

Tennessee Department of Transportation Project Scoping Guide (PSG)

Module 1: Chapters 1 through 4



TDOT PROJECT SCOPING GUIDE
SEPTEMBER 2024




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Outline

- Chapter 1: Introduction and Overview
- Chapter 2: Decision-Making Framework and Documentation
- Chapter 3: Identifying Design Year Context
- Chapter 4: Multimodal Planning and Design

- Chapter 5: Intersection Planning and Design
- Chapter 6: Context Design Guidance and Criteria
- Chapter 7: Case Studies
- Appendices




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Chapter 1: Introduction and Overview



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Chapter 1: Introduction and Overview

- Purpose of the Guide and How to Use
- Qualifying Words and Key Terminology
- TDOT Project Development Process
- TDOT Policies
- Accessibility
- National Policies
- State and National Resources
- Tort Liability

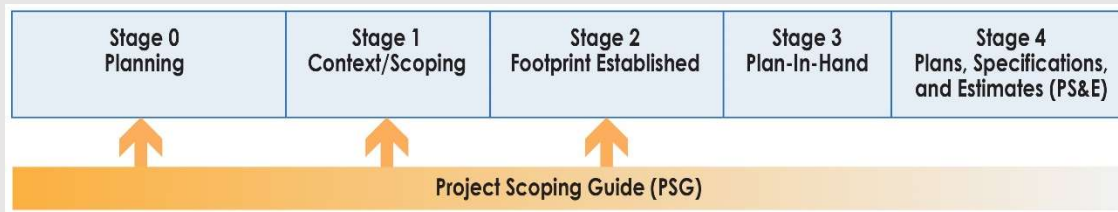


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Chapter 1: Introduction and Overview

Purpose of the Guide and How to Use

- Support Project Development Network (PDN)
- Outline decision-making framework
- Provide roadway design criteria and guidance for five TDOT contexts:
Rural, Rural Town, Suburban, Urban, Urban Core

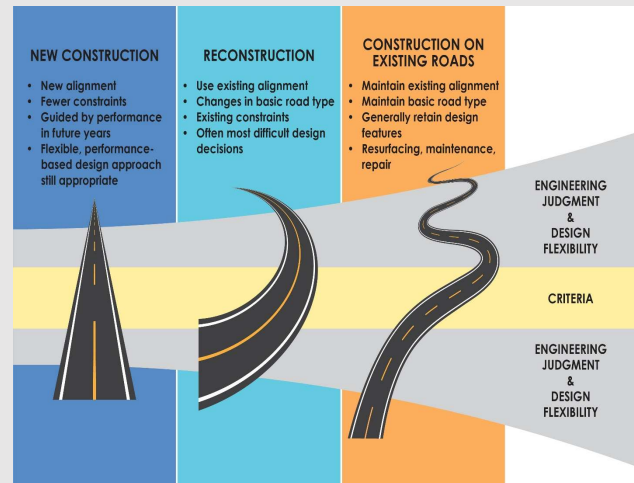


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Chapter 1: Introduction and Overview

Purpose of the Guide and How to Use

- PSG applies to all project types, including:
 - *New construction*
 - *Reconstruction*
 - *Construction on existing roads*
- Understanding roadway users and their needs are key to the design process



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Chapter 1: Introduction and Overview

Qualifying Words and Key Terminology

- Additional terms and list of acronyms in Appendix A

1.3.1 Qualifying Words

Many qualifying words are used throughout design projects and within the *PSG*. For consistency and uniformity in the application of various design criteria, the following definitions apply:

- **Should, Recommend:** An advisory condition. The project team is encouraged to follow the criteria and guidance presented in this context unless a compelling justification not to do so. The decision made by the project team is final.
- **May, Could, Can, Suggest, Consider:** A permissive condition. The project team is allowed to apply individual judgment and discretion to the criteria presented in this context.
- **Standard:** A statement of minimum required practice. An exception may be granted through the Design Exception/Waiver/Deviation process (see Chapter 2) and requires approval.

1.3.2 Key Terminology

The following key terms are used consistently throughout the *PSG*:

- **Context Classifications:** Five TDOT contexts (Rural, Rural Town, Suburban, Urban, and Urban Core) that broadly identify the various built environments along TDOT roadways based on existing or future land use characteristics, development patterns, and roadway connectivity. The term context and context classification are used interchangeably throughout the *PSG*.
- **Roadway User:** Pedestrian, bicyclist, micromobility user, motorcyclist, motorist, transit user, freight handler, or other individual traveling on, crossing, or accessing a roadway.
- **Functional Classification (Facility Type):** The process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide. The *PSG* focuses on local, collector, and arterial roadways.

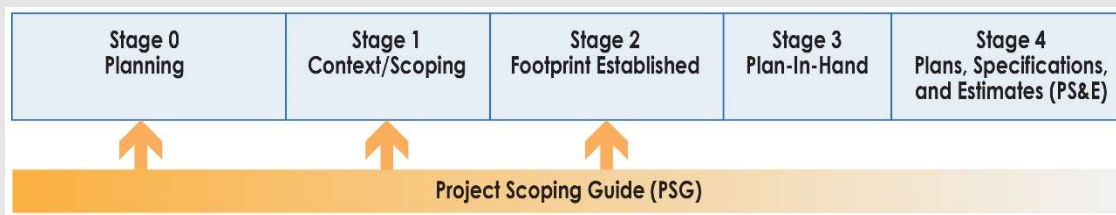


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Chapter 1: Introduction and Overview

TDOT Project Development Process

- *PSG* supports milestone, activities, and documentation in PDN



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Chapter 1: Introduction and Overview

Policies, Accessibility, Resources, and Tort Liability

- *PSG* supports TDOT policies and project decision-making, including those around accessibility
- Additional information on policies in **Appendix B**
- Key TDOT resources include:
 - Project Delivery Network
 - Roadway Design Guidelines
 - Standard Drawings
 - Standard Specifications
 - Highway System Access Manual
 - Traffic Design Manual
 - Collection of Transportation Plans
- *PSG* supports documentation of design decisions, which helps manage risk



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Chapter 2: Decision-Making Framework and Documentation



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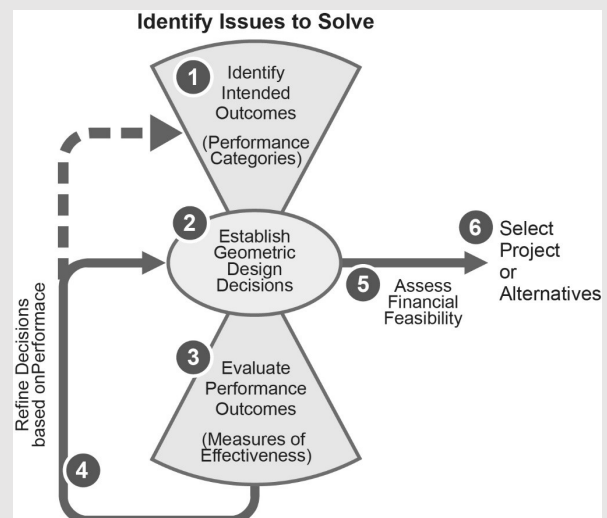
Chapter 2: Decision-Making Framework and Documentation

- Performance-Based Design Approach
- Establishing Project Goals and Performance Measures
- Concept Development
- Evaluation and Selection
- Design Phase
- Documenting Design Decisions
- Design Exceptions/Deviations/Waivers

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Chapter 2: Decision-Making Framework and Documentation Performance-Based Design Approach

- Enables project teams to make informed decisions about the performance trade-offs of alternative solutions
- Iterative process
- Supports TDOT's existing design process

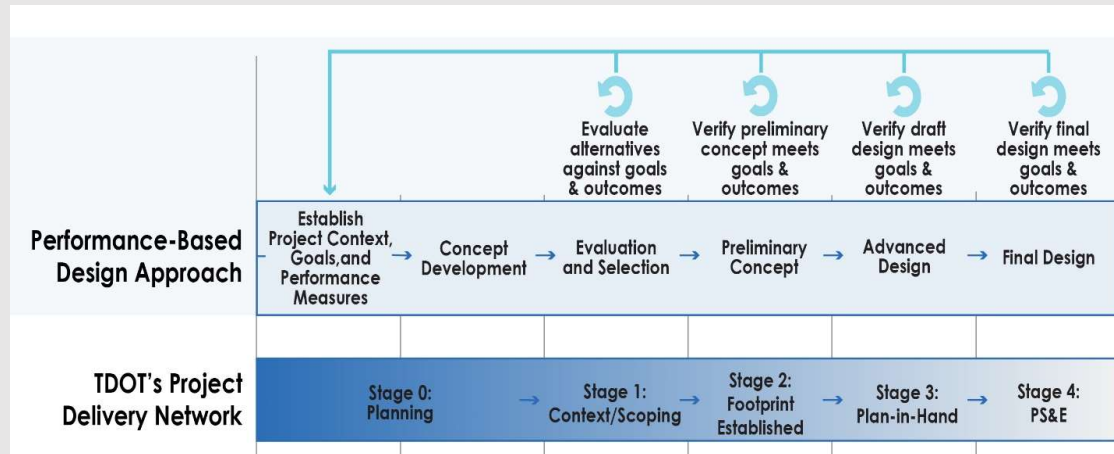


Source: NCHRP Report 785, Exhibit 1-1 (3)

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Chapter 2: Decision-Making Framework and Documentation

Performance-Based Design Approach



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Chapter 2: Decision-Making Framework and Documentation

Project Goals and Performance Measures

PSG includes:

- Guidance on developing goals and performance measures
- Example goals and performance measures
- Connection to PDN documentation

Goal	Performance Measures
Provide increased safety and access for pedestrians and bicyclists along the corridor.	• Expected change in travel speeds • Anticipated change in crashes • Pedestrian assessment • Bicyclist assessment
Accommodate future vehicular traffic anticipated on the corridor.	• Design year volume-to-capacity (v/c) ratio • Design year level of service (LOS) • Expected change in travel time reliability

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Chapter 2: Decision-Making Framework and Documentation

Project Goals and Performance Measures

• Example performance measures

Performance Category	Example Performance Measure	Mode	Project Level Performance Measures
Safety	- Conflict point analysis - Pedestrian and bicycle intersection evaluation (TDOT 20 Flags Manual) - Vehicle speeds - Crossing distances - Crash history (severity and type of crash) - Calibrated safety performance functions (Highway Safety Manual) - Crash reduction factors	Vehicular	- Maximum volume-to-capacity (v/c) ratio - Travel-time reliability (review of available existing data and estimated microsimulation data) - Peak and off-peak travel time - Estimated potential reduction in crashes using crash reduction factors - Number of major crashes per year - Number of high-crash locations - Length of vehicle queues - Average or 85th percentile travel speed - Intersection delay
Mobility/Traffic Operations	- Average Daily Traffic (ADT) threshold values - Capacity Analysis for Planning of Junctions (CAP-X) - Volume-to-capacity (v/c) ratio - Travel delay - Corridor travel time - Travel time reliability (review of available existing data and estimated microsimulation data) - Level of service (LOS) - Queue lengths (50th or 95th percentile) - Design vehicle	Freight	- Volume-to-capacity (v/c) ratio - Travel-time reliability (review of available existing data and estimated microsimulation data) - Peak and off-peak travel time - Ability to serve freight origins and destinations - Loading zone availability - Average or 85th percentile travel speed
Footprint	- Right-of-way - Property acquisition impacts - Utility conflicts - Access management issues	Bicycle	- Bicycle level of traffic stress (LTS) - Percent of roadway served by an exclusive bicycle facility - Percent of roadway with bicycle facilities meeting current standards - Estimated potential reduction in crashes using crash reduction factors - Number of crashes involving bicyclists - Forecast volumes of bicyclists (various methods available)
Structural Capacity	- Design life - Ability to widen the structure	Pedestrian	- Pedestrian level of traffic stress (LTS) - Sidewalk coverage and connectivity - Sidewalk width and effective width - Pedestrian space - Average distance between marked crossings - Percentage of ADA-compliant pedestrian crossings - Average pedestrian delay at intersections - Presence of pedestrian refuge islands - Number of street trees and percentage of shade - Level of pedestrian-scale street lighting - Estimated potential reduction in crashes using crash reduction factors
Design Roadway User	- Life cycle cost - Construction cost - Benefit-to-cost ratio	Transit	- Number/percent of ADA-compliant transit stops - Number of residents/jobs within a quarter mile of stop locations (or within a half a mile of high-frequency transit) - Anticipated transit delay due to stop location (in-lane stops and far-side stops typically reduce delay) - Presence or degree of transit priority treatments (where appropriate) - Sidewalk width - Proximity of marked street crossings to transit stop locations - Average travel speed
Financial Investment	- Vehicle miles traveled (VMT) - Congested vehicle miles traveled - Greenhouse gas emissions - Other emissions and particulate matter - Transit accessibility - Mode share - Impacts to wetlands or other environmentally sensitive areas		
Environmental Considerations	- Livability - Walkability - Economic revitalization - History (e.g., protection of a tree) - Heritage		
Other Site-Specific Considerations			



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Chapter 2: Decision-Making Framework and Documentation

Concept Development

- Concept Development is part of PDN Stage 0
- PSG includes high-level guidance and connection to PDN documentation

The network approach requires close coordination between TDOT and local agencies. For example, the analysis of an alternative that prioritizes on-street parking over a dedicated bicycle facility should be informed by local vision, availability of parallel routes, and the local agency's willingness to invest in and maintain parallel facilities. The project team may find this information documented in local plans. Further, the evaluation of this alternative (and others) could also be informed by collecting data about the on-street parking use—who is using it, utilization rates, turnover rates, and side street parking availability. Finally, the decision must also be informed by technical analysis of bicycling trip origins and destinations and the need for bicycling connectivity, safety data, and user input.

TDOT PDN Documentation: Project alternative concepts are initially identified in the Final Concept Report in Stage 0 and further refined in Stage 1 as part of the Draft Project Commitment Documentation.

PSG uses call out boxes for key text and connections to PDN



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Chapter 2: Decision-Making Framework and Documentation

Evaluation and Selection

- Alternative evaluation and selection is part of PDN Stage 1
- PSG includes guidance on evaluating trade-offs, including scoring performance measures
- Design decisions should be well documented

Project Goal	Performance Measure	Improvement Rating		
		Low	Medium	High
Provide increased safety and access for pedestrians and bicyclists along the corridor.	Expected change in travel speeds	Project includes 0-1 treatments with documented effectiveness at speed reduction .	Project includes 2 treatments with documented effectiveness at speed reduction .	Project includes 3 or more treatments with documented effectiveness at speed reduction .
	Anticipated change in crashes	Project is not anticipated to reduce crashes.	Project provides a moderate value crash reduction factor.	Project provides a high value crash reduction factor.
	Pedestrian assessment	Project provides a facility of minimum width.	Project provides a wider facility with horizontal separation .	Project provides a wider facility with vertical separation .
	Bicycle assessment	Project provides a facility of minimum width.	Project provides a wider facility with horizontal separation .	Project provides a wider facility with vertical separation .

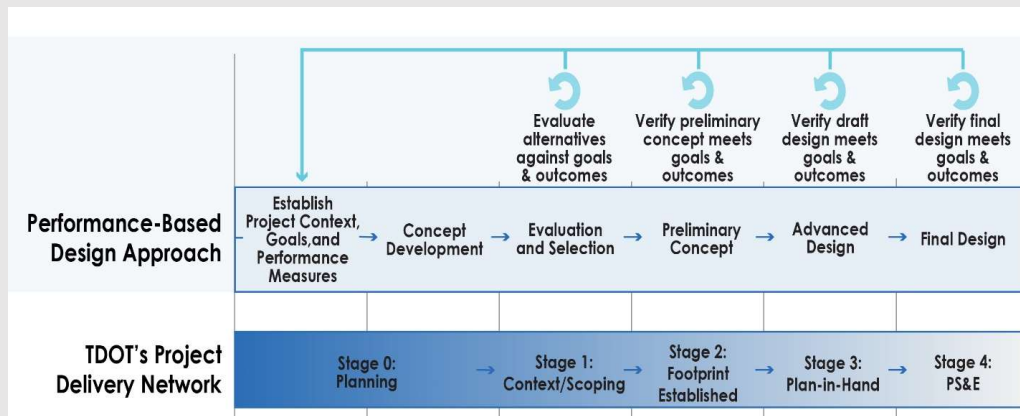


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Chapter 2: Decision-Making Framework and Documentation

Design Phase

- A performance-based design approach is iterative
- Documentation and engagement with stakeholders are key

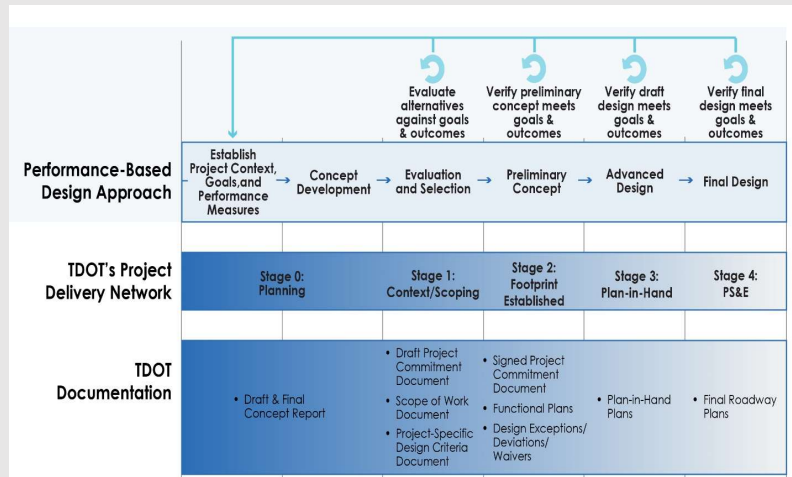


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Chapter 2: Decision-Making Framework and Documentation

Documenting Design Decisions

- PSG provides information to support PDN deliverables in Stages 0, 1 and 2



Chapter 3: Identifying Design Year Context

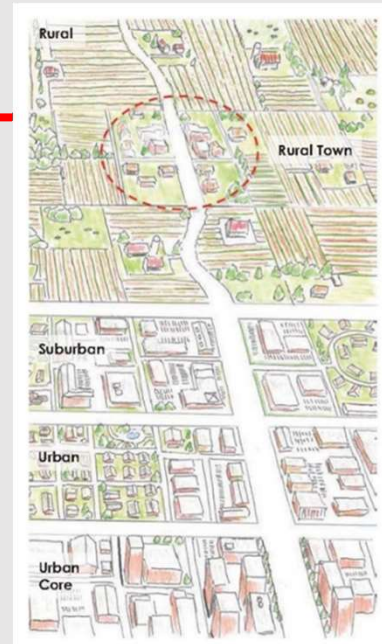


Chapter 3: Identifying Design Year Context

- TDOT Context Classifications
- Connection to Other Roadway Classifications
- Documenting Context
- Context Design Considerations

Chapter 3: Identifying Design Year Context TDOT Context Classifications

- Five contexts
- Consistent with *Green Book*
- Defined in *Highway System Access Manual* and *PSG*
- Definitions consider development density, setback, land use, on-street parking, and pedestrian/bicyclist activities



Source: NCHRP Research Report 855

Chapter 3: Identifying Design Year Context

TDOT Context Classifications

- PSG provides guidance on how to identify context, including tables and examples

Table 3-1: Potential Existing and Future Characteristics of Contexts for TDOT Roadways

Context Classification	Land Use ¹	Density of Structures ²	Building Setback ³	Block Size ²	Access Control ¹	Parking Location ¹	Pedestrian Activity	Bicycle Activity	Transit	Utilities	Landscaping
Rural	Agricultural, natural resource preservation, and outdoor recreation uses with some isolated residential and commercial	Lowest (few houses or structures)	Usually large setbacks	Undefined blocks	Limited access, varied direct vehicle access to land uses, limited pedestrian and bicycle access	Mostly off-street parking	Limited	Limited	Limited	Overhead utilities with varied setback	Unlikely within right-of-way
Rural Town	Primarily commercial uses along a main street, with some mixed residential neighborhood and commercial clusters	Low to medium (single-family houses and other single-purpose structures)	On-street parking and sidewalks with predominately small setbacks	Small to medium blocks	High access opportunities for all users	On-street parking	Likely	Limited	Limited	Overhead utilities with varied setback	Unlikely
Suburban	Mixed residential neighborhood and commercial clusters (includes town centers, commercial corridors, big box commercial, and light industrial)	Low to medium (single- and multifamily structures and multistory commercial)	Varied setbacks with some sidewalks and mostly off-street parking	Medium to large blocks, not well defined	Low to moderate access opportunities for all users	Mostly off-street parking	Varied	Varied	Potential	Overhead utilities with minimal setback	Likely
Urban	Mixed residential and commercial uses, with some institutional and industrial and prominent destinations	High (multistory, low-rise structures with designated off-street parking)	On-street parking and sidewalks with mixed setbacks	Small to medium blocks	High access opportunities for all users	On-street parking and structured parking	Likely	Likely	Likely	Most utilities underground, light poles likely adjacent to the roadway	Likely
Urban Core	Mixed commercial, residential, and institutional uses within and among predominately high-rise structures	Highest (multistory and high-rise structures)	Small setbacks with sidewalks and pedestrian plazas	Small, well-defined blocks	High access opportunities for pedestrians and bicycles, limited parking may limit access for vehicles	Restricted on-street parking and structured parking	Likely	Likely	Likely	Most utilities underground, light poles likely adjacent to the roadway	Likely

¹ Inclusion of Density of Structures, Building Setback, Permeability, and Land Use as described in NCHRP Research Report 1022 (3)

² Inclusion of Block Size and Parking Location as described in the AASHTO Green Book (7)

³ Inclusion of Natural Environment, Community Characteristics, and Social Demographics as described by NCHRP Web-Only Document 320 (5)



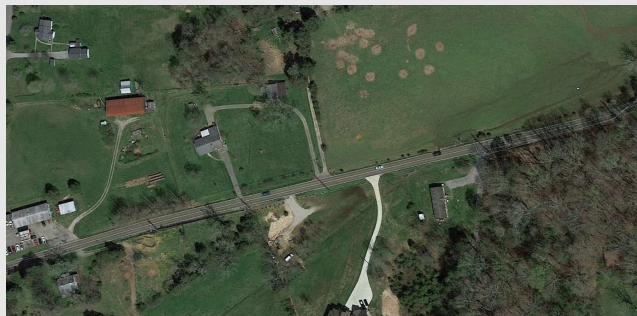
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Chapter 3: Identifying Design Year Context

TDOT Context Classifications

- PSG provides guidance on how to identify context, including tables and examples

S Main Street (SR 013), Lobelville—Rural Town Context



Source: Google Maps



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Chapter 3: Identifying Design Year Context

TDOT Context Classifications

- *PSG* provides guidance on how to identify context, including tables and examples

W Main Street (SR 03776), Knoxville—Urban Context



Source: Google Maps



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Chapter 3: Identifying Design Year Context

TDOT Context Classifications

“Context can help the project team identify the types of roadway users and the intensity of use that can be expected within each context” – *PSG*

Table 3-3: General Modal Integration in Different Contexts

Context	Motorist	Freight	Transit	Bicyclist	Pedestrian
Urban Core	Low	Low	High	High	High
Urban	Medium	Low	High	High	High
Suburban	High	High	High	Medium	Medium
Rural Town	Medium	Medium	Varies	High	High
Rural	High	High	Low	Low	Low

High: Highest level facility should be considered and prioritized over other modal treatments.

Medium: Design elements should be considered; trade-offs may exist based on desired outcomes and user needs.

Low: Incorporate design elements as space permits.



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Chapter 3: Identifying Design Year Context

Connection to Other Roadway Classifications

- *PSG* focused on local, collector, and arterial roadways
- Context driver for design decisions
- Important to document facility type and other roadway designations that affect modal expectations and regional travel, including:
 - Freight Route
 - State Industrial Access (SIA) Program and Industrial Highways
 - National Highway System
 - State Highway System



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Chapter 3: Identifying Design Year Context

Documenting Context

- Context primarily documented in Concept Report in Stage 0 of the PDN process
- Chapter 2 of the *PSG* provides additional information on documentation



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Chapter 3: Identifying Design Year Context

Context Design Considerations

- Chapter 3 includes table showing how context, modal expectations, and roadway characteristics can be applied together
- Chapter 4 and Chapter 6 of the *PSG* provide additional design guidance

Table 3-4: Designing Based on Context, Considering Roadway Designations and Activity of Different Modes

Context	Travel Lanes	Turn Lanes	Shy Distance	Median	Roadside Features	Bicycle Facility	Sidewalk	Target Pedestrian Crossing Spacing Range (feet) ¹	On-street parking
Rural	Start with minimum widths, wider by roadway characteristics	Balance crossing width and operations depending on desired use	Consider roadway characteristics, desired speeds	Flush or depressed medians are optional.	Roadside ditches	Start with separated bicycle facility, consider roadway characteristics	Continuous and buffered sidewalks or shared-use path	600+	Not typical
Rural Town	Start with minimum widths, wider by roadway characteristics	Balance crossing width and operations depending on desired use	Consider roadway characteristics, desired speeds	Flush or raised medians are optional and may be used as pedestrian crossing refuge	May vary between curb and gutter and ditches	Start with separated bicycle facility, consider roadway characteristics	Continuous and buffered sidewalks or shared-use path, sized for desired use	250-550 (1-2 blocks)	Consider on-street parking if space allows
Suburban	Start with minimum widths, wider by roadway characteristics	Balance crossing width and operations depending on desired use	Consider roadway characteristics, desired speeds	Flush or raised medians are optional and may be used as pedestrian crossing refuge	Curb and gutter	Start with separated bicycle facility, consider roadway characteristics	Continuous and buffered sidewalks or shared-use path	600+	Not typical
Urban	Start with minimum widths, wider by roadway characteristics	Minimize additional crossing width at intersections	Minimal	Flush or raised medians are optional and may be used as pedestrian crossing refuge	Curb and gutter	Start with separated bicycle facility, consider roadway characteristics	Ample space for sidewalk activity (e.g., sidewalk cafes, transit shelters)	250-550 (1-2 blocks)	Consider on-street parking if space allows
Urban Core	Start with minimum widths, wider by roadway characteristics	Minimize additional crossing width at intersections	Minimal	Flush or raised medians are optional and may be used as pedestrian crossing refuge	Curb and gutter	Start with separated bicycle facility	Ample space for sidewalk activity (e.g., sidewalk cafes, transit shelters)	250-550 (1-2 blocks)	Varied, consider impacts to bicycles, transit, and loading/unloading areas.



¹ Intersection spacing should follow guidance provided in *TDOT Highway System Access Manual (HSAM) Volume 3 (3)*. Intersections are typically too far apart for pedestrian permeability; therefore, mid-block crosswalks will likely be required to achieve recommended crossing spacings.

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Chapter 4: Multimodal Planning and Design



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Chapter 4: Multimodal Planning and Design

- Accessibility Policies
 - Pedestrian and Bicycle Safety and Experience
 - Pedestrian Design
 - Bicycle Design
 - Shared-Use Paths
 - Crossings
 - Transit Design
- Includes:**
 General Principles
 Elements of Design
 Mode/Facility Specific Sections

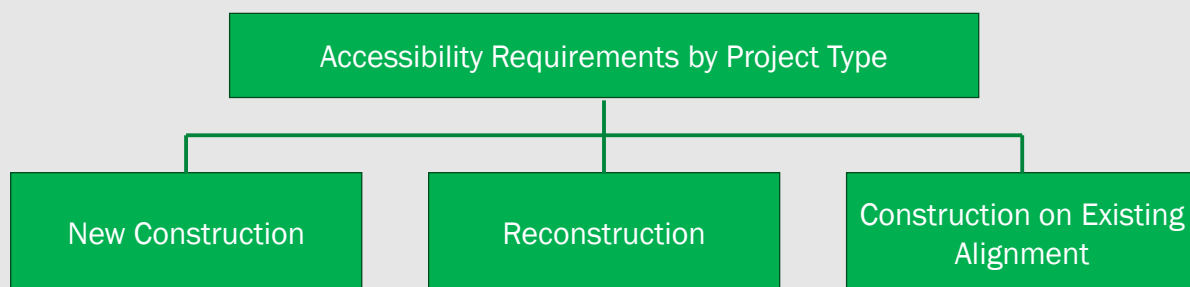


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Chapter 4: Multimodal Planning and Design

Accessibility Policies

- TDOT's Multimodal Access Policy
- Public Right-of-Way Accessibility Guidelines (PROWAG)
- Americans with Disabilities Act (ADA)

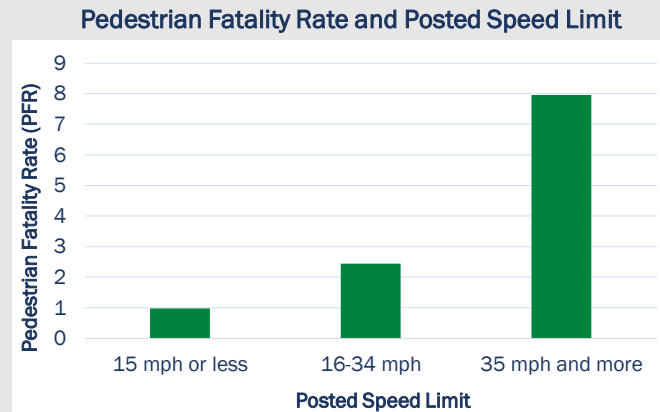


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Chapter 4: Multimodal Planning and Design

Pedestrian and Bicycle Safety and Experience

- Safety
- Level of Traffic Stress (LTS)
- Speed
- Separation
- Exposure



Source: The University of Tennessee and Vanderbilt University

Chapter 4: Multimodal Planning and Design

Pedestrian Design

- General Principles
- Elements of Design
- Types of Pedestrian Facilities
 - Sidewalks
 - Shared Streets
- Pedestrian Facility Selection



Source: TDOT

Chapter 4: Multimodal Planning and Design

Pedestrian Design – General Principles

- Walking speeds
- Spatial needs
- People with disabilities
- Distance and density
- Route directness
- Personal safety and security
- Personal comfort and environmental attractiveness



Source: TDOT

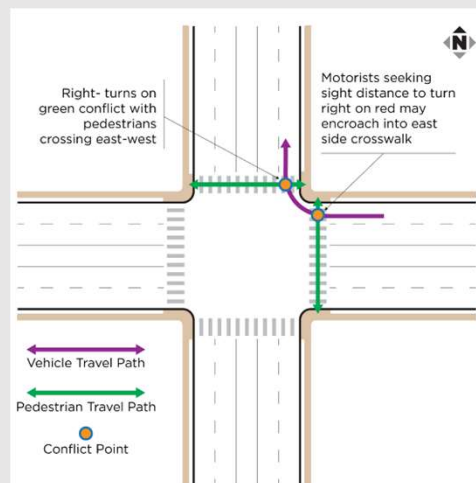


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Chapter 4: Multimodal Planning and Design

Pedestrian Design – Elements of Design

- Conflict points
- Walkway width
- Separation or buffer



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Chapter 4: Multimodal Planning and Design

Pedestrian Design – Types of Pedestrian Facilities

Sidewalk



Source: TDOT

Shared Street



Source: Kittelson & Associates, Inc.

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Chapter 4: Multimodal Planning and Design

Pedestrian Design – Pedestrian Facility Selection

- Consider key factors
- Apply performance-based design approach
- Evaluate trade-offs if needed
- Document decisions

Step 1. Identify intended project outcomes by which performance can be measured



Step 2. Establish geometric design decisions, such as design criteria and preliminary design



Step 3. Evaluate the performance of alternatives compared to desired project outcomes



Step 4. Iterate design alternatives based on the evaluation results.



Step 5. Evaluate benefits and costs to determine the value of the geometric design compared to the project outcomes.



Step 6. Select or advance alternatives based on viability within the project context.

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Chapter 4: Multimodal Planning and Design

Bicycle Design

- General Principles
- Elements of Design
- Types of Bicycle Facilities
 - Separated Bicycle Lanes
 - Buffered Bicycle Lanes
 - Conventional Bicycle Lanes
 - Shared Lane
 - Paved Shoulders
- Bicycle Facility Selection



Chapter 4: Multimodal Planning and Design

Bicycle Design – General Principles

BICYCLIST DESIGN USER PROFILES

Interested but Concerned

51%-56% of the total population

Often not comfortable with bike lanes, may bike on sidewalks even if bike lanes are provided; prefer off-street or separated bicycle facilities or quiet or traffic-calmed residential roads. May not bike at all if bicycle facilities do not meet needs for perceived comfort.

Somewhat Confident

5-9% of the total population

Generally prefer more separated facilities, but are comfortable riding in bicycle lanes or on paved shoulders if need be.

Highly Confident

4-7% of the total population

Comfortable riding with traffic; will use roads without bike lanes.



**LOW STRESS
TOLERANCE**

**HIGH STRESS
TOLERANCE**

Source: HWA Bikeway Selection Guide

Network Design Principles:

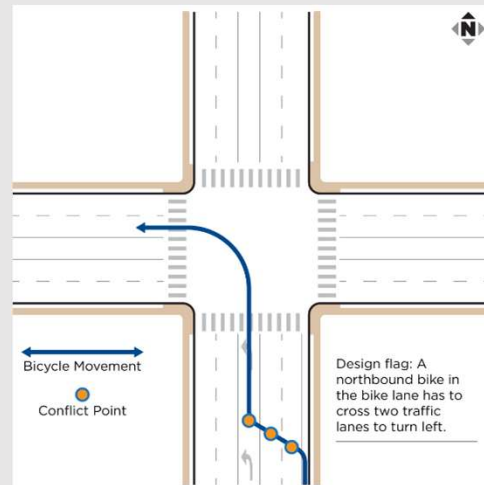
- Safety
- Comfort
- Connectivity
- Directness
- Cohesion
- Attractiveness
- Unbroken Flow



Chapter 4: Multimodal Planning and Design

Bicycle Design – Elements of Design

- Shy distance
- Conflict Points
- Width
- Separation or Buffer



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Chapter 4: Multimodal Planning and Design

Bicycle Design – Types of Bicycle Facilities

Separated Bicycle Lane



Source: Kittelson & Associates, Inc.

Buffered Bicycle Lane



Source: TDOT

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Chapter 4: Multimodal Planning and Design

Bicycle Design – Types of Bicycle Facilities

Conventional Bicycle Lane



Source: TDOT

Shared Lane



Source: Kittelson & Associates, Inc.

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Chapter 4: Multimodal Planning and Design

Bicycle Design – Types of Bicycle Facilities

Paved Shoulders

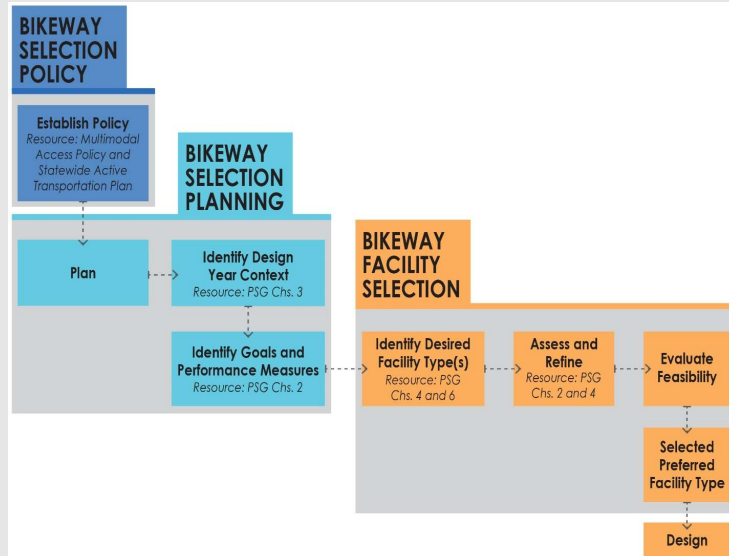


Source: TDOT

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Chapter 4: Multimodal Planning and Design

Bicycle Design – Bicycle Facility Selection



Source: Adapted from FHWA Bikeway Selection Guide

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Chapter 4: Multimodal Planning and Design

Shared-Use Paths

- General Principles
- Elements of Design
- Route Selection
- Mixing Users



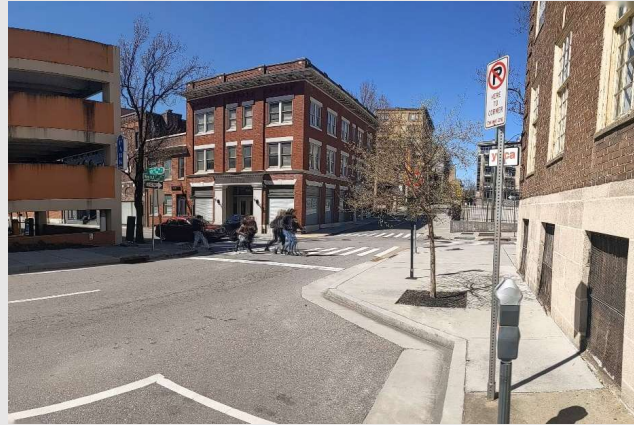
Source: TDOT

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Chapter 4: Multimodal Planning and Design

Crossings

- General Principles
- Elements of Design
- Marked and Unmarked Crossings
- Crossing Treatments
- Crossing Selection
- Spacing Requirements and Considerations
- Crossings at Intersections
- Railroad Crossings
- Bridges



Source: TDOT



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Chapter 4: Multimodal Planning and Design

Crossings – Elements of Design

- Crosswalk Markings
- High-Visibility Crosswalk Markings
- Crosswalk Marking Architectural Features
- Curb Extensions/Bulb-Outs
- Curb Ramps
- Detectable Warning Surfaces
- Crossing Island/Pedestrian Refuge
- Raised Crossing
- Lighting



Source: TDOT



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Chapter 4: Multimodal Planning and Design

Crossings – Marked and Unmarked Crossings

“Unmarked crosswalks are legal pedestrian routes but not marked with signage or pavement markings. Pedestrians have the same right-of-way at unmarked crosswalks as they do at marked crosswalks.” – *PSG*



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Chapter 4: Multimodal Planning and Design

Crossings – Crossing Treatments

RRFB



Source: TDOT

PHB



Source: TDOT

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Chapter 4: Multimodal Planning and Design

Crossings – Crossing Treatments

Pedestrian Signal



Source: Kittelson

Grade-Separated Crossing



Source: TDOT

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Chapter 4: Multimodal Planning and Design

Crossings – Crossing Selection

- Large amount of national guidance on crossing selection
- TDOT generally uses approach in FHWA's *STEP Guide*, with an added focus on context and other key factors:

- Safety
- Context
- Accessibility
- Feasibility/ Cost
- Operations
- Network Connectivity
- Demand



Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	1 2 4 5 6	1 5 7 9	1 5 7 9	1 5 4 5 6	1 5 7 9	1 5 7 9	1 5 4 5 6	1 5 7 9	1 5 7 9
3 lanes with raised median (1 lane in each direction)	1 2 3 4 5	1 5 7 9	1 5 7 9	1 5 4 5	1 5 7 9	1 5 7 9	1 5 4 5	1 5 7 9	1 5 7 9
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	1 2 3 4 5 6	1 5 7 9	1 5 7 9	1 5 4 5 6	1 5 7 9	1 5 7 9	1 5 4 5 6	1 5 7 9	1 5 7 9
4+ lanes with raised median (2 or more lanes in each direction)	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9
4+ lanes w/o raised median (2 or more lanes in each direction)	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9	1 5 7 8 9

Given the set of conditions in a cell,
 * Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
 • Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.
 ○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
 2 Raised crosswalk
 3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
 4 In-Street Pedestrian Crossing sign
 5 Curb extension
 6 Pedestrian refuge island
 7 Rectangular Rapid-Flashing Beacon (RRFB)**
 8 Road Diet
 9 Pedestrian Hybrid Beacon (PHB)**

Source: FHWA STEP Guide

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Chapter 4: Multimodal Planning and Design

Crossings – Spacing Requirements and Considerations

- PSG includes factors to consider to determine appropriate spacing of crossings
- PSG provides ranges for crossings based on context

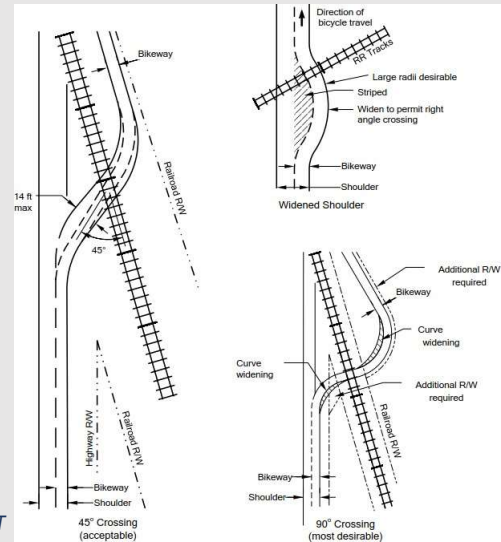
Table 4-3: Target Pedestrian Crossing Spacing by Context

Context	Target Pedestrian Crossing Spacing Range (feet) ¹
Rural	600+, varies based on adjacent land uses
Rural Town	250-550 (1-2 blocks)
Suburban	600+, varies based on adjacent land uses
Urban	250-550 (1-2 blocks)
Urban Core	250-550 (1-2 blocks)

Chapter 4: Multimodal Planning and Design

Crossings – Railroad Crossings and Bridges

- PSG includes:
 - Key design elements for railroad crossings
 - Pedestrian and bicycle considerations at bridges



Source: TDOT

Chapter 4: Multimodal Planning and Design

Transit Design

- General Principles
- Elements of Design
- Transit Stop Placement
- Bus Rapid Transit
- Light Rail Transit and Streetcars

Chapter 4: Multimodal Planning and Design

Transit Design – General Principles

- Accessibility
- Transit stops and stations
- Transit priority measures
- Crossings



Source: TDOT

Chapter 4: Multimodal Planning and Design

Transit Design – Elements of Design

- Buffer Zone Width
- Travel Lane Width
- Shoulder Width
- Separation/Buffer
- Bicycle Facility
- Curb Extensions/Bus Bulbs
- Intersections



Chapter 4: Multimodal Planning and Design

Transit Design – Transit Stop Placement

PSG provides tables with advantages and disadvantages for:

- Far-side, near-side, and midblock transit stops
- In-lane and pull-out stops
- Four configurations of transit stops and bicycle facilities

Table 4-7 Transit Vehicles and Bicycle Facilities

	Advantages	Disadvantages
Pull-Out Transit Stop: Transit vehicle pulls across bicycle facility to access stop	Reduces delay to bicyclists compared to curbside transit stops	- Disturbance to transit operations - Potential conflicts between transit vehicle and bicyclist, as well as transit vehicle and motor vehicle traffic
Curbside Transit Stop with Bicycle Lane: Transit vehicle pulls into bicycle facility to access stop or stops in travel lane adjacent to stop	Minimal disturbance to transit operations	- Requires bicyclists to stop behind the transit vehicle and wait, or pass the transit vehicle using the vehicle travel lane - Potential conflicts between transit vehicle and bicyclist - If transit vehicle does not fully pull up to the curb, requires passengers to step off curb and cross bicycle lane to board the transit vehicle
Curbside Transit Stop with Raised or Shared Bicycle Lane: Bicycle lane is raised to the height of the sidewalk and either delineated from the sidewalk or marked as shared space.	- Minimal disturbance to transit operations - Removes conflict between transit vehicle and bicyclist	- Requires bicyclists to yield to pedestrians boarding or alighting the transit vehicle - Potential conflicts between pedestrians and bicyclists - Potential impacts to drainage
Transit Boarding Island: Bicycle lane is routed behind the transit stop, creating a boarding island.	- Minimal disturbance to transit operations - Removes conflict between transit vehicle and bicyclist - Clearly delineates modal zones - Improves pedestrian visibility	- Requires more right-of-way - Requires bicyclists to yield to pedestrians crossing the bicycle lane to access the boarding island - Potential impacts to drainage - Diverts bike lane laterally

Source: Based on content provided in the WeGo Public Transit Design Guidelines (30)

Chapter 4: Multimodal Planning and Design

Transit Design – BRT, Light Rail Transit and Streetcars

- PSG includes short sections on bus rapid transit (BRT) and light rail transit and streetcars, with key design considerations



Source: Kittelson & Associates, Inc.



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Outline

- Chapter 1: Introduction and Overview
- Chapter 2: Decision-Making Framework and Documentation
- Chapter 3: Identifying Design Year Context
- Chapter 4: Multimodal Planning and Design
- Chapter 5: Intersection Planning and Design
- Chapter 6: Context Design Guidance and Criteria
- Chapter 7: Case Studies
- Appendices



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Questions?

