburg Boulevard and County Line

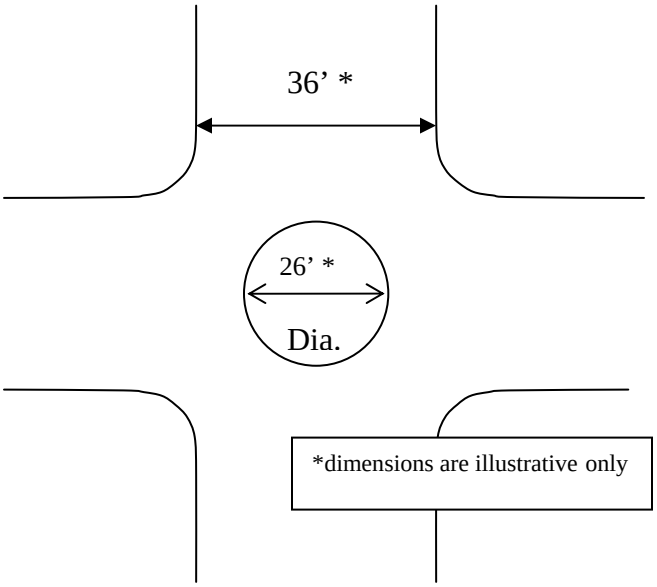
Advantages	Disadvantages	Criteria
• Increases green space • Reduces speed of vehicles • Increases pedestrian safety by reducing distance to cross street • Usually provides wider utility strip	• Can be expensive • Reduces the space for bicycles to be passed by motor vehicles • May affect on-street parking	• 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected area must support

Arlington locations where street narrowing are installed: North Albemarle Street, between North Glebe Road and the County line; North Powhatan Street, between Williamsburg Boulevard and the County line.

TRAFFIC CIRCLE

Description: A traffic circle is a small island, usually landscaped, placed in the middle of an intersection on a neighborhood street. It is most frequently used to address speeding on neighborhood streets and is most effective when built in a series.

Key Boulevard and North Fillmore Street



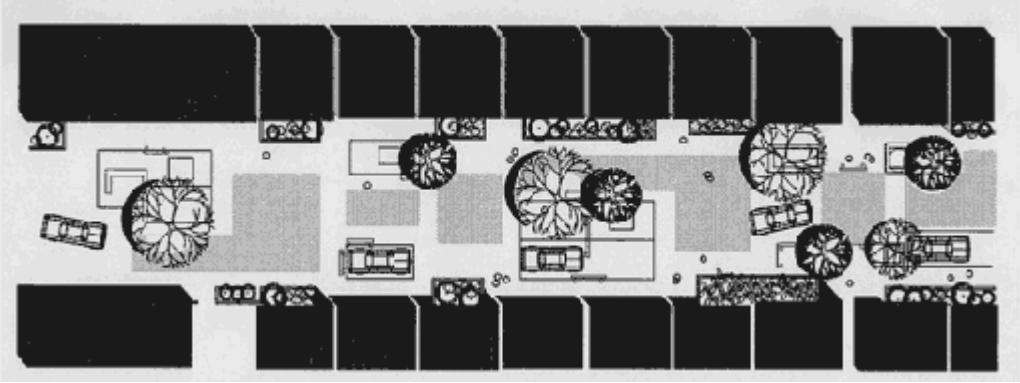
Traffic Circle

Advantages	Disadvantages	Criteria
• Reduces travel speeds • Provides area for landscaping	• May be confusing to some drivers • Some trucks cannot negotiate left turns • Landscaping requires watering and maintenance	• Most effective if at consecutive intersections • 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected area must support

Arlington locations where traffic circles are installed: 7th Street South @ North Fillmore Street; 30th Street North @ North Edison Street; 7th Street South @ South Monroe Street; 7th Street South @ South Oakland Street.

WOONERF

Description: A Woonerf is a Dutch term for "living yard" which integrates sidewalks and roadways into one surface, creating the impression of a yard and creates a shared space used by both pedestrians and motor vehicles (in the U.K. these are called "home zones"). A woonerf creates a situation where drivers and pedestrians are placed on the same level (no curbs) and drivers are directed along a path by bollards, street furniture, trees and varied and pavement treatments. Quite a few of theses measures are in place in densely developed European cities.



Advantages	Disadvantages	Criteria
• Slow travel speeds • Shared usage of the right-of-way by all users	• Very expensive to retrofit existing streets • Difficult for emergency vehicles to access • Limited application in suburban setting	• 85th percentile speed is 5 mph above the speed limit, or greater • 60% of households in affected must support

Arlington locations where woonerf are installed: None today.

APPENDIX 8

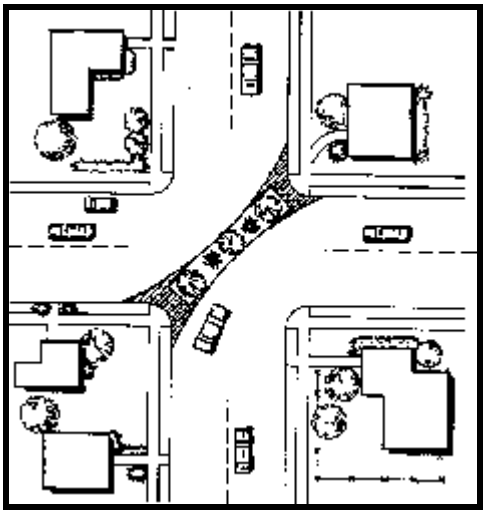
TRAFFIC MANAGEMENT TECHNIQUES

The following four measures are traffic management measures and are not available as part of the Neighborhood Traffic Calming Program.

- **Diverters/Diagonal Street Closures**
- **Half Street Closure**
- **One-Way Street Designation**
- **Turn/Access Restrictions**

DIVERTERS/DIAGONAL STREET CLOSURES

Description: The use of Diverters and Diagonal Street Closures interrupts traffic flow on a street reducing or eliminating through traffic, but maintaining traffic circulation. The purpose of this type of closure is to force traffic back onto the arterial roads around a neighborhood.



Advantages	Disadvantages
• Eliminates through traffic • Provides area for landscaping • Reduces traffic conflict points • Increases pedestrian safety • Can include bicycle path connection	• May inconvenience residents trying to access their property • May inhibit access by emergency vehicles • May divert through traffic to other local streets • Altered traffic patterns may increase trip length

Arlington locations where diverters/diagonal street closures are installed: None today. Previously tested in Arlington but removed because of controversy.

HALF STREET CLOSURE (Semi – Diverter)

Description: Half Street Closures are barriers that block travel in one direction for a short distance on otherwise two-way streets. They are good for locations with extreme traffic volume problems and non-restrictive measures have been unsuccessful.

Half Street Closure in Eugene, OR

Half Street Closure in Phoenix, AZ

Advantages	Disadvantages
• Able to maintain two way circulation beyond sign/barrier • Effective in reducing traffic volumes	• Cause circuitous routes for local residents • May limit access to businesses • Depending on the design, drivers may be able to circumvent the barrier

Arlington locations where half street closures are installed: North Garfield Street at 10th Street North (northbound direction).

ONE-WAY STREET DESIGNATION

Description: One-way street operation can be used to partially restrict vehicle access and lower traffic volume, to control traffic movement within a neighborhood, or to break up cut-through routes. They are clearly marked with signs to indicate the direction of travel. They may be used in pairs, with traffic flowing in one direction on one street, in the opposite direction on the other. The penalties associated with violating one way street restrictions may help ensure drivers' compliance with them, but one way streets can sometimes result in increased speed and traffic violation rates.

Washington Boulevard at North Edison Street

Advantages	Disadvantages
• Appropriate when some condition unique to a street makes it attractive to traffic moving in one direction • May increase on-street parking area • Can be used as a safety measure	• May inconvenience residents in gaining access to their properties • May move traffic to other neighborhood streets • May result in increased speeds, especially if street is wide

Arlington locations where "One-Way" street designations are installed: In Ballston, North Taylor and North Utah (one-way pair); North Edison Street north of Washington Boulevard; South Oak Street and South Ode Street (one-way pair).

TURN/ACCESS RESTRICTIONS

Description: These restrictions include: "Do Not Enter", "No Left Turn or No Right Turn" Signs. "Do Not Enter" signs and turn restrictions are often used to divert traffic from neighborhood streets. The times the restrictions are in effect can be varied for maximum effectiveness. This type of control device is most effective in areas where compliance can be expected to be high and enforcement is possible. In those cases, a significant improvement in the level and effect on traffic can be expected. With little enforcement, compliance will be low and the devices may not be effective,

Key Boulevard at North Veitch Street (Lyon Village)

Advantages	Disadvantages
• Can reduce non-local traffic • Times of restriction can be varied for maximum impact • Can be used to address safety issues	• May require extensive enforcement to be effective • May divert traffic to surrounding neighborhoods • Impedes access by residents • Not as effective as self-enforcing physical device

Arlington locations where "Turn/Access Restrictions" are installed: North Edison Street @ Yorktown Boulevard and Little Fall Road (time restrictions); Key Boulevard at North Veitch Street (also used in conjunction with turn restrictions); 20th Street South at South Arlington Ridge Road.

APPENDIX 9

MULTIWAY STOP SIGNS
Adopted by the County Board - October 2003

Multiway Stop Signs are *traffic control* devices primarily installed to assign the right of way at intersections. These measures are also installed to improve safety at intersections where there has been a persistent accident problem which may be correctible by the installation of Multiway Stop Signs.

Multiway Stop Signs are not considered to be *traffic calming* measures and are not installed for the purpose of controlling speeding. Numerous studies have proven that stop signs are not effective at controlling speeding. While motorists may slow and stop within 100 feet of the intersection where stop signs are installed, studies have shown that beyond this distance speeds remain the same, and in some cases, motorists will increase their speeds to make up for time lost. By contrast, *traffic calming* measures slow motorists the entire length of a traffic calming project, not just at an intersection.

The Federal Manual on Uniform Traffic Control Devices (MUTCD) provides warrants and guidelines for the installation of all *traffic control* devices including Stop Signs and Multiway Stop Signs. Arlington County has developed a set of Multiway Stop Sign warrants which are similar to the MUTCD warrants, but modified to allow the installation of more Multiway Stop Signs, especially on neighborhood streets. The Arlington County Warrants are provided on the following pages.

Multiway Stop Sign Request Process: Residents may request that particular intersections be evaluated by staff for all-way stop sign traffic control. When a request is received by staff, data are collected on the volume of traffic approaching the intersection from all approaches, accident records for the past three years are reviewed and staff visits the site to estimate vertical sight distances and to observe conditions such as on-street parking and vegetation. With all these data, an evaluation is conducted to determine whether the intersection meets any of the warrants.

If the intersection does not meet any warrant, a letter is written to the requestor and the civic association president indicating such, with a chart showing the warrant analysis. If the intersection meets a warrant, the requestor and the civic association president receive a letter indicating that a warrant was met and the County is willing to install the Multiway Stop Signs, if approved by the civic association. Once a letter is received from the civic association indicating approval of the installation, staff will schedule installation of the additional stop signs at the intersection.

Residents who are informed by staff that the intersection does not meet a warrant and staff does not support the installation of Multiway Stop Signs, may appeal the staff decision to the Neighborhood Traffic Calming Committee (NTCC). The NTCC will hear the appeal at a regular monthly meeting. The requestor is expected to be present to present their reasons for requesting the Multiway Stop Signs. Staff will provide the NTCC the warrant analysis and provide a written explanation for denying the request. The NTCC will provide a letter to the County Manager to indicate that an appeal of a Multiway Stop Sign request was heard on a certain date, and forwarding the NTCC recommendation to support or not to support the staff recommendation.

ARLINGTON COUNTY WARRANTS FOR MULTIWAY STOP SIGNS

Any of the following conditions may warrant a multiway stop sign installation:

1. Signal Installation:
Where traffic signals are warranted and urgently needed, a multiway stop sign is an interim measure that can be installed quickly to control traffic while arrangements are being made for the signal installation. (MUTCD)

2. **Traffic Accidents:**
An accident problem, as indicated by five or more reported accidents of a type susceptible to correction by a multiway stop sign installation, in a 12-month period. Such accidents include right- and left-turn collisions, as well as right-angled collisions (MUTCD), **or**

Where the total number of reported accidents of a type susceptible to correction by a multiway stop sign within the most recent 12-month period is fewer than five, but where the number of accidents has averaged three or more per year over the past five years. (Arlington County Warrant)

3. Minimum Traffic Volumes:

a) For any street (MUTCD):
   1) The total vehicular volume entering an intersection from all approaches must average at least 300 vehicles per hour for any eight hours of an average day, and
   2) The combined pedestrian, bicycle, and motor vehicle volume from the minor street must average at least 200 units per hour for the same eight hours, with an average delay to minor street vehicular traffic of at least 30 seconds per vehicle during the maximum hour **but**
   3) If the 85th percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the above values. **or**

b) For neighborhood streets (Arlington County Warrant):
   1) The combined pedestrian, bicycle and motor vehicle volume entering the intersection from all approaches must average at least 300 weighted units* per hour for any eight hours of an average day, and
   2) The combined pedestrian, bicycle and motor vehicle volume from the minor street must average at least 120 weighted units* per hour for the same eight hours.

4. Combination Warrant:

1) Where no single criterion from MUTCD is satisfied, but where Criteria 2, 3.a.1 and 3.a.2 are **all** satisfied to 80 percent of the minimum values. Criterion 3.a.3 is excluded from this condition.

2) A multiway stop sign installation may be considered at intersections where at least **two** of the following are met:
   a) The combined pedestrian, bicycle and motor vehicle volumes on each street approaching the intersection are no fewer than 1,000 weighted units* per day on each street, and have a volume distribution within the range of 50/50 to 60/40.
   b) The total number of reported accidents of a type susceptible of correction by a multiway stop sign has averaged three or more per year for the past three years.

c) There is a significant restricted visibility problem, which limits the pedestrians', bicyclists', or motorists' views of oncoming traffic to less than 200 feet, measured from the most distant decision point, that cannot be corrected by normal maintenance activity (vegetation trimming) or the installation of parking restrictions. (Arlington County Warrant)

5. Crossing Safety Warrant: (Arlington County Warrant)

A multiway stop sign installation may be considered, after an engineering study, in exceptional cases where other measures have not been effective or are judged not feasible, in regulating crossing safety for pedestrian, bicyclists, or motorists. An engineering study includes, but is not limited to, the consideration of the following factors: reported accidents; pedestrian, bicycle and motor vehicle volumes; pedestrian, bicyclist and motor vehicle patterns; crossings near schools and parks; existing roadway conditions and geometry; and operating characteristics.

6. Unimpeded Travel Distance Warrant on Neighborhood Streets: (Arlington County Warrant)

Following an engineering study finding that overall intersection safety would not decrease, if the unimpeded travel distance on a neighborhood street exceeds 1200 feet and there is a minor street along it with a pedestrian, bicycle and motor vehicle volume exceeding 500 weighted units* per day, a multiway stop sign installation may be installed at the most appropriate minor street intersection location. The unimpeded distance is that which is free of measures that assign right-of-way (signals, stop signs, and yield signs) and of physical measures (e.g., traffic circles) to influence speeds.

*Weighted Units (total of motor vehicles, bicyclists and pedestrians) are weighted by doubling non-motor vehicles, to reflect their higher injury potential in crashes.

Neighborhood Approval Process for Multiway Stop Requests Under the Arlington County Warrants: Any multiway stop request determined by the County staff to be warranted for multiway stop under the Arlington County warrants shall be approved by a formal vote of the host civic association in which the intersection is located and, in the case of neighborhood boundary streets, all such civic associations. For neighborhoods without an active civic association, a petition shall be required with the support of at least 50% of the affected residents.

Note: Warrants 5 and 6 are not applicable when one of the intersecting streets is classified as an "arterial street" on the County's Master Transportation Plan.