MULTIMODAL SYSTEM DESIGN GUIDELINES

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Virginia Department of Rail and Public Transportation

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CHAPTER 1

Introduction & Benefits of Multimodal Planning

Why Multimodal Planning?

Cities and towns across the nation are undertaking a variety of multimodal transportation planning efforts to give their communities more travel choices. Transportation planning professionals use the term multimodal to describe anything that involves more than one mode of transportation, implying that there are more travel choices than just driving. Multimodal transportation improvements include providing new sidewalks or bike lanes, installing bus shelters at transit stops, striping crosswalks, and many other ways of transforming streets to make it easier and safer to travel using a variety of travel modes. Multimodal transportation improvements can also occur beyond the roadway right-of-way, such as with heavy rail transit and off-road bike trails that do not follow road alignments.

The Commonwealth of Virginia over the past few years has embraced the goal of providing its citizens, businesses and visitors with a better multimodal and intermodal transportation system. To assist in implementing this goal the Virginia Department of Rail and Public Transportation (DRPT) has undertaken the development of guidelines for planning and designing multimodal places and corridors. To assist DRPT, a consultant team was selected, and representatives from transit providers, local and regional transportation and planning agencies, state agencies, and professional organizations formed a steering committee to provide suggestions, ideas and information to make the guidelines as relevant and useful as possible.

Vision for Multimodal Transportation in Virginia

Virginia will have a coordinated system of roads, rails, ports, transit, bicycle, pedestrian and aviation resources that provides integrated and efficient options that meet citizen, visitor and business transportation needs.

- *Governor's Multimodal Strategic Plan for the Commonwealth of Virginia, December, 2010.*

This document is the culmination of over two years of study, review and outreach to establish a basic framework set of guidelines for multimodal planning in the Commonwealth. It is important to note that these are guidelines and industry practices customized to a Virginia context. They are intended as a resource for local planners, engineers, designers, policy and decision makers, and anyone else engaged in multimodal planning throughout Virginia.

This chapter begins with a discussion on the recent initiatives on multimodal planning in Virginia, followed by a discussion of the need for establishing multimodal guidelines and the mission and goals of these guidelines. The chapter ends with a discussion on the benefits of providing a connected multimodal transportation system. Throughout this document the Multimodal System Design Guidelines will often be referred to as "these Guidelines" or "the Guidelines".

The Context of Multimodal Planning in Virginia

The Governor's Multimodal Strategic Plan

The Governor's Multimodal Strategic Plan for the Commonwealth of Virginia was completed in December, 2010.[1] The Plan's overall vision calls for Virginia to have "a coordinated system of roads, rails, ports, transit, bicycle, pedestrian and aviation resources that provides integrated and efficient options that meet citizen, visitor and business transportation needs."

The plan also defined multimodal transportation planning as "*a coordinated process that provides an integrated and efficient network for the seamless movement of people and goods*." It further identified key concepts associated with this approach such as:

- All modes of transportation are included
- Linkages and reliability between various transportation modes are essential
- The transportation system is linked to land use and economic development objectives

These Guidelines support the vision of the Governor's Multimodal Strategic Plan through the sharing of best practices and design techniques for ensuring safe and seamless incorporation of multiple modes in transportation planning in Virginia. Furthermore, they outline effective techniques for integrating land use and economic development factors into multimodal planning by comprehensively considering the whole complex of factors that go into a Multimodal System Plan, including land use, built form of development, corridor design and Transportation Demand Management (TDM). By presenting industry best practices and techniques for multimodal planning in a Virginia-specific context, these Guidelines are intended to serve as an effective resource for local planners, engineers, designers, policy and decision makers, and anyone else engaged in multimodal planning throughout Virginia to coordinate their efforts and meet the needs of the Commonwealth for the coming years.

VTrans

Under Virginia law, a multimodal long-range transportation plan must be developed and regularly updated to assess needs and assign priorities on a statewide basis. The latest update of this plan , the VTrans2035 Update, was adopted by the Commonwealth Transportation Board in February 2013.[2] VTrans is a policy document that frames the overall future vision for multimodal transportation in the Commonwealth. These Guidelines are related to several of the VTrans 2035 Update goals, including:

- *Mobility, Connectivity and Accessibility* – to facilitate the easy movement of people and goods, improve interconnectivity of regions and activity centers, and provide access to different modes of transportation
- *Environmental Stewardship* – to protect the environment and improve the quality of life for Virginians
- *Economic Vitality* – to provide a transportation system that supports economic prosperity
- *Coordination of Transportation and Land Use* – to promote livable communities and reduce transportation costs by facilitating the coordination of transportation and land use

As noted in these goals, the integration and coordination of factors such as land use, livability and environmental stewardship are all vitally important to the development of a sound multimodal transportation system. These Guidelines specifically develop practices for integrating these factors and present a holistic "how to" for incorporating the variety of factors that go into making our corridors and our communities more supportive of multimodal transportation.

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[1] All references to this plan refer to the Governor's Multimodal Strategic Plan for the Commonwealth of Virginia, December, 2010.

[2] The VTrans2035 Update was revised in April 2013. See www.vtrans.org for further information.

It is important to note that the standards used in these Guidelines are not intended in any way to conflict with the standards used by any other modal agency in the Commonwealth, including VDOT road design standards. However, VDOT road design standards, in particular, have been considered in the development of these Guidelines.

The Department of Rail and Public Transportation and the Virginia Department of Transportation

DRPT has as its core mission "*to improve the mobility of people and goods while expanding transportation choices in the Commonwealth.*" It works in concert with Virginia's other modal agencies to implement the Commonwealth's overall transportation vision and to ensure the safe and effective movement of people and goods throughout Virginia. These Guidelines help to implement DRPT's mission by increasing communication and coordination on the best practices for multimodal transportation planning with transportation planning professionals, decision makers and the general public. Through a diverse steering committee representing the many stakeholders involved in multimodal planning in Virginia, these Guidelines have been shaped and guided throughout their development to ensure that they fulfill this purpose of collaborative communication. In particular, as part of the development of these Guidelines, coordination with the Virginia Department of Transportation (VDOT) has been of critical importance since VDOT is the agency with primary oversight of Virginia's state maintained roadway corridors.

Figure 1 Norfolk, VA Virginia's established downtown areas can benefit from multimodal planning principles to enhance the safety, economic vitality and livability of their streets and public spaces.

A number of prior and ongoing studies by DRPT are related to, or provide important building blocks for the foundation of these Guidelines. For example, DRPT's Transit Service Design Guidelines provide a solid foundation for defining development levels supportive of transit that have been incorporated in these Guidelines. In addition, DRPT's Amtrak Station Area Plans provide real case studies of how TOD can work in Virginia, while the Statewide Transit and TDM Plan Update[3] and Super NoVa Transit and TDM Vision Plan[4] serve as important tie-ins with these Guidelines through similar methodologies for determining transit supportive place types.

Furthermore, VDOT's policies on context sensitive design and integrating bicycle and pedestrian accommodations have influenced new roadway design and construction projects to increase the safety and accessibility for pedestrians and bicyclists.

It is important to note that the standards used in the development of these Guidelines are not intended in any way to conflict with the standards used by any other modal agency in the Commonwealth, including VDOT road design standards. However, VDOT road design standards, in particular, have been considered in the development of these Guidelines. In general these Guidelines do not conflict with, but meet or exceed, VDOT road design standards.

[3] See: http://www.drpt.virginia.gov/activities/StatewidePlanUpdate.aspx
[4] See: http://www.drpt.virginia.gov/activities/supernovatransitstudy.aspx

Purpose of the Multimodal System Design Guidelines

The Multimodal System Design Guidelines are intended to address a need for a comprehensive resource for multimodal planning in Virginia. They address several emerging issues under this topic, as identified by the steering committee members and as summarized below.

Multimodal transportation planning in Virginia has greatly advanced in importance and application in recent years. In addition to the statewide policy priorities for multimodal coordination noted previously, there are a number of regional and local efforts that address multimodal planning throughout the Commonwealth. Besides the increased consideration of multimodal planning in Long-Range Transportation Plans by Metropolitan Planning Organizations (MPOs) throughout Virginia, some localities have begun developing detailed guidelines for multimodal corridors in their jurisdictions. These include the City of Roanoke's Street Design Guidelines[5] and Fairfax County's multimodal corridor vision for the Tysons Corner Urban Center.[6] As part of the development of the Guidelines in this document, a comprehensive literature search of similar efforts was conducted - both at the national level and in Virginia - and the results of this research have been compiled in an annotated bibliography in Appendix G.

As guided by the collective experience of the steering committee, these Guidelines are intended first and foremost as a collective resource – to serve as a common language and set of best practices that can be used to characterize effective multimodal planning in the Commonwealth.

Figure 2 - Gloucester, VA. Although multimodal planning is most often thought of in a dense urban context, even historic rural centers can benefit from enhanced walkability of their streets.

While each of these studies has unique needs and objectives, they all touch on a common set of design principles and concepts that are in frequent use within the professional transportation planning and design field. Principles of walkability, context sensitive street design, Transit Oriented Development (TOD) and Traditional Neighborhood Design (TND), for example, are used widely in most of these plans and studies. In fact, in 2012, VDOT developed the *Transportation Efficient Land Use and Design Guide*, a manual for localities that links transportation and land use with many of these same types of concepts.[7] However, while the concepts are in common circulation within the field, there is very little coordination of terminology and a lack of a common language for addressing multimodal planning more systematically. Moreover, quantitative standards for items such as typical densities needed to support transit technologies or sidewalk widths to promote walkability, which vary considerably, have been the focus of professional debate repeatedly. While it may be

[5] See: http://www.roanokeva.gov/85256a8d0062af37/CurrentBaseLink/03BF255E742B4368852578A8004765E5/$File/STREET_DESIGN_GUIDELINES.pdf
[6] See: http://www.fairfaxcounty.gov/dpz/comprehensiveplan/area2/tysons1.pdf and http://www.fairfaxcounty.gov/tysons/transportation/download/transportation_design_standards_attachment_d.pdf
[7] See: http://www.fairfaxcounty.gov/dpz/comprehensiveplan/area2/tysons1.pdf

counterproductive to attempt to standardize an inherently evolving dialogue among professionals, it is nevertheless helpful to have common guidelines that take the best of current design practices for multimodal places and corridors as a resource for transportation professionals. These Guidelines address this need in particular for the Virginia context. As guided by the collective experience of the steering committee, these Guidelines are intended first and foremost as a collective resource – to serve as a common language and set of best practices that can be used to characterize effective multimodal planning in the Commonwealth.

Mission and Goals of These Guidelines

During the regular meetings of the steering committee, an overall project mission and goals were developed to give direction to the development of the Guidelines document. Based on the ongoing steering committee feedback from the meetings, the following mission statement was developed as a benchmark and guiding direction for all elements of the Guidelines:

Mission of These Guidelines

The DRPT Multimodal System Design Guidelines will provide guidance on how to plan multimodal corridors, places and regions throughout the Commonwealth of Virginia. The purpose of the Guidelines is to establish common statewide principles and best practices for multimodal planning that can be used as a resource and model by local planners, engineers, designers, policy and decision makers, and anyone else engaged in multimodal planning throughout Virginia.

In addition, three basic goals for the project were established at the beginning of the process as a general direction.

Goals of These Guidelines

- Create a statewide resource for local planners, engineers, designers, policy and decision makers, and anyone else engaged in multimodal planning throughout Virginia.
- Identify integrated land use, transportation and urban design approaches to support multimodal mobility.
- Provide guidelines to help planners optimize transit investments and reduce reliance on single occupancy vehicles.

While this set of goals relates only to the purpose and need for a set of guidelines such as these, there are of course, wider goals that can be described for any multimodal planning effort, including these Guidelines. Rather than describe these as goals for the Guidelines, it was decided instead to describe them in the context of the benefits of multimodal transportation planning. Although the benefits of anything can be debated, below is a list of the benefits of multimodal planning and providing a multimodal transportation system that are commonly cited by the transportation industry.

Benefits of a Connected Multimodal Transportation System

1. Cost Efficient Use of Public Dollars
   a. Benefits more travelers with the same amount of money (move more people not vehicles)
   b. Optimizes use of existing facilities instead of building new ones

2. Energy Conservation
   a. Reduce emissions through less vehicle trips and shorter vehicle trips

The Mission of These Guidelines

The DRPT Multimodal System Design Guidelines will provide guidance on how to plan multimodal corridors, places and regions throughout the Commonwealth of Virginia. The purpose of the Guidelines is to establish common statewide principles and best practices for multimodal planning that can be used as a resource and model by local planners, engineers, designers, policy and decision makers, and anyone else engaged in multimodal planning throughout Virginia.

3. More Transportation Choices
    a. Eliminates constraints to using cars to get around
    b. Provides mode, time, location, and route choices
4. Mobility and Opportunity Equity
    a. Better meets basic transportation needs of populations with low incomes and disabilities
    b. Provides more opportunities for employment access, educational opportunities, health care, and social connectedness
5. Public Health[8]
    a. Makes a safer environment for walkers and cyclists – fewer crashes and lower fatality rates
    b. Promotes active lifestyles through more opportunities for walking and biking
    c. Provides more access to a wider range of healthy goods and services
6. Economic Vitality[9]
    a. Provides greater accessibility to existing and future workforces
    b. Attracts businesses through more multimodal transportation options for employees
    c. Increases property values by making places more accessible and livable
7. Reduced Congestion
    a. Gives more modal choices that in turn reduce overall roadway congestion
    b. Provides more alternate roads to take in case the usual route is blocked due to an accident
8. Quality of Life
    a. Designs streets as places to spur social interaction
    b. Generates pride in local neighborhoods and creates more "eyes on the street" to reduce crime
    c. Supports greater sense of community through more accessible places and corridors

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[8] Appendix F briefly describes the connections between transportation planning and public health and introduces Health Impact Assessments as a tool to better understand the potential impacts of transportation decisions on public health. The academic community has produced a wealth of research documenting the health benefits of walking and bicycling. Some notable resources include:

- Cavill, N. et. al. (2008)."Economic Analyses of Transport Infrastructure and Policies Including Health Effects Related to Cycling and Walking: A Systematic Review." *Transport Policy*. Vol. 15(5). Pp. 291-304.
- Litman, T. (2003). "Integrating Public Health Objectives in Transportation Decision-Making." *American Journal of Health Promotion*. Vol. 18(1). Pp. 103-108.
- National Conference of State Legislatures. (2010). *Promoting Health Communities and Preventing Childhood Obesity: Trends in Recent Legislation.*

[9] Resources on the economic development benefits of multimodal transportation investments:

- U.S. Environmental Protection Agency (2012). Smart Growth and Economic Success: *Benefits for Real Estate Developers, Investors, Businesses, and Local Governments*. <http://www.epa.gov/smart growth>.
- Litman, T.A. (2003). "Economic Value of Walkability." *Transportation Research Board*. Vol. 1828. Pp. 3-11.
- League of American Bicyclists. (2009). *The Economic Benefits of Bicycle Infrastructure Investments.* <http://www.bikeleague.org/resources/reports/pdfs/economic_benefits_bicycle_infrastructure_report.pdf>.

A Note on Sources

Although this project has included an extensive review of comparable studies and standards nationally, there are two primary source materials that were used extensively, particularly for the corridor design standards in these Guidelines. These are the guidebook jointly developed by the Institute of Transportation Engineers (ITE) and the Congress for New Urbanism (CNU) "Designing Walkable Urban Thoroughfares: A Context Sensitive Approach.[10]" and the VDOT Road Design Manual.[11] The first of these sources, the ITE/CNU Guidebook, is a commonly cited industry standard, particularly in the areas of context sensitive street standards and has a very comprehensive set of parameters for corridor design elements as well as a widely familiar typology of multimodal corridors (boulevard, avenue, street, etc.). The second of these sources, the VDOT Road Design Manual is an important set of standards for corridor design in Virginia, as it defines standards for the design of streets to be accepted into statewide maintenance.

In general and with some minor variations, the VDOT standards were used as the minimum standards recommended and ITE/CNU's parameters as the optimum design standards recommended for most corridor design elements.

In the Corridor Matrix that contains the corridor design standards in these Guidelines, both sources were used to establish optimal and minimum standards for the design of corridor elements such as bicycle facilities, sidewalk widths and travel lane widths. In general and with some minor variations, the VDOT Road Design standards were used as the minimum standards recommended and ITE/CNU's parameters as the optimal design standards recommended for most corridor design elements.

Figure 3 - Roanoke, VA. Decorative sidewalk paving not only enhances the pedestrian experience but can also connect visitors with local history.

[10] See: http://www.ite.org/bookstore/RP036.pdf
[11] See: http://www.extranet.vdot.state.va.us/locdes/Electronic%20Pubs/2005%20RDM/RoadDesignCoverVol.1.pdf

CHAPTER 2

The Multimodal System Plan - Building the Foundation for Multimodal Planning

This chapter lays out the basic foundation of multimodal planning upon which these Guidelines are built – The Multimodal System Plan. Multimodal System Plans are not a new concept. They can be done in a variety of forms, whether as part of a regional Long-Range Transportation planning project or as part of a city or county comprehensive transportation plan. A Multimodal System Plan is simply a comprehensive look at all the modal transportation networks in an area, whether auto, transit, bicycle or pedestrian, along with the key land use destinations and centers that they are connecting.

Multimodal considerations should be integrated into the development of a long-term transportation network, both in order to achieve greater diversity of travel choices and to improve the overall operation of the transportation system.

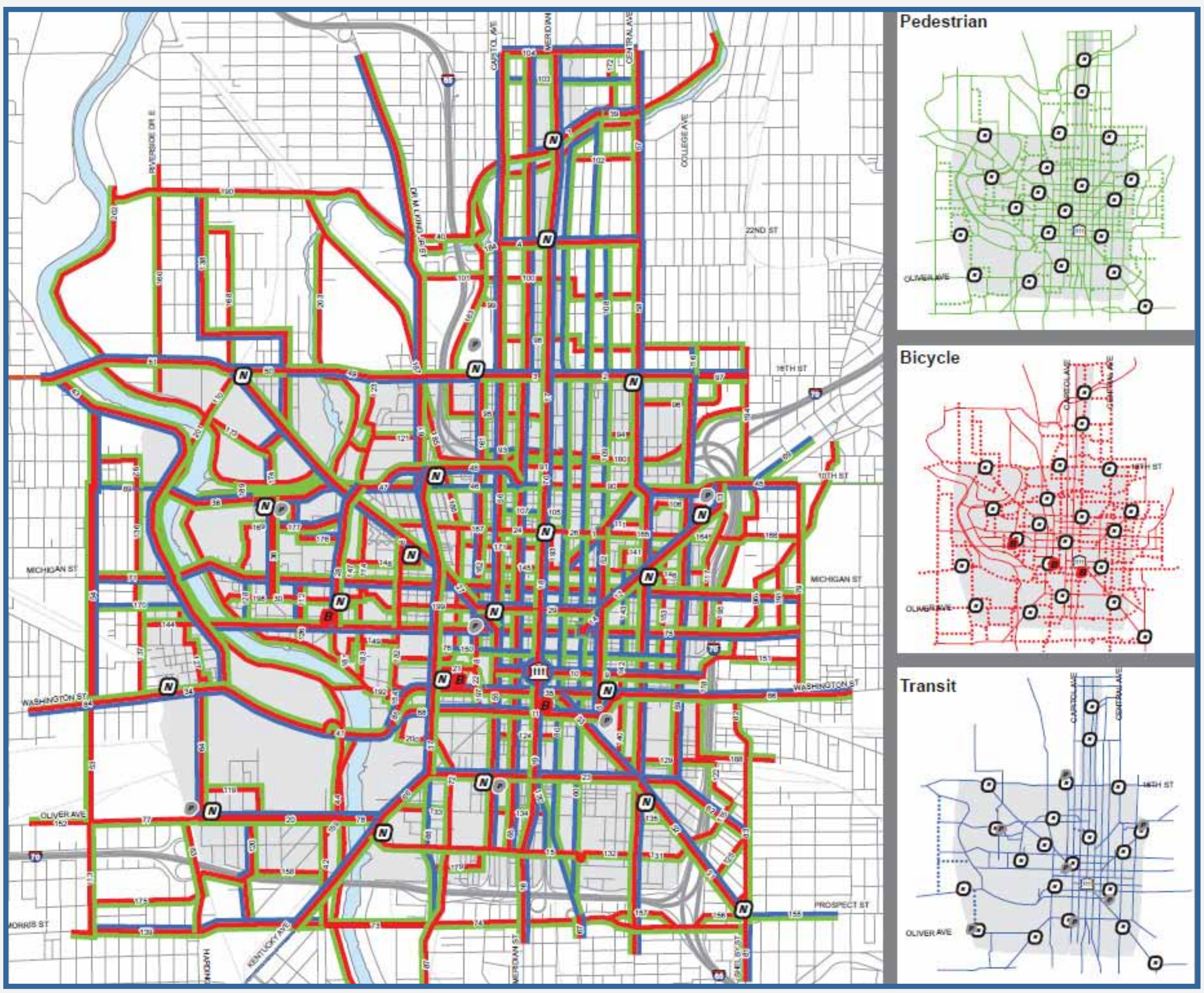


Figure 4 - Indianapolis MPO Multimodal Systems - March 2009. An example of the networks in a large region that shows the network connectivity for each travel mode – derived from the Regional Pedestrian Plan. Image source: Storrow Kinsella Associates

Key Concepts and Definitions Used in These Guidelines

What is a Multimodal System Plan?

A Multimodal System Plan is simply a comprehensive look at all the modal transportation networks in an area, whether auto, transit, freight or bike/ped, along with the key land use destinations and centers that they are connecting.

There are a number of basic concepts and terminologies used in these Guidelines. These concepts are all integral to the development of a Multimodal System Plan, and they are described below with sample illustrations.

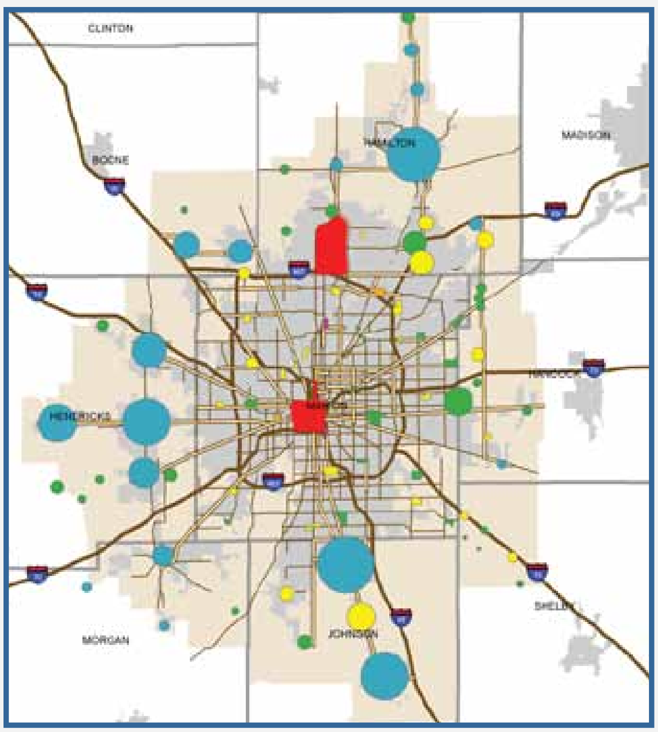


Figure 5 - The Indianapolis Region. Multimodal Districts and Multimodal Centers derived from the Regional Pedestrian Plan. Image source: Storrow Kinsella Associates

Figure 6 – The Indianapolis Downtown Multimodal District. A detail of the Multimodal System Plan for the Indianapolis Region showing Multimodal Corridor types in the downtown Multimodal District. Image source: Storrow Kinsella Associates

Multimodal System Plan

A Multimodal System Plan is an integrated land use and multimodal transportation plan that shows the key Multimodal Districts, Centers and Multimodal Corridors in a region and ensures that there is a connected circulation network for all travel modes. A Multimodal System Plan can either be done “from scratch” (without using any prior modal or land use plans), or more often by assembling all of the existing land use and transportation plans into a unified whole. In this latter case, the Multimodal System Plan neither establishes any new policies nor changes any existing policies – it merely assembles existing land use and transportation policies into a single unified plan.

Typically, developing a Multimodal System Plan is a mapping and analysis exercise and consists primarily in assembling the GIS layers from existing modal plans and land use plans so they are all integrated. However, as regions and localities in Virginia may use slightly different terminology and approaches to their land use and transportation planning, the Multimodal System Plan is also a way to assemble their existing plans into a standardized technical and graphic language for ease of communication with each other or with state agencies. In addition, the exercise of developing a Multimodal System Plan will quite often highlight any disconnects in a multimodal circulation network, such as potential gaps in a trail network or a need to connect the regional transit plan to the bike or pedestrian plan. The Multimodal System Plan is also an opportunity for the regional or local entity to address these disconnects by adding policies and actions to fix them in the future. Ideally, the Multimodal System Plan will show that all the multimodal networks in a region are part of a continuous and connected system of circulation that offers a diversity of travel choices. The diagram to the right shows the overlays that make up a Multimodal System Plan, and the methodology for developing it is described later in this chapter.

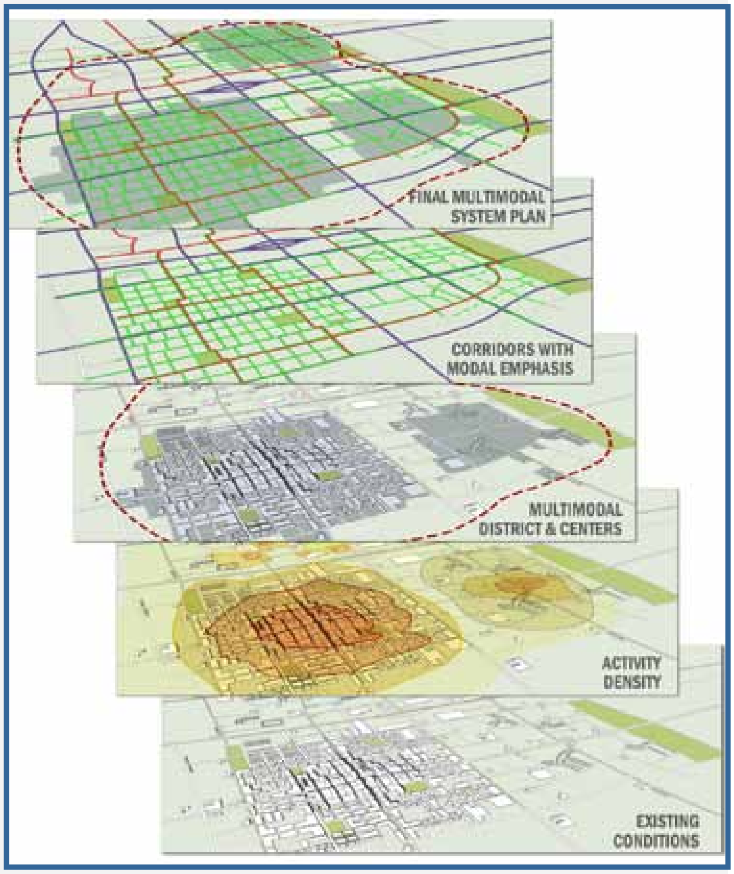


Figure 7 - Multimodal System Plan. Diagram showing the overlays of land use and transportation networks by mode that make up a Multimodal System Plan.

The exercise of developing a Multimodal System Plan will quite often highlight any disconnects in a multimodal circulation network, such as potential gaps in a trail network or a need to connect the regional transit plan to the bike or pedestrian plan.

Modal Emphasis

One of the most important concepts in these Guidelines is that of Modal Emphasis. Modal Emphasis is the designation of one or more travel modes that should be emphasized in the design of the cross-section for a corridor. It is important to note, however, that Modal Emphasis does not mean that other travel modes are excluded; other modes should still be accommodated in a Multimodal Corridor. For example, a corridor that passes through a dense urban downtown that is walkable, bikable and has extensive transit service could be designated with Modal Emphases of Pedestrian, Bicycle and Transit. By contrast, a corridor that carries a lot of high-speed auto traffic and premium commuter transit service but few bicyclists and pedestrians could be designated with only a Transit Modal Emphasis, but may still accommodate other modes in some fashion.

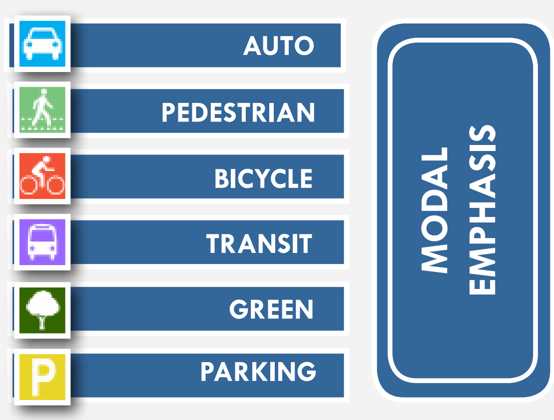
Modal Emphasis means that a travel mode may be emphasized on a corridor through certain design features but that other modes are still accommodated although not always in an optimal way depending on right-of-way or other constraints. Modal Emphasis is an important technique for looking at travel mode accommodation within a Multimodal System Plan, and it helps make it clear how continuous the circulation pattern is for each mode in a region. While there may occasionally be cases where some modes are excluded (as in a pedestrian only street, for example), the basic principle followed in these Guidelines is to accommodate all travel modes within a Multimodal Corridor.

The Modal Emphasis approach adopted in these Guidelines is a Complete Streets approach. It starts with the same principle of accommodating all modes from the Complete Streets perspective. It goes beyond this principle, however, in that it also allows certain modes to go beyond minimum accommodation and be optimized according to the Multimodal System Plan for the region or locality.

What is Modal Emphasis?

Modal Emphasis is the designation of travel mode or modes that should be emphasized in the design of the cross section for a corridor. For example, a corridor that passes through a dense urban downtown that is walkable, bikable and has extensive transit service could be designated with a Modal Emphasis of Pedestrian, Bicycle and Transit.

There are six Modal Emphases used in these Guidelines and corridors may carry any combination of these Modal Emphases:



It should be noted that two of the Modal Emphases – Green and Parking – are not travel modes per se. However, they are included in the consideration of Modal Emphasis because they have a significant impact on roadway cross-section design. For example, a Green Modal Emphasis roadway may need extra right-of-way width to allow for tree planting in the median or along sidewalks, and a roadway with Parking Modal Emphasis will need to accommodate on-street parking. It should also be noted that Auto Modal Emphasis is assumed on all corridors unless specifically excluded in rare cases such as a pedestrian-only street.

The Modal Emphasis chosen for a particular corridor should always come from its Modal Emphasis designation on the Multimodal System Plan. In fact, these Guidelines are intended always to refer roadway designers and engineers back to the Multimodal System Plan as the basis for deciding how to design any feature of a particular corridor.

Chapter 5 of these Guidelines discusses how Modal Emphasis is used at the corridor scale to design a multimodal cross-section for a roadway. This chapter describes how Modal Emphasis is used at the regional scale in the development of a Multimodal System Plan. It is important to understand, however, the critical linkage between these two scales in planning for multimodality.

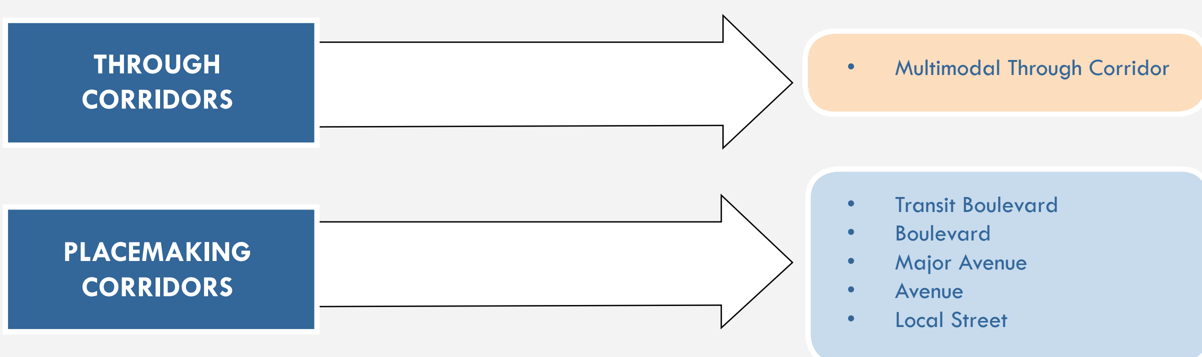
Multimodal Corridors

The prime goal of the Multimodal System Plan is to ensure a connected multimodal transportation network for an area. Multimodal Corridors are the building blocks for such a system that move people through a region. A Multimodal Corridor, as used in these Guidelines, is generally a roadway that accommodates multiple modes (or in special cases a trail or rail right-of-way) and includes all the area within the right-of-way, as well as the adjacent building context zone. As explained previously, a true multimodal transportation system is one where travelers of every mode have a connected network of corridors to move within and between destinations. Without first developing a Multimodal System Plan that identifies connected networks for each travel mode, the design of any individual corridor may lead to disconnected or underused facilities that fail to provide safe and convenient connections for pedestrians, bicyclists and transit riders.

These Guidelines introduce a typology of Multimodal Corridors that is based on overall characteristics such as their general function in a network, their surrounding context and their Modal Emphasis. Chapter 5 of these Guidelines explains how to design and retrofit corridors to best fulfill their multimodal function within the larger regional multimodal transportation system. There are six basic types of Multimodal Corridors used in these Guidelines, divided into two broad categories of corridors – Through Corridors and Placemaking Corridors, as detailed in Chapter 5.

What is a Multimodal Corridor?

A Multimodal Corridor, as used in these Guidelines, is generally a roadway that accommodates multiple modes and includes all of the area within the public right-of-way, as well as the adjacent building context zone.



Corridor Design

Without first developing a Multimodal System Plan that identifies connected networks for each travel mode, the design of any individual corridor may lead to disconnected or underused facilities that fail to provide safe and convenient connections for pedestrians, bicyclists, and transit riders.

Figure 8 - Typical Multimodal Through Corridor in Tallahassee, FL. Image source: Michael Baker, Inc.

What is a Multimodal District?

A Multimodal District is any portion of a city or region of any size that has good multimodal connectivity – either currently or proposed in the future.

Multimodal Districts and Multimodal Centers

An additional core concept used in these Guidelines is that of Multimodal Districts and Multimodal Centers. A Multimodal District is any portion of a city or region of any size that has good multimodal connectivity – either currently or proposed in the future. Multimodal connectivity in this context means the relative ease of making trips without needing access to a car, and can be gauged by the number of bus routes available, and safe walking or biking paths. In addition Multimodal Districts have land use characteristics that support multimodal travel, such as higher densities and mixed uses.

Much of the developed portions of Richmond, Norfolk, or Alexandria, for example can be considered as a series of Multimodal Districts. Multimodal Districts can be quite extensive, and because of their size, they can be further broken down into specific Multimodal Centers.

Unlike Multimodal Districts, Multimodal Centers are much smaller areas of even higher multimodal connectivity and more intense activity, roughly equivalent to a 10-minute walk-shed, which can be approximated by a one-mile diameter circle. This 10-minute walk-shed is a general rule of thumb in planning practice for the maximum area that people will practically walk to in the course of daily

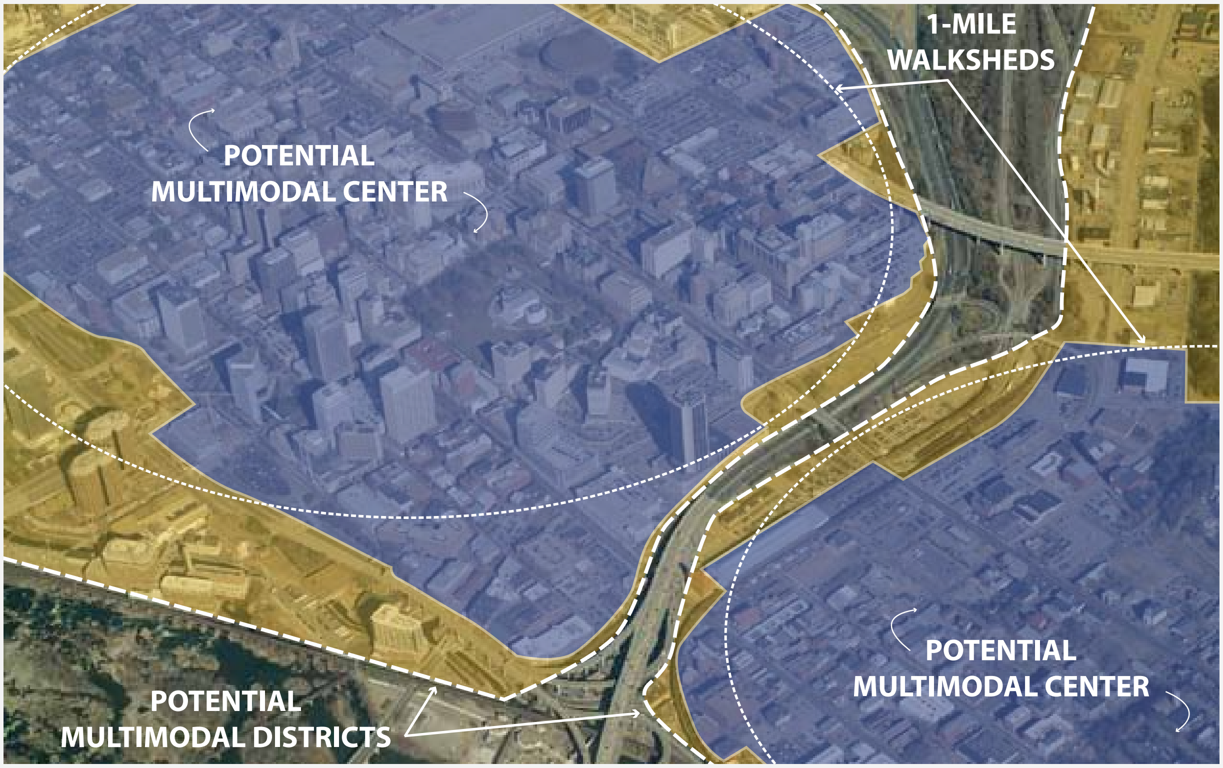


Figure 9 - Aerial view of Richmond. Potential Multimodal Districts and Centers illustrated in Downtown Richmond

activities, although Multimodal Center boundaries in practice may vary from this shape, in order to conform to existing walkable districts or to avoid barriers such as rivers or high speed highways. Multimodal Districts can be quite large – for example, large sections of a city can be defined as Multimodal Districts. However, Multimodal Centers are much smaller areas defined by a walk-shed that can serve as a primary focus for providing more multimodal connectivity and higher density development. Multimodal Centers are also often centered on a key local destination, such as a transit stop or key intersection within a downtown that is also a local center of development intensity, population and/or employment. There are seven types of Multimodal Centers used in these Guidelines, ranging on a scale from dense urban to low intensity rural centers:

P-6	Urban Core
P-5	Urban Center
P-4	Large Town or Suburban Center
P-3	Medium Town or Suburban Center
P-2	Small Town or Suburban Center
P-1	Rural or Village Center
SP	Special Purpose Center

These Multimodal Center types are further explained and illustrated in Chapter 3 of these Guidelines. Designating Multimodal Districts and Multimodal Centers in a region helps to identify priority locations for focusing multimodal connectivity improvements where they can potentially create the most public benefit.

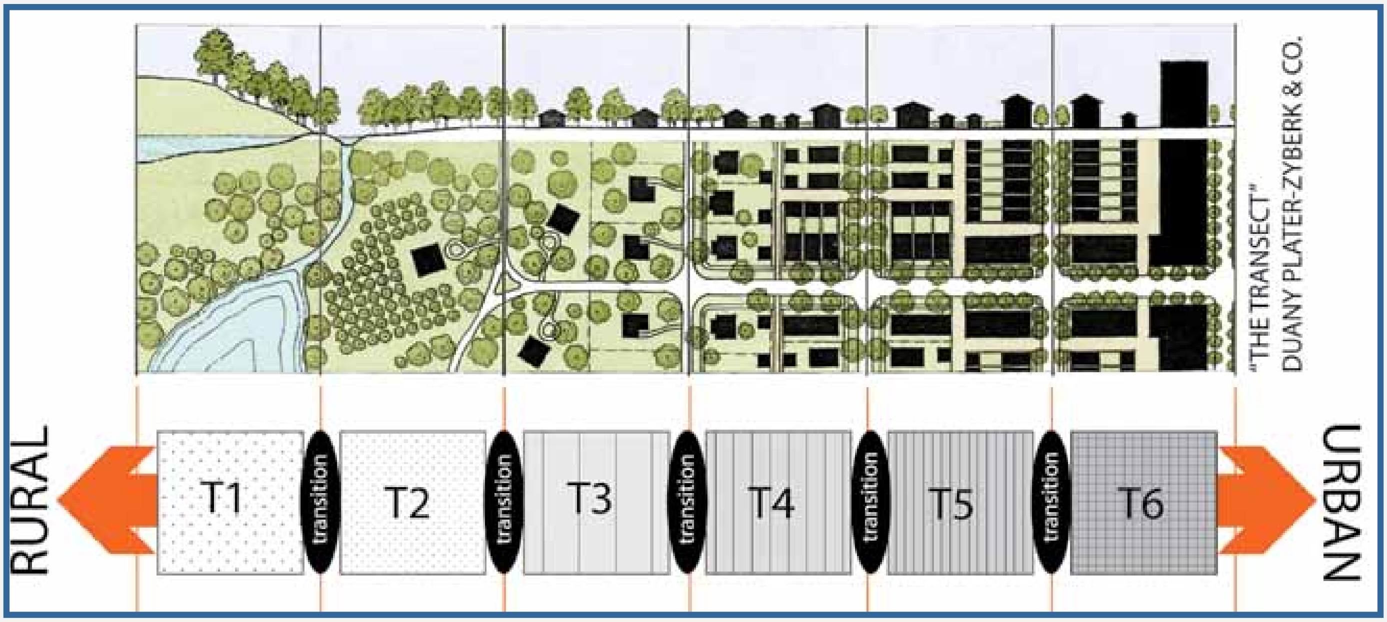


Figure 10 - The Transect Diagram. The Transect describes the range of natural and built environments across a spectrum of density. Places can be classified into one of the six different Transect Zones or "T-Zones" depending on the density or intensity of the land uses in an area.

The Transect and Activity Density

The final core concepts used in these Guidelines are those of the Transect and Activity Density. Activity Density is simply a way to combine the density of existing or future population and jobs in an area to allow them to be classified more simply. Activity Density for an area is the sum of people and jobs in the area divided by the acreage, yielding a total density of jobs plus people per acre. The Transect is a relatively common way of describing density and intensity of development in the urban planning profession.

The Transect is a way to describe the range of natural and built environments from the countryside to the center of the city as a set of bands of uniform density called Transect Zones or "T-Zones". Each T-Zone defines a consistent scale of density and intensity of development and the whole complement of streets, buildings and open space that goes along with that level of intensity. In Chapter 3 of these Guidelines, a standard table of T-Zone densities is defined for all of Virginia using Activity Densities. This table of Transect Zone densities and typical characteristics was developed through an analysis of real Virginia places, ranging from large urban downtowns to rural village centers. Throughout these Guidelines, this system of Transect densities has been used to define the types and surrounding contexts of both Multimodal Centers and Multimodal Corridors. The Activity Densities for each Transect Zone can reflect either existing or future densities, although typically future, planned densities should be considered in the development of a Multimodal System Plan.

The Transect

Throughout these Guidelines, this system of Transect densities has been used to define the types and surrounding contexts of both Multimodal Centers and Corridors.

Overview of the Multimodal System Plan

The previous sections of this chapter introduced the key concepts and definitions used in these Guidelines. As noted, all of these concepts are integral to the development of a Multimodal System Plan, which is the basic foundation for the whole planning methodology used in these Guidelines. The following is an outline of how to develop a Multimodal System Plan at a regional scale. The methodology is described through a case study of a hypothetical region in Virginia. The case study represents a range of land use contexts, from rural to urban, and can serve as a sample of conditions found statewide as an introduction on how to develop a Multimodal System Plan.

As mentioned previously, the goal of a Multimodal System Plan approach is to link together prime destinations and areas of activity in a region in order to make both the places and their connections safer, more accessible and provide a wider array of travel choices for the population. There are a few basic steps in designing a Multimodal System Plan that incorporate all of the separate aspects of these Guidelines – Multimodal Corridors, Multimodal Centers, and Modal Emphasis - into a unified whole. The process chart in Figure 11 shows the general approach for developing a Multimodal System Plan.

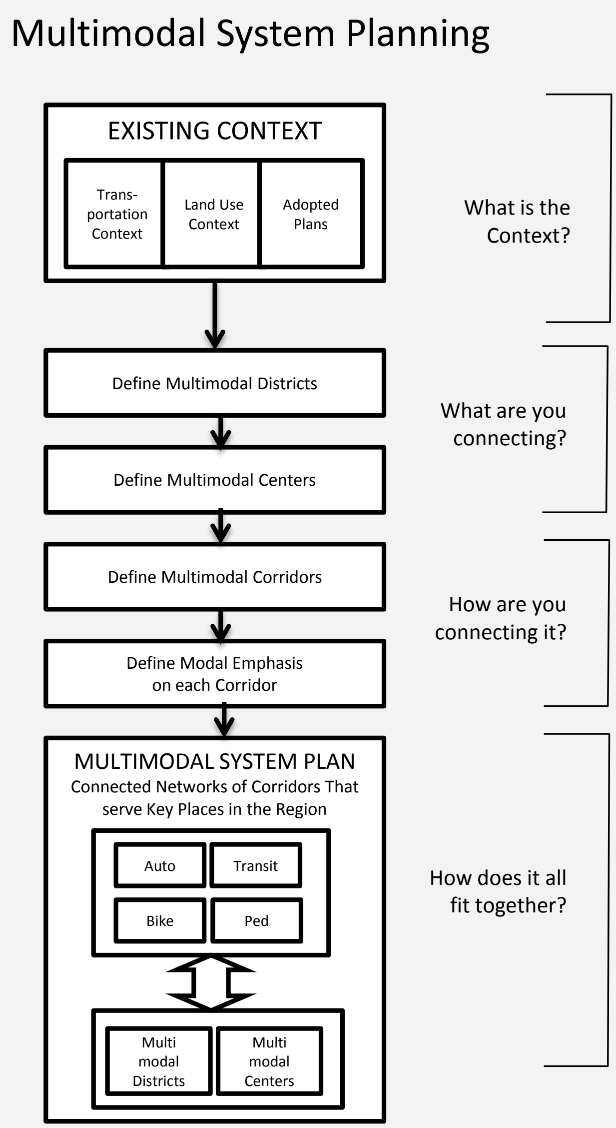


Figure 11 - The Recommended Planning Process for a Multimodal System Plan.

Step 1 – Ensuring Public Engagement and Ongoing Input

A Multimodal System Plan is ultimately designed for the public, and as such, should reflect the perceptions, opinions, and concerns of the public served by the plan. The public should be factored into the creation of the plan, and the plan should clearly address existing issues that have been identified by the public, policy makers, and leaders in the area. Key destinations in a region should be identified through a public process as well as by measurable analysis, and destinations such as schools, universities, hospitals, and job centers can play a key role in the designation of Multimodal Districts, due to their land use and high transit, pedestrian, and bicycle potential.

Effective public involvement tools that can be used to tie the public in during the development of a Multimodal System Plan can include community surveys, place-making field trips, sidewalk inventories and assessments, and focus groups. As with any public planning process, the first steps should involve broadly engaging the public and stakeholders in a project and maintaining that involvement through the analysis, visioning, and design and planning phases. While this document is not intended to address the whole public involvement process or the general details of the planning process for a regional transportation plan, some points to keep in mind in the initial stages of project initiation include:

- Early and continual involvement of the public and stakeholders in the project in meaningful ways through interactive meetings, and various traditional and innovative means to get continual input
- Active outreach to stakeholders, particularly including people who travel by modes other than or in addition to personal vehicles – ensuring participation by so called "choice" and "dependent" populations for each travel mode, as well as outreach to minority and underserved populations.
- Equal outreach to, and representation of, all stakeholders in the planning process.
- Clear information and education about the agency and jurisdictional roles and constraints within the process, including funding constraints, legal constraints, and obligations.

Figure 12 - Public Process. Public Involvement for multimodal planning can often involve workshops with interactive exercises and activities.

- A clear picture of the regional trends for growth and land use change in the planning time horizon.
- The current and future relationships between land uses and the transportation system.
- Anticipated travel trends and growth of travel by various modes.
- The key areas of activity and destinations in the region that serve as focal points for future growth or existing activity and prime locations for generating multimodal trips, either now or in the future.
- The role of thoroughfares in the network and their current and anticipated future Modal Emphasis.

Step 2 – Analyzing Existing and Future Population and Employment

The analysis phase of a Multimodal System Plan can be quite complex and involve a variety of transportation, land use, safety, economic, demographic, and many other types of data collection. The particular aspects of this data collection and analysis from a multimodal perspective include elements such as:

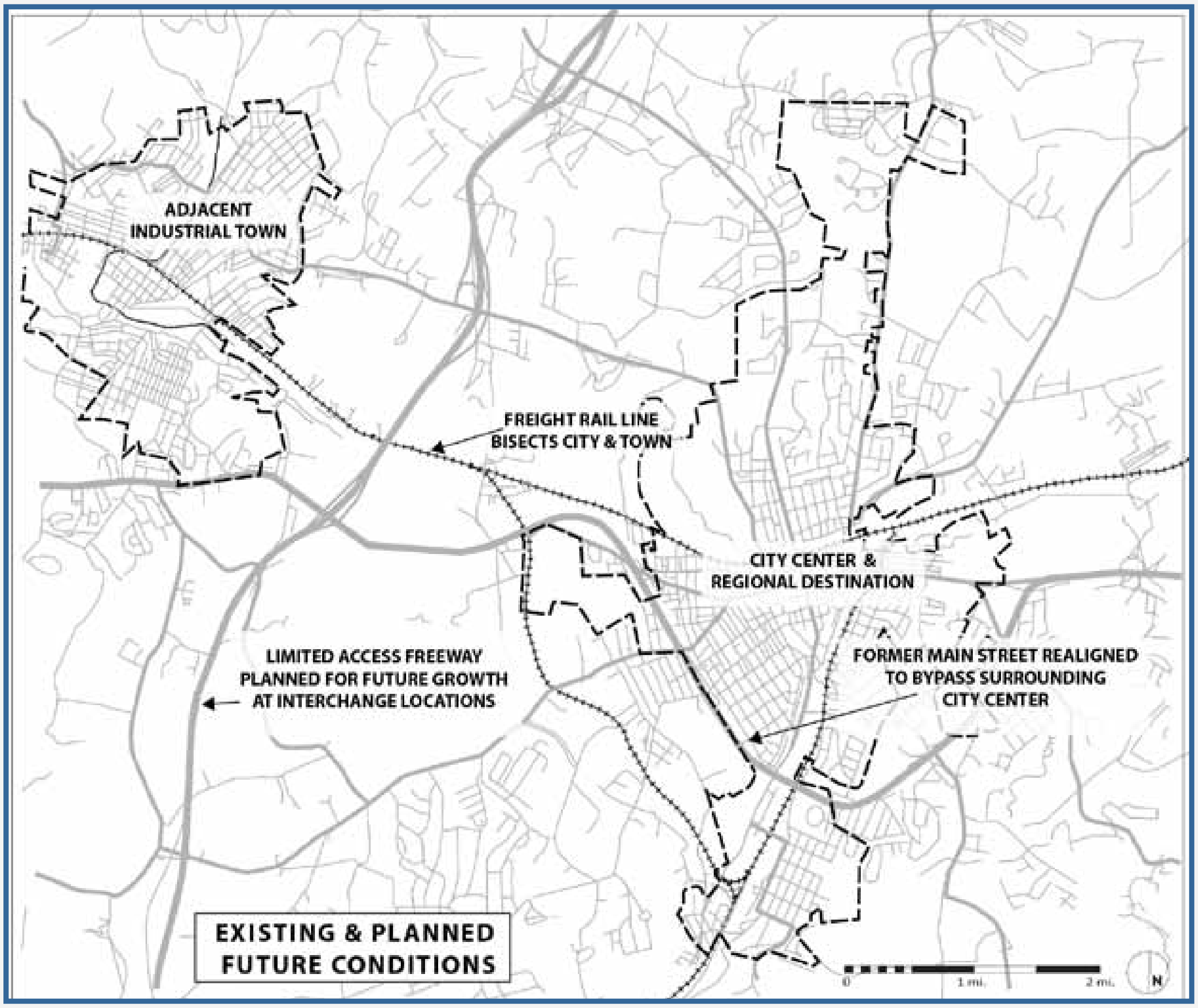


Figure 13 - Hypothetical Region Map. A hypothetical region showing a historic city center, surrounding suburban and rural areas and an adjacent industrial town.

From this type of data, a picture can be assembled of the future patterns of transportation and land use in the region. This is the core information needed to build a Multimodal System Plan, so that future networks can be designed to better accommodate all users and modes in a region in a connected manner. A series of maps in Figures 13 through 20 show a simplified analysis of the broad land use and transportation systems for a hypothetical region. An actual planning process would involve many more steps and varieties of data than is shown in these graphics, but the sequence of illustrations shows a basic analysis of the existing and future land use intensity and the future networks by travel mode.

Once the data for a region is assembled, one of the key analyses that should be performed is mapping the pattern of existing and anticipated future regional population and employment density and intensity. The data for this analysis typically comes from several sources, including local comprehensive plans and prior regional plans and studies, population and employment projections[12] and recently approved or proposed development projects.

[12] In Virginia, standard population projections are done by the Virginia Employment Commission for cities and counties. Employment projections can be estimated using several private sources, such as Woods and Poole and ESRI Business Data.

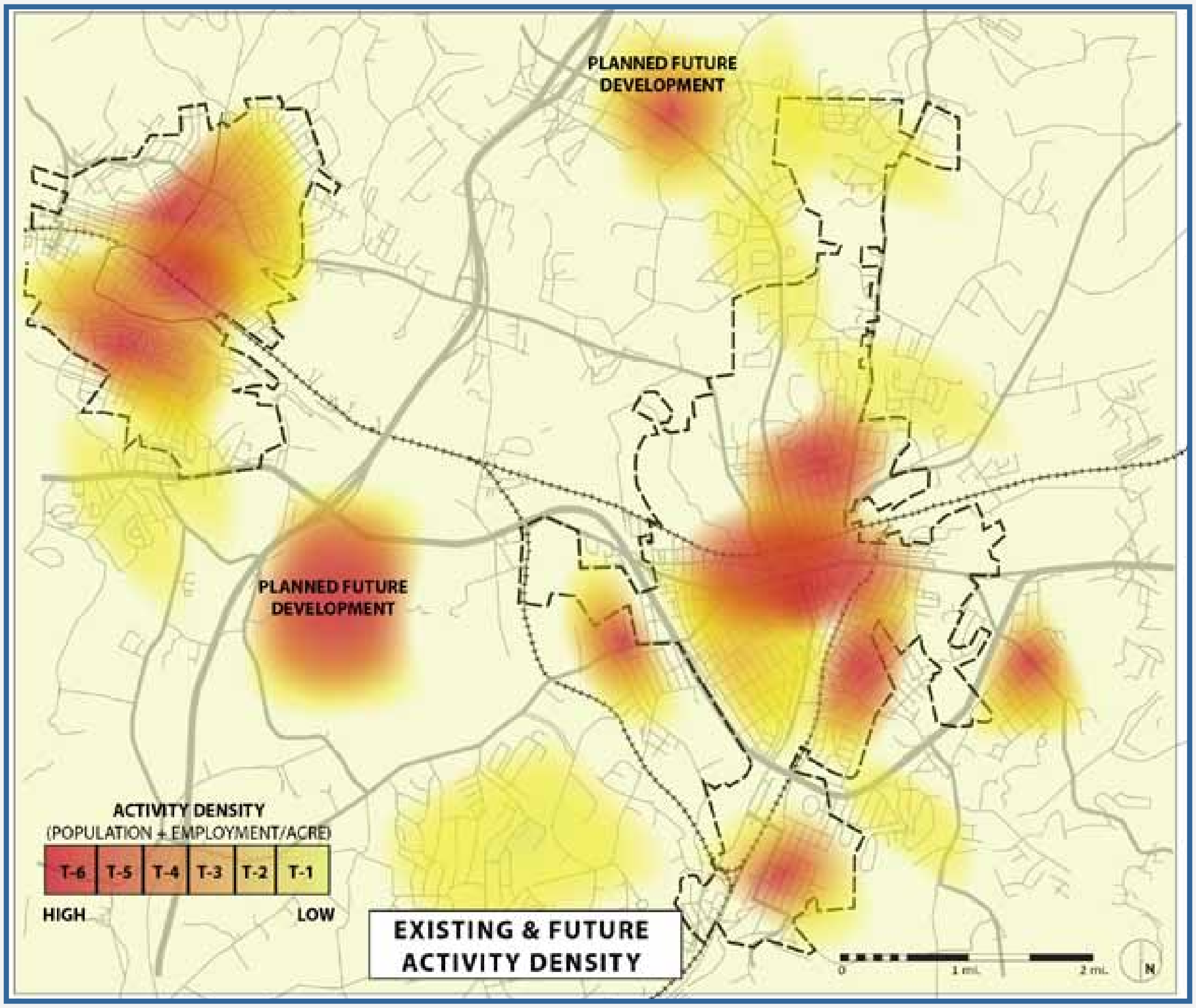


Figure 14 - Existing and Future Activity Density. This map shows a simple "heat map" of the relative density of jobs and population in the region.

Figure 14 shows the first step in this analysis – to summarize existing and future population and employment density in terms of a simple gradient of Activity Densities using the Transect Zones. Chapter 3 describes the specific metrics of Activity Density by Transect Zone in greater detail. Note that Figure 14 combines population and employment as total Activity Density. This is useful for very general and large scale transportation planning purposes as it aggregates any kind of trip-generating activity into a single measure. Note also that future Activity Density is included in the analysis along with existing Activity Density. Projections for future population and employment are usually available in a locality's comprehensive plan or future land use plan and it is important to include these in any type of analysis for a Multimodal System Plan.

Step 3 – Designating Multimodal Districts and Centers

The analysis from Step 2 will yield a very broad picture of existing and future population and employment in a region. The next step in building a Multimodal System Plan is to take the already identified future growth pattern and use it to designate potential Multimodal Districts based on both existing and future development. Multimodal Districts are generally broad swaths of land area designated by a locality or region to have at least a moderate level of multimodal connectivity[13], either now or in the future. Multimodal Districts are typically areas having moderate to high Activity Density, and they may overlap with areas defined by local policy documents as urban growth boundaries, service districts, mixed use neighborhoods, etc. As shown in Figure 16, areas with the highest Activity Density form the basis for the Multimodal Districts in the hypothetical example (areas outlined with dashed red lines). However, the designation of Multimodal Districts should look beyond just Activity Density and also take into account those areas that have or will have in the future a combination of high density, good travel options and well-connected street grids.[14] These factors are also important to consider when defining those areas of the region that should form part of an interconnected system of Multimodal Districts in the future.

In cases where a detailed plan of existing and future growth areas is lacking, an approximation of existing and future growth can be made based on existing population and employment data and on the combined comprehensive plans in all the localities in the region. In most cases, however, the MPO or Planning District Commission (PDC) will have compiled local land use projections and will have a summary of future growth, based on policy designations in local comprehensive plans, that can be used as the basis for determining potential Multimodal Districts. From this basic framework of Multimodal Districts, a series of Multimodal Centers can be developed within each Multimodal District, based on walkable neighborhoods and transit linkages.

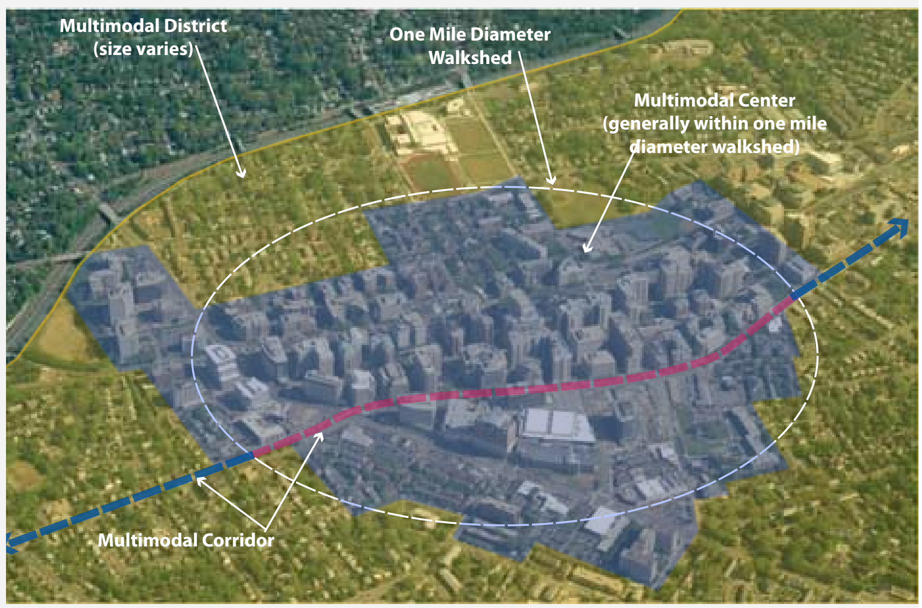


Figure 15 - The Difference between Multimodal Districts and Centers as illustrated in Ballston, Virginia

[13] Multimodal connectivity describes the relative ease of making trips without needing access to a car, and can be gauged by the number of transit options available, and safe walking or biking paths. Areas with low multimodal connectivity have very few if any transit options, may lack connected sidewalks, crosswalks, and facilities for bicyclists, and are typically auto-oriented. In areas with moderate or high multimodal connectivity, multimodal transportation options may exist, but there may still be some gaps, and some trips may require a car.

[14] The ITE/CNU Guidebook Designing Walkable Urban Thoroughfares: A Context Sensitive Approach explains the concept of network connectivity and provides various indices and targets for desirable connectivity (see Chapter 3 in the ITE/CNU Guidebook).

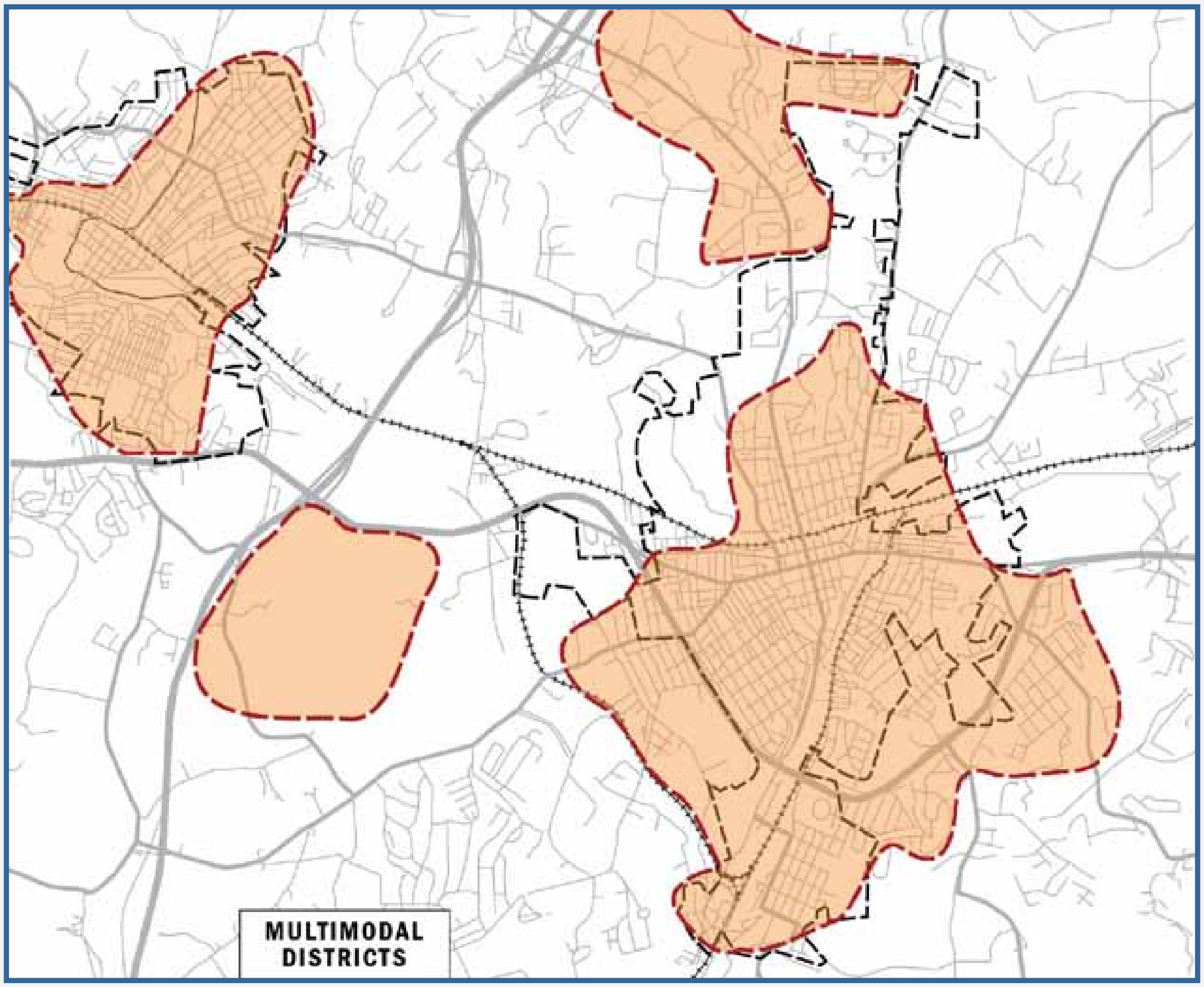


Figure 16 - Potential Multimodal Districts. Map showing areas that are identified as future Multimodal Districts based on their high activity density and good potential multimodal connectivity - either existing or planned.

Step 4 – Designating Multimodal Centers

The next step in the planning process is to look closer at each Multimodal District and define the future Multimodal Centers. Whereas a Multimodal District can be defined as the broader areas having, either now or in the future, a moderate level of multimodal connectivity with good multimodal characteristics such as high density and a closely spaced walkable street network, a Multimodal Center is a smaller area of high multimodal connectivity and more intense activity, roughly equivalent to a 10-minute walk-shed, which can be approximated by a one-mile diameter circle. This 10-minute walk-shed forms the nucleus for activities and destinations within easy walking distance. It is this close proximity of destinations and lack of barriers (such as rivers or high speed highways) that makes walking a viable form of transportation for most trips, and is thus supported by high levels of multimodal connectivity. Multimodal Districts can be quite large – for example, large sections of a city can be defined as Multimodal Districts. However, Multimodal Centers are much smaller areas centered around a walk-shed that can serve as a primary focus for providing more multimodal connections and higher density development.

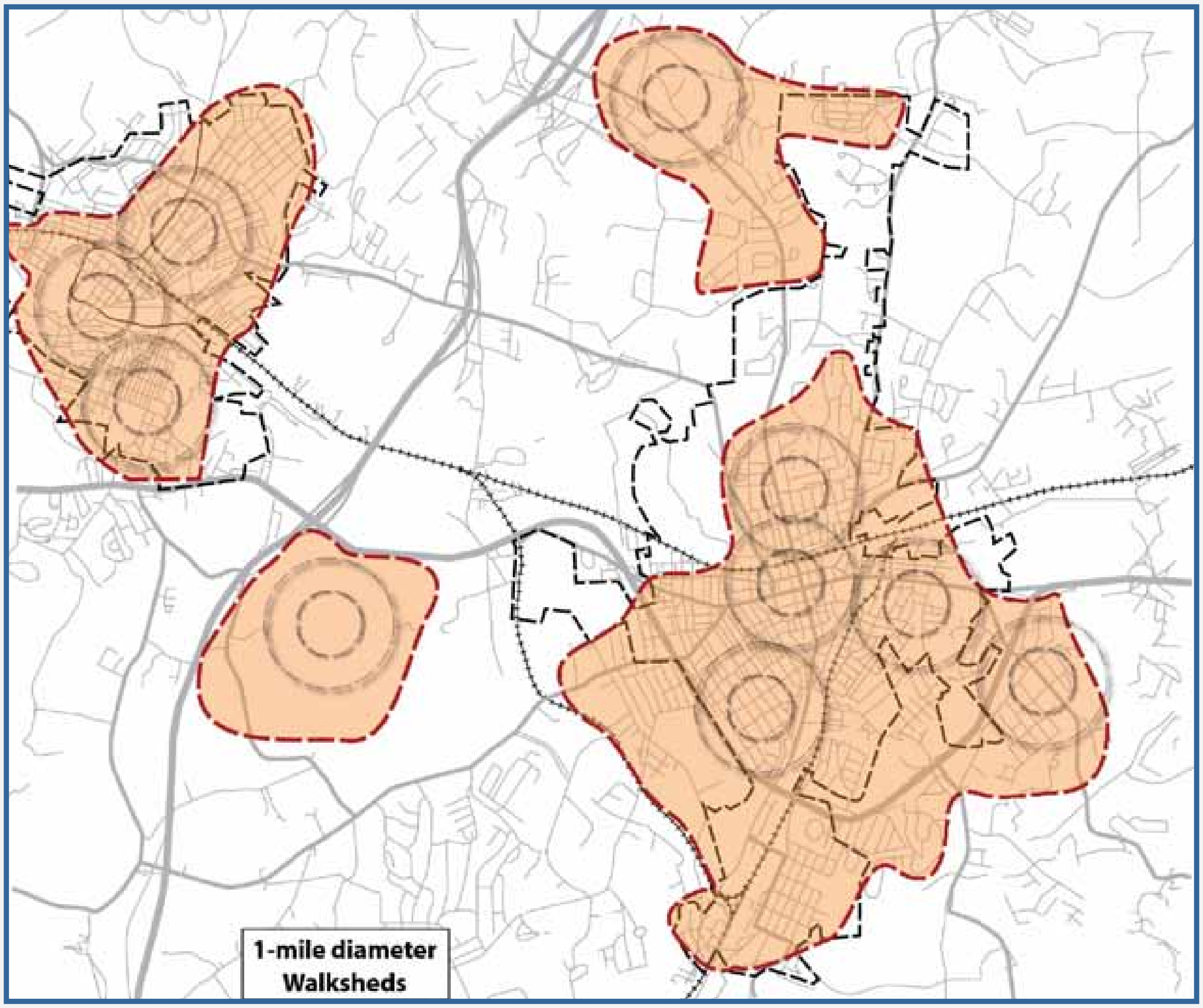


Figure 17 - One Mile Walksheds within each Multimodal District. Multimodal Centers are smaller areas within each Multimodal District that are generally described within a one mile walkshed.

As shown in Figure 17, the one-mile diameter circles are used to approximate the locations of potential Multimodal Centers within each Multimodal District. Then, in Figure 18, these one-mile circles are morphed into more organic-looking shapes as they are modified by natural or man-made barriers, or by parcel-level designation on local governments' future land use maps and zoning codes. Despite these modifications, the organic-looking shapes of Multimodal Centers should roughly retain the general scale of the one-mile walk-shed. This translation is discussed in more detail in Chapter 7.

The specific types of Multimodal Centers and their characteristics will be discussed in Chapter 3 and will also be used to determine the Multimodal Corridor types in the detailed design of corridors. Figure 18 does not show how the Multimodal Centers in this hypothetical region can be classified based on the typology of Multimodal Centers used in these Guidelines. The designation of these types of Multimodal Centers, however, is discussed in more detail in Chapter 3.

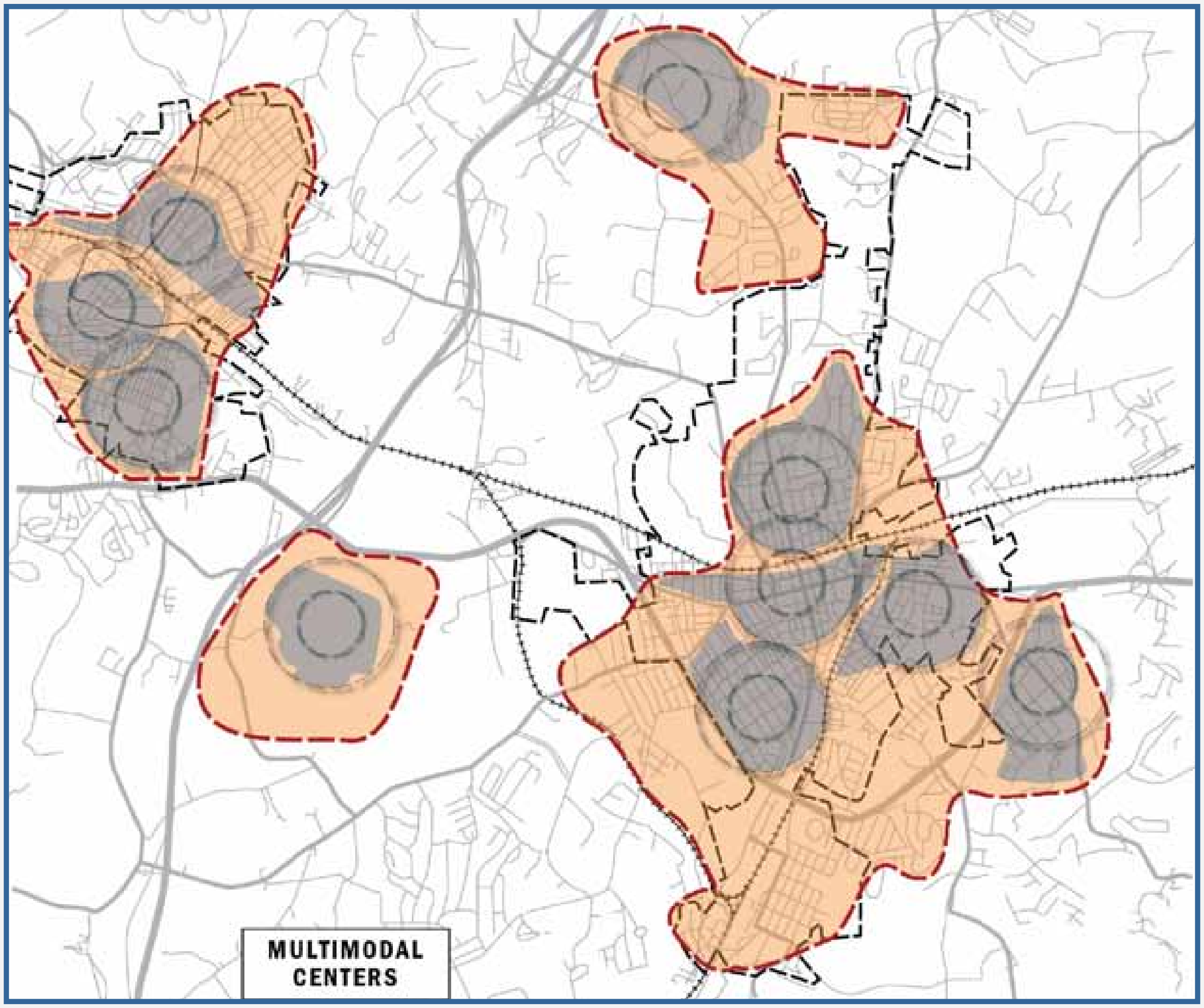


Figure 18 - Multimodal Centers within each Multimodal District. Multimodal Centers are areas of highest multimodal connectivity and have a mix of uses and close proximity of destinations such that most trips can be made by walking. Multimodal Centers are designated roughly according to one-mile diameter circles, but morphed to fit actual conditions and barriers to connectivity such as rivers or high speed highways.

Step 5 – Designating Multimodal Corridors

The previous steps established the basic designation of Multimodal Districts and Multimodal Centers in the Multimodal System Plan. These are the key areas that need moderate and high levels of multimodal connectivity within the region's transportation system. The next step in the analysis is to look at existing and future transportation networks in the region. The series of maps in Figure 19 shows the primary transportation networks for the region by mode, including transit, bicycle, and pedestrian (auto mode is assumed on all networks in this case) – these maps serve as the basis for determining the Modal Emphasis of each corridor. Each of these modal networks is shown on a separate map along with the Multimodal Centers for reference.

These modal networks represent the long-range proposed networks, and not just the existing networks. Ideally, localities or regions have already identified these networks either through their comprehensive planning process, or through specific modal plans, such as a Regional Pedestrian Plan, a Regional Bicycle or Greenway Trails Plan, and a Regional Transit Plan or Transit Development Plan (TDP). If localities have not developed similar plans, the Multimodal System Planning Process is an opportunity to identify which corridors could provide the best connections for each travel mode to the various destinations throughout a region.

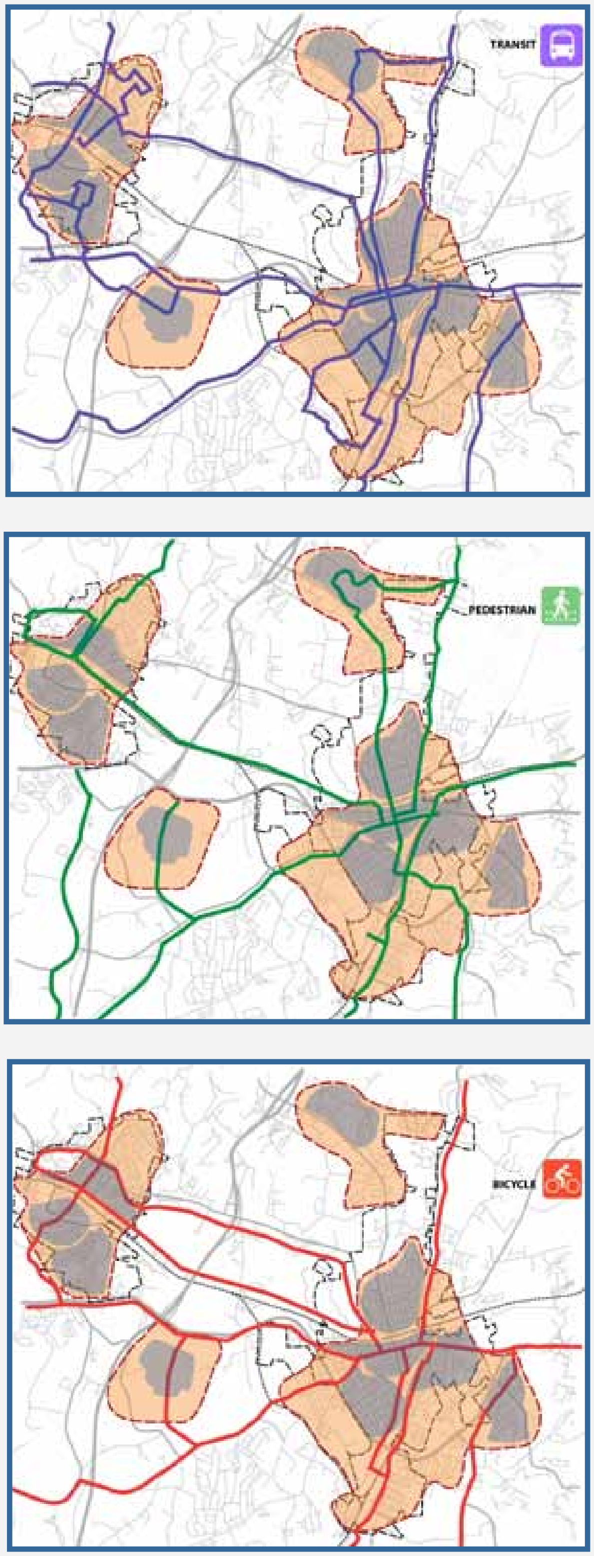


Figure 19 - Modal Networks. These maps show the networks for each mode – Transit, Pedestrian, and Bicycle.

After assembling the mapping of all the modal networks, it is important to look for any gaps or discontinuity in each network, as well as to look for opportunities to connect the gaps in the networks in order to develop more connected circulation systems in the region. These gaps can be identified and addressed as part of the process of developing a Multimodal System Plan.

These Multimodal Corridors and modal networks represent the heart of the Multimodal System Plan. However, there are other critical components of a truly multimodal regional transportation system that are not addressed in great detail in these Guidelines. High-Occupancy Vehicle (HOV) facilities in major metropolitan areas are also important to encourage people to travel by modes other than driving alone. Connectivity is crucial in a HOV network. Providing direct connections to high capacity transit, such as HOV-only ramps to park-and-ride facilities for Metrorail further encourages residents to use transit for daily transportation needs. Taxicabs also provide a critical link in the multimodal system, especially at train, bus, and light rail transit stations, and have the potential to partner with transit agencies to provide human services transportation. In addition, providing access for non-auto modes and for transit to water-based transportation facilities is essential for linking destinations in tidal areas like Hampton Roads.

The next step in the transportation analysis is to assemble all of the modal networks onto one map, to show the interaction of each network as part of a whole multimodal system. Figure 20 shows all of the modal networks from Figure 19 overlaid onto one map, along with the Multimodal Centers.

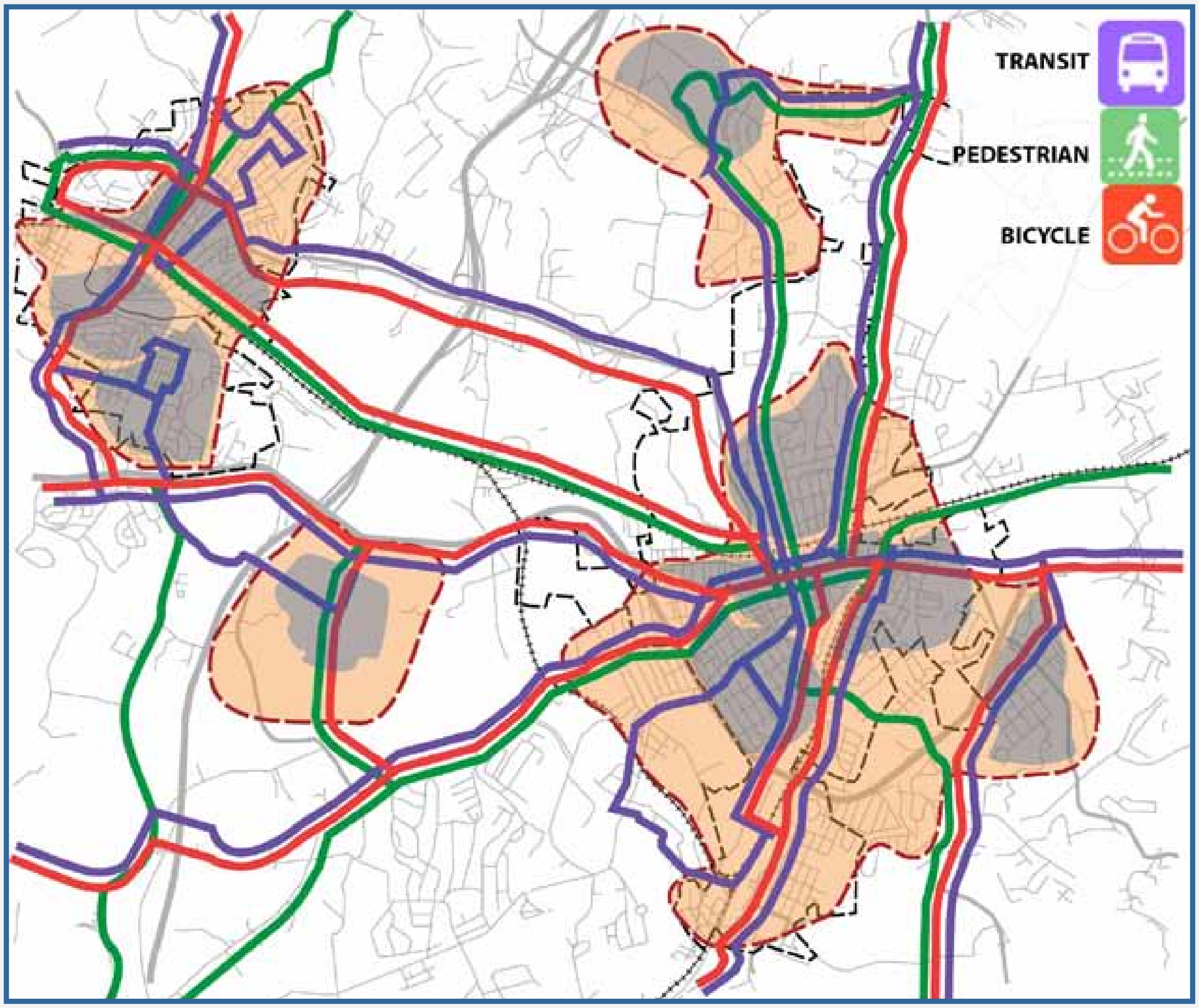


Figure 20 - Multimodal Corridors with Modal Emphasis. The modal networks have been assembled onto one map and define the Modal Emphasis for each corridor.

By assembling all the modal networks onto one map, the Modal Emphasis for each of the major corridors has been identified.[15] It should be remembered, however, that Modal Emphasis only defines the modes that are given particular emphasis in the design of a cross section – each Multimodal Corridor can still accommodate all modes regardless of its Modal Emphasis. Figure 20 identifies each corridor's Modal Emphases. It does not, however, identify the Multimodal Corridor Types. More discussion of the Multimodal Corridor typology and designations is in Chapter 5 of these Guidelines.

Step 6 – The Final Multimodal System Plan

The final step in developing a Multimodal System Plan is to now put everything together on a single map. The Multimodal System Plan should show the Multimodal Centers by type, the Multimodal Corridors by type and the Modal Emphasis for each corridor. As this is a complicated map for a whole region, Figure 21 shows a detail of what this would look like in one of the Multimodal Centers. It shows several Multimodal Through Corridors and a Major Avenue serving a Multimodal Center. As mentioned,

[15] Note that Green and Parking Modal Emphasis is not designated at this scale. These Modal Emphases are typically designated at a closer scale, either through a small area plan for a Multimodal District or Multimodal Center, or incorporated in the corridor design phase. In addition, more detailed pedestrian and bicycle Modal Emphases for local streets are not shown at this scale but should be shown in a more detailed scale of Multimodal System Plan.

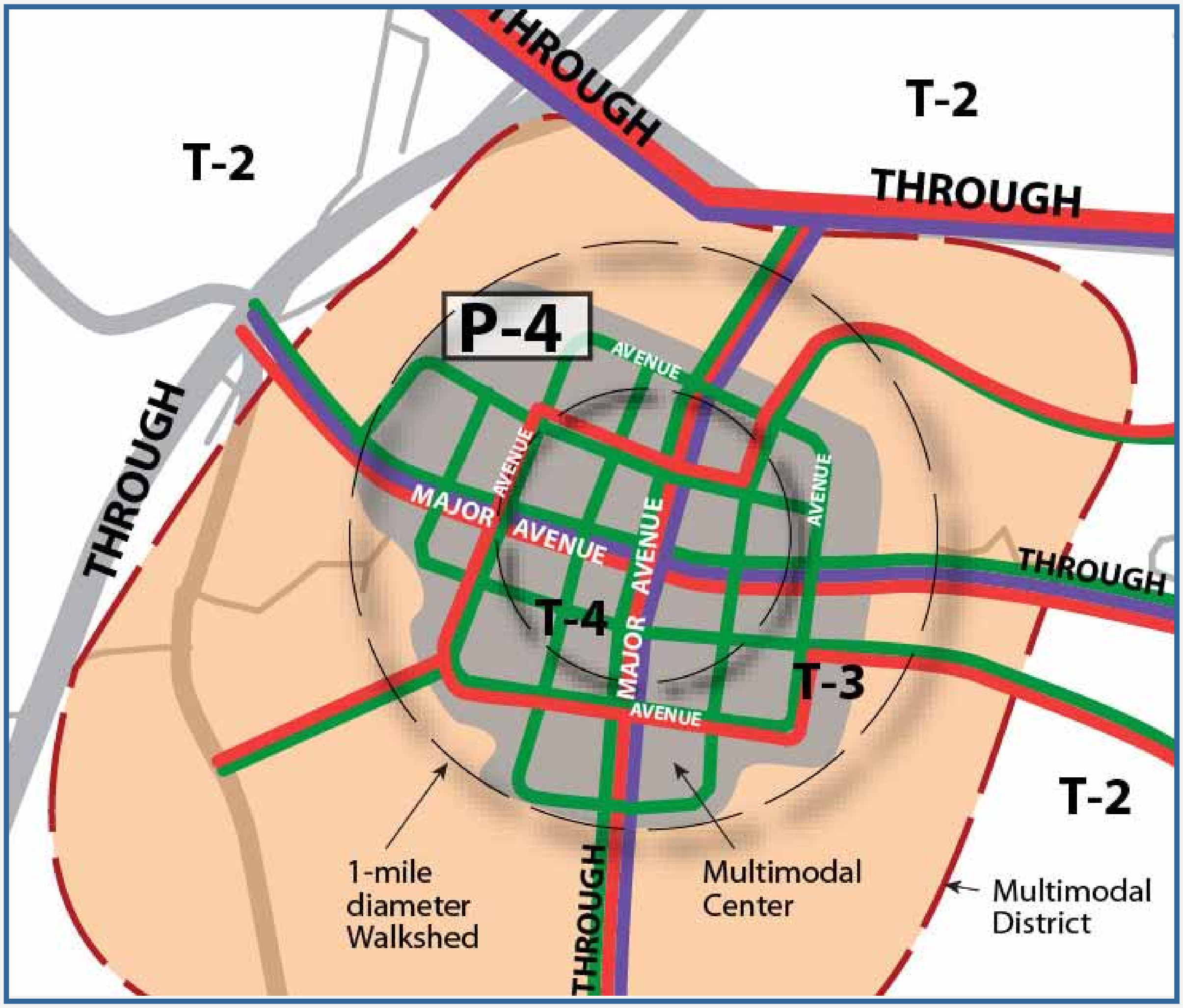


Figure 21- Detail of a Final Multimodal System Plan. This map shows how a Multimodal Center and Multimodal Corridors are designated according to the Multimodal Center types and Multimodal Corridor types described in Chapters 3 and 5 of these Guidelines.

a more detailed explanation of the typologies of Multimodal Centers and Multimodal Corridors is given in Chapters 3 and 5 of these Guidelines.

The designation of Multimodal Corridors and Modal Emphasis through the Multimodal System planning process is not a substitute for developing more detailed modal plans. Regional bicycle plans, for example, often specify which particular types of facilities (on-road bike lanes, off-road paved trails, etc.) would be best for each corridor. Similarly, transit development plans often require in-depth studies on separate right-of-way configurations and anticipated funding sources. The designation of Multimodal Corridors and Modal Emphasis in the Multimodal System Planning Process does not need to go into this much detail, but localities and regions should develop these more specific modal plans to better assess the feasibility and options for implementing these networks.

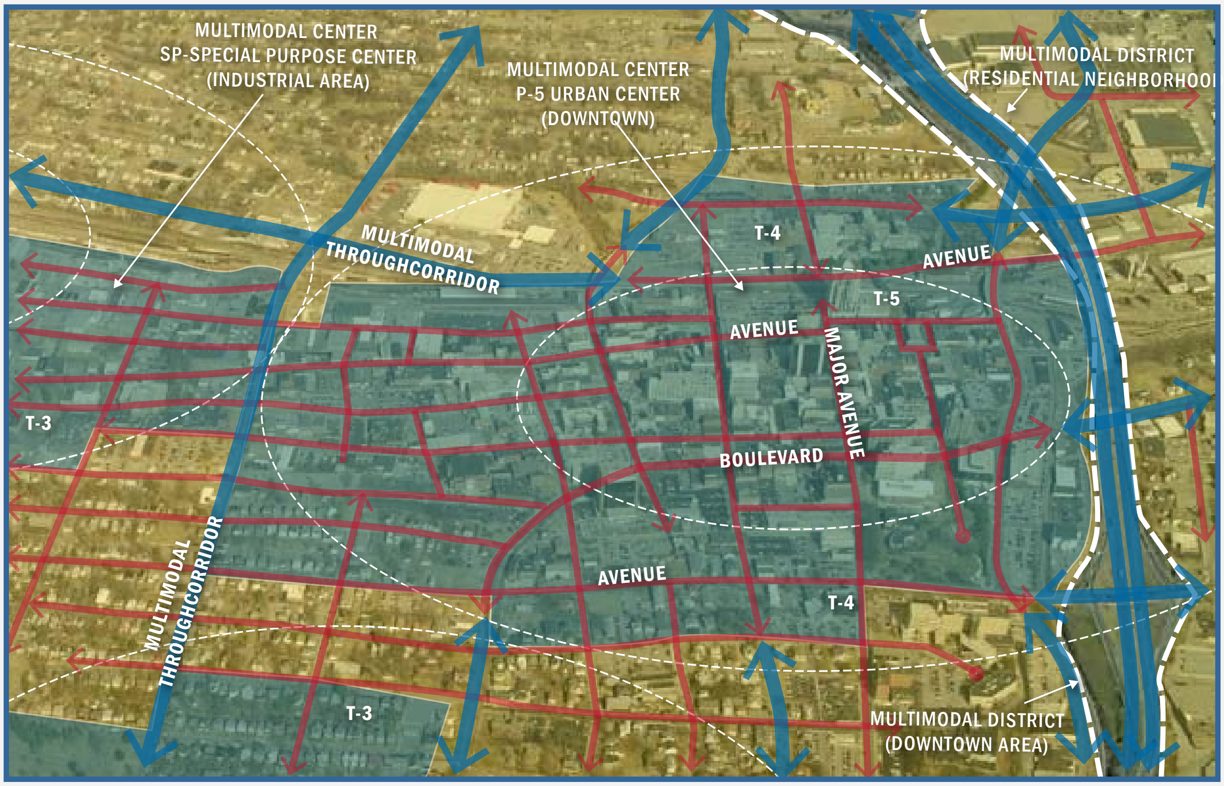


Figure 22 - Downtown Roanoke, VA. The superimposed Multimodal Districts, Multimodal Center and Multimodal Corridors show how a Multimodal System Plan could be applied to this downtown area.

Summary

This process describes the basic foundations of multimodal planning in these Guidelines – the development of a Multimodal System Plan. While there are many possible variations of this basic planning process, the core methodology of identifying destinations and multimodal transportation networks and their interplay is fundamental to multimodal planning at any scale.

The next chapters will delve deeper into the typologies for Multimodal Centers and Multimodal Corridors and how they can be designed to make the most of public investments that enhance travel choices and quality of life.

CHAPTER 3
Multimodal Districts and Multimodal Centers

What are Multimodal Districts and Multimodal Centers?

As described in the previous chapter, **Multimodal Districts** are any portion of a city, town or county that has good multimodal characteristics such as:

- Moderate to high density development, quite often with mixed uses
- Good connectivity of roads and a compact, connected system of blocks
- Roads that have good transit, bike, and pedestrian networks or where such networks are planned

While Multimodal Districts can vary in size, even being as large as a whole town or section of a city, **Multimodal Centers** as used in these Guidelines are much more compact centers that are defined by a specific walkable travel-shed, generally with a one-mile diameter. Multimodal Centers have the following characteristics:

- Based on a comfortable walk-shed, generally defined as a one-mile diameter circle (modified as needed for barriers and natural or man-made features)
- Consist of localized centers of activity and density, whether population, employment or activities (retail, civic or other activity generating uses)
- Served by existing or future transit (although in low intensity centers this may not be possible)
- Have a well-connected (current or planned) network of walkable and bikable streets with low vehicular speeds and accommodations for bicycles, pedestrians, and buses.

One of the most important benefits of identifying potential Multimodal Centers within a region is that it gives a focus for prioritizing multimodal improvements to ensure that they serve the greatest number of people and leverage the most private investment and job growth. Identifying Multimodal Centers in a region helps to focus key locations for investing in multimodal improvements and helps ensure that these investments are located where they will create the most public benefit.

Multimodal Centers and Transit Oriented Development

It is important to distinguish Multimodal Centers from Transit Oriented Development (TOD). Many excellent studies have been done on planning for TOD within the context of a region or a corridor.[16] However, there are many places in Virginia with no or only limited transit that nevertheless still have good multimodal characteristics, such as density, walkability, and compact development patterns. Therefore the focus of Multimodal Centers in these Guidelines is much broader than just TOD and includes all centers with good multimodal characteristics as described above, not just those with transit-focused development. In the context of these Guidelines, TOD is an overlay on top of higher intensity Multimodal Centers. TODs and their connection with Multimodal Centers will be discussed in greater detail in the next chapter.

Figure 23 – Multimodal Centers with and without Transit Oriented Development. In higher intensity areas, Multimodal Centers may be focused on a premium transit station, like the Tide light rail in downtown Norfolk (photo on the left). However, Multimodal Centers also occur in lower intensity areas without TOD, such as in Staunton (photo on the right).

Multimodal Centers and TOD

Therefore the focus of Multimodal Centers in these Guidelines is much broader than just TOD and includes all centers with good multimodal characteristics as described above, not just those with high intensity transit-focused development.

[16] One of the most recent and comprehensive of these is the Center for Transit Oriented Development's "Planning for TOD at the Regional Scale," 2011.

The Range of Multimodal Centers in Virginia

Analyzing Potential Multimodal Centers for Virginia

Multimodal Centers can be found in a wide range of contexts in Virginia, from dense urban downtowns, like Richmond and Norfolk, to historic town and village centers such as Lexington and Staunton, to relatively new walkable suburban hubs, such as Reston Town Center or New Town in James City County. In order to define a typology of Multimodal Centers with a range of scale and character as diverse as these, the typology was based on a careful analysis of real places in Virginia.

In this analysis, one-mile wide circles representing potential Multimodal Centers were placed over a large number of rural, suburban, and urban centers throughout Virginia. The population and employment densities were analyzed in each potential Multimodal Center using 2010 Census data and compared among a set of over 300 such centers in the Commonwealth. A summary of results from this analysis is in Appendix E of these Guidelines. A standardized way of comparing these densities was adopted called "Activity Density." Activity Density is a measure of population and employment density and is expressed in terms of jobs plus population per acre.[17]

One characteristic that is present in many of these potential Multimodal Centers in Virginia is a marked gradation of density from high to low from the center to the edge of the one-mile circle. This gradation in density was systematized in the Multimodal Center typology by the use of density transects, and is described in the following sections.

Figure 24 – One-Mile Circles Identified as Potential Multimodal Centers throughout Virginia. This image shows some of the potential Multimodal Centers analyzed in the Richmond area. The colors indicate different levels of Activity Density.

Measuring Multimodal Centers in Virginia

One-mile wide circles were placed over a large number of rural, suburban, and urban centers throughout Virginia. The population and employment densities were analyzed in each potential Multimodal Center and compared among a set of over 300 such centers in the Commonwealth. A standardized way of comparing these densities was adopted called Activity Density. Activity Density is a measure of population and employment density and is expressed in terms of jobs plus population per acre.

[17] Although there are a variety of other factors that affect the intensity and trip-making characteristics of a region (e.g. tourism and hotel rooms), population and employment densities are a simple, consistent, and effective way of measuring the activity of an area at many different scales and in various regions throughout the Commonwealth. References to Activity Density throughout these Guidelines refer to gross activity density, the sum of population and employment divided by the gross acreage.

Using the Transect to Define Density

The Transect as used in the planning profession has been a relatively common way of describing density and intensity for more than a decade. It has been used as the basis for numerous zoning codes, for the Smart Code system of standardized development codes nationwide, and as the basis for ITE/CNU's Guidebook on designing walkable urban thoroughfares, also used as a primary source for these Guidelines. The Transect was first defined by the CNU to describe the range of natural and built environments from the countryside to the center of the city. The diagram for the Transect shows these as Transect ("T") zones: each T-Zone defines a consistent scale of density and intensity of development and the whole complement of streets, buildings, and open space that goes along with that level of intensity.

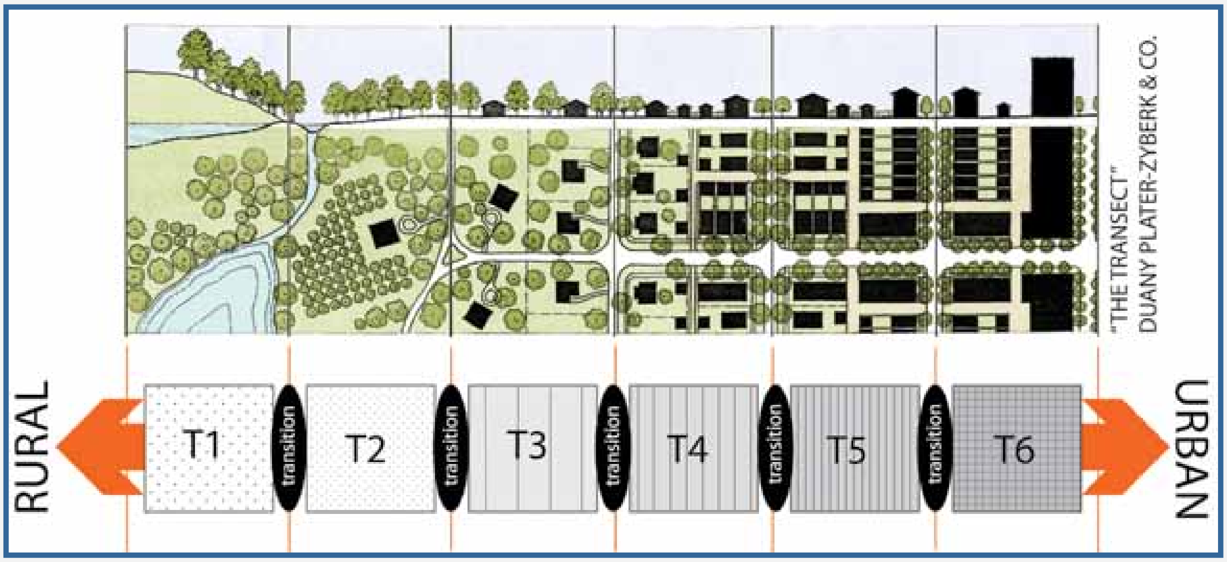


Figure 25 - The Transect Diagram. The Transect describes the range of natural and built environments across a spectrum of density. Places can be classified into one of the six different Transect Zones or "T-Zones" depending on the density or intensity of the land uses in an area.

As used in these Guidelines, T-Zones help to clearly identify a level of intensity of development, from a T-6, which is generally a dense urban core area, to a T-4 which is the type of smaller scale urban environment that might be found toward the edges of a large city or at the very core of a small town, to a T-1 which is a generally rural area. Thus, Transect Zones are the basic building blocks to define the intensity of development whether within a Multimodal Center or along a Multimodal Corridor. Transect Zones can also be applied in areas outside of Multimodal Districts and Centers.

Transect Zones have been used throughout these Guidelines, both to define density and intensity in Multimodal Centers, and to define levels of intensity along Multimodal Corridors. Within each Multimodal Center type, there is a spectrum of intensity levels described by T-Zones. The basic metrics for density and intensity for each of these T-Zones is described in Table 1, along with typical gross and net Floor Area Ratios (FARs) associated with each Transect Zone. The ranges of Activity Density for each T-Zone were derived through the analysis of over 300 potential Multimodal Centers in Virginia, as previously described, and the Activity Density ranges in Table 1 were based on this density spectrum across Virginia.

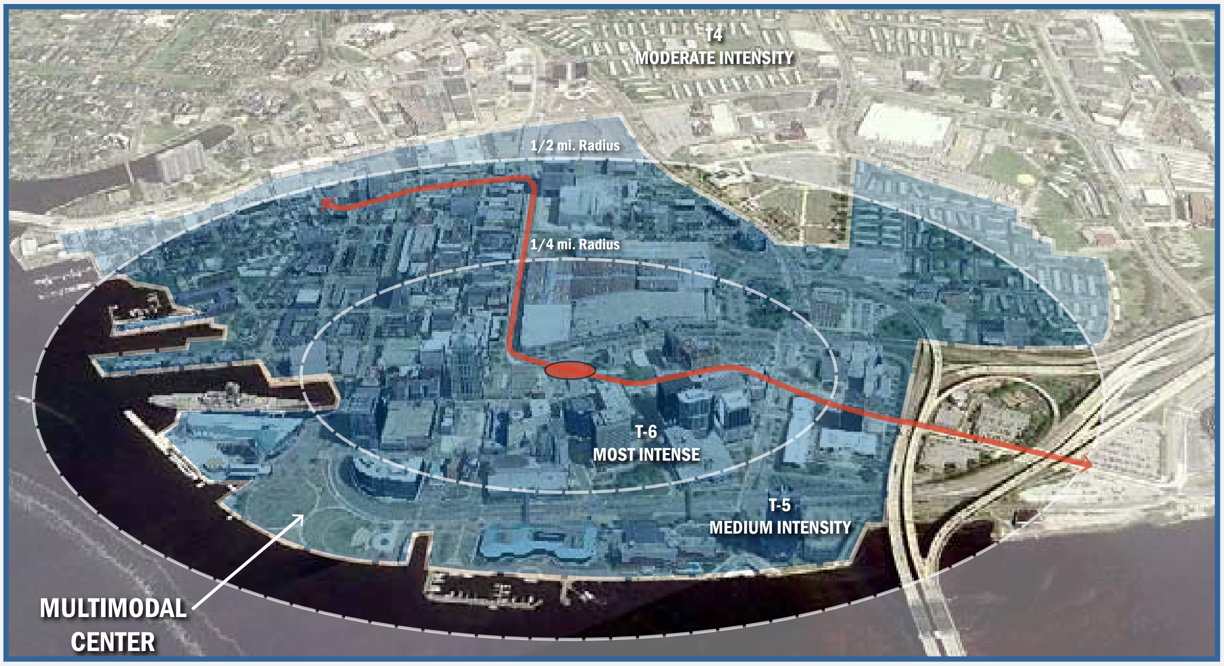


Figure 26 - T-Zones in a Multimodal Center in Downtown Norfolk. The red line is the alignment of the light rail line and the station in the center is MacArthur Square.

However, density does not occur in a uniform pattern in real places. When we average the density over an area of several city blocks, for example, it will usually include a range of densities and building heights, with some parcels having multi-story buildings adjacent to surface parking lots or vacant sites. The series of three-dimensional illustrations in Figure 26 show the built form of a typical block and give a more realistic picture of the density in each Transect Zone. These typical blocks show the variety and range of building heights and parking layouts commensurate with each T-Zone, and help to visualize the density of each T-Zone with some basic metrics of development scale. The supported transit technology indicated for each T-Zone describes the most advanced type of transit technology that these densities are able to support. The concept of supported transit technology and how they were determined is explained in greater detail in Chapter 4.

TRANSECT ZONE INTENSITY			
Transect Zone	Activity Density (Jobs + people/acre)	Gross Development FAR (residenial + non-residential)	Net Development FAR (residenial + non-residential)
T-1	1 or less	0.01 or less	0.02 or less
T-2	1 to 10	0.01 to 0.15	0.02 to 0.23
T-3	10 to 25	0.15 to 0.37	0.23 to 0.57
T-4	25 to 60	0.37 to 0.9	0.57 to 1.38
T-5	60 to 100	0.9 to 1.49	1.38 to 2.3
T-6	100 or more	1.49 or more	2.3 or more

Table 1 - Transect Zone Intensities. These metrics were calibrated based on analyzing the existing Activity Density in potential Multimodal Centers in Virginia.

Typical Blocks for each T-Zone

Density does not occur in a uniform pattern in real places. In order to give a more realistic picture of the density in each Transect Zone, a series of three-dimensional illustrations have been developed for these Guidelines that show the built form of a typical block for each Transect Zone.

T6

MIXED USE INTENSITY	High
ACTIVITY DENSITY (jobs + people/ac)	100+/ac
AVG. BLDG. HEIGHT	8+ Stories
TYPICAL MAX BLDG. HEIGHT	20+ Stories
TYPICAL NET FAR	2.30+
SUPPORTED TRANSIT TECHNOLOGY	LRT/Rail

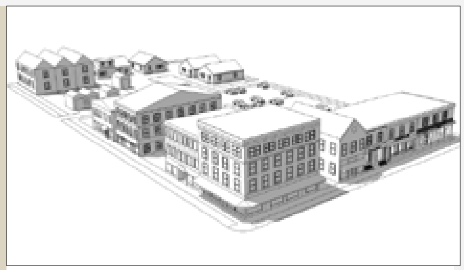
T5

MIXED USE INTENSITY	High
ACTIVITY DENSITY (jobs + people/ac)	60-100/ac
AVG. BLDG. HEIGHT	6 Stories
TYPICAL MAX BLDG. HEIGHT	12 Stories
TYPICAL NET FAR	1.38-2.30
SUPPORTED TRANSIT TECHNOLOGY	BRT/LRT

T4

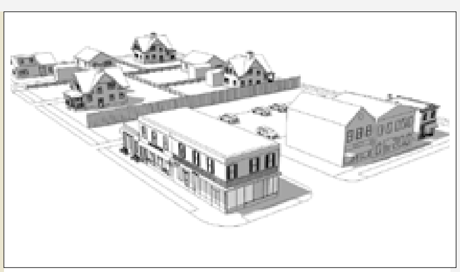
MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	25-60/ac
AVG. BLDG. HEIGHT	4 Stories
TYPICAL MAX BLDG. HEIGHT	8 Stories
TYPICAL NET FAR	0.57-1.38
SUPPORTED TRANSIT TECHNOLOGY	Express Bus

T3



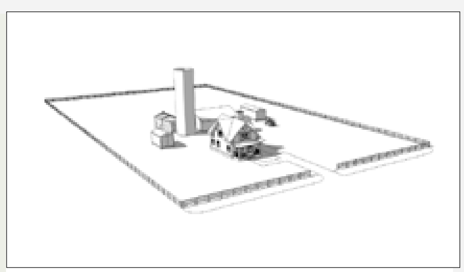
MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	10-25/ac
AVG. BLDG. HEIGHT	3 Stories
TYPICAL MAX BLDG. HEIGHT	5 Stories
TYPICAL NET FAR	0.23-0.57
SUPPORTED TRANSIT TECHNOLOGY	Fixed Route Bus

T2



MIXED USE INTENSITY	Low
ACTIVITY DENSITY (jobs + people/ac)	1-10/ac
AVG. BLDG. HEIGHT	1.5 Stories
TYPICAL MAX BLDG. HEIGHT	3 Stories
TYPICAL NET FAR	0.02-0.23
SUPPORTED TRANSIT TECHNOLOGY	Demand Response

T1



MIXED USE INTENSITY	Very Low
ACTIVITY DENSITY (jobs + people/ac)	0-1/ac
AVG. BLDG. HEIGHT	1 Stories
TYPICAL MAX BLDG. HEIGHT	2 Stories
TYPICAL NET FAR	0-0.02
SUPPORTED TRANSIT TECHNOLOGY	Demand Response

Figure 27 - Illustrations of Typical Block Types by Transect Zone.

The Basic Typology of Multimodal Centers

As described previously, the one-mile diameter circles walk-sheds representing Multimodal Centers – although based on real places in Virginia – are somewhat idealized representations of a real place. They are represented as two concentric circle of uniform density – the first quarter-mile with higher density and the second quarter-mile with a step lower density. While not many places exhibit this exact kind of regular decrease in density in quarter-mile bands, it is nevertheless a general diagrammatic representation of the way that real Multimodal Centers are composed. The 10-minute walk-shed that is the basis for Multimodal Centers forms the nucleus for activities and destinations within easy walking distance. The one-mile diameter circles are used to approximate the locations of potential Multimodal Centers within each Multimodal District. However, these one-mile circles are typically morphed into more organic-looking shapes as they are modified by natural or man-made barriers, or by parcel-level designation on local governments' future land use maps and zoning codes. Despite these modifications, the organic-looking shapes of Multimodal Centers should roughly retain the general scale of the one-mile walk-shed. This translation is discussed in more detail in Chapter 7.

Figure 28 - Activity Densities in Downtown Lynchburg with a One-Mile Circle Superimposed.

Activity Density

Figure 28 shows the Activity Density of downtown Lynchburg, represented by a range of colors from T-1 (dark green) to T-6 (dark red). The data is at the census block level and shows the sum of jobs and population in each census block. Overlaid on the map is a one-mile circle representing the basis for a potential Multimodal Center. The pattern of densities in the map highlights the real world variability of densities on a block by block basis. In this case, however, Lynchburg's downtown generally corresponds to a T-4 inner ring and T-3 outer ring of densities, which would be classified as a "P-4 Large Town or Suburban Center" Multimodal Center type (discussed below) according to these Guidelines.

Based on the analysis of a wide variety of potential Multimodal Centers in Virginia according to these basic metrics of Activity Density, the following six Multimodal Center types and corresponding densities have been defined for these Guidelines to establish a basic palette of place types for planning purposes.

MULTIMODAL CENTER INTENSITY			
Center Type	**Activity Density (Jobs + people/acre)**	**Gross Development FAR (residenial + non-residential)**	**Net Development FAR (residenial + non-residential)**
P-6 Urban Core	70.0 or more	1.0 or more	1.6 or more
P-5 Urban Center	33.75 to 70.0	0.5 to 1.0	0.8 to 1.6
P-4 Large Town or Suburban Center	13.75 to 33.75	0.21 to 0.5	0.3 to 0.8
P-3 Medium Town or Suburban Center	6.63 to 13.75	0.10 to 0.21	0.15 to 0.3
P-2 Small Town or Suburban Center	2.13 to 6.63	0.03 to 0.10	0.05 to 0.15
P-1 Rural or Village Center	2.13 or less	0.03 or less	0.05 or less
SP Special Purpose Center	Varies	Varies	Varies

Table 2- Multimodal Center Types and Activity Density Ranges.

Figure 29 shows these seven Multimodal Center types graphically as a spectrum of place types from dense urban to low density rural centers:

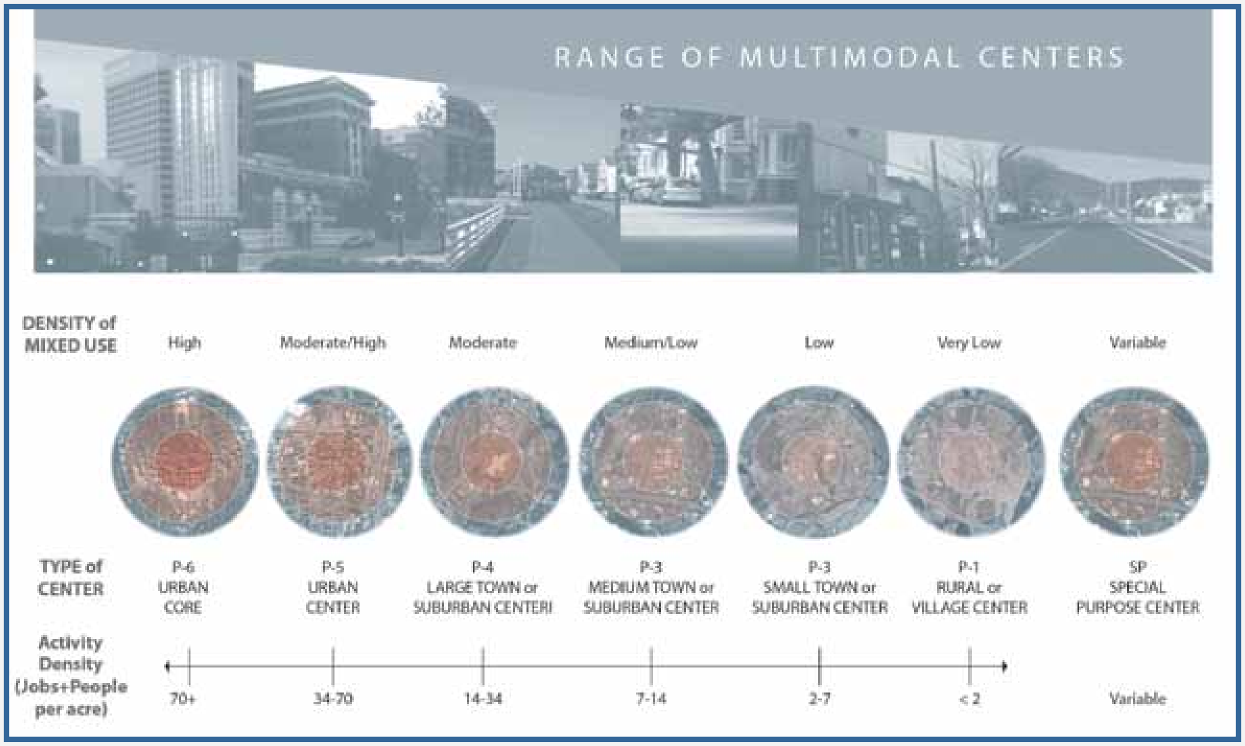


Figure 29 - Range of Multimodal Center Types. Urban to rural defined by Activity Density (number of jobs + people) in each Multimodal Center.

Land Use Mix

One of the primary characteristics of a Multimodal Center is a mixture of land uses. For the purposes of these Guidelines, all Multimodal Centers are assumed to have a mixture of uses and a general balance of housing and employment. However, as noted in the next section, a spreadsheet-based tool was developed to allow the creation of customized Multimodal Center types with alternate proportions of housing and employment.

Creating Special Purpose Multimodal Centers

Although there are six Multimodal Center types that are intended to give a comprehensive set of place types for planning purposes throughout Virginia, there may be a need to define a customized Special Purpose Multimodal Center. For example, an employment-rich center such as Innsbrook in Henrico County can be an important destination and regional activity center while not having a diverse mixture of uses or a pattern of density that matches a typical Multimodal Center. For this reason, the Guidelines include a spreadsheet tool for creating customized Special Purpose Multimodal Centers illustrated in Appendix C.

The Multimodal Centers Calculator tool allows a user to select various factors such as density and land use mix. A full list of the values that can be adjusted for Multimodal Centers is listed below:

Customizable Data for Multimodal Centers
Percent of Activity Units that are jobs
Percent of Activity Units that are population
Square feet per job
Square feet per dwelling unit
Persons per dwelling unit
Gross-to-Net Ratio (Ratio of gross site density to net site density)
Percent of inner quarter-mile residential density concentrated to 1/8 mile TOD node
Percent of inner quarter-mile residential density located outside of 1/8 mile TOD node
Percent of inner quarter-mile employment density concentrated to 1/8 mile TOD node
Percent of inner quarter-mile employment density located outside of 1/8 mile TOD node

Table 3 - Data for Special Purpose Multimodal Centers. Special Purpose Multimodal Centers can be customized using the Multimodal Centers Calculator Tool in Appendix C.

Special Purpose Multimodal Centers

Although there are six Multimodal Center types that are intended to give a comprehensive set of place types for planning purposes throughout Virginia, there may be a need to define a customized Special Purpose Multimodal Center. For this reason, the Guidelines include a spreadsheet tool for creating customized, Special Purpose Multimodal Centers, illustrated in Appendix C.

Comparing Multimodal Centers in Virginia

Using this basic typology of Multimodal Centers, the dataset of over 300 potential Multimodal Centers in Virginia was analyzed to compare their existing densities to each other and assess how they would fit into this basic typology by density and intensity. Table 4 summarizes a handful of the potential Multimodal Centers according to their existing Activity Density, based on 2010 Census data, and shows which Multimodal Center type they would fit into based on their current densities. A full summary of all potential Multimodal Centers that were analyzed is in Appendix E.

This analysis reflects only existing population and employment, and does not incorporate future growth. It is simply a snapshot of where these potential Multimodal Centers fall in relation to each other and to the Multimodal Center types today.

Potential Multimodal Center (1 mile diameter)	Employment (2008)	Population (2010)	Population/ Employment Ratio	Total Activity Units (Jobs + People)	Activity Units/Acre	Multimodal Center Type
Tysons Corner	50,491	419	0.01	50,910	101	P6 Urban Core
Ballston	27,902	14,202	0.51	42,104	84	
Rosslyn	24,385	16,688	0.68	41,073	82	
Crystal City	24,704	12,377	0.50	37,081	74	
Norfolk	30,917	4,582	0.15	35,499	71	
Alexandria	15,587	9,489	0.61	25,076	50	P5 Urban Center
Clarendon	13,231	10,598	0.80	23,829	47	
Richmond	14,513	8,989	0.62	23,502	47	
Charlottesville	12,496	4,046	0.32	16,542	33	P4 Large Town or Suburban Center
Roanoke	12,956	2,295	0.18	15,251	30	
Fairfax	10,088	4,488	0.44	14,576	29	
Blacksburg	10,360	3,709	0.36	14,069	28	
Winchester	4,581	4,933	1.08	9,514	19	
Reston	2,406	6,134	2.55	8,540	17	
Fredericksburg	4,918	3,143	0.64	8,061	16	
Manassas	2,371	3,965	1.67	6,336	13	P3 Medium Town or Suburban Center
Salem	2,910	3,205	1.10	6,115	12	
Petersburg	4,038	2,035	0.50	6,073	12	
Staunton	2,536	3,300	1.30	5,836	12	
Front Royal	2,525	3,211	1.27	5,736	11	
Newport News	3,555	2,027	0.57	5,582	11	
Bristol	4,033	1,245	0.31	5,278	11	
Virginia Beach	2,509	2,034	0.81	4,543	9	
Galax	2,581	1,326	0.51	3,907	8	
Dunn Loring	854	2,382	2.79	3,236	6	
South Boston	871	1,185	1.36	2,056	4	P2 Small Town or Suburban Center
Crozet	284	1,697	5.98	1,981	4	
Chester	704	883	1.25	1,587	3	
Lake Monticello	6	1,187	197.83	1,193	2	
Bluefield	388	768	2	1,156	2	
Timberlake	409	717	2	1,126	2	
Aquia Harbour	1	742	742	743	1	P1 Rural or Village Center
Forest	484	115	0	599	1	
Poquoson	6	577	96	583	1	
Great Falls	1	455	455	456	1	

Table 4 - Activity Densities of Potential Multimodal Centers throughout Virginia. These activity densities are based on existing data, and do not incorporate anticipated future growth. Several of these potential Multimodal Centers are anticipated to add enough population and employment to transition to more intense Multimodal Center types in the future.

From Table 4, it is clear that there is a very wide range of Activity Densities in Virginia places, as well as some interesting similarities among the densities of very different places. For example, the downtown areas of Norfolk and Richmond are similar in density to the urban Metrorail station areas along the Rosslyn-Ballston corridor. However, other stops on the same Metrorail line, such as Dunn Loring, have much lower Activity Densities that correspond to those of smaller towns such as Galax and Staunton. However, these densities reflect only the existing population and jobs, and do not reflect future growth. Some localities' comprehensive plans articulate a very different vision for some of these potential Multimodal Centers. Fairfax County's Comprehensive Plan, for example, anticipates Dunn Loring to add population and employment to move from a P-3 Medium Town or Suburban Center to a P-5 Urban Center in the next 25 years, some of which has already occurred since the 2010 Census.

Although this analysis used 2010 Census data, local and regional planners should incorporate long-range future land use and intensity projections into their population and employment calculations when designating Multimodal Districts and Multimodal Centers in the Multimodal System planning process, as described in Step 2 of Chapter 2

In Figure 30, the one-mile circles for the Richmond area are shown overlaid onto a color coded map of Activity Density. This map shows the variability of density in a large region and how potential Multimodal Center locations identified for analysis purposes were chosen as representative of the diverse densities of areas throughout the region. The selection of potential Multimodal Centers shown here is simply illustrative. Local and regional planners should use their comprehensive plans and other planning documents to select their Multimodal Districts and Multimodal Centers to best reflect the future visions articulated in their local and regional plans.

Many more observations can be made by comparing the Activity Densities among these potential Multimodal Centers in Virginia. However, the prime value of this analysis is to have a standard frame of comparison and common language to begin comparing the density of different Multimodal Centers throughout Virginia.

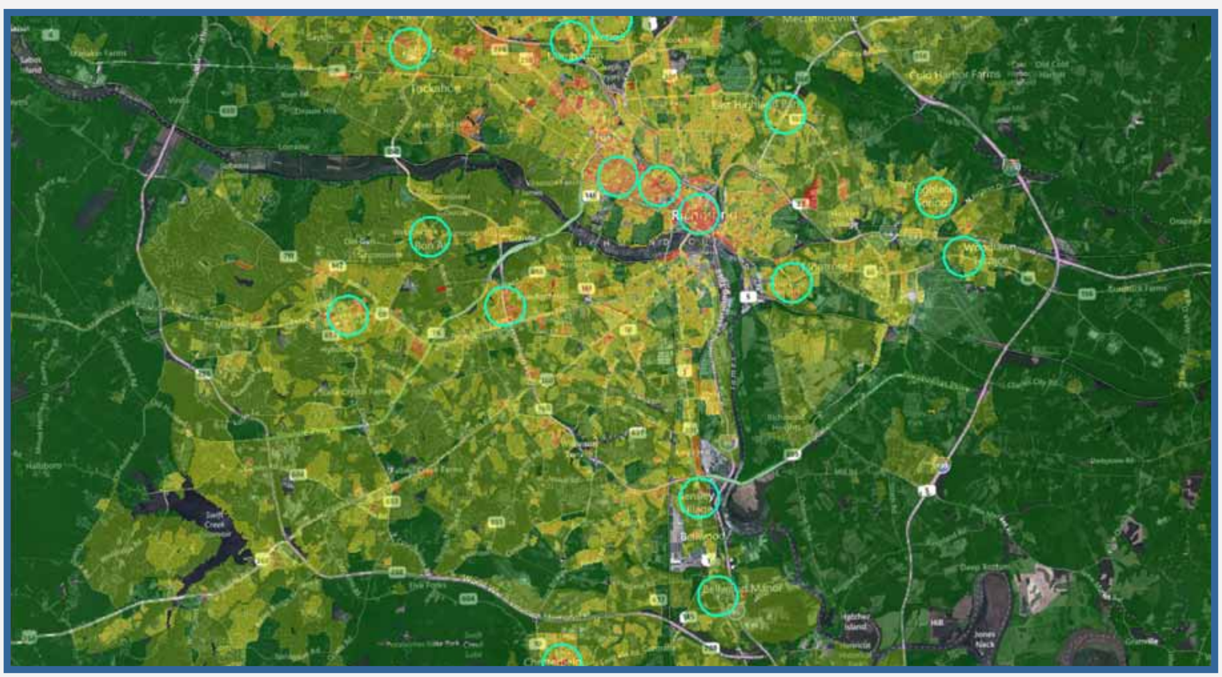


Figure 30 - Map of Activity Density in the Richmond Region. One-mile circles used for analysis purposes as potential Multimodal Centers for illustrative purposes only.

Detailed Descriptions of the Multimodal Center Types

"The arrangement and spacing of corridors in these diagrams is based generally on rules for roadway spacing and hierarchy of road types. However, just as road networks in real places don't look like the diagrams in engineering manuals, it is not expected that real Multimodal Centers will look exactly like these diagrammatic representations."

As described in Chapter 2, Multimodal Centers are the primary destinations and hubs of activity within a region. The purpose of designating Multimodal Centers in a Multimodal System Plan is twofold – first, to be able to provide a focus of destinations with the highest levels of multimodal connectivity; and second, to be able to identify the types of Multimodal Corridors recommended for each Multimodal Center. This last point – that the type of Multimodal Center suggests the selection of a Multimodal Corridor – is an important point for these Guidelines. In other words, answering the question of the larger context of a corridor (in which Multimodal Center type is the corridor located?) will help us answer the question of which Multimodal Corridor type we should use for a particular roadway.

The following summary pages contain a series of diagrams and tables that describe each Multimodal Center type. Each summary page also has a diagram that shows the "prototypical" arrangement of Multimodal Corridors within the Multimodal Center. These are idealized diagrams and are not intended to represent any particular real example of a place. The purpose of these diagrams, instead, is to give a basic design framework for a prototypical arrangement of Multimodal Corridors for that Multimodal Center type. The arrangement and spacing of Multimodal Corridors in these diagrams is based generally on rules for roadway spacing and hierarchy of road types. However, just as road networks in real places don't look like the diagrams in engineering manuals, it is not expected that real Multimodal Centers will look exactly like these diagrammatic representations.

A summary page of all the Multimodal Center types is provided on the next page, followed by more detailed diagrams and metrics of each of the Multimodal Center types. The Summary Tables for each Multimodal Center type provide the typical characteristics (Activity Density, floor area ratio, supported transit technology, and building height) that would generally be found in the places that would fall into this type. Planners can use the Activity Density ranges in the Multimodal System Planning Process to determine which types of Multimodal Centers they have identified in their region. The floor area ratios and typical building heights are provided simply to suggest typical development patterns associated with each of the Multimodal Center types. The supported transit technology indicates the highest or most advanced type of transit service that might be supported given the land use intensities. The concept of supported transit technology is explained in greater detail in Chapter 4.

MULTIMODAL CENTERS

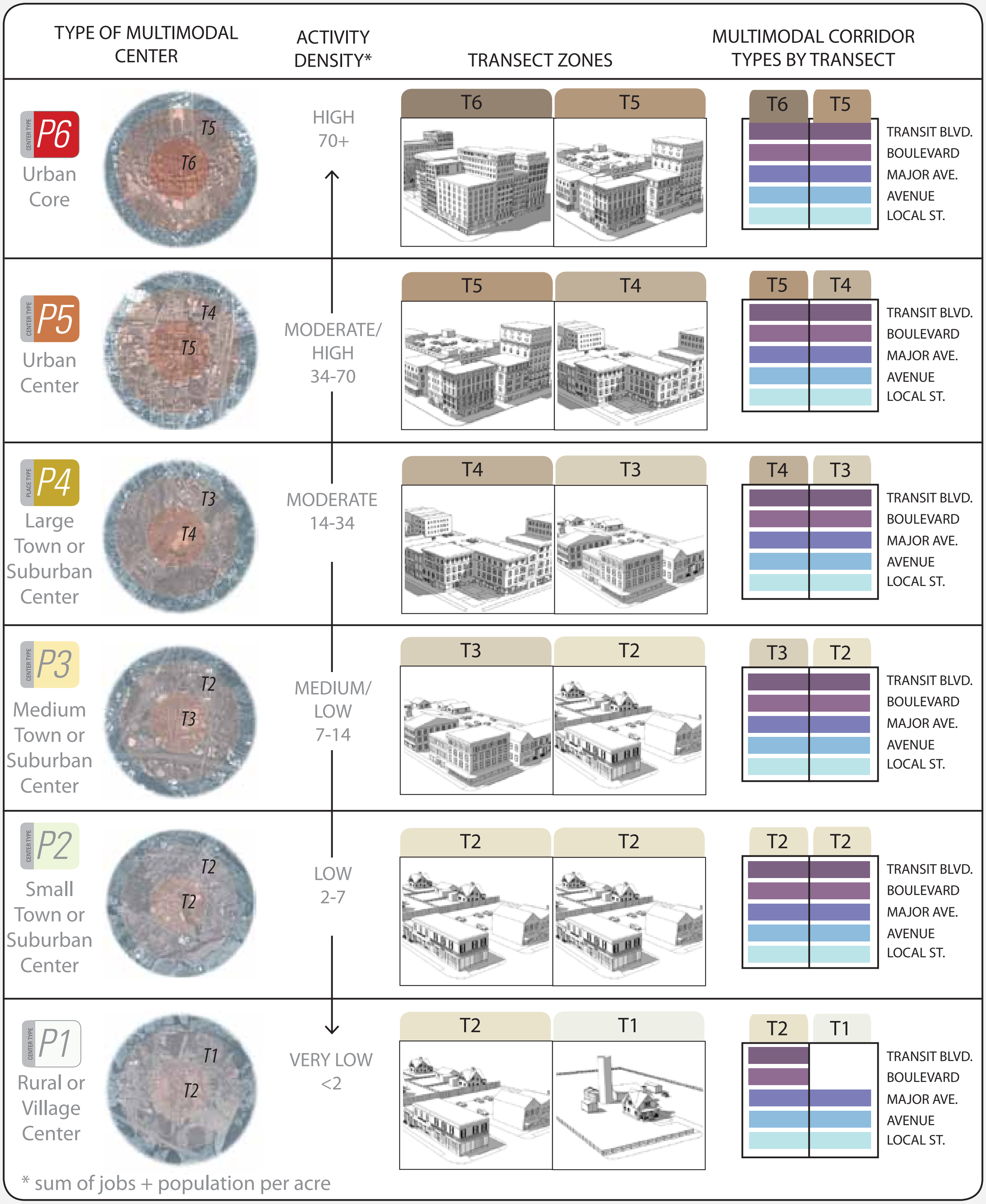
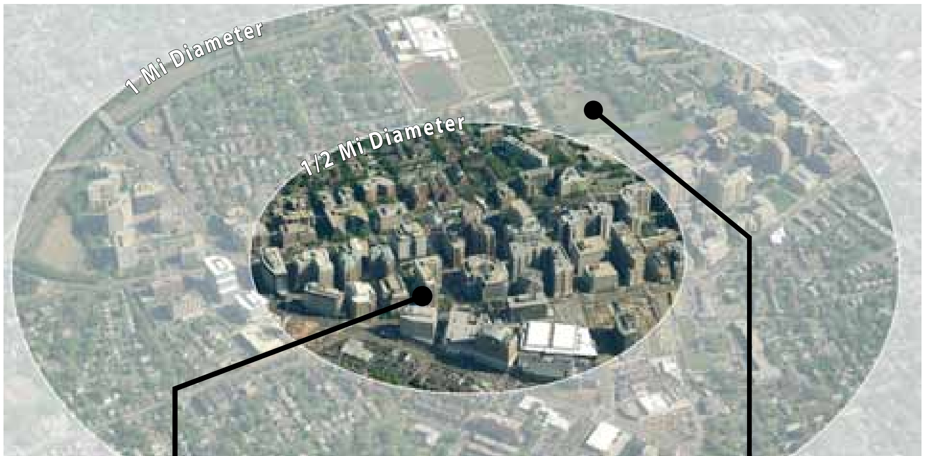


Figure 31 – Multimodal Center Types Summary Page.

P6 URBAN CORE

CENTER TYPE

Typical P6 Center (Ballston, Virginia)



Typical Street view (Ballston, Virginia)

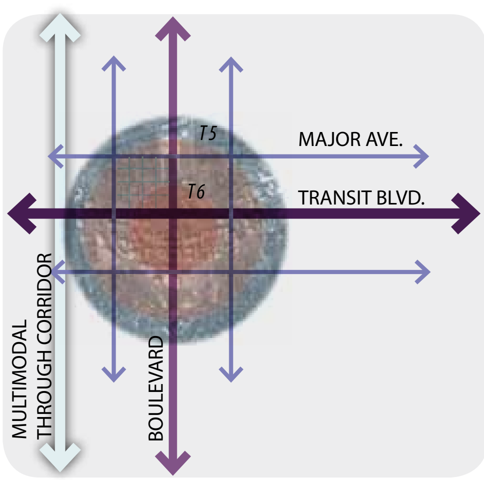
T6

MIXED USE INTENSITY	High
ACTIVITY DENSITY (jobs + people/ac)	100+/ac
AVG. BLDG. HEIGHT	8+ Stories
TYPICAL MAX BLDG. HEIGHT	20+ Stories
TYPICAL NET FAR	2.30+
SUPPORTED TRANSIT TECHNOLOGY	LRT/Rail

T5

MIXED USE INTENSITY	High
ACTIVITY DENSITY (jobs + people/ac)	60 - 100/ac
AVG. BLDG. HEIGHT	6 Stories
TYPICAL MAX BLDG. HEIGHT	12 Stories
TYPICAL NET FAR	1.38 - 2.30
SUPPORTED TRANSIT TECHNOLOGY	BRT/LRT

Prototypical Arrangement of Multimodal Corridors (P6 Urban Core)

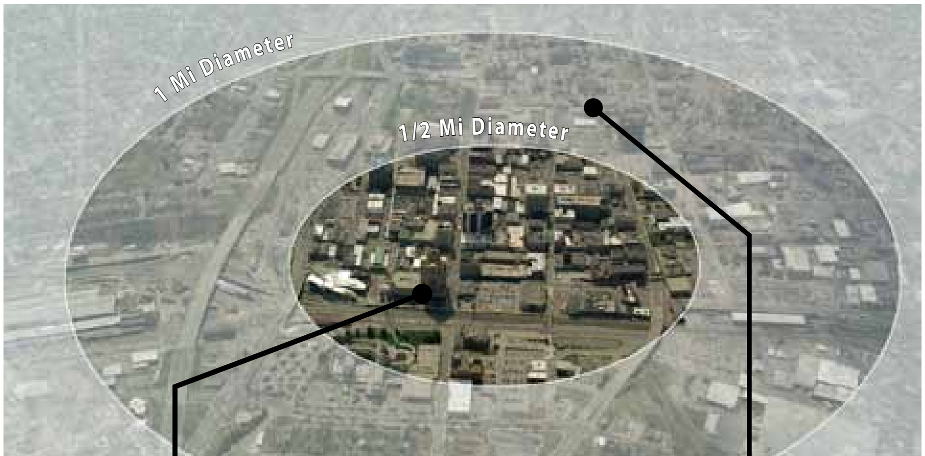


P6 URBAN CORE SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	70 or more
GROSS DEVELOPMENT FAR (residential + non-residential)	1.0 or more
NET DEVELOPMENT FAR (residential + non-residential)	1.6 or more
SUPPORTED TRANSIT TECHNOLOGY	LRT/Rail
Height of Buildings	7 story average 14 story typical maximum

Figure 32 – P-6 Urban Core Multimodal Center Diagrams & Metrics.

CENTER TYPE P5 URBAN CENTER

Typical P5 Center (Roanoke, Virginia)



Typical Street view (Roanoke, Virginia)

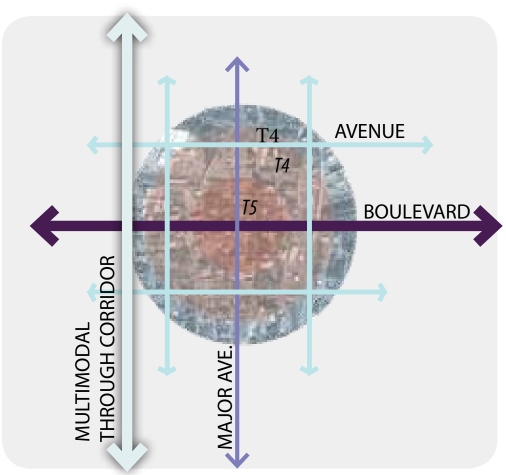
T5

MIXED USE INTENSITY	High
ACTIVITY DENSITY (jobs + people/ac)	60-100/ac
AVG. BLDG. HEIGHT	6 Stories
TYPICAL MAX BLDG. HEIGHT	12 Stories
TYPICAL NET FAR	1.38-2.30
SUPPORTED TRANSIT TECHNOLOGY	BRT/LRT

T4

MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	25-60/ac
AVG. BLDG. HEIGHT	4 Stories
TYPICAL MAX BLDG. HEIGHT	8 Stories
TYPICAL NET FAR	0.57-1.38
SUPPORTED TRANSIT TECHNOLOGY	Express Bus

Prototypical Arrangement of Multimodal Corridors (P5 Urban Center)

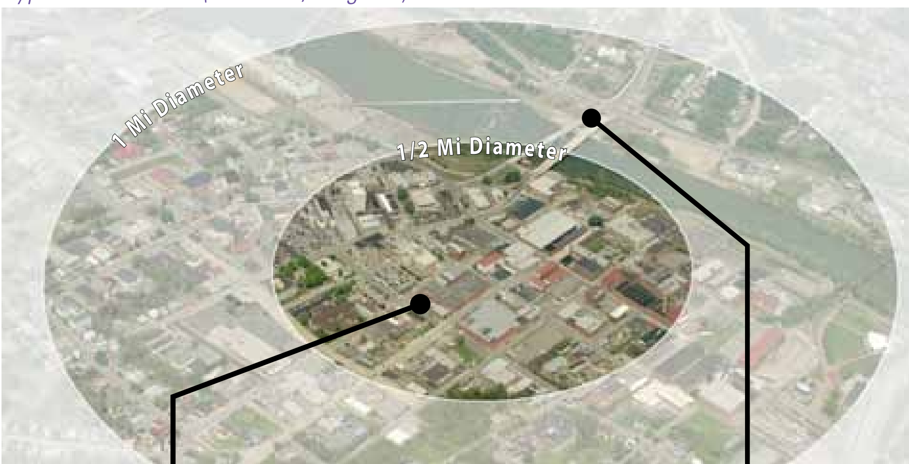


P5 URBAN CENTER SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	34 to 70
GROSS DEVELOPMENT FAR (residential + non-residential)	0.5 to 1.0
NET DEVELOPMENT FAR (residential + non-residential)	0.8 to 1.6
SUPPORTED TRANSIT TECHNOLOGY	BRT/LRT
Height of Buildings	5 story average 9 story typical maximum

Figure 33 - P-5 Urban Center Multimodal Center Diagrams & Metrics.

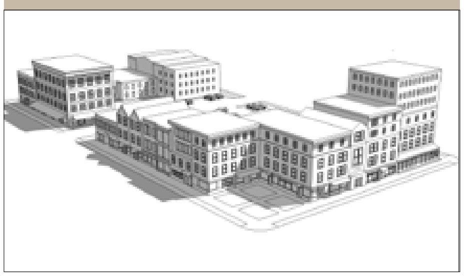
P4 LARGE TOWN/SUBURBAN CENTER

Typical P4 Center (Danville, Virginia)



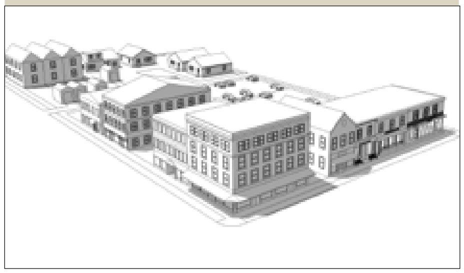
Typical Street view (Danville, Virginia)

T4



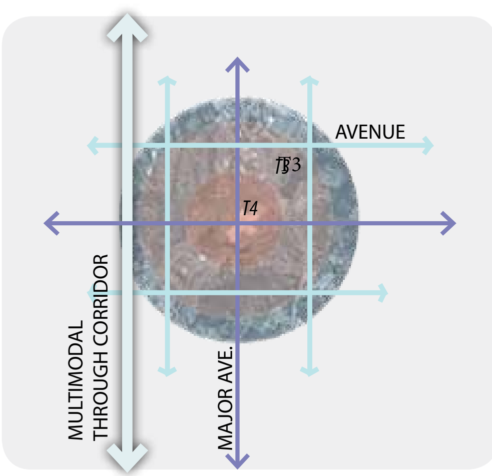
MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	25-60/ac
AVG. BLDG. HEIGHT	4 Stories
TYPICAL MAX BLDG. HEIGHT	8 Stories
TYPICAL NET FAR	0.57-1.38
SUPPORTED TRANSIT TECHNOLOGY	Express Bus

T3



MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	10-25/ac
AVG. BLDG. HEIGHT	3 Stories
TYPICAL MAX BLDG. HEIGHT	5 Stories
TYPICAL NET FAR	0.23-0.57
SUPPORTED TRANSIT TECHNOLOGY	Fixed Route Bus

Prototypical Arrangement of Multimodal Corridors (P4 Large Town/Suburban Center)

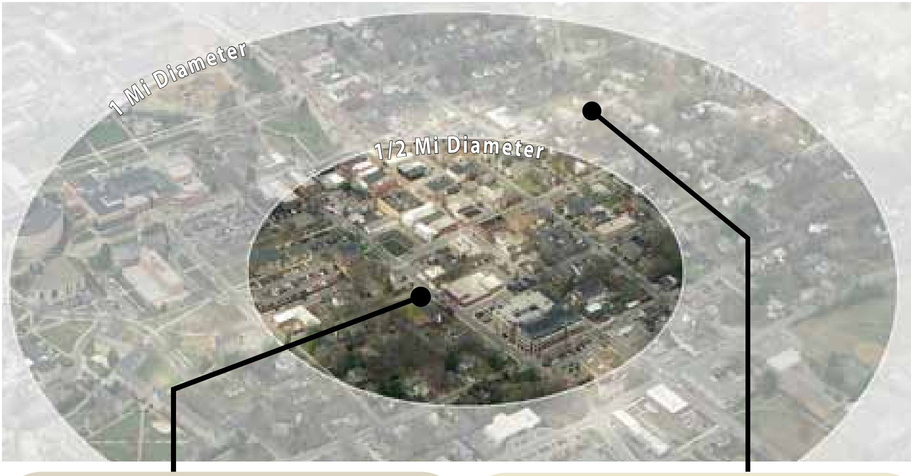


P4 LARGE TOWN/SUBURBAN CENTER SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	14 to 34
GROSS DEVELOPMENT FAR (residential + non-residential)	0.2 to 0.5
NET DEVELOPMENT FAR (residential + non-residential)	0.3 to 0.8
SUPPORTED TRANSIT TECHNOLOGY	Express Bus
Height of Buildings	3 story average 6 story typical maximum

Figure 34 - P-4 Large Town/Suburban Center Multimodal Center Diagrams & Metrics.

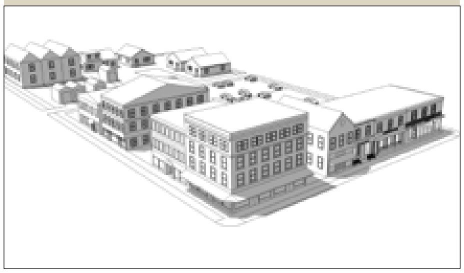
P3 MEDIUM TOWN/SUBURBAN CENTER

Typical P3 Center (Blacksburg, Virginia)



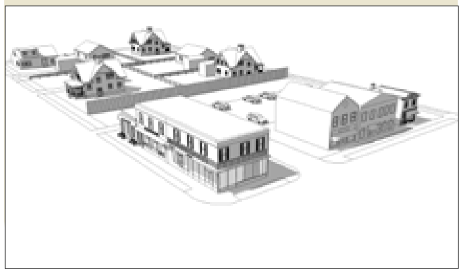
Typical Street view (Blacksburg, Virginia)

T3



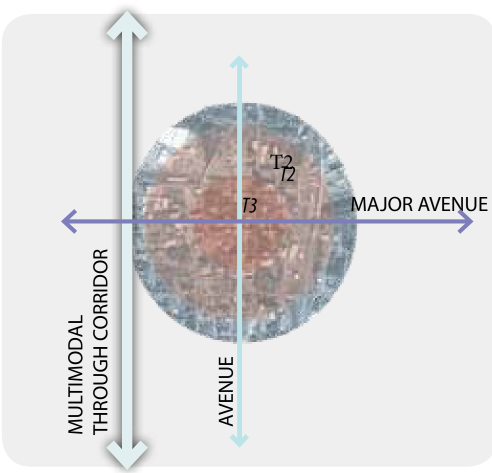
MIXED USE INTENSITY	Medium/Low
ACTIVITY DENSITY (jobs + people/ac)	10-25/ac
AVG. BLDG. HEIGHT	3 Stories
TYPICAL MAX BLDG. HEIGHT	5 Stories
TYPICAL NET FAR	0.23-0.57
SUPPORTED TRANSIT TECHNOLOGY	Fixed Route Bus

T2



MIXED USE INTENSITY	Medium/Low
ACTIVITY DENSITY (jobs + people/ac)	1-10/ac
AVG. BLDG. HEIGHT	1.5 Stories
TYPICAL MAX BLDG. HEIGHT	3 Stories
TYPICAL NET FAR	0.02-0.23
SUPPORTED TRANSIT TECHNOLOGY	Demand Response

Prototypical Arrangement of Multimodal Corridors (P3 Medium Town/Suburban Center)

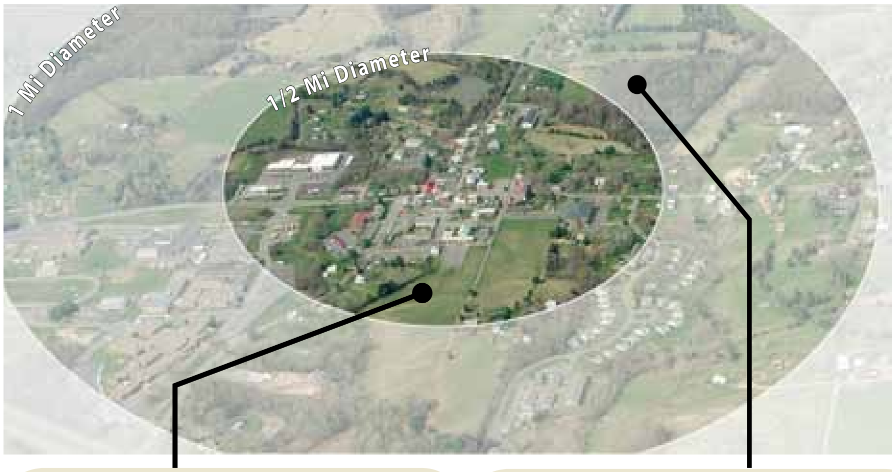


P3 MEDIUM TOWN/SUBURBAN CENTER SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	7 to 14
GROSS DEVELOPMENT FAR (residential + non-residential)	0.1 to 0.2
NET DEVELOPMENT FAR (residential + non-residential)	0.15 to 0.3
SUPPORTED TRANSIT TECHNOLOGY	Fixed Route Bus

Figure 35 - P-3 Medium Town/Suburban Center Multimodal Center Diagrams & Metrics.

P2 SMALL TOWN/SUBURBAN CENTER

Typical P2 Center (Stanardsville, Virginia)



Typical Street view (Stanardsville, Virginia)

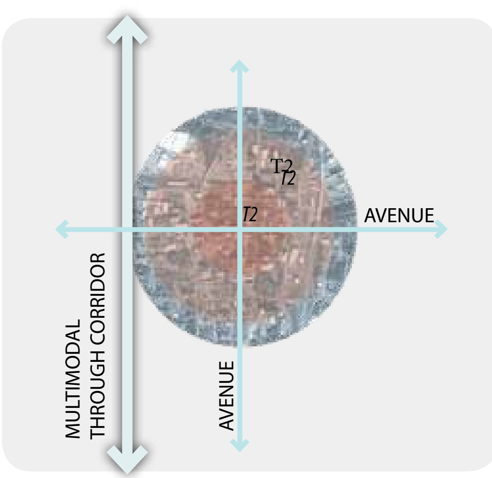
T2

MIXED USE INTENSITY	Low
ACTIVITY DENSITY (jobs + people/ac)	1-10/ac
AVG. BLDG. HEIGHT	1.5 Stories
TYPICAL MAX BLDG. HEIGHT	3 Stories
TYPICAL NET FAR	0.02-0.23
SUPPORTED TRANSIT TECHNOLOGY	Demand Response

T2

MIXED USE INTENSITY	Low
ACTIVITY DENSITY (jobs + people/ac)	1-10/ac
AVG. BLDG. HEIGHT	1.5 Stories
TYPICAL MAX BLDG. HEIGHT	3 Stories
TYPICAL NET FAR	0.02-0.23
SUPPORTED TRANSIT TECHNOLOGY	Demand Response

Prototypical Arrangement of Multimodal Corridors (P2 Small Town/Suburban Center)



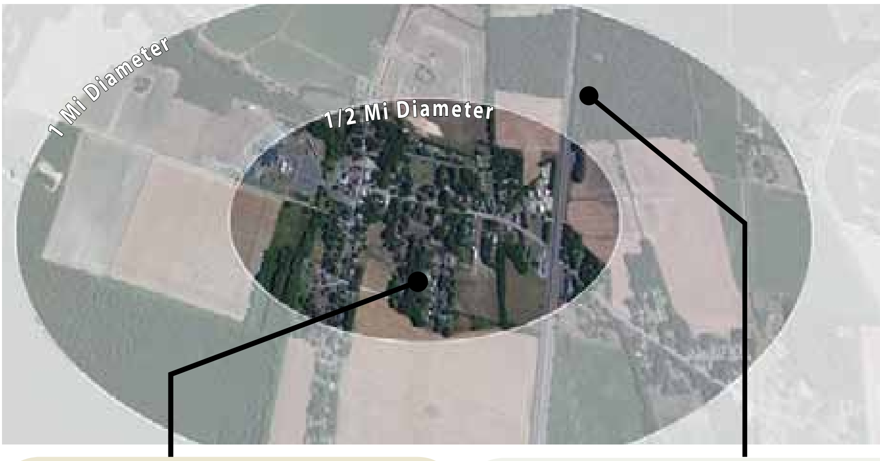
P2 SMALL TOWN/SUBURBAN CENTER SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	2 to 7
GROSS DEVELOPMENT FAR (residential + non-residential)	0.03-0.10
NET DEVELOPMENT FAR (residential + non-residential)	0.05-0.15
SUPPORTED TRANSIT TECHNOLOGY	Demand Response
Height of Buildings	1.5 story average 3 story typical maximum

Figure 36 – P-2 Small Town/Suburban Center Multimodal Center Diagrams & Metrics.

P1 RURAL/VILLAGE CENTER

CENTER TYPE P1

Typical P1 Center (Eastville, Virginia)

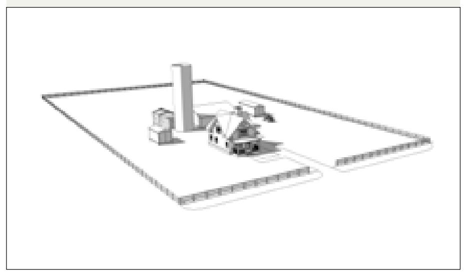


Typical Street view (Eastville, Virginia)

T2

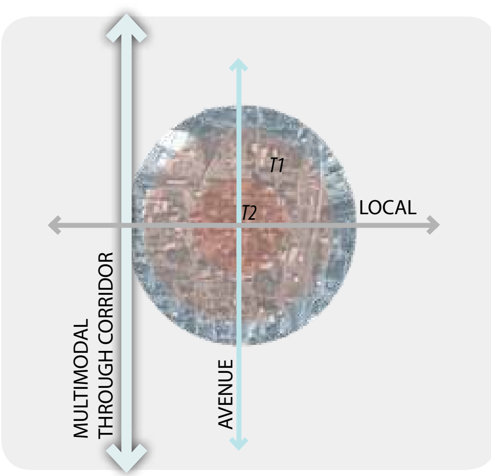
MIXED USE INTENSITY	Low
ACTIVITY DENSITY (jobs + people/ac)	1-10/ac
AVG. BLDG. HEIGHT	1.5 Stories
TYPICAL MAX BLDG. HEIGHT	3 Stories
TYPICAL NET FAR	0.02-0.23
SUPPORTED TRANSIT TECHNOLOGY	Demand Response

T1



MIXED USE INTENSITY	Very Low
ACTIVITY DENSITY (jobs + people/ac)	0-1/ac
AVG. BLDG. HEIGHT	1 Stories
TYPICAL MAX BLDG. HEIGHT	2 Stories
TYPICAL NET FAR	0-0.02
SUPPORTED TRANSIT TECHNOLOGY	Demand Response

Prototypical Arrangement of Multimodal Corridors (P1 Rural/Village Center)



P1 RURAL/VILLAGE CENTER SUMMARY TABLE

ACTIVITY DENSITY (jobs + people/acre)	0 to 2
GROSS DEVELOPMENT FAR (residential + non-residential)	0-0.03
NET DEVELOPMENT FAR (residential + non-residential)	0-0.05
SUPPORTED TRANSIT TECHNOLOGY	Demand Response
Height of Buildings	1 story average 2 story typical maximum

Figure 37 – P-1 Rural/Village Center Multimodal Center Diagrams & Metrics.

CHAPTER 4
Multimodal Centers and Transit Oriented Development

The previous chapter described Multimodal Centers as local concentrations of activities with good multimodal connectivity. This chapter describes more specifically how Transit Oriented Development (TOD) works with Multimodal Centers and how the basic metrics of Multimodal Centers are modified when they are served by high capacity transit.

Traditionally, TOD has been defined as compact walkable areas of moderate to high density and mixed uses that surround the area within walking distance of a high capacity transit stop. Typically TOD areas have been scaled as a quarter-mile to a half-mile radius around the transit station. As noted previously though, the concept of Multimodal Centers is much broader than the concept of TODs, although it includes many of the same characteristics of density, walkablility, and general scale.

Transit Oriented Development within Multimodal Centers

What happens to a Multimodal Center when it contains a transit stop? From analyzing a wide variety of Multimodal Centers, it is apparent that the answer to this question depends to a large part on the type of transit that is serving the Multimodal Center. For Multimodal Centers that are served by lower capacity transit service such as demand response and fixed route bus service, there is generally no additional increase in density in the core of the Multimodal Center resulting from its being served by a bus stop. However, with higher capacity transit service such as bus rapid transit (BRT), light rail transit (LRT), or heavy rail transit, Multimodal Centers tend to have a noticeable jump in density at the very core of the Multimodal Center around the transit stop. This is reflected in these Guidelines by a refinement of Multimodal Centers that are served by high capacity transit through the addition of an eighth-mile radius **TOD Node** overlaid on top of those Multimodal Centers. Figure 38 shows how a TOD Node is overlaid onto the basic geometry of a Multimodal Center.

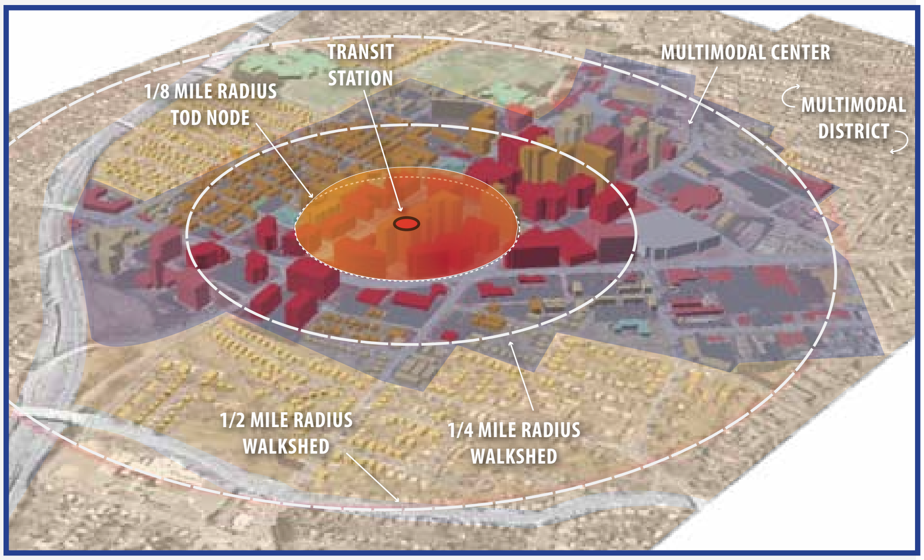


Figure 38 – Illustration of the Relationship of Walksheds and a TOD Node in a Multimodal Center.

As shown in Figure 38, the inner eighth-mile radius core of a Multimodal Center with high capacity transit forms a TOD Node with correspondingly higher densities than the surrounding quarter-mile radius ring. Appendix C contains summary tables that show the basic metrics for densities within the TOD Nodes within Multimodal Centers. Although the overall density of the Multimodal Center as a whole does not change, there is a reallocation of density within the inner eighth-mile radius core of the Multimodal Center when there is a TOD Node. It should be noted that TOD Nodes are assumed only for the higher intensity Multimodal Centers: P-3 through P-6. Tables 5 and 6 (from Appendix C) show how these densities are allocated in Multimodal Centers P-3 through P-6:

TRANSIT-ORIENTED DEVELOPMENT NODE DENSITIES (Multimodal Centers P3 and Above)

	INSIDE TOD NODE (1/8 mile radius circle)							
	ACTIVITY DENSITY		TOTAL FLOOR-AREA-RATIO based on Activity Density (combined residential and commercial)				BUILDING HEIGHT based on visual inspection (No. of stories)	
Multimodal Center Types	Activity Density = (Jobs + HH)/acre		Gross Building FAR (includes res + com)		Net Building FAR (includes res + com)		Average Building Height	Typical Maximum Bldg Height
	Low	High	Low	High	Low	High		
P-3 Medium Town or Suburban Center	13.3	27.5	0.20	0.41	0.30	0.63	4	7
P-4 Large Town or Suburban Center	27.5	67.5	0.41	1.01	0.63	1.55	7	12
P-5 Urban Center	67.5	140.0	1.01	2.09	1.55	3.21	9	18
P-6 Urban Core	140.0	-	2.09	-	3.21	-	13	28

Table 5 - Densities and Intensities within the Eighth-Mile Radius TOD Node.

TRANSIT-ORIENTED DEVELOPMENT NODE DENSITIES (Multimodal Centers P3 and Above)

INSIDE TOD NODE (1/8 mile radius	OUTSIDE TOD NODE (1/8 mile to 1/4 radius ring)							
	ACTIVITY DENSITY		TOTAL FLOOR-AREA-RATIO based on Activity Density (combined residential and commercial)				BUILDING HEIGHT based on visual inspection (No. of stories)	
Multimodal Center Types	Activity Density = (Jobs + HH)/acre		Gross Building FAR (includes res + com)		Net Building FAR (includes res + com)		Average Building Height	Typical Maximum Bldg Height
	Low	High	Low	High	Low	High		
P-3 Medium Town or Suburban Center	4.4	9.2	0.07	0.14	0.10	0.21	3	5
P-4 Large Town or Suburban Center	9.2	22.5	0.14	0.34	0.21	0.52	4	8
P-5 Urban Center	22.5	46.7	0.34	0.70	0.52	1.07	6	12
P-6 Urban Core	46.7	-	0.70	-	1.07	-	9	19

Table 6 - Densities and Intensities outside the Eighth-Mile Radius TOD Node.

The basis of transit supportive density metrics used in these Guidelines comes from two primary sources; the Federal Transit Administration (FTA) guidelines for transit supportiveness, and the Virginia DRPT Transit Service Design Guidelines."

The above metrics are important benchmarks for those who are planning for transit and TOD in the context of Multimodal Centers according to these Guidelines. By defining optimal Activity Densities for each type of TOD Node and Multimodal Center, an overall framework can be established for station area intensities around high capacity transit stops.

What Levels of Activity Density are Needed to Support Transit?

As mentioned above, not all Multimodal Centers have transit within them. In fact, many of the lower intensity Multimodal Centers (P-1 to P-3) have no transit service when they are located away from larger metropolitan areas. However, in higher intensity Multimodal Centers transit is typically a key feature in making the Multimodal Centers denser, more multimodal, and more vital.

What kinds of densities are needed to support transit? This is a frequent industry question and a complex issue that has been studied extensively. Ultimately the market for transit in a location is derived from a complex of multiple factors, including density around the station as well as in the system itself, other available transportation choices, and characteristics of the transit population. These Guidelines cannot address the full array of issues associated with transit markets. However, these Guidelines have used a standardized approach to defining transit supportive densities in Multimodal Centers correlated to different types of transit technologies. The supported transit technology simply means that the density levels for each Transect Zone or Multimodal Center type are generally high enough to generate adequate ridership to justify the investment in that particular type of transit service. However, it should be noted that in order to understand transit supportiveness in a region, the densities for much broader areas than just a single Multimodal Center need to be considered.

The basis of transit supportive density metrics used in these Guidelines comes from two primary sources; the Federal Transit Administration (FTA) guidelines for transit supportiveness, and the Virginia DRPT Transit Service Design Guidelines. Both of these sources give typical residential and commercial density/intensity standards for transit supportiveness. The FTA guidelines describe densities supportive of rail transit and the DRPT Transit Service Design Guidelines give densities supportive of bus transit. Using these existing standards as benchmarks, the densities needed for Bus Rapid Transit and Light Rail Transit were interpolated between these standards and checked against the densities of places in Virginia that had heavy rail transit (i.e. Metrorail stops) and light rail transit (Norfolk's Tide stations). The resulting transit supportive Activity Densities for the T-1 through T-6 Transect Zones and the P-1 through P-6 Multimodal Center types are listed in Tables 7 and 8. It should be noted that the transit technologies are cumulative, i.e. that each higher technology also supports the lower technologies.

TRANSECT ZONE INTENSITY		
Transect Zone	**Activity Density (Jobs + people/acre)**	**Supported Transit Technology**
T-1	**1 or less**	**Demand Response**
T-2	**1 to 10**	**Demand Response**
T-3	**10 to 25**	**Fixed Route Bus**
T-4	**25 to 60**	**Express Bus**
T-5	**60 to 100**	**BRT/LRT**
T-6	**100 or more**	**LRT/Rail**

Table 7 - Supported Transit Technologies by Transect Zone.

MULTIMODAL CENTER INTENSITY		
Center Type	**Activity Density (Jobs + people/acre)**	**Supported Transit Technology**
P-6 Urban Core	70.0 or more	LRT/Rail
P-5 Urban Center	33.75 to 70.0	BRT/LRT
P-4 Large Town or Suburban Center	13.75 to 33.75	Express Bus
P-3 Medium Town or Suburban Center	6.63 to 13.75	Fixed Route Bus
P-2 Small Town or Suburban Center	2.13 to 6.63	Demand Response
P-1 Rural or Village Center	2.13 or less	Demand Response
SP Special Purpose Center	Varies	Varies

Table 8 - Supported Transit Technologies by Multimodal Center Type.

Transit Corridor Planning:

Using the Multimodal Center Types, TOD Nodes and Multimodal Corridor Types

The Multimodal Center types and TOD Nodes are intended to work in concert with the Multimodal Corridor typology in these Guidelines to give a complete framework for planning for TODs and supportive land uses around station areas as part of an overall transit system plan. The steps involved in planning for TOD in the context of a transit corridor or system plan will vary from project to project. However, a basic six step process for using the Multimodal Center and TOD typology in this planning process is outlined below:

Step 1- Identify the destinations (Multimodal Centers) to be served by transit and the Multimodal Corridors that will serve each Multimodal Center.

Step 2 – Identify the transit technology and type of service for the near and long term, based on a thorough analysis of the potential market for transit and ridership projections.

Step 3 – Identify the potential station areas based on the existing or proposed Multimodal Centers, spacing requirements of the transit technology, and overall future transit network.

Step 4 – For each station area, identify the Multimodal Center type (P-3 to P-6) best suited to each station area based on the anticipated future build-out of the area.

Step 5 – Develop a TOD plan for each station area based on the metrics for the type of Multimodal Center and TOD Node from the Guidelines.

Step 6 – Develop Multimodal Corridor plans for each of the corridors within the TOD based on the Multimodal Corridor types in these Guidelines.

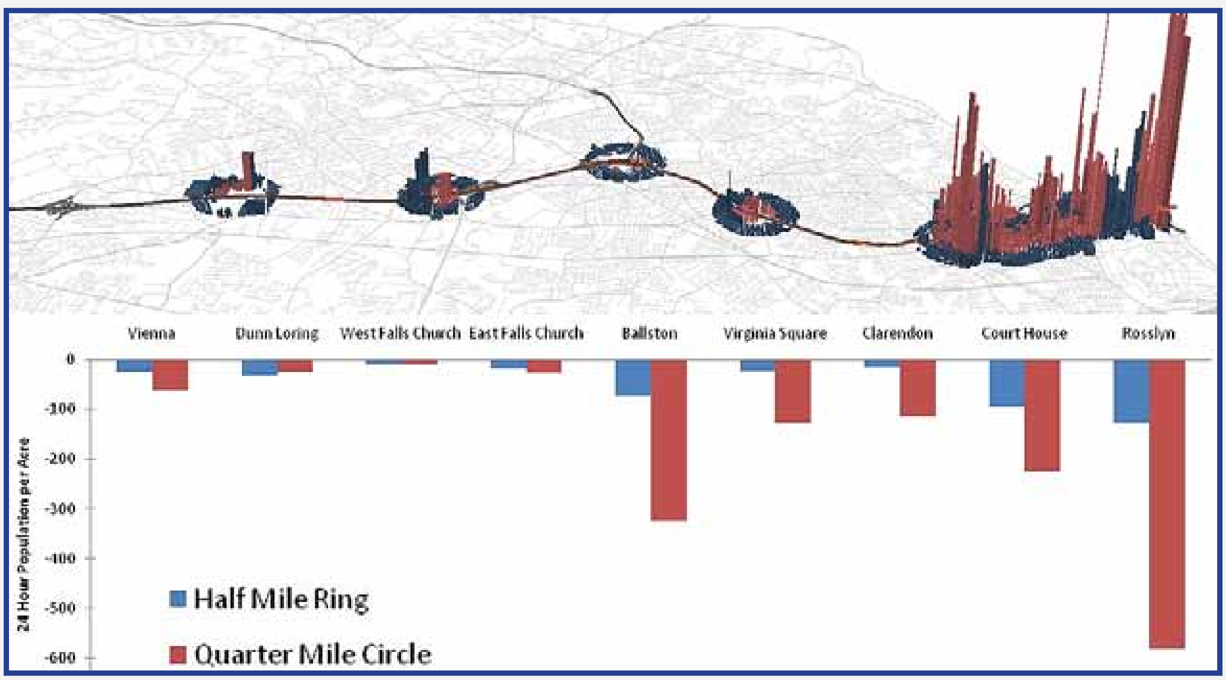


Figure 39 - Analysis of Orange Line Station Area Densities in Virginia. Note that stations in the Rosslyn to Ballston corridor show significant density differential between the first and second quarter-mile rings.

It is important to keep in mind that not all stations along a transit corridor will support dense TOD. Even a very successful transit line, such as the Metrorail Orange Line in Virginia can have relatively low density land uses around some stations – particularly in more suburban areas at the end of the line.

It is important to keep in mind that not all stations along a transit corridor will support dense TOD. Even a very successful transit line, such as the Metrorail Orange Line in Virginia can have relatively low density land uses around some stations – particularly in more suburban areas at the end of the line. Figure 39 shows the existing Activity Density of jobs plus population (called 24-hour population in the chart) within the Orange Line Metrorail corridor in Northern Virginia. It shows that well developed Multimodal Centers, such as those in the Rosslyn to Ballston corridor exhibit this same typical pattern of higher density in the inner quarter mile ring; while more dispersed Multimodal Centers, such as those west of Ballston, tend to have relatively low densities in both the first and second quarter-mile rings. Note, this analysis is based on existing data and does not reflect the anticipated future growth in many of these station areas as articulated in Fairfax County's Comprehensive Plan.

In addition, as noted in the Orange Line example, it is important to note that the uniform "rings" of density shown in these Guidelines are idealized representations of the pattern of densities found in real world Multimodal Centers and TODs. As shown in the map view of the same area in Figure 40, the highest densities (shown in dark red) don't always conform to a pattern of equal rings around the station areas, but can be "stretched" in the direction of the transit corridor and can overlap with adjacent Multimodal Centers when the station spacing is less than one mile.

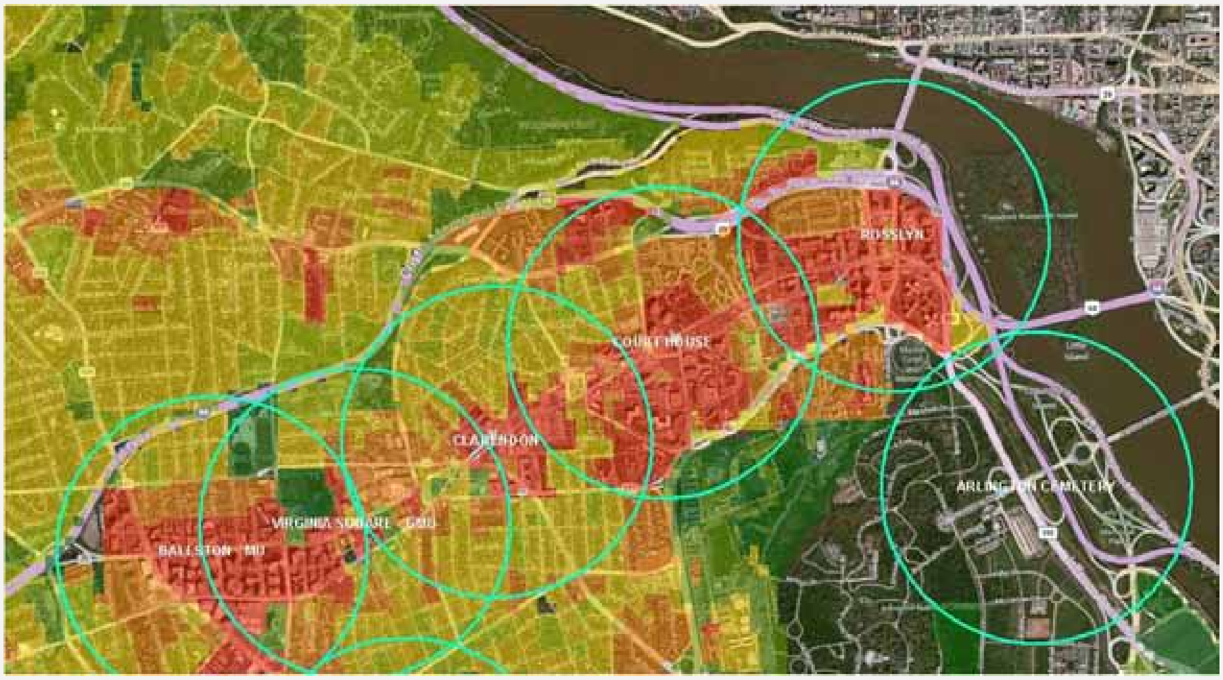


Figure 40 – Map of Densities around Metrorail Stations in the Rosslyn/Ballston Corridor.

Figure 41 – Ballston, VA. A stop on the Metrorail Orange Line shows many of the typical characteristics of a TOD Node within a P-6 Urban Core. Colors represent varying land uses.

CHAPTER 5
Multimodal Corridors

The prime goal of multimodal planning as a whole is to define a multimodal transportation network for an entire region or metropolitan area. Multimodal Corridors are the building blocks for such a system that move people and goods between and within Multimodal Districts and Multimodal Centers.

The previous chapters described how multimodal planning transitions from the regional scale to the scale of Multimodal Districts and Multimodal Centers. They described a series of Multimodal Center types based on the Activity Density (jobs + people per acre) in each. As shown in Chapter 3, a series of prototype diagrams for each Multimodal Center described the ideal or "prototype" arrangement of Multimodal Corridors in each Multimodal Center. This chapter describes the Multimodal Corridor types that are the building blocks of each Multimodal Center. A Multimodal Corridor, as used in these Guidelines, is generally a roadway that accommodates multiple modes, (or in special cases a trail or rail right-of-way) that includes all the area within the public right-of-way, as well as the adjacent building context zone.

The prime goal of multimodal planning as a whole is to define a multimodal transportation network for an entire region or metropolitan area. Multimodal Corridors are the basic elements for such a system that move people and goods between and within Multimodal Districts and Multimodal Centers. As explained in Chapter 2, a true multimodal transportation system is one where travelers of every mode have a connected network of corridors to move within and between Multimodal Districts and Multimodal Centers. Without first understanding the context or identifying connected networks for each travel mode, designing individual corridors may lead to disconnected or underused facilities that fail to provide safe and convenient connections for pedestrians, bicyclists and transit riders.

This chapter introduces a typology of Multimodal Corridors that is sensitive to the surrounding Activity Density and context, and customized to the needs of the particular travel modes that are emphasized. This chapter explains how to design and retrofit corridors to best fulfill their multimodal function within the larger regional multimodal transportation system. The flowchart in Figure 42 generally describes the design process for developing a typical cross-section for a Multimodal Corridor. Each step will be further described in this chapter.

Several sections of this chapter refer to the Corridor Matrix, provided in Appendix A. The Corridor Matrix provides customized design elements for each Multimodal Corridor type, as explained in the following sections of this chapter. Appendix B includes the Corridor Matrix Annotation Document, which thoroughly documents the engineering resources used to define the dimensions for each corridor design element.

This chapter explains how to design and retrofit corridors to best fulfill their multimodal function within the larger regional multimodal transportation system. The flowchart generally describes the design process for developing a typical cross-section for a Multimodal Corridor. Each step will be further described in this chapter.

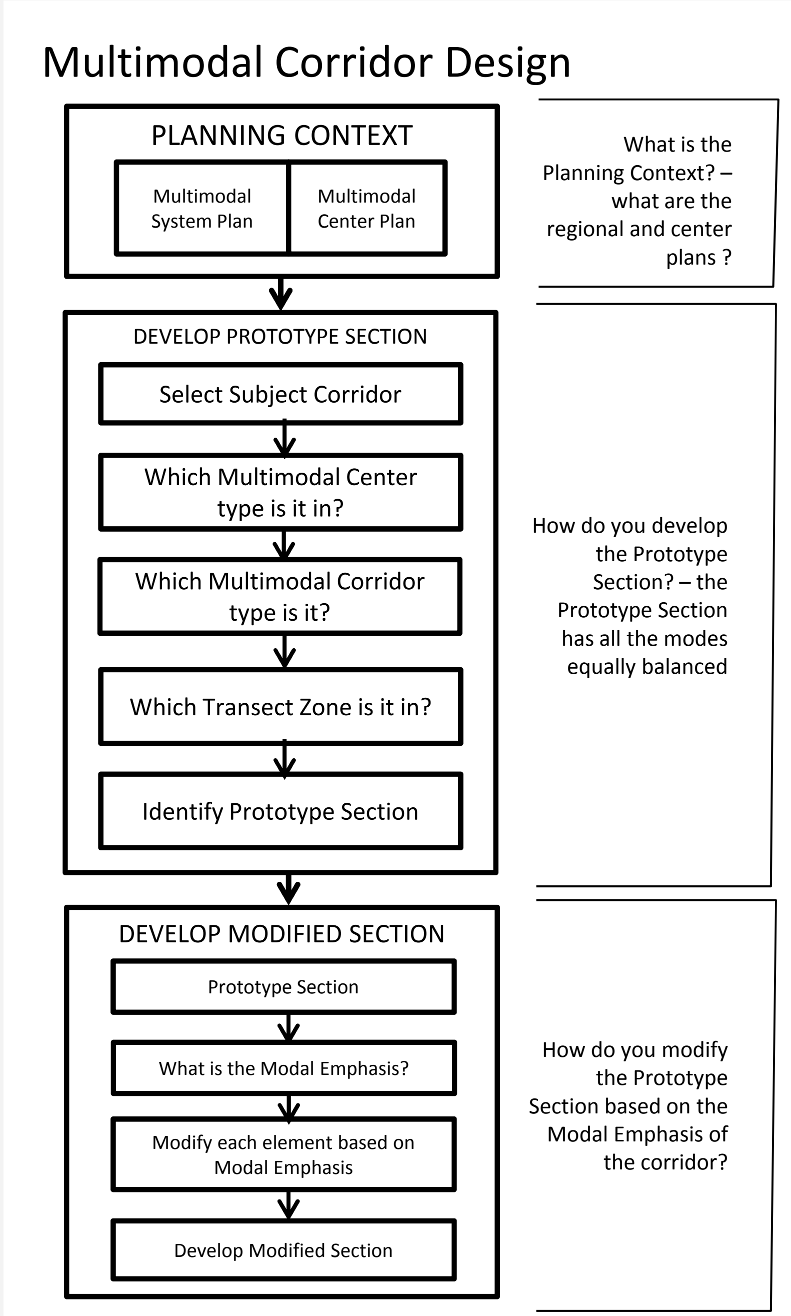


Figure 42 - The Process for Designing Multimodal Corridors.

Multimodal Corridors and Complete Streets

The concept of *Complete Streets* has influenced the transportation planning profession for the last several years. Complete Streets are streets that are designed and operated to enable safe access for all travelers regardless of travel mode, age, and ability. Localities across the nation have undertaken this task of designing and redesigning streets to safely accommodate all travel modes, and changing their land development and transportation infrastructure policies to make it easier to do so. The overriding purpose of these Guidelines is the same as that of Complete Streets – to rethink the design of transportation infrastructure to make sure all pedestrians, bicyclists, and transit riders have equal access to all destinations. The approach of these Guidelines goes beyond simply accommodating all travel modes. It also allows specified modes to go beyond minimum accommodation and be optimized according to the Multimodal System Plan for the region or locality.

The ideal Complete Street has designated space for each travel mode, including sidewalks, bike lanes, and transit service. However, many streets have limited right-of-way making it impossible to provide an optimal facility for each travel mode. The methodology for Multimodal Corridor design presented in these Guidelines allows additional flexibility to address constrained rights of way. It allows all modes to be accommodated at least using minimum acceptable dimensions according to industry standards. For those modes that are most important – according to the Multimodal System Plan – it also shows where to allocate any additional space within the right-of-way. This concept of Multimodal Corridor design is more fully described at the end of this chapter.

Many localities have implemented 'road diets' as part of the Complete Streets principles, which take away travel lanes and/or narrow the width of travel lanes, and reallocate the right-of-way to facilities for non-vehicular modes such as bike lanes, wider sidewalks, and wider buffer space between the sidewalk and the road. In some instances, taking away travel lanes is the only way to make space for bike lanes. However, road diets need to be carefully considered in the context of available capacity and other operational issues. For this reason, these Guidelines do not address road diets that take away travel lanes. The methodology of corridor design assumes that the number of travel lanes for an existing corridor will remain the same. Localities may find that a road diet would be appropriate for a specific corridor; yet road diets require more in-depth traffic and incident management studies than these Guidelines can provide. Regardless of whether the number of travel lanes is to change or remain the same, the process for multimodal corridor design within this chapter will be helpful in understanding the optimal and minimum corridor elements for each travel mode.

All Multimodal Corridors safely accommodate all travel modes regardless of Modal Emphasis. This is the basis for the 'minimum' corridor design.

Multimodal Through Corridors and Placemaking Corridors

Corridors have different functions in a region. Some corridors are used to get smoothly and rapidly through a region or to get quickly to major destinations in the region. For the purpose of these Guidelines, these kinds of corridors are called Multimodal Through Corridors. Other corridors are more slow speed and used to access local businesses, residences and activities within a destination. Usually these types of corridors are found in Multimodal Districts and Multimodal Centers, and they are called Placemaking Corridors in these Guidelines.

This fundamental distinction – between Multimodal Through Corridors and Placemaking Corridors is a key concept in these Guidelines. All Multimodal Corridors within a Multimodal Center, and often many of the corridors in a Multimodal District are considered to be Placemaking Corridors; these corridors facilitate movement to destinations within a Multimodal Center or Distrcit. The higher speed Multimodal Corridors that travel between and connect Multimodal Centers within a Multimodal District, or connect between Districts, are considered to be Multimodal Through Corridors. Multimodal Through Corridors and Placemaking Corridors work together in a region by getting people quickly from one Multimodal District or Multimodal Center to another and ultimately to activities within a Multimodal District or Multimodal Center. Multimodal Through Corridors will typically transition to Placemaking Corridors as they enter a Multimodal Center. Ideally, though, they are located at the edge of Multimodal Centers, remaining as higher-speed facilities to which Placemaking Corridors provide access from the core of the Multimodal Center.

Placemaking Corridors are usually located within Multimodal Centers, but can extend outward beyond the Multimodal Center boundaries into a Multimodal District. Any street that communities desire to make into a lively, pedestrian-oriented street may be designated as a Placemaking Corridor, regardless of location. Because of the concentration and diversity of land uses within Multimodal Centers, the streets within Multimodal Centers should be designated as Placemaking Corridors.

Multimodal Through Corridors are located exclusively outside of Multimodal Centers, but may traverse Multimodal Districts. If possible, Multimodal Centers should be located such that Multimodal Through Corridors skirt the edges of a Multimodal Center. Alternatively, Multimodal Through Corridors should transition to Placemaking Corridors if they go through a Multimodal Center. Once they have passed through the Multimodal Center, they may transition back to Multimodal Through Corridors.

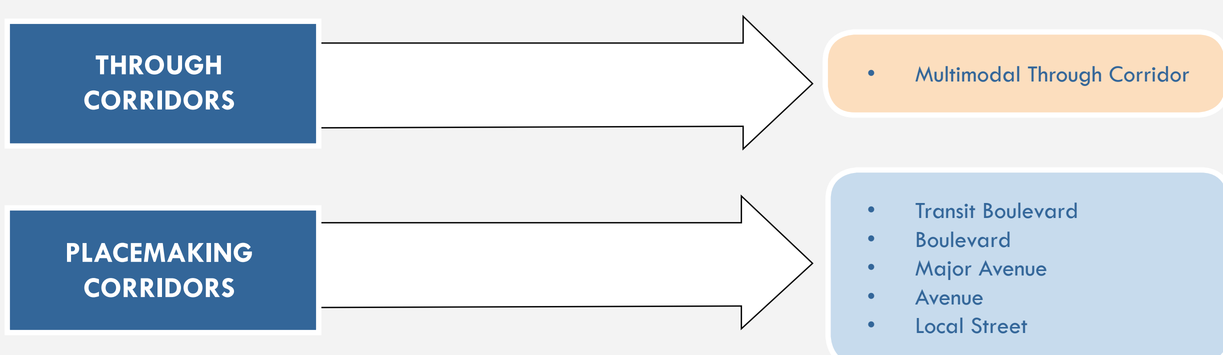


Figure 43 - List of Multimodal Corridor Types.

The basic relationship between Multimodal Through and Placemaking Corridors is described in Figure 44.

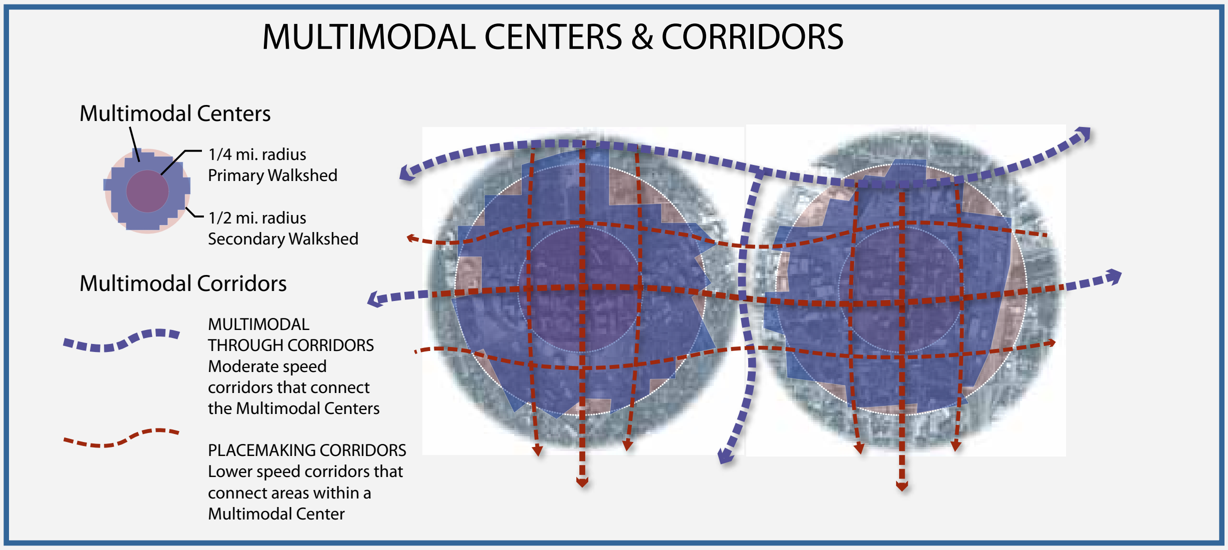


Figure 44 - Multimodal Through and Placemaking Corridors. The diagram distinguishes Placemaking Corridors from Multimodal Through Corridors – the two general categories of Multimodal Corridors that together comprise a true multimodal transportation system in a region.

Through Corridors

Multimodal Through Corridor

The Multimodal Through Corridor is a higher speed corridor that connects multiple activity centers. It is intended for longer distance, higher speed automobile, bus, or rail travel and ideally has limited at-grade intersections with other roadway types. Multimodal Through Corridors are good candidates for high speed commuter transit having few impediments to traffic flow. High speeds limit pedestrian and bicycle modes and hence the corridor design should provide separated facilities for these modes if they are needed. The design of the adjacent buildings should be oriented away from Multimodal Through Corridors and towards Placemaking Corridors on the other side of the buildings, providing more desirable pedestrian facilities and pedestrian-oriented land uses on the Placemaking Corridors, while still accommodating pedestrian travel along the Multimodal Through Corridors. Design speeds for Multimodal Through Corridors range from 35 to 55 mph.

Figure 45 – Fairfax County Parkway. An example of a Multimodal Through Corridor.

Placemaking Corridors

Within Multimodal Centers, the street network consists of different types of corridors with different functions relative to access, mobility, and multimodal features. Placemaking corridors are thus further divided into five types, each of which has a unique function and interface with the surrounding land uses. The following five Placemaking Corridor types were derived from the basic typology of Boulevard, Avenue and Street used in the ITE/CNU Guidebook, but with two additional Multimodal Corridor types added (Transit Boulevards and Major Avenues) for additional flexibility in designing Multimodal Corridors and Multimodal Centers. Thus the five Placemaking Corridor types used in these Guidelines are described in the following sections:

Transit Boulevard

The Transit Boulevard is the highest capacity and most transit supportive Multimodal Corridor in the typology. It would typically only be found in dense urban centers that have sufficient density and market for premium transit. A Transit Boulevard is a multi-lane and multimodal boulevard with a dedicated lane or right-of-way for transit. Transit technologies could be bus service with a bus only lane (BRT or express bus), light rail, or other transit technologies with a separate right-of-way. Other transit types that share lanes with general traffic, such as streetcar or local bus service, could be accommodated on a Boulevard, Major Avenue, or Avenue, but the dedicated transit-only right-of-way defines the Transit Boulevard corridor type. Design speeds for Transit Boulevards range from 30 to 35 mph.

Figure 46 – Plume Street in Norfolk. An example of a Transit Boulevard.

Boulevard

Figure 47 - Glebe Road in Arlington County. An example of a Boulevard.

A Boulevard is the corridor type of highest multimodal capacity that accommodates multiple motorized and non-motorized modes. Boulevards allow for higher traffic volumes and greater efficiency of vehicular movements than Major Avenues, Avenues, and Local Streets, and typically have four to six lanes of traffic but may grow to eight in particularly dense centers such as Tysons Corner. Boulevards provide safe and convenient pedestrian and bicycle access to adjacent land uses. Boulevards feature a median, landscaped amenity elements, street trees, and wider sidewalks. Design speeds for Boulevards range from 30 to 35 mph.

Major Avenue

Figure 48 - Crawford Street in Portsmouth. An example of a Major Avenue.

Major Avenues contain the highest density of destinations, intensity of activity, and mix of modes. Because of the close proximity of destinations, pedestrians and street activity are common on Major Avenues. Major Avenues have wide sidewalks to accommodate high numbers of pedestrians and a variety of outdoor activities, including sidewalk cafes, kiosks, vendors, and other street activities. Major Avenues can be areas of high transit ridership for local bus routes. Traffic is low speed and localized. Due to the intensity of destinations, longer regional trips do not use Major Avenues; rather they would typically be on Boulevards or Multimodal Through Corridors. Autos and buses on Major Avenues travel at slow speeds because pedestrian crossings and on-road bicyclists are frequent. Major Avenues typically have four or fewer lanes for motor vehicle travel while providing adequate facilities for bicycling and typically providing roadway space dedicated to on-street parking. Design speeds for Major Avenues range from 30 to 35 mph.

Avenue

Figure 49 - Henley Avenue in Winchester. An example of an Avenue.

Avenues provide a balance between access to the businesses and residences that front upon them and the collection of vehicular and pedestrian traffic. While having fewer destinations than Major Avenues, pedestrian and bicycle activity is very common, as Avenues serve as critical links in the non-motorized network. Avenues are low speed roadways that facilitate shorter trips, but still contain a fair amount of destinations. Avenues typically have three travel lanes or fewer, and do not exceed four lanes. Avenues may have roadway space dedicated for on-street parking and provide adequate bicycle facilities. Avenues have a 25-30 mph design speed.

Local Street

Figure 50 - Page Street in Charlottesville. An example of a Local Street.

Local Streets see the lowest amount of activity and have the slowest speeds and the highest access. Bicyclists typically can share the road with autos, because speeds are slow and auto traffic is sparse, although they have separate sidewalks and trails for pedestrian accommodation. Local Streets are primarily in more residential areas and are intended to serve only trips that originate or end along them. They connect to Avenues, Boulevards or Major Avenues, funneling longer trips to these higher capacity corridor types. Local Streets are characterized by slow design speeds, wider setbacks; they may not have lane striping, and they emphasize on-street parking. Local Streets have a 25 mph design speed.

Transitions Between Through Corridors and Placemaking Corridors

When Multimodal Through Corridors enter a Multimodal Center, the surrounding context signals a change in corridor character and function, and they transition to Placemaking Corridors. This transition is marked by slower traffic speeds, more frequent pedestrian crossings, and pedestrian-oriented buildings. Multimodal Through Corridors that transition to Placemaking Corridors can maintain vehicular throughput by access management (consolidating driveways and unsignalized intersections to minimize the number of entrances onto a road) and traffic signal coordination and optimization. These techniques are particularly relevant for Corridors of Statewide Significance, National Highway System (NHS) Routes, and emergency evacuation routes.

Relationship to Functional Class

The Multimodal Corridor typology within these Guidelines is related, but not identical, to the functional classification of roads. Functional classification is a concept within roadway design and engineering circles that recognizes that roads have different functions for motorized vehicles. Streets that provide direct access to destinations for cars via driveways, curb cuts, and frequent intersections often cannot retain high speeds and serve high volumes of traffic. Conversely, high capacity roads with heavy volumes and higher speeds have less frequent access points to keep traffic moving.

Roads are designated into functional classes mainly for federal and state funding purposes. The Federal Highway Administration (FHWA) provides guidelines on how to classify roads, and these are based on having a certain percentage of total road miles for each classification. For example, urban principal arterials should only account for 5 to 10 percent of an area's total road centerline miles, but should carry 40 to 65 percent of the area's total vehicle-miles traveled (VMT).

Functional classification is also a relevant concept for Multimodal Corridor design, but must be broadened to include other travel modes. The five types of Placemaking Corridors are different in nomenclature from the functional classification systems used by VDOT and the FHWA. However, the concept of functional classification is similar. The Corridor Matrix Annotation Document in Appendix B has a more detailed discussion on VDOT functional classification. Table 9 shows the general translation of Multimodal Corridor types to the functional classes of roadways:

<table>
<tr><th rowspan="2"></th><th colspan="5">VDOT Functional Classification (Design Speed)</th></tr>
<tr><th>Interstate, Freeway, or Expressway (50 – 70 mph)</th><th>Urban Other Principal Arterial (30 – 60 mph)</th><th>Urban Minor Arterial (30 – 60 mph)</th><th>Urban Collector (30 – 50 mph)</th><th>Local Street (20 – 30 mph)</th></tr>
<tr><th rowspan="6">Multimodal Corridor Types (Design Speed)</th><td colspan="2">Multimodal Through Corridor (35-55 mph)</td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="2">Transit Boulevard (30-35 mph)</td><td></td><td></td></tr>
<tr><td></td><td colspan="2">Boulevard (30-35 mph)</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="2">Major Avenue (30-35 mph)</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Avenue (25-30 mph)</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Local Street (25 mph)</td></tr>
</table>

Table 9 – Comparison of VDOT Functional Classes to Multimodal Corridor Types.

The Multimodal Corridor types do not have a one-to-one correlation to the VDOT functional classes. The Multimodal Corridor types are purposely elastic to allow localities flexibility in designating roads into Multimodal Corridor types. A road may be classified into one particular functional class to meet the percentage criteria, but may serve a very different function for non-motorized modes. For example, Water Street in Charlottesville is designated as an Urban Collector, but with multi-story buildings on either side of the street and ground-floor pedestrian-oriented retail, it serves a higher function for pedestrians and transit, and would likely be classified as a Major Avenue.

Figure 51 – Water Street in Charlottesville. Although classified as an Urban Collector in VDOT's Functional Classification system, Water Street functions more like a Major Avenue for pedestrians, bicyclists, and transit. Image source: Google Streetview.

Planners should consider the functional classification of a road as one factor when designating roads into the various Placemaking Corridor types. Other factors to consider would be the amount of pedestrian-generating land uses that line the street, the number of transit routes that serve the corridor, and the length and frequency of connections to other roads.

Corridor Intensity Zones

The purpose of applying Transect Zones to the Multimodal Corridor types is to better describe the context surrounding a particular corridor. For example, a Local Street in a (P-1) Rural Center is vastly different from a Local Street in a (P-5) Urban Center.

Just as the Transect Zones were used to define intensity zones in the Multimodal Centers, they are also used to define intensity levels among Multimodal Corridors. Within each Multimodal Corridor type, there is a spectrum of land use contexts ranging from T-1 to T-6. The intensity levels directly correspond to the Transect Zones. The purpose of applying Transect Zones to the Multimodal Corridor types is to describe the context surrounding a particular corridor. For example, a Local Street in a T-1 context zone is vastly different from a Local Street in a T-6 context zone. Both corridors may function similarly, i.e. to carry purely local traffic within a neighborhood. However, the Local Street in a T-1 rural context may have very low density development, wide setbacks and correspondingly rural design details in the corridor, while the Local Street in a T-6 urban context may have high density development, narrow setbacks and more urban design details. Therefore, the six Multimodal Corridor types are all modified by their Transect Zone.

Not all intensity levels exist in all Multimodal Corridor types. For example, the intensity levels for a Boulevard range from T-6 to T-2, since a very low intensity Boulevard is not practical. In the least dense Multimodal Center (P-1), roads that provide a high level of mobility will not correspond with the description and function of a Boulevard. In these cases, a Major Avenue or Avenue will serve as the primary Multimodal Corridor within the Multimodal Center and will provide the facilities for multimodal transportation scaled to their less dense context.

The Multimodal System Design Guidelines are designed to address urban and rural areas of many scales and intensities. A Rural or Village Center may be a village crossroads through which two regional routes (or a regional route and a smaller road) intersect. For example, in the small town of Palmyra in Fluvanna County, US 15 intersects with Courthouse Road. Outside of this local center, US 15 has a posted speed limit of 55 mph with no sidewalks and is used for high speed regional auto travel. But within the primary walkshed of the center, the road serves a different function. It becomes more like a Major Avenue as described above, although it is located within what could be described as a P-2 (Small Town or Suburban Center) context. In this example, in particular, the Transect Zones differentiate the intensity levels of similar Multimodal Corridor types. For example, a Major Avenue in downtown Richmond looks and feels different from the Major Avenue just described in Palmyra, but the functions of the two roads are similar. They both serve more localized traffic, contain destinations for pedestrians, have slower speeds to allow safe pedestrian crossings, and are more focused on destinations and access than mobility. The T-Zones, however, help differentiate the intensities and characteristic features of the two examples of Major Avenue corridors – one rural and one urban.

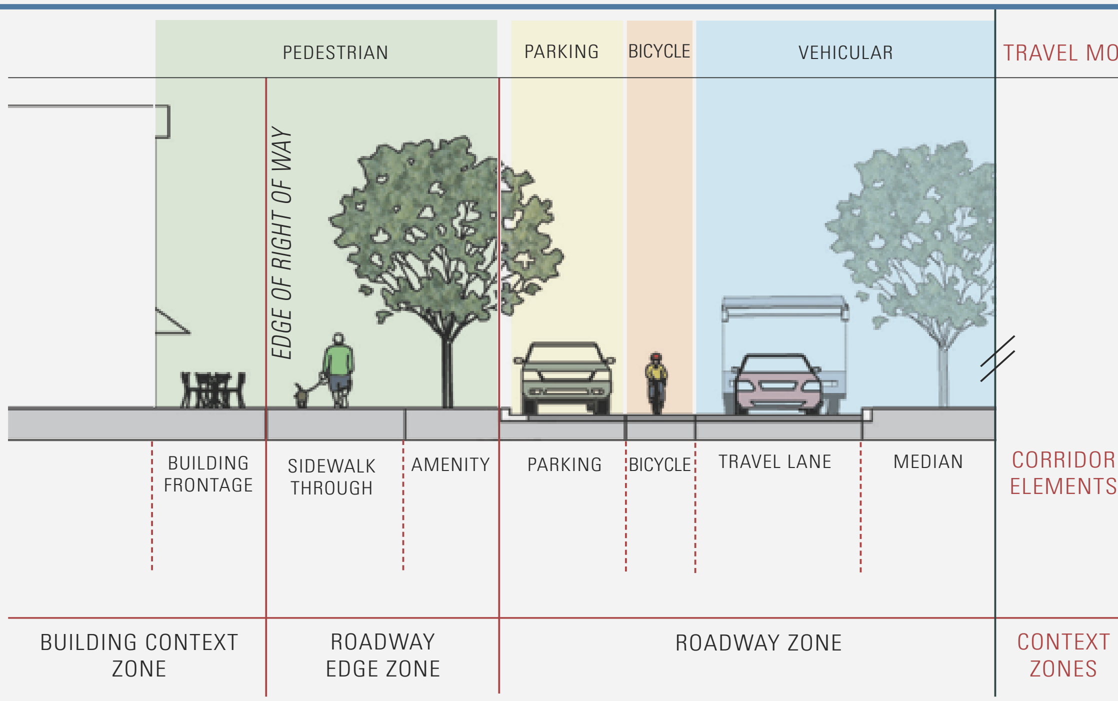
Table 10 specifies which Multimodal Corridor types are appropriate for each Transect Zone.

<table>
<tr><th>Intensity Zone</th><th>T-6 HIGH INTENSITY</th><th>T-5 MEDIUM HIGH INTENSITY</th><th>T-4 MEDIUM INTENSITY</th><th>T-3 MEDIUM LOW INTENSITY</th><th>T-2 LOW INTENSITY</th><th>T-1 VERY LOW INETNSITY</th></tr>
<tr><td rowspan="6">MULTIMODAL CORRIDOR TYPES</td><td colspan="5">Transit Boulevard</td><td></td></tr>
<tr><td colspan="5">Boulevard</td><td></td></tr>
<tr><td colspan="6">Major Avenue</td></tr>
<tr><td colspan="6">Avenue</td></tr>
<tr><td colspan="6">Local Street</td></tr>
<tr><td colspan="6">Multimodal Through Corridor</td></tr>
</table>

Table 10 - Relation of Transect Zones to Multimodal Corridor Types.

Using Corridor Elements

The most important step in designing Multimodal Corridors is to understand the typical Corridor Elements that make up a Multimodal Corridor. Figure 52 is a diagram of a cross-section that is broken down into Context Zones, which are broad segments of a corridor that contain different contexts such as the Building, Roadway and Roadway Edge Zone. Each Context Zone is further broken down into Corridor Elements, which are the individual "pieces" of the corridor, such as the Travel Lane element, Median element, Parking element, etc. For ease of identification in these Guidelines, each Corridor Element is assigned a letter and is referenced in the master Corridor Matrix in Appendix A. The Corridor Matrix lists the recommendations for the design and the size of each Corridor Element according to the type of Multimodal Corridor and T-Zone. Also shown in Figure 53 are the typical travel modes associated with each Corridor Element. This understanding of how Corridor Elements serve different travel modes is essential to understanding how to plan Multimodal Corridors using Modal Emphasis, described in the following sections.



Note: Not all modes are shown in this diagram. Some modes such as Green, that overlaps with other modes, are not precisely depicted. Refer to Corridor Matrix for recommended dimensions for each Corridor Element by Corridor Type and Transect Zone.

Figure 52 - Diagram of Context Zones, Corridor Elements, and Travel Modes.

Planning For Modal Emphasis

One of the most important features of these Guidelines is the process for designing corridors around Modal Emphasis. Modal Emphasis is defined in these Guidelines as giving greater weight, or emphasis, to those elements of the street that serve a particular travel mode. It is important to note, however, that Modal Emphasis does not mean that other travel modes are excluded – other modes are still accommodated in a Multimodal Corridor - Modal Emphasis means the primary but not the sole travel mode that is emphasized on a corridor. This is a realistic way of looking at travel mode accommodation within a Multimodal Corridor planning context. While there may occasionally be cases where some modes are excluded (as in a pedestrian only street, for example), the basic principle followed in these Guidelines is to accommodate as many modes as possible within a Multimodal Corridor. All Multimodal Corridors provide at minimum safe accommodations for all travel modes. Modal Emphasis simply prioritizes which Corridor Elements (e.g. sidewalks, bicycle lanes, travel lanes, etc.) will receive additional space, according to the travel modes that are emphasized (pedestrian, transit, bicycle, or a combination thereof). The Modal Emphasis for each corridor is determined through the Multimodal System Plan, which is explained in Chapter 2.

In addition to non-auto travel modes, there are other considerations that affect which Corridor Elements are emphasized in cross-section design. These additional considerations include on-street parking in downtown business districts, and special landscaping features along entrance corridors or other "Green Streets." While 'Parking' and 'Green' are not travel modes, they are considerations for emphasis in corridor cross-section design, and are incorporated in the Multimodal Corridor design methodology in these Guidelines. Parking and Green considerations are not identified in a Multimodal System Plan, but rather are designated during corridor design.

For the purposes of these Guidelines, the modes and other considerations that are used to define Modal Emphasis on a corridor are:

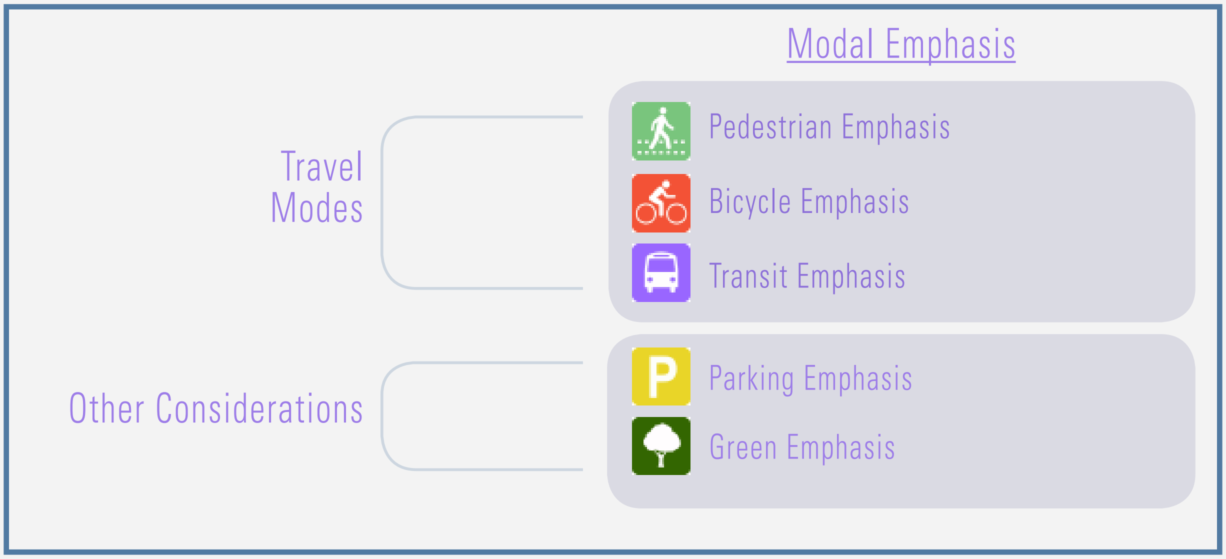


Figure 53 - Travel Modes and Other Considerations for Modal Emphasis in Corridor Cross-Section Design.

How Corridor Elements are used in Modal Emphasis

Table 11 shows how a Multimodal Corridor cross-section can be designed using Modal Emphasis. It shows how to select and size Corridor Elements according to the Modal Emphasis of the corridor. Corridor Elements are allocated according to whether they are Primary, Secondary, Contributing or Non-Contributing Elements. This allows the designer of a Multimodal Corridor cross-section to select an appropriate balance among Corridor Elements and their relative size, according to their importance in achieving the intended Modal Emphasis of the corridor. For example, to achieve Pedestrian Modal Emphasis, the road designer would first look up the Primary Corridor Element for Pedestrian Modal Emphasis from this table, and select the optimal standards for that Corridor Element from the Corridor Matrix in Appendix A. Then, as space within the right-of-way permits, the designer would maximize the Secondary and Contributing Corridor Elements. If a corridor has more than one Modal Emphasis, the designer would balance the Primary Elements for both emphases first, then allocate any remaining space within the right-of-way to the Secondary and Contributing Elements.

HOW CORRIDOR ELEMENTS ARE USED IN MODAL EMPHASIS				
MODAL EMPHASIS	PRIMARY ELEMENTS	SECONDARY ELEMENTS	CONTRIBUTING ELEMENTS	NON-CONTRIBUTING ELEMENTS
Pedestrian	B-Sidewalk Through Element	A-Building Frontage Element C-Amenity Element	D- Parking Element Buidling Element	E-Bicycle Element F-Travel Lane Element G-MedianElement
Bicycle	E-Bicycle Element	N/A	C-Amenity Element	A-Building Frontage Element B-Sidewalk Through Element D-Parking Element F-Travel Lane Element G-MedianElement
Transit	F-Travel Lane Element	B-Sidewalk Through Element	A-Building Frontage Element C-Amenity Element E-Bicycle Element	D-Parking Element G-MedianElement
Green	C-Amenity Element	G-Median Element	A-Building Frontage Element	B-Sidewalk Through Element D-Parking Element E-Bicycle Element F-Travel Lane Element
Parking	D-Parking Element	N/A	E-Bicycle Element	A-Building Frontage Element B-Sidewalk Through Element C-Amenity Element F-Travel Lane Element G-MedianElement

Table 11 - Using Corridor Elements in Corridor Design According to Modal Emphasis.

Choosing Design Standards

Table 12 shows specifically how to choose a design standard from the Corridor Matrix. It describes which standard to choose – optimal, minimum, or somewhere in between, based on whether a Corridor Element is Primary, Secondary, Contributing or Non-Contributing. While this process has several steps, the purpose is to have a very flexible framework for Multimodal Corridor design. It allows for trade-offs to be made among Corridor Element sizes in a constrained right-of-way situation, while still optimizing those Corridor Elements that are most important for the key travel modes in the corridor.

HOW TO CHOOSE DESIGN STANDARDS BASED ON TYPE OF ELEMENT					
	TYPE OF ELEMENT	PRIMARY ELEMENTS	SECONDARY ELEMENTS	CONTRIBUTING ELEMENTS	NON-CONTRIBUTING ELEMENTS
	Which Standard to Choose	Use Optimal Standard in all cases	Use Optimal Standard whenever ROW width allows	Use Optimal if ROW allows - May use Minimum if ROW is constrained	May use Minimum Standard

Table 12 - Using Modal Emphasis to Choose Design Standards.

With Table 12, the designer of a Multimodal Corridor can choose the specific standard to use for each Corridor Element based on the emphasized travel modes for the corridor and other considerations for cross-section design. Figure 54 shows an example of how to choose the Primary, Secondary, Contributing and Non-Contributing Elements in a Multimodal Corridor based on Pedestrian Modal Emphasis.

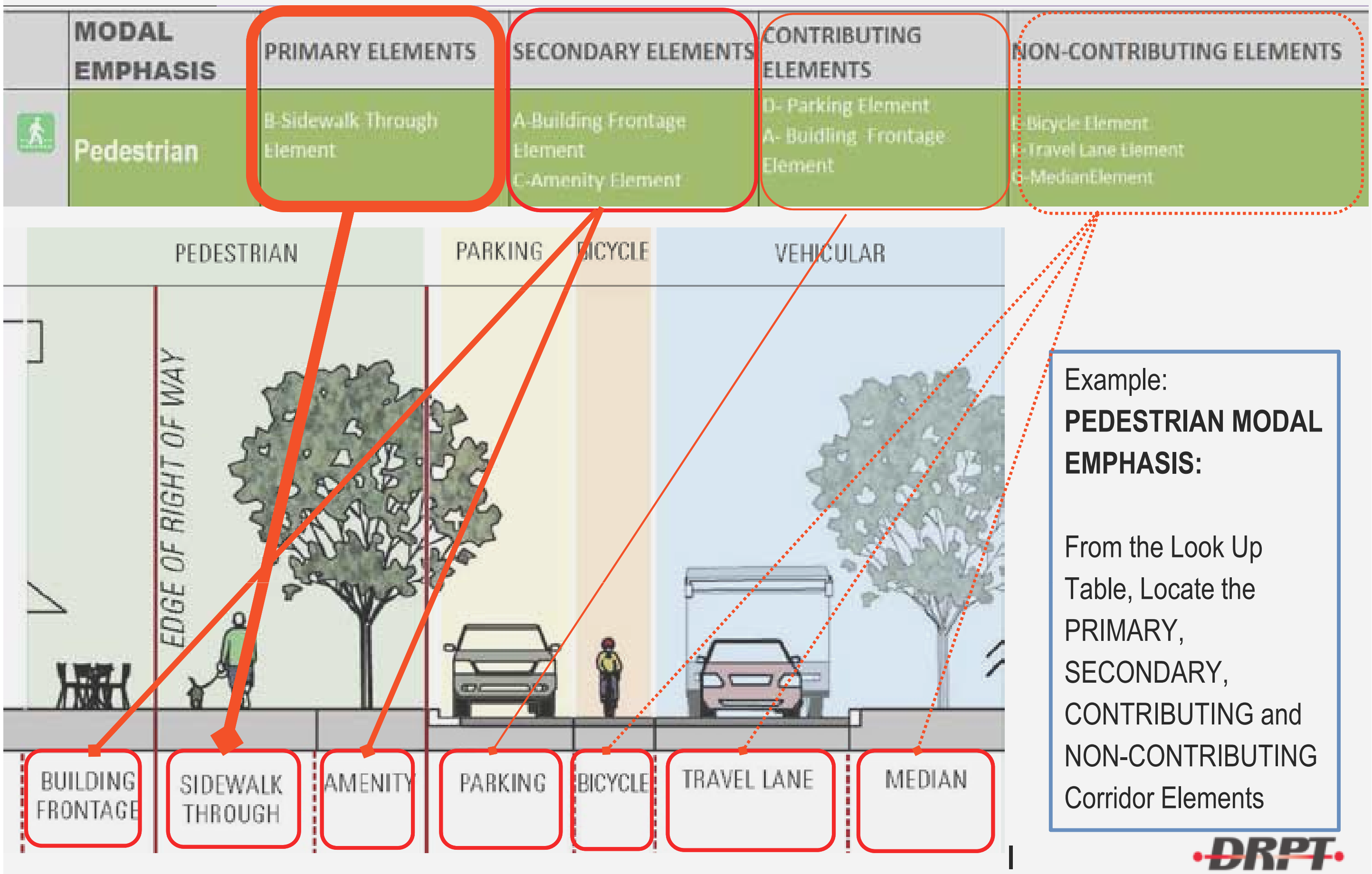


Figure 54 - Example of Choosing Corridor Elements for a Pedestrian Modal Emphasis.

The Corridor Matrix

The previous sections describe how Corridor Elements form the basic building blocks of a Multimodal Corridor – as well as how these Corridor Elements are selected. This section describes the basic design standards for each Corridor Element as organized in the Corridor Matrix.

The Corridor Matrix defines a series of Multimodal Corridor types organized according to a composite of features that includes their scale, capacity, function and Context Zone characteristics. These features have been selected based on a statewide context and are related to the VDOT functional classification hierarchy, Access Management Standards, and Road Design Manual.

The Multimodal Corridor types used in these guidelines are based on two primary sources:

1. "*Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*," published by ITE and CNU. The ITE/CNU Guidebook defines thoroughfare types that correspond to the Transect Zones from CNU's SmartCode and to traditional functional classifications for roadways.
2. The Road Design Manual, published by VDOT. The VDOT Road Design Manual is the informational and procedural guide for engineers, designers, and technicians involved in the development of plans for Virginia's highways. It provides the standards and specifications for road design and is used in conjunction with AASHTO publications. The Road Design Manual is adapted from the AASHTO Greenbook[18] for the Virginia context.

Optimal and Minimum Standards

Optimal and Minimum Standards

The design standards in the Corridor Matrix are shown as a range of two values – optimal and minimum. The reason for this range is to allow flexibility in applying the Modal Emphasis for each Corridor Element. This range allows the designer to select a design standard within the range depending on whether that Corridor Element needs to be optimized, minimized or somewhere in between.

The design standards in the Corridor Matrix are shown as a range of two values – optimal and minimum. The reason for this range is to allow flexibility in applying the Modal Emphasis for each Corridor Element as described in the previous section. This range allows the designer to select a design standard within the range depending on whether that Corridor Element needs to be optimized, minimized or somewhere in between.

The optimal values in most cases were derived from the ITE/CNU Guidebook. The minimum standards in all cases derive from VDOT minimum standards, generally as defined in the Road Design Manual, with the exception of the Bicycle Element. The optimal and minimum recommendations for the Bicycle Element were derived from the 2012 AASHTO Guide for the Development of Bicycle Facilities, which was published after the latest revisions to the VDOT Road Design Manual and supersedes the bicycle recommendations therein. VDOT intends to modify the bicycle recommendations in the Road Design Manual in the next update.

[18] A Policy on Geometric Design of Highways and Streets (or the Green Book) is a reference manual published by the American Association of State Highway and Transportation Officials (AASHTO). It is the baseline manual for roadway designers and provides a range of acceptable values for various elements of cross-section design. State road design manuals are often based on the AASHTO Green Book.

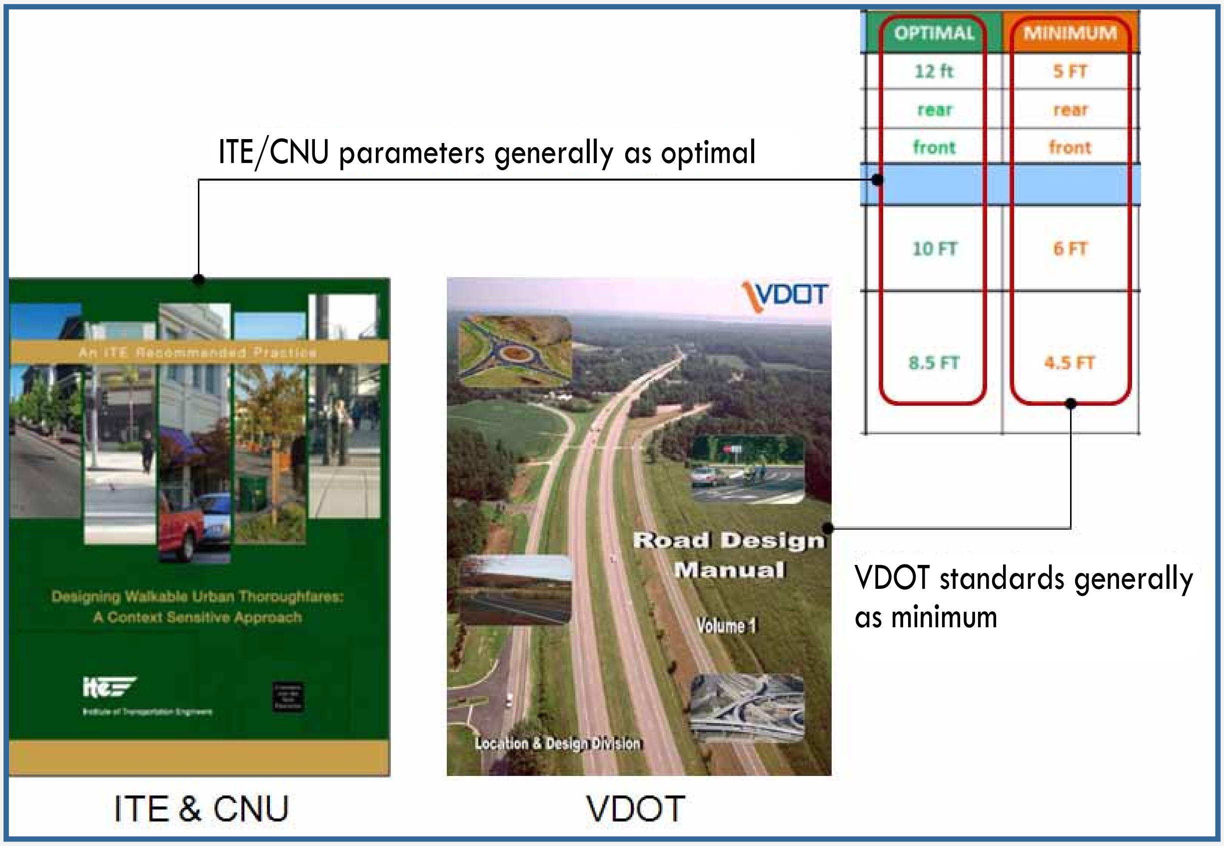


Figure 55 – Illustration of Sources of Optimal and Minimum Design Standards.

The Corridor Matrix and Corridor Matrix Annotation Document

The Corridor Matrix is given in its full version in Appendix A. In addition, there is an accompanying document in Appendix B - the Corridor Matrix Annotation Document that serves as the detailed reference for the Corridor Matrix, which provides sources and further discussion for each of the standards in the Corridor Matrix. It is important to note that all of the detailed recommendations for these Guidelines are located in the Corridor Matrix in Appendix A, and explained in the Corridor Matrix Annotation Document in Appendix B. They were not included within the text of this chapter due to their length but are given in full in those Appendices. Figure 56 is an excerpt from the Corridor Matrix to show its organization and structure:

The Corridor Matrix

The Corridor Matrix defines a series of Multimodal Corridor types organized according to a composite of features that includes their scale, capacity, function and context zone characteristics. These features have been selected based on a statewide context and are related to the VDOT functional classification hierarchy, Access Management Standards, and Road Design Manual.

Corridor Element Key	CORRIDOR MATRIX										
	Corridor Type ⇨	Transit Boulevard									
	Intensity ⇨	T-6		T-5		T-4		T-3		T-2	
⇩	Context Zones & Corridor Elements ⇩	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM
	Building Context Zone										
A	BUILDING FRONTAGE ELEMENT	5 ft	3 ft	5 ft	3 ft	5 ft	2.5 ft	7 ft	1.5 ft	12 ft	1.5 ft
	Location of off street parking	rear	rear	rear	rear	rear	rear	rear	rear	rear	rear
	Typical building entry locations	front	front	front	front	front	front	front	front	front	front
	Roadway Edge Zone										
B	SIDEWALK THROUGH ELEMENT	10 ft	6 ft	10 ft	6 ft	8 ft	6 ft	6 ft	6 ft	6 ft	6 ft
C	AMENITY ELEMENT	8 ft	6 ft	8 ft	6 ft	8 ft	6 ft	8 ft	6 ft	9 ft	6 ft
	Surface Treatment for Amenity Element	Paved with tree wells		Paved with tree wells		Paved with tree wells		Paved with tree wells		Grassy strip with trees	
	Roadway Zone										
D	PARKING ELEMENT	8 ft both sides	None	8 ft both sides	None	8 ft both sides	None	8 ft both sides	None	8 ft both sides	None
E	BICYCLE ELEMENT	5 ft bike lane[1]	14 ft wide curb lane with shared lane markings	5 ft bike lane[1]	14 ft wide curb lane with shared lane markings	4 ft bike lane[1]	Shared lane markings with no additional lane width	4 ft bike lane[1]	Shared lane markings with no additional lane width	4 ft bike lane[1]	Shared lane markings with no additional lane width
F	TRAVEL LANE ELEMENT	12 ft[2]	11 ft[2]	12 ft[2]	11 ft[2]	12 ft[2]	11 ft[2]	12 ft[2]	11 ft[2]	12 ft[2]	11 ft[2]
	Design Speed	30 - 35 mph		30 - 35 mph		30 - 35 mph		30 - 35 mph		30 - 35 mph	
	Number of Through Lanes	4 to 6		4 to 6		4 to 6		4 to 6		2 to 6	
	Typical Traffic Volume Range (vehicles per day)	15,000 to 40,000		15,000 to 40,000		10,000 to 50,000		8,000 to 40,000		5,000 to 30,000	
G	MEDIAN ELEMENT	Transit provided in median	6 ft[3]	Transit provided in median	6 ft[3]	Transit provided in median	6 ft[3]	Transit provided in median	6 ft[3]	Transit provided in median	6 ft[3]

[1] Bike lane widths assume there is no on-street parking. Bike lane widths do not include the width of the gutter pan and assume a gutter pan is provided. On roadways with curb but no gutter (no on-street parking), add one foot of width. If 8-ft wide on-street parking is provided, add one foot of width. If 7-ft wide on-street parking is provided, add two feet of width. (Refer to Appendix B Corridor Matrix Annotation Document for discussion.) Additionally, more innovative bicycle facilities like buffered bike lanes, bicycle boulevard features, contra-flow bike lanes, and shared bike and bus facilities may be desirable. Please refer to the latest AASHTO Guide for the Development of Bicycle Facilities and the latest NACTO Urban Bikeway Design Guide for more detailed guidance on these more innovative facilities.

[2] Travel lane width does not include the shy distance and curb or curb and gutter pan. Note: 12 ft is the optimum **only** for transit modal emphasis. For all other modal emphases, travel lane width should be minimized. (Refer to Appendix B Corridor Matrix Annotation Document for discussion.)

[3] Median element widths are measured from back of curb to back of curb. Median element widths do not include the width of the curb and shy distance.

Figure 56 - Excerpt from the Corridor Matrix. The full Corridor Matrix is in Appendix A.

How to use the Corridor Matrix in an Unconstrained Right-of-Way

The Corridor Matrix is a flexible framework for selecting corridor standards that allows a roadway designer to determine the best way to accommodate the identified travel modes for that corridor. In the case of an unconstrained right-of-way, such as is the situation with a new road, the designer may want to equally balance all the modes and not favor one over another. In that case, the designer would choose the optimal value for each Corridor Element. The resulting cross section would reflect a corridor with true modal balance, with the optimal dimensions and design for each travel mode. The set of example cross-sections illustrated in Figures 60 though 65 reflect this "prototype" condition for each of the Placemaking and Multimodal Through Corridor types. Note that not all T-Zones are applicable to each Multimodal Corridor type. The cross-sections illustrated assume that the right-of-way is unconstrained and all Corridor Elements are optimized. Figure 59 is a summary page of all the Multimodal Corridor types followed by summaries of each Multimodal Corridor type in detail in Figures 60 through 65.

The Corridor Prototype Cross-Sections

The set of example cross-sections illustrated in Figures 60 through 65 reflect the "prototype" condition for each of the Placemaking and Multimodal Through Corridor types. Note that not all T-Zones are applicable to each Multimodal Corridor type. The cross-sections illustrated assume that the right-of-way is unconstrained and all Corridor Elements are optimized.

Figure 57 - Pedestrian Corridor Elements Illustrated on a Street in Roanoke.

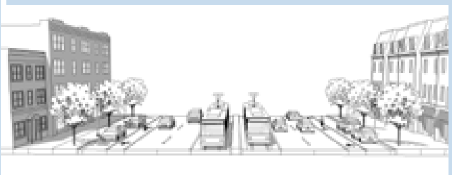
Figure 58 - Vehicular Corridor Elements Illustrated on a Street in Portsmouth.

Transit					Boulevard					Major Avenue						Avenue						Local Street						Through Corridor					
T6	T5	T4	T3	T2	T6	T5	T4	T3	T2	T6	T5	T4	T3	T2	T1	T6	T5	T4	T3	T2	T1	T6	T5	T4	T3	T2	T1	T6	T5	T4	T3	T2	T1

Each Corridor Type is modified by the Transect Zone through which it passes

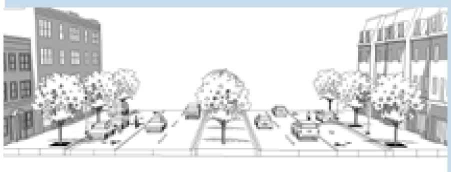
MULTIMODAL CORRIDOR TYPES

Placemaking Corridors

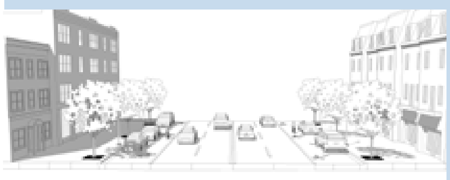


Transit Boulevard

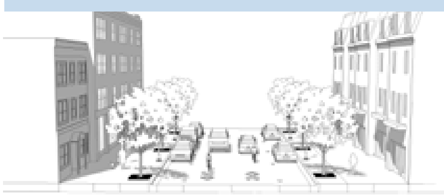
Boulevard



Major Avenue

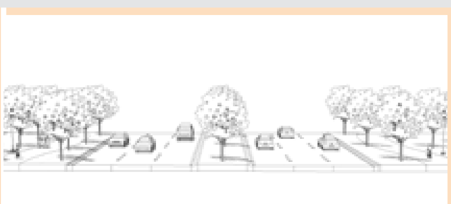


Avenue

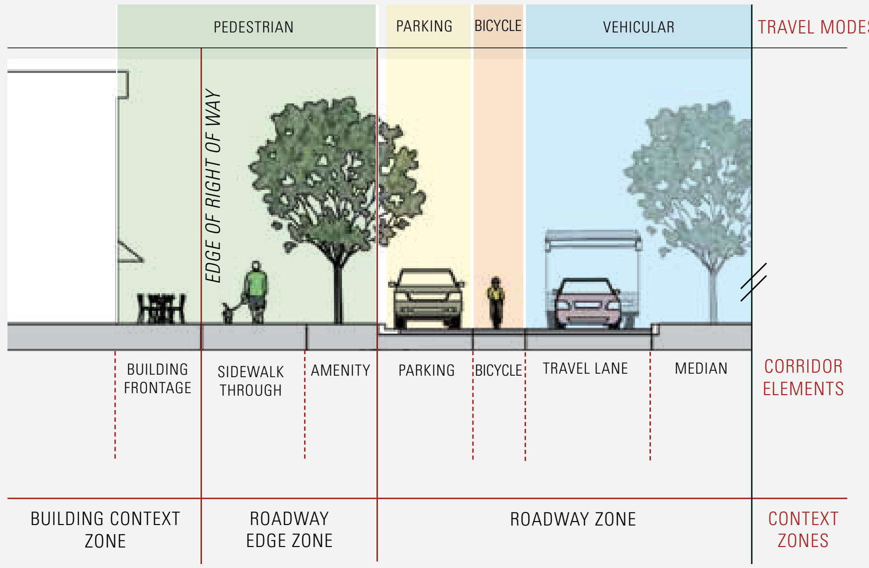


Local Street

Through Corridor



Multimodal Through Corridor



Multimodal Corridors are divided into Context Zones. Each element of the corridor relates to a Travel Mode.

Design speed: 30-35 mph

Optimal Values from the Corridor Matrix

Building Frontage	A	5'
Sidewalk Through	B	10'
Amenity	C	8'
Parking	D	8'
Bicycle	E	5'
Travel Lanes	F	12'
Transit Median	G	Transit*

Sample T6 Transit Boulevard

* Varies based on transit median design

Figure 59 – Multimodal Corridors Summary Page.

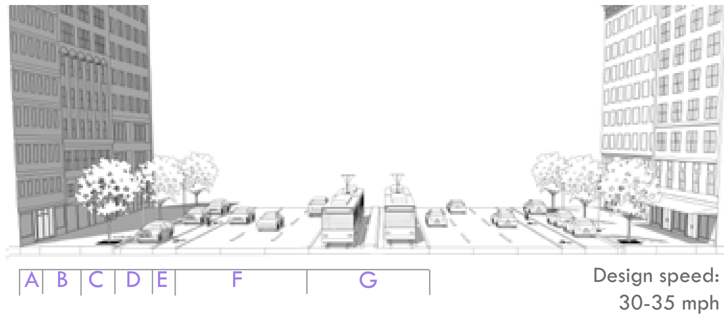
TRANSIT BOULEVARD

PLACEMAKING CORRIDOR

Optimal values from the Corridor Matrix | Cross-sectional views of optimal values

T6

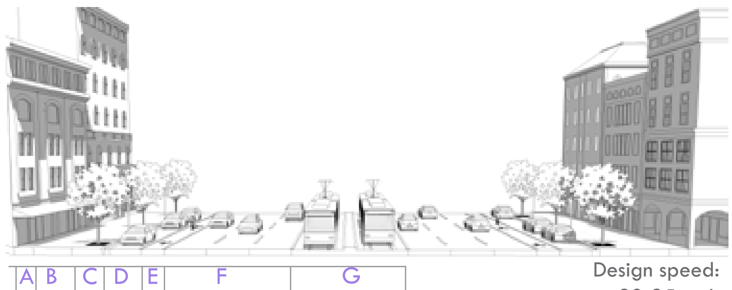
Building Frontage	A	5’
Sidewalk Through	B	10’
Amenity	C	8’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	Varies*



Design speed: 30-35 mph

T5

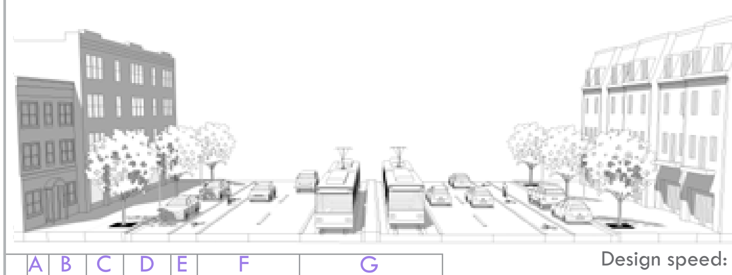
Building Frontage	A	5’
Sidewalk Through	B	10’
Amenity	C	8’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	Varies*



Design speed: 30-35 mph

T4

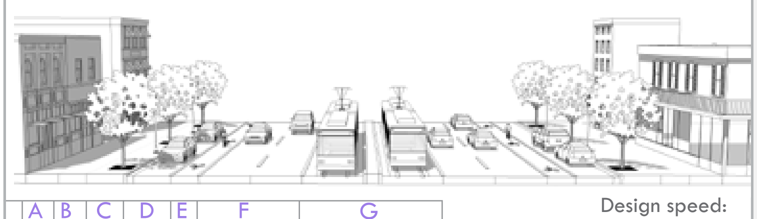
Building Frontage	A	5’
Sidewalk Through	B	8’
Amenity	C	8’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	Varies*



Design speed: 30-35 mph

T3

Building Frontage	A	7’
Sidewalk Through	B	6’
Amenity	C	8’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	Varies*



Design speed: 30-35 mph

T2

Building Frontage	A	12’
Sidewalk Through	B	6’
Amenity	C	9’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	Varies*

Design speed: 30-35 mph

NOTE: Cross sections depict “optimal” corridor element dimensions listed in the Corridor Matrix unless otherwise noted
**Varies based on transit median design*

Figure 60 - Prototype Cross-Sections for Transit Boulevards.

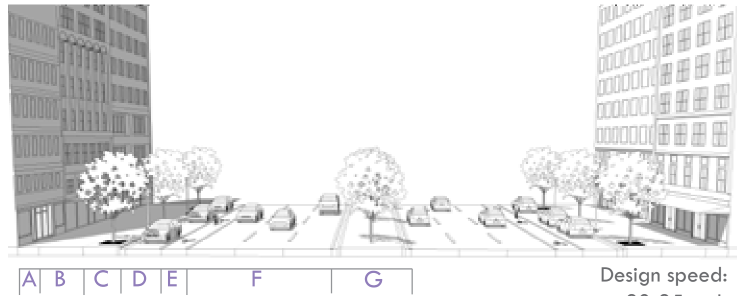
BOULEVARD

PLACEMAKING CORRIDOR

Optimal values from the Corridor Matrix | *Cross-sectional views of optimal values*

T6

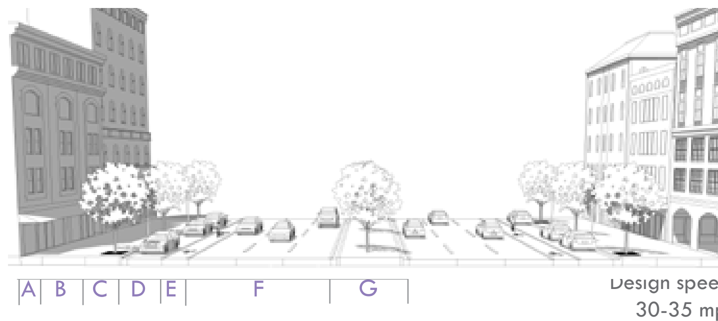
Building Frontage	A	5'
Sidewalk Through	B	10'
Amenity	C	8'
Parking	D	8'
Bicycle	E	5'
Travel Lane	F	12'
Median	G	18'



Design speed: 30-35 mph

T5

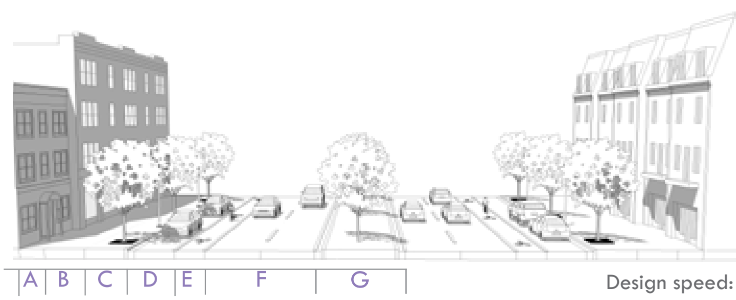
Building Frontage	A	5'
Sidewalk Through	B	10'
Amenity	C	8'
Parking	D	8'
Bicycle	E	5'
Travel Lane	F	12'
Median	G	18'



Design speed: 30-35 mph

T4

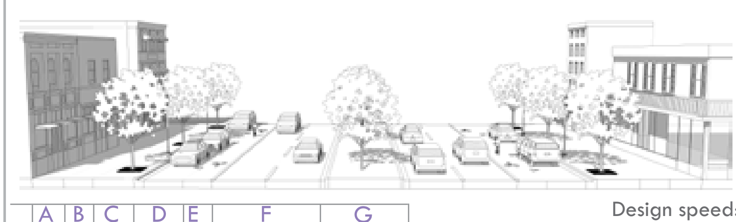
Building Frontage	A	5'
Sidewalk Through	B	8'
Amenity	C	8'
Parking	D	8'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'



Design speed: 30-35 mph

T3

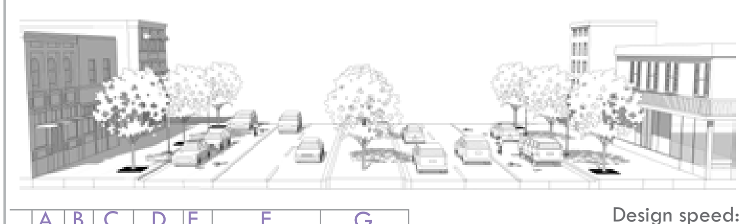
Building Frontage	A	7'
Sidewalk Through	B	6'
Amenity	C	8'
Parking	D	8'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'



Design speed: 30-35 mph

T2

Building Frontage	A	12'
Sidewalk Through	B	6'
Amenity	C	9'
Parking	D	8'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'



Design speed: 30-35 mph

NOTE: Cross sections depict "optimal" corridor element dimensions listed in the Corridor Matrix unless otherwise noted

Figure 61 - Prototype Cross-Sections for Boulevards.

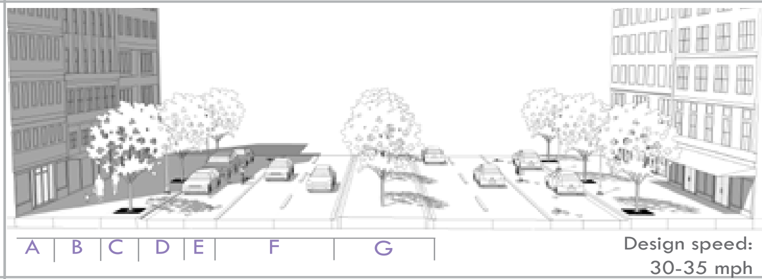
MAJOR AVENUE

PLACEMAKING CORRIDOR

Optimal values from the Corridor Matrix | *Cross-sectional views of optimal values*

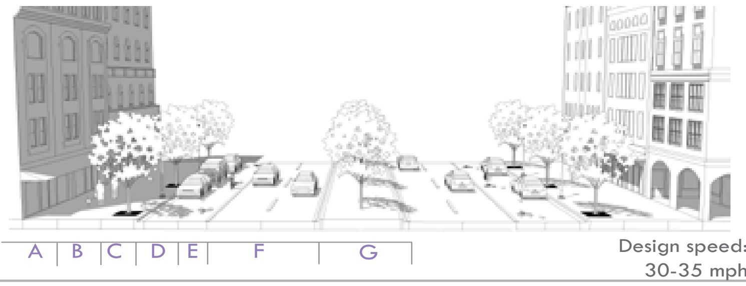
T6

Building Frontage	A	7’
Sidewalk Through	B	9’
Amenity	C	7’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	18’



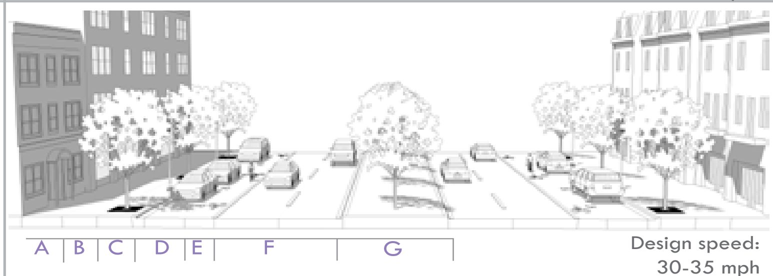
T5

Building Frontage	A	7’
Sidewalk Through	B	9’
Amenity	C	7’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	18’



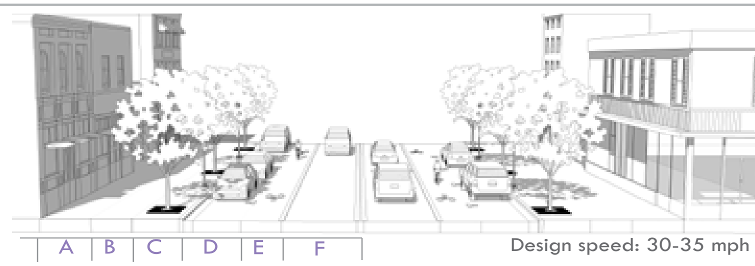
T4

Building Frontage	A	7’
Sidewalk Through	B	6’
Amenity	C	7’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’



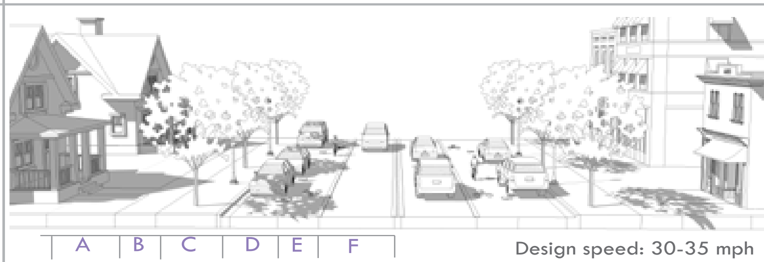
T3

Building Frontage	A	7’
Sidewalk Through	B	6’
Amenity	C	7’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’*



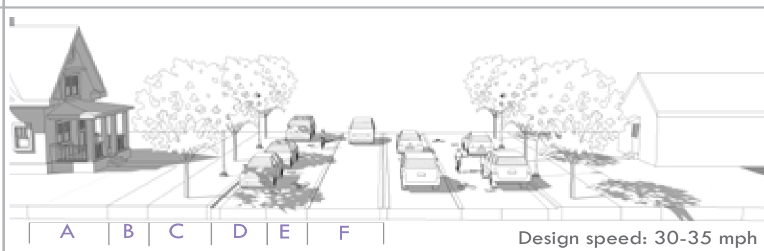
T2

Building Frontage	A	12’
Sidewalk Through	B	6’
Amenity	C	9’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’*



T1

Building Frontage	A	12’
Sidewalk Through	B	6’
Amenity	C	9’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’*



NOTE: Cross sections depict “optimal” corridor element dimensions listed in the Corridor Matrix unless otherwise noted
**Median Element (G) is not shown in cross-section illustrations for some less intense Transect Zones*

Figure 62 - Prototype Cross-Sections for Major Avenues.

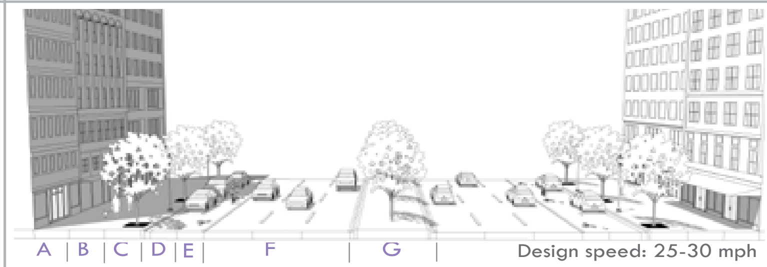
AVENUE

PLACEMAKING CORRIDOR

Optimal values from the Corridor Matrix | Cross-sectional views of optimal values

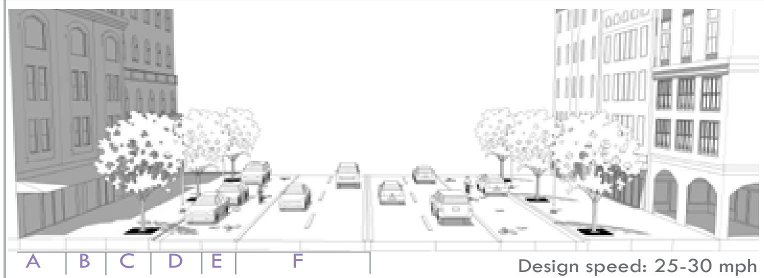
T6

Building Frontage	A	8'
Sidewalk Through	B	8'
Amenity	C	7'
Parking	D	8'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'



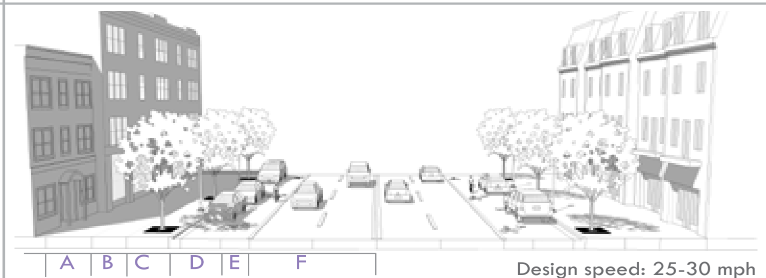
T5

Building Frontage	A	8'
Sidewalk Through	B	7'
Amenity	C	7'
Parking	D	8'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'*



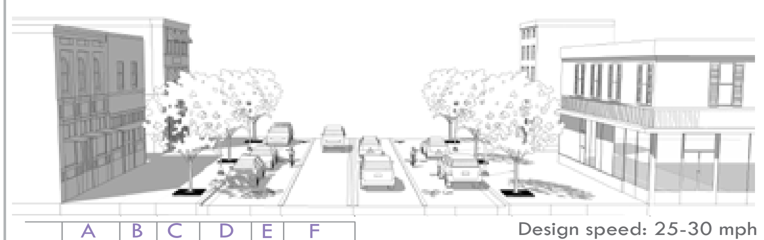
T4

Building Frontage	A	8'
Sidewalk Through	B	6'
Amenity	C	7'
Parking	D	8'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'*



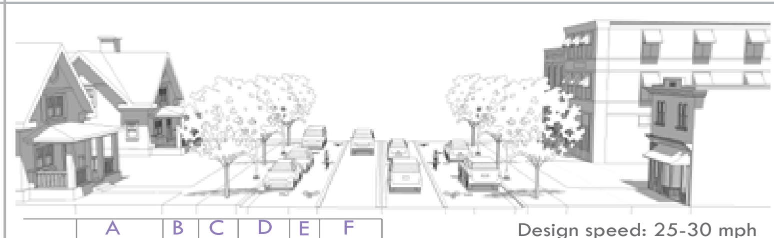
T3

Building Frontage	A	10'
Sidewalk Through	B	6'
Amenity	C	7'
Parking	D	7'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'*



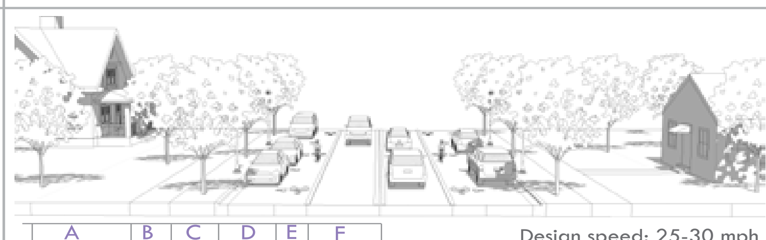
T2

Building Frontage	A	15'
Sidewalk Through	B	6'
Amenity	C	8'
Parking	D	7'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'*



T1

Building Frontage	A	15'
Sidewalk Through	B	6'
Amenity	C	7'
Parking	D	7'
Bicycle	E	4'
Travel Lane	F	12'
Median	G	18'*



NOTE: Cross sections depict "optimal" corridor element dimensions listed in the Corridor Matrix unless otherwise noted
**Median Element (G) is not shown in cross-section illustrations for some less intense Transect Zones*

Figure 63 - Prototype Cross-Sections for Avenues.

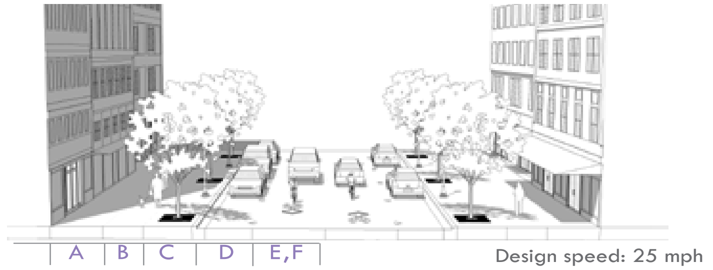
LOCAL STREET

PLACEMAKING CORRIDOR

Optimal values from the Corridor Matrix — *Cross-sectional views of optimal values*

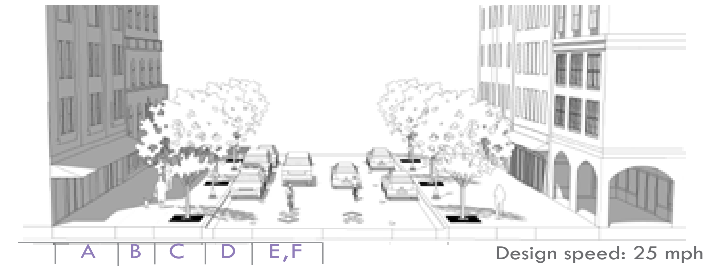
T6

Building Frontage	A	8’
Sidewalk Through	B	6’
Amenity	C	7’
Parking	D	7’
Bicycle	E	shared
Travel Lane	F	11’



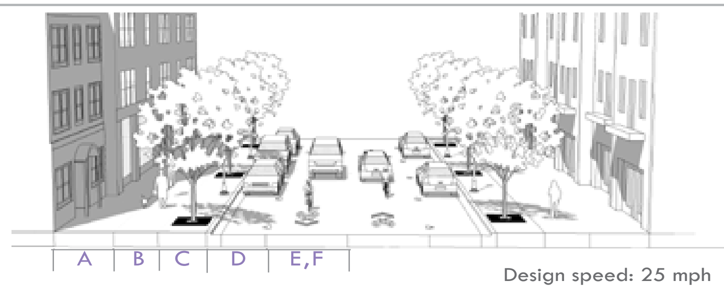
T5

Building Frontage	A	8’
Sidewalk Through	B	6’
Amenity	C	7’
Parking	D	7’
Bicycle	E	shared
Travel Lane	F	11’



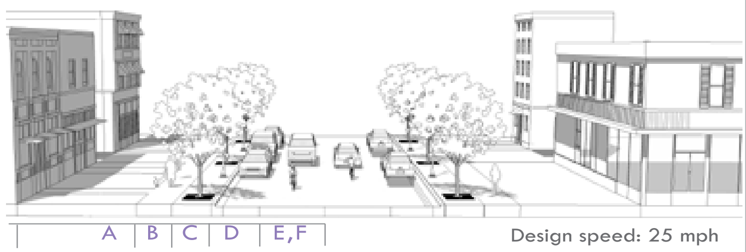
T4

Building Frontage	A	8’
Sidewalk Through	B	6’
Amenity	C	7’
Parking	D	7’
Bicycle	E	shared
Travel Lane	F	11’



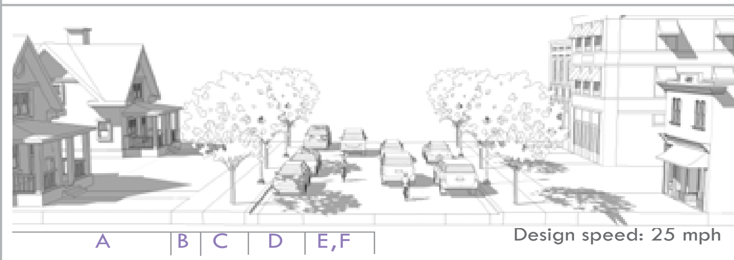
T3

Building Frontage	A	15’
Sidewalk Through	B	6’
Amenity	C	7’
Parking	D	7’
Bicycle	E	shared*
Travel Lane	F	11’



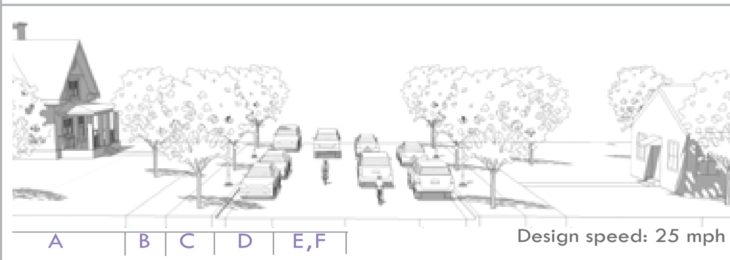
T2

Building Frontage	A	20’
Sidewalk Through	B	5’
Amenity	C	6’
Parking	D	7’
Bicycle	E	shared*
Travel Lane	F	11’



T1

Building Frontage	A	30’
Sidewalk Through	B	5’
Amenity	C	6’
Parking	D	7’
Bicycle	E	shared*
Travel Lane	F	11’



NOTE: Cross sections depict “optimal” corridor element dimensions listed in the Corridor Matrix unless otherwise noted
**Bicycle boulevard features*

Figure 64 - Prototype Cross-Sections for Local Streets.

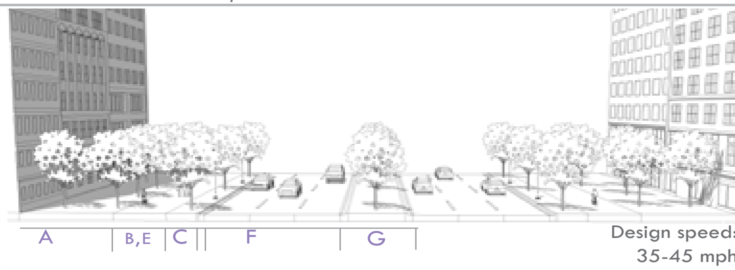
MULTIMODAL THROUGH CORRIDOR

THROUGH CORRIDOR

Optimal values from the Corridor Matrix — *Cross-sectional views of optimal values*

T6

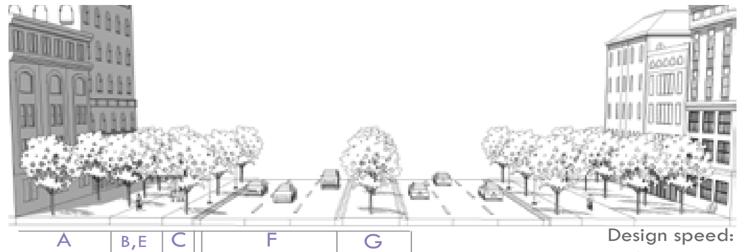
Building Frontage	A	25'
Sidewalk Through	B	14'*
Amenity	C	8'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	18'



Design speed: 35-45 mph

T5

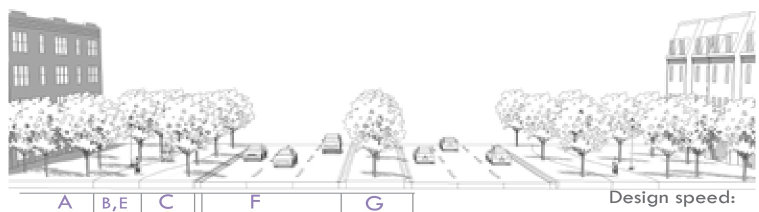
Building Frontage	A	25'
Sidewalk Through	B	14'*
Amenity	C	8'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	18'



Design speed: 35-45 mph

T4

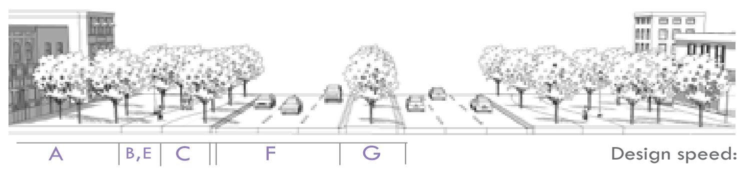
Building Frontage	A	35'
Sidewalk Through	B	12'*
Amenity	C	8'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	18'



Design speed: 35-45 mph

T3

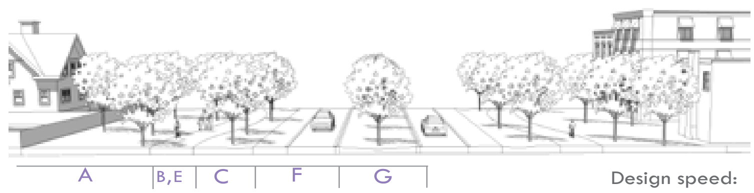
Building Frontage	A	35'
Sidewalk Through	B	12'*
Amenity	C	8'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	18'



Design speed: 35-55 mph

T2

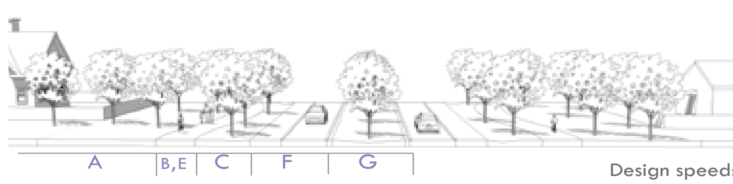
Building Frontage	A	45'
Sidewalk Through	B	10'*
Amenity	C	22'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	40'



Design speed: 45-55 mph

T1

Building Frontage	A	45'
Sidewalk Through	B	10'*
Amenity	C	22'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	40'



Design speed: 45-55 mph

NOTE: Cross sections depict "optimal" corridor element dimensions listed in the Corridor Matrix unless otherwise noted

**Shared-use path*

Figure 65 - Prototype Cross-Sections for Multimodal Through Corridors.

It is important to note that the standards for each Corridor Element are modified by the T-Zones. As the context for the corridor lessens in density and intensity (from T-6 to T-1), the setbacks generally get wider and design standards get more relaxed – such as the bicycle lane becoming a shared lane in the lower intensity T-Zones.

How to use the Corridor Matrix in a Constrained Right-of-Way

The typical cross-sections illustrated in Figures 60 through 65 can be used to build prototypical corridors in which all modes are equally balanced. In these cases, the "optimal" corridor standards are used resulting in relatively generous right-of-way widths. In many cases, however, Multimodal Corridors must be retrofitted into existing rights-of-way that are too constrained to build a full prototype cross-section.

For constrained rights-of-way, the Corridor Matrix allows a great deal of flexibility to build a customized cross-section based on the travel modes that need to be emphasized on a particular corridor. Figure 66 below shows an example of how to build a cross-section for a T-4 Major Avenue with Pedestrian Modal Emphasis in a constrained right-of-way.

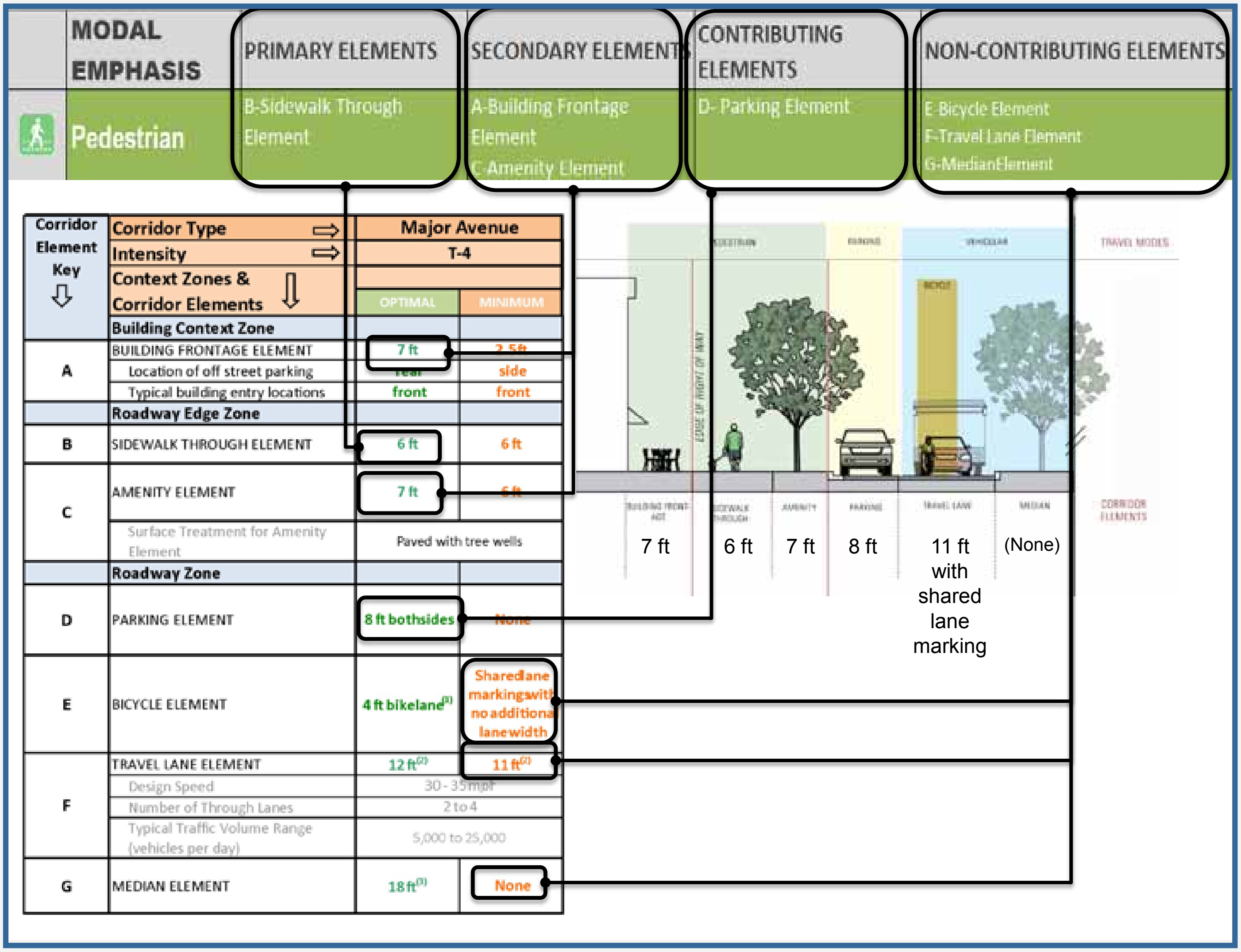


Figure 66 - Example of Selecting Corridor Standards for a T-4 Major Avenue with Pedestrian Modal Emphasis.

Figure 66 shows how optimal or minimal corridor standards are chosen based on whether they are Primary, Secondary, Contributing or Non-Contributing for the Pedestrian Modal Emphasis. This method of selecting corridor standards ensures that the cross-section is no larger than needed for emphasizing pedestrians.

An Example of Retrofitting an Existing Corridor

In order to better illustrate the detailed process of selecting corridor standards in a retrofit situation, the following analysis was conducted on a an actual corridor in a city in Virginia. The existing cross-section is illustrated Figure 67. It reflects accommodations for cars and pedestrians via one one-way travel lane, one parallel and one diagonal lane of parking, and sidewalks ranging from 8.5 to 9.5 feet wide.

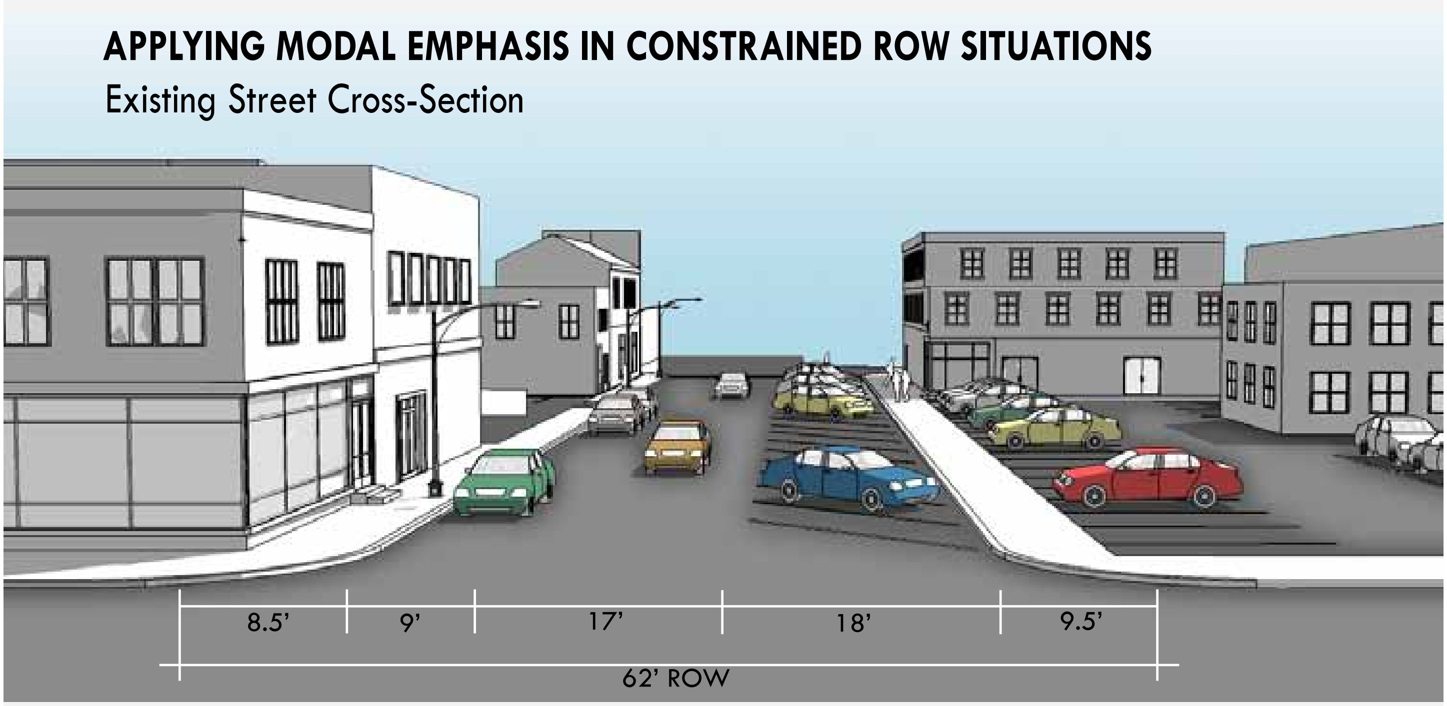


Figure 67 - Illustration of an Existing Street to be Retrofitted to a Multimodal Corridor.

It should be noted that the proposed cross section was built using sound judgment and not just a mechanical application of the standards in the Matrix. For example, the existing constrained right of way did not allow for parking to be included on both sides of the street. Therefore, a design decision was made to allow parking on only one side of the street, with the assumption that the new infill development, shown on the right side of the street, would also incorporate some structured parking to make up for the on street diagonal parking and surface parking lot that would be lost in this redevelopment proposal.

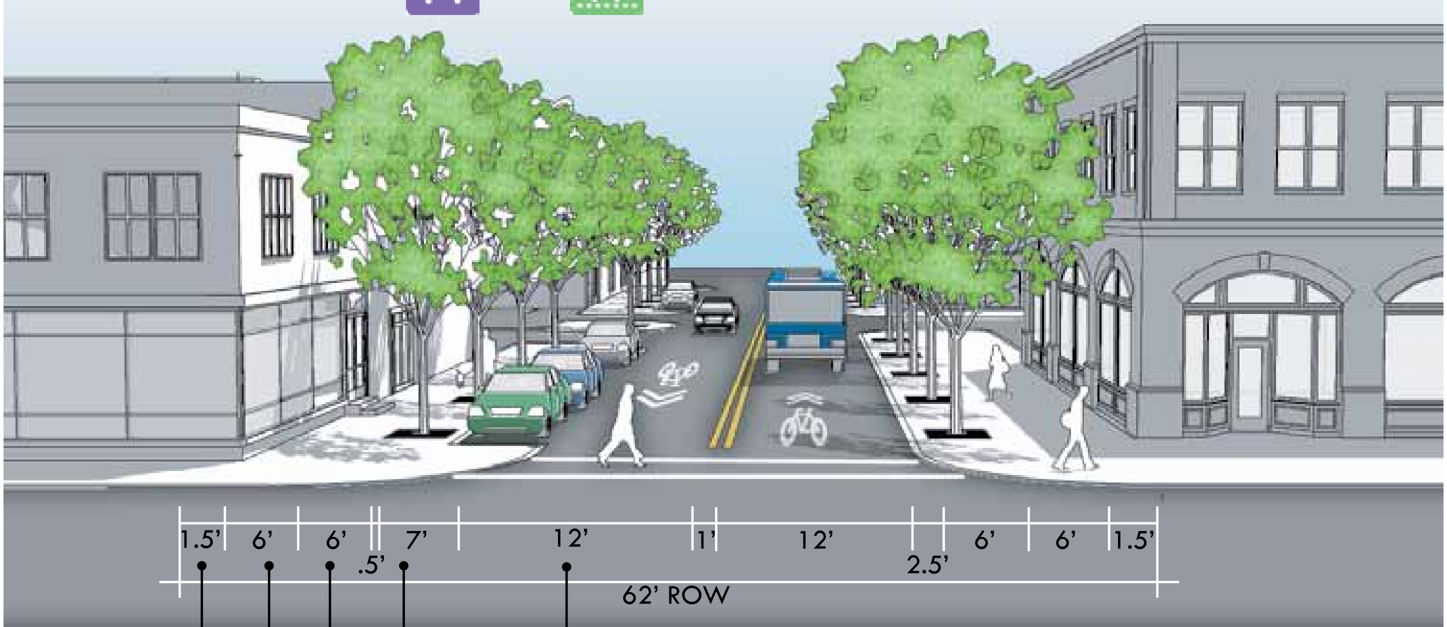
After analyzing the Multimodal Center type and the Multimodal System Plan for this region, it was determined that the proposed Multimodal Corridor type for this roadway would be a T-3 Avenue with both Transit and Pedestrian Modal Emphases. Figure 68 shows how the proposed cross-section was built using the Modal Emphasis applied to each Corridor Element.

Avenue

T3

BUILDING THE PROPOSED CROSS SECTION

Modal Emphasis = Transit + Pedestrian



	BUILDING FRONTAGE ELEMENT	SIDEWALK THROUGH ELEMENT	AMENITY ELEMENT	PARKING ELEMENT	BICYCLE ELEMENT	TRAVEL LANE ELEMENT	MEDIAN ELEMENT
Optimal	10 ft	6 ft	7 ft	7 ft both sides	4 ft bike lane	12 ft	18 ft
Minimum	1.5 ft	5 ft	6 ft	None	Shared Lane Markings	11 ft	None
Standard Used	1.5 ft	6 ft	6 ft	7 ft one side	Shared Lane Markings	12 ft	None

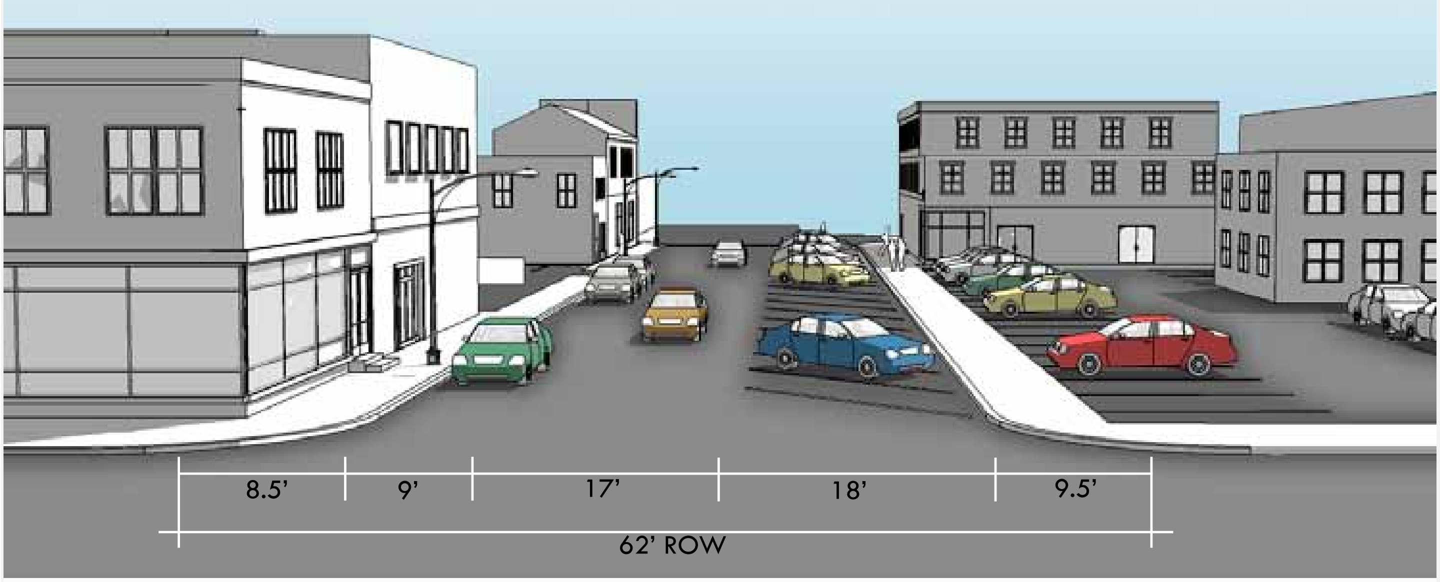
Figure 68 - Using Optimal and Minimum Standards to Build the Proposed Cross Section.

It should be noted that the proposed cross-section was built using sound judgment and not just a mechanical application of the standards in the Corridor Matrix. For example, the existing constrained right-of-way did not allow for parking to be included on both sides of the street. Therefore, a design decision was made to allow parking on only one side of the street, with the assumption that the new infill development, shown on the right side of the street, would also incorporate some structured parking to make up for the on-street diagonal parking and surface parking lot that would be lost in this redevelopment proposal.

Figure 69 shows the final comparison of the existing and proposed cross-sections.

APPLYING MODAL EMPHASIS IN CONSTRAINED ROW SITUATIONS

Existing Street Cross-Section



BUILDING THE PROPOSED CROSS SECTION

Modal Emphasis = Transit + Pedestrian

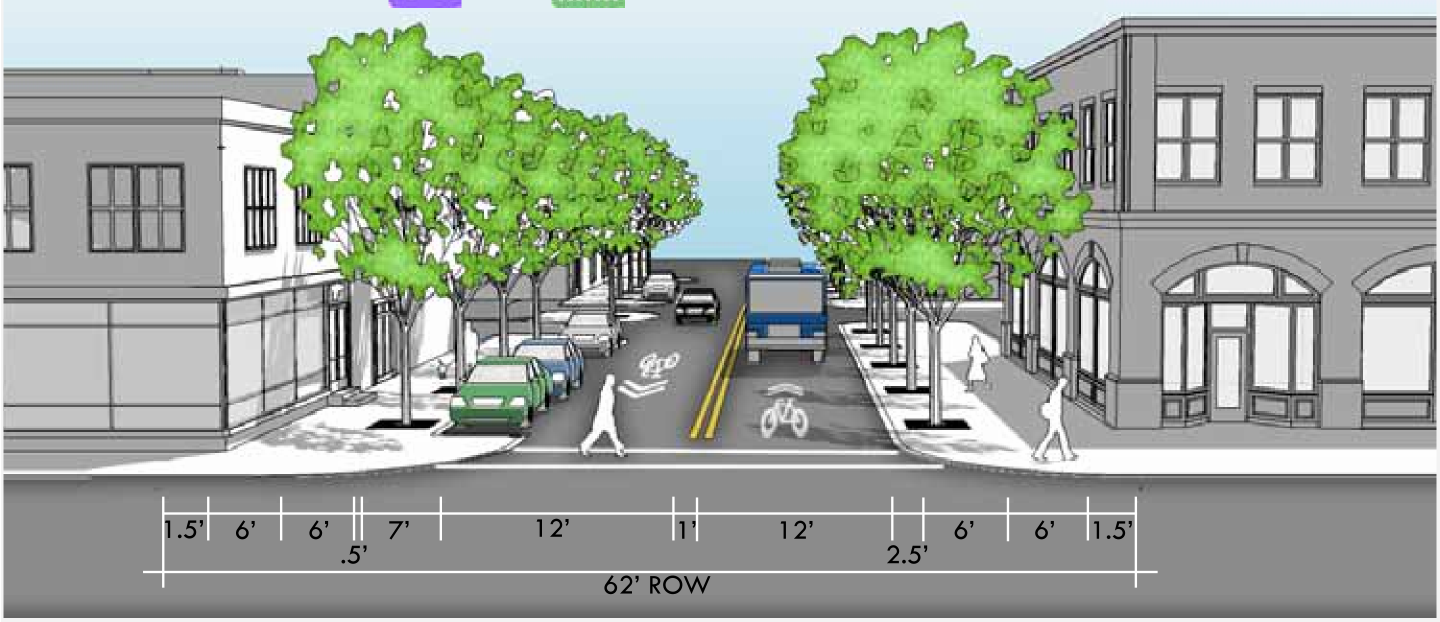


Figure 69 - Comparison of Existing and Proposed Cross Sections.

The methodology described previously outlines a flexible process for Multimodal Corridor design. The basic steps of this methodology are as follows:

1. Identifying the Multimodal Corridor Type
2. Identifying the Transect Zone of the Multimodal Corridor
3. Identifying the Modal Emphasis for the Multimodal Corridor
4. Building the proposed cross-section for the Multimodal Corridor by applying Modal Emphasis to the standards for each Corridor Element

The benefits of applying this process to future road design for Multimodal Corridors are many. In addition to ensuring that the final corridor design conforms to the best industry standards and VDOT requirements, this design process will ensure an efficient and economical road design. Furthermore, by following a clear and logical step by step design process, the whole process of roadway design can become more transparent to all stakeholders and end users of the future corridor. A more clear and transparent process of making design decisions for future multimodal investments is also crucial to ensuring buy in and support from the diverse group of stakeholders that stands to benefit from these types of public or private investments.

Intersections are areas of complex interactions between multiple modes of transportation. Drivers, pedestrians, and bicyclists must yield to each other from multiple directions, creating conflict points. The U.S. Department of Transportation estimates that 43 percent of crashes occur at intersections.[19] Intersection design is extremely important as it helps pedestrians, bicyclists, and drivers better communicate and anticipate the movements of others.

This chapter presents multimodal design considerations at intersections as a set of best practices. It does not present detailed design standards for these intersection elements. Readers are encouraged to reference the following resources on specific intersection design for further guidance.

- Manual on Uniform Traffic Control Devices (MUTCD), published by the Federal Highway Administration (FHWA)
- Guide for the Planning, Design, and Operation of Pedestrian Facilities, published by American Association of State Highway and Transportation Officials (AASHTO), referred to as the AASHTO Pedestrian Guide in future references
- A Policy on Geometric Design of Highways and Streets, published by AASHTO, referred to as the AASHTO Green Book in future references
- Road Design Manual, published by VDOT
- Guide for the Development of Bicycle Facilities, published by AASHTO, referred to as the AASHTO Bike Guide in future references
- Urban Bikeway Design Guide, published by the National Association of City Transportation Officials (NACTO)

Elements of Intersection Design

The following sections describe important elements of intersections for each travel mode. As with corridor design, different modes need different intersection elements, and limited right-of-way can constrain designers from optimizing the design of intersections. These Guidelines describe concepts to keep in mind, particularly for Modal Emphasis and different Multimodal Corridor types, but they are not directly tied to the Corridor Matrix that describes detailed corridor design.

The elements described in this section assume signal controlled intersections, however many elements are applicable at stop-controlled intersections, roundabouts, and mid-block crossings. These non-signal-controlled intersections are described in more detail in subsequent sections of this chapter.

Key Intersection Elements for Pedestrians

Intersections without safe facilities for pedestrians create critical gaps in the pedestrian network. Fifty-eight percent of all pedestrian injuries and 21 percent of pedestrian fatalities occur at intersections.[20] Intersections are the most potentially dangerous places for pedestrians, because they are stepping outside of the Roadway Edge Zone and into the Roadway Zone.

Pedestrians who are Blind or Visually Impaired

Intersection design best practices incorporate features for persons with physical disabilities, including those who are blind or visually impaired. Often these kinds of design features that are optimized for persons with disabilities are advantageous to able-bodied pedestrians too.

[19] http://www.saferoads.org/intersection-safety

[20] Insurance Institute of Highway Safety, 2005. http://www.saferoads.org/intersection-safety

Intersection design best practices incorporate features for persons with physical disabilities, including those who are blind or visually impaired. Often these kinds of design features that are optimized for persons with disabilities are advantageous to able-bodied pedestrians too.

Crosswalks

Crosswalks provide critical connections for pedestrians, and should be striped on all approaches that provide a pedestrian link for all intersections along Placemaking Corridors and Multimodal Through Corridors. Figure 70 shows examples of three different types of crosswalk markings. The two solid white lines shown at the top may be appropriate for Local Streets, Avenues without Pedestrian Modal Emphasis, or other roads with low traffic volumes and slow speeds. Higher visibility markings like the lateral striping (on the bottom) or diagonal striping (on the right) are preferred for Major Avenues, Boulevards, Transit Boulevards, Multimodal Through Corridors, and other roads with high traffic volumes or high travel speeds.

Designers should consider special paving or pavement markings for crosswalks on corridors with Pedestrian Modal Emphasis, such as those in Figure 71, to highlight the connection for pedestrians and to alert drivers to the possible presence of pedestrians.

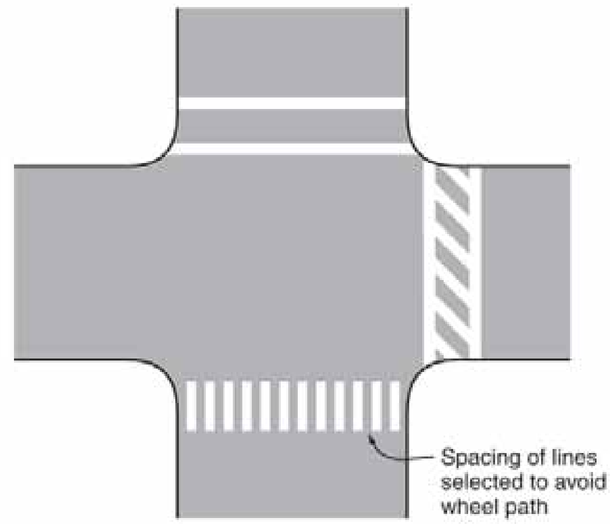


Figure 70 - Example of Crosswalk Markings. There several different options for striping crosswalks. Lateral and diagonal striping are higher-visibility and usually preferred to the two parallel stripes. Image source: Manual on Uniform Traffic Control Devices (Figure 3B-19).

Broadway, Virginia

Charlottesville, Virginia

Figure 71 - Special Crosswalk Paving. Crosswalks with brick pavers alert drivers to pedestrian areas and add visual appeal.

Additional features at mid-block crossings such as signs, activated flashers, and in-road pavement flashers are recommended and described further in this chapter.

All crossings should be in compliance with the MUTCD and the Americans with Disabilities Act (ADA) standards.

Curb Ramps

Curb ramps provide a transition between the curb and the road surface for people with wheelchairs or strollers, and others who are unable to step down from the curb. ADA standards require curb ramps be constructed at the corners of all intersections. Separate curb ramps are preferred for each corner at a crossing. At most intersections, this means two curb ramps should be provided at each corner to align directly with the crosswalks, as shown in Figure 72.

Curb ramps shall have detectable warning surfaces such as truncated domes of a high color contrast, as shown in Figure 73. These detectable warning surfaces warn pedestrians who are visually impaired that they are about to step into the road.

All curb ramps shall be designed to meet ADA and local jurisdiction requirements and to prevent water from ponding at the base.

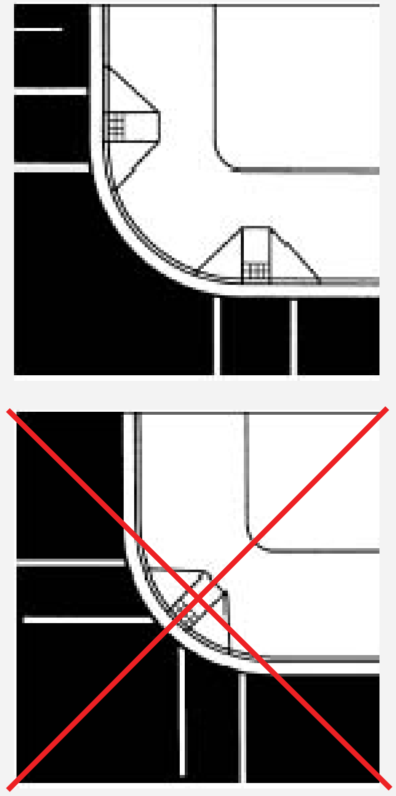


Figure 72 - Curb Ramp Design. The design above is preferred with two curb ramps that align directly with the crosswalks. The bottom image design is undesirable, as it does not align with the crosswalks. Image source: Federal Highway Administration

Figure 73 - Detectable Warning Surface. Truncated domes are a surface treatment for curb ramps that alert pedestrians who are visually impaired that they are about to walk off a sidewalk into a roadway.

Pedestrian Crossing Signals

Pedestrian crossing signals let pedestrians know when the pedestrian phase is on at signalized intersections. Pedestrian crossing signals are coordinated with the traffic signals and are especially helpful at intersections with complex phasing, such as left turn only phases. There are several different types of pedestrian signals. Countdown pedestrian signals indicate how much time is left during the 'flashing don't walk' phase, and are preferred to those pedestrian signals which simply show the flashing red hand.[21] Accessible pedestrian signals (APS)[22] provide audible

[21] Pedestrian signals typically have three phases. The 'don't walk' phase displays a solid red or orange hand symbol that indicates pedestrians should wait. The 'walk' phase displays a white pedestrian symbol that indicates that the pedestrian phase is on and pedestrians should have adequate time to cross the street. The 'flashing don't walk' phase displays a flashing red or orange hand symbol that indicates that the pedestrian phase is on, but pedestrians leaving the curb to cross the street at that moment may not have enough time to cross the street before the pedestrian phase is over.

[22] More information about Accessible Pedestrian Signals is available at http://accessforblind.org.

and vibratory cues for pedestrians who are visually impaired or hearing impaired. APS are the most desirable, yet most expensive type of pedestrian crossing signals, although any type of pedestrian signal is better than none at all.

Curb ramps shall have detectable warning surfaces such as truncated domes. These detectable warning surfaces warn pedestrians who are visually impaired that they are about to step into the road. All curb ramps shall be designed to meet ADA and local jurisdiction requirements and to prevent water from ponding at the base.

Some pedestrian crossing signals are activated by a push-button. The push-button shall be located in accordance with the MUTCD. Most often the push-button is located on the base of the cantilever beam that holds the traffic signals. If this is too far away from the curb ramp, pedestrians may be less likely to activate it, putting themselves in greater danger of crossing when it is not safe. A break in the pavement between the sidewalk and the push-button can be especially disorienting for persons with vision impairments, and can be difficult for persons with physical disabilities to reach.

Intersections with activated pedestrian phases and median refuges should include push buttons in the median to prevent pedestrians from becoming 'stranded' in a median refuge with no way to activate the pedestrian phase and finish crossing the street.

APS give auditory cues when the pedestrian phase is on. Some APS give vibratory cues for people who are hearing impaired. Pedestrians with hearing impairments can touch the push-button, and it will vibrate when the walk phase is on. Those that simply chirp or beep are neither helpful for pedestrians who are visually impaired, as it is difficult to discern which direction the audio cue is indicating is safe, nor for pedestrians who are hearing impaired because they cannot hear them. APS that speak the name of the road are much more helpful for pedestrians who are visually impaired. Designers should consider implementing

Figure 74- Activated APS Push-Button. This traffic signal is activated, meaning pedestrians push the black button to call a pedestrian phase to cross the street. It is also an APS that speaks the name of the street and vibrates when the pedestrian phase is on.

APS wherever possible, especially on corridors with Pedestrian Modal Emphasis in Multimodal Centers.

Median Refuges

The Corridor Matrix specifies that if median refuges are provided, they should be a minimum of six feet wide measured from back of curb to back of curb, as shown in Figure B-11 in Appendix B. This minimum median width will accommodate double two-foot wide detectable warning surfaces with a two-foot wide smooth surface between them. This allows all medians to serve as refuges for pedestrians if there is not enough time to cross.

All traffic signals should be timed such that pedestrians have adequate time to cross the entire roadway in a single phase, even when median refuges are provided. Push-buttons should be provided at median refuges for intersections with activated pedestrian phases, even if the signal phasing provides enough time to cross.
Median refuges that are at least six feet wide

shall have detectable warning surfaces on either side to indicate to persons with visual impairments that they are stepping onto the roadway.[23] These refuges and any ramps on them should be designed in accordance with ADA standards.

Some intersections may have concrete curbed islands between same-direction traffic lanes, such as a 'pork chop' island between a channelized right turn lane and a through lane. These medians may help vehicular traffic to flow faster at intersections, but they can be disadvantageous for pedestrians. These types of channelized turn lane treatments make the crossing distance longer for pedestrians and speed up traffic, making the overall environment more dangerous for pedestrians. Moreover, pedestrians who are visually impaired can find these islands particularly disorienting. These types of concrete islands are not recommended for Placemaking Corridors in Multimodal Centers and should be avoided on Multimodal Through Corridors wherever possible, especially in areas of high pedestrian activity.

Curb Extensions

Curb extensions or 'bulb-outs' are an intersection treatment where the curb is extended out into the roadway at the crosswalk to shorten the crossing distance. Curb extensions also serve as traffic calming devices, as they have been shown to slow traffic speeds. They are typically used in conjunction with on-street parking and/or bus pull-offs.

Curb extensions are recommended as a best practice for the design of Multimodal Corridors, as they provide additional space at the corner and allow pedestrians to see and be seen before entering the crosswalk. Curb extensions are especially recommended in Multimodal Centers, and on all corridors with Pedestrian Modal Emphasis. If space constraints limit the feasibility of curb extensions on both sides, one side may be constructed without the other.

Curb extensions or 'bulb-outs' are an intersection treatment where the curb is extended out into the roadway at the crosswalk to shorten the crossing distance.

Figure 75 - Curb Extensions. Curb extensions like these in Winchester, VA bring pedestrians out closer to the street at key crossing locations, putting them in better view of motorists. They provide more space for pedestrians, add aesthetic value, and can even create space for recreation.

[23] VDOT Road & Bridge Standards Section 200 provides more information on pedestrian median refuge design.

Key Intersection Elements for Bicyclists

Intersections can be dangerous areas for all levels of bicyclists and often difficult to navigate particularly for inexperienced bicyclists. When bicycle lanes are not continuous through the intersection, bicyclists must merge with motorized vehicles into the travel lane. Bicyclists often have different speeds and different rates of acceleration. Vehicle drivers may not be alert and actively looking for bicyclists. Bicyclists may prefer to ride to the right of motor vehicles, but may have to merge with traffic to avoid conflicts with right-turning vehicles or to make left turns. Some left-turning bicyclists may choose to dismount at intersections and use the crosswalk to walk with their bicycle across the intersection acting like a pedestrian; other more experienced bicyclists will prefer to merge with traffic.

The following design elements can facilitate better interaction between bicyclists, vehicles, and pedestrians at intersections.

Bicycle Left Turn Lanes

Bicycle left-turn-only lanes are especially helpful on the larger Multimodal Corridor types with Bicycle Modal Emphasis, including Boulevards, Transit Boulevards, Major Avenues, and Multimodal Through Corridors.

Turn Lanes

Wherever possible, bicycle lanes should be extended through the intersection. If limited right-of-way at the intersection makes this infeasible, proper upright and/or on-pavement signage should be used to make both vehicle drivers and bicyclists aware that the bicycle lane ends and bicyclists will be merging into the travel lane.

At intersections without a right-turn lane, bicycle lanes should be discontinued or dotted to indicate the merging of bicyclists and vehicles, and to avoid conflicts between a right-turning vehicle and a bicyclist traveling through the intersections. At intersections with exclusive right turn lanes, the bicycle lane should be placed to the left of the right turn lane. Bicycle left-turn-only lanes may be provided, and are especially helpful on the larger

Figure 76 - Bicycle Lane Transition at Intersection. Dashed lines indicate motor vehicles may encroach into the bicycle lane to enter the right turn lane, and warn drivers to yield to bicyclists. Image source: City of Harrisonburg.

Multimodal Corridor types with Bicycle Modal Emphasis, including Boulevards, Transit Boulevards, Major Avenues, and Multimodal Through Corridors. Please refer to the AASHTO Bike Guide for the Development of Bicycle Facilities, Section 4.8, for more detailed guidance on designing bike lanes at intersections.

Bike Boxes

A bike box describes an intersection treatment that leaves space between the stop bar for motor vehicles and the crosswalk for bicyclists to wait in front of the motor vehicles. This configuration helps motorists to see the bicyclists, and allows the bicyclists to proceed through the intersection, either going straight or turning, before the motor vehicles, eliminating conflicts between turning vehicles and bicyclists going straight, or between turning bicyclists and vehicles going straight.

The bike box is a relatively new treatment in the United States. At the time of this writing, 20 U.S. cities have installed bike boxes, including Alexandria, Virginia. Bike boxes are commonly used in dozens of European cities.

Bike boxes may be appropriate treatments for corridors with Bicycle Modal Emphasis and high volumes of vehicular traffic, for example Boulevards, Transit Boulevards and Multimodal Through Corridors. The NACTO Urban Bikeway Design Guide provides detailed design guidance on the benefits and typical applications of bike boxes, and outlines the required, recommended and optional features.

Figure 77 - Bike Boxes. The model on the left (Image source: Richard Masoner) shows the preferred design of bike boxes as specified in the NACTO Urban Bikeway Design Guide. The photo on the right (Image source: Blind Pilot) shows a bike box installed on Commonwealth Avenue in Alexandria, Virginia.

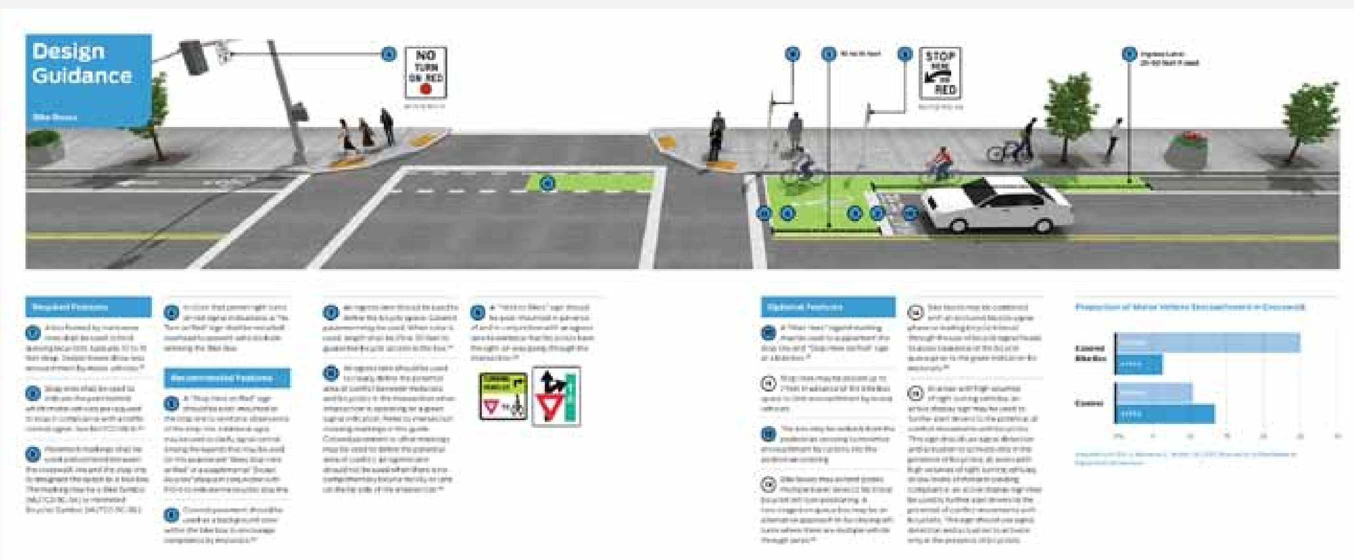


Figure 78 - Bike Box Design Guidance. The NACTO Urban Bikeway Design Guide provides detailed recommendations for designing bike boxes at intersections. Image source: NACTO.

Bicycle Signals

Some actuated traffic signals are unable to detect bicyclists waiting at an intersection. On low volume roads, this becomes particularly problematic, as bicyclists will not be able to call a green signal without a motor vehicle. Actuated traffic signals should be upgraded to detect bicycles. The AASHTO Guide for the Development of Bicycle Facilities, Section 4.12.5 provides guidance on a variety of detection systems that are available.

Key Intersection Elements for Buses

Bus drivers experience numerous complexities at intersections. Buses and trucks have wide turning radii, making it more difficult than passenger cars or bicyclists to navigate turns. Often bus stops are located near intersections. Bus drivers need to pull off to the side of the road to discharge passengers, which can make it difficult to merge back in with traffic, or traffic must stop behind the bus. Buses may obstruct the bicycle lane, and bicyclists might need to merge into the travel lane to get around the bus. Several elements of intersection design described below affect transit buses.

Turning Radii

In general, smaller curb radii are better for pedestrians, as they shorten the crossing distance, provide more room for pedestrians at the corner, and require vehicles to slow down as they turn the corner. However, small curb radii are particularly difficult for large vehicles like transit buses, emergency vehicles, and trucks to navigate. Design features like bicycle lanes and on-street parking can effectively increase the turning radius for larger vehicles without increasing the curb radius for pedestrians. Road designers must balance all factors to select the most appropriate curb radius at each intersection.

Bus Stops on Curb Extensions

On Placemaking Corridors with Transit Modal Emphasis, bus stops can often be located along curb extensions. This allows buses to stop and safely pick up riders without having to exit the flow of traffic and minimizes delay in bus travel.

Bus Stop Location

Bus stops are best placed on the far (receiving) end of the intersection, instead of the approach end of the intersection, to minimize conflicts with turning vehicles. In corridors with Transit Modal Emphasis, bus stops can often be located along curb extensions. This allows buses to stop and safely pick up riders without having to exit the flow of traffic and minimizes delay in bus travel.

Transit Signal Priority

Transit signal priority is a way of modifying the traffic signal to give preferential treatment to transit vehicles, making it easier for them to pass through the intersection. Transit signal priority can detect transit vehicles and either hold a green signal until they pass through, or shorten the green time for other approaches to give the approach with a transit vehicle a green signal faster to reduce waiting time. Transit signal priority is highly recommended for all Transit Boulevards, and for Boulevards with Transit Modal Emphasis and Multimodal Through Corridors with Transit Modal Emphasis.

Other Intersection Elements

Free-Flow Turn Lanes

In general, free-flow turning movements, such as with channelized right turn lanes, should be avoided on all Placemaking Corridors and all Multimodal Through Corridors with high pedestrian activity, especially those with Pedestrian or Bicycle Modal Emphasis. Drivers are less likely to look for and yield to pedestrians or bicyclists at free-flow turns such as found with channelized turn lanes.

Wayfinding Signs

Wayfinding systems and street signs should be legible and visible for all users, including pedestrians and bicyclists, in addition to motorized vehicles.

Street Corners

Designers should keep intersection corners clear of all obstructions to allow pedestrians clear paths and for clear sight lines for motorists and bicyclists. Utility poles should be placed away from the intersection corners to avoid interfering with sight distance. Low bollards or planters may be used to separate pedestrians from traffic or enhance the aesthetic quality of an intersection. These bollards or planters should be less than 2.5 feet high. Hanging planters should be taller than nine feet high to keep the pedestrian sight line clear.

Figure 79 - Bicycle Rack Placement in Arlington County. Obstructions like bicycle racks should be placed away from street corner areas. Bicycle racks should be place in the amenity zone between the sidewalk and curb.

Mid-Block Crossings

All Placemaking Corridors within Multimodal Centers should have frequent pedestrian crossings. Ideally in Multimodal Centers, block sizes are small and intersections are rarely more than 400 feet apart in dense urban areas (T-4, T-5, and T-6), and no more than 600 feet apart in less dense areas (T-1, T-2, and T-3).[24] When intersection spacing exceeds 600 feet, mid-block pedestrian crossings should be considered to prevent pedestrians from crossing at unmarked locations.[25] Additional design features like in-pavement flashers, signs, and colorful pavement treatments should be considered. Figure 80 shows an example of a mid-block pedestrian crossing with a brick-colored surface and a stop sign in the road centerline that alerts drivers to look and stop for pedestrians.

Mid-Block Crossings

When intersection spacing exceeds 600 feet, mid-block pedestrian crossings should be considered to prevent pedestrians from crossing at unmarked locations.

Figure 80 – Mid-Block Crossing in Reston Town Center.

[24] Block lengths to support walkability are preferably 200 to 300 feet in dense urban areas, and 200 to 400 feet in less dense areas. ITE/CNU's *Designing Walkable Urban Thoroughfares*: A Context Sensitive Approach, Chapter 3 provides guidance on block lengths and ideal street spacing.

[25] AASHTO Bike *Guide,* Section 3.4 provides additional guidance on mid-block crossings.

Other Intersection Considerations

Many of the previously described design features for signalized intersections are also appropriate for stop-controlled intersections. Four-way stop signs are preferred for corridors with Bicycle Modal Emphasis that intersect with other major roads as opposed to two-way stop signs.

Intersections that differ from the typical four-leg perpendicular configuration may require special design considerations to adequately accommodate pedestrians and bicyclists.

Roundabouts should be designed in accordance with NCHRP Report 672 Roundabouts: An Informational Guide – Second Edition, which thoroughly addresses how to accommodate pedestrians and bicyclists at roundabout.

Other irregularly shaped intersections, such as skewed intersections where the angle of the intersection is less than 90 degrees or multileg intersections where five or more legs intersect at one point, should be designed in accordance with the latest AASHTO Green Book, and follow the guidance of the AASHTO Pedestrian Guide and the AASHTO Bike Guide.

Figure 81 – Roundabout in Amherst, Virginia. Roundabouts should be designed in accordance NCHRP Report 672 Roundabouts: An Informational Guide – Second Edition, which thoroughly addresses how to accommodate pedestrians and bicyclists at roundabout. Image source: VDOT.

CHAPTER 7
Developing Multimodal Centers & Corridors Over Time

One of the potential benefits of these Guidelines to planners and designers is in providing a unified framework for coordinating land use and transportation investments over time. Traditionally transportation investments are made by the public sector, and land use investments are made by the private sector, although usually regulated to some degree by the public sector. However, as recent economic challenges are calling for more creative financing of infrastructure and closer public/private partnering, it is becoming even more important that our public and private investments work in concert towards a unified and agreed-upon vision of the future built environment. These Guidelines are intended to foster that integration between transportation, land use, and community design through their comprehensive approach to multimodal transportation design at the regional, neighborhood and street scale.

Visualizing How the Guidelines could be applied

The following sequence of visualizations presents a capsule summary of the Guidelines methodology by showing how multimodal planning can work from the region down to the corridor scale. For the purpose of describing the methodology, a three dimensional computer model of a hypothetical region was built. The following images show how this hypothetical region can be analyzed to develop a series of interlocking plans, including:

Region – Multimodal System Plan
Neighborhood – Multimodal Center Plan
Street – Multimodal Corridor Plan

Figure 82 shows the hypothetical region, highlighting the built form and roadway system. The region contains two general hubs of activity that are separated by a major expressway. A third activity hub is planned in the future in a relatively undeveloped area in one quadrant of the expressway interchange.

Figure 82 - Hypothetical Region Showing Activity Areas Separated by a Major Expressway.

Figure 83 shows an analysis of the Activity Densities in this region. As described previously in Chapter 2, this is the first step in developing the potential Multimodal Districts and Multimodal Centers. Note that the future Activity Density for the proposed activity hub is also included.

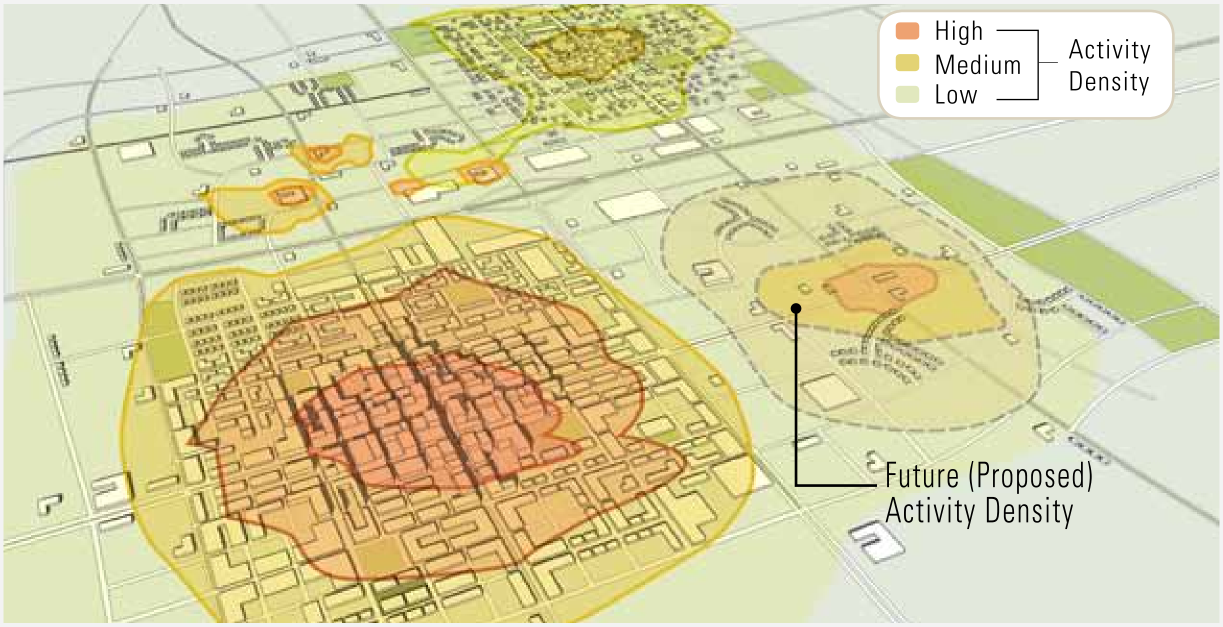


Figure 83 - Analysis of Activity Density in the Region. Activity Density is the sum of jobs and population divided by the acreage.

Based on this analysis of Activity Density, the potential Multimodal District can be identified, with three potential Multimodal Centers centered on the areas with the highest Activity Densities.

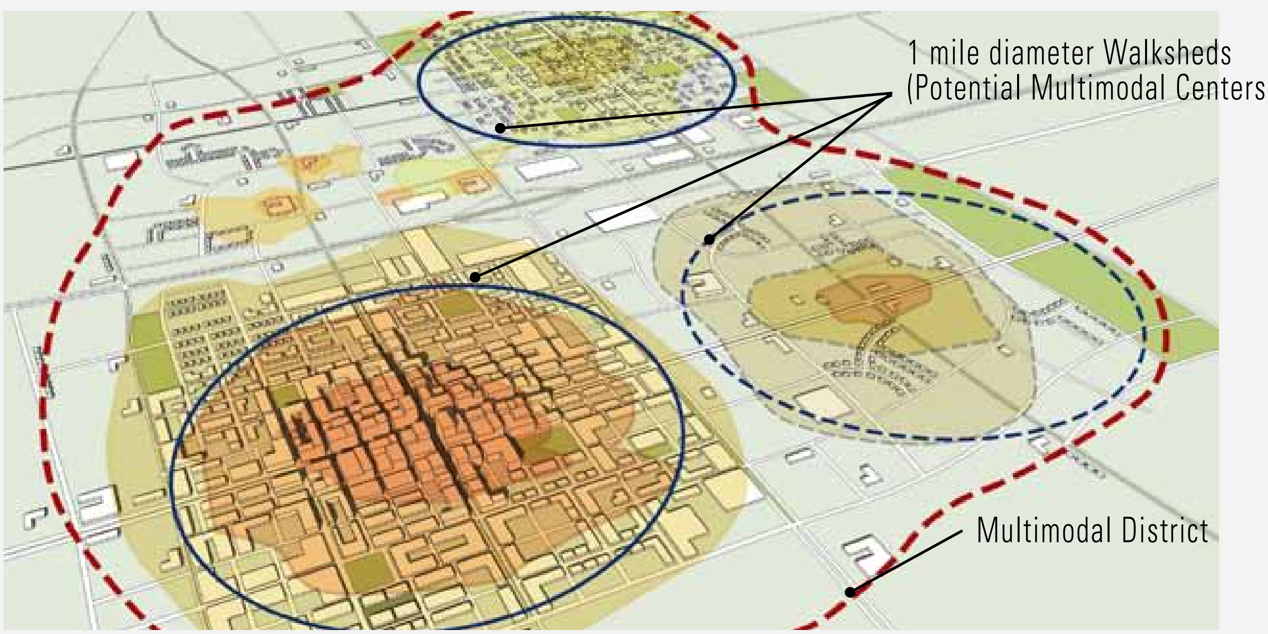


Figure 84 - Potential Multimodal District and Potential Multimodal Centers. Based on the regional Activity Density.

As noted in Chapter 2, the dimensions of a Multimodal District vary and should encompass any area that has good potential multimodal connectivity. The potential Multimodal Centers, however, start with identifying half-mile radius circles since these are based on a primary walk-shed and are a more focused area for high multimodal connectivity. After measuring general half-mile radius walksheds, the Multimodal Centers are defined, allowing for more flexible boundaries that accord with actual features on the ground.

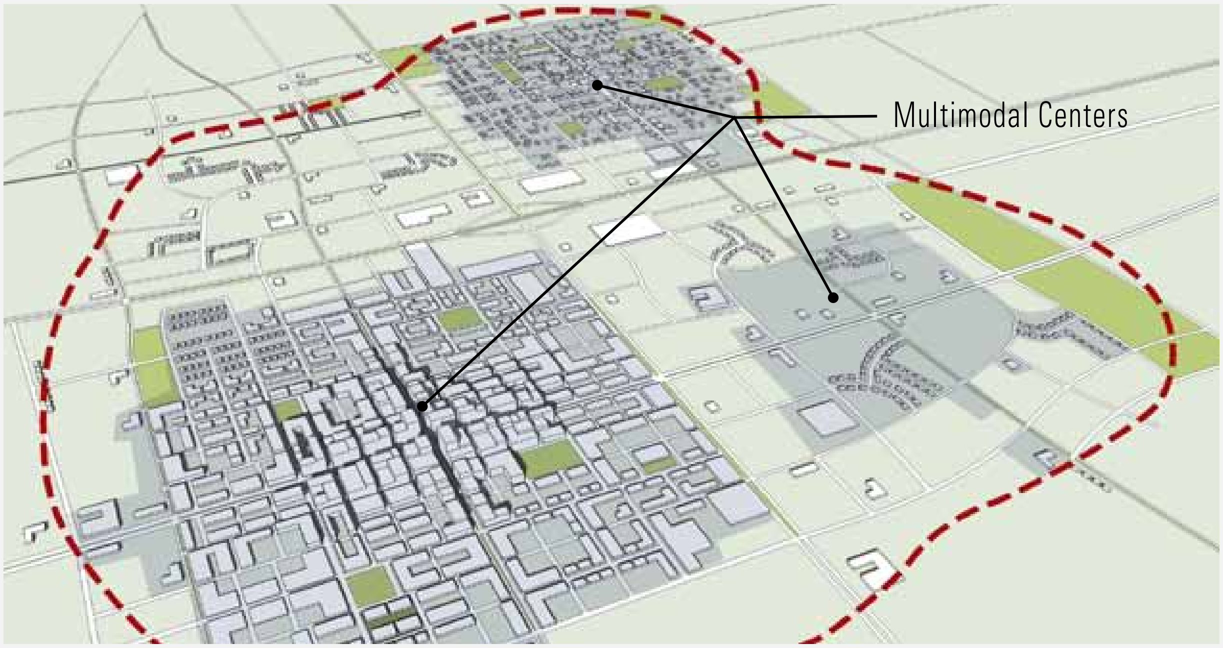


Figure 85 - Multimodal District and Multimodal Centers. Multimodal Center boundaries have been modified to fit with actual conditions.

Figure 85 shows how the Multimodal Center boundaries have been modified to fit with actual conditions on the ground.

As described in Chapter 5, a key organizing principle is to organize a region into a logical and flexible multimodal network through the designation of Multimodal Through Corridors and Placemaking Corridors. The Multimodal Through Corridors can be thought of as the routes "to" and "between" Multimodal Districts and Multimodal Centers, and the Placemaking Corridors as the routes "through" and "within" Multimodal Districts and Multimodal Centers.

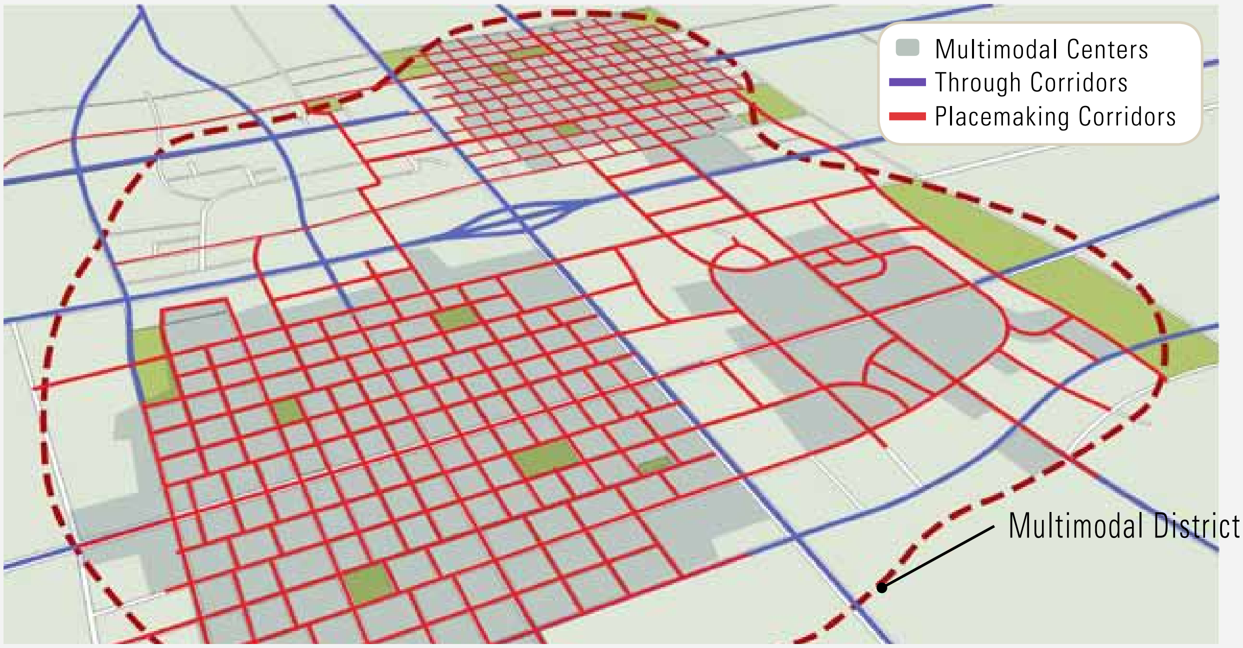


Figure 86 - Multimodal Through Corridors and Placemaking Corridors. Showing a logical network of corridors in the region for getting "through" and "to" Multimodal Districts and Centers.

The next step in planning the multimodal region is to identify the applicable travel modes for Modal Emphasis on each corridor, as shown in Figure 87. The designation of Modal Emphasis should be done as part of the development of the Multimodal System Plan, as described in Chapter 2.

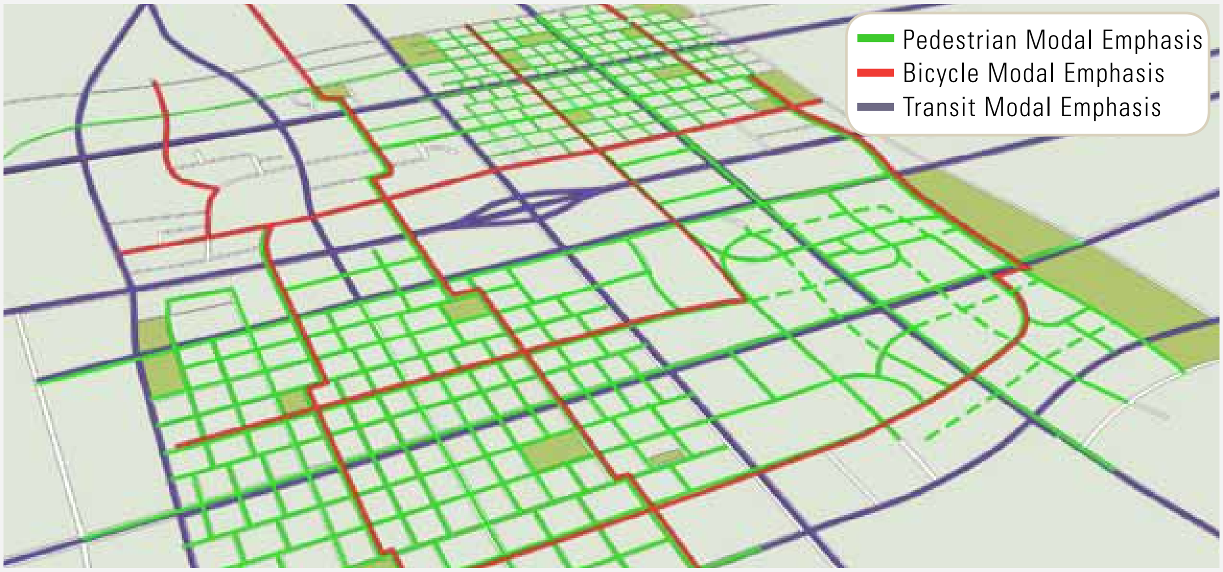


Figure 87 - Using Modal Emphasis to Designate the Emphasized Travel Modes on Each Corridor.

Figure 88 shows the fully developed Multimodal System Plan for this region, with each of the Multimodal Corridors and Multimodal District and Centers identified, along with the basic network for each travel mode in the region.

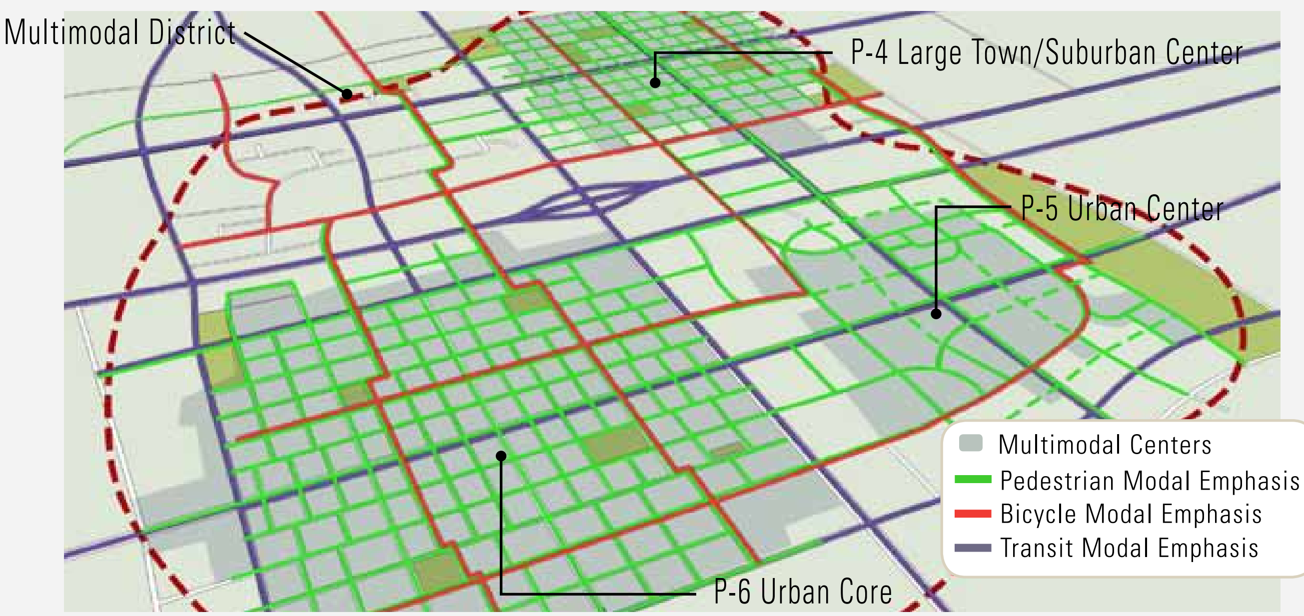


Figure 88 - Complete Multimodal System Plan for the Region.

As shown in Figure 88, the three Multimodal Centers identified in this region are P-6, P-5, and P-4 Multimodal Centers, according to the typology described in Chapter 3.

Now that the basic Multimodal System Plan has been developed for the region, the next step is to plan for an individual Multimodal Center and the Multimodal Corridors within it.

The following series of images zooms into one of those centers, the P-4 Large Town or Suburban Center at a closer scale.

Figure 89 represents a "before" version of the Multimodal Center and one of the Multimodal Corridors within it. It is assumed for this case study that the locality has designated this as a future P-4 Multimodal Center and has aligned its planning and zoning policy framework to help implement the intended future Multimodal Center. Based on the Guidelines, a P-4 Multimodal Center should ideally have a Major Avenue as its main cross street.

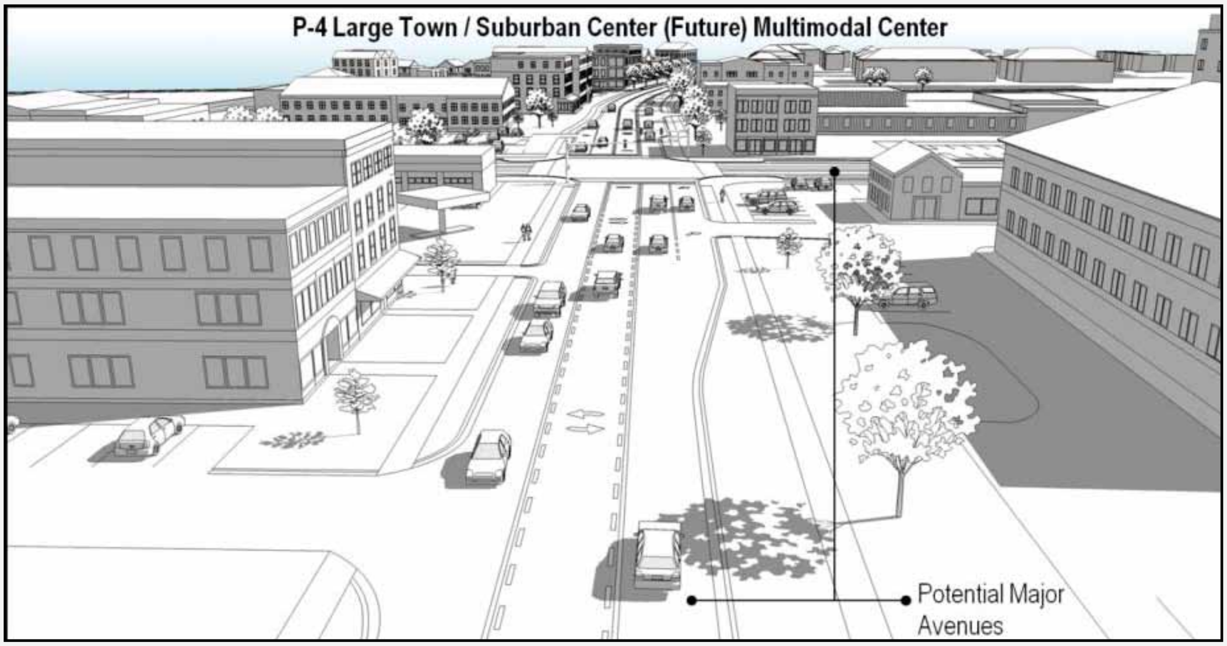


Figure 89 – A View Zooming into the Main Intersection of the P-4 Center.

As shown in Figure 90, the corridor that is designated as a "future" Major Avenue has very few modal options, being primarily oriented toward the auto/vehicular travel mode with a minimal accommodation for pedestrians.

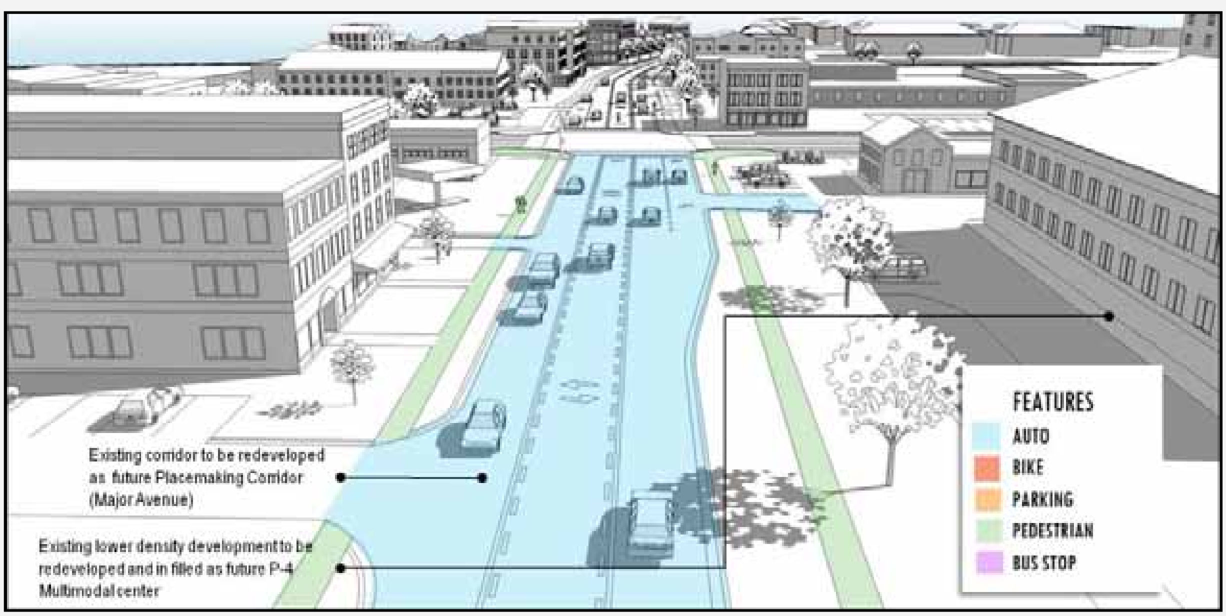


Figure 90 – P-4 Multimodal Center Main Intersection. "Before" Image. Existing conditions in this P-4 Multimodal Center include lower density development and non-multimodal corridors.

The intent of these Guidelines is to show how to get from the "before" image to the "after" image in a series of logical steps, with flexibility for making key design decisions at both the Corridor and the Center scale. The following image shows how the corridor has been transformed into a Major Avenue (Placemaking) Corridor with the addition of wider sidewalks, on-street parking, bicycle lanes and a curbed median with turn lanes. In addition, it shows how private development has responded over time to public investment in the Multimodal Corridor with more intense infill development and redevelopment of buildings fronting the corridor.

Moreover, both the private investment and the public investment have been done in accordance with the overall framework of standards identified in these Guidelines, ensuring that the built environment is appropriately scaled for the type of Multimodal Corridor and that the corridor has sufficient capacity among all travel modes to serve the intensity of development that it contains.

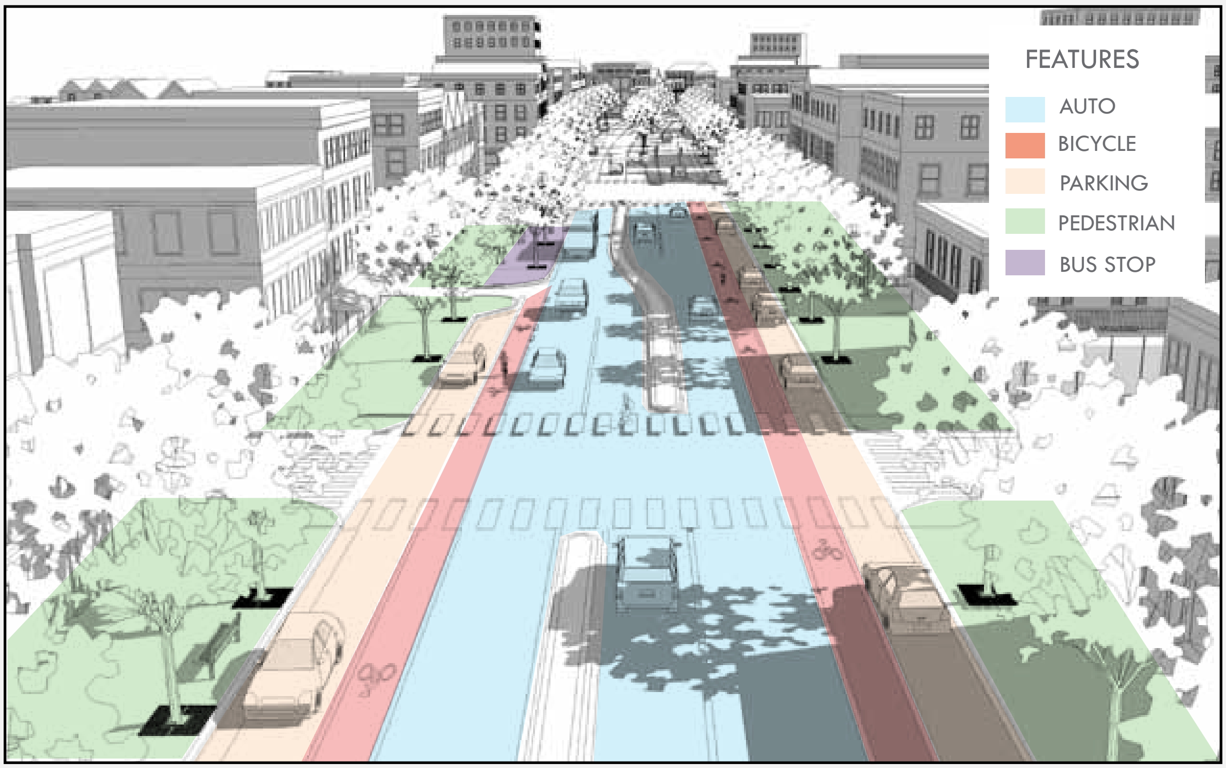


Figure 91 – P-4 Multimodal Center Main Intersection "After" Image. The area gradually evolves into a true Multimodal Center.

Figures 83 through 91 showed how a hypothetical region could be planned for according to the basic principles of these Guidelines. In addition, the example shows how these same principles can be applied at both the Center and Corridor scales to facilitate the gradual transformation of a primarily auto-oriented community into a true Multimodal Center and Multimodal Corridor. It is important to note that these kinds of transformations are typically gradual and require efforts on the part of both the public and private sectors in a community over many years or even decades. However, one of the primary intents behind these Guidelines is to allow communities to establish a blueprint for this transformation over time. As described later in Chapter 9, there are a number of options for implementing and funding multimodal improvements through state and federal funding programs.

The most important long term issue, though, is not which funding option is selected, but to have an agreed-upon vision for how multimodal places should evolve over time. These Guidelines are intended not to give a one-size-fits-all version of that vision for all communities, but to provide a flexible framework, using industry standards and best practices, to allow communities to build a clear picture of their multimodal future.

Modifying the Typology of Multimodal Centers and Corridors for Real Places

The delineation of Multimodal Centers is based on the concept of a travel-shed for a ten minute walk, hence the one-mile circle geometry of the ideal Multimodal Center types. Planning theory makes general assumptions that most people will consider walking if they can reach their destination within a five to ten minute walk, but likely will not consider walking if they perceive their destination to be further away than this. The one-mile circle geometry is a simple approximation of a ten minute walk from center to edge. Concentrating land uses within these one-mile circles brings trip origins and destinations close enough so that walking becomes a viable means of transportation. This is a core concept of the Multimodal Center types.

Yet the simple approximation of a one-mile circle masks many complex factors in people's decisions about whether to walk, drive or use other modes. Some factors depend on an individual's personal characteristics, such as their age, physical health, time availability and access to a personal vehicle. Other factors depend on the fairly unchangeable external environment, such as steep terrain or physical barriers such as rivers or busy highways. Other factors that depend on the built environment include elements such as the quality of surroundings, perceived safety and access to transit among many others. Any of these external factors may modify the actual walk-shed of a Multimodal Center beyond a pure one-mile wide circle.

These Guidelines recognize that a perfect one-mile circle will need to be modifiable and flexible when defining Multimodal Centers and dealing with on-the-ground conditions. The one-mile circle is a valid construct in initial planning for Multimodal Centers and is also useful in having a standard geography to use when measuring relative Activity Density in an existing or proposed Multimodal Center. Using one mile circles to measure Activity Density in designating a Multimodal Center as P-2 or P-3, for example allows all users of these Guidelines to be consistent in how they are applying the typology. Actual Multimodal Center delineation, however, may often stray from the perfect geometry of one mile wide circles.

Modifying Multimodal Center Boundaries for Actual Conditions

Local planners are typically familiar with the dynamics of neighborhoods, transportation facilities and community preferences, and should keep these in mind when modifying the one-mile circles for Multimodal Centers to apply to real life situations. The following considerations are important in preserving the integrity of the Multimodal Center concept in application:

Preserve the Principles behind the Multimodal Center Concept: Multimodal Centers should be roughly the size and shape of the area within a ten minute walk. They should have a centralized gravitational shape centered on a key transit station, intersection or other center of activity; they are generally not linear. The one mile wide circle should define the boundary within which Activity Density is calculated in order to determine which Multimodal Corridor types are appropriate, while actual Multimodal Center boundaries may stray from the perfect one-mile circle geometry.

As explained in greater detail in Chapter 5, the location of Multimodal Centers should be selected such that Multimodal Through Corridors are either located at the edges of the Multimodal Center or transition to Placemaking Corridors if they go through the Multimodal Center. Planners should carefully consider the placement of the Multimodal Center so as not to bisect them with a road that cannot transition to a Placemaking Corridor.

Consider Natural and Man-Made Barriers to Walking: Interstate highways, rivers, and railroads are barriers for pedestrians and bicyclists. Ideally planners would locate Multimodal Centers so that these barriers frame the edges, rather than bisect a Multimodal Center. In these instances, two Multimodal Centers on either side of the barrier may be more appropriate.

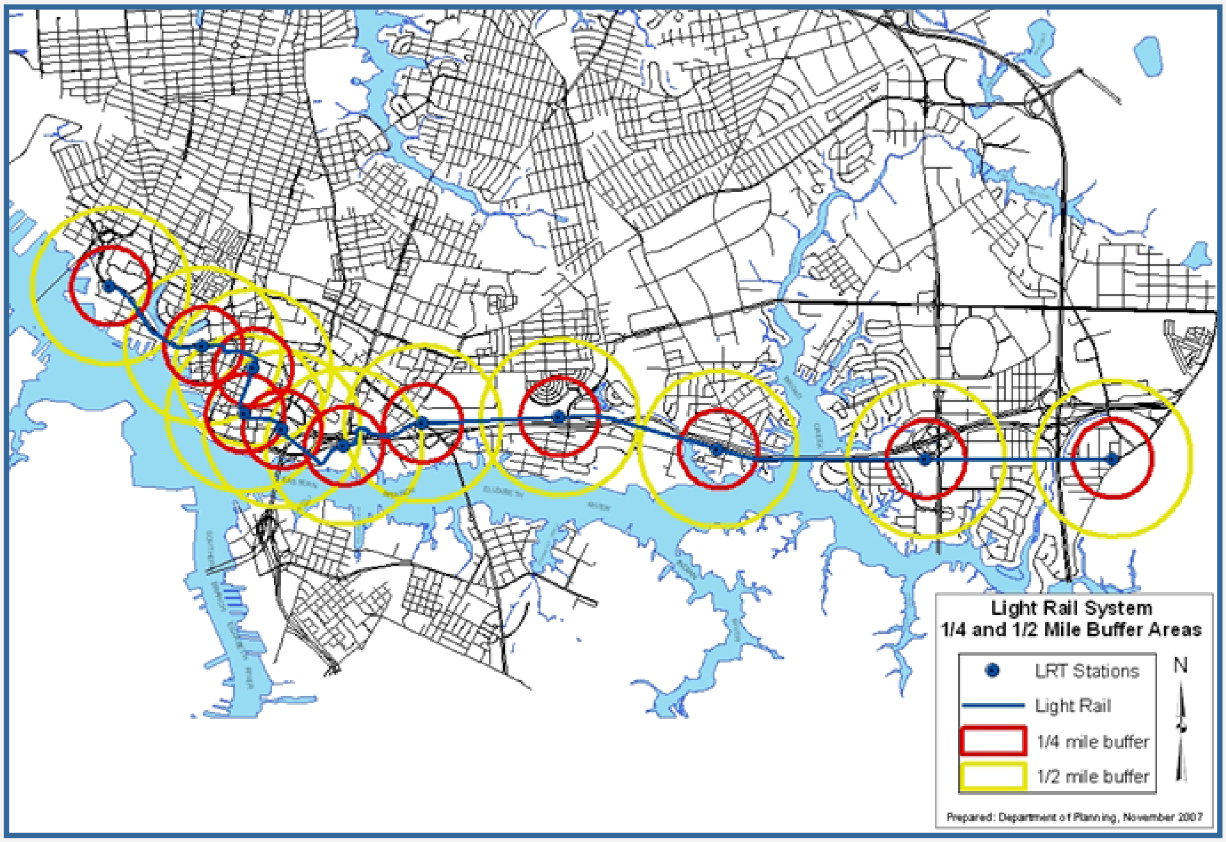
Communicate with Community Members: As part of any planning process, the opinions and concerns of local residents, landowners, and other community members should be considered meaningfully in the designation of future Multimodal Centers. Community involvement can be an opportunity to converse with residents about the benefits of planning for multimodal systems and how the designation of Multimodal Centers plays a vital role in the broader transportation system.

Combine Multimodal Centers where Overlap Occurs: Multimodal Centers may overlap, especially in dense downtowns or business districts. In these instances, Multimodal Center boundaries may be combined to form a larger area.

Example of Applying Multimodal Centers in a Real Place

The City of Norfolk's planning effort for the Tide Light Rail station areas provides an excellent example of applying these considerations and translating an idealized circle into parcel-level geometry, even though it was developed before these Guidelines were in place. In Figure 92, the red and yellow areas combined, labeled as core and support areas in the legend, could represent the Multimodal Centers. The red core areas could represent the TOD nodes as explained further in Chapter 4 of these Guidelines. This map does not depict Multimodal Districts; the City might designate areas within another half-mile of the yellow support areas as Multimodal Districts, or may designate the entire City proper as a series of Multimodal Districts.

This example particularly highlights the importance of examining the barriers to walking when identifying the location of Multimodal Centers. The designated TOD core areas rarely cross over Interstate 264, yet many of the light rail stations are adjacent to the Interstate, which bisects the support areas. This is not an ideal arrangement, and demonstrates the tradeoffs that may occur when planning at the Multimodal System level.



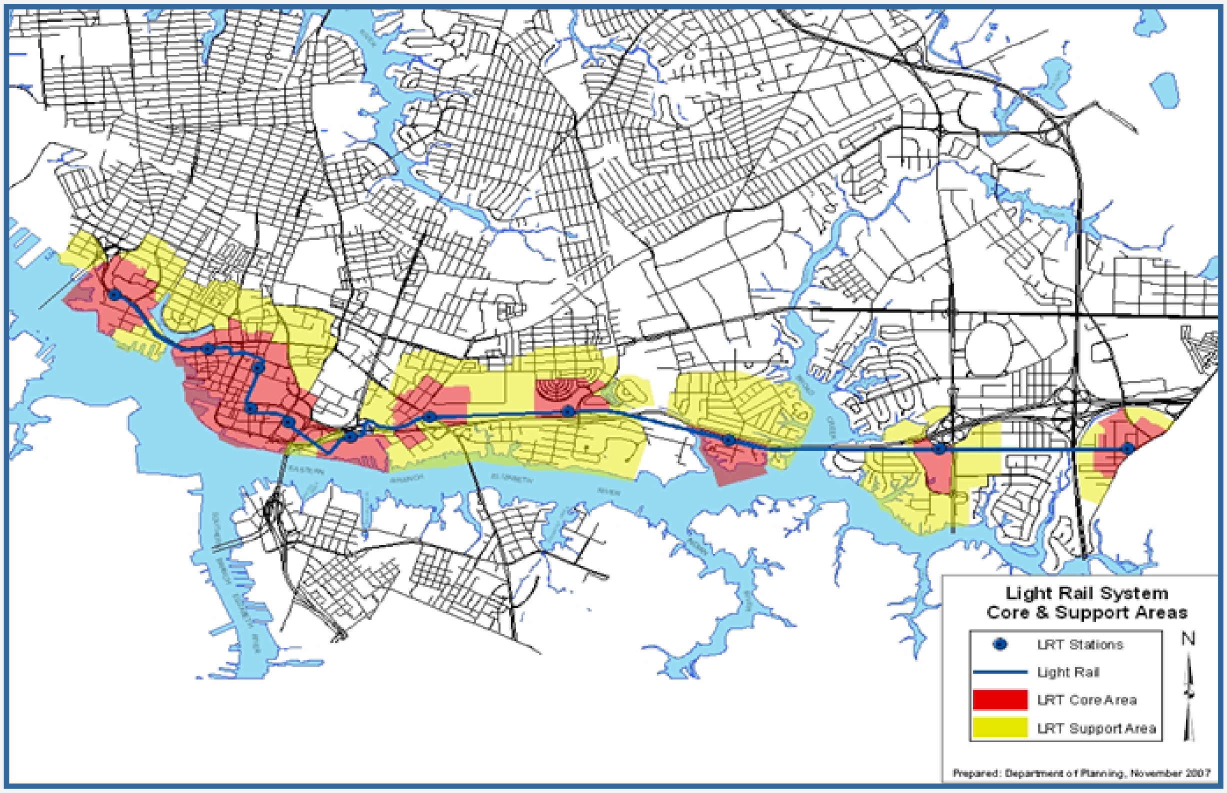


Figure 92 – City of Norfolk Tide Light Rail Station Areas. In planning for light rail stations, the City of Norfolk translated idealized quarter-mile and half-mile circles into parcel-level geometries that together are analogous to modifying the one-mile circles for Multimodal Centers for on the ground conditions. Image source: City of Norfolk.

Applying the Multimodal Corridors Methodology in Real Places

Monticello Avenue in Norfolk is one of the streets that have been transformed by the development of the Tide light rail system. Although it took place before these Guidelines were developed, it is an example of a corridor transformation that is consistent with the methodology of the Multimodal Corridor types, and illustrates the complexities involved with re-designing a corridor to serve a more multimodal function. Monticello Avenue transformed into what would be called a Transit Boulevard under these Guidelines with the construction of the Tide Light Rail system in 2012. It illustrates the decisions and tradeoffs involved in the reconfiguring right-of-way to better serve non-auto modes. Designers had to eliminate some on-street parking and reduce building setbacks in some areas in order to make room for the light rail vehicles. Furthermore, in some areas, the light rail was designed to operate in shared traffic lanes, as opposed to its own dedicated right-of-way due to space constraints. Figure 93 shows the before and after views of this corridor, which demonstrate the transformation to better emphasize transit and walking within the right-of-way.

Figure 93 - Monticello Avenue in Norfolk. Before and after views show Monticello Avenue's transformation to accommodate light rail.

At a more modest scale, the City of Charlottesville retrofitted 6th Street to provide a contra-flow bike lane and on-street parking to slow down traffic speeds and create a safer pedestrian environment. This is an example of retrofitting a corridor at much lower cost and without moving curbs. Sixth Street was an unmarked one-way street. By simply striping the pavement and installing signs, planners transformed the street to retain two rows of parking, but add one contra-flow bicycle lane and a shared lane in the direction of vehicular travel. The new street configuration makes bicyclists more visible while retaining on-street parking.

Finally, maintenance can often be a complex issue. VDOT maintains all state roads and most local roads on the primary and secondary road network. Localities sometimes maintain their own roads. Sometimes property owners are responsible for maintaining the sidewalk and amenity element. Some roads may have unique maintenance agreements for different elements. When communities are considering a project to re-design a Multimodal Corridor, communication with all agencies involved should be a priority to establish clear maintenance responsibilities and agreements.

Figure 94 - Sixth Street in Charlottesville. Before and after views show 6th Street's transformation to provide a contra-flow bicycle lane and a shared lane while retaining on-street parking and slowing speeds to enhance the pedestrian environment.

CHAPTER 8
Transportation Demand Management Strategies

Planning multimodal places and designing Multimodal Corridors can benefit communities by increasing transportation choices and improving transportation system efficiency. Various other strategies and initiatives can further improve transportation choices and system efficiency. Transportation Demand Management (TDM, also referred to as Travel Demand Management) is an area of transportation planning and operations that involves strategies and policies to maximize transportation system efficiency through improved travel choices and reliability. This chapter introduces current TDM strategies used in Virginia and discusses TDM initiatives and policies relative to various community contexts. Communities can use these strategies in concert with the planning framework for multimodal places and design guidance for Multimodal Corridors to further enhance overall benefits for a community's transportation system and reduce the tendency to drive alone.

While these Guidelines are primarily concerned with how multimodal regions, Multimodal Centers, and Multimodal Corridors are physically planned and developed, the synergy with TDM strategies is critically important as part of an overall picture of improving travel choices in a region. TDM strategies and policies provide travelers with real-time information and create options to enhance flexibility and reliability. TDM initiatives affect demand by enhancing travelers' choices about whether or not to make a trip, where to travel to, which mode of transportation to use, which route to take, and when to travel.

TDM encompasses a broad spectrum of strategies including the following. These strategies will be discussed in greater detail in later sections:

- Carpooling and vanpooling
- High Occupancy Vehicle (HOV) infrastructure investments
- Rail and bus transit service
- Employer-developed programs to incentivize employees to commute via modes besides driving alone like parking cash out programs, rideshare subsidies, and tax-free transit passes
- Car sharing and bicycle sharing programs
- Flexible work schedules and telecommuting
- Bicycle and pedestrian infrastructure improvements
- Shuttle services and Guaranteed Ride Home programs
- Road pricing
- Congestion pricing
- Parking pricing

Transportation Demand Management (TDM)

TDM involves services, strategies and policies to maximize transportation system efficiency by moving more people with fewer vehicles. TDM initiatives enhance travelers' choices about whether or not to make a trip, where to travel to, which mode of transportation to use, which route to take, and when to travel, making the entire transportation system more flexible and reliable.

Transportation Demand Management in Virginia Today

Virginia's TDM Community

A unique partnership of state, regional, and local agencies that work together:

- *Virginia Department of Transportation (VDOT)*
- *Virginia Department of Rail and Public Transportation (DRPT)*
- *Virginia Office of Intermodal Planning and Investment (OIPI)*
- *Planning District Commissions (PDCs)*
- *Metropolitan Planning Organizations (MPOs)*
- *Transportation Management Associations (TMAs)*
- *Public Transit Agencies*
- *TDM Agencies (local commuter assistance)*

TDM Agencies in Virginia

- *Arlington County Commuter Services*
- *Rideshare*
- *Local Motion*
- *Fairfax County Transportation Services Group*
- *GWRideConnect*
- *Loudoun County Commuter Services*
- *Middle Peninsula Rideshare*
- *NeckRide*
- *OmniMatch*
- *Commuter Services by RRRC*
- *RideFinders*
- *RIDE Solutions*
- *TRAFFIX*
- *RideSmart*

A wide variety of agencies and organizations work together to promote TDM strategies in Virginia at statewide, regional, and local levels. This unique partnership includes DRPT, VDOT, the state Office of Intermodal Planning and Investment (OIPI), PDCs, MPOs, transportation management associations (TMAs), transit agencies, 18 TDM agencies, and private companies.

TDM agencies throughout the state provide rideshare services and commuter assistance. DRPT assesses the need for TDM investment across the state, directs funding to the TMAs, and provides financial and technical support to local commuter assistance agencies through grant programs, research, training, and marketing assistance. VDOT constructs and maintains infrastructure like bicycle lanes, sidewalks, HOV facilities, and Park and Ride facilities to make bicycling, walking, carpooling, and taking transit safer and faster. TMAs (e.g. Commuter Connections) help businesses and commuters identify TDM opportunities by promoting telework programs, matching commuters to rideshare programs, offering Guaranteed Ride Home programs, and regionally distributing traveler information. MPOs and PDCs house TDM agencies and promote TDM strategies through outreach and commuter assistance efforts. Local governments can create bicycle sharing programs and promote TDM strategies through advertising campaigns and other outreach efforts. Bicycle and pedestrian advocacy organizations increase visibility of these services and work with employees to find more commuting options. Some urban localities including the City of Alexandria and Fairfax County incorporate TDM requirements into the development review process.

Private companies are a critical component to TDM. Private vanpool and bus companies provide alternative transportation choices for commuters, especially in areas where mass transit does not exist or is inconvenient. Car sharing companies like Zipcar offer flexibility in car ownership. Employers are key to providing TDM strategies, as they are the ones to offer incentive programs and flexible working environments to reduce demand.

Major TDM Initiatives

The various organizations, agencies, and private companies that provide and promote TDM strategies provide a range of services, programs, and projects that enhance travel choice throughout the Commonwealth.

Long-Range TDM Plans

Virginia's TDM agencies are preparing Long-Range TDM Plans with assistance from DRPT to establish long-term planning goals and strategies, identify performance measures to track program effectiveness, and develop financial plans, funding sources, and budgets for operating TDM programs.

Telework!VA

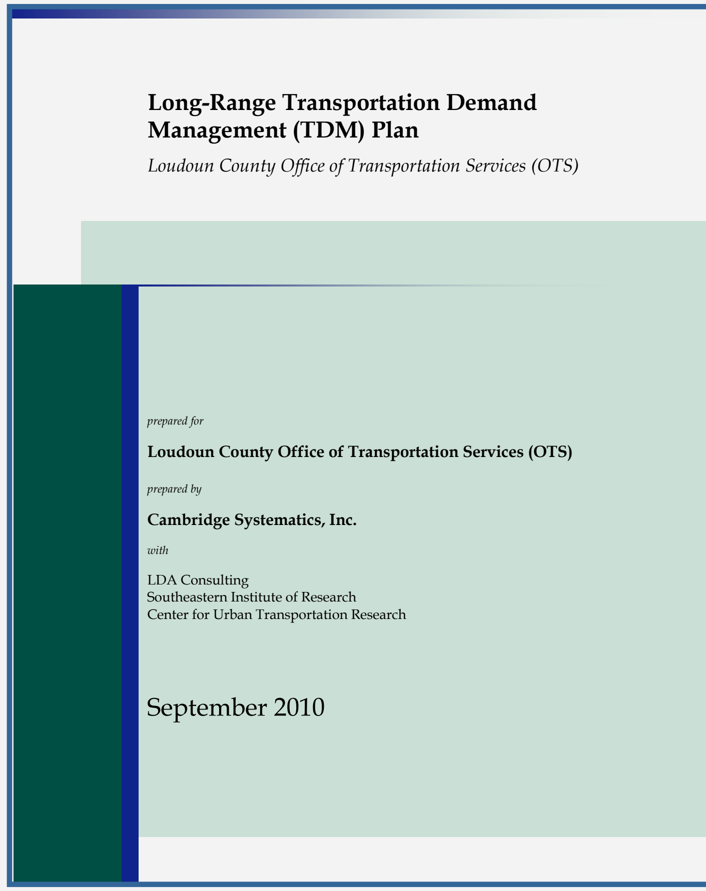
DRPT launched the Telework!VA program to provide incentives and resources for Virginia businesses to establish or expand telework programs for employees. Telework!VA offers step-by-step instructions on how to implement a new program and tools to help businesses better manage existing programs. Telework!VA also gives information on financial incentives like tax credits to encourage businesses to create telework programs.

State of the Commute Survey

In 2007, DRPT conducted the first statewide commute survey to document a profile of Virginians' commuting characteristics and trends, the TDM services they use, and their attitudes and opinions. The ground-breaking study revealed five important findings about how and why TDM strategies are essential to travel in Virginia.

1. **When it comes to work trips, Virginians are embracing transportation choices.** Transportation choices are attracting people that used to drive alone. Alternate mode share is significantly higher in Northern Virginia, where more transportation mode choices exist.

2. **Infrastructure and outreach are key for transportation choices.** HOV system connectivity makes a bigger difference in commuters' travel


Long-Range Transportation Demand Management (TDM) Plan

Loudoun County Office of Transportation Services (OTS)

prepared for

Loudoun County Office of Transportation Services (OTS)

prepared by

Cambridge Systematics, Inc.

with

LDA Consulting
Southeastern Institute of Research
Center for Urban Transportation Research

September 2010

Figure 95 – Long-Range Transportation Demand Management Plans. DRPT and TDM agencies are developing long range TDM plans to provide Virginians with more travel choices.

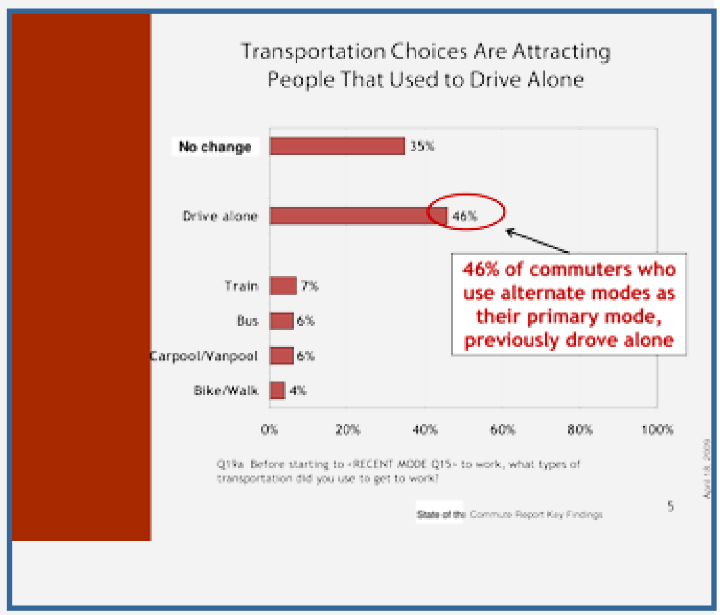


Figure 96 – State of the Commute Survey Results. Virginians value having travel choices regardless of where they live and work, and what mode they currently take. Data strongly indicates that Virginians are choosing alternatives to driving alone when choices are available.

decisions. Park and Ride lots significantly reduce the rate of commuters who drive alone. Almost 75 percent of commuters recognize the benefits of ridesharing and transit.

3. **Employer involvement raises participation in transportation choices.** The proportion of workers who drive alone is higher among those whose employers provide no commute assistance service. Carpool/vanpool and bus/train mode choice is twice as high when commute services are available.

4. **Telework has tremendous growth potential, regardless of the workplace geographic region.** Teleworking currently replaces nearly six percent of weekly commute trips in Virginia. Nearly one quarter of non-teleworkers "could and would" telework if offered the opportunity, equaling about 751,000 potential new teleworkers.

5. **Investment in transportation choices has broad based support.** Support for investment in transportation choices is equally strong among both commuters who carpool, vanpool or ride a bus and commuters who drive alone.

Virginia Megaprojects

VDOT is making serious investments in infrastructure for high occupancy travel, especially in the Northern Virginia area. These 'megaprojects' will make carpooling, vanpooling, and transit faster, easier, and more convenient, moving more people in fewer vehicles. Projects include express lanes on I-95 and I-495 and extension of Metrorail to Dulles International Airport.

Statewide Transit and TDM Plan Update

Through the Statewide Transit and TDM Plan Update effort, DRPT is evaluating where current TDM strategies, programs and projects are sufficient or lacking, and developing recommendations for TDM program creation and expansion throughout the Commonwealth. The analysis organizes areas of the state into four distinct area types, which are similar but not identical to the Multimodal Center types in Chapter 3 of these Guidelines. The TDM area types, service levels, and recommendations will be more thoroughly discussed in the next section of this chapter.

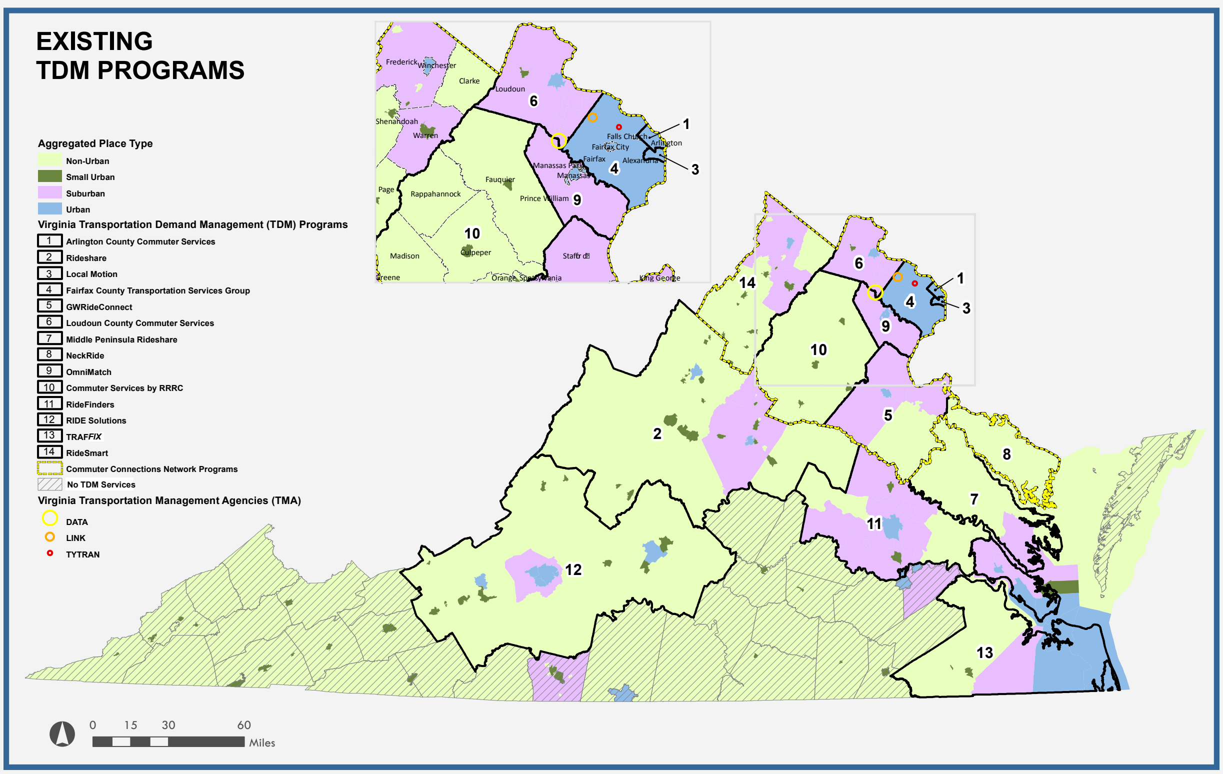


Figure 97 - TDM Agencies and TMAs in Virginia. Local commuter assistance programs are available for most northern, central and eastern Virginia residents. TDM gaps exist in southwest and south-central Virginia. This gap analysis was conducted as part of the Statewide Transit &and TDM Plan Update effort.

The Super NoVa Transit and TDM Vision Plan takes a similar approach to organizing a large metropolitan region into area types and recommending TDM service levels that are specific to the unique characteristics and needs of each area type.

TDM STRATEGIES

There are a multitude of TDM strategies that can increase the efficiency of the transportation system and manage travel demand. This section describes many of these strategies by TDM service category, as categorized for the ongoing Statewide Transit and TDM Plan Update effort.

Transportation Information

Giving commuters more information about travel conditions and travel options helps them plan their trip and make adjustments to their travel mode, departure time, and route to avoid long delays. Travelers might decide to drive another route if their usual route is delayed; or they may choose to walk, bike, or take the bus to avoid the headache. **Mobility centers** and information kiosks at transit hubs can attract walk-in users for information on rideshare modes and offer transit fare sales. **Call centers and help lines** can help travelers approaching congested areas make detours, and travelers stuck in congestion can provide information to these call centers to distribute to other travelers. Additionally, call centers can help bicyclists with flat tires or other bike problems, as well as stranded or confused transit passengers. Updated information on **radio, television, and newspapers** can warn travelers of upcoming roadwork schedules and possible delays. **Websites and social media** and other **real-time travel information** strategies provide up-to-the-minute information on crashes and other areas of congestion as they occur, so travelers can continually adjust their travel plans. Commuters can check transit agencies' websites to see exactly when the next bus is arriving; or this information may be posted at the transit stop via a LED display.

TDM Strategies

There are a multitude of TDM strategies that can increase the efficiency of the transportation system and manage travel demand. This section describes many of these strategies by TDM service category, as categorized for the ongoing Statewide Transit and TDM Plan Update effort.

Employer Services

Employers can incentivize employees to consider making changes to their daily commutes. **Commute planning** efforts make employees aware of travel options like carpooling or vanpooling. **Telework** support programs help employers find ways to make working remotely a viable option for employees. Employees can work from home at least one day a week, or work at a telework center closer to home to reduce the number of trips and the trip distance of their commute. **Commuter benefit programs** offer pre-tax paycheck deductions or subsidies to help save money on commute expenses when employees do not drive to work. **Alternative work schedules**, including compressed work schedules, enable employees to work flexible hours to avoid commuting during peak travel times or work more hours each day with more days off to reduce commute trips.

Education & Outreach

Education and outreach efforts can make residents and workers aware of travel options. **Corridor-level programs** focus on severely-congested roads. General **bike and walk** advocacy and education efforts help commuters find safe routes and provide safety tips. **New resident kits** can be distributed to real estate offices to give information about commuter assistance to new residents.

Ridesharing

Carpooling and vanpooling help commuters save money and stress. **Ridematching** strategies connect workers to others who live or work nearby. **Vanpool subsidies** provide financial incentives for using or starting up a vanpool service. **Slug lines** make it easy for driving commuters to pick up additional passengers to use an HOV facility.

Infrastructure

Park and Ride facilities provide dedicated places for commuters who would normally drive to work to meet up with others to carpool, vanpool, or take transit. Providing signs and stops for **private shuttles** can help take commuters to destinations not served by the public transportation system. **Carshare and bikeshare** signs and spaces make it more convenient for travelers to bike when they can, and drive a car when they need to, without worrying about the cost and maintenance of ownership.

Financial Incentives

Goal-based programs create financial incentives to meet certain quantitative goals like mode share or percent teleworking.

Support Services

Support services like **Guaranteed Ride Home** programs ensure commuters that they will not be left stranded if they need to work late or travel outside of normal commuting hours.

Land Use & Zoning

Localities can implement several TDM strategies through land use and zoning regulations. Localities can coordinate site plan development with commuter and transit services through **TDM site plan** conditions, which are agreements between developers and local governments, usually negotiated, during the development review process. Localities may require developers to provide infrastructure (e.g. bicycle parking facilities and van-accessible garages) or services (e.g. managing showers and lockers for bicycle commuters and distributing brochures about local transportation options like bus routes and schedules and bicycle routes) in order to gain the necessary approval to move forward with construction. Parking management techniques include reduced parking requirements for developers, 'unbundling' the cost of parking spaces from rental leases, maximum parking ratios, and real-time information on parking space availability.

Fairfax County and the City of Alexandria are two examples of localities that have fully integrated TDM initiatives into the land development process. Fairfax County requires developers to include various TDM elements in order for their development plans to be approved. Basic program requirements include designating an on-site transportation coordinator, providing a Guaranteed Ride Home program, distributing information on travel choices, offering transit incentives, and providing bicycle amenities and carpool/vanpool preferred parking. Fairfax County also requires regular monitoring and reporting of the performance of these TDM initiatives to ensure they are reducing travel demand.

TDM in the Land Development Process

Fairfax County and the City of Alexandria are two examples of localities that have fully integrated TDM initiatives into the land development process. Fairfax County requires developers to include various TDM elements in order for their development plans to be approved.

The City of Alexandria's zoning ordinance requires large development projects to submit transportation management plans (TMPs) as part of the special use permit application.

The City of Alexandria's zoning ordinance requires large development projects to submit transportation management plans (TMPs) as part of the special use permit application. The TMPs specify strategies to provide transportation options besides driving alone, such as discounted transit fares, shuttle bus services, registration for car sharing, etc., and set up a TMP fund to finance these strategies. As of July 2011, 80 TMPs have been prepared for the City of Alexandria.

TDM Strategy Recommendations By Multimodal Center and Area Types

Some of the TDM strategies discussed in the previous section are more applicable in urban or suburban areas; others are more useful in rural areas. Many TDM strategies are beneficial regardless of context. This section describes which TDM strategies are most beneficial for different kinds of contexts and relates these contexts to the Multimodal Center types used in these Guidelines. **Table 13** summarizes which TDM strategies are recommended based on areas with different intensities of Multimodal Centers.

TDM Strategies in Areas with Higher Intensity Multimodal Centers

Urban areas with higher intensity Multimodal Centers (P-6 and P-5) typically have enough destinations and travel activity to support all of the possible TDM strategies. Mobility centers and private shuttles are likely only applicable for the densest (P-6) Multimodal Centers.

TDM Strategies in Areas with Moderate Intensity Multimodal Centers

Areas with moderate intensity Multimodal Centers (P-4 and P-3) will likely have some concentration of employment, making employer services key strategies for these areas. Land use and zoning strategies within these areas can shorten trips and encourage travelers coming from outside of the area to find alternatives to driving alone.

TDM Strategies in Areas with Low Intensity Multimodal Centers

High priority strategies for areas with low intensity Multimodal Centers (P-2 and P-1) focus on distributing information for travel choices and providing designated spaces for commuters to meet up to transfer to a carpool or vanpool. Ridematching is difficult in more dispersed areas, therefore ridematching assistance is a high priority. Residents in areas with low intensity Multimodal Centers may have longer commutes, making telework and alternative work schedules key to reducing commuting trips and trip lengths.

Service Category	TDM Strategy	Areas with Higher Intensity Multimodal Centers (P-6 to P-5)	Areas with Moderate Intensity Multimodal Centers (P-4 to P-3)	Areas with Lower Intensity Multimodal Centers (P-2 to P-1)
Transportation Information	Mobility Center/Kiosk	High priority	Low priority	Not applicable
	Call Center/Help Line	High priority	High priority	Not applicable
	Radio/TV/Paper	High priority	Low priority	Low priority
	Websites/Social Media	High priority	High priority	High priority
	Real-Time Travel Information	High priority	High priority	High priority
Employer Services	Commute Planning	High priority	High priority	High priority
	Telework Support	High priority	High priority	High priority
	Commuter Benefit Programs	High priority	High priority	Low priority
	Alternative Work Schedules	High priority	High priority	High priority
Education & Outreach	Corridor-Level Programs	High priority	Low priority	Not applicable
	Bike	High priority	Low priority	Not applicable
	Walk	High priority	Low priority	Not applicable
	New Resident Kits	High priority	High priority	High priority
Ridesharing	Ridematching	High priority	High priority	High priority
	Vanpool Subsidy	High priority	Low priority	Low priority
	Slug Lines	High priority	Low priority	Not applicable
Infrastructure	Park & Ride Lots	High priority	High priority	High priority
	Private Shuttles	High priority	Low priority	Not applicable
	Carshare	High priority	Low priority	Not applicable
	Bikeshare	High priority	Low priority	Not applicable
Financial Incentives	Goal-Based Programs	High priority	Low priority	Low priority
Support Services	Guaranteed Ride Home	High priority	High priority	High priority
Land Use & Zoning	TDM Conditions	High priority	High priority	Low priority
	Parking Management	High priority	High priority	Not applicable

Table 13 - Recommended TDM Strategies.[26]

[26] This table is adapted from draft content for the Statewide Transit and TDM Plan Update. Area types were translated to Multimodal Center types to more closely correlate to the Multimodal Centers described in previous chapters of the Guidelines. **The recommendations from the Statewide Transit and TDM Plan Update are currently under development.**

CHAPTER 9
Implementation & Funding Best Practices

Identifying specific improvements for Multimodal Corridors, as discussed in previous chapters, is crucial to realizing the benefits of multimodal transportation. Identifying a source of funding for these improvements is a fundamental implementation step. This chapter provides a broad overview of funding options for multimodal improvements. Traditionally, the widest opportunities and greatest transportation funding resources have been generally devoted to highway projects. Many of these sources can also be used for multimodal improvements. This section explains how communities can utilize these and other less traditional funding options at the local, regional, state and national levels.

This chapter is not intended to be an exhaustive description of how to fund multimodal improvement projects. Rather, it covers the highlights and points toward options that can be explored further, depending on the nature of improvements and the local funding priorities. It should be noted that these opportunities are changing annually in many cases and should be checked for any revisions subsequent to the publishing of this document.

The Virginia Center for Transportation Innovation and Research (VCTIR) is currently developing two reports on transportation funding, which are anticipated to be available shortly after the completion of these Guidelines. *VTCIR Project 103638 Traditional and Innovative Funding and Financing Options for Virginia and Its Localities*[27] will provide a guide to funding sources and financing tools specifically serving transportation projects in Virginia localities, including criteria for locality eligibility. The guide will inform VDOT district planners, local authorities, and eligible private-sector entities of current means to fund or finance local transportation projects.

VTCIR Project 101369 Local Transportation Funding in Virginia: Lessons Learned[28] will establish a factual basis of information on what local governments have been able to accomplish when using existing legislative authority and resources as alternative funding sources to implement transportation improvements when state funding was not available. This study will also identify funding sources that are promising for road-construction projects but that currently are not used in Virginia.

This chapter is not intended to be an exhaustive description of how to fund multimodal improvement projects. Rather, it covers the highlights and points toward options that can be explored further, depending on the nature of improvements and the local funding priorities. It should also be noted that these opportunities are changing annually in many cases and should be checked for any revisions subsequent to the publishing of this document.

[27] More information about VTCIR Project 103638 is available online at http://vtrc.virginiadot.org/ProjDetails.aspx?id=511.
[28] More information about VTCIR Project 101369 is available online at http://vtrc.virginiadot.org/ProjDetails.aspx?id=510.

Funding for Transportation Projects in Virginia

Commonwealth Transportation Fund (CTF)29

At the state level, the Commonwealth Transportation Board (CTB) directs funding for transportation projects by approving the annual budget for the Commonwealth Transportation Fund (CTF), which is the main source of funds for Virginia's transportation agencies (VDOT, DRPT, The Virginia Department of Aviation, and the Virginia Port Authority). Revenues for the CTF are categorized into five major sources:

1. **Highway Maintenance and Operating Fund (HMOF)** – provides funding for highway maintenance, operations and administration.

2. **Transportation Trust Fund (TTF)** – provides funding for highway construction, as well as mass transit, airports and ports. These funds are distributed by formula, as defined by the Code of Virginia, to the Construction Fund (78.7%), Mass Transit Fund (14.7%), Airport Fund (2.4%), and Port Fund (4.2%).

3. **Priority Transportation Fund (PTF)** – provides funding for specified transportation projects and debt service funding in support of various debt financed projects.

4. **Capital Project Revenue (CPR) Bonds** – issued over the three year period from Fiscal Year 2012 through Fiscal Year 2014 as part of Governor McDonnell's Omnibus Transportation Funding Bill from the 2011 General Assembly Session.

5. **Federal Funds** – dedicated from FHWA and FTA, and used for their defined purposes to support construction, maintenance, or transit.

State taxes and fees are the main revenue sources for the HMOF, TTF, and PTF. These taxes and fees include motor vehicle fuels taxes, road taxes, motor vehicle sales and use taxes, international registration plans, motor vehicle license fees, and recordation taxes among others. Table 14 shows the CTF Transportation Revenues for Fiscal Year 2012-2013.

Highway Maintenance and Operating Fund	**$ 1,425,524,654**
State Revenue	$ 1,396,800,000
Motor Vehicle Fuels Tax	*$ 729,000,000*
Road Tax	*$ 5,100,000*
Motor Vehicle Sales & Use Tax	*$ 354,100,000*
International Registration Plan	*$ 62,600,000*
Motor Vehicle Licenses	*$ 220,400,000*
Miscellaneous Revenues	*$ 12,800,000*
Recordation Tax	*$ 12,800,000*
Other	$ 28,724,654
Transportation Trust Fund & Bonds	**$ 1,304,207,780**
Special Session Revenue	$ 930,000,000
Motor Vehicle Fuels Tax	*$ 108,000,000*
Road Tax	*$ 7,400,000*
Aviation Fuels Tax	*$ 2,200,000*
State General Sales & Use Tax	*$ 543,300,000*
Motor Vehicle Sales & Use Tax	*$ 188,800,000*
Motor Vehicle Rental Tax	*$ 33,300,000*
Licenses Fees	*$ 21,400,000*
Recordation Tax	*$ 25,600,000*
Interest Earnings	$ 14,508,505
Toll Facilities	$ 30,311,501
Local Revenue Sources	$ 211,457,038
CPR Bonds	$ 600,000,000
Net Premiums from Previous Sales	$ 78,502,635
Other Trust Fund Revenue	$ 121,292,242
Priority Transportation Fund	**$ 182,575,345**
State Revenue	$ 170,922,458
Other	$ 11,652,887
Federal Funds	**$ 1,093,923,037**
Federal Highway Administration	$ 1,046,356,866
Federal Transit Administration	$ 47,566,171

Table 14 - Commonwealth Transportation Fund Revenue Sources FY 2012-13.

[29] The CTF budget for Fiscal Years 2012-2013 was approved by the CTB on June 20, 2012 and is available online at http://www.virginiadot.org/VDOT/About_VDOT/asset_upload_file841_58764.pdf.

The CTF revenues are then distributed to eight major categories:

1. Maintenance and Operations
2. Construction
3. Debt Service
4. Mass Transit Fund
5. Tolls, Administration and Other Programs
6. Other State Agencies and Transfers
7. Port Trust Fund
8. Airport Trust Fund

Table 15 shows the CTF Distribution of Revenues for Fiscal Year 2012-2013.

Maintenance & Operations	**$ 1,830,390,733**
Highway System Maintenance	$ 1,454,182,000
Financial Assist. to Localities for Ground Transp. - Cities	$ 326,755,339
Financial Assist. to Localities for Ground Transp. - Counties	$ 49,453,394
Construction	**$ 1,605,693,253**
Dedicated and Statewide Construction	$ 1,036,879,412
Financial Assist. To Localities for Ground Transportation	$ 14,656,743
Interstate System	$ 166,357,184
Primary System	$ 221,146,620
Secondary System	$ 65,029,136
Urban System	$ 101,624,158
Debt Service	**$ 300,034,121**
Toll Facilities Debt	$ 7,226,852
Northern Virginia Transportation District	$ 34,279,079
Oak Grove Connector	$ 2,224,500
Route 28	$ 7,530,300
Route 58	$ 48,264,750
GARVEE Bonds	$ 33,430,026
FRANs	$ 45,423,063
CPR Bonds	$ 118,655,551
Mass Transit Fund	**$ 460,219,418**
Share of Special Session Funds (14.7%)	$ 133,055,119
Surface Transportation Program (7%)	$ 16,131,523
Equity Bonus (13%)	$ 8,946,892
Federal Transit Authority	$ 47,566,171
CMAQ (w/o. State Match)	$ 10,866,615
STP Regional (w/o State Match)	$ 13,487,364
Rail Fund	$ 24,825,000
Interest Earnings	$ 2,781,000
Metro Matters	$ 50,000,000
Transit Capital Bonds	$ 91,401,054
Rail Bonds	$ 16,275,613
Recordation Taxes for Transit Operating	$ 25,600,000
Support from Construction	$ 13,240,245
Support from HMOF	$ 5,236,863
Other	$ 805,959
Tolls, Administration & Other Programs	**$ 379,721,289**
Ground Transportation System Planning & Research	$ 65,093,846
Environmental Monitoring & Compliance	$ 10,162,192
Administrative & Support Services	$ 231,280,656
Program Management & Direction	$ 25,489,826
Toll Facilities Operations	$ 36,094,769
Capital Outlay	$ 11,600,000
Other State Agencies and Transfers	**$ 51,534,181**
Trust Fund Management	$ 2,973,029
Support to Other State Agencies (excludes DRPT)	$ 45,532,835
Indirect Costs	$ 3,028,317
Port Trust Fund	**$ 38,489,125**
Share of Special Session Funds (4.2%)	$ 38,015,748
Interest Earnings	$ 473,377
Airport Trust Fund	**$ 22,012,837**
Share of Special Session Funds (2.4%)	$ 21,723,284
Interest Earnings	$ 289,553

Table 15 - Commonwealth Transportation Fund Revenue Distribution FY 2012-13.

Six-Year Improvement Program (SYIP)

The projected funds from the CTF for the next six fiscal years are allocated in the Six-Year Improvement Program (SYIP), which distributes the state funding for highway, road, bridge, rail, transit, bicycle, pedestrian, and other transportation improvements throughout the state. SYIP funds are allocated to seven different systems (percentages reflect the breakdown of funding for the current FY2013-18 SYIP):

1. Interstate (19.0%)
2. Primary (31.3%)
3. Secondary (6.3%)
4. Urban (7.2%)
5. Enhancement (1.5%)
6. Transit (2.2%)
7. Rail (0.4%)
8. Other (32.1%)

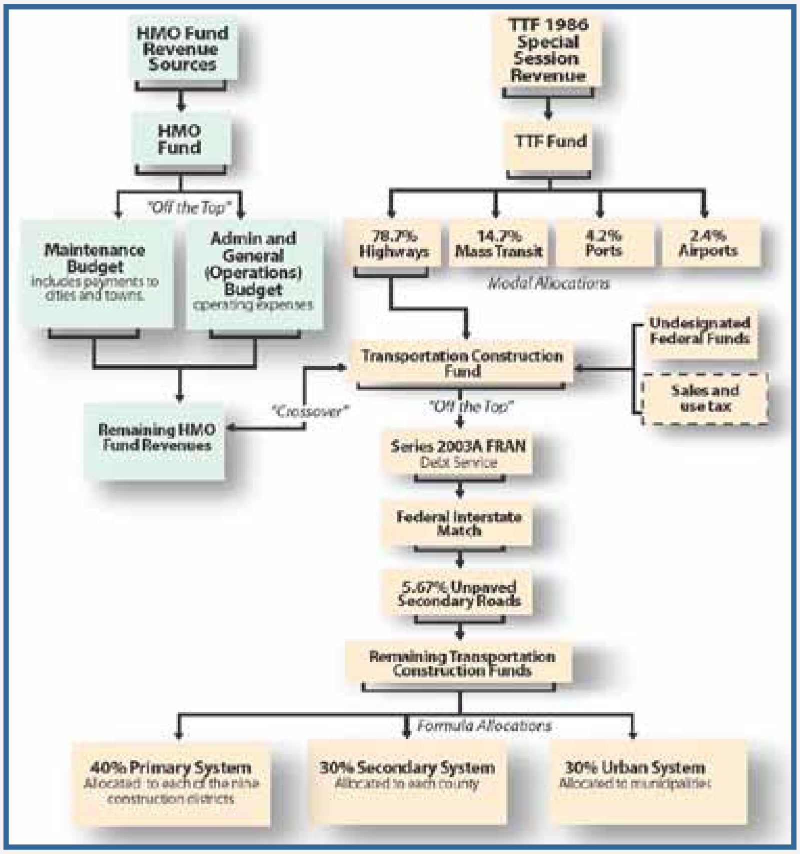


Figure 98 - Allocation of Transportation Funds in Virginia.

The SYIP also specifies individual projects for funding within the seven defined systems. A large number of multimodal corridor improvements in the past have traditionally been funded with Transportation Enhancement (TE) Funds although multimodal improvements can also be funded through other systems. Within the current SYIP, there are a number of pedestrian and bicycle projects that are funded with Enhancement, Urban, Primary, and Secondary system funds.

Figure 98 shows an overview of how monies from the HMOF and TTF are allocated.[30]

The new two-year federal transportation bill "Moving Ahead for Progress in the 21st Century" (MAP-21), set into effect October 1, 2012, includes significant changes to the federal TE Program, which funds 98 percent of Virginia's Enhancement system improvements in the FY 2013-18 SYIP. The federal Transportation Alternatives Program (TAP) has replaced the TE Program. MAP-21 more narrowly defines the types of projects that qualify for TAP funding. Construction, planning and design of on-road and off-road trail facilities for pedestrians, bicyclists, and other non-motorized forms of transportation are still considered

[30] AASHTO. "Virginia Transportation Revenue Initiatives Case Study." NCHRP 20-24(62). Making the Case for Transportation Investment and Revenue. September 2009. http://downloads.transportation.org/Making_the_Case_Transportation_Investment_and_Revenue.pdf

eligible projects, but other types of projects are no longer eligible. For example "beautification" projects like landscaping are not eligible for funding under the TAP unless considered vegetation management along transportation rights-of-way.[31]

Commercial Transportation Tax

Localities within the Northern Virginia Transportation Authority and the Hampton Roads Transportation Authority have the authority to impose an additional real property tax on commercial property with the revenues to be used for transportation.[32] This is an additional potential funding source for multimodal transportation improvements for those localities that are within these Transportation Authorities' boundaries. Other potential funding sources are described later in the next section.

Virginia Transportation Planning Process

The following is a brief overview of how transportation funding decisions are made within the overall context of statewide transportation planning.

From a local standpoint, transportation projects selected to be included in the SYIP must also be included in the local MPO's regional Transportation Improvement Program (TIP), a financially constrained short-term plan for projects that can be funded with expected revenues in the next three to five years. MPOs also produce Long-Range Transportation Plans (LRTPs) which are vision plans that include all desired projects for the next 25 years, and select projects for a fiscally constrained element using funding projections. Localities prepare Comprehensive Plans, in accordance with Virginia law, with transportation elements that outline the locality's desired future transportation projects and priorities. Other planning documents including corridor studies, thoroughfare plans, rural long-range plans, and small area studies can also be used to identify future transportation project needs. From a statewide standpoint, the major policy initiatives, like those deriving from VTrans, Virginia's statewide long-range multimodal transportation policy plan, also influence which projects will be included in the SYIP. VDOT and DRPT also contribute to the decision-making process through needs assessments and recommendations in the Virginia Surface Transportation Plan (VSTP), which is essentially a synthesis of three statewide modal plans, the Statewide Highway Plan (VDOT), the Statewide Rail Plan (DRPT), and the Statewide Transit and TDM Plan (DRPT). The Statewide Highway Plan and the highway element of the VSTP also include pedestrian and bicycle facilities, intermodal connectors, and park-and-ride lots. The Statewide Transit and TDM Plan and Statewide Rail Plan specify recommendations for transit and rail service expansion.

[31] More information about project eligibility under the TAP program can be found online at http://www.fhwa.dot.gov/map21/guidance/guidetap.cfm.
[32] Virginia House Bill 3202 was enacted in April 2007 and incorporated into the Acts of Assembly as Chapter 896.

Figure 99 outlines the basic concepts of transportation planning in Virginia.

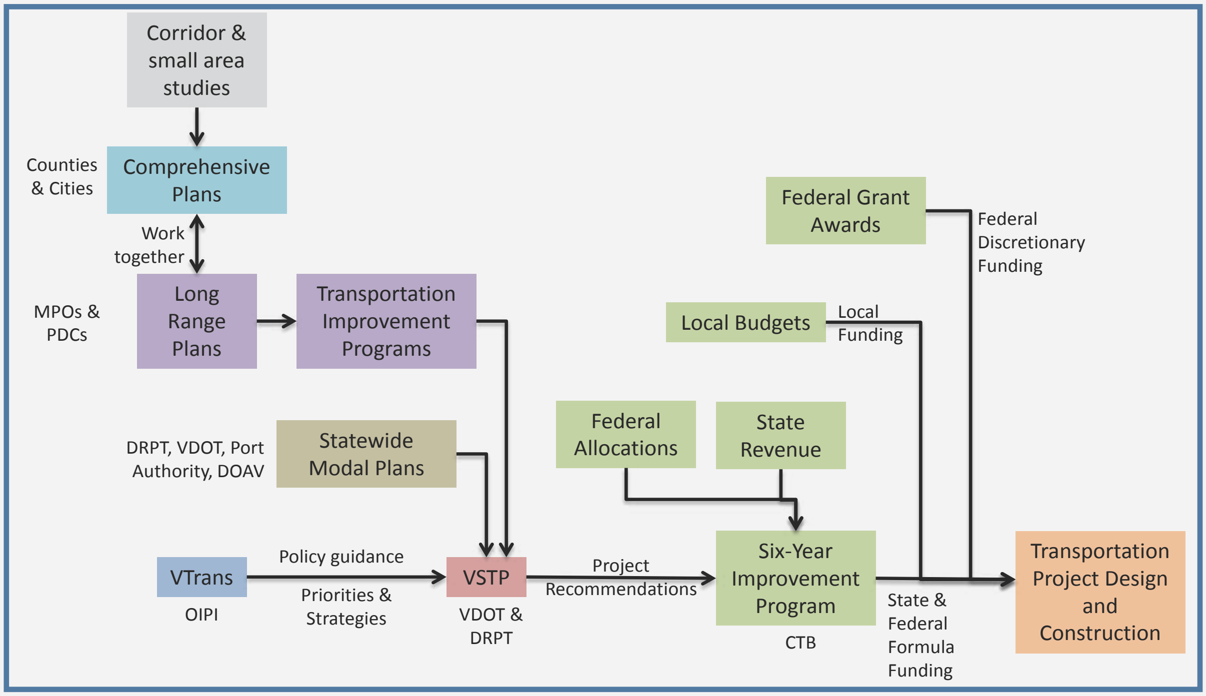


Figure 99 - Transportation Planning in Virginia Diagram.

Specific Strategies for Project Funding

From the standpoint of funding local multimodal corridor improvements, there are a number of complementary strategies that can be pursued at various levels. Four strategies are outlined below, based on the current structure of transportation funding in Virginia to pursue funding for the multimodal improvements described elsewhere in these Guidelines.

1. Localities can incorporate improvement projects into City or County Capital Improvement Programs and MPO plans and priority lists (such as the LRTP, TIP Alternatives Projects List, and Congestion Management Process) to ensure their eligibility for funding under various federal and state programs.

2. MPOs can consider increasing the amount of funds set aside from federal and state funding allocations each year to provide an ongoing funding allocation for bicycle and pedestrian projects that would not get completed as part of widening, resurfacing, or other major roadway projects.

3. Local governments and MPOs can coordinate projects with VDOT for inclusion in State Highway Plan.

4. Localities and MPOs can pursue additional funding sources as described in the following sections.

Federal Funding Sources

As explained in the first part of this chapter, federal transportation dollars from programs like the Surface Transportation Program (STP), Congestion Mitigation and Air Quality Improvement Program (CMAQ), and the newly created TAP are distributed to states by formulas based on population and other factors.

In addition to these formulaic funding allocations, the current administration has offered additional funding opportunities for transportation projects through discretionary grants. Localities and states throughout the nation apply for funds, and a federal agency selects which applicants receive the funds. This competitive nature rewards innovation and creativity. It also provides a funding stream for projects like pedestrian, bicycle, and multimodal improvements that have historically been difficult to fund through the more traditional formulaic funding programs because they do not easily fit into the traditional funding silos of highways and transit.

For example, recently the U.S. Department of Transportation awarded four rounds of TIGER[33] funding grants and the U.S. Department of Housing and Urban Development has awarded two rounds of Sustainable Communities Regional Planning Grant and Community Challenge grant programs. Many of the TIGER grantees were selected because they improved multimodal transportation. The Sustainable Communities grant program intends to improve regional planning efforts similar to those described in the first several chapters of these Guidelines.

Localities seeking to fund multimodal projects should also be on the lookout for emerging federal discretionary grant opportunities, particularly to fund innovative regional planning projects such as described in these Guidelines.

Funding through other government departments or agencies may be possible through complementary grants. The U.S. Department of Health and Human Services has a Community Transformation Grants program designed to create healthy communities.[34]

Additional Local Implementation Options

In addition to revenue from local jurisdiction budgets, a number of other opportunities for funding multimodal transportation improvements can be explored at the purely local level. These options will vary from locality to locality, depending on the availability of revenue and political receptiveness to local taxing programs.

Proffers

Under the State enabling legislation, localities may negotiate with developers for voluntary proffers during a rezoning approval process for a variety of improvements related to the proposed development. This has been a very effective way to fund limited and localized improvements related to a project, as well as to obtain dedications of right of way for future multimodal improvements such as widened sidewalks or bike lanes. It is by its nature an incremental approach, though, and may be a very long term approach to funding a corridor-wide improvement.

Revenue Sharing

VDOT also administers a Revenue Sharing Program that can provide funding for counties, cities and towns to construct, reconstruct and improve the highway system. Localities' governing bodies pass resolutions to apply for funds. Multimodal corridor

[33] The Transportation Investment Generating Economic Recovery (TIGER) program is a discretionary grant program of the U.S. Dept. of Transportation that began as part of the American Recovery and Reinvestment Act of 2009 and funds surface transportation projects on a competitive basis. More information on TIGER is available online at http://www.dot.gov/tiger.
[34] More information about the Community Transformation Grant Program is available online at http://www.cdc.gov/communitytransformation/.

and streetscaping improvements may be included as improvement projects.

Public Private Partnerships

Partnering with private entities can streamline implementation and maximize available financial and technical resources by leveraging the best resources from multiple parties. Public-private partnerships are formed as ventures between a government organization and a private business. The government organization contracts out a public service or project to a private business. The private party assumes some or all of the financial and other risks associated with the project. The financial agreement between the public and private parties can vary depending upon the scale, timeline and risk of the project. Public sector contributions may be onetime grants, revenue subsidies, tax breaks, guaranteed annual revenues, or in kind asset transfers. Multimodal and streetscape improvement projects can be implemented through public-private partnerships.

Special Districts

Business improvement districts and downtown business partnerships can generate funds for a specified area. Transportation Improvement Finance Districts are authorized in the Virginia code (Title 33.1 Chapter 15). These are land value based tax assessments that can generate a maximum additional tax assessment of $0.40 per $100 of the assed fair market value of any taxable real estate within the district. When multimodal improvements are desired for a particular small area, this option can not only generate additional revenue for improvement, but also bring together the business owners and residents in a small area to work for a common vision of a downtown or main street corridor. Other types of business improvement districts would likely need legislative approval, including those where a new local sales tax would be dedicated to transportation.

In summary, multimodal improvements can be funded by a variety of federal, state and local sources. Most of the funding strategies identified above can be used in combination. A comprehensive strategy for funding a package of multimodal enhancements should explore the full range of local state and federal opportunities outlined in order to maximize the opportunities for implementing multimodal improvements.

Tax Increment Financing

Tax-Increment Financing (TIF) is another funding strategy that is currently enabled in Virginia (Title 58.1 Chapter 32) based on the assumption that public improvements raise property values. A locality would pass an ordinance that designates a TIF area, and issue bonds to construct an improvement in that area. Any increases on property tax revenues would then be used to pay off the construction bonds used to originally fund the improvements.

Other Potential Partnering Opportunities

Many other sectors of the community benefit from allocating resources to multimodal transportation projects, including economic development, community health, and private employers. These connections could lead to potential creative funding solutions in the future. Transportation planners should engage in ongoing communication with representatives from these sectors, and can use the multi-faceted nature of transportation benefits as justification for future allocation of local funds.

In summary, multimodal improvements can be funded by a variety of federal, state and local sources. Most of the funding strategies identified above can be used in combination. A comprehensive strategy for funding a package of multimodal enhancements should explore the full range of local state and federal opportunities outlined in order to maximize the opportunities for implementing multimodal improvements.