Chapter 6: Multimodal Project Design – Overall Framework

Designing Multimodal Corridors

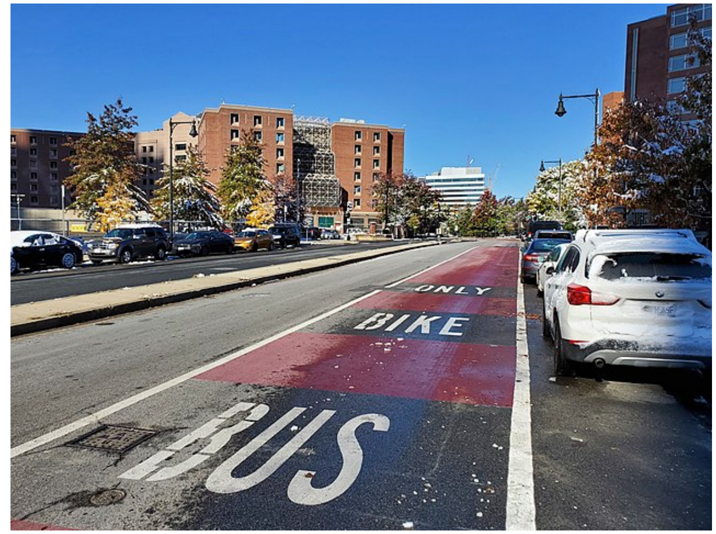
The Multimodal System Plan gets implemented through the design of multimodal corridors and individual projects. Changes to Norfolk's transportation system occur in a variety of ways. The City may use funding to completely redesign an entire corridor or reconfigure an intersection, or it may incrementally expand the sidewalk or bike network as funding becomes available. Regular repaving of the roadways also present opportunities for restriping and changing the configuration of the pavement area between the curbs.

Through the development review and approval process, the City can sometimes negotiate with developers to build specific facilities along or adjacent to their property. Small-scale projects might be funded through the City's annual Capital Improvement Program. Larger projects may rely on other sources of federal and state funds for addressing safety issues, mitigating congestion, improving air quality, and enhancing non-motorized transportation. These are just a few examples of the many ways in which an opportunity could arise for a project to make an improvement to the transportation system.

This chapter presents a process for designing a project on a multimodal corridor so that it works towards building out the future vision of the Multimodal System Plan.

The design process outlined in this chapter is called the Multimodal Project Design Framework. It can apply whenever an opportunity for a project arises. This process is most applicable to linear projects on Multimodal Corridor segments, like a pavement restriping to provide bicycle and/or bus lanes, a sidewalk expansion project, or a streetscaping improvement project. But it is also useful when considering spot improvements like striping crosswalks, bus stop improvements, and other intersection reconfiguration projects.

This chapter outlines the Multimodal Project Design Framework overall. The next chapter defines the design approaches and design considerations for each mode.



Roadway striping for a combined bus and bike lane. Image source: Wikimedia Commons


Roadway reconstruction to install wide sidewalks. Image source: Wikimedia Commons

The process for designing projects on multimodal corridors in this chapter works together with the process for evaluating how well those projects align with Norfolk's vision and goals for multimodal transportation in Chapter 8. Determining the best use of curb space is a critical part of the design process, and it is explained in further detail in Chapter 9.

The Multimodal Project Design Framework

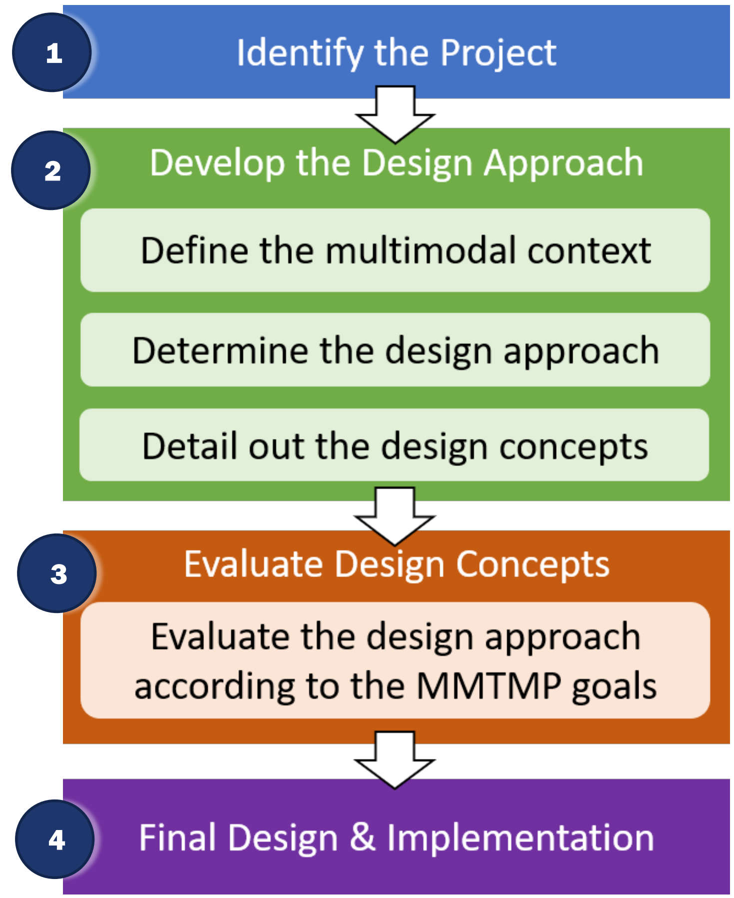
The Multimodal Project Design Framework is illustrated as a four-step flowchart in the graphic to the right.

This section provides an overview of the four steps. Subsequent sections in this chapter and the next chapter focus on the second step – *Developing the Design Approach*. Chapter 8 elaborates on the third step – *Evaluating Design Concepts*. The first and fourth steps are not addressed in greater detail beyond the overview provided in this section, as they simply illustrate the steps that occur before and after the conceptual design phase that is the focus of this framework.

Step 1: Identify the Project

The first step of the Multimodal Project Design Framework is to identify a project. As explained in the introduction of this chapter, the starting point for projects can vary. The program of projects in Chapter 13 list projects that are anticipated to be funded within the near, mid, and long-term timeframes. Opportunities for other projects may arise from unanticipated funding opportunities. The point of this step is to define the purpose and need for the project, the extent of the project , and the degree to which the corridor can be reconfigured (e.g., repaving between the existing curbs, moving curbs within the existing right-of-way, or acquiring additional right-of-way from adjacent properties).

The Multimodal Project Design Framework



The Multimodal Project Design Framework is a four-step process for selecting, designing, and implementing a project on a multimodal corridor.

Step 2: Develop the Design Approach

After a potential project location and need are identified, the next step is to come up with a high-level *design approach* to the corridor.

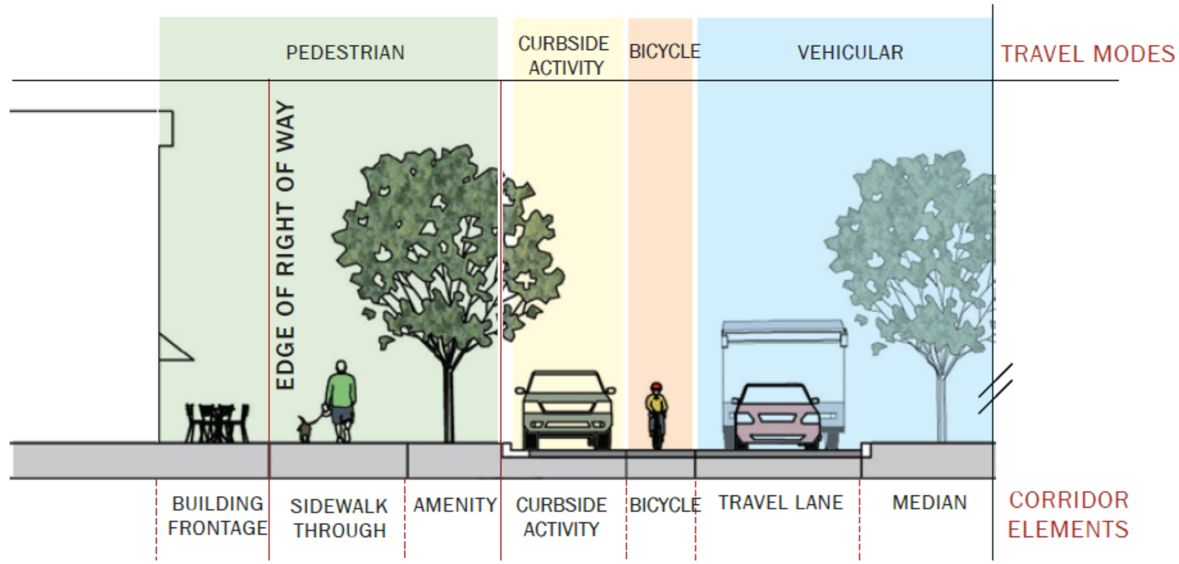
A ***design approach*** *spells out the way in which each mode will be accommodated within the street.*

In this step, the type of facility that will be provided for each mode is determined. For example, is it desirable to provide a dedicated lane for buses, or is it appropriate for buses to operate in lanes shared with traffic? The design approach may consider if it is feasible to convert a general travel lane into a different type of facility.

Developing the design approach starts with identifying the multimodal context of the corridor, which consists of the Multimodal Corridor type, Modal Emphasis, Transect Zone, and whether the corridor segment is in a Multimodal Center – all components defined in the Multimodal System Plan in Chapter 4.

Next, other factors like traffic volumes, speeds, bus frequencies, desirability for bicycle facilities, potential conflicts with other modes, and other characteristics are identified to determine the desired design approach for each mode.

FIGURE 6-1: MULTIMODAL CORRIDOR CROSS-SECTION ELEMENTS



The design approach determines how each mode will be accommodated and what type of facility will be provided. In this step, you determine which modes receive separate dedicated space within the cross-section and which modes share space with other modes. In the illustration above, this design approach provides a separate facility for bicyclists, while buses and autos share a vehicular travel lane.

Vehicular capacity is one among several considerations to examine when developing a multimodal design approach. Other considerations that reflect the goals of safety, connectivity, and equitable prosperity for pedestrians, bicyclists, scooter riders, and transit passengers should be considered too, and balanced with vehicular capacity, level of service, and overall safety. The acceptable balance among these considerations will depend on the project context, analysis, and public input to determine the appropriate design approach. Examining and assessing these tradeoffs is discussed in more detail in Chapter 7 and 8.

After choosing the desired design approach, the design approach is detailed into a *design concept* with specific dimensions for each *corridor element*.

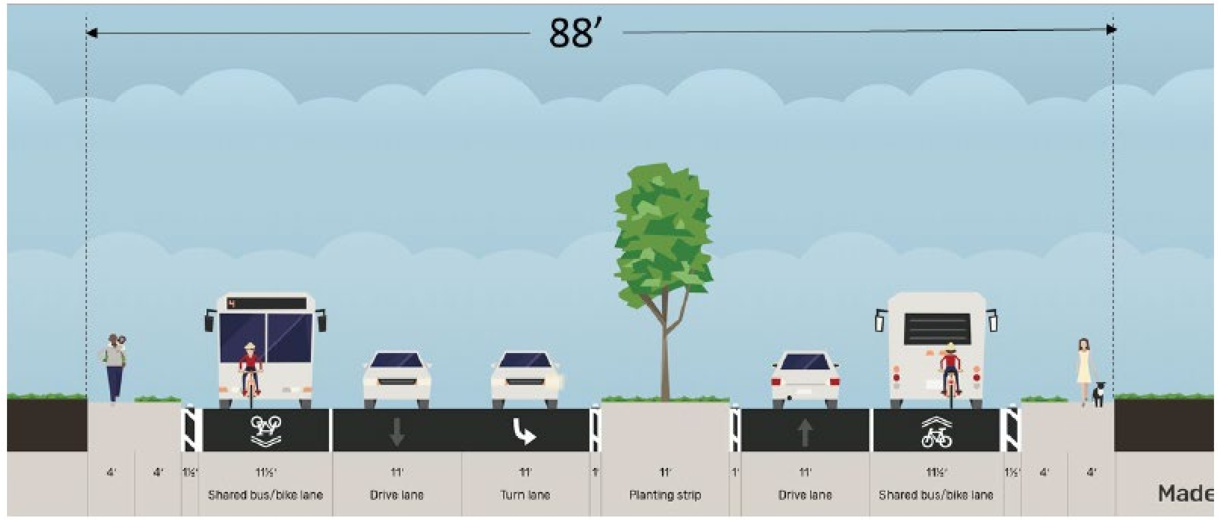
__Corridor elements__ are the individual "pieces" that are allocated space within the corridor cross-section.

A __design concept__ is an illustration of a corridor cross-section with specific dimensions for each corridor element.

A design concept may be a typical corridor cross-section illustration with widths for each element within the cross-section, or it may be a plan view concept along a corridor including treatments for each segment and intersection.

The outcome of this second step in the Multimodal Project Design Framework is one or more design concepts that are design approaches detailed out with specific dimensions.

An example of a design concept is shown on the illustration to the right - it takes into account general feasibility and right-of-way constraints. The dimensions determined in the design concept are preliminary planning-level dimensions that will need to go through more detailed engineering-level design. The purpose of this step is to prepare a concept that should be generally feasible and that can be evaluated in the following step.



The outcome of the second step of the Multimodal Project Design Framework is one or more design concepts with specific dimensions for each element in the corridor cross-section.

Step 3: Evaluate Design Concepts

After developing one or more design concepts, the next step involves evaluating the design concept to determine how well it achieves the Norfolk's vision and goals for multimodal transportation.

The purpose of this step is to understand the benefits and tradeoffs of each design concept and choose the best one to carry forward to final design and implementation.

This step is described in greater detail in Chapter 8, which provides several evaluation metrics that illustrate multimodal tradeoffs beyond the traditional metrics associated with vehicular capacity and delay.

The proposed evaluation metrics in Chapter 8 are useful not only for planners and engineers on the project team to understand the tradeoffs associated with different design concepts; they are also useful for communicating the value and benefits of projects to stakeholders, elected officials, and the public.

Step 4: Final Design and Implementation

After choosing the design concept to advance into final design, the process goes into developing engineering drawings and cost estimates and preparing the project for construction.

Developing the Design Approach: A Closer Look at Step 2 of the Multimodal Project Design Framework

As described previously, the second step of the Multimodal Project Design Framework is "Developing the Design Approach." This step consists of three smaller steps:

a. Defining the multimodal context
b. Determining the design approach
c. Detailing out the design concepts

The first of these smaller steps is described in detail in the following section. Chapter 7 continues the discussion and describes the second and third of these smaller steps in detail.

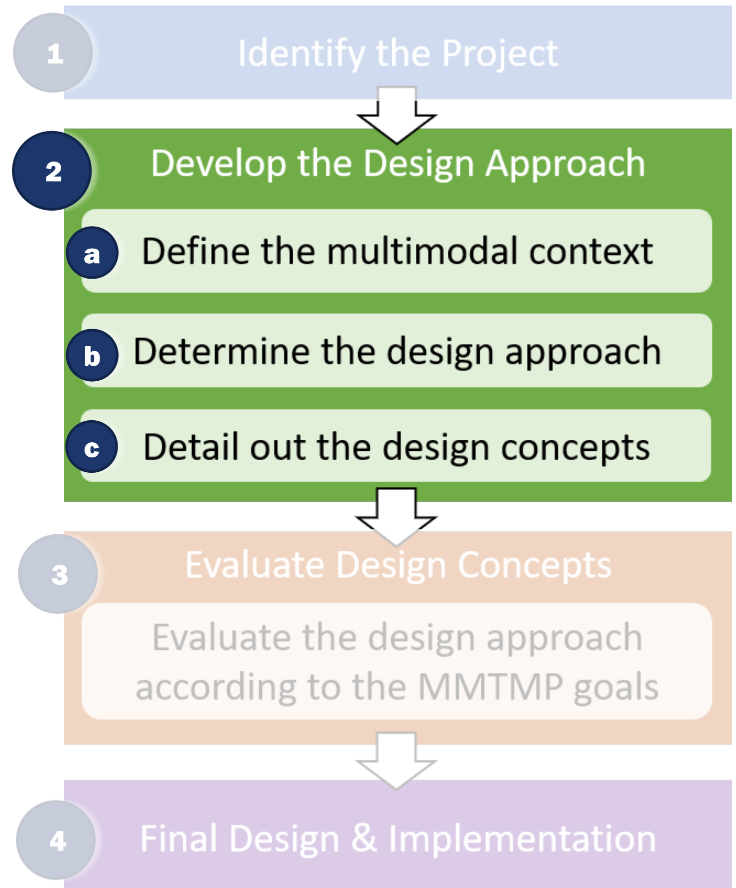
Step 2a: Defining the Multimodal Context

The context of a street, the surrounding land use, and the role it plays in the larger multimodal transportation system all shape the design approach for a multimodal corridor project. The first step to developing a design approach is to understand the context of the project corridor.

The Multimodal System Plan in Chapter 4 defines several important components that describe the multimodal context of a project corridor and influence how that corridor is designed, including whether a corridor is located in a Multimodal Center or a Multimodal District, the Transect Zone, the Multimodal Corridor type, and the Modal Emphasis. Understanding how these components are defined for the project corridor frames the role it plays in the larger multimodal system and sets important context for the design approach. How these components of the Multimodal System Plan influence corridor design are explained in the following sections.

It is also important at this stage to seek stakeholder and public input to identify additional context characteristics or functions that are specific to the project area so the design approach can be tailored to these specific context needs.

The Multimodal Project Design Framework



The second step of the Multimodal Project Design Framework is the focus of this chapter. It consists of three smaller steps.

Multimodal Centers and Multimodal Districts

As described in Chapter 4, a Multimodal Center is an area envisioned to have a high mix and density of uses within walking distance so that everyday destinations can be reached by walking or bicycling. Multimodal Centers are envisioned to be places with vibrant street activity. The environment within Multimodal Centers, including the streets, buildings, and urban form, is designed for people, not for vehicles. Multimodal Districts are areas outside of Multimodal Centers that are envisioned to be safe and comfortable for walking and bicycling. Multimodal Districts have a lesser intensity of destinations and density than Multimodal Centers and are mainly residential neighborhoods and other single-use areas.

Multimodal Corridors in Multimodal Districts will typically see lower demand for non-auto modes than in Multimodal Centers. It is important to provide minimum safe accommodations for all modes on Multimodal Corridors in Multimodal Districts. Multimodal Corridors in Multimodal Centers could see higher demand for non-auto modes, making it important to try to achieve more than just the minimum safe accommodations, depending on other factors like Modal Emphasis.

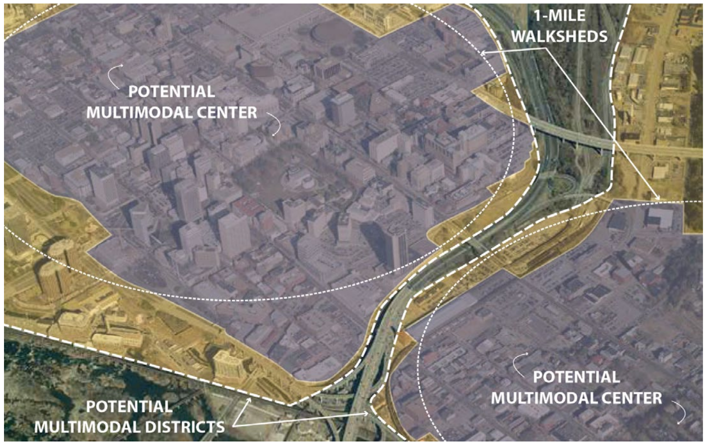
It is important to have a fine-grained network of high-quality facilities for walking and bicycling within Multimodal Centers. Pedestrian crossings should be spaced closer together in Multimodal Centers, and more streets should have bicycle modal emphasis than in areas outside of Multimodal Centers.

Also, all Multimodal Through Corridors should transition to Placemaking Corridors within Multimodal Centers because Multimodal Centers are the areas envisioned to have the highest pedestrian activity. All streets within a Multimodal Center should be designed with slower vehicle speeds and designed to accommodate a variety of activities within the public right-of-way.

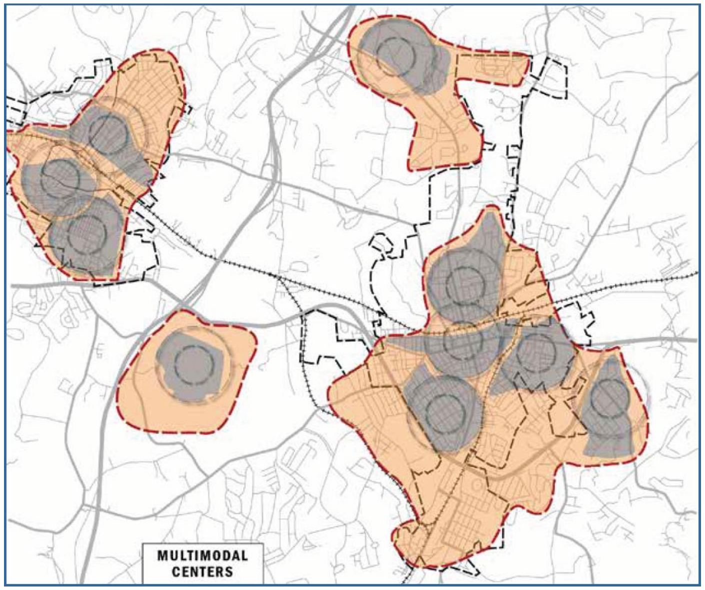
Transect Zones

Transect zones classify the land use intensity of an area into six ranges, as described in Chapter 4, from the least intense T-1 transect zone with zero to one person or job per acre to the most intense T-6 transect zone with 100 or more persons and jobs per acre.

More intense transect zones usually have higher potential for generating walking, bicycling, and scooter trips. In more intense transect zones, it may be more



Multimodal Centers and Districts. Image source: DRPT Multimodal System Design Guidelines



Multimodal Centers are areas of highest multimodal connectivity and have a mix of uses and proximity of destinations such that most trips can be made by walking. Multimodal Centers are designated roughly according to one-mile diameter circles but morphed to fit actual conditions and barriers to connectivity such as rivers or high-speed highways. Image source: DRPT Multimodal System Design Guidelines important to provide higher-capacity facilities for non-auto modes to accommodate higher volumes of pedestrians, bicyclists, and scooter riders, such as sidewalks and/or bicycle lanes that are wider than the minimum requirements. It may also be important to provide higher quality amenities at bus stops, including more or larger bus shelters to accommodate higher demand.

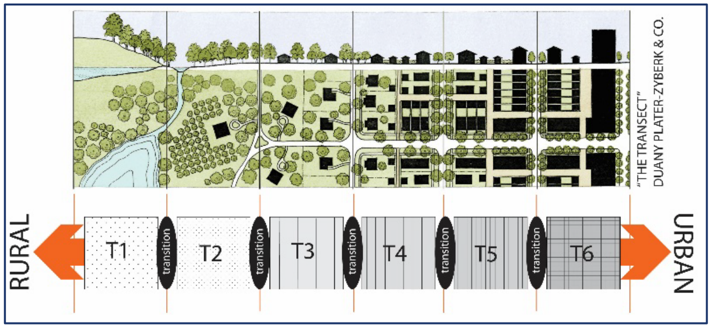
Transect zones also influence design speeds. Design speeds on corridors in more intense transect zones will likely need to be on the lower end of the range of acceptable design speeds because these are areas with the highest amount of pedestrian and non-motorized activity. These areas also have more activity in the curb space, and land uses and access points are more closely spaced together. Design speeds on corridors in less intense transect zones may be in the middle or higher end of the range of acceptable design speeds because land use activity is not as intense and non-motorized users are less frequent.

A project corridor may pass through more than one transect zone along its length. There may be segments of a project corridor where there are two different transect zones on either side of the street. The transect zones identified in the Transect Zone map in Chapter 4 are shown in a hexagonal grid and represent a generalized indication of density for a consistent geometry across the entire city. The Transect Zone map in Chapter 4 should be examined to inform the project team of the general land use intensity. The project team should select one or more Transect Zones for the project corridor using this map as a starting point. The individual break points may be adjusted based on more detailed local knowledge and using professional judgment.

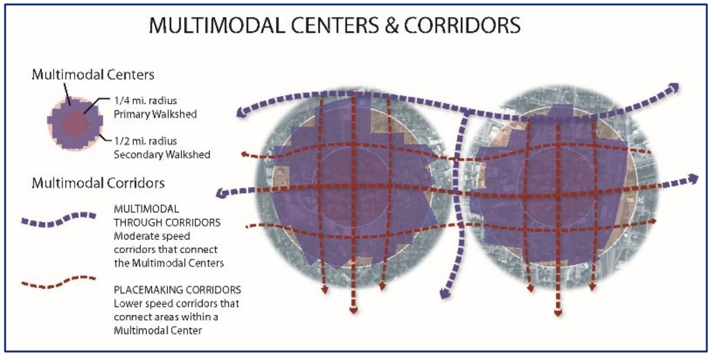
Multimodal Corridor Types

As explained in Chapter 4, there are five types of Multimodal Corridors based on the function and character of a street. Every street in Norfolk, with the exception of interstates and other limited-access highways where non-motorized modes are prohibited, has been assigned a Multimodal Corridor type that reflects the envisioned role of that street within the broader multimodal transportation system.

Chapter 4 defines a specific function for each Multimodal Corridor type. Projects on all Multimodal Corridors should be designed in consideration of that Multimodal corridor type.



Transect Zones. The Transect describes the range of natural and built environments across a spectrum of density. Places can be classified into one of the six different Transect Zones or "T-Zones" depending on the density or intensity of the land uses in an area. Image source: DRPT Multimodal System Design Guidelines



Multimodal Through and Placemaking Corridors. The diagram distinguishes Placemaking Corridors from Multimodal Through Corridors – the two general categories of Multimodal Corridors that together comprise a true multimodal transportation system in a region. Image source: DRPT Multimodal System Design Guidelines

The Multimodal Corridor type can influence many different aspects of design, including total multimodal capacity, design speed, number of travel lanes, medians, on-street parking widths, and sidewalk and amenity zone widths.

The Corridor Matrix, which is explained later in Chapter 7, guides the selection of dimensions for each corridor element, and it is organized by Multimodal Corridor type.

Modal Emphasis

As explained in Chapter 4, Multimodal Corridors can have any combination of the three Modal Emphases – Pedestrian, Bicycle/Scooter, and Transit. General design principles for each Modal Emphasis are provided below. Additional guidance for Bicycle/Scooter Modal Emphasis and Transit Modal Emphasis is provided in Chapter 7. Design considerations for pedestrian crossings are provided in Appendix E.

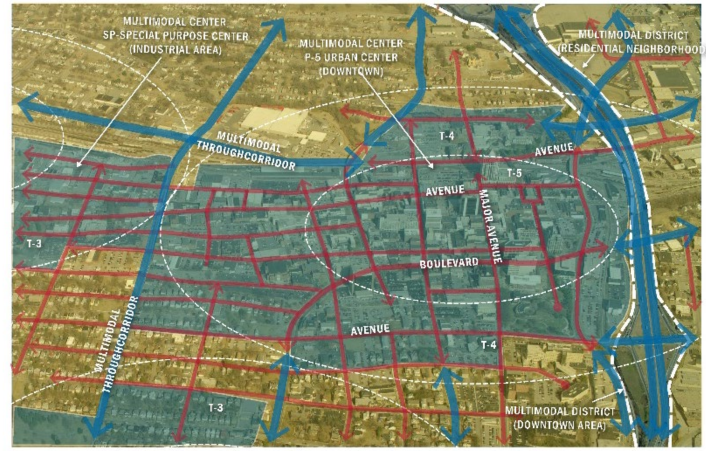
General Design Principles for Pedestrian Modal Emphasis

As described in Chapter 4, the majority of streets in the city have been proposed to have Pedestrian Modal Emphasis. This modal emphasis relates to preferred design standards and dimensions in the Corridor Matrix.

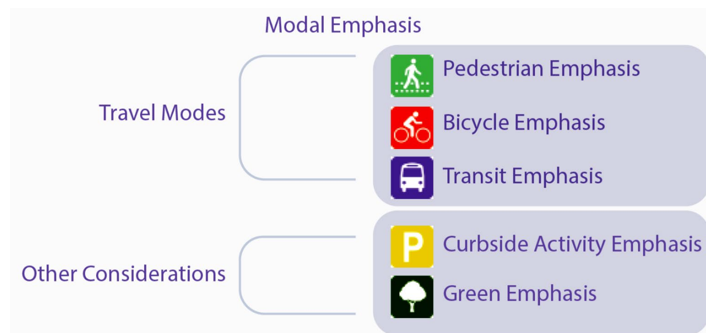
As explained later in Chapter 7, the Corridor Matrix provides optimal and minimum dimensions for each corridor element. The optimal dimensions are used for those modes that are emphasized and the minimal dimensions are used for those modes that are not emphasized.

For Pedestrian Modal Emphasis, the sidewalk through element is the most important one.

The optimal dimensions for the sidewalk through element should be used on streets with Pedestrian Modal Emphasis. Other corridor elements that are related to Pedestrian Modal Emphasis are the amenity element and the building frontage element. On corridors with available right-of-way, these elements should also use optimal dimensions to the degree practicable. The sidewalk through, amenity, and building frontage elements of a multimodal corridor cross-section are illustrated previously in Figure 6-1.



Downtown Roanoke, VA. The superimposed Multimodal Districts, Multimodal Centers and Multimodal Corridors show how a Multimodal System Plan could be applied to this downtown area. Image Source: DRPT Multimodal System Design Guidelines



Travel Modes and Other Considerations for Modal Emphasis in Corridor Cross-Section Design. Image source: DRPT Multimodal System Design Guidelines

General Design Principles for Bicycle/Scooter Modal Emphasis

The selection and design of a facility for bicyclists and scooter riders primarily depends upon traffic volumes, traffic speeds, and available right-of-way. Corridors with Bicycle/Scooter Modal Emphasis are critical connections for bicyclists and scooter riders.

The design considerations for Bicycle/Scooter Modal Emphasis provided later in Chapter 7 provide recommendations for identifying the preferred design approach - based on traffic volume and speed - that is designed for the "Interested but Concerned" type of bicyclist. Norfolk's bicycle network vision in Chapter 5 reinforces the intention to design the city's bicycle network for this type of bicyclist.

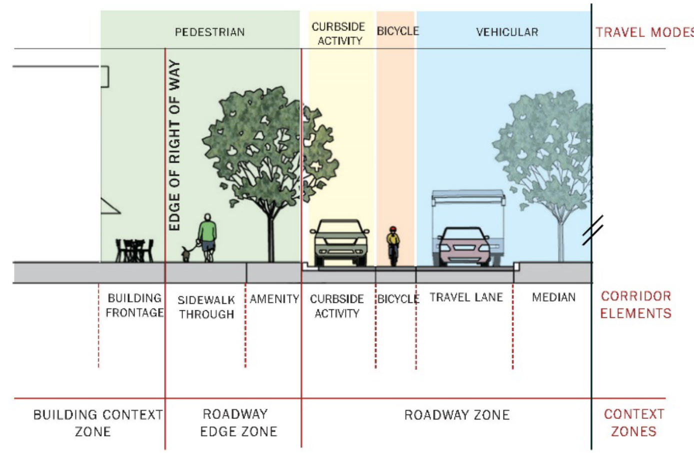
Wherever possible, the preferred design approach for corridors with Bicycle/Scooter Modal Emphasis should follow the guidance for facility selection specified in Step 2b to provide a low-stress facility that serves bicyclists of all ages and abilities.

If it is not possible to provide the preferred design approach due to constraints of site conditions, funding or safety issues, a next best facility should be identified as well as a parallel route that would serve the same trip as much as possible and provide a low-stress option. This parallel route may be less direct but will accommodate the "Interested by Concerned" types of bicyclists who are unlikely to ride a bike if low-stress routes are unavailable.

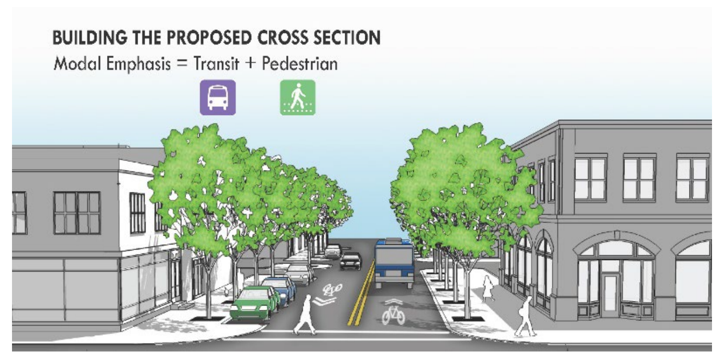
General Design Principles for Transit Modal Emphasis

As explained in Chapter 4, the Transit Modal Emphasis map identifies a network of the most critical transit connections and streets with the highest potential for generating transit trips.

The biggest design decision on corridors with Transit Modal Emphasis is whether a dedicated lane for transit is needed. In general, the design of corridors with Transit Modal Emphasis should follow the design considerations guidance in Chapter 7. If it is determined that a dedicated transit lane is not feasible, the outside travel lane should be optimized to 12 feet wide, to the extent feasible, to provide optimal lane width for bus operations.



Multimodal Corridors are divided into Context Zones. Each element of the corridor relates to a Travel Mode. Image source: DRPT Multimodal System Design Guidelines



Using Modal Emphasis to build a typical roadway cross section. Image source: DRPT Multimodal System Design Guidelines

This chapter has provided an overview of the Multimodal Project Design Framework and explained how the different components of the multimodal system plan define the multimodal context for corridor design. The next chapter focuses in on the design approaches and design considerations for each mode.