

REGIONAL MULTIMODAL PLANNING

KEY ELEMENTS OF A REGIONAL MULTIMODAL SYSTEMS PLAN

The largest and in many ways the most important scale at which multimodal planning can be applied is the regional scale. Multimodal considerations can and should be integrated into the development of a long-term transportation network, in order to achieve increasingly diverse travel modes and improve the overall operation of the transportation system. Multimodal corridors and place types should ideally be planned and designed within the context of an overall regional Multimodal Systems Plan that lays out the network of corridors and modal emphasis for each corridor.

The following is an outline of how multimodal corridor and place typologies can be planned at a regional scale. The methodology for multimodal regions is described through a case study of a hypothetical region in Virginia. The case study used represents a cross section of land use contexts, from rural to urban, and can serve as a sample of conditions found statewide to apply the planning approach recommended in these Guidelines. Subsequent chapters of this document will explain center types and corridors in detail but this chapter starts at the regional scale and shows how to assemble a regional multimodal systems plan.

The basis for this approach is to link together prime destinations and centers 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 multi-modal region that incorporate all of the separate aspects of these guidelines – corridors, center types, design details - into a unified whole.

Step 1 – Ensuring Public Engagement and Ongoing Input

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

Multimodal Systems Planning

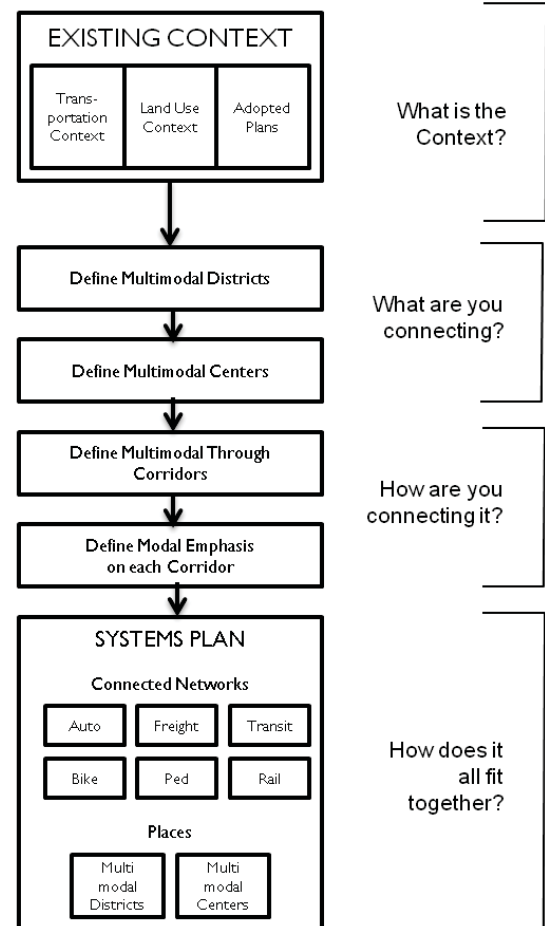


Figure 4 - The recommended planning process for a Multimodal Systems Plan at a regional scale

design/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 those who use modes in addition to autos – 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

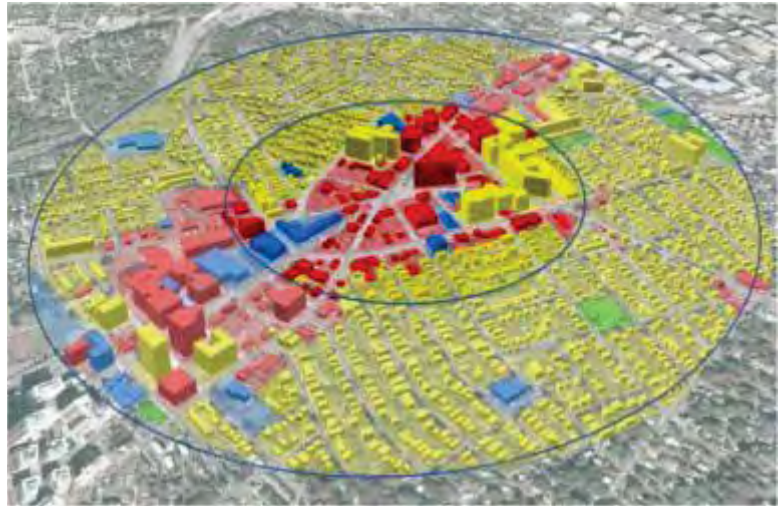


Figure 5 Clarendon Station, Arlington County, VA - Multimodal Planning operates at many scales, from corridor to place to region

Step 2 – Transportation & Land Use Analysis

The analysis phase of a regional transportation 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:

- 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



Figure 6 Charlottesville, VA - This view of the hospital district shows a localized center of employment activity

- The key centers in the region that serve as activity centers and prime destinations for trips – whether current, emerging or future centers
- The role of thoroughfares in the network and their current and anticipated future modal emphasis

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 systems plan, so that future networks can be designed to better accommodate all users and modes in a region. A series of maps on the following pages show a simplified analysis of the broad land use and transportation systems for the hypothetical region. An actual planning process would involve many more steps and varieties of data than is shown below, but the sequence of illustrations show a basic analysis of two key types of information:

1. Existing/future land use intensity
2. Existing/future networks by travel mode

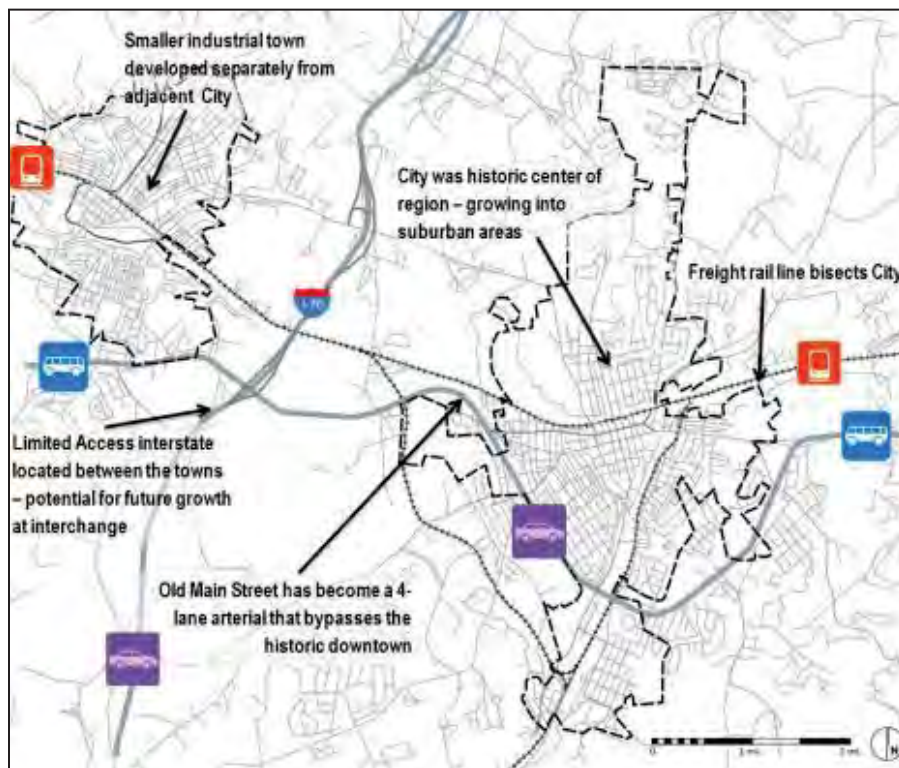


Figure 7 - Hypothetical Region Map - A hypothetical region showing a historic city center, surrounding suburban and rural areas and an adjacent industrial town. The various primary travel modes have been highlighted for some of the main corridors

Once the data for a region is assembled, one of the key analyses that should be performed is an analysis of the pattern of regional population and employment density and intensity. The data for this analysis typically comes from several sources, including:

- Locality comprehensive plans and prior regional plans and studies
- Population and Employment projections⁸
- Recently approved or proposed development projects

The map below on Figure 6, shows one way of summarizing population and employment density in terms of a simple gradient. Note that population and employment data are combined as total development intensity. This can also be called “activity density” and is useful for transportation planning purposes as it aggregates any kinds of trip-generating activity density.

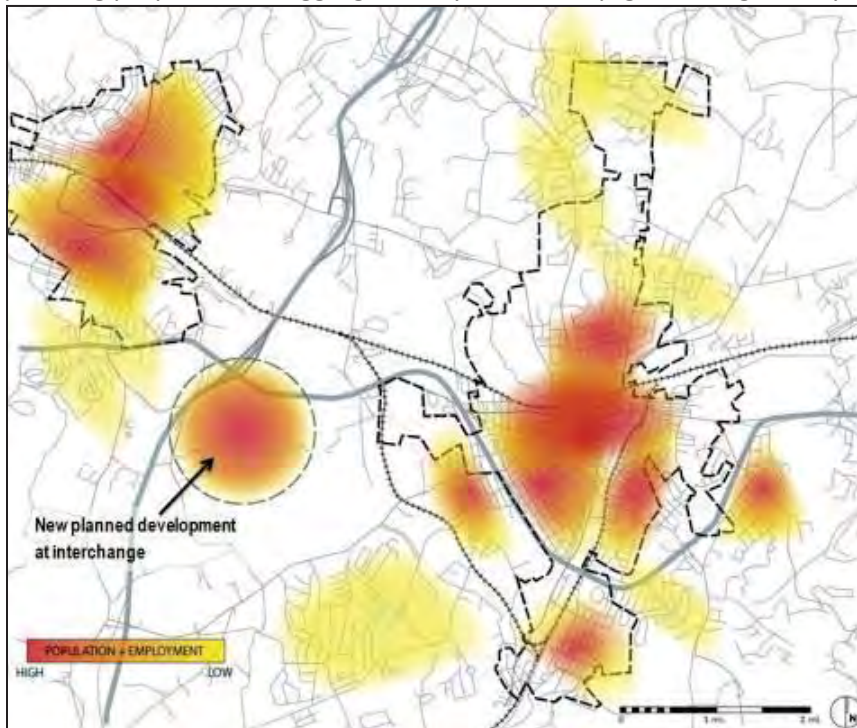


Figure 8 Existing and Future Land Use Intensity - This map shows a simplified analysis of the ultimate future intensity of development in the region. It is derived from analyzing the future population and employment density per acre.

The next key dataset to analyze is the existing and potential future transportation patterns in the region. The maps on Figures 7 and 8 below show two key transportation networks – the planned transit and bike/ped networks for the region. These are in addition, of course, to other modal networks normally analyzed for a region, such as auto and freight modes.

⁸ 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 9 Regional Transit Routes Map showing existing and proposed transit routes in the region. For this case study, it is assumed that fixed route bus is the only transit mode available

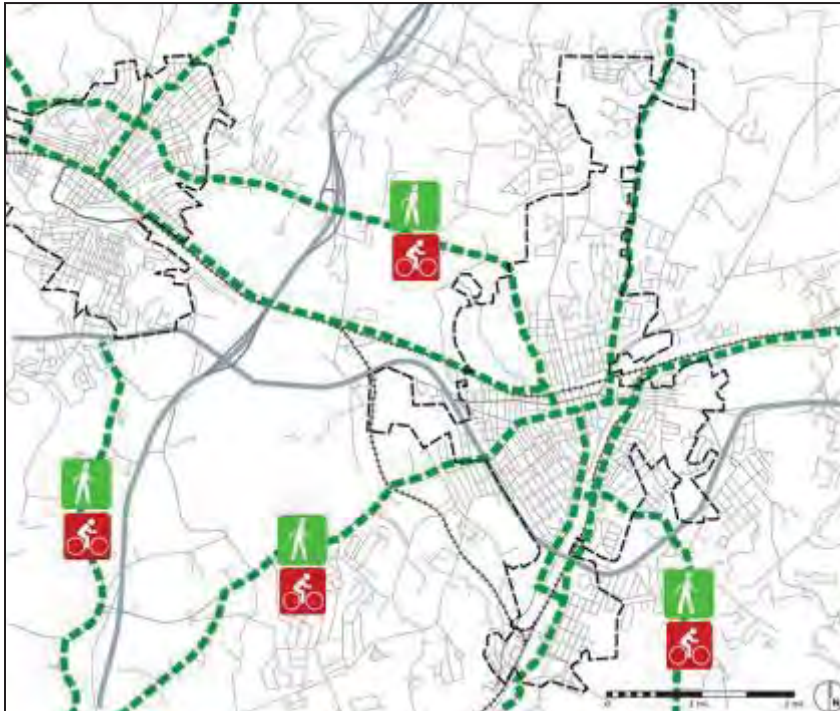


Figure 10 Regional Bike/Ped Network - Map showing only major regional bicycle and pedestrian trails. Local sidewalk networks are not shown

The above series of maps show some basic information that should be analyzed before the application of multimodal districts, centers and corridors in a region.

Step 3 – Assigning Potential Multimodal Districts

The next step in building a multimodal region is to take the already identified future growth pattern and use it to assign potential multimodal districts based on both existing and future development. As shown in the accompanying map below, the centers with the highest future population and employment intensity have been used as the basis for defining potential multimodal districts in the region (in orange). However, this analysis looked beyond just “activity density” and also took into account those areas that had a combination of high density, good transit connections and well connected street grids in order to define potential multimodal districts. This step is an important one in defining those areas of the region that should form part of an interconnected system of multimodal districts in the future. From this basic framework of districts, a series of multimodal centers can be developed within each district, based on walkable neighborhoods and transit linkages.

What is a Multimodal District?

Multimodal Districts are those areas that have (or are planned to have) the following characteristics:

- 1. Concentrations of people/jobs*
- 2. Compact, walkable street networks*
- 3. Planned transit, and/or bikeway networks*

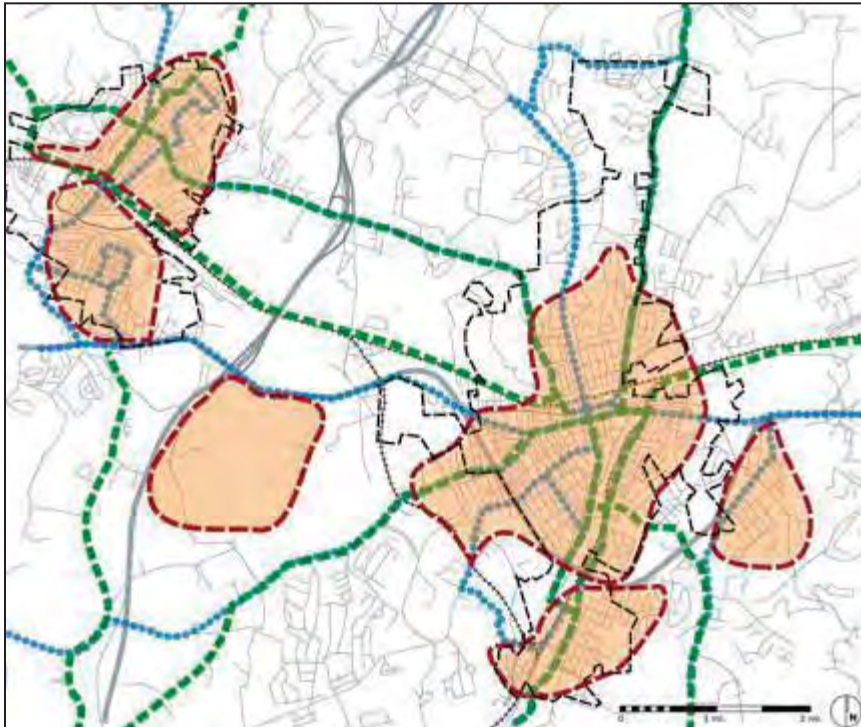


Figure 11 Potential Multimodal Districts - Map showing areas with high activity density and good potential multimodal networks that are identified as future Multimodal Districts

In cases where a detailed plan of existing and future growth centers 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 PDC will have compiled local land use projections and will have a summary of future growth that can be used as the basis for assigning potential Multimodal Districts.

What is a Multimodal Center?

Multimodal Centers are the walkable/bikable centers of each Multimodal District – they are defined by their travelsheds and their land use intensity.

Step 4. – Defining Potential Multimodal Centers within each future Multimodal District.

The next step in the planning process is to zoom into each multimodal district and define the future multimodal centers. Whereas multimodal districts can be any area that has good multimodal characteristics such as high density and a closely spaced walkable street network, a multimodal center is a specific center within a district that forms the nucleus for activities. Multimodal districts can be quite large – for example, large sections of a city can be defined as multimodal districts. However, multimodal centers are smaller and are defined by their travelsheds – primarily a walkshed of ¼ to ½ mile radius, but sometimes extending into a wider bikeshed as well.

One important reason for identifying multimodal centers within each district is to be able to better focus investments in public improvements. If multimodal improvements such as crosswalks or street trees are anticipated, it is important to have specific centers identified as first-priority areas for those improvements that are logically related to a comfortable walkshed around a defined center of activity.

Multimodal centers have the following characteristics:

- Localized centers of activity and density, defined as population, employment and activity (retail, civic or other activity generating uses)
- Limited to a comfortable walkshed, with a secondary bikeshed beyond the walkshed
- Served by existing or future transit (although in low intensity centers this may not be possible)
- A well connected (current or planned) network of walkable and bikable streets with low vehicular speeds and accommodations for bicycles, pedestrians and buses.

As shown in the regional map below (Figure 14), a multimodal

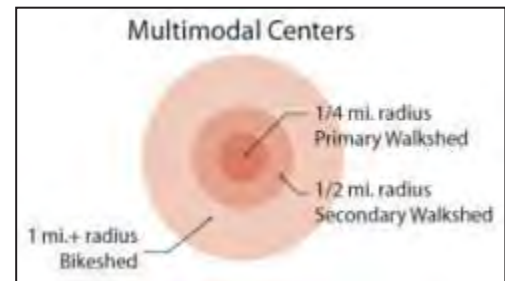


Figure 12 Diagram of Travelsheds in a Multimodal Center

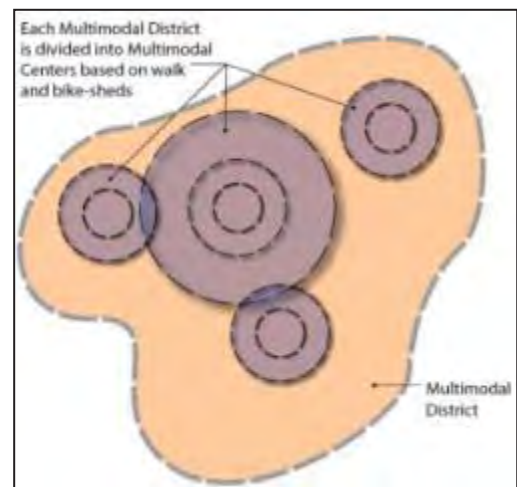


Figure 13 - The difference between Multimodal Districts and Centers

center (or centers) has been defined in each multimodal district. These multimodal centers (blue circles) are defined by travel sheds as follows:

- Primary walkshed – ¼ mile radius around center
- Secondary walkshed -1/2 mile radius around center
- Bikeshed – 1 mile or more radius around center

Each multimodal center should be scaled based on these bike/walksheds and the general expectations for future growth in each. For example, the areas that are lower density and more suburban in character have been shown as only one mile in diameter (primary and secondary walksheds only). This is not to mean that these areas should not be bikable outside a ½ -mile radius, but that the primary area for multimodal improvements should be focused within ½ mile of the center.

Focusing Investments

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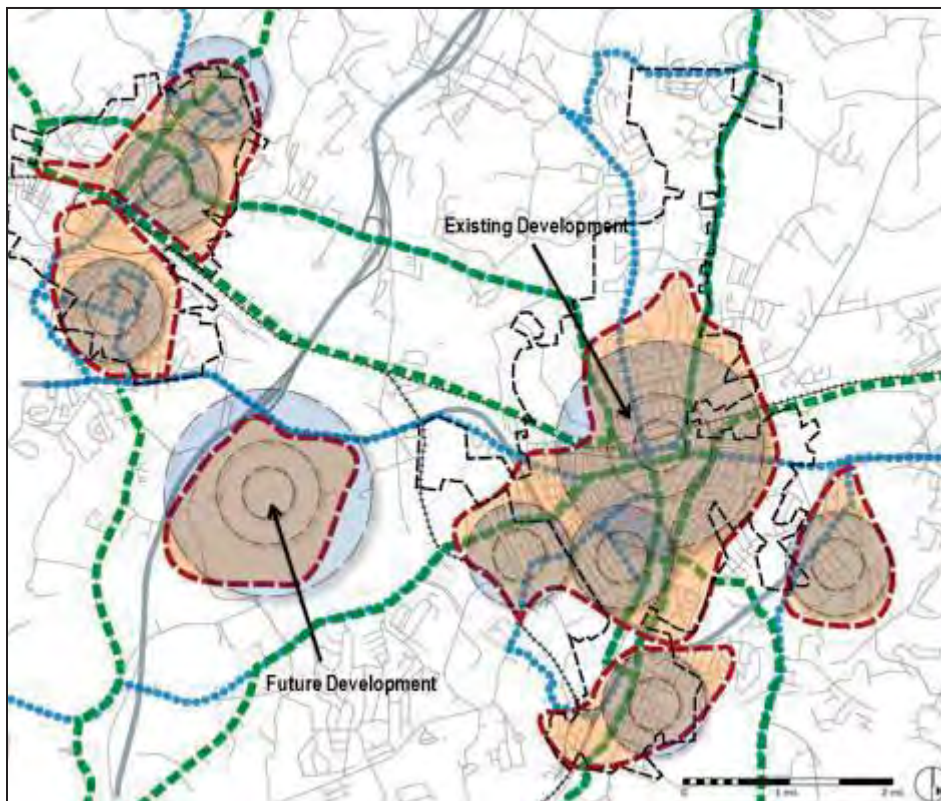
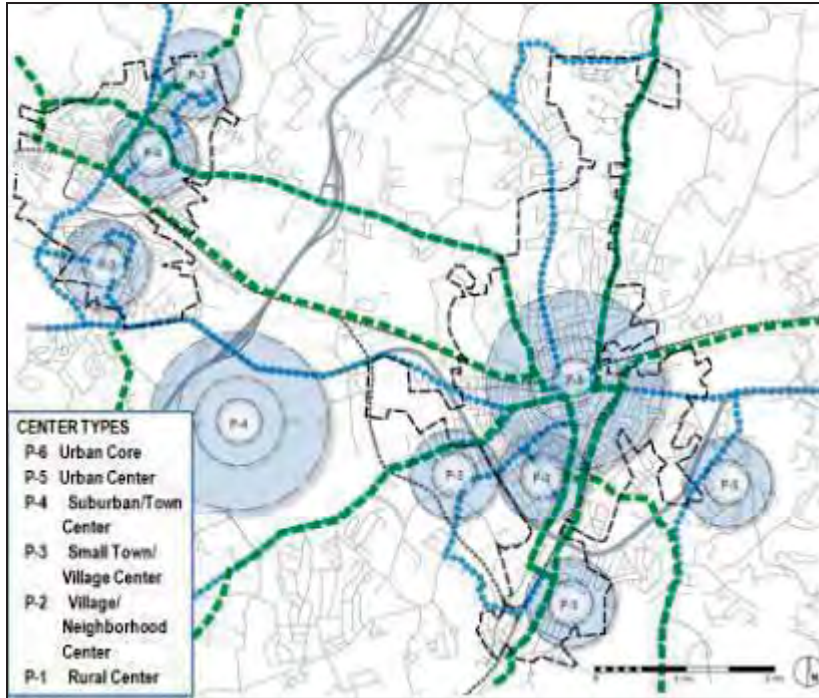


Figure 14 Multimodal Centers within each Multimodal District - Multimodal Centers are smaller areas within each district that are defined by walk/bikesheds and are the primary focus for public investments in multimodal improvements

The specific types of Multimodal Centers will be discussed in the Chapter 3 and will be important for the detailed design of corridors. The map below shows how the Centers in this region can be classified based on the center typology used in these guidelines. For this step in the regional planning process, however, it is not necessary to identify the types of centers – only their general size and location.



What are Multimodal Through Corridors?

Multimodal Through Corridors are mobility-primary corridors that connect each Multimodal Center. By fostering moderate to high speed connections between Multimodal Centers, they allow the corridors within Centers themselves (called “Placemaking” Corridors in these Guidelines) to be slower speed and more bike/ped supportive.

Figure 15 Multimodal Center Types - The Multimodal Center Typology is discussed in Chapter3

Step 5 – Identifying Multimodal Through Corridors

The next step in developing a multimodal systems plan is to connect the Centers that have been identified with a series of multimodal Through Corridors. Multimodal Through Corridors are the major thoroughfares that connect multimodal centers across a region. The concept behind a Through Corridor is to have moderate speed connections allowing reasonable travel times between centers and allow the road network within the centers to be low speed and thereby more conducive to a high density walkable center. Through Corridors will be discussed in subsequent chapters of these Guidelines within the overall corridor typology. The map also indicates that a different kind of corridor typology will be developed within the centers – called “Placemaking” Corridors – that will also be developed in subsequent chapters of these Guidelines. For this stage in a regional planning process, though, it is only necessary to identify which corridors should be the primary multimodal through connections between centers.



Figure 16 Aerial view of Arlington Courthouse - Metro stops are one of the most recognizable kinds of multimodal centers

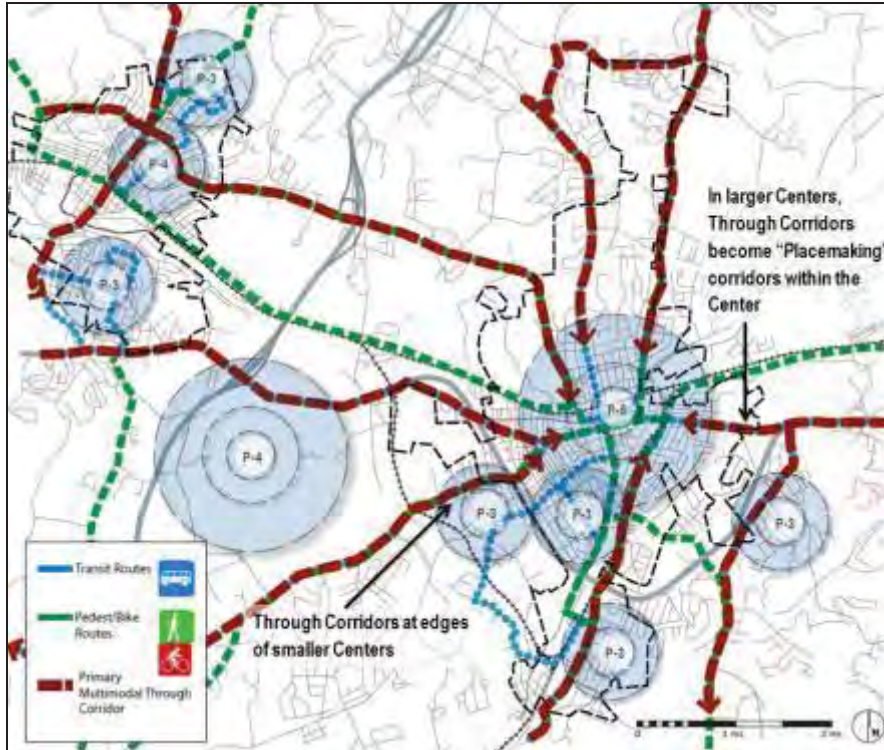


Figure 17 - Map of Multimodal Through Corridors - Through Corridors are mobility-primary corridors that connect all the Multimodal Centers in a Region

Step 6 – Identifying Modal Emphasis on Each Through Corridor

The final step in developing a multimodal systems plan is to identify the system of Modal Emphasis on each Through Corridor. Modal emphasis is different from modal priority. Modal priority on a corridor generally means that it is primarily designed for a single travel mode – such as auto-oriented or transit-oriented. Modal Emphasis recognizes that corridors can have multiple modal needs and that the corridor can be designed to balance multiple modes, with certain modes having greater emphasis than others in the detailed design of elements of the corridor. For example, most transit corridors are also dependent on being very accessible to pedestrian and bike trips as the primary transfer modes for transit. For this reason, the term modal “emphasis” is more appropriate than modal “priority.” The map below shows the modal emphasis for each



Figure 18 - Typical Multimodal Through Corridor in Tallahassee, FL photo credit: Michael Baker, Inc.

through corridor in the case study region.

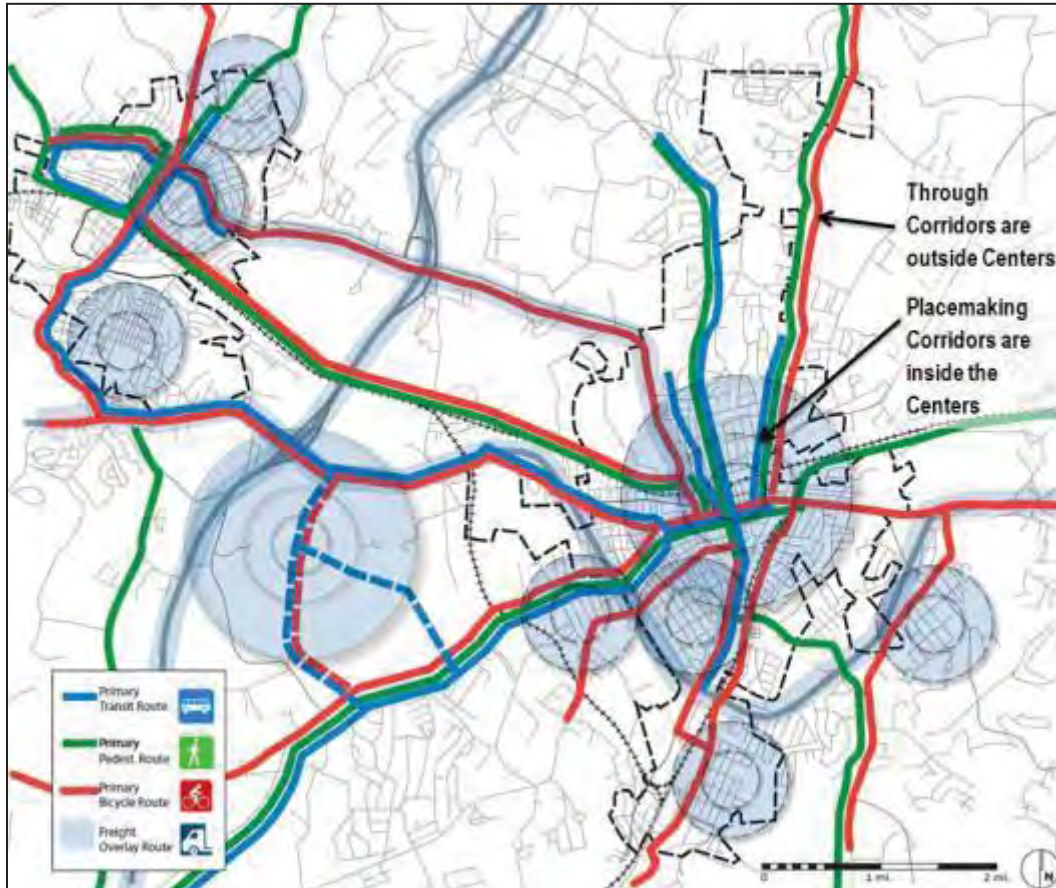


Figure 19 - Multimodal Systems Plan for a Region - The map shows a fully developed Multimodal Systems Plan, including Multimodal Centers, Through Corridors and Modal Emphasis on each Through Corridor

Final Step – Multimodal System Plan Integration

The final step in developing a multimodal systems plan is to now put everything together on a single map. The systems plan should include the multimodal districts, multimodal centers by type, the multimodal through corridors and the modal emphasis for each Through Corridor. The map could also identify key freight corridors, both highways and rail. Figure 18 shows an example of the final multimodal systems plan for the hypothetical region used in the case study.

Summary

The above analysis was intended to show the basic foundations of multimodal planning at the regional scale – the development of a multimodal systems plan. While there are many possible variations of this basic planning process, the core methodology of identifying land uses, transportation networks and their interplay is fundamental to multimodal planning at any scale. The next chapters will delve deeper into the typology for Multimodal Centers and Corridors and how they can be designed to make the most of public investments that enhance travel choices and quality of life.

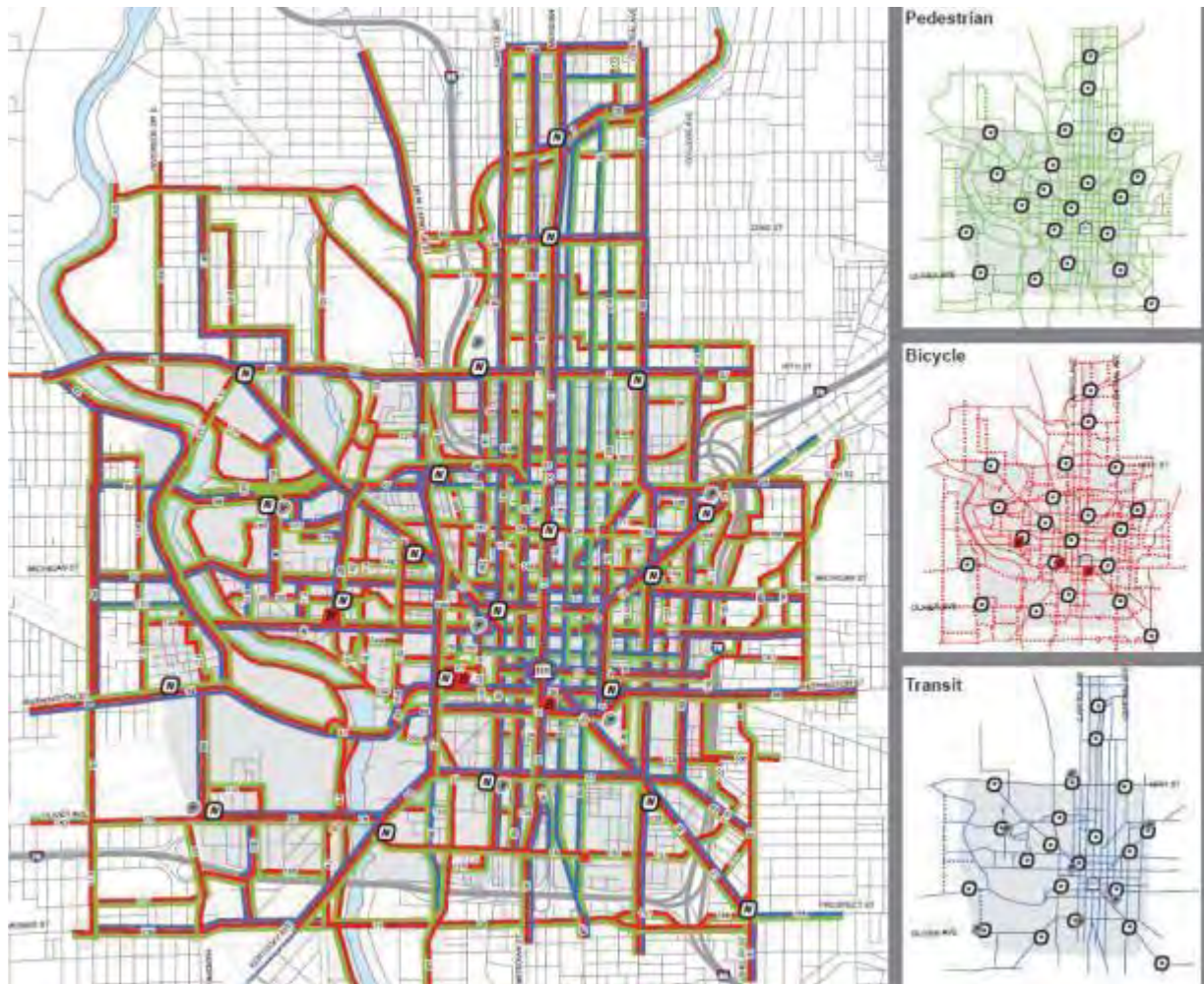


Figure 20 - Indianapolis MPO Multimodal Systems Plan - March 2009 – an example of a complex systems plan for a large region that identifies network connectivity for each travel mode. Source: Storrow Kinsella Associates

PLANNING & DESIGNING MULTIMODAL CENTERS

Multimodal Districts and Centers as a Focus for Public Investment

As described in the above chapter, one of the most important steps in the regional planning process is to define the Multimodal Districts and Multimodal Centers within a region. One of the benefits of identifying potential Multimodal Centers within a region is that it gives a focus for prioritizing where public improvements should be made 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 the 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 TOD

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.⁹

However, many places in Virginia have limited transit, no transit, or no premium transit, but nevertheless have good multimodal characteristics, such as density, walkability and compact development patterns. The historic downtowns of many Virginia cities and towns outside the main metropolitan areas of Northern Virginia and Hampton Roads reflect excellent examples of multimodal centers without the presence of premium transit or well defined TOD. These include dense centers of traditional cities such as Roanoke, Winchester, or Bristol, or even smaller historic towns or villages such as Smithfield, Blacksburg or Berryville. Moreover, unless a multimodal center has high capacity, premium transit such as light or heavy rail, it does not usually have a noticeable increase in densities and building heights around bus stops that could properly be called TOD. Therefore, these guidelines were written from a much broader perspective than just TOD. They are based on Multimodal Centers as a category of places that includes TOD but is more comprehensive and not limited to TOD alone.

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⁹ 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.



Figure 21 - Downtown Staunton, VA - An example of a historic downtown with characteristics such as density, mixed uses and walkable street grids that define it as a Multimodal Center, despite not having premium transit (image credit: Google Earth).

In fact, TOD nodes are a specialized overlay on top of certain Multimodal Centers that have premium transit and the kinds of densities and land uses that come from premium transit such as light rail. These kinds of places in Virginia are concentrated in the urban fringe of Northern Virginia, especially in the Rosslyn to Ballston corridor Metro stations and around the Norfolk Tide downtown station areas. The diagram below shows the basic definition of Multimodal District, Center, Corridor and TOD used in these Guidelines, and shows how a TOD Node is overlaid onto a Multimodal Center and is defined as the 1/8 mile radius “inner circle” of a Multimodal Center that has a premium transit station at its center. TOD nodes will be discussed in greater detail elsewhere in these Guidelines.

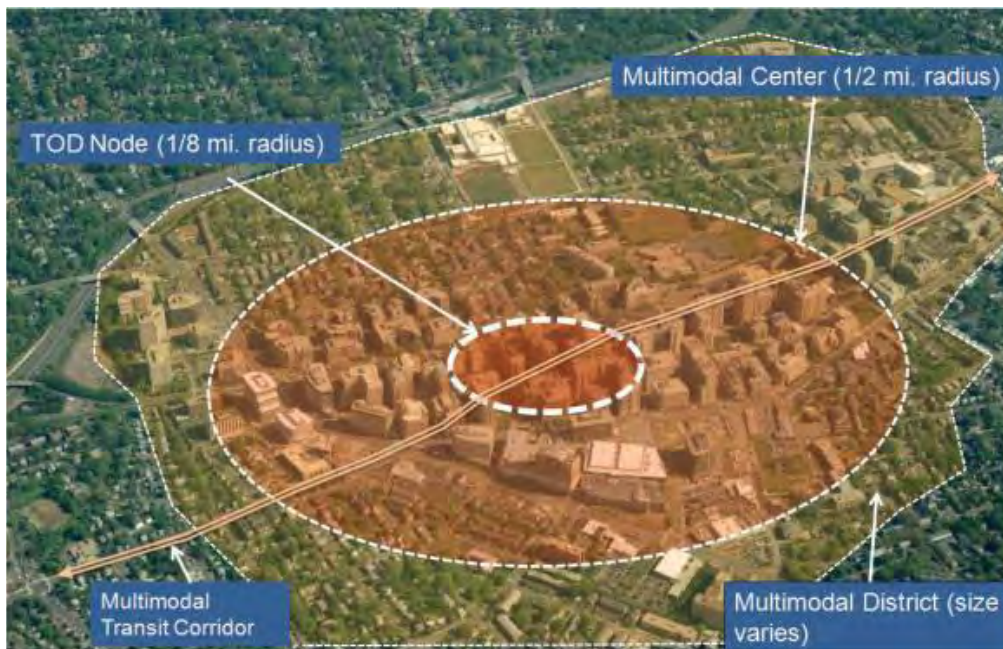


Figure 22 - Multimodal Districts, Centers, Corridors and TOD Nodes

The Types of Multimodal Centers

Analyzing Multimodal Centers for Virginia

Multimodal Centers span a wide range of contexts in Virginia, from dense urban downtowns, like Richmond and Norfolk, to historic town and village centers. Like Lexington and Staunton, to new walkable suburban centers, like 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 and centers in Virginia.



Figure 23 - One mile circles were identified as potential Multimodal centers throughout Virginia - this image shows some of the centers analyzed in the Richmond area. The colors indicate different levels of density of activities.

Measuring Multimodal Centers in Virginia

... one-mile wide circles were placed over a large number of rural, suburban and urban centers throughout the Commonwealth. The population and employment densities were analyzed in each center and compared among a set of over two hundred such centers in the State. A standardized way of comparing these densities was adopted called “activity density.” - a measure of population and employment density and is expressed in terms of jobs plus population per acre.

In this analysis, one-mile wide circles were placed over a large number of rural, suburban and urban centers throughout the State. The population and employment densities were analyzed in each center and compared among a set of over two hundred such centers in the State. 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. By analyzing existing centers in Virginia, one characteristic that was present in many centers was a marked gradation of density from high to low as one went 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, described below:

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 the Institute of

Traffic Engineers' Context Sensitive Solutions street guidelines, also used as a primary source for these Guidelines. The Transect was first defined by the Congress for New Urbanism 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.

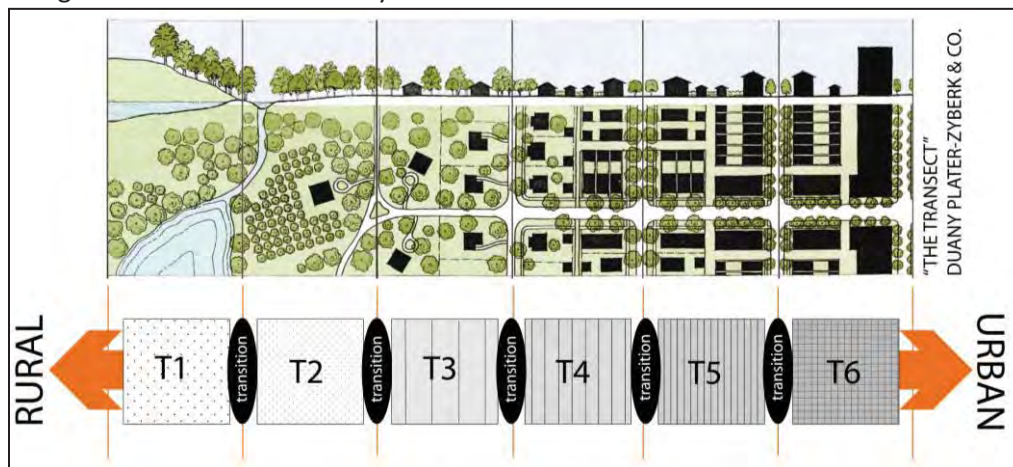


Figure 24 - The Transect as a standard way of defining density and intensity

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 in a center or along a corridor.



Figure 25 - T-Zones in a Multimodal Center in Downtown Norfolk - the blue line is the alignment of the light rail line and the station in the center is McArthur Square.

Transect zones have been used throughout these Guidelines, both to define density/intensity in Multimodal Centers, and to define levels of intensity among 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 zones is described in the table below. Density in terms of Activity Units for each zone was derived by analyzing real centers in Virginia and developing a spectrum of transect densities that reflected the range of urban to rural places in Virginia.

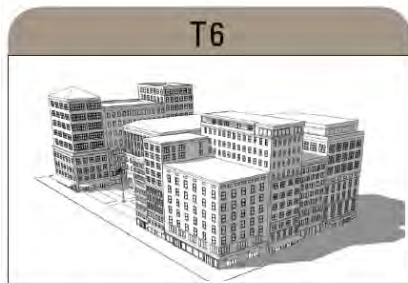
Table 1 - Transect Zone Intensities - calibrated based on analyzing existing centers in Virginia

TRANSECT ZONE INTENSITY			
Transect Zone	Activity Density (Jobs + people/acre)	Gross Development FAR (residential + non-residential)	Net Development FAR (residential + non-residential)
T1	1 or less	0.01 or less	0.02 or less
T2	1 to 10	0.01 to 0.15	0.02 to 0.23
T3	10 to 25	0.15 to 0.37	0.23 to 0.57
T4	25 to 60	0.37 to 0.9	0.57 to 1.38
T5	60 to 100	0.9 to 1.49	1.38 to 2.3
T6	100 or more	1.49 or more	2.3 or more

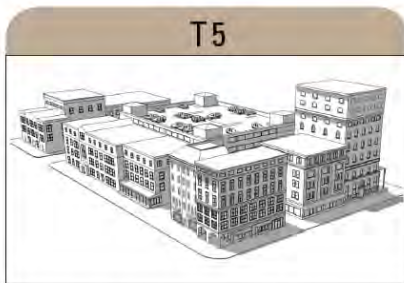
However, density does not occur in a uniform pattern in real places. When we average the density over an area of several city blocks, for example, it will usually include a range of densities and building heights, with some properties having multi story buildings adjacent to surface parking lots or vacant sites. 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. The typical blocks show the typical variety and range of building heights and parking layouts commensurate with each T-zone. The tables and illustrations below help to visualize the density of each T-zone and give some basic metrics of development scale for each zone:

Typical Blocks for each T-Zone

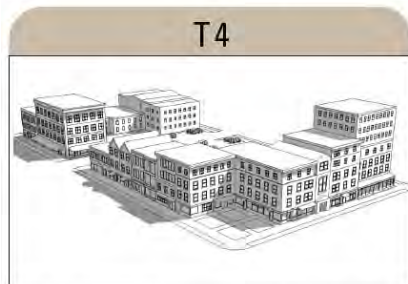
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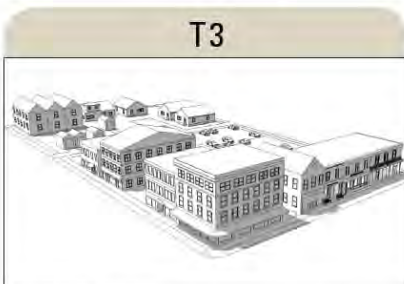
MIXED USE INTENSITY	High
ACTIVITY DENSITY (jobs + people/ac)	100+/ac
AVG. BLDG. HEIGHT	8+ Stories
TYPICAL MAX BLDG. HEIGHT	20+ Stories
TYPICAL NET FAR	2.30+
SUPPORTED TRANSIT TECHNOLOGY	LRT/Rail



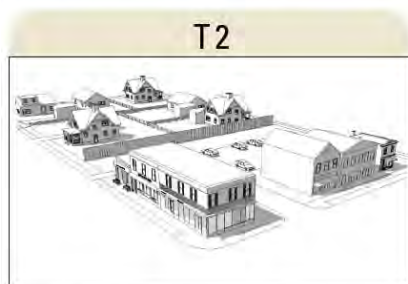
MIXED USE INTENSITY	High
ACTIVITY DENSITY (jobs + people/ac)	60-100/ac
AVG. BLDG. HEIGHT	6 Stories
TYPICAL MAX BLDG. HEIGHT	12 Stories
TYPICAL NET FAR	1.38-2.30
SUPPORTED TRANSIT TECHNOLOGY	BRT/LRT



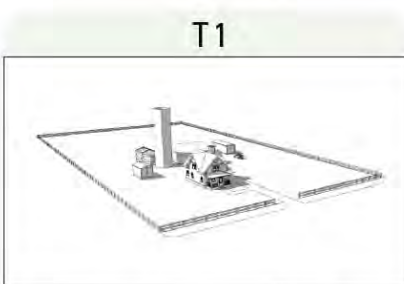
MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	25-60/ac
AVG. BLDG. HEIGHT	4 Stories
TYPICAL MAX BLDG. HEIGHT	8 Stories
TYPICAL NET FAR	0.57-1.38
SUPPORTED TRANSIT TECHNOLOGY	Express Bus



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



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



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 26 Diagrams of Typical Block Types by Transect Zone

The Basic Typology of Multimodal Centers

As described above, Multimodal Centers – although based on real centers in Virginia – are somewhat idealized representations of a real place. They are represented as two concentric circles 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 centers are composed.

The map below shows the activity density of the Lynchburg downtown, 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 a potential activity 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 fits well into a P-4 Multimodal Center type, which would have a T-4 inner ring and T-4 outer ring of densities, according to these Guidelines.



Figure 27 _Downtown Lynchburg with a 1-mile circle superimposed.

Based on an analysis of a wide variety of activity 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.

Table 2- Multimodal Center Types and Activity Density ranges

MULTIMODAL CENTER INTENSITY			
Center Type	Activity Density (Jobs + people/acre)	Gross Development FAR (residential + non-residential)	Net Development FAR (residential + non-residential)
P1 Rural or Village Center	2 or less	0.03 or less	0.05 or less
P2 Small Town or Suburban Center	2 to 6	0.03 to 0.10	0.05 to 0.15
P3 Medium Town or Suburban Center	6 to 14	0.10 to 0.21	0.15 to 0.3
P4 Large Town or Suburban Center	14 to 34	0.21 to 0.5	0.3 to 0.8
P5 Urban Center	34 to 70	0.5 to 1.0	0.8 to 1.6
P6 Urban Core	70 or more	1.0 or more	1.6 or more

The chart below shows these six Multimodal Center types, along with a seventh (Special Purpose Center) graphically as a spectrum of place types from dense urban to low density rural centers:

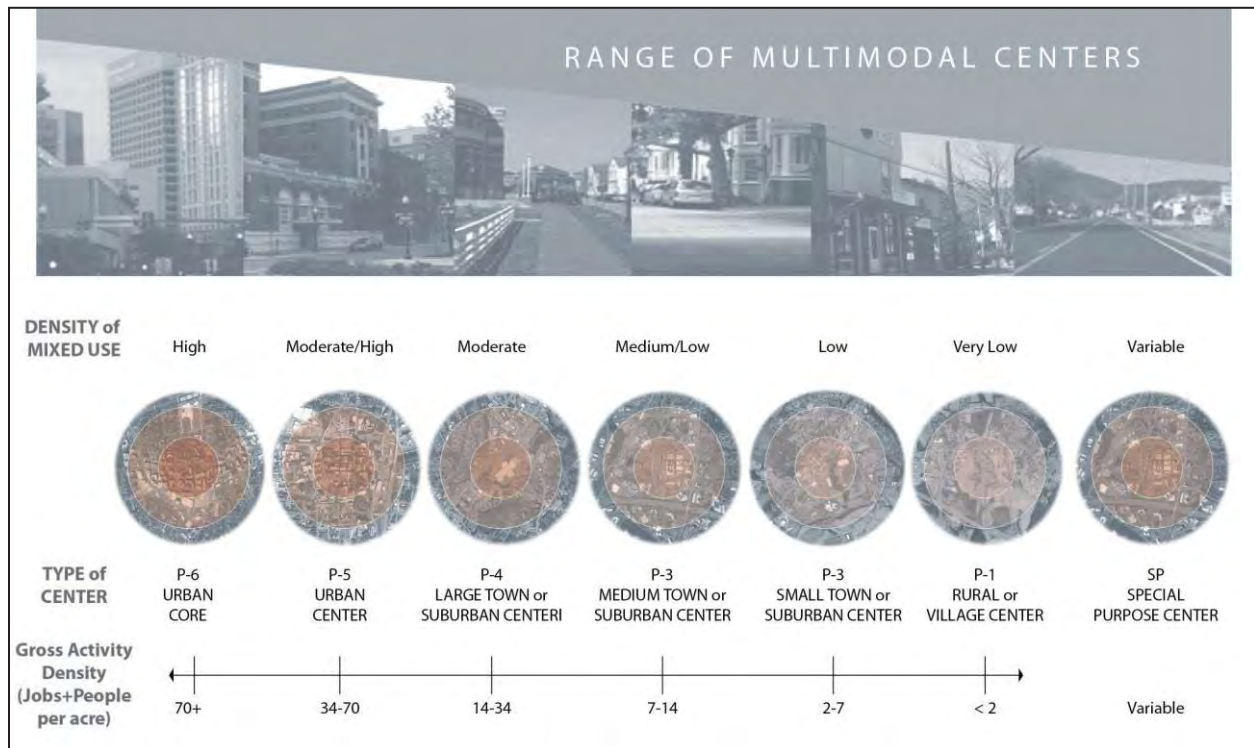


Figure 28 - Range of Multimodal Center types from urban to rural defined by Activity Density (number of jobs + people) in each center

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 generally balance of housing and employment. However, as noted below, a special tool in the Guidelines also allows the creation of customized center types with alternate proportions of housing and employment.

Creating Special Purpose Centers

Although the above set of Multimodal Center types is intended to give a comprehensive set of place types for planning purposes throughout Virginia, there may be a need to define a customized or special purpose center. For example, an employment rich center such as Innsbrook in Henrico County or Tyson’s corner in Fairfax County can be important destinations and regional activity centers 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 tool for creating customized, Special Purpose Multimodal Centers by using the spreadsheet matrix in the appendix.

The spreadsheet tool in the matrix 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:

Special Purpose Centers

Although the above set of Multimodal Center types is intended to give a comprehensive set of place types for planning purposes throughout Virginia, there may be a need to define a customized or special purpose center... For this reason, the Guidelines include a tool for creating customized, Special Purpose Multimodal Centers by using the spreadsheet matrix in the appendix.

Table 3 - Data for Special Purpose Multimodal Centers that can be customized using the Multimodal Center Tool in the Appendix

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

Comparing Multimodal Centers in Virginia

Using the basic typology of Multimodal centers defined above, a dataset of over 200 potential Multimodal Centers in Virginia were analyzed to compare their densities and how they would fit into this basic typology by density and intensity. The table below summarizes a handful of the centers

according to their Activity Density and how they fit into the Multimodal Center Typology used in these Guidelines:

Table 4 - Activity Densities of Potential Multimodal Centers throughout Virginia

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	
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	
Forest	484	115	0	599	1	P1 Rural or Village Center
Poquoson	6	577	96	583	1	
Great Falls	1	455	455	456	1	

From the above table, 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 centers. For example, the downtown centers of Norfolk and Richmond are similar in density to the urban metro station areas along the Rosslyn-Ballston corridor. However, other stops on the same metro line, such as Dunn Loring, have much lower activity densities that correspond to those of smaller towns such as Galax and Staunton. Many more observations can be made by comparing the activity densities among Virginia’s Multimodal Centers. 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 centers in Virginia.

Detailed Descriptions of the Multimodal Center Types

As described in Chapter 2, Multimodal Centers are the primary destinations and centers of activity within a region. The purpose of designating Multimodal Centers in a regional plan is twofold – first, to be able to focus public multimodal investments in the most efficient way possible; and second, to be able to identify the types of Multimodal Corridors that should be designated in each Multimodal Center. This last point – that the type of Multimodal Center directs the selection of a Multimodal Corridor – is an important foundational point for these Guidelines. In other words, answering the question of the larger context of a corridor (in which type of Multimodal Center type is the corridor located?) will help us answer the question of which Multimodal Corridor type should we use for a particular roadway.

The summary pages below 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 Center. This is an idealized diagram and is not intended to represent any particular real example of a place. Its purpose, instead, is to give a basic design framework for a prototypical arrangement of corridors for that Center type. 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.

“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.”

For example, a P6 Center (Urban Core) has an arrangement of Multimodal Corridors that shows a crossroads of two Transit Boulevards at the centroid, with Avenues spaced generally ¼ mile apart. This is based on established roadway network design that generally calls for arterials and collectors to be spaced ¼ mile apart in relatively dense urban areas. For the purpose of these Guidelines, the Transit Boulevards function as arterials and the Avenues as collectors to efficiently distribute trips on the network. However, unlike conventional roadway network design, the design of Multimodal Corridors and Centers in these Guidelines accommodate all modes, and ultimately have greater potential capacity (in terms of total number of trips by all modes) than a conventional auto-only roadway network.

Following are the diagrams and metrics of each of the prototype Multimodal Center Types

MULTIMODAL CENTER TYPE URBAN CORE



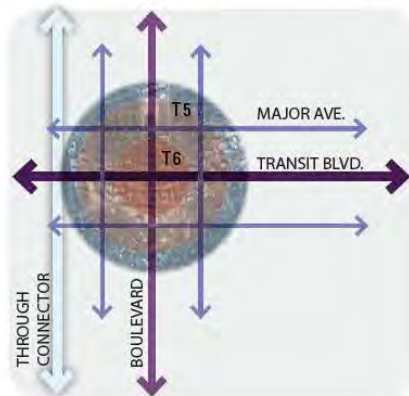
Typical Street view
(Ballston, Virginia)

Typical P6 Center (Ballston, Virginia)



T6		T5	
MIXED USE INTENSITY	High	MIXED USE INTENSITY	High
ACTIVITY DENSITY (jobs + people/ac)	100+/ac	ACTIVITY DENSITY (jobs + people/ac)	60 - 100/ac
AVG. BLDG. HEIGHT	8+ Stories	AVG. BLDG. HEIGHT	6 Stories
TYPICAL MAX BLDG. HEIGHT	20+ Stories	TYPICAL MAX BLDG. HEIGHT	12 Stories
TYPICAL NET FAR	2.30+	TYPICAL NET FAR	1.38 - 2.30
SUPPORTED TRANSIT TECHNOLOGY	LRT/Rail	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

MULTIMODAL CENTER TYPE URBAN CENTER



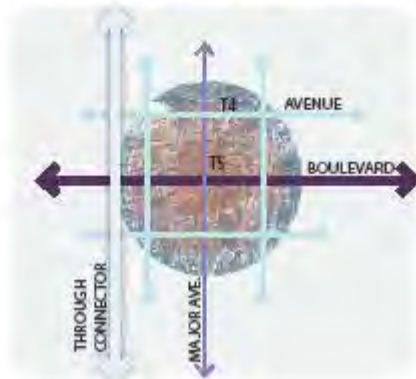
Typical Street view
(Roanoke, Virginia)

Typical P5 Center (Roanoke, Virginia)



T5		T4	
MIXED USE INTENSITY	High	MIXED USE INTENSITY	Moderate
ACTIVITY DENSITY (jobs + people/ac)	60-100/ac	ACTIVITY DENSITY (jobs + people/ac)	25-60/ac
AVG. BLDG. HEIGHT	6 Stories	AVG. BLDG. HEIGHT	4 Stories
TYPICAL MAX BLDG. HEIGHT	12 Stories	TYPICAL MAX BLDG. HEIGHT	8 Stories
TYPICAL NET FAR	1.28-2.30	TYPICAL NET FAR	0.57-1.38
SUPPORTED TRANSIT TECHNOLOGY	BRT/LRT	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

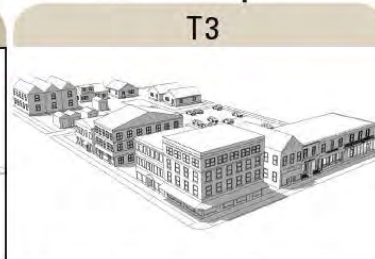
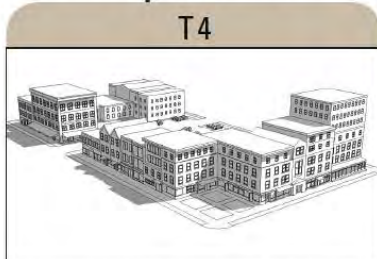
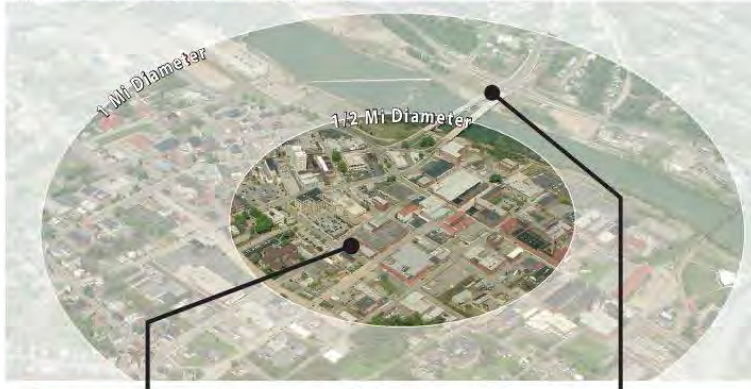
MULTIMODAL CENTER TYPE LARGE TOWN/SUBURBAN CENTER

P4



Typical Street view
(Danville, Virginia)

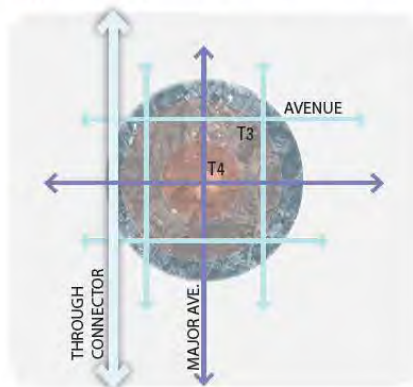
Typical P4 Center (Danville, Virginia)



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

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

Typical Arrangement of MultiModal Corridors (P4 Large Town/Suburban Center)



P4 LARGE TOWN/SUBURBAN CENTER SUMMARY TABLE

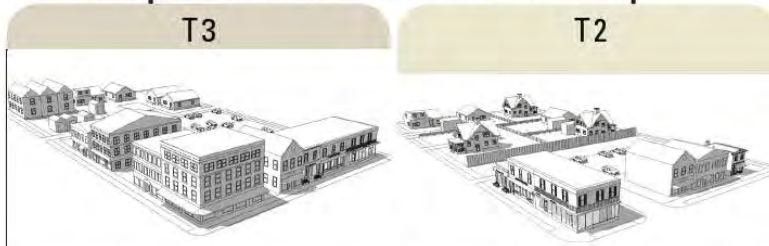
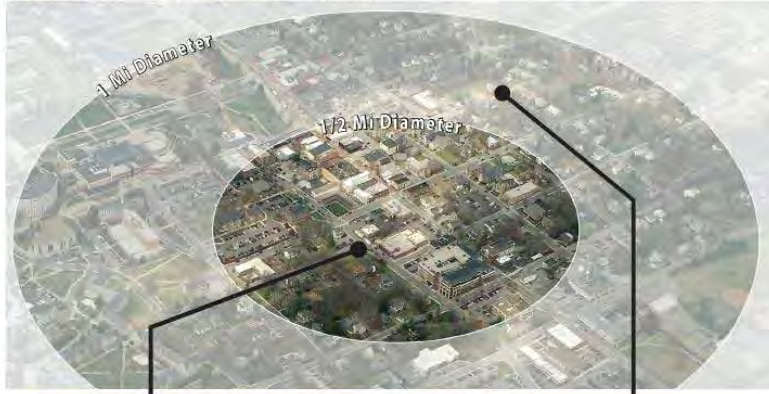
ACTIVITY DENSITY (jobs + people/acre)	14 to 34
GROSS DEVELOPMENT FAR (residential + non-residential)	0.2 to 0.5
NET DEVELOPMENT FAR (residential + non-residential)	0.3 to 0.8
SUPPORTED TRANSIT TECHNOLOGY	Express Bus
Height of Buildings	3 story average 6 story typical maximum

MULTIMODAL CENTER TYPE MEDIUM TOWN/SUBURBAN CENTER



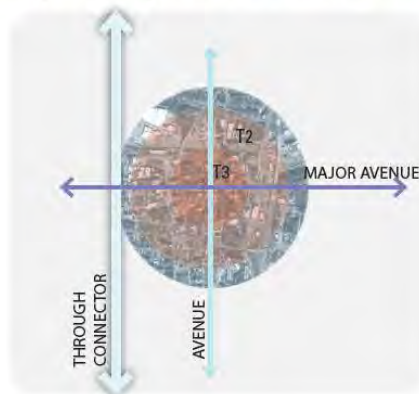
Typical Street view
(Blacksburg, Virginia)

Typical P3 Center (Blacksburg, Virginia)



MIXED USE INTENSITY	Medium/Low	MIXED USE INTENSITY	Medium/Low
ACTIVITY DENSITY (jobs + people/ac)	10-25/ac	ACTIVITY DENSITY (jobs + people/ac)	1-10/ac
AVG. BLDG. HEIGHT	3 Stories	AVG. BLDG. HEIGHT	1.5 Stories
TYPICAL MAX BLDG. HEIGHT	5 Stories	TYPICAL MAX BLDG. HEIGHT	3 Stories
TYPICAL NET FAR	0.23-0.57	TYPICAL NET FAR	0.02-0.23
SUPPORTED TRANSIT TECHNOLOGY	Fixed Route Bus	SUPPORTED TRANSIT TECHNOLOGY	Demand Response

Typical 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
Height of Buildings	2 story average 4 story typical maximum

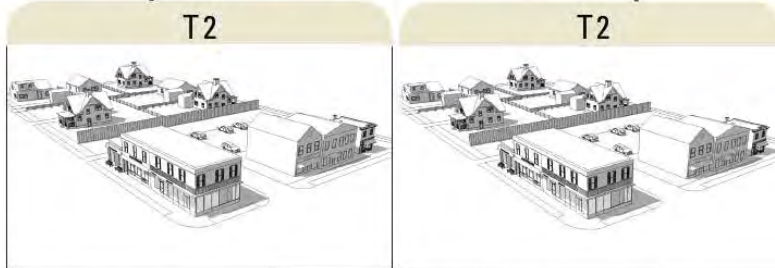
MULTIMODAL CENTER TYPE SMALL TOWN/SUBURBAN CENTER

P2



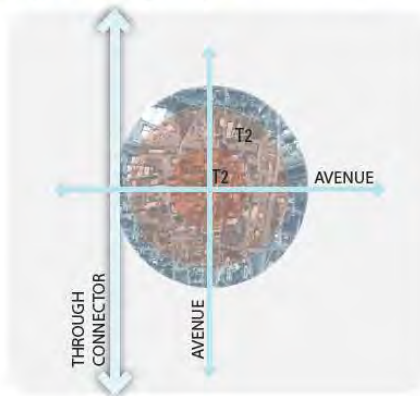
Typical Street view
(Stanardsville, Virginia)

Typical P2 Center (Stanardsville, Virginia)



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

MULTIMODAL CENTER TYPE RURAL/VILLAGE CENTER

P1



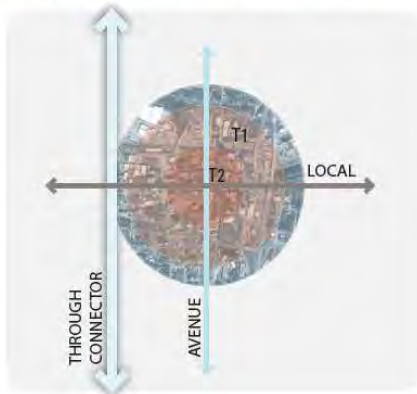
Typical Street view
(Eastville, Virginia)

Typical P1 Center (Eastville, Virginia)



T2		T1	
MIXED USE INTENSITY	Low	MIXED USE INTENSITY	Very Low
ACTIVITY DENSITY (jobs + people/ac)	1-10/ac	ACTIVITY DENSITY (jobs + people/ac)	0-1/ac
AVG. BLDG. HEIGHT	1.5 Stories	AVG. BLDG. HEIGHT	1 Stories
TYPICAL MAX BLDG. HEIGHT	3 Stories	TYPICAL MAX BLDG. HEIGHT	2 Stories
TYPICAL NET FAR	0.02-0.23	TYPICAL NET FAR	0-0.02
SUPPORTED TRANSIT TECHNOLOGY	Demand Response	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

MULTIMODAL CENTERS AND TOD

The previous chapter described how the concept of Multimodal Centers expanded upon the traditional idea of Transit Oriented Development (TOD). This chapter describes more specifically how TOD nodes are overlaid onto Multimodal Centers and how the basic metrics of Multimodal Centers are modified when they are served by high capacity transit.

Traditionally, a TOD center has been defined as a compact walkable center of moderate to high density and mixed uses that is centered on a transit stop. Typically TODs have been scaled as a ¼ to a ½ mile radius around the transit station. As noted in the above chapter though, the concept of Multimodal Centers is much broader than the concept of TODs, although it includes many of the same characteristics of density, walkability and general scale.

What happens to a Multimodal Center when it has a transit stop at its center? From analyzing a wide variety of centers, it is apparent that the answer to this question depends to a large part on the type of transit that is serving the center. 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 having it served by a bus stop. However, with higher capacity transit service such as light or heavy rail transit, Multimodal Centers tend to have a noticeable jump in density at the very core of the 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 a 1/8 mile radius TOD Node overlaid on top of those centers. The illustration below shows how a TOD node is overlaid onto the basic geometry of a Multimodal Center:

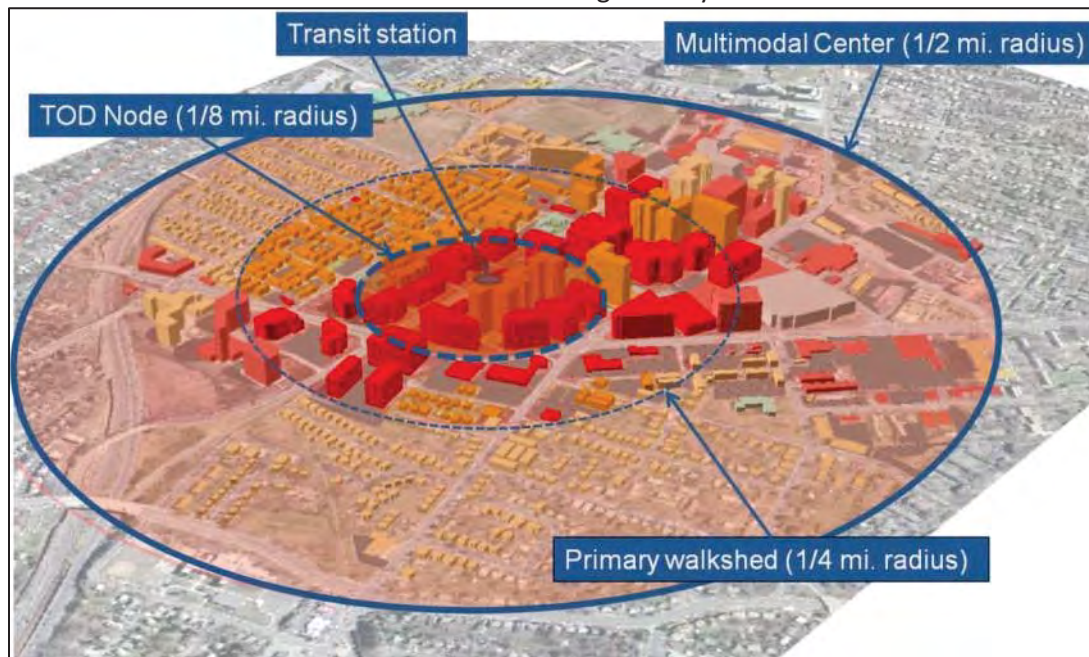


Figure 29 – Illustration of the relationship of walksheds and a TOD node in a Multimodal Center

As shown in the above diagram, the inner 1/8 mile radius ring of a Multimodal Center with high capacity transit forms a TOD node with correspondingly higher densities than the surrounding 1/4 mile radius ring. In the Corridor Typology Matrix in the Appendix of this report, there are 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 doesn't change, there is a reallocation of density within the inner 1/8 mile radius core of the Center when there is a TOD Node. It should be noted that TOD nodes are assumed only for the higher intensity centers – P-3 through P-6. The charts below (from the Appendix) show how these densities are allocated in Multimodal Centers P-3 through P-6:

Table 5 - Densities and Intensities within the 1/8 mile radius TOD Node

TRANSIT-ORIENTED DEVELOPMENT NODE DENSITIES (Multimodal Centers P3 and Above)								
INSIDE TOD NODE (1/8 mile radius circle)								
Multimodal Center Types	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 = (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		
P3 Medium Town or Suburban Center	13.3	27.5	0.20	0.41	0.30	0.63	4	7
P4 Large Town or Suburban Center	27.5	67.5	0.41	1.01	0.63	1.55	7	12
P5 Urban Center	67.5	140.0	1.01	2.09	1.55	3.21	9	18
P6 Urban Core	140.0	-	2.09	-	3.21	-	13	28

Table 6 - Densities and Intensities outside the 1/8 mile radius TOD Node

TRANSIT-ORIENTED DEVELOPMENT NODE DENSITIES (Multimodal Centers P3 and Above)								
OUTSIDE TOD NODE (1/8 mile to 1/4 radius ring)								
Multimodal Center Types	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 = (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		
P3 Medium Town or Suburban Center	4.4	9.2	0.07	0.14	0.10	0.21	3	5
P4 Large Town or Suburban Center	9.2	22.5	0.14	0.34	0.21	0.52	4	8
P5 Urban Center	22.5	46.7	0.34	0.70	0.52	1.07	6	12
P6 Urban Core	46.7	-	0.70	-	1.07	-	9	19

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 densities and activity levels for each type of TOD/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 (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 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, in these Guidelines there is at least a standardized approach to defining transit supportive densities in Multimodal Centers correlated to different types of transit technologies.

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 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 rail transit (i.e. metro stops) and Light Rail Transit (Norfolk’s Tide stations). The resulting transit supportive activity densities for both the T-1 through T-6 T-zones and the P-1 through P-6 Multimodal Center types are listed in the tables below:

Table 7 - Supported Transit Technologies by Transect Zone

TRANSECT ZONE INTENSITY		
Transect Zone	Activity Density (Jobs + people/acre)	Supported Transit Technology
T1	1 or less	Demand Response
T2	1 to 10	Demand Response
T3	10 to 25	Fixed Route Bus
T4	25 to 60	Express Bus
T5	60 to 100	BRT/LRT
T6	100 or more	LRT/Rail

Table 8 - Supported Transit Technologies by Multimodal Center Type

MULTIMODAL CENTER INTENSITY		
Center Type	Activity Density (Jobs + people/acre)	Supported Transit Technology
P1 Rural or Village Center	2.13 or less	Demand Response
P2 Small Town or Suburban Center	2.13 to 6.63	Demand Response
P3 Medium Town or Suburban Center	6.63 to 13.75	Fixed Route Bus
P4 Large Town or Suburban Center	13.75 to 33.75	Express Bus
P5 Urban Center	33.75 to 70.0	BRT/LRT
P6 Urban Core	70.0 or more	LRT/Rail

Transit Corridor planning using the Multimodal Center types, TODs and 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 systems plan. The steps involved in planning for TOD in the context of a transit corridor or systems plan will vary from project to project. However, a basic 6 step process for using the Multimodal Center and TOD typology in this planning process is outlined below:

Step 1- Identify the destinations (activity centers) to be served by transit and the corridors that will serve each center.

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

Step 3 – Identify the potential station areas based on the existing or proposed centers of activity, 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 buildout of the center

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.

It is important to keep in mind that not all stations along a transit corridor will support a dense TOD. Even a very successful transit line, such as the Metro 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. The image below shows the density of jobs plus population (called 24-hour population in the chart) within the orange line metro corridor in 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 centers, such as those west of Ballston, tend to have relatively low densities in both the first and second quarter-mile rings.

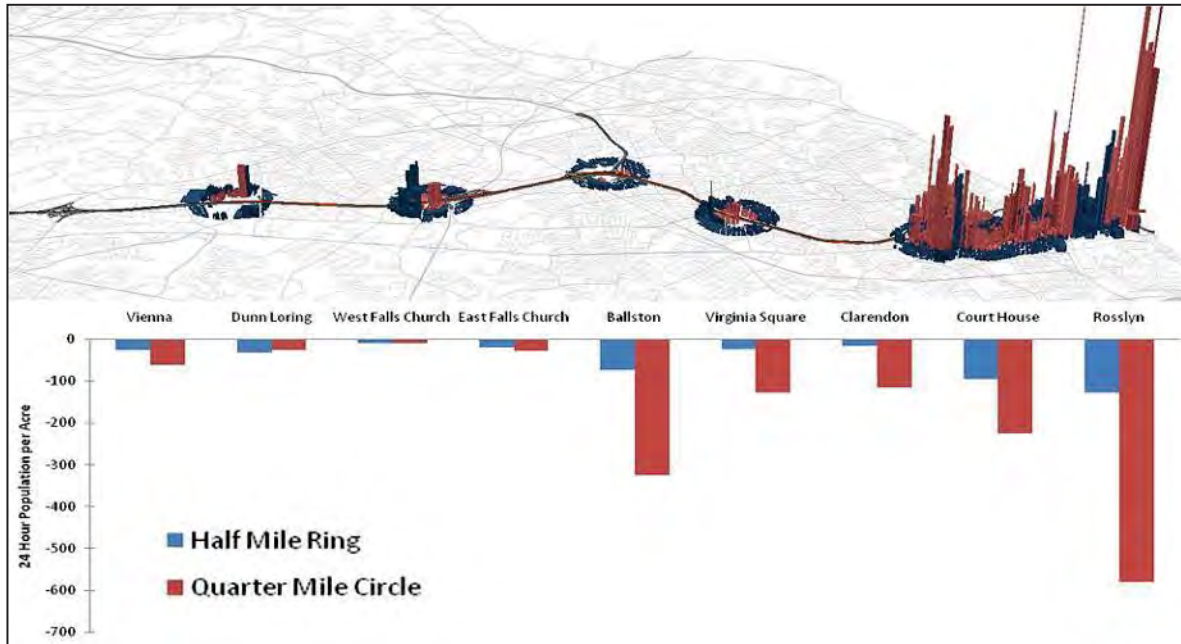


Figure 30 - Analysis of the densities on the orange line stations in Virginia - Note that stations in the Rosslyn to Ballston corridor show significant density differential between the first and second quarter mile rings

In addition, as noted in the Lynchburg example above, 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 centers and TODs. As shown in the map view of the same area below, 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 centers when the station spacing is less than 1 mile.

It is important to keep in mind that not all stations along a transit corridor will support a dense TOD. Even a very successful transit line, such as the Metro 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.

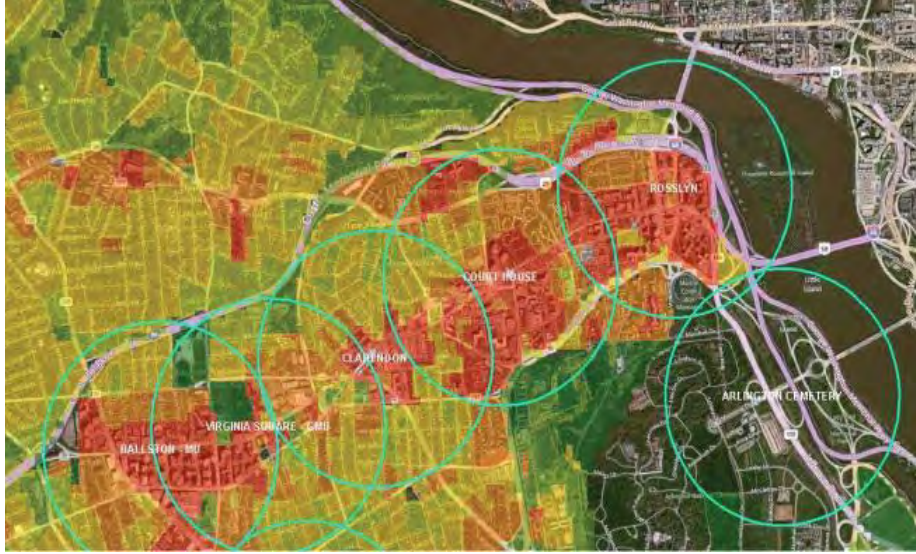


Figure 31 – Map of densities around transit stops in the Rosslyn/Ballston corridor

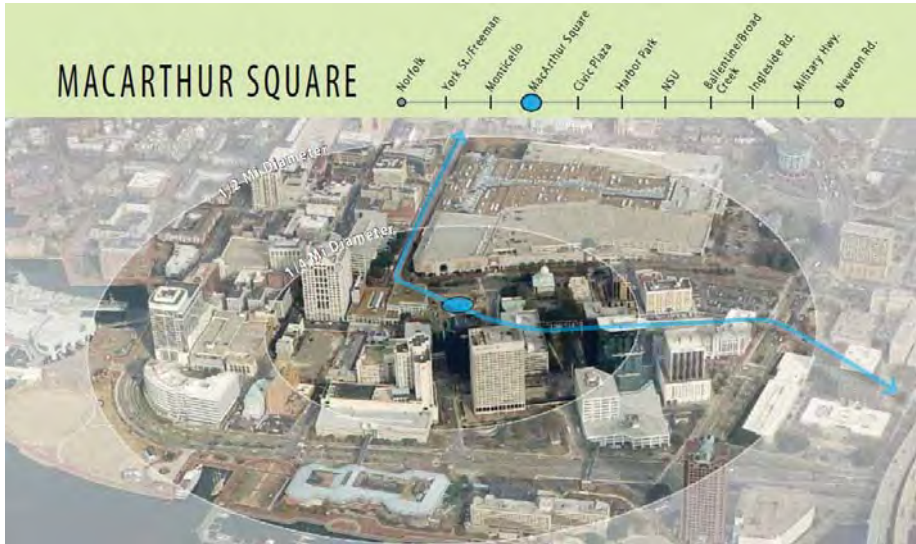


Figure 32 - MacArthur Square – a stop on the Norfolk light rail system shows many of the typical characteristics of a TOD node within a P-5 Multimodal Center

PLANNING & DESIGNING MULTIMODAL CORRIDORS

Chapter 5 –Planning and Designing Multimodal Corridors

KEY ELEMENTS OF MULTIMODAL CORRIDOR PLANNING

The previous chapters described how multimodal planning transitions from the regional scale to the scale of multimodal centers. They described a series of multimodal center types based on the intensity of activities (jobs + people) in each. As shown above, a series of diagrams described the ideal or “prototype” arrangement of multimodal corridors in each center. This chapter describes those multimodal corridor types that are the building blocks of each multimodal center.

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

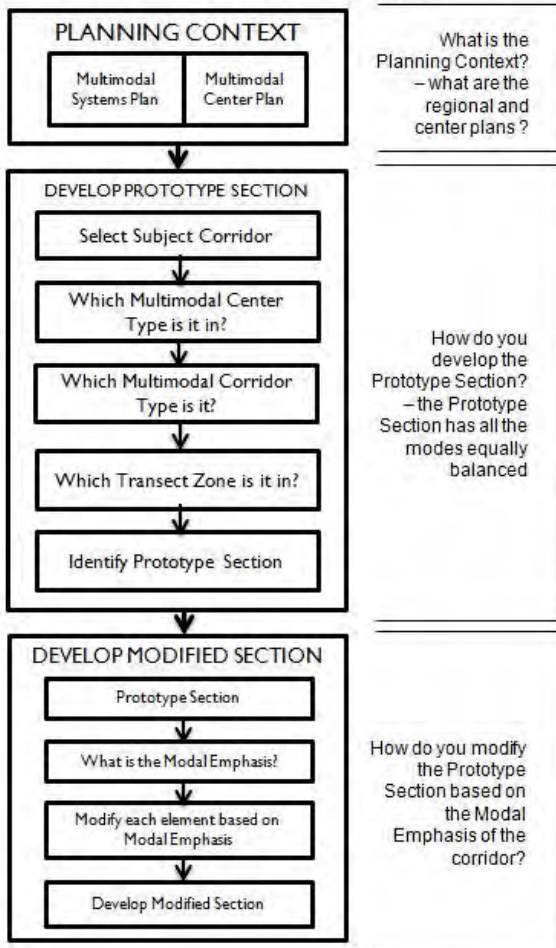
This chapter introduces a typology of multimodal corridors that is sensitive to the surrounding activity density and context, and customized to the needs of the particular travel modes of emphasis. This chapter explains how to design and retrofit corridors to best fulfill their multimodal function within the larger regional multimodal transportation system. The flowchart below 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 33 - Monticello Avenue in Norfolk - before and after views show its transformation into a Transit Boulevard

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

Multimodal Corridor Design



This chapter explains how to design and retrofit corridors to best fulfill their multimodal function within the larger regional multimodal transportation system. The flowchart below 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 34 - The process for designing Multimodal Corridors

Several sections of this chapter refer to the Multimodal Corridor Matrix, shown at the end of this chapter and provided in larger form in the Appendix. This Matrix provides customized design elements for each type of corridor, as explained in the following sections of this chapter. The Appendix also includes the Multimodal Corridor Matrix Annotations and Documentation supplement, which thoroughly documents the engineering resources used to define the dimensions for each corridor design element.

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 and centers in the region. For the purpose of these Guidelines, these kinds of corridors are called Through Corridors. Other corridors are more slow speed and used to access local businesses, residences and activities within a destination. If they are in a Multimodal Center, they are called Placemaking Corridors in these Guidelines.

This fundamental distinction – between Through Corridors and Placemaking Corridors is a key concept in these Guidelines. All corridors within a Multimodal Center are considered Placemaking Corridors; these corridors facilitate movement within a center. Corridors that travel between and connect centers are considered Through Corridors. Through Corridors and Placemaking Corridors work together in a region by getting people quickly from center to center and getting them more slowly and safely to activities within a center. Through Corridors may transition to Placemaking Corridors as they enter a Multimodal Center. Ideally, though, they are located at the edge of centers without penetrating the primary or secondary walkshed of a Multimodal Center, remaining as a higher-speed facility to which Placemaking Corridors provide access from the core of the Multimodal Center.

The basic relationship between Through and Placemaking Corridors is described in the following illustration:

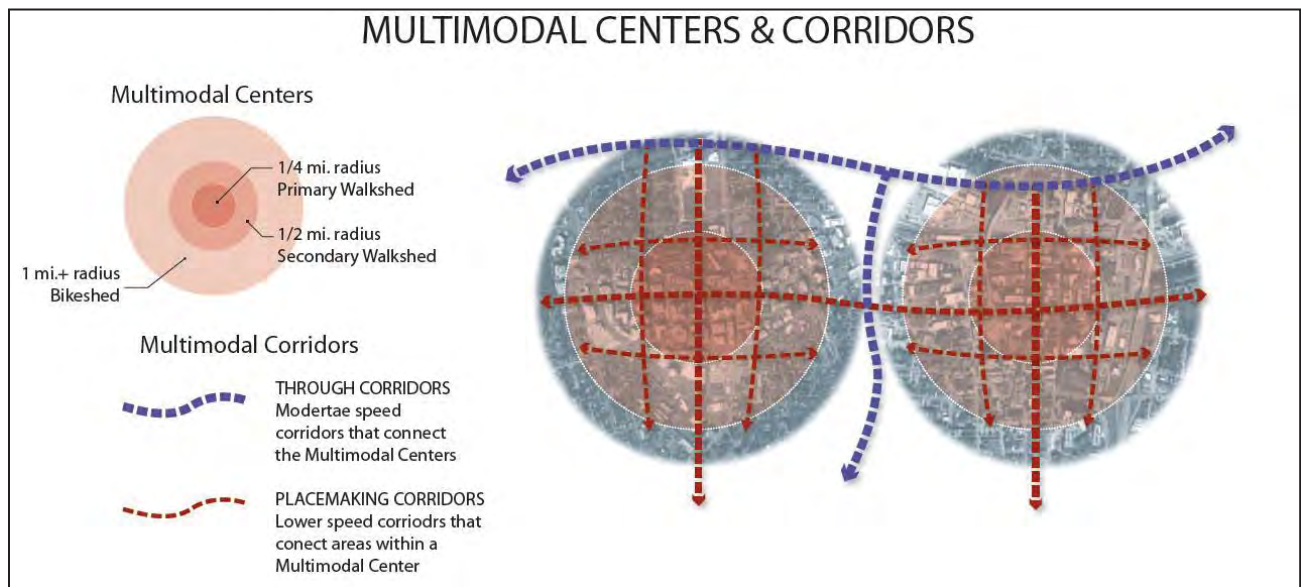


Figure 35 - Multimodal Through and Placemaking Corridors - The diagram distinguishes Placemaking Corridors from Mobility Primary Through Corridors – the two general categories of multimodal corridors that together comprise a true multimodal transportation system in a region

THE TYPES OF 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 categorized into five categories, 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 local used in the ITE/CNU Walkable Urban Thoroughfare guidelines document, but with two additional corridor types added (transit Boulevards and Major Avenues) for additional flexibility in designing corridors and centers. Thus the five Placemaking Corridor types used in these Guidelines are as follows:

Table 9 – List of Multimodal Placemaking Corridors

Multimodal Placemaking Corridors	
1.	Transit Boulevard
2.	Boulevard
3.	Major Avenue
4.	Avenue
5.	Local

This fundamental distinction – between Through Corridors and Placemaking Corridors is a key concept in these Guidelines. All corridors within a Multimodal Center are considered Placemaking Corridors; these corridors facilitate movement within a center. Corridors that travel between and connect centers are considered Through Corridors. Through Corridors and Placemaking Corridors work together in a region by getting people quickly from center to center and getting them more slowly and safely to activities within a center.

Relationship to Functional Classes

Streets that provide direct access to destinations via driveways, curb cuts, and frequent intersections often cannot provide a high level of mobility. Conversely, high capacity roads with heavy volumes and higher speeds have less frequent access points to keep traffic moving. Within roadway design and engineering circles, this concept is known as functional classification. Functional classification is also a relevant concept for multimodal corridor design, although with the accommodation of multiple modes, the translation of multimodal corridor types to functional classes is less precise and more general. These five categories of Placemaking Corridors are slightly different in nomenclature from the functional classification systems used by VDOT and the Federal Highway Administration. However, the concept of functional classification is similar. The Corridor Matrix Annotations Document in the Technical Appendix has a more detailed discussion on VDOT Functional Classification. The following table shows the general translation of multimodal corridor types to functional classes of roadway:

Table 10 – Comparison of VDOT Functional Classes to Multimodal Corridor Types

VDOT Functional Class	Interstate, Freeway or Expressway	Urban Other Principal Arterial	Urban Minor Arterial	Urban Collector	Local Street
Multi Modal Corridor Type	Through Corridor				
		Transit Boulevard			
		Boulevard			
			Major Avenue		
			Avenue		
					Local Street

Description of the Typology

Following are general descriptions of each of the five Placemaking Corridor types:

Transit Boulevard

The Transit Boulevard is the highest capacity and most transit supportive 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.



Figure 36 – Plume Street in Norfolk – an example of a Transit Boulevard

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 categorized into five categories, 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 local used in the ITE/CNU Walkable Urban Thoroughfare guidliens document, but with two additional corridor types added (transit Boulevards and Major Avenues) for additional flexibility in designing corridors and centers.

Boulevard

A boulevard is the street type of highest multimodal capacity that accommodates multiple motorized and non-motorized modes. Boulevards may have higher speeds than major avenues, avenues, and local streets, and typically have four to six lanes of traffic but may grow to eight in dense suburban centers such as Tyson's corner. They are intended to move traffic efficiently at a high level of service in urban environments and are used for longer trips. Depending on the T zone they are located in, boulevards may have a median separation and/or landscaped tree lawns or street trees along them. They will also typically have wide sidewalks and landscaped amenity zones.



Figure 37 - Columbia Pike in Arlington County - an example of a Boulevard

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 have the highest priority 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 Through Corridors. Autos and buses on Major Avenues travel at slow speeds because pedestrian crossings and on-road bicyclists are frequent.



Figure 38 –Crawford Street in Portsmouth VA – an example of a Major Avenue

Avenue

Avenues serve to connect local streets and Major Avenues to boulevards. While having less destinations than Major Avenues, pedestrian and bicycle activity is a priority, as avenues serve as critical links in the non-motorized network. Avenues are low to moderate speed roadways that facilitate shorter trips, but still contain a fair amount of destinations. Avenues are sometimes two lanes with on street parking, do not exceed 4 lanes, and provide access to businesses and residential areas as a primary function



Figure 39 - Henley Avenue in Winchester, VA - an example of an Avenue

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 curb parking.



Figure 40 - Page Street in Charlottesville, VA - an example of a Local Street

CORRIDOR INTENSITY ZONES

Just as the Transect “T” 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 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. Both corridors may function similarly, i.e. to carry purely local traffic within a neighborhood. However, the local street in a Rural Center may have very low density development, wide setbacks, and correspondingly rural design details in the corridor, while the local street in an Urban Center may have high density development, narrow setbacks and more urban design details. Therefore, the six basic corridor types are all modified by their Transect or “T” zone.

The purpose of applying transect zones to the 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

Not all intensity levels exist in all corridor types. For example, the intensity levels for a boulevard range from T-6 to T-3, since lower intensity boulevards are not practical. In the less dense activity centers (P-2 and 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 corridor within the activity center and will provide the facilities for multimodal transportation scaled to their less dense context.

The Multimodal and Public Space Design Guidelines are designed to address urban and rural areas of many scales and intensities. A Rural 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 watershed of the activity 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 village) context. In this example, in particular, the transect zones differentiate the intensity levels of similar 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.

The table below specifies which the Multimodal Corridor types that exist within each Transect Zone.

Table 11 - Relation of Transect Zones to Multimodal Corridor Types

	Transect Zone (Intensity Zone)					
	T-6 High Intensity	T-5 Medium High Intensity	T-4 Medium Intensity	T-3 Medium Low Intensity	T-2 Low Intensity	T-1 Very Low Intensity
Multimodal Corridor Types	Transit Boulevard					
	Boulevard					
	Major Avenue					
	Avenue					
	Local Street					
	Mobility Primary Through Street					

USING CORRIDOR ELEMENTS

The most important step in designing multimodal corridors is to understand the typical Corridor Elements that make up a multimodal corridor. The illustration below shows the typology of Corridor Elements used in these Guidelines. Each Corridor Element is assigned a letter and is referenced in a master Corridor Typology Matrix in the Appendix. The Corridor Typology Matrix lists the recommendations for the design and the size of each Corridor Element according to the type of multimodal corridor type. Also shown in the illustration below 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.

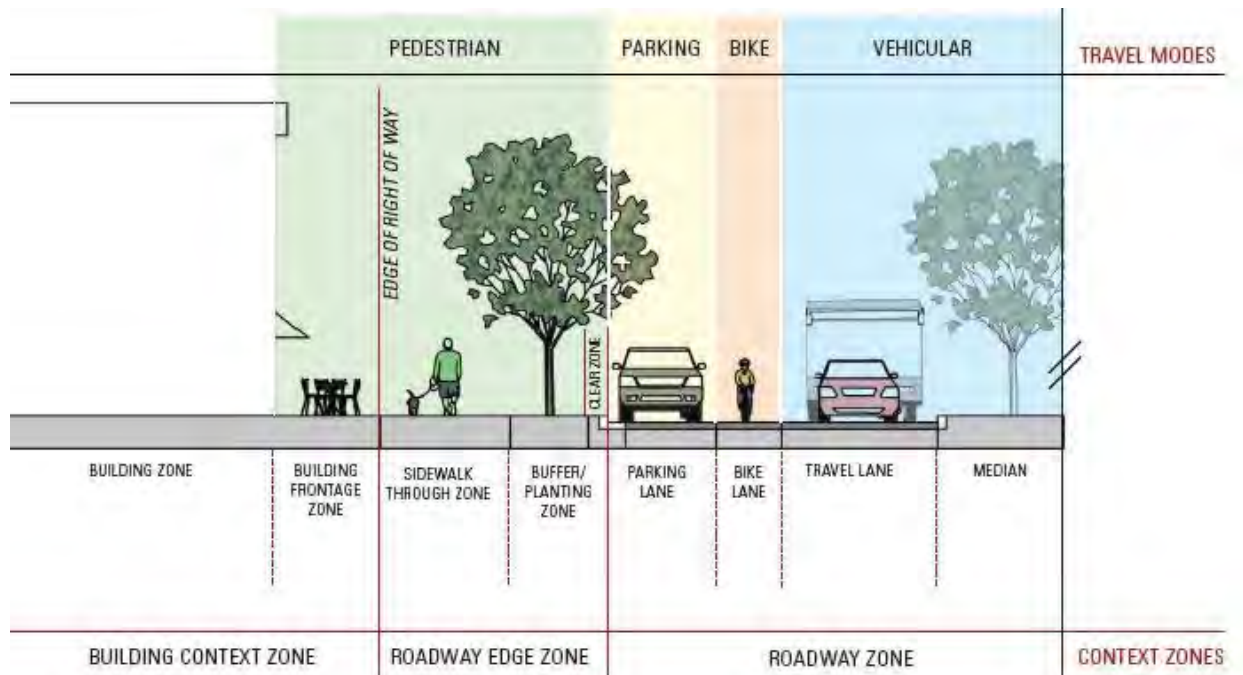









Figure 41- Diagram of Corridor Elements and Travel Modes

PLANNING FOR MODAL EMPHASIS

One of the most important features of these Guidelines is described below – 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 doesn't mean that other travel modes are excluded – other modes should still be 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. For the purposes of these Guidelines, the modes that will be used to define Modal Emphasis on a corridor are as follows:

Table 12 - List of Modal Emphases and Typical Corridor Elements used in These Guidelines

MODAL EMPHASIS		
	MODE (1)	TYPICAL ELEMENTS EMPHASIZED (2)
	Auto	• Travel Lane Element (3)
	Pedestrian	• Building Frontage Element • Sidewalk Through Element • Amenity Element
	Bicycle	• Bicycle Element
	Transit (4)	• Amenity Element • Travel Lane Element
	Freight (5)	• Travel Lane Element • Median Element
	Green (6)	• Amenity Element • Median Element
	Parking (7)	• Parking Element

NOTES







1. Note that "modes" may not necessarily be travel modes - rather a mode is any component that needs to be physically accommodated within the right of way
2. Refer to Corridor Zone Diagram for Corridor Elements - note table below explains further how Corridor Elements are used
3. Automobile mode is assumed on all Multimodal Corridors unless otherwise noted
4. Transit modal emphasis assumes conventional bus technology. Other technologies are accommodated in Transit Boulevards with dedicated transit right of ways
5. Freight mode is generally not emphasized on Placemaking corridors - only on Through corridors

6. "Green" is not a mode but a consideration dealing with stormwater infiltration and maximizing the planting/green potential of a street
7. Parking is not a travel mode per se is a consideration that may be emphasized

How Corridor Elements are used in Modal Emphasis

The table below 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 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 a Pedestrian Modal Emphasis, the road designer would look up the primary, secondary and contributing corridor elements for the Pedestrian Modal Emphasis category from the table. Then – according to the values in the table for using optimum or minimum standards – the designer would choose the appropriate size for each corridor element from the Corridor Typology Matrix in the Appendix.

Table 13 - Using Corridor Elements in Corridor Design According to Modal Emphasis

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 A- Buidling Frontage 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
	Freight	F-Travel Lane Element	G-Median Element	N/A	A-Building Frontage Element B-Sidewalk Through Element C-Amenity Element D-Parking Element E-Bicycle Element
	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

Using Modal Emphasis to Choose Design Standards

The table below shows specifically how to choose a design standard from the look up table in the Corridor Typology Matrix. It describes which standard to choose – optimum, 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 elements that are most important for the key travel modes in the corridor.

Table 14- Using Modal Emphasis to Choose Design Standards

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

With the above table, the designer of a multimodal corridor can choose the specific standard to use for each Corridor Element based on the most important travel modes for the corridor. The illustration below shows an example of how to choose the primary, secondary, contributing and non-contributing elements in the corridor based on a Pedestrian Modal Emphasis:

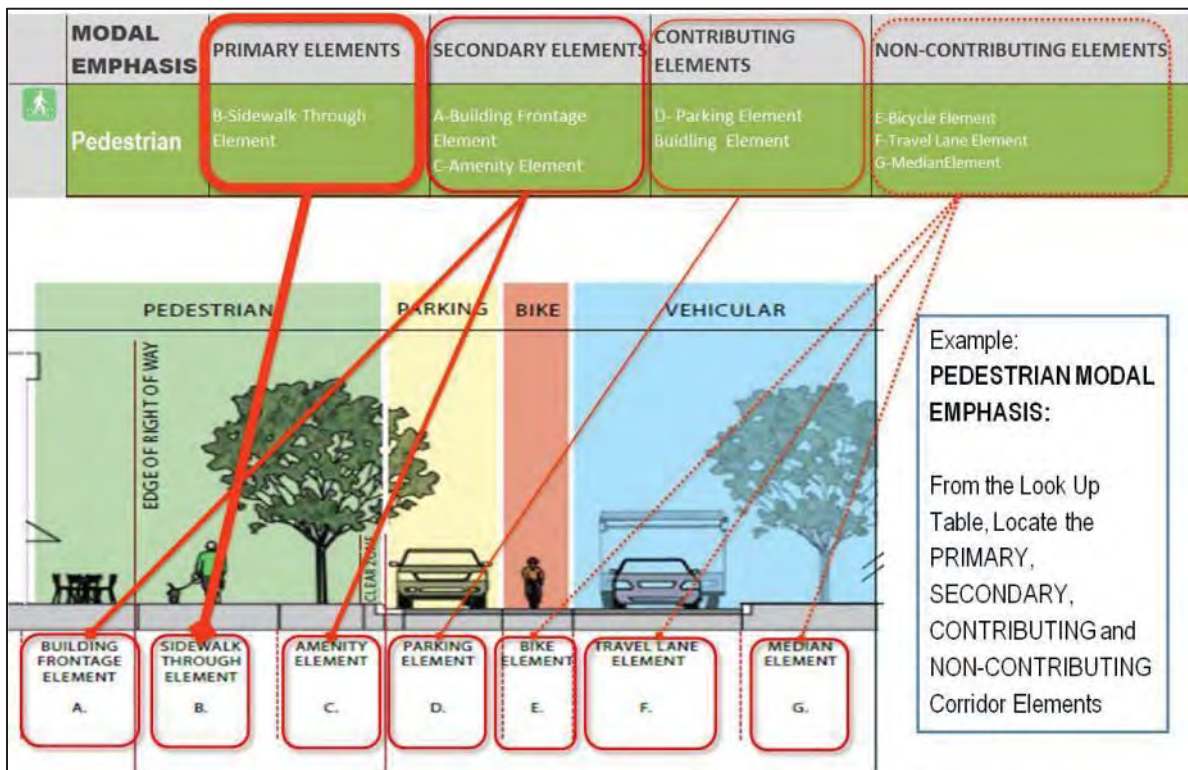


Figure 42 - Example of Choosing Corridor Elements for a Pedestrian Modal Emphasis

THE CORRIDOR TYPOLOGY MATRIX

The above sections describe how Corridor Elements form the basic building blocks of a multimodal corridor – as well as how these Corridor Elements are selected using the process of Modal Emphasis. This section describes the basic design standards for each Corridor Element as organized in a master table - the Corridor Typology Matrix.

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

Optimal and Minimum Standards

The design standards in the Corridor Typology 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 Element as described in the section above. This range allows the designer to select a design standard within the range depending on whether that element needs to be optimized, minimized or somewhere in between.

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 the Institute of Transportation Engineers (ITE) and the Congress for the New Urbanism (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.
2. *The Road Design Manual*, published by the 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 and specifications for road design, and is used in conjunction with AASHTO publications.

Optimal and Minimum Standards

The design standards in the Corridor Typology 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 Element as described in the section above. This range allows the designer to select a design standard within the range depending on whether that element needs to be optimized, minimized or somewhere in between.

The optimal values in most cases were derived from the ITE/CNU *“Designing Walkable Urban Thoroughfares: A Context Sensitive Approach”* document. The minimum standards in all cases derive from VDOT minimum standards, generally as defined in the Road Design Manual.

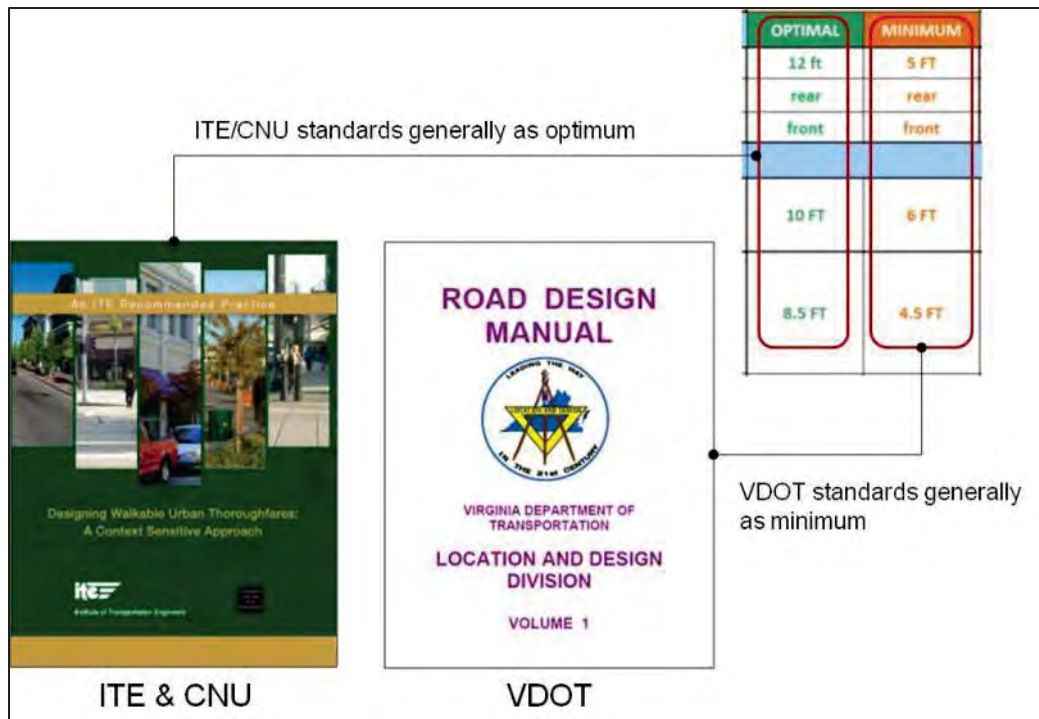


Figure 43 – Illustration of Sources of Optimal and Minimal Design Standards

The Corridor Typology Matrix and Matrix Annotations Document

The Corridor Typology Matrix is given in its full version in the Appendix to this document. In addition, there is an accompanying document in the Appendix - the Corridor Matrix Annotations document that serves as the detailed reference for the Corridor Matrix, which provides sources and further discussion for each of the standards in the Matrix. Below is an excerpt from the Corridor Typology Matrix to show its organization and structure:

The Corridor Typology Matrix

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

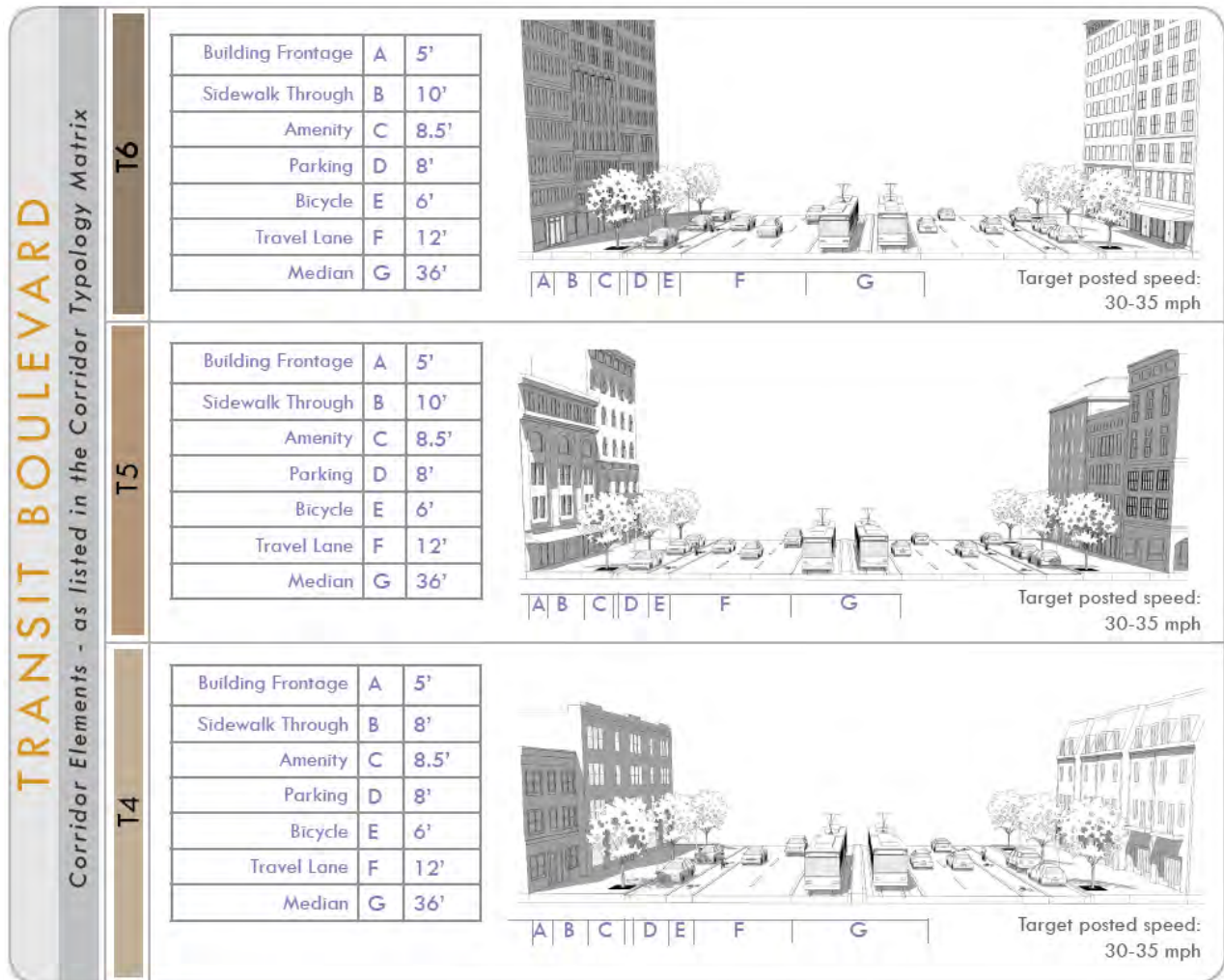
Corridor Element Key ⇒ ⇒ ↓	CORRIDOR TYPOLOGY MATRIX						
	Corridor Type	Transit Boulevard					
	Intensity	T-6		T-5		T-4	
	Context Zones & Corridor Elements	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM	OPTIMAL	MINIMUM
	Building Context Zone						
A	BUILDING FRONTAGE ELEMENT	5 ft	3 ft	5 ft	3 ft	5 ft	2.5 ft
	Location of off street parking	rear	rear	rear	rear	rear	rear
	Typical building entry locations	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
C	AMENITY ELEMENT	8.5 ft	4.5 ft	8.5 ft	4.5 ft	8.5 ft	4.5 ft
Roadway Zone							
D	PARKING ELEMENT	8 ft both sides	None	8 ft both sides	None	8 ft both sides	None
E	BIKE ELEMENT	6 ft bike lane	On parallel facility	6 ft bike lane	On parallel facility	6 ft bike lane	On parallel facility
F	TRAVEL LANE ELEMENT	12 ft*	11 ft	12 ft*	11 ft	12 ft*	11 ft
	Target Speed	30 - 35 mph		30 - 35 mph		30 - 35 mph	
	Number of Through Lanes (not including parking lanes)	4 to 6		4 to 6		4 to 6	
G	MEDIAN ELEMENT	35 ft	4 ft	35 ft	4 ft	35 ft	4 ft
*Note: 12 ft is the optimum only for transit and freight modal emphasis. For all other modal emphases, travel lane width should be minimized. (Refer to annotations)							

Figure 44 - Excerpt from the Corridor Typology Matrix - Full Matrix is in the Appendix

How to use the Corridor Typology Matrix in an unconstrained right of way

The Corridor Matrix is a flexible framework for selecting corridor standards that allows a roadway designer to balance all travel modes relatively equally or to favor some travel modes over others. Once the Modal Emphasis is added to the process, selected standards can be chosen to emphasize certain travel modes. However, the designer of a corridor with an unconstrained right of way – such as is the situation with a new road - 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 optimum dimensions and design for each travel mode. The set of example cross sections illustrated below reflect this “prototype” condition for each of the Placemaking and Through Corridor types. Note that not all T-zones are applicable to each Corridor type. The cross sections below assume that the right of way is unconstrained and all elements are optimized:

Figure 45 - Prototype Cross Sections for each Placemaking Corridor type



NOTE: Cross sections depict "optimal" corridor element dimensions unless otherwise noted

The Corridor Prototype Cross Sections

The set of example cross sections illustrated below reflect this "prototype" condition for each of the Placemaking and Through Corridor types. Note that not all T-zones are applicable to each Corridor type. The cross sections below assume that the right of way is unconstrained and all elements are optimized:

BOULEVARD

Corridor Elements - as listed in the Corridor Typology Matrix

T6	Building Frontage	A	5'
	Sidewalk Through	B	10'
	Amenity	C	8.5'
	Parking	D	8'
	Bicycle	E	6'
	Travel Lane	F	12'
	Median	G	18'
Target posted speed: 30-35 mph			
T5	Building Frontage	A	5'
	Sidewalk Through	B	10'
	Amenity	C	8.5'
	Parking	D	8'
	Bicycle	E	6'
	Travel Lane	F	12'
	Median	G	18'
Target posted speed: 30-35 mph			
T4	Building Frontage	A	5'
	Sidewalk Through	B	8'
	Amenity	C	8.5'
	Parking	D	8'
	Bicycle	E	6'
	Travel Lane	F	12'
	Median	G	18'
Target posted speed: 30-35 mph			
T3	Building Frontage	A	7'
	Sidewalk Through	B	6'
	Amenity	C	8.5'
	Parking	D	8'
	Bicycle	E	5'
	Travel Lane	F	12'
	Median	G	18'
Target posted speed: 30-35 mph			

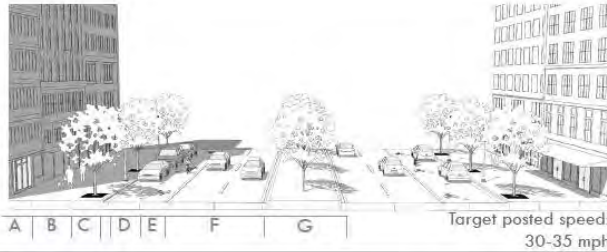
NOTE: Cross sections depict "optimal" corridor element dimensions listed in the Corridor Typology Matrix unless otherwise noted

MAJOR AVENUE

Corridor Elements - as listed in the Corridor Typology Matrix

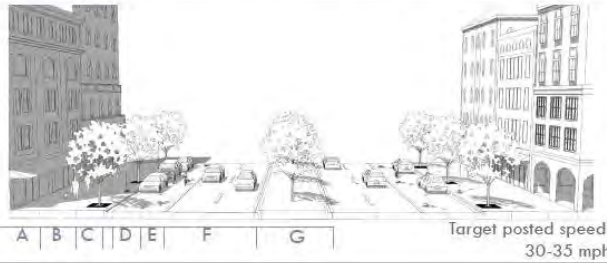
T6

Building Frontage	A	7'
Sidewalk Through	B	9'
Amenity	C	7.5'
Parking	D	8'
Bicycle	E	6'
Travel Lane	F	12'
Median	G	18'



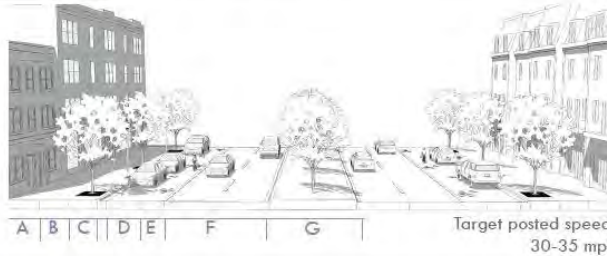
T5

Building Frontage	A	7'
Sidewalk Through	B	9'
Amenity	C	7.5'
Parking	D	8'
Bicycle	E	6'
Travel Lane	F	12'
Median	G	18'



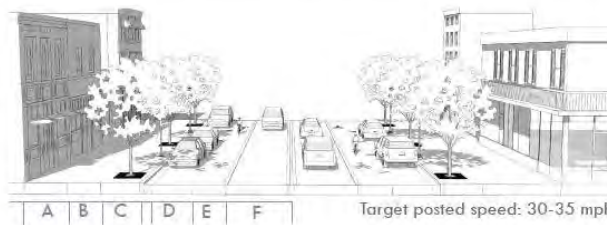
T4

Building Frontage	A	7'
Sidewalk Through	B	6'
Amenity	C	7.5'
Parking	D	8'
Bicycle	E	6'
Travel Lane	F	12'
Median	G	18'



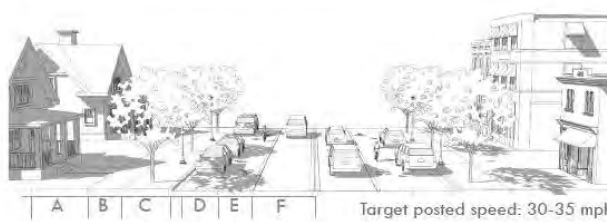
T3

Building Frontage	A	7'
Sidewalk Through	B	6'
Amenity	C	7.5'
Parking	D	8'
Bicycle	E	6'
Travel Lane	F	12'
Median	G	18 ^{1*}



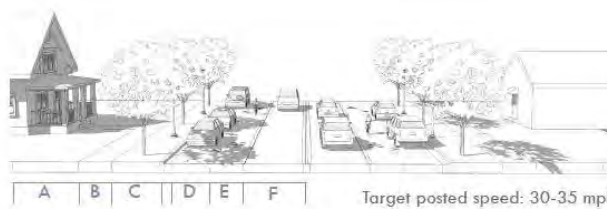
T2

Building Frontage	A	12'
Sidewalk Through	B	6'
Amenity	C	9.5'
Parking	D	8'
Bicycle	E	6'
Travel Lane	F	12'
Median	G	18 ^{1*}



T1

Building Frontage	A	12'
Sidewalk Through	B	6'
Amenity	C	9.5'
Parking	D	8'
Bicycle	E	6'
Travel Lane	F	12'
Median	G	18 ^{1*}



*The Median Element shown differs from the "optimal" dimension listed in the Corridor Typology Matrix

AVENUE

Corridor Elements - as listed in the Corridor Typology Matrix

T6	Building Frontage	A	8'		Target posted speed: 30 mph
	Sidewalk Through	B	8'		
	Amenity	C	7.5'		
	Parking	D	8'		
	Bicycle	E	6'		
	Travel Lane	F	12'		
	Median	G	18'		
T5	Building Frontage	A	8'		Target posted speed: 30 mph
	Sidewalk Through	B	7'		
	Amenity	C	7.5'		
	Parking	D	8'		
	Bicycle	E	6'		
	Travel Lane	F	12'		
	Median	G	18' ^{1*}		
T4	Building Frontage	A	8'		Target posted speed: 30 mph
	Sidewalk Through	B	6'		
	Amenity	C	7.5'		
	Parking	D	8'		
	Bicycle	E	6'		
	Travel Lane	F	12'		
	Median	G	18' ^{1*}		
T3	Building Frontage	A	10'		Target posted speed: 30 mph
	Sidewalk Through	B	6'		
	Amenity	C	7.5'		
	Parking	D	7'		
	Bicycle	E	6'		
	Travel Lane	F	12'		
	Median	G	18' ^{1*}		
T2	Building Frontage	A	15'		Target posted speed: 30 mph
	Sidewalk Through	B	6'		
	Amenity	C	7.5'		
	Parking	D	7'		
	Bicycle	E	5'		
	Travel Lane	F	12'		
	Median	G	18' ^{1*}		
T1	Building Frontage	A	15'		Target posted speed: 30 mph
	Sidewalk Through	B	6'		
	Amenity	C	6.5'		
	Parking	D	7'		
	Bicycle	E	5'		
	Travel Lane	F	12'		
	Median	G	18' ^{1*}		

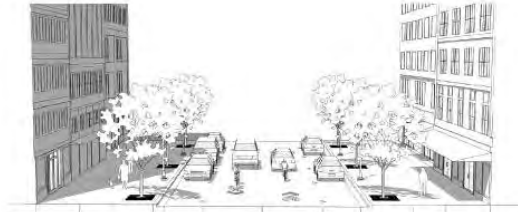
¹The Median Element shown differs from the "optimal" dimension listed in the Corridor Typology Matrix

LOCAL STREET

Corridor Elements - as listed in the Corridor Typology Matrix

T6

Building Frontage	A	8'
Sidewalk Through	B	6'
Amenity	C	7.5'
Parking	D	7'
Travel/Shared Lane	E,F	11'
Median	G	n/a



A | B | C | D | E,F

Target posted speed: 25 mph

T5

Building Frontage	A	8'
Sidewalk Through	B	6'
Amenity	C	7.5'
Parking	D	7'
Travel/Shared Lane	E,F	11'
Median	G	n/a



A | B | C | D | E,F

Target posted speed: 25 mph

T4

Building Frontage	A	8'
Sidewalk Through	B	6'
Amenity	C	6.5'
Parking	D	7'
Travel/Shared Lane	E,F	11'
Median	G	n/a

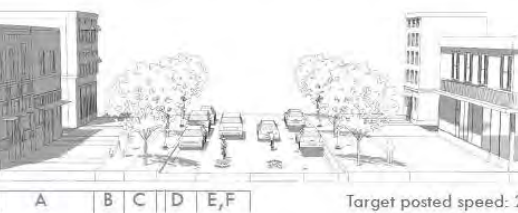


A | B | C | D | E,F

Target posted speed: 25 mph

T3

Building Frontage	A	15'
Sidewalk through	B	6'
Amenity	C	6.5'
Parking	D	7'
Travel/Shared Lane	E,F	11'
Median	G	n/a

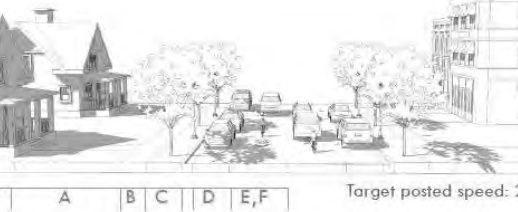


A | B | C | D | E,F

Target posted speed: 25 mph

T2

Building Frontage	A	20'
Sidewalk Through	B	5'
Amenity	C	6.5'
Parking	D	7'
Travel/Shared Lane	E,F	11'
Median	G	n/a

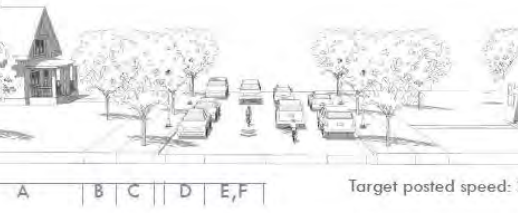


A | B | C | D | E,F

Target posted speed: 25 mph

T1

Building Frontage	A	30'
Sidewalk through	B	5'
Amenity	C	6.5'
Parking	D	7'
Travel/Share Lane	E,F	11'
Median	G	n/a



A | B | C | D | E,F

Target posted speed: 25 mph

THROUGH STREET

Corridor Elements - as listed in the Corridor Typology Matrix

T6	<table border="1"> <tr><td>Building Frontage</td><td>A</td><td>25'</td></tr> <tr><td>Sidewalk Through (Shared Use Path)</td><td>B, E</td><td>14'</td></tr> <tr><td>Amenity*</td><td>C</td><td>8'</td></tr> <tr><td>Parking</td><td>D</td><td>n/a</td></tr> <tr><td>Travel Lane</td><td>F</td><td>12'</td></tr> <tr><td>Median</td><td>G</td><td>19'</td></tr> </table>	Building Frontage	A	25'	Sidewalk Through (Shared Use Path)	B, E	14'	Amenity*	C	8'	Parking	D	n/a	Travel Lane	F	12'	Median	G	19'	<p style="text-align: right;">Target posted speed: 35-45 mph</p>
Building Frontage	A	25'																		
Sidewalk Through (Shared Use Path)	B, E	14'																		
Amenity*	C	8'																		
Parking	D	n/a																		
Travel Lane	F	12'																		
Median	G	19'																		
T5	<table border="1"> <tr><td>Building Frontage</td><td>A</td><td>25'</td></tr> <tr><td>Sidewalk Through (Shared Use Path)</td><td>B, E</td><td>14'</td></tr> <tr><td>Amenity*</td><td>C</td><td>8'</td></tr> <tr><td>Parking</td><td>D</td><td>n/a</td></tr> <tr><td>Travel Lane</td><td>F</td><td>12'</td></tr> <tr><td>Median</td><td>G</td><td>19'</td></tr> </table>	Building Frontage	A	25'	Sidewalk Through (Shared Use Path)	B, E	14'	Amenity*	C	8'	Parking	D	n/a	Travel Lane	F	12'	Median	G	19'	<p style="text-align: right;">Target posted speed: 35-45 mph</p>
Building Frontage	A	25'																		
Sidewalk Through (Shared Use Path)	B, E	14'																		
Amenity*	C	8'																		
Parking	D	n/a																		
Travel Lane	F	12'																		
Median	G	19'																		
T4	<table border="1"> <tr><td>Building Frontage</td><td>A</td><td>35'</td></tr> <tr><td>Sidewalk Through (Shared Use Path)</td><td>B, E</td><td>12'</td></tr> <tr><td>Amenity*</td><td>C</td><td>8'</td></tr> <tr><td>Parking</td><td>D</td><td>n/a</td></tr> <tr><td>Travel Lane</td><td>F</td><td>12'</td></tr> <tr><td>Median</td><td>G</td><td>19'</td></tr> </table>	Building Frontage	A	35'	Sidewalk Through (Shared Use Path)	B, E	12'	Amenity*	C	8'	Parking	D	n/a	Travel Lane	F	12'	Median	G	19'	<p style="text-align: right;">Target posted speed: 35-45 mph</p>
Building Frontage	A	35'																		
Sidewalk Through (Shared Use Path)	B, E	12'																		
Amenity*	C	8'																		
Parking	D	n/a																		
Travel Lane	F	12'																		
Median	G	19'																		
T3	<table border="1"> <tr><td>Building Frontage</td><td>A</td><td>35'</td></tr> <tr><td>Sidewalk Through (Shared Use Path)</td><td>B, E</td><td>12'</td></tr> <tr><td>Amenity*</td><td>C</td><td>8'</td></tr> <tr><td>Parking</td><td>D</td><td>n/a</td></tr> <tr><td>Travel Lane</td><td>F</td><td>12'</td></tr> <tr><td>Median</td><td>G</td><td>19'</td></tr> </table>	Building Frontage	A	35'	Sidewalk Through (Shared Use Path)	B, E	12'	Amenity*	C	8'	Parking	D	n/a	Travel Lane	F	12'	Median	G	19'	<p style="text-align: right;">Target posted speed: 35-45 mph</p>
Building Frontage	A	35'																		
Sidewalk Through (Shared Use Path)	B, E	12'																		
Amenity*	C	8'																		
Parking	D	n/a																		
Travel Lane	F	12'																		
Median	G	19'																		
T2	<table border="1"> <tr><td>Building Frontage</td><td>A</td><td>45'</td></tr> <tr><td>Sidewalk Through (Shared Use Path)</td><td>B, E</td><td>10'</td></tr> <tr><td>Amenity*</td><td>C</td><td>22'</td></tr> <tr><td>Parking</td><td>D</td><td>n/a</td></tr> <tr><td>Travel Lane</td><td>F</td><td>12'</td></tr> <tr><td>Median</td><td>G</td><td>19'</td></tr> </table>	Building Frontage	A	45'	Sidewalk Through (Shared Use Path)	B, E	10'	Amenity*	C	22'	Parking	D	n/a	Travel Lane	F	12'	Median	G	19'	<p style="text-align: right;">Target posted speed: 45-55 mph</p>
Building Frontage	A	45'																		
Sidewalk Through (Shared Use Path)	B, E	10'																		
Amenity*	C	22'																		
Parking	D	n/a																		
Travel Lane	F	12'																		
Median	G	19'																		
T1	<table border="1"> <tr><td>Building Frontage</td><td>A</td><td>45'</td></tr> <tr><td>Sidewalk Through (Shared Use Path)</td><td>B, E</td><td>10'</td></tr> <tr><td>Amenity*</td><td>C</td><td>22'</td></tr> <tr><td>Parking</td><td>D</td><td>n/a</td></tr> <tr><td>Travel Lane</td><td>F</td><td>12'</td></tr> <tr><td>Median</td><td>G</td><td>19'</td></tr> </table>	Building Frontage	A	45'	Sidewalk Through (Shared Use Path)	B, E	10'	Amenity*	C	22'	Parking	D	n/a	Travel Lane	F	12'	Median	G	19'	<p style="text-align: right;">Target posted speed: 45-55 mph</p>
Building Frontage	A	45'																		
Sidewalk Through (Shared Use Path)	B, E	10'																		
Amenity*	C	22'																		
Parking	D	n/a																		
Travel Lane	F	12'																		
Median	G	19'																		

*See the Corridor Typology Matrix for further details

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-2), the setbacks generally get wider and design standards get more relaxed – such as the bike lane becoming a shared use lane in the lower intensity T-zones.

How to use the Corridor Typology Matrix in a constrained right of way

The typical cross sections illustrated above 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 Typology 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. The chart below shows an example of how to build a cross section for a T-4 Major Avenue with Pedestrian Modal Emphasis in a constrained right of way.

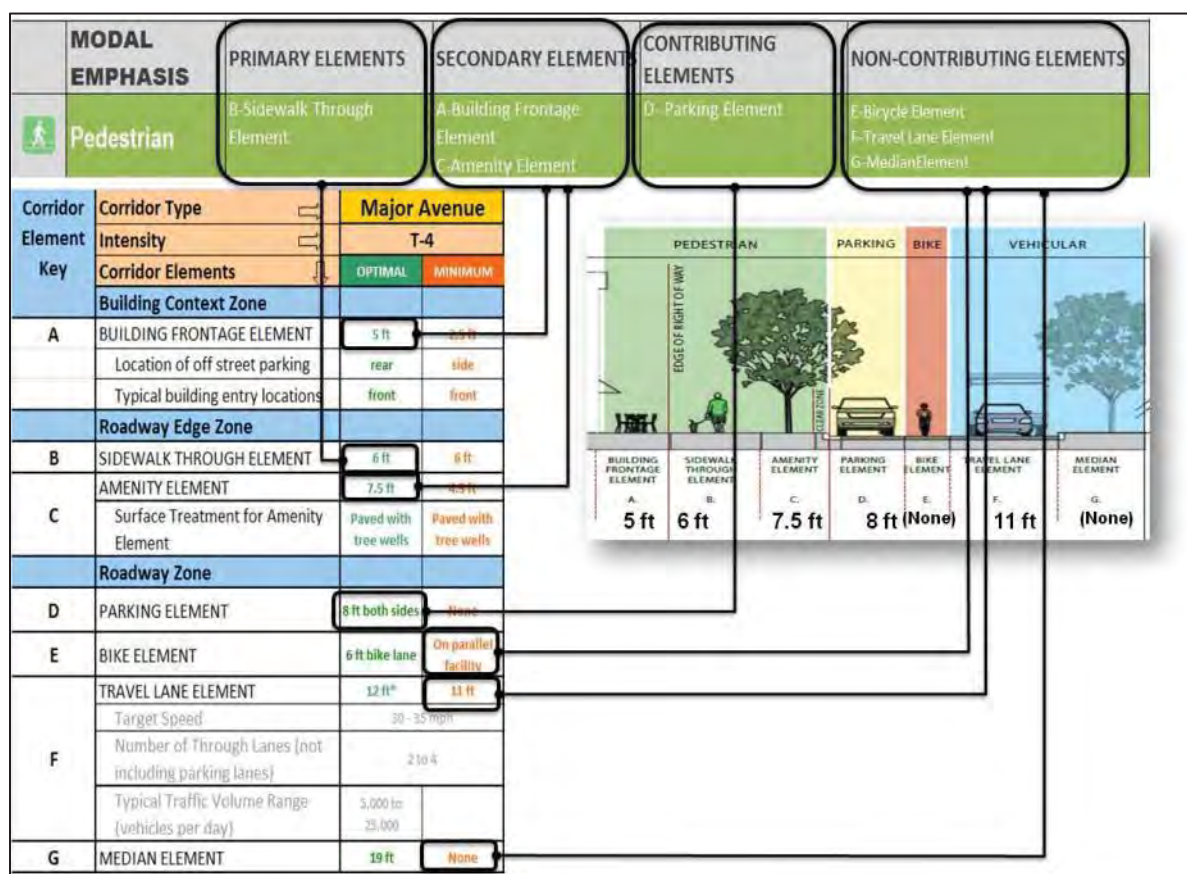


Figure 46 - Example of selecting corridor standards for a T-4 Major Avenue with Pedestrian Modal Emphasis

The chart 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 and only those elements that are important to the primary travel mode are optimized.

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 corridor in downtown Lynchburg. The existing cross section is illustrated below. It reflects primarily an auto modal emphasis (two one-way travel lanes) and a more secondary emphasis on parking (one parallel and one diagonal lane of parking) and pedestrians (sidewalks ranging from 6 to 8 feet wide).



Figure 47 - Illustration of an existing street with 58 ft. right of way to be retrofitted to a Multimodal Corridor

After analyzing the Multimodal Center type and the Multimodal Systems plan for this region, it was determined that the proposed corridor type for this roadway would be a T-4 Major Avenue with both Transit and Pedestrian Modal Emphasis. The chart below shows how the proposed cross section was built using the Modal Emphasis applied to each Corridor Element.

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 to the right of the illustration above 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.

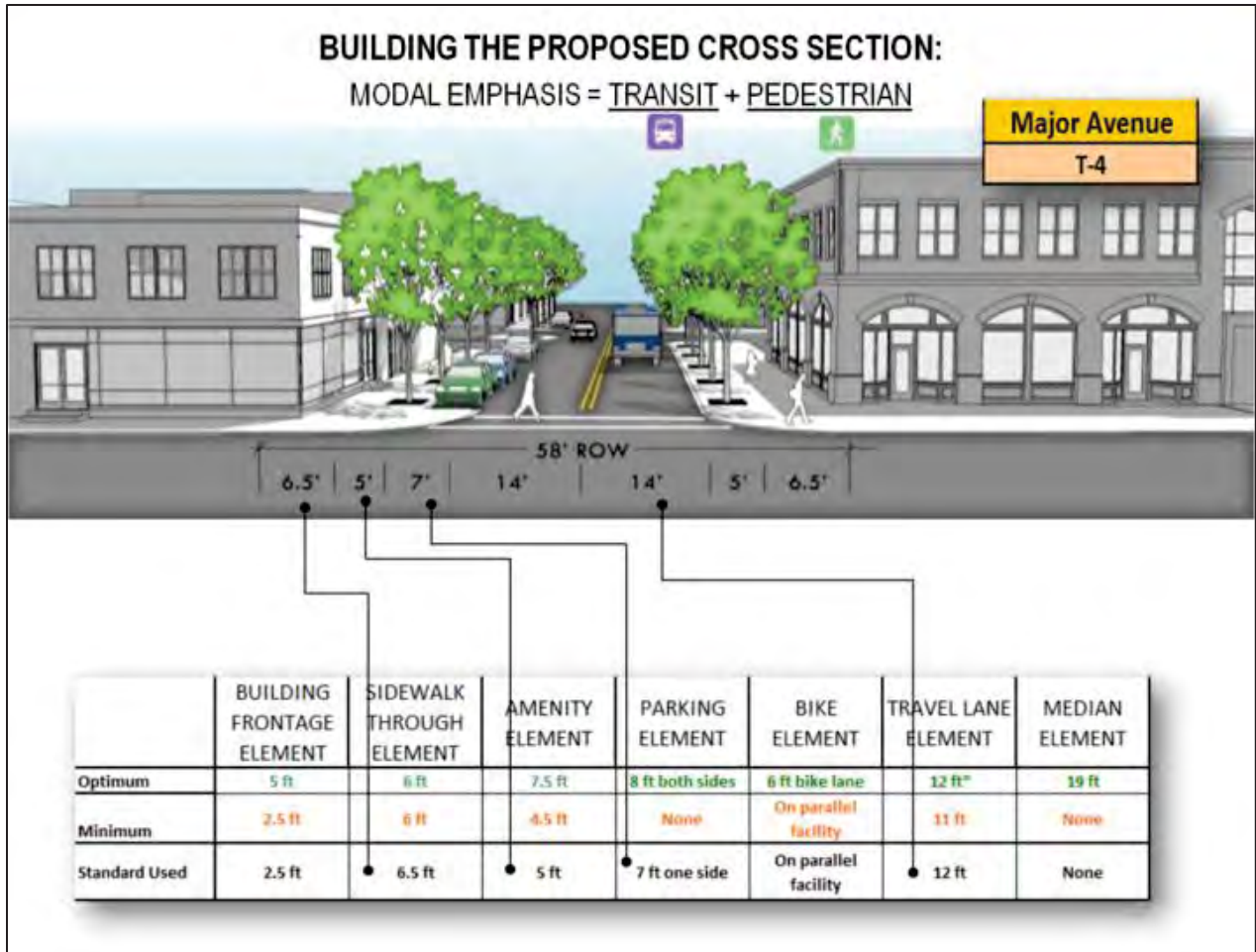


Figure 48 - Using Optimal and Minimal Standards to Build the Proposed Cross Section

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 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 to the right of the illustration above 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.

The illustrations below show the final comparison of the existing and proposed cross sections.

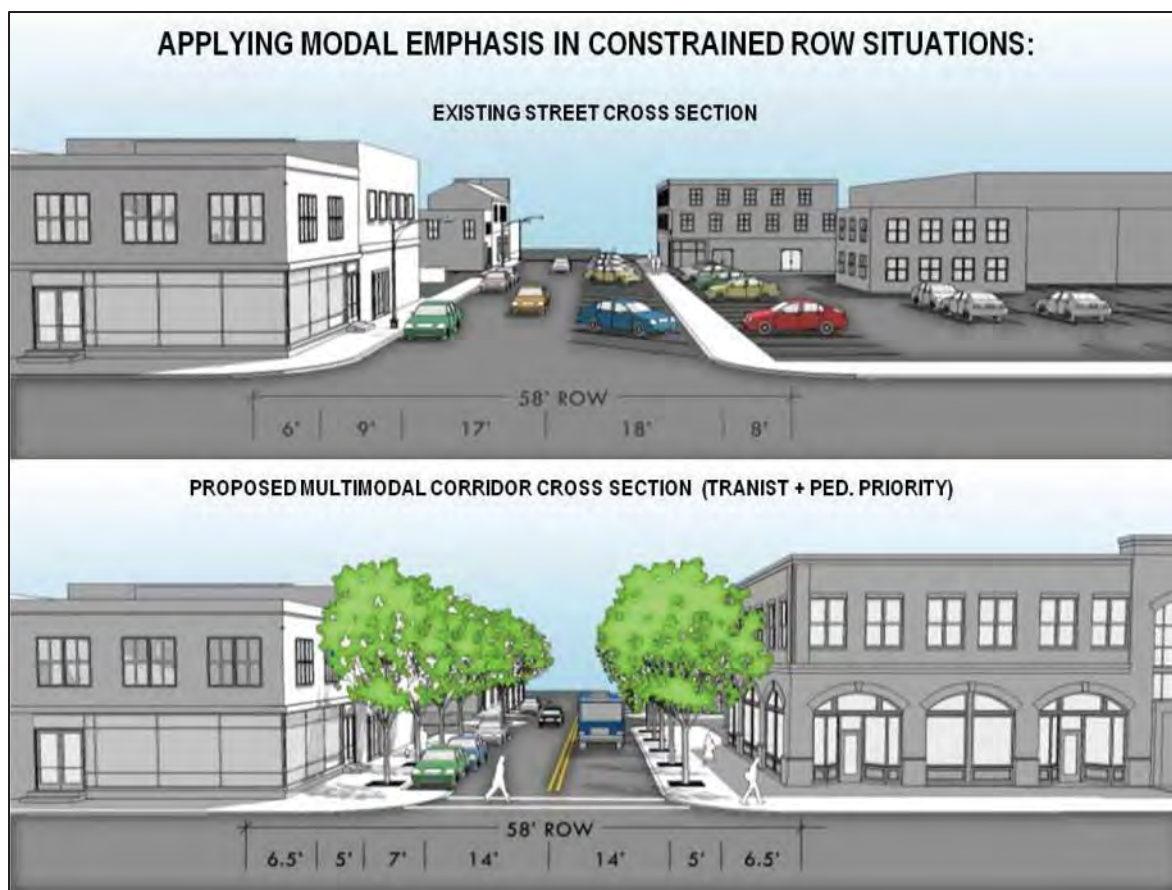


Figure 49 - Comparison of Existing and Proposed Cross Sections for the 58 ft. Right of Way

The methodology described above outlines a flexible process for multimodal corridor design. The basic steps of this methodology are as follows:

1. Identifying the Corridor Type
2. Identifying the Context of the Corridor (T-Zone)
3. Identifying the Modal Emphasis for the Corridor
4. Building the proposed cross section for the 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 State requirements, this design process will ensure an efficient and economical road design by only calling for maximizing those elements that are needed for the most important modes on each corridor. 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.

**EVOLVING MULTIMODAL CENTERS & CORRIDORS
OVER TIME**

INTEGRATING LAND USE AND TRANSPORTATION INVESTMENTS

One of the potential benefits of these Guidelines to planners and designers is in providing a unified framework for combining 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-on 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 design at the regional, place type and corridor 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 images below show how this hypothetical region can be analyzed to develop a series of interlocking plans, including:

- Region – Multimodal Systems Plan
- Place Type – Multimodal Center Plan
- Corridor – Multimodal Corridor Plan

The first image below shows the hypothetical region, highlighting the built form and roadway system that serves the main centers of activity in the region.



Figure 50 - Hypothetical region showing two activity centers separated by a major expressway

The next image shows an analysis of the densities of activities in this region. As described in Chapter 2 above, this is the first step in developing the potential Multimodal Distracts and Centers.

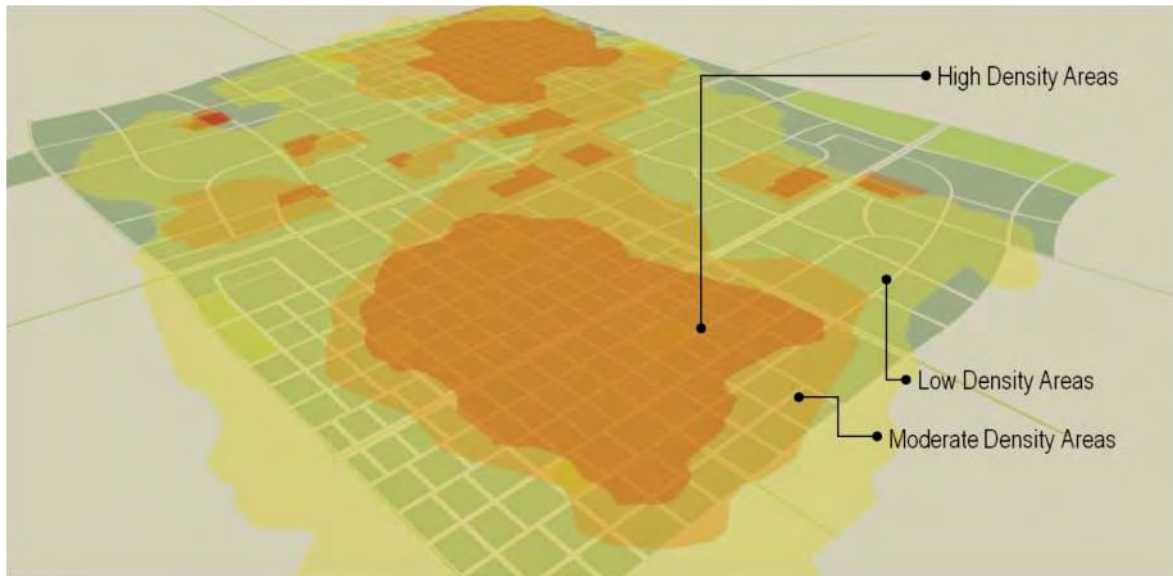


Figure 51 - Analysis of activity density in the region (sum of jobs + population)

Based on this analysis of activity density, the potential Multimodal District can be identified, with two potential Multimodal Centers centered on the areas with the highest activity densities.

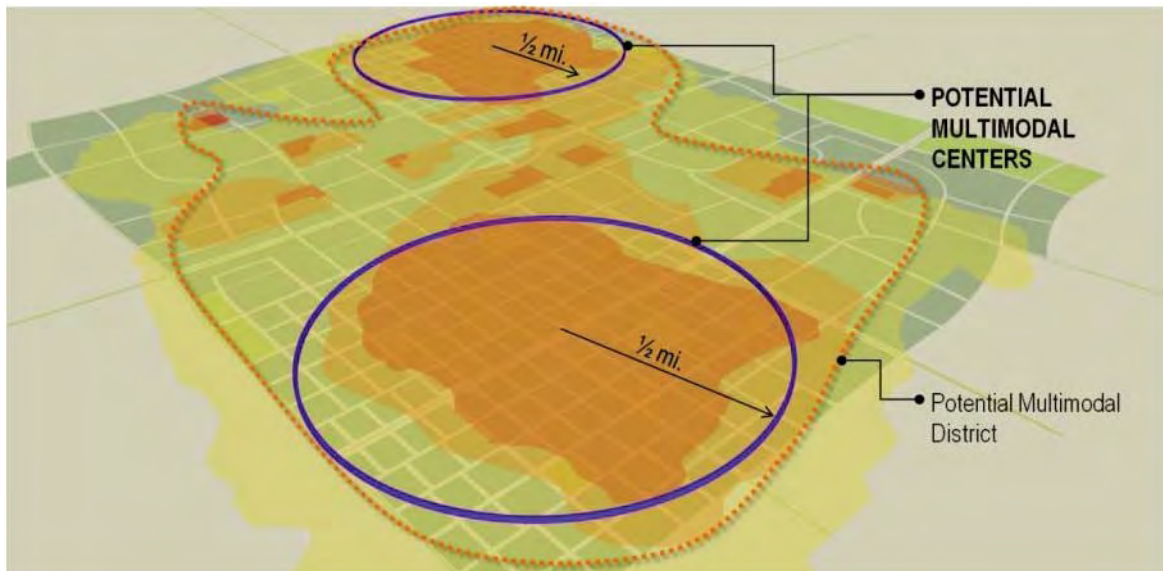


Figure 52 - Potential Multimodal District and Multimodal Centers based on the regional activity density

As noted in Chapter 2, the dimensions of a Multimodal District vary and should encompass any area that has potential multimodal characteristics. However, the dimensions of Multimodal Centers are fixed at 1/2 mile radius circles since these are based on a primary walkshed and are a more focused area for multimodal investments and improvements. The next image shows how the roadway system in the

region can serve these centers of activity through the designation of primary through corridors. The discussion of Through and Placemaking corridors is covered more extensively in Chapter 4 above.

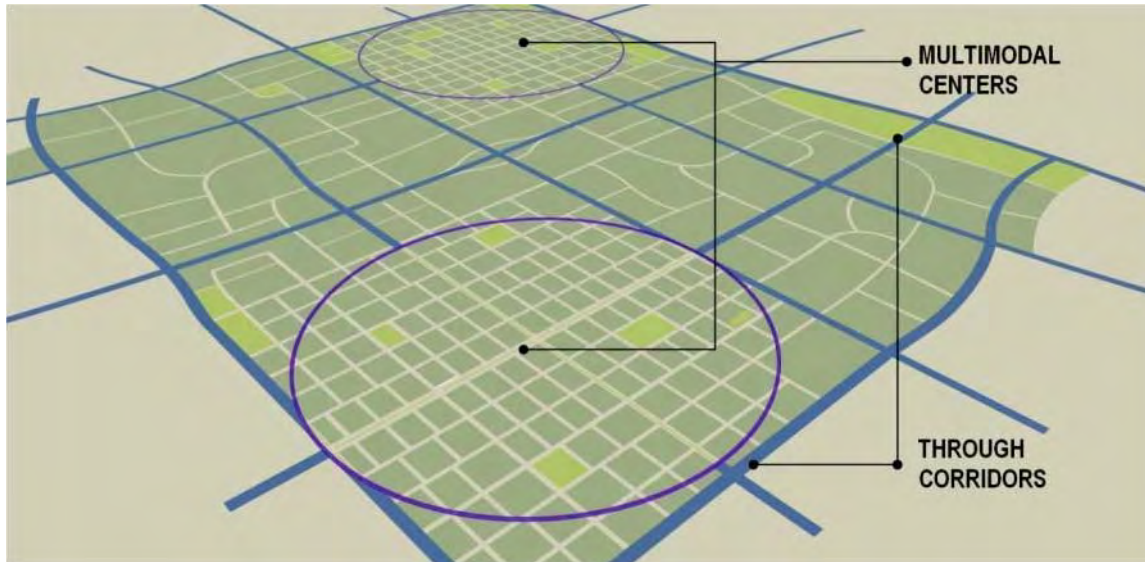


Figure 53 - Through Corridors are higher speed routes that go between Multimodal Centers

As described in Chapter 4 of these Guidelines, a key organizing principle is to organize a region into Through and Placemaking corridors. The Through corridors can be thought of as the routes “to” and between Multimodal Centers, and the Placemaking Corridors as the routes “through” and within Multimodal Centers.

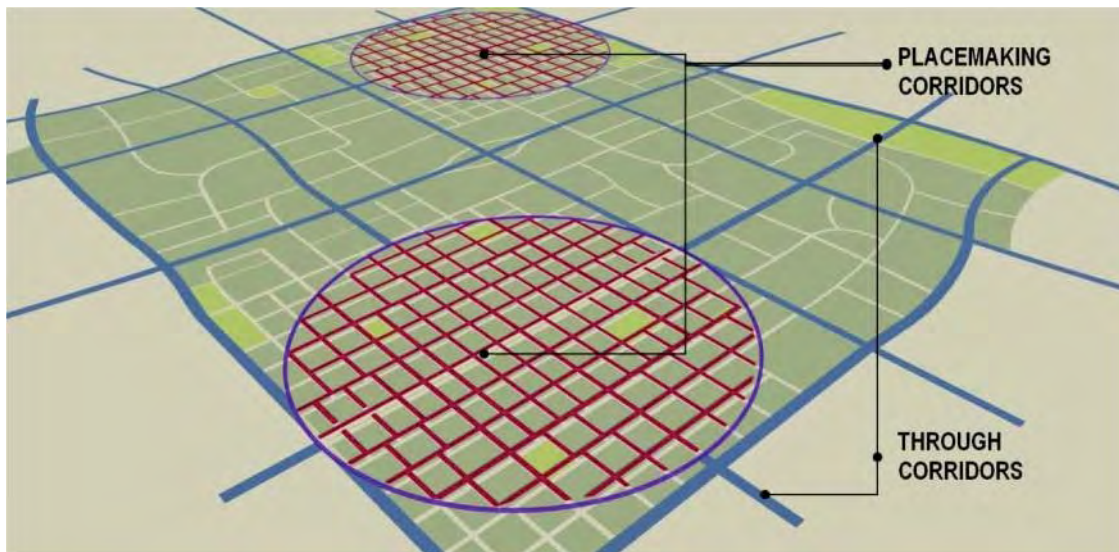


Figure 54 - Placemaking Corridors are the lower speed routes that are within Multimodal Centers

The next step in planning the multimodal region is to identify the Modal Emphasis on each corridor. The image below shows how the corridors have been designated according to their Modal Emphasis.

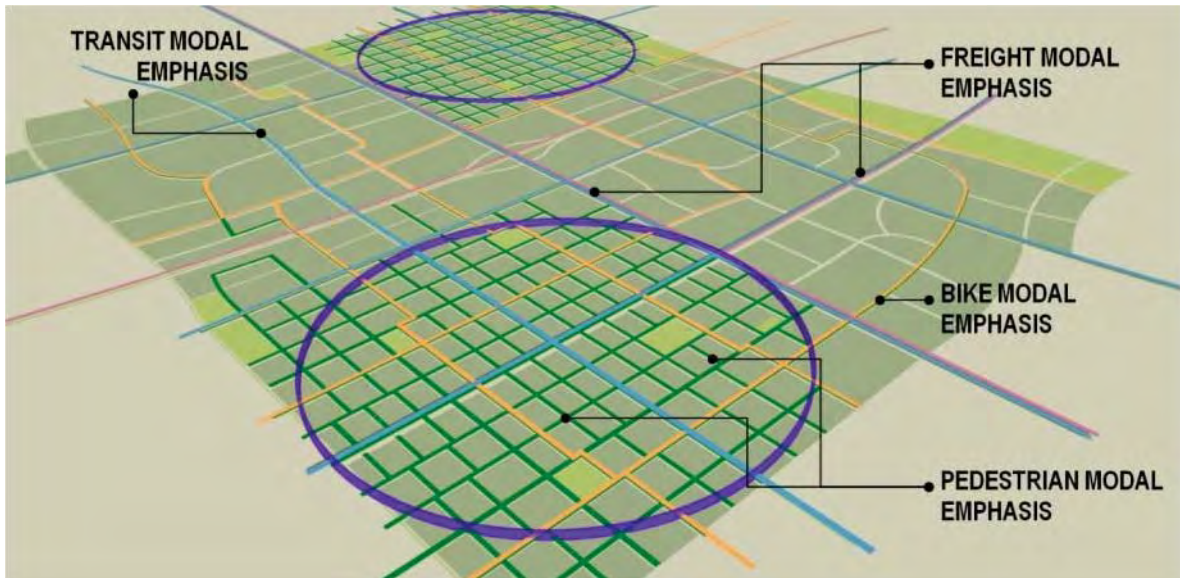


Figure 55 - Using Modal Emphasis to designate the primary travel modes on each corridor

The image below shows the fully developed Multimodal Systems Plan for this region, with each of the major corridors and centers identified, along with the basic network for each travel mode in the region.

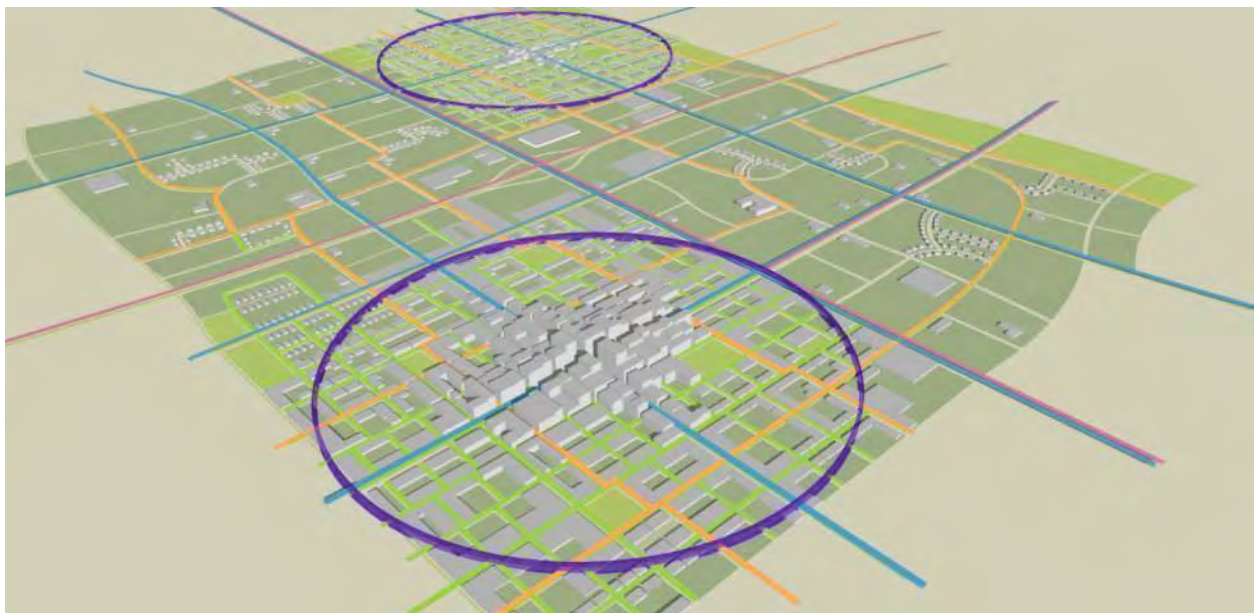


Figure 56 - Complete Multimodal Systems Plan for the region

Now that the basic multimodal systems plan has been developed for the region, the next step is to plan for an individual Multimodal Center and Corridors. The image below shows the basic layout of Multimodal Centers and TOD Nodes in each center.

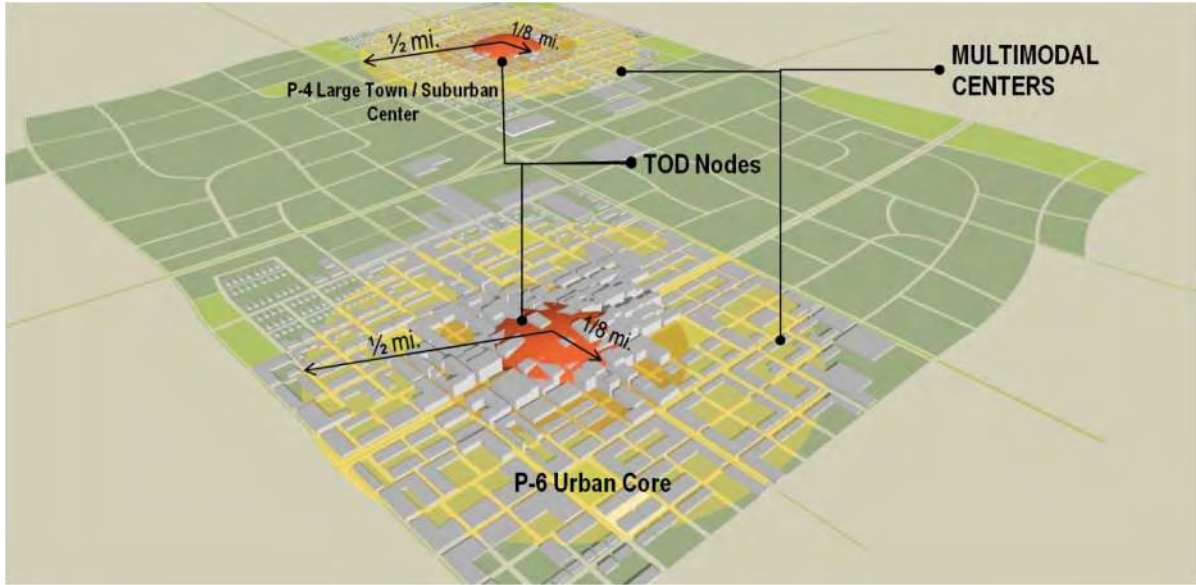


Figure 57 - Multimodal Centers showing the primary walksheds and the TOD nodes

As shown above, the two Multimodal Centers identified in this region are P-6 and P-4 centers, according to the typology described in Chapter 4 above. The next series of images zooms into one of those centers, the P-4 Large Town / Suburban Center at a closer scale.

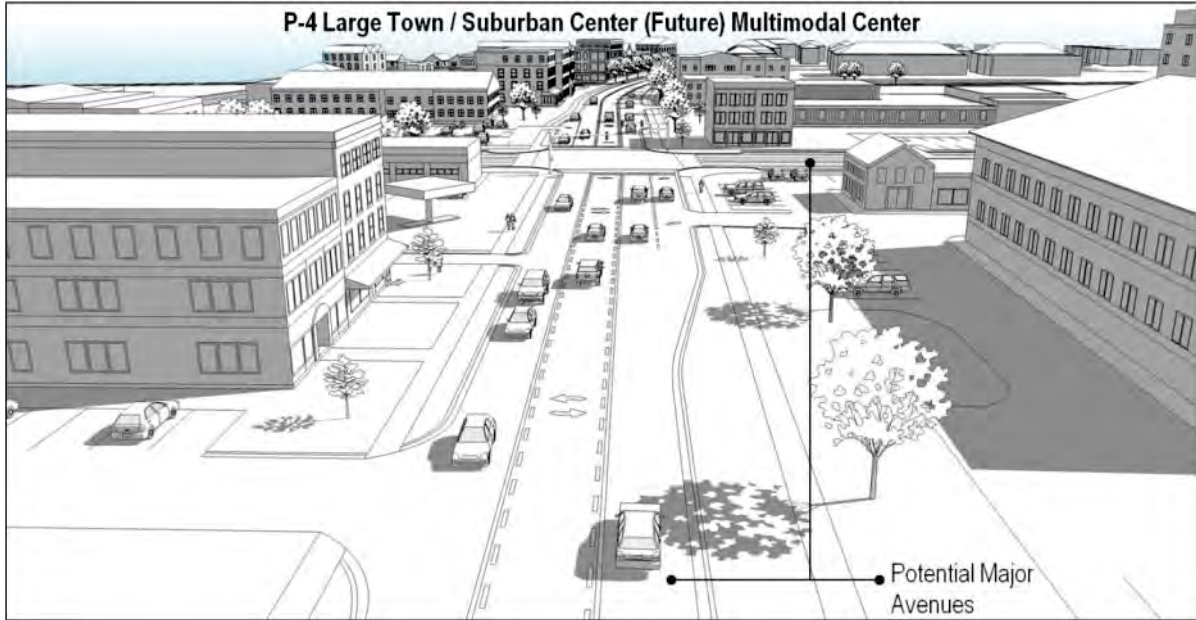


Figure 58 – A view zooming into the main intersection of the P-4 center shown above

As shown in the zoomed in image above, one of the centers has been designated as a P-4 Large Town / Suburban Center. The image above represents a “before” version of the center and corridors. It is assumed for this case study that the locality has designated this as a future P-4 center and has aligned its planning and zoning policy framework to help implement the intended future center. Based on the Guidelines, a P-4 center should ideally have a Major Avenue as its main cross streets. As shown in the

image below, the “future” Major Avenue has very few modal options, being primarily oriented toward the auto/vehicular travel mode with a minimal accommodation for pedestrians.

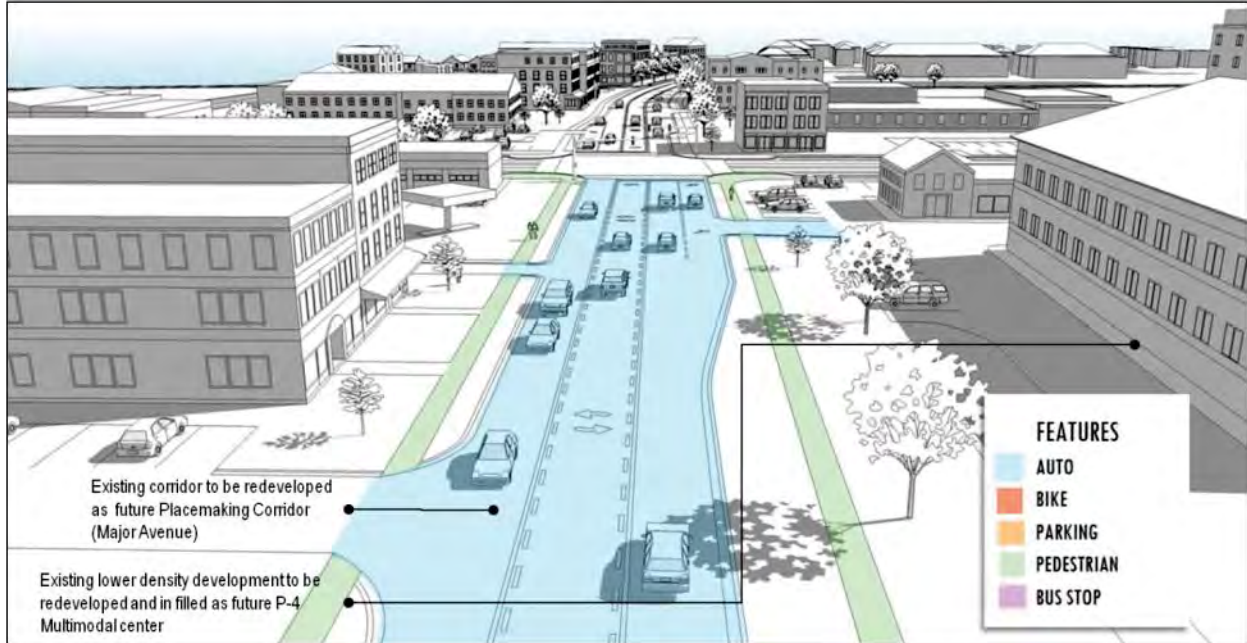


Figure 59 - Existing conditions in the center include lower density development and non-multimodal corridors

The intent of these Guidelines is to show how to get from the “before” image above to the “after” image below in a series of logical steps, with flexibility for making key design decisions at both the corridor and the center scale. The image below shows how the corridor has been transformed into a Major Avenue (Placemaking) corridor with the addition of wider sidewalks, on-street parking, bike lanes and a curbed median with turn lanes. In addition, it shows how private development has responded over time to the 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 corridor and that the corridor has sufficient capacity among all travel modes to serve the intensity of development that it serves.

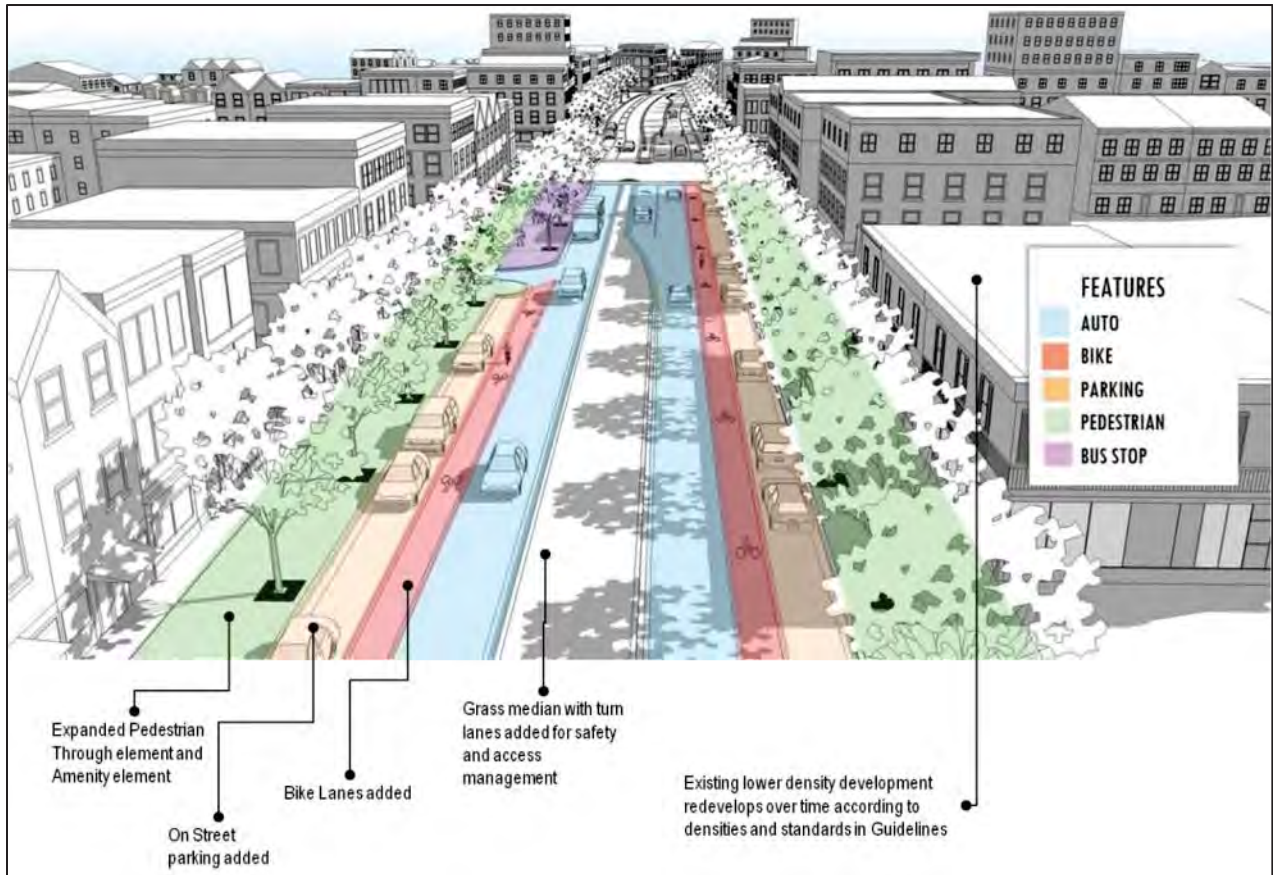


Figure 60 - "After" image of the center and corridor showing its gradual evolution to a true multimodal center

Evolving over time

The above sequence of visualizations shows how a hypothetical region could be planned for according to the basic principles of these Guidelines. In addition, it 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 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 below in Chapter 8, there are a number of options for funding multimodal improvements through state or 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.