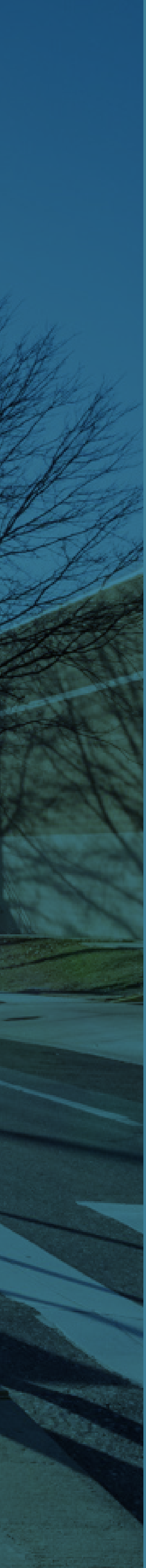


Chapter 8: Speed Management

8.1 Overview

This chapter is specific to Speed Management and is organized in three sections:

» Section 8.2: Design Speed, Target Speed, and Posted Speed

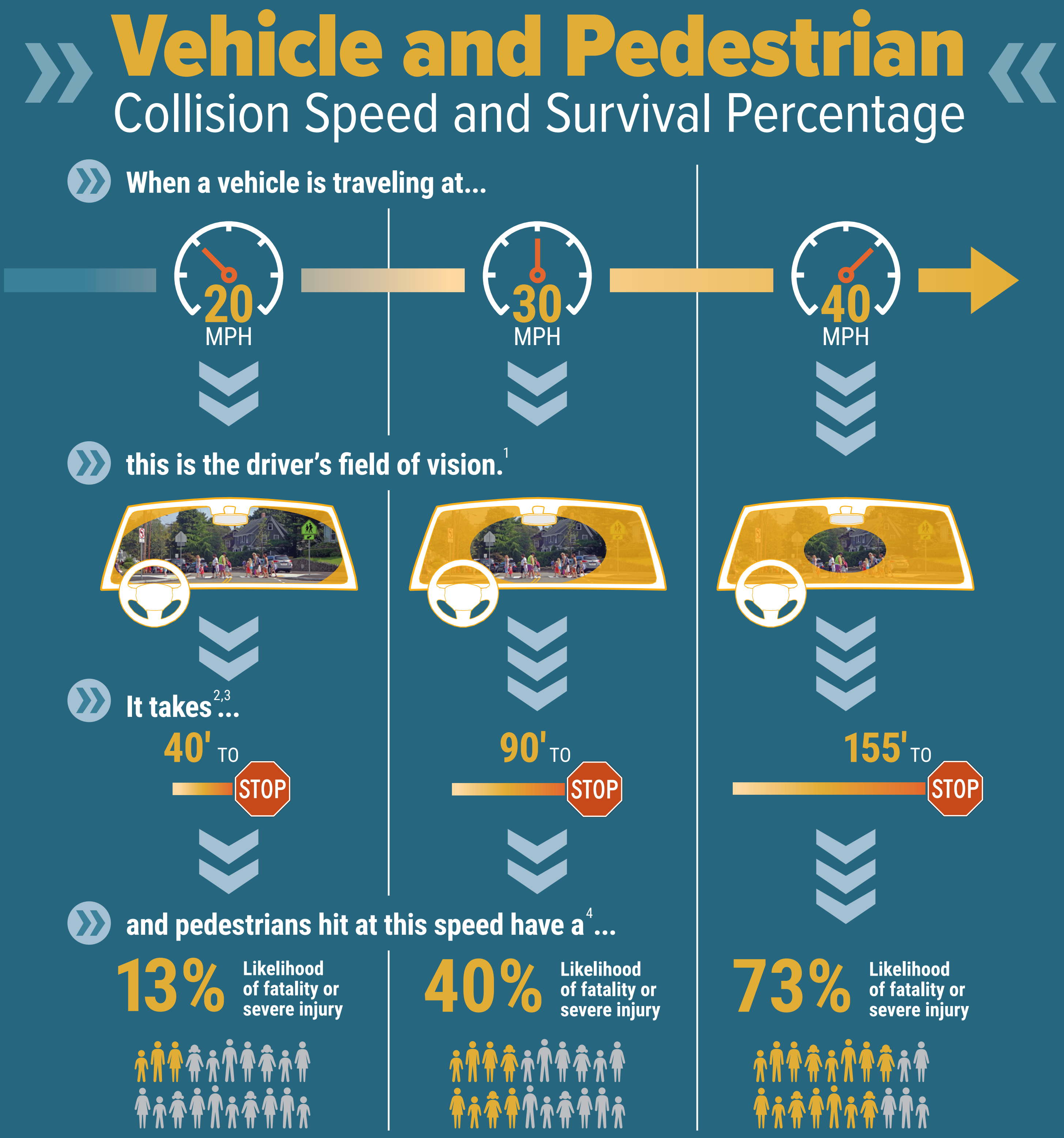
» Section 8.3: Strategies for Achieving Target Speed

» Section 8.4: Retrofitting Arterials for Lower Speed

With Montgomery County's adoption of Vision Zero and a commitment to protecting the safety of the most vulnerable users of the road network, management of traffic speeds is paramount as there is a strong correlation between vehicle speeds and crash outcomes. As vehicle speeds increase, the severity of crashes (i.e., the likelihood of injury and fatality) goes up for all road users, and pedestrians are particularly at risk (see Figure 8-1). Through Vision Zero and the adoption of this guide, the county is renewing its commitment to better align vehicle speeds with the context of the surrounding community. **This will require that public and private sector designers seize every viable opportunity (e.g., redevelopment, street reconstruction, repaving, capital projects) to implement changes aimed at managing driving speeds.**

This chapter presents design guidance that can be used to manage traffic speeds and reduce hazards for all users. While speed management programs have traditionally focused on reducing speeds and cut-through traffic on neighborhood streets, a broader set of tools is needed to manage speeds on all roadways in Montgomery County. For that reason, this chapter includes a section focused on retrofitting arterials for slower speeds. (Arterials roughly correspond with the Boulevard street types described in this guide.) Arterials are magnets for land development, serve as the backbone of the transit network, and typically carry the highest volume and speed of vehicle traffic. Thus, the risk of serious injury or fatality for road users is higher on arterials. Principal arterials (e.g., Georgia Avenue and Rockville Pike) represented 52 percent of severe injuries and fatalities in the county between 2012 and 2016.[122] A strong focus on speed management on arterial roads is necessary to achieve the county's goal of zero severe injuries and fatalities from traffic crashes by 2030.

122 Montgomery County Vision Zero 2-Year Action Plan, 2017.



1 A. Bartmann, W. Spijkers and M. Hess, "Street Environment, Driving Speed and Field of Vision" Vision in Vehicles III (1991).
W. A. Leaf and David F. Preusser. Literature review on vehicle travel speeds and pedestrian injuries. (Washington, D.C.: U.S. Dept. of Transportation, National Highway Traffic Safety Administration, 1999).

2 Braking distances do not account for braking reaction time.

3 AASHTO Green Book—A Policy on Geometric Design of Highways and Streets, 7th Edition. American Association of State and Highway Transportation Officials, 2018.

4 Tefft, Brian C. Impact speed and a pedestrian's risk of severe injury or death. Accident Analysis & Prevention. 50. 2013.

Figure 8-1. Relationship between speed and crash survival for people walking

8.2 Design Speed, Target Speed, and Posted Speed

On arterial roadways, there is often a mismatch between the speed a road was designed for — with the goal of minimizing travel time for motor vehicles — and the speed that would be reasonably safe for the full range of people traveling along the route. Key definitions:

Posted Speed. Speed limits are typically set based on the speed that most people travel on the roadway (termed "85th percentile speed," which means 85 percent of the drivers travel at or below this speed). This means roads designed for faster speeds are more likely to eventually be posted at higher speed limits. However, FHWA has acknowledged several valid approaches to setting speed limits, including an approach where "speed limits are set according to the crash types that are likely to occur, the impact forces that result, and the human body's tolerance for those forces."[123] In other words, speed limits can be set based on the context of a particular roadway. This approach is appropriate in places where people walk or bike.

Design Speed. Design speed, or the speed that the roadway is designed for, is a fundamental factor in roadway design and is used to establish the geometric criteria (such as width, curvature, banking) for the road. Major streets in Montgomery County were built in the conventional highway design paradigm, where arterials were designed with an emphasis on decreasing motor vehicle travel time and the typical practice was to set the design speed as high as reasonably practical. The geometric features of the road were oriented to ensuring that a driver could comfortably operate their vehicle at that speed. The national standards that define these geometric design criteria (the AASHTO Green Book) assume a "lower performing" design vehicle that does not handle as well as most modern passenger cars.[124] As a result, a road with an original design speed of 40 mph is comfortable for most modern passenger cars at speeds of 50 mph or even higher. The combination of selecting higher design speeds for arterials and accommodating lower performing vehicles has created the potential for hazardous crashes, especially in places where people walk, ride a bike, or take the bus along arterial roadways.

123 FHWA Methods and Practices for Setting Speed Limits, Federal Highway Administration (2012)

124 American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets (2018), p. 2-86

Target Speed. A better approach is to design the street to operate at or below a target speed, which intentionally encourages slower speeds through roadway geometry. The target speed is the desired operating speed for a roadway facility. These speeds are based on safe operations on the relevant roadway sections and are tailored to the functionality and context of the roadway in a Complete Streets system. Presence, proximity, and volume of pedestrians, bicyclists, passenger vehicles, transit vehicles, and commercial vehicles are considered when determining an appropriate target speed. **On a well-designed street, the target speed is self-enforcing.** Wherever feasible, the target speed should match the posted speed limit.[125]

Going forward, the target speeds presented in Figure 8-2 will be the default for each street type in Montgomery County. Over time, measures should be taken to align speeds on existing roadways with these targets, and new streets should be designed to produce operating speeds at or below these speeds. The target speeds for the most local-serving streets reflect the efforts of the "20 Is Plenty" campaign, which advocates capping speeds at 20 mph in some areas. Note: Current Maryland state law requires a minimum posted speed of 25 mph, other than in places defined as "Urban Districts."[126] While that law exists, applicable streets with lower target speeds will be posted at 25 mph.

Street Type	Target Speed (mph)
Downtown Boulevard	25
Downtown Street	20
Boulevard	35
Town Center Boulevard*	30
Town Center Street	25
Neighborhood Connector	25
Neighborhood Street	20
Neighborhood Yield Street	20
Industrial Street	25
Country Connector	40
Country Road	20 - 35
Major Highway	45 - 55

* In Urban Areas, streets that are already 25 MPH will retain that target/posted speed.

Figure 8-2. Target speeds

125 American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets (2018), p. 2-24

126 The law defines an Urban District as anywhere with buildings <100' from each other over a 1/4 mile area. https://law.justia.com/codes/maryland/2018/transportation/title-21/subtitle-8/section-21-803/

8.3 Strategies for Achieving Target Speeds

The following pages provide engineering and operational strategies that can be used to achieve the target speeds in Figure 8-2. Figure 8-3 presents common speed management techniques and indicates whether they are required, recommended, optional or not permitted/applicable on each street type. This table is a starting point for decision-making. **The ultimate design measures for each roadway will be determined based on the local context and through consultation with MCDOT.**

When a speed management approach is considered for any street, Montgomery County applies the following considerations:

» Speed management measures prioritize bicyclists, pedestrians, transit users, and people with disabilities, and should not diminish safety, access, or comfort for these modes.

» Neighborhood involvement is integral to the successful implementation of speed management on neighborhood streets.

» Designs intended to reduce speeds should be predictable and easy to understand for all people.

» Speed management measures should accommodate emergency vehicles, and emergency-response times shall be taken into consideration during project review.

» Speed management projects on major through-streets (e.g., Downtown Boulevards, Boulevards, and Town Center Boulevards) should not significantly impact freight or transit service.

» The area-wide street network should be considered so as not to divert traffic from one street to another.

Where a higher-speed roadway changes to a lower-speed roadway, attention must be given to the degree of speed reduction and the manner in which the reduction occurs. Motorists should be traveling at the slower speed at the start of the slower-speed street type; reductions should occur prior to the establishment of a lower speed. Section 8.4 shows examples of how to achieve this in different contexts.

LEGEND

- ■ Required
- ▲ Recommended (Context-Sensitive)
- O Optional (Context-Sensitive)
- x Not Permitted or N/A
- * Unless determined otherwise by Planning Board

		Downtown Boulevard	Downtown Street	Boulevard	Town Center Boulevard	Town Center Street	Neighborhood Connector	Neighborhood Street	Neighborhood Yield Street	Industrial Street	Country Connector	Country Road	Major Highway	Page Reference
ROAD NARROWING	Road Diet (if volumes meet thresholds for road diet)	O	O	O	O	O	x	x	x	O	O	O	O	210
ROAD NARROWING	Lane Diet	▲ (see default dimensions for street type)												211
VERTICAL MEASURES	Speed Humps/Cushions	O	O	x	O	O	O	O	O	O	x	x	x	212
VERTICAL MEASURES	Speed Tables/ Raised Crosswalks	O	▲	x	O	▲	O	O	O	O	x	x	x	213
VERTICAL MEASURES	Raised Intersections	O	▲	x	O	▲	O	O	O	O	x	x	x	213
HORIZONTAL MEASURES	Curb Extensions/ Bulb Outs	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	O	213
HORIZONTAL MEASURES	Neckdowns/Chokers	▲	▲	▲	▲	▲	▲	▲	▲	▲	O	O	O	214
HORIZONTAL MEASURES	Roundabouts	O (engineering judgement needed, see Section 6.9)												
HORIZONTAL MEASURES	Crossing Islands	▲	▲	▲	▲	▲	▲	O	O	▲	O	O	▲	152
HORIZONTAL MEASURES	Traffic Diverters	x	x	x	x	x	x	O	O	O	x	x	x	209
HORIZONTAL MEASURES	Chicanes/ Roadway Curvature	▲	O	O	▲	O	O	O	O	O	O	O	x	214
SURFACE	Textured Paving Treatment	O	O	O	O	O	O	O	O	O	x	x	x	216
ENCLOSURE	Sense of Enclosure (e.g., via street trees, landscaping, buildings, medians, etc.)	■	■	■	■	■	■	■	■	■	O	O	O	107

Figure 8-3. Appropriate speed management measures by street type

Road Narrowing

Road narrowing involves continuous changes to narrow the cross section of the road. Road diets and lane diets, as defined below, are often used in conjunction to narrow the overall width of the roadway dedicated to motor vehicles. These “diets” reduce pedestrian crossing distance and allow space reallocation to other uses.

Road diets reduce the number of travel lanes on a roadway. Roads that have more capacity (i.e., more lanes) than they need during the peak hour are among the most likely to have high speeds. **Right-sizing streets so that they have no more lanes than necessary is one of the most effective ways to reduce speeds and improve the safety of streets.** The most common road diet treatment is converting a four-lane road to three lanes (one travel lane in each direction with center left turn lanes where needed); however, any removal of travel lanes would be considered a road diet. A two-way center turn lane should not be used when there are two or more through lanes in each direction.

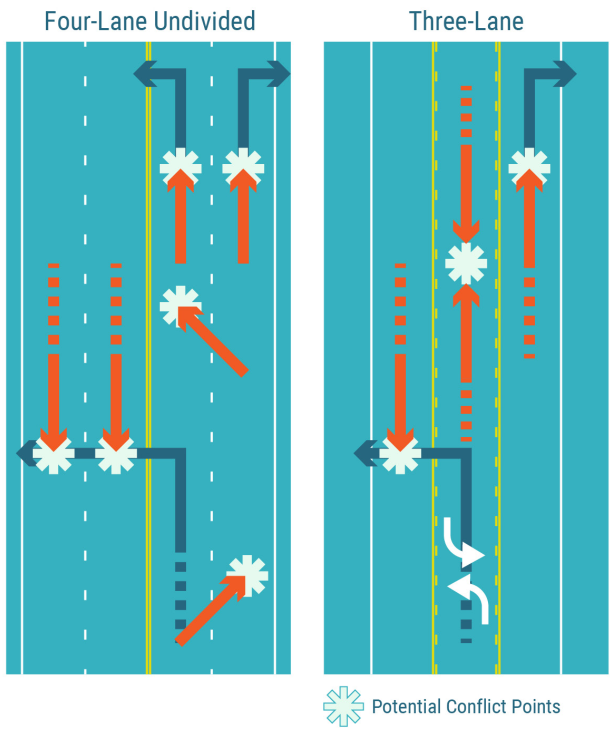


Figure 8-4. Example of the reduced number of conflict points on a 4-lane to 3-lane roadway conversion (Source: Federal Highway Administration, Adapted from Welch, T. The Conversion of Four Lane Undivided Urban Roadways to Three Lane Facilities. 1999.)

Figure 8-5 shows typical volumes for road diets on four-lane roads, which can be used to determine if a roadway may be a candidate for lane reduction. These figures are estimates – actual capacity depends on context, travel patterns, and prevailing driving behaviors. Level of service must be considered; however, in some cases implementing a road diet (including the elimination of turn lanes in some locations) will mean recognizing that some increased congestion during the peak hours of travel is a worthwhile tradeoff for increased safety. Research shows that road diets typically result in improved safety via lower speeds and less exposure to traffic for vulnerable users at crossings.

Less than 10,000 ADT	10,000 – 15,000 ADT
Great candidate for road diets in most instances. Capacity will most likely not be affected.	Good candidate for road diets in many instances. Agencies should conduct intersection analysis and consider signal retiming to determine any effect on capacity.
15,000 – 20,000 ADT	**Greater than 20,000 ADT**
Good candidate for road diets in some instances. Agencies should conduct a corridor analysis. Capacity may be affected at this volume depending on the "before" condition.	Agencies should complete a feasibility study to determine whether this is a good location for a road diet. There are several examples across the U.S. where road diets have been successful with ADTs as high as 26,000. Capacity may be affected at this volume.

Figure 8-5. Typical volumes for arterial road diets, (ADT = Average Daily Traffic) (Source: FHWA Road Diet Myth Busters, safety.fhwa.dot.gov/road diets)

Lane Diets narrow vehicular travel lane widths to default or minimum dimensions per street type. Research shows that narrower travel lanes can contribute to lower operating speeds and reduced crash rates.[127] Narrower travel lanes can also free up roadway width for other uses, such as green infrastructure and bicycle facilities, and shorten crossing distances (and thus exposure) for pedestrians and bicyclists at intersections. Refer to the lane width dimensions in Chapter 4: Street Zone for Montgomery County's default lane widths by street type. Sometimes, narrower lanes can be implemented simply by striping edge lines on streets that do not have them. Any decision to implement a lane diet should be determined using current traffic safety research including the Highway Safety Manual (HSM).

127 FHWA Achieving Multimodal Networks, Federal Highway Administration (2017)

Vertical Measures

Vertical measures involve periodic treatments to slow the speed of the road by creating vertical deflection. They can be used to achieve target driving speeds and keep drivers attentive and aware. **Vertical elements require coordination with emergency service providers and transit agencies to ensure that their operations are not impacted. Their implementation may be limited by other regulations - consult MCDOT.**

Speed humps are commonly used in neighborhood traffic calming, as they are inexpensive and effective. Montgomery County Executive Regulation 1-18AM regulates the spacing and design of speed humps. For streets with target speeds lower than 25 mph, Figure 8-7 provides additional guidance. Speed humps should be placed perpendicular to the flow of traffic. Speed humps are used as a retrofit for streets to achieve an overall lower speed along the corridor. The profile and placement of the speed humps should be designed to achieve the target design speed of the street. Gaps should be provided between the curb line and the end of the speed hump to allow stormwater to bypass the treatment.

Speed cushions reduce vehicle speeds but also provide a cut-through for vehicles with a wider wheelbase. Speed cushions are typically only considered on streets with posted speeds of 30 mph or lower and lower traffic volumes, though they may be used as part of a suite of design strategies to signal a transition to drivers (e.g., when the street type transitions from a Boulevard to a Town Center Boulevard). Speed cushions should be clearly marked with reflective markings and signs. The height of the speed cushion should be tapered towards the gutter to allow for unimpeded bicycle movement.

Figure 8-6. Speed hump

Raised Crossings can reduce speed and provide safety benefits by increasing visibility of people crossing. A raised crossing located at the transition to a neighborhood street from faster roadway is a good indicator of a change in expected driver behavior, especially on streets designated as Neighborhood Greenways by the Bicycle Master Plan.

Raised intersections have similar benefits to raised crossings – see Chapter 6: Intersections for more information.

Raised crossings and raised intersections are also appropriate as retrofit projects on existing streets where the goal is to reduce turning speeds and increase yielding to pedestrians, especially on channelized right-turn lanes (i.e., slip lanes) on arterial roads.

Horizontal Measures

Horizontal measures involve periodic treatments to slow the speed of the road by both narrowing the street to minimum widths and deflecting traffic from a straight path by introducing curvature. Horizontal measures have the potential to change the “wide and straight” character of many of the county’s Boulevards, which can encourage higher-speed driving. To achieve the desired target speeds, the spacing between speed management measures should be a minimum of 250-feet apart and a maximum of 500-feet apart (see Figure 8-7).

Curb extensions extend the sidewalk or curb line into the street at an intersection or mid-block crossing location in order to shorten the crossing distance for pedestrians and improve visibility. Curb extensions extend the full width of an on-street parking lane. Check the Master Plan of Highways

Target Speed (mph)	Spacing (feet)
10	250’
15	300’
20	400’
25	500’

Figure 8-7. Recommended spacing of horizontal and vertical speed management measures

Figure 8-8. Horizontal traffic calming treatment

and Transitways[128] and the Bicycle Master Plan[129] to determine whether the design of the curb extensions needs to accommodate future or existing bikeways, transit or freight priority routes. In some cases, curb extensions may be integrated with vegetation or bioretention to serve as another visual cue to drivers and help manage stormwater runoff from the right-of-way.

A **neckdown or choker** consists of two curb extensions placed mid-block directly opposite each other to physically and visually reduce the width of the roadway. They may be implemented by eliminating on-street parking, shoulders or unneeded roadway width. Neckdowns sometimes narrow the travelway to a single lane and encourage motorists to yield to oncoming traffic to pass before proceeding. A minimum clear width of 12 feet is required between curb extensions to allow safe vehicle passage and emergency access.

Crossing islands can be placed at intersections, mid-block crossing locations, or at the entrance to a community to slow vehicles turning onto a street. When their purpose is solely to reduce motor vehicle speeds, the median can be as narrow as 2 feet wide. When designing to also serve as a pedestrian refuge, the median must be at least 6 feet wide to comply with ADA requirements. At trail crossings of four or six lane roads, a width of 10 feet is preferred. The length of the shifting taper approaching a raised median should be calculated based on design speed. When shifting tapers are provided on streets with speeds of 25 mph or less, the length of the shifting taper calculated from the Manual on Uniform Traffic Control Devices may be reduced in half; this guidance is similar to shifting tapers for work zones and provides a more abrupt transition, which requires drivers to progress at slow speeds. By varying the width of a median along an arterial, some horizontal deflection can also be achieved.

Horizontal traffic calming measures that introduce curvature into the roadway are among the most effective measures to keep speeds at or below the target goal.

Chicanes introduce curvature into a roadway by placing three or more curb extensions in an offset pattern to create a winding path for motorists. Chicanes may require the removal of on-street parking in spot locations. On streets where drivers regularly exceed a target speed of 25 mph or less, chicanes or other speed management tools should be spaced at least every 500 feet. Chicanes should be designed to minimize impacts to storm water drainage.

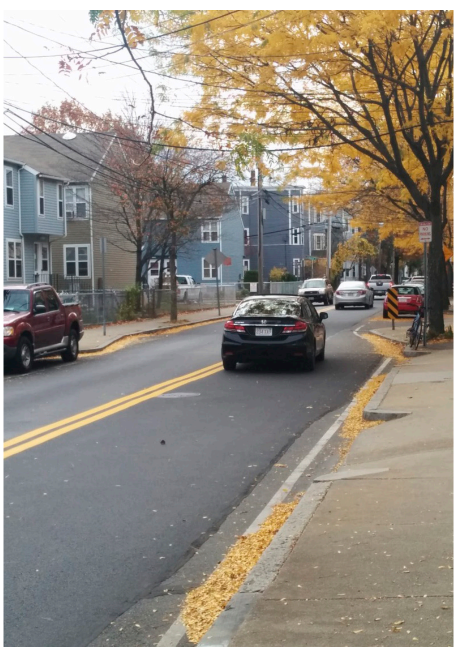


Figure 8-9. Chicane

128 https://montgomeryplanning.org/planning/transportation/highway-planning/master-plan-of-highways-and-transitways/

129 https://montgomeryplanning.org/planning/transportation/bicycle-planning/bicycle-master-plan/

Roadway curvature is a key consideration in roadway design, for speed management and overall safety. When feasible, it is advantageous to maintain existing curves on Country Connectors and Country Roads and to superimpose curves on existing straight street segments. Radii for horizontal curves should use the minimum radius identified in the AASHTO Green Book[130] for the desired turning speed. The desired turning speed may be less than the posted speed but may require posting a supplemental speed plaque to identify the recommended speed for the curve. Horizontal curves must also be designed in coordination with vertical alignments and adjacent roadside conditions (vegetation, building siting, etc.) to ensure that clear sight triangles and sight distances are provided. The design vehicle must also be considered when selecting the radius of curvature and the lane widths to ensure that larger vehicles can properly navigate the roadway. Encroachment by infrequent large vehicles into oncoming lanes may be appropriate on low volume, low speed roadways, but a larger radius of curvature, wider lanes, or a mountable truck apron may be appropriate to address off-tracking issues where large vehicles are frequent.

In suburban contexts, roadways with gentler curves may encourage faster driving speeds. It may be feasible to retrofit curving streets like these with speed management measures such as curb extensions or chokers. Or, as part of development/redevelopment projects, in some contexts it may be preferable to design roadways with sharper corners as long as sight lines to oncoming travel lanes and pedestrian crossings are maintained.

In some suburban contexts where gentler curves may lead to higher vehicle speeds, it may also be preferable to design a one-way circuit around a central plaza or park (see Figure 8-10 lower). Because this design requires sharp turns, analysis is needed to ensure whether the county's fire apparatus will be able to navigate the streets. On-street parking may need to be limited in areas with this design, to enable fire access. However, the lower design has advantages over the alternative on the top in that it may help slow vehicle speeds and also creates a greenspace that can be used for recreation and/or stormwater management.

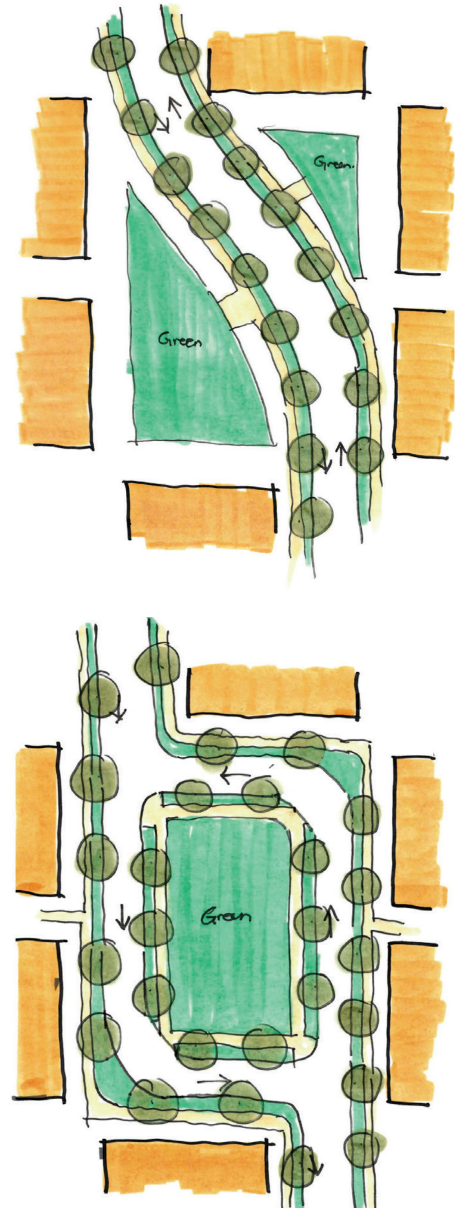


Figure 8-10. Alternative options for roadway geometry in suburban contexts

130 American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets (Green Book)

Figure 8-11. Example of optical speed bars

Surface Measures

A variety of pavement markings can be used to encourage slower driving speeds.

- Converging chevron marking patterns create the illusion of traveling faster as well as the impression of narrower lanes.[131]
- Optical speed bars, a series of white rectangular markings spaced progressively closer, create the illusion of traveling faster.[132]
- Lane narrowing with edge lines, painted medians, or different surface treatment for parking lanes, which can visually narrow the street.
- Textured pavement may be effective in areas with higher pedestrian traffic, or where roads transition from faster, more suburban contexts to slower, more urban zones.

Sense of Enclosure

Urban streets frequently have vertical elements along the edge of the street, such as street trees, buildings that face the street, or other amenities that create a sense of enclosure and visual interest. These design elements create side friction and make a street feel narrower than it is. This has the effect of reducing travel speeds. A street with a raised landscaped median will feel narrower than a street that only has a painted median.

On-street parking can help reduce travel speeds. However, if the parking is underutilized it can have the opposite effect, because vacant on-street parking visually widens the road, resulting in higher speeds.

Using fixed objects and landscaping/trees to create a sense of enclosure can be appropriate in suburban and rural areas or in urban areas lacking enclosure; however, clear zones and sight distance for higher speed streets should be considered when placing street adjacent amenities.

Additional speed management strategies specific to intersections, including signal timing and mini roundabouts, are presented in Chapter 6: Intersections.

131 PennDOT Speed Management Action Plan, Pennsylvania Department of Transportation (2016)

132 https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=835 (Section 3B.22)

Progression Speed

The progression speed on a corridor is the speed used to set traffic signal timing such that a user who is traveling that speed can pass through several traffic signals in a row. This is referred to as a “green wave.” The progression speed for corridors in Montgomery County is managed by MCDOT Division of Traffic Engineering and Operations. **If the progression speed is aligned with the target speed for the roadway, drivers who drive the desired speed are “rewarded” with less wait time at red lights.** Similarly, on priority bicycle corridors, where appropriate the progression speed can be set closer to bicycle operating speeds in order to improve convenience for bicyclists and encourage compliance with signals. Common green wave progression speeds for bicyclists are between 12 and 15 mph. This speed can vary depending on the specifics of each location (e.g., grade, sight distance). A green wave encourages slower travel speeds for motor vehicles, which improves safety for all roadway users. Any signal progression issues require evaluation and approval by MCDOT.

Enforcement

An underlying objective of complete streets designs is they achieve self-enforcement of target operating speeds. This enforcement-through-design should reduce the need for enforcement in the first place. Where further enforcement is necessary, however, automated enforcement and radar feedback signs are beneficial tools to reinforce posted speeds, particularly when implemented alongside design solutions. Both tools provide a more consistent application of the law and reduce the need for interactions between police officers and the public.

While radar feedback signs provide a more educational approach to enforcement without assessed penalties, attention must be given toward the implementation of automated enforcement devices to ensure that the implementation of the program is not itself inequitable. As enforcement is more likely to be needed on facilities that have not yet been reconstructed toward achieving the target speeds: this reinforces a need for Equity Emphasis Areas to be considered in prioritizing the Capital Improvement Program and maintenance activities (see Chapter 9).

For more information on enforcement: contact the Montgomery County Police Department, Field Services Bureau for more information.

8.4 Retrofitting Arterials for Lower Speeds

Speed management is particularly important on Montgomery County's arterial network, which serves more than half of all vehicle miles traveled and experiences more than half of all crashes. Higher speeds are encouraged by the straight alignments, low-scale buildings that are set back from the road, and long distances between signals. At higher speeds, drivers have a much narrower cone of vision, and need more time to stop (see Figure 8-1). At lower speeds, drivers have much better visibility of people walking or biking along the road and can stop much more quickly. A significant change in design practices and policies will be needed to address the mismatch between how the existing arterial network was designed (with the goal of increasing capacity and mobility for motor vehicles) and the county's Vision Zero policy.

Speed management on arterials applies the same principles as on other street types but recognizes the role of the corridor as a major thoroughfare and ensures that reduced speeds do not diminish vehicle access and divert traffic onto local streets.

The following pages present three common conditions found throughout Montgomery County, and present a hypothetical set of speed-management strategies that could be employed in cases like these.

Example A: Transitioning a Higher-Speed Road into an Urban Area

In this example, a Boulevard transitions into a Downtown Boulevard as it enters an urbanizing area with shops, employment, and housing. The Boulevard target speed is 35 mph. As a Downtown Boulevard, the target speed is 25 mph. There is significant transit service on the road, and there are limited side streets for comfortable bicycling, which means that many bicyclists use the road too.

The first step is to look at the overall width of the street. The traffic volumes in the corridor should be evaluated to determine if this street is a candidate for lane reduction through a road diet. The widths of the lanes should also be evaluated to see if they can be narrowed – especially as the allowable lane width changes to the new street type. Narrower and/or fewer lanes can allow space for bicycle facilities and/or shorten the pedestrian crossing at intersections. The maximum spacing for protected crossings and minimum spacing for signalized intersections will reduce and provide more pedestrian access. If the signals are timed strategically, speed can be better managed in the more congested environment. Additional changes in the streetscape and the implementation of speed management measures will further communicate the change in land use and target speed to the motor vehicle drivers.

Existing

- Major community destinations and school front the corridor
- Long crossing distances
- Long gaps between pedestrian crossings
- Road design encourages higher driving speeds
- Pedestrian desire lines between transit stops and destinations

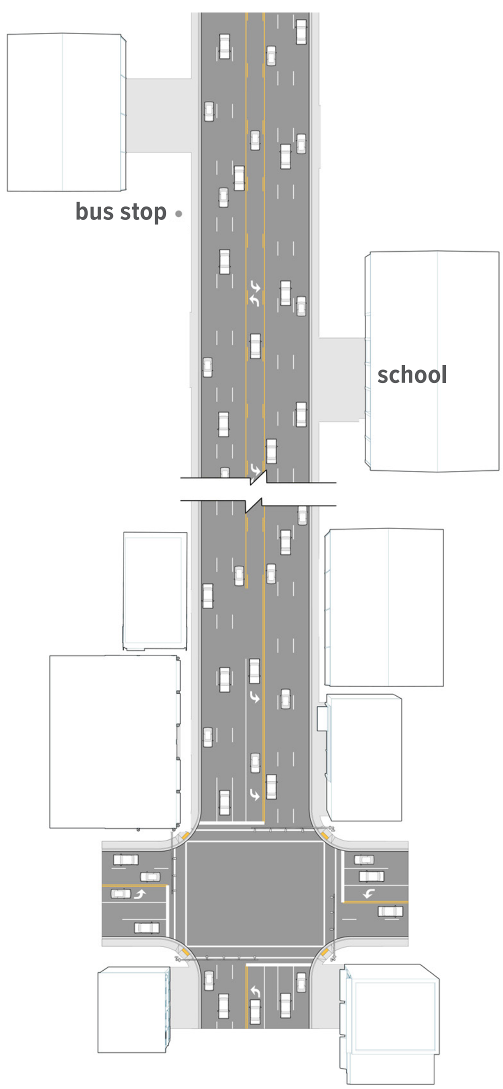


Figure 8-12. Example A, before

Proposed

- Lane reduction
- Separated bike lanes
- Varying-width curb extensions overlay curvature into the roadway as you enter the urban area
- Textured pavement is a cue to drivers that they are entering a different zone
- Signal timing allows continued green flow for vehicles traveling the design speed of 25 mph
- Enhanced mid-block crossing
- Relocate bus stop close to crossing

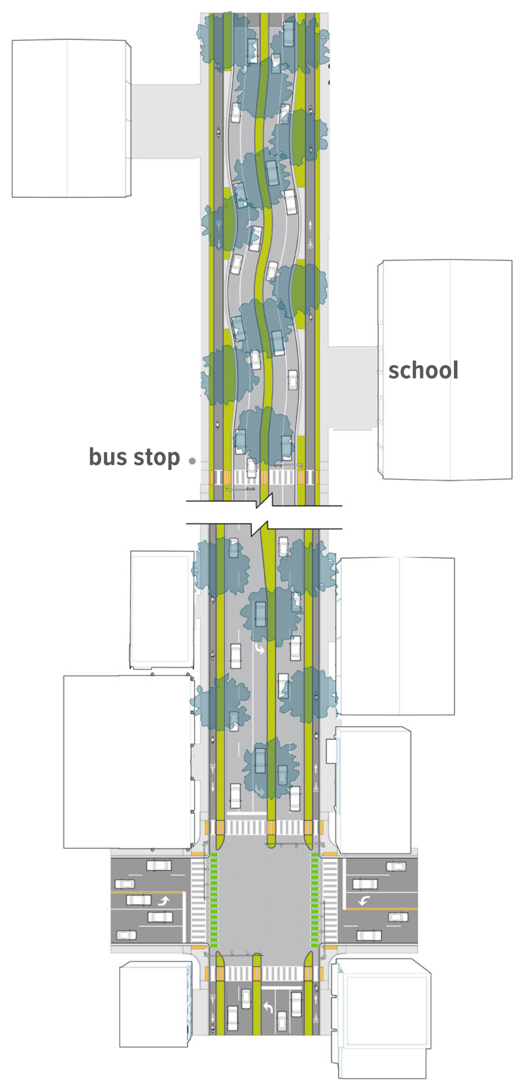


Figure 8-13. Example A, after

Example B: Undivided Town Center Boulevard with Pedestrian Activity

In this example, an undivided Town Center Boulevard in a suburban setting has transit service that results in pedestrian activity with desire lines across the corridor. The suburban development pattern with large setbacks and development oriented away from the arterial contribute to a sense of openness, which leads to higher speeds. The long right turn lanes and painted median also contribute to the feeling of a wider corridor. The existing speed limit is 35 mph, but traffic is often moving significantly faster than the posted speed limit. As a Town Center Boulevard, the target speed is 25 mph.

The traffic volumes in the corridor should be evaluated to determine if this street is a candidate for lane reduction through a road diet. Removal of extra turn lanes should also be considered. The widths of travel lanes should also be evaluated to see if they can be narrowed. The two-way left turn lane is discouraged for this street type and should be removed. Available space from road/lane diets should be allocated to pedestrian and/or dedicated transitway space. The spacing of protected crossing and signalized intersections should match the Street Design Parameters in Figure A-1. Horizontal and enclosure speed management measures should be considered per Figure 8-3. Future land use planning should require development set closer to the road.

Existing

- » Pedestrian desire lines between destinations
- » No buffer between sidewalk and travel lanes
- » Development set back from road increases sense of open, fast roadway
- » Bicyclists share sidewalks with pedestrians or travel lanes with vehicles, creating conflicts
- » Long spaces between crossings and wide crossing distances for pedestrians
- » Two-way center turn lanes lead to wide cross section and creates potential conflicts for drivers

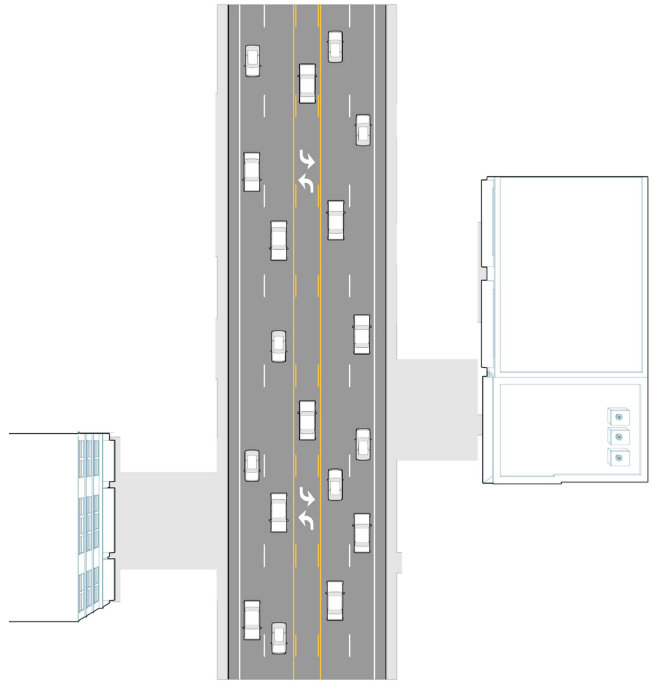


Figure 8-14. Example B, before

Proposed

- » Lane reconfiguration slows traffic and creates on-street parking
- » Raised mid-block crossing island with high-visibility crosswalks
- » Radar speed feedback signs
- » Optical speed bars
- » Over time, development oriented closer to frontage to create a sense of enclosure
- » Street trees, a street buffer, and bike lanes create a more comfortable space for people walking and bicycling

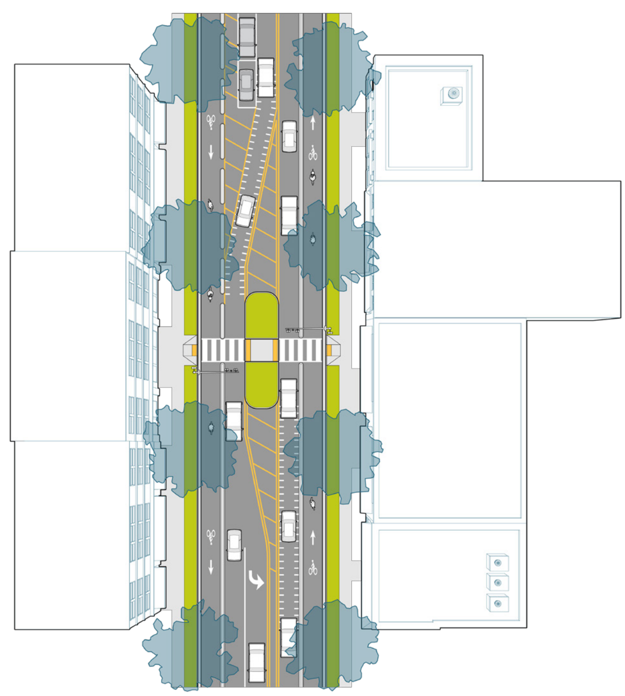


Figure 8-15. Example B, after

Example C: Transitioning a Country Connector into a Town Center Street

In Example C, a two-lane Country Connector with high-speed traffic along much of its course travels through the center of a small town, serving as the “main street” of the community. Traffic is typically exceeding the posted speed limit of 50 mph. As you enter town, there is an increase in vehicle turning movements, pedestrians, and bicyclists. As a Country Connector, the target speed should be 40 mph and as a Town Center Street, the target speed should be reduced to 25 mph. Potential treatments include visual cues to the motorist that they are entering an area of higher development density, lower travel speed, and increased vulnerable users. These visual cues to the driver should be implemented outside of the town center to provide ample time for speed reduction.

Existing

- Vehicles approaching Town Center are traveling 40+ mph
- Wide shoulders and open road section signal a higher speed environment

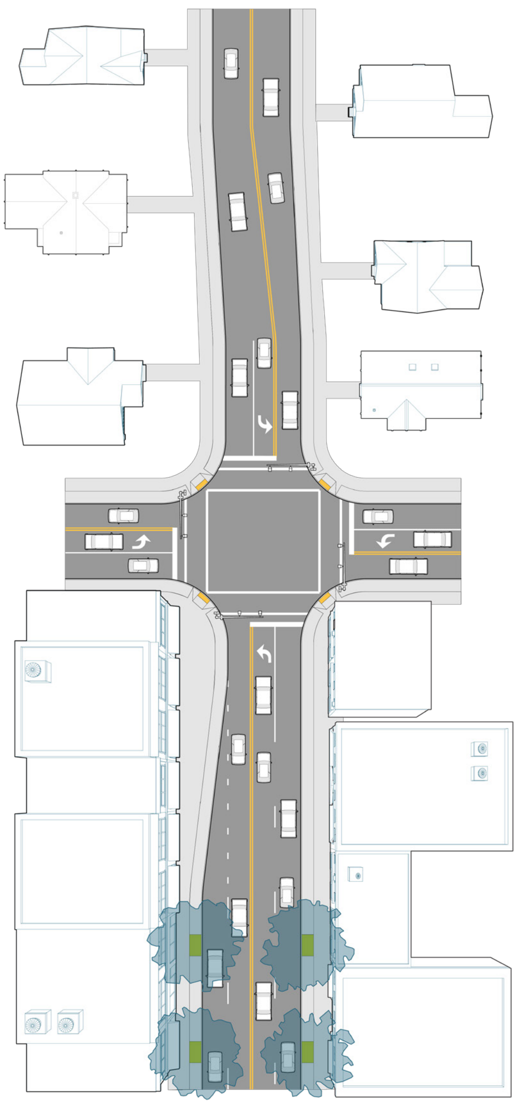


Figure 8-16. Example C, before

Proposed

- Chicanes add curvature that slows drivers as they enter the Town Center
- Landscaping, textured pavement and gateway treatments provide a visual cue
- Narrower lanes, edge line striping, and optical speed bars help reinforce that a change is occurring
- Tighter curb radii, high-visibility crossings, and a raised intersection help pedestrians cross

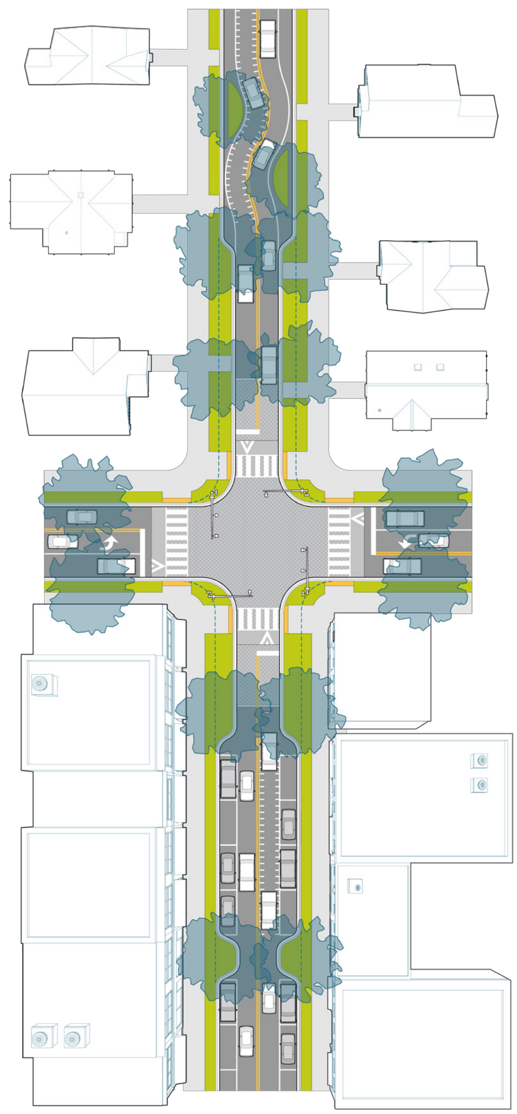


Figure 8-17. Example C, after


NO TURN ON RED