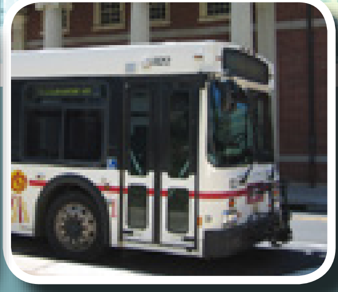


MULTIMODAL SYSTEM
DESIGN GUIDELINES

October 2013

DRPT
Virginia Department of Rail and Public Transportation

(This page intentionally left blank)

ACKNOWLEDGEMENTS

Virginia Department of Rail and Public Transportation

Thelma Drake, Director
Amy Inman, MS, Planning and Mobility Programs Administrator/Multimodal System Design Guidelines Project Manager

Virginia Department of Transportation

George Rogerson, Policy and Procedures Section Manager, Location and Design
Robert Hofrichter, Assistant Administrator, Transportation and Mobility Planning Division
Joseph Koscinski, P.E., State Geometric Design Engineer, Location and Design

Project Steering Committee

Nick Alexandrow – Potomac & Rappahannock Transportation Commission
Fatemeh Allahdoust – VDOT, Northern Virginia District
Ray Amaruso – Hampton Roads Transit
Gha-is Bashir – Petersburg Area Transit
John Bolecek – VDOT, Statewide Bicycle and Pedestrian Planner
JD Bondurant – Virginia Housing Development Authority
Bee Buergler – Arlington County, Department of Environmental Services, Transportation Division
Mike Carroll – Greater Lynchburg Transit Company
Wayne Cilimberg – Albemarle County, Department of Community Development
Scott Clark – GRTC Transit System
Megan Cummings – City of Alexandria
John Dittmeier – Washington Metropolitan Area Transit Authority
Cristina Finch – Roanoke Valley-Alleghany Regional Commission
Kathy Finniff – Virginia Regional Transit
Marsha Fiol – VDOT, Transportation and Mobility Planning Division
Robin Grier – VDOT, Transportation and Mobility Planning Division; Institute of Transportation Engineers
Mike Hawkins – Virginia Housing Development Authority
Carrie Hileman – Virginia Economic Development Partnership
Ron Hodges – Hampton Roads Transit
George Homewood – City of Norfolk; American Planning Association
Matthew Huston – Arlington County, Department of Environmental Services, Transportation Division
Mike Latiff – Amtrak
Nancy Lo – Virginia Department for the Aging
Amanda Lutke – City of Norfolk
Rebecca Martin – Blacksburg Transit
Mark McGregor – Virginia Regional Transit
Linda McMinimy – Virginia Transit Association
Sandi McNinch – Virginia Economic Development Partnership
Clara Meier – Middle Peninsula Planning District Commission
Peter Ohlms – Virginia Center for Transportation Innovation and Research
Valerie Pardo – VDOT, Northern Virginia District
Pavithra Parthasarathi – Hampton Roads Transportation Planning Organization
Camelia Ravanbakht – Hampton Roads Transportation Planning Organization

Project Steering Committee (continued)

Daniel Reese – Fredericksburg Area Metropolitan Planning Organization
Mike Royster – Virginia Department of Health
Mark Schnaufer – City of Virginia Beach
Elijah Sharp – New River Valley Planning District Commission
Brad Sheffield – JAUNT, Inc.
Keith Sherrill – Virginia Department of Housing and Community Development
Eric Stringfield – VDOT, Hampton Roads District
Glen Slonneger – Virginia Department for the Blind and Vision Impaired
Debbie Swetnam – Blacksburg Transit
Joe Vinsh – Crater Planning District Commission
Julie Timm – Hampton Roads Transit
Bob White – Region 2000 Local Government Council
Steve Williams – Thomas Jefferson Planning District Commission
William Wuensch – Virginia Section Institute of Transportation Engineers
Lee Yolton – Richmond Regional Metropolitan Planning Organization

Consultant Team

Renaissance Planning Group
Storrow Kinsella Associates, Inc.
Michael Baker Jr., Inc.
Parsons Transportation Group

Document was prepared by: Renaissance Planning Group in October 2013.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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.

---

[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

---

[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.

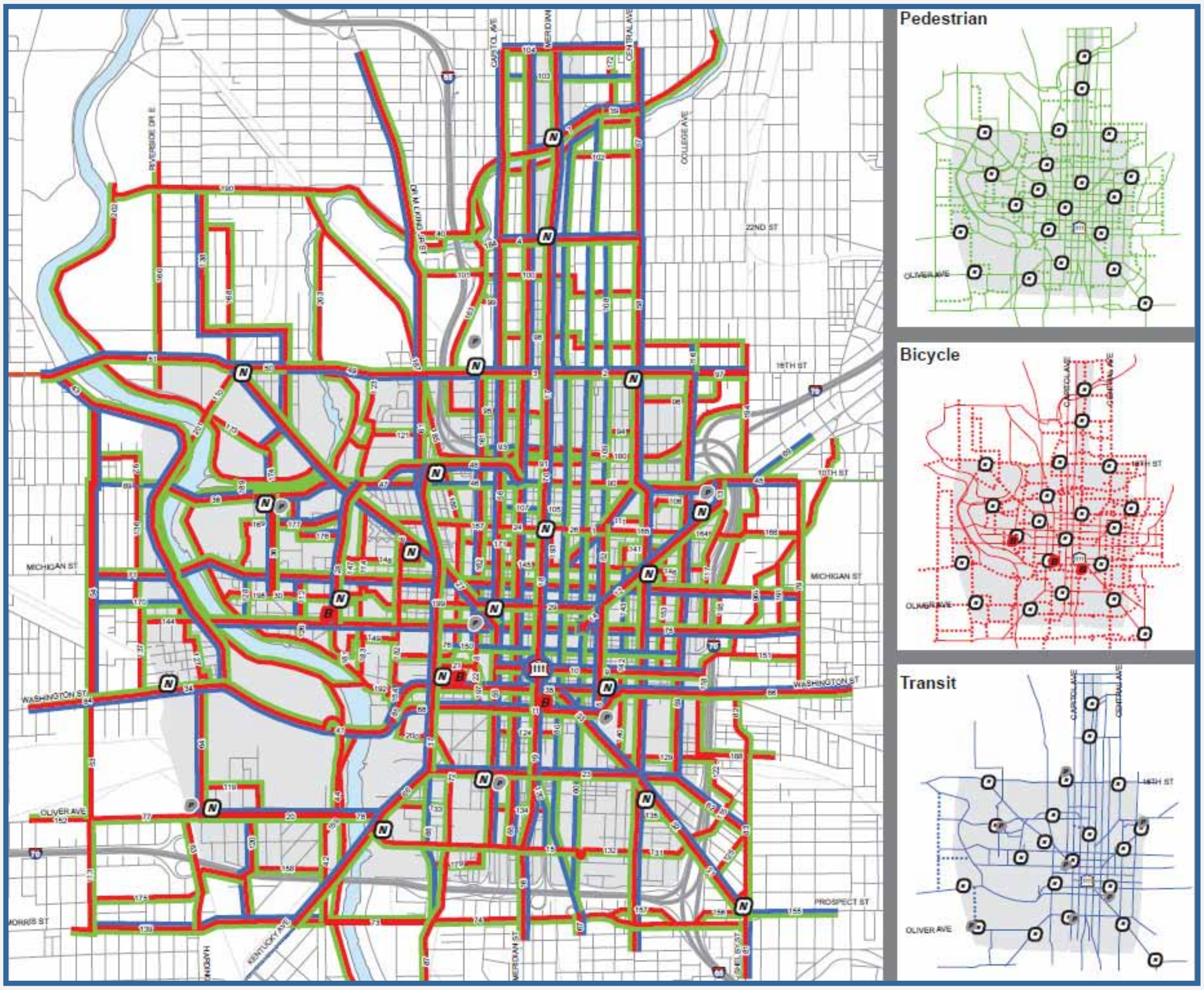


Figure 4 - Indianapolis MPO Multimodal Systems - March 2009. An example of the networks in a large region that shows the network connectivity for each travel mode – derived from the Regional Pedestrian Plan. Image source: Storrow Kinsella Associates

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.

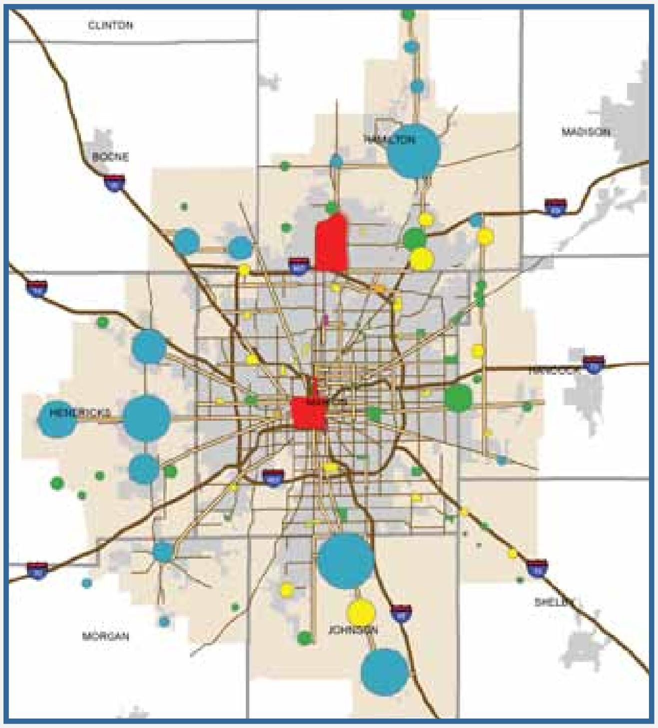


Figure 5 - The Indianapolis Region. Multimodal Districts and Multimodal Centers derived from the Regional Pedestrian Plan. Image source: Storrow Kinsella Associates

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.

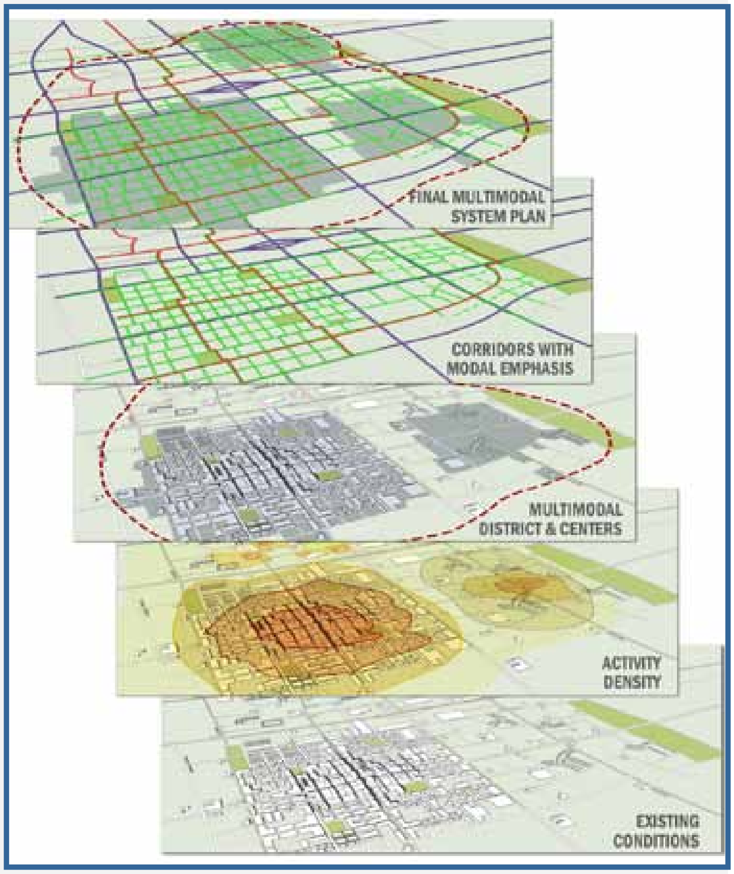


Figure 7 - Multimodal System Plan. Diagram showing the overlays of land use and transportation networks by mode that make up a Multimodal System Plan.

> *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.

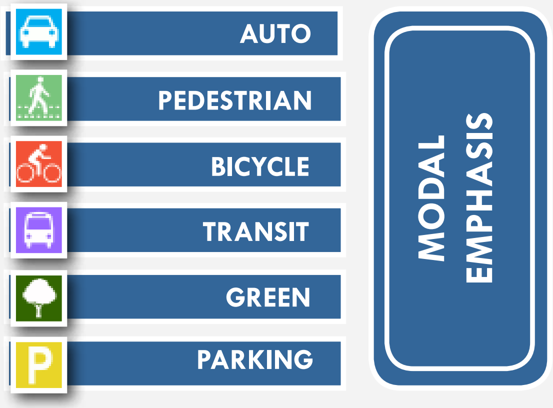
Modal Emphasis means that a travel mode may be emphasized on a corridor through certain design features but that other modes are still accommodated although not always in an optimal way depending on right-of-way or other constraints. Modal Emphasis is an important technique for looking at travel mode 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.

THROUGH CORRIDORS

- Multimodal Through Corridor

PLACEMAKING CORRIDORS

- Transit Boulevard
- Boulevard
- Major Avenue
- Avenue
- Local Street

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

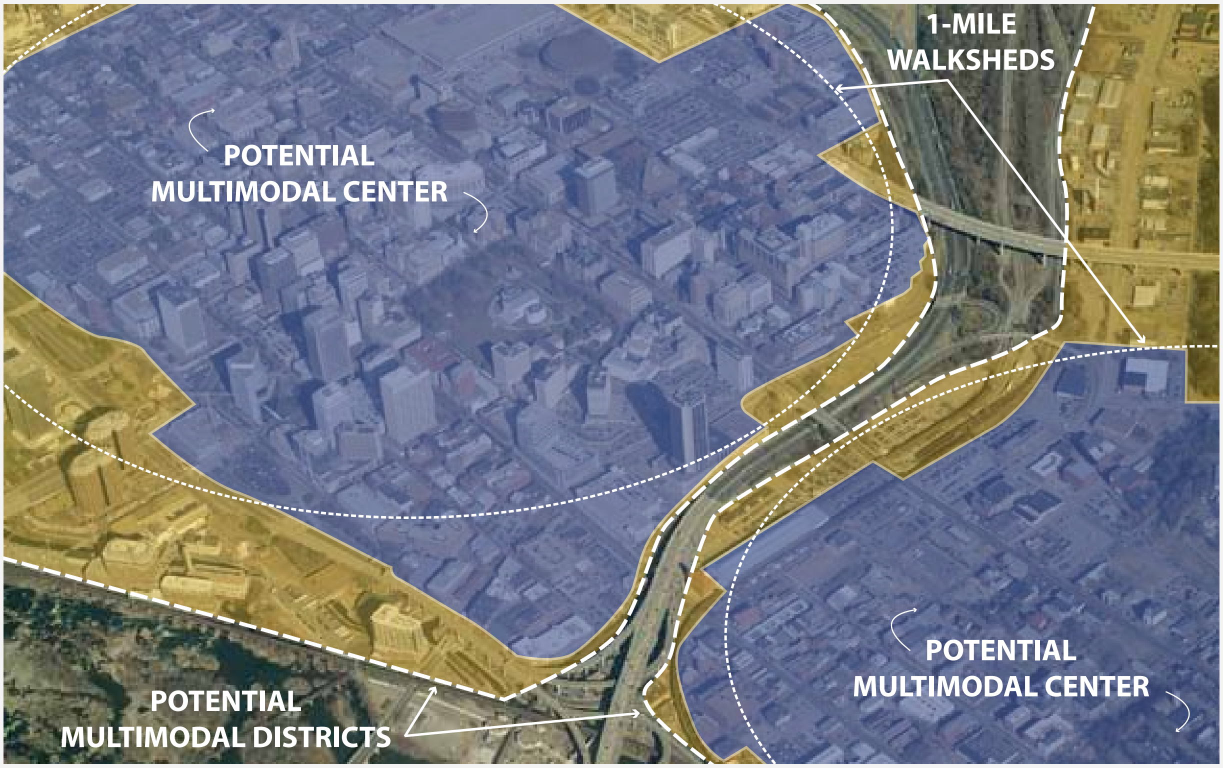


Figure 9 - Aerial view of Richmond. Potential Multimodal Districts and Centers illustrated in Downtown Richmond

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.

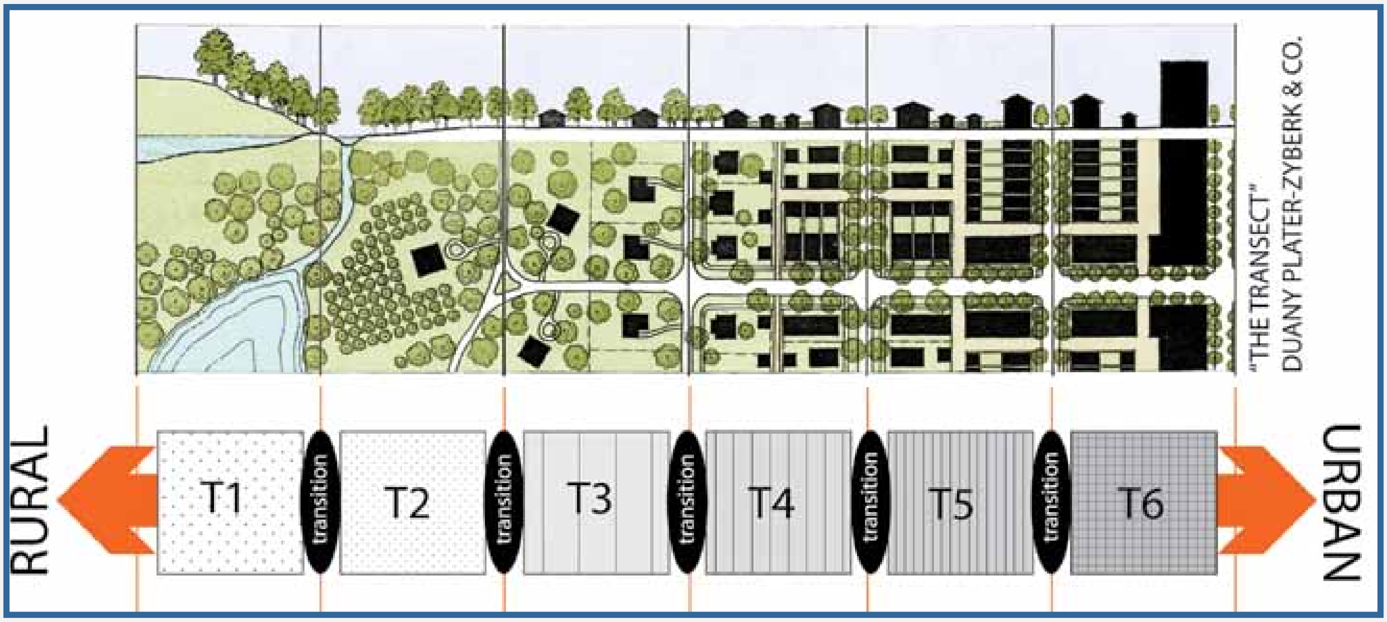


Figure 10 - The Transect Diagram. The Transect describes the range of natural and built environments across a spectrum of density. Places can be classified into one of the six different Transect Zones or "T-Zones" depending on the density or intensity of the land uses in an area.

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.

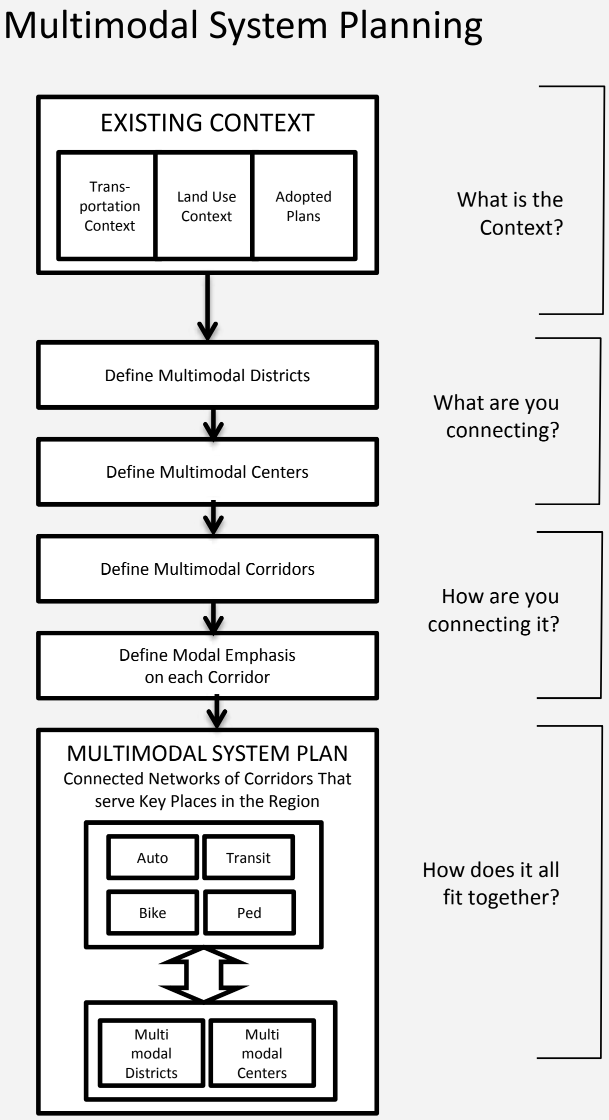


Figure 11 - The Recommended Planning Process for a Multimodal System Plan.

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:

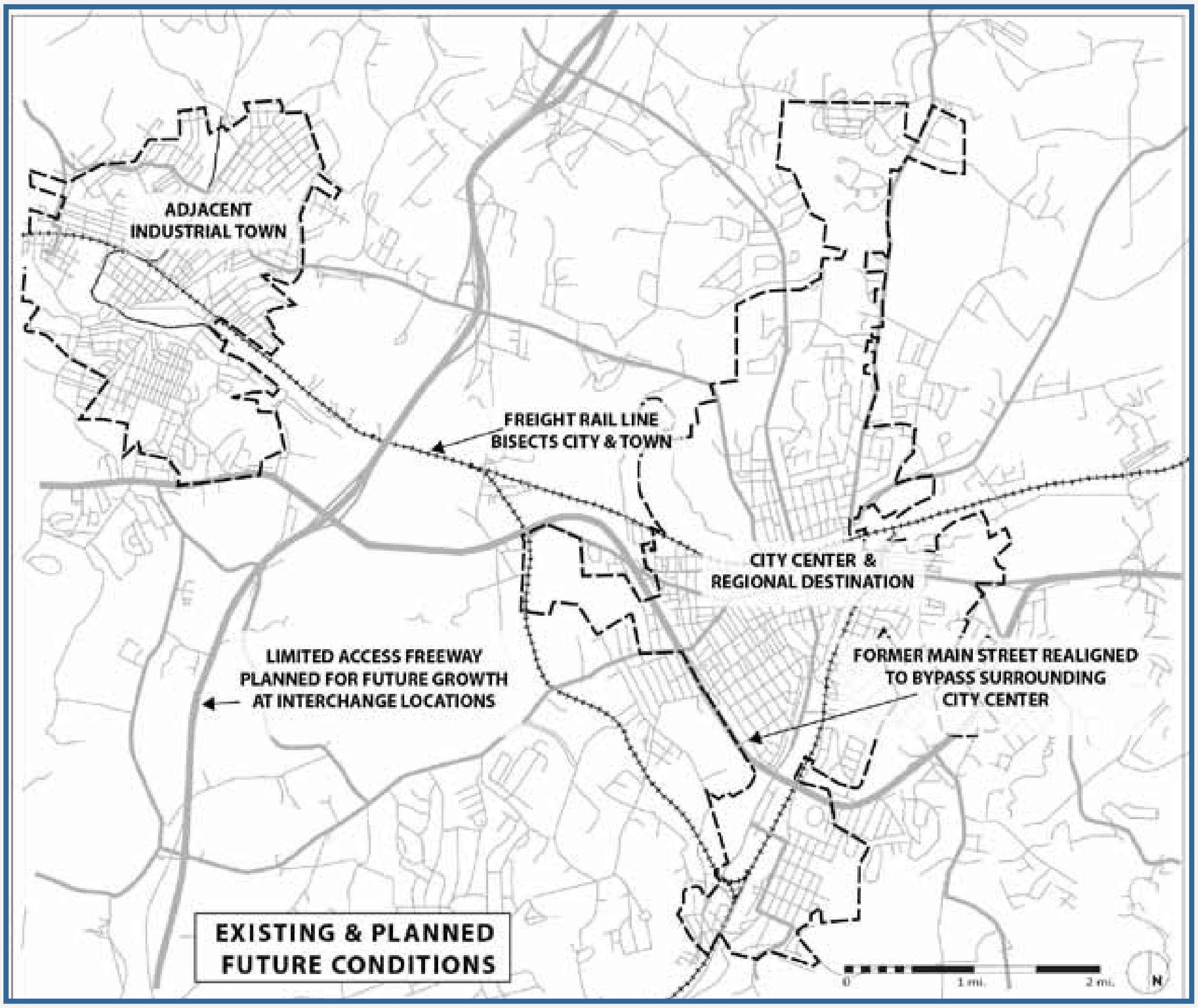


Figure 13 - Hypothetical Region Map. A hypothetical region showing a historic city center, surrounding suburban and rural areas and an adjacent industrial town.

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.

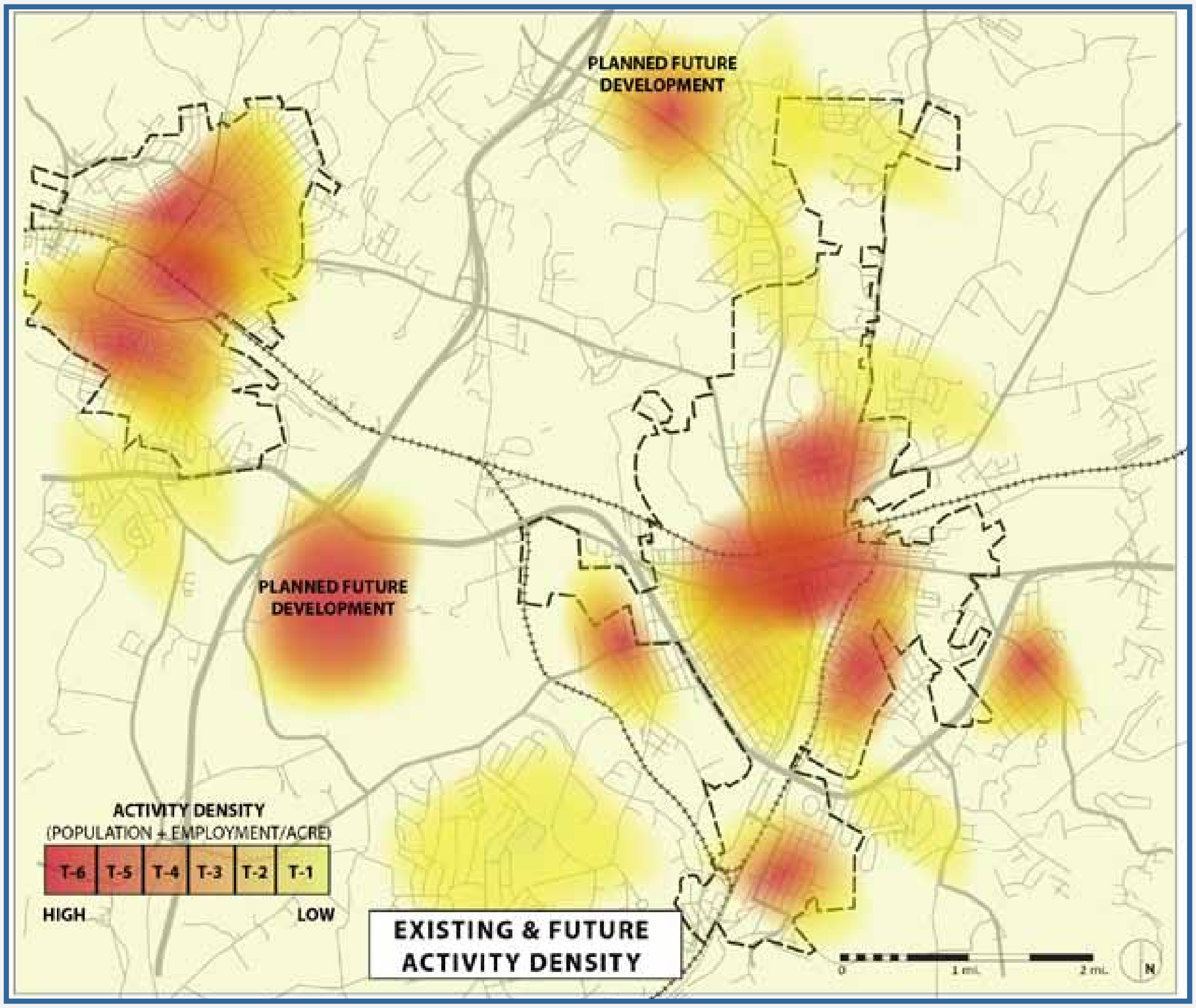


Figure 14 - Existing and Future Activity Density. This map shows a simple "heat map" of the relative density of jobs and population in the region.

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.

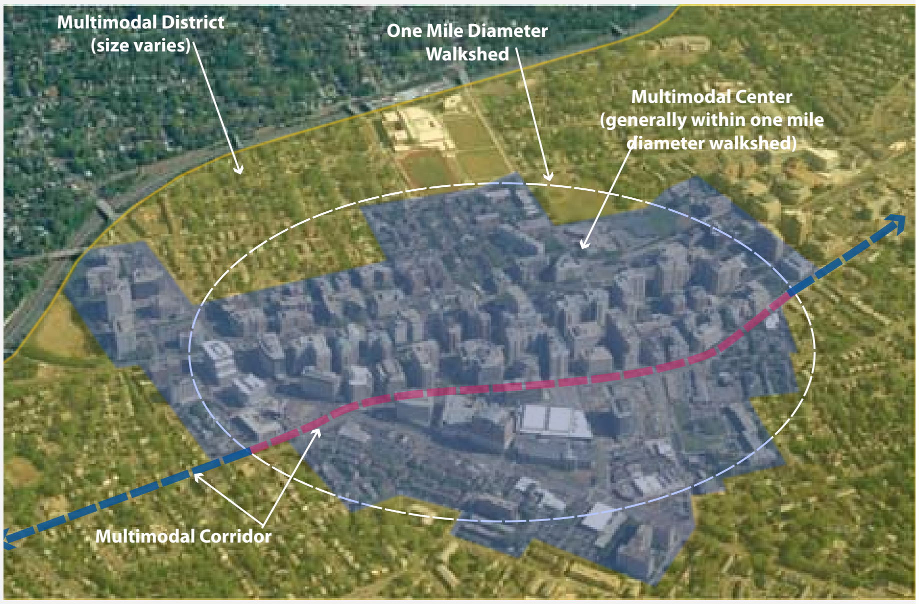


Figure 15 - The Difference between Multimodal Districts and Centers as illustrated in Ballston, Virginia

---

[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).

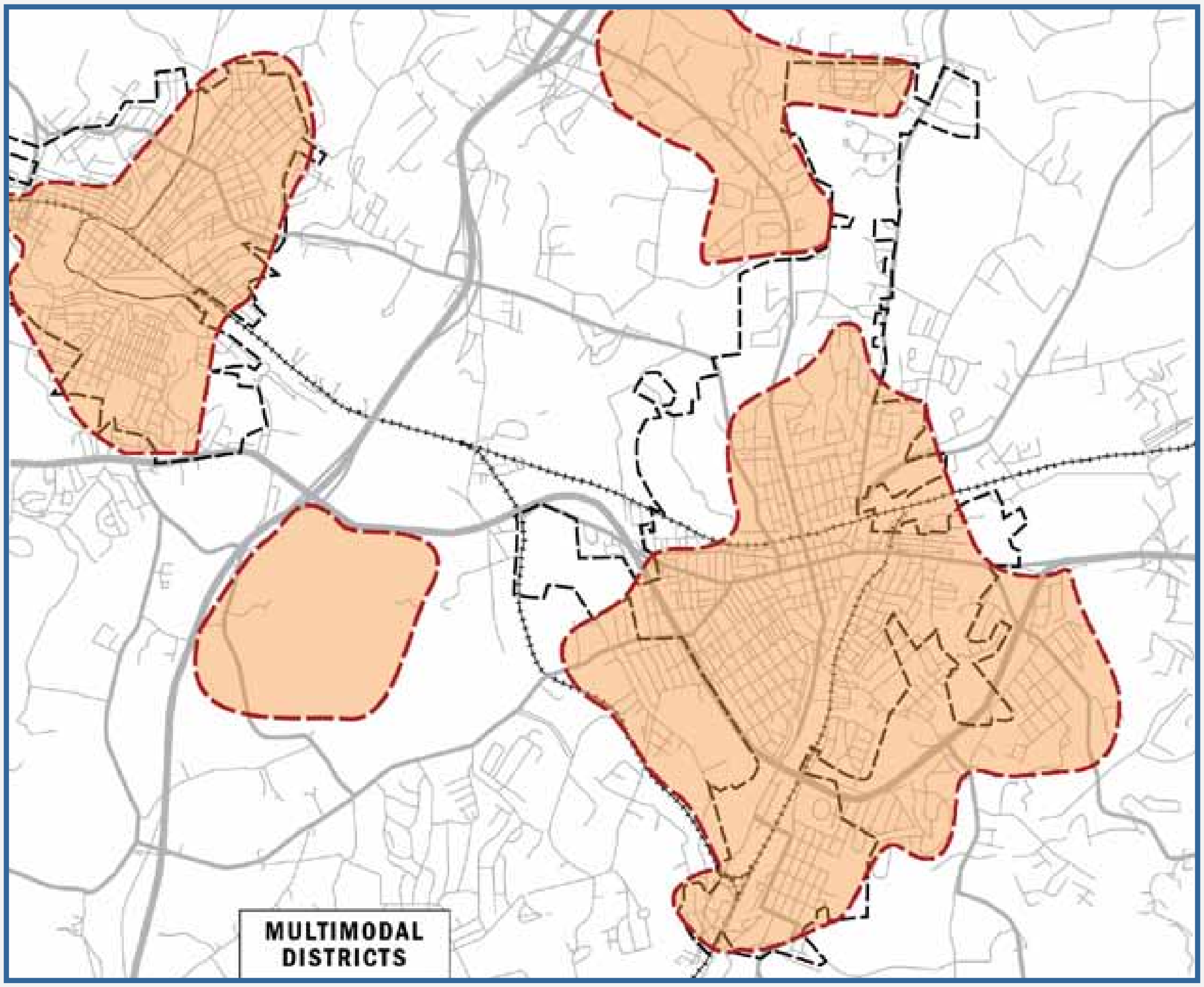


Figure 16 - Potential Multimodal Districts. Map showing areas that are identified as future Multimodal Districts based on their high activity density and good potential multimodal connectivity - either existing or planned.

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.

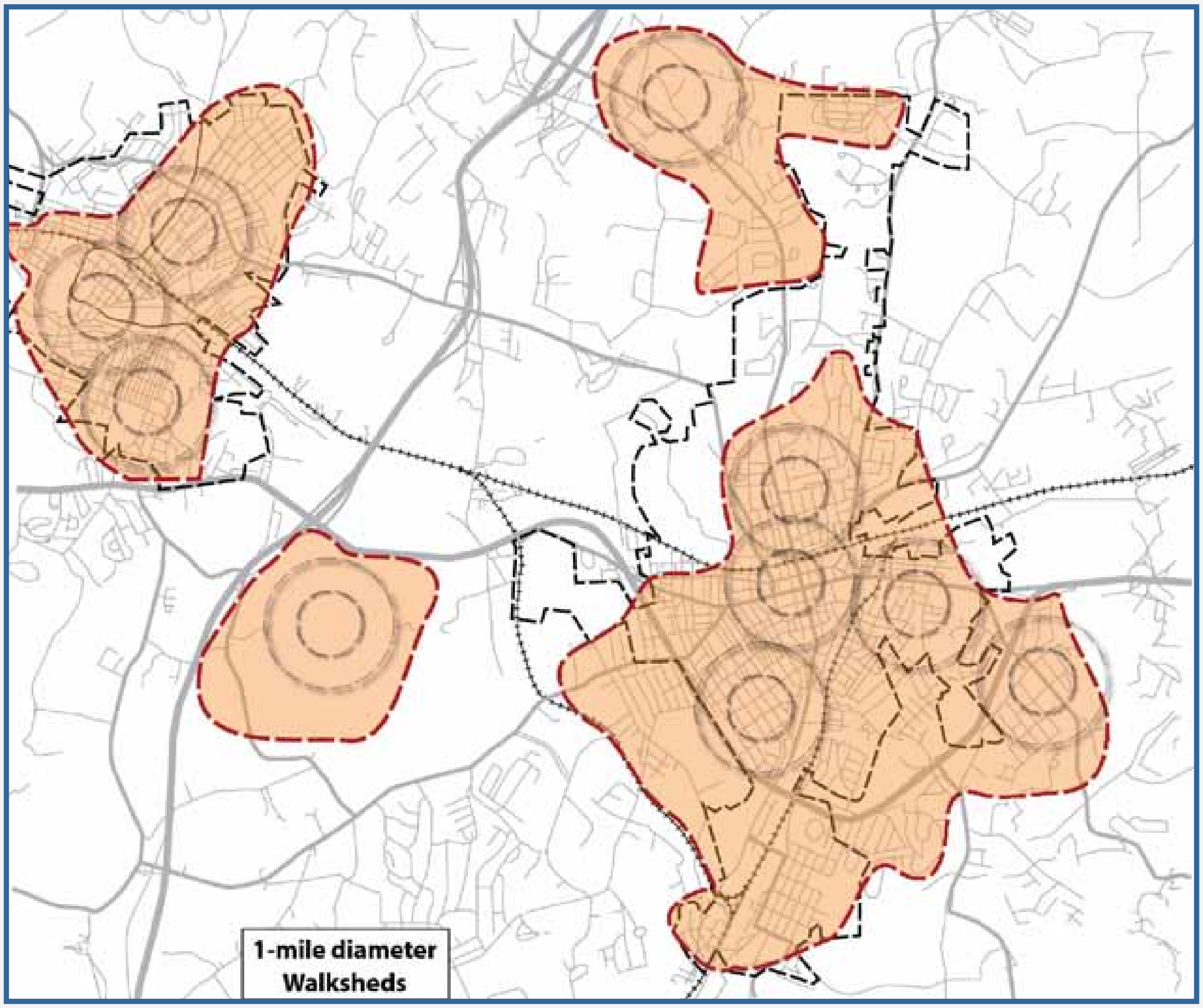


Figure 17 - One Mile Walksheds within each Multimodal District. Multimodal Centers are smaller areas within each Multimodal District that are generally described within a one mile walkshed.

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.

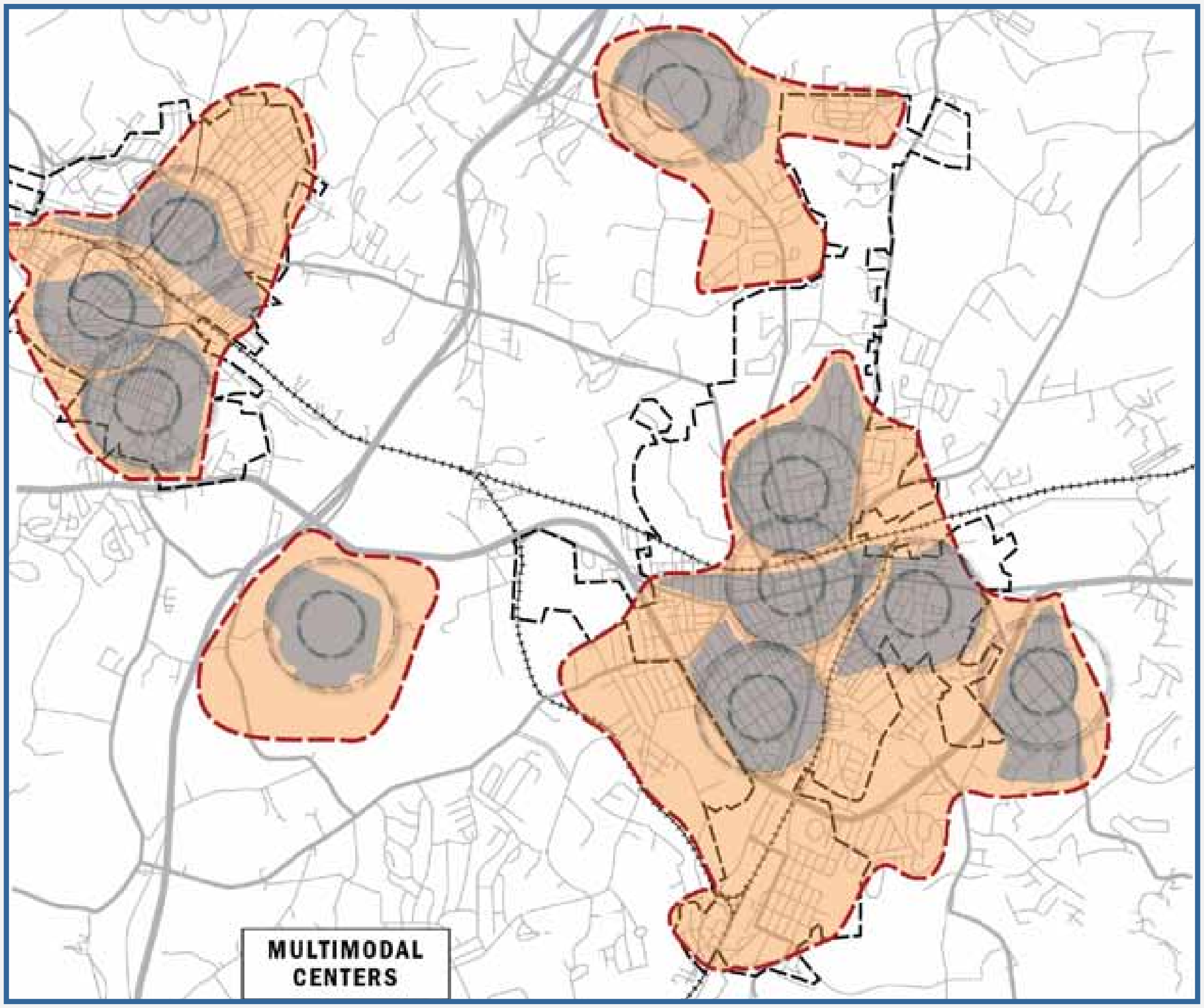


Figure 18 - Multimodal Centers within each Multimodal District. Multimodal Centers are areas of highest multimodal connectivity and have a mix of uses and close proximity of destinations such that most trips can be made by walking. Multimodal Centers are designated roughly according to one-mile diameter 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.

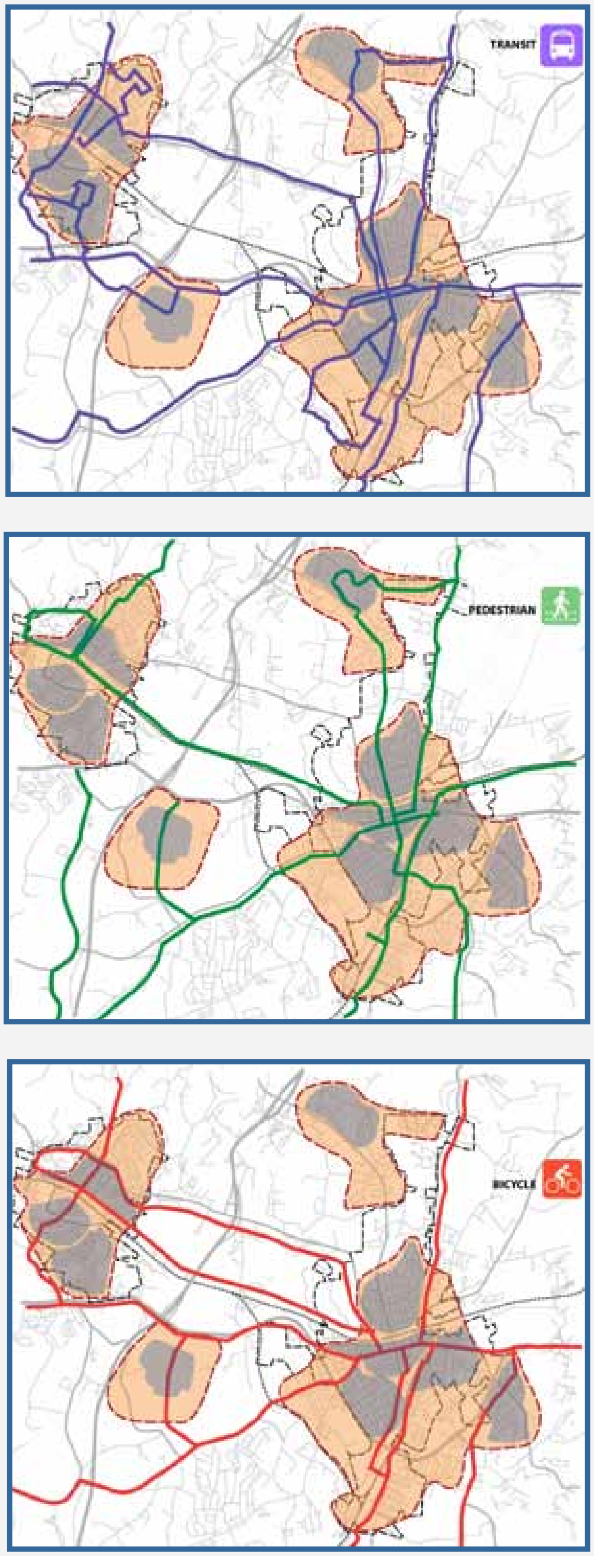


Figure 19 - Modal Networks. These maps show the networks for each mode – Transit, Pedestrian, and Bicycle.

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.

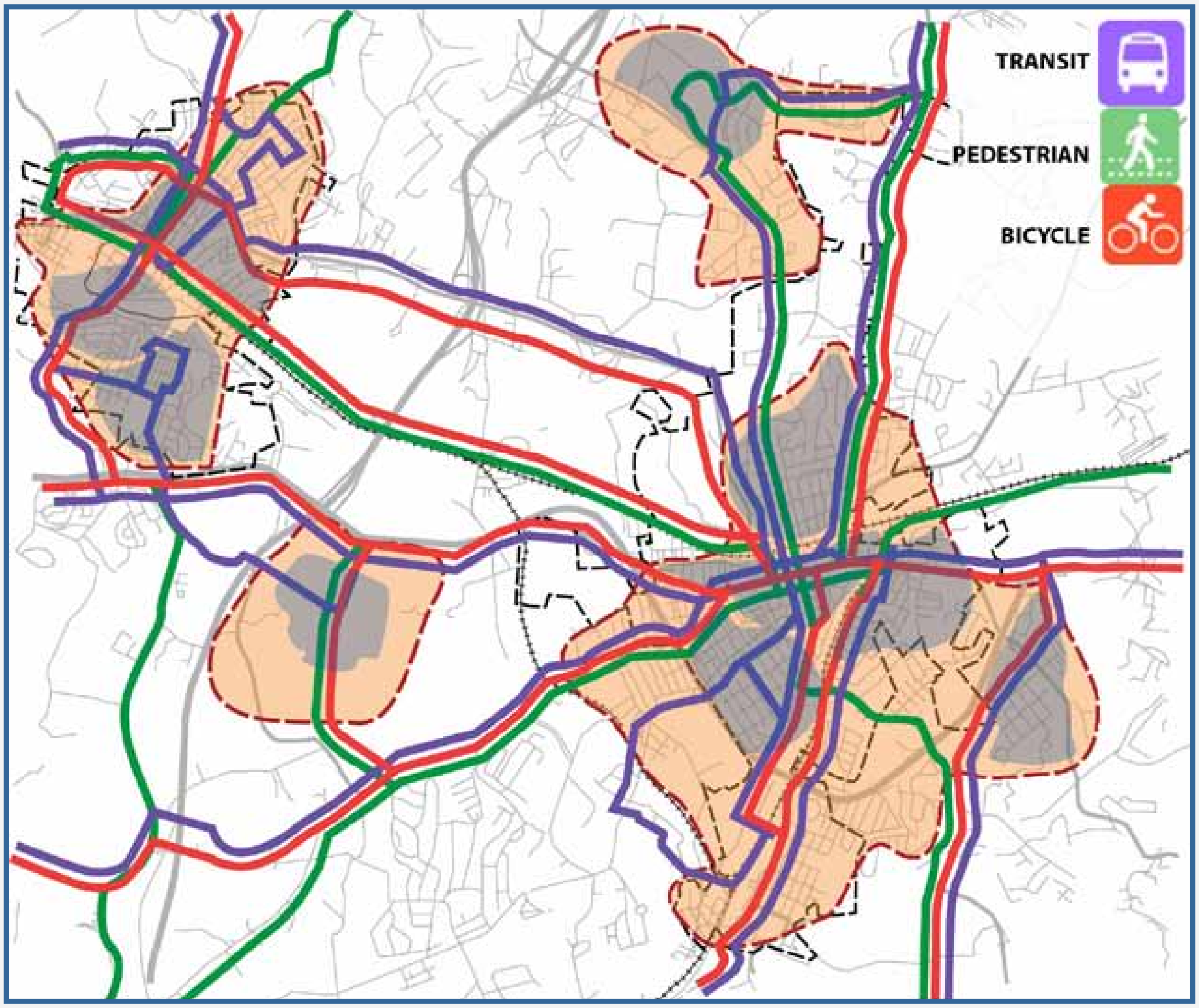


Figure 20 - Multimodal Corridors with Modal Emphasis. The modal networks have been assembled onto one map and define the Modal Emphasis for each corridor.

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.

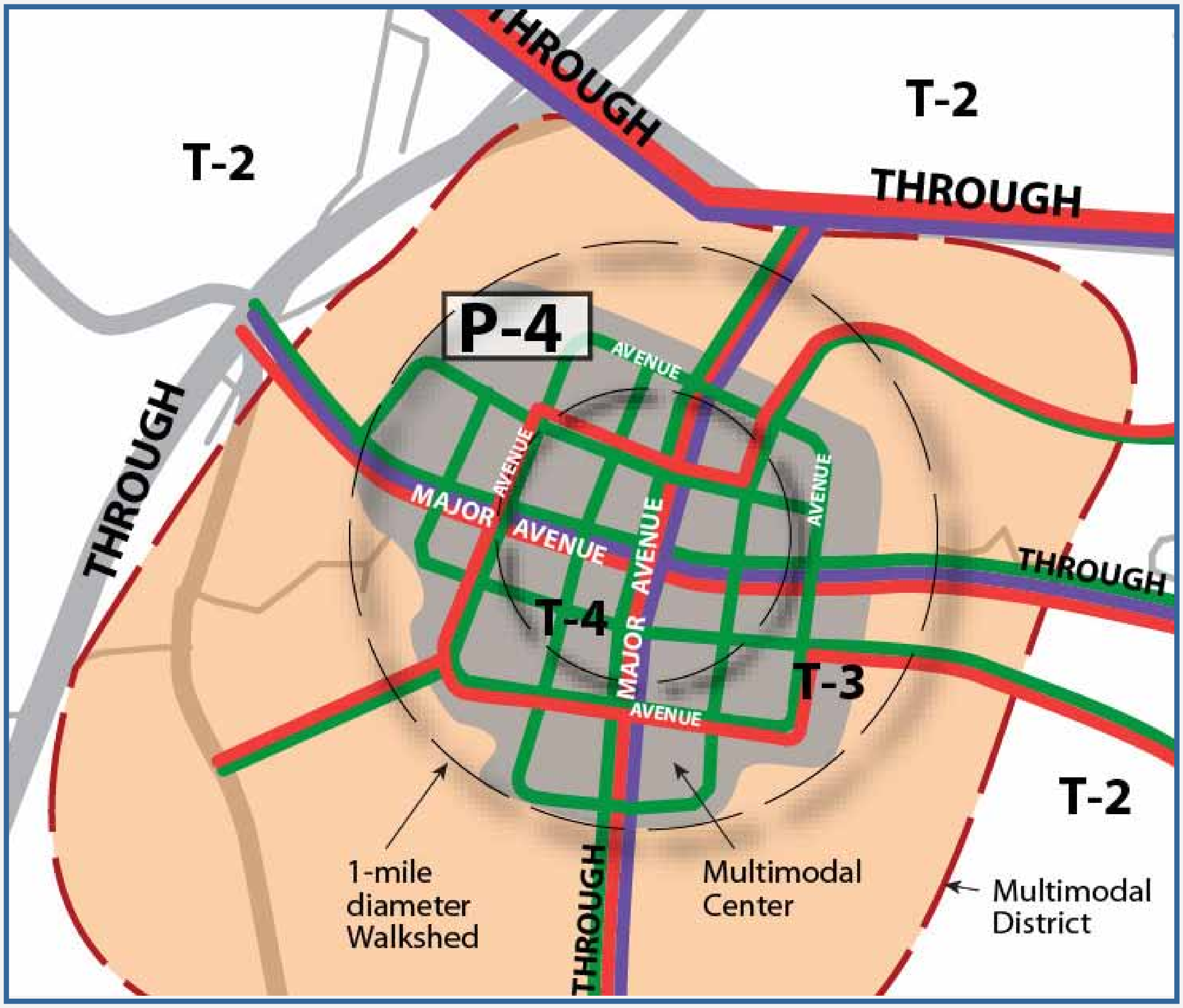


Figure 21- Detail of a Final Multimodal System Plan. This map shows how a Multimodal Center and Multimodal Corridors are designated according to the Multimodal Center types and Multimodal Corridor types described in Chapters 3 and 5 of these Guidelines.

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.

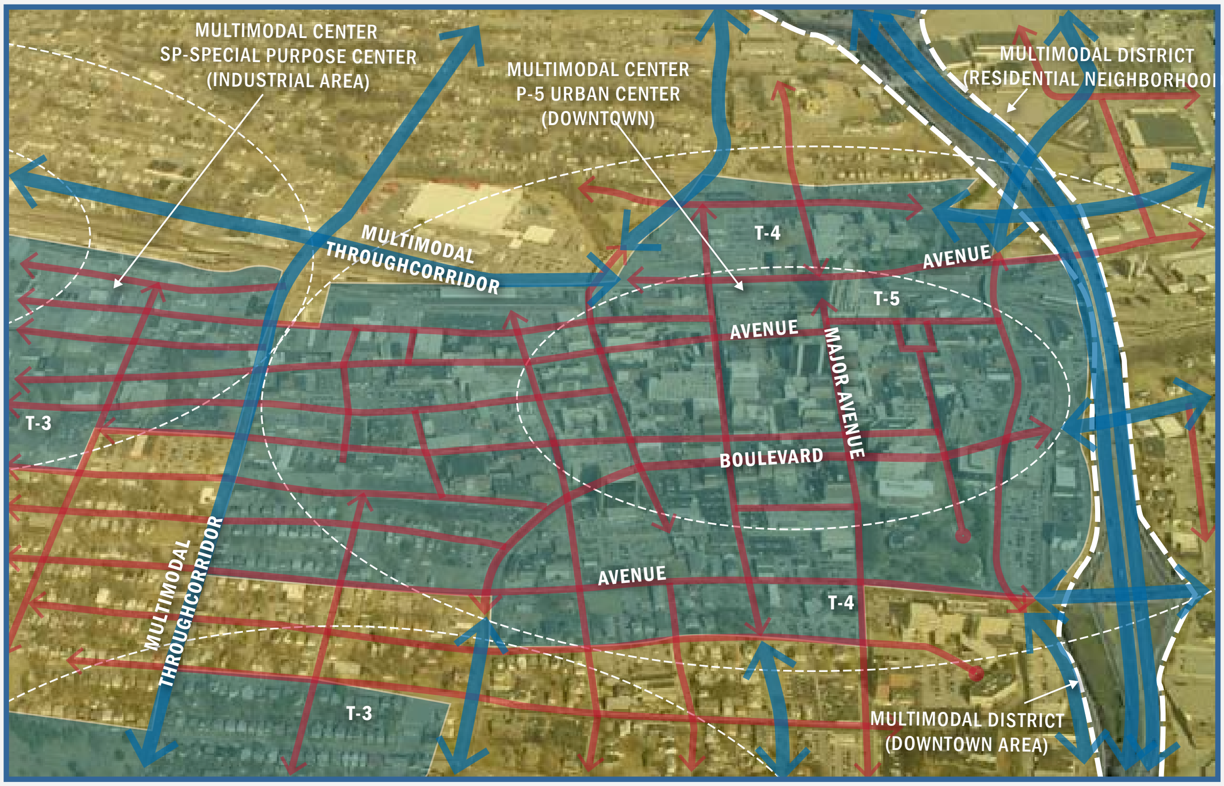


Figure 22 - Downtown Roanoke, VA. The superimposed Multimodal Districts, Multimodal Center and Multimodal Corridors show how a Multimodal System Plan could be applied to this downtown area.

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.

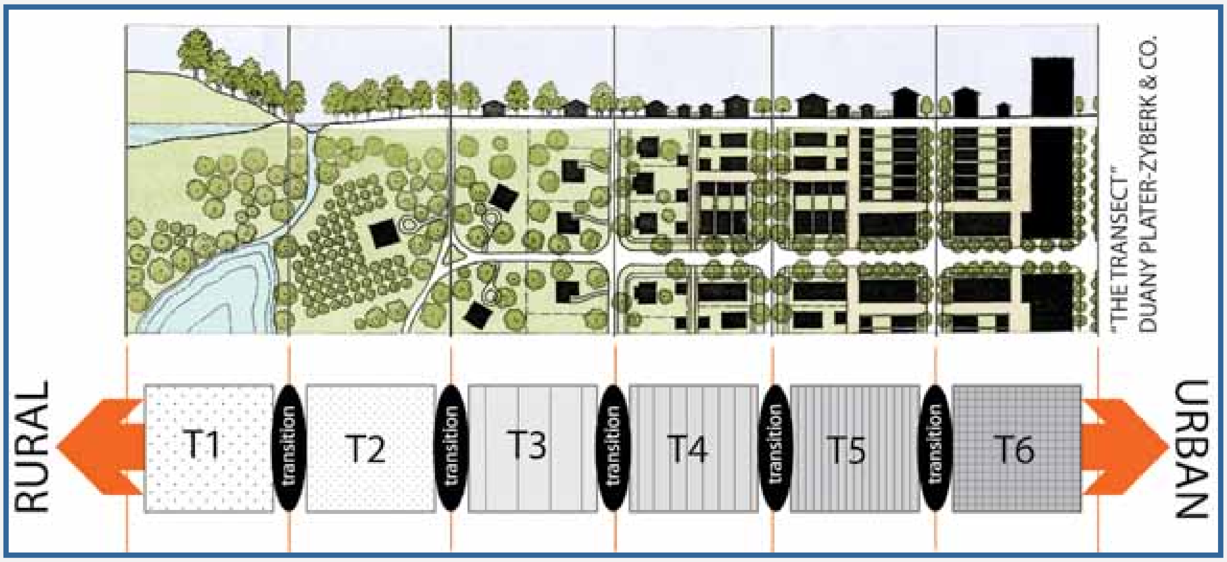


Figure 25 - The Transect Diagram. The Transect describes the range of natural and built environments across a spectrum of density. Places can be classified into one of the six different Transect Zones or "T-Zones" depending on the density or intensity of the land uses in an area.

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.

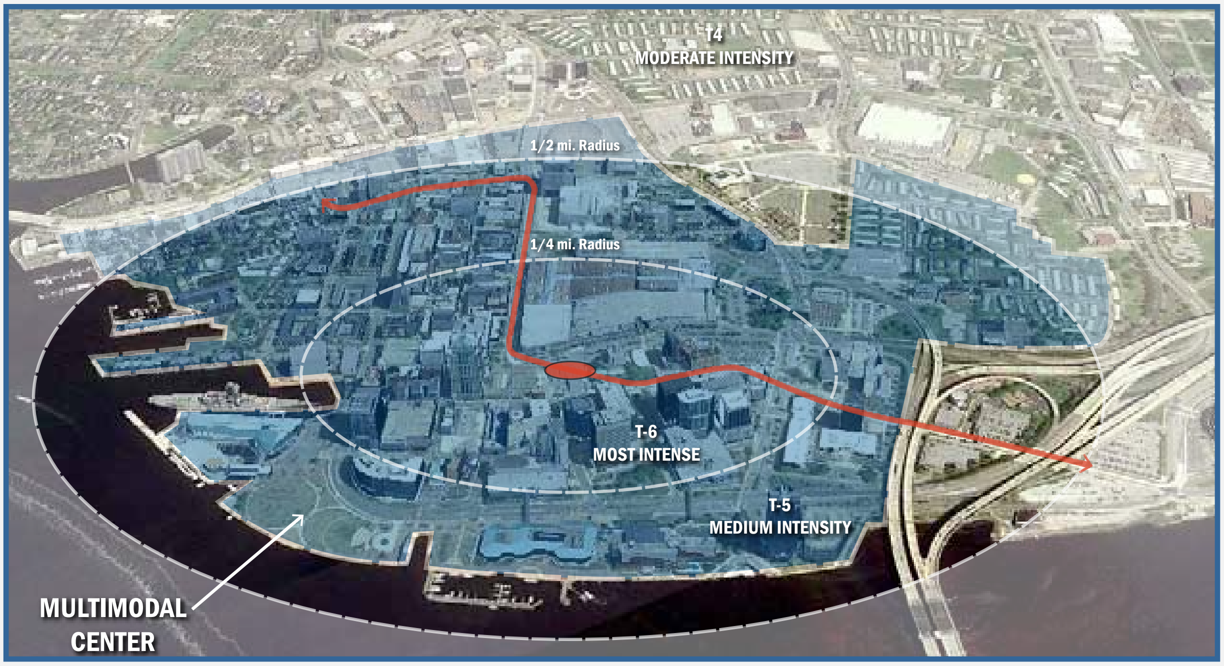


Figure 26 - T-Zones in a Multimodal Center in Downtown Norfolk. The red line is the alignment of the light rail line and the station in the center is MacArthur Square.

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

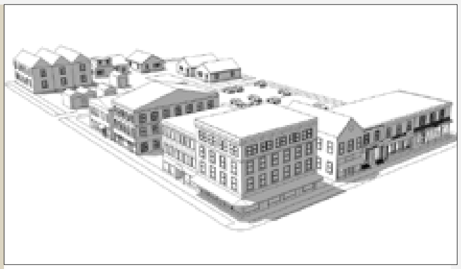
T5

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

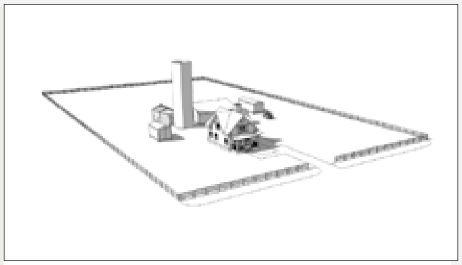


MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	10-25/ac
AVG. BLDG. HEIGHT	3 Stories
TYPICAL MAX BLDG. HEIGHT	5 Stories
TYPICAL NET FAR	0.23-0.57
SUPPORTED TRANSIT TECHNOLOGY	Fixed Route Bus

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.

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.

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

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 (residential + 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:

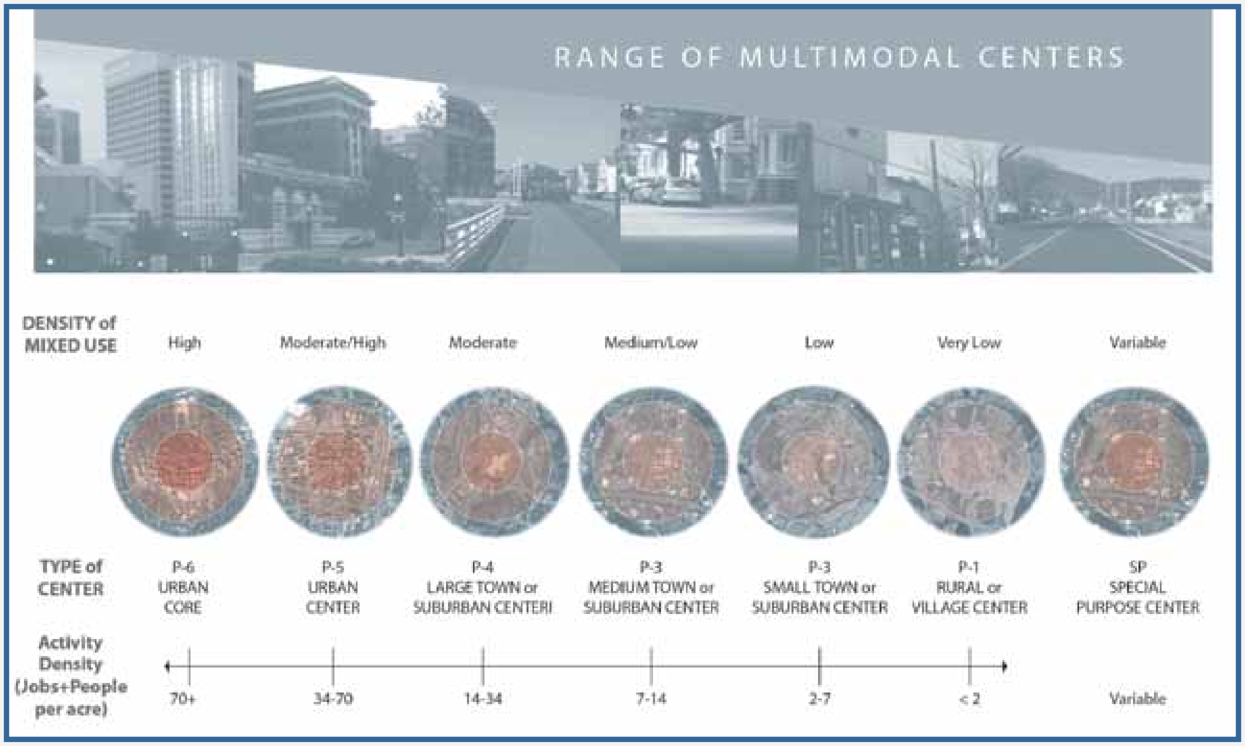


Figure 29 - Range of Multimodal Center Types. Urban to rural defined by Activity Density (number of jobs + people) in each Multimodal Center.

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.

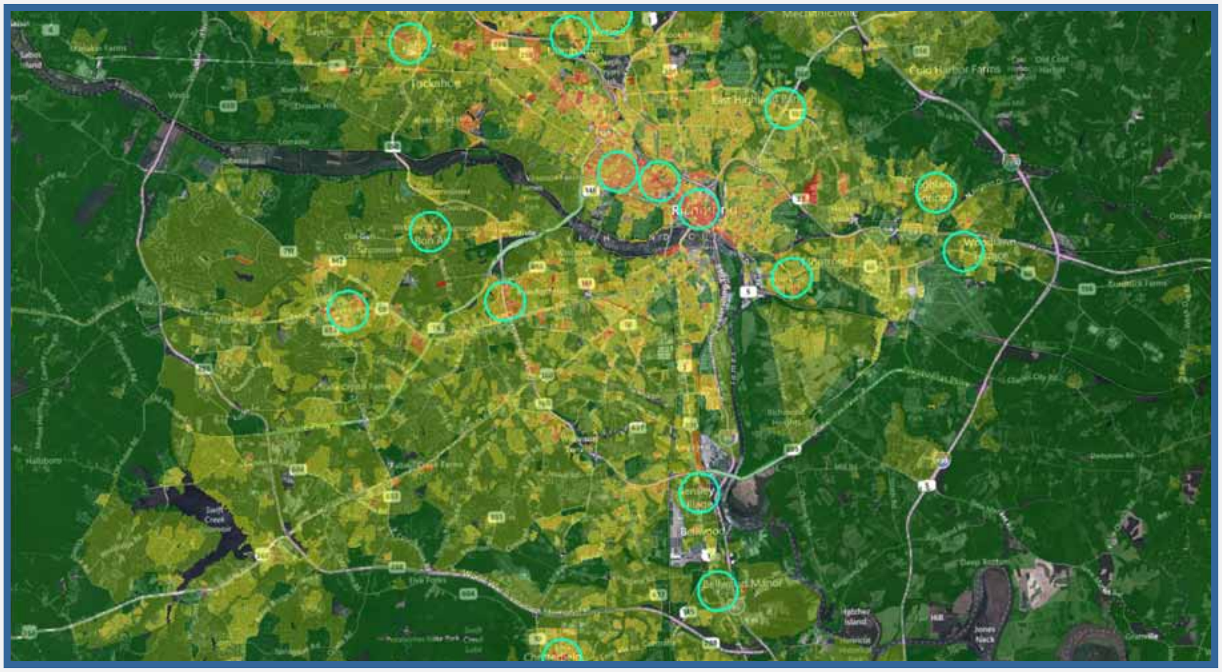


Figure 30 - Map of Activity Density in the Richmond Region. One-mile circles used for analysis purposes as potential Multimodal Centers for illustrative purposes only.

Detailed Descriptions of the Multimodal Center Types

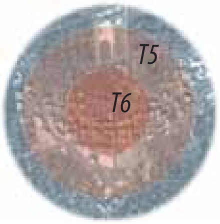
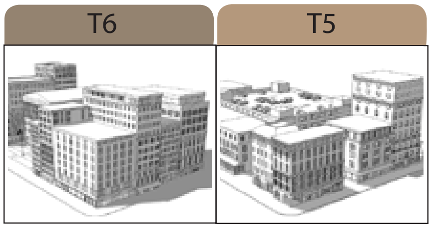
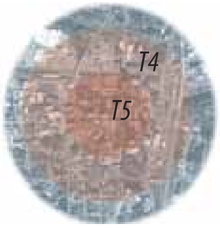
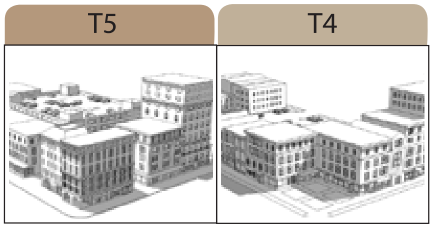
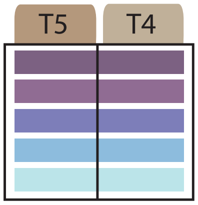
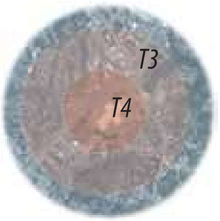
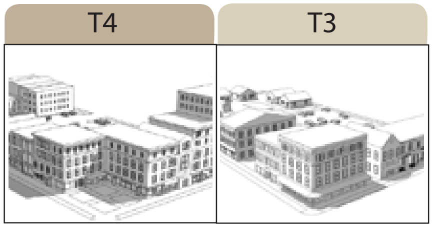
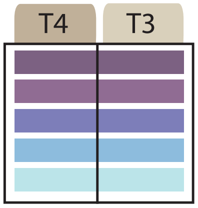
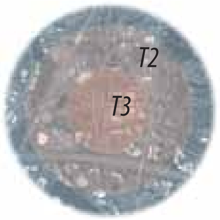
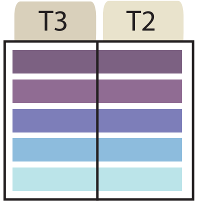
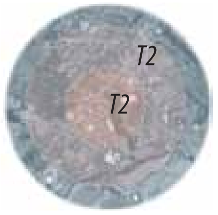
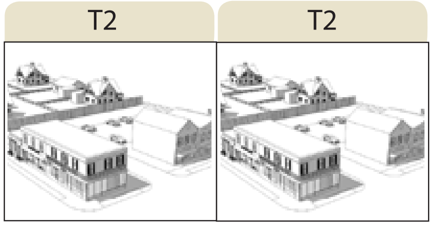
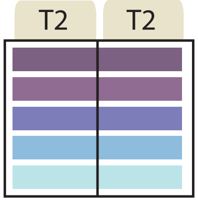
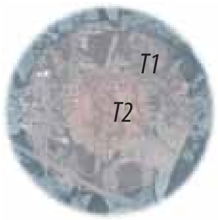
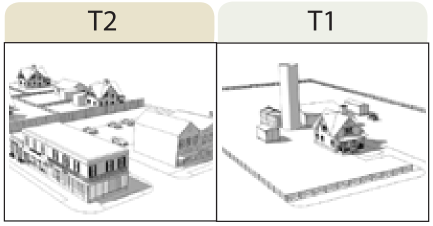
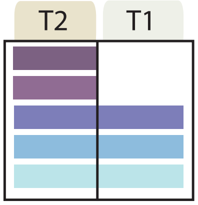
> *"The arrangement and spacing of corridors in these diagrams is based generally on rules for roadway spacing and hierarchy of road types. However, just as road networks in real places don't look like the diagrams in engineering manuals, it is not expected that real Multimodal Centers will look exactly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

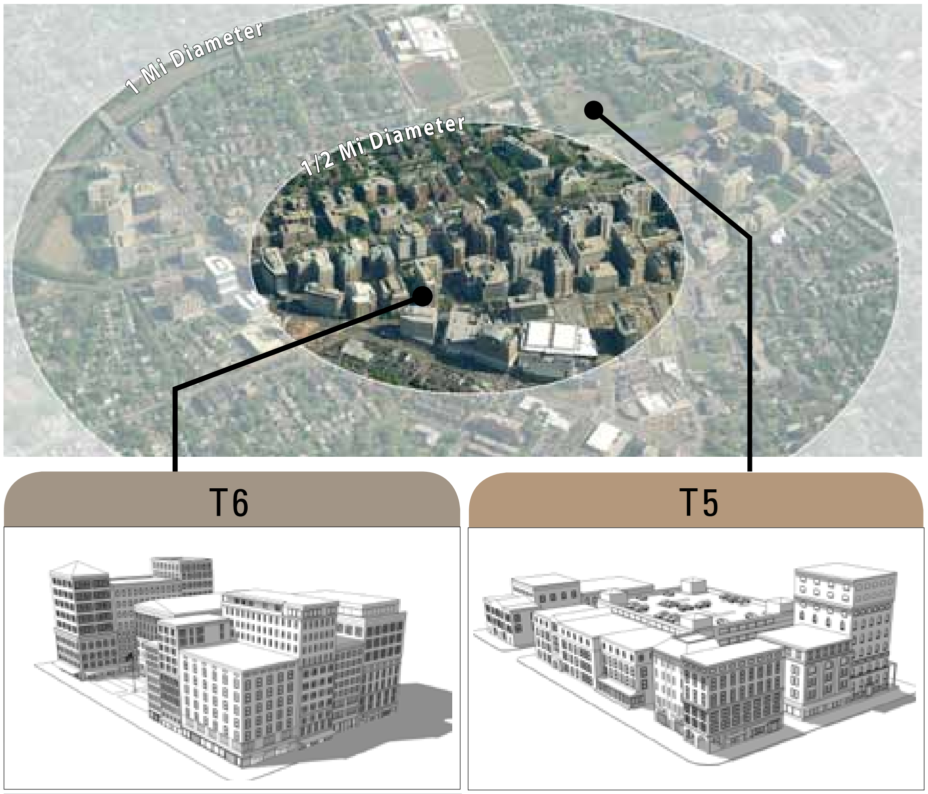
TYPE OF MULTIMODAL CENTER	ACTIVITY DENSITY*	TRANSECT ZONES	MULTIMODAL CORRIDOR TYPES BY TRANSECT
P6 Urban Core 	HIGH 70+		 TRANSIT BLVD. BOULEVARD MAJOR AVE. AVENUE LOCAL ST.
P5 Urban Center 	MODERATE/ HIGH 34-70		 TRANSIT BLVD. BOULEVARD MAJOR AVE. AVENUE LOCAL ST.
P4 Large Town or Suburban Center 	MODERATE 14-34		 TRANSIT BLVD. BOULEVARD MAJOR AVE. AVENUE LOCAL ST.
P3 Medium Town or Suburban Center 	MEDIUM/ LOW 7-14		 TRANSIT BLVD. BOULEVARD MAJOR AVE. AVENUE LOCAL ST.
P2 Small Town or Suburban Center 	LOW 2-7		 TRANSIT BLVD. BOULEVARD MAJOR AVE. AVENUE LOCAL ST.
P1 Rural or Village Center 	VERY LOW <2		 TRANSIT BLVD. BOULEVARD MAJOR AVE. AVENUE LOCAL ST.

* sum of jobs + population per acre

Figure 31 – Multimodal Center Types Summary Page.

CENTER TYPE P6 URBAN CORE

Typical P6 Center (Ballston, Virginia)

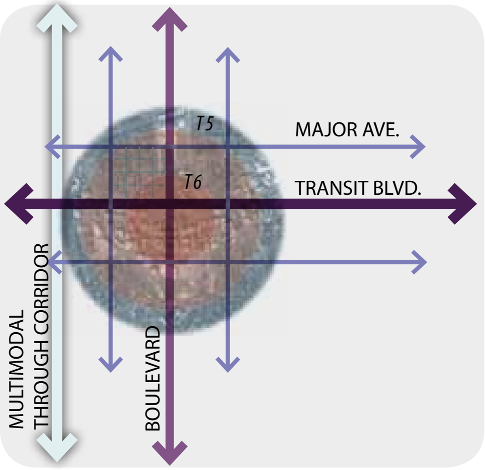


Typical Street view (Ballston, Virginia)

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)

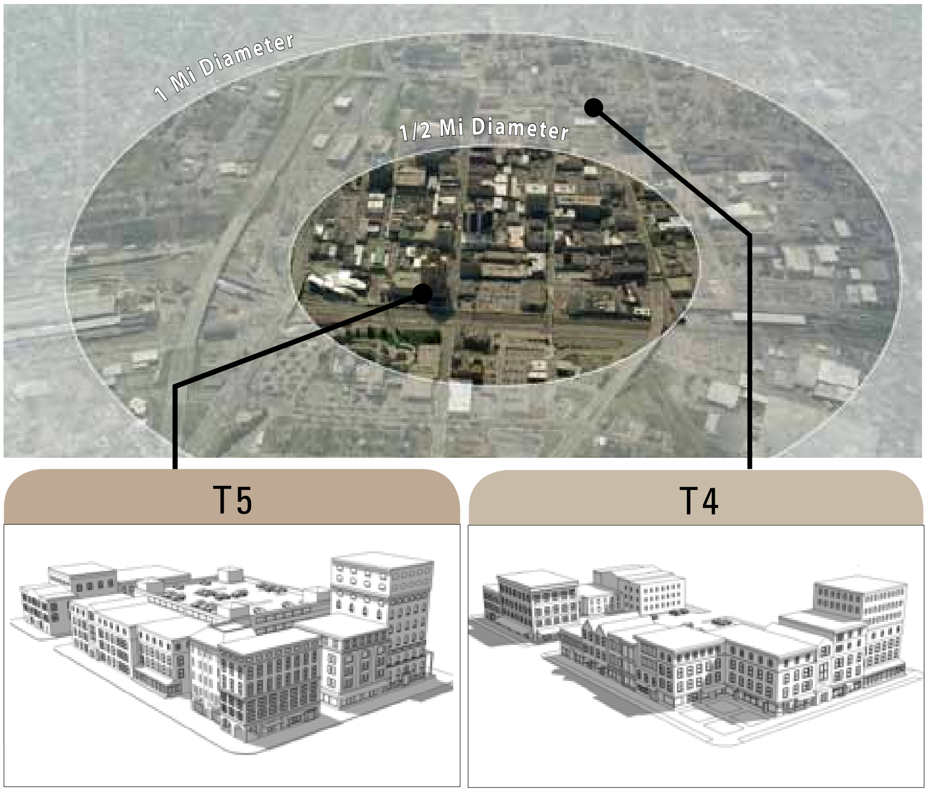


P6 URBAN CORE SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	70 or more
GROSS DEVELOPMENT FAR (residential + non-residential)	1.0 or more
NET DEVELOPMENT FAR (residential + non-residential)	1.6 or more
SUPPORTED TRANSIT TECHNOLOGY	LRT/Rail
Height of Buildings	7 story average 14 story typical maximum

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

CENTER TYPE P5 URBAN CENTER

Typical P5 Center (Roanoke, Virginia)

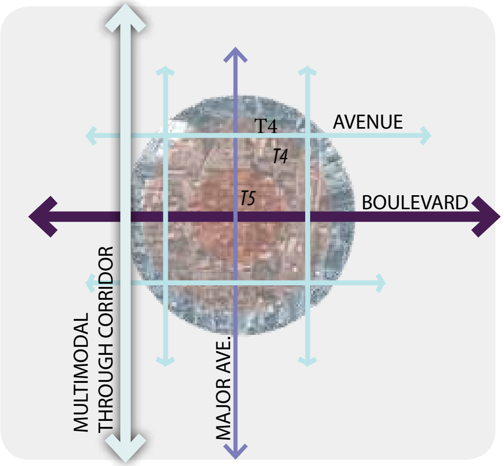


Typical Street view (Roanoke, Virginia)

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

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)



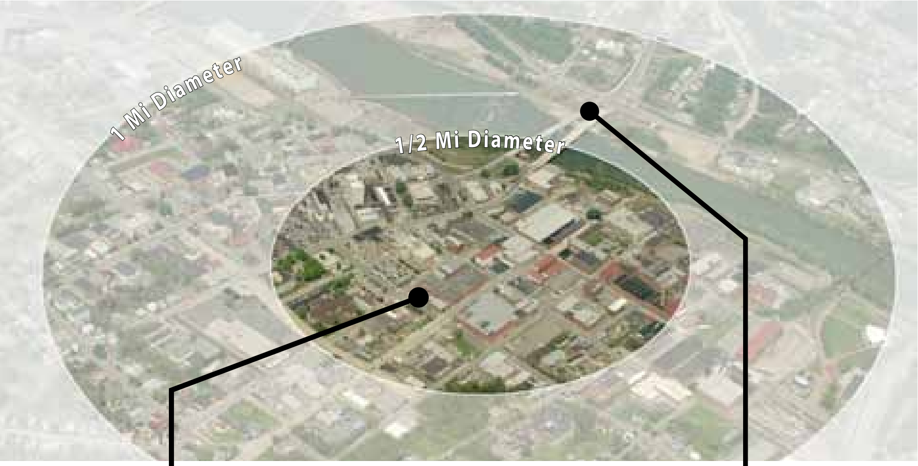
P5 URBAN CENTER SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	34 to 70
GROSS DEVELOPMENT FAR (residential + non-residential)	0.5 to 1.0
NET DEVELOPMENT FAR (residential + non-residential)	0.8 to 1.6
SUPPORTED TRANSIT TECHNOLOGY	BRT/LRT
Height of Buildings	5 story average 9 story typical maximum

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

P4 LARGE TOWN/SUBURBAN CENTER

CENTER TYPE

Typical P4 Center (Danville, Virginia)

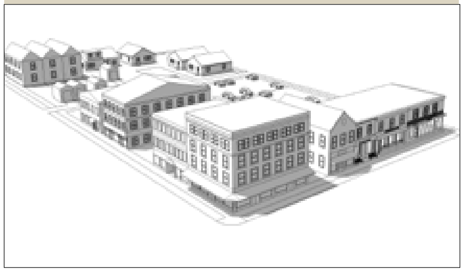


Typical Street view (Danville, Virginia)

T4

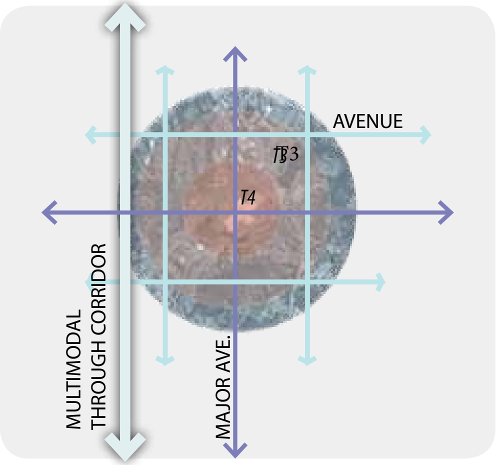
MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	25-60/ac
AVG. BLDG. HEIGHT	4 Stories
TYPICAL MAX BLDG. HEIGHT	8 Stories
TYPICAL NET FAR	0.57-1.38
SUPPORTED TRANSIT TECHNOLOGY	Express Bus

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)



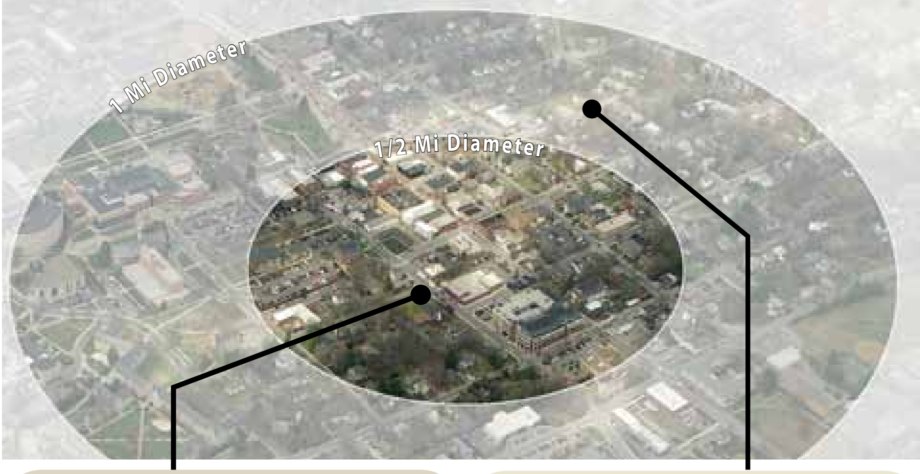
P4 LARGE TOWN/SUBURBAN CENTER SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	14 to 34
GROSS DEVELOPMENT FAR (residential + non-residential)	0.2 to 0.5
NET DEVELOPMENT FAR (residential + non-residential)	0.3 to 0.8
SUPPORTED TRANSIT TECHNOLOGY	Express Bus
Height of Buildings	3 story average 6 story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

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

CENTER TYPE

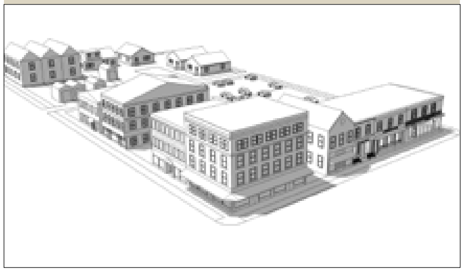
P3 MEDIUM TOWN/SUBURBAN CENTER

Typical P3 Center (Blacksburg, Virginia)



Typical Street view (Blacksburg, Virginia)

T3

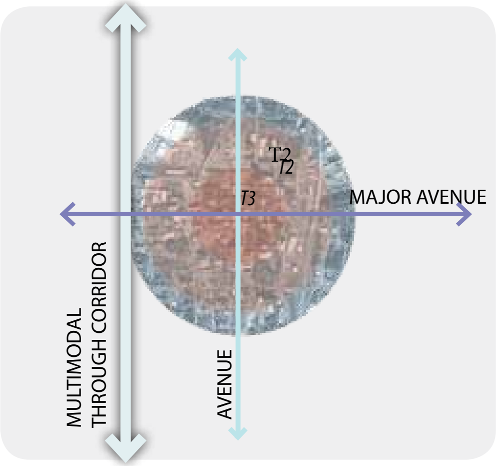


MIXED USE INTENSITY	Medium/Low
ACTIVITY DENSITY (jobs + people/ac)	10-25/ac
AVG. BLDG. HEIGHT	3 Stories
TYPICAL MAX BLDG. HEIGHT	5 Stories
TYPICAL NET FAR	0.23-0.57
SUPPORTED TRANSIT TECHNOLOGY	Fixed Route Bus

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)



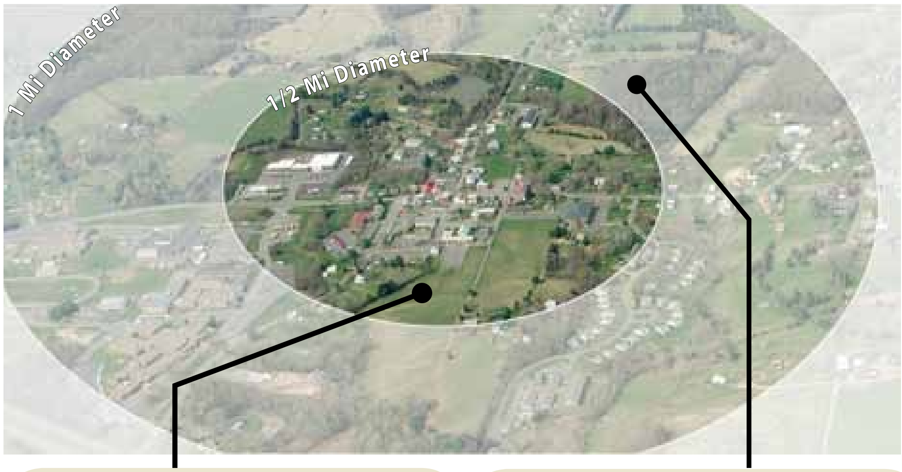
P3 MEDIUM TOWN/SUBURBAN CENTER SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	7 to 14
GROSS DEVELOPMENT FAR (residential + non-residential)	0.1 to 0.2
NET DEVELOPMENT FAR (residential + non-residential)	0.15 to 0.3
SUPPORTED TRANSIT TECHNOLOGY	Fixed Route Bus

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

CENTER TYPE P2

SMALL TOWN/SUBURBAN CENTER

Typical P2 Center (Stanardsville, Virginia)



Typical Street view (Stanardsville, Virginia)

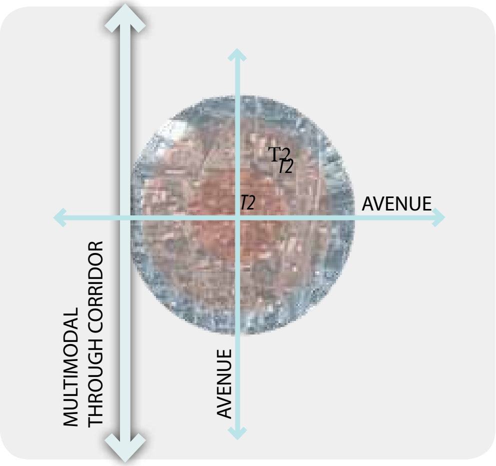
T2

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)

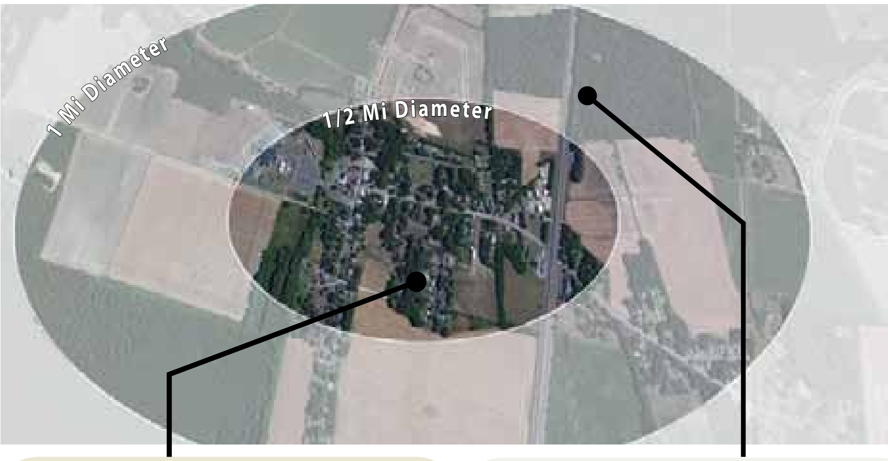


P2 SMALL TOWN/SUBURBAN CENTER SUMMARY TABLE	
ACTIVITY DENSITY (jobs + people/acre)	2 to 7
GROSS DEVELOPMENT FAR (residential + non-residential)	0.03-0.10
NET DEVELOPMENT FAR (residential + non-residential)	0.05-0.15
SUPPORTED TRANSIT TECHNOLOGY	Demand Response
Height of Buildings	1.5 story average 3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

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

CENTER TYPE P1 RURAL/VILLAGE CENTER

Typical P1 Center (Eastville, Virginia)

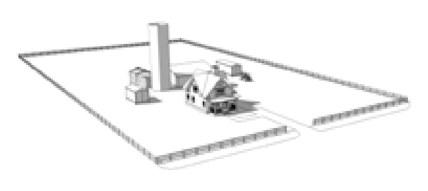


Typical Street view (Eastville, Virginia)

T2

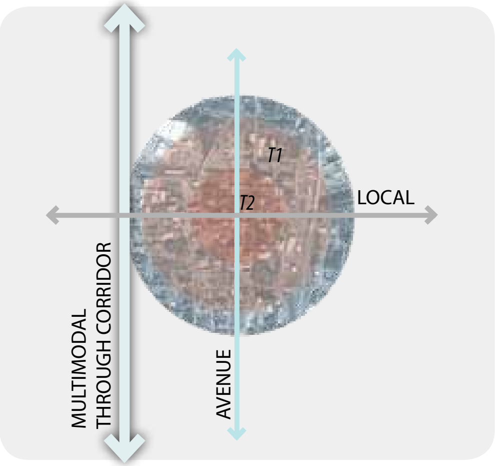
MIXED USE INTENSITY	Low
ACTIVITY DENSITY (jobs + people/ac)	1-10/ac
AVG. BLDG. HEIGHT	1.5 Stories
TYPICAL MAX BLDG. HEIGHT	3 Stories
TYPICAL NET FAR	0.02-0.23
SUPPORTED TRANSIT TECHNOLOGY	Demand Response

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.

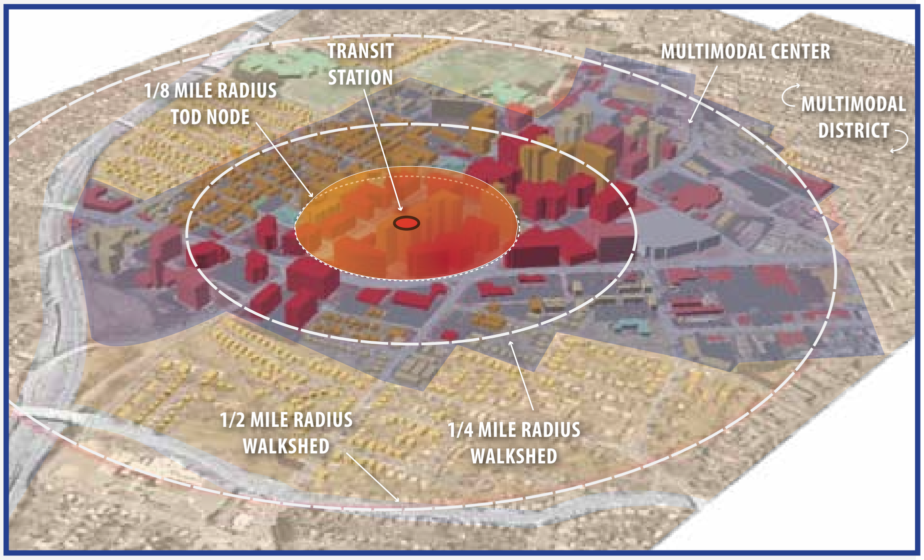


Figure 38 – Illustration of the Relationship of Walksheds and a TOD Node in a Multimodal Center.

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.

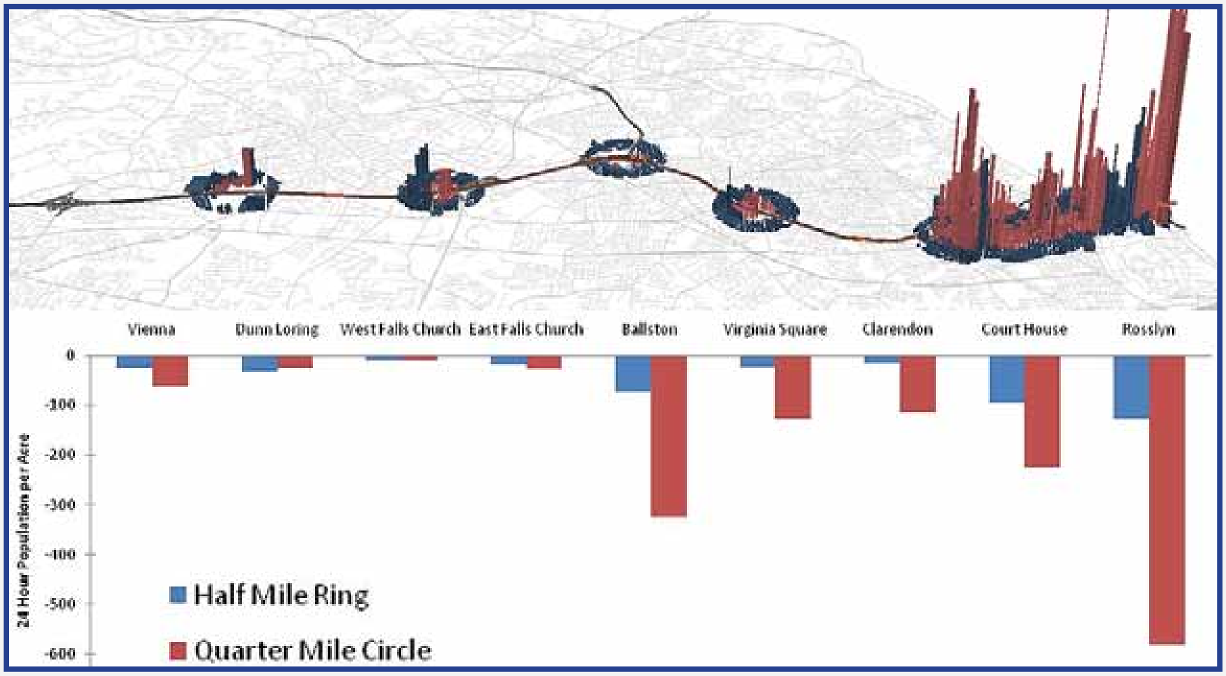


Figure 39 - Analysis of Orange Line Station Area Densities in Virginia. Note that stations in the Rosslyn to Ballston corridor show significant density differential between the first and second quarter-mile rings.

> *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.

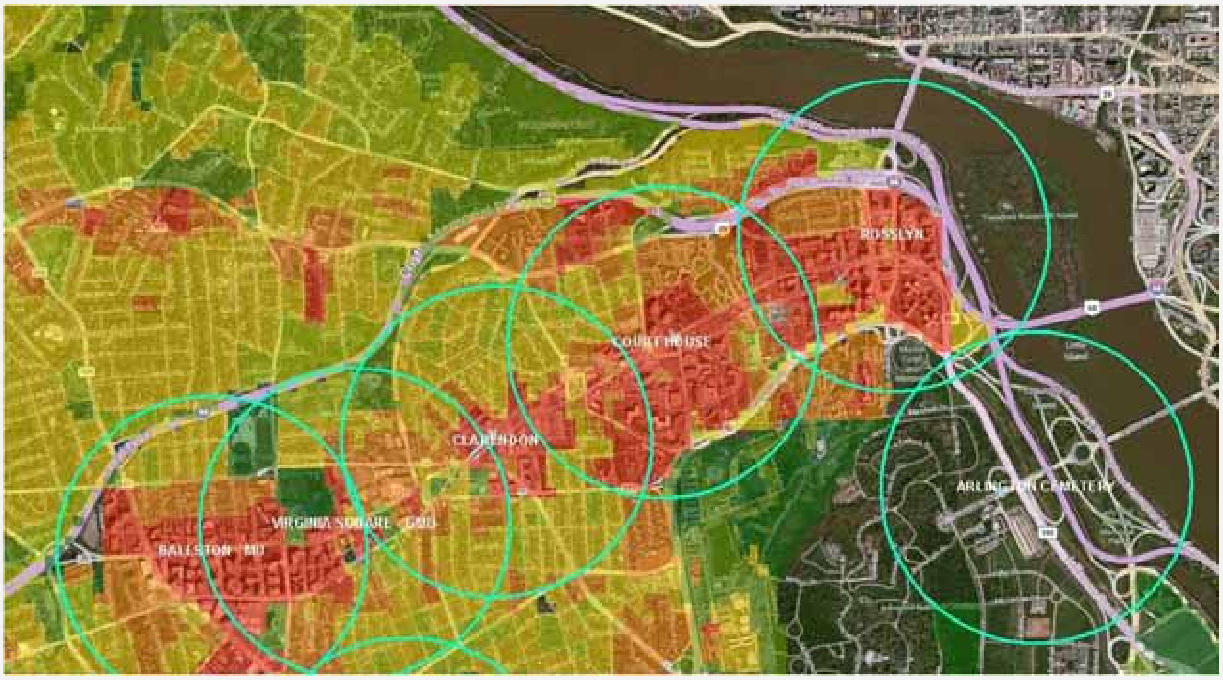


Figure 40 – Map of Densities around Metrorail Stations in the Rosslyn/Ballston Corridor.

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.

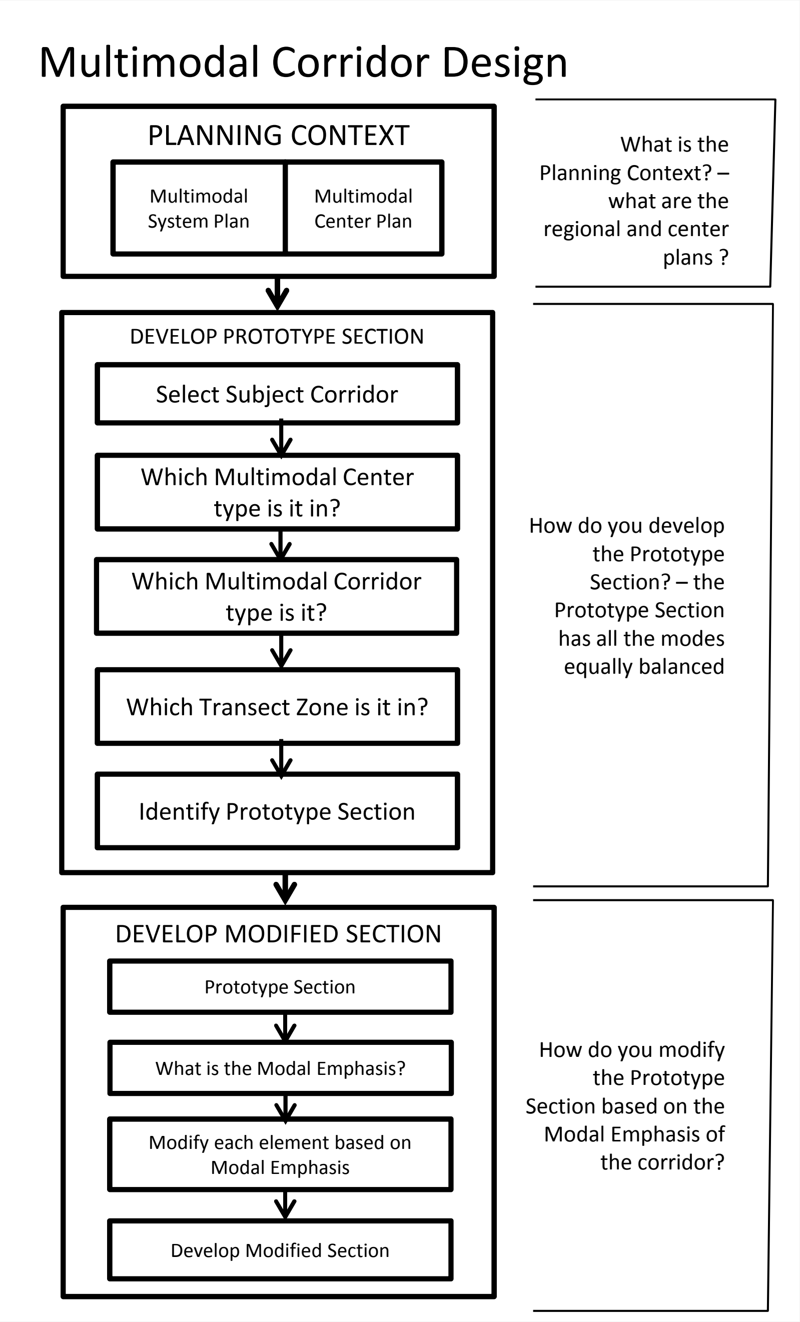


Figure 42 - The Process for Designing Multimodal Corridors.

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.

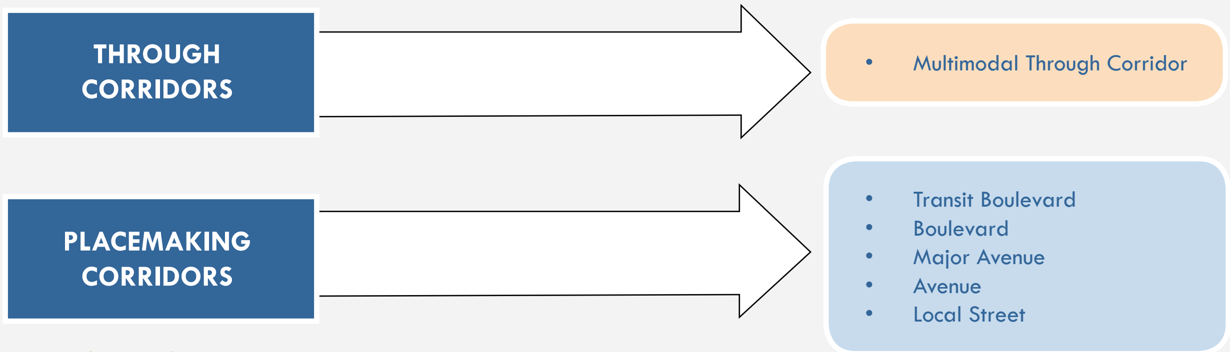


Figure 43 - List of Multimodal Corridor Types.

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

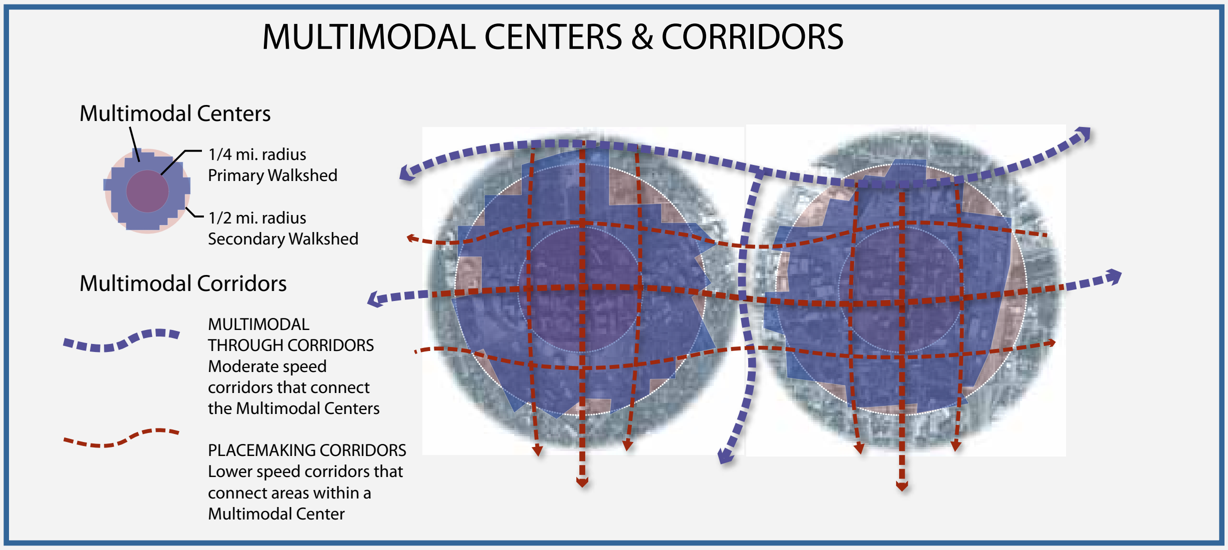


Figure 44 - Multimodal Through and Placemaking Corridors. The diagram distinguishes Placemaking Corridors from Multimodal Through Corridors – the two general categories of Multimodal Corridors that together comprise a true multimodal transportation system in a region.

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

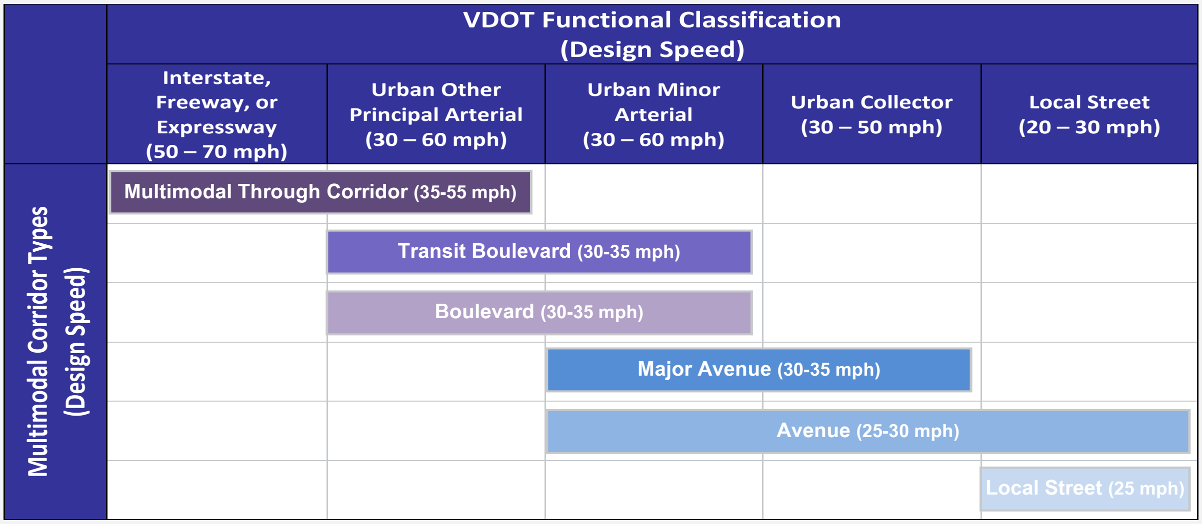
When Multimodal Through Corridors enter a Multimodal Center, the surrounding context signals a change in corridor character and function, and they transition to Placemaking Corridors. This transition is marked by slower traffic speeds, more frequent pedestrian crossings, and pedestrian-oriented buildings. 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:



Multimodal Corridor Types (Design Speed)	VDOT Functional Classification (Design Speed)				
	Interstate, Freeway, or Expressway (50 – 70 mph)	Urban Other Principal Arterial (30 – 60 mph)	Urban Minor Arterial (30 – 60 mph)	Urban Collector (30 – 50 mph)	Local Street (20 – 30 mph)
Multimodal Through Corridor (35-55 mph)	●	●			
Transit Boulevard (30-35 mph)		●	●		
Boulevard (30-35 mph)		●	●		
Major Avenue (30-35 mph)			●	●	
Avenue (25-30 mph)			●	●	●
Local Street (25 mph)					●

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.

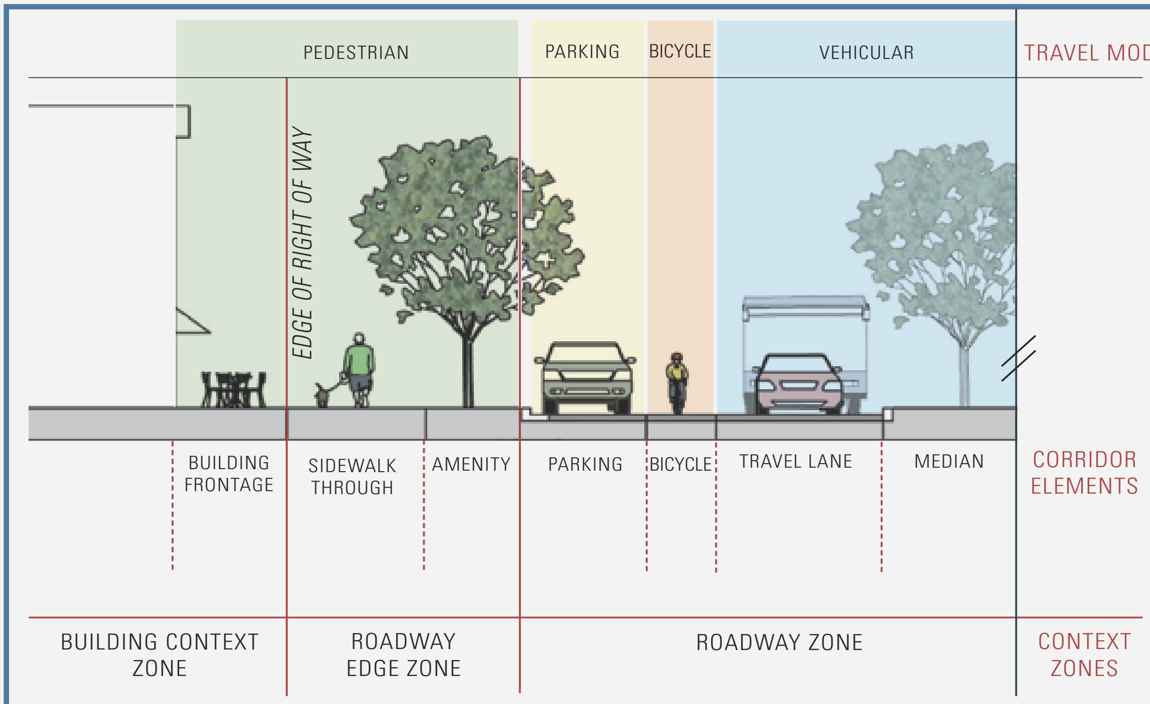
Table 10 specifies which Multimodal Corridor types are appropriate for each Transect Zone.

<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:

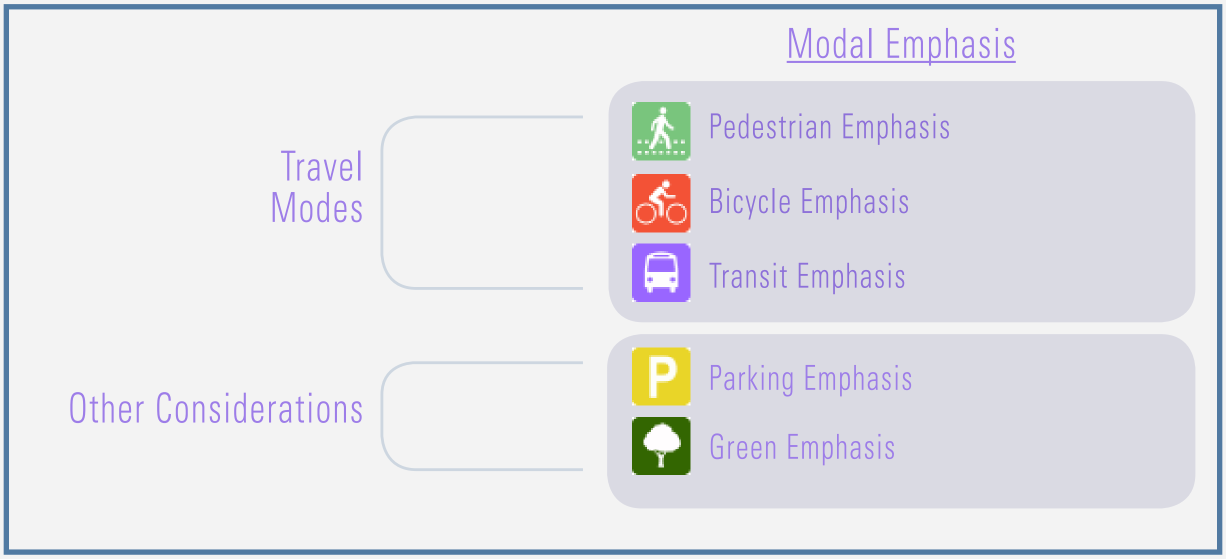
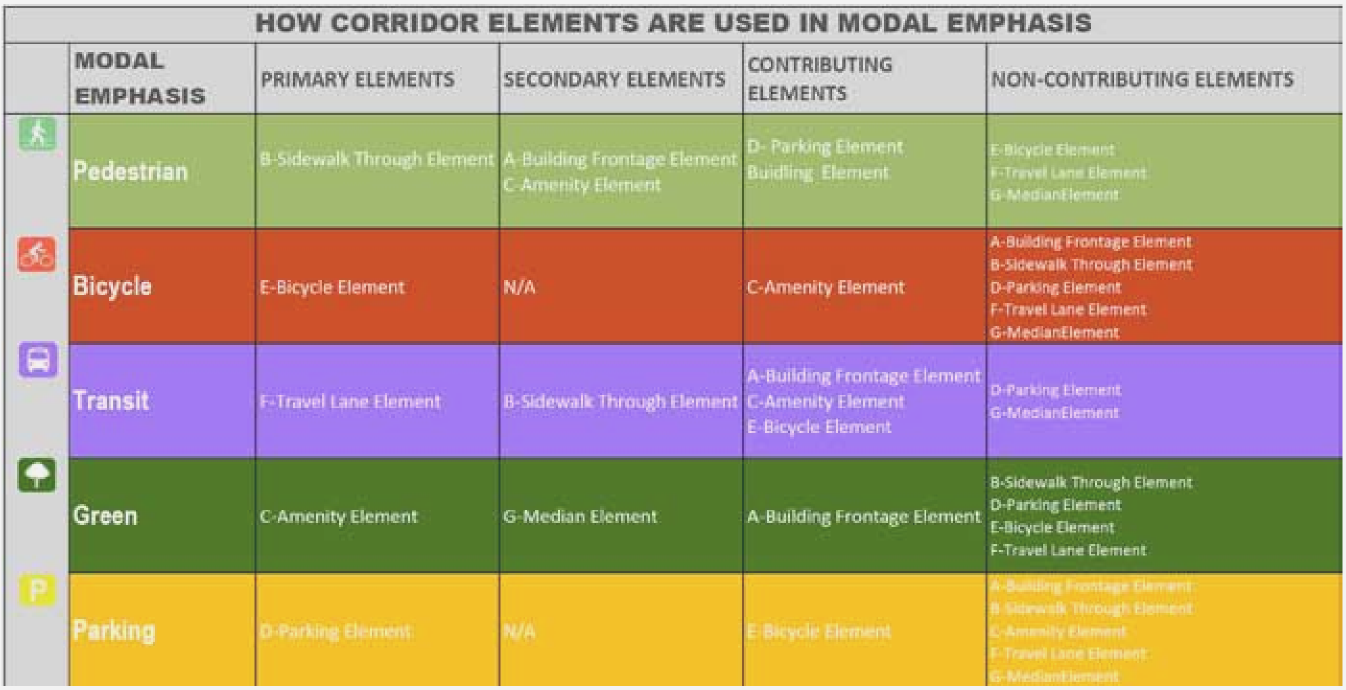


Figure 53 - Travel Modes and Other Considerations for Modal Emphasis in Corridor Cross-Section Design.

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.

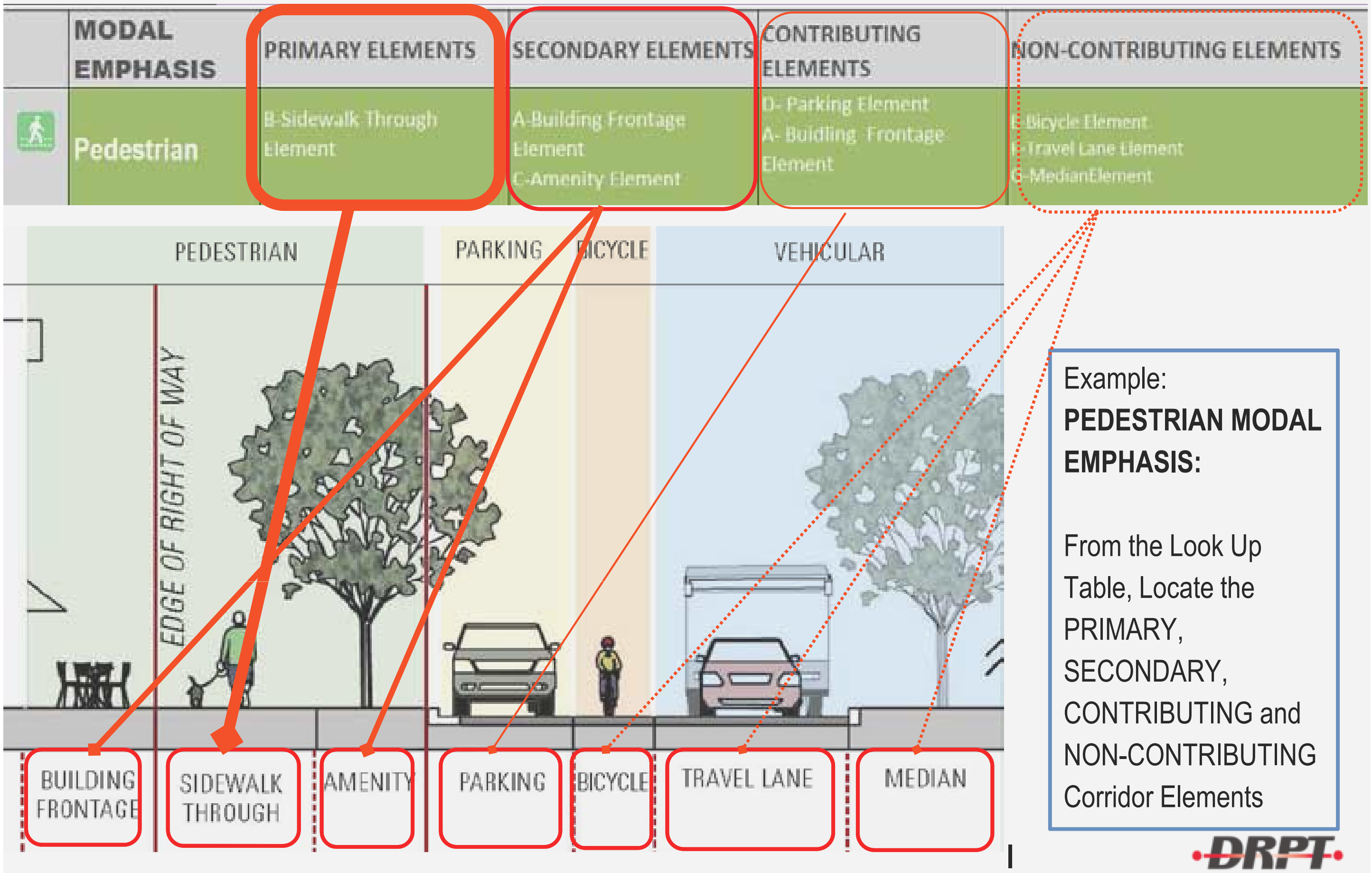
Choosing Design Standards

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.



	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 A- Buidling Frontage Element	E-Bicycle Element F-Travel Lane Element G-MedianElement

Example:
PEDESTRIAN MODAL EMPHASIS:

From the Look Up Table, Locate the PRIMARY, SECONDARY, CONTRIBUTING and NON-CONTRIBUTING Corridor Elements

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.

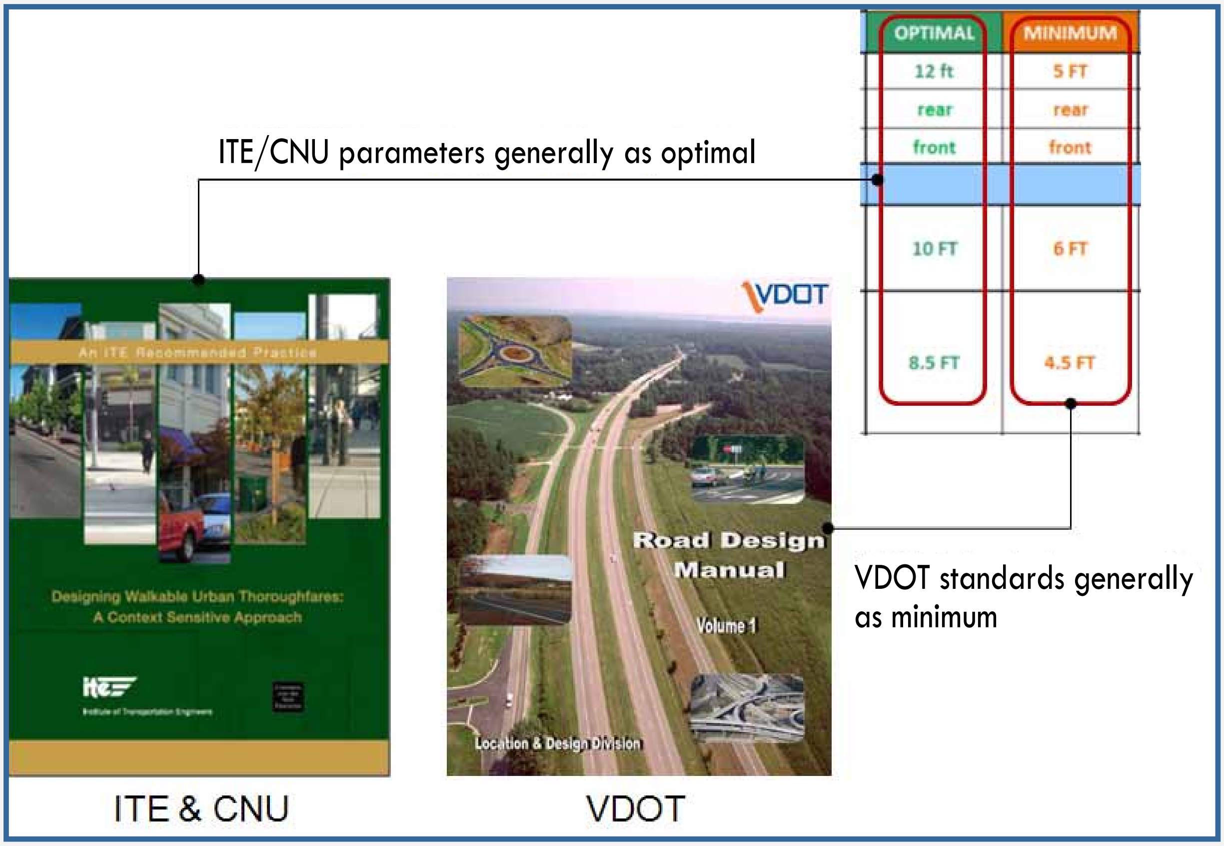


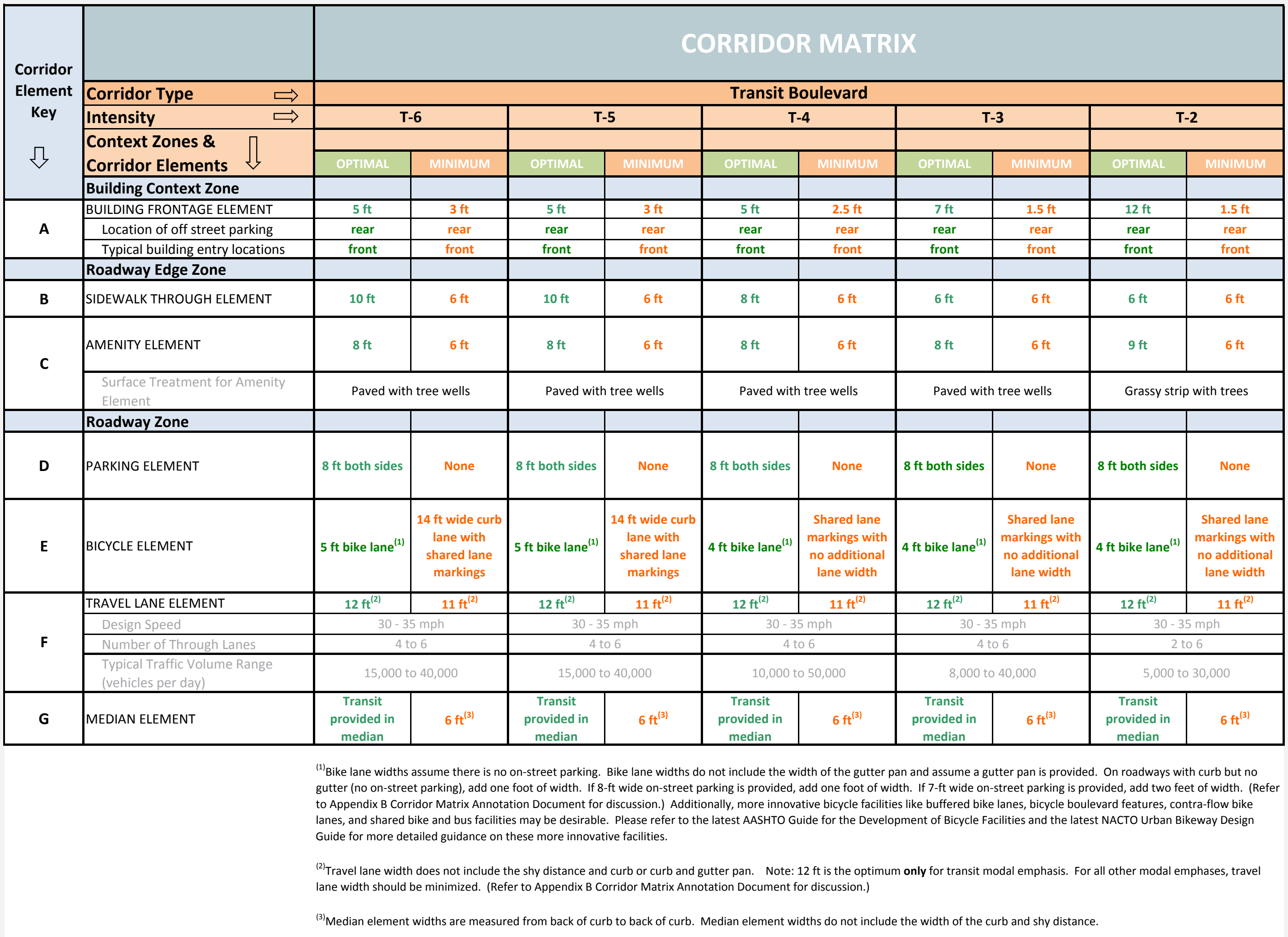
Figure 55 – Illustration of Sources of Optimal and Minimum Design Standards.

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.

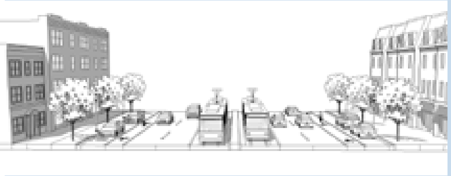
Figure 57 - Pedestrian Corridor Elements Illustrated on a Street in Roanoke.

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

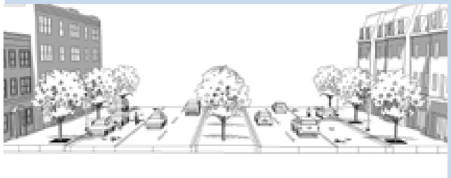
MULTIMODAL CORRIDOR TYPES

Placemaking Corridors

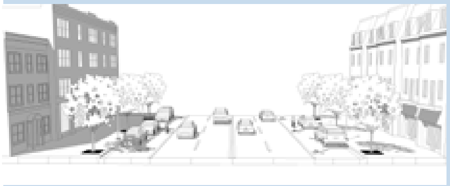


Transit Boulevard

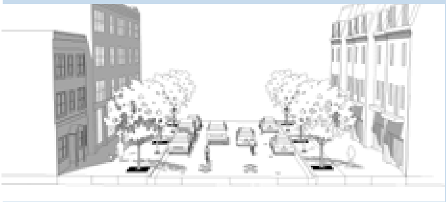
Boulevard



Major Avenue

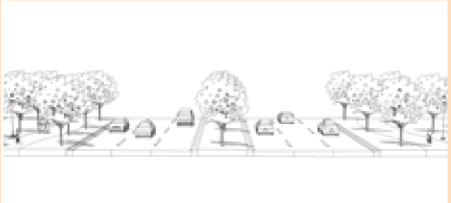


Avenue



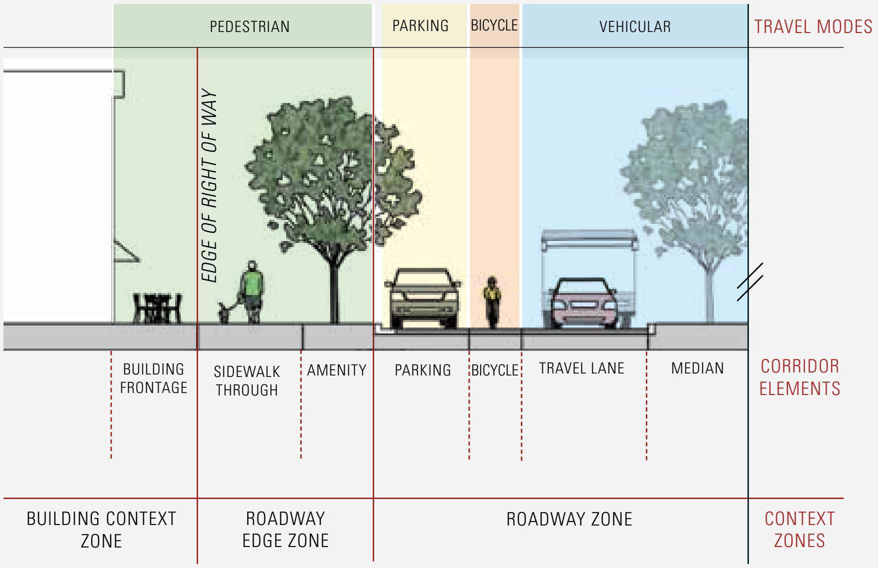
Local Street

Through Corridor



Multimodal Through Corridor

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



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.

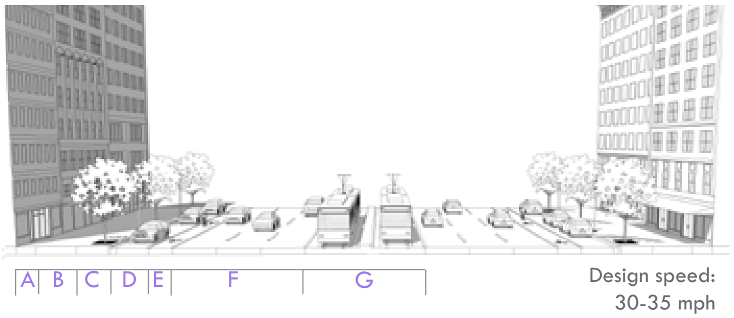
TRANSIT BOULEVARD

PLACEMAKING CORRIDOR

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

T6

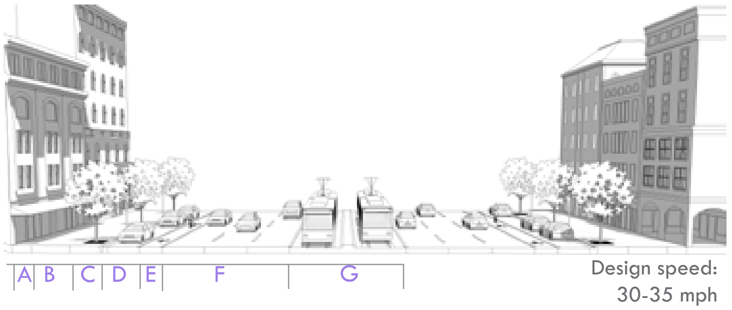
Building Frontage	A	5’
Sidewalk Through	B	10’
Amenity	C	8’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	Varies*



Design speed:
30-35 mph

T5

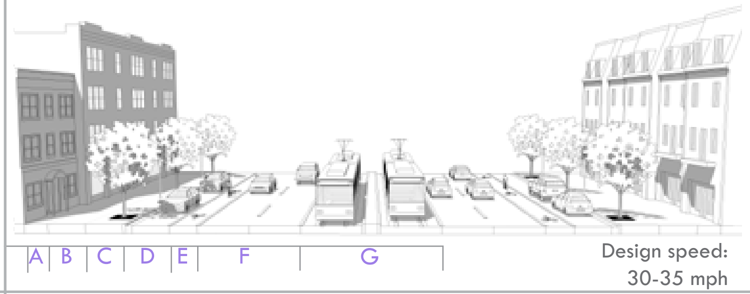
Building Frontage	A	5’
Sidewalk Through	B	10’
Amenity	C	8’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	Varies*



Design speed:
30-35 mph

T4

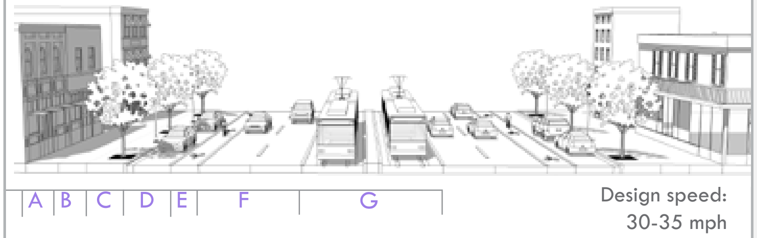
Building Frontage	A	5’
Sidewalk Through	B	8’
Amenity	C	8’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	Varies*



Design speed:
30-35 mph

T3

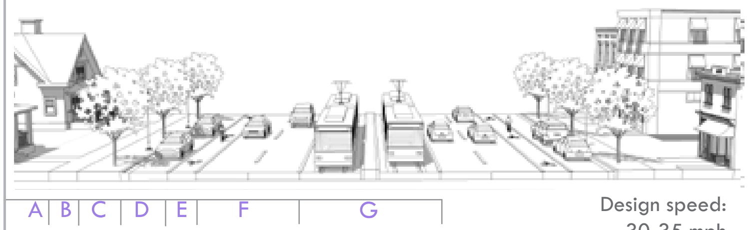
Building Frontage	A	7’
Sidewalk Through	B	6’
Amenity	C	8’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	Varies*



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

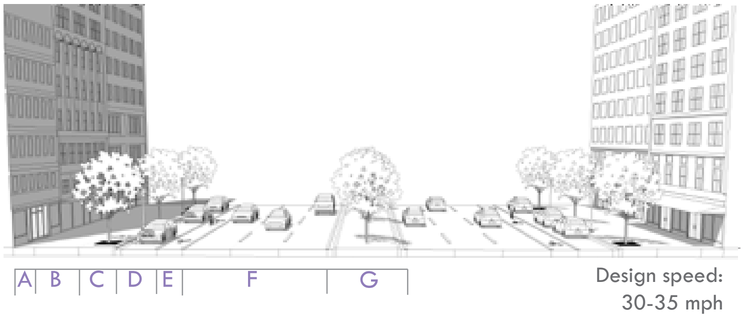
PLACEMAKING CORRIDOR

Optimal values from the Corridor Matrix

Cross-sectional views of optimal values

T6

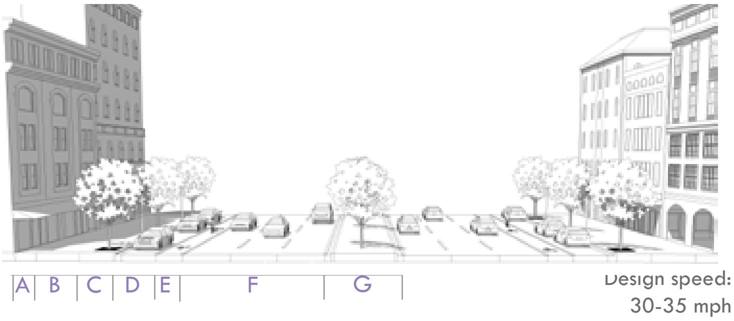
Building Frontage	A	5’
Sidewalk Through	B	10’
Amenity	C	8’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	18’



Design speed:
30-35 mph

T5

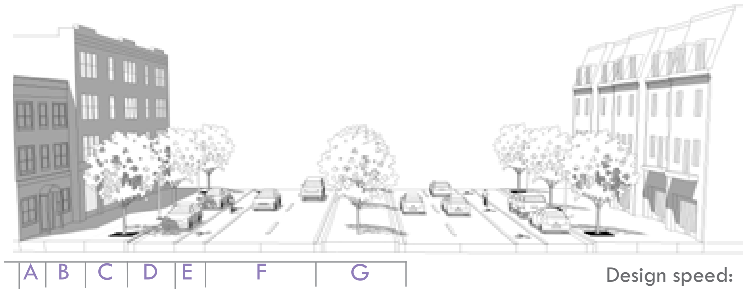
Building Frontage	A	5’
Sidewalk Through	B	10’
Amenity	C	8’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	18’



Design speed:
30-35 mph

T4

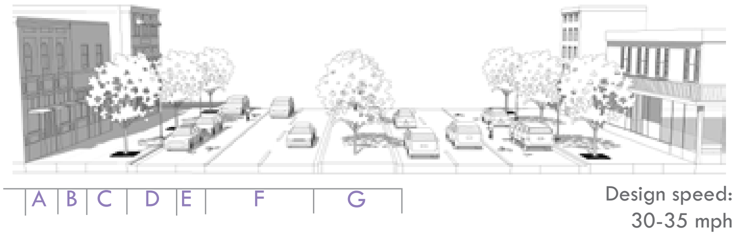
Building Frontage	A	5’
Sidewalk Through	B	8’
Amenity	C	8’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’



Design speed:
30-35 mph

T3

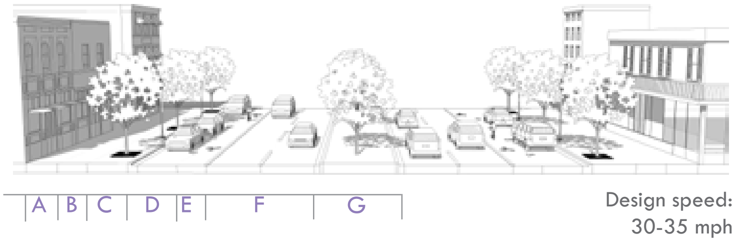
Building Frontage	A	7’
Sidewalk Through	B	6’
Amenity	C	8’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’



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.

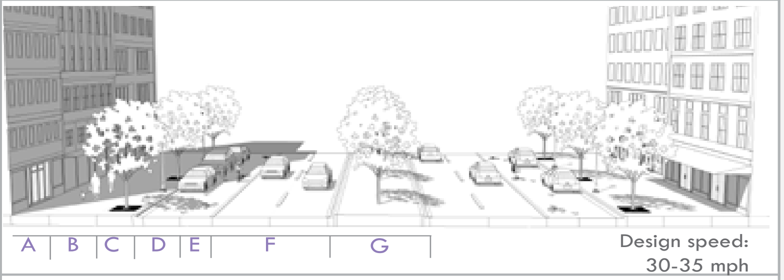
MAJOR AVENUE

PLACEMAKING CORRIDOR

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

T6

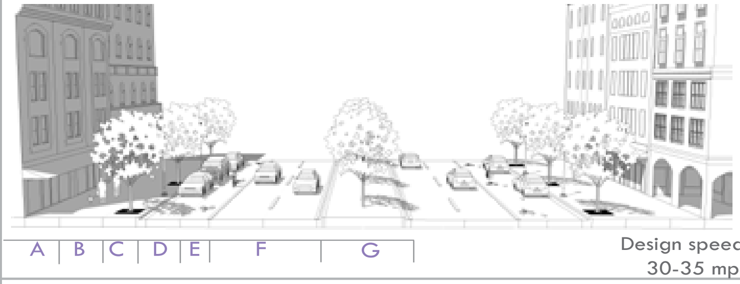
Building Frontage	A	7’
Sidewalk Through	B	9’
Amenity	C	7’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	18’



Design speed: 30-35 mph

T5

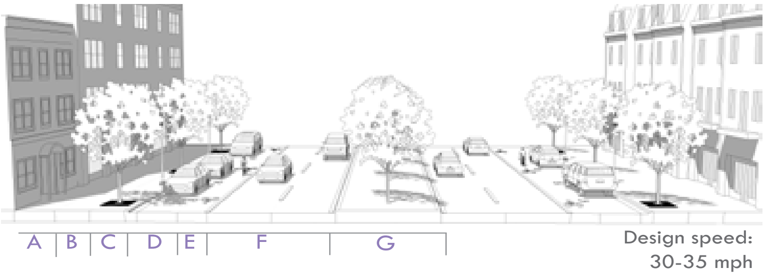
Building Frontage	A	7’
Sidewalk Through	B	9’
Amenity	C	7’
Parking	D	8’
Bicycle	E	5’
Travel Lane	F	12’
Median	G	18’



Design speed: 30-35 mph

T4

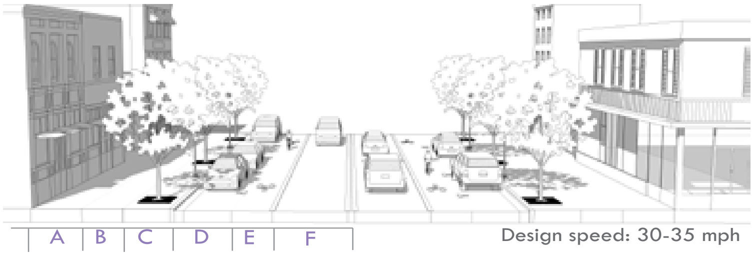
Building Frontage	A	7’
Sidewalk Through	B	6’
Amenity	C	7’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’



Design speed: 30-35 mph

T3

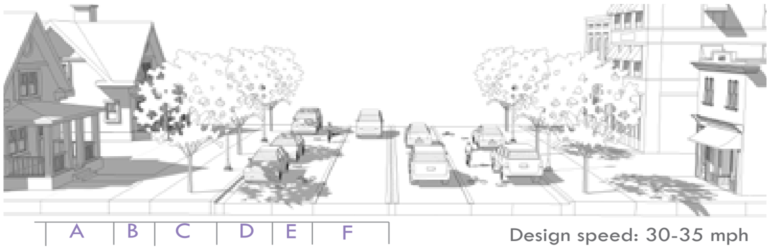
Building Frontage	A	7’
Sidewalk Through	B	6’
Amenity	C	7’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’*



Design speed: 30-35 mph

T2

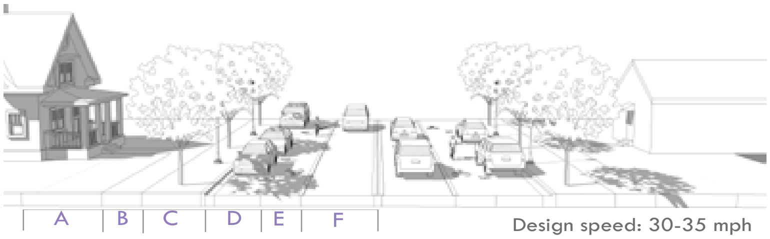
Building Frontage	A	12’
Sidewalk Through	B	6’
Amenity	C	9’
Parking	D	8’
Bicycle	E	4’
Travel Lane	F	12’
Median	G	18’*



Design speed: 30-35 mph

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’*



Design speed: 30-35 mph

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.

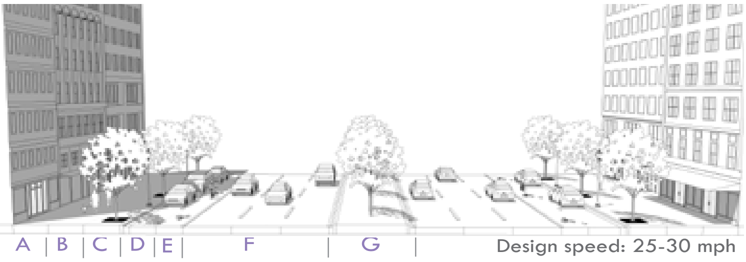
AVENUE

PLACEMAKING CORRIDOR

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

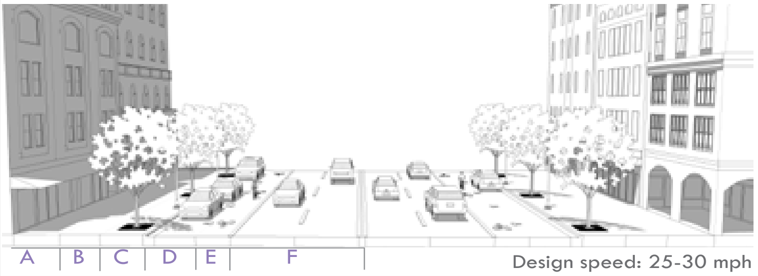
T6

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



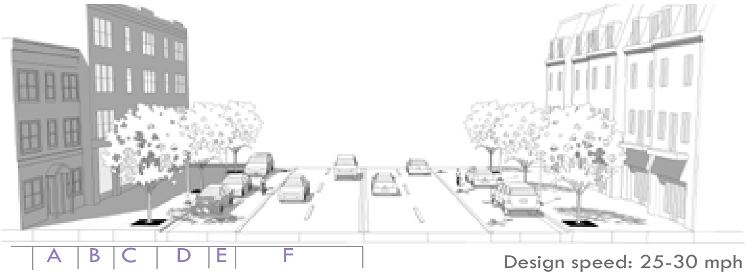
T5

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



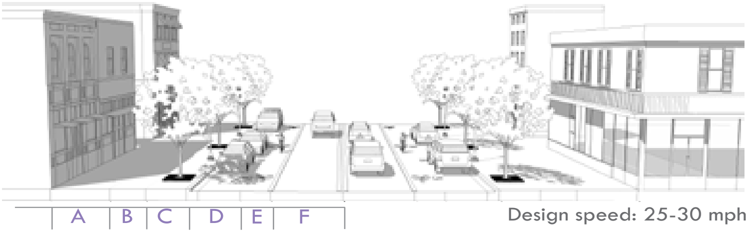
T4

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



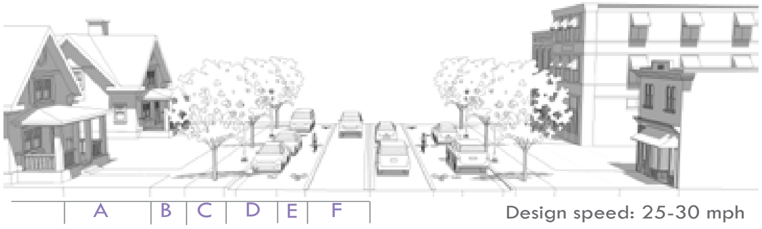
T3

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



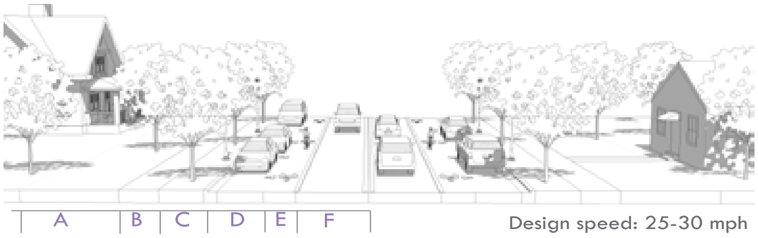
T2

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

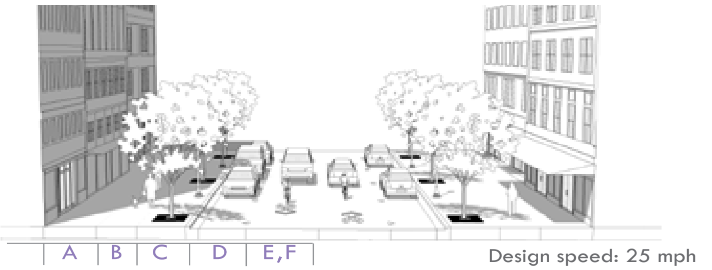
PLACEMAKING CORRIDOR

Optimal values from the Corridor Matrix

Cross-sectional views of optimal values

T6

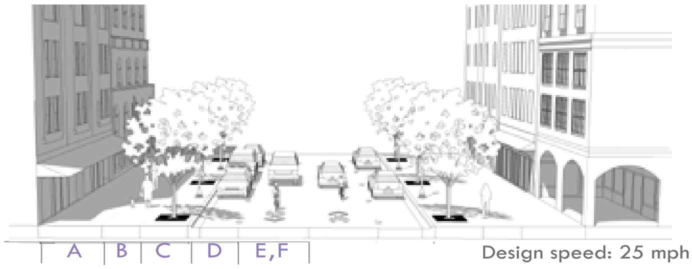
Building Frontage	A	8'
Sidewalk Through	B	6'
Amenity	C	7'
Parking	D	7'
Bicycle	E	shared
Travel Lane	F	11'



Design speed: 25 mph

T5

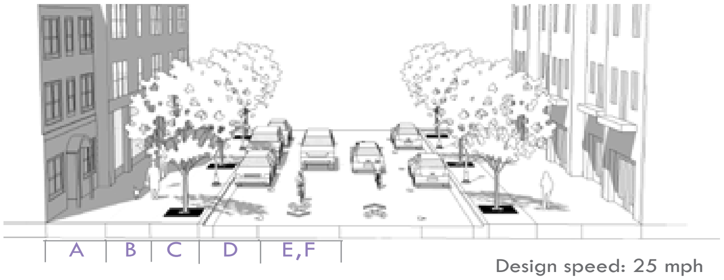
Building Frontage	A	8'
Sidewalk Through	B	6'
Amenity	C	7'
Parking	D	7'
Bicycle	E	shared
Travel Lane	F	11'



Design speed: 25 mph

T4

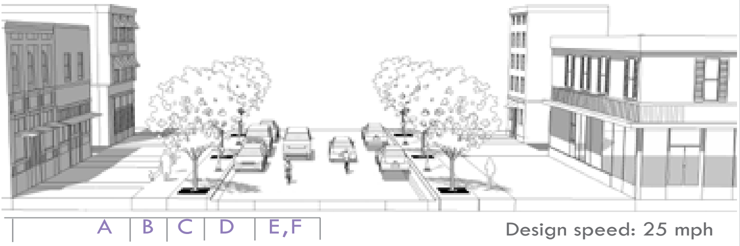
Building Frontage	A	8'
Sidewalk Through	B	6'
Amenity	C	7'
Parking	D	7'
Bicycle	E	shared
Travel Lane	F	11'



Design speed: 25 mph

T3

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



Design speed: 25 mph

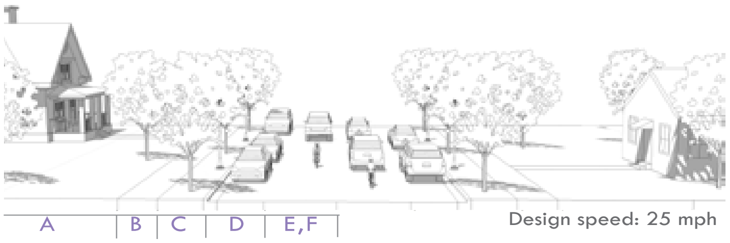
T2

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

Design speed: 25 mph

T1

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



Design speed: 25 mph

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.

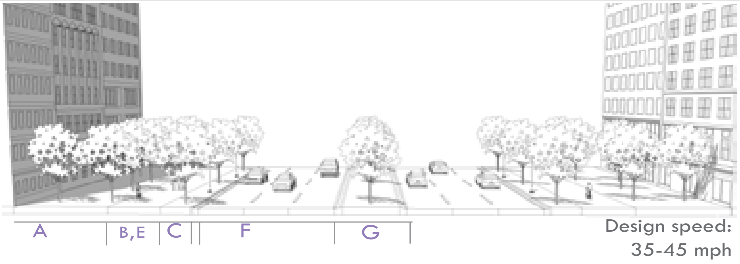
MULTIMODAL THROUGH CORRIDOR

THROUGH CORRIDOR

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

T6

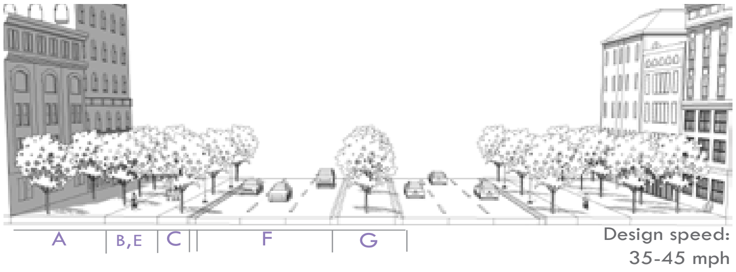
Building Frontage	A	25'
Sidewalk Through	B	14'*
Amenity	C	8'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	18'



Design speed:
35-45 mph

T5

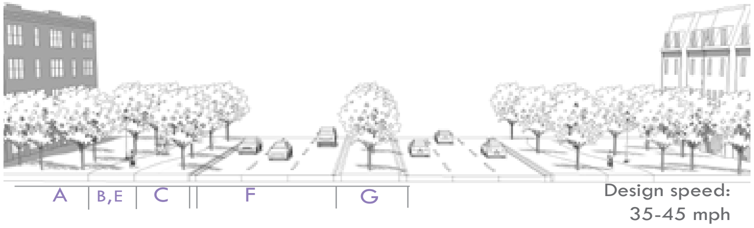
Building Frontage	A	25'
Sidewalk Through	B	14'*
Amenity	C	8'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	18'



Design speed:
35-45 mph

T4

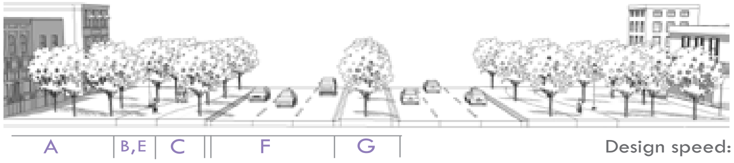
Building Frontage	A	35'
Sidewalk Through	B	12'*
Amenity	C	8'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	18'



Design speed:
35-45 mph

T3

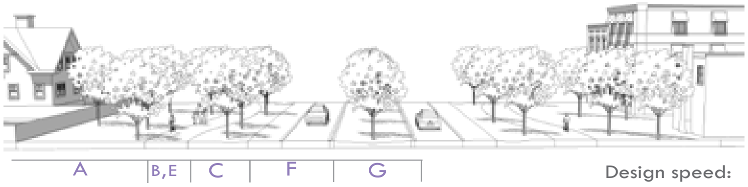
Building Frontage	A	35'
Sidewalk Through	B	12'*
Amenity	C	8'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	18'



Design speed:
35-55 mph

T2

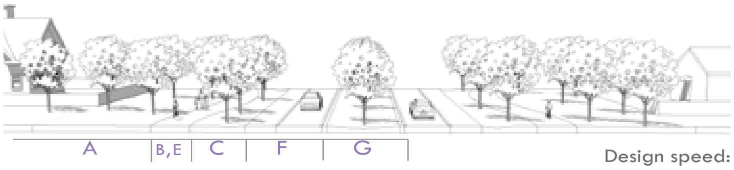
Building Frontage	A	45'
Sidewalk Through	B	10'*
Amenity	C	22'
Parking	D	n/a
Bicycle	E	shared*
Travel Lane	F	12'
Median	G	40'



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*

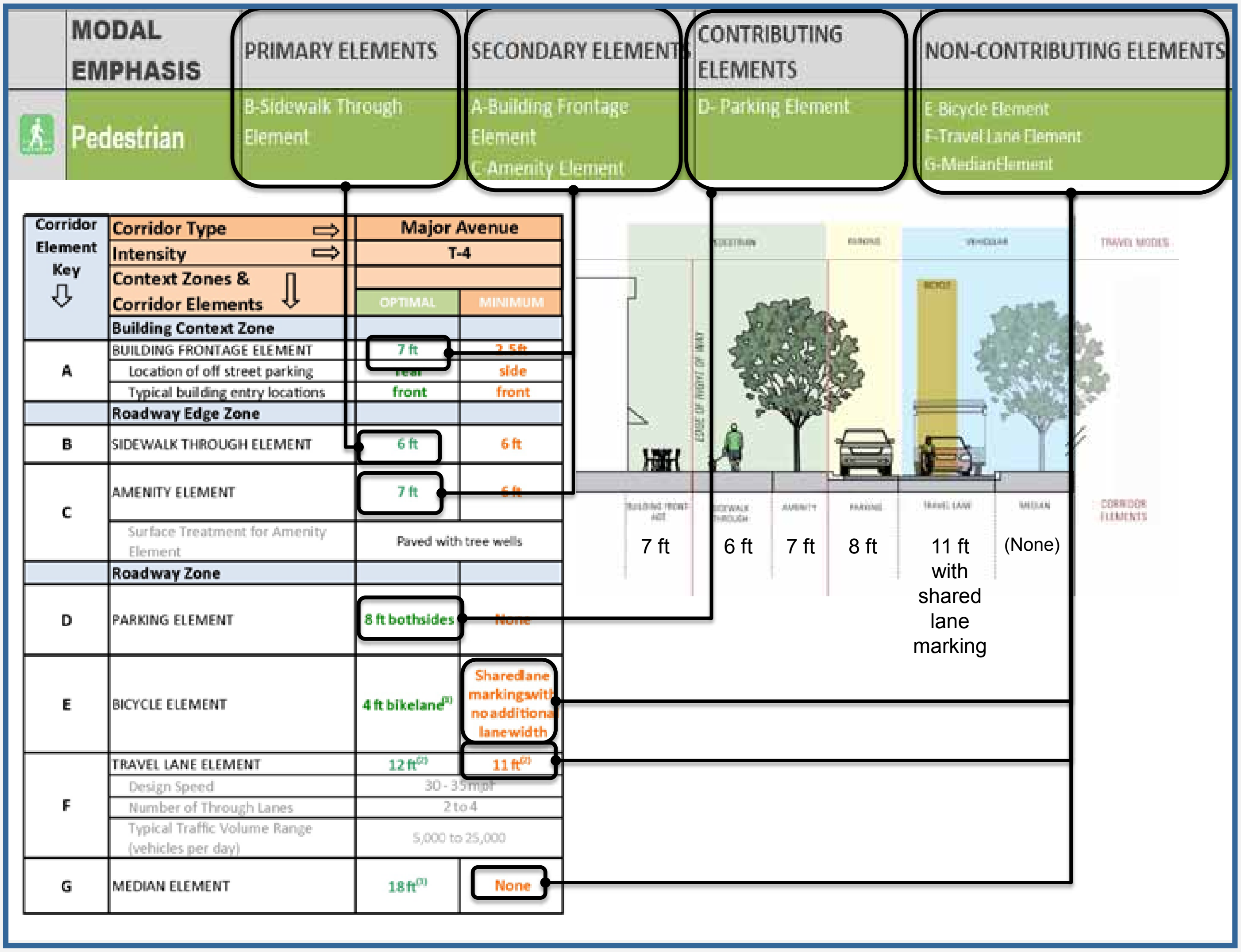
Figure 65 - Prototype Cross-Sections for Multimodal Through Corridors.

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.



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	E-Bicycle Element F-Travel Lane Element G-MedianElement

Corridor Element Key ⇩	Corridor Type ⇨	Major Avenue	
	Intensity ⇨	T-4	
	Context Zones & Corridor Elements ⇩		
		OPTIMAL	MINIMUM
	Building Context Zone		
A	BUILDING FRONTAGE ELEMENT	7 ft	2.5ft
	Location of off street parking	rear	side
	Typical building entry locations	front	front
	Roadway Edge Zone		
B	SIDEWALK THROUGH ELEMENT	6 ft	6 ft
C	AMENITY ELEMENT	7 ft	6 ft
	Surface Treatment for Amenity Element	Paved with tree wells	
	Roadway Zone		
D	PARKING ELEMENT	8 ft bothsides	None
E	BICYCLE ELEMENT	4 ft bikelane[1]	Sharedlane markingswith no additional lanewidth
F	TRAVEL LANE ELEMENT	12 ft[2]	11 ft[2]
	Design Speed	30 - 35mph	
	Number of Through Lanes	2 to 4	
	Typical Traffic Volume Range (vehicles per day)	5,000 to 25,000	
G	MEDIAN ELEMENT	18 ft[3]	None

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.

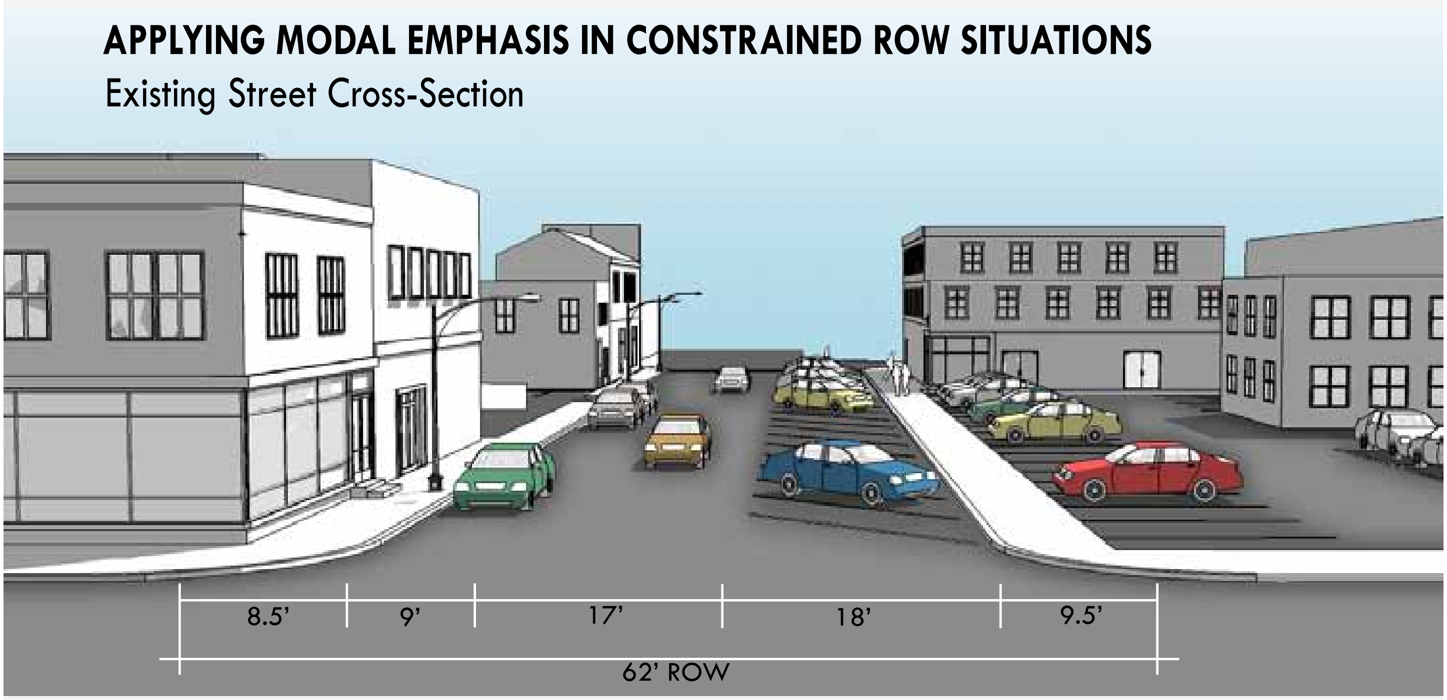


Figure 67 - Illustration of an Existing Street to be Retrofitted to a Multimodal Corridor.

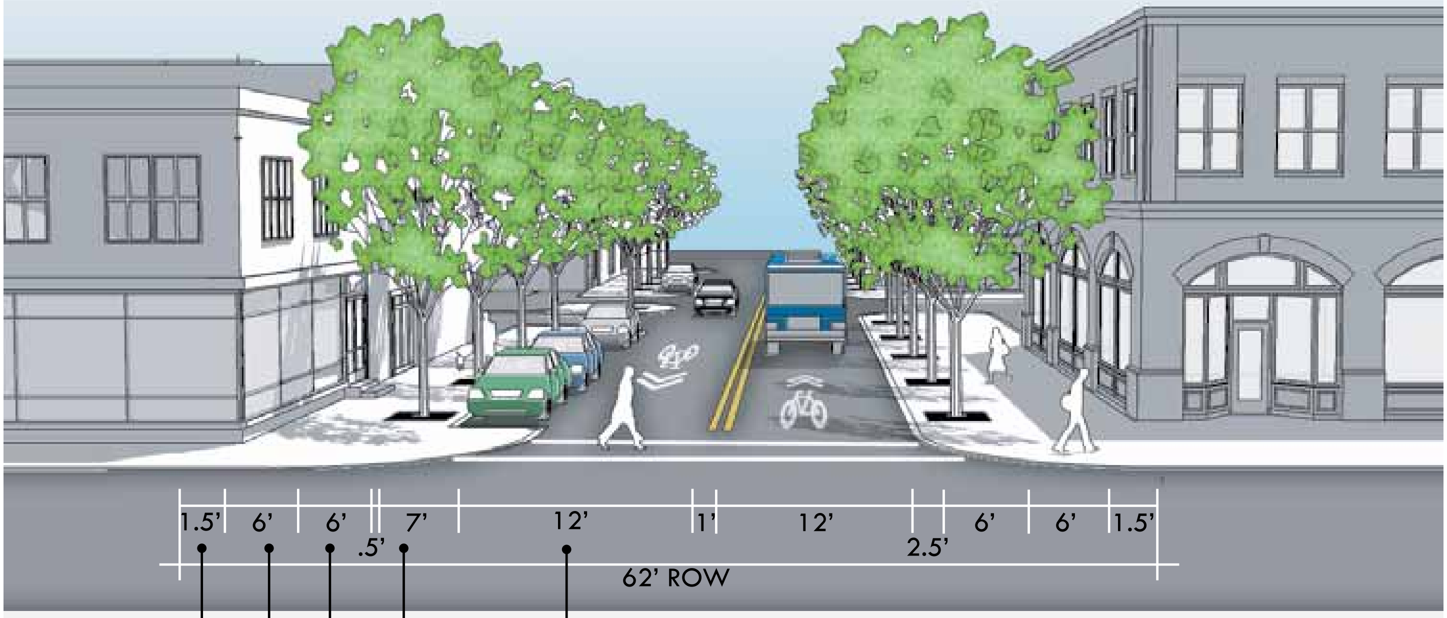
It should be noted that the proposed cross section was built using sound judgment and not just a mechanical application of the standards in the Matrix. For example, the existing constrained right of way did not allow for parking to be included on both sides of the street. Therefore, a design decision 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.

BUILDING THE PROPOSED CROSS SECTION

Modal Emphasis = Transit + Pedestrian

Avenue
T3



	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

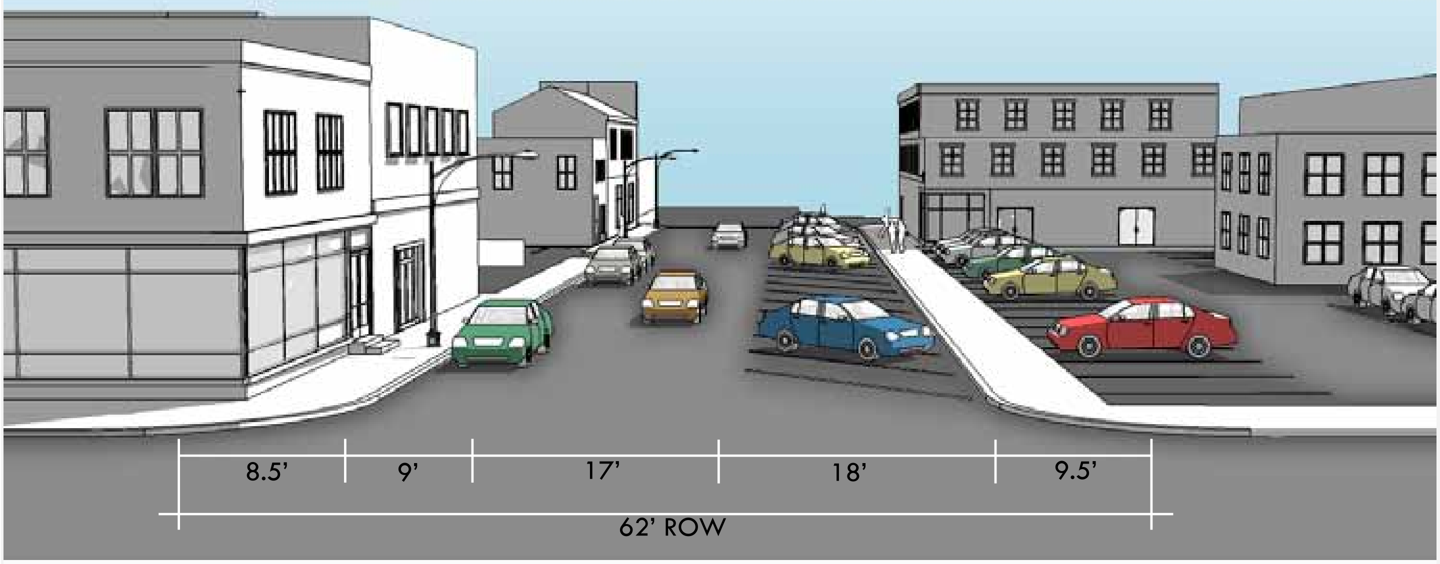
Figure 68 - Using Optimal and Minimum Standards to Build the Proposed Cross Section.

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

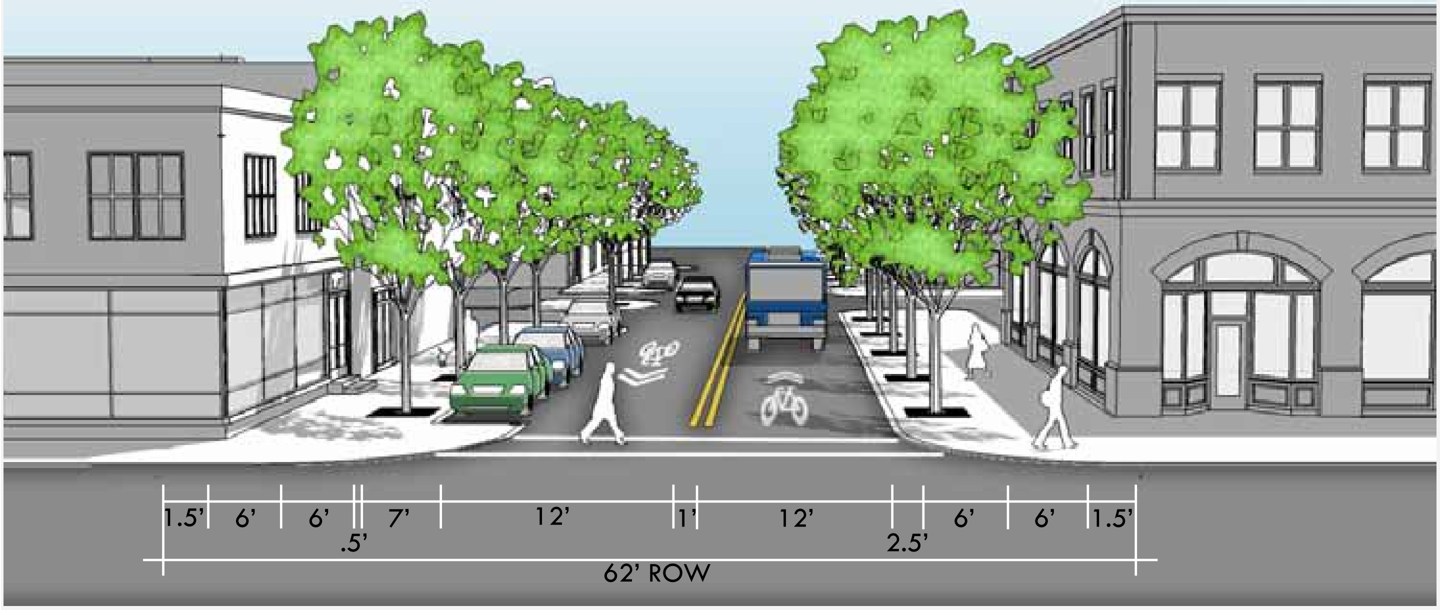


Figure 69 - Comparison of Existing and Proposed Cross Sections.

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.

CHAPTER 6 *Intersections*

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.

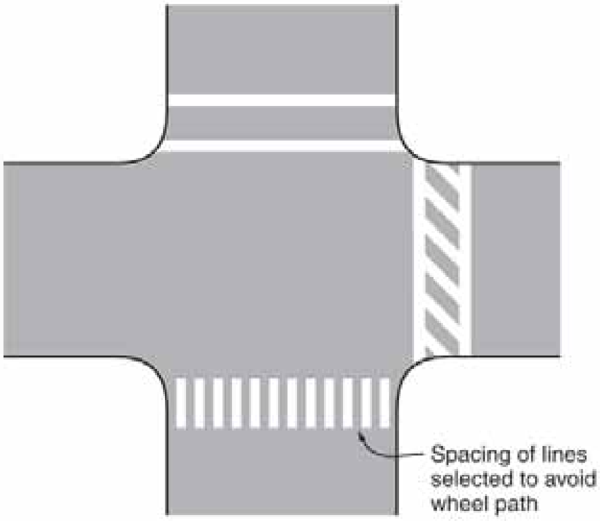


Figure 70 - Example of Crosswalk Markings. There several different options for striping crosswalks. Lateral and diagonal striping are higher-visibility and usually preferred to the two parallel stripes. Image source: Manual on Uniform Traffic Control Devices (Figure 3B-19).

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.

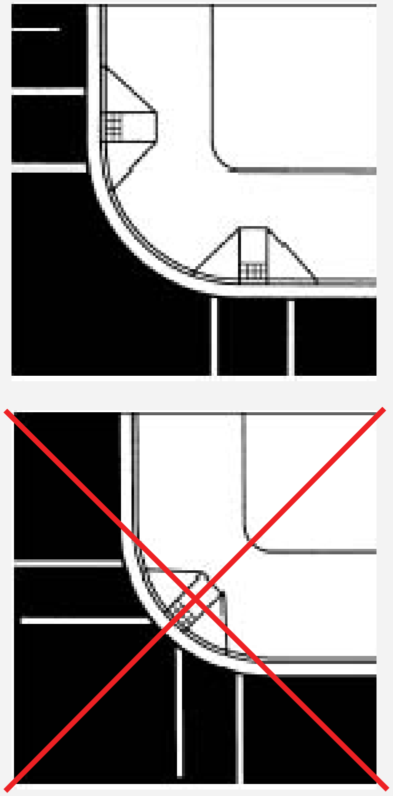


Figure 72 - Curb Ramp Design. The design above is preferred with two curb ramps that align directly with the crosswalks. The bottom image design is undesirable, as it does not align with the crosswalks. Image source: Federal Highway Administration

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.

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 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 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 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.

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.

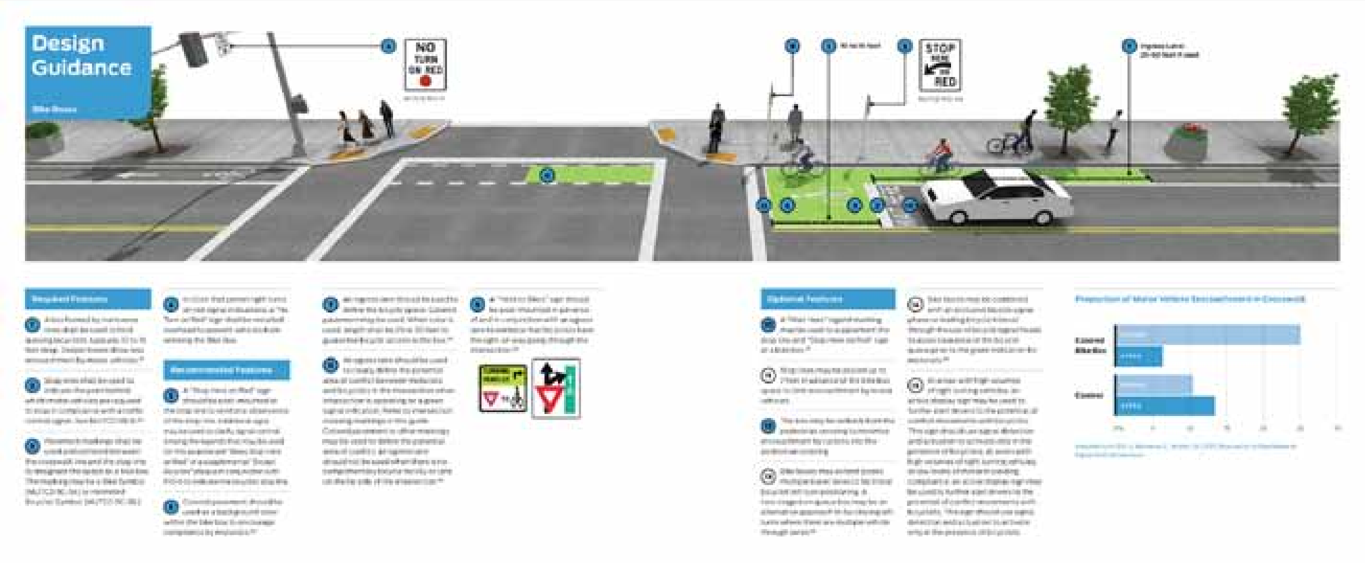
Bike Boxes

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.



Design Guidance

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.

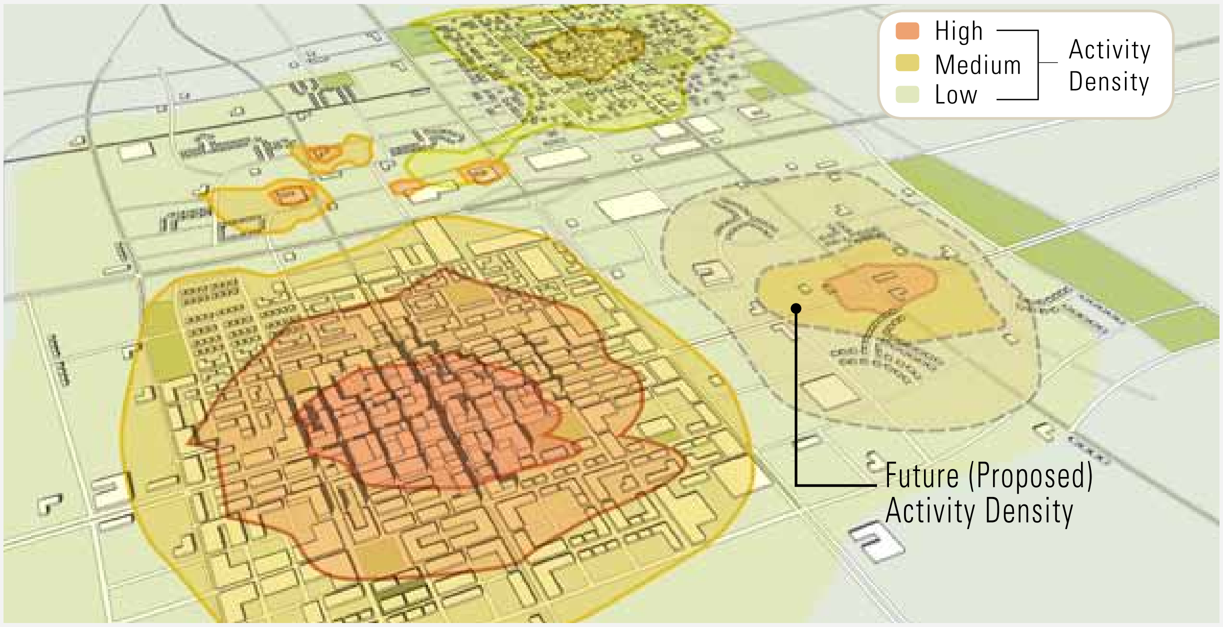


Figure 83 - Analysis of Activity Density in the Region. Activity Density is the sum of jobs and population divided by the acreage.

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.

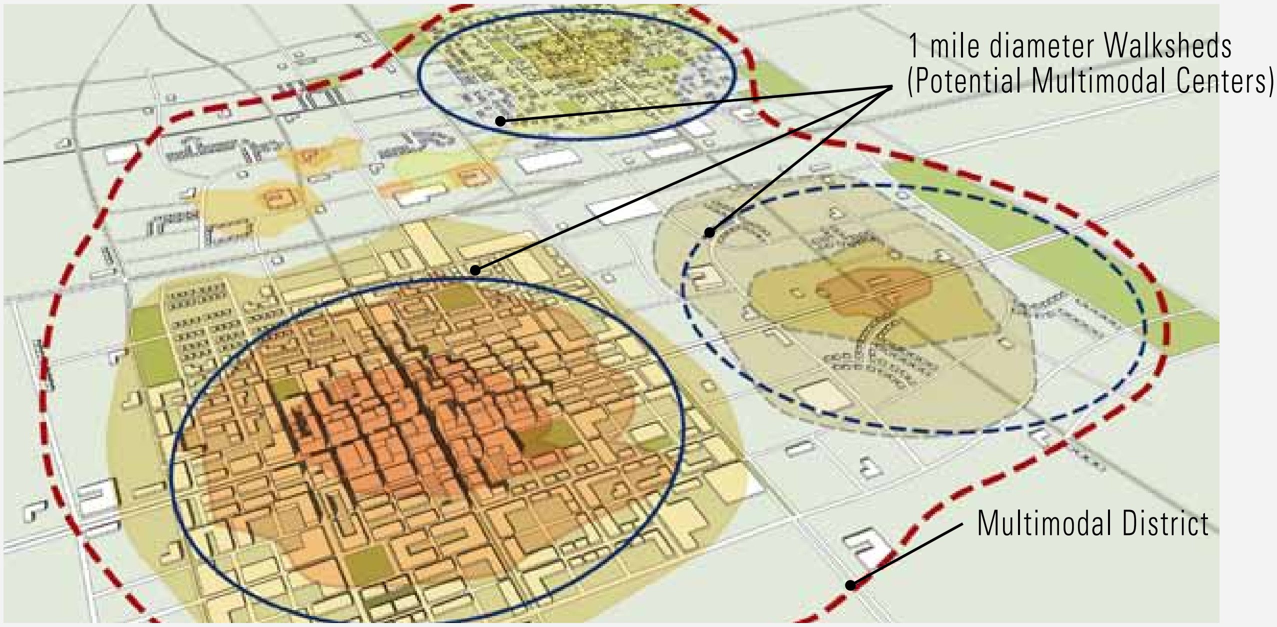


Figure 84 - Potential Multimodal District and Potential Multimodal Centers. Based on the regional Activity Density.

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.

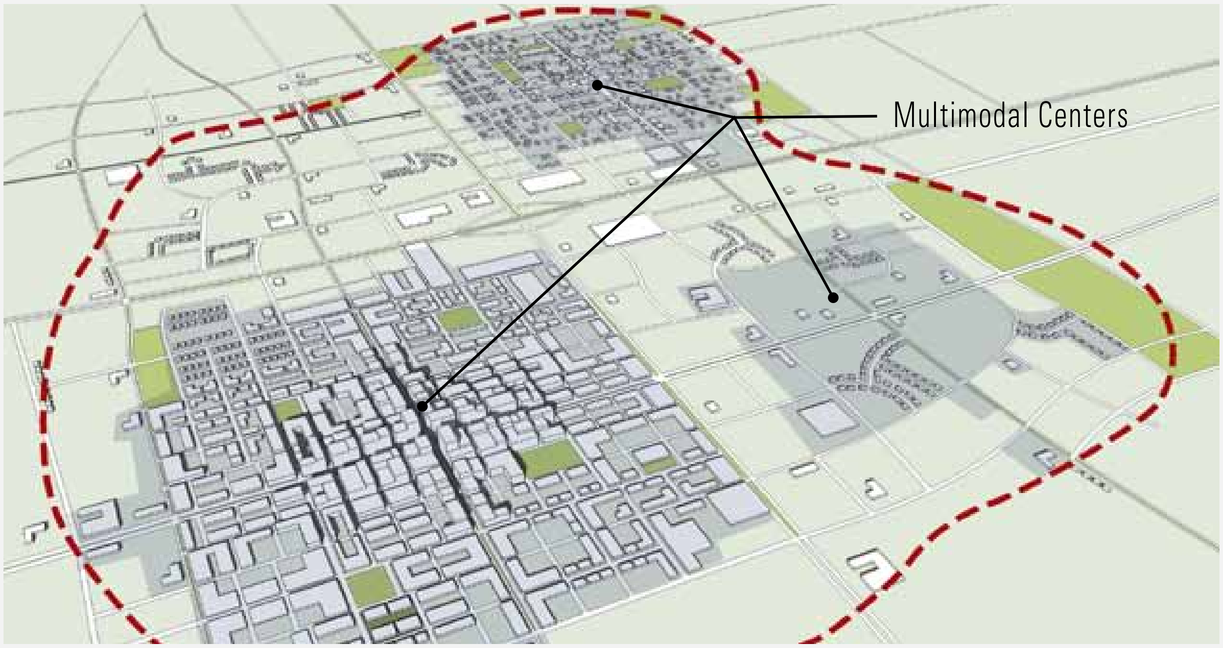


Figure 85 - Multimodal District and Multimodal Centers. Multimodal Center boundaries have been modified to fit with actual conditions.

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.

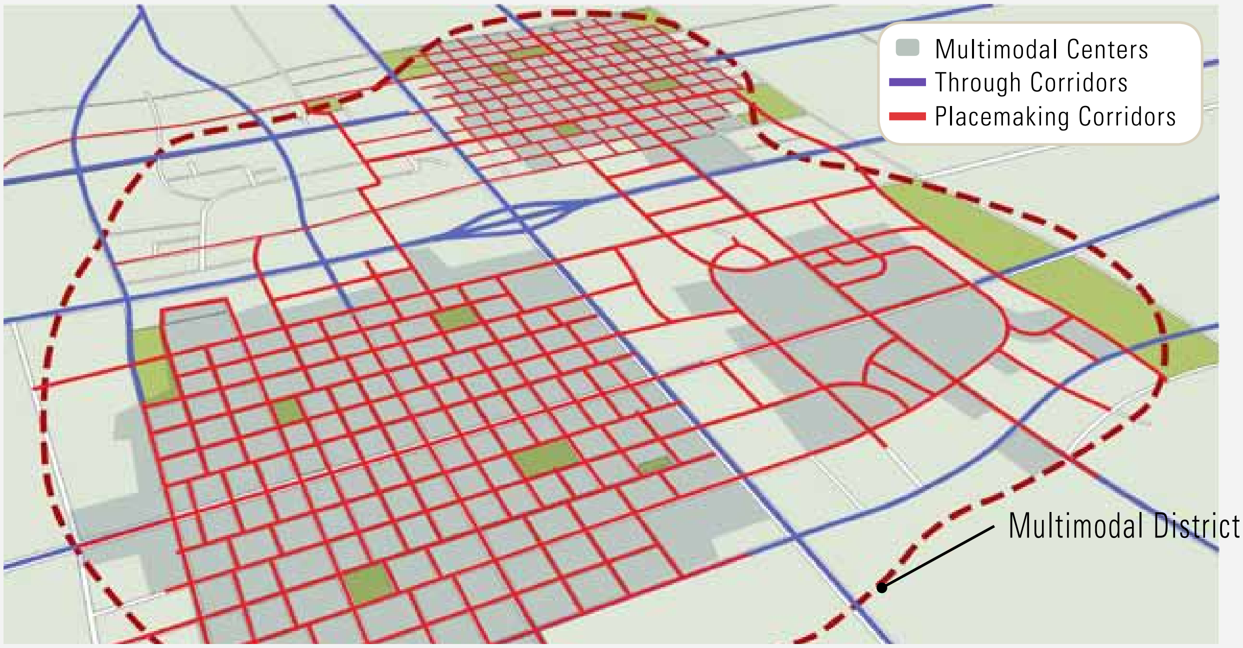


Figure 86 - Multimodal Through Corridors and Placemaking Corridors. Showing a logical network of corridors in the region for getting “through” and “to” Multimodal Districts and Centers.

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.

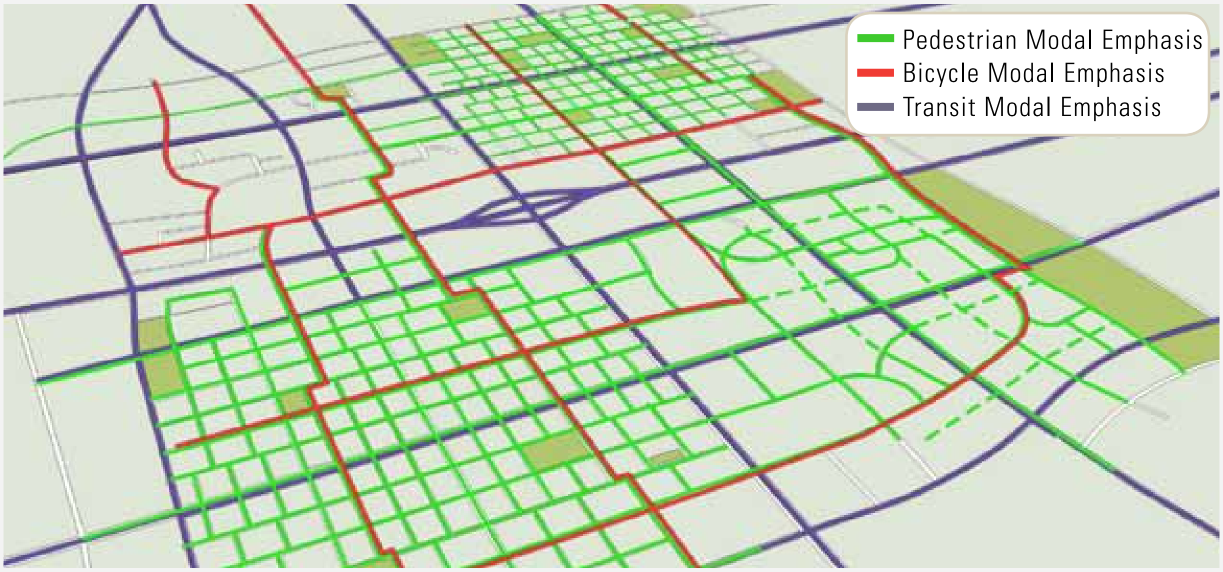


Figure 87 - Using Modal Emphasis to Designate the Emphasized Travel Modes on Each Corridor.

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.

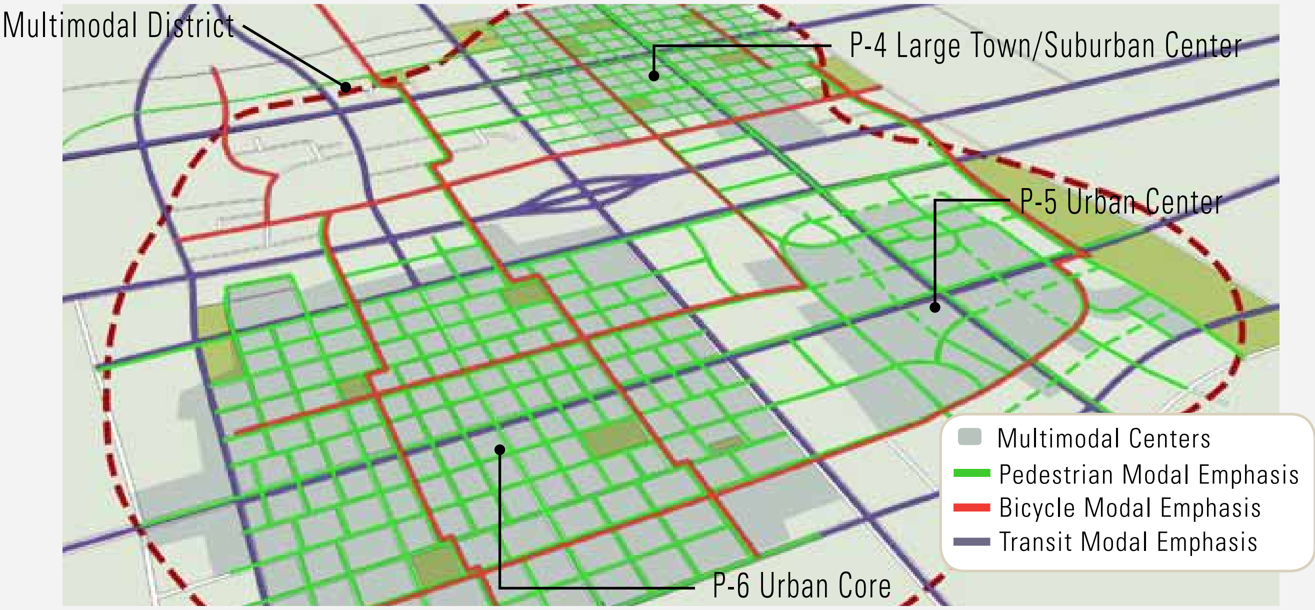


Figure 88 - Complete Multimodal System Plan for the Region.

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.

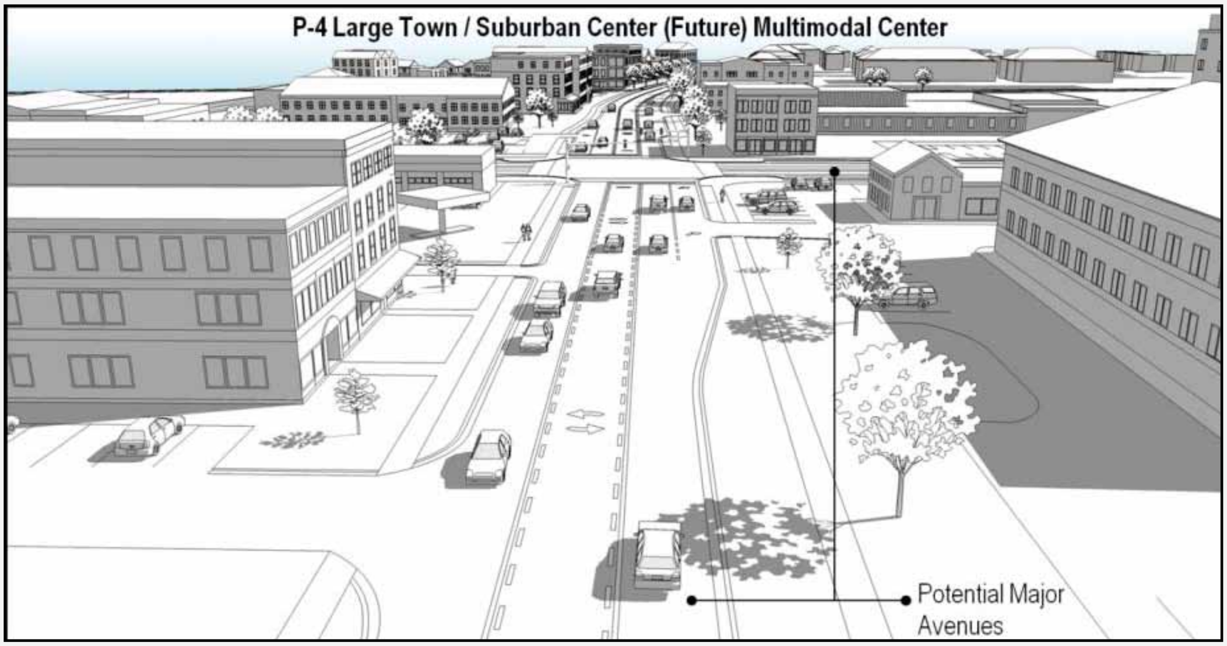


Figure 89 – A View Zooming into the Main Intersection of the P-4 Center.

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.

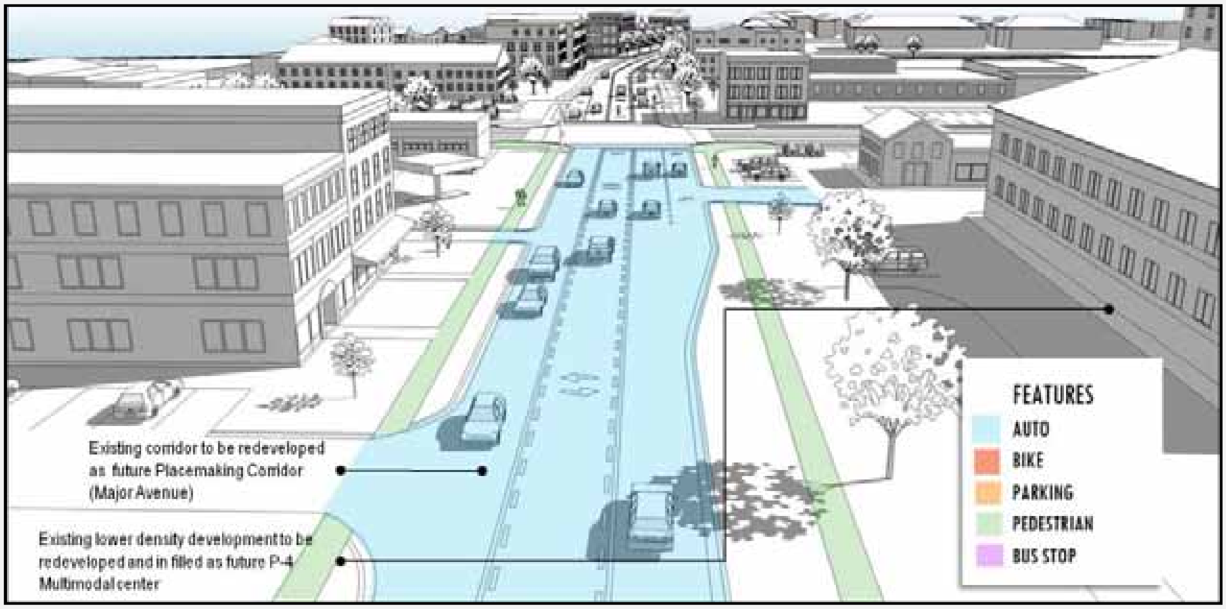


Figure 90 – P-4 Multimodal Center Main Intersection. "Before" Image. Existing conditions in this P-4 Multimodal Center include lower density development and non-multimodal corridors.

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.

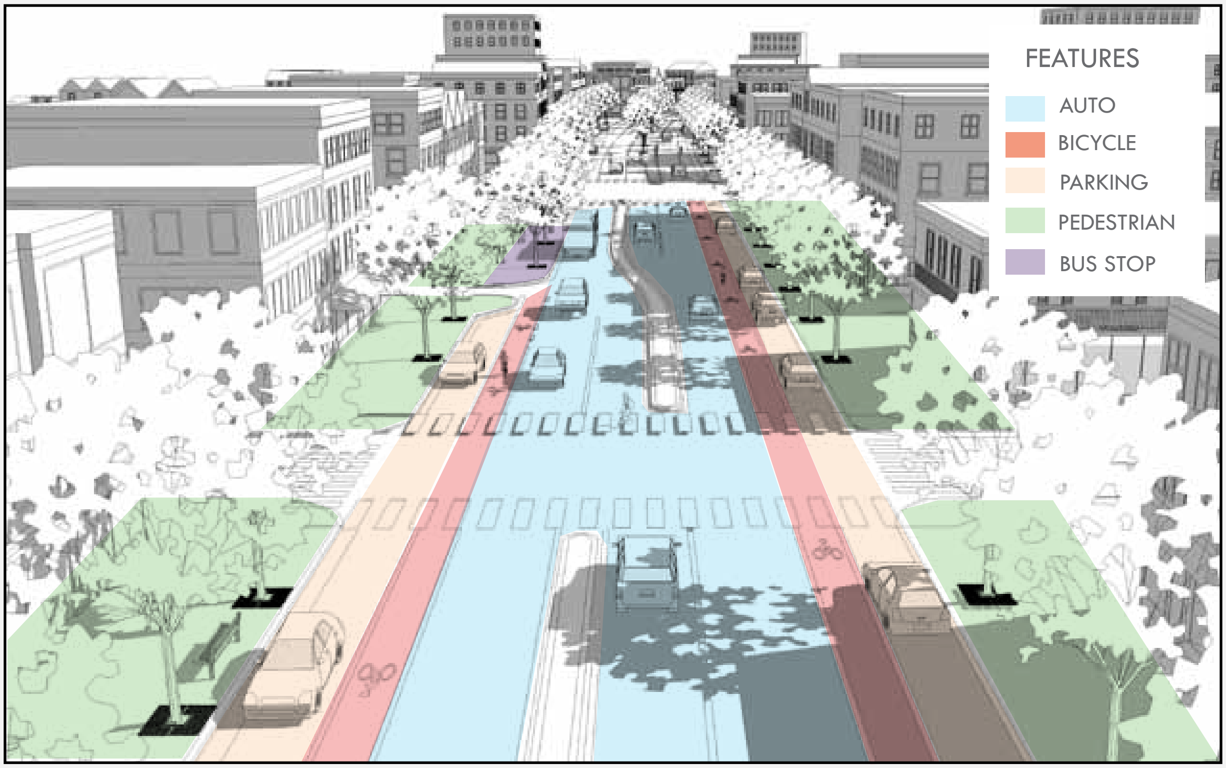


Figure 91 – P-4 Multimodal Center Main Intersection “After” Image. The area gradually evolves into a true Multimodal Center.

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.

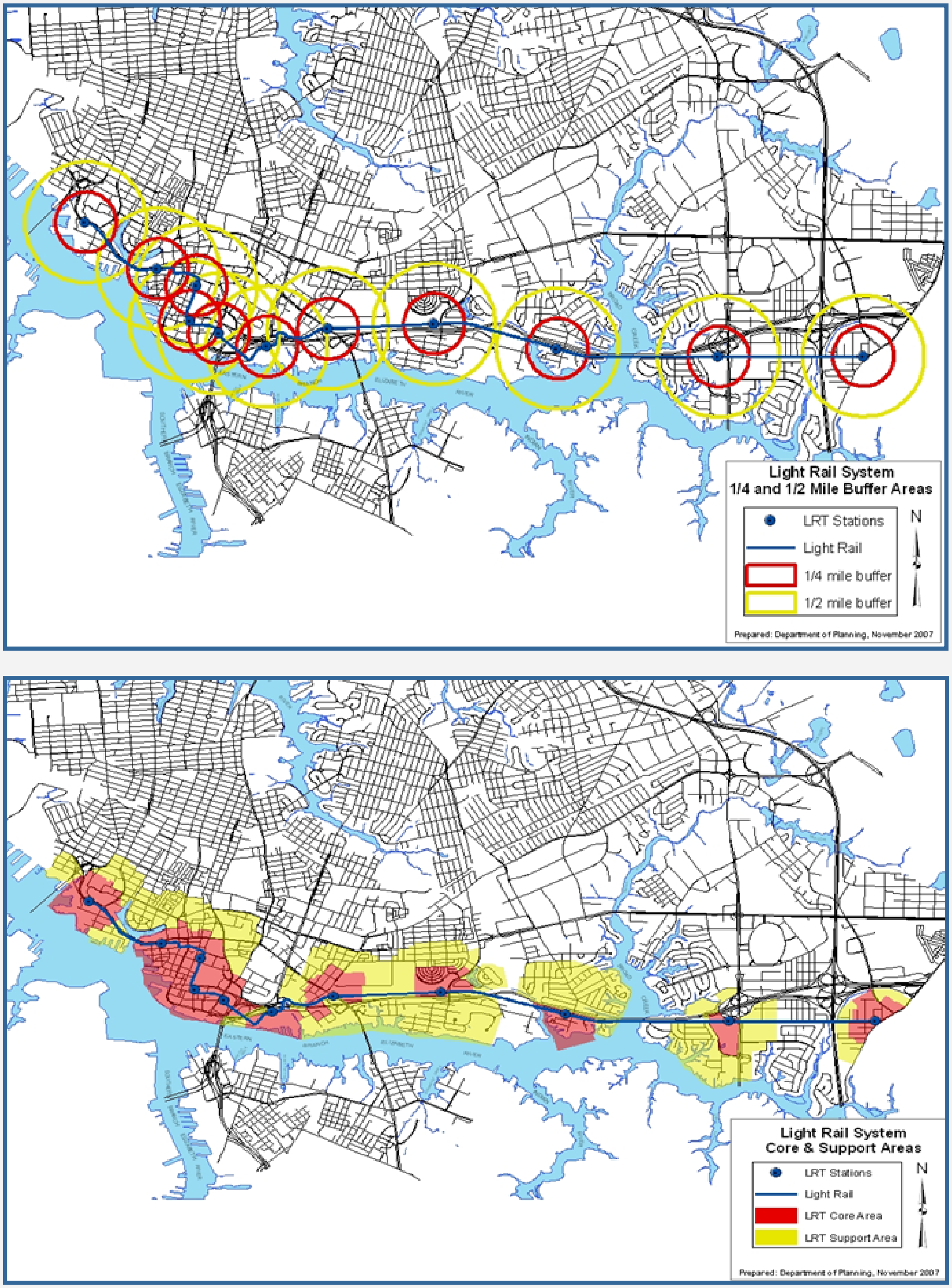


Figure 92 – City of Norfolk Tide Light Rail Station Areas. In planning for light rail stations, the City of Norfolk translated idealized quarter-mile and half-mile circles into parcel-level geometries that together are analogous to modifying the one-mile circles for Multimodal Centers for on the ground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

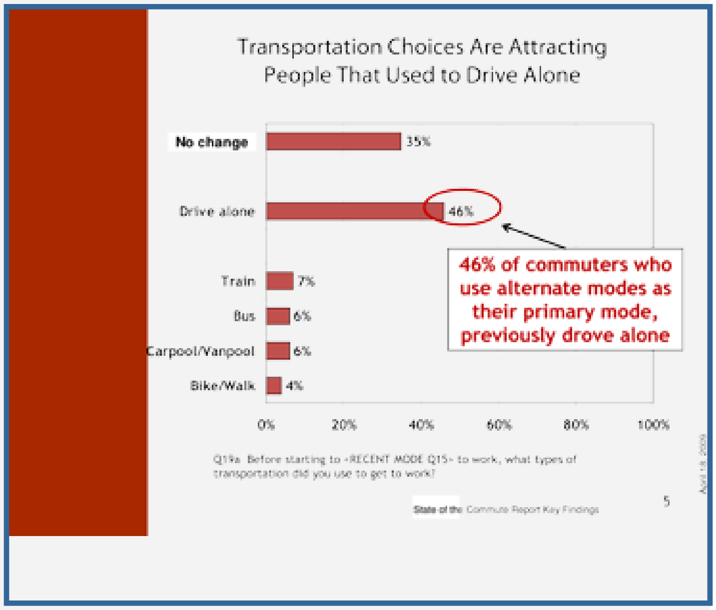


Figure 96 – State of the Commute Survey Results. Virginians value having travel choices regardless of where they live and work, and what mode they currently take. Data strongly indicates that Virginians are choosing alternatives to driving alone when choices are available.

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.

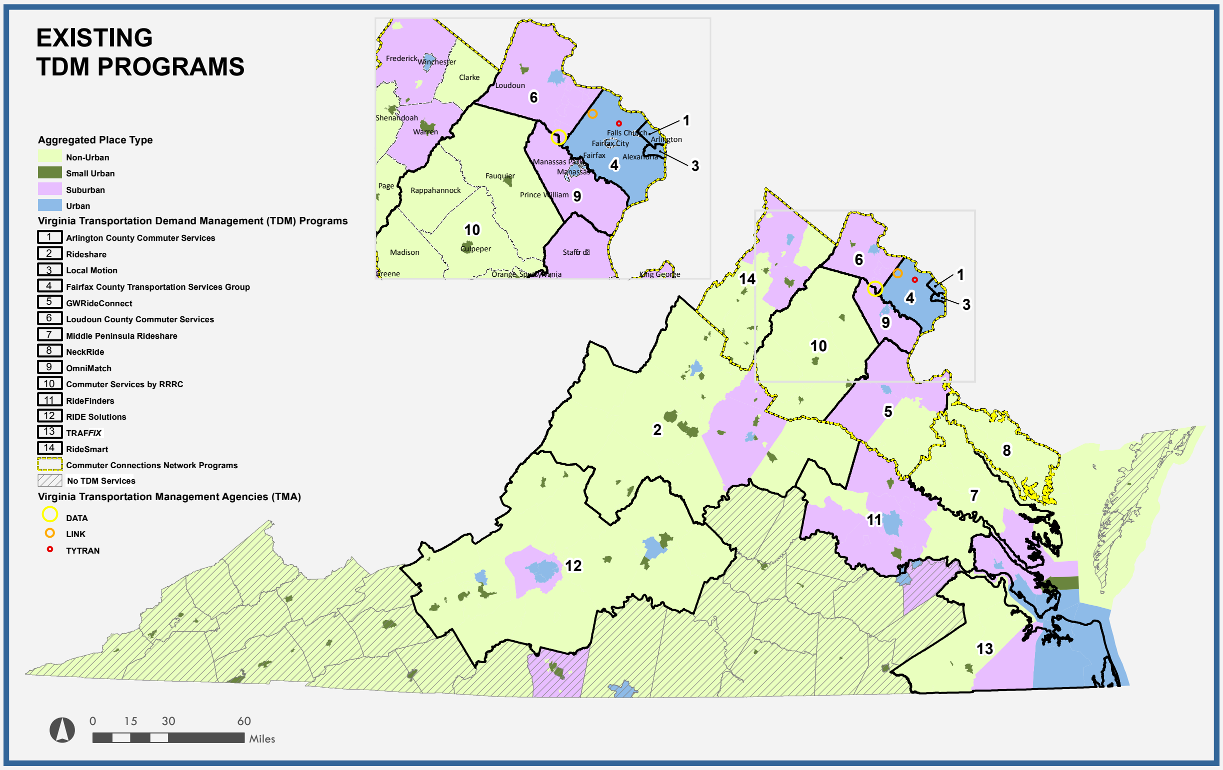


Figure 97 - TDM Agencies and TMAs in Virginia. Local commuter assistance programs are available for most northern, central and eastern Virginia residents. TDM gaps exist in southwest and south-central Virginia. This gap analysis was conducted as part of the Statewide Transit &and TDM Plan Update effort.

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%)

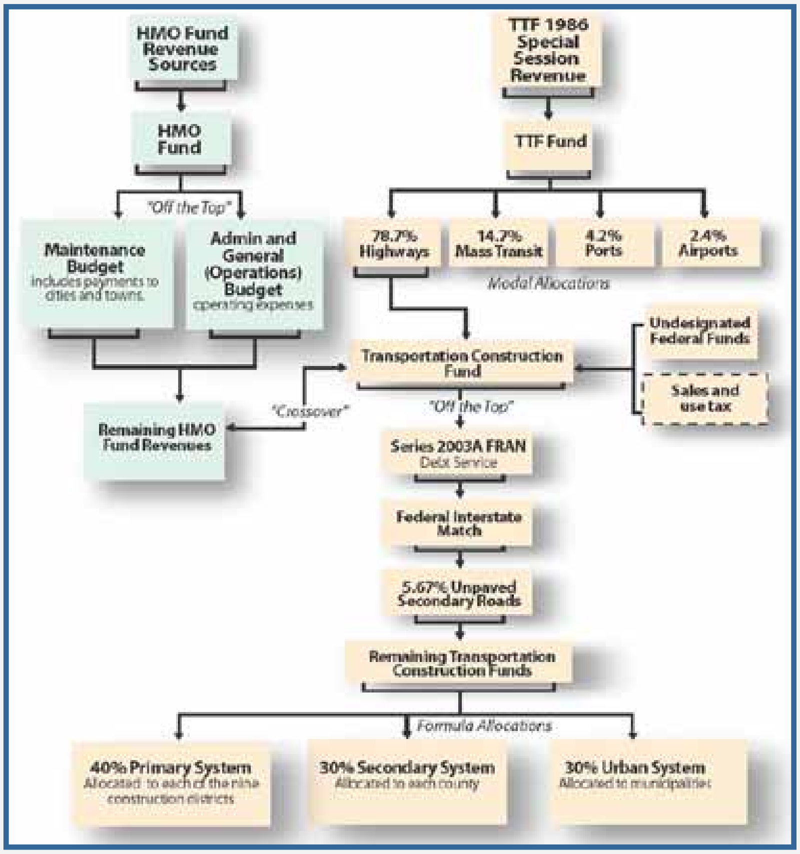


Figure 98 - Allocation of Transportation Funds in Virginia.

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.

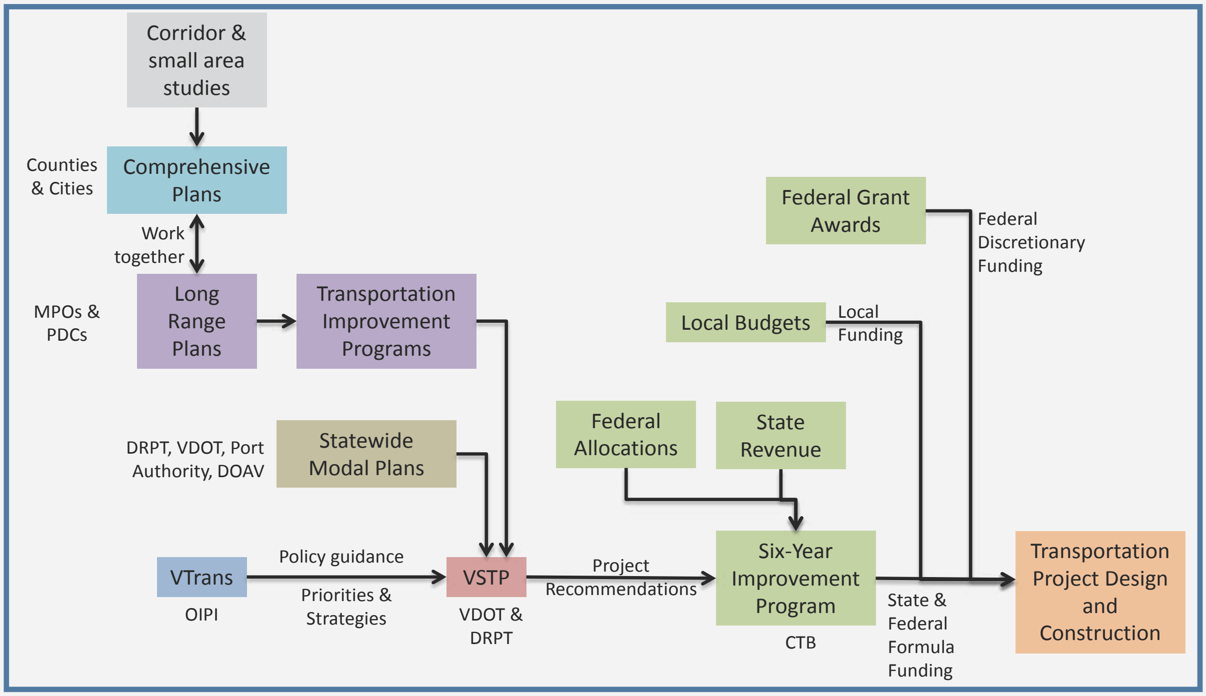


Figure 99 - Transportation Planning in Virginia Diagram.

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.

APPENDIX A.

CORRIDOR MATRIX

The following Appendix contains the Corridor Matrix. The original matrix is in a spreadsheet format and is laid out in single sheet format by Multimodal Corridor type in the following pages.

CORRIDOR MATRIX

Corridor Element Key	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.

Corridor Element Key ⇩		CORRIDOR MATRIX									
	Corridor Type ⇨	**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	18 ft(3)	6 ft(3)	18 ft(3)	6 ft(3)	18 ft(3)	6 ft(3)	18 ft(3)	6 ft(3)	18 ft(3)	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.

CORRIDOR MATRIX

Corridor Element Key ⇩	Corridor Type ⇨	Major Avenue											
	Intensity ⇨	T-6		T-5		T-4		T-3		T-2		T-1	
	Context Zones & Corridor Elements ⇩	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM
	Building Context Zone												
A	BUILDING FRONTAGE ELEMENT	7 ft	3 ft	7 ft	3 ft	7 ft	2.5 ft	7 ft	2.5 ft	12 ft	2 ft	12 ft	2 ft
	Location of off street parking	rear	rear	rear	rear	rear	side	rear	side	rear	side	rear	side
	Typical building entry locations	front	front	front	front	front	front	front	side	front	side	front	side
	Roadway Edge Zone												
B	SIDEWALK THROUGH ELEMENT	9 ft	6 ft	9 ft	6 ft	6 ft	6 ft	6 ft	6 ft	6 ft	5 ft	6 ft	5 ft
C	AMENITY ELEMENT	7 ft	6 ft	7 ft	6 ft	7 ft	6 ft	7 ft	6 ft	9 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		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	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	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)	12 ft(2)	11 ft(2)
	Design Speed	30 - 35 mph		30 - 35 mph		30 - 35 mph		30 - 35 mph		30 - 35 mph		30 - 35 mph	
	Number of Through Lanes	2 to 4		2 to 4		2 to 4		2 to 4		2 to 4		2 to 4	
	Typical Traffic Volume Range (vehicles per day)	10,000 to 30,000		8,000 to 25,000		5,000 to 25,000		5,000 to 20,000		2,000 to 10,000		2,000 to 10,000	
G	MEDIAN ELEMENT	18 ft(3)	None	18 ft(3)	None	18 ft(3)	None	18 ft(3)	None	18 ft(3)	None	18 ft(3)	None

(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.

CORRIDOR MATRIX

Corridor Element Key	Corridor Type	Avenue											
	Intensity	T-6		T-5		T-4		T-3		T-2		T-1	
	Context Zones & Corridor Elements	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM
	Building Context Zone												
A	BUILDING FRONTAGE ELEMENT	8 ft	2.5 ft	8 ft	2.5 ft	8 ft	2.5 ft	10 ft	1.5 ft	15 ft	1.5 ft	15 ft	1.5 ft
	Location of off street parking	rear	rear	rear	rear	rear	side	rear	side	rear	side	rear	side
	Typical building entry locations	front	front	front	front	front	front	front	side	front	side	front	side
	Roadway Edge Zone												
B	SIDEWALK THROUGH ELEMENT	8 ft	5 ft	7 ft	5 ft	6 ft	5 ft	6 ft	5 ft	6 ft	5 ft	6 ft	5 ft
C	AMENITY ELEMENT	7 ft	6 ft	7 ft	6 ft	7 ft	6 ft	7 ft	6 ft	8 ft	6 ft	7 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		Grassy strip with trees	
	Roadway Zone												
D	PARKING ELEMENT	8 ft both sides	None	8 ft both sides	None	8 ft both sides	None	7 ft both sides	None	7 ft both sides	None	7 ft both sides	None
E	BICYCLE ELEMENT	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	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)	12 ft(2)	11 ft(2)
	Design Speed	25-30 mph		25-30 mph		25-30 mph		25-30 mph		25-30 mph		25-30 mph	
	Number of Through Lanes	2 to 4		2 to 4		2 to 4		2 to 4		2 to 4		2 to 4	
	Typical Traffic Volume Range (vehicles per day)	2,000 to 20,000		2,000 to 15,000		1,500 to 10,000		1,000 to 10,000		1,000 to 5,000		1,000 to 5,000	
G	MEDIAN ELEMENT	18 ft(3)	None	18 ft(3)	None	18 ft(3)	None	18 ft(3)	None	18 ft(3)	None	18 ft(3)	None

(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.

CORRIDOR MATRIX

Corridor Element Key ⇩													
	Corridor Type ⇨	**Local Street**											
	Intensity ⇨	**T-6**		**T-5**		**T-4**		**T-3**		**T-2**		**T-1**	
	Context Zones & Corridor Elements ⇩	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM
	Building Context Zone												
A	BUILDING FRONTAGE ELEMENT	8 ft	2.5 ft	8 ft	2.5 ft	8 ft	2.5 ft	15 ft	1.5 ft	20 ft	1.5 ft	30 ft	1.5 ft
	Location of off street parking	rear	rear	rear	rear	rear	rear	rear	side	rear	side	rear	side
	Typical building entry locations	front	front	front	front	front	front	front	side	front	side	front	side
	Roadway Edge Zone												
B	SIDEWALK THROUGH ELEMENT	6 ft	5 ft	6 ft	5 ft	6 ft	5 ft	6 ft	5 ft	5 ft	5 ft	5 ft	5 ft
C	AMENITY ELEMENT	7 ft	6 ft	7 ft	6 ft	7 ft	6 ft	7 ft	6 ft	6 ft	6 ft	6 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		Grassy strip with trees	
	Roadway Zone												
D	PARKING ELEMENT	7 ft both sides	None	7 ft both sides	None	7 ft both sides	None	7 ft both sides	None	7 ft both sides	None	7 ft both sides	None
E	BICYCLE ELEMENT	Shared lane markings or bicycle boulevard features	Unmarked shared lane (no additional lane width)	Shared lane markings or bicycle boulevard features	Unmarked shared lane (no additional lane width)	Shared lane markings or bicycle boulevard features	Unmarked shared lane (no additional lane width)	Bicycle Boulevard features (see AASHTO & NACTO)	Unmarked shared lane (no additional lane width)	Bicycle Boulevard features (see AASHTO & NACTO)	Unmarked shared lane (no additional lane width)	Bicycle Boulevard features (see AASHTO & NACTO)	Unmarked shared lane (no additional lane width)
F	TRAVEL LANE ELEMENT	11 ft(1)	10 ft(1)	11 ft(1)	10 ft(1)	11 ft(1)	10 ft(1)	11 ft(1)	10 ft(1)	11 ft(1)	10 ft(1)	11 ft(1)	10 ft(1)
	Design Speed	25 mph		25 mph		25 mph		25 mph		25 mph		25 mph	
	Number of Through Lanes	2 to 4		2 to 4		2		2		2		2	
	Typical Traffic Volume Range (vehicles per day)	less than 10,000		less than 10,000		less than 8,000		less than 5,000		less than 2,000		less than 2,000	
G	MEDIAN ELEMENT	None	None	None	None	None	None	None	None	None	None	None	None

(1)Travel lane width does not include the shy distance and curb or curb and gutter pan.

Corridor Element Key ⇩		CORRIDOR MATRIX											
	Corridor Type ⇨	**Multimodal Through Corridor**											
	Intensity ⇨	**T-6**		**T-5**		**T-4**		**T-3**		**T-2**		**T-1**	
	Context Zones & Corridor Elements ⇩	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM
	Building Context Zone												
A	BUILDING FRONTAGE ELEMENT	15 to 25 ft	10 ft	15 to 25 ft	10 ft	20 to 35 ft	15 ft	25 to 35 ft	15 ft	30 to 45 ft	20 ft	30 to 45 ft	20 ft
	Location of off street parking	rear	front	rear	front	rear	front	rear	front	rear	front	rear	front
	Typical building entry locations	front/side	rear	front/side	rear	front/side	rear	front/side	rear	front/side	rear	front/side	rear
	Roadway Edge Zone												
B	SIDEWALK THROUGH ELEMENT	14 ft shared use path	5 ft sidewalk	14 ft shared use path	5 ft sidewalk	12 ft shared use path	5 ft sidewalk	12 ft shared use path	5 ft sidewalk	10 ft shared use path	5 ft sidewalk	10 ft shared use path	5 ft sidewalk
C	AMENITY ELEMENT	A minimum of 8 feet width is necessary between the face of the curb and the edge of the shared use path. Physical barriers, such as dense shrubbery, railings, or fencing may be placed between travel lanes and shared use path.								Shoulder and drainage ditch recommended instead of curb and gutter. Width between travel lanes and shared use path varies depending on speed. 20 to 28 ft for 60 mph design speed. 14 to 22 ft for 50 mph design speed.			
	Surface Treatment for Amenity Element												
	Roadway Zone												
D	PARKING ELEMENT	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited	On Street Parking Prohibited
E	BICYCLE ELEMENT	14 ft shared use path	14 ft wide curb lane with shared lane markings	14 ft shared use path	14 ft wide curb lane with shared lane markings	12 ft shared use path	14 ft wide curb lane with shared lane markings	12 ft shared use path	14 ft wide curb lane with shared lane markings	10 ft shared use path	6 ft paved shoulder or 15 ft wide curb lane with shared lane markings	10 ft shared use path	6 ft paved shoulder or 15 ft wide curb lane with shared lane markings
F	TRAVEL LANE ELEMENT	12 ft(1)	11 ft(1)	12 ft(1)	11 ft(1)	12 ft(1)	11 ft(1)	12 ft(1)	11 ft(1)	12 ft(1)	12 ft(1)	12 ft(1)	12 ft(1)
	Design Speed	35 - 45 mph		35 - 45 mph		35 - 45 mph		35 - 55 mph		45 - 55 mph		45 - 55 mph	
	Number of Through Lanes	4 to 6		4 to 6		4 to 6		2 to 4		2 to 4		2 to 4	
	Typical Traffic Volume Range (vehicles per day)	20,000 to 60,000		20,000 to 50,000		15,000 to 40,000		10,000 to 30,000		5,000 to 20,000		2,000 to 20,000	
G	MEDIAN ELEMENT	18 ft(2),(3)	17 Ft(2),(3)	18 ft(2),(3)	17 Ft(2),(3)	18 ft(2),(3)	17 Ft(2),(3)	18 ft(2),(3)	None	40 ft(3)	None	40 ft(3)	None

(1) Travel lane width does not include the shy distance and curb or curb and gutter pan.

(2) 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.

(3) Median width does not include accommodation for transit in the median. If transit runs in the median, the width will vary based upon detailed design.

APPENDIX B.

CORRIDOR MATRIX ANNOTATION DOCUMENT

The following Appendix contains the Corridor Matrix Annotation Document. This is an accompanying document to the Corridor Matrix and explains the sources, justification, and additional considerations for each of the recommended standards in the Corridor Matrix.

CORRIDOR MATRIX ANNOTATION DOCUMENT

This Corridor Matrix Annotation Document is an accompanying document to the Corridor Matrix and gives additional information on the sources, rationale, and additional considerations for each of the recommended standards in the Corridor Matrix. This document starts with a narrative explaining the overall approach to Multimodal Corridor design that is recommended in these Guidelines. Although some of this repeats information in Chapter 5 of the Guidelines, it is included in this document for ease of reference.

Places are defined in large part by the character and scale of the streets that traverse them. The Multimodal Corridor types are organized according to a composite of features that include their scale, capacity, function and context zone, characteristics. All of these are detailed in the Corridor Matrix. These features are customized to the Virginia context and correlated with the VDOT functional classification hierarchy, Access Management Standards, and Road Design Manual.

The Multimodal Corridor types used in these Guidelines are based on *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach* published by the Institute of Transportation Engineers (ITE) and the Congress for the New Urbansim (CNU). This ITE/CNU Guidebook defines thoroughfare types that correspond to the Transect Zones from CNU's *SmartCode* and to traditional functional classifications for roadways. This Corridor Matrix Annotation Document references specific pages and tables within the ITE/CNU Guidebook; readers will need a copy of the ITE/CNU Guidebook to refer to as a reference.

This Corridor Matrix Annotation Document serves as the detailed reference for the Corridor Matrix, which provides standards for each Multimodal Corridor type within each Transect Zone.

Corridor Matrix References and Resources

Road Design Manual

Virginia Department of Transportation

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 for road design, and is used in conjunction with publications from the American Association of State Highway and Transportation Officials (AASHTO).

All standards provided in the Corridor Matrix meet the minimum standards as specified in the VDOT Road Design Manual, ensuring that the multimodal recommendations from these Guidelines are consistent with the VDOT Road Design Manual for constructability.

This Annotation Document explains how each corridor standard meets or exceeds the specifications within the VDOT Road Design Manual.

Designing Walkable Urban Thoroughfares: A Context Sensitive Approach

Institute of Transportation Engineers and Congress for the New Urbanism

This ITE/CNU report provides guidance for the design of walkable urban thoroughfares in places that currently support the mode of walking or in places where the community desires to provide a more walkable thoroughfare in the future. It focuses primarily on arterials and collectors. This document is a key industry best practice for Context Sensitive Solutions (CSS) and walkable thoroughfare design. It includes many details related to corridor design and process. Application is generally limited to low speed urban arterials and collectors - streets that require tradeoffs between pedestrian and vehicle priority. Separate sections highlight various elements of the planning and design process.

The ITE/CNU Guidebook was used as a key resource in the development of the corridor standards in the Corridor Matrix. All of the recommended metrics in the ITE/CNU Guidebook meet VDOT standards; some exceed the VDOT Standards. Generally, where the ITE/CNU parameters exceed VDOT standards, the ITE/CNU parameters are used. For example, VDOT requires a minimum sidewalk width of five feet, whereas the ITE/CNU Guidebook recommends a minimum sidewalk width of six feet in commercial areas. The ITE/CNU parameters were incorporated as appropriate, as further explained in this Annotation Document.

General Corridor Types and Correlation

The Corridor Matrix specifies six different Multimodal Corridor types: Transit Boulevard, Boulevard, Major Avenue, Avenue, Local Street, and Multimodal Through Corridor. The six Multimodal Corridor types are further subdivided by Transect Zone. The 34 detailed Multimodal Corridor types are variations of the six basic Multimodal Corridor types described below. The first five basic Multimodal Corridor types are based primarily on the ITE/CNU typology, are located usually within Multimodal Centers, and are referred to as Placemaking Corridors. For this reason, the Multimodal Through Corridor is included as a sixth Multimodal Corridor type, and generally describes the corridors and segments of corridors outside Multimodal Centers.

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. This relationship is shown in **Figure B-1**.

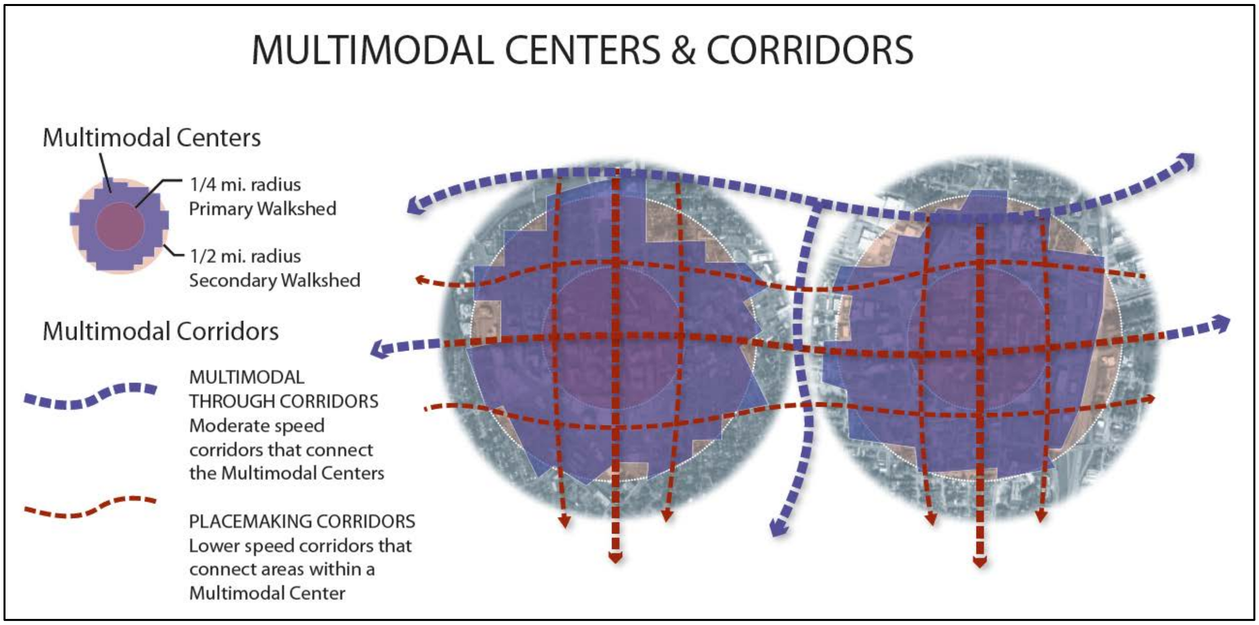


Figure B-1 – Multimodal Through and Placemaking Corridors. This diagram distinguishes Placemaking Corridors from Multimodal Through Corridors – the two general categories of multimodal corridors that together comprise a true multimodal transportation system in a region.

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 must 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.

Multimodal Corridor Types

Each Multimodal Corridor type has a unique function relative to access, mobility, and multimodal features; this is similar, but more detailed than the VDOT roadway functional classes. The six Multimodal Corridor types used in these Guidelines are listed and individually described below.

Through Corridors

- Multimodal Through Corridor

Placemaking Corridors

- Transit Boulevard
- Boulevard
- Major Avenue
- Avenue
- Local

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.

Placemaking Corridors

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.

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

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

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. Design speeds for Avenues range from 25 to 30 mph.

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.

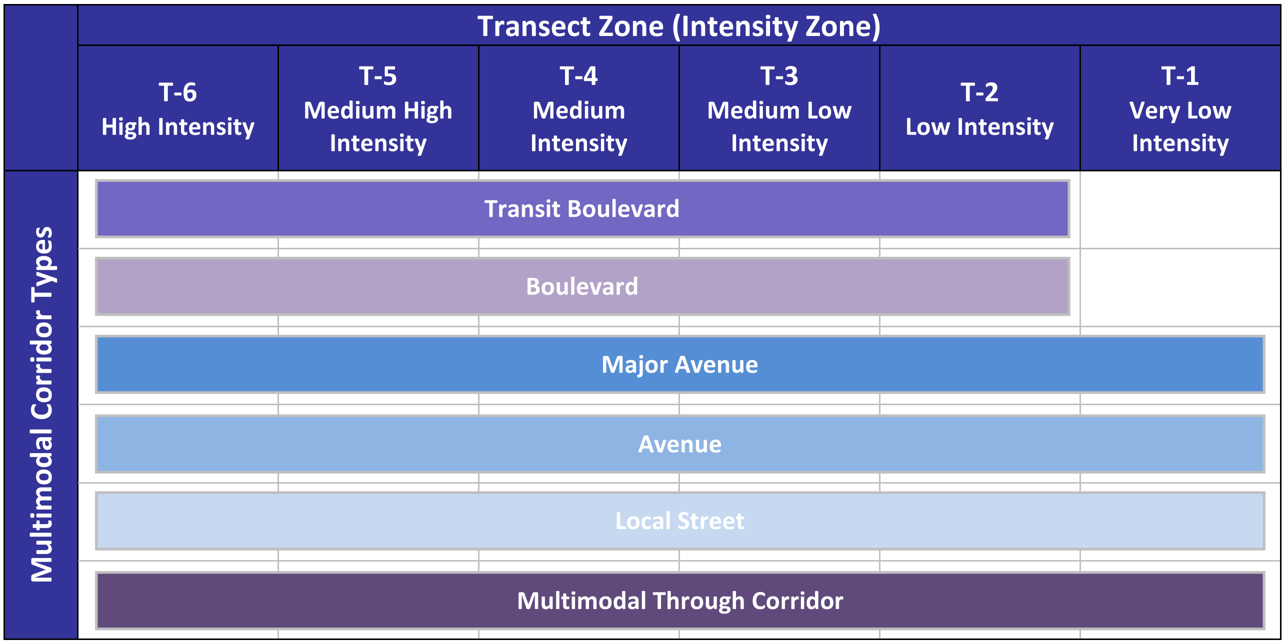
Corridor Intensity Zones

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 intensity levels ranging from T-1 to T-6. The intensity levels directly correspond to the Transect Zones.

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 B-1** specifies which of the Multimodal Corridor types exist within each Transect Zone.

Table B-1 – Multimodal Corridor Types and Transect Zones. Not all Multimodal Corridor types apply to all Transect Zones. Transit Boulevards and Boulevards only apply to the moderate and high intensity Transect Zones. Major Avenues, Avenues, Local Streets and Multimodal Through Corridors can be found in any of the Transect Zones.



<table>
<tr><th rowspan="2"></th><th colspan="6">Transect Zone (Intensity Zone)</th></tr>
<tr><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 Intensity</th></tr>
<tr><th rowspan="6">Multimodal Corridor Types</th><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>

Correlation to VDOT Functional Classes

The VDOT Transportation and Mobility Planning Division maintains an official functional classification system for all roads within the Commonwealth. A road's functional classification is determined by criteria including trip types, traffic volumes, system connections, and mileage percentage thresholds.[1]

VDOT classifies roads as either urban or rural based on whether they are located within an urbanized area. Urban roads are those roads located within an urbanized area or urban cluster; rural roads are those outside of urbanized areas and urban clusters.[2] Roads are further classified based on the ability to access land and the mobility through an area. Local facilities emphasize the land-access function.

---

[1] More information about VDOT's functional classification criteria and process can be found on VDOT's website at http://www.virginiadot.org/projects/fxn_class/home.asp.

[2] Urbanized areas are defined as areas designated by the U.S. Census Bureau having a population of 50,000 or more. Urban clusters are areas having a population of 5,000 or more and are not part of an urbanized area.

Arterials emphasize a high level of mobility for through traffic. Collectors offer a compromise between the two functions. **Figure B-2** shows the VDOT functional classification types as applied to the downtown area of Richmond.

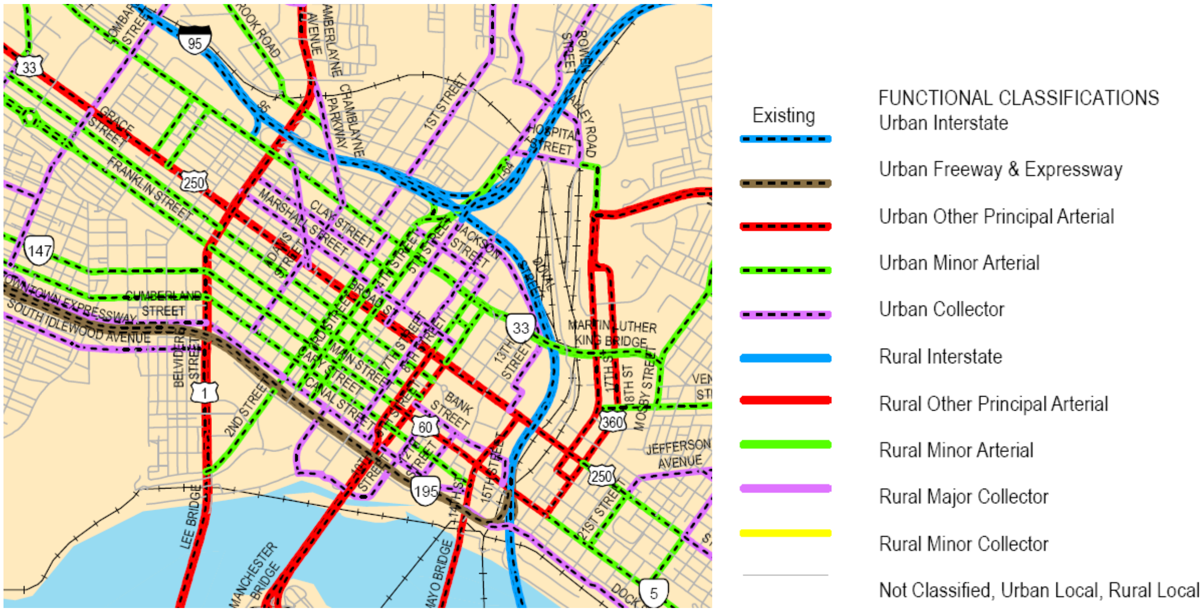


Figure B-2 – VDOT Functional Classification Example. This functional classification map of downtown Richmond illustrates that different roads are designated into different functional classes depending on the ability to provide mobility and access land. The functional classes work together as a system.

The Multimodal Corridor types within the Multimodal System Design Guidelines generally correlate to the VDOT functional classification types as illustrated in **Table B-2**.

Table B-2 – Correlation of Multimodal Corridor Types and VDOT Functional Classes. The Multimodal Corridor types are similar, but not identical to VDOT functional classes. Local planners will designate Multimodal Corridor types as part of the Multimodal System Plan, to establish each corridor's multimodal role in the overall region.

	VDOT Functional Classification				
	Freeway	Urban Principal Arterial	Urban Minor Arterial	Urban Collector	Local Street
Multimodal Corridor Types	Multimodal Through Corridor	Multimodal Through Corridor	Multimodal Through Corridor		
		Transit Boulevard	Transit Boulevard		
		Boulevard	Boulevard		
			Major Avenue	Major Avenue	
			Avenue	Avenue	Avenue
					Local Street

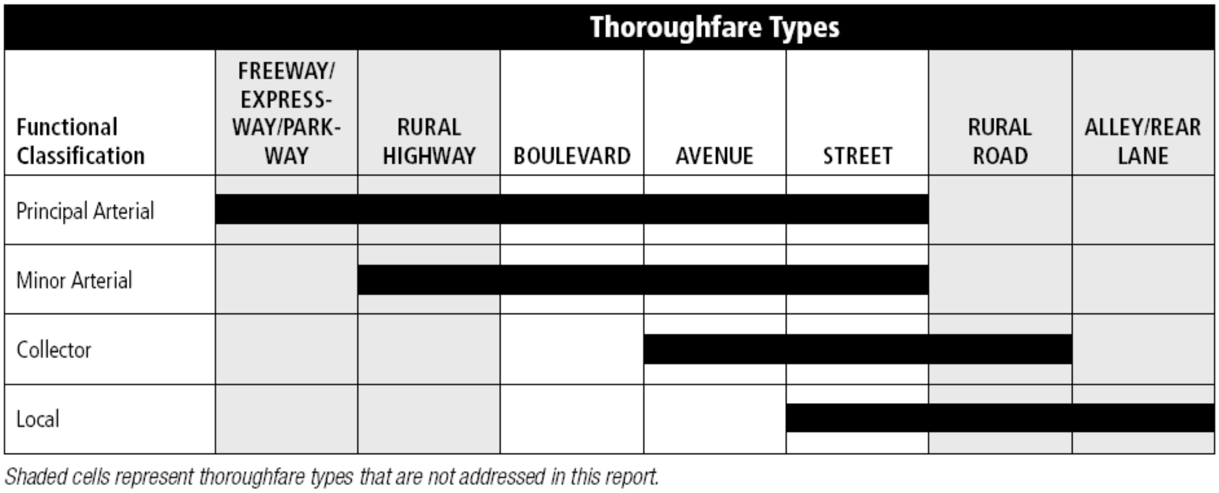
Each individual locality will determine the Multimodal Corridor type designation through the development of a Multimodal System Plan, a holistic multimodal planning process involving Multimodal Centers and Multimodal Districts as described in the Guidelines. As such, the Multimodal Corridor type correlation to the VDOT functional class is not a perfect one-to-one relationship.

VDOT uses functional classification for a variety of applications; the most relevant to the Multimodal System Design Guidelines is to determine road design and access management features. As mentioned previously, the recommended standards within the Corridor Matrix meet or exceed the VDOT Road Design standards for each corridor type and functional class.

Correlation to ITE/CNU Guidebook Corridor Types

The ITE/CNU Guidebook provides the foundation of thoroughfare types on which the Multimodal Corridor types in these Multimodal System Design Guidelines are based. These Guidelines expand upon and delve deeper into general thoroughfare typology established by ITE and CNU.

The ITE/CNU Guidebook establishes seven thoroughfare types, of which three are considered to be within walkable urban areas and thus are the focus of the ITE/CNU Guidebook. The following chart from the ITE/CNU Guidebook shows a similar relationship between thoroughfare type and functional classification, and highlights the three thoroughfare types applicable to the urban walkable thoroughfare concept (Boulevards, Avenues, and Streets).



	Thoroughfare Types						
Functional Classification	FREEWAY/ EXPRESS-WAY/PARK-WAY	RURAL HIGHWAY	BOULEVARD	AVENUE	STREET	RURAL ROAD	ALLEY/REAR LANE
Principal Arterial	■	■	■	■	■		
Minor Arterial		■	■	■	■		
Collector				■	■	■	
Local					■	■	■

Shaded cells represent thoroughfare types that are not addressed in this report.

Figure B-3 – ITE/CNU Thoroughfare Types & Relationship to Functional Class. The three walkable urban thoroughfare types in the ITE/CNU Guidebook are the foundational basis for the Multimodal Corridor types in these Multimodal System Design Guidelines. The Multimodal Corridor types in these Guidelines expand upon the corridor type concept to offer a more robust and flexible system for designing Multimodal Corridors. Image source: Institute of Transportation Engineers and Congress for the New Urbanism. *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach.*

The Multimodal Corridor types in these Multimodal System Design Guidelines are more expansive than the three focus thoroughfare types of the ITE/CNU Guidebook. The ITE/CNU Guidebook focuses only on medium to higher intensity context zones (Transect Zones T-3 and higher), and it specifies different parameters for areas with primarily commercial or primarily residential land uses. The Multimodal

System Design Guidelines provide a larger range of Multimodal Corridor types and applicable Transect Zones, as previously discussed in the Corridor Intensity Zones section.

All Multimodal Centers should ideally have a mix of residential and commercial uses. This mix of land uses is what makes multimodal transportation viable. Origins and destinations need to be within walking distance to support walking and bicycling as viable means of transportation, even if only for a small portion of trips within a rural place. It is this mix of uses that is a key feature of a Multimodal Center. Based on this assumption, the recommended metrics in the Corridor Matrix are not dependent upon the prevailing type of land use.

Places do not need to be urban or even moderately dense to have Multimodal Centers. The *closeness* of destinations, not the *number* of destinations, is what creates a Multimodal Center. Thus even in very low density rural places, Multimodal Centers can be identified. Walkability and bikability within these low density Multimodal Centers is still possible. The Corridor Matrix includes standards for Multimodal Corridors within a broad spectrum of Transect Zones, which are applicable to all Multimodal Centers, from Urban Cores to Rural Centers.

Recommended Corridor Metrics by Context Zone

The elements of corridor design are organized into three distinct Context Zones, each of which has a unique purpose and specific design considerations. **Figure B-4** illustrates the three distinct Context Zones for these Multimodal System Design Guidelines:

1. Building Context Zone
2. Roadway Edge Zone
3. Roadway Zone

The Roadway Zone describes the space between the edges of curb, or between the edges of pavement if curb and gutter is not present. Autos, buses, and bicycles move within the Roadway Zone, and it includes on-street parking. The Roadway Edge Zone includes space for pedestrian travel, and it includes amenities for pedestrians such as buffer space, lighting, bus shelters, benches, etc. Signage, utility poles, and other features will be located within the Roadway Edge Zone. The Building Context Zone generally describes the space between the pedestrian travel way (sidewalk or shared use path) and the buildings along the street.

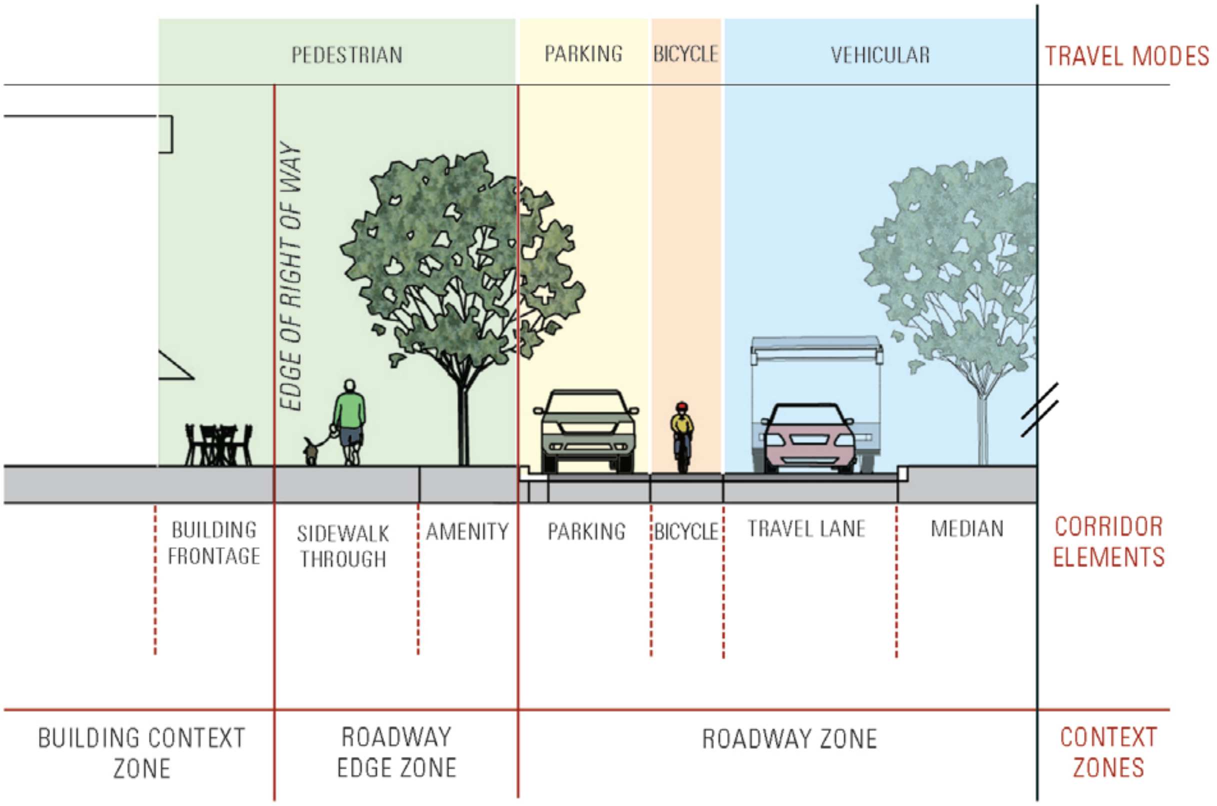


Figure B-4 – Multimodal Corridor Context Zones & Corridor Elements. The different Corridor Elements are organized into three Context Zones. Each Corridor Element can be optimized or minimized, depending on which travel modes are emphasized.

Building Context Zone

The Corridor Elements within the Building Context Zone affect how adjacent buildings 'interact' with pedestrians, bicyclists, and motorists. When this zone is small, pedestrians interact with the buildings more easily. Buildings that are closer to the sidewalk are simply easier to enter. Windows close to the sidewalk invite pedestrians to look in. Front lot parking can create conflicts between motorists who are parking and pedestrians who are entering the building or just walking by, and is therefore discouraged. This zone can include space for street activities like café tables, sidewalk sales, and other extensions of building activity. These activities should be kept within the Building Context Zone and should not encroach upon the space for the clear pedestrian travel way in the Roadway Edge Zone.

All of the elements in the Building Context Zone are usually outside of the roadway right-of-way. VDOT road design standards do not address these elements; local planners and site plan reviewers should review local ordinances for these metrics during development review. The building owner would generally be responsible for maintenance for these elements.

Table 6.4 on pages 70 to 71 in the ITE/CNU Guidebook guided the recommended metrics within the Building Context Zone portion of the Corridor Matrix. However, in some T-Zones, these setbacks were increased since the ITE/CNU standards are not clear on where the public right-of-way is located within the Building Context Zone.

A: Building Frontage Element

The Building Frontage Element is the typical width of the setback between the wall, porch, patio, or outdoor stairs of a building and the Sidewalk Through Element. Setbacks are typically specified in a locality's zoning ordinance with intention to fit within a desired streetscape design and sense of place. As such, the typical front building setbacks shown in the Corridor Matrix are simply advisory.

Generally buildings in more urban multimodal areas will have retail or other non-residential uses on the first floor. Minimal setbacks provide a sense of enclosure within the streetscape and are desirable to encourage street life. Large windows next to the sidewalk draw interest from pedestrians and maintain a sense of security with 'eyes on the street'. In less intense areas, larger setbacks are suitable, especially when residential uses are on the first floor. Generally, as explained in the Off-Street Parking Location section, parking should be located in the back of buildings, not between the right-of-way and the building.

VDOT & ITE/CNU Guidance

VDOT gives no guidance on building setback, as localities generally provide their own setback standards in the local zoning code. The ITE/CNU Guidebook provides maximum setbacks ranging from 0 feet to 20 feet, as shown in Table 6.4 on pages 70-71. These values do not include pedestrian lateral or shoulder clearance; that is the space needed between the edge of the clear pedestrian travelway and the edge of the building. Pedestrian lateral clearance should be a minimum of 18 inches when the edge of the building meets the sidewalk (pg. 123 in ITE/CNU). Pedestrian lateral clearance can be zero if the remaining setback includes lawn or groundcover between the sidewalk and the building edge. Twelve inches will suffice along low walls and fences and hedges; and 18 inches is necessary along facades and tall walls and fences. The ITE/CNU Guidebook includes the pedestrian lateral (shoulder) clearance in the frontage zone.

The ITE/CNU values for setbacks vary depending on whether the area is primarily commercial or primarily residential. Setbacks in commercial areas vary from 0 to 5 feet; in residential areas from 10 to 20 feet. These maximum setback values are exclusive of sidewalk frontage zone, which has a minimum of 18 inches for lateral or shoulder clearance. Table 8.1 on page 124 specifies frontage zone widths (where frontage zone is the recommended lateral or shoulder clearance) by transect. As previously mentioned, the ITE/CNU Guidebook is limited to Transect Zones T-3 and above. No guidance is provided for T-2 or T-1 zones.

Optimal Recommendations

The Building Frontage Element is most important for pedestrians; it is also beneficial for transit and for landscaping (such as for the 'Green' Modal Emphasis). Designers should use the optimal recommendations when a corridor has Pedestrian Modal Emphasis. If sufficient right-of-way exists, the optimal values for this element should also be used with Transit or Green Modal Emphasis, but not to the detriment of other Primary and Secondary Elements.

The optimal values used for the Building Frontage Element are slightly larger than the recommended values from ITE/CNU because the values in this Corridor Matrix include pedestrian lateral or shoulder clearance, and because the ITE/CNU standards are not clear on where the public right-of-way is located within the Building Context Zone. The recommended Corridor Matrix values for the Building Frontage Element represent the recommended pedestrian lateral clearance (frontage zone) plus the building setback. The minimum total setback is five feet to account for ease of construction. However, if existing buildings are built at the zero lot line, the setback for future construction should be continuous to keep a consistent line at which the building meets the sidewalk.

Minimum Recommendations & Potential Modifications

Corridors that do not have Pedestrian, Transit or Green Modal Emphasis may use the minimum recommendations for the Building Frontage Element.

In general, setbacks within the primary walk-shed (e.g. T-6 in a P-6) would be smaller than setbacks in the secondary walk-shed (e.g. T-5 in a P-6). The setback metrics may be taken as relative values. Designers may increase setbacks in secondary walk-sheds or decrease setbacks in primary walk-sheds. These values may also be modified depending on local ordinances.

Additionally, communities may wish to increase setbacks particularly in the more intense Transect Zones to allow space for café tables, retail sidewalk sale clearance racks, and other streetside items.

Location of Off-Street Parking

Generally off-street parking should be located behind or beside buildings. Building facades that open directly onto the sidewalk without parking in front are more inviting to pedestrians and have more aesthetic quality. Parking spaces in front of buildings create conflicts between pedestrians and parking vehicles, and require curb cuts which are dangerous for on-road bicyclists.

VDOT & ITE/CNU Guidance

The ITE/CNU Guidebook recommends rear parking for all walkable urban thoroughfares, and allows side parking for slower streets and in less intense areas. Front parking is not recommended.

Optimal Recommendations

The Corridor Matrix recommends rear parking for all street types, including Multimodal Through Corridors. Side parking is appropriate for all Local Streets and for Major Avenues and Avenues in T-Zones T-1 through T-4. Front parking is discouraged in all circumstances.

Minimum Recommendations & Potential Modifications

Rear parking is preferable to side parking in all areas. Front parking is discouraged in all circumstances.

Typical Building Entry Locations

Buildings with front doors that face the street create a better environment for pedestrians.

VDOT & ITE/CNU Guidance

The ITE/CNU guidebook recommends front access for all walkable urban thoroughfares, and allows side access for slower streets and in less intense areas.

Optimal Recommendations

The Corridor Matrix recommends front entry for all Multimodal Corridor types, including Multimodal Through Corridors. Side entry is appropriate for all Local Streets and for Major Avenues and Avenues in T-Zones T-1 through T-4. This is consistent with the recommendations for off-street parking location.

Minimum Recommendations & Potential Modifications

Front entry is preferable to side entry in all areas. Rear entry may be convenient for automobiles when parking is in the back and may be provided as a secondary entrance location. The main entry point should be along the street in front of the building.

Roadway Edge Zone

The Roadway Edge Zone describes the space between the travelway of on-road vehicles and the Building Context Zone, see **Figure B-4** shown previously on page B-10. This space is generally designed to maximize pedestrian safety and comfort. It includes the pedestrian travelway (Sidewalk Through Element) and space for streetside amenities like benches, trashcans, and newspaper boxes (Amenity Element). It also includes space where lighting fixtures and signs are placed, and provides buffer space between traveling vehicles and streetside activity.

The Roadway Edge Zone is measured from the back of curb to the outside edge of the Sidewalk Through Element (the space kept clear of obstructions for pedestrian travel). For roads without curb and gutter, the Roadway Edge Zone is typically measured from the edge of pavement.

B: Sidewalk Through Element

The Sidewalk Through Element is the space where pedestrians walk. It should be kept clear of any obstructions like utility poles, signage, trash cans, and other streetside amenities. These objects should be placed in the Amenity Element.

VDOT & ITE/CNU Guidance

The Geometric Design Standards in Appendix A of the VDOT Road Design Manual specify a minimum sidewalk width of five feet for all roads with curb and gutter, and footnotes that a width of eight feet or more may be needed in commercial areas. The VDOT Road Design Manual also states that a minimum of eight feet of sidewalk is necessary when the sidewalk is placed adjacent to the curb (i.e. no buffer space) and on-street parking exists to allow vehicle doors to open and people to exit from parked vehicles without blocking the pedestrian access route (see SIDEWALKS section in Appendix A-5).

The ITE/CNU Guidebook is generally consistent with the VDOT Road Design Manual. It recommends an absolute minimum width of five feet for the pedestrian travel way in residential areas, and six feet in commercial areas (see Table 5.2 on pg. 65 in ITE/CNU Guidebook). In more intense context zones, the minimum sidewalk width increases. Avenues need more sidewalk width than Local Streets, and Boulevards need more sidewalk width than Avenues.

Optimal Recommendations

The Sidewalk Through Element is a Primary Element for Pedestrian Modal Emphasis, and a Secondary Element for Transit Modal Emphasis. This element has the highest priority in Pedestrian Modal

Emphasis; optimal values should be used in corridors with Pedestrian Modal Emphasis and if possible, in corridors with Transit Modal Emphasis.

The Corridor Matrix recommends 10 feet for Boulevards and Transit Boulevards in T-6 and T-5, with widths generally decreasing to 5 feet for Local Streets in T-2 and T-1.

Shared use paths are recommended for Multimodal Through Corridors. These streets have generally higher speeds, and a shared use path will allow bicyclists to ride off-street. A shared use path is typically accompanied by wider buffer space, which will increase pedestrian comfort and safety.

Minimum Recommendations & Potential Modifications

The Corridor Matrix generally reflects the recommendations from the ITE/CNU Guidebook, and specifies an absolute minimum sidewalk width of five feet for Local Streets and Avenues, and six feet for Major Avenues and Boulevards. Major Avenues in T-1 or T-2 have a minimum width of five feet as these are in very low intense Multimodal Centers.

Multimodal Through Corridors with design speeds of 45 mph or less may use a sidewalk instead of a shared use path.

The Corridor Matrix standards for the Sidewalk Through Element may be increased wherever possible to provide more space for pedestrians. This is especially relevant for corridors within the primary walk-sheds in the more intense Multimodal Centers, as these places typically see more pedestrian travelers than in the less intense Multimodal Centers and secondary walk-sheds. This space may also be increased for plaza or other public space uses.

C: Amenity Element

The Amenity Element describes the space between the back of curb and the edge of the pedestrian travel way (Sidewalk Through Element). This space separates pedestrians from moving vehicles, and can be referred to as the buffer or planting strip. It does not include the curb, gutter pan, parked cars, bicycle lanes, or other items within the roadway. The Amenity Element is the ideal place for streetside amenities and lateral obstructions including street trees, transit stops, bicycle racks, food carts, fire hydrants, street lights, parking meters, signal control boxes, signs, and utility poles. These objects are outside of the clear pedestrian travel way and serve as a physical barrier between pedestrians and moving vehicles. Ideally the Amenity Element includes landscaping to add aesthetic quality to the streetscape and prevent pedestrians from jaywalking.

VDOT & ITE/CNU Guidance

For curb and gutter urban roadways with design speeds less than or equal to 45 mph, VDOT requires a minimum of four feet of buffer space between the back of curb and the sidewalk (see Road Design Manual, Appendix A, Figure A-2-1).

VDOT does have several options to the four foot minimum for the buffer space (refer to the discussion of buffer width in the Road Design Manual, Appendix A, Section A-5). Three feet may be appropriate when using smaller signs. If trees are to be planted in the buffer strip, it shall be a minimum of six feet wide and the trees should be planted so that the center of the trees are three feet minimum behind the back of curb. It is also important to make sure that trees will not block road signs once they reach a mature height.

Appendix B(1) Subdivision Street Design Guide in the VDOT Road Design Manual restates the six-foot minimum buffer from the back of curb for trees. Buffers without trees may be four feet wide measured from the back of curb, and for streets with a posted speed of 25 mph or slower, a three-foot buffer zone measured from the back of curb may be appropriate for smaller signs (see Figure 6 and Figure 10 in Appendix B(1).)

At intersections and driveway openings, VDOT requires a minimum lateral offset of three feet between the face of curb and obstructions to provide sufficient clearance for truck overhangs (Road Design Manual, Appendix A-2).

The ITE/CNU Guidebook defines the space of the Amenity Element into two separate zones: the Edge Zone and the Furnishings Zone (these two terms should not be confused with the terminology of the Corridor Elements in the Multimodal System Design Guidelines Corridor Matrix). The ITE/CNU Guidebook's Edge Zone is the lateral offset, the distance between the face of curb and any lateral obstructions. The ITE/CNU Guidebook recommends a minimum of 1.5 feet for the Edge Zone, and recommends widening the Edge Zone to a minimum of 4 feet at transit stops with bus shelters to allow people with wheelchairs to maneuver in front of the shelter (see pg. 122 in the ITE/CNU Guidebook). The ITE/CNU Guidebook's recommended widths for the Furnishings Zone vary between six to eight feet; wider widths are recommended for Boulevards and narrower widths for Local Streets. The ITE/CNU Guidebook also recommends tree wells in more intense areas and areas with predominantly commercial ground floor use. Landscape strips with trees and grasses or groundcovers are recommended in more residential areas.

For shared use paths that are adjacent to roads with curb, the VDOT Road Design Manual requires a minimum separation of eight feet between the face of curb and the edge of the shared use path. The necessary separation between a shared use path and a road with shoulder and ditch (instead of curb) varies depending on travel speed. Shared use paths should be placed behind the ditch.

Optimal Recommendations

The Amenity Element is a Primary Element for Green Modal Emphasis, and a Secondary Element for Pedestrian Modal Emphasis. It is a Contributing Element for Bicycle and Transit Modal Emphasis. Corridors with Green Modal Emphasis should always use the optimal recommendations. If possible, optimal values should be used for Pedestrian, Bicycle and Transit Modal Emphasis.

Optimal values range from nine feet to six feet for the five Placemaking corridors, to be consistent with the recommendations in the ITE/CNU Guidebook. Optimal widths for the Amenity Elements in T-Zones T-2 and T-1 are slightly wider than those in T-Zones T-6 through T3 to reflect the change in context.

The surface treatment for the Amenity Element for Placemaking Corridors in T-Zones T-6 through T-3 should typically be tree wells that provide a continuous walking surface between the Sidewalk Through

Element and the back of curb. The surface treatment for Placemaking Corridors in T-Zones T-2 and T-1 should be landscaped grass, or other natural surfaces. Corridors with a Green Modal Emphasis in the higher intensity T-Zones (and no Pedestrian Modal Emphasis) may incorporate bioswales or have a landscaped surface (either grass, dirt, or such surface to treat the stormwater runoff). Corridors in the lower intensity T-Zones with a Pedestrian Modal Emphasis may have a hard surface like tree grates that pedestrians can walk on.

Multimodal Through Corridors typically have higher traffic volumes and higher speeds than Placemaking Corridors. Ideally, shared use paths would be provided on Multimodal Through Corridors to provide a safe facility for pedestrians and bicyclists that is set back from the roadway. The recommendations for the Amenity Element for Multimodal Through Corridors follow the VDOT Road Design Manual requirements and recommendations for shared use paths.

Minimum Recommendations & Potential Modifications

The minimum recommendations for the Amenity Element are six feet for all Placemaking Corridors, as this is the minimum width VDOT allows for trees. Six feet with trees (in tree wells for T-6 through T-3 and with grass for T-2 and T-1) is recommended as the minimum element because trees are desired on all Placemaking Corridors.

If trees cannot be planted because of funding or other constraints, six feet is still recommended as the minimum because communities may decide to plant trees in the future as part of a streetscaping initiative, and six feet would allow them to do so without needing additional right-of-way.

In cases of severely constrained right-of-way, designers can use the absolute minimums in the VDOT Road Design Manual, Appendix A. Section A-5 in the VDOT Road Design Manual allows a minimum buffer width of four feet for posted speeds of 25 mph or greater, and a minimum of three feet with smaller signs and posted speeds of 25 mph or less. Please note these absolute minimum buffer widths do not allow trees to be planted.

The optimal values should be used wherever possible when Green, Pedestrian, Bicycle, or Transit modal emphasis is applied. The lateral offset of the Amenity Element should be increased at transit shelters for adequate wheelchair access between the transit shelter and the back of curb. In low intensity Transect Zones like T-1 and T-2, the minimum widths may be further reduced if adequate space exists between the far edge of the pedestrian way and the property line. However, this is not recommended as buffer space for pedestrians should always be at least four feet, or three feet if the posted speed is 25 mph or less and smaller signs are used.

In instances of severely constrained right-of-way for Multimodal Through Corridors, a shared use path may not be feasible. If a sidewalk is provided, the maximum amount of buffer space should be provided between the sidewalk and the edge of road. The minimum buffer distance for Multimodal Through Corridors with sidewalk and curb is four feet. If a sidewalk is used on a Multimodal Through Corridor with shoulder and ditch, the sidewalk shall be placed behind the ditch (see VDOT Road Design Manual Appendix A, Section A-5).

Roadway Zone

The Roadway Zone can be defined as the space from face of curb to face of curb (or between the edges of asphalt pavement if there is no curb). It includes the vehicle travel lanes, bus only lanes, bike lanes, on-street parking spaces, medians, and gutter pans. This space is where higher speed travel occurs and is usually separated from the Roadway Edge Zone by the curb.

The Placemaking Corridors within these Guidelines are assumed to have a curb and gutter design (VDOT urban road design). A shoulder design is highly discouraged for corridors within Multimodal Centers and Multimodal Districts. Drivers on curb and gutter roadways are likely to travel at slower speeds and be aware of the possible presence of pedestrians and bicyclists. A shoulder design may be appropriate only for a Multimodal Through Corridors in T-2 and T-1 transect zones, and if used should have enough buffer space between the pedestrian travel way (sidewalk or shared use path) and the vehicle travel lanes to meet VDOT's clear zone requirements.

The following sections describe the Corridor Elements within the Roadway Zone. **Figures B-5 through B-7** illustrate how the Corridor Elements fit together in a typical cross-section, and show where each Corridor Element is measured from and to. **Figure B-5** shows a cross-section with bicycle lanes and on-street parallel parking in both directions. **Figure B-6** shows bicycle lanes with no on-street parking. **Figure B-7** shows a cross-section with no bicycle lanes and no on-street parking.

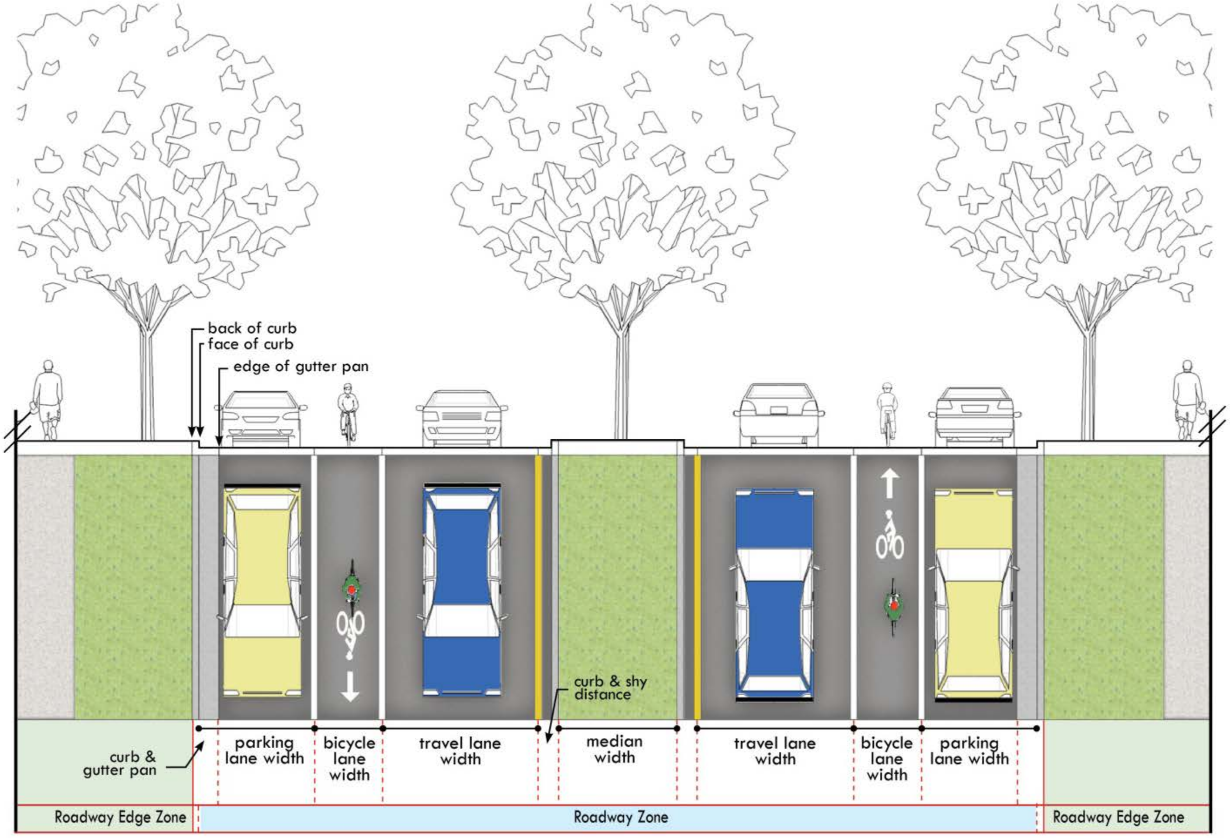


Figure B-5 - Roadway Zone Cross-Section with Bicycle Lanes and On-Street Parallel Parking. On-street parking lane widths include the width of the gutter pan.

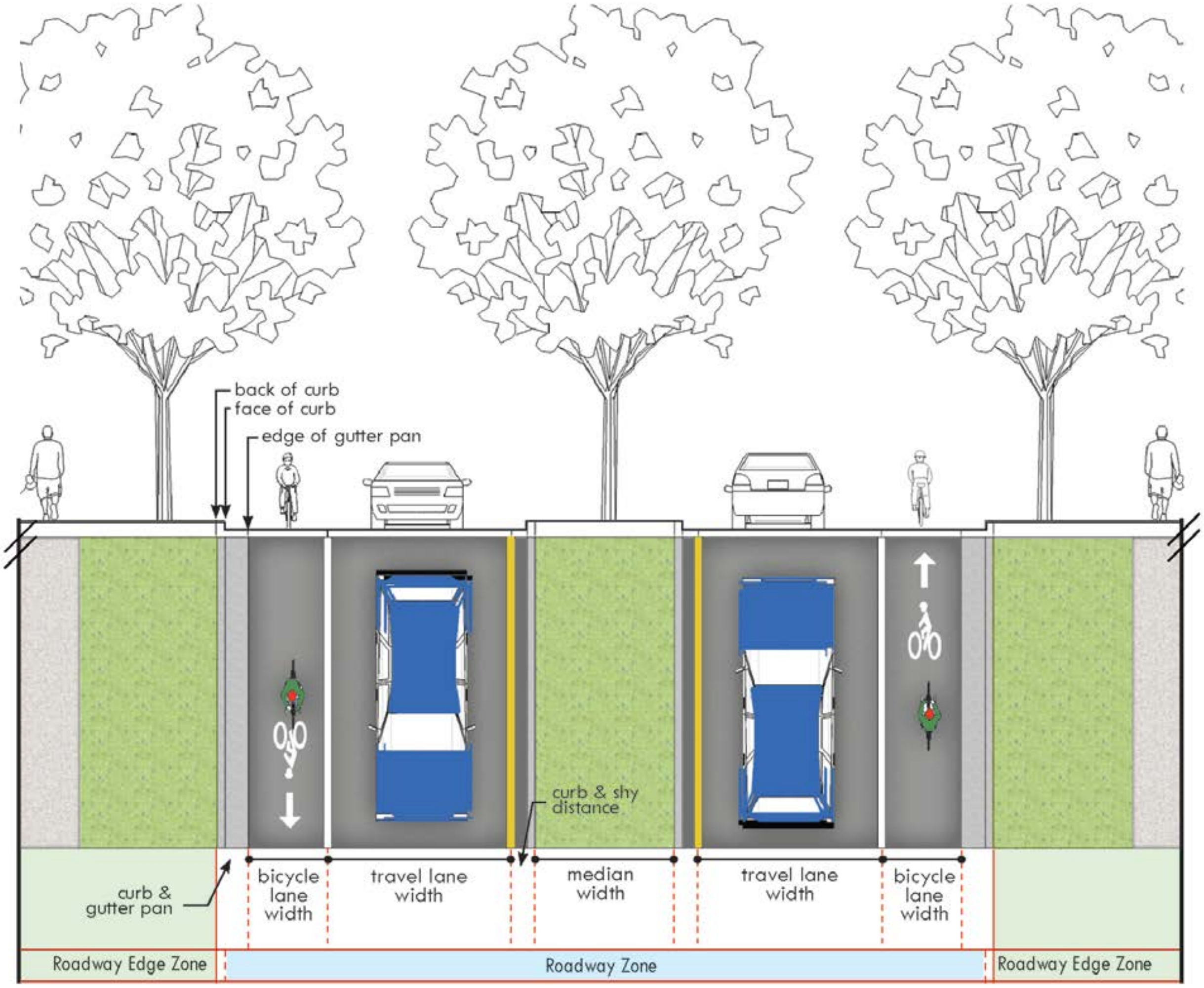


Figure B-6 – Roadway Zone Cross-Section with Bicycle Lanes and No On-Street Parking. When the bicycle lane is adjacent to the curb and gutter, the width of the bicycle lane does not include the gutter pan.

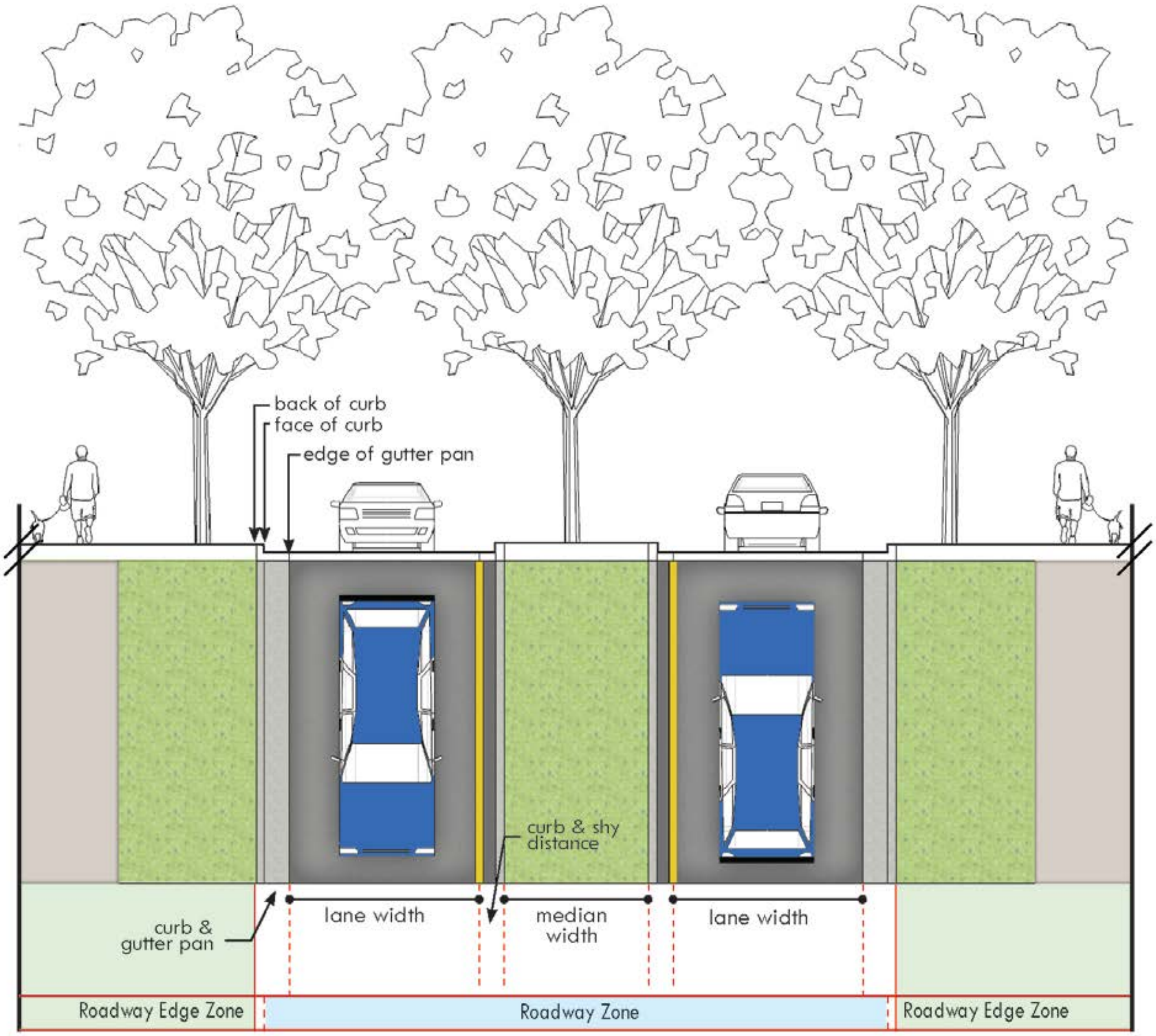


Figure B-7 – Roadway Zone Cross-Section with No Bicycle Lanes and No On-Street Parking. When the travel lane is adjacent to the curb and gutter, the travel lane width does not include the width of the gutter pan.

D: Parking Element

The Parking Element describes the width of parallel on-street parking. On-street parking is usually desirable for lower speed roads (35 mph or less) for a variety of reasons. Local businesses prefer on-street parking to attract customers. Parked cars serve as a physical buffer between moving vehicles and pedestrians, increasing pedestrian safety and comfort. On-street parking adds to street activity and promotes a vibrant street life for a neighborhood corridor.

On-street parking may not be appropriate on all streets. Opening parked car doors on the driver's side can create serious safety conflicts for on-road bicyclists. Parking maneuvers also create conflicts for moving vehicles. On-street parking reduces the capacity of the adjacent travel lane, anywhere from three to 30 percent depending on the frequency of parking maneuvers.[3]

VDOT & ITE/CNU Guidance

The Subdivision Street Design Guide (SSAR) in Appendix B(1) of the VDOT Road Design Manual specifies on-street parking should be seven feet wide on residential and mixed-use local streets, and eight feet wide on commercial and industrial streets. These values include the width of the gutter pan (see **Figure B-5**, shown previously on page B-17). When combined with a bicycle lane, 12 feet of combined bicycle travel and parking should be the minimum for this type of shared use (see Figure A-5-1 in SHARED ROADWAYS section of Appendix A-5 in the VDOT Road Design Manual).   The SSAR states that the use of curb and gutter anticipates on-street parking, and parking along streets with shoulder and ditch design is not desirable.

The ITE/CNU Guidebook recommends against providing parking for streets with speeds greater than 35 mph due to potential hazards associated with maneuvering in and out of spaces. In developing and redeveloping areas, provide the amount of on-street parking for planned, rather than existing, land use densities. Table 6.4 in the ITE/CNU Guidebook recommends a range of widths for on-street parking ranging from seven feet in less intense areas and eight feet in more dense areas.

Optimal Recommendations

The optimal recommendations are most important for corridors that have a Parking Modal Emphasis. Optimal values are also encouraged for corridors with Pedestrian Modal Emphasis as a Contributing Element.

The recommended parallel on-street parking lane widths are consistent with the VDOT and ITE/CNU guidance. Eight-foot widths are recommended for Boulevards. Major Avenues may have seven- to eight-foot widths. Seven-foot widths are appropriate for all Local Streets and for Avenues in lower intensity areas. These widths include the width of the gutter pan. The Corridor Matrix values for Transit Boulevards assume that the dedicated right-of-way for transit is located in the median, allowing space for on-street parking next to the curb without conflicting with the transit right-of-way.

Minimum Recommendations & Potential Modifications

In all cases, no on-street parking is an option in instances with constrained rights-of-way. On-street parking is appropriate for Transit Boulevards if the dedicated right of way for transit is in the median and the parking is located on the outside lanes. On-street parking is not recommended for Transit Boulevards where the dedicated right-of-way is curbside. On-street parking is also not recommended for Multimodal Through Corridors, as the safety hazards of parking maneuvers become too great at speeds higher than 35 mph.

E: Bicycle Element

Bicycle accommodations serve a variety of bicyclists with a range of experience and confidence. Experienced bicyclists may prefer to ride in the street sharing travel lanes with traffic to reach higher

---

[3] ITE/CNU Guidebook. Pg. 146.

speeds. Less experienced bicyclists prefer to have a dedicated space such as a bicycle lane. Very inexperienced bicyclists will only feel comfortable on a shared use path with physical separation from moving traffic.

Localities can choose from an extensive array of bicycle facilities and treatments to implement. Typical facilities for bicyclists can range from an on-street bicycle lane, shared lane markings, and wide outside curb lanes or shoulders to an off-road shared use path that may or may not run parallel to a roadway. Some low speed low volume streets may be appropriate for bicycle travel without any special pavement treatment or signage. Cities across the U.S. and abroad are implementing newer and more innovative bicycle features such as bicycle boulevards, cycle tracks, contra-flow bike lanes, and shared bicycle and bus facilities. Many of these new innovative features are not included in these Multimodal System Design Guidelines, but communities should pursue options for these more innovative features if they desire. The Urban Bikeway Design Guide,[4] published by the National Association of City Transportation Officials (NACTO), and referred to as the NACTO Bike Guide in future references, provides guidance on where these facilities might be appropriate and provides important design considerations.

It is important to note that bicycle facility design should not begin at the detailed corridor scale. As with other travel modes, planning at the **systems** level is a critical first step. Cities, counties and towns usually prepare regional bicycle or greenway trail plans that provide connections throughout a region or city. When these plans are prepared, planners usually have specific facilities in mind for each corridor. The recommendations for the Bicycle Element in these Guidelines are intended to supplement, not replace, regional bicycle planning efforts.

VDOT & ITE/CNU Guidance

VDOT's policy for integrating bicycle and pedestrian accommodations states that VDOT will initiate every construction project with the presumption that the project shall accommodate bicycling and walking.

Section A-5 Bicycle and Pedestrian Facility Guidelines of the VDOT Road Design Manual provides recommendations for facilities for each bicyclist type (Group A advanced, Group B basic, and Group C children), however these tables are based on previous tables from the Federal Highway Administration, which have been superceded by the release of the Guide for the Development of Bicycle Facilities, 4th Edition (published by AASHTO in 2012, and referred to as the AASHTO Bike Guide in future references). The ITE/CNU Guidebook provides recommendations for bicycle lanes and references the previous edition of the AASHTO Bike Guide for other types of accommodations. The ITE/CNU Guidebook recognizes that bicycle lanes may not be appropriate for all road types. With the exception of freeways and streets where bicycling is specifically prohibited, bicyclists are permitted to use any street for travel. The ITE/CNU Guidebook explains that bicycle lanes are desirable on major thoroughfares with target speeds of 30 mph or greater, and on streets with high traffic volumes. The ITE/CNU Guidebook also states that availability of parallel bicycle facilities does not eliminate the need to have a bicycle lane on thoroughfares, as bicyclists need to access properties along corridors. Furthermore, walkable urban thoroughfares should at least meet the needs of Group B Basic bicyclists. Table 6.4 in the ITE/CNU

---

[4] http://nacto.org/cities-for-cycling/design-guide/

Guidebook recommends a preferred width of six feet for bicycle lanes and a minimum width of five feet for all walkable urban corridor types.

The AASHTO Bike Guide is a comprehensive resource and contains recommendations for a variety of different bike facilities. Determining which facility is appropriate depends on a wide array of characteristics including traffic volume, speed, traffic mix, expected users, road conditions, driveways and access points, topography, adjacent land uses, and cost. Bike lanes are most appropriate on major roads that provide direct, convenient, quick access to major land uses and on collector roads and busy urban streets with slower speeds.

The AASHTO Bike Guide recommends five-foot wide bicycle lanes in most circumstances. Bicycle lanes that are adjacent to a curb and gutter should have a usable width of four feet, measured from the longitudinal joint (where the gutter pan meets the asphalt pavement) to the center of the bicycle lane stripe. On roads with on-street parking, bicycle lanes should be placed between the parking lane and the travel lane. AASHTO recommends six feet for the width of bicycle lanes in these locations, and a minimum of not less than five feet. On streets with narrow parking lanes (seven feet wide) and high parking turnover, a wider bicycle lane (six to seven feet wide) may be desirable to provide more operating space for bicyclists to ride out of the area of opening vehicle doors. See AASHTO Bike Guide Sections 4.6.4 and 4.6.5.

Please note the recommendations for the Bicycle Element in the Corridor Matrix are generalized; a different type of facility may be more appropriate for the unique characteristics of the corridor and surrounding transportation network. Please refer to the AASHTO Bike Guide for all corridors with Bicycle Modal Emphasis. For example, these Multimodal System Design Guidelines do not give detailed information on bicycle boulevards, contra-flow bike lanes, signage, street markings, or other bicycle facility design considerations.

Optimal Recommendations

For corridors with Bicycle Modal Emphasis, it is critical to provide the optimal bicycle accommodation as specified in the Corridor Matrix (or other appropriate accommodation as directed by the AASHTO Bike Guide); the bicycle accommodation will take higher priority than the ideal metrics for other design elements. Optimal bicycle accommodations would also be beneficial for corridors with Transit or Parking Modal Emphasis, as they are a Contributing Element.

On-road bicycle lanes are appropriate for all of the Placemaking Corridors except for Local Streets. The appropriate width of a bicycle lane varies between four and seven feet. The bicycle lane widths in the Corridor Matrix assume the bicycle lane is located adjacent to a curb and gutter pan, and that there is no on-street parking. The bicycle lane widths do not include the width of the gutter pan. If the bicycle lane is adjacent to a curb without a gutter pan (no on-street parking), add one foot of width. If eight-foot wide on-street parking is provided, add one foot of width. If seven-foot wide on-street parking is provided, add two feet of width.

Four-foot wide bicycle lanes are recommended for all Avenues and for Major Avenues, Boulevards, and Transit Boulevards in T-4 and lower transect zones, meaning the width of the bicycle lane would be four feet plus the width of the gutter pan assuming no on-street parking (see **Figure B-7**), or five feet if there is curb but no gutter pan assuming no on-street parking (see **Figure B-8**). If an eight-foot wide parking lane is provided, the bicycle lane would be five feet wide (see **Figure B-9**), and if a seven-foot wide parking lane is provided, the bicycle lane would be six feet wide (see **Figure B-10**).

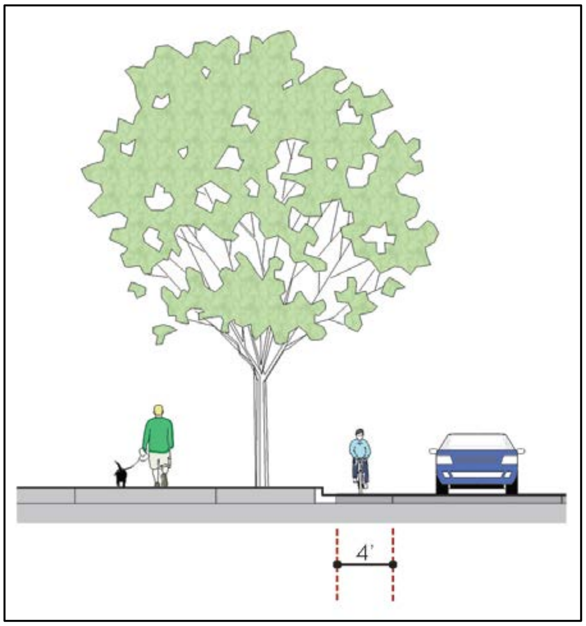


Figure B-7 – Optimal Bicycle Element for Avenues and Major Avenues (Illustration A). Four-foot wide bicycle lanes do not include the width of the gutter pan when adjacent to curb and gutter.

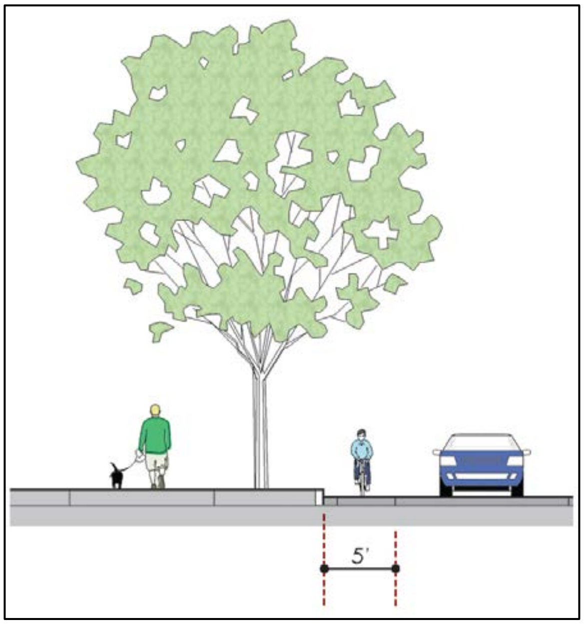


Figure B-8 – Optimal Bicycle Element for Avenues and Major Avenues (Illustration B). A four-foot wide bicycle lane becomes a five-foot wide bicycle lane when located adjacent to curb without a gutter pan.

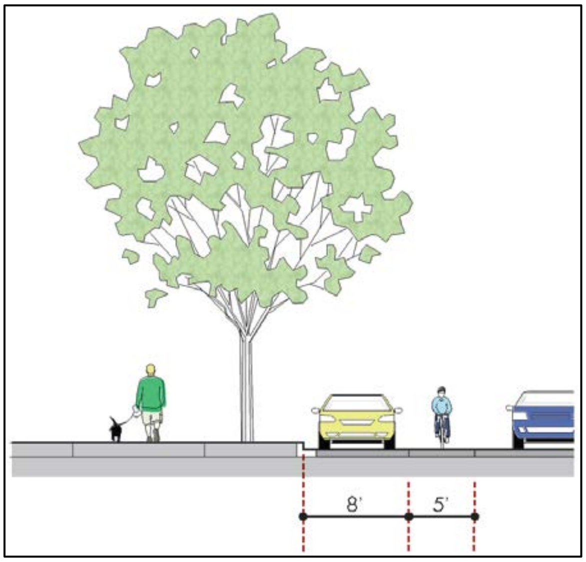


Figure B-9 – Optimal Bicycle Element for Avenues and Major Avenues (Illustration C). A four-foot wide bicycle lane becomes a five-foot wide bicycle lane when paired with an eight-foot wide parking lane.

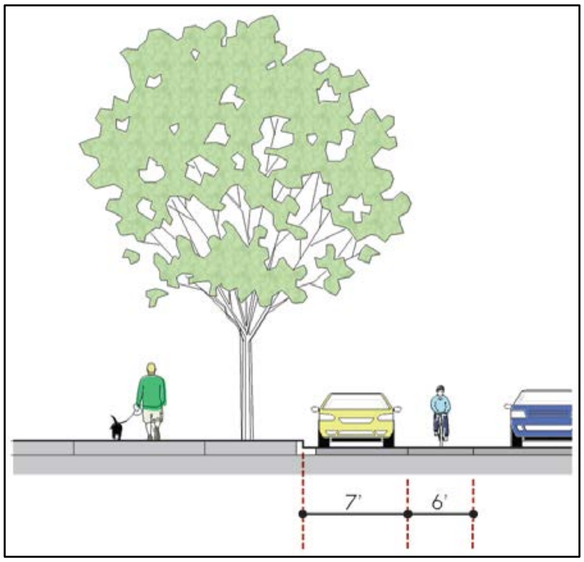


Figure B-10 – Optimal Bicycle Element for Avenues and Major Avenues (Illustration D). A four-foot wide bicycle lane becomes a six-foot wide bicycle lane when paired with a seven-foot wide parking lane.

Transit Boulevards, Boulevards, and Major Avenues in the T-6 and T-5 Transect Zones typically have higher bicycle use and higher traffic volumes. The optimal Bicycle Element for these Multimodal Corridor types is a five-foot wide bicycle lane, which would translate to a six-foot wide bicycle lane if an eight-foot wide parking lane is provided; and a seven-foot wide bicycle lane if a seven-foot wide parking lane is provided. *Note: Five feet is the minimum allowable width for an exclusive bicycle lane for T-6 and T-5 Transit Boulevards, Boulevards and Major Avenues. A four-foot wide bicycle lane is not appropriate on these Multimodal Corridors types. If insufficient space exists for a five-foot wide exclusive bicycle lane on these Multimodal Corridor types, designers may choose to use the minimum treatment of a 14-foot wide curb lane with shared lane markings.

It is important to note these bicycle lane widths are ideal treatments, but that other more innovative options should be considered. Planners and designers should consult the AASHTO Bike Guide, and possibly the NACTO Bike Guide, for further design treatment options like buffered bicycle lanes.

Generally bicycle lanes are unnecessary on Local Streets in all Transect Zones because of the low volume of traffic and low speeds, however shared lane markings are recommended for corridors with Bicycle Modal Emphasis to encourage bicyclists to ride outside of the 'door zone' where they risk being hit by opening car doors. Shared lane markings also help alert motorists to the possible presence of bicyclists.

As part of the regional bicycle planning process, localities may designate some local roads as bicycle boulevards. These are low volume, low speed road connections that provide critical links in the bicycle network, but typically have traffic calming features like in road planting boxes, curb treatments, or other design elements to discourage cut through road traffic. Traffic diverters should not be used on corridors with transit modal emphasis. Planners and designers should refer to the AASHTO Bike Guide for more detailed guidance on bicycle boulevards.

Shared use paths that are separated from the road with buffer space are recommended for Multimodal Through Corridors as basic level bicyclists generally do not feel comfortable on these higher speed roads. Regional bike plans should also identify areas for off-road bicycle trails for other potential connections.

Minimum Recommendations & Potential Modifications

On corridors that do not have Bicycle Modal Emphasis, the optimal accommodations are not as critical. It is imperative to design corridors to allow for the safe travel of bicyclists. The minimum recommendation for all Avenues and for Major Avenues, Boulevards, and Transit Boulevards in a T-4 or lower Transect Zone is shared lane markings with no additional lane width. This recommendation is consistent with the AASHTO Bike Guide, which recommends shared lane markings on collectors and minor arterials where the speed limit is 35 mph or less, particularly on space-constrained roads with narrow travel lanes or road segments where bicycle lanes are not selected due to space constraints or other limitations (see Table 2-3 in the AASHTO Bike Guide).

T-6 and T-5 Transit Boulevards, Boulevards, and Major Avenues will likely have high volumes of motorized vehicle traffic, and additional lane width on the outside lane will likely increase bicyclist safety and comfort. The minimum Bicycle Element recommendation for these Multimodal Corridor types is a

14-foot wide curb lane with shared lane markings. This recommendation is consistent with the AASHTO Bike Guide, which recommends wide outside shared lanes on arterials and collectors intended for major motor vehicle traffic movements (see Table 2-3 in the AASHTO Bike Guide). The wide outside curb lane measurement does not include the gutter pan; it is measured from the longitudinal joint.

Local Streets in all transect zones may not need any special provisions for bicyclists, as bicyclists can comfortably ride with traffic on the low speed low volume streets. However, if the traffic volume exceeds 1,000 vehicles per day, designers may consider using shared lane markings to simply alert motorists to the possible presence of bicyclists.

On Multimodal Through Corridors, a shared use path separated from the roadway is recommended, but if space is constrained, a bicycle lane is the preferred alternate treatment. The minimum bicycle accommodation on Multimodal Through Corridors in Transect Zones T-6 through T-3 should be a 14-foot wide curb lane with shared lane markings, and in Transect Zones T-2 and T-1, either a six-foot wide paved shoulder or a 15-foot wide outside curb lane with shared lane markings.

In addition to these recommendations, a range of alternative treatments are available, and the AASHTO Bike Guide and NACTO Bike Guide should be consulted for further options. For example, if a four-foot bicycle lane on both sides is not possible on a T-4 Transit Boulevard, a designer may consider a range of alternatives such as providing a bicycle lane in the uphill direction and shared lane markings in the downhill direction, providing a wide outside curb lane, or using shared lane markings on both sides of the street. All of these alternatives are better than relegating a facility to a parallel corridor, but many of these alternatives are not appropriate in certain circumstances. Refer to the latest AASHTO Bike Guide to design a bicycle facility that best accommodates bicyclists given the right-of-way constraints and roadway characteristics for a particular corridor.

Facilitating interaction between bicyclists and transit buses is often difficult. Special considerations at transit stops and at intersections must be given to safely accommodate bicyclists on transit routes.

F: Travel Lane Element

The Travel Lane Element describes the width of each travel lane for motorized vehicles. Lane width influences the speed at which vehicles will drive. Typically lane width is determined by the design speed of a roadway. Traditionally, designers and engineers consider wider lanes to be safer, as vehicles have more room to self-correct before going outside of the travel lane. However, this ‘overdesign’ results in vehicles driving faster, which creates more severe safety problems when crashes do occur.

VDOT & ITE/CNU Guidance

The VDOT Road Design Manual contains minimum lane widths for each functional class based on minimum design speed. The minimum lane width for urban arterials and collectors is 12 feet if the design speed is 50 mph or greater and 11 feet if the design speed is 45 mph or lower. If heavy truck traffic is anticipated, 12-foot widths are recommended even if the design speed is 45 mph or lower. Similarly roads with design speeds of 50 mph or greater may have 11-foot widths if there are restrictions on truck traffic. Urban local streets have a minimum lane width of 10 feet. Urban collector streets may have 10 foot lane widths under the following conditions (see Table 6-5 in A Policy on Geometric Design of Highways and Streets, published by AASHTO):

a) Design speed is 50 mph or less and traffic volumes are less than 400 vehicles per day
b) Design speed is 30 mph or less and traffic volumes are less than 1,500 vehicles per day

Lane widths in the VDOT Road Design Manual do not include the curb and gutter (See VDOT Road Design Manual Appendix A).

The ITE/CNU Guidebook acknowledges that lane width will vary and provides a number of useful design considerations (see pg. 137 in ITE/CNU Guidebook). Most thoroughfare types can effectively operate with 10- to 11-foot wide lanes, with 12-foot lanes desirable on higher speed transit and freight facilities. The ITE/CNU Guidebook recommends 10- to 11-foot lane widths for all corridor types in all areas, except in C3 and C4 commercial boulevards, where 10- to 12-foot lane widths are recommended.

Optimal Recommendations

The Travel Lane Element is a Primary Element for Transit Modal Emphasis. For all other modes, it is a Non-Contributing Element. 12-foot lanes are appropriate for corridors with transit routes or heavy truck traffic. Twelve-foot lanes should *only* be used when a corridor has a Transit Modal Emphasis, or serves as a major freight route. All other Multimodal Corridors should use the minimum recommended lanes widths, as specified in the Corridor Matrix.

Minimum Recommendations & Potential Modifications

The recommended lane widths in the Corridor Matrix meet the ITE/CNU and VDOT guidelines and comply with the AASHTO standards. The Corridor Matrix recommends 10 to 11 feet for Local Streets, 11 feet for Avenues and Major Avenues, 11 feet for Boulevards and Transit Boulevards in T-6 and T-5 T-Zones, and 11 to 12 feet for Boulevards and Transit Boulevards in T-4 and T-3 T-Zones.

Wider outside lanes may be preferable to encourage bicyclists to share the outside travel lane with automobiles; up to 15 feet may be advisable if no other bicycle facilities are possible within the right of way (refer to the previous section on the Bicycle Element for more detail on the wide outside curb lane option and the use of shared lane markings). Avoid using all minimum dimensions for lane width, bicycle lane, and on-street parking lanes.

Design Speed

Vehicle speed is the most influential factor in roadway design. In the conventional road design process, designers select a minimum design speed. The minimum design speed determines most of a roadway's physical characteristics including horizontal and vertical curvature, stopping sight distance, lane width, buffer (or shoulder) width, slope, bridge widths and vertical clearances, etc. Design speed is a function of roadway classification (rural or urban; arterial, collector, or local) and terrain (level, rolling, or mountainous). In traditional roadway design, designers will design the road for the minimum design speed and post the speed limit at usually five to ten miles per hour slower than the minimum design speed. Designers are traditionally encouraged to select the minimum design speed to be as high as practical. This conventional approach leads to 'overdesigning' roadways to be able to go faster than the posted speed. While it reduces the crash rate for vehicles going over the posted speed, it also encourages more vehicles to drive faster than the posted speed.

Target speed is the anticipated operating speed of a roadway, and the basis for the selection of the design speed. In the traditional road design process, target speed and design speed are assumed to be the same without much if any discussion, and usually set to five miles per hour higher than the expected posted speed limit. Recent developments in the road design process, particularly in Context Sensitive Solutions[5] projects, have included the determination of target speed as a discussion amongst all involved stakeholders including community members to ensure that the anticipated operating speed is appropriate for the land use context and safe for pedestrians and bicyclists. The term 'target speed' simply implies that the selection of this speed has been agreed upon by stakeholders and not just assumed. For the purposes of selecting the physical design elements of the roadway, target speed is equal to design speed.

Posted speeds for newly constructed high speed roads are typically set to five miles per hour below the design speed. Occasionally, communities may perform a speed study to see if the current posted speed is appropriate, and change the posted speed to match the 85th percentile speed from the speed study.

When designing slower speed roads (generally 45 mph or less), designers may assume the anticipated posted speed will be the same as the minimum design speed. Road design projects that involve the selection of target speed usually result in the purposeful selection of the same speed for the target speed, design speed, and posted speed. Once a road is constructed, communities may decide to post the speed limit lower than a roadway's design speed for a variety of safety and community benefits. Posted speeds may be lower than design speeds.

VDOT & ITE/CNU Guidance

The Geometric Design Standards in the VDOT Road Design Manual Appendix A provide a range of appropriate design speeds for each functional classification and terrain type. Design speeds for Urban Arterials generally range from 40 to 60 mph and occasionally may be as low as 30 mph. The lower (40 mph and below) speeds apply in the central business district and intermediate areas. The higher speeds are more applicable to the outlying business and developing areas." Design speeds for Urban Collectors range from 30 mph to 60 mph. Urban local streets have design speeds ranging from 20 to 30 mph. Urban freeway design speeds range from 50 to 70 mph.

---

[5] Context Sensitive Solutions (CSS) is a type of design process that is more collaborative and interdisciplinary than the traditional road design processes. CSS involves all stakeholders in providing a transportation facility that fits its setting to encourage all community members early and continuously throughout the process.

Table B-3 – Design Speeds & VDOT Functional Classes. The Geometric Design Standards in Appendix A of the VDOT Road Design Manual specify a range of design speeds for each functional class.

<table>
<tr><th rowspan="2"></th><th colspan="6">VDOT Design Speed Range</th></tr>
<tr><th>20 mph</th><th>30 mph</th><th>40 mph</th><th>50 mph</th><th>60 mph</th><th>70 mph</th></tr>
<tr><th rowspan="5">VDOT Functional Classification</th><td colspan="2">Urban Local Street</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="3">Urban Collector</td><td></td><td></td></tr>
<tr><td></td><td colspan="4">Urban Minor Arterial</td><td></td></tr>
<tr><td></td><td colspan="4">Urban Other Principal Arterial</td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">Urban Freeway</td></tr>
</table>

The ITE/CNU Guidebook recommends basing thoroughfare design on target speed. The ITE/CNU Guidebook recommends target speeds of 25 to 35 mph for the thoroughfare types it describes, which generally include all of the corridor types except the Multimodal Through Corridor. The ITE/CNU Guidebook recommends a 25 mph target speed for all local streets, a range of 25 to 30 mph for avenues generally, and a range of 25 to 35 mph for boulevards. Note, these recommendations from the ITE/CNU Guidebook are slightly different from the design speed recommendations in the Corridor Matrix in Appendix A of these Multimodal System Design Guidelines.

In May 2011, VDOT instituted IIM-LD-117 which allows the posted speed to equal the design speed on facilities with a minimum design speed of 45 mph or less, which is consistent with the target speed concept.

Recommended Metrics

The design speeds recommended in the Corridor Matrix are based on the theoretical approach of the ITE/CNU Guidebook and are consistent with the VDOT Road Design Manual. These speeds should be considered both the design speed and also the posted speed, although communities may choose to post speed limits lower than the design speeds. The values for design speed were based on the target speed recommendations in the ITE/CNU Guidebook. These are generally at the lower end of the design speeds from the VDOT Road Design Manual which says that roads in central business districts should have slower design speeds.

The ITE/CNU recommendation for the 25 mph lower end of the design speed range for Boulevards and Major Avenues is not consistent with the VDOT Road Design Manual, which states the lowest acceptable design speed for collectors and arterials is 30 mph. The design speeds in the Corridor Matrix have a smaller range but are acceptable to both the ITE/CNU Guidebook and the VDOT Road Design Manual.

Design speeds for Multimodal Through Corridors are higher than the other corridor types. The ITE/CNU Guidebook does not provide recommendations for this type of corridor. Because this corridor type is focused on moving higher volumes of traffic at higher speeds, the design speeds are higher than the other corridor types. In Transect Zones T-4 through T-6, 45 mph is recommended as the upper limit because of the higher number of pedestrians and bicyclists and the closeness of buildings to the street. However, pedestrian and bicycle travel can still be safely and comfortably accommodated on a 55 mph speed corridor in Transect Zones T-1 through T-3 with the recommended facilities in the Roadway Edge Zone Including a shared use path and wide buffer zone.

Table B-4 shows the design speeds for each Multimodal Corridor type and compares them to the design speeds of the VDOT functional classes for clarity.

Table B-4 – Comparison of VDOT Functional Classes to the Multimodal Corridor Types with Design Speeds. The design speeds for each Multimodal Corridor type fit within the range of appropriate design speeds of the VDOT functional classes. The design speeds of all five Placemaking Corridor types are 35 mph or slower.

<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>

See Road Design Manual, Appendix A for geometry design criteria based on Design Speed.
Posted Speed = Design Speed when Design Speed is 45 mph or less.
Roadway (Street) can be posted less than the Design Speed.

Potential Modifications

Exceptions to the design speeds are not recommended. The design speeds in the Corridor Matrix specifically represent reasonable vehicular speeds that balance the needs for all road users. Access management techniques are recommended to reduce delay rather than the selection of a higher design speed. By following the comprehensive multimodal planning process described in the Multimodal System Design Guidelines, communities will outline networks for each mode that ensure a balance of mobility for all travelers.

Number of Through Lanes

The number of through lanes has a large effect on the character of a corridor. Fewer through lanes are generally desirable for streetside activities, and are generally safer for pedestrians, bicyclists and vehicles. Roads with fewer lanes take less time for pedestrians to cross, and passing maneuvers are minimized. More lanes provide more vehicular capacity, but also increase noise and potential safety hazards.

VDOT & ITE/CNU Guidance

According to the VDOT Road Design Manual, capacity analysis of traffic data will determine the number of through lanes necessary for operation at a satisfactory level of service.[6]

The ITE/CNU Guidebook provides a range for each thoroughfare type. Four to six lanes are recommended for all Boulevards, two to four lanes are recommended for all Avenues, and two to four lanes are recommended for local streets in C6, C5, and C4 commercial areas, and two lanes are recommended for local streets in C4 residential and C3 areas.

The ITE/CNU Guidebook recommends weighing a number of different factors when determining the number of through lanes. These factors include community objectives, thoroughfare type, long-range transportation plans, and corridor-wide and network capacity analysis.

Recommended Metrics

The recommended number of through lanes in the Corridor Matrix includes both directions of travel. A road with four to six through lanes would have two to three lanes in each direction. These values do not include bus-only lanes, bike lanes, or parking lanes. The recommended values are consistent with the ITE/CNU Guidebook.

Potential Modifications

In more intense areas like T-6 and T-5, the street network may include one-way pairs that together function as a Boulevard or Transit Boulevard. In these instances, more than three travel lanes may exist. Generally more than three travel lanes is discouraged even in one-way pairs for safety reasons and to maintain a comfortable context for pedestrians and bicyclists.

Typical Traffic Volume Range

Average annual daily traffic (AADT) volumes indicate how many vehicles use a road on a daily basis.

VDOT & ITE/CNU Guidance

The ITE/CNU Guidebook provides a typical traffic volume range for each Multimodal Corridor type to help determine the characteristics of thoroughfares.

Recommended Metrics

The volume ranges provided in the Corridor Matrix are adapted from Table 6.4 in the ITE/CNU Guidebook, with a finer range to distinguish between the corridor types. This range is provided to give an idea of the typical usage of a facility and compare to other roadways with similar AADTs.

---

[6] VDOT Road Design Manual. Chapter 2B, Section 2B-3: Determination of Roadway Design.

Potential Modifications

The AADT ranges provided are not intended to serve as upper or lower bounds for design. Instead they are simply provided for comparison. Traffic volumes widely vary on all Multimodal Corridor types.

G: Medians

Medians can be designed to enhance the aesthetic value of a corridor with landscaping and trees thereby increasing the urban green canopy, and provide a buffer between multiple travel lanes, and are especially important for pedestrians on high speed roads.

Medians can provide pedestrian refuge at intersections when crossing multiple travel lanes. However, medians also increase the distance a pedestrian must travel to cross from one side of the road to the other. Depending on the design of the signal phasing and timing, the increase in pedestrian crossing time can increase the green time for side-streets, which in turn may take away green time from the mainline movements at an intersection. Medians have both positive and negative tradeoffs and the effects for all travel modes should be considered when designing the corridor cross-section.

VDOT & ITE/CNU Guidance

Section 2E-3 Detailed Plan Design of the VDOT Road Design Manual discusses medians from the perspective of motor vehicle safety. Generally, wider medians are better in rural contexts and narrower medians are preferred in urban contexts. The VDOT Road Design Manual states that raised medians should have a minimum width of four feet, with one foot offset from the through lane edge in each direction, but four feet is not suitable for use as a pedestrian refuge. When the raised median's primary purpose is to provide space for left turn storage, the minimum width of the median is the required lane width plus four feet, with one foot on either side. Six feet from back-of-curb to back-of-curb is the minimum width for a median that is to be used as a pedestrian refuge. Six feet provides adequate space for two feet of detectable warning surface (truncated domes) on curb ramps for both sides of the median, plus two feet of flat surface in the middle where pedestrians who are visually impaired can detect that they are in a safe space (see **Figure B-11**). The minimum width for planting street trees is six feet. The 2008 VDOT Road and Bridge Standards provide more detailed specifications for median and refuge island applications (see Section 200: Curbs, Median, and Entrances).

The ITE/CNU Guidebook recommends that wherever medians are provided at intersections, they should be at least six feet wide to accommodate groups of pedestrians for refuge. Median width should not exceed 18 feet to keep streets compact and pedestrian-scaled. Table 6.4 in the ITE/CNU Guidebook recommends no medians on Local Streets, optional medians for Avenues, and medians with four to 18 foot widths for Boulevards. Continuous medians that narrow at intersections to provide left turn lanes should be 16 to 18 feet wide to allow for a turn lane (10 to 12 feet wide) plus a pedestrian refuge (six feet wide). Additionally, road designers must include one foot on either side of the median between the curb and the road stripe.

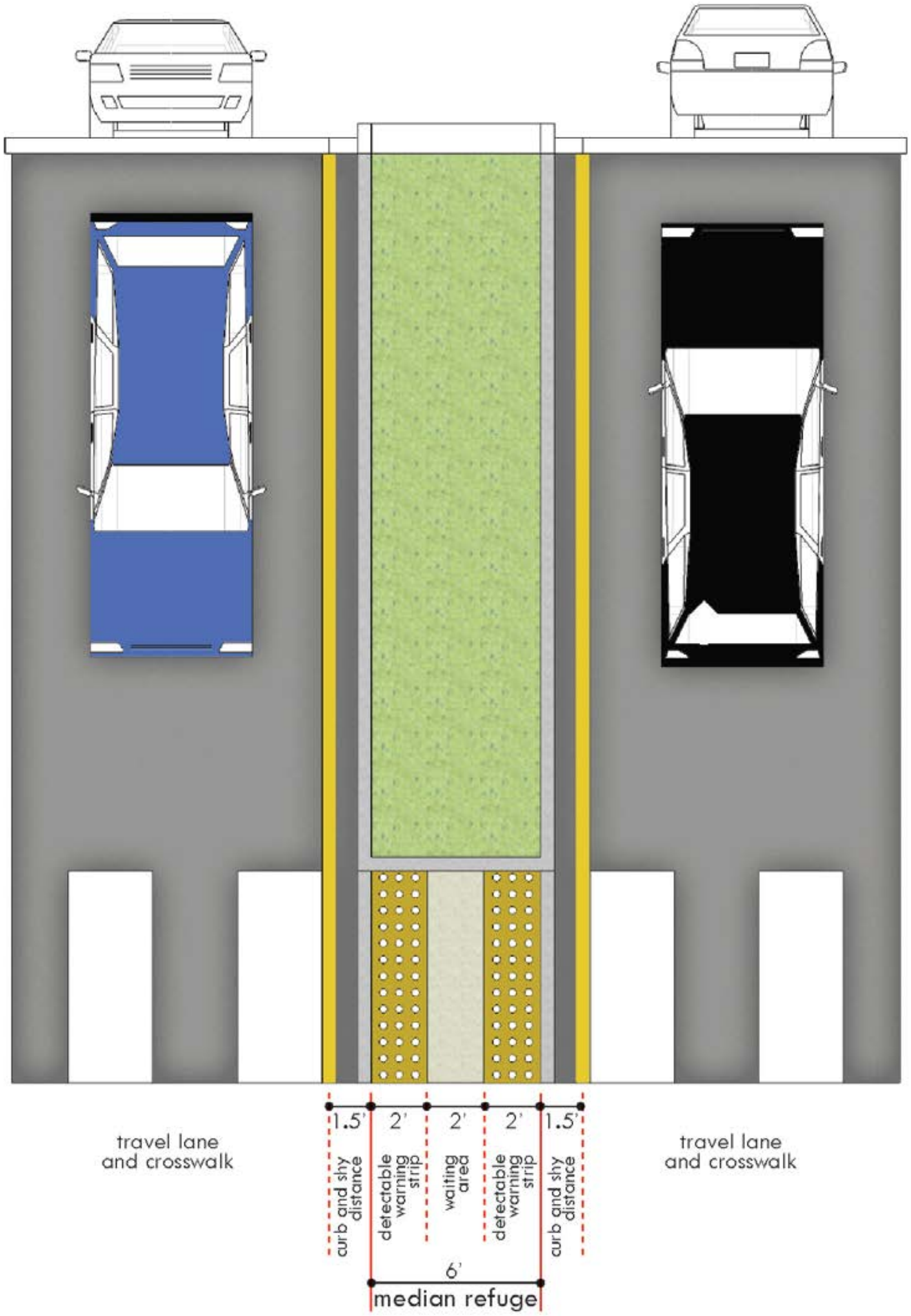


Figure B-11 – Detail of Six-Foot Wide Median Refuge. A median can serve as a pedestrian refuge if it is a minimum of six-feet wide from the back of curb to back of curb. This provides two feet of detectable warning surface ramps on either side of a two-foot wide smooth waiting area.

Optimal Recommendations

The Median Element is a Secondary Element for Green Modal Emphasis. At intersections, medians are very important for pedestrians, and thoughtful consideration should be given as to whether they would be more beneficial or detrimental to pedestrians at intersections. The values for Median Element width are measured from back of curb to back of curb. Median widths do not include the width of the curb and the one foot shy distance on either side between the road stripe and the median curb. The recommendations in the Corridor Matrix follow the ITE/CNU guidance very closely, where medians are recommended for Boulevards and Transit Boulevards and optional for Major Avenues and Avenues. Medians are inappropriate for Local Streets. Where medians are combined with left turn lanes, the recommended width is 18 feet to provide a 12-foot turn lane with a six-foot pedestrian refuge.

Optimal values for the Median Element assume optimal travel lane widths and include space for a left turn lane at intersections of the same width. If minimum travel lane width is used, reduce the optimal median with by the same width. I.e. if the optimal travel lane width is 12 feet, but the minimum lane width of 11 feet should be used, reduce the optimal median width by one foot (from 18 feet to 17 feet).

Medians are especially recommended for Multimodal Through Corridors. In T-1 and T-2 areas, 40 foot medians may be appropriate on Multimodal Through Corridors if future widening is anticipated. However, medians this wide substantially decrease walkability, and should be critically considered for alternatives.

The median for Transit Boulevard assumes transit will run in the median; in this case median widths will likely vary between 24 and 36 feet, depending on the design of the transit alignment and station location.

Minimum Recommendations & Potential Modifications

A six- foot minimum median is recommended for Transit Boulevards (with curbside transit) and Boulevards to provide the adequate width for a pedestrian refuge. Major Avenues and Avenues with limited right-of-way may choose to forgo a median for another element that is more beneficial for the corridor’s modal emphasis.

Minimum recommendations for Multimodal Through Corridors depend on the number of lanes. T-1 and T-2 Multimodal Through Corridors may have no median if they are two lanes (one lane in each direction). Roads with four lanes should have a median.

APPENDIX C.

MULTIMODAL CENTERS CALCULATOR TOOL

The following pages show screenshots of a spreadsheet-based tool that computes typical building heights and floor-area-ratios for the Transect Zones, Multimodal Center Types, and TOD Nodes based on activity density and other assumptions. The yellow boxes indicate inputs to the tool, and reflect the assumptions for the Transect Zones and Multimodal Center types as presented in these Guidelines. The additional metrics of building heights and floor-area-ratios provide readers with a deeper understanding of the building and activity patterns within the Guidelines typology.

Planners may change the assumptions in the yellow boxes to better reflect the conditions within their locality, such as the percentage of activity units that are jobs or the square footage per dwelling unit. Revising these assumptions will change the floor-area-ratios and building heights. However, it is **not** recommended that planners change the values that describe the range of activity densities for each Transect Zone, as these were specifically calibrated for real places in Virginia to accurately span the range of contexts that exist in the Commonwealth.

Additional information about the Multimodal Center typology and recommended metrics is located in Chapter 3 of these Guidelines.

Calculations for Transect Zone and Place Type (Center Type) Activity Density, FAR, and other density metrics

Values in yellow boxes can be changed
Values in orange are calculated values
Values in grey are necessary for calculation.

TRANSECT DENSITIES

ACTIVITY DENSITY by TRANSECT ZONE | **BUILDING HEIGHT based on visual inspection (No. of stories)** | **TOTAL FLOOR-AREA-RATIO based on Activity Density (combined residential and commercial)**

Transect Zone	Activity Density = (Jobs + Pop)/acre		Average Building Height	Typical Maximum Bldg Height	Gross Building FAR (includes res + com)		Net Building FAR (includes res + com)	
	Low	High			Low	High	Low	High
T1	-	1	1	2	-	0.01	-	0.02
T2	1	10	1.5	3	0.01	0.15	0.02	0.23
T3	10	25	3	5	0.15	0.37	0.23	0.57
T4	25	60	4	8	0.37	0.90	0.57	1.38
T5	60	100	6	12	0.90	1.49	1.38	2.30
T6	100	-	8	20	1.49	-	2.30	-

MULTIMODAL CENTER DENSITIES

MULTIMODAL CENTER GROSS ACTIVITY DENSITY | **TOTAL FLOOR-AREA-RATIO based on Activity Density (combined residential and commercial)** | **BUILDING HEIGHT based on visual inspection (No. of stories)**

Multi-modal Centers	Transect Zones		Activity Density = (Jobs + HH)/acre		Gross Building FAR (includes res + com)		Net Building FAR (includes res + com)		Average Building Height	Typical Maximum Bldg Height
	Inner	Outer	Low	High	Low	High	Low	High		
P1 Rural or Village Center	T2	T1	-	2.13	-	0.03	-	0.05	1	2
P2 Small Town or Suburban Ce	T2	T2	2.13	6.63	0.03	0.10	0.05	0.15	1.5	3
P3 Medium Town or Suburban	T3	T2	6.63	13.75	0.10	0.21	0.15	0.32	2	4
P4 Large Town or Suburban Ce	T4	T3	13.75	33.75	0.21	0.50	0.32	0.77	3	6
P5 Urban Center	T5	T4	33.75	70.00	0.50	1.04	0.77	1.61	5	9
P6 Urban Core	T6	T5	70.00	-	1.04	-	1.61	-	7	14

REVISE ASSUMPTIONS BELOW

ASSUMPTIONS	
50%	of activity units are jobs
50%	of activity units are population
500	sq. ft. = 1 job
2,000	sq. ft. = 1 dwelling unit
2.5	persons = 1 dwelling unit
0.65	Gross-to-Net Ratio
50%	of inner quarter-mile residential density concentrated to 1/8 mile TOD node
50%	of inner quarter-mile residential density located outside of 1/8 mile TOD node
50%	of inner quarter-mile employment density concentrated to 1/8 mile TOD node
50%	of inner quarter-mile employment density located outside of 1/8 mile TOD node

*The inner 1/8 mile circle contains 25% of the land area of the entire 1/4 mile circle.
A distribution of 25% within and 75% outside will result in equal densities in the inner circle and outer ring.

MULTIMODAL CENTER GROSS ACTIVITY DENSITY | **TOTAL FLOOR-AREA-RATIO based on Activity Density (combined residential and commercial)**

Create your own Center. Enter Inner and Outer T Zones.	Transect Zones		Activity Density = (Jobs + HH)/acre		Gross Building FAR (includes res + com)		Net Building FAR (includes res + com)	
	Inner	Outer	Low	High	Low	High	Low	High
Custom MM Center A	T6	T4	31.25	-	0.47	-	0.72	-
Custom MM Center B	T5	T5	30.00	50.00	0.45	0.75	0.69	1.15
Custom MM Center C	T3	T1	-	6.50	-	0.10	-	0.15

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

	INSIDE TOD NODE (1/8 mile radius circle)								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)		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	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			Low	High	Low	High	Low	High		
P3 Medium Town or Suburban Center	13.3	27.5	0.20	0.41	0.30	0.63	4	7	4.4	9.2	0.07	0.14	0.10	0.21	3	5
P4 Large Town or Suburban Center	27.5	67.5	0.41	1.01	0.63	1.55	7	12	9.2	22.5	0.14	0.34	0.21	0.52	4	8
P5 Urban Center	67.5	140.0	1.01	2.09	1.55	3.21	9	18	22.5	46.7	0.34	0.70	0.52	1.07	6	12
P6 Urban Core	140.0	-	2.09	-	3.21	-	13	28	46.7	-	0.70	-	1.07	-	9	19

APPENDIX D.

ACCESS MANAGEMENT CONSIDERATIONS FOR MODAL EMPHASIS

The following Appendix summarizes the recommended standards for access management by Multimodal Corridors in these Guidelines. The original matrix is in spreadsheet format and is laid out in individual page formats in this Appendix. Additional information about the Multimodal Center typology and recommended metrics is located in Chapter 3 of these Guidelines.

The frequency and spacing of intersections and driveways can affect how well a corridor accommodates different modes. Generally Placemaking Corridors, except for Local Streets, should have limited driveway access points to reduce conflict points for all modes. Automobile access to buildings is preferably oriented to the back of buildings, or along the side in some instances. Except for Local Streets in residential neighborhoods, access to properties should be provided in back of the buildings with a backage (or reverse frontage) road.

The following discussion examines the effects of intersection and driveway spacing on each modal emphasis. Table D-1 provides recommendations for spacing for each intersection and entrance type relative to the Minimum Spacing Standards in the VDOT Road Design Manual.

Access Management Effects on Modal Emphasis

Pedestrian

Pedestrians will typically walk anywhere they feel safe. They do not follow designated travel paths like automobiles and are more likely to ignore visual cues. They may walk in the street instead of on the sidewalk, cross the street where there is no crosswalk, cross the street outside of the pedestrian signal phase, and they may be less aware of their surroundings (texting, talking, etc). Pedestrians will usually take shortcuts to avoid going out of the way for a designated crosswalk. Providing frequent crossings minimizes the likelihood that pedestrians will cross midblock and helps motorists to stay alert to the possible presence of pedestrians.

The ITE/CNU Guidebook recommends providing smaller block lengths for walkable thoroughfares, with block lengths ranging from 200 to 660 feet.[1] Pedestrians generally need frequent crossings to access destinations on both sides of the street. This is especially important on major avenues where the traffic volumes may be high. Frequent driveway cuts and partial access intersections are discouraged on corridors with pedestrian emphasis. Midblock pedestrian crossings should not be necessary if block lengths are short enough.

At intersections, especially high-volume intersections, pedestrians need high-visibility crosswalks. Curb extensions are recommended when on street parking is provided; on street parking is generally beneficial with pedestrian emphasis. Median refuges are beneficial for roads with more than two travel lanes, and especially for unsignalized intersections for larger street types where there is moderate to heavy vehicular traffic, as they allow pedestrians to focus on crossing one direction at a time and provide a safe space to wait for a gap in oncoming traffic. At signalized intersections, pedestrian count-down signals, adequate crossing times, and shorter cycle lengths are strongly recommended. Small curb return radii are beneficial for pedestrians; channelized right turn lanes should be discouraged. Driveway cuts, if necessary, should be 24 feet wide or less.

---

[1] ITE/CNU's *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*, Chapter 3 provides guidance on block length and street spacing.

Bicycle

Frequent driveway entrances can pose safety problems for bicyclists. Motorists pulling out of driveways may not be looking for bicyclists riding closer to the edge of the roadway, and especially if bicyclists are riding on the sidewalk. Motorists may attempt to pass a bicyclist and immediately turn off the road into a driveway, which creates a serious conflict. Bicyclists turning left to access a destination on the other side of the road may need to stop to wait for a gap in oncoming traffic. Even with proper hand signals, vehicles behind the bicyclist may not be expecting the cyclist to slow down or stop, and run the risk of collision, which is extremely dangerous for the cyclist.

Transit

There are advantages and disadvantages to access management for transit modal emphasis. For commuter and express bus service, frequent intersection and driveway spacing will create more conflict points and slow speeds. For local service, more frequent intersections will provide more opportunities for bus stops. More frequent stops slows transit travel speeds, but it makes it more convenient for transit riders to access their destinations. This is the classic mobility vs. accessibility dilemma of transit and transportation planning.

Green

Access management has little effect on green modal emphasis. Tree plantings, shrubbery and other landscaping elements are interrupted by driveway entrances. As with the other modal emphases, driveway access points should be limited.

Parking

Frequent driveway openings limit the number of on street parking spaces. Parallel-parked cars limit the sight distance of vehicles that pull out of driveways, creating potential safety hazards. Corridors with parking modal emphasis should consolidate driveway openings wherever possible. Backage (or reverse frontage) roads can provide access to properties without curb cuts. These backage roads would ideally connect to other roads that intersect the main road with a full-access intersection. This configuration provides continuous length for on street parking and minimizes conflicts between vehicles maneuvering into parking spaces and vehicles pulling out of driveways.

Spacing Recommendations by Modal Emphasis

The following table provides recommendations for intersection and entrance spacing for each Modal Emphasis relative to the Minimum Spacing Standards in the VDOT Design Manual.

A indicates that intersections of this type should be spaced as closely together as possible on corridors with this Modal Emphasis. The VDOT minimum spacing standards provide a baseline for minimum spacing. Operational analyses may indicate that more frequent (i.e. shorter) spacing may be appropriate. The shortest spacing for these types of intersections should be used whenever possible.

B indicates that the VDOT minimum spacing standards are likely the best option. Intersections of these types with these Modal Emphases may have mixed impacts. The VDOT minimum spacing standards will provide an adequate number of connections and crossings for each mode. Less frequent (i.e. longer) spacing will make accessing destinations for difficult, especially for pedestrians and bicyclists.

C indicates that these types of entrances should be minimized (i.e. less frequent or longer spacing between entrances). These types of entrances create conflict points and safety problems.

Table D-1 – Access Management Considerations for Modal Emphasis

ACCESS MANAGEMENT CONSIDERATIONS FOR MODAL EMPHASIS					
	Pedestrian	Bicycle	Transit	Green	Parking
Signalized Intersections	A	A	A	B	B
Unsignalized Intersections & Crossovers	B	A	B	B	B
Full Access Entrances	C	C	C	C	C
Partial Access Entrances	C	C	C	C	C

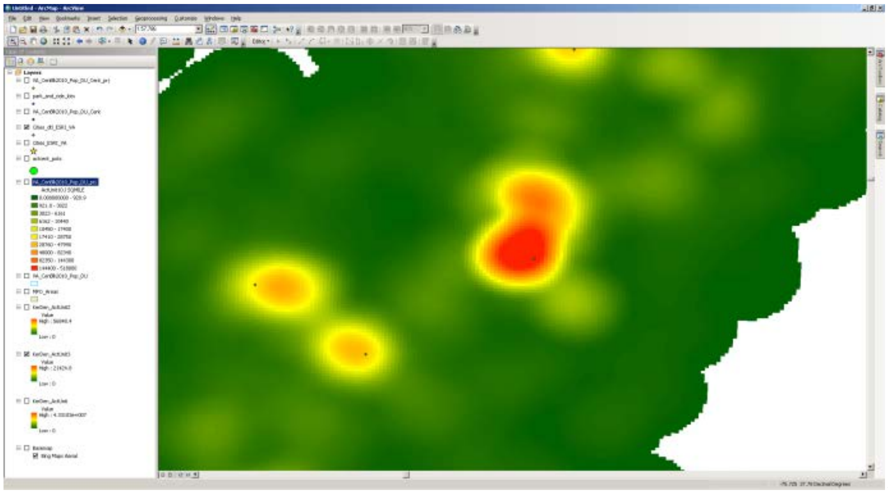
A = Use VDOT minimum. If possible, provide more frequently than VDOT minimum.
B = Use VDOT minimum. Neutral factor to Modal Emphasis, or contains both benefits and drawbacks.
C = Provide maximum possible distance between intersections or entrances.
See VDOT Road Design Manual Appendix F for types of access points.

APPENDIX E.

ANALYSIS OF POTENTIAL MULTIMODAL CENTERS IN VIRGINIA

The following describes the methodology used for analyzing Potential Multimodal Centers in Virginia. This work was done as part of a contract with the Office of Intermodal Planning and Investment to study statewide accessibility in 2011. The results of that study were also used in the development of the Multimodal System Design Guidelines by classifying the activity density of each of the 319 centers in that study according to the Multimodal Center types (P-1 to P-6) used in the Multimodal System Design Guidelines.

A Potential Multimodal Center, as defined in this study, is a local concentration of population and/or employment. Potential Multimodal Centers throughout Virginia range from the downtowns of large cities to small town centers to concentrations of suburban employment or population. The geography used for testing in this study for Potential Multimodal Centers was a 1-mile wide (diameter) circle. Defining a statewide dataset of activity centers required a flexible methodology and multiple iterations of edits to refine what would become the final set of 319 one-mile diameter activity centers. Rather than only including the centers with the highest concentrations of population and jobs in the Commonwealth, it was decided to distribute the centers geographically and include all counties in the State, numerous villages, small towns and large cities, in order to span the full range of rural, suburban, and urban contexts in Virginia. What they share in common is a relative concentration of people and jobs, compared with their surrounding areas, suggesting their historic significance relative to their surrounding area or surrounding region.



To define activity centers, the first thing that was needed was an understanding of the spatial distribution of activity in the Commonwealth. For the purpose of this study, the definition of activity was the sum of population and jobs in an area. This was analyzed in several ways.

- First, ArcGIS was used to calculate the kernel density of jobs and population across the state. This resulted in a continuous surface of job or population density, interpolated from Census block centroids. From this, high activity values can be shown by themselves, making these “hotspots” readily apparent (see the “heat map” of activity density below).

- A cross check on this method of analyzing activity density was to use the density of the Census blocks themselves, color-coded to represent the level of density in each block. An industry-standard way to describe the density of a built environment is by use of a "Transect," which categorizes the spectrum of density from very rural (T1) to very urban (T6).
- A final way to verify activity centers was through the use of aerial imagery. Aerial imagery was overlaid with the previously described activity 'heat maps' to verify and confirm the specific center of density in each activity center.

After using this methodology for identifying potential activity centers, the next step was to compare it to Census data on major cities and Census Designated Places (CDP - both of which were layers available from the US Census) as starting points for identifying activity centers. Centroids were created from the CDP layer, as it was originally a polygon layer describing the CDP boundaries. These layers included a total of 452 points, some of which were located in centers of activity density, although most were not. The locations of these points were manually adjusted so that they were brought in alignment with the clusters of activity density. There were several criteria used for relocating these points:

- Maximize activity density (place the centroid so that it captures the maximum amount of activity units)
- If possible, place the point on a major street or intersection
- Do not move the centroid out of its boundary (either CDP or municipal boundary)

This methodology provided an initial set of candidate activity centers. Centers were also located in activity rich areas, like major commercial districts, universities, and Metro Rail stations in northern Virginia. Basic metrics for this first set of candidate activity centers were calculated to aid in the selection process, which was necessary due to the overrepresentation of activity-poor areas. This was particularly evident among the CDPs, an analysis of which showed that just because they are designated as a "place" does not mean that they are a center of activity.

As noted above, there were many small towns initially considered as potential activity centers due to their designation as CDPs. However, CDPs accounted for about 89 percent of the centers tagged for deletion in this round. During the deletion process, the geographic representation of the activity centers was paramount. If a center was the only one in a county or large area, it was kept as part of the activity center set. Also during this stage, centers were thinned out where there was excessive overlap. This was especially the case along some Metro Rail transit corridors as shown in the two images below – the one on the left before the deletion process and the one on the right after the deletion process.

Other centers were added or moved based on further analysis of aerial imagery, especially to identify suburban activity centers, where identifying distinct central locations can be difficult.

Data Used

The following is a listing of primary data sources used in this analysis:

- **Population.** US Census Blocks [1], with SF1 Summary data for population.
- **Employmen**t. US Census LED On the Map Tool[2], obtained statewide employment at the Census Block level for 2010, downloaded in March 2012.

A Summary table of the activity density by Multimodal Center type is shown on the following pages.

---

1 U.S. Census Bureau 2010 TIGER/Line® Shapefiles. http://www.census.gov/cgi-bin/geo/shapefiles2010/main

2 U.S. Census Bureau. 2012. OnTheMap Application. Longitudinal-Employer Household Dynamics Program. http://onthemap.ces.census.gov/

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Tysons West	55,013	109.7	P6
Richmond	54,640	108.9	P6
Richmond South of River	54,640	108.9	P6
Rosslyn	44,791	89.3	P6
Backlick & Edsall	42,426	84.6	P6
Ballston - MU	42,372	84.5	P6
Norfolk	37,772	82.3	P6
Pentagon City/Crystal City	37,475	74.7	P6
Alexandria	27,176	54.2	P5
Reston Parkway	26,412	52.6	P5
Reston South Lakes	26,412	52.6	P5
Reston Lake Anne	26,412	52.6	P5
Clarendon	20,012	39.9	P5
Bailey's Crossroads	19,673	39.2	P5
Alexandria West	19,045	38.0	P5
University of Virginia	17,763	35.4	P5
Hampton	14,787	33.9	P5
Lake Monticello	16,134	33.3	P4
Tysons East	16,692	33.3	P4
Merrifield	16,645	33.2	P4
Herndon-Monroe	16,434	32.8	P4
Chantilly	16,297	32.5	P4
Richmond West	16,291	32.5	P4
Charlottesville	16,134	32.2	P4
Roanoke	15,953	31.8	P4
Van Dorn Street	15,319	30.5	P4
Chesterfield Court House	15,311	30.5	P4
Fair Oaks East	15,147	30.2	P4
Fair Oaks South	15,147	30.2	P4
Fairfax	15,043	30.0	P4
George Mason University	15,043	30.0	P4
Idylwood	14,313	28.5	P4
Lincolnia	14,224	28.4	P4
Fan District	13,408	26.7	P4
King St/Eisenhower Ave	13,326	26.6	P4
Staples Mill Rd	13,095	26.1	P4
Lynnhaven	13,085	26.1	P4
Hybla Valley	12,728	25.4	P4
Falls Church	12,715	25.3	P4
Alexandria Old Town North	11,587	25.3	P4
istopher Newport University	12,589	25.1	P4

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Fair Oaks	12,578	25.1	P4
Chesapeake Great Bridge	12,559	25.0	P4
Columbia Pike	12,492	24.9	P4
Portsmouth Downtown	12,320	24.6	P4
Shirlington	12,145	24.2	P4
Lake Barcroft	11,727	23.4	P4
Alexandria North	11,587	23.1	P4
Manassas	11,542	23.0	P4
Bull Run	11,488	22.9	P4
Virginia Beach Town Center	11,322	22.6	P4
Seven Corners	10,719	21.4	P4
McLean	10,639	21.2	P4
Cox Rd & Nuckols Rd	10,616	21.2	P4
Wiehle Avenue	10,473	20.9	P4
Williamsburg	10,016	20.0	P4
Winchester	10,005	19.9	P4
Annandale	9,622	19.2	P4
Norfolk North Downtown	9,519	19.0	P4
Old Dominion University	9,519	19.0	P4
Chippenham	9,499	18.9	P4
Diamond Springs & Wesleyan	9,414	18.8	P4
Jefferson	9,204	18.3	P4
Harrisonburg	9,101	18.1	P4
James Madison University	9,101	18.1	P4
Vienna/Fairfax - GMU	9,072	18.1	P4
Centreville	9,019	18.0	P4
Newport News	8,983	17.9	P4
Route 28	8,641	17.2	P4
Chantilly East	8,615	17.2	P4
Virginia Beach Greenwich	8,607	17.1	P4
Thomas Corner	8,607	17.1	P4
Laurel	8,325	16.6	P4
Radford University	8,250	16.4	P4
Chesapeake Greenbriar	8,251	16.4	P4
Mount Vernon	7,993	15.9	P4
Farmville	7,873	15.7	P4
Warrenton	7,817	15.6	P4
Franconia	7,811	15.6	P4
Danville	7,767	15.5	P4
Burke	7,740	15.4	P4
Lynchburg	7,678	15.4	P4
Sherwood Forest	7,689	15.3	P4
Marumsco Woods	7,677	15.3	P4
Leesburg	7,671	15.3	P4

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Leesburg Fort Evans	7,671	15.3	P4
Loch Lomond	7,441	14.8	P4
Portsmouth West	7,412	14.8	P4
Broad Street & Pemberton	7,366	14.7	P4
Fredericksburg	7,362	14.7	P4
Springfield	7,361	14.7	P4
S Sterling Blvd	7,350	14.7	P4
Acredale	7,300	14.5	P4
Blacksburg	7,252	14.5	P4
West Gate	7,242	14.4	P4
Newington	7,177	14.3	P4
Manassas Park	7,152	14.3	P4
Suffolk	7,087	14.1	P4
Peninsula Town Center	7,077	14.1	P4
Port of Newport News	6,917	14.0	P4
Bristol	6,961	13.9	P4
Newport News Shipyard	6,917	13.8	P4
Level Green	6,903	13.8	P4
Sudley	6,846	13.6	P3
Staunton	6,713	13.4	P3
Occoquan	6,659	13.3	P3
Vienna	6,609	13.2	P3
Groveton	6,551	13.1	P3
Ashburn	6,461	12.9	P3
Midlothian	6,430	12.8	P3
Hodges Manor	6,299	12.5	P3
Salem	6,251	12.5	P3
Lexington	6,236	12.4	P3
Tuckahoe	6,190	12.3	P3
Christiansburg	6,161	12.3	P3
Woodbridge	6,120	12.2	P3
Virginia Beach	6,038	12.0	P3
Quantico Station	5,517	12.0	P3
West Springfield	6,009	12.0	P3
Cascades	5,944	11.8	P3
Dulles Town Center	5,944	11.8	P3
Lake Ridge	5,697	11.4	P3
Gayton Centre	5,683	11.3	P3
Ashburn Farm & Claiborne	5,643	11.2	P3
Broad Street & 64	5,594	11.2	P3
University of Richmond	5,594	11.2	P3
Dumbarton	5,594	11.2	P3
Dumfries	5,517	11.0	P3
North Springfield	5,406	10.8	P3

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Bloxoms Corner	5,407	10.8	P3
Front Royal	5,358	10.7	P3
Woodfield & Laurelwood	5,298	10.6	P3
Petersburg	5,272	10.5	P3
Fort Belvoir	5,244	10.5	P3
Lorton	5,244	10.5	P3
Hopewell	4,946	10.4	P3
and Rd & Independence Blvd	5,187	10.3	P3
Bedford	5,175	10.3	P3
Herndon	5,133	10.2	P3
Waynesboro	5,074	10.1	P3
Cave Spring	5,068	10.1	P3
Marion	5,060	10.1	P3
East Falls Church	5,019	10.0	P3
Dale City	4,999	10.0	P3
Spring Knoll Plaza	4,981	9.9	P3
Radford	4,859	9.7	P3
Ettrick	4,828	9.6	P3
Ashland	4,812	9.6	P3
Yorkshire	4,665	9.3	P3
Haymarket	4,613	9.2	P3
Vinton	4,583	9.1	P3
Five Mile Fork	4,574	9.1	P3
Culpeper	4,559	9.1	P3
Belle Haven	4,558	9.1	P3
Montrose	4,402	8.8	P3
Loxley Gardens	4,398	8.8	P3
Industrial Complex	4,393	8.8	P3
Galax	4,316	8.6	P3
Oakton	4,268	8.5	P3
Wise	4,196	8.4	P3
Colonial Heights	4,132	8.2	P3
Purcellville	4,125	8.2	P3
Round Hill	4,125	8.2	P3
Smithfield	3,720	8.2	P3
Martinsville	4,074	8.1	P3
Aquia Harbour	4,070	8.1	P3
Mechanicsville	4,065	8.1	P3
Grundy	3,995	8.0	P3
Berryville	3,956	7.9	P3
Highland Springs	3,952	7.9	P3
Emporia	3,954	7.9	P3
Linton Hall	3,926	7.8	P3

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Pulaski	3,880	7.7	P3
Dunn Loring	3,825	7.6	P3
Rose Hill Dr	3,824	7.6	P3
Richlands	3,825	7.6	P3
Woodstock	3,776	7.5	P3
Lakeside	3,768	7.5	P3
Norton	3,741	7.5	P3
Short Pump	3,679	7.3	P3
Elkton	3,515	7.0	P3
Stephens City	3,510	7.0	P3
Hollymead	3,427	6.8	P3
Albemarle Square	3,427	6.8	P3
Clintwood	3,362	6.7	P3
Abingdon	3,356	6.7	P3
East Highland Park	3,345	6.7	P3
Covington	3,331	6.6	P3
Gloucester Courthouse	3,203	6.4	P2
Glen Allen	3,126	6.2	P2
Fort Hunt	3,121	6.2	P2
Route 772	3,043	6.1	P2
Wytheville	2,996	6.0	P2
West Falls Church -VT/UVA	2,968	5.9	P2
Jonesville	2,947	5.9	P2
Timberville	2,920	5.8	P2
Bridgewater	2,859	5.7	P2
Franklin	2,859	5.7	P2
Bensley	2,841	5.7	P2
Wyndham	2,824	5.6	P2
Broadway	2,705	5.4	P2
Bon Air	2,671	5.3	P2
Hillsville	2,643	5.3	P2
Buena Vista	2,589	5.2	P2
Montclair	2,417	5.0	P2
Bealeton	2,457	4.9	P2
Gate City	2,433	4.8	P2
Orange	2,428	4.8	P2
Appomattox	2,421	4.8	P2
Roanoke Mall	2,389	4.8	P2
Hollins	2,389	4.8	P2
Fort Lee	2,370	4.7	P2
Luray	2,362	4.7	P2
Sandston	2,342	4.7	P2
Monticello Marketplace	2,300	4.6	P2
Clifton Forge	2,238	4.5	P2

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Lebanon	2,219	4.4	P2
Halifax	2,217	4.4	P2
Lawrenceville	2,183	4.3	P2
Strasburg	2,176	4.3	P2
South Hill	2,159	4.3	P2
Stuart	2,120	4.2	P2
Verona	2,100	4.2	P2
Bluefield	2,069	4.1	P2
Grafton Village	2,063	4.1	P2
Falmouth	2,063	4.1	P2
South Boston	2,057	4.1	P2
Shenandoah	1,973	3.9	P2
Grottoes	1,956	3.9	P2
Mantua	1,948	3.9	P2
Fishersville	1,947	3.9	P2
Timberlake	1,942	3.9	P2
Gloucester Point	1,896	3.9	P2
Accomac	1,914	3.8	P2
Colonial Beach	1,827	3.8	P2
Tappahannock	1,522	3.7	P2
Dublin	1,803	3.6	P2
Chase City	1,797	3.6	P2
Chamberlayne	1,752	3.5	P2
Big Stone Gap	1,726	3.4	P2
Gordonsville	1,701	3.4	P2
Bowling Green	1,698	3.4	P2
Glasgow	1,688	3.4	P2
Waverly	1,679	3.3	P2
Blackstone	1,673	3.3	P2
Madison Heights	1,671	3.3	P2
Lovettsville	1,662	3.3	P2
Chester	1,652	3.3	P2
Coeburn	1,607	3.2	P2
Crewe	1,572	3.1	P2
Cloverdale	1,570	3.1	P2
Mount Crawford	1,553	3.1	P2
Marshall	1,505	3.0	P2
Altavista	1,491	3.0	P2
Floyd	1,474	2.9	P2
West Point	1,215	2.9	P2
Kilmarnock	1,452	2.9	P2
Amherst	1,397	2.8	P2
Tazewell	1,382	2.8	P2
Chatham	1,376	2.7	P2

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Pearisburg	1,320	2.6	P2
Narrows	1,320	2.6	P2
Gretna	1,318	2.6	P2
Dahlgren	1,148	2.5	P2
Exmore	1,265	2.5	P2
Chincoteague	1,240	2.5	P2
Collinsville	1,235	2.5	P2
Pennington Gap	1,233	2.5	P2
Goochland	1,193	2.4	P2
Woodlawn	1,166	2.3	P2
Louisa	1,164	2.3	P2
Clarksville	991	2.3	P2
Brookwoods Golf Club	1,122	2.2	P2
Victoria	1,112	2.2	P2
New Castle	1,111	2.2	P2
Elliston-Lafayette	1,088	2.2	P2
Cape Charles	948	2.1	P2
Spotsylvania Courthouse	1,036	2.1	P2
Poquoson	1,000	2.0	P1
Madison	980	2.0	P1
Kenbridge	959	1.9	P1
Warsaw	952	1.9	P1
Fincastle	947	1.9	P1
Independence	945	1.9	P1
Powhatan	934	1.9	P1
Boykins	910	1.8	P1
Stanardsville	905	1.8	P1
Crozet	903	1.8	P1
Ferrum College	885	1.8	P1
Rocky Mount	885	1.8	P1
Courtland	881	1.8	P1
Amelia Court House	792	1.6	P1
Urbanna	654	1.5	P1
Yorktown	621	1.4	P1
Keysville	623	1.2	P1
Rustburg	579	1.2	P1
Jarratt	562	1.1	P1
Washington	512	1.0	P1
Scottsville	486	1.0	P1
Surry	475	0.9	P1
McKenney	474	0.9	P1
Mineral	468	0.9	P1
Buchanan	464	0.9	P1
Rose Hill	455	0.9	P1

NAME	Activity Units (People + Jobs)	Activity Units/Acre	Multimodal Center Type
Lovingston	452	0.9	P1
Dryden	447	0.9	P1
Ivor	436	0.9	P1
Bland	382	0.8	P1
Forest	369	0.7	P1
Reedville	328	0.7	P1
Port Royal	273	0.7	P1
Monterey	241	0.5	P1
Mathews	236	0.5	P1
Dillwyn	233	0.5	P1
Dendron	193	0.4	P1
Warm Springs	99	0.2	P1
Cumberland	97	0.2	P1
Charles City	63	0.1	P1
King and Queen Courthouse	3	0.0	P1

MULTIMODAL CENTER INTENSITY			
Center Type	**Activity Density (Jobs + people/acre)**	**Gross Development FAR (residenial + non-residential)**	**Net Development FAR (residenial + non-residential)**
P1 Rural or Village Center	2.13 or less	0.03 or less	0.05 or less
P2 Small Town or Suburban Center	2.13 to 6.63	0.03 to 0.10	0.05 to 0.15
P3 Medium Town or Suburban Cente	6.63 to 13.75	0.10 to 0.21	0.15 to 0.3
P4 Large Town or Suburban Center	13.75 to 33.75	0.21 to 0.5	0.3 to 0.8
P5 Urban Center	33.75 to 70.0	0.5 to 1.0	0.8 to 1.6
P6 Urban Core	70.0 or more	1.0 or more	1.6 or more

APPENDIX F.

CONNECTIONS TO PUBLIC HEALTH

Multimodal Transportation Planning and Public Health

Public health is not just a measure of access to medical care. A variety of factors influence physical, mental and social health, most notably social and environmental circumstances. Where and how we live, work, learn and play has an enormous influence on how healthy we are. Different types of neighborhoods have differing levels of toxin exposure, access to affordable healthy food, connected social institutions, and other resources. Transportation planning decisions greatly influence access to these resources, and have direct implications on public health.

Transportation policies affect travel choices. Research has shown that policies that provide more opportunities for active transportation (bicycling, walking, and taking public transportation) provide numerous benefits for public health. When people walk or bike, they are more physically active, and statistically less likely to develop heart disease, cancer and diabetes, suffer strokes and negative effects from stress, and die young. Research also shows that these policies have resulted in a lower risk of pedestrian and bicyclist fatalities. Transportation decisions also affect air pollution, which in turn affect rates of asthma, lung disease, lung cancer and mortality, noise pollution, water quality, overall mental health, and the likelihood of injury or death from car crashes.[1,2] Decisions to provide more opportunities to walk, bike and take public transportation instead of driving alone can improve all of these aspects of public health.

Health Indicators in Virginia

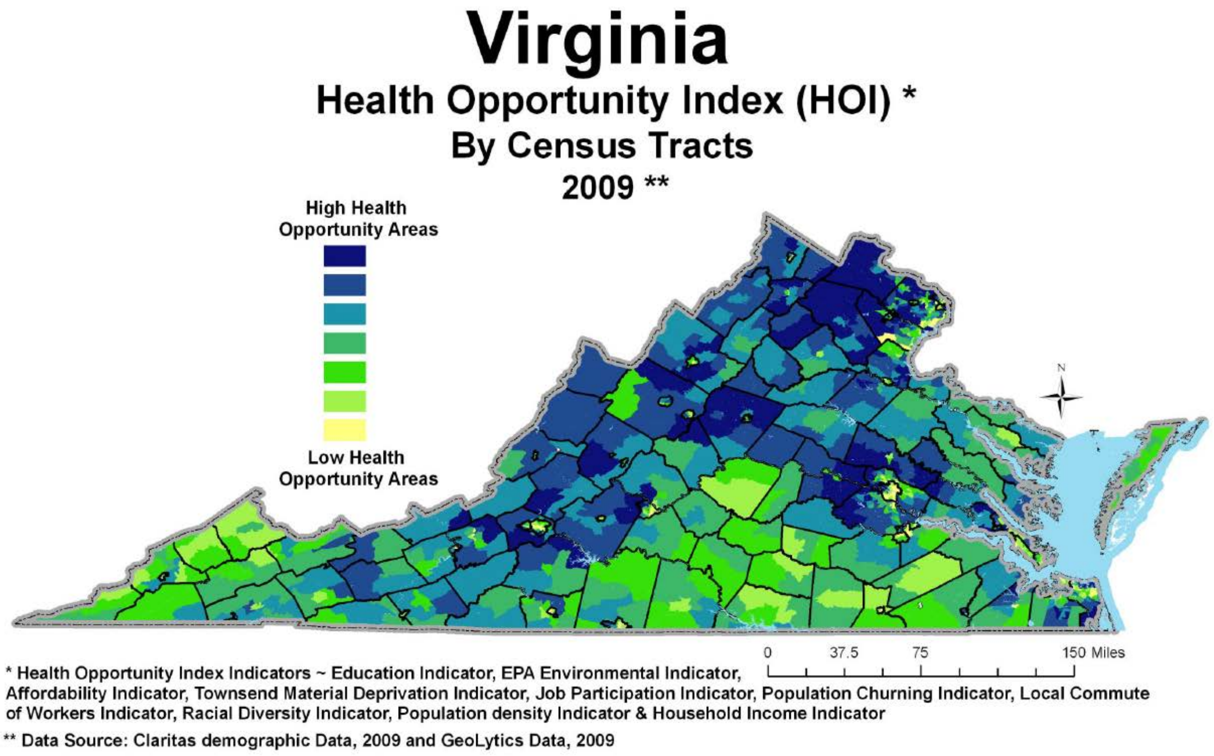
The Virginia Department of Health (VDH) is committed to protecting and promoting the health of all Virginians and has been involved in the development of these Multimodal System Design Guidelines. VDH publishes an annual Health Equity Report which evaluates the health status of Virginia's residents, especially for disadvantaged populations. The 2012 report provides a Health Opportunity Index (HOI) by census tract across the Commonwealth. The HOI reflects the indirect factors that contribute to public health including education, environmental hazards, transportation and housing affordability, income, employment, population density, racial diversity, and commuting patterns, referred to as the social determinants of health. Social determinants essentially reflect the opportunities or lack thereof to live a physically, mentally and socially healthy lifestyle.

Figure F-1 shows the results of the HOI analysis across Virginia. Some large rural areas perform poorly, as do some mid-sized and specific areas of larger cities. This analysis shows that areas across the Commonwealth in both urban and rural contexts can benefit from increased opportunities for healthy living.

---

[1] American Public Health Association. *At the Intersection of Public Health and Transportation: Promoting Healthy Transportation Policy.* http://www.apha.org/NR/rdonlyres/43F10382-FB68-4112-8C75-49DCB10F8ECF/0/TransportationBrief.pdf.

[2] Policy Link, Prevention Institute, and Convergence Partnership. *The Transportation Prescription: Bold New Ideas for Healthy, Equitable Transportation Reform in America.* http://www.policylink.org/atf/cf/%7B97C6D565-BB43-406D-A6D5-ECA3BBF35AF0%7D/transportationRX_final.pdf.



* Health Opportunity Index Indicators ~ Education Indicator, EPA Environmental Indicator, Affordability Indicator, Townsend Material Deprivation Indicator, Job Participation Indicator, Population Churning Indicator, Local Commute of Workers Indicator, Racial Diversity Indicator, Population density Indicator & Household Income Indicator

** Data Source: Claritas demographic Data, 2009 and GeoLytics Data, 2009

Figure F-1 - Health Opportunity Index Throughout Virginia

What is a Health Impact Assessment?

A Health Impact Assessment[3] (HIA) is a process that evaluates the potential effects of a community design plan or policy on public health. Through an HIA, communities can make more informed decisions about transportation, land use and other public policy concepts to ensure these decisions are providing benefits for public health. HIAs are particularly valuable for identifying and understanding potential health impacts that are not outwardly apparent and those that may disproportionately affect disadvantaged populations. HIAs are compared to other assessments like environmental impact assessments as a formal process to understand all potential implications of a policy or decision.

A Health Impact Assessment typically consists of the following steps[4]:

1. **Screening** determines whether a proposal is likely to have health effects and whether in the HIA will provide information useful to the stakeholders and decision-makers.
2. **Scoping** establishes the scope of health effects that will be included in the HIA, the populations affected, the HIA team, sources of data methods to be used, and alternatives to be considered.
3. **Assessment** describes the baseline health status of the affected population and assesses potential impacts.

---

[3] For more information on Health Impact Assessments, please visit the Centers for Disease Control and Prevention website at http://www.cdc.gov/healthyplaces/hia.htm.

[4] The National Research Council outlines and describes this six-step framework in *Improving Health in the United States: The Role of Health Impact Assessment* (2011). http://www.nap.edu/catalog.php?record_id=13229

4. **Recommendations** suggest alternatives that could improve health or actions that could be taken to manage the health effect, if any, that are identified.
5. **Reporting** documents and presents the findings and recommendations.
6. **Monitoring and Evaluation** can address adoption and implementation of HIA recommendations and changes in health or health determinants.

The steering committee for these Multimodal System Design Guidelines expressed interest in conducting an HIA for these guidelines. Should this be pursued, the following section provides an overview of other communities in the U.S. that have conducted HIAs on transportation planning initiatives.

Examples of Health Impact Assessments

Health Impact Assessments are commonly used internationally in Europe, Australia, New Zealand, and Canada, and are gaining momentum in the U.S. as a holistic approach to promoting health.

Health Impact Assessments in Virginia

Although few HIAs have been conducted in Virginia, interest in this field is rapidly growing. The academic community is pioneering several HIAs in Virginia.

The Center on Human Needs at Virginia Commonwealth University is currently conducting an HIA for a biomass facility that would convert poultry litter into an energy source in the Shenandoah Valley.[5] Participants in this HIA process are working through concerns regarding air quality, water quality, the local economy, employment, and social cohesion.

In 2008, students at the University of Virginia customized an HIA for the City of Charlottesville for future implementation by community leaders.[6]

Examples of Health Impact Assessments on Transportation Planning Initiatives

Several localities have applied the HIA process to transportation planning initiatives.

HIA on Transportation Policies in the Eugene Climate and Energy Action Plan (Eugene, OR)

In 2010, Upstream Public Health, a non-profit organization, conducted a collaborative six-step HIA process in Eugene, Oregon, to examine the potential health effects of transportation recommendations in the City's Climate and Energy Action Plan. It addressed health issues including injuries and chronic cardiovascular and respiratory diseases, crash rates, physical activity, and air pollution.[7]

---

[5] More information about the Shenandoah Valley Poultry Litter to Energy HIA can be found online at http://humanneeds.vcu.edu/Page.aspx?nav=217.

[6] http://news.virginia.edu/content/students-take-community-goal-help-charlottesville-become-americas-healthiest-city.

[7] For more information on the HIA on the transportation recommendations from the Eugene Climate and Energy Action Plan, please visit http://www.upstreampublichealth.org/resources/eugene-climate-and-energy-action-plan-hia.

HIA on Transit-Oriented Development Policy (Saint Paul, MN)

The Twin Cities in Minnesota are planning four transit corridors for transit-oriented development (TOD), with the Central Corridor Light Rail Line under construction. The community expressed concern that the light rail line and subsequent land use changes may negatively affect the existing communities, which include some of the region's most diverse and low-income populations who have experienced disinvestment and historic discrimination.

A community collaborative of Policy Link (a national research and action institute for advancing economic and social equity), Take Action Minnesota (a statewide non-profit), and ISAIAH (a regional faith-based coalition) launched an HIA to better understand the potential impacts. The HIA focused on maintaining a healthy economy, affordable healthy housing, and safe and sustainable transportation. It resulted in five policy recommendations: starting a Community Equity Program, codifying a commitment to affordable housing, starting a density bonus program, relieving the lack of commercial parking, and requiring first source hiring.[8]

---

[8] For more information on the HIA on Saint Paul's Transit-Oriented Development Policy, please visit http://www.policylink.org/site/c.lkIXLbMNJrE/b.7841971/k.7BB/The_Healthy_Corridor_for_All_Health_Impact_Assessment.htm.

APPENDIX G.

BEST PRACTICES RESEARCH

The following Appendix summarizes research conducted as part of this project that looked at national and Virginia examples of best practices in multimodal planning.

Appendix G. Best Practices Research Table of Contents

A. Introduction

Cities and states throughout the country are recognizing the importance of integrating multimodal transportation and transit-oriented development policies with land use planning and urban design. Many agencies and localities have implemented policies and guidelines aimed at providing multimodal transportation options and encouraging supporting development patterns. This document provides a summary of the best practices review of multimodal planning and design, transit-oriented development and multimodal corridor guidelines.

This review focused on identifying examples and best practices in the industry relative to:

- Multimodal Corridor Planning
- Multimodal Corridor Design
- Multimodal Districts
- TOD Typologies and Place Types
- Performance Measures relative to Accessibility and Multimodal Quality of Service

This review also sought to identify the commonalities between various efforts relative to the specific measures and methods for multimodal and TOD guidelines; and identify notable presentation and illustrative elements for effectively communicating information to a broad constituency. This literature review will aid in developing the statewide guidelines and best practices in planning for multimodal districts, corridors and TOD within the Virginia context.

Included in the last section (Section F) is a table summarizing all relevant plans, policies and other literature reviewed as part of this best practices research. From this master list, the study team conducted a more detailed review of select plans and guidelines for inclusion herein as an annotated bibliography.

B. State of the Practice Synthesis and Relevance to Virginia

Research Synthesis

Cities, regions, and national research institutions continue to probe into theories of land use and transportation interaction. The example resources demonstrate the variety of ways to approach land use planning and urban design to promote context sensitive design, enhance community character, maintain appropriate scale, support different transportation choices and grow strategically.

Generally, the context sensitive resources for multimodal design and TOD area plans follow a standard structure of defining land use context and roadway classification, and designing the road or surrounding area accordingly. This approach is consistent with the ITE recommended practice in *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*. This general structure can be used as a starting point for the Virginia Multimodal and Public Space Design Guidelines.

The example resources define land use contexts with a wide spectrum of methodologies. Each community is unique and places differ by many variables. Capturing these similarities and theorizing the structure and organization of how they fit together are challenging tasks. Most cities and metropolitan areas define TOD place types by levels of densities, land use composition, and transit type. Denver's TOD typology is organized in this fashion. Indianapolis's multimodal guidelines address these variables and give additional descriptive information. Utah's Wasatch Front avoids creating specific place types, but specifies the ways in which TODs differ, including place and location, development type, and transit type. The general place types outlined in Reconnecting America and the Center for Transit Oriented Development's *Station Area Planning* are defined by levels of density/intensity, typical uses, and transit type, as well as the reach of economic influence. *Station Area Planning* briefly addresses connections between place types. For example, urban neighborhoods are connected to urban centers and regional centers.

Creating a typology that incorporates all potential station areas within an entire state is a daunting task. The Florida Department of Transportation (FDOT) and the California Department of Transportation (CalTrans) are two state agencies that have made progress on this front, and both use a two-dimensional graph to illustrate the connections between the various scales. FDOT's *A Framework for Transit Oriented Development in Florida* approaches place types according to level of activity and accessibility, and transit type   Community context is another major variable and represents a third dimension.   CalTrans uses a similar approach but with regional accessibility as one scale and community design as the other. Different place types have different locations within the graph. For example, rural towns have strong community design but weak regional accessibility (see page 34 for image). Both methodologies reveal differences between urban and suburban place types, but this designation is not the primary variable. Accessibility inherently explains differences in urban place types. These methodologies both hold promise and relevance for the Virginia effort.

Metro Portland and the Center for Transit Oriented Development have also developed interesting approaches to place types with a two-dimensional graph, which may also be of use in developing guidelines for Virginia. Metro Portland places level of transit orientation along one axis and market strength along the other. The level of transit orientation assesses things like connectivity of sidewalks, concentration of activities, and mix of uses. Metro uses this methodology to prioritize stations in allocating funds from their TOD program. Of particular use to the Virginia effort may be the repackaging of the "Ds" of density into "Ps" of transit orientation: people (residents and employees per acres), places (retail and services that serve daily needs), pedestrian and bicycle connectivity (presence of sidewalks and low-stress bikeways), performance (transit frequency – bus and rail), and physical form (underlying block structure). In *Performance-Based Transit Oriented Development Typology Guidebook*, the Center for Transit Oriented Development (CTOD) places VMT along one axis and worker intensity along the other.

National resources also emphasize that transit oriented development does not just happen at the station area level. Transit corridors connect the station areas, and station areas fit within larger districts. The market shed of transit trips extends past the typical half-mile radius of a station area.

Ensuring that corridors and areas surrounding the station area are well-planned, context sensitive and provide for safe and convenient travel for all modes is critical.

Like place types, definitions of transit or multimodal corridors vary. Defining corridors and districts for the Virginia Multimodal Guidelines will be a critical task. In *Transit Corridors and TOD*, CTOD defines a transit corridor as the walkable areas around all of the stations along a transit line. However, multimodal corridors produce benefits even when a transit station is not within walking distance. Charlotte, NC, and Roanoke, VA, are two of many cities nationwide who (that?) are developing multimodal corridor guidelines to achieve "Complete Streets" throughout the city regardless whether that street is served by transit.

Multimodal corridors can vary in size depending on the transit type and function. A local bus corridor may be only one mile wide, since passengers typically walk to the transit station. A commuter transit corridor might be 3 to 5 miles wide depending on the speed of the mode that a passenger takes to reach the transit station. Even within one type of transit line, travel patterns between station areas will vary, as recognized in the WMATA *Station and Site Access Planning Manual*. Core stations are accessible by primarily walking, bicycling and bus, whereas passengers rely on non-walking modes to access mid-line and terminus stations. Addressing the complexities between different scales and different market sheds through corridors or districts will be a challenging endeavor and critical for understanding how the pieces fit together for the Virginia statewide effort.

The definition for multimodal transit corridors should also address the overlap between automobile demand and transit service. Within the statewide context, VTrans2035, Virginia's long range transportation plan has identified eleven corridors of statewide significance. Some of these corridors are interstates where high speed regional vehicular travel can be comparable to intercity rail. Other corridors of statewide significance are roads where higher speed regional and lower speed local traffic mix. The Virginia effort will need to address the competing needs of regional and local trips by creating new prototypes or hierarchy of multimodal corridors that accommodate the various modes at each scale. The guidelines will also need to address both the existing and future conditions of communities within Virginia relative to the evolution and growth of transit systems relative to growth of the community as a whole.

The concept of districts is less widely explored. The Indianapolis guidelines provide one way to define a district. A multimodal district is an area where daily destinations are within walking distance and usually within biking distance of a transit node. The concept of districts can bridge the gap between high density station areas and areas outside of the transit market shed.

Based on the best practices review, the Virginia guidelines should first identify the theoretical construct and typologies for station areas, corridors, and districts. From this will come specific design guidelines, measures and variables that can best support multimodal mobility within differing community place types. Determining the scale (in terms of level of detail for statewide prototypes) of recommendations will be a critical decision. The Florida and California statewide examples avoid detailed design guidelines like building transparency and garage treatments and address more macro issues like population and employment densities. More specific design guidelines are likely best reserved for more detailed station area plans. Broad elements that should be addressed include land use mix and placement, circulation and connectivity, station access and parking and other measures of multimodal mobility and accessibility.

The most interesting example resources did not just focus on design aspects of TOD, but acknowledged that market conditions also play a significant part in actualizing TOD build out over time. Utah's Wasatch Front guidelines explain market conditions as the fourth context in which TODs differ. Metro Portland uses market readiness as a variable in prioritizing investments in TOD.

Implementation strategies varied across the plans reviewed, but were present in most works. Implementation steps provide the guidance on how to translate policies and recommendations into reality. The best policies provide action items/ next steps within an implementation plan, including assigning roles and responsibilities of different players (local governments, transit agencies, developers, and others), creating and adopting strategies (parking management, affordable/ mixed income housing in TODs, etc), developing funding tools, and developing performance measures to track success. This level of implementation guidance should be included in the Virginia work.

Based on the national best practices review, the Virginia Multimodal and Public Space Design Guidelines should include the following key elements:

1. Present overarching principles of values, vision and the reasons for encouraging more efficient land use and transportation patterns and the benefits of targeting growth into areas already served or to be served by transit.
2. Acknowledge variations in community/ land use contexts, and create a system of categorization or classification (typologies, place types, etc.) such that a range of rural to urban conditions are addressed.
3. Discuss the differences in corridor and roadway network functions, character, and influence on surrounding land use, and present a typology or classification for the corridors and multimodal transportation networks necessary to support transit oriented or pedestrian oriented development patterns while at the same time ensuring reasonable levels of vehicular mobility.
4. Provide design guidance for the possible combination of land use place types and multimodal corridor typologies.
5. Present implementation strategies and phased approaches to assist communities in evolving multimodal corridors and districts over time.

The Virginia Context

The Virginia Multimodal and Public Space Guidelines will fill a critical gap in the practices and policies of the Commonwealth. Virginia already has several key policies and resources for integrated multimodal planning and transit supportive development. VTrans2035 and the 2035 Virginia Surface Transportation Plan evidence the Commonwealth's commitment to approach transportation planning that integrates all modes from beginning to end. DRPT's *Transit Service Design Guidelines* provide a solid foundation for defining development levels supportive of transit and providing different options for modes such that all communities could be served by some form of transit, even if it is only demand response bus. VDOT's policies on context sensitive design and integrating bicycle and pedestrian accommodations have adapted roadway design and construction projects to increase the safety and accessibility for pedestrians and bicyclists. WMATA's *Station Site Access Planning Manual* provides valuable information about how to design for efficient access that fits within the current design protocols.

With the Urban Development Area legislation, Virginia localities are also thinking more about how to focus growth into compact development areas that could also be prime locations for transit service. The Virginia guidelines will help bridge the gap between the generalities of the Transit Service Design Guidelines and the specificity of the Station Site Access Planning Manual. Localities will be able to use this resource to determine the ideal location for multimodal corridors and TODs within their jurisdiction. It will provide guidance on the densities, connections, and other urban design, land use and transportation considerations necessary to make it work, at the station area, corridor and district scales.

DRPT's Amtrak Area Plans provide excellent examples of how TOD can work in Virginia. Arlington County has set the precedent for transit oriented development through numerous policies and plans, and Loudoun County is following by creating new zoning categories for TOD and incorporating TOD language into its comprehensive plan. Other individual localities have initiated TOD planning on their own, namely Tysons' Corner in preparation for the Metro silver line extension and the City of Norfolk in anticipation of its new light rail system.

The lessons learned and best practices from these case studies will influence the development of the guidelines. The Multimodal and Public Space design guidelines will build upon previous Virginia efforts and incorporate exemplar methodologies and approaches from national sources. The ultimate goal of the Virginia guidelines is to provide a resource for transit agencies, localities and other interested parties to identify key land use, urban design and transportation plans, policies and guidelines to create the optimal conditions for getting the best return on their transit investments and syncing up local community growth visions with desired multimodal transportation options.

C. Annotated Bibliography of Select Best Practices

The lists below highlight the selected best practices included in the following pages as an annotated bibliography. Additional resources reviewed are also included in tabular format in the Section F.

Transit-Oriented Development (TOD) Policies and Guidelines:

Reconnecting America and Center for Transit-Oriented Development. *Station Area Planning: How to Make Great Transit-Oriented Places*. Feb 2008.

Reconnecting America and Center for Transit-Oriented Development. *Transit Corridors and TOD: Connecting the Dots*. Dec 2010.

Envision Utah. *Wasatch Front Transit Oriented Development Guidelines*. 2002.

City of Denver Community Planning and Development. *Transit Oriented Development Strategic Plan*. Aug 2006.

Center for Transit-Oriented Development. *Performance-Based Transit-Oriented Development Typology Guidebook*. Dec 2010.

Multimodal Transportation Guidelines:

Institute of Transportation Engineers and Congress for New Urbanism. *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*. Mar 2010.

City of Charlotte. *Urban Street Design Guidelines*. Oct 2007.

Indianapolis Regional Center & Metropolitan Planning Area. *Multi-Modal Corridor and Public Space Design Guidelines.* Aug 2008.

Caltrans. *Smart Mobility 2010: A Call to Action for the New Decade*. Feb 2010.

City of Boulder. *Multimodal Corridors.*

TOD and Multimodal Transportation Policies and Guidelines in Virginia:

Virginia Department of Rail and Public Transportation. *Transit Service Design Guidelines*. Jul 2008.

Washington Metropolitan Area Transit Authority. *Station and Site Access Planning Manual*. May 2008.

Tysons Land Use Task Force, Fairfax County, Virginia. *Transforming Tysons: Vision and Area Wide Recommendations*. Sep 2008.

City of Roanoke. *Street Design Guidelines.* Jul 2007.

Arlington County's Transit Corridor Growth Strategy.

Virginia's Integrated Multimodal Planning Framework.

1. Station Area Planning: How to Make Great Transit-Oriented Places, *by Reconnecting America and Center for Transit-Oriented Development (Feb 2008)*

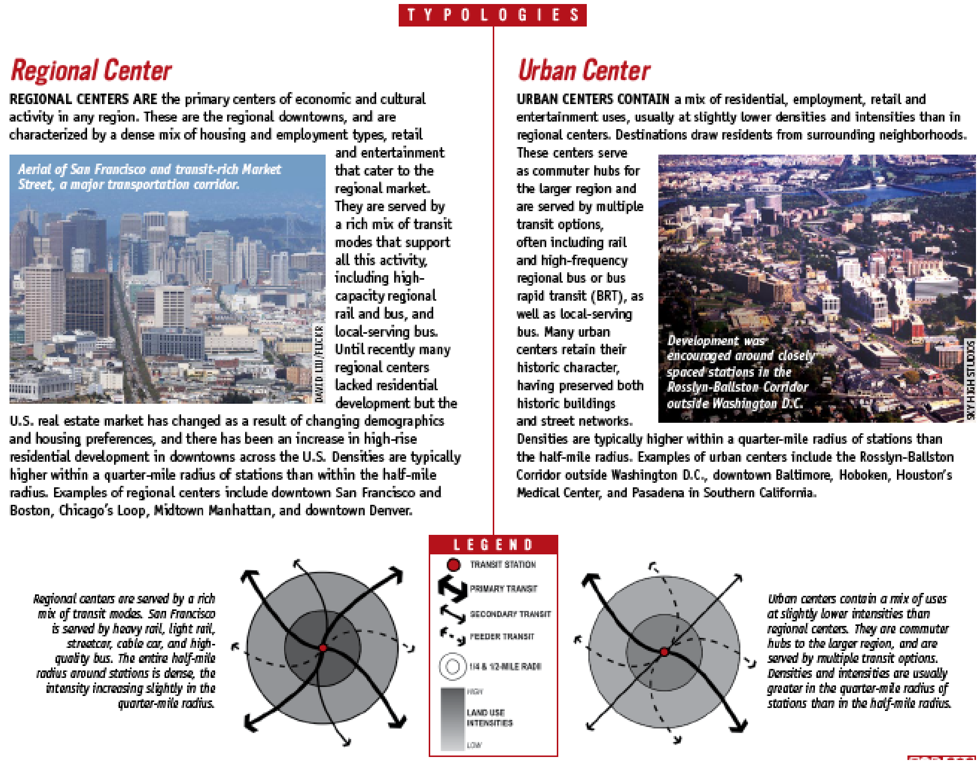
This brief document focuses specifically on TOD station areas and how to achieve TOD that maximizes ridership potential. It defines eight TOD place types and provides nine station area planning principles.

Transit-Oriented Places Typologies

Eight place types are defined: four centers (regional center, urban center, suburban center, and transit town center); three districts (urban neighborhood, transit neighborhood, and special use/ employment district); and one corridor (mixed-use corridor).

Place types are defined according to the type of development within the area, the type of transit that serves them and the characteristics of transit service. For example, a transit neighborhood has lower densities, economic activity is not concentrated around stations, and secondary transit service is less frequent, whereas an urban neighborhood has multiple transit options to regional and urban centers.

Each place type has a description and graphic showing typically how robust and connected the transit system is, and (?) the intensity of surrounding land use. The diagrammatic graphics show each place type with ¼- and ½-mile radius circles around the transit station. In this case, a center and a district have the same spatial scale; districts are neighborhood or special use land uses that are not in an economic 'center'. For example, the Pearl District in Portland and Greenwich Village in NYC are considered urban neighborhoods; they are outside of the huge booming center of the city but still have a robust transit network to facilitate TOD.



TYPOLOGIES

Regional Center

REGIONAL CENTERS ARE the primary centers of economic and cultural activity in any region. These are the regional downtowns, and are characterized by a dense mix of housing and employment types, retail and entertainment that cater to the regional market. They are served by a rich mix of transit modes that support all this activity, including high-capacity regional rail and bus, and local-serving bus. Until recently many regional centers lacked residential development but the U.S. real estate market has changed as a result of changing demographics and housing preferences, and there has been an increase in high-rise residential development in downtowns across the U.S. Densities are typically higher within a quarter-mile radius of stations than within the half-mile radius. Examples of regional centers include downtown San Francisco and Boston, Chicago's Loop, Midtown Manhattan, and downtown Denver.

Aerial of San Francisco and transit-rich Market Street, a major transportation corridor.

DAVID LIU/FLICKR

Urban Center

URBAN CENTERS CONTAIN a mix of residential, employment, retail and entertainment uses, usually at slightly lower densities and intensities than in regional centers. Destinations draw residents from surrounding neighborhoods. These centers serve as commuter hubs for the larger region and are served by multiple transit options, often including rail and high-frequency regional bus or bus rapid transit (BRT), as well as local-serving bus. Many urban centers retain their historic character, having preserved both historic buildings and street networks. Densities are typically higher within a quarter-mile radius of stations than the half-mile radius. Examples of urban centers include the Rosslyn-Ballston Corridor outside Washington D.C., downtown Baltimore, Hoboken, Houston's Medical Center, and Pasadena in Southern California.

Development was encouraged around closely spaced stations in the Rosslyn-Ballston Corridor outside Washington D.C.

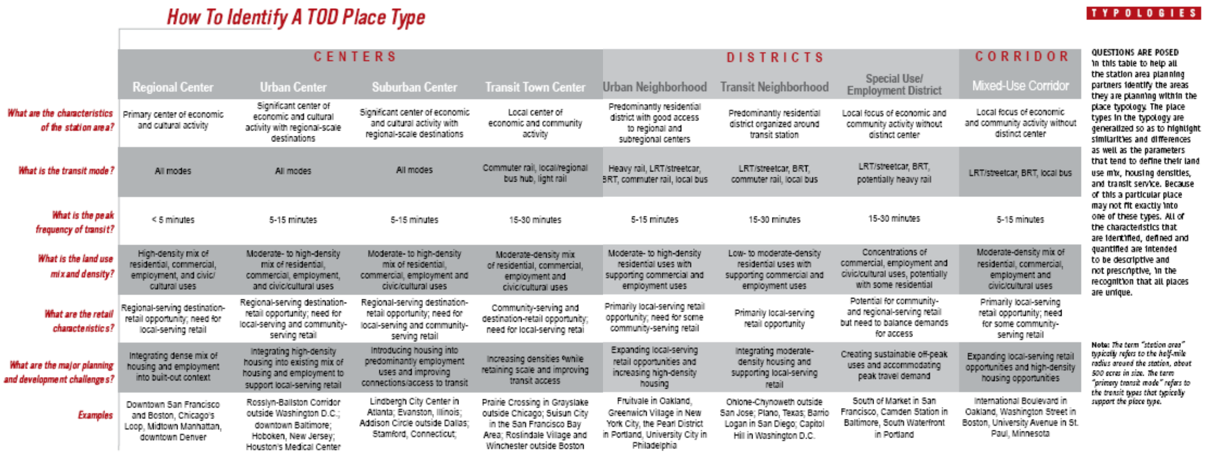
SKY HIGH STUDIOS

Regional centers are served by a rich mix of transit modes. San Francisco is served by heavy rail, light rail, streetcar, cable car, and high-quality bus. The entire half-mile radius around stations is dense, the intensity increasing slightly in the quarter-mile radius.

LEGEND

Urban centers contain a mix of uses at slightly lower intensities than regional centers. They are commuter hubs to the larger region, and are served by multiple transit options. Densities and intensities are usually greater in the quarter-mile radius of stations than in the half-mile radius.

A matrix compares characteristics of each place type (transit mode, peak frequency, land use mix and intensity, and examples) to help readers identify under which category a specific place would fall. Another matrix provides standardized development guidelines (housing mix, density and FAR) within station area for TOD place types. This second matrix is prescriptive for TOD; the first is simply descriptive.



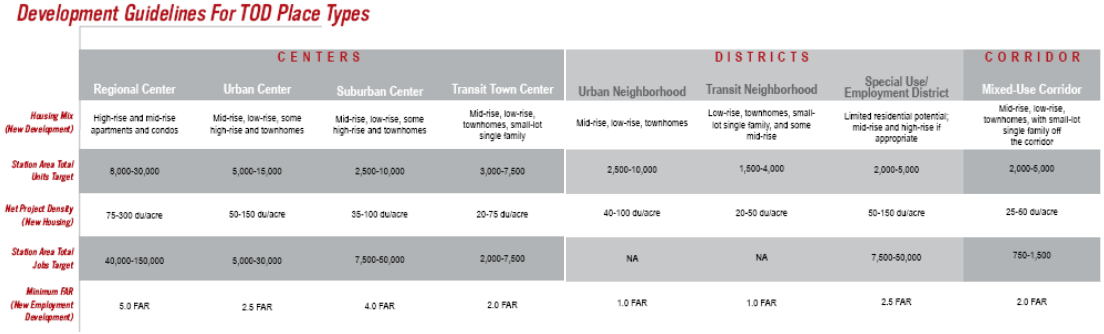
How To Identify A TOD Place Type

TYPOLOGIES

	CENTERS				DISTRICTS			CORRIDOR
	Regional Center	Urban Center	Suburban Center	Transit Town Center	Urban Neighborhood	Transit Neighborhood	Special Use/ Employment District	Mixed-Use Corridor
What are the characteristics of the station area?	Primary center of economic and cultural activity	Significant center of economic and cultural activity with regional-scale destinations	Significant center of economic and cultural activity with regional-scale destinations	Local center of economic and community activity	Predominantly residential district with good access to regional and subregional centers	Predominantly residential district organized around transit station	Local focus of economic and community activity without distinct center	Local focus of economic and community activity without distinct center
What is the transit mode?	All modes	All modes	All modes	Commuter rail, local/regional bus hub, light rail	Heavy rail, LRT/streetcar, BRT, commuter rail, local bus	LRT/streetcar, BRT, commuter rail, local bus	LRT/streetcar, BRT, potentially heavy rail	LRT/streetcar, BRT, local bus
What is the peak frequency of transit?	< 5 minutes	5-15 minutes	5-15 minutes	15-30 minutes	5-15 minutes	15-30 minutes	15-30 minutes	5-15 minutes
What is the land use mix and density?	High-density mix of residential, commercial, employment, and civic/cultural uses	Moderate- to high-density mix of residential, commercial, employment, and civic/cultural uses	Moderate- to high-density mix of residential, commercial, employment and civic/cultural uses	Moderate-density mix of residential, commercial, employment and civic/cultural uses	Moderate- to high-density residential uses with supporting commercial and employment uses	Low- to moderate-density residential uses with supporting commercial and employment uses	Concentrations of commercial, employment and civic/cultural uses, potentially with some residential	Moderate-density mix of residential, commercial, employment and civic/cultural uses
What are the retail characteristics?	Regional-serving destination-retail opportunity; need for local-serving retail	Regional-serving destination-retail opportunity; need for local-serving and community-serving retail	Regional-serving destination-retail opportunity; need for local-serving and community-serving retail	Community-serving and destination-retail opportunity; need for local-serving retai	Primarily local-serving retail opportunity; need for some community-serving retail	Primarily local-serving retail opportunity	Potential for community- and regional-serving retail but need to balance demands for access	Primarily local-serving retail opportunity; need for some community-serving retail
What are the major planning and development challenges?	Integrating dense mix of housing and employment into built-out context	Integrating high-density housing into existing mix of housing and employment to support local-serving retail	Introducing housing into predominantly employment uses and improving connections/access to transit	Increasing densities while retaining scale and improving transit access	Expanding local-serving retail opportunities and increasing high-density housing	Integrating moderate-density housing and supporting local-serving retail	Creating sustainable off-peak uses and accommodating peak travel demand	Expanding local-serving retail opportunities and high-density housing opportunities
Examples	Downtown San Francisco and Boston, Chicago's Loop, Midtown Manhattan, downtown Denver	Rosslyn-Ballston Corridor outside Washington D.C.; downtown Baltimore; Hoboken, New Jersey; Houston's Medical Center	Lindbergh City Center in Atlanta; Evanston, Illinois; Addison Circle outside Dallas; Stamford, Connecticut;	Prairie Crossing in Grayslake outside Chicago; Suisun City in the San Francisco Bay Area; Roslindale Village and Winchester outside Boston	Fruitvale in Oakland, Greenwich Village in New York City, the Pearl District in Portland, University City in Philadelphia	Ohlone-Chynoweth outside San Jose; Plano, Texas; Barrio Logan in San Diego; Capitol Hill in Washington D.C.	South of Market in San Francisco, Camden Station in Baltimore, South Waterfront in Portland	International Boulevard in Oakland, Washington Street in Boston, University Avenue in St. Paul, Minnesota

QUESTIONS ARE POSED in this table to help all the station area planning partners identify the areas they are planning within the place typology. The place types in the typology are generalized so as to highlight similarities and differences as well as the parameters that tend to define their land use mix, housing densities, and transit service. Because of this a particular place may not fit exactly into one of these types. All of the characteristics that are identified, defined and quantified are intended to be descriptive and not prescriptive, in the recognition that all places are unique.

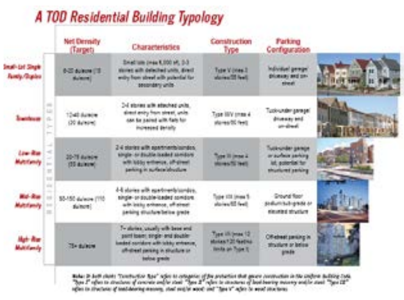
Note: The term "station area" typically refers to the half-mile radius around the station, about 500 acres in size. The term "primary transit mode" refers to the transit types that typically support the place type.



Development Guidelines For TOD Place Types

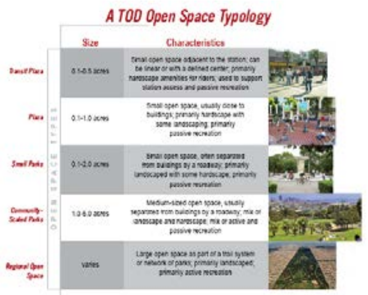
	CENTERS				DISTRICTS			CORRIDOR
	Regional Center	Urban Center	Suburban Center	Transit Town Center	Urban Neighborhood	Transit Neighborhood	Special Use/ Employment District	Mixed-Use Corridor
Housing Mix (New Development)	High-rise and mid-rise apartments and condos	Mid-rise, low-rise, some high-rise and townhomes	Mid-rise, low-rise, some high-rise and townhomes	Mid-rise, low-rise, townhomes, small-lot single family	Mid-rise, low-rise, townhomes	Low-rise, townhomes, small-lot single family, and some mid-rise	Limited residential potential; mid-rise and high-rise if appropriate	Mid-rise, low-rise, townhomes, with small-lot single family off the corridor
Station Area Total Units Target	8,000-30,000	5,000-15,000	2,500-10,000	3,000-7,500	2,500-10,000	1,500-4,000	2,000-5,000	2,000-5,000
Net Project Density (New Housing)	75-300 du/acre	50-150 du/acre	35-100 du/acre	20-75 du/acre	40-100 du/acre	20-50 du/acre	50-150 du/acre	25-60 du/acre
Station Area Total Jobs Target	40,000-150,000	5,000-30,000	7,500-50,000	2,000-7,500	NA	NA	7,500-50,000	750-1,500
Minimum FAR (New Employment Development)	5.0 FAR	2.5 FAR	4.0 FAR	2.0 FAR	1.0 FAR	1.0 FAR	2.5 FAR	2.0 FAR

The document also provides residential, mixed use/employment and open space building typologies that illustrate the options for achieving TOD density as specified in the place type development guidelines.



A TOD Residential Building Typology

A TOD Mixed Use/Employment Building Typology

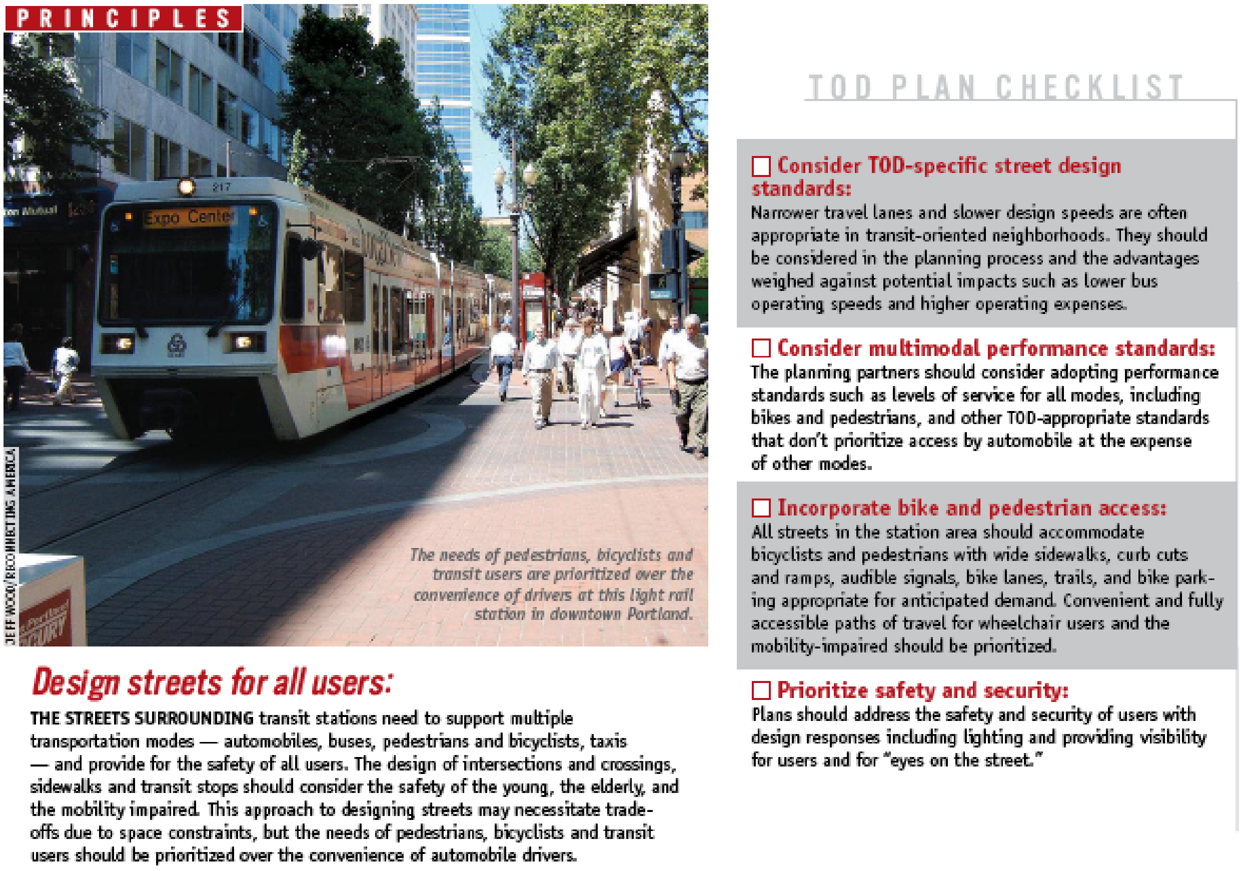


A TOD Open Space Typology

Station Area Planning Principles

The document also provides nine planning principles and describes several corresponding strategies for each principle in checklist form for planners to consider throughout the TOD planning effort. The nine planning principles are:

1. Maximize ridership with transit-oriented development
2. Generate meaningful community involvement
3. Design streets for all users
4. Create opportunities for affordable and accessible living
5. Make great public spaces
6. Manage parking effectively
7. Capture the value of transit
8. Maximize neighborhood and station connectivity
9. Implement the plan and evaluate its success



PRINCIPLES

JEFF WOOD/RECONNECTING AMERICA

The needs of pedestrians, bicyclists and transit users are prioritized over the convenience of drivers at this light rail station in downtown Portland.

Design streets for all users:

THE STREETS SURROUNDING transit stations need to support multiple transportation modes — automobiles, buses, pedestrians and bicyclists, taxis — and provide for the safety of all users. The design of intersections and crossings, sidewalks and transit stops should consider the safety of the young, the elderly, and the mobility impaired. This approach to designing streets may necessitate trade-offs due to space constraints, but the needs of pedestrians, bicyclists and transit users should be prioritized over the convenience of automobile drivers.

TOD PLAN CHECKLIST

☐ **Consider TOD-specific street design standards:** Narrower travel lanes and slower design speeds are often appropriate in transit-oriented neighborhoods. They should be considered in the planning process and the advantages weighed against potential impacts such as lower bus operating speeds and higher operating expenses.

☐ **Consider multimodal performance standards:** The planning partners should consider adopting performance standards such as levels of service for all modes, including bikes and pedestrians, and other TOD-appropriate standards that don't prioritize access by automobile at the expense of other modes.

☐ **Incorporate bike and pedestrian access:** All streets in the station area should accommodate bicyclists and pedestrians with wide sidewalks, curb cuts and ramps, audible signals, bike lanes, trails, and bike parking appropriate for anticipated demand. Convenient and fully accessible paths of travel for wheelchair users and the mobility-impaired should be prioritized.

☐ **Prioritize safety and security:** Plans should address the safety and security of users with design responses including lighting and providing visibility for users and for "eyes on the street."

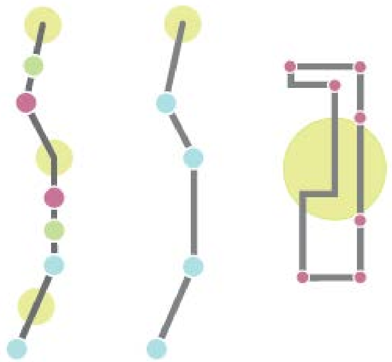
2. Transit Corridor and TOD: Connecting the Dots

by Reconnecting America and Center for Transit-Oriented Development (Dec 2010)

This report synthesizes the importance of planning for TOD at a corridor scale. This is important because corridor planning integrates the regional and local contexts, creates momentum for TOD implementation, and increases efficient use of public and private resources. The organization of different types of corridors, and the objectives and strategies discussed may prove useful in the discussion of multimodal transit corridors for the statewide Virginia guidelines effort.

Corridor planning typically begins when a new transit investment is proposed. When planning for TOD, a transit corridor is best defined as the walkable areas around all of the stations along a transit line. Any transit technology can define a transit corridor – heavy or light rail, streetcar, trolley or bus. The TOD potential depends more on the design and quality of service than it does on the transit technology.

Three basic corridor types (destination connector, commuter, and district circulator) are defined by what it connects and how these connections influence the overall potential for TOD. A description, examples, and implications for TOD are provided for each corridor type.



Objectives and Strategies for Transit and TOD at the Corridor Level

Each of the following objectives and strategies are discussed and examples of case studies are provided.

Objective	Strategy
Guide growth and development	Understand potential market reaction to transit
Support regional economic growth	Connect residents to activity centers with transit
Enhance regional and local equity	Develop a mixed-income TOD strategy
Promote reinvestment and increase spending power	Create an economic revitalization policy
Invigorate stakeholder engagement and collaboration	Coordinate key stakeholders
Maximize TOD potential and benefits	Establish a phased TOD implementation and investment plan

3. Wasatch Front Transit Oriented Development Guidelines
by Envision Utah (2002)

These TOD guidelines identify targeted areas for TOD within the Wasatch Front, a large urban area approximately 120 miles long and an average of five miles wide in which 80 percent of Utah's population reside. This resource is particularly relevant to the Virginia statewide guidelines effort as it provides qualitative guidelines for a large region with different types of transit systems and acknowledges variations in context. The report highlights several main concepts of TOD design including circulation, urban design, and parking and transportation demand policy, without providing quantitative parameters and standards for TOD place types. The report has a comprehensive section on implementation and focuses on economic feasibility of TOD.

The Utah Transit Authority operates a combination of bus and light rail service throughout the Wasatch Front region. After the development of the TOD guidelines, the FrontRunner commuter rail service began in 2008 in the northern portion of the region. The report identifies light rail and commuter rail stations as having the best opportunities for transit-oriented growth, as well as high-speed bus corridors and community hubs, places where bus lines, bikeways, trails and sometimes rail will meet.

Applying TOD to Different Contexts

The document outlines four ways in which TODs can differ: by place, by development type, by transit type, and based on economic analysis. General place types are identified, but not discussed relative to the other context variables, acknowledging that the four types of variables are independent of one another. The economic analysis discussion emphasizes the synergistic relationship between a locally appropriate public regulatory framework for TOD and private market forces. This content may be useful to the implementation piece of the Virginia statewide guidelines effort.

Place	Development Type	Transit Type	Economic Analysis
• Urban Core • Urban Neighborhood • Suburban Town Center/ Community Hub • Suburban Employment/ Retail Center • University or Institutional Campus • Park-and-Ride	• Redevelopment of Opportunity Sites (potential for large-scale redevelopment) • Incremental Infill/ Neighborhood Revitalization • New Growth Areas (Greenfields)	• Light Rail • Commuter Rail • Rapid and Feeder Buses	• Regional Economic and Demographic Trends and Projections • Local Real Estate Market Conditions • Specific Opportunity Sites

Ideal TOD Planning Area and Land Use Composition

The ideal planning area for TOD is the area within a half-mile circle around the station area. Barriers to achieving a 360-degree pedestrian oriented district may exist, and connections across such barriers should be maximized.

The document discusses different ways in arranging the land use around transit stations. The most intensely developed **mixed-use core** should loosely comprise the quarter-mile walking radius around the transit station. General guidance on building height and land use mix depending on place type is provided in narrative form. The area surrounding the mixed-use core needs properly designed

secondary employment and residential areas. Relatively lower intensities as compared to the mixed-use core will avoid competition between the same uses. This area should accommodate enough people to support the transit station, but at a smaller neighborhood scale. **Natural, open space and rural areas** are an important aspect in the regional growth picture and should be included in TOD planning. A variety of housing choices for a complete range of incomes is stressed.

General TOD Guidelines

The TOD guidelines provide underlying principles for circulation, urban design, and parking and transportation demand strategies that are applicable for all TODs. Several topic areas are discussed in detail, as listed below. The discussions focus on how these elements affect the station area, and provide general guidance. For example, the discussion of connected street systems emphasizes parallel roads and offers strategies on retrofitting contemporary cul-de-sac subdivisions. The report acknowledges that specifics of the how the guidelines apply will differ depending on the TOD context. These specifics are not provided; they will be addressed in specific station area plans.

Circulation

- Connected street systems
- Small block size
- Traffic calming
- Appropriate Roadway Standards
- Alleys
- Off-street Trails, Bicycle and Pedestrian Pathways

Site and Building Design

- Street-oriented building placement
- Visible and accessible entries
- Garage treatments
- Architectural variation
- Transparency
- Compatible height, massing and style

Public Space Design Strategies

- Streetscaping
- Civic Plaza at transit station
- Landmark features

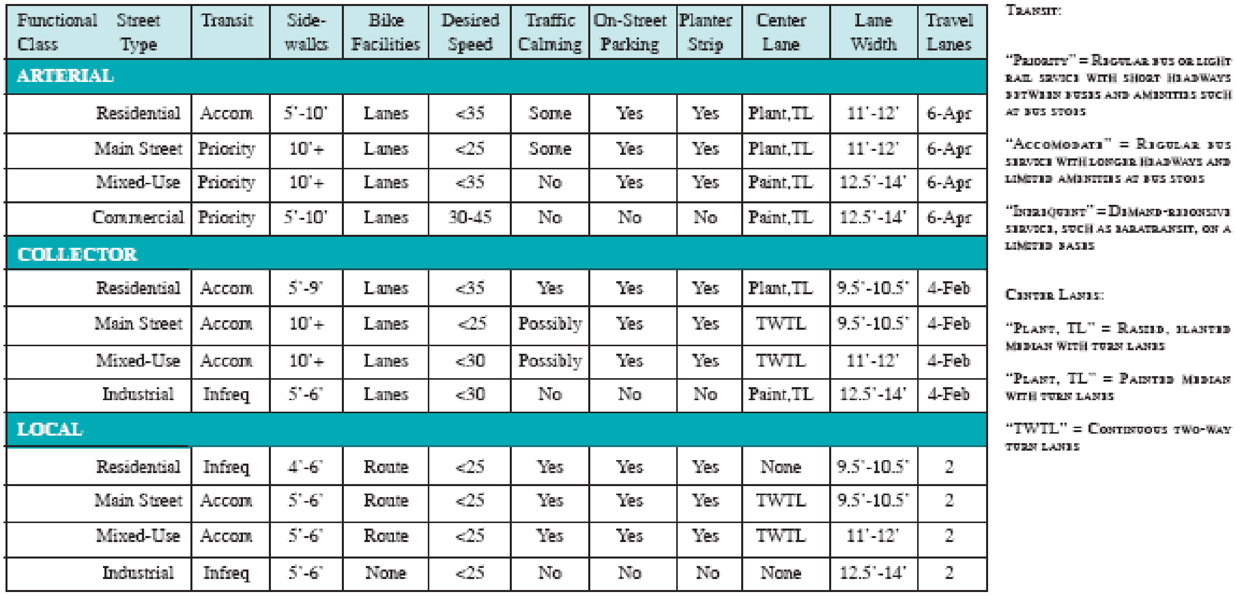
Station Design

- Connections to adjacent spaces and buildings
- Station amentities
- Transit station as community landmark
- Parking and Loading Areas

Parking and Transportation Demand Policy

- Parking Maximums and Minimums
- Shared Parking
- District Wide Parking
- Parking Structures and On-Street Parking
- Car Sharing
- Parking Pricing
- Other Transportation Demand Management Strategies

The document acknowledges that roadway standards with traditional functional classifications (arterial, collector, and local) do not adequately differentiate between different types of access needs, neighborhood character, or the character of adjacent land uses. To better define the character and livability of a neighborhood or district, street types should be considered. The following chart shows the differences in user needs and specifies several design characteristics that synthesize the speed and design of the road with the desired context depending on the street type and functional classification.



Functional Class	Street Type	Transit	Side-walks	Bike Facilities	Desired Speed	Traffic Calming	On-Street Parking	Planter Strip	Center Lane	Lane Width	Travel Lanes
ARTERIAL											
	Residential	Accom	5'-10'	Lanes	<35	Some	Yes	Yes	Plant,TL	11'-12'	6-Apr
	Main Street	Priority	10'+	Lanes	<25	Some	Yes	Yes	Plant,TL	11'-12'	6-Apr
	Mixed-Use	Priority	10'+	Lanes	<35	No	Yes	Yes	Paint,TL	12.5'-14'	6-Apr
	Commercial	Priority	5'-10'	Lanes	30-45	No	No	No	Paint,TL	12.5'-14'	6-Apr
COLLECTOR											
	Residential	Accom	5'-9'	Lanes	<35	Yes	Yes	Yes	Plant,TL	9.5'-10.5'	4-Feb
	Main Street	Accom	10'+	Lanes	<25	Possibly	Yes	Yes	TWTL	9.5'-10.5'	4-Feb
	Mixed-Use	Accom	10'+	Lanes	<30	Possibly	Yes	Yes	TWTL	11'-12'	4-Feb
	Industrial	Infreq	5'-6'	Lanes	<30	No	No	No	Paint,TL	12.5'-14'	4-Feb
LOCAL											
	Residential	Infreq	4'-6'	Route	<25	Yes	Yes	Yes	None	9.5'-10.5'	2
	Main Street	Accom	5'-6'	Route	<25	Yes	Yes	Yes	TWTL	9.5'-10.5'	2
	Mixed-Use	Accom	5'-6'	Route	<25	Yes	Yes	Yes	TWTL	11'-12'	2
	Industrial	Infreq	5'-6'	None	<25	No	No	No	None	12.5'-14'	2

Transit:

"Priority" = Regular bus or light rail service with short headways between buses and amenities such at bus stops

"Accomodate" = Regular bus service with longer headways and limited amenities at bus stops

"Infrequent" = Demand-responsive service, such as paratransit, on a limited bases

Center Lanes:

"Plant, TL" = Raised, planted median with turn lanes

"Plant, TL" = Painted median with turn lanes

"TWTL" = Continuous two-way turn lanes

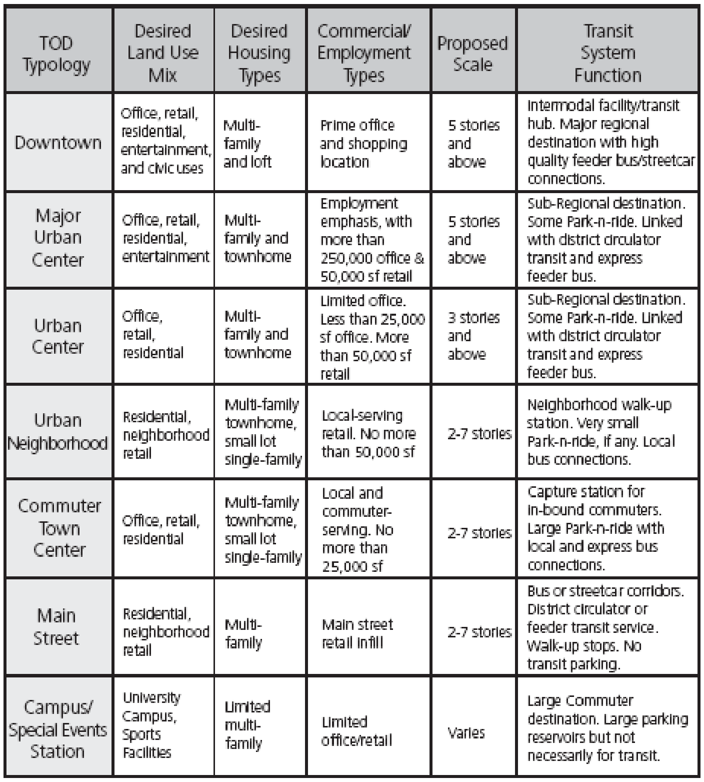
The table in Section F contains several case studies of transit station areas where plans have been developed and the resulting future land use maps and photo renderings for future development.

4. Transit Oriented Development Strategic Plan
by City of Denver, Colorado: Community Planning and Development (Aug 2006)

Between the T-Rex line and FasTracks, Denver is planning 23 new transit station and five new transit corridors. This guide will help city staff to prioritize the planning and implementation activities for TOD. It provides background info on what TOD is and TOD in the Denver context; specific city-wide action strategies to implement TOD, and briefly identifies issues, opportunities and recommendations for transit corridors and station areas. Station area plans are completed or underway for most station areas as separate documents.

TOD Typologies

Recognizing that not all TODs look and function the same way, the Denver TOD typology defines basic station area place types by the overall character and vision without spelling out specific details. The two basic functions of the typologies are to (1) provide enough detail so that if development proposals are submitted prior to completion of the plan, there is some basis for evaluation of its appropriateness, and (2) form a shared vision from which planning process participants can work form to develop the specifics of a station area plan.



TOD Typology	Desired Land Use Mix	Desired Housing Types	Commercial/ Employment Types	Proposed Scale	Transit System Function
Downtown	Office, retail, residential, entertainment, and civic uses	Multi-family and loft	Prime office and shopping location	5 stories and above	Intermodal facility/transit hub. Major regional destination with high quality feeder bus/streetcar connections.
Major Urban Center	Office, retail, residential, entertainment	Multi-family and townhome	Employment emphasis, with more than 250,000 office & 50,000 sf retail	5 stories and above	Sub-Regional destination. Some Park-n-ride. Linked with district circulator transit and express feeder bus.
Urban Center	Office, retail, residential	Multi-family and townhome	Limited office. Less than 25,000 sf office. More than 50,000 sf retail	3 stories and above	Sub-Regional destination. Some Park-n-ride. Linked with district circulator transit and express feeder bus.
Urban Neighborhood	Residential, neighborhood retail	Multi-family townhome, small lot single-family	Local-serving retail. No more than 50,000 sf	2-7 stories	Neighborhood walk-up station. Very small Park-n-ride, if any. Local bus connections.
Commuter Town Center	Office, retail, residential	Multi-family townhome, small lot single-family	Local and commuter-serving. No more than 25,000 sf	2-7 stories	Capture station for in-bound commuters. Large Park-n-ride with local and express bus connections.
Main Street	Residential, neighborhood retail	Multi-family	Main street retail infill	2-7 stories	Bus or streetcar corridors. District circulator or feeder transit service. Walk-up stops. No transit parking.
Campus/ Special Events Station	University Campus, Sports Facilities	Limited multi-family	Limited office/retail	Varies	Large Commuter destination. Large parking reservoirs but not necessarily for transit.


Downtown


Major Urban Center


Urban Center

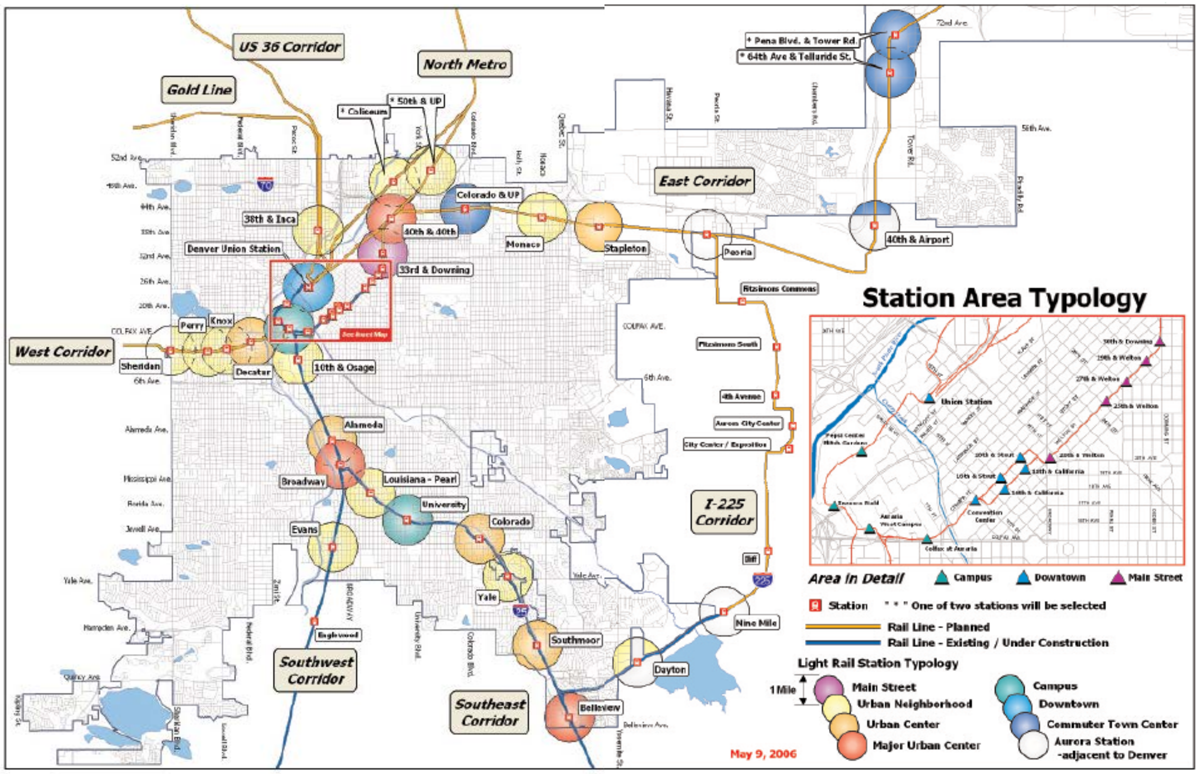

Urban Neighborhood


Commuter Town Center


Main Street


Campus/Special Events Station

Thirty-two existing and future transit station areas were assigned a TOD typology and priority. Issues, conditions and recommendations for each station area are identified. The discussion of station areas is organized by transit corridor.



Downing Street Stops

TOD Typology: Main Street

Priority: Monitor and Respond

Issues and Conditions: In addition to the station at 30th & Downing, one or two additional stations are anticipated to be added between 30th and 40th. Much of this land has an opportunity over a period of time to redevelop. It will be important for the City to ensure that new projects and the transit system respect the established character of the area.

Recommendations:

- Consider carefully the street cross-section in conjunction with the extension of light rail or alternatively, the use of a street car to assure that a pedestrian and development friendly atmosphere is created.
- Determine whether Main Street zoning should be applied to this corridor.
- Monitor and respond to opportunities as necessary.

30th and Downing Street

The document identifies six principles that should be addressed in each station area plan: design guidelines: land use mix & placement, circulation & connectivity, station access & station planning, public realm, and parking.

Citywide Policy and Action Recommendations

After a review of the City's plans and policies that recognize and support TOD principles, it identifies citywide policy and action recommendations to address policy gaps:

1. Fine-tune roles and responsibilities between the transit authority and the council of governments.
2. Adopt the TOD typology and encourage the region to embrace a common definition of TOD.
3. Engage in proactive planning and zoning.
4. Adopt a package of TOD parking and parking management strategies
5. Focus funding tools on TOD and create new tools
6. Prepare an affordable and mixed-income housing strategy for TOD
7. Develop a public housing renewal strategy

This plan provides a good model for incorporating necessary policies at the city-wide level and assessing economic market for each station area. Design recommendations for the corridors and station areas are lacking. There are no quantitative parameters or standards as these to be addressed in individual station area plans.

This document was completed in 2006. Since then, many station areas have completed station area plans. The progress is available online at http://www.denvergov.org/StationAreas/tabid/395230/Default.aspx.

5. Performance-Based Transit-Oriented Development Typology Guidebook
by Center for Transit-Oriented Development (Dec 2010)

The purpose of this research effort was to develop a performance-based typology that TOD practitioners and decision makers can use to identify the different conditions that exist in places and to determine the form that TOD takes. This tool will help to answer questions like: What economic, environmental and social outcomes can we expect from investments in transit and TOD? What differentiates transit-oriented development from transit-adjacent development? What standards should be utilized in evaluating zoning for TOD or other policy interventions?

Rail TODs are organized into nine place types according to VMT and the percentage of workers to residents. The report compares other characteristics relative to the place types (e.g. auto ownership, transportation costs, commute travel behavior, employment proximity, and urban form). Case studies are provided for each place type. The report also includes scenario studies to analyze the effect of additional growth in reducing VMT. A template is provided for communities to assess station areas in comparison to others, and this tool can be used to determine how to lower VMT in an individual zone.

TOD Typology

The typology creates 15 distinct place types by identifying the number of miles the typical household within each transit zone will travel in a year and whether the area is primarily residential, employment, or a balance of the two. Understanding where an individual transit zone sits in this spectrum, or how all of the transit zones in a region compare to one another can make it easier for stakeholders to identify strategies to reduce VMT or to take advantage of existing low VMT places. The 15 place types are organized by VMT on the vertical axis and use mix on the horizontal axis.

Table 1. VMT Types

Household VMT Type	VMT Range
1 – Low	< 9,100
2 – Low-Moderate	9,100 to 11,600
3 – Moderate	11,600 to 14,300
4 – High-Moderate	14,300 to 17,200
5 - High	> 17,200

Table 2. Use Mix Types

Use Mix Type	Percentage of workers relative to workers and residents
1 primarily residential	33.3% or less
2 balanced	33.3% to 66.7%
3 primarily employment	66.7% or more

Figure 4: Performance-Based Place Types

The purpose of this typology is to compare place types within a system or across multiple systems. Putting transit zones into their regional contexts illuminates the differences in TOD performance. The report compares the station area place types within the Chicago region and between the Chicago and San Francisco Bay Area regions.

Figure 5: All Stations Sorted into Performance-Based TOD Typology

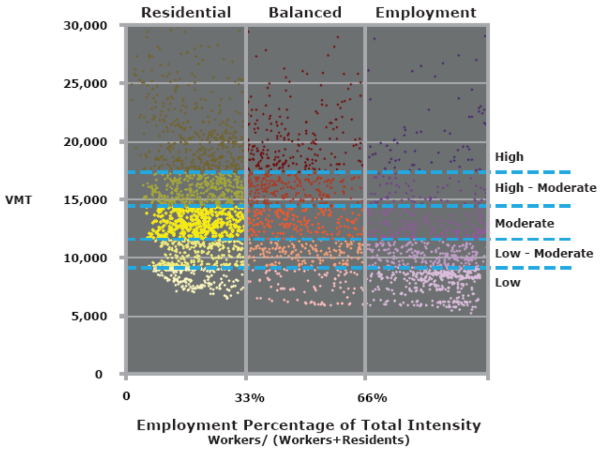


Figure 6. Chicago Region Place Types

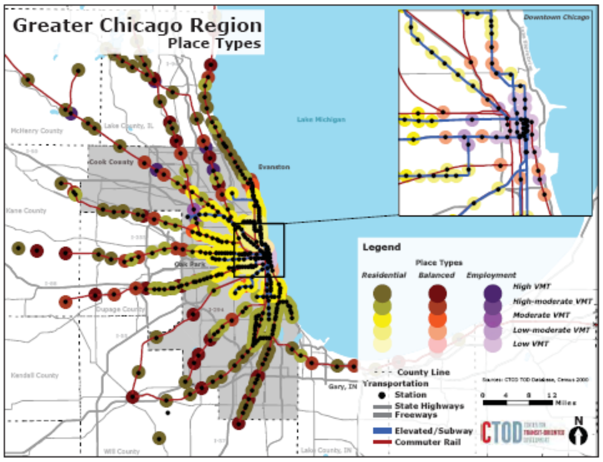


Table 4. Normative Metrics

Place Types	Residential Places					Balanced Places					Employment Places				
	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT	Low VMT	Low-Mod VMT	Mod VMT	High-Mod VMT	High VMT
Total Intensity (residents + workers)	54,215	24,717	12,581	7,708	3,430	64,155	21,762	11,599	6,867	3,242	109,306	34,914	13,009	5,969	2,326
Residents	44,293	20,106	10,229	6,292	2,716	29,875	10,732	5,884	3,695	1,764	12,581	5,103	2,065	1,154	321
Workers	9,923	4,612	2,351	1,416	713	34,280	11,031	5,716	3,172	1,478	96,725	29,811	10,944	4,815	2,004
Workers/Residents	18.3%	19.5%	19.6%	20.3%	19.6%	51.6%	49.7%	48.2%	46.0%	46.2%	86.5%	83.9%	84.2%	83.0%	87.1%
Households	16,214	7,684	3,906	2,253	974	15,466	4,646	2,429	1,467	670	6,828	2,524	861	467	120
Household Size	2.71	2.61	2.62	2.71	2.68	1.95	2.21	2.41	2.43	2.60	1.58	1.67	2.22	2.28	2.64
Gross Density (units/acre)	50.0	21.6	10.3	5.7	2.2	48.7	16.4	7.6	4.0	1.9	28.5	10.3	4.6	2.2	0.9
Residential Density (units/acre)	53.2	23.6	12.1	6.7	3.4	55.6	20.9	10.5	5.8	3.5	51.4	20.6	10.8	6.0	2.9
Block Size (acres)	4.2	4.1	5.7	7.7	18.8	3.7	5.8	8.5	9.9	23.7	3.7	6.4	14.2	69.9	86.7
Monthly T Cost	$422	$563	$688	$781	$906	$394	$597	$721	$794	$900	$463	$613	$713	$793	$920
Yearly T Cost	$5,060	$6,752	$8,255	$9,377	$10,872	$4,732	$7,166	$8,647	$9,526	$10,796	$5,560	$7,360	$8,550	$9,518	$11,041
Average Median Income (1999)	$31,713	$35,643	$41,344	$53,492	$62,069	$43,997	$37,364	$43,395	$51,138	$65,544	$41,875	$34,183	$43,935	$40,985	$57,562
Travel Time to Work (minutes)	35.6	31.4	27.4	25.5	24.7	23.5	22.1	21.4	21.6	22.9	18.0	17.1	18.7	19.0	21.5
Employment Proximity	233,890	127,448	65,640	42,260	20,788	451,725	152,310	73,393	41,335	27,131	396,277	159,118	99,648	58,747	32,167
Transit Access Index	31	19	13	10	3	56	28	11	9	4	85	45	19	10	4
Autos/Household	0.45	0.82	1.18	1.47	1.71	0.52	0.87	1.22	1.41	1.68	0.48	0.74	1.11	1.18	1.61
Home Journey to Work Transit	58%	39%	23%	15%	8%	43%	25%	14%	10%	8%	25%	16%	13%	9%	5%
Home Journey to Work Walk/Bike/ Transit	68%	47%	27%	18%	10%	64%	40%	23%	15%	11%	58%	37%	24%	18%	9%
Workplace Journey to Work Transit	33%	20%	11%	7%	2%	38%	17%	8%	5%	3%	38%	16%	9%	5%	3%
Workplace Journey to Work Walk/Bike/ Transit	47%	30%	18%	12%	6%	48%	23%	12%	8%	5%	43%	19%	11%	7%	5%

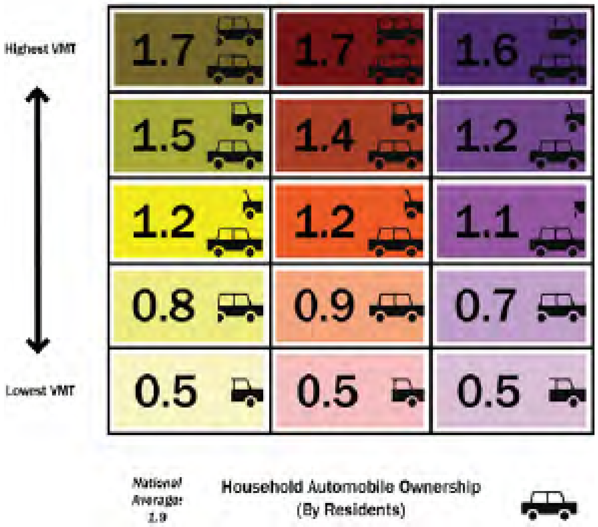
Normative Metrics

In addition to VMT and use mix, each place type has other characteristics such as travel time to work, average median income, auto ownership per household, and gross density that can be used to evaluate performance. These other characteristics are 'normative metrics.' When generalized by place type, they can identify common trends.

Key Findings

Auto Ownership & Transportation Costs:

Transit zones in low VMT places types tend to have low transportation costs and low rates of automobile ownership. Auto ownership in the lowest VMT places average 0.5 cars per household.



Low VMT transit zones have lower car ownership rates

Commute Travel Behavior:

Low VMT place types exhibit more transit ridership and higher rates of walking and biking to work than high VMT transit zones. This finding is equally true of commutes by residents living in transit zones and commutes by workers who work in transit zones. Transit commute mode share in the lowest VMT place types is from 5 to 11 times greater than the national average.

Employment Proximity:

Low VMT transit zones are located much closer to employment than high VMT transit zones. A typical low VMT place is proximate to ten times more jobs than the highest VMT places.

Urban Form:

Low VMT transit zones tend to have more intensity (residents + workers) and higher residential densities than high VMT transit zones. Residential densities in low VMT transit zones are over 15 times as high compared to high VMT transit zones. Additionally, transit zones have smaller block sizes.

Scenarios to Reduce VMT

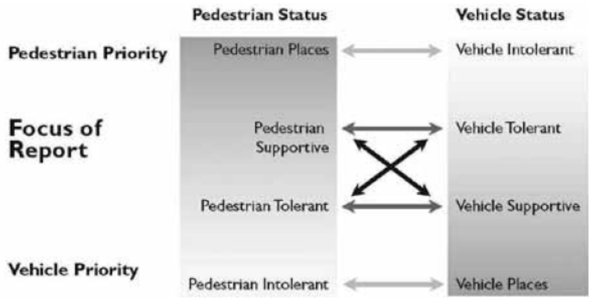
Several scenarios were conducted to see how new development within station areas would impact VMT. The scenarios show broad pictures of VMT reductions possible with increases in housing and employment.

The typology tool can help prioritize areas for growth by showing where these changes can be most impactful. For example, researchers analyzed how adding 2,000 households to two different station areas in St. Louis would affect VMT. The overall VMT savings obtained from having new residential growth happen near transit stations is significant in both examples. But because the number of people living around Forest Park is much higher, the benefits from even small reductions in VMT are also higher.

6. Designing Walkable Urban Thoroughfares: A Context Sensitive Approach

by Institute of Transportation Engineers and Congress for New Urbanism (Mar 2010)

This report provides guidance for the design of walkable urban thoroughfares in places that currently support the mode of walking and in places where the community desires to provide a more walkable thoroughfare, and the context to support them in the future. It focuses primarily on arterials and collectors. This document is the industry standard for Context Sensitive Solutions (CSS) and walkable thoroughfare design. It includes many details related to corridor design and process. Application is generally limited to low-speed, urban arterials and collectors, streets that require tradeoffs between pedestrian and vehicle priority. Separate sections highlight various elements of the planning and design process.



CSS in the Transportation Planning Process

The planning section contains chapters about transportation planning and project development process, addressing how CSS can be applied at each stage and how CSS can be applied at different scales (network, region, and corridor).

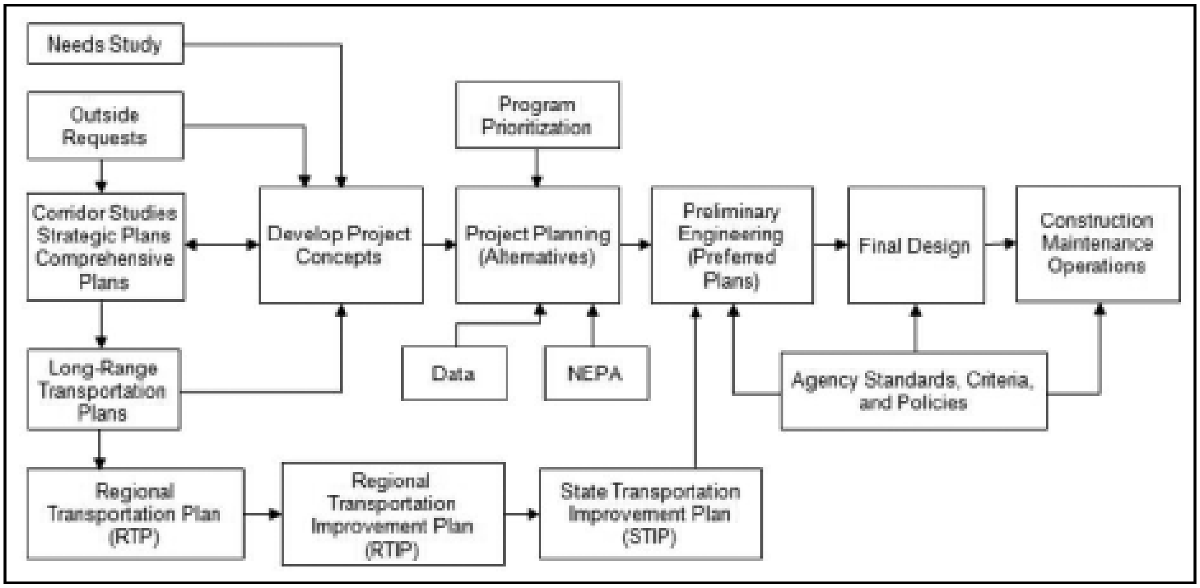


Figure 2.2 Transportation planning and project development processes. Source: Kimley-Horn and Associates, Inc.

Framework for Walkable Urban Thoroughfare Design

The process essentially boils down to three key steps:

1. Identify the roadway's context zone, functional classification, and thoroughfare type
2. Based on the decisions made in step one, establish parameters for the size and scale of the road, including the roadway's target/design speed and the design/control vehicle
3. Design the roadway to best fit the characteristics of its context zone and thoroughfare type, focusing on four major elements or "realms":
    a. Context (e.g. building scale, facades, and orientation)
    b. Streetside (e.g. sidewalks, landscaping, street furniture, and transit stops)
    c. Traveled way (e.g. bicycle, transit and vehicle lanes, and medians)
    d. Intersections (e.g. corner and mid-block crossings, signals, striping, and turn lanes)

Context zones describe the physical form and character of a place. Context zone is a primary consideration in selecting design parameters of urban thoroughfares. Context is defined by multiple parameters, including land use, density and design features.

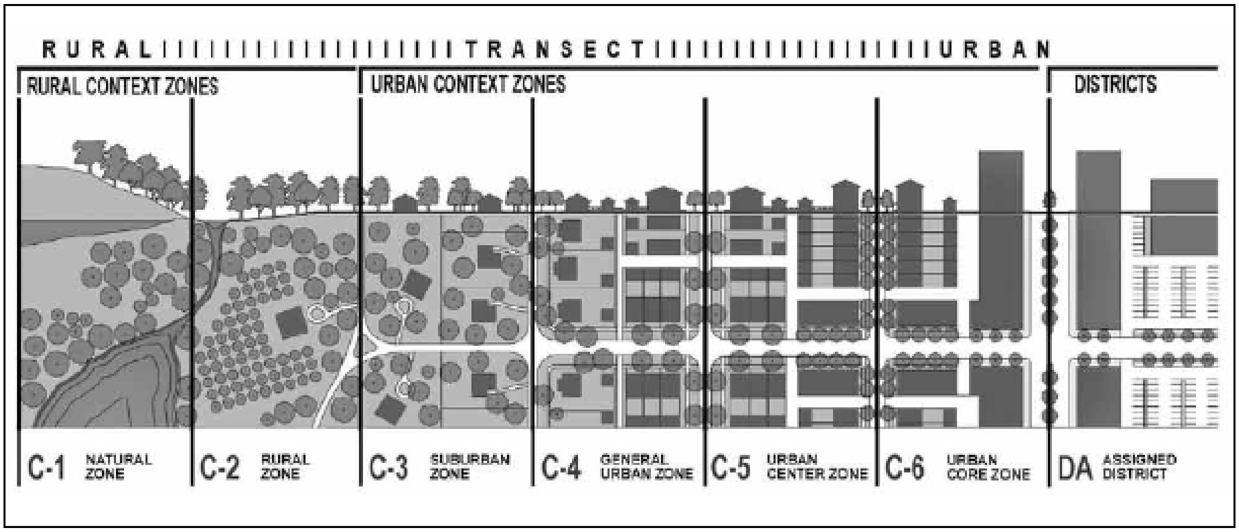
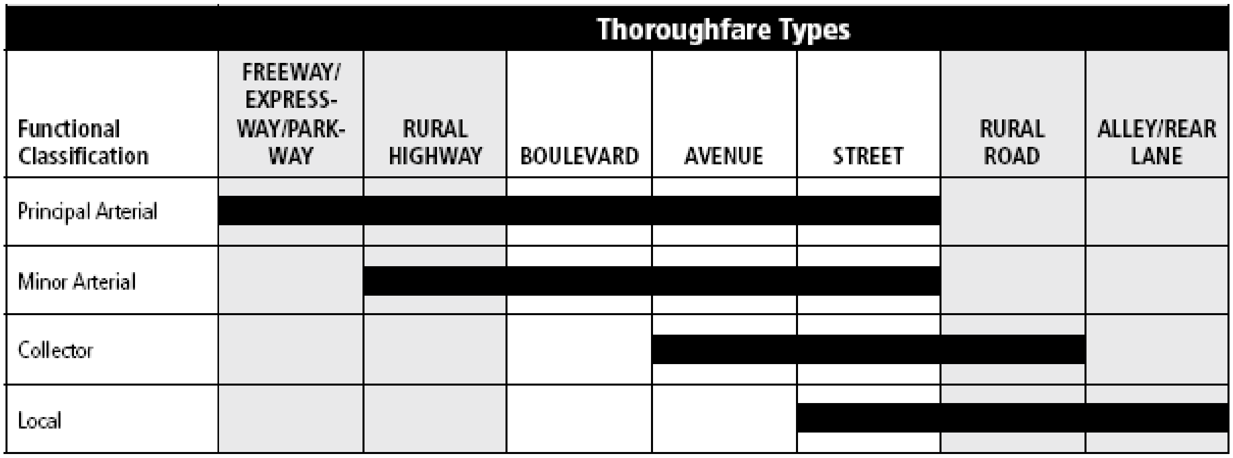


Figure 4.4 Illustration of a gradient of development patterns ranging from rural in Context Zone 1 (C-1), to the most urban in C-6. Source: Duany Plater-Zyberk and Company.

Functional classification defines a thoroughfare's function and role in the network and governs the selection of certain design controls. Functional class may determine continuity through a region and the types of places it connects, purpose and lengths of trips accommodated, level of land access and level of access management, type of freight service, and types of public transit services.

Thoroughfare type governs the selection of the thoroughfare's design criteria and, along with the surrounding context is used to determine the physical configuration of the thoroughfare.

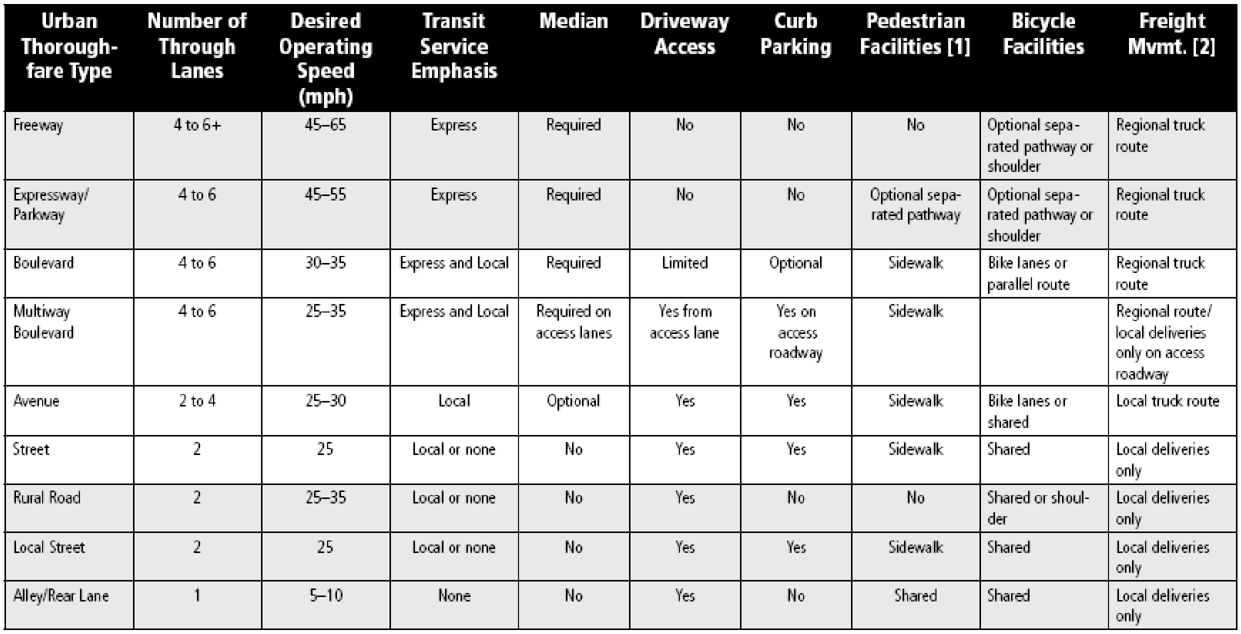
Table 4.3 Relationship Between Functional Classification and Thoroughfare Type



Functional Classification	Thoroughfare Types FREEWAY/ EXPRESS-WAY/PARK-WAY	RURAL HIGHWAY	BOULEVARD	AVENUE	STREET	RURAL ROAD	ALLEY/REAR LANE
Principal Arterial	■	■	■	■	■		
Minor Arterial		■	■	■	■		
Collector				■	■	■	
Local					■	■	■

Shaded cells represent thoroughfare types that are not addressed in this report

Table 4.4 Urban Thoroughfare Characteristics



Urban Thorough-fare Type	Number of Through Lanes	Desired Operating Speed (mph)	Transit Service Emphasis	Median	Driveway Access	Curb Parking	Pedestrian Facilities [1]	Bicycle Facilities	Freight Mvmt. [2]
Freeway	4 to 6+	45–65	Express	Required	No	No	No	Optional separated pathway or shoulder	Regional truck route
Expressway/ Parkway	4 to 6	45–55	Express	Required	No	No	Optional separated pathway	Optional separated pathway or shoulder	Regional truck route
Boulevard	4 to 6	30–35	Express and Local	Required	Limited	Optional	Sidewalk	Bike lanes or parallel route	Regional truck route
Multiway Boulevard	4 to 6	25–35	Express and Local	Required on access lanes	Yes from access lane	Yes on access roadway	Sidewalk		Regional route/ local deliveries only on access roadway
Avenue	2 to 4	25–30	Local	Optional	Yes	Yes	Sidewalk	Bike lanes or shared	Local truck route
Street	2	25	Local or none	No	Yes	Yes	Sidewalk	Shared	Local deliveries only
Rural Road	2	25–35	Local or none	No	Yes	No	No	Shared or shoulder	Local deliveries only
Local Street	2	25	Local or none	No	Yes	Yes	Sidewalk	Shared	Local deliveries only
Alley/Rear Lane	1	5–10	None	No	Yes	No	Shared	Shared	Local deliveries only

Shaded cells represent thoroughfare types that are not addressed in this report

Notes:

[1] Boulevard, Multiway Boulevard, Avenue, and Street thoroughfare types have sidewalks on both sides. Sidewalk width varies as a function of context zone, fronting land use and other factors.

[2] Freight movement is divided into three categories: 1) Regional truck route, 2) Local truck route and 3) Local deliveries only. Cells show highest order of truck movement allowed.

The remainder of the document provides specific design standards, similar to those found in other road design manuals, for different combinations of context zones, thoroughfare types and predominant land uses. Design standards include not just parameters between the edges of the pavement, but also streetside parameters. Intersection design guidelines are also provided.

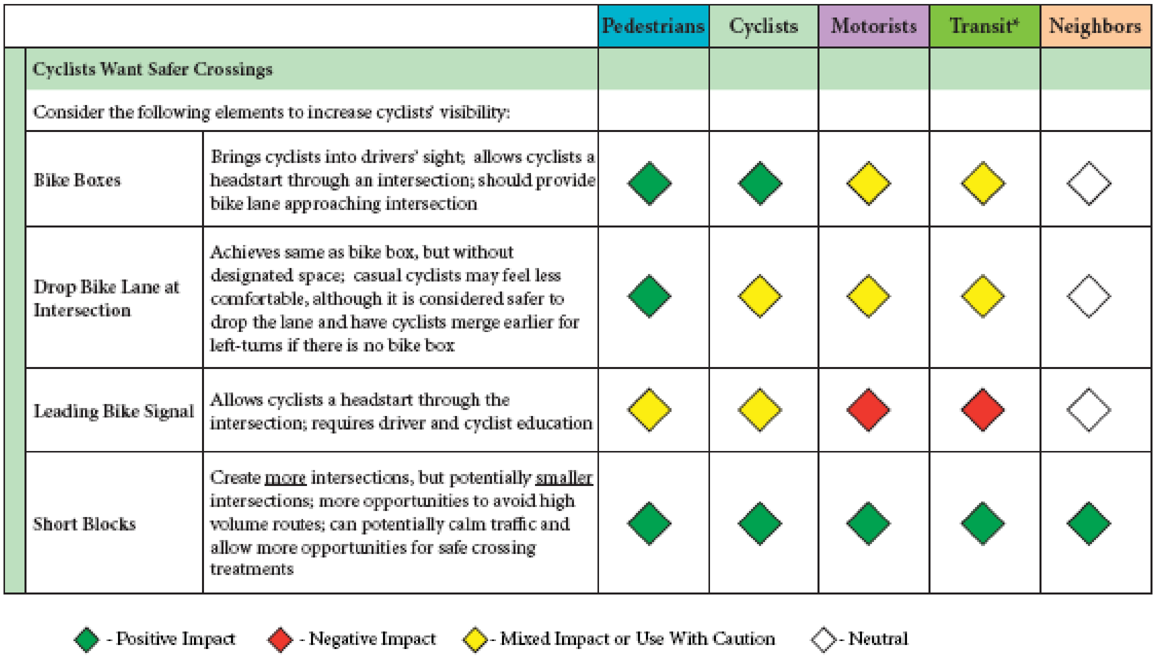
7. Urban Street Design Guidelines

by City of Charlotte, North Carolina (October 2007)

Charlotte's Urban Street Design Guidelines acknowledge conflicts between road users (pedestrians, motorists, neighbors, etc) and provide design guidelines and standards for road segments and intersections. These guidelines are intended to fit with the City's Transportation Action Plan (TAP) and the Centers, Corridors and Wedges growth framework.

Multiple Users

The document explains the often conflicting needs and desires of all road users including pedestrians, cyclists, motorists, transit and neighbors. An extensive matrix identifies the tradeoffs of design elements from different users' perspectives. For example, on-street parking helps shield pedestrians from moving traffic, yielding a positive impact for pedestrians and neighbors, but mixed impact for cyclists, motorists and transit because it slows traffic and opening car doors present potential safety hazards for cyclists.



		Pedestrians	Cyclists	Motorists	Transit*	Neighbors
Cyclists Want Safer Crossings						
Consider the following elements to increase cyclists' visibility:						
Bike Boxes	Brings cyclists into drivers' sight; allows cyclists a headstart through an intersection; should provide bike lane approaching intersection	🟩	🟩	🟨	🟨	◇
Drop Bike Lane at Intersection	Achieves same as bike box, but without designated space; casual cyclists may feel less comfortable, although it is considered safer to drop the lane and have cyclists merge earlier for left-turns if there is no bike box	🟩	🟨	🟨	🟨	◇
Leading Bike Signal	Allows cyclists a headstart through the intersection; requires driver and cyclist education	🟨	🟨	🟥	🟥	◇
Short Blocks	Create more intersections, but potentially smaller intersections; more opportunities to avoid high volume routes; can potentially calm traffic and allow more opportunities for safe crossing treatments	🟩	🟩	🟩	🟩	🟩

🟩 - Positive Impact 🟥 - Negative Impact 🟨 - Mixed Impact or Use With Caution ◇ - Neutral

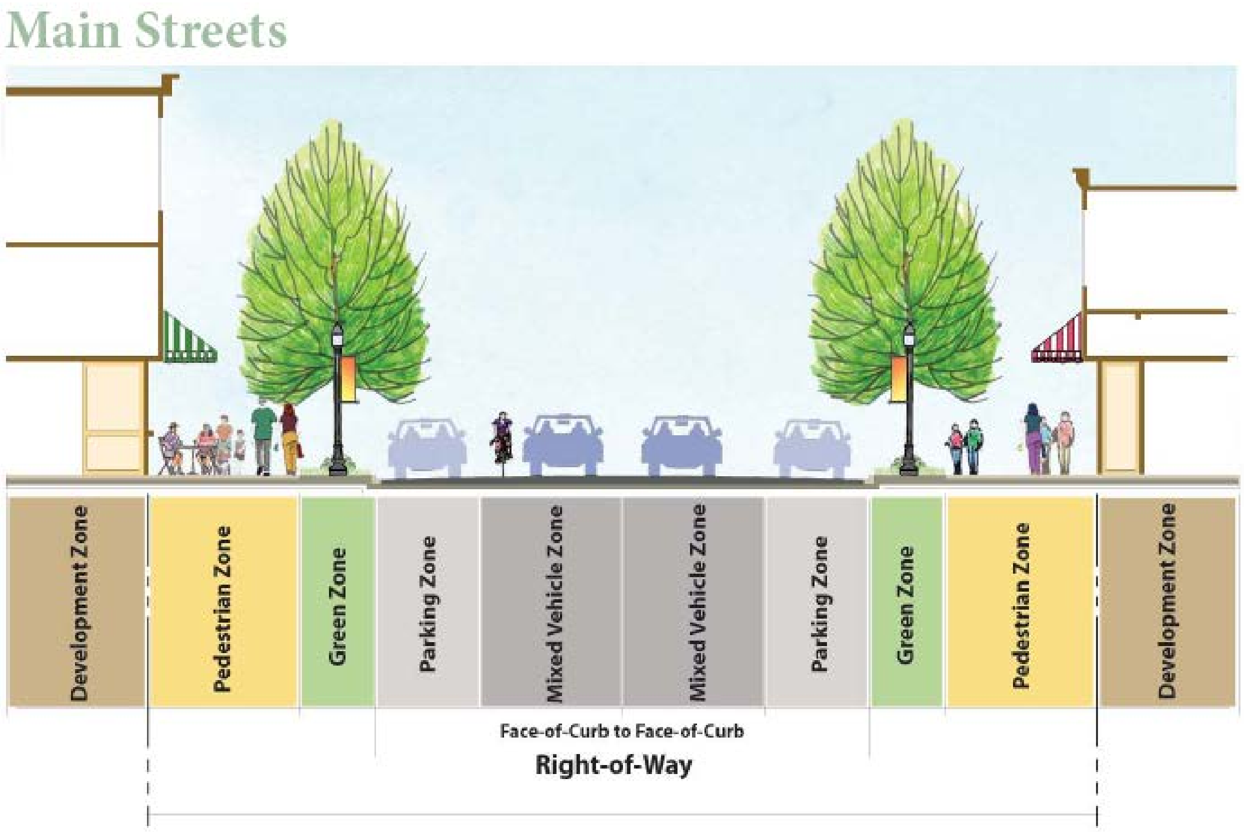
A six-step process is provided on how to apply these guidelines to reflect the appropriate context and provide for the safety and comfort of all users to the best extent possible.

1. Define Land Use Context
2. Define Transportation Context
3. Identify Deficiencies
4. Describe Future Objectives
5. Define Street Type and Initial Cross-Section
6. Describe Tradeoffs and Select Cross-Section

Steps 5 and 6 may be repeated if the initial cross-section should be refined to better address the transportation and land use objectives.

Detailed Guidelines

Chapters 4 and 5 contain the detailed guidelines for street segments and intersections. The segment guidelines are organized by street type, as specified in the Transportation Action Plan. The five street types (Main Street, Avenues, Boulevards, Parkways, and Local Streets) follow a continuum where main streets are the most pedestrian-oriented and parkways are the most auto-oriented. For each street type, the segment guidelines show a generalized cross-section with different zones and discuss a variety of design elements including posted speed, number of through lanes, lane width, sidewalks, on-street parking, curb extensions, lighting, block length, utilities, traffic calming, medians, pedestrian crossings, bus stops, bike lanes, planting strips, driveways and pedestrian refuges. The guidelines specify which design features are appropriate for each street type.



The intersection guidelines are organized by street type, similarly to the segment guidelines. The intersection guidelines contain a matrix that specifies which design elements are appropriate for different types of intersection approaches. For example, at a main street intersection, the pedestrian level of service (LOS) objective for the main street approach is LOS A, whereas it is LOS B for avenue or boulevard approaches. The design elements for intersections include pedestrian and bicycle LOS objectives, motor vehicle v/c threshold, median, pedestrian refuge, number of through lanes, left turn lane, bike lanes, curb extensions, bus stops, curb radii, crosswalks, ADA ramps, traffic control, and lighting among others.

The final chapter is a glossary, which describes the purpose, benefits and design considerations for different elements within the guidelines.   It includes graphics of many design elements.

The appendices define the methodologies for calculating pedestrian and bicycle level of service and contain design guidelines for curb return radii.

8. Multi-Modal Corridor and Public Space Design Guidelines
by Indianapolis Regional Center & Metropolitan Planning Area (Aug 2008)

A multi-modal transportation system is a network of facilities designed for joint use with connections between two or more modes of transportation. This manual proposes recommendations for development of multi-modal facilities in order to realize the vision of a balanced transportation system.

Planning Guidelines

This section describes the planning concepts behind the development of the guidelines. The guidelines describe multi-modal district types and their proposed locations in the Metropolitan Planning Area. Then, a number of corridor typologies that serve the needs of the districts are described, corridor overlays (or special characteristics pertaining to certain districts or corridors) and some recommended transitions between multi-modal corridors.

Districts and Corridors

The basic corridor framework of the district is composed of placemaking corridors at the center containing the district node, thru corridors at the district edge and connector corridors connecting the two. Local corridors access the balance of the district.

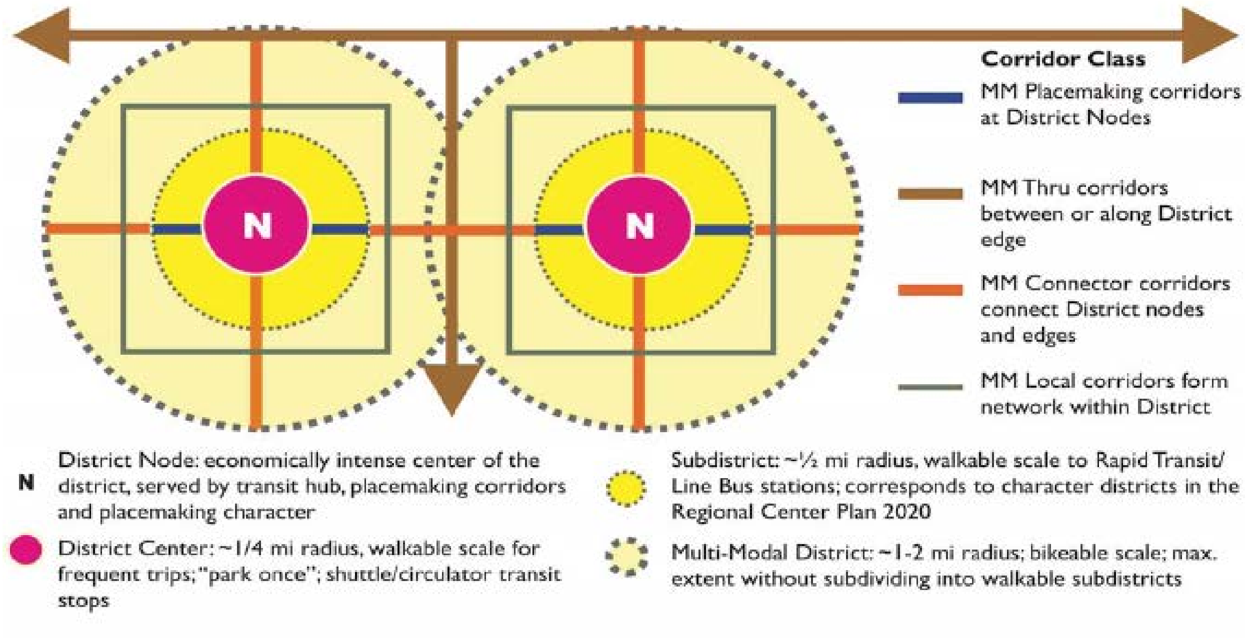


Figure ES.5 Schematic of the relationship between corridors and districts.

District Typologies

1. Central Business
2. Village Mixed-Use
3. Cultural
4. Campus
5. Transit-Oriented
6. Village Residential

INDIANAPOLIS REGIONAL CENTER & METROPOLITAN PLANNING AREA
MULTI-MODAL CORRIDOR AND PUBLIC SPACE DESIGN GUIDELINES
D.1 CENTRAL BUSINESS PEDESTRIAN DISTRICT

Figure 33.1 A Central Business Pedestrian District is an area, often referenced as "downtown," that is characterized by a dense and close-coupled mix of land uses including commercial, retail, cultural, hospitality, governmental, educational, institutional, a strong residential component, and remainder historic industrial uses that are often adapted to more urban center uses.

PEDESTRIAN CONNECTIVITY INDEX

District Size (square miles)	No. of Closed Loops
1.0	50
0.8	40
0.6	30
0.4	20
0.2	10
0.1	5

BIKE CONNECTIVITY INDEX

District Size (square miles)	No. of Closed Loops
1.0	50
0.8	40
0.6	30
0.4	20
0.2	10
0.1	5

THROUGH-VEHICLE CONNECTIVITY INDEX

District Size (square miles)	No. of Closed Loops
1.0	40
0.75	30
0.5	20
0.25	10
0.125	5

Figure 33.2 Multi-modal connectivity indices based on looping densities, same for all districts unless otherwise specified.

CENTRAL BUSINESS PEDESTRIAN DISTRICT

A Central Business Pedestrian District (CBPD) is an area, often referenced as "downtown," that is characterized by a dense and closely coupled mix of land uses including commercial, retail, cultural, hospitality, governmental, educational, institutional, a strong residential component, and frequently some historic industrial uses that are often adapted to more urban center uses. This mix and density of uses creates the economic and user population base imperative for multi-modal transportation and walkability. The district is bounded and bisected by several multi-modal corridors, where transit and pedestrian activity are prevalent.

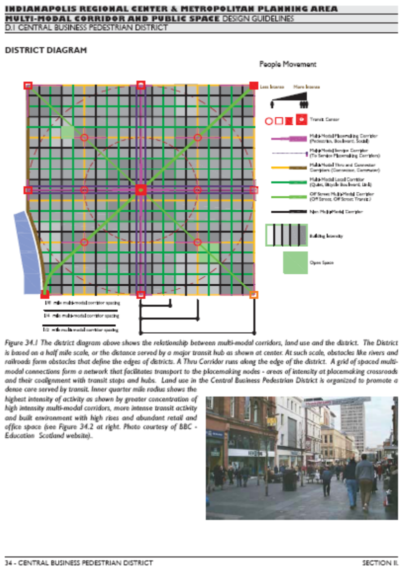
A healthy and vital Central Business Pedestrian District has extended hours and weekend pedestrian presence based on quality of life characteristics achieved through a rich mix of uses and a walkable environment.

A Central Business Pedestrian District is considerably larger in area and user/visitor population than the Village Mixed-Use Pedestrian District. It is a regional destination. Indianapolis' Regional Center is identified as a Central Business Pedestrian District. A Central Business Pedestrian District may have sub-districts with additional guidelines, depending on the jurisdiction. For example the Indianapolis Regional Center has eight sub-districts: Urban Core, New Town Center, Transit-Oriented, Village Mixed-Use, Historic Residential, Entertainment Mixed-Use, Campus, and Utility and Industrial.

Figure 34.1 shows a schematic street grid for the CBPD. Within a Central Business Pedestrian District, the land use intensity increases towards the center of the district and is centered on a transit hub, so its scale is a half mile radius. The hub is served by multiple modes of transit and is easily accessible to the pedestrian. Frequent trips are preferably within a quarter mile radius, so the inner quarter mile radius has a particularly high intensity (see photo figure 34.2), including more retail and office space. Multi-modal corridors are of higher intensity and more numerous within this quarter mile. Non multi-modal corridors tend to alternate with multi-modal ones, especially at greater distances from the district's core.

The district core is also centered around its placemaking corridors, often the social street, boulevard and urban pedestrian corridors. Since a half mile is typically the largest walkable scale, the district borders are often less permeable. Consequently, the district has less pedestrian crossings at its limits, instead having higher speed corridors, parks and parkways at its borders.

SECTION II. CENTRAL BUSINESS PEDESTRIAN DISTRICT - 33

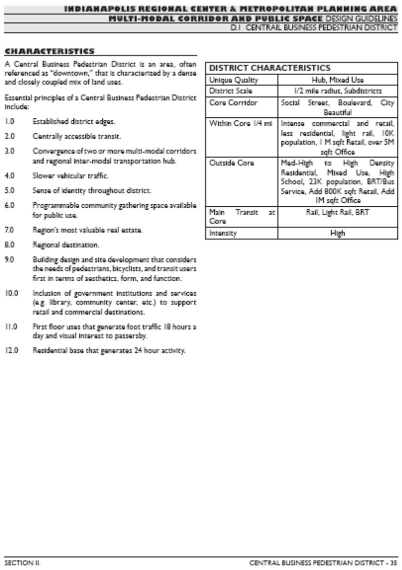


INDIANAPOLIS REGIONAL CENTER & METROPOLITAN PLANNING AREA
MULTI-MODAL CORRIDOR AND PUBLIC SPACE DESIGN GUIDELINES
D.1 CENTRAL BUSINESS PEDESTRIAN DISTRICT

DISTRICT DIAGRAM

Figure 34.1 The district diagram above shows the relationship between multi-modal corridors, land use and the district. The District is based on a half mile scale, or the distance served by a major transit hub as shown at center. At such scale, obstacles like rivers and railroads form obstacles that define the edges of districts. A Thru Corridor runs along the edge of the district. A grid of spaced multi-modal connections form a network that facilitates transport to the placemaking nodes - areas of intensity at placemaking crossroads and their coalignment with transit stops and hubs. Land use in the Central Business Pedestrian District is organized to promote a dense core served by transit. Inner quarter mile radius shows the highest intensity of activity as shown by greater concentration of high intensity multi-modal corridors, more intense transit activity and built environment with high rises and abundant retail and office space (see Figure 34.2 at right. Photo courtesy of BBC - Education Scotland website).

34 - CENTRAL BUSINESS PEDESTRIAN DISTRICT SECTION II.



INDIANAPOLIS REGIONAL CENTER & METROPOLITAN PLANNING AREA
MULTI-MODAL CORRIDOR AND PUBLIC SPACE DESIGN GUIDELINES
D.1 CENTRAIL BUSINESS PEDESTRIAN DISTRICT

CHARACTERISTICS

A Central Business Pedestrian District is an area, often referenced as "downtown," that is characterized by a dense and closely coupled mix of land uses.

Essential principles of a Central Business Pedestrian District include:

1.0 Established district edges.
2.0 Centrally accessible transit.
3.0 Convergence of two or more multi-modal corridors and regional inter-modal transportation hub.
4.0 Slower vehicular traffic.
5.0 Sense of identity throughout district.
6.0 Programmable community gathering space available for public use.
7.0 Region's most valuable real estate.
8.0 Regional destination.
9.0 Building design and site development that considers the needs of pedestrians, bicyclists, and transit users first in terms of aesthetics, form, and function.
10.0 Inclusion of government institutions and services (e.g. library, community center, etc.) to support retail and commercial destinations.
11.0 First floor uses that generate foot traffic 18 hours a day and visual interest to passersby.
12.0 Residential base that generates 24 hour activity.

DISTRICT CHARACTERISTICS	
Unique Quality	Hub, Mixed Use
District Scale	1/2 mile radius, Subdistricts
Core Corridor	Social Street, Boulevard, City Beautiful
Within Core 1/4 mi	Intense commercial and retail, less residential, light rail, 10K population, 1 M sqft Retail, over 5M sqft Office
Outside Core	Med-High to High Density Residential, Mixed Use, High School, 23K population, BRT/Bus Service, Add 800K sqft Retail, Add 1M sqft Office
Main Transit at Core	Rail, Light Rail, BRT
Intensity	High

SECTION II. CENTRAL BUSINESS PEDESTRIAN DISTRICT - 35

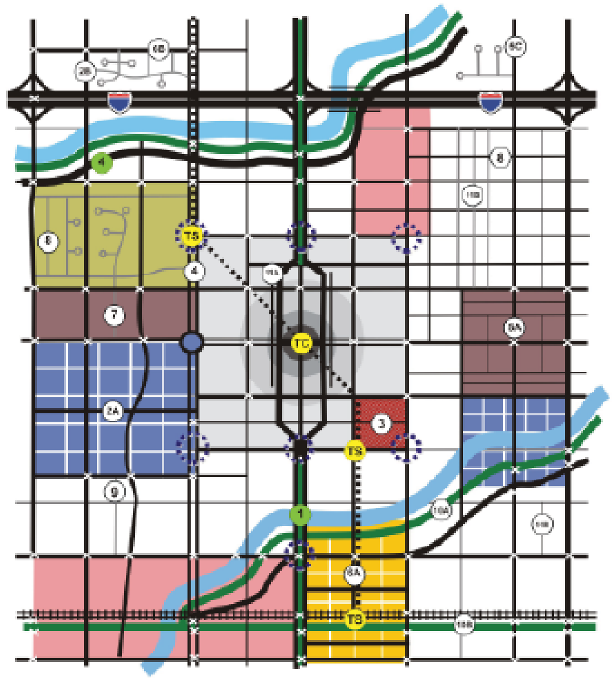


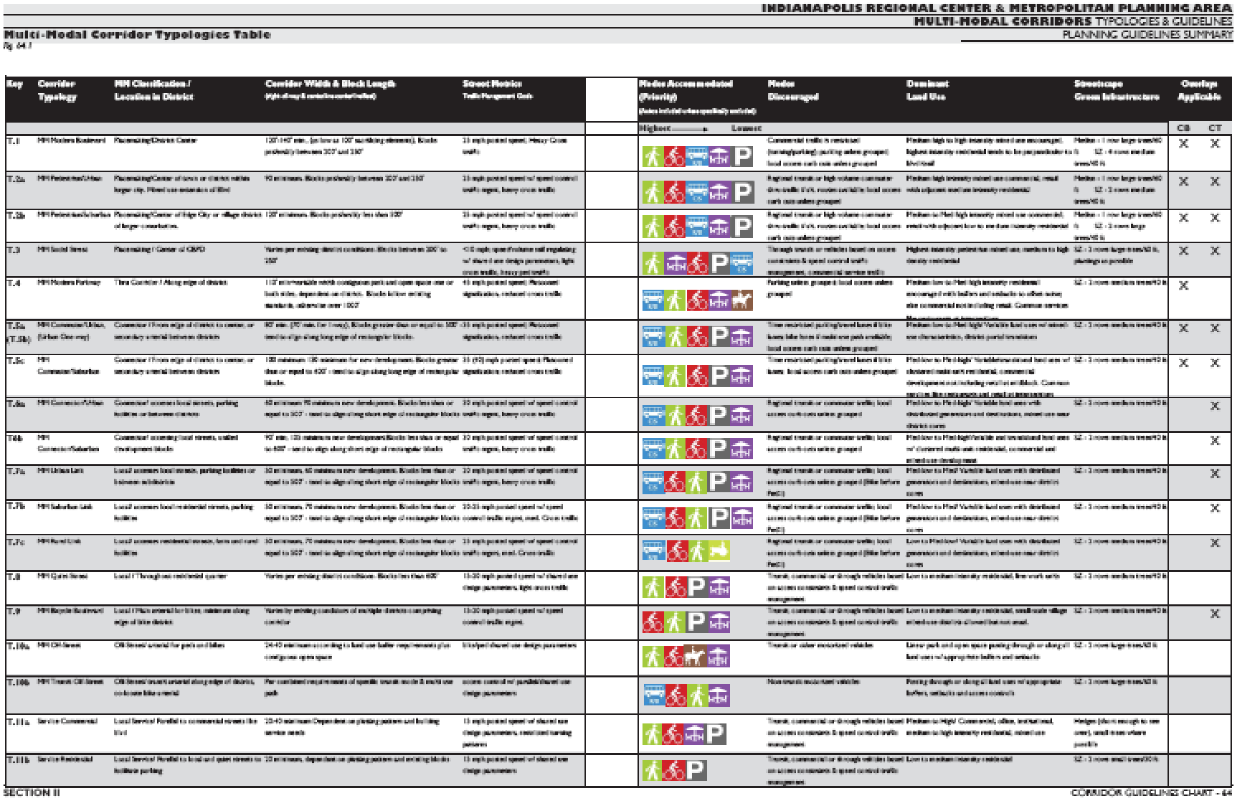
Figure 49.1 The network diagram schematically shows the relationship between corridors and districts in a theoretical network. The CBPD shows rings of increasing intensity the closer to the center of the district.

The different pedestrian districts for each locality within the Metropolitan Planning Area are shown in a map series.

Corridor Typologies

1. Placemaking Corridors
2. Thru Corridors
3. Connector Corridors
4. Local Corridors
5. Off-Street Corridors
6. Service Corridors
7. Overlays
8. Multi-Modal Transitions

There are several different typologies within each set. For example, there are four different corridor types under Placemaking Corridors: Multimodal Modern Boulevard, Multimodal Pedestrian/Urban, Multimodal Pedestrian/Suburban, and Multimodal Social Street. Each corridor type has a defined set of characteristics, including functional classification and location within district, ROW width, street geometrics and metrics, modes accommodated and modes discouraged, dominant land use pattern, facility determination (for pedestrian, bicycle and transit facilities), typical thoroughfare classification, streetscape and green infrastructure, and special design guidelines. These characteristics are summarized in matrix form.



INDIANAPOLIS REGIONAL CENTER & METROPOLITAN PLANNING AREA

MULTI-MODAL CORRIDORS TYPOLOGIES & GUIDELINES

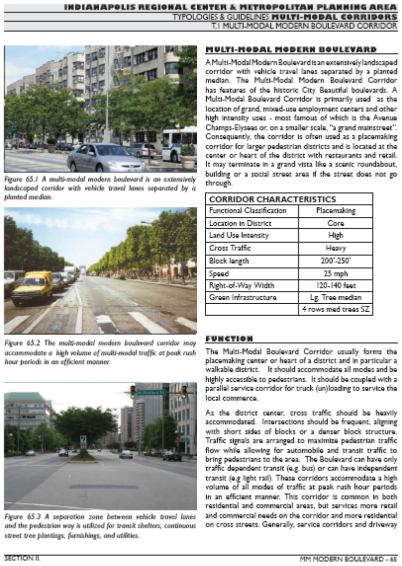
PLANNING GUIDELINES SUMMARY

Multi-Modal Corridor Typologies Table

SECTION II

CORRIDOR GUIDELINES CHART - 64

Each corridor type has a 3-4 page summary that defines the function and characteristics and provides illustrations.



INDIANAPOLIS REGIONAL CENTER & METROPOLITAN PLANNING AREA
TYPOLOGIES & GUIDELINES **MULTI-MODAL CORRIDORS**
T.1 MULTI-MODAL MODERN BOULEVARD CORRIDOR

MULTI-MODAL MODERN BOULEVARD

A Multi-Modal Modern Boulevard is an extensively landscaped corridor with vehicle travel lanes separated by a planted median. The Multi-Modal Modern Boulevard Corridor has features of the historic City Beautiful boulevards. A Multi-Modal Boulevard Corridor is primarily used as the location of grand, mixed-use employment centers and other high intensity uses - most famous of which is the Avenue Champs-Elysees or, on a smaller scale, "a grand mainstreet". Consequently, the corridor is often used as a placemaking corridor for larger pedestrian districts and is located at the center or heart of the district with restaurants and retail. It may terminate in a grand vista like a scenic roundabout, building or a social street area if the street does not go through.

Figure 65.1 A multi-modal modern boulevard is an extensively landscaped corridor with vehicle travel lanes separated by a planted median.

CORRIDOR CHARACTERISTICS	
Functional Classification	Placemaking
Location in District	Core
Land Use Intensity	High
Cross Traffic	Heavy
Block length	200'-250'
Speed	25 mph
Right-of-Way Width	120-140 feet
Green Infrastructure	Lg. Tree median
	4 rows med trees SZ

Figure 65.2 The multi-modal modern boulevard corridor may accommodate a high volume of multi-modal traffic at peak rush hour periods in an efficient manner.

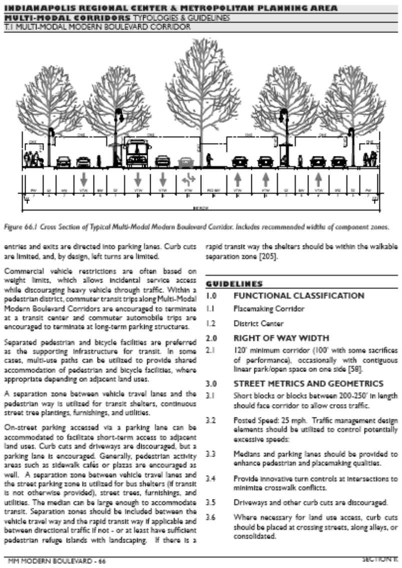
FUNCTION

The Multi-Modal Boulevard Corridor usually forms the placemaking center or heart of a district and in particular a walkable district. It should accommodate all modes and be highly accessible to pedestrians. It should be coupled with a parallel service corridor for truck (un)loading to service the local commerce.

As the district center, cross traffic should be heavily accommodated. Intersections should be frequent, aligning with short sides of blocks or a denser block structure. Traffic signals are arranged to maximize pedestrian traffic flow while allowing for automobile and transit traffic to bring pedestrians to the area. The Boulevard can have only traffic dependent transit (e.g. bus) or can have independent transit (e.g light rail). These corridors accommodate a high volume of all modes of traffic at peak rush hour periods in an efficient manner. This corridor is common in both residential and commercial areas, but services more retail and commercial needs on the corridor and more residential on cross streets. Generally, service corridors and driveway

Figure 65.3 A separation zone between vehicle travel lanes and the pedestrian way is utilized for transit shelters, continuous street tree plantings, furnishings, and utilities.

SECTION II.　　MM MODERN BOULEVARD - 65



INDIANAPOLIS REGIONAL CENTER & METROPOLITAN PLANNING AREA
MULTI-MODAL CORRIDORS TYPOLOGIES & GUIDELINES
T.1 MULTI-MODAL MODERN BOULEVARD CORRIDOR

Figure 66.1 Cross Section of Typical Multi-Modal Modern Boulevard Corridor. Includes recommended widths of component zones.

entries and exits are directed into parking lanes. Curb cuts are limited, and, by design, left turns are limited.

Commercial vehicle restrictions are often based on weight limits, which allows incidental service access while discouraging heavy vehicle through traffic. Within a pedestrian district, commuter transit trips along Multi-Modal Modern Boulevard Corridors are encouraged to terminate at a transit center and commuter automobile trips are encouraged to terminate at long-term parking structures.

Separated pedestrian and bicycle facilities are preferred as the supporting infrastructure for transit. In some cases, multi-use paths can be utilized to provide shared accommodation of pedestrian and bicycle facilities, where appropriate depending on adjacent land uses.

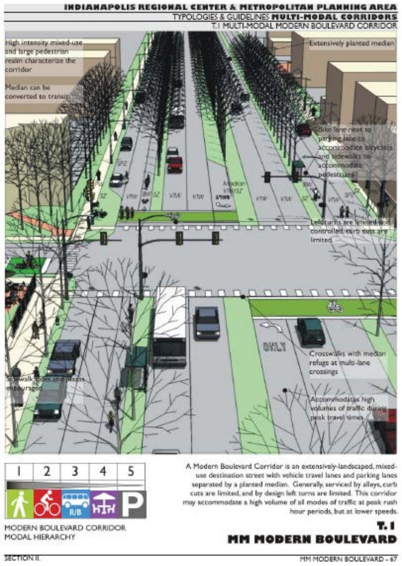
A separation zone between vehicle travel lanes and the pedestrian way is utilized for transit shelters, continuous street tree plantings, furnishings, and utilities.

On-street parking accessed via a parking lane can be accommodated to facilitate short-term access to adjacent land uses. Curb cuts and driveways are discouraged, but a parking lane is encouraged. Generally, pedestrian activity areas such as sidewalk cafés or plazas are encouraged as well. A separation zone between vehicle travel lanes and the street parking zone is utilized for bus shelters (if transit is not otherwise provided), street trees, furnishings, and utilities. The median can be large enough to accommodate transit. Separation zones should be included between the vehicle travel way and the rapid transit way if applicable and between directional traffic if not - or at least have sufficient pedestrian refuge islands with landscaping. If there is a rapid transit way the shelters should be within the walkable separation zone [205].

GUIDELINES

1.0 FUNCTIONAL CLASSIFICATION
1.1 Placemaking Corridor
1.2 District Center
2.0 RIGHT OF WAY WIDTH
2.1 120' minimum corridor (100' with some sacrifices of performance), occasionally with contiguous linear park/open space on one side [58].
3.0 STREET METRICS AND GEOMETRICS
3.1 Short blocks or blocks between 200-250' in length should face corridor to allow cross traffic.
3.2 Posted Speed: 25 mph. Traffic management design elements should be utilized to control potentially excessive speeds:
3.3 Medians and parking lanes should be provided to enhance pedestrian and placemaking qualities.
3.4 Provide innovative turn controls at intersections to minimize crosswalk conflicts.
3.5 Driveways and other curb cuts are discouraged.
3.6 Where necessary for land use access, curb cuts should be placed at crossing streets, along alleys, or consolidated.

MM MODERN BOULEVARD - 66　　SECTION II.



INDIANAPOLIS REGIONAL CENTER & METROPOLITAN PLANNING AREA
TYPOLOGIES & GUIDELINES **MULTI-MODAL CORRIDORS**
T.1 MULTI-MODAL MODERN BOULEVARD CORRIDOR

High intensity mixed-use and large pedestrian realm characterize the corridor

Median can be converted to transit

Extensively planted median

Bike lane next to parking lane to accommodate bicyclists and sidewalks to accommodate pedestrians

Left turns are limited and controlled, curb cuts are limited

Crosswalks with median refuge at multi-lane crossings

Sidewalk cafes and plazas encouraged

Accommodates high volumes of traffic during peak travel times

1	2	3	4	5

MODERN BOULEVARD CORRIDOR
MODAL HIERARCHY

A Modern Boulevard Corridor is an extensively-landscaped, mixed-use destination street with vehicle travel lanes and parking lanes separated by a planted median. Generally, serviced by alleys, curb cuts are limited, and by design left turns are limited. This corridor may accommodate a high volume of all modes of traffic at peak rush hour periods, but at lower speeds.

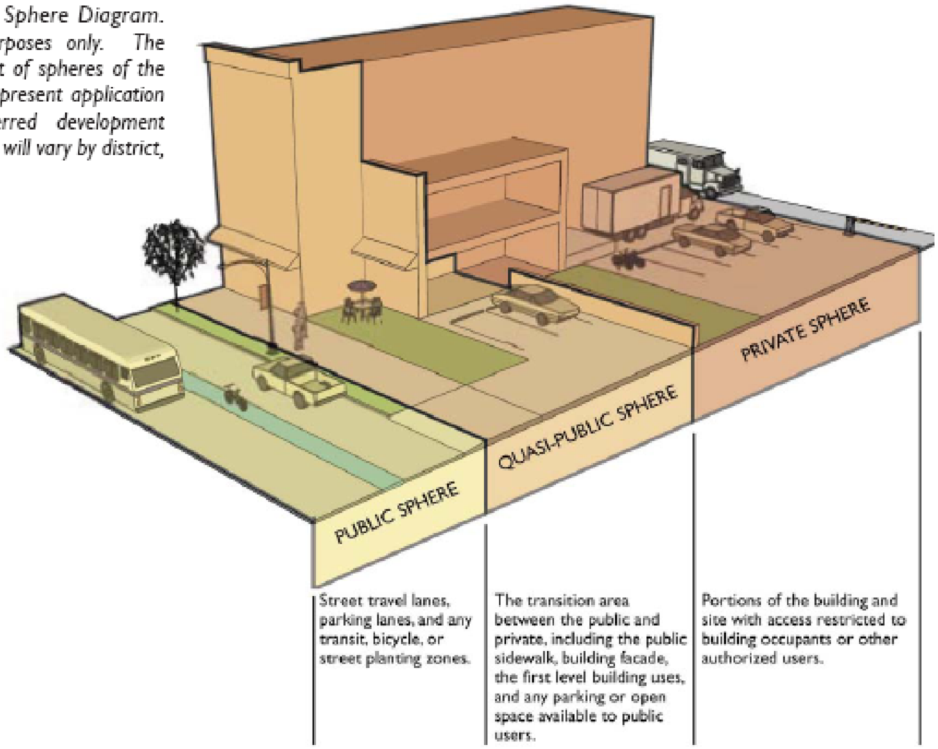
T.1
MM MODERN BOULEVARD

SECTION II.　　MM MODERN BOULEVARD - 67

Designing Guidelines

This section describes the concepts behind public, quasi-public and private spaces and the elements of the streetscape (called component zones) that constitute the public and quasi-public space and streetscape.

Figure 137.1 Built Environment Sphere Diagram. This figure is for illustrative purposes only. The diagram demonstrates the concept of spheres of the built environment and does not represent application of design guidelines nor preferred development arrangement. Locations of spheres will vary by district, corridor and use.



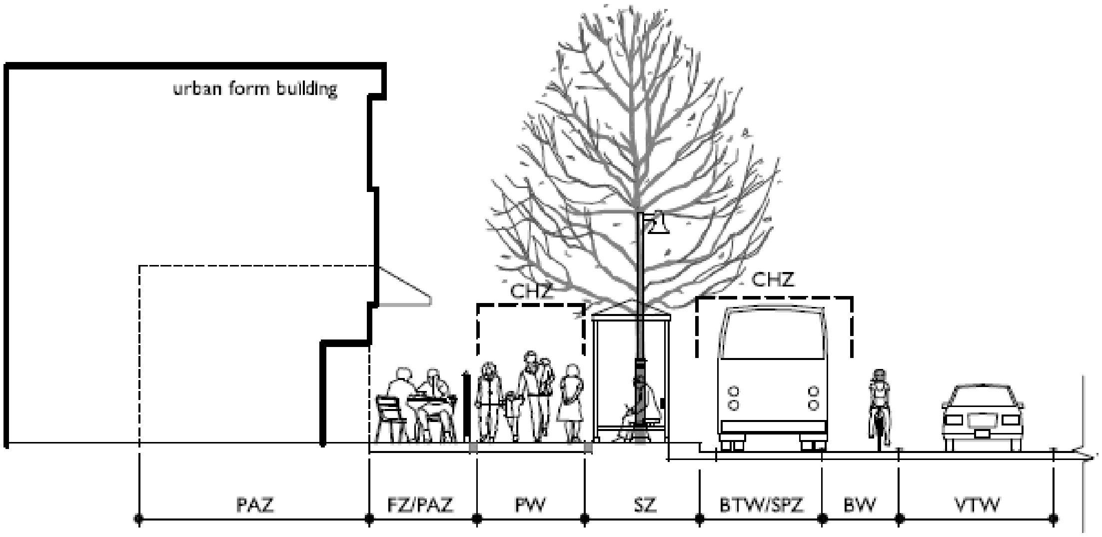


Figure 138.1 Component Zone Diagram. Definitiions are provided in the table below.

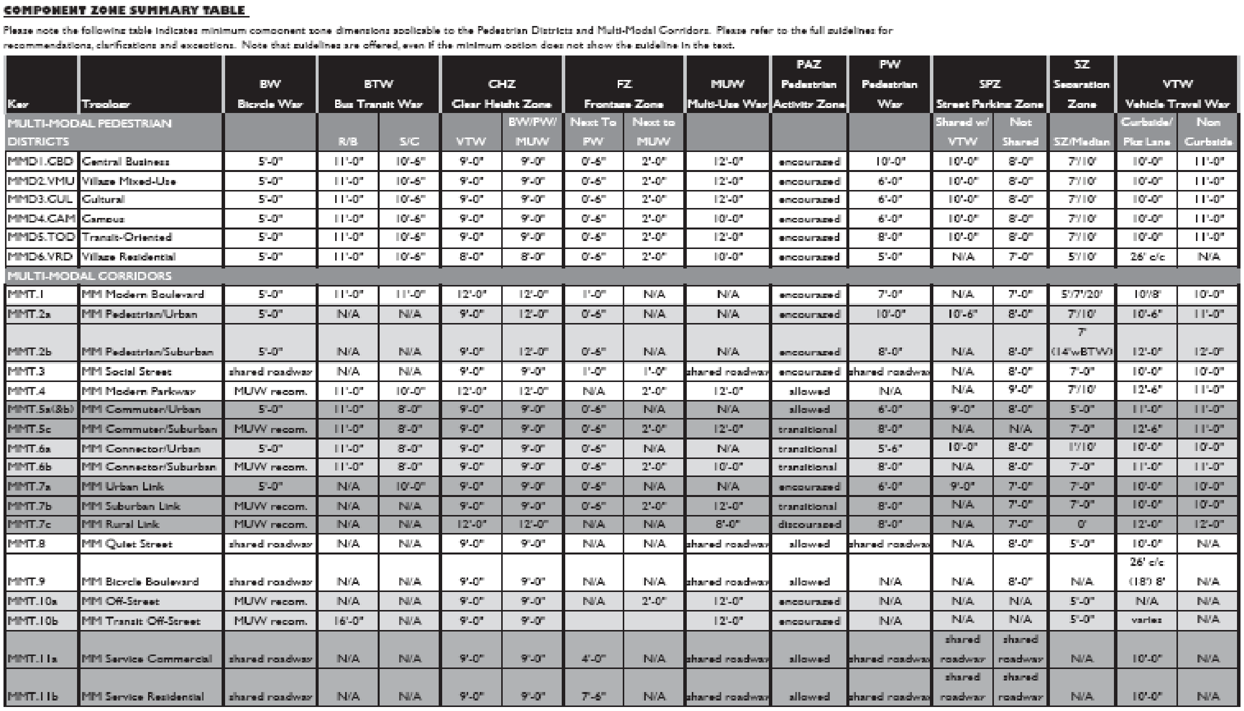
Component Zones

Within the guideline descriptions for both district and corridor typologies, additional detailed guidelines are further categorized into "Component Zones." These components fit into the "Built Environment Spheres" and are a way to abstractly apply design guidelines to both public and private development based on a "menu" of components that reflect real-world scenarios. It is possible that certain zones may be addressed differently depending upon the relevant district or corridor. For example, bike facilities can either be provided as a multi-use path to serve both pedestrians and bicyclists, or may be provided as a combination of on-street bike lanes and collector sidewalks. The component zones, classified as either a continuous "way" or as discontinous "zones", are defined below and represent toolkit options in realizing the district and corridor typologies.

Zone Diagram Definitions

BW	Bicycle Way: area where bicycles travel.
BTW	Bus Transit Way: area where bus transit vehicles travel or stop to load and unload.
CZ	Crossing Zone: area where pedestrians or other non-motorized modes interface with and traverse through motorized transportation zones.
CHZ	Clear Height Zone: vertical distance between a transportation facility and the lowest overhead obstruction. *Note: There is not a separate design guideline for the CHZ, rather, its requirements are addressed in all other zones.*
FZ	Frontage Zone: area of interaction between the pedestrian way and grade-level uses.
MUW	Multi-Use Way: area for shared use between multiple alternative transportation users.
PAZ	Pedestrian Activity Zone: area for public gathering in both the public, quasi-public, and private spheres.
PW	Pedestrian Way: area where pedestrians travel.
RTW	Rapid Transit Way: area where rapid transit vehicles travel or stop to load and unload.
SPZ	Street Parking Zone: area within the roadway where vehicles are permitted to stop, stand, or park, with various levels of permission and/or restriction.
SZ	Separation Zone: area of protection between the roadway and the pedestrian way that contains various utilities, signs, and streetscaping elements.
VTW	Vehicle Travel Way: area where motorized vehicles (automobiles, trucks, buses) travel.

Each of the component zones has several pages of design guidelines. A matrix at the end of the design guidelines section specifies minimum zone dimensions for each of the district and corridor typologies.



COMPONENT ZONE SUMMARY TABLE

Please note the following table indicates minimum component zone dimensions applicable to the Pedestrian Districts and Multi-Modal Corridors. Please refer to the full guidelines for recommendations, clarifications and exceptions. Note that guidelines are offered, even if the minimum option does not show the guideline in the text.

Key	Typology	BW Bicycle Way	BTW Bus Transit Way		CHZ Clear Height Zone		FZ Frontage Zone		MUW Multi-Use Way	PAZ Pedestrian Activity Zone	PW Pedestrian Way	SPZ Street Parking Zone		SZ Separation Zone	VTW Vehicle Travel Way	
MULTI-MODAL PEDESTRIAN DISTRICTS			R/B	S/C	VTW	BW/PW/ MUW	Next To PW	Next to MUW				Shared w/ VTW	Not Shared	SZ/Median	Curbside/ Pkg Lane	Non Curbside
MMD1.CBD	Central Business	5'-0"	11'-0"	10'-6"	9'-0"	9'-0"	0'-6"	2'-0"	12'-0"	encouraged	10'-0"	10'-0"	8'-0"	7'/10'	10'-0"	11'-0"
MMD2.VMU	Village Mixed-Use	5'-0"	11'-0"	10'-6"	9'-0"	9'-0"	0'-6"	2'-0"	12'-0"	encouraged	6'-0"	10'-0"	8'-0"	7'/10'	10'-0"	11'-0"
MMD3.CUL	Cultural	5'-0"	11'-0"	10'-6"	9'-0"	9'-0"	0'-6"	2'-0"	12'-0"	encouraged	6'-0"	10'-0"	8'-0"	7'/10'	10'-0"	11'-0"
MMD4.CAM	Campus	5'-0"	11'-0"	10'-6"	9'-0"	9'-0"	0'-6"	2'-0"	10'-0"	encouraged	6'-0"	10'-0"	8'-0"	7'/10'	10'-0"	11'-0"
MMD5.TOD	Transit-Oriented	5'-0"	11'-0"	10'-6"	9'-0"	9'-0"	0'-6"	2'-0"	12'-0"	encouraged	8'-0"	10'-0"	8'-0"	7'/10'	10'-0"	11'-0"
MMD6.VRD	Village Residential	5'-0"	11'-0"	10'-6"	8'-0"	8'-0"	0'-6"	2'-0"	10'-0"	encouraged	5'-0"	N/A	7'-0"	5'/10'	26' c/c	N/A
MULTI-MODAL CORRIDORS																
MMT.1	MM Modern Boulevard	5'-0"	11'-0"	11'-0"	12'-0"	12'-0"	1'-0"	N/A	N/A	encouraged	7'-0"	N/A	7'-0"	5'/7'/20'	10'/8'	10'-0"
MMT.2a	MM Pedestrian/Urban	5'-0"	N/A	N/A	9'-0"	12'-0"	0'-6"	N/A	N/A	encouraged	10'-0"	10'-6"	8'-0"	7'/10'	10'-6"	11'-0"
MMT.2b	MM Pedestrian/Suburban	5'-0"	N/A	N/A	9'-0"	12'-0"	0'-6"	N/A	N/A	encouraged	8'-0"	N/A	8'-0"	7' (14'wBTW)	12'-0"	12'-0"
MMT.3	MM Social Street	shared roadway	N/A	N/A	9'-0"	9'-0"	1'-0"	1'-0"	shared roadway	encouraged	shared roadway	N/A	8'-0"	7'-0"	10'-0"	10'-0"
MMT.4	MM Modern Parkway	MUW recom.	11'-0"	10'-0"	12'-0"	12'-0"	N/A	2'-0"	12'-0"	allowed	N/A	N/A	9'-0"	7'/10'	12'-6"	11'-0"
MMT.5a(&b)	MM Commuter/Urban	5'-0"	11'-0"	8'-0"	9'-0"	9'-0"	0'-6"	N/A	N/A	allowed	6'-0"	9'-0"	8'-0"	5'-0"	11'-0"	11'-0"
MMT.5c	MM Commuter/Suburban	MUW recom.	11'-0"	8'-0"	9'-0"	9'-0"	0'-6"	2'-0"	12'-0"	transitional	8'-0"	N/A	N/A	7'-0"	12'-6"	11'-0"
MMT.6a	MM Connector/Urban	5'-0"	11'-0"	8'-0"	9'-0"	9'-0"	0'-6"	N/A	N/A	transitional	5'-6"	10'-0"	8'-0"	1'/10'	10'-0"	10'-0"
MMT.6b	MM Connector/Suburban	MUW recom.	11'-0"	8'-0"	9'-0"	9'-0"	0'-6"	2'-0"	10'-0"	transitional	8'-0"	N/A	8'-0"	7'-0"	11'-0"	11'-0"
MMT.7a	MM Urban Link	5'-0"	N/A	10'-0"	9'-0"	9'-0"	0'-6"	N/A	N/A	encouraged	6'-0"	9'-0"	7'-0"	7'-0"	10'-0"	10'-0"
MMT.7b	MM Suburban Link	MUW recom.	N/A	N/A	9'-0"	9'-0"	0'-6"	2'-0"	12'-0"	transitional	8'-0"	N/A	7'-0"	7'-0"	10'-0"	10'-0"
MMT.7c	MM Rural Link	MUW recom.	N/A	N/A	12'-0"	12'-0"	N/A	N/A	8'-0"	discouraged	8'-0"	N/A	7'-0"	0'	12'-0"	12'-0"
MMT.8	MM Quiet Street	shared roadway	N/A	N/A	9'-0"	9'-0"	N/A	N/A	shared roadway	allowed	shared roadway	N/A	8'-0"	5'-0"	10'-0"	N/A
MMT.9	MM Bicycle Boulevard	shared roadway	N/A	N/A	9'-0"	9'-0"	N/A	N/A	shared roadway	allowed	N/A	N/A	8'-0"	N/A	26' c/c (18') 8'	N/A
MMT.10a	MM Off-Street	MUW recom.	N/A	N/A	9'-0"	9'-0"	N/A	2'-0"	12'-0"	encouraged	N/A	N/A	N/A	5'-0"	N/A	N/A
MMT.10b	MM Transit Off-Street	MUW recom.	16'-0"	N/A	9'-0"	9'-0"			12'-0"	encouraged	N/A	N/A	N/A	5'-0"	varies	N/A
MMT.11a	MM Service Commercial	shared roadway	N/A	N/A	9'-0"	9'-0"	4'-0"	N/A	shared roadway	allowed	shared roadway	shared roadway	shared roadway	N/A	10'-0"	N/A
MMT.11b	MM Service Residential	shared roadway	N/A	N/A	9'-0"	9'-0"	7'-6"	N/A	shared roadway	allowed	shared roadway	shared roadway	shared roadway	N/A	10'-0"	N/A

Overview of Methodology

1. Determine multi-modal districts and corridors
2. Apply corridor and district typologies – understand their function, typology (characteristics and layout) and how they relate to each other
    a. Placemaking corridor
    b. Thru corridor
    c. Connector corridor
    d. Local corridor
    e. District Node
    f. District Center – ¼ mile radius around node
    g. Subdistrict – ½ mile radius around node
    h. Multi-modal District – 1 to 2 mile radius
3. Apply component zone guidelines
    a. Pedestrian Activity Zone
    b. Frontage Zone
    c. Pedestrian Way (sidewalk/path)
    d. Separation Zone (buffer)
    e. Bus Transit Way (bus lanes)
    f. Street Parking Zone (on-street parking)
    g. Bicycle Way (bike lanes)
    h. Vehicle Travel Way

9. Smart Mobility 2010: A Call to Action for the New Decade
by Caltrans (Feb 2010)

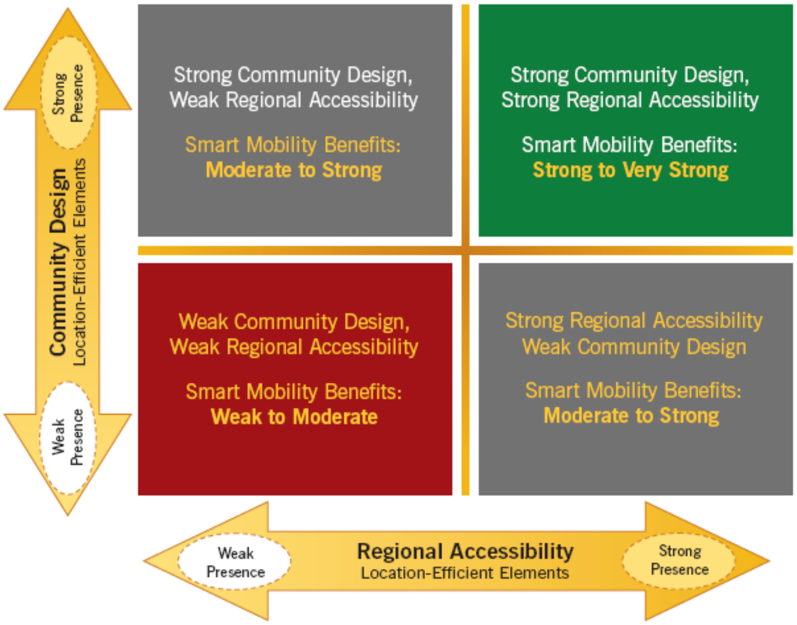
The Smart Mobility handbook represents an approach to integrating transportation and land use using the concept of location efficiency. It presents a methodology for understanding smart mobility within the context of location efficiency and identifies different place types throughout the state based on location efficiency potential. The place types create a distinct context for transportation investments and opportunities for mobility benefits. They are necessarily broad and should be applied at a general planning level of detail. Finer-grained analysis would show large areas characterized as one place type would actually consist of several subareas with characteristics of other place types.

The handbook provides multimodal performance measures for smart mobility, compares them to conventional Caltrans performance measures, and explains how the performance measures apply to different place types. This document has particular relevance to the Virginia statewide guidelines effort, as it represents an effort to classify areas within a state into different place types and may be helpful in defining multimodal districts for Virginia.

Location Efficiency: Community Design and Regional Accessibility

One of the six Smart Mobility Principles is Location Efficiency, which describes the fit between a specific physical environment and its transportation system and services. Location efficiency is defined by two elements: community design and regional accessibility. Community design consists of the characteristics of development use, form, and location that combine with the multimodal transportation system to support convenience, non-motorized travel, and efficient vehicle trips at the neighborhood and area scale. Regional accessibility describes similar characteristics at the regional, interstate and international scales.

Exhibit 6: Location Efficiency Factors and Smart Mobility Benefits



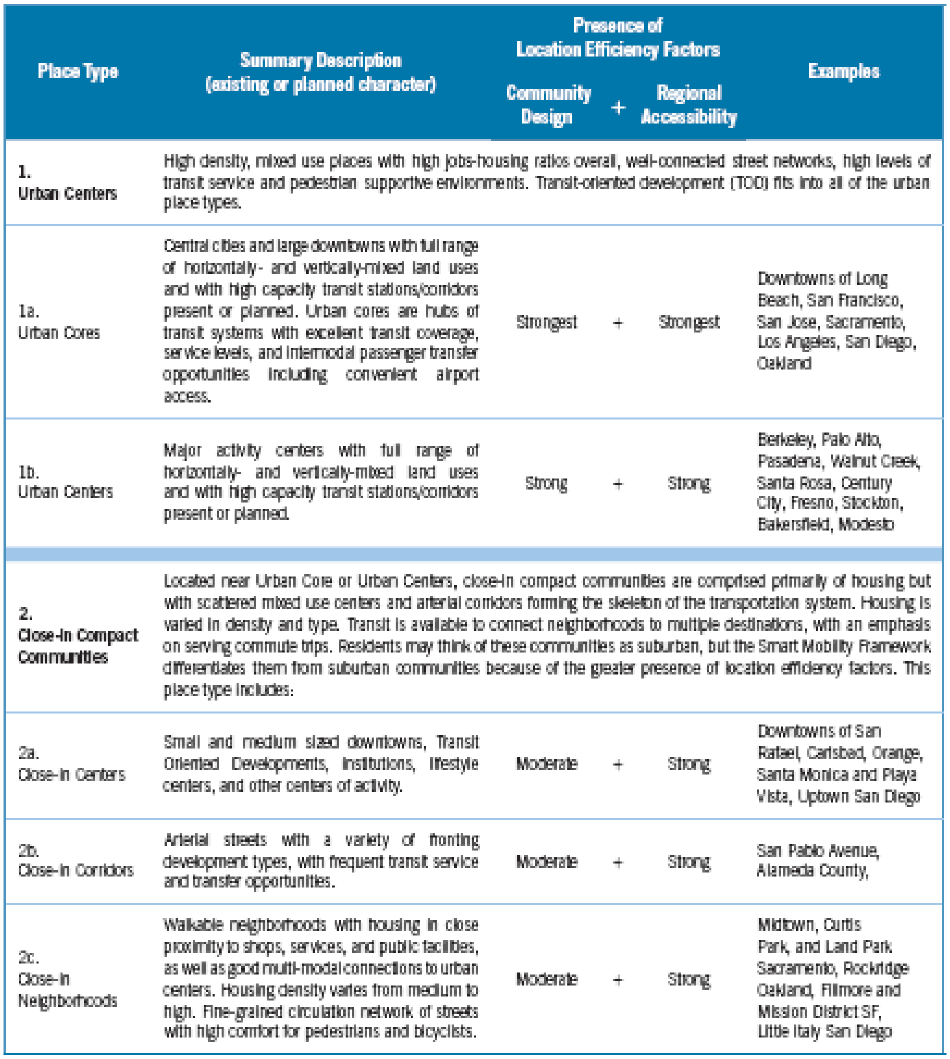
Place Types across California:

The report identifies seven place types, some of which are further broken down into subcategories:

1. Urban Centers – further categorized into urban cores and urban centers
2. Close-in Compact Communities – further categorized into centers, corridors and neighborhoods
3. Compact Communities
4. Suburbs – further categorized into centers, corridors, dedicated use, and neighborhoods
5. Rural and Agricultural Lands – further categorized into rural towns and rural settlements & agricultural lands
6. Protected Lands
7. Special Use Areas

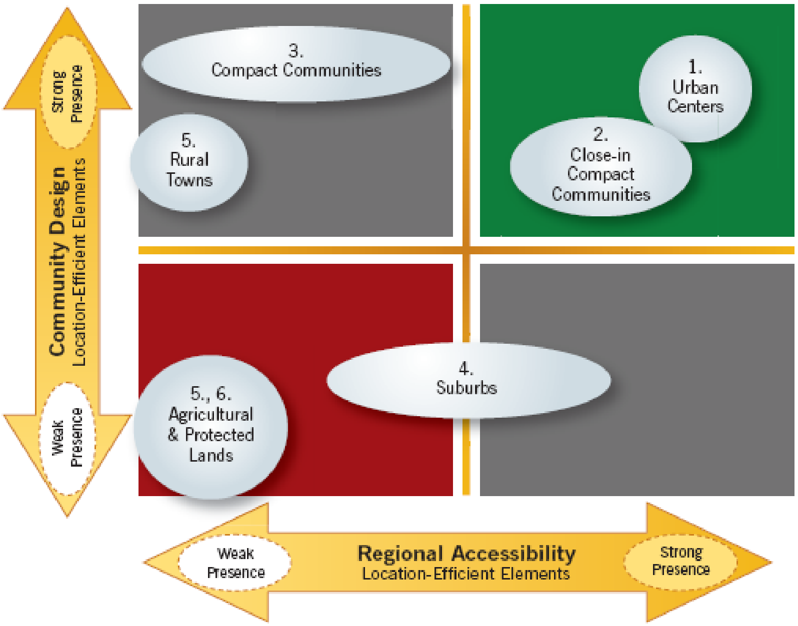
The handbook defines the levels of community design and regional accessibility for each place type, and shows how each place type fits in the location efficiency spectrum.

Exhibit 7: Smart Mobility Place Types

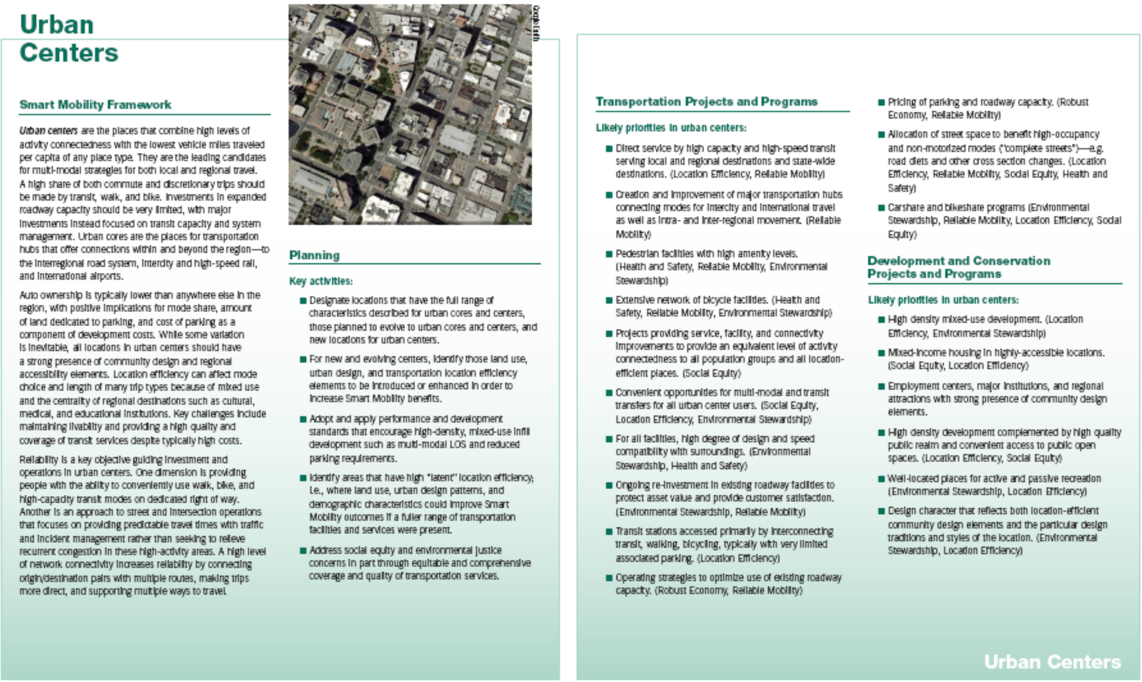


Place Type	Summary Description (existing or planned character)	Presence of Location Efficiency Factors			Examples
		Community Design	+	Regional Accessibility	
1. Urban Centers	High density, mixed use places with high jobs-housing ratios overall, well-connected street networks, high levels of transit service and pedestrian supportive environments. Transit-oriented development (TOD) fits into all of the urban place types.				
1a. Urban Cores	Central cities and large downtowns with full range of horizontally- and vertically-mixed land uses and with high capacity transit stations/corridors present or planned. Urban cores are hubs of transit systems with excellent transit coverage, service levels, and intermodal passenger transfer opportunities including convenient airport access.	Strongest	+	Strongest	Downtowns of Long Beach, San Francisco, San Jose, Sacramento, Los Angeles, San Diego, Oakland
1b. Urban Centers	Major activity centers with full range of horizontally- and vertically-mixed land uses and with high capacity transit stations/corridors present or planned.	Strong	+	Strong	Berkeley, Palo Alto, Pasadena, Walnut Creek, Santa Rosa, Century City, Fresno, Stockton, Bakersfield, Modesto
2. Close-In Compact Communities	Located near Urban Core or Urban Centers, close-in compact communities are comprised primarily of housing but with scattered mixed use centers and arterial corridors forming the skeleton of the transportation system. Housing is varied in density and type. Transit is available to connect neighborhoods to multiple destinations, with an emphasis on serving commute trips. Residents may think of these communities as suburban, but the Smart Mobility Framework differentiates them from suburban communities because of the greater presence of location efficiency factors. This place type includes:				
2a. Close-In Centers	Small and medium sized downtowns, Transit Oriented Developments, Institutions, lifestyle centers, and other centers of activity.	Moderate	+	Strong	Downtowns of San Rafael, Carlsbad, Orange, Santa Monica and Playa Vista, Uptown San Diego
2b. Close-In Corridors	Arterial streets with a variety of fronting development types, with frequent transit service and transfer opportunities.	Moderate	+	Strong	San Pablo Avenue, Alameda County,
2c. Close-In Neighborhoods	Walkable neighborhoods with housing in close proximity to shops, services, and public facilities, as well as good multi-modal connections to urban centers. Housing density varies from medium to high. Fine-grained circulation network of streets with high comfort for pedestrians and bicyclists.	Moderate	+	Strong	Midtown, Curtis Park, and Land Park Sacramento, Rockridge Oakland, Fillmore and Mission District SF, Little Italy San Diego

Exhibit 8: Smart Mobility Place Types and Location Efficiency Potential



Key planning activities and priorities for transportation, development and conservation projects and programs are identified for each place type. A brief discussion on place type transitions over time identifies places as either anchored or transitional to increase location efficiency.



Urban Centers

Smart Mobility Framework

Urban centers are the places that combine high levels of activity connectedness with the lowest vehicle miles traveled per capita of any place type. They are the leading candidates for multi-modal strategies for both local and regional travel. A high share of both commute and discretionary trips should be made by transit, walk, and bike. Investments in expanded roadway capacity should be very limited, with major investments instead focused on transit capacity and system management. Urban cores are the places for transportation hubs that offer connections within and beyond the region—to the interregional road system, intercity and high-speed rail, and international airports.

Auto ownership is typically lower than anywhere else in the region, with positive implications for mode share, amount of land dedicated to parking, and cost of parking as a component of development costs. While some variation is inevitable, all locations in urban centers should have a strong presence of community design and regional accessibility elements. Location efficiency can affect mode choice and length of many trip types because of mixed use and the centrality of regional destinations such as cultural, medical, and educational institutions. Key challenges include maintaining livability and providing a high quality and coverage of transit services despite typically high costs.

Reliability is a key objective guiding investment and operations in urban centers. One dimension is providing people with the ability to conveniently use walk, bike, and high-capacity transit modes on dedicated right of way. Another is an approach to street and intersection operations that focuses on providing predictable travel times with traffic and incident management rather than seeking to relieve recurrent congestion in these high-activity areas. A high level of network connectivity increases reliability by connecting origin/destination pairs with multiple routes, making trips more direct, and supporting multiple ways to travel.

Planning

Key activities:

- Designate locations that have the full range of characteristics described for urban cores and centers, those planned to evolve to urban cores and centers, and new locations for urban centers.
- For new and evolving centers, identify those land use, urban design, and transportation location efficiency elements to be introduced or enhanced in order to increase Smart Mobility benefits.
- Adopt and apply performance and development standards that encourage high-density, mixed-use infill development such as multi-modal LOS and reduced parking requirements.
- Identify areas that have high "latent" location efficiency; i.e., where land use, urban design patterns, and demographic characteristics could improve Smart Mobility outcomes if a fuller range of transportation facilities and services were present.
- Address social equity and environmental justice concerns in part through equitable and comprehensive coverage and quality of transportation services.

Transportation Projects and Programs

Likely priorities in urban centers:

- Direct service by high capacity and high-speed transit serving local and regional destinations and state-wide destinations. (Location Efficiency, Reliable Mobility)
- Creation and improvement of major transportation hubs connecting modes for intercity and international travel as well as intra- and inter-regional movement. (Reliable Mobility)
- Pedestrian facilities with high amenity levels. (Health and Safety, Reliable Mobility, Environmental Stewardship)
- Extensive network of bicycle facilities. (Health and Safety, Reliable Mobility, Environmental Stewardship)
- Projects providing service, facility, and connectivity improvements to provide an equivalent level of activity connectedness to all population groups and all location-efficient places. (Social Equity)
- Convenient opportunities for multi-modal and transit transfers for all urban center users. (Social Equity, Location Efficiency, Environmental Stewardship)
- For all facilities, high degree of design and speed compatibility with surroundings. (Environmental Stewardship, Health and Safety)
- Ongoing re-investment in existing roadway facilities to protect asset value and provide customer satisfaction. (Environmental Stewardship, Reliable Mobility)
- Transit stations accessed primarily by interconnecting transit, walking, bicycling, typically with very limited associated parking. (Location Efficiency)
- Operating strategies to optimize use of existing roadway capacity. (Robust Economy, Reliable Mobility)
- Pricing of parking and roadway capacity. (Robust Economy, Reliable Mobility)
- Allocation of street space to benefit high-occupancy and non-motorized modes ("complete streets")—e.g. road diets and other cross section changes. (Location Efficiency, Reliable Mobility, Social Equity, Health and Safety)
- Carshare and bikeshare programs (Environmental Stewardship, Reliable Mobility, Location Efficiency, Social Equity)

Development and Conservation Projects and Programs

Likely priorities in urban centers:

- High density mixed-use development. (Location Efficiency, Environmental Stewardship)
- Mixed-income housing in highly-accessible locations. (Social Equity, Location Efficiency)
- Employment centers, major institutions, and regional attractions with strong presence of community design elements.
- High density development complemented by high quality public realm and convenient access to public open spaces. (Location Efficiency, Social Equity)
- Well-located places for active and passive recreation (Environmental Stewardship, Location Efficiency)
- Design character that reflects both location-efficient community design elements and the particular design traditions and styles of the location. (Environmental Stewardship, Location Efficiency)

Urban Centers

Smart Mobility Performance Measures

The handbook defines 17 performance measures that relate back to the six Smart Mobility principles. These performance metrics are similar to conventional Caltrans metrics but redefined and reemphasized.

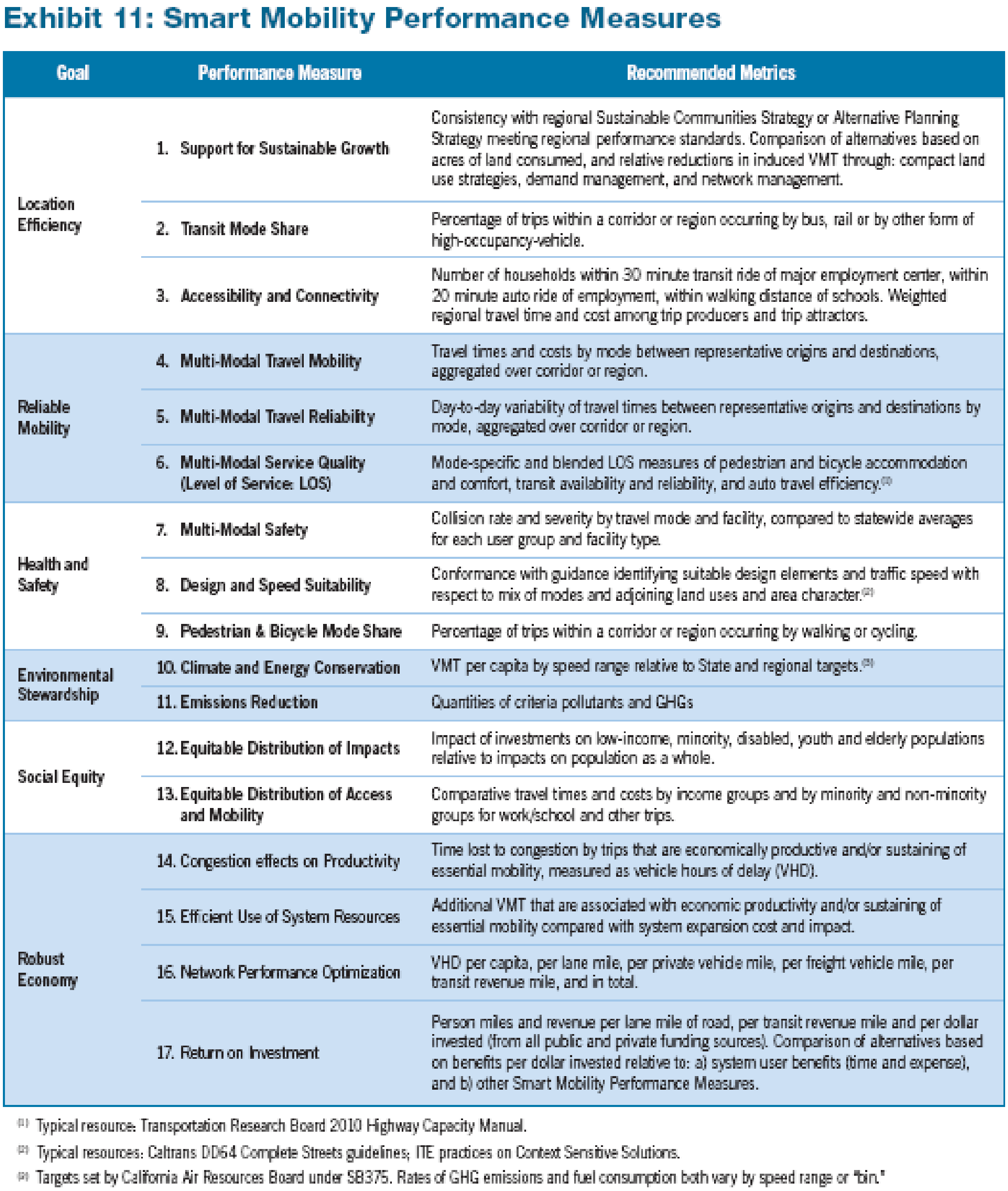


Exhibit 11: Smart Mobility Performance Measures

Goal	Performance Measure	Recommended Metrics
Location Efficiency	1. Support for Sustainable Growth	Consistency with regional Sustainable Communities Strategy or Alternative Planning Strategy meeting regional performance standards. Comparison of alternatives based on acres of land consumed, and relative reductions in induced VMT through: compact land use strategies, demand management, and network management.
	2. Transit Mode Share	Percentage of trips within a corridor or region occurring by bus, rail or by other form of high-occupancy-vehicle.
	3. Accessibility and Connectivity	Number of households within 30 minute transit ride of major employment center, within 20 minute auto ride of employment, within walking distance of schools. Weighted regional travel time and cost among trip producers and trip attractors.
Reliable Mobility	4. Multi-Modal Travel Mobility	Travel times and costs by mode between representative origins and destinations, aggregated over corridor or region.
	5. Multi-Modal Travel Reliability	Day-to-day variability of travel times between representative origins and destinations by mode, aggregated over corridor or region.
	6. Multi-Modal Service Quality (Level of Service: LOS)	Mode-specific and blended LOS measures of pedestrian and bicycle accommodation and comfort, transit availability and reliability, and auto travel efficiency.[1]
Health and Safety	7. Multi-Modal Safety	Collision rate and severity by travel mode and facility, compared to statewide averages for each user group and facility type.
	8. Design and Speed Suitability	Conformance with guidance identifying suitable design elements and traffic speed with respect to mix of modes and adjoining land uses and area character.[2]
	9. Pedestrian & Bicycle Mode Share	Percentage of trips within a corridor or region occurring by walking or cycling.
Environmental Stewardship	10. Climate and Energy Conservation	VMT per capita by speed range relative to State and regional targets.[3]
	11. Emissions Reduction	Quantities of criteria pollutants and GHGs
Social Equity	12. Equitable Distribution of Impacts	Impact of investments on low-income, minority, disabled, youth and elderly populations relative to impacts on population as a whole.
	13. Equitable Distribution of Access and Mobility	Comparative travel times and costs by income groups and by minority and non-minority groups for work/school and other trips.
Robust Economy	14. Congestion effects on Productivity	Time lost to congestion by trips that are economically productive and/or sustaining of essential mobility, measured as vehicle hours of delay (VHD).
	15. Efficient Use of System Resources	Additional VMT that are associated with economic productivity and/or sustaining of essential mobility compared with system expansion cost and impact.
	16. Network Performance Optimization	VHD per capita, per lane mile, per private vehicle mile, per freight vehicle mile, per transit revenue mile, and in total.
	17. Return on Investment	Person miles and revenue per lane mile of road, per transit revenue mile and per dollar invested (from all public and private funding sources). Comparison of alternatives based on benefits per dollar invested relative to: a) system user benefits (time and expense), and b) other Smart Mobility Performance Measures.

[1] Typical resource: Transportation Research Board 2010 Highway Capacity Manual.

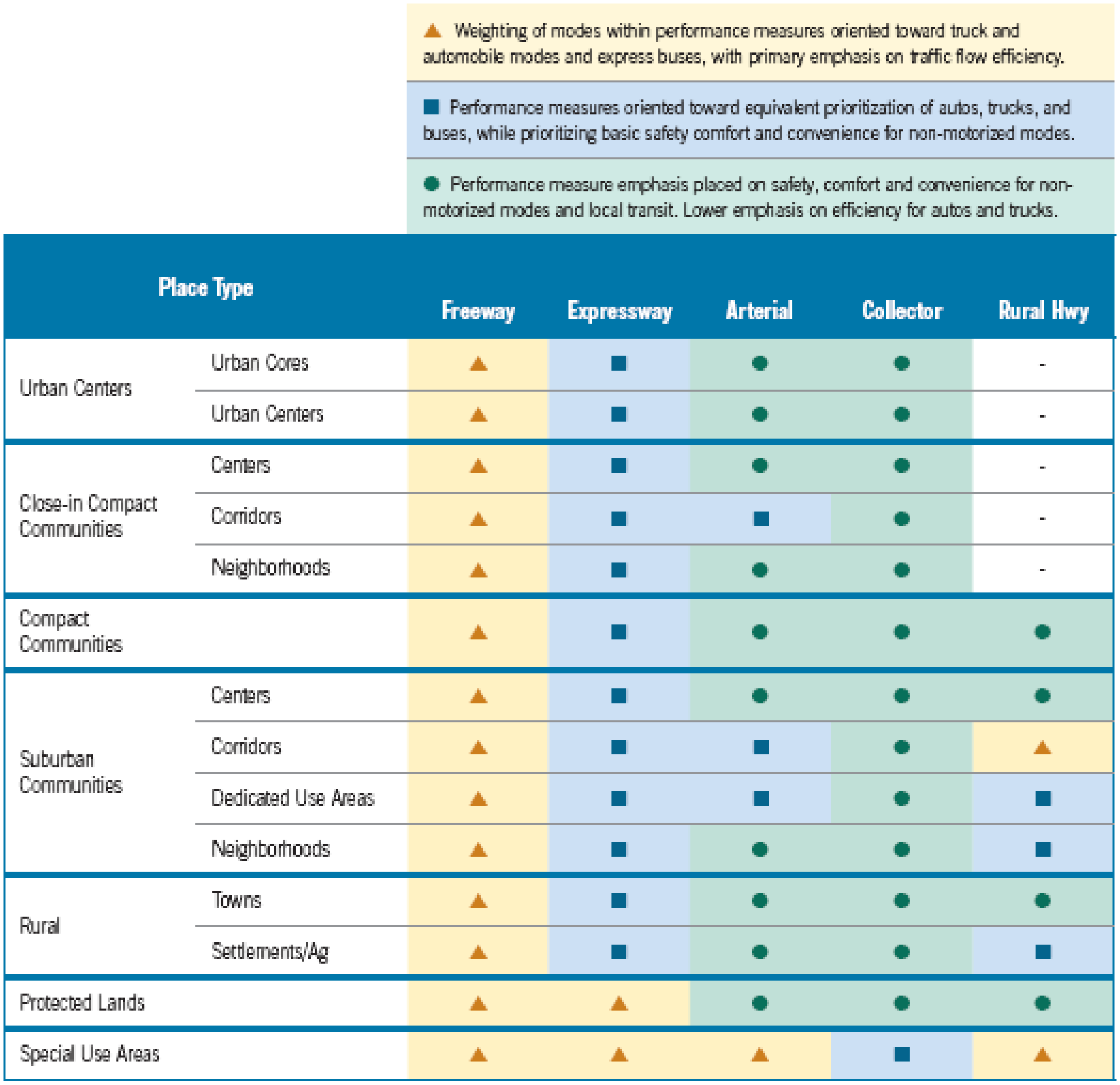
[2] Typical resources: Caltrans DD64 Complete Streets guidelines; ITE practices on Context Sensitive Solutions.

[3] Targets set by California Air Resources Board under SB375. Rates of GHG emissions and fuel consumption both vary by speed range or "bin."

Specific planning and projected development processes into which the Smart Mobility performance measure can be implemented are identified. The handbook provides examples of agencies across the nation who have successfully implemented these metrics and outlines the guidelines, methods, and tools and data needs for each performance measure.

The handbook ties together the concepts of performance metrics and place types by specifying modal emphasis by facility type for each place type. This prioritizes performance measures based on facility type and place type. Some performance measures should receive high importance regardless of facility or place type (e.g. modal collision rates, speed suitability and travel time consistency). Others vary. For example, network performance optimization and speed management rank higher for arterials and urban freeways than for rural freeways and highways.

Exhibit 15: Framework for Integrating Place Type and Facility Type in Weighing Modal Priorities in Planning and Project Evaluation Criteria



▲ Weighting of modes within performance measures oriented toward truck and automobile modes and express buses, with primary emphasis on traffic flow efficiency.

■ Performance measures oriented toward equivalent prioritization of autos, trucks, and buses, while prioritizing basic safety comfort and convenience for non-motorized modes.

● Performance measure emphasis placed on safety, comfort and convenience for non-motorized modes and local transit. Lower emphasis on efficiency for autos and trucks.

Place Type		Freeway	Expressway	Arterial	Collector	Rural Hwy
Urban Centers	Urban Cores	▲	■	●	●	-
	Urban Centers	▲	■	●	●	-
Close-in Compact Communities	Centers	▲	■	●	●	-
	Corridors	▲	■	■	●	-
	Neighborhoods	▲	■	●	●	-
Compact Communities		▲	■	●	●	●
Suburban Communities	Centers	▲	■	●	●	●
	Corridors	▲	■	■	●	▲
	Dedicated Use Areas	▲	■	■	●	■
	Neighborhoods	▲	■	●	●	■
Rural	Towns	▲	■	●	●	●
	Settlements/Ag	▲	■	●	●	■
Protected Lands		▲	▲	●	●	●
Special Use Areas		▲	▲	▲	■	▲

10. Multimodal Corridors *by City of Boulder, Colorado (1996)*

The 1996 Transportation Master Plan identified 10 multimodal corridors within the City of Boulder. The 10 corridors were divided and prioritized into 42 segments. The Current Funding program specifies 11 segments that can be constructed with allocated funds. Additional funds identified in the Action plan would allow 21 of these corridor segments to be implements, while the Vision program builds out all 42 segments.

The City's website provides several general improvements for each mode that will be implemented in the 10 corridors:

Roadway

- Roadway reconstruction to reduce long-term maintenance liabilities;
- Improved operational and traffic flow through intersection enhancements focusing on system bottlenecks;
- Roadway improvements which support multi-occupant vehicle use;
- Roadway-related (functional efficiency/safety) improvements in priority corridors; and
- Signal coordination optimization based on current traffic flow patterns.

Pedestrian

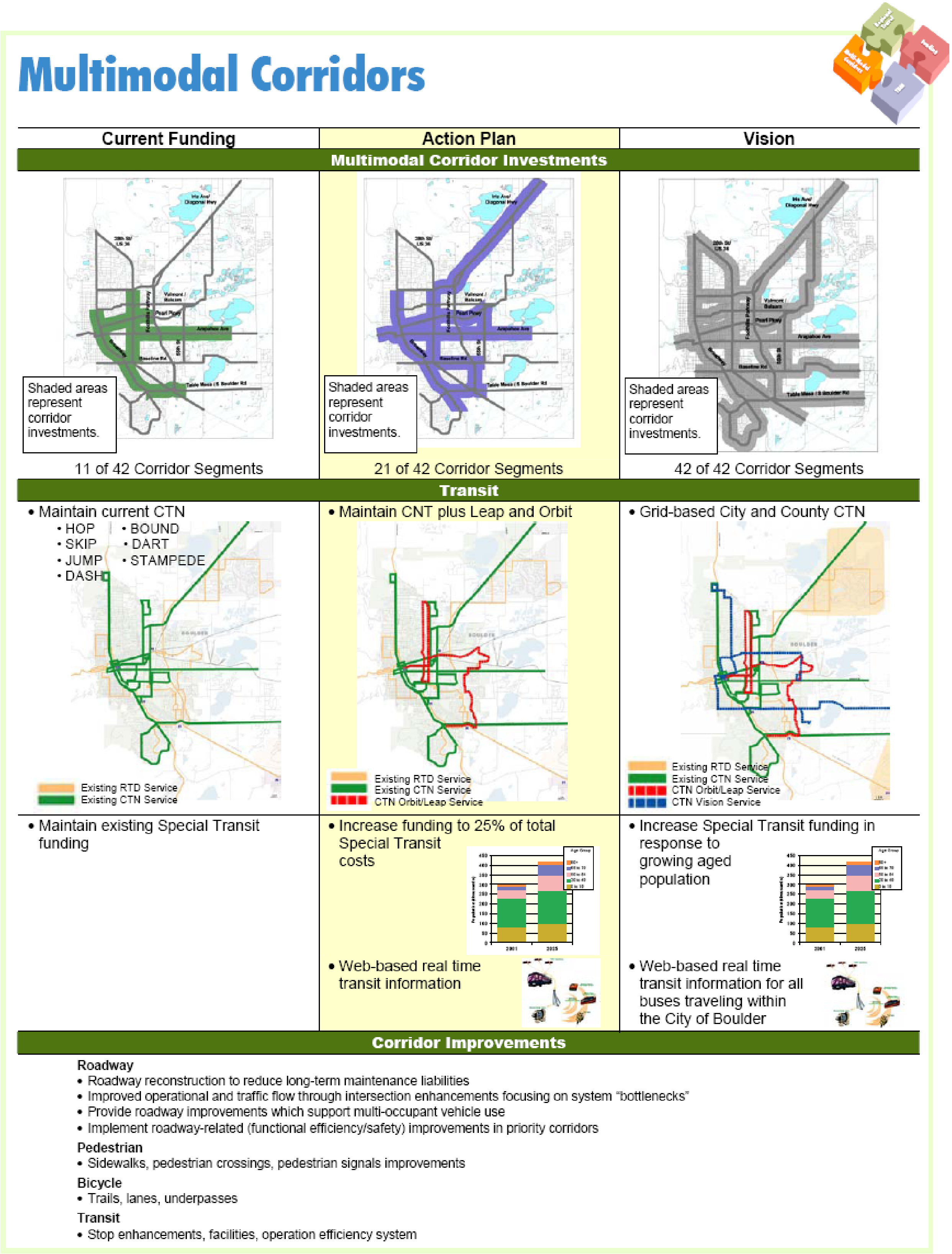
- Complete segments of missing sidewalks to provide direct and continuous connections between destinations and to transit;
- Continue adding enhanced pedestrian crossings at strategic locations; and
- Continue installation of pedestrian signals and crossing count-down heads.

Bicycle

- Complete missing bicycle trails and bicycle lanes to provide direct and continuous connections;
- Construct needed underpasses at high volume locations to provide safe connections; and
- Provide bicycle route signage.

Transit

- Deploy the high-frequency Community Transit Network (CTN);
- Construct enhancements at key high-frequency transit stops to include, at a minimum, transit signs and pavement platforms. At higher demand transit stops, shelters, benches and trash receptacles will be provided; and
- Operational system efficiency improvements, such as bus bypass lanes, bus signal prioritization and other improvements to increase the efficiency of the CTN.



Multimodal Corridors

Current Funding	Action Plan	Vision
Multimodal Corridor Investments		
Shaded areas represent corridor investments. 11 of 42 Corridor Segments	Shaded areas represent corridor investments. 21 of 42 Corridor Segments	Shaded areas represent corridor investments. 42 of 42 Corridor Segments
Transit		
• Maintain current CTN • HOP • BOUND • SKIP • DART • JUMP • STAMPEDE • DASH Existing RTD Service Existing CTN Service	• Maintain CNT plus Leap and Orbit Existing RTD Service Existing CTN Service CTN Orbit/Leap Service	• Grid-based City and County CTN Existing RTD Service Existing CTN Service CTN Orbit/Leap Service CTN Vision Service
• Maintain existing Special Transit funding	• Increase funding to 25% of total Special Transit costs • Web-based real time transit information	• Increase Special Transit funding in response to growing aged population • Web-based real time transit information for all buses traveling within the City of Boulder
Corridor Improvements		

Roadway
- Roadway reconstruction to reduce long-term maintenance liabilities
- Improved operational and traffic flow through intersection enhancements focusing on system "bottlenecks"
- Provide roadway improvements which support multi-occupant vehicle use
- Implement roadway-related (functional efficiency/safety) improvements in priority corridors

Pedestrian
- Sidewalks, pedestrian crossings, pedestrian signals improvements

Bicycle
- Trails, lanes, underpasses

Transit
- Stop enhancements, facilities, operation efficiency system

http://www.bouldercolorado.gov/index.php?option=com_content&view=article&id=355&Itemid=1624

11. Transcit Service Design Guidelines *by Virginia Department of Rail and Public Transportation (November 2008)*

The Transit Service Design Guidelines were compiled by the Virginia Department of Rail and Public Transportation (DRPT) in 2008 in an effort to provide communities with guidance on starting new transit service. The guidelines are intended to help local governments, transit providers and citizens better understand the types of transit systems and services that are available to meet community and regional transportation needs, as well as helping DRPT in making recommendations to the Commonwealth Transportation Board for transit investment.

The guidelines are an excellent primer for anyone interested in basic information about how to plan for transit and key considerations for matching local needs with solutions. Some of the basic considerations include: local land use, trip patterns, affordability, economic development goals, environmental factors and many others. It describes various planning studies that a community might undertake to determine transportation needs, and describes what steps a community might take depending on their level of experience with transit. The document also outlines various other cost-effective, transportation demand management (TDM) options to consider before investing in transit. Examples include: Alternative Cash Incentive Program, Carpool and Vanpool Matching, Car Sharing and Bike Sharing Programs, Flexible Schedules, Guaranteed Ride Home, Parking Cash Out Programs, and Telecommuting.

Two sections of the document are particularly relevant for this study. The first is the section on land use considerations, which outlines transit supportive development levels by transit category. While adopted from FTA and ITE, these two tables can help provide a framework for understanding Multimodal Districts and TOD placetypes statewide.

Development Levels Supportive of Rail

Measure	Development Level
Population densities (persons per square mile)	6,667 - 15,000
Employment Served	125,000 - 250,000
Central Business District commercial floor to area ratio (FAR)	6.0 – 10.0
Other commercial floor to area ratio (FAR)	1.0 - 2.5
Residential dwelling units per acre	10 - 25

Sources: Federal Transit Administration: Guidelines and Standards for Assessing Transit Supportive Land Use – May 2004

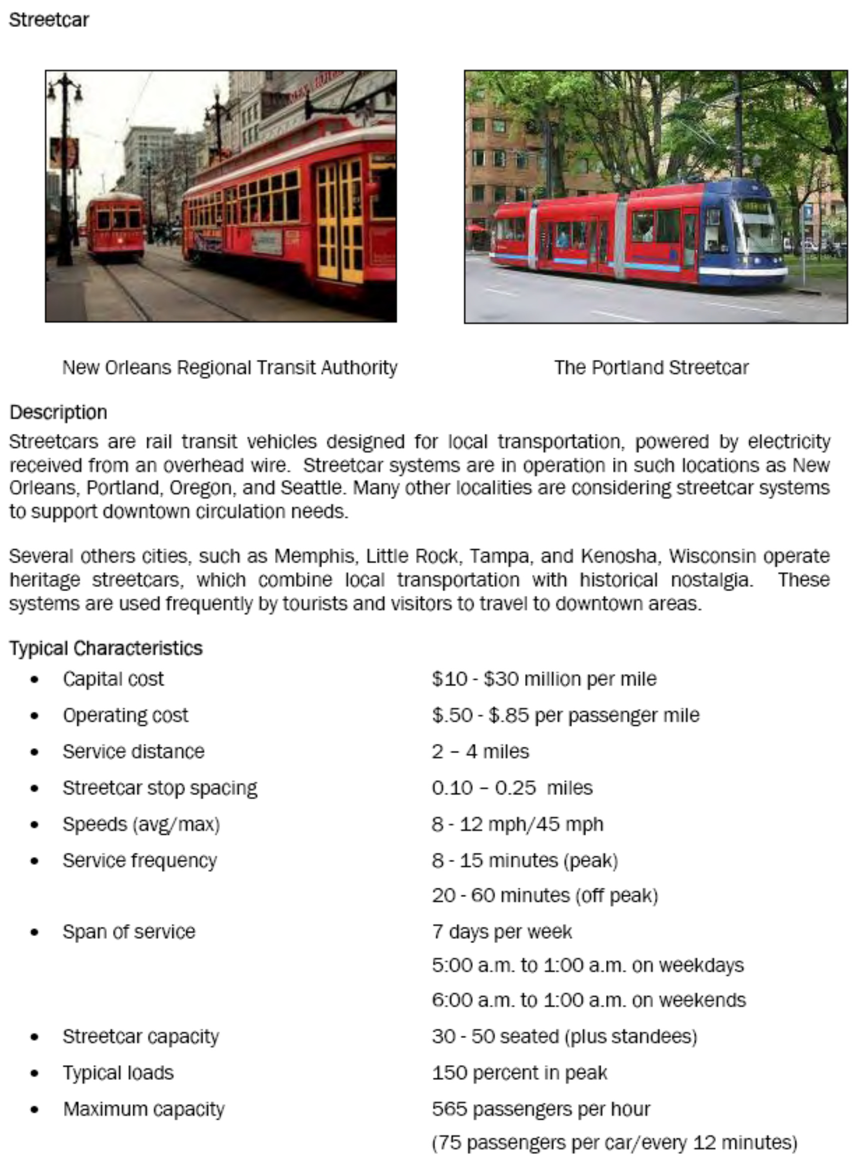
Development Levels Supportive of Fixed Route Bus

Measure	Development Level
Population densities (persons per square mile)	2,500 - 4,000
Employment Served (per acre)	4 - 5
Commercial floor to area ratio (FAR)	0.35 – 1.0
Residential dwelling units per acre	4 - 5

Sources: Institute of Traffic Engineers, A Toolbox for Alleviating Traffic Congestion, 1998; Pushkarev and Zupan, 1977; Ewing, 1999; Cervero, et. al., 2004; TCRP Report 100, 2003.

Transit Service Guidelines

The second item of interest is the section on Transit Service Guidelines. This section of the guidelines provides an overview of specific modes within each of the four transit mode categories: Rail, Fixed Route Bus, Demand Response Bus, and Ferry. Individual modes range from small vans serving low-density rural areas to high capacity rail systems providing quick, convenient service for commuters traveling in high-density urban areas. For each mode, a brief description is provided, along with typical physical and operating characteristics of the system such as station spacing and frequency of the service. Typical physical and operating characteristics of each mode are presented in ranges. Information also is provided about how the service might be operated, and over what periods of time and days of the week. For the purposes of this study, this type of information will help to inform the composition of a multimodal district, and can further be linked to different land use characteristics associated with TOD.



Streetcar

New Orleans Regional Transit Authority

The Portland Streetcar

Description

Streetcars are rail transit vehicles designed for local transportation, powered by electricity received from an overhead wire. Streetcar systems are in operation in such locations as New Orleans, Portland, Oregon, and Seattle. Many other localities are considering streetcar systems to support downtown circulation needs.

Several others cities, such as Memphis, Little Rock, Tampa, and Kenosha, Wisconsin operate heritage streetcars, which combine local transportation with historical nostalgia. These systems are used frequently by tourists and visitors to travel to downtown areas.

Typical Characteristics

• Capital cost	$10 - $30 million per mile
• Operating cost	$.50 - $.85 per passenger mile
• Service distance	2 – 4 miles
• Streetcar stop spacing	0.10 – 0.25 miles
• Speeds (avg/max)	8 - 12 mph/45 mph
• Service frequency	8 - 15 minutes (peak) 20 - 60 minutes (off peak)
• Span of service	7 days per week 5:00 a.m. to 1:00 a.m. on weekdays 6:00 a.m. to 1:00 a.m. on weekends
• Streetcar capacity	30 - 50 seated (plus standees)
• Typical loads	150 percent in peak
• Maximum capacity	565 passengers per hour (75 passengers per car/every 12 minutes)

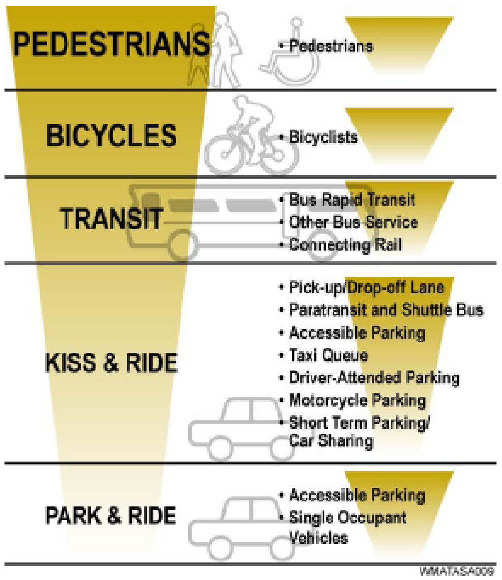
12. Station Site and Access Planning Manual,

By Washington Metropolitan Area Transportation Authority (May 2008)

The Station Site and Access Planning Manual provides station area and facility design guidelines to maximize accessibility for all Metrorail passengers. It is intended to address physical design and operation issues that arise during the planning and design phases of development projects within transit station areas. Key transit access principles, approaches and parameters are provided to clarify transit access needs while serving as a flexible guide to allow designers to find the best solution for any situation.

The document acknowledges that all modes of access to a station cannot be given equal priority. As such, the station site facility design guidelines prioritize facilities based on mode, as illustrated in the access hierarchy, with pedestrian and sensory-impaired passengers having the highest importance, followed by bicycles, transit, Kiss & Ride and Park & Ride.

FIGURE 1-1: ACCESS HIERARCHY



Basic planning considerations tell designers what facilities should be provided for each access mode. Dimensional guidelines specify standards for these facilities and are accompanied by design illustrations.

Pedestrian facilities have the highest importance for access. Conflicts between pedestrians and other modes should be minimized through the provision of direct pathways designed for maximum pedestrian safety. Pedestrian design considerations include connectivity, walkway surfaces, elevation changes and intersection treatments. Bicycle access is the second highest priority, with a focus on enhancing connectivity and providing safe and convenient parking and storage. Transit has the highest priority of all motorized modes. Design considerations for transit include location and connection of bus stop relative to Metrorail station entrance and exit, transit priority improvements, walkway and stop canopies, and bus bay layout and location. Kiss & Ride and Park & Ride facility design considerations include pick-up and drop-off zones, parking layout, and revenue control.

FIGURE 2-1: SAMPLE SITE PLAN

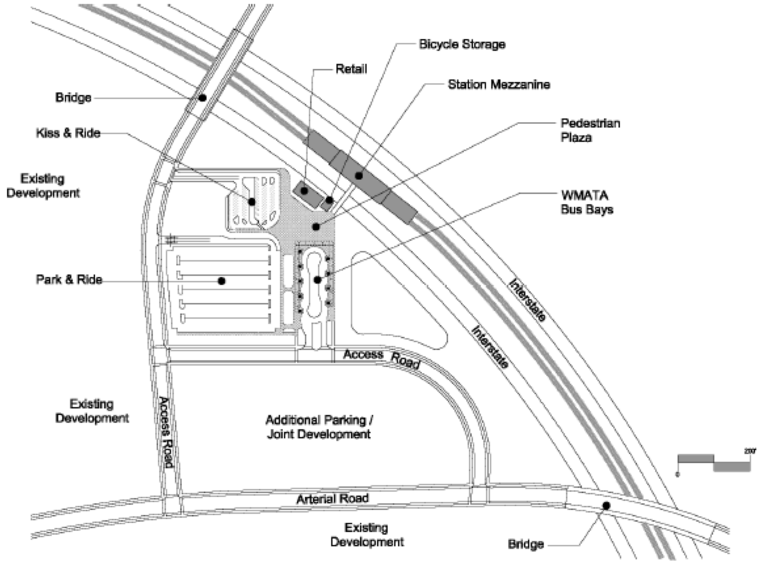


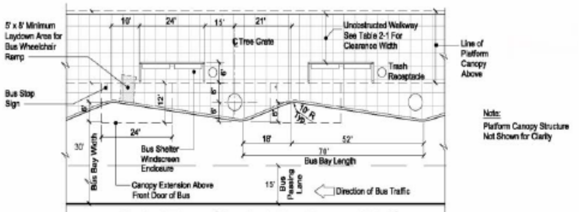
TABLE 2-2: SITE DESIGN STANDARDS

Ref. No.	Facility	Standard
2.1.1	Pedestrian Walkways	Width varies according to procedures described in Appendix D. The minimum width for walkways is 6'-0" plus an additional 1'-6" buffer from building edges or street curbs.
2.1.1 2.5.1-3 4.1.3	Pedestrian Waiting Areas at Bus Platforms	The minimum unobstructed walkway widths along bus platforms are as indicated in Table 2-1 and as shown in Figure 2-4. For bus platforms that share sidewalk space with non-bus passenger traffic, the minimum width must be calculated according to procedures described in Appendix D and with the minimum widths indicated in Table 2-1.
2.6.2 4.1.3	Pedestrian Waiting Areas in Kiss & Ride Drop-Off/Pick-Up Zones	Width varies according to procedures described in Appendix D. The minimum unobstructed sidewalk width is 6'-0" plus an additional 1'-6" buffer from building edges.
2.4.1	Bicycle Path	8'-0"-minimum width
2.4.2	Bicycle Lockers	3'-2" x 6' with a 6' aisle at either end (2 lockers back to back)
2.3.3	Crosswalks and Curb Cuts	Minimum width same as walkway required at all walkway/road intersections
2.5.2	Sawtooth Bus bays (Standard Bus)	70' length with 6' indent as shown in Figure 2-4
2.5.2	Sawtooth Bus Bays (Articulated Bus)	'96 length with 6' indent as shown in Figure 2-4
2.5.1	Tangent Bus Bay (Standard Bus)	15' x 44' + 48' *taper at rear of bus bay array and 70' taper at front of bus bay array* (Figure 2-3)
2.5.1	Tangent Bus Bay (Articulated Bus)	15' x 66' + 48' *taper at rear of bus bay array and 70' taper at front of bus bay array* (Figure 2-3)
2.5.1	Bus Lane Widths	15' through lane as shown in Figures 2-3 and 2-4. See Figure 2-5 for turning lane widths.
2.5.2	Bus Storage Bays	Same as tangent bays.
4.1.3	Bus Shelter	Minimum equivalent of one 6'x12' or 6'x24' shelter per bus bay, as directed by WMATA. (Fig. 2-4)
2.5.1	Bus Loop Radii	60' outside radius to curb, 45' centerline radius, 30' inside curb radius (Figures 2-5 and 2-6)
2.8.3	Automobile Turning Radii	23' outside curb radius on access roads, 15' curb radius in parking facilities
2.6.6	Motorcycle Parking Spaces	4' x 8'
2.6.2	Kiss & Ride Curb Side Pick-Up/Drop-Off Lane	Automobile spaces: 8' x 30'; Shuttle Bus spaces: 8 'x 25', Taxi spaces: 8' x 22'
2.6.3	Kiss & Ride Parking Spaces	ADA and Driver-Attended: 9' x 18' (45 degree); Short-Term: 8.5' x 18' (angled or 90 degree)

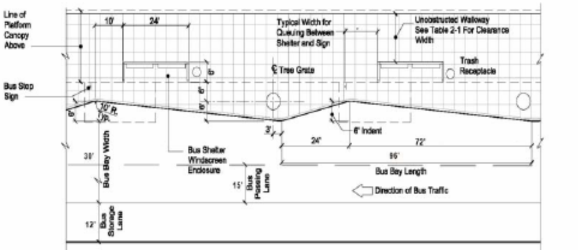
Directional guidance for the joint development of facilities illustrates how the station can best fit within the surrounding development and existing transportation network. Planners, developers and community members working together will create vibrant memorable places. Guidance in the Station Site and Access Manual includes procedural strategies to encourage coordination between planners and developers so both can effectively contribute to and benefit from transit station and create a transit-oriented community.

The design guidelines can be used by developers during joint development projects and should help clarify design expectations and ease coordination between developers, site designers, and transit planners in the review and approval process. Design considerations for joint development projects include: setbacks between transit alignments and buildings; location of bus stop transfer facilities; maintenance of pedestrian connectivity and provisions for pedestrian safety, street patterns, parking considerations, landscaping amenities, wayfinding signage and security features. Place making initiatives, like provision of open space and strategic grouping of public facilities, should be employed to allow the transit facility to serve as the catalyst for an activity center.

FIGURE 2-4: SAWTOOTH BUS BAY CONFIGURATION



Typical Plan - Standard Bus Bays and Platform



Typical Plan - Articulated Bus Bays and Platform

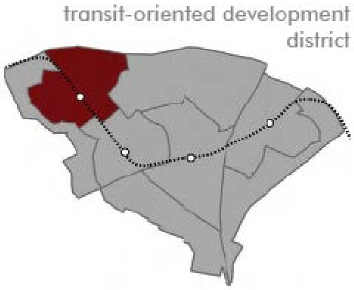
This document will help in developing prototypical station area designs, as it acknowledges the conflicts of access between modes and offers guidance for establishing priorities.

Most relevant to this study effort is the definition of different station area types. Stations located in a dense downtown area will have different characteristics than stations located at the end of the line or in a low-density area. Although not a primary focus of the document, the Station Area Access Manual defines three different area types. This classification serves as a guide to understanding which transit site facilities may be expected in a particular geographical area.

Core Stations: These are stations located in a high density, downtown areas, such as Washington DC, Rosslyn, and Crystal City, where other Metrorail stations serve the adjacent area. These stations are accessible primarily by walking, bicycling, and bus.	**Mid-Line Stations:** Mid-line stations are typically located in areas with low to medium density and are usually accessed by Park & Ride, Kiss & Ride, bus, bicycling, and walking modes. Mid-line stations are located in areas where other Metrorail stations are further away and serves a greater area, thus many customers must rely on the non-walking mode to access the station.	**Terminus Stations:** Terminus stations are located at the end of Metrorail lines. Typically, terminus stations are accessed by Park & Ride, bus, Kiss & Ride, then walking. However, comprehensive regional planning that improves pedestrian and bicycle access to the station could increase the walking and bicycle mode. Terminus stations typically serve a wide geographical area that normally extends beyond the greater Washington area, creating a high demand for Park & Ride mode.

13. Transforming Tysons: Vision and Area Wide Recommendations, Tysons Land Use Task Force, *by Fairfax County (September 2008)*

In 2005, the Fairfax County Board of Supervisors created the 36-member Tysons Land Use Task Force to gather community input and recommend a land use and transportation plan that would transform four future Metrorail stations in Tysons Corner proposed as part of the extension to Dulles Airport from suburban office parks into livable urban centers. Three years later, the task force presented its recommendations for an innovative vision and area plan for **land use**, **transportation**, **environmental stewardship**, **public facilities** and **urban design**.



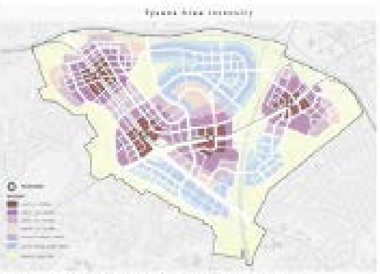
Tysons is divided into eight districts, four surrounding the future rail stations and four creating a transition to adjacent communities. Land use designations within each district are articulately described and carefully selected to achieve a unique sense of place and logical layout of destinations and paths of travel.

The vision for Tysons consists of **six guiding principles**:

1. Create a people-focused urban setting which significantly increases residential opportunities;
2. Redesign the transportation network with a strong focus on transit, walking, and bikes;
3. Place a strong emphasis on the environment;
4. Develop a vital civic infrastructure of the arts, culture, recreation and the exchange of ideas;
5. Sustain and enhance the contributions of Tysons as the county's employment center and economic engine; and
6. Create an authority for implementation that provides the flexibility, accountability, consensus and resources necessary to achieve the vision.

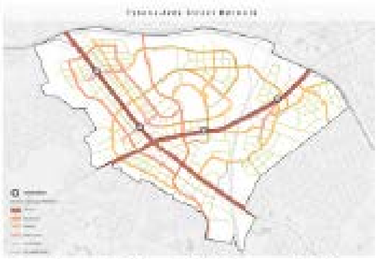
The area-wide land use and transportation plan emphasizes the working together of multiple elements to create a center with a sense of place. The land use designations and transportation recommendations are reinforced with connections, amenities, strategically located parking and a focus on a people-scaled environment.

The Tysons plan is an excellent example of a specific area plan that approaches the different aspects of transit-oriented planning and design from a holistic perspective. Each element (urban design, land use, transportation, etc) is viewed through a unique lens, but focuses on overarching guiding principles. The urban design designations are different from the land use designations and intensity designations, but all come together to achieve a unified pattern for intensity in the center with decreasing densities and a well thought-out circulation plan. The Tysons plan demonstrates how an individual locality might apply statewide recommendations at a smaller scale.



Intensity Around Transit

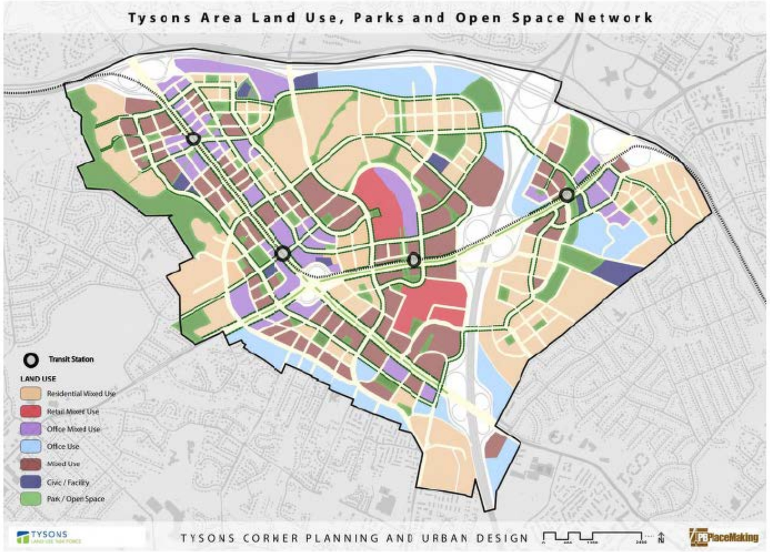
A Network of Green



People-friendly Transportation

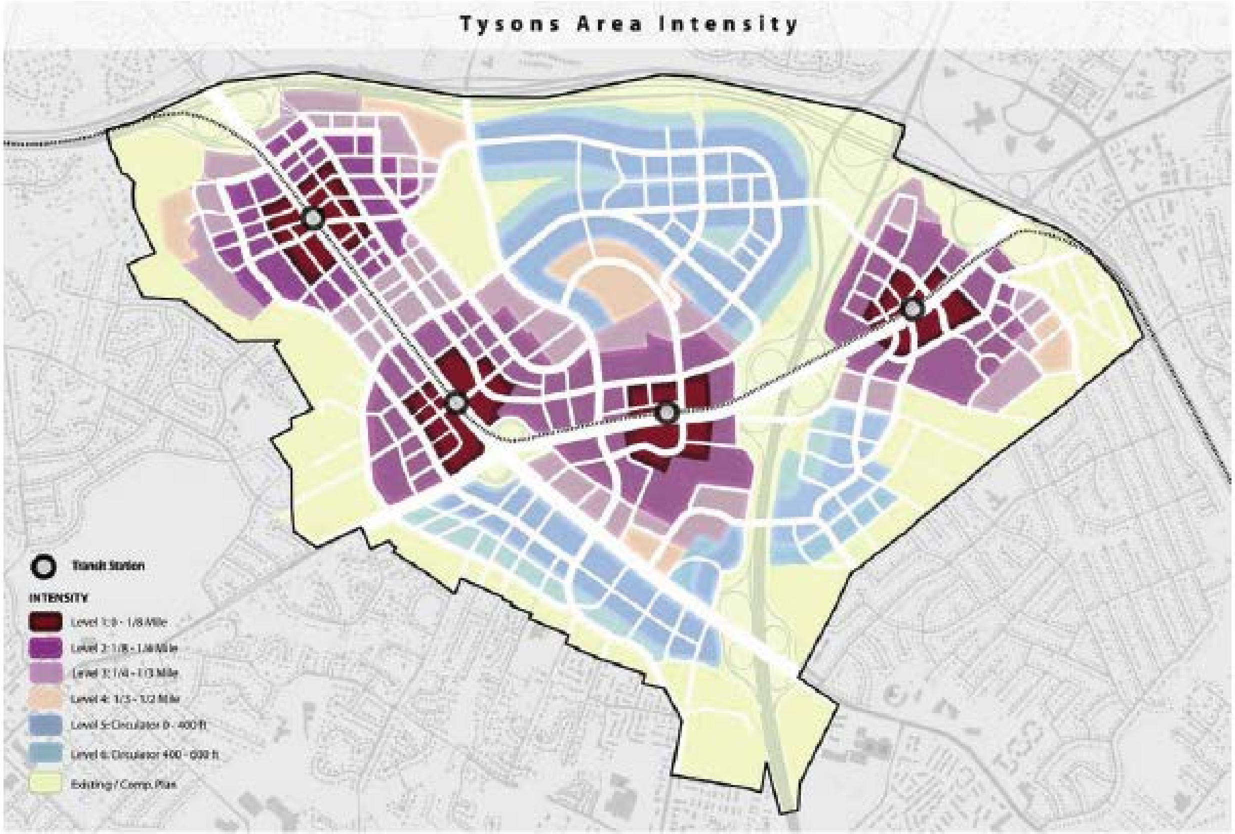
Land Use

The land use component stresses transit-oriented development, a balance of jobs and housing, defined neighborhoods, protection of the edges, and well-integrated community benefits. Over 95 percent of all development will be located within a half-mile of the rail stations or within 600 feet of the circulator, with transitions between the higher densities near the rail stations and the lower densities of the adjacent communities.



CONCEPTUAL MAP 1- The plan envisions a new Tysons transformed into a compact walkable urban center with a balance of jobs and housing focused around transit.

In addition to the traditional land use map with categories like residential mixed use and office mixed use, the area is also subdivided into intensity categories.

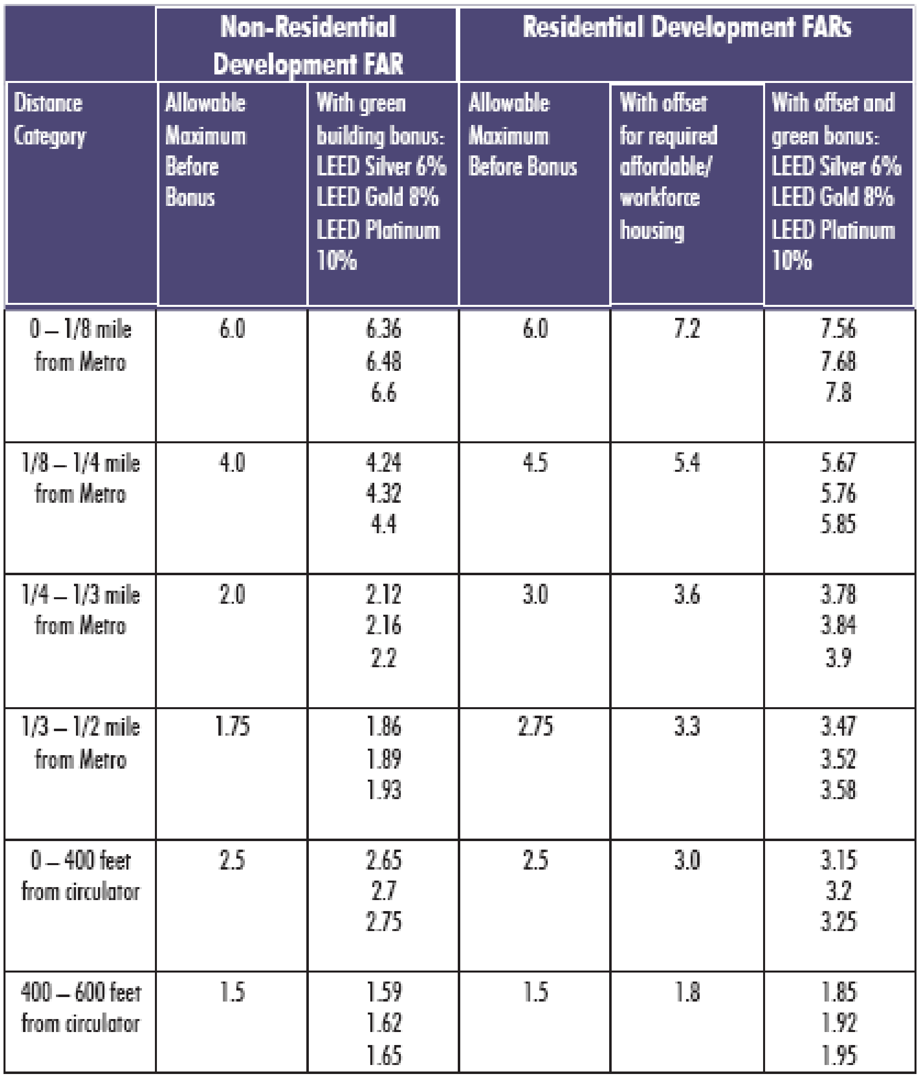


CONCEPTUAL MAP 2: The greatest densities are located within an easy walk of Metro stations.

This section on intensity may be of particular use to the Virginia statewide effort as it contains specific definitions and standards. The intensity categories are based on distance from transit (Metro and circulator). Each category has a range of allowable densities, expressed by a minimum and maximum FAR to allow the flexibility to respond to market changes while ensuring all development will be consistent with the vision and support the transit investments. Areas closest to the Metro stations have the highest densities, and densities decrease incrementally as you move away from the Metro stations.

The tiered density approach is coupled with requirements for a mix of uses and infrastructure to guarantee other livability factors are in place. Land use guidelines include considerations for affordable and workforce housing, parcel consolidation and coordinated development plans, and existing uses and buildings.

TABLE 1: Maximum Allowable Floor Area Ratios

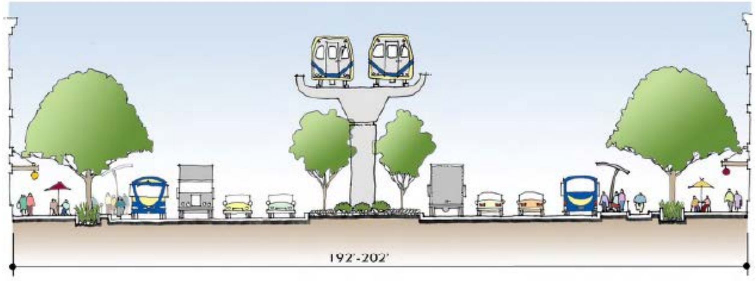


	Non-Residential Development FAR		Residential Development FARs		
Distance Category	Allowable Maximum Before Bonus	With green building bonus: LEED Silver 6% LEED Gold 8% LEED Platinum 10%	Allowable Maximum Before Bonus	With offset for required affordable/ workforce housing	With offset and green bonus: LEED Silver 6% LEED Gold 8% LEED Platinum 10%
0 – 1/8 mile from Metro	6.0	6.36 6.48 6.6	6.0	7.2	7.56 7.68 7.8
1/8 – 1/4 mile from Metro	4.0	4.24 4.32 4.4	4.5	5.4	5.67 5.76 5.85
1/4 – 1/3 mile from Metro	2.0	2.12 2.16 2.2	3.0	3.6	3.78 3.84 3.9
1/3 – 1/2 mile from Metro	1.75	1.86 1.89 1.93	2.75	3.3	3.47 3.52 3.58
0 – 400 feet from circulator	2.5	2.65 2.7 2.75	2.5	3.0	3.15 3.2 3.25
400 – 600 feet from circulator	1.5	1.59 1.62 1.65	1.5	1.8	1.85 1.92 1.95

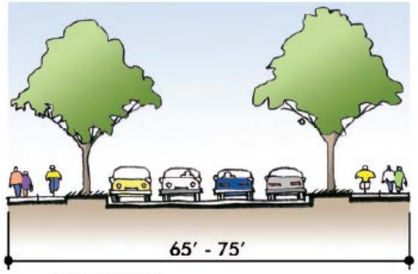
Note: In the case of residential FAR, the bonus and offset will be each applied to the allowable maximum before bonuses; they will not be compounded. For mixed-use development, the allowable intensity will blend the residential and non-residential FARs proportionally.

Transportation

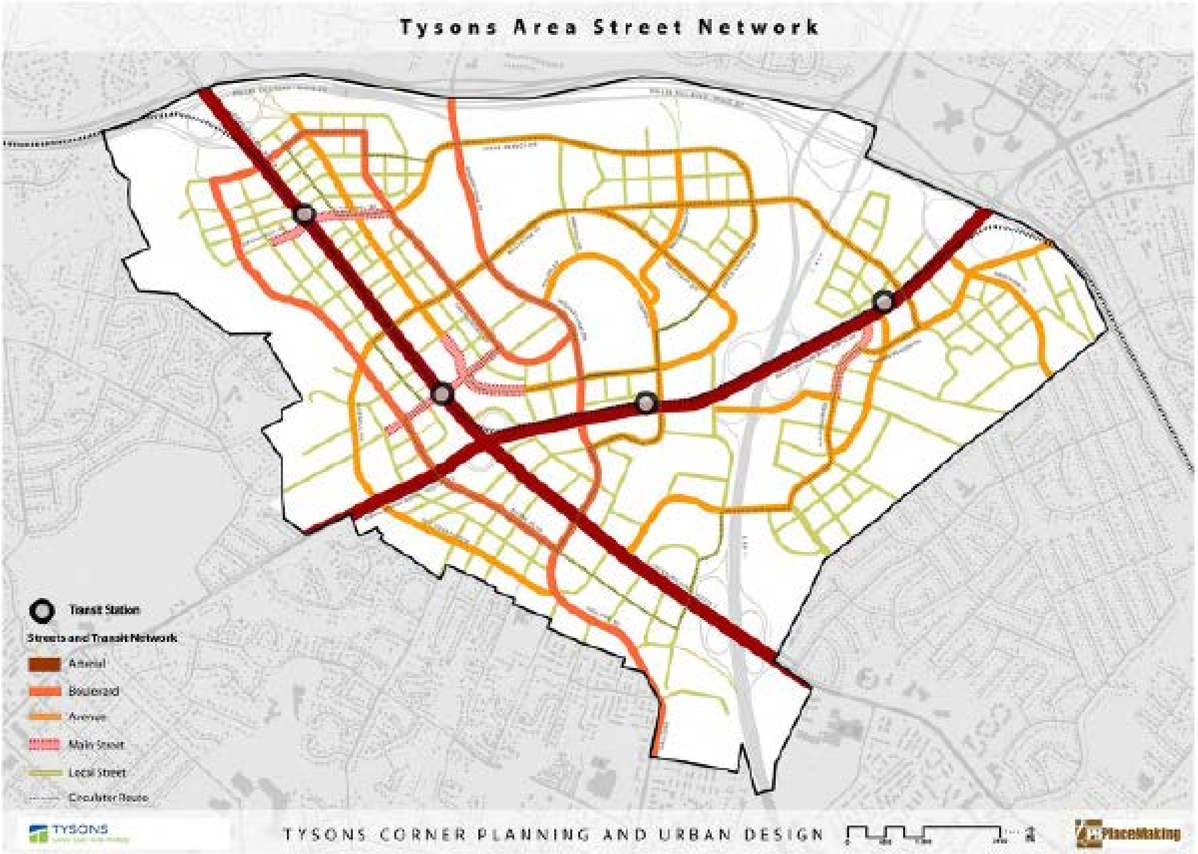
The transportation recommendations focus on improved mobility within the area for greater mode choice, a system of circulators, regional connectivity and new urban standards for all streets and roads. A functionally classified street map is coupled with illustrated typical sections to demonstrate the versatility of the street system in allowing different types of trips to use different streets. To ensure Tysons residents can get around without a car, a system of three circulator routes will extend the reach of the Metrorail system and connect the districts. Bicycle and pedestrian movement is integrated in the design of the street network. Transportation demand management and parking management strategies are also discussed.



Arterial Street 1



Local Street 2

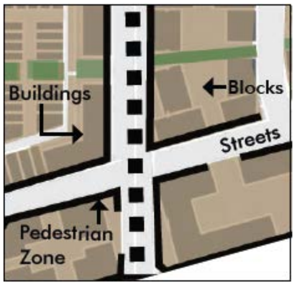


CONCEPTUAL MAP 5- A fundamental transformation of Tysons transportation is required with a network of walkable streets, bike lanes, and a robust transit system

Urban Design

The urban design recommendations consist of general Urban Design Principles and more specific Urban Design Guidelines. The Tysons Land Use Task Force consolidated a ‘constellation’ of Urban Design Principles to provide the framework for transitioning to the future. The principles address regional identity, identifiable centers and edges, vibrant streets and walkable block pattern, quality public realm and natural features, mix of uses, balanced growth and community benefits, and edge areas.

The Urban Design Guidelines provide more detail and direction on how to implement the principles and create the desired urban form. The guidelines organize the urban fabric into four elements: **blocks**, **streets**, **pedestrian zones**, and **buildings**. Several general guidelines for each of the four elements are applicable throughout the Tysons area regardless of district. More detailed guidelines are specific to three distinct character zones:



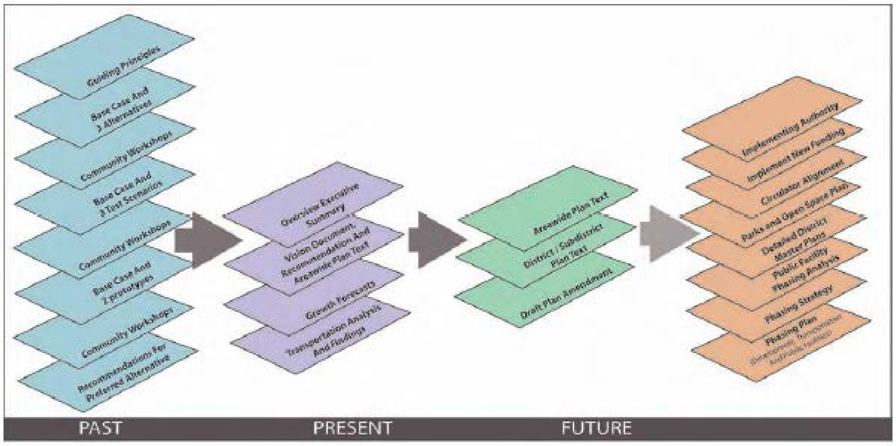
1. **Station Core Zone**
2. **Circulator Zone**
3. **Transition Zone**

Conceptual Map showing Character Zones

These detailed design guidelines include specifications for block size, parking, build-to lines, setbacks, bulk, massing, building articulation, fenestration, transparency, landmarks, gateways and public art. The plan also contains sections on environmental stewardship and public facilities, incorporating aspects of sustainability, stormwater management, green architecture, parks and open space, and community services.

Implementation Strategy

The area-wide plan is accommodated by an implementation strategy that establishes priorities and responsibilities, recognizing the need for evolution to achieve successful implementation. More detailed planning will be required, including preparing district plans, identifying the circulator alignment, creating a coordinated parks and open space network, and crafting an environmental stewardship strategy. Other essential elements include establishing an implementing authority, a funding strategy, public-private partnerships, a regulatory framework, and a phasing plan. National examples of cities that have successfully utilized innovative implementation strategies are provided, including the Midtown Alliance in Atlanta and the Downtown Denver Partnership.



14. Street Design Guidelines, by City of Roanoke, Virginia (July 2007)

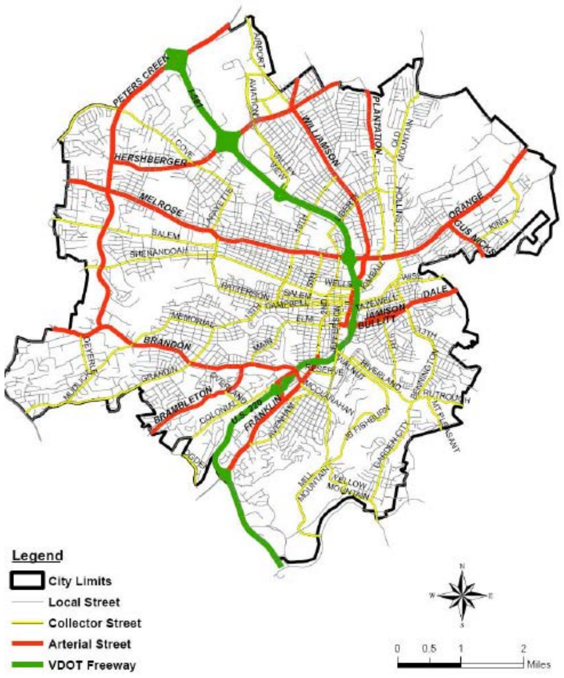
The City of Roanoke created and adopted its Street Design Guidelines to provide viable transportation options, ensure its city streets serve all modes of transportation, enhance pedestrian and bicycle safety and convenience, encourage active living, reduce congestion and improve air quality.

These guidelines provide a local example of classifying streets based on function and character. The statewide Virginia guidelines could use the approach of the Roanoke Street Design Guidelines as a basis for the multimodal corridors element. The City of Roanoke classifies its street network into three categories by function and character: arterials, collectors, and locals.

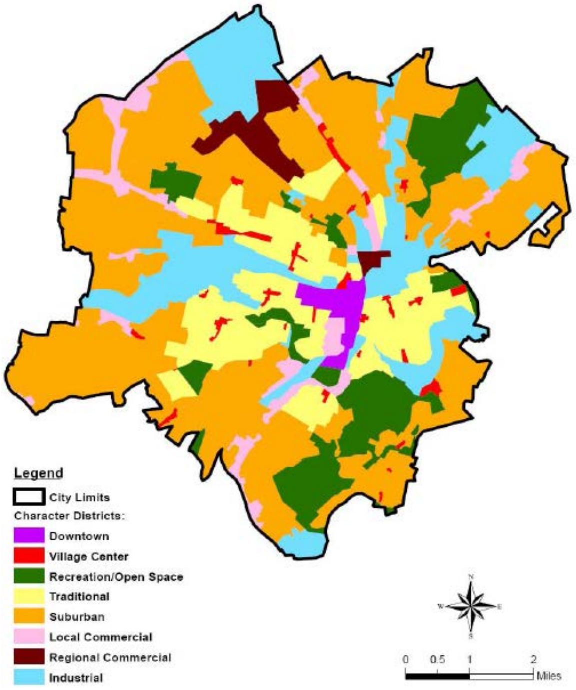
The City also organizes its land area into eight character districts that describe the general building style, development form and land purpose.

1. Downtown
2. Village Center
3. Recreation/Open Space
4. Traditional Residential Neighborhood
5. Suburban Residential Neighborhood
6. Local Commercial
7. Regional Commercial
8. Industrial

Roanoke's Street Hierarchy

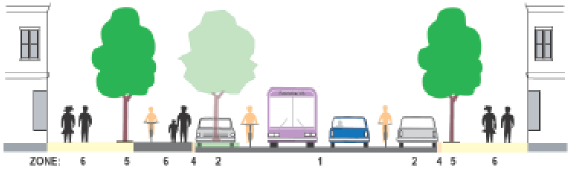


Roanoke's Character Districts

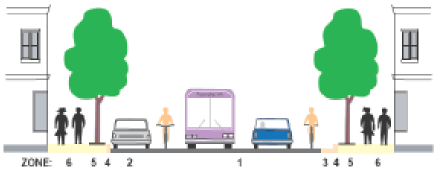


The Street Design Guidelines provide corridor recommendations for each street type within each character district. These corridor guidelines organize the street cross-section in to seven zones as they relate to automobile accommodations, bicycle accommodations, pedestrian accommodations, transit accommodations, trees, signs, and lighting. Street cross-section illustrations of the street types for each character district demonstrate the ideal minimum width for each zone. Preferred and retrofit options are presented, acknowledging that the ideal cross-section may not be attainable in all instances because of right-of-way constraints.

Preferred Multimodal Options for
Downtown Character District Collector Streets
Village Center Character District "Main Streets"

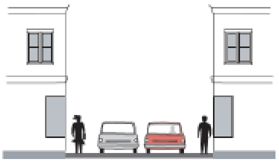


DV (2a)
Zone 1: Travel - 28' (2-14' shared-lanes)
Zone 2: Parking - 14'
Zone 3: Gutter/Drainage - 0'
Aone 4: Curb - 1'
Zone 5: Planter/Utilities - 10'
Zone 6: Pedestrian - 30'
Zone 7: ROW Edge - 0'
Total ROW: 83'



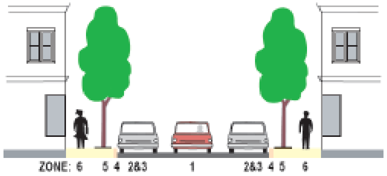
DV (2b)
Zone 1: Travel - 30' (5'/11'/11'/3') striped bicycle lanes
Zone 2: Parking - 7'
Zone 3: Gutter/Drainage - 2'
Zone 4: Curb - 1'
Zone 5: Planter/Utilities - 8'
Zone 6: Pedestrian - 12'
Zone 7: ROW Edge - 0'
Total ROW: 60'

Retrofit Options for
Downtown and Village Center Character Districts
Local and Collector Streets

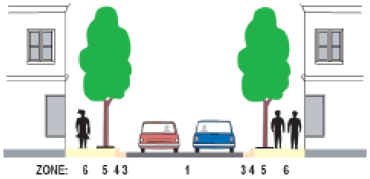


L-Woonerf
in this narrow shared-space, zones are not defined; automobile traffic is often one-way.

Total ROW: 25'



LDV-one-way
(1 or 2 lanes)
Zone 1: Travel - 10' or 20'
Zone 2: Parking - 13'
Zone 3: Gutter/Drainage - 0'
Zone 4: Curb - 1'
Zone 5: Planter/Utilities - 6'
Zone 6: Pedestrian - 10'
Zone 7: ROW Edge - 0'
Total ROW: 40' or 50'



LCDV (2c)
Zone 1: Travel - 20'
Zone 2: Parking - 0'
Zone 3: Gutter/Drainage - 2'
Zone 4: Curb - 1'
Zone 5: Planter/Utilities - 7'
Zone 6: Pedestrian - 10'
Zone 7: ROW Edge - 0'
Total ROW: 40'

General streetscape guidelines are provided for elements like benches and bicycle parking that are applicable to all areas with the city regardless of character district.

15. Arlington County's Transit Corridor Growth Strategy

Since the 1960s, Arlington County has successfully concentrated high-density development within Metro corridors and preserved lower-density residential areas throughout the County using a variety of planning and policy documents, regulatory tools and ordinances. The General Land Use Plan describes broad goals and establishes policies that focus on areas within Metro Station Areas and Metro Corridors. It also establishes zoning mechanisms to achieve these goals. Policy plans and land use plans for the Rosslyn-Ballston and Jefferson-Davis Metro Corridors provide the foundation for a unified long-range planning approach. Sector plans for the individual station areas delve into the details of urban design, zoning, transportation, and market trends, distinguishing the unique character of each station area. Arlington County continually tracks development statistics within the Metro corridors dating back to 1960 to quantify its success.

General Land Use Plan

The General Land Use Plan's goals include concentrating high-density development, promoting mixed-use development, and increasing the supply and variety of housing within the Metro corridors. It concentrates the highest density uses within walking distance of Metro stations; tapers densities, heights and uses down to single-family residential neighborhoods; and provides for a mix of office, hotel, retail and residential development. The Plan establishes regulatory mechanisms, namely special coordinated mixed-use zoning districts which allow FARs that exceed general zoning designations and special residential zoning districts which promote tapering of heights between higher-density commercial development and lower-density residential neighborhoods.

Each station area serves a unique function within the corridor. Rosslyn is a first class office and business center. Courthouse is the County's government center. Clarendon is planned as an "urban village." Virginia Square contains a concentration of residential, cultural and educational facilities. Ballston is developing as Arlington's "new downtown."

Crystal City Sector Plan

This sector plan provides the policy framework, master plan, and implementation steps for the Crystal City planning area, a 260-acre (0.4 sq. mi.) area within the 361-acre (0.6 sq. mi.) Crystal City Metro Station Area, as defined by the General Land Use Plan. It includes a discussion on the impact of regional growth, including identification of activity centers and their dispersion along major transportation corridors. It is an example of high density mixed use neighborhood and an economic engine with high-rises approaching full build-out of existing plans.

The planning area for station has an oblong shape. It is 1.3 miles from north to south and varies in length from east to west with a maximum width of 0.5 miles. It excludes the areas of low-density residential. Within the planning area, the plan defines neighborhoods and districts based on use characteristics and identifies destinations. It also distinguishes the ways in which the transportation infrastructure influences the area, local and collector streets connecting places within the area, and large arterials acting as barriers or edges to the districts.

East Falls Church Area Plan

The East Falls Church Area represents an example of a commuter station area with park-and-ride and kiss-and-ride facilities. It is less dense than the other Metro station areas within Arlington County. The East Falls Church Area Plan provides a policy framework, concept plan, design guidelines, and implementation actions.

The study area includes the commercial development and multi-family housing along I-66 and some of the single-family housing. Much of the existing single-family housing is not included, even though it is within a quarter-mile of the Metro station, in an effort to preserve it. The plan introduces the Neighborhood Center concept, a collection of three low- to medium-scale mixed use development nodes, each with its own specific character and role. These are essentially different mini-districts working together to create a cohesive whole.

Clarendon Sector Plan

Clarendon represents a future "urban village" with public spaces, accessibility, connectivity and a rich mix of uses to achieve a sense of place and uniqueness. The sector plan includes policies on urban form, transportation, land use, historic preservation and other topics. It includes urban design guidelines and a matrix of implementation recommendations. The station area boundary is approximately a quarter-mile radius within the Metro Station areas.

D. Virginia's Statewide Integrated Multimodal Planning Framework

The Virginia Department of Transportation (VDOT) has taken numerous steps in recent years to better accommodate multiple modes in its transportation planning and design process. This section reviews the various policies that support integrated, multimodal transportation in Virginia including:

- Policy for Integrating Bicycle and Pedestrian Accommodations
- Context Sensitive Solutions Policy
- Urban Development Areas
- Secondary Street Acceptance Requirements
- Chapter 527 Traffic Impact Analysis Regulations
- Access Management Regulations and Standards
- VTrans2035 and the Virginia Surface Transportation Plan

1. Policy for Integrating Bicycle and Pedestrian Accommodations

In March 2004, the Commonwealth Transportation Board (CTB) adopted the "Policy for Integrating Bicycle and Pedestrian Accommodations." The policy identifies bicycling and walking as fundamental travel modes and states that all transportation projects will start with the assumption that accommodation will be provided. The intent of the policy is to integrate bicycle and pedestrian accommodations into all of VDOT's procedures and projects, therefore increasing multimodal options for Virginians. Following the adoption of the policy, a VDOT interdisciplinary team was formed to promote the funding, development, operation, and maintenance of bicycle and pedestrian accommodations. The team developed updated procedures and best practices for VDOT including guidelines for coordinating with localities, planning level cost estimates, and updated construction and maintenance scoping forms to ensure inclusion of bicycle and pedestrian accommodations.

The procedures identified by the team include:

- Guidelines for coordinating with localities that encourage the development and use of bicycle and pedestrian plans as the primary resource for discussions regarding accommodations
- Spending two percent of the paving budget in each VDOT Construction District to provide paved shoulders
- Clarification and guidance for when the Policy's six exceptions can be used, those exceptions are: (1) absence of need for accommodations, (2) environmental or social impacts that outweigh the need for accommodations, (3) evidence that safety would be compromised, (4) costs excessively disproportionate to the need, (5) project purpose and scope that do not facilitate the provision of accommodations, and (6) locations where bicycle and pedestrian travel is prohibited by state or federal law
- A decision process tree to evaluate and document how bicycle and pedestrian accommodations are provided during the scoping of VDOT managed projects
- Revision and updates to numerous design and maintenance forms and instructional memos

Note: In May 2007, VDOT issued a Department Policy Memorandum (DPM) on Implementation of the CTB *Policy for Integrating Bicycle and Pedestrian Accommodations*. This DPM provides definitions, procedures, and exceptions and identifies reference materials to clarify and supplement the Policy, to the extent necessary for operational effectiveness and compliance.

VDOT has embarked on a three-tiered approach to further integrate the policy in daily VDOT business practices, which includes:

- Development of a Bicycle Policy Plan
- Development of a Pedestrian Policy Plan
- Implementation Plan for both the Bicycle and Pedestrian Policy Plans

VDOT is currently developing a Statewide Bicycle Policy Plan that provides a framework to implement the bicycle portion of that policy and establishes a vision for the future of bicycling in the Commonwealth. It builds upon past VDOT initiatives to ensure that bicycle facilities are an integral component of the transportation system. It provides goals and objectives, recommends actions, and sets a platform for the development of a series of performance measures that will track progress over time. The Statewide Bicycle Policy Plan specifically addresses the following areas:

- The Plan provides strategies for enhancing the implementation of the Policy for Integrating Bicycle and Pedestrian Accommodations approved by the CTB in 2004.
- It establishes policies to guide the planning and design of bicycle facilities.
- It identifies opportunities for enhancing coordination between and within the various levels of VDOT, as well as with stakeholders outside of the organization.
- It recommends training programs needed for professionals who are responsible for planning and designing bicycle facilities.
- It sets forward benchmarks for tracking the implementation over time.

The Bicycle Policy Plan does not identify specific bicycle and pedestrian projects, but provides planning level guidance and policies that address the need for providing access, connectivity, and integration across individual modes to make bicycling a safe and feasible commuting and recreational alternative.

2. Context Sensitive Solutions Policy

VDOT's Context Sensitive Solutions (CSS) policy promotes transportation facilities that provide transportation safety and mobility, while also fitting the physical setting and reflecting concerns regarding scenic, aesthetic, historic, and environmental resources. The CSS policy seeks a realistic and practical balance between transportation goals and community values and needs. It encourages enhanced stakeholder engagement and consensus on clearly defined project goals before proceeding to the design phase of a project. The CSS policy requires VDOT to consider that motorists, pedestrians, bicyclists, and public transit vehicles jointly use transportation systems for both transportation and recreational purposes.

3. Urban Development Areas

In 2007, the General Assembly added Section 15.2-2223.1 to the Code of Virginia requiring high growth localities to designate Urban Development Areas (UDA) in their comprehensive plans by July 1, 2011 (counties) and July 1, 2012 (cities and towns). UDAs are intended to improve the coordination between transportation and land use. They include locations with reasonably compact existing development that can accommodate 10 to 20 years of projected growth.

The comprehensive plan must provide for commercial and residential densities within urban development areas that are appropriate for reasonably compact development at a density of at least four residential units per gross acre and a minimum floor area ratio of 0.4 per gross acre for commercial development. These minimum requirements fit very well with necessary development levels to support fixed route bus and going beyond the minimum requirements can achieve a level that supports rail.

The amendment to the Code also requires comprehensive plans to incorporate principles of new urbanism and traditional neighborhood development, a development strategy that encourages smart managed growth. The legislation highlights a number of key principles which may include but are not limited to: pedestrian-friendly road design, interconnection of new local streets with existing local streets and roads, connectivity of road and pedestrian networks, preservation of natural areas, satisfaction of requirements for stormwater management, mixed-use neighborhoods, including mixed housing types, reduction of front and side yard building setbacks, and reduction of subdivision street widths and turning radii at subdivision street intersections. Encouraging well-designed development and growth in appropriate areas can help reduce trip lengths, encourage trips by other modes, foster more sustainable development patterns, and manage costs in the future.

4. Secondary Streets Acceptance Requirements

The Commonwealth Transportation Board approved the Secondary Street Acceptance Requirements (SSAR) in February 2009. The SSARs establish requirements that newly constructed streets must meet in order to be accepted into the secondary system of state highways and as a result to qualify for ongoing VDOT maintenance.

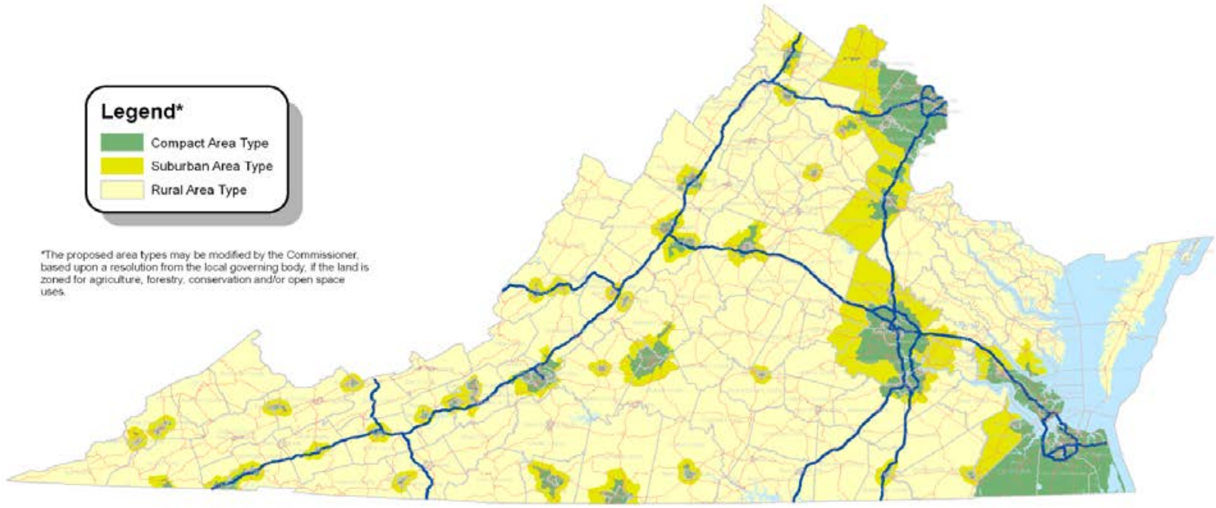
The most significant aspect of the revised regulation is that it introduces a change in public policy regarding the design and function a street must meet in order to be added to the state system.

The Commonwealth agrees to maintain streets built by developers and accepted by counties to the benefit and marketability of their developments. In exchange, the developer must build streets that connect with the surrounding transportation network in a manner that enhances the capacity of the overall transportation network and accommodates pedestrians.

The following describes the policies within the SSAR which are new to Virginia and most relate to the context of this research:

Area Types

- The division of the state into three categories based on long-term local, regional and federal planning boundaries.
- These area types are Compact, Suburban, and Rural.
- The importance of area types within the SSAR is that a parcel's area type will determine the connectivity and may impact pedestrian accommodation requirements which need to be met.



Connectivity Requirements

- Standards to ensure multiple connections with existing streets and adjacent properties.
- The “connectivity index” requirement is based upon a development’s area type.
- The connectivity index can be found by dividing the development’s street segments by its intersections (street segments/intersections). The SSAR Guidance Document has an extensive section on these calculations and definitions.
- Compact and Suburban area types must meet a 1.6 and a 1.4 index, respectively, while developments in the Rural area type are not required to meet an index amount.
- All newly built developments, regardless of area type, must have multiple transportation connections in different directions. This can be accomplished with connections to existing roads in the state system or “stub outs” constructed to the property line for a future connection.

Pedestrian and Bicycle Accommodations

- Sidewalk, trail, and path requirements are based upon density, proximity to public schools, and the functional classification of streets.
- Pedestrian accommodations are required on both sides of streets for developments with a median lot size of one half acre or less, a floor area ratio of 0.4 or greater, and along collector and arterial roads with three or more lanes.
- Accommodations must be provided on one side of the street for developments with median lot sizes between one half acre and two acres, developments within one half centerline mile of a public school in Compact and Suburban area types, and along collector and arterial roads with less than three lanes.
- If a development can be categorized into both groups requiring sidewalks on both and one side of a street, the higher requirement (pedestrian accommodations on both sides of the street) shall apply.
- Context sensitive street design – Revised street design requirements to provide initial design that will serve as built-in traffic calming and help ensure appropriate vehicular speeds. The SSAR also offers increased flexibility to use low impact development techniques to help reduce storm water runoff.

New development proposals initially submitted to counties and VDOT after June 30, 2009, must comply with the requirements of the SSAR.

5. Chapter 527 Traffic Impact Analysis Regulations

In 2006, the Code of Virginia was amended to add §15.2-222.1, which establishes procedures by which localities are directed to submit to VDOT for review and comment a traffic impact analysis for development proposals that would significantly impact the state transportation system. The goals of the amendment are to improve coordination between land use and transportation planning across Virginia by providing consistent information regarding traffic impacts of proposed land-use decisions to local decision-makers and citizens; and ensuring traffic impacts, both local and regional, are considered when land use decisions are made.

The requirement for localities to submit development proposals for VDOT to review through a traffic impact analysis is triggered at three key stages of land use: comprehensive plans and amendments, rezonings and site plans. At each of these key stages, VDOT has a fixed timeframe to review and comment on the traffic impact of the proposed land use change. The information and comments provided back to localities by VDOT is advisory since land use decisions remain a local prerogative.

The objectives of VDOT's traffic impact analysis include the following:

- Present recommendations for potential improvements or changes that may mitigate traffic impacts of proposed development
- Identify impacts to the existing transportation network associated with vehicle trips generated by the proposed development
- Identify potential impacts to bicycle and pedestrian facilities as well as to transit accommodations
- Determine need for signal additions or modifications and other traffic engineering features

The Commonwealth has formalized this process through regulations, known as Chapter 527. In 2010, the Chapter 527 regulations were amended to offer local governments the option of conducting a single traffic analysis at the comprehensive plan stage of the development process for all parcels that are part of a small area plan for an urban development area or for a transit oriented development. These amendments will reduce the number of traffic impact analyses required for developments located within small area plan areas in an effort to realize the benefits of compact development, which are not always quantified when each proposed developments are considered individually.

Furthermore, the amendments require VDOT to approve a trip generation methodology that accurately determines the traffic impacts of urban developments. VDOT will need to adopt by July 1, 2011 at least one non-Institute of Transportation Engineers methodology or alternative trip/internal capture/modal split rate for determining the trip generation of development proposals within small area plans. The approved methodology will need to recognize the reduced vehicle trip generation of mixed-use, compact development patterns and transportation demand management measures.

Finally, the amendments will ensure that the applicable provisions of the Secondary Street Acceptance Requirements and the Access Management Regulations: Principal Arterials (24 VAC 30-72) and Access Management Regulations: Minor Arterials, Collectors, and Local Streets (24 VAC 30-73) are included in the traffic impact analyses.

6. Access Management Regulations and Standards

In 2007, the General Assembly approved legislation directing VDOT to develop access management regulations that would balance the right of property owners to reasonable access to the highway with the right of users of the roads to mobility, safety, and efficient expenditure of public funds. Regulations and standards address:

- Spacing entrances intersections, median openings and traffic signals;
- locating entrances a safe distance from intersection turning movements and from interchange ramps;
- providing vehicular, and where appropriate, pedestrian circulation between adjoining properties; and
- sharing highway entrances.

The Access Management Regulations took effect on July 1, 2008 for Principal Arterials (24 VAC 30-72) and on October 14, 2009 for Minor Arterials, Collectors and Local Streets (24 VAC 30-73). Both Access Management Regulation documents require compliance with the CTB's Policy for Integrating Bicycle and Pedestrian Accommodations, and require entrance design to accommodate transit users of the adjacent highways to the extent possible.

These documents require entrance and intersection spacing to comply with standards in Appendix F of the VDOT Road Design Manual. The spacing standards are based on functional classification (urban vs. rural and arterial vs. collector), the speed limit, and type of entrance. Exceptions to the spacing standards within the Road Design Manual include developments within a designated UDA or an area that the local comprehensive plan designates for higher development that incorporates principles of new urbanism and traditional neighborhood development (including pedestrian-friendly road design and connectivity of road and pedestrian networks). As a condition of a commercial entrance permit, applicants are required to provide pedestrian connections to the property line, unless the new access point is right-in-right-out only.

7. VTrans2035 and the 2035 Virginia Surface Transportation Plan

The Code of Virginia (§33.1-23.03) and federal regulations (23CFR450.214) require the CTB to develop a statewide multimodal long-range transportation plan every five years. VTrans2035 is Virginia's long-range multimodal transportation plan and sets forth an overall vision with transportation policy goals, key investment priorities, and action items to set the foundation for future transportation in the Commonwealth.

VTrans2035 represents a uniquely integrated planning approach, as it was developed by the Office of Intermodal Planning and Investment and involved Virginia's five statewide transportation agencies - Department of Aviation (DOAV), Department of Motor Vehicles (DMV), Department of Rail and Public Transportation (DRPT), Virginia Port Authority (VPA), and Department of Transportation (VDOT) - from start to finish. The guiding vision of the document is a multimodal transportation system that is safe, strategic and seamless. This vision directly relates to the purpose of the statewide multimodal and public space design guidelines, as it promotes the safe accommodation of and complete connected networks for all transportation modes.

VTrans2035 acknowledges the changing circumstances and growth pressures that are increasing the demand for transportation choices and the mobility needs of all residents. Investment priorities include all ranges of transit service and infrastructure, from high speed intercity rail between Washington DC, Richmond and Hampton Road and Metrorail expansion, to ensuring a state of good repair in Virginia's local transit systems, to improving rural connectivity with transit and coordinated human services transportation. VTrans2035 provides high level policy guidance to integrate transportation and land use planning, and prioritizes increasing transit usage and encouraging supportive land uses.

The 2035 Virginia Surface Transportation Plan (VSTP) follows the policy guidance of VTrans2035 and identifies specific multimodal solutions for Virginia's different regions, including public transportation strategies, rail investments and highway improvement projects. The 2035 VSTP represents a continuation of the integrated multimodal approach to statewide transportation planning in Virginia. Public transportation recommendations balance maintaining existing assets, expanding capacity, and investing in major capital projects like rapid transit service. The rail element of the VSTP explains the demand for increased passenger rail service. The statewide scope of the VSTP is too broad to include individual bicycle and pedestrian projects, but acknowledges the current regional trails available.

Several policy papers were prepared in conjunction with the VTrans2035 effort. The Transportation and Land Use: Challenges and Opportunities paper explains how the past growth patterns and expected growth influence the demand for transportation. It recognizes the need to accommodate future growth with compact development patterns that create proximity, especially for transit service. Analysis of the Fredericksburg area shows that allocating future growth into compact development areas results in better levels of service in major roads. The Regional Accessibility paper showcases the advantages of having proximity of activities, multimodal connectivity and transportation choices. It identifies the accessibility issues associated with varying levels of future growth rates, and regions within Virginia where those issues may arise. Recommendations from this paper include focusing growth in high density communities with a mix of activities and convenient connections for all transportation modes and expanding multimodal regional transportation networks.

E. Other Useful Web Resources

City of Charlotte, NC. Aug 2010. *Centers, Corridors and Wedges Growth Framework*. http://charmeck.org/city/charlotte/planning/AreaPlanning/CentersCorridorsWedges/Pages/Home.aspx.

City of Denver, CO: Regional Transportation District FasTracks. Sep 2010. *Strategic Plan for Transit Oriented Development*. http://www.rtd-fastracks.com/main_45.

Florida Department of Transportation and the Department of Community Affairs. Oct 2010. *A Framework for Transit Oriented Development in Florida Draft Report*.

New Jersey Department of Transportation and Pennsylvania Department of Transportation. Mar 2008. *Smart Transportation Guidebook: Planning and Designing Highways and Streets that Support Sustainable and Livable Communities*. http://www.state.nj.us/transportation/community/mobility/pdf/smarttransportationguidebook2008.pdf.

Reconnecting America. Nov 2009. *Mixed-Income Housing Near Transit: Increasing Affordability with Location Efficiency*.

Reconnecting America. Nov 2009. *Realizing the Potential for Sustainable and Equitable TOD: Recommendations to the Interagency Partnership on Sustainable Communities.*

Sacramento Regional Transit District. Aug 2002. *Transit for Livable Communities*. http://www.sacrt.com/TLC/index.stm.

San Francisco Bay Area Rapid Transit District. Apr 2003. *BART Station Access Guidelines*. http://www.bart.gov/about/planning/station.aspx.

San Francisco Bay Area Rapid Transit District. Jun 2003. *BART Transit Oriented Development Guidelines*. http://www.bart.gov/about/planning/station.aspx.

F. Full Literature Review Summary Table

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Center for Transit Oriented Development	Station Area Planning: How to Make Great Transit Oriented Places	This guidebook focuses on TOD station areas and strategies to achieve TOD that maximizes ridership potential. It presents TOD place types and defines their characteristics, and provides station area planning principles.	Transit Oriented Development Policy and Strategy Guidance	Primarily focuses on **local** areas, but has applicability for region-wide scales.	Commuter Rail, Local Bus, Regional Bus, Light Rail, Streetcar, BRT, Heavy Rail	Place types are defined according to the intensity of surrounding development, the transit technology, and the characteristics of transit service.	http://www.reconnectingamerica.org/public/show/tod202	Published in February 2008.
Institute of Transportation Engineers and Congress for New Urbanism	Designing Walkable Urban Thoroughfares: A Context Sensitive Approach	This report is the industry standard for Context Sensitive Solutions and walkable thoroughfare design. intended to facilitate the restoration of the complex multiple functions of urban streets. It provides planning and design guidance for urban roads, acknowledging their complexity and multiple functions. Application is generally limited to low-speed, urban arterials and collectors, streets that require tradeoffs between pedestrian and vehicle priority.	Multimodal Corridor Planning Strategies and Design Guidelines	All scales	Pedestrian, Bicycle, Roadway, Local Bus	Context zones describe the physical form and character of a place and are defined by multiple parameters, including land use, density and design features. Context zone is combined with functional classification and thoroughfare type.	http://www.ite.org/emodules/scriptcontent/Orders/ProductDetail.cfm?pc=RP-036A-E	Adopted as an ITE Recommended Practice in March 2010.
Center for Transit Oriented Development	Mixed Income Housing Near Transit: Increasing Affordability with Location Efficiency	This best practice guidebook outlines 11 strategies on how to preserve and encourage mixed income transit oriented housing. It defines the scale for which each strategy is applicable: state/region, corridor, city/locality, neighborhood.	Transit Oriented Development Policy and Strategy Guidance	Primarily focuses on **local** areas, but has applicability for region-wide scales.	N/A	N/A	http://www.reconnectingamerica.org/public/display_asset/091030ra201mixedhousefinal	Published in November 2009.
Center for Transit Oriented Development	Realizing the Potential for Sustainable and Equitable TOD: Recommendations to the Interagency Partnership on Sustainable Communities	This policy white paper discusses coordination efforts between government agencies on how to attain sustainable development. It includes a discussion on livability principles and their application to TOD; the history of federal government agency coordination between USDOT, HUD and EPA for sustainability and livability. Best practices for agency coordination at the state, regional and local level provide examples on legislative measures that were passed and funding programs. The paper presents recommendations for short and long term actions for different agencies.	Sustainability White Paper	All scales	N/A	N/A	http://www.reconnectingamerica.org/public/display_asset/091118ra_sustainabilityrecommendations_final	Published in November 2009.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Indianapolis MPO	Multimodal Corridor and Public Space Design Guidelines	This manual is a tool for the region's jurisdictions to guide implementation of public improvements within the ROW that are based on attaining a balanced transportation system and thoroughfare character. It integrates transportation and land use to enhance economic and community development and sustain the region's quality of life and environmental health. The manual outlines 6 types of pedestrian districts, mapped as part of a Regional Pedestrian Plan and establishes various multimodal corridor typologies. The design guidelines focus on those elements that are within the public and quasi-public sphere, providing detailed guidance on the application of certain multimodal treatments for various conditions. Numerous diagrams and pictures illustrate the presented concepts.	Corridor Design Guidelines	Local	Automobile, Pedestrian, Bicycle, Local Bus, Rapid Bus, Light Rail	The six pedestrian districts outlined in the Regional Pedestrian Plan form the basis of the district design guidelines. The terms Ped Districts and Multimodal Districts appear to be used interchangeably in places, yet they are defined slightly differently. A multimodal district is 1-2 mile radius, bikeable scale; consists of district node, center, and subdistrict. A pedestrian district is 1/4 - 1/2 mile radius.	http://www.indympo.org/Plans/Documents/MM_DesignGuidelines.pdf	Approved in August 2008.
Florida Department of Transportation	A Framework for Transit Oriented Development in Florida	This framework is a tool to help local communities take the first steps in planning for TOD. It provides key considerations and includes a set of station area place types that address land use and design considerations. The guidelines present qualitative and quantitative information to assess how transit ready existing development patterns are and establish targets to create transit supportive development patterns in the future. The document provides goals, benchmarks and strategies for implementation across the state.	Transit Oriented Development Framework and Policy Guide	State	Heavy Rail, Commuter Rail, Streetcar, Light Rail, Bus Rapid Transit, Express Bus, Local Bus, Pedestrian, Bicycle, Automobile, Park & Ride	The framework illustrates multiple levels TOD concepts at the system, corridor and station area scales. Place types are defined by varying levels and types of activity and accessibility, varying types of transit, and varying community contexts. Ranges for intensity/density indicators, mix of uses, network and building design, and parking parameters are defined for each place type.	Available from the Florida Department of Transportation and Department of Community Affairs.	Draft Published in October 2010.
Utah's Wasatch Front	Transit Oriented Development Guidelines	The Wasatch Front TOD guidelines identify and provide general qualitative guidance for targeted TOD areas for a large region with different types of transit systems. The report highlights several main concepts of TOD design including circulation, urban design, and parking and transportation demand policy, without providing quantitative parameters and standards for TOD place types. It contains a comprehensive section on implementation and focuses on economic feasibility of TOD.	Transit Oriented Development Guidelines	Region	Pedestrian, Bicycle, Rapid Bus, Feeder Bus, Light Rail, Commuter Rail, Automobile, Park & Ride, Kiss & Ride	The document generally defines station areas as the area within walking distance of the station. It discusses ways in which TOD context can vary between station areas, but does not identify or organize specific place types or districts. Layers that contribute to a TOD's context include place/location (urban core, suburban employment center), development type (infill, greenfield), and transit type.	http://www.envisionutah.org/Wasatch%20Front%20Transit%20Oriented%20Development%20Guidelines_2002.pdf	Published in 2002.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
City of Charlotte, NC	Urban Street Design Guidelines	This document is Charlotte's 'Complete Streets' guidelines. It acknowledges conflicts between road users (pedestrians, motorists, neighbors, etc) and provides design guidelines and standards for road segments and intersections. The guidelines go hand-in-hand with the Transportation Action Plan (TAP) and the Centers, Corridors and Wedges growth framework.	Corridor Design Guidelines	Local	Automobile, Pedestrian, Bicycle, Bus Transit	Charlotte's streets are classified according to five street types that follow a continuum from pedestrian-oriented (Main Streets) to auto-oriented (Parkways).	http://charmeck.org/city/charlotte/Transportation/PlansProjects/Pages/Urban%20Street%20Design%20Guidelines.aspx	Adopted in October 2007.
City of Charlotte, NC	Centers, Corridors and Wedges Growth Framework	The Centers, Corridors and Wedges concept is Charlotte's vision for future growth. The framework provides general guidance for future area plans on where and how to focus new growth and development. It identifies different areas with different characteristics and sub-areas within those areas. It discusses transportation and public facilities that should accompany new growth to allow the system to function effectively, as appropriate for the geographic type.	Growth Management Policy	Local	Automobile, Pedestrian, Bicycle, Bus Transit	Charlotte's land area is organized into three different types. Activity centers are concentrated areas of economic activity. Growth corridors are radial spokes from city center to city limits with typically at least three high capacity transportation facilities running parallel to each other. Corridors are wide swaths of land and include a variety of land use types. Wedges are areas in between. Transit station areas are a subarea type of growth corridors, the half-mile around the station. In addition to station areas, there are mixed use centers that do not correlate to a particular corridor but have a goal for multimodal transportation network.	http://charmeck.org/city/charlotte/planning/AreaPlanning/CentersCorridorsWedges/Pages/Home.aspx	Adopted in August 2010.
City of Denver, CO: Community Planning & Development	Transit Oriented Development (TOD) Strategic Plan	Between the T-Rex line and FasTracks, Denver is planning 23 new transit station and five new transit corridors. This guide is intended to help city staff to prioritize the planning and implementation activities for TOD. It provides background info on what TOD is and TOD in the Denver context; specific city-wide action strategies to implement TOD, and briefly identifies issues, opportunities and recommendations for transit corridors and station areas. Parameters and standards for station areas are reserved for individual station are plans, most of which are completed or underway.	Transit Oriented Development Policy	Region	Regional Bus, Local Bus, Light Rail, Park & Ride	The document contains a TOD typology matrix that categorizes each station area into one of seven different typologies and specifies the market opportunity and priority. TOD typologies are distinguished by desired land use mix, desired housing types, commerical and employment types, proposed scale, and transit system function.	http://www.denvergov.org/HomePage/tabid/395229/Default.aspx	Published in August 2006.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
City of Denver, CO: Regional Transportation District (RTD) FasTracks	FasTracks: Strategic Plan for Transit Oriented Development	The Regional Transportation District (RTD) is the regional transit agency for the Denver-Aurora and Boulder metro areas, and FasTracks is RTD's 12-year comprehensive transit plan. FasTracks provides the TOD vision, goals, and strategies, It outlines the review process for TOD development proposals and focuses on defining the roles of RTD, local governments, private developers and other professional and research organizations.	Agency Procedural Policy	Region	Commuter Rail, Light Rail, Bus Rapid Transit, Park & Ride	The document does not discuss different TOD contexts, but it directs RTD to track all development within a half-mile of the transit stations and prepare an annual report on status of TOD including quantitative, spatial and trends analysis of TOD development.	http://www.rtd-fastracks.com/main_45	Revised in September 2010.
Sacramento Regional Transit	Transit for Livable Communities	Sacramento's land use plan for 21 light rail stations consists of conceptual land use plans including transit overlay zones and proposed development standards; joint development strategies and development plans for property owned by the transit agency; and a discussion on barriers to TOD and implementation measures. It includes interim station area land use standards to regulate development until permanent transit zoning is adopted.	Transit Oriented Development Guidelines	Local	Light Rail	Three light rail lines are identified, and the land use plans for each light rail station cover a quarter-mile radius around the station.	http://www.sacrt.com/TLC/index.stm	Approved in August 2002.
Bay Area Rapid Transit (BART) - San Francisco, CA	BART Station Access Guidelines (Apr 2003)	These guidelines identify access priorities for different travel modes around transit stations and set goals for future mode share. Key considerations and design principles for improving non-motorized access to transit including direct walking routes, safety, pedestrian-friendly design and wayfinding information are provided.	Station Area and Facility Design Guidelines	Region, Local	Pedestrian, Bicycle, Local Bus, Automobile, Light Rail, Heavy Rail	N/A	http://www.bart.gov/about/planning/station.aspx	Published in April 2003.
Bay Area Rapid Transit (BART) - San Francisco, CA	BART Transit Oriented Development Guidelines (Jun 2003)	BART's TOD Guidelines clarify the agency's priorities for TOD. It presents recommendations to assist planning and development process. It purposefully does not cite dimensions or specify precise land uses to allow flexibility in adapting to local conditions. The guidelines focus on connecting to destinations and providing design features for different modes to foster community, increase safey, and make the transportation system work. Minimum densities within station areas are included	Transit Oriented Development Guidelines	Region	Pedestrian, Bicycle, Local Bus, Automobile, Light Rail, Heavy Rail	The guidelines identify three different "zones of urgency" within a station area, defined by the intent and purpose of the people moving through them. Design principles reflect the state of urgency within each zone.	http://www.bart.gov/about/planning/station.aspx	Published in June 2003

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Metro Portland, OR	Transit Oriented Development Program	The Metro Portland TOD program is admired across the nation for its public-private partnerships, investments and incentives in TOD projects. The 2040 Growth Concept calls for a significant amount of the region's growth to be concentrated in medium- to high-density mixed use, walkable urban centers and corridors linked by high quality transit service. The TOD Program provides funds for development projects within designated TOD areas (around rail station areas and frequent bus stops).	Development Assistance Program	Region	Heavy Rail, Light Rail, Streetcar, Express Bus	Metro Portland assesses the performance of its station areas through by looking at its transit orientation and market strength. The level of performance determines Metro's investment priorities.	http://www.oregonmetro.gov/index.cfm/go/by.web/id=140	Ongoing TOD Program created in 1998.
Center for Transit Oriented Development	Performance-Based Transit Oriented Development Typology Guidebook	This research report introduces a unique methodoly for characterizing and analyzing TOD performance. It organizes rail station areas into place types according to VMT and percentage of workers to residents. It also looks at other characteristics relative to the place types (e.g. auto ownership, transportation costs, commute travel behavior, employment proximity, and urban form. The report provides case studies for each of the nine place types and includes scenario studies to analyze effect of additional growth in reducing VMT. The report provides a template for communities to assess station areas in comparison to others and can be used to determine how to lower VMT in an individual zone.	Research Report	National, Local	Commuter Rail, Light Rail, Heavy Rail	Place types are organized by VMT on vertical axis and use mix on horizontal axis. The purpose is to compare place types within a system or across multiple systems. Other measures, called normative metrics can be compared to the place types (e.g. travel time to work, avg median income, autos per HH, gross density, etc).	http://reconnectingamerica.org/public/display_asset/2010_performancebasedtodtypologyguidebook	Published in December 2010.
New Jersey Department of Transportation and Pennsylvania Department of Transportation	Smart Transportation Guidebook: Planning and Designing Highways and Streets that Support Sustainable and Livable Communities	This resource provides guidance on planning and designing all classes of non-limited access roadways in New Jersey and Pennsylvania to fit within the existing and planned community context. The handbook provides tools and techniques to integrate context sensitivity into the project development processes of the DOTs. It presents a set of land use contexts and roadway types that influence the appropriate design values. It also provides design guidelines for roadway elements like travel lanes and on-street parking, roadside elements like pedestrian and transit facilities, and general systems issues like access management and traffic calming.	Multimodal Corridor Planning Strategies and Design Guidelines	State	Automobile, Bicycle, Pedestrian, Bus Transit	The handbook defines different land use contexts according to ____ and roadway types based on ___.	http://www.nj.gov/transportation/community/mobility/guide.shtm	Published in March 2008.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
(California Department of Transportation)	Smart Mobility: A Call to Action for the New Decade	The Smart Mobility handbook represents an approach to integrating transportation and land use. It presents a methodology for understanding smart mobility within the context of location efficiency and identifies different place types throughout the state based on location efficiency potential. The place types create a distinct context for transportation investments and opportunities for mobility benefits. The handbook provides multimodal performance measures for smart mobility, compares them to conventional Caltrans performance measures, and explains how the performance measures apply to different place types.	Growth Framework	State	Pedestrian, Automobile, Transit, Bicycle	CalTrans is an example of a statewide agency that has categorized places into place types. Place types are based on locational efficiency, which considers levels of community design and regional accessibiltiy. They are necessarily broad and should be applied at a general planning level of detail. Finer-grained analysis would show large areas characterized as one place type would actually consist of several subareas with characteristics of other place types.	http://www.dot.ca.gov/hq/tpp/offices/ocp/smf.html	Published in February 2010.
Virginia Department of Rail and Public Transportation	Transit Service Design Guidelines	These guidelines help localities understand their options for implementing transit service and explain which planning activities should be conducted to make the effort successful. The document explains the range of different transit options available and helps localities determine which transit technology may be appropriate for their community based on factors like density, diversity, design and transit station type.	Policy Guidance on Transit Service	Statewide guidance for regions and localities	Heavy rail, Light Rail, Streetcar/Trolley, Express Bus, Local Bus, and others	The document acknowledges the spectrum of transit network designs, target markets and service area sizes throughout the state. It contrasts the radial systems of VRE and WMATA with the grid-type bus networks of more dispersed areas.	http://www.drpt.virginia.gov/activities/Transit_ref_materials.aspx	Finalized in November 2008.
Virginia Department of Rail and Public Transportation	Amtrak Station Area Planning and Land Use Analysis	DRPT staff and local planners collaborated to create six transit oriented land use plans at existing and potential Amtrak stations along the I-95/I-64 rail corridor linking Washington DC, Richmond and Newport News. Station Area Plans present land use plans for compact development with particular urban design characteristics around the station areas to achieve a walkable transit oriented place. The Plans provide in-depth analyses of the resulting effects of creating these TODs, including assessed market conditions, economic impacts, and potential funding mechanisms. Traffic, transit, pedestrian and bicycle analyses assess the effects of increased activity around the train station for all modes, and infrastructure and service improvements are noted in the report. Environmental effects for water resources, historic sites, hazardous materials and protected species are also addressed.	TOD Station Area Plans	Regional (Amtrak Corridor) and Local (Station Areas)	Commuter Rail, Local Bus, Pedestrian, Bicycle, Automobile	The document identifies each station's unique function and character within the corridor and establishes overarching themes specific to each station area. It is unclear why each station was chosen, but together they represent a range of station area types, from rural towns to downtown centers.	Available from the Virginia Department of Rail and Public Transportation.	Finalized in November 2008.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Washington Metropolitan Area Transit Authority (WMATA)	Station and Site Access Planning Manual	Illustrates how station site facilities should be planned to optimize pedestrian and vehicular access to Metro, with focus on physical design and operational issues. Similar to BART's Station Access Guidelines.	Station Area and Facility Design Guidelines	Regional (Metro system) and Local (Station Areas)	Heavy rail, Pedestrian, Bicycle, Local bus, Light Rail, Streetcar, Kiss & Ride, Park & Ride	Stations are classified into three general types: Core Stations, Mid-Line Station, and Terminus Stations, according to the variety of modes used to access that station and surrounding development density.	http://www.wmata.com/pdfs/planning/Station%20Access/SSAPM.pdf	Published in May 2008.
Washington Metropolitan Area Transit Authority (WMATA)	Joint Development Policies and Guidelines	Outlines the general practices of the joint development program. Under this program, WMATA markets publicly owned property to developers to create TOD projects. WMATA selects a developer to work with WMATA and local jurisdictions in the development of the property to integrate transit investments in the development process. The Policies and Guidelines document specifies the program's objectives, procedures, and roles and responsibilities of WMATA, local jurisdictions, developers and the community.	Procedural Guidelines	Region	Heavy rail, Local Bus	N/A	http://www.wmata.com/pdfs/business/Guidelines%20Revision11-20-08.pdf	Revised in November 2008.
Fairfax County and Tysons Land Use Task Force	Transforming Tysons: Vision and Area Wide Recommendations	This integrated land use and transportation plan provides a parcel level land use plan with intensity focused around transit, transportation recommendations for a variety of street types that accommodate all modes, and urban design guidelines specified by character zones. It is a nationally recognized model for TOD planning.	Transit Oriented Development Plan	Local	Heavy Rail, Circulator Bus, Automobile, Bicycle, Pedestrian	The Tysons area is divided into eight districts; four surrounding the future rail stations and four creating transitions between adjacent communities. 95% of development is concentrated within walking distance of transit (1/2 mile of rail or 600 feet of the circulator). The urban design guidelines organize the area into three different character zones (station core, circulator and transition) and provide guidelines for blocks, streets, pedestrian zones and buildings. Streets are classified by function and range from arterial to local street.	http://www.fairfaxcounty.gov/dpz/tysonscorner/finalreport.htm	Revised in October 2008. Fairfax County Comprehensive Plan amended in June 2010.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Hampton Roads Metropolitan Planning Organization	Vision Plan Document: A Transit Vision Plan for Hampton Roads	This vision plan acknowledges the need for integration of land use and transit plans. The plan identifies major activity centers based on HRPDC demographic estimates and projections and examines the land use composition of current and potential transit corridors that could connect the centers. Potential transit corridors were evaluated to assess the "transit supportiveness" of the governing land use policies and regulations and the feasibility of implementation. The document includes guidelines for transit supportive development, drawing mainly from the Virginia Transit Service Design Guidelines (4Ds) and FTA guidelines. It provides a matrix of place types localities can use to plan for feasible future transit corridors. It also includes a vision for transportation demand management.	Vision Plan	Region	Local Bus, Enhanced bus, Express bus, Bus rapid transit, Streetcar/Trolley, Light Rail, Commuter rail	Place types are categorized by land use type, density, mix and design characteristics. Each place type is given a range of typical housing and job densities and a list of feasible transit options. The place types do not have a specific shape or area size, and can be applied at any scale.	http://www.hrtpo.org/TPO_SpecReports.asp	Draft Report published in April 2009. Public meetings held and public comments received by December 2010. Final Report underway.
City of Norfolk	Downtown Norfolk 2020 Plan	In the advent of light rail, Norfolk's downtown plan envisions itself as one large TOD with all development within a ten minute walk of transit, using the light rail stations as foundations. The plan focuses on the creation of place around transit and along the waterfront and the creation of improved connections between the downtown the city's neighborhoods.	Vision Plan & Transit Oriented Development Station Area Plans	Local	Light Rail, Local Bus, Pedestrian	The plan focuses on several centers located along the waterfront, around transit stations, or close to a new town square to be served by shuttle bus. Each small area has a unique vision and purpose.	http://www.norfolk.gov/Planning/Downtown.asp	Adopted in April 2009.
City of Norfolk	Downtown Norfolk Pattern Book: Architectural Guidelines for Place Making	The Pattern Book accompanies the Downtown Norfolk 2020 Plan and provides guidelines for urban and building design that will be consistent with the vision of the downtown plan. The book is essentially a step-by-step handbook that provides guidelines based on street type (urban spatial type), site type, building height (facade type), and archtectural style.	Design Guidelines	Local	N/A	The streets are categorized by existing or future urban character (e.g. neighborhood streets vs. commercial streets). Downtown greens and squares are also identified as a specific urban spatial type.	http://www.norfolk.gov/Planning/PDFFiles/Downtown_Pattern_Book.pdf	Adopted in April 2009.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Arlington County, Virginia	Transit Corridor Growth Strategy	Since the 1960s, Arlington County has successfully concentrated high-density development within Metro corridors and preserved lower-density residential areas throughout the County using a variety of planning and policy documents, regulatory tools and ordinances. The General Land Use Plan describes broad goals and establishes policies that focus on areas within Metro Station Areas and Metro Corridors. It also establishes zoning mechanisms to achieve these goals. Policy plans and land use plans for the Rosslyn-Ballston and Jefferson-Davis Metro Corridors provide the foundation for a unified long-range planning approach. Sector plans for the individual station areas dig into the details of urban design, zoning, transportation, and market trends, distinguishing the unique character of each station area. Arlington County continually tracks development statistics within the Metro corridors dating back to 1960 to quantify its success.	TOD and Growth Management Policy	Regional, Local	Heavy Rail, Pedestrian	N/A	http://www.arlingtonva.us/departments/CPHD/planning/docs/CPHDPlanningDocsMain.aspx#bs_plan	Strategy adopted in early 1970s in preparation for Metro system. General Land Use Plan last updated in June 2010. Sector Plans range in date from the 1980s to the present.
Arlington County, Virginia	General Land Use Plan	The General Land Use Plan's goals include concentrating high-density development, promoting mixed use development, and increasing the supply and variety of housing within the Metro corridors. It concentrates the highest density uses within walking distance of Metro stations; tapers densities, heights and uses down to single-family residential neighborhoods; and provides for a mix of office, hotel, retail and residential development. The Plan establishes regulatory mechanisms, namely special coordinated mixed use zoning districts which allow FARs that exceed general zoning designations and special residential zoning districts which promote tapering of heights between higher-density commercial development and lower-density residential neighborhoods.	Land Use Plan	Regional, Local	Heavy Rail, Pedestrian	Each station area serves a unique function within the corridor. Rosslyn is a first class office and business center. Courthouse is the County's government center. Clarendon is planned as an "urban village." Virginia Square contains a concentration of residential, cultural and educational facilities. Ballston is developing as Arlington's "new downtown."	http://www.arlingtonva.us/departments/CPHD/planning/docs/CPHDPlanningDocsGLUP.aspx.	Last updated in June 2010.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Arlington County, Virginia	Crystal City Sector Plan	This sector plan provides the policy framework, master plan, and implementation steps for the Crystal City planning area, a 260-acre (0.4 sq. mi.) area within the 361-acre (0.6 sq. mi.) Crystal City Metro Station Area, as defined by the General Land Use Plan. It includes a discussion on the impact of regional growth, including identification of activity centers and their dispersion along major transportation corridors. It is an example of high density mixed use neighborhood and an economic engine with high-rises approaching full build-out of existing plans.	Station Area Plan	Local	Heavy Rail, Automobile, Pedestrian, Bicycle, Commuter Rail, Local Bus, Express Bus	The planning area for station has an oblong shape. It is 1.3 miles from north to south and varies in length from east to west with a maximum width of 0.5 miles. It excludes the areas of low-density residential. Within the planning area, the plan defines neighborhoods and districts based on use characteristics and identifies destinations. It also distinguishes the ways in which the transportation infrastructure influences the area, local and collector streets connecting places within the area, and large arterials acting as barriers or edges to the districts.	http://www.arlingtonvirginiausa.com/index.cfm/11250	Draft published in June 2010. Adopted in September 2010 with final changes to be incorporated.
Arlington County, Virginia	East Falls Church Area Plan	The East Falls Church Area represents an example of a commuter station area with park-and-ride and kiss-and-ride facilities. It is less dense than the other Metro station areas within Arlington County. The East Falls Church Area Plan provides a policy framework, concept plan, design guidelines, and implementation actions.	Station Area Plan	Local	Heavy rail, Pedestrian, Bicycle, Automobile, Local Bus	The study area includes the commercial development and multi-family housing along I-66 and some of the single-family housing. Much of the existing single-family housing is not included, even though it is within a quarter-mile of the Metro station, in an effort to preserve it. The plan introduces the Neighborhood Center concept, a collection of three low- to medium-scale mixed use development nodes, each with its own specific character and role. These are essentially different mini-districts working together to create a cohesive whole.	http://www.arlingtonva.us/departments/CPHD/forums/eastfallschurch.aspx	Draft published in January 2011.
Arlington County, Virginia	Clarendon Sector Plan	Clarendon represents a future "urban village" with public spaces, accessibility, connectivity and a rich mix of uses to achieve a sense of place and uniqueness. The sector plan includes policies on urban form, transportation, land use, historic preservation and other topics. It includes urban design guidelines and a matrix of implementation recommendations.	Station Area Plan	Local	Heavy rail, Pedestrian, Bicycle, Automobile, Local Bus	The station area boundary is approximately a quarter-mile radius within the Metro Station areas.	http://www.arlingtonva.us/departments/CPHD/planning/docs/CPHDPlanningDocsMain.aspx#clarendon	Original Sector Plan adopted in 1984. Revised and re-adopted in 2006.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Arlington County, Virginia	Master Transportation Plan	Arlington's Transportation Plan echoes the policies of the General Land Use Plan. One main goal of the plan is moving more people without more traffic by implementing transit oriented and mixed use development for better access and use of the transportation system, minimizing person delay across modes rather than focusing exclusively on minimizing vehicle delay, and encouraging bicycling, walking, transit, carpooling and telecommuting.	Transportation Plan	Local	Heavy rail, Pedestrian, Bicycle, Automobile, Local Bus	N/A	http://www.arlingtonva.us/departments/EnvironmentalServices/dot/planning/mplan/mtp/MTP_Draft.aspx	Goals and policies adopted in November 2007. Final element adopted in February 2011.
Arlington County Transportation Demand Research Center	Arlington County Commercial Building Research Summary Report	Arlington County Commuter Services (ACCS) distributed a survey to employers and employees in Arlington County to study roles of location factors, transportation facilities, commuter assistance services and other factors on business location decisions and employee's travel choices in Arlington County. The survey tracked distance to transit, area of the county, level of "urban-ness," availability of commuter services, parking availability and parking charge.	Survey Results	County	Carpool, vanpool, bike, pedestrian, bus, train, drive alone	The document does not identify place type, but accounts for differences in level of "urban-ness" and proximity to Metrorail stations and bus stops.	http://www.commuterpage.com/research/study_list.asp?jobID=ACCS030&studyID=110	Published in December 2009.
Arlington County Transportation Demand Research Center	2007 State of the Commute Study: Arlington Perspective. The Factors of Success in Reducing Drive Alone Commuting in Arlington	This study assessed the factors of reducing the drive alone mode share, including market need, ridesharing infrastructure, commuter mindset, employer support and involvement, telework opportunity, and societal awareness and support of ridesharing. It provides recommendations for ACCS to reduce the drive alone mode share for work trips.	Survey Results and Recommendations	County	Drive alone, Metrorail, carpool, vanpool, bus, bike, pedestrian	N/A	http://www.commuterpage.com/research/study_list.asp?jobID=ACCS035&studyID=120	Published in March 2010.
Loudoun County	TOD Planning and Zoning Districts	Loudoun County has included policies for transit oriented development into its comprehensive plan. and has instituted several zoning codes to actively encourage this type of development. The County's two transit nodes are key components of its suburban policy area, intended to limit sprawl, reduce public costs, provide the critical mass for bus and rail transit, provide a development alternative the separates auto-oriented land uses from transit oriented uses.	Comprehensive Plan and Zoning Policy	Local	Bus Transit, Rail Transit, Pedestrian, Automobile	There are two transit nodes within the county. One is a Transit Related Employment Center, consisting of offices and support services. The other is a Transit Oriented Development, a mix of high-intensity land uses ranging from high-density residential uses, regaional offices, entertainment and cultural centers and other businesses.	http://www.loudoun.gov/Default.aspx?tabid=327&fmpath=/Comp%20Plan	Incorporated in current Comprehensive Plan and Zoning Ordinance.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Loudoun County Department of Planning	Route 28 Corridor Plan	Loudoun County is working on an amendment to their comprehensive plan for the Route 28 Corridor. The Corridor Plan and Implementation Strategy were created as part of this effort. The vision for this corridor includes pedestrian- and transit oriented mixed use office centers. The Plan includes policies for land use, transportation, design,economic development, housing and sustainability. Policies include a multimodal transportation network, including transit, within the corridor, and highest intensities within a quarter-mile of planned bus or rail stations. Design policies and standards promote general TOD design and will be accompanied by an illustrative design handbook. The implementation plan outlines specific action items like amending existing zoning ordinance.	Corridor Plan and Implementation Strategy	Local	Automobile, General Transit (bus or rail), Pedestrian, Bicycle	N/A	http://www.loudoun.gov/Default.aspx?tabid=2978	Draft Plan dated February 2011. Board of Supervisors currently reviewing.
City of Roanoke, VA	Street Design Guidelines	Roanoke's guidelines accommodate all modes of transportation on its city streets and are consistent with Complete Streets principles. The document provides design guidelines for each character district as well as general streetscape element guidelines applicable for all areas within the city. Right-of-way cross sections for each street class illustrate options for new streets (preferred) and for retrofitting in situations where the preferred is not feasible.	Multimodal Corridor Design Guidelines	Local	Automobile, Truck, Local Bus, Bicycle, Pedestrian	Streets are classified into three categories by function and character: arterials, collectors and locals. Land area is organized into eight character districts (downtown, industrial, etc) depending on general building style, development form and land purpose. **Connection between character and function - street types within character districts**	http://www.roanokeva.gov/85256A8D0062AF37/CurrentBaseLink/B444FCBE9084DAE48525781D0049F958/$File/STREET_DESIGN_GUIDELINES.pdf	Adopted in July 2007.
Virginia Department of Transportation	Policy for Integrating Bicycle and Pedestrian Accommodations	This policy integrates bicycle and pedestrian accommodations into all of VDOT's procedures and projects. It requires that all transportation projects will start with the assumption that accommodation for bicycling and walking will be provided. As a result of this policy, VDOT has updated its procedures and best practices to include guidlines for coordinating with localities, planning level cost estimates, and updated construction and maintenance scoping forms.	Transportation Policy	State	Bicycle, Pedestrian, Automobile	N/A	http://www.virginiadot.org/programs/resources/bike_ped_policy.pdf	Adopted in March 2004.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Virginia Department of Transportation	State Bicycle Policy Plan	The Bicycle Policy Plan provides a framework to implement the bicycle portion of VDOT's Policy for Integrating Bicycle and Pedestrian Accommodations. It establishes policies for bicycle facility planning and design, identifies opportunities for enhancing coordination, recommends training programs, and sets forward benchmarks for tracking implementation over time.	Transportation Policy Plan	State	Bicycle, Pedestrian, Automobile	N/A	http://www.virginiadot.org/programs/bicycling_and_walking/bicycle_policy_plan.asp	Draft published in April 2010.
Virginia Department of Transportation	Context Sensitive Solutions Policy	The CSS policy requires VDOT to consider that motorists, pedestrians, bicyclists, and public transit vehicles jointly use transportation systems for both transportation and recreational purposes. It promotes transportation facilities that provide transportation safety and mobility, while also fitting the physical setting and reflecting concerns regarding scenic, aesthetic, historic, and environmental resources.	Transportation Policy	State	Automobile, Bicycle, Pedestrian, Transit	N/A	http://www.extranet.vdot.state.va.us/locdes/electronic%20pubs/iim/IIM235.pdf	Instructional and Informational Memorandum dated August 2008.
Virginia General Assembly	Urban Development Areas (Code of Virginia Section 15.2-2223.1)	The amendment requires high growth localities to designate Urban Development Areas (UDAs) in their comprehensive plans. UDAs will be areas of compact development that incorporate principles of new urbanism and tranditional neighborhood development. Encouraging well-designed development and growth in these areas will help reduce trip lengths, encourage trips by other modes, and foster more sustainable development patterns.	Virginia Legislation	State	Automobile, Bicycle, Pedestrian, Transit	N/A	http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+15.2-2223.1	General Assembly added to Code of Virginia in 2007.
Virginia Department of Transportation	Secondary Street Accepantance Requirements	These regulations incorporate the design and function of a street as criteria for acceptance into the state system of roads. Developers must build streets that connect with the surrounding transportation network in a way that enhances the capacity of the overall transportation system and accommodates pedestrians, as determined by the area type.	Transportation Policy	State	Automobile, Bicycle, Pedestrian	The state is divided into three categories based on long-term local, regional and federal planning boundaries: compact, suburban, and rural.	http://www.virginiadot.org/projects/ssar/default.asp	Approved in February 2009.

ORGANIZATION	DOCUMENT/ POLICY TITLE	DESCRIPTION	DOCUMENT/ POLICY TYPE	SCALE (STATE, REGION, LOCAL)	TRANSPORTATION SYSTEM (ROADWAY, TRANSIT TYPE, BIKE/PED)	PLACE TYPE / CORRIDOR TYPE / DISTRICT TYPE (DESCRIPTION)	URL	STATUS
Virginia Department of Transportation	Chapter 527 Traffic Impact Analysis Regulations	This regulation requires localities to submit a traffic impact analysis (TIA) to VDOT for development proposals that would significantly impact the state transportation system during comprehensive plan amendments, rezonings and site plan approvals. Amendments to the regulations require VDOT to approve a trip generation methodology for urban developments and small area plans that recognizes the reduced vehicle trip generation of mixed use, compact development patterns and transportation demand managemetns measures.	Transportation Policy	State, Local	Automobile, Bicycle, Pedestrian, Bus	N/A	http://www.virginiadot.org/projects/chapter527/default.asp	Established in 2006 and amended in 2010.
Virginia Department of Transportation	Access Management Regulations and Standards	These regulations define standards for design of intersections and entrances to reduce conflict points and enhance vehicular and pedestrian circulation. The regulations attempt to balance efficient highway operation and reasonable property access.	Transportation Policy	State, Local	Automobile, Bicycle, Pedestrian	Spacing standards vary by functional classification (urban or rural, arterial or collector)	http://www.virginiadot.org/projects/accessmgt/default.asp	Effective July 2008 for Principal Arterials and October 2009 for Minor Arterials, Collectors and Local Streets.
Virginia Office of Intermodal Planning and Investment	VTrans2035 and the Virginia Surface Transportation Plan	VTrans2035 is Virginia's long-range multimodal transportation plan. VTrans2035 acknowledges the changing circumstances and growth pressures that are increasing the demand for transportation choices and the mobility needs of all residents. The Virginia Surface Transportation Plan (VSTP) follows the policy guidance of VTrans2035 and identifies specific multimodal solutions for Virginia's different regions, including public transportation strategies, rail investments and highway improvement projects.	Transportation Policies	State	Automobile, Bicycle, Pedestrian, Public Transportation, Rail	N/A	http://www.vtrans.org/	Completed in 2010.