



Neighborhood Traffic Management Program

CITY OF RICHMOND



MARCH
2022



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Introduction



The Neighborhood Traffic Management Program (NTMP) represents a commitment by the Department of Public Works (Department) with its partners to promote and maintain the safety and livability of the City's neighborhoods. Speeding and unsafe driving practices have become an increasing concern for many of the City's residents as well as for the government agencies responsible for promoting public safety. The Department receives more than 1,000 requests every year. In response to these concerns, in 2004, the City's Department of Transportation Services staff, together with the City Planning Commission, the City Council, and representatives from neighborhood groups and emergency service agencies, developed these guidelines. Based on current traffic calming practices and the changes in the organizational structure of the City of Richmond, the Department has issued this manual to update the 2004 NTMP guidelines.



The City is committed to improving the safety of the roadway network using various strategies found in the Vision Zero Action Plan including speed management. The Vision Zero goal is to end traffic deaths and serious injuries on City streets by 2030, while increasing safe, healthy, and equitable access for all. Vision Zero starts with the ethical belief that everyone has the right to move safely within the transportation system and that designers and policymakers share the responsibility of ensuring safe systems.

This manual will present new guidelines to provide an understanding of the current state of practice that can be used to impact speeding on residential streets, criteria for considering the development of a traffic calming plan, and a description of the process from identified speed management concerns to implementation.

The manual focuses on the process addressing citizen concerns. The Department also implements traffic calming improvements as a part of their paving program.



Historical Perspective

The City of Richmond, like any other city, receives numerous requests, concerns, and suggestions from residents about traffic issues pertaining to maintenance, sight distance, parking, traffic signal timing, lane striping, speeding, traffic volumes, trucks, crashes, and other issues. The 2004 NTMP was developed to these create a process for concerns. The guidance depended on the use of state and national standards for traffic calming.

Of this list of residential traffic issues, concerns about chronic problems affecting local residential streets—such as speeding or unsafe driving practices (affecting areas ranging from a single block to an entire neighborhood)—pose a unique challenge to City staff because they are not easily addressed by the usual City actions.



Historically, many streets were not designed to be multimodal and may be too wide, causing drivers to exceed the speed limit. Compounding the issue of design, some streets may not have the degree of speeding or traffic volumes that warrant taking Police Department time away from the High Injury Street Network where higher speeds and traffic volumes have the potential to kill or seriously injure people.

Finally, communities have not been fostering a safety culture where people may routinely talk with their neighbors about the negative impacts of speed on community streets.

Prior to the development of the NTMP in 2004, City residents desiring traffic calming typically sought the support of other neighbors or neighborhood associations and then approached City Council for action. Other requests went directly to City staff. The process from that point forward could take several different paths, ranging from no action to a simple fix to a complex study with City Council, City Planning, and the Departments all involved at several points. Residents who wanted traffic calming measures were also frustrated by the lack of resources devoted to engineering, education, and enforcement to discourage aggressive driving and promote a safety culture. The City believed that this ad-hoc system worked against many potential traffic-calming installations and might have discouraged some individuals from even approaching the City with traffic concerns.

A Neighborhood Traffic Management Program for Richmond

The processes and procedures outlined in this manual establish a consistent approach to addressing neighborhood traffic and transportation concerns that can be applied uniformly throughout the City. It focuses on speed reduction—a problem experienced on many residential streets.

When successfully implemented, Neighborhood Traffic Management Plans can result in improved traffic conditions and enhance the character of a neighborhood for residents, businesses, and other travelers, whether walking, biking, rolling, driving, taking transit, or moving goods.

The program elements presented in this manual are intended to address speeding and safety issues on the City's residential streets. It applies to residential streets that are classified as local streets, although some collector streets may qualify. The City recognizes that management solutions that work on one street may not be appropriate on another. The character of each roadway or neighborhood will dictate the range of potential solutions, focused on context-sensitive solutions. Table 1 in Chapter 3 provides guidance on the application of various NTMP elements.

In general, the four primary goals of the NTMP are to:

1 Improve the safety and livability of the City's neighborhoods to provide a transportation system that works for and is accessible to everyone, no matter their age, ability, or mode of travel.

2 Encourage resident participation in the program's planning process.

3 Secure funding from the City to support the program and its implementation.

4 Make efficient use of those funds by prioritizing the program elements and identifying alternative funding sources, whenever possible.



This manual provides a uniform approach to neighborhood traffic management in Richmond. It provides guidelines that the City can follow, regardless of who presents a proposal (residents, elected officials, or City staff). These guidelines are not intended to be rigid policies. Accordingly, the City reserves the right to apply engineering judgment and deviate from these guidelines in certain situations, allowing for design flexibility in the study and implementation process.

This manual does not mandate that traffic calming measures be installed on all local streets that might qualify. However, if residents, businesses, political leaders, or City staff members nominate a street for study, the City will follow these guidelines to assess the scope and nature of the safety or operational concern and recommend these measures as necessary.

The design of residential streets should also use these guidelines and those in the Better Streets Manual.



NTMP: Part of the Transportation Toolbox

Richmond's City-wide Master Plan, Richmond 300: A Guide for Growth, places great emphasis on livable neighborhoods. The NTMP is consistent with that vision by considering the impact of speeding on residential streets. The individual transportation solutions that are developed through this program should also be consistent with the goals of the City's *Vision Zero Action Plan, Better Streets Manual* (designing complete streets for all modes of transportation), master plan, and state and national standards for traffic calming.

This manual is divided into three chapters. The first chapter presents the City's philosophy for addressing speeding on residential streets and the considerations in the planning process. The second chapter presents the planning process. The third chapter contains the strategies that can be used to impact speeds on residential streets.



Chapter 1

Traffic Calming Philosophy



Chapter 2

NTMP Planning Process



Chapter 3

Neighborhood Traffic Management Strategies

CHAPTER 1

Traffic Calming Philosophy



The point of any transportation system is not just to travel without purpose or intent—it's to get people to where they want to go and to the things they want to do using multiple modes. Our transportation system is what we use to get to our jobs, visit our friends and family, and fulfill our daily needs. Everyone has a right to use the system safely, in the way that works best for them, and it is the duty of the Department of Public Works (Department) to ensure that the system is accessible to everyone no matter where they live or what mode they choose for travel.

Given its central role in street design and managing the right-of-way, the Department is the lead agency in this work with its partners on the Vision Zero Task Force and City Council's Safe and Healthy Streets Commission.



But the task force and commission cannot do this without significant partnership and engagement with the community. Vision Zero is not just a City policy or goal; it is a City of Richmond initiative focused on advancing physical, mental, social, and environmental health in an equitable manner that addresses transportation-disadvantaged communities first.

Speeding is a common problem on our residential streets. Speeding impacts the quality of life and the safety of those living on these residential streets—the Department receives over 1,000 requests for traffic calming every year.

The approach to addressing speeding on residential streets should use education and enforcement strategies as well as physical improvements such as speed tables. Chapter 3 presents several Level 1 strategies (strategies that do not include physical improvements, such as education and enforcement) that should be implemented throughout the City. Level 2 strategies are permanent improvements that reduce speeding and may be identified as the appropriate strategy to influencing speeds. The Department's ability to implement these strategies relies on resources. The goal is to efficiently use resources made available through the budget process by prioritizing streets based upon need, identifying alternative funding sources, wherever possible.



The Department is addressing speeding on residential streets by coordinating traffic calming (speed tables) into the paving program, working with community partners and non-profits to educate, and implementing equitable, high-visibility enforcement practices.

Considerations

Impact on Emergency Responders

One of the most important concerns about the use of physical traffic calming strategies is the delay that they can impose on emergency service vehicles, primarily on fire and paramedic vehicles. Police response is also affected, but generally to a lesser degree. Delays caused by traffic calming measures could negatively impact the adopted mission goals of the Richmond Fire Department (RFD). In responding to cardiac arrest cases, seconds count in the patient's chance for survival.

The Department understands the concerns of the emergency responders and requires the review and approval of the RFD before implementing a physical traffic calming improvement. RFD has identified key emergency response routes where certain measures will not be approved.

Resources for Implementation (Funding and People)

The Department oversees the Neighborhood Traffic Management Program (NTMP) and manages the procedural aspects of the program. The Department produces conceptual designs for traffic calming projects and is responsible for design, construction inspection, and maintenance of the traffic calming projects. The Department works with the Richmond Police Department (RPD), who provide any needed enforcement, including spot enforcement and placement of mobile speed trailers.

The Department also works with local, state, and national agencies and advocacy organizations, such as Bike Walk RVA, Drive Smart Virginia, AAA Mid-Atlantic, and the Virginia Department of Motor Vehicles (DMV), to provide educational resources.

Neighborhood Engagement

The involvement of the neighborhood is important to the success of a comprehensive speed management approach to reducing speeds and addressing traffic safety concerns. At a minimum, engagement with neighbors, community groups and leaders, and elected officials throughout the process ensures that the Department understands the extent of the safety concern and the specific nature of the request. Engagement within the neighborhood and with the City Council representative(s) can also ensure that potential improvements or countermeasures have resident support during the design, funding, and construction processes.

Additionally, in many cases, the drivers observed speeding or driving recklessly are also residents in the neighborhood, particularly on local streets. Education is first and should be driven by the neighborhood and community organizations as a way to raise awareness of the negative impacts of speeding and reckless driving behaviors. Neighborhood-level and family-level conversations at home, the workplace, and places of worship are an important step to addressing traffic safety and speeding concerns. There are many resources available that can be shared with neighbors and friends which are presented in Chapter 3.

CHAPTER 2

Planning Process



This chapter provides details on the entire planning process from project initiation through study, design and implementation for requests received by the public or other stakeholders. A flow chart of the process for implementing a Level 2 Strategy and the paving program is shown in Figure 1. In addition to specific requests, the Department of Public Works (Department) is taking the initiative to implement traffic calming strategies as a part of its annual resurfacing program. This practice began in 2020.

Request Initiation

Citizen requests can originate via RVA311 Home or RVA311.com, although some requests may come from Richmond Police Department (RPD) or through direct emails, phone calls, regular mail, and City Council representatives. The Department encourages the use of RVA311 to ensure that requests are tracked internally as well as visible to the public.

All requests are taken seriously; however, issues like traffic signal malfunctions and stop sign knockdowns are prioritized as emergencies and are responded to within 2 hours of notification. Requests from the RPD, Citizen Service and Response Division, City Council representatives, neighborhood associations, and the media are given even greater attention.

Preliminary Assessment

Upon receipt of a speed management request, the Department initiates a preliminary assessment to determine the extent of the speeding problem. The Department will visit the site of concern and check to see if proper regulatory and warning signs are installed. The Department will also review crash history and determine if crash patterns necessitate remedial measures. Finally, the Department will look for existing data on traffic and speeds. The Department also will complete roadway operational studies that consider context (for example, land use, sight distance, road widths, presence of sidewalk, etc.).

If the conclusion of this preliminary assessment is that further study is required and warranted, the process will move to a full assessment.

Neighborhood Traffic Management Program (NTMP) Flow Chart Level 2 Strategies

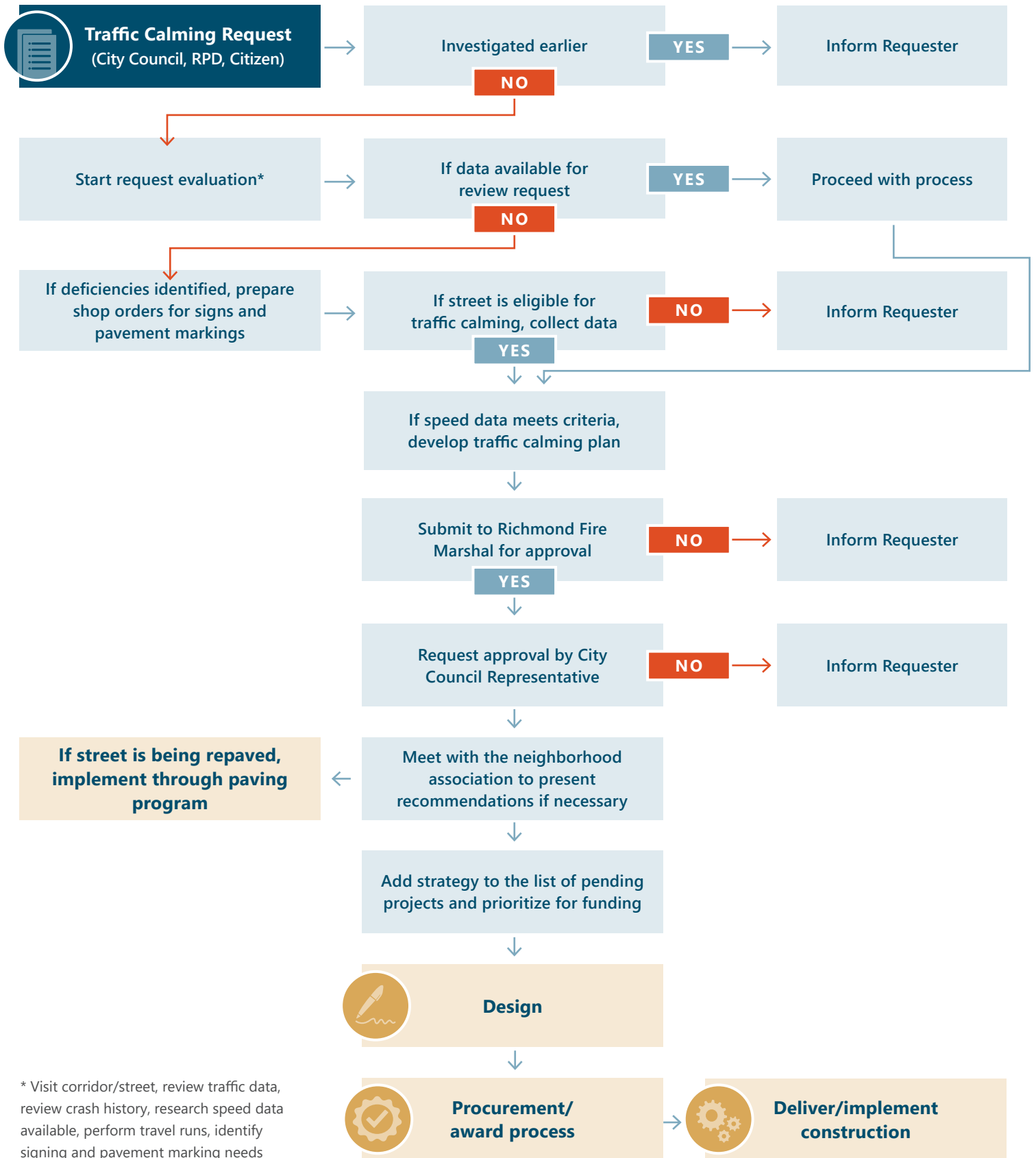


Figure 1. Neighborhood Traffic Management Program (NTMP) Flow Chart Level 2 Strategies

Cumulative Frequency Curve

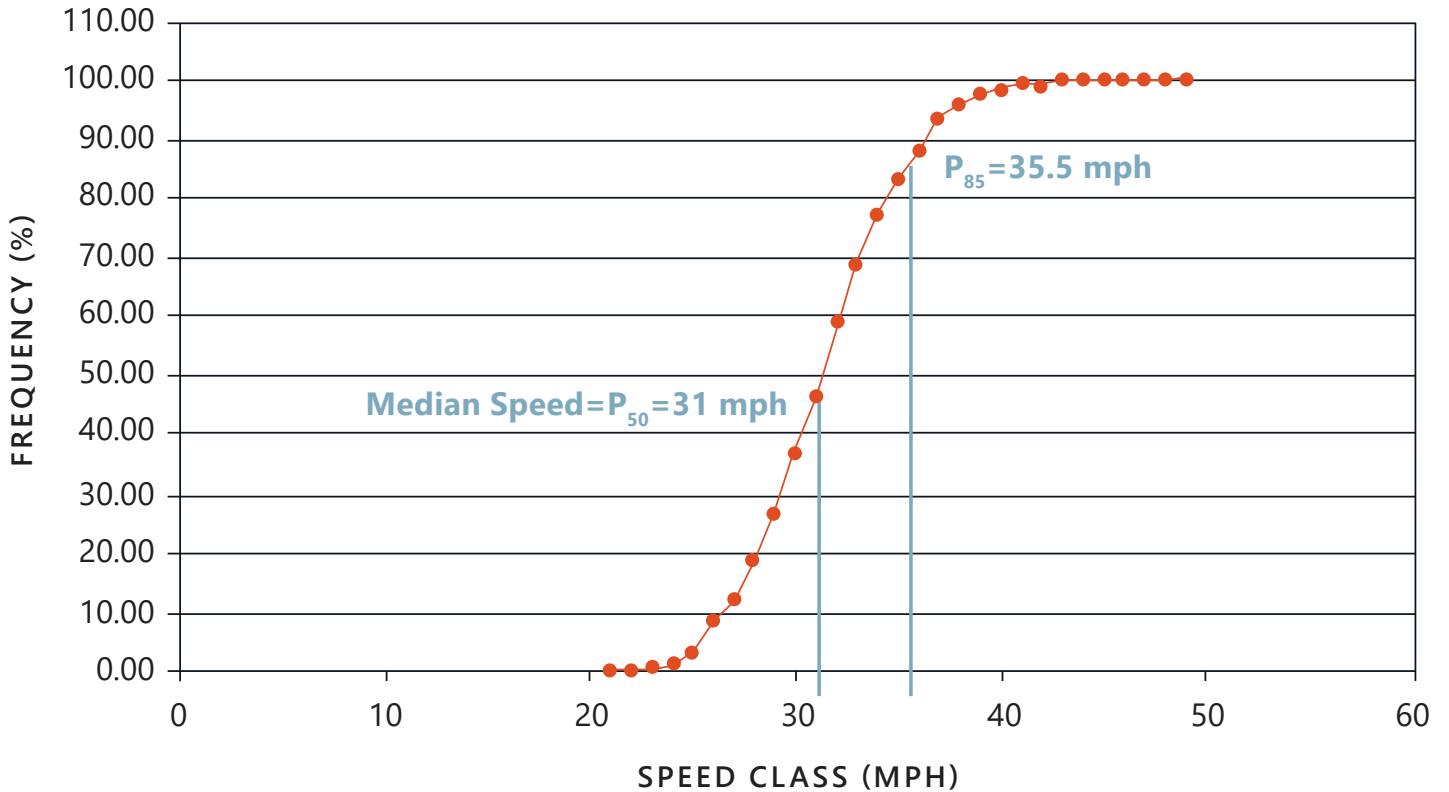


Figure 2. Cumulative Frequency Curve

Full Assessment

For locations that warrant further study and where existing speed data is not available, speed samples will be obtained as resources become available. The speed data will be reviewed to derive the following statistics that illustrate driver behavior:

- » Mean speed, which is the average speed at which drivers are traveling on the roadway segment;
- » 50th percentile (median) speed, which is the speed at or below which 50% of the drivers are traveling (50% of the drivers travel faster than this speed) and generally reflects reasonable and prudent driver behavior in urban areas;

- » 85th percentile speed, which is the speed at or below which 85% of the drivers are traveling (15% of the drivers travel faster than this speed) and represents the speed at which the majority of drivers travel and how the “normal” driver perceives the street. The 85th percentile speed is used to determine the applicability of the Enhanced Speed Fine program; and,
- » The standard deviation, which is a measure of how dispersed the speed data is in relation to the mean (or average) speed and represents the potential variation of driver behavior.

Figure 3 shows an example graphic of plotted speed data to determine the 85th percentile speed. The graph plots the cumulative percentage for each speed value, showing the likelihood that drivers are traveling at or below a given speed. From this plot, the 85th percentile can be determined. In this example, if 100 drivers are observed on a roadway with a calculated 85th percentile speed of 35 mph, 85% of the drivers are traveling at less than or equal to 35 mph, and 15% of the drivers are traveling at 36 mph or faster.

The 85th percentile speed is used to measure overall driver compliance with the speed limit. In many cases, the Department will consider strategies to influence the speed of drivers if the 85th percentile speed is 10 mph over the posted speed limit. However, the Department considers additional factors such as the neighborhood context, presence of pedestrian and bike facilities, adjacent land uses, and the general speed profile of the roadway when determining appropriate traffic calming measures. The results of the assessment will be shared with the requestor.

Recommendations for Improvements

If the full assessment concludes that speed management strategies should be implemented, the Department will identify the recommended improvement(s) as resources allow. Initial considerations will be using the continuous Level 1 strategies (strategies that do not include physical improvements) such as education and enforcement. Level 2 (physical improvements) will be considered for roads that require physical measures to impact travel speeds.

Level 1 Strategies

Education can be a logical first step to address speeding concerns, as in many instances, the drivers observed speeding or driving recklessly are residents in the neighborhood. The community can advocate and use educational tools that encourage their local drivers to slow down. Resources are available from local, state, and national organizations and agencies, including Bike Walk RVA, the Virginia Department of Motor Vehicles, and the National Highway Traffic Safety Administration. These resources can be shared with neighbors, businesses, and local leaders and elected officials to promote safe driving practices.

Neighborhood leaders can also provide space for conversations, such as neighborhood association meetings, where residents can talk with their neighbors about their concerns. These groups can also work together to create neighborhood watch groups, which frequently work internally and with the local police precinct on crime and other neighborhood safety issues, like speeding and reckless driving. Reminders of new laws such as stopping for people crossing the street or additional fines and penalties for striking a person walking can also have a big impact in shifting and growing our safety culture. However, residents should not take the issue into their own hands by confronting drivers directly. Confronting drivers can lead to road rage incidents.

Enforcement can also be an effective first step. The Richmond Police Department (RPD) can assist by using various techniques to influence driver speeds, including hot spot enforcement of speeding and other traffic safety violations and placement of mobile speed trailers. Neighborhoods can also consider an Enhanced Speed Fine program (process is outlined in the city code and requires a City Council resolution). This strategy increases the fine for speeding to \$200 and includes additional signage informing drivers of the increased penalty. More information on this and other enforcement-based strategies is included in Chapter 3.

Level 2 Strategies

Level 2 strategies are those that focus on using physical measures to better manage speeds. If the full assessment shows that physical measures are necessary to address travel speeds, the Department will initiate the design process as resources allow. The specific measure recommended is based on the speed data collected and the characteristics of the roadway. More information on the types of measures available and the design and cost considerations is provided in Chapter 3.

Before preparing scaled drawings, the Department will seek approvals from the Richmond Fire Department (RFD), Greater Richmond Transit Company (GRTC), the neighborhood association, and the local City Council representative. Once approvals have been received, a formal project will be prepared for implementation as necessary.



Project Implementation

The process for implementation includes identifying a funding source, design, construction, and inspection. The City pays for traffic calming improvements through the City's Capital Improvement Program (CIP). The cost varies depending on the street design and type of traffic calming measure recommended. The designed projects are prioritized and installed along with other identified locations citywide. Implementation can be stand alone; however, greater cost savings are achieved when projects are grouped together, particularly when tied to the Department's resurfacing program.

In 2021, the Department has identified more than 125 neighborhood streets that require further investigation to determine if traffic calming is justified.

These streets are being studied to determine if there is a speeding problem. Based on the results of data collection, streets that warrant traffic calming will be eligible for future funding and implemented in coordination with the Department's paving program.

The Department will follow the regular approval process. The approved list will be cross-checked with the paving schedule for the upcoming year and strategies will be implemented on those streets being paved. The traffic calming measure to be implemented under the resurfacing program is the use of speed tables.

Every year, the Department requests funding for traffic calming improvements (Level 2 strategies) in neighborhoods in the CIP as well as funds for paving streets. Based on City Council's inclusion of funds in the budget, the schedule for implementation is shown in Figure 3. This schedule outlines the process for both Level 2 strategies and Department initiated traffic calming projects in coordination with the paving program.

Prioritization

Frequently, due to the volume of requests received and measures approved for installation each year, there are more projects designed than funding available to implement. Thus, the Department has developed a set of criteria to prioritize projects for implementation.

The **primary factors** for consideration when prioritizing projects are:

- » Crash history;
- » Traffic volumes;
- » The speed profile of the roadway;
- » The length of the roadway segment; and,
- » The distance to the nearest traffic control device (all-way stop or traffic signal) or traffic calming measure.

Secondary factors considered are:

- » Proximity to neighborhood attractors (such as schools, parks, libraries, commercial zones, rec centers, etc.);
- » Adjacent land use;
- » Presence of bicycle and pedestrian infrastructure (such as Bike-Walk Streets); and,
- » Distance to the nearest GRTC bus stop or other transit facility.

Both the primary and secondary factors are considered by the Department in determining the final order of projects to be implemented each year.

Traffic Calming Project Schedule

KEY

Paving Process Schedule - **in green.**

Level 2 Strategy Process - **in blue.**

Start here: ●

July – October

Finalize the traffic calming locations to build given the funding | Review the paving schedule (go to **April – July paving process**) and include the traffic calming measure if the street is planned to be repaved | Design NTMP

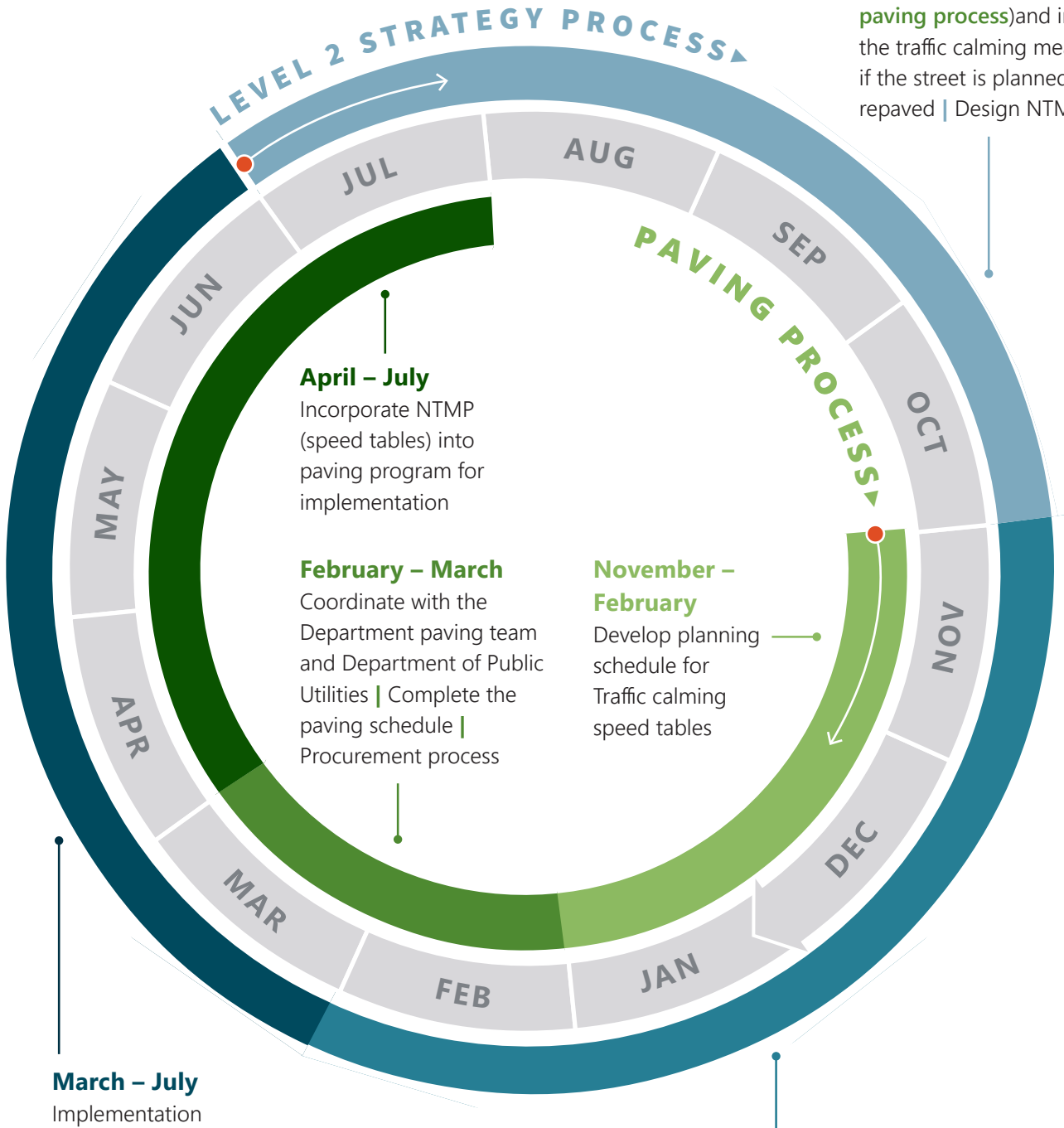


Figure 3. Traffic Calming Project Schedule

CHAPTER 3

Speed Management Strategies



This chapter provides an overview of the ten most commonly used strategies as part of the Neighborhood Traffic Management Program (NTMP). As outlined in Chapter 2, these plan elements have been classified into two primary categories: Level 1 and Level 2. Level 1 strategies include elements that are less restrictive, and may be easily (and inexpensively) removed. Level 1 strategies include education and enforcement, changes in signage, and, increased fines for speeding. Level 2 strategies focus on physical roadway improvements to change driver behavior and promote better speed management. Taken together, Level 1 and 2 form a comprehensive speed management approach.



These strategies, which are also summarized in Table 1, are described in further detail in this chapter. The attributes of each strategy are presented followed by a discussion of anticipated impacts, the advantages and disadvantages of each element, appropriate locations for implementation, design considerations and estimated costs. The cost is measured as low, medium, or high.

Level 1 Strategies

1. Education
2. Enforcement
3. Signage
4. Enhanced Speed Fine program

Level 2 Strategies

5. Speed Tables
6. Raised Crosswalks
7. Neighborhood Traffic Circles
8. Curb Extensions
9. Roadway Reconfiguration/Road Diet
10. Traffic Signal Retiming

Table 1. Summary of Traffic Calming Strategies

	Strategies	Page #	Residential Roads		Typical Cost
			Average Daily Traffic (ADT)	Posted Speed Limit	
LEVEL 1	Education	14	NA	Any	Low
	Enforcement	16	≥500 vpd	Any	Medium
	Signing	19		Placed in accordance with the MUTCD**	Low
	Enhanced Speed Program*	23	Any	Any	Low
LEVEL 2	Speed Tables	24	≤7,500 vpd	≤30 MPH	Medium (in coordination with paving program) - High (individual project)
	Raised Crosswalks	26	≤7,500 vpd	≤30 MPH	Medium (in coordination with paving program) - High (individual project)
	Neighborhood Traffic Circles	27	≤7,500 vpd	≤35 MPH	High
	Curb Extensions	29	≤16,000 vpd	≤35MPH	High
	Roadway Reconfiguration /Road Diet	31	<16,000 VPD	Varies	High
	Traffic Signal Retiming	33	Signalized corridors	Signalized corridors	Medium

* certain criteria as established by Richmond City Council must be met and then requires a City Council Resolution.

** MUTCD - Manual on Uniform Traffic Control Devices



LEVEL 1

Education Strategies

Description

Education can be a logical first step to address speeding concerns, as in many instances, the drivers observed speeding or driving recklessly on local streets are residents in the neighborhood. The primary goals of various education programs are to:

- » Work collectively to grow a safety culture within the City of Richmond and the surrounding region;
- » Increase driver awareness of people walking, biking, and riding transit; and,
- » Promote safe driving practices by educating drivers about the posted speed limit and why speeding impacts the most vulnerable road users.

Education programs may be designed to target specific problem streets and neighborhoods or can apply across the City and greater Richmond area. This section focuses on the former, where neighbors and community leaders can help the City and the Department of Public Works (Department) promote our commitment to Vision Zero and a transportation system built to provide safe, healthy, and equitable access for all.

Safety Programs

Overview

Several safety resources are available to help grow the safety culture through outreach about the negative impacts of people who speed and how crashes become exponentially more severe as impact speeds increase. Most people exposed to crash impact speeds above 21MPH will see a higher likelihood of experiencing a traffic-related serious injury or death. These programs include the circulation of speed alert literature where speeding violations are prevalent. This literature focuses on the consequences of speeding to both the motorist and the community and the benefits achieved when speed limits are appropriately observed. This literature can be shared in digital or hard copy format. This strategy may also include discussions at neighborhood-level meetings and working with local leaders to promote safe driving practices. Local neighborhood groups can also publish articles in their own newsletters asking for cooperation from residents (who are often found to be contributing to the speeding problem) in reducing their speeds throughout their own community.

Application

Use of community education programs is most appropriate for local residential streets that are not “through” or collector routes. In general, these roadways carry a traffic volume of 500 vehicles or less per day. Since most of the violators are typically members of the community, they are reachable with education programs targeting the community and/or through neighbor-to-neighbor awareness campaigns.

Additional Details

+ Advantages: Can be effective in reducing speeding by community residents. Most effective when community is supportive and has an active role.

- Disadvantages: Impact may be reduced over time unless regularly reinforced.

\$ Cost: Low. Educational resources are typically provided for free from the sources listed below. The primary costs are for production and distribution of printed materials. Grant funding may also be available for larger programs.

Education Strategies Continued...



Speed Awareness Signs

Overview

Richmond's biking and walking advocacy organization, Bike Walk RVA, developed yard signs to promote safe driving practices and encourage drivers to follow the posted speed limit.¹ These signs can be placed in the yards and private land of concerned citizens and organizations that are located along roads that experience speeding, have a higher rate of crashes, or could benefit with additional safety signage. There are multiple sign designs with various messages around speed and being aware of other users of the road. These signs are designed to alert and remind drivers of their surroundings and take note of their speeds.

Application

Speed awareness signs are placed on private property. They should be placed in the field of vision for drivers but not impeding on the sidewalks or travel lanes. Residents can contact Bike Walk RVA for more information.

Additional Details

+ Advantages: Encourages drivers to lower speeds, take into consideration their surroundings and shows community support to discourage speeding. Very cost-effective.

- Disadvantages: Limited impact when not paired with other enforcement strategies.

\$ Cost: Low. Signs are available from Bike Walk RVA for free or minimal cost to residents, neighborhood associations, and businesses.

More information and additional resources are available from the following national, state, and local sources:

- » **City of Richmond:** rva.gov/index.php/public-works/new-engineering-transportation
- » **National Highway Traffic Safety Administration:** <https://www.nhtsa.gov/risky-driving/speeding>
- » **National Safety Council:** <https://www.nsc.org/road>
- » **Governor's Highway Safety Association:** <https://www.ghsa.org/issues/speeding-aggressive>
- » **Virginia Department of Motor Vehicles:** <https://www.dmv.virginia.gov/safety/>
- » **Virginia Department of Transportation:** <https://www.virginiadot.org/programs/Safety-Center.asp>
- » **Drive Smart Virginia:** <https://www.drivesmartva.org/>
- » **Richmond Families for Safe Streets:** <https://www.facebook.com/RichmondFamiliesForSafeStreets/>
- » **Bike Walk RVA:** <https://www.sportsbackers.org/program/bike-walk-rva/>

¹ <https://www.sportsbackers.org/program/bike-walk-rva/>



LEVEL 1

Enforcement Strategies

Description

Enforcement can also be an effective first step to address speeding concerns. The Richmond Police Department (RPD) can assist in enforcement using various techniques to influence driver speeds.

Enforcement programs are designed to target specific problem streets and are most effective when community support and participation is included as part of the program. These speed reduction tools include increased police enforcement of existing speed limits (traditional and high visibility), the use of radar trailers on a temporary basis to educate motorists on their speeds, and the deployment of automated speed enforcement.

High Visibility Speed Enforcement (HVE) is “a universal traffic safety approach designed to create deterrence and change unlawful traffic behaviors. Law enforcement efforts are combined with visibility elements and a publicity strategy to educate the public and promote voluntary compliance with the law.

HVE is different to traditional enforcement tactics, through incorporating enforcement strategies using visible elements such as electronic message boards, road signs, and command posts, which are designed to be obvious and highly visible to the public.”² The enforcement should be placed in areas that are easily visible to drivers, or areas that have a high crash rate or high volume of traffic. The messaging on the enforcement is important, as well as, how the media alerts the public of the new enforcement and educates the public on the necessary changes and effects of the enforcement. Some forms of publicity for HVE, include: billboards, flyers, social media distribution, and stakeholder letters. Alerting the public to the HVE and how long it will take place, will provide information on where and why the enforcement is occurring, and educates on the desired results of the enforcement efforts.

Increased Speed Enforcement

Overview

Targeted HVE is one of the primary means of reducing speeds throughout the City of Richmond. RPD deploys officers to monitor and enforce the existing speed limit in problem areas. The additional police presence in the area specifically targets high-speed violators and increases driver awareness of the posted speed limit. While increased enforcement represents an added expense to the police department, it is generally recommended as a first step, prior to implementing more costly traffic calming measures. While RPD provides enforcement of all traffic violations city-wide, for the purposes of this process, increased speed enforcement is discussed below for residential streets.

Application

Enforcement efforts by RPD typically focus on high-volume and high-speed roadways on the High Injury Street Network, where most traffic violations (including speeding) occur.

² <https://www.nhtsa.gov/enforcement-justice-services/high-visibility-enforcement-hve-toolkit#types-mediapublicity-32271>

Enforcement Strategies Continued...

Lower volume roadways—those classified as “local” or “collector” and those with an Average Daily Traffic (ADT) of 500 vehicles per day or fewer—are not generally a priority for enforcement. The RPD devotes a substantial number of hours to the enforcement program to maximize the probability of achieving measurable results. However, targeted speed enforcement may be recommended for a number of reasons, such as severe and egregious speed violations measured during data collection, areas where drivers are using a neighborhood street at high speed to avoid congestion, and locations where engineering strategies are not feasible or education strategies have not been effective.

Additional Details

+ Advantages: Effective in reducing speeding and increasing speed awareness in target areas, especially along local streets, while supplemental enforcement program is in operation.

— Disadvantages: Impact is reduced over time after increased enforcement program is terminated. Less effective on low volume streets.

\$ Cost: Low. The cost of increased speed enforcement varies and is part of RPD’s annual budget, but limited resources are available and may require shifting away from higher-priority areas.



Mobile Speed Trailers

Overview

Mobile speed trailers consist of the temporary use of speed detection radar equipment along with the legal posted speed limit mounted on trailers. These trailers are managed by the RPD and are placed along the target roadway to increase driver awareness of their travel speed. On board is a radar unit that measures an approaching driver’s speed and displays it in large, illuminated numbers. It does not record the license plate information or take pictures of violators. The trailers are typically stationed for one week and may be coupled with active enforcement. Permanent speed trailers are not recommended because they quickly lose their effectiveness. Displaying a speed monitor over a short-term period seems to be more effective than using it for a long-term period.

Application

Mobile speed trailers are typically installed on single lane approaches where speeding is an issue. The trailer is generally installed for one week and then removed and placed in another target location. They must be installed in areas where space is available for the equipment (such as behind the curb, on adjacent grass strip, in a wide shoulder area, etc.) and does not impede travel by those walking, biking, or rolling.

Additional Details

+ Advantages: Encourages voluntary compliance with legal limits. Speeds may be reduced during short intervals where radar trailer is located. Can be an effective public relations and education tool.

— Disadvantages: Radar trailers are not enforcement tools by themselves and their availability is limited. Their effectiveness is increased when supplemented by periodic police enforcement. The effectiveness of radar trailers is reduced over time and can drop significantly once removed from the target area.

\$ Cost: Low. The cost of placement varies and is part of RPD’s annual budget; additional units typically cost \$10,000 to \$15,000 (based on 2021 figures).

Enforcement Strategies Continued...

Automated Speed Enforcement

Overview

Automated Speed Enforcement (ASE) consists of cameras that use radar or LIDAR-based speed detection and produce recorded images of speeding drivers. Current Virginia Code limits the use of ASE to active school zones and work zones. The ASE units digitally capture and record the date, time, and vehicle speed, along with the license plate information. ASE in school and work zones across the City will begin in 2022, with a limited number of assets included in the initial deployment. As the program grows, additional units may be available for installation, but strict placement criteria must be followed to ensure effective and equitable deployment.

Application

As the program is in its infancy, a limited number of units are available for deployment in 2022, and thus, they will be placed strategically in the highest priority locations (determined by RPD and the Department). Placement of an ASE unit must include installation of conspicuous signage indicating the use of a speed monitoring device.

Additional Details

+ Advantages: Extremely effective, as ASE units can detect and record multiple violations per minute, providing a strong deterrent effect by increasing drivers' perceived likelihood of being cited for speeding. ASE units can also operate in locations where traditional roadside traffic stops are dangerous or infeasible and where traffic conditions are unsafe for police vehicles to enter the traffic stream and stop suspected violators. Use of ASE also reduces the need for officers to block the flow of traffic when stopping suspected violators and may reduce the occurrence of traffic congestion or crashes due to driver distraction caused by roadside traffic stops. ASE also removes the potential for enforcement bias, as violations are recorded for all drivers traveling in excess of the enforcement threshold.

- Disadvantages: ASE is currently limited by Virginia Code to use only in active school and work zones, and a limited number of units will be deployed beginning in 2022. Unlike traditional enforcement, ASE does not intercept speeding drivers, which allows them to possibly continue at unsafe speeds. ASE also only enforces speeding violations, and thus, other moving violations or illegal activities are not enforced simultaneously.

\$ Cost: Medium. Leasing of ASE units has a moderate cost, and units are typically procured through lease from an independent operator. Revenue gained from ASE is directed first into sustaining the program and second into implementing the strategies set forth in the City's Vision Zero Action Plan, including other Level 1 and Level 2 strategies outlined in the NTMP.



LEVEL 1

Signing Strategies

Description

Signing is a means of informing drivers of speed limits and includes the installation of warning and regulatory signs (such as “curve ahead” and speed limit signs). In some instances, visibility and conspicuity enhancements may be warranted, such as the use of LED signs or other flashing beacons.

All signs shall be installed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), which defines the standards used to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel. The MUTCD is published by the Federal Highway Administration (FHWA) and a state supplement is published by the Virginia Department of Transportation (VDOT).



Speed Limit Signs

Overview

Speed limit signs are typically located at specific intervals to inform drivers of the applicable speed limit, such as after major intersections. Speed limit signs are also required at locations where the speed limit changes from one speed limit to another.

Speed limit signs in and of themselves are rarely effective in reducing travel speeds, and they should not be used as a stand-alone device. Experience has shown that drivers tend to travel at the speed that is most comfortable based on the surrounding roadway environment. Speed limit signs may be installed to reinforce existing speed limits, or to supplement other traffic calming devices. 25 mph speed limits on local residential streets have been proven effective to reduce exposure to vulnerable users, when the limit is adhered to.

Setting speed limits and achieving speed limits are two different items. A standalone sign does not make a speeder feel uncomfortable speeding. The Department recommends retaining 25 mph as the statutory speed limit for residence and business districts, based on its research on national best practices.

Application

Signing may be appropriate on any roadway, provided conditions warrant their installation. The size and placement of speed limit signs are governed by the MUTCD, as previously noted.

Additional Details

+ Advantages: Reinforces existing speed limits and can supplement other traffic calming measures.

- Disadvantages: Ineffective as a standalone measure; may contribute to sign clutter.

\$ Cost: Low. Speed limit signs should not be placed indiscriminately, but they are easy to deploy and can be installed faster than other measures. Placement of speed limit signs is part of annual budget, but specific funding needs may be identified, if necessary. New signs typically cost \$300 to \$400 (based on 2021 figures).

Signing Strategies Continued...



Warning Signs

Overview

Warning signs call attention to unexpected conditions on or adjacent to a street and to situations that might not be readily apparent to drivers. Warning signs alert drivers to conditions that might call for a reduction of speed or a potentially evasive action.

Application

Warning signs are typically installed where safety concerns have been identified, such as placement of “curve ahead” signs. The size and placement of warning signs are governed by the MUTCD.

Additional Details

+ Advantages: Provides notice to drivers of unexpected conditions and can supplement other traffic calming measures.

- Disadvantages: May contribute to sign clutter.

\$ Cost: Low. Warning signs should not be placed indiscriminately, but they are easy to deploy and can be installed faster than other measures. Placement of warning signs is part of TED’s annual budget, but specific funding needs may be identified, if necessary. New signs typically cost \$300 to \$400 (based on 2021 figures).



All-Way Stop Control (AWSC)

Overview

An all-way stop control is a form of intersection control which requires vehicles on all approaches to a road intersection to stop at the intersection before proceeding through. The MUTCD defines the standards used for the application of all-way stops.

Application

A common request from residents is to use all-way stop sign control (AWSC) to slow traffic. While placement of AWSC along a street can result in reduced travel speed, AWSC should only be installed based on an engineering study performed in accordance with the criteria listed in the MUTCD. This is because the purpose of a stop sign is to assign vehicular right-of-way at an intersection, not to slow drivers. Failure to follow the outlined MUTCD criteria for all-way stop installations currently results in increased crashes and liability.

Conversion to AWSC when an intersection does not meet the criteria results in an increase in crashes due to:

- » Encouraging motorists to drive faster between intersections in order to save time;
- » Encouraging violation of traffic laws; and,
- » Increasing the chance that drivers will disregard vehicles and pedestrian traffic, and pedestrian traffic, which raises the risk of collisions.

Intersections controlled by AWSC when the MUTCD criteria are not met results in motorists ignoring these signs or only slowing down without fully stopping. This can lead to an increase in the type of crashes that the AWSC signage is intended to correct, and can present a significant pedestrian safety concern.³

³ https://safety.fhwa.dot.gov/intersection/other_topics/fhwasa10005/brief_4.cfm

Signing Strategies Continued...

Additional Details

+ Advantages: Effective as a traffic control devices when criteria are met for placement, based on an engineering study.

- Disadvantages: AWSC is not a traffic calming measure. Placement of AWSC at intersections that do not meet the specified engineering criteria can lead to an increase in crashes that the stop sign is intended to correct, as well as present a significant pedestrian safety concern.

\$ Cost: Low. Placement of stop signs is part of the Department's annual budget, but specific funding needs may be identified, if necessary. New signs and the addition of stop bars typically costs \$2,000 per intersection (based on 2021 figures).



Figure 4. Maymont Neighborhood Basket Weave Stop Signs Map

Basket Weave Stop Sign Pattern

Overview

A possible measure in neighborhoods with a gridded street pattern of residential streets is the placement of stop signs in a basket weave pattern, where stop signs are placed at every other intersection.

Application

The placement of signs is based on engineering judgement and best practices. The exact size and placement of stop signs are governed by the MUTCD, as previously noted.

Additional Details

+ Advantages: Can be effective at reducing right-angle crashes at intersections. When properly deployed, can improve driver compliance by providing a regular, expected pattern of traffic control within a neighborhood.

- Disadvantages: Requires neighborhood-wide assessment and design and is not a point-based solution for traffic calming on a single street. Not effective at reducing speeds or addressing traffic volume concerns.

\$ Cost: Medium. The cost of application varies based on the size of the neighborhood, but the addition of stop bars and new stop signs typically costs \$1,000 per approach (based on 2021 figures).

Signing Strategies Continued...



Flashing Beacons

Overview

A Flashing Beacon is a traffic signal that operates in a flashing mode. It can provide traffic control when used as an intersection control beacon or it can provide warning when used in other applications.

Application

Placement of Flashing Beacons is governed by the MUTCD. The most commonly used types of Flashing Beacons in the City of Richmond are:

- Intersection Control Beacons, which have a yellow or red signal indication to control two or more directions of travel;
- Warning Beacons, which have a yellow signal indication as a supplemental emphasis to a warning sign, a countermeasure in locations with limited sight distance or obstructed view, or in conjunction with a regulatory or warning sign that includes the phrase “when flashing” to indicate that the regulation is in effect or that the condition is present only at certain times; and,
- Speed Limit Sign Beacons, which have a yellow signal indication as a supplement to a speed limit sign, typically used in school zones.

Additional Details

+ Advantages: Effective to improve conspicuity of an existing or new regulatory or warning sign, especially in locations where additional emphasis is necessary to ensure drivers are notified of an upcoming traffic control device, warning device, or change in speed limit.

– Disadvantages: Placement of a Flashing Beacon requires connecting to an existing power system or use of solar power, which may be limited in certain locations. Flashing Beacons, especially when used in locations with limited sight distance or on signs with “when flashing,” require regular inspection and maintenance to ensure their continual operation.

\$ Cost: Medium to high. \$75,000 to \$100,000



LEVEL 1

Enhanced Speed Fine Program



Overview

The Enhanced Speed Fine Program is available for local residential streets, where there is a documented speeding problem (defined as when the 85th percentile speed of vehicles is at least 10 mph above the posted speed limit). Adopted by City Council as Code Section 27-163, the program allows for an additional \$200 fine for speeding in signed areas. This program is effective when coupled with enforcement and discourages drivers to speed due to the high price of the ticket that is a mandatory fine.

Application

Increased fines can be proposed and implemented on residential streets only in Richmond provided that data indicates a documented speeding problem with measured 85th percentile speeds at least 10 mph above the posted speed limit. The use of increased fines should be applied primarily in locations where other speed reduction strategies are either impractical or are cost prohibitive. Additionally, other means of speed reduction should be attempted first, such as the use of speed trailers or increased enforcement. Imposing increased fines for violations of the posted speed limit requires approval by City Council. If approved, the appropriate signing should be installed on all roads subject to the increased fines. As noted in previous sections, the design and placement of the signs, similar to other regulatory and warning signs, is governed by the MUTCD.

Additional Details

- + Advantages:** Relatively low cost and moderate efficacy, when paired with enforcement due to the additional penalty.
- Disadvantages:** Effectiveness depends partly on level of enforcement, which is not guaranteed. Potential negative public perception of penalties, as well as concerns over equitable impacts of higher fines.
- \$ Cost:** Low. May vary based on the presence of existing speed limit signs. New signs typically cost \$400 (based on 2021 figures) each.



LEVEL 2

Speed Tables



Description

A speed table is typically a midblock traffic calming measure that raises the entire wheelbase of a vehicle to reduce its travel speed. Speed tables are different from speed bumps; they are typically 22 feet long and have a flat section in the middle of the device. The flat section may be marked with striping or pavers to highlight its purpose. Speed tables are typically constructed out of asphalt, and pavement markings are added to increase visibility. Warning signs are also provided to inform drivers of their presence.

Speed tables have a design crossing speed of 15-25 MPH for standard passenger vehicles. Larger vehicles may travel at lower speeds over speed tables. Installation of a series of speed tables along several blocks tends to yield the greatest traffic calming benefits.



Application

Table 2 below provides guidelines for the traffic conditions under which installation of speed tables may be considered.

Table 2. Speed Table Criteria

	Residential Streets
Average Daily Traffic (ADT)	≤ 7,500 vehicles per day (vpd)
Posted Speed Limit	≤ 30 MPH
Primary Emergency Route	No
Transit Route	No
Grade	≤ 8%

The following design considerations apply when considering the placement of speed tables:

- » Speed tables should not be installed on primary emergency vehicle routes, high-volume transit routes, steep grades or on sharp curves.
- » The Department must coordinate with Richmond Fire Department and the Greater Richmond Transit Company (GRTC) before constructing new speed tables
- » Placement of devices must avoid conflicts with other transportation and utility infrastructure.
- » Speed tables should be located near a streetlight to ensure nighttime illumination.
- » Speed tables may be installed at least 200 feet apart but not greater than 750 feet apart.
- » When placed in series, speed tables should be installed between 600 feet and 750 feet apart. Speed tables should be placed at least 5 feet from a driveway, 20 feet from an alley, 300 feet from a STOP or YIELD sign, 600 feet from a traffic signal, and 750 feet from another traffic calming device.

Speed Tables Continued...

- » Speed tables must be visible from a distance of at least 250 feet and shall NOT be installed on vertical curves unless the radius of the curve is greater than 300 feet.
- » Speed tables shall NOT be installed in the path of a pedestrian crossing or curb ramp, unless intended to be installed as a raised crosswalk or intersection.
- » Speed tables shall NOT be installed over manholes or water valves.
- » Speed tables shall NOT be installed adjacent to fire hydrants.
- » Speed tables installed near drainage inlets should be installed on the downslope side of the inlet as to not impact drainage flow.

\$ Cost: Medium to low. As an independent project, speed tables can cost approximately \$14,000 to \$24,000 (based on 2021 figures), depending on the width of the roadway and other factors. Installation costs include placement of the speed table, roadway markings, and warning signage. When paired with the Department's paving program, installation costs drop significantly (approximately \$5,000 each, based on 2021 figures).

Additional Details

+ Advantages: Speed tables are a proven and documented traffic calming measure and are very effective when properly designed and installed. They are generally self-enforcing and help reinforce safe driving behavior. They can also be very cost-effective due to their high efficiency.

- Disadvantages: Must meet specific design and siting criteria, as outlined previously. Speed tables may impact emergency response times. They can also have some unintended consequences, such as causing drivers to speed up between devices and an increase in noise or physical vibration, especially when traversed by heavy vehicles such as trucks and buses.



LEVEL 2

Raised Crosswalks



Overview

Raised crosswalks are speed tables that have been installed either in the middle of a block or at an intersection, where the flat middle section is marked as a crosswalk with striping. While a 3-inch height is preferable, raised crosswalks should ensure that they are level with the adjacent sidewalk/curb or they taper appropriately for drainage and to maintain ADA compliance. Typical construction is asphalt with pavement markings added to increase visibility. Concrete may also be used. Warning signs are also provided to inform drivers of their presence.

Application

The design and construction of a raised crosswalk follows the same criteria and considerations outlined previously for a speed table. However, additional care must be taken to ensure that the design is in compliance with the Americans with

Disabilities Act, specifically that those with visual impairments have adequate cues to differentiate the roadway from the sidewalk and that those with physical disabilities can safely navigate the crosswalk without impediment.

Additional Details

+ Advantages: Similar to speed tables, raised crosswalks are very effective when properly designed and installed. They also provide additional benefits, such as improving pedestrian safety and increasing pedestrian visibility when crossing the intersection.

- Disadvantages: Raised crosswalks must meet specific design and siting criteria, same as speed tables and have similar impacts to emergency response times and unintended consequences. Additional care must be paid to ensure that raised crosswalks are constructed in compliance with the Americans with Disabilities Act. Raised crosswalks placed at intersections may be more difficult to design and construct, particularly considering drainage and stormwater infrastructure such as drop inlets.

\$ Cost: Medium to low. As an independent project, speed tables can cost approximately \$14,000 to \$24,000 (based on 2021 figures), depending on the width of the roadway and other factors. Installation costs include placement of the speed table, roadway markings, and warning signage. When paired with the Department's paving program, installation costs drop significantly (approximately \$5,000 each, based on 2021 figures). However, installation costs may be much higher at intersections, due to other impacting elements such as stormwater infrastructure, traffic signal poles, and other street furniture.



LEVEL 2

Neighborhood Traffic Circles



Overview

A neighborhood traffic circle is a small, raised island, placed in the middle of an intersection, that require vehicles to travel through the intersection in a counterclockwise direction around the island. These traffic circles force vehicles to slow down in order to safely negotiate the turn around the circle. Neighborhood traffic circles are an intersection improvement as well as a traffic-calming measures. All traffic circle approaches are yield-controlled by state law.

Neighborhood traffic circles, while similar in operation, are different from intersection roundabouts, which are typically provided at higher-volume intersections. The primary difference between neighborhood traffic circles and roundabouts is the size of the intersection and center island; neighborhood traffic circles typically do not have curb extensions and splitter islands, while roundabouts do.

Application

Table 3 below provides guidelines for the traffic conditions under which installation of neighborhood traffic circle may be considered.

Table 3. Traffic Circle Criteria

	Residential Streets
Average Daily Entering Traffic	≤ 7,500 vehicles per day (vpd)
Posted Speed Limit	25 mph
Primary Emergency Route	No
Transit Route	No
Grade	≤ 8%

Neighborhood traffic circles are typically intended for use on residential streets with operating speeds of 25 mph or less and may be landscaped to enhance their aesthetic appeal and improve visibility of the circle (however, shrubs and trees should be selected that minimize impact to drivers' sight lines). Neighborhood traffic circles, which yield crossing speeds of 15 mph or less, typically require only minor modification to existing intersections.

Depending on the width of the intersection and the diameter of the circular island, large vehicles (emergency vehicles and buses) may not be unable to negotiate the turn around the circle. To facilitate those vehicles, circles may be designed to include mountable concrete aprons. Large vehicles may be permitted to turn left in front of the traffic circle rather than going around it.

The primary design considerations for neighborhood traffic circles are:

- » Clear signing and pavement markings are essential.
- » All approaches are yield-sign controlled.
- » Adequate sight distance must be provided from all approaches to allow drivers, cyclists, and pedestrians to negotiate the circle with adequate view of other users of the circle, particularly of approaching motorists on other legs of the circle.
- » The design vehicle for a neighborhood traffic circle is a single unit truck, which should be able to pass through the circle without mounting the center island.

Neighborhood Traffic Circles Continued...

Additional Details

+ Advantages: Neighborhood traffic circles are shown to significantly improve safety over traditional intersection design by reducing the number of potential conflicts between drivers, pedestrians, and cyclists. A traditional four-legged intersection has 16 potential vehicle/pedestrian conflict points and 16 potential vehicle/vehicle conflict points (16+16=32 total). A neighborhood traffic circle has only eight potential vehicle/pedestrian conflict points and only four potential vehicle/vehicle conflict points (8+4=12 total). Neighborhood traffic circles also provide both traffic control and traffic calming, and have calming effects on both streets entering the circle. They also have low maintenance costs and can provide space for landscaping, improving neighborhood livability through beautification.

- Disadvantages: Speed reduction through neighborhood traffic circles is largely dependent on the proper design of the approach lanes being engineered to deflect vehicles. Without proper deflection, vehicles will be able to pass through the circle without the desired speed reduction. Neighborhood traffic circles may impact emergency response speeds, particularly in locations where emergency vehicles cannot navigate the circle and must divert to an adjacent roadway. Neighborhood

traffic circles may also require additional lighting, signage, and maintenance and can cause impacts to on-street parking. There are also potential impacts to cyclists and pedestrians, especially from drivers unfamiliar with the operation. Snow removal can be more challenging.

\$ Cost: High. Cost varies based on the design and constraints of the intersection, including the available right-of-way. A typical neighborhood traffic circle, including construction of the circle, striping, signage, and landscaping, costs approximately \$20,000 to \$40,000 (based on 2021 figures).



LEVEL 2

Curb Extensions



Overview

Curb extensions visually and physically narrow the roadway, slowing down drivers and creating shorter crossings for pedestrians. Curb extensions can be used to tighten curb radii and encourage slower turning speeds. Curb extensions are typically placed in locations in line with to on-street parking.

“Curb extension” is an umbrella term that encompasses several different treatments and applications. The curb extensions most commonly used in the City of Richmond are:

- » Conventional curb extensions, placed at an intersection, where on-street parking is provided but restricted a specified distance from the intersection; and,
- » Curb extensions at bus stops, which allow a transit vehicle to stop in-lane instead of pulling into the adjacent parking lane.

Application

Table 4 provides guidelines for the traffic conditions under which installation of curb extensions may be considered.

Table 4. Criteria for Curb Extensions

	Minor Arterials
Average Daily Traffic (ADT)	≤ 16,000 vehicles per day (vpd)
Posted Speed Limit	≤ 35 MPH
Primary Emergency Route	OK
Transit Route	OK
Grade	≤ 8%

	Residential Streets
Average Daily Traffic (ADT)	≤ 7,500 vpd
Posted Speed Limit	≤ 30 mph
Primary Emergency Route	OK
Transit Route	OK
Grade	≤ 8%

The primary design considerations for curb extensions are:

- Curb extensions should only be used on corridors with a maximum speed of 35 mph or below.
- The minimum street width between chokers shall be 20 feet, complying with the International Fire Code that has been adopted by Emergency Services and which is enforced by the City Fire Marshal
- Consideration should be given to cyclists during the design process. On streets with little bicycle traffic and/or low motor vehicle volumes, the probability of vehicles and bicycles meeting at the choker is sufficiently low enough to require no special accommodation of bicycles. However, at higher volumes, the City may consider bypass lanes for bicycles, separated from the main travel lanes by the curb extensions.
- The curb extensions should include signs and/or landscaping that draw attention to them. However, preference should be given to low-lying or slow growing shrubs to maintain adequate sight lines and minimize maintenance costs.

Curb Extensions Continued...

- If raised pedestrian crosswalks are included as a component of the design, care must be taken so that the visually impaired have adequate cues to differentiate the roadway from the sidewalk at raised crosswalks. Color contrasts and detectable warning strips at edges enable pedestrians with vision impairments to detect the crossing.

\$ Cost: High. Cost varies based on the design and number of curb extensions constructed. Typically, a single curb extension ranges from \$30,000 to \$60,000, while an entire intersection costs \$80,000 to \$160,000 (based on 2021 figures). Additional costs may be needed for maintenance, or a maintenance agreement with a local community organization could be considered, which would reduce the need for City-provided maintenance.

Additional Details

+ Advantages: Curb extensions have several benefits, including reducing the overall width of the roadway and crossing distance when provided at an intersection or mid-block location. This reduction in roadway width provides a visual cue to drivers to slow down and also reduces turning speeds by tightening corner radii. Curb extensions also prevent illegal parking close the intersection or crosswalk, which can block sight distance. When designed correctly, they do not impact emergency vehicle access. Curb extensions can also provide landscape opportunities and can be used as a gateway treatment, notifying drivers that they are entering a neighborhood street or area.

— Disadvantages: Curb extensions do not have significant impact on travel speeds, unless used in conjunction with other speed reduction measures. They do, however, require additional coordination with transit stops, drainage, and utilities. There may also be a perceived loss of on-street parking in locations where existing corner-clearance parking signs are not provided or existing on-street parking is allowed too close to the intersection.

LEVEL 2



Roadway Reconfiguration/ Road Diet



Overview

A roadway reconfiguration, road diet, or road conversion is generally described as removing travel lanes from a roadway and repurposing the space for other uses or travel modes. Roadway conversions can offer several improvements to a roadway, user behavior, and use of the corridor. These improvements include enhanced safety, access and mobility for all road users, and increased livability of the roadway by providing a 'complete streets' environment for multiple modes of transportation. Typical roadway conversions include converting a four-lane roadway with two travel lanes on each side to a three-lane roadway with one travel lane on each side and a center two-way left-turn lane. The excess space can be used to provide on-street parking, bike lanes, space for street trees and other street furniture, and other uses.



Roadway conversions can offer numerous safety benefits and transform a street into being more accessible and user friendly. Roadway conversions can reduce crash risk, especially for vulnerable users, such as those walking, biking, or rolling. A reduction in travel lanes prevents pedestrians from having to cross multiple travel lanes and also reduces lane switching and the potential for side-swipe or rear-end crashes. Adding a center turn lane allows vehicles space to turn, which prevents back-ups, congestion, and lane switching.

Roadway conversions reduce high-end vehicle speeds and, by providing a turn-lane on roadways where one currently does not exist, have minimal impact on overall traffic operations and emergency response. These conversions are typically done through restriping and costs can be reduced when completed as part of the Department's resurfacing program.

Application

Many factors and elements need to be considered when applying a roadway conversion. Referring to existing federal and state guidance can best support and advise appropriate design needs and requirements. Public support and engagement are key to a successful roadway conversion; it is important to build support throughout the community. Designs will depend on existing right-of-way, land use, and need. Roadway conversions are typically handled by either the Department's bicycle and pedestrian team or the Capital Improvement Projects Division, depending on the scope of design and construction.

Roadway Reconfiguration / Road Diet Continued...

Additional Details

+ Advantages: Roadway conversions have significant proven and documented safety benefits, including lowered driver speeds, reduced crash risk, and improved access for those who walk, bike, or roll. Roadway conversions also do not typically increase congestion or impact emergency vehicle access.

- Disadvantages: Depending on the size and scope of the project, roadway conversions can be costly and time consuming, involving a multi-year planning, design, and construction process. Roadway conversions are not appropriate for single street segments and typically include entire corridors (ranging from a half-mile to approximately 3 miles).

\$ Cost: High. Cost varies based on the scope of the design and construction, as well as the length of the project. Projects with only signing and striping changes can cost \$50,000 to \$100,000 for design, while projects with additional elements such as signal or stormwater design can cost upwards of \$1,000,000 (based on 2021 figures). Construction for projects with only signing and striping changes can cost \$400,000 to \$750,000, but those costs can be dramatically reduced when coupled with the City's paving program (\$75,000 to \$150,000). Construction of large capital projects typically range from \$4,000,000 to \$10,000,000 (based on 2021 figures), with costs increasing with complexity, community engagement, and right-of-way needs.



LEVEL 2

Traffic Signal Retiming



Overview

Changes in signal coordination may be implemented to better manage speeds through a corridor. By coordinating adjacent intersections to provide optimal signal progression at at or below the posted speed limit, drivers are discouraged from speeding (because there would be no benefit to speeding, as drivers would still have to wait for a red signal at each intersection).

Application

Traffic signal modifications can be done on most surface roadways. However, a thorough analysis is required for signal coordination changes to be effective and to ensure the orderly progression of traffic flow.

Additional Details

+ Advantages: Traffic signal timing changes can improve safety, while also metering travel speeds through synchronization and coordination. This technique is particularly effective on one-way streets.

- Disadvantages: These changes can only be applied at locations with existing traffic signals and traffic signal retiming is most effective along a corridor. Traffic signal retiming may be done at a single location, but is typically done across multiple intersections when used to control travel speeds.

\$ Cost: Low. Traffic signal timing is typically low cost, but depends on the number of intersections included. Costs can be around \$5,000 per intersection (based on 2021 figures) for the analysis and implementation of a single intersection.

APPENDIX A

Documentation of Program Origin - 2004

Development of Richmond's Neighborhood Traffic Management Program (NTMP)

This program was developed largely from the experience of other cities, states and municipalities throughout the country and abroad.

It is also the result of an extensive outreach program initiated by the City's Department of Transportation Services (now in the Department of Public Works) to solicit input from the City's residents, from the Transportation and Technology Council Standing Committee (now called the, Land Use, Housing, and Transportation Council Standing Committee), from the City Planning Commission and from the City Council.

Part 1: Literature Review

The process began by gathering and analyzing existing programs from a broad cross-section of cities and states. This list of sources included some of the nation's earliest and most successful programs (Seattle, Washington; Montgomery County, Maryland; and Austin, Texas), as well as some more recent but also

successful programs from the local area (Charlottesville, Virginia; Arlington County, Virginia; the State of Delaware and Baltimore County, Maryland). All together, the programs from more than a dozen municipalities were reviewed. This data was compared to the information provided in the Institute of Transportation Engineer's recently published (1999) *Traffic Calming- State of the Practice*.

Each program was reviewed in its entirety and a matrix was developed comparing the various program elements included in each (see Table 1). It was evident that nearly all programs contained similar goals, focused primarily on improving the safety and livability of neighborhoods by reducing vehicle speeds and reducing non-local traffic. (The Department now uses a more global citywide approach to travel demand management than a street-by-street approach) Most programs also followed similar processes for developing solutions to specific transportation problems, although with varying levels of public support. The largest difference in the programs centered on the potential solutions (elements) supported by each agency, as shown in Table 1.

Some programs took a modest approach of less than ten elements while others included a more extensive list, with as many as thirty potential elements. A few elements were common to nearly all programs such as the use of traffic circles, roundabouts, chokers, chicanes and speed humps. Other elements were somewhat more unconventional and were included in just one or two plans, such as the use of wide painted centerlines or reflective lane line markers.

Each of these program elements was reviewed by the City of Richmond and a final list developed for inclusion in this Neighborhood Traffic Management Program. The City opted to formulate its program after the plans that included a more comprehensive list of elements. Therefore, Chapter 3 of this Manual provides a "toolbox" of more than 20 options, giving each of Richmond's neighborhoods an ample list of potential solutions for their individual transportation concerns. By taking this approach, the City also recognizes that it accepts additional responsibility for helping each neighborhood select an appropriate set of solutions for their individual set of circumstances.

Table 5. Summary of Various Existing NTMP and Traffic Calming Programs

Table 1 Summary of Various Existing NTMP and Traffic Calming Programs															
Type of Improvement	Seattle, WA (1978)	Montgomery Co, MD (1978-1998)	Austin, TX (1986-1997)	Sacramento, CA (1996)	Tempe, AZ (1996)	Virginia DOT (1997)	ITE (1999)	Massachusetts DOT (2000)	Delaware DOT (2000)	Charlottesville, VA (2000)	Arlington Co, VA (2000)	Denver, CO (2002)	Baltimore, MD (2003)	Fort Worth, TX	Suggested for Richmond's NTMP
Signing															
Stop			X	X						X	X		X		A
Yield				X									X		
Speed limit			X	X							X		X		B
Access Restrictions								X		X			X		X
Allow Parking							X								X
No Parking			X	X									X		X
Permit Parking					X										
Handicap Parking					X										
Loading Zone					X										
Traffic Directions (truck route, to mall...)			X							X					X
Warning Signs (incl. Flashing signs)			X					X		X			X		X
Speed Advisory Plates								X							
Turn Restrictions										X	X	X	X		X
Striping															
Centerline			X	X							X	X			X
Wide Painted Centerlines													X		
Centerline Reflectors (incl. Bots Dots)				X							X				
Edge Line (install or narrow)	X		X	X	X		X		X	X	X	X	X	X	X
Edge Line Reflectors			X								X				
Crosswalks (w/ or w/o textured pavement)			X	X						X	X		X		X
Designated Multipurpose Lanes			X		X								X		X
Stop Bars					X					X					X
Red/Yellow Curb					X										
Parking Areas					X	X					X				X
Enforcement/Education															
Increase Police Enforcement	X	X	X	X		X							X		X
Community Day Out &/or Education	X	X								X			X		X
Speed Alert Program / Flyers / Mailers	X	X	X	X		X							X		X
Photo Radar						X				X					
Radar Trailer Use	X	X	X	X		X				X			X		X
Traffic Diversion Measures															
Semi-Diversers/Ove-way Roads/Partial Closures			X	X	X		X	X	X	X	X	X	X	X	X
Diagonal Diversers			X	X		X	X	X	X	X	X	X	X	X	X
Island Diversers			X	X		X		X	X	X	X	X	X	X	X
Right Turn Diversers			X	X		X		X	X	X	X	X	X	X	X
Full Road Closures			X	X		X	X	X	X	X	X	X	X	X	X
Cul-De-Sacs					X			X	X				X		X
Add/Remove Turn Lanes			X												
Realigned Intersections						X			X		X				
Horizontal Calming Measures															
Traffic Circles / Roundabouts	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Woonerf (combined measures)						X	X	X	X	X	X				X
Chokers			X	X	X	X	X	X	X	X	X	X	X	X	X
Center Island Narrowings (also for peds)		X		X		X	X	X	X	X	X		X		X
Continuous Median Barriers (to reduce speeds)						X	X	X	X	X	X				X
Lateral Shifts (only minor shift, for arterials?)						X		X	X						X
Chicanes (more abrupt shifts)	X		X	X	X	X	X	X	X	X	X		X		X
Intersection Chokers/Curb Bulbs	X	X	X	X		X	X	X	X	X			X		X
Vertical Calming Measures															
Rumble Strips										X	X				
Speed Humps/Lumps	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Speed Cushions			X	X	X								X		X
Raised Crosswalks		X		X		X		X	X		X		X		X
Raised Intersections (tables)		X		X		X	X	X	X		X		X		X
Other Items															
4-Way Stop					X						X	A	A	A	A
Increased Fines for Speed Violations											X				X
Streetscape / Landscaping		X													X
Gateway Entrance (signs/pavement/median/etc.)				X		X	X	X	X	X					X
Signal Phasing Changes											X				X
Signal Coordination / Installation					A							A	A	A	A

Notes: A: Installation based on MUTCD Warrants
 B: Posted speed limits should be based on 85th-percentile speeds

Part 2: Neighborhood Input

The second portion of development process focused on soliciting input from Richmond's nine Neighborhood Teams (the organization of Neighborhood Teams was discontinued). These neighborhood teams (listed in Table 2) represent all of the individual communities throughout the City, and meet on a monthly basis to discuss a wide range of community concerns. All meetings are open to the general public.

Representatives from the City's Department of Transportation Services (now Department of Public Works) and consultants for the City attended evening meetings with each of the nine Neighborhood Teams and presented the framework of the Neighborhood Traffic Management Program. Following the presentations, the City solicited input on several issues such as the appropriate size of the Neighborhood Traffic Committees, and the required level of neighborhood support needed to implement a Neighborhood Traffic Plan. The neighborhood groups were also asked if they had any specific comments on the program, or specific transportation concerns that did not seem to be addressed in the program. Altogether, over 130 citizens provided written input and comments. A summary of the community input is provided in Table 3 on the following page. These comments were incorporated into the development of the final program.

Part 3: Input from the City Planning Commission and City Council

Throughout the NTMP development process, several presentations were made by the Department of Transportation Services (now Department of Public Works) to the Transportation & Technology Standing Committee (now Land Use, Housing, and Transportation Council Standing Committee), the Public Safety Committee, and the City Planning Commission, providing them with details on the progress and content of the program. Following each presentation, their input was solicited and incorporated into the development of program. On September 13, 2004 the final draft of the Neighborhood Traffic Management Program was presented to City Council. In the weeks to follow, the program was finalized to incorporate their comments, and on September 24, 2004 the City Council gave final approval to the program.

Table 6. Summary of Community Input for Richmond’s NTMP Development

Table 3 Summary of Community Input for Richmond’s NTMP Development			
Questions		Response Rate	Result
1a. Who should be able to nominate a project?			
	Neighborhood Teams Only?	20%	
	Neighborhood Associations and Teams Only?	34%	
	Neighborhood Associations, Team and Individuals?	45%	✓
1b. How many accompanying signatures should be required?			
	10	22%	
	25	46%	✓
	Other	13%	
Result: Anyone can nominate a project as long as they gather a minimum of 25 signatures from the neighborhood to support the request			
2a. What should the maximum number of people be on a typical neighborhood traffic committee?			
	5	40%	✓
	7	30%	
	9	20%	
2b. Should one spot be reserved for a local Councilperson (or their representative)?			
	Yes	62%	✓
	No	38%	
Result: The neighborhood Traffic Committee (NTC) will have 5 members with one spot reserved for a local councilperson (or their representative) Note: The City may expand the NTC for larger projects, as needed			
3a. Should the City require a minimum response rate if a petition is used for project implementation?			
	Yes	84%	✓
	No	16%	
3b. If so, what should the minimum response rate be?			
	20%	35%	
	25%	47%	✓
3c. What level of support should constitute approval?			
	<1/2? (51% or more)	69%	✓
	<2/3? (67% or more)	30%	
Result: For those larger projects that warrant a petition, a simple majority is needed for neighborhood project approval, with at least 25% of residents responding.			
4. Should “minor” improvements (signs, enforcement, etc.) be required before “major” improvements?			
	Yes	73%	✓
	No	27%	
Result: The City will require a trial of minor improvements before attempting major ones.			
5. Please indicate which of the following is a major traffic issue for both main roads and local roads:			
		<u>Main</u> <u>Local</u>	
	Speeding	61% 74%	✓
	Presence of Schools	48% 51%	✓
	Transit Accessibility	36% 21%	
	Pedestrian Mobility	39% 47%	
	Cut-Through Traffic	22% 51%	
	Bicycle Mobility	28% 32%	
Result: The primary concern of local citizens for both streets was speeding (#1 on both lists) followed by the presence of schools. On local roads, cut-through traffic and pedestrian mobility were also significant concerns.			

