Complete Streets: A Guide to Best Management + Design Practice

STREETPLANS
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Androscoggin Transportation Resource Center
planning for the movement of goods and people in our community.

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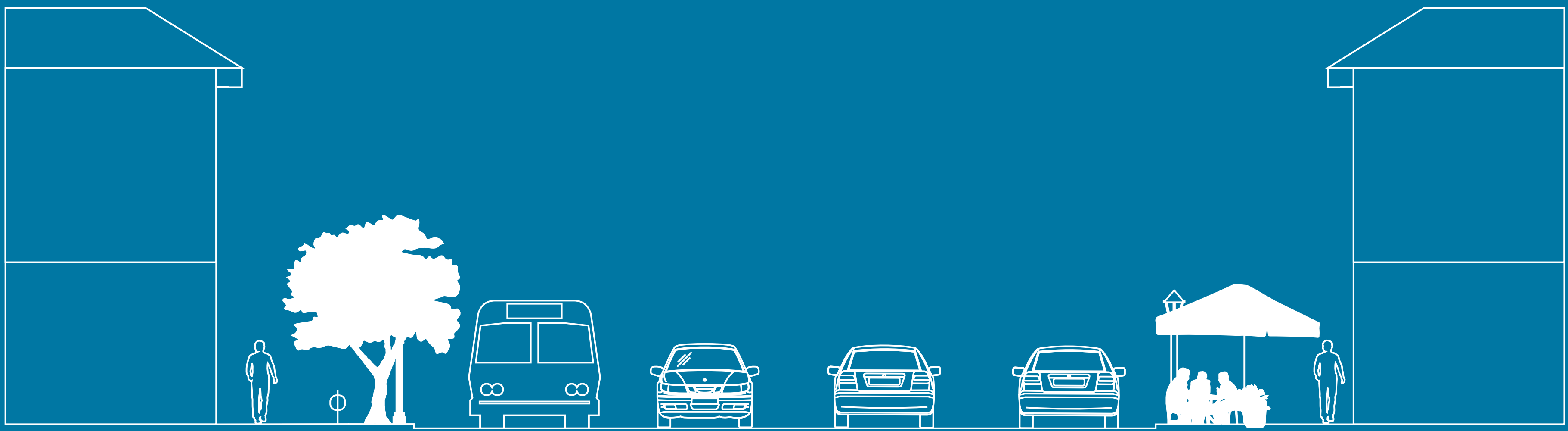
1. Introduction



"When we build our landscape around places to go, we lose places to be."

- Rick Cole

Image: Michigan Municipal League

Let's Build Complete Streets

Introduction

Transportation infrastructure that accommodates the needs of all roadway users is the most tangible aspect of a community that values "complete streets." Indeed, each day, the presence (or absence) of safe, inviting streets and crossings influence how people decide to run errands, travel to work, or get to school. A community's approach to planning, designing, and engineering streets also helps determine people's behavior while they are mobile. For example, a posted speed limit of 25mph will not be enough to encourage slow, careful driving if the street is designed with wide lanes that enable motorists to comfortably travel at speeds in excess of the posted speed limit.

Today, America's most safe, vibrant, and prosperous communities share one thing in common: well-connected and increasingly "complete" thoroughfare networks that feature safe and robust pedestrian infrastructure, bikeway facilities of various types, and accessible, reliable transit. The road to achieving such results is never short, but those communities who have invested in such infrastructure usually began with proactive policies that direct design and investment decisions to support mobility choices.

This Best Practice Management Guide (BMP) was commissioned by the Androscoggin Transportation Resource Center (ATRC), with funding from the Maine Department of Transportation (MDOT). It offers guidance and design protocols customized for the variety of thoroughfare and diverse land use conditions found across the Twin Cities. The goal of this docucment is to assist the cities of Lewiston and Auburn in the planning, design, and implementation of Complete Streets. The desired outcomes of using this BMP Guide is for Lewiston and Auburn to achieve a balanced and complete transportation system, one that accommodates people of all ages and abilities, no matter their chosen mode or distance of travel.

How to use this guide

This BMP guide is intended to provide Complete Streets planning, design, and implementation guidance to ATRC staff, city planning / public works departments, MDOT, concerned citizens, business owners, and civic organizations. This document offers its users design concepts, dimensions, and application details that re-focus professional attention on Complete Streets, with a special emphasis on walking, biking, and transit use, while also prioritizing safety for those who drive. More specifically, this BMP Guide will help Lewiston-Auburn implement its joint Complete Streets policy.

The body of the Guide is organized into four distinct chapters, which include this introduction, an overview of Complete Streets, the detailing of how Lewiston-Auburn's unique thoroughfare network is comprised of 16 thoroughfare types, and a "toolbox" of 38 best practices, which includes walking, cycling, public space, transit, and driving infrastructure design techniques. Each infrastructure type is then described at length, with details about design, application, and maintenance. Finally, the last chapter concludes with a short discussion of best operational and implementation practices.

If you are not familiar with Complete Streets, you'll want to read the next chapter closely. It includes a clear definition of what is and what is not to be considered a Complete Street and includes an anatomical breakdown of street components, as well as 9 Complete Streets design principles. First, we turn to a brief discussion of three overarching Complete Streets values: Access, Safety, and Equity.

Access | Safety | Equity

Access

The move away from auto-centric planning and the incorporation of Complete Streets also includes moving away from the prioritization of a singular transportation metric that has permeated town planning for two generations: mobility.

According to Todd Litman of the Victoria Transport Policy Institute, "Accessibility (or just access) refers to the ability to reach desired goods, services, activities and destinations..." In other words, access, rather than mobility, is the point of most transportation systems. Shifting to this perspective underscores that there are multiple ways to improve transportation and our cities as a whole. These include changing land use paradigms to bring destinations closer together, improving overall mobility choices, and nowadays, eliminating the need to travel in the first place with the rapid adoption of digital communication.

Safety

No matter the mode of travel, safety must be the top priority for any transportation system. Yet, each year, more than 35,000+ people — a population roughly the size of Lewiston — are killed on American streets, with thousands upon thousands more injured. In Lewiston-Auburn, there are more than a hundred crashes happening each year, which cause property damage, serious injuries, and even fatalities. This BMP Guide serves as Lewiston-Auburn's call to action: building low-stress, safe, and complete streets for all roadway users will save lives.

Equity

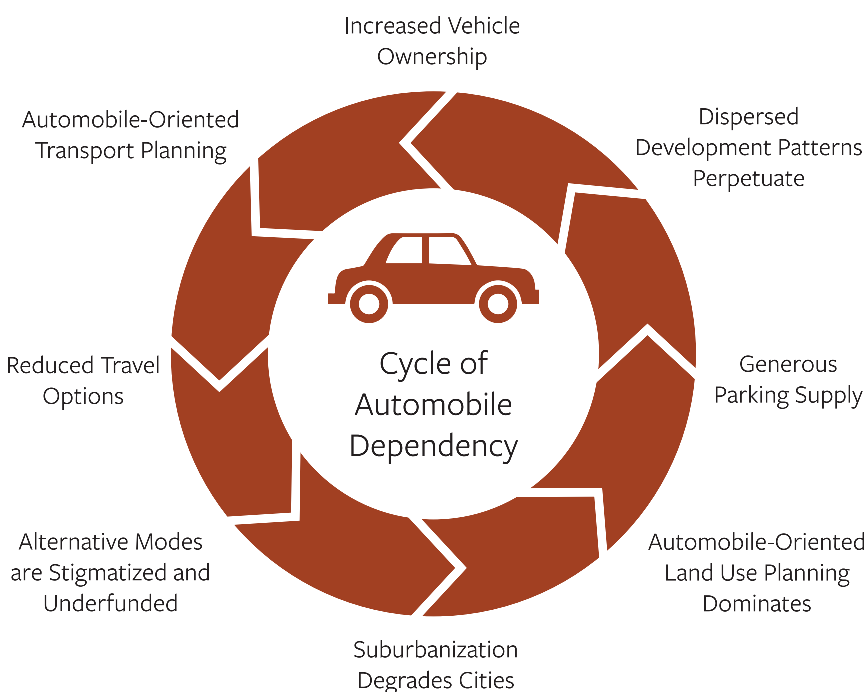
Communities across the country are putting policies and procedures in place to ensure that underserved populations are included in the creation of Complete Streets. The communities of Lewiston and Auburn should do the same by paying special attention to the disabled, women, children, elderly, communities of color, and the poor. This last group - the poor - includes all of the others. As of 2013, more than 30.5% and 21% of Lewiston and Auburn residents lived below the povery line. Part of this poverty burden is the high cost of transportation. Transportation costs are considered affordable if they are 15% or less of household income, or $6,738/yr for the typical Lewiston-Auburn household. In the Twin Cities, estimated driving costs for an average household is $10,397/yr, or 154% more than what is considered affordable. If Complete Streets planning meets the needs of these people, then they'll meet the needs of everyone else.

Getting in Gear

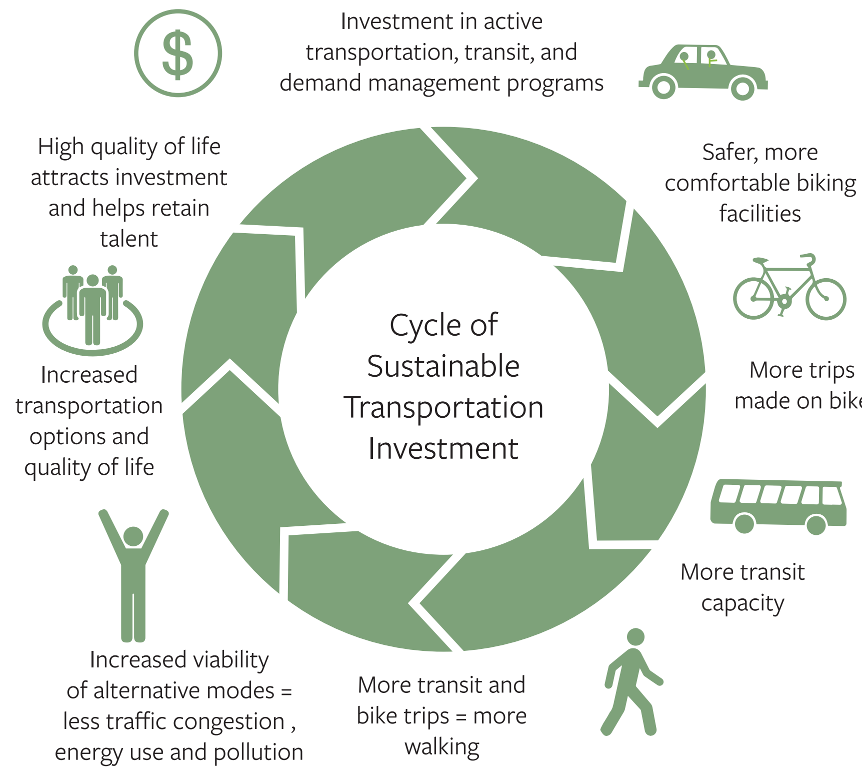
Asking the Right Questions

In looking at Complete Streets projects that may change the balance of space allocated to vehicles and people, the question to ask should not be limited to "What will happen to the traffic?" We should also ask: "What will happen if we provide an attractive, low-stress bikeway in this corridor? What will happen if we make safe and accessible street crossings for people walking or taking the bus? What are the outcomes for transportation access and choice? Will these changes reduce need for peak hour traffic capacity or parking?" Yes, when coupled with other land use and urban design policies, Complete Streets improvements instigate a sustainable cycle of investments that reinforce a safe, low-cost, and healthy transportation system, but they more importantly create wonderful places to live.

Current Trend



Sustainable Cycle




STARTER ATHLETICS
71

2. Complete Streets

"The vision of the Cities of Lewiston-Auburn is of a community in which all residents and visitors, regardless of their age, ability, or financial resources, can safely and efficiently use the public right-of-way to meet their transportation needs regardless of their preferred mode of travel."

- Lewiston-Auburn Complete Streets Policy

Complete Streets

What's a Complete Street?

Complete Streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists, and transit riders of all ages and abilities must be able to move safely along and across the transportation network. Complete Streets policies, such as the one passed jointly by Lewiston and Auburn in 2013, are intended to ensure that transportation agencies and municipal officials routinely design and operate the entire right-of-way to enable safe access for all users.

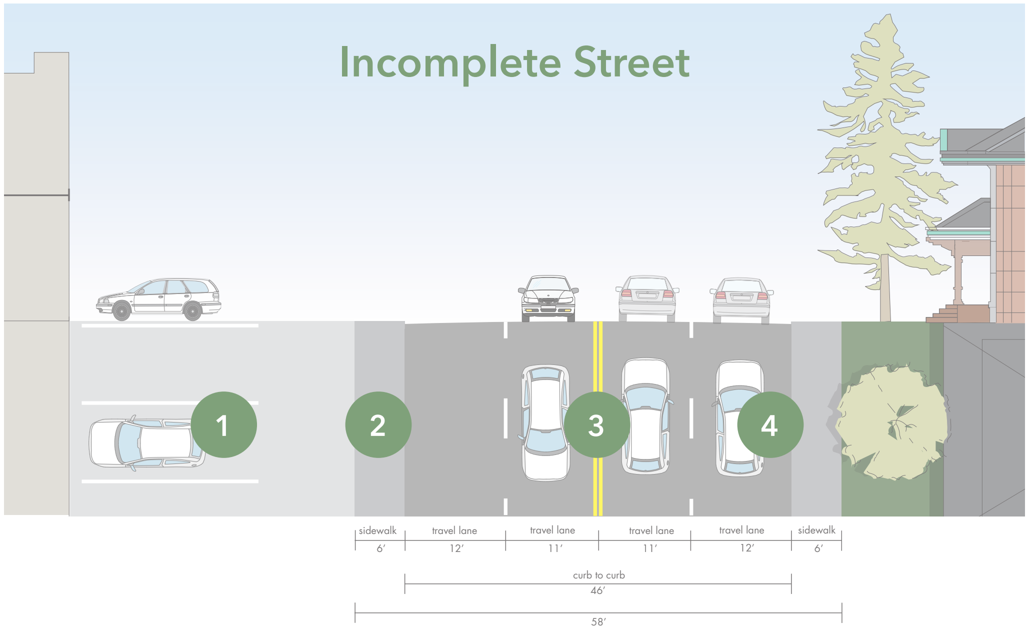
The fundamentals of Complete Streets policy as defined by Smart Growth America, focus on safety and inclusion of all thoroughfare users regardless of age and ability. There is no specific formula for Complete Streets design, as so many complex decisions must be made in response to built, social, and economic context. Thus, Complete Streets does not mean simply adding a bicycle lane or a crosswalk where previously there was none. Instead, Complete Street policies seek to provide meaningful transportation choices for all people, and in urban areas, to put public life back into the public realm — as defined as the public space between private buildings. This approach elevates all users of the street onto an equitable playing field and changes the way transportation projects are conceived and delivered.

Complete Streets Characteristics

In short, Complete Streets:

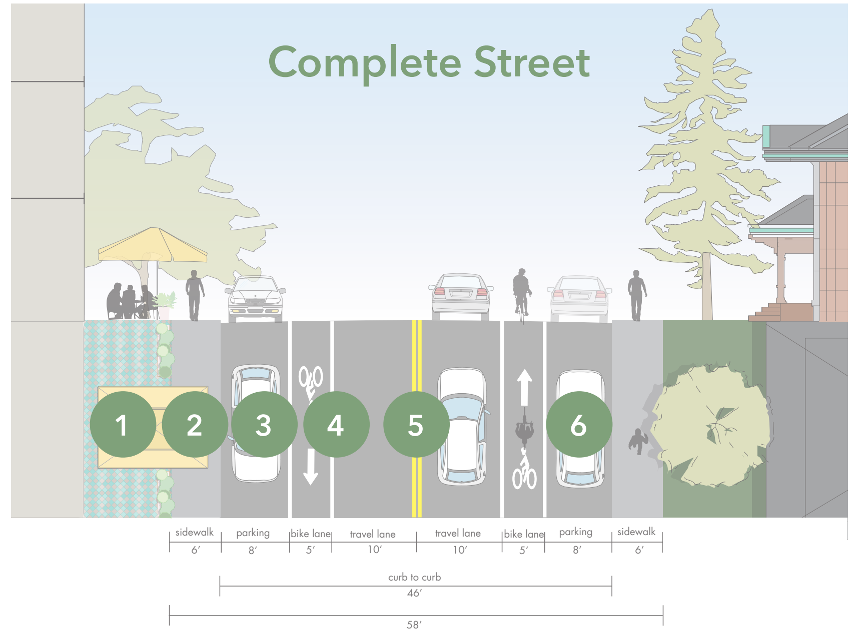
- Ensure thoroughfares create a safe environment for all users, recognizing that there are different needs for various transportation modes (walking, cycling, transit, driving, freight etc.);
- Provide pedestrians with a contiguous network of sidewalks that are wide enough, landscaped, and safe to cross at all intersections;
- Support a protected or otherwise low-stress bicycle network that allows people to commute and/ or exercise safely;
- Provide public spaces where neighbors and visitors can gather and enjoy a range of social and physical activities;
- Reduce/mitigate the negative impacts associated with traffic congestion;
- Provide Safe Routes to School;
- Create physically active communities where public health is valued;
- Support a multi-modal transportation system that integrates Complete Streets planning, design, and best management practices;
- Allow greater route choice for pedestrians and bicyclists, thereby promoting physical activity.
- Create streets and public spaces that promote safety, commerce, and engaging social interactions;
- And place a renewed focus on access, safety, and equity.

Incomplete vs. Complete Streets



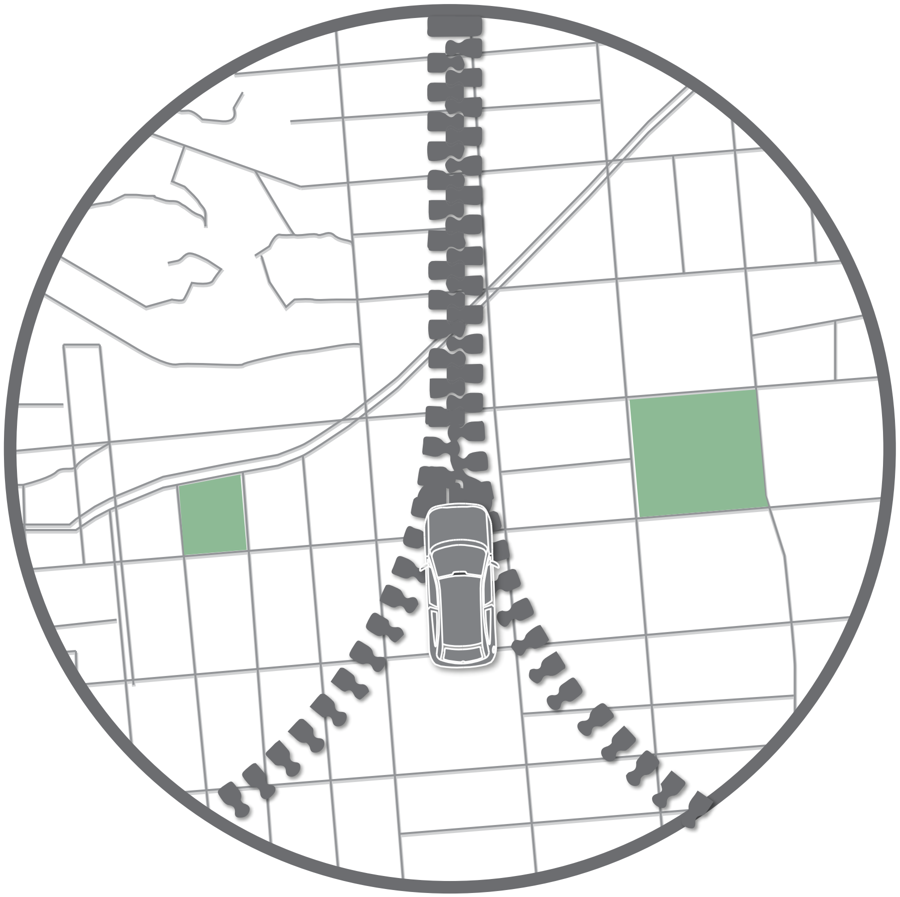
Vehicular-Only Space: 78%
People/ Non-Motorized Space: 22%

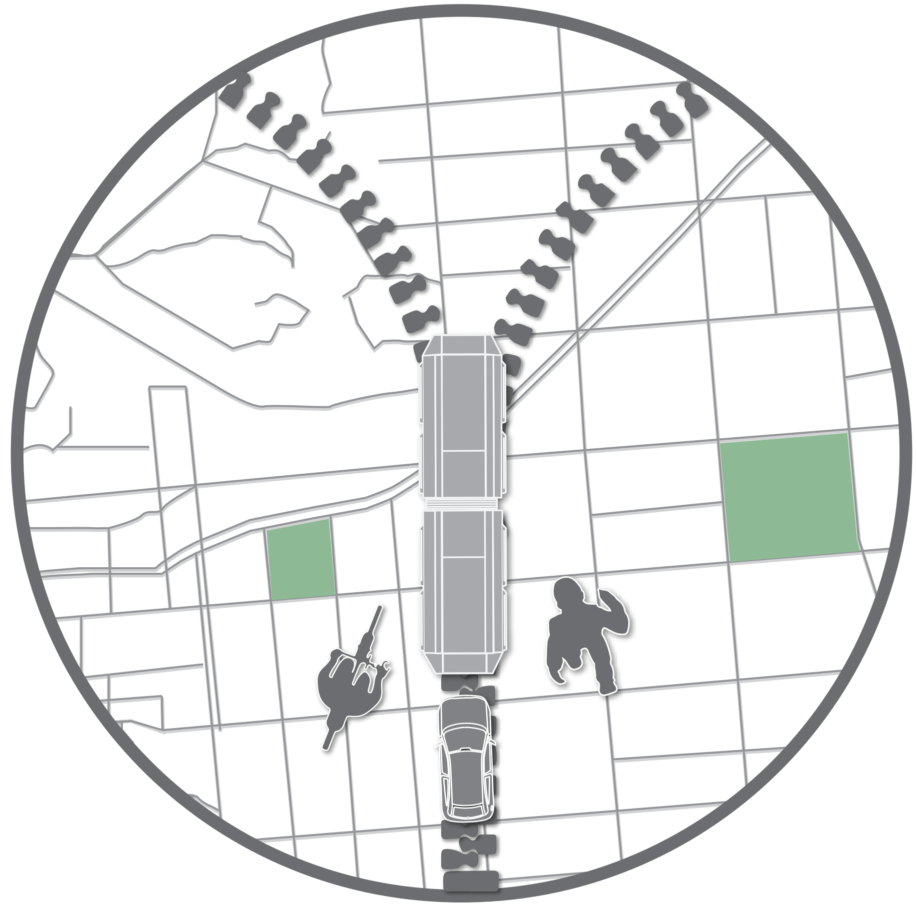
1. Frontage Surface Parking Lot
2. Narrow, Unlandscaped Sidewalk
3. Vehicular-Only Travelway
4. No On-Street Parking



Vehicular-Only Space: 46%
People Space: 54%

1. Active, Pedestrian-Oriented Frontage
2. Landscaped Sidewalk
3. Variable Curbside Use
4. Bicycle Lane
5. Traffic-Calmed Vehicular Travelway
6. On-Street Parking



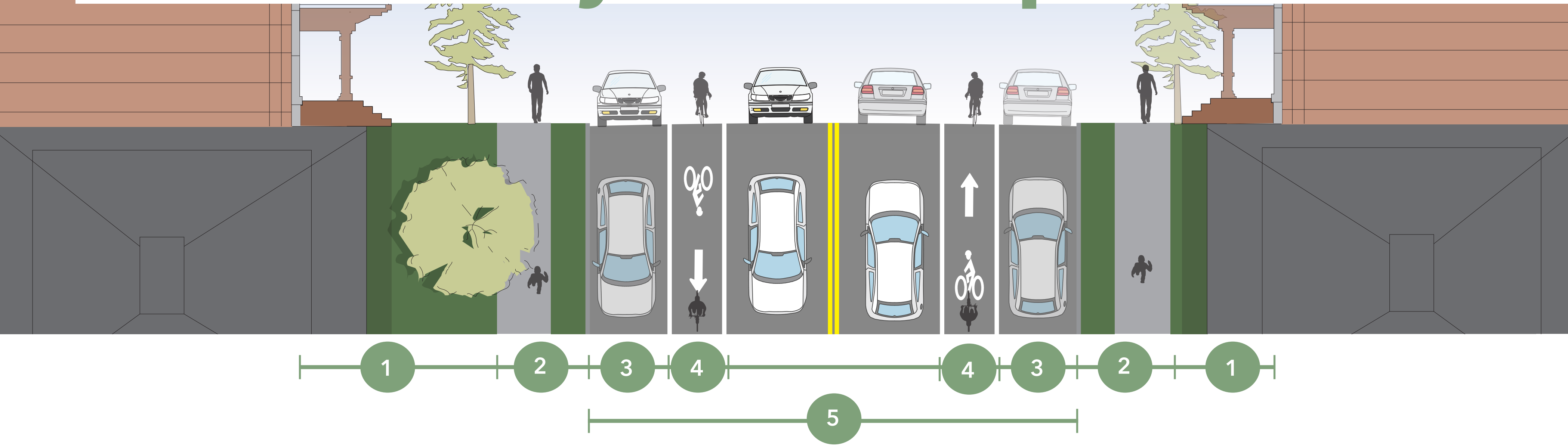


"Zipper" Streets

At the street network scale, Incomplete or Complete Streets act as the “zippers” of a community. In Lewiston and Auburn, decades of designing thoroughfares primarily for vehicular use has segregated land uses and people from each other, making attempts to cross the street, bicycle, or the experience of waiting for a bus uncomfortable, if not downright dangerous. The graphic above demonstrates how our transportation planning decisions can divide a community physically and socially.

Multi-modal thoroughfare design (graphic above, showing walking, cycling, driving, and public transport) allows for inclusion, efficiency, and social interaction, while also moving freight, and accommodating regional travel and public transit. This transportation planning approach can knit a community together without compromising the need to move people and goods to and through a given community.

The Anatomy of a Complete Street



1 PRIVATE FRONTAGE

The Private Frontage is the area between the building facades and the lot line. The private frontage presents many architectural and landscape variations, which depend on the context.

2 PUBLIC REALM

The Public Realm is defined by the public space located between the private lot line and the street edge. It is comprised of various physical design elements, including:

- The Walking Zone
- The Furnishing Zone
- The Street Edge Zone

3 VARIABLE CURBSIDE USES

Variable curbside uses include the storage of private automobiles — which can also protect pedestrians and bicyclists from moving traffic — on-street bicycle parking, parklets, bus lanes, and other public uses.

4 BIKEWAYS

Bicycle Facilities can be implemented in a variety of ways depending on context. This section shows on-street bicycle lanes. Streets should always aim to be multimodal in various intensities and configurations.

5 TRAVELWAY

The travelway includes the space between the curbs, or the outside edge of pavement in more rural conditions. It may be segmented by landscaping, variable curbside uses, medians, transit facilities, bicycle facilities, etc.

Complete Streets Design Principles

The recommendations in this Guide are based on best practices for safe street design, which are summarized in the 9 principles described below.

ACCESS + MOBILITY FOR EVERYONE

Streets should allow people to travel in a safe, dignified, and efficient manner no matter their age, gender, or level of ability. The focus of this Guide is to not only improve the conditions for walking and biking generally, but to also prioritize the safety of people driving. Indeed, all city streets must allow for harmony between multiple modes — allowing for safe and efficient movement of trucks, public transit, and emergency response vehicles.

ENVIRONMENTAL SUSTAINABILITY

Sustainable streets protect and enhance natural ecosystems with tools like esplanades, pervious pavement, and bioswales that control stormwater. Street trees are a vital part of sustainable streets: they provide shade, filter the air, and slow traffic. Street trees have been shown to be associated with lower crime rates and higher household income, and also increase home values. Integrating ecological considerations into street design can also ease maintenance costs, as uncontrolled stormwater can damage street surfaces over time.

SAFETY + SECURITY

Streets should be designed to reduce or eliminate traffic-related fatalities or serious injuries. Vehicle speed is one of the most significant factors in crash severity, so controlling speed has a big impact on street safety for everyone. Street safety is also closely connected to public life — well-lit streets that encourage walking and biking throughout all hours of the day provide more "eyes on the street," and increase people's sense of security.

CONNECTIVITY

A connected street network helps make walking and biking viable modes of transportation, and disperses traffic across the network. Thus, intersection density is one of the most important ways to create slower, safer streets; high ratios of intersections are associated with fewer fatalities. Cul-de-sacs and dead-end streets should be avoided; they create indirect routes that cause people to drive longer distances and discourage walking and biking. Where existing cul-de-sacs cannot be connected to the street grid, multi-use paths should be used to at least improve connectivity for people walking and biking.

LAND USE CONTEXT

A great land use plan is also a great transportation plan. Indeed, good street design is inherently connected to land use — compact land use patterns and connected multi-modal streets support transportation options and reduce demand for drive-alone trips, easing parking pressure and traffic congestion. A Complete Streets focus, and any transportation plan in Lewiston-Auburn, should also include land use strategies that provide essential services within walking distances of people's homes and/or places of employment.

CLIMATE CONSIDERATIONS

Complete Streets should respond to local environmental factors such as climate. Recommendations for improving walking and biking conditions in Lewiston-Auburn must embrace the city's winter climate and integrate best practices for providing safe walking and biking options year-round.

COMFORT

When creating new walk and bike infrastructure, comfort is an important consideration. For example, sidewalks should be made as wide as practical and retrofitted to be fully ADA accessible. They should feature amenities such as benches and street trees. Bikeways should allow people cycling to be separated from passing motor vehicles, and be designed to allow people to pass each other safely and ride two abreast wherever possible.

ECONOMIC DEVELOPMENT

Complete Streets are an economic asset to cities. Well-designed streets have been shown to generate higher revenues for businesses, and increase home values. Lewiston-Auburn's streets should be designed to support a mix of commercial and cultural activities, and leveraged to attract economic opportunities and talent.

ACTION!

Lewiston and Auburn can start improving safety now with low-cost materials. Chapter 4 of this Guide outlines how Complete Streets projects may be implemented quickly, with little else than paint. For large projects that require significant capital planning and investment, Lewiston-Auburn should look for opportunities to use demonstration and/or "pilot" projects to test options and inform public decision-making before committing to big ticket infrastructure investments.


DISCOVER
DOWNTOWN
AUBURN
WEST
202
SOUTH
11
SOUTH
100

3. Thoroughfare Network

"Urbanism works when it creates a journey as desirable as the destination."

– Paul Goldberger

Context-Sensitive Planning

CONTEXT-SENSITIVE PLANNING

The Institute for Transportation Engineers (ITE) describes conventional engineering practice as a process that "prioritizes vehicular mobility and access using functional classification, design speed, traffic volume, and vehicular level of service as the primary determinants for design criteria—an approach with limited sensitivity to the surrounding context."

A counter-approach and recommended practice is what the Federal Highway Administration calls Context-Sensitive Solutions (CSS). CSS recognizes that thoroughfare design should respond to and positively influence the character of neighborhoods, advancing the community vision for the future. FHWA describes CSS as "an approach that considers the total context within which a transportation improvement project will exist." Thus, applying the principles of CSS in thoroughfare design allows for planners and engineers to integrate Complete Street design principles that are more consistent with their surroundings and that support the activities of the adjacent or desired land uses and urban form.

The CSS and Complete Streets approach does not abandon conventional traffic measurement tools entirely, but augments them with new user-oriented considerations that enrich the design decision-making process.

CONTEXT ZONES

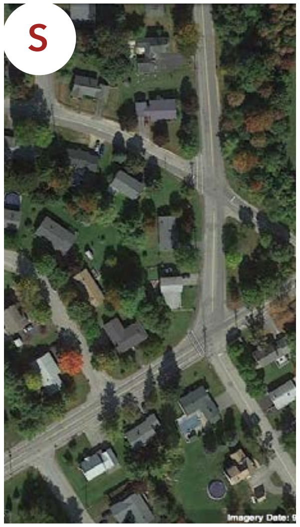
There are 6 normative context zones included in the diagram above. The folllowing page includes a more detailed description of each one, from rural to urban core, and demonstrates how they apply to Lewiston-Auburn.

LEWISTON / AUBURN CONTEXT ZONES

While Lewiston and Auburn are two unique cities, the normative Context Zones described on the previous page may easily be applied. Below are 6 images that depict how the various context zones relate to the Twin Cities. Can you identify each location?

R - RURAL

The Rural Zone consists of lands unsuitable for settlement, or that are sparsely settled in an open or cultivated state. It is inclusive of woodland, agricultural lands, or open grasslands.



S - SUBURBAN

The Suburban Zone consists of low-density suburban residential areas with relatively deep setbacks, large blocks, and irregular roads that accommodate natural conditions.

GU - GENERAL URBAN

The General Urban Zone consists of a mixed-use, but primarily residential, urban fabric. It has a wide range of building types; single-family, sideyard, and rowhouses, for example. Setbacks and landscaping are variable. Streets typically define medium-sized blocks.

UC - URBAN CENTER

The Urban Center Zone consists of higher density mixed-use building types that accommodate retail, offices, rowhouses, and apartments. It has a tight network of streets and buildings set close to the sidewalk.

C - URBAN CORE

The Urban Core includes the highest density and height, with the greatest variety of uses, and civic buildings of regional importance. It has a network of streets, with wide sidewalks, street tree planting, and buildings built to the sidewalk. The Urban Core is otherwise known as "downtown," and serves as a regional shopping and employment center.

SD-SPECIAL DISTRICT

The Special District Zone includes uses that by their intrinsic size, function, or configuration cannot conform to the five normative context zones. These uses include shopping malls, college campuses, airports, business parks, etc.

Lewiston-Auburn Thoroughfare Types

Functional classification is a methodology for categorizing throughfare types according to their ability to move traffic and provide access to adjacent properties. The three general classes include Local, Collector, and Arterial streets. However, many streets found in Lewiston-Auburn were built long before functional classification was adopted into the Federal Highway System. As a result, functional classification is unable to accurately describe the true diversity of land use, urban design characteristics, and roles that streets play within communities, especially in an older urban area like Lewiston-Auburn. In order to coordinate with state and federal standards, the table below and the maps on the following pages provide a translation from the 6 types of thoroughfares included in Lewiston-Auburn's conventional functional classification nomenclature to a more robust menu of 16 thoroughfare types. Page 25 demonstrates how each thoroughfare type relates to the 6 normative context zones, and the rest of the chapter includes a typical cross-section for each type with a table outlining its key characteristics.

FUNCTIONAL CLASSIFICATION

	LOCAL	COLLECTOR	ARTERIAL
THOROUGHFARE TYPE			
Rural Highway			■
Rural Road	■	■	
Residential Street - Suburban	■		
Residential Avenue - Suburban		■	
Commercial Ave. - Suburban		■	■
Neighborhood Greenway	■		
Residential Yield Street - Urban	■		
Residential Street - Urban	■	■	
Residential Ave. - Urban		■	■
Commercial Ave. - Urban		■	■
Boulevard			■
Community Street		■	■
Destination Street		■	
Shared Use Path	N / A	N / A	N / A
Commercial Alley	■		
Pedestrian Passage	N / A	N / A	N / A

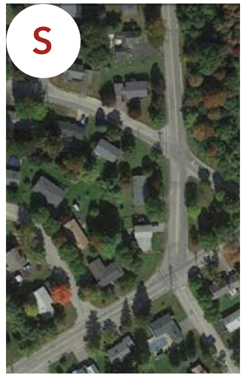
CONVENTIONAL PRACTICE MAPPED

- Local
- Major Collector
- Minor Arterial
- Principal Arterial - Other
- Principal Arterial - Interstate
- Principal Arterial - F&E

RECOMMENDED PRACTICE MAPPED

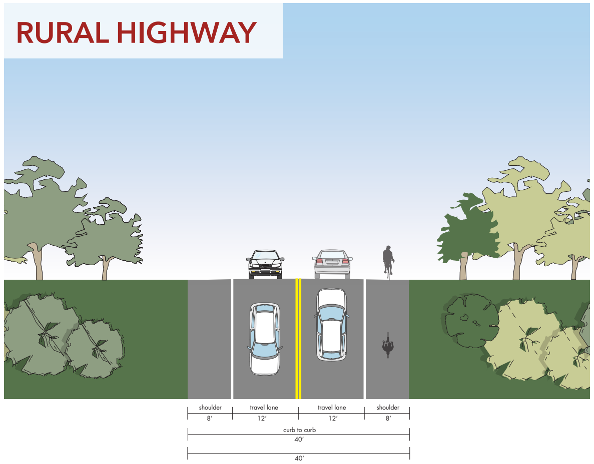
- Rural Highway
- Rural Road
- Residential Street - Suburban
- Residential Avenue - Suburban
- Commercial Avenue - Suburban
- Neighborhood Greenway
- Residential Yield Street - Urban
- Residential Street - Urban
- Residential Avenue - Urban
- Commercial Avenue - Urban
- Boulevard
- Community Street
- Destination Street
- Shared Use Path
- Commercial Alley - Utility
- Pedestrian Passage
- Interstate
- Other

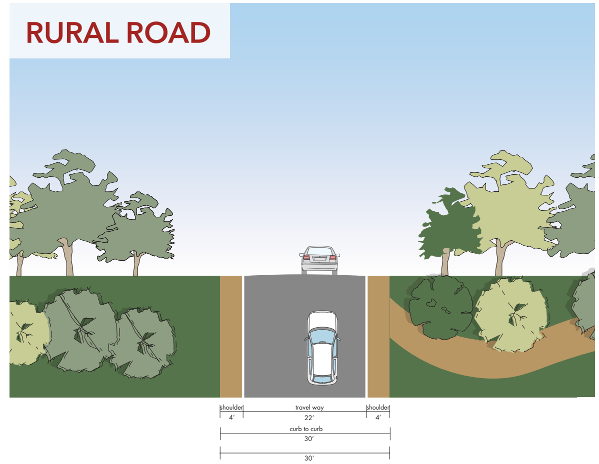
Thoroughfare Types In Context



	RURAL	SUBURBAN	GENERAL URBAN	URBAN CENTER	URBAN CORE	SPECIAL DISTRICT
THOROUGHFARE TYPE						
Rural Highway	■					
Rural Road	■					
Residential Street - Suburban		■				
Residential Avenue - Suburban		■				
Commercial Ave. - Suburban		■				■
Neighborhood Greenway		■	■			
Residential Yield Street - Urban			■			
Residential Street - Urban			■	■		
Residential Ave. - Urban			■			
Commercial Ave. - Urban				■	■	
Boulevard		■	■	■	■	
Community Street		■	■	■		
Destination Street					■	
Shared Use Path	■	■	■	■		■
Commercial Alley				■	■	■
Pedestrian Passage		■	■	■	■	

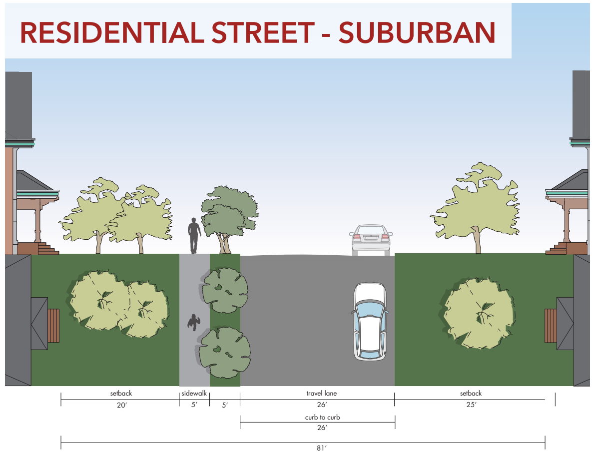
Thoroughfare Typology

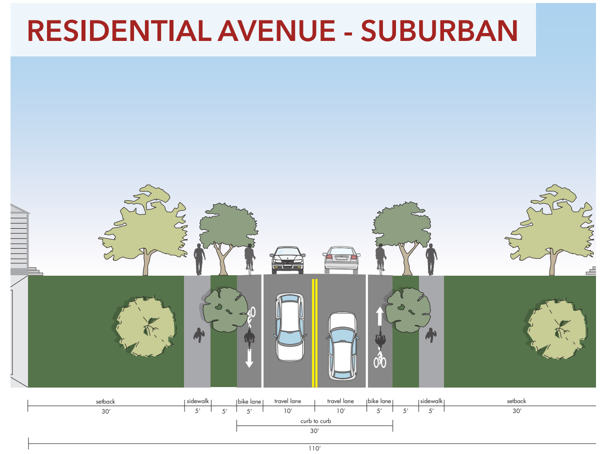




	Rural Highway	Rural Road
Local Example	Outer Main Street (Lewiston)	North River Road (Auburn)
Conventional Street Type	Principal Arterial	Minor Arterial
Context Zone(s)	Rural	Rural
Travel Lanes	2 Travel Lanes	2 Travel Lanes
Travel Lane Width	12'	22'
Target Speed	55 mph	45 mph
Parking	None	None
Transit	None	None
Bikeway Type	Shoulder	None
Walkway Type	None	None
Curb Type	No Curb	No Curb
Landscaping	Naturalistic	Naturalistic

Lewiston-Auburn Thoroughfare Typology

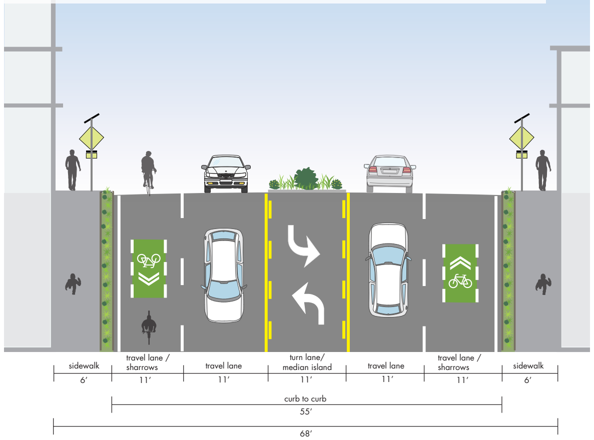




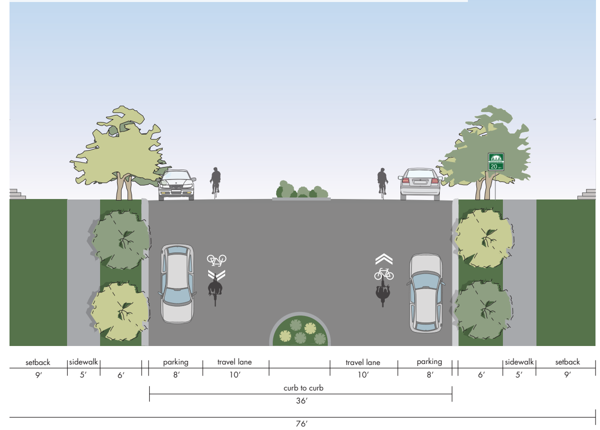
	Residential Street - Suburban	Residential Avenue - Suburban
Local Example	Marsten Street (Lewiston)	Central Avenue (Lewiston)
Conventional Street Type	Local	Collector
Context Zone(s)	Suburban	Suburban
Travel Lanes	2 Travel Lanes	2 Travel Lanes
Travel Lane Width	9'	10'
Target Speed	20 mph	25 mph
Parking	Parallel, One Side	None
Transit	None	None
Bikeway Type	None	Bike Lanes
Walkway Type	Sidewalk, One Side	Sidewalks
Curb Type	Curb and Gutter	Curb and Gutter
Landscaping	Esplanade, Bioswale	Esplanade, Bioswale

Lewiston-Auburn Thoroughfare Typology

COMMERCIAL AVENUE - SUBURBAN

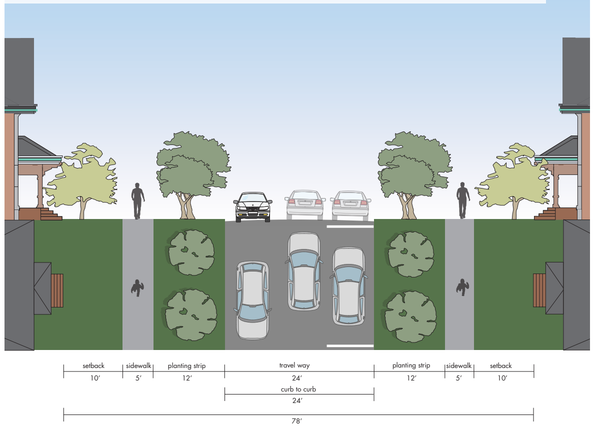
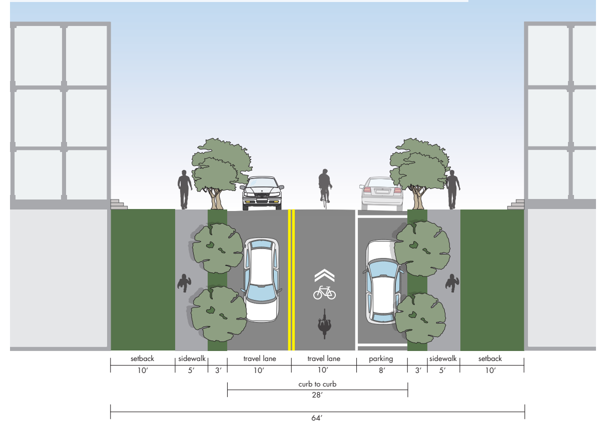


NEIGHBORHOOD GREENWAY



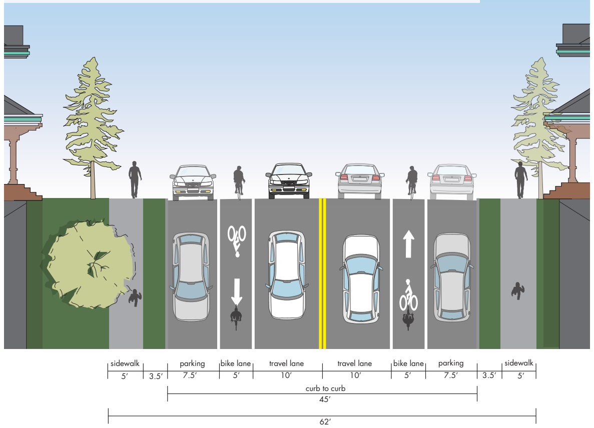
	COMMERCIAL AVENUE - SUBURBAN	NEIGHBORHOOD GREENWAY
Local Example	Outer Lisbon St. (Lewiston)	Pettingill Street (Lewiston)
Conventional Street Type	Principal Arterial	Local
Context Zone(s)	Suburban	Suburban, General Urban
Travel Lanes	4 Travel Lanes + Median / Center-Turn Lane	2 Travel Lanes
Travel Lane Width	10'-11'	10'
Target Speed	25 - 30 mph	20 mph
Parking	None	Parallel
Transit	Local Bus	None
Bikeway Type	Super Sharrows	Sharrows or Super Sharrows
Walkway Type	Sidewalk	Sidewalk
Curb Type	Curb and Gutter	Curb and Gutter
Landscaping	Planting Strip, Planted Median, Bioswale	Esplanade, Bioswale

Lewiston-Auburn Thoroughfare Typology

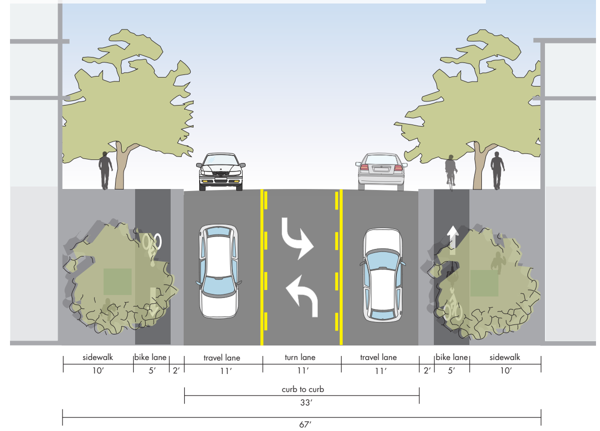
	RESIDENTIAL YIELD STREET - URBAN	RESIDENTIAL STREET - URBAN
		
Local Example	Spring Street (Auburn)	Horton Street (Lewiston)
Conventional Street Type	Local	Local, Minor Collector
Context Zone(s)	General Urban	Urban Center, Urban Core
Travel Lanes	1 Travel Lane, Bi-Directional Traffic	2 Travel Lanes
Travel Lane Width	16'	10'
Target Speed	15 mph	20 mph
Parking	Parallel, One Side	Parallel, One or Two Sides
Transit	None	Local Bus, None
Bikeway Type	None or Sharrows	Sharrows, Bike Lanes
Walkway Type	Sidewalk	Sidewalk
Curb Type	Curb and Gutter	Curb and Gutter
Landscaping	Esplanade, Bioswale	Esplanade, Tree Well, Bioswale

Lewiston-Auburn Thoroughfare Typology

RESIDENTIAL AVENUE - URBAN

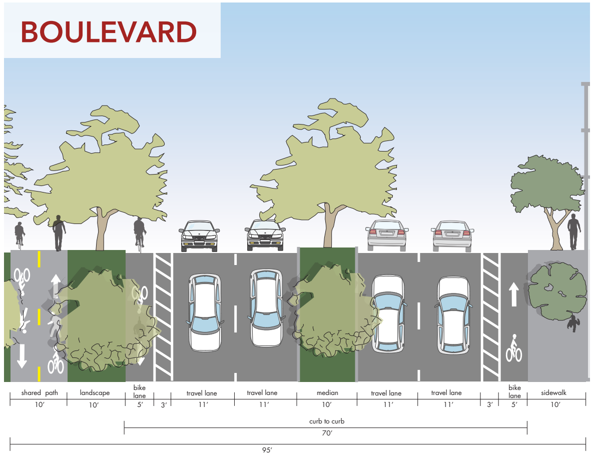


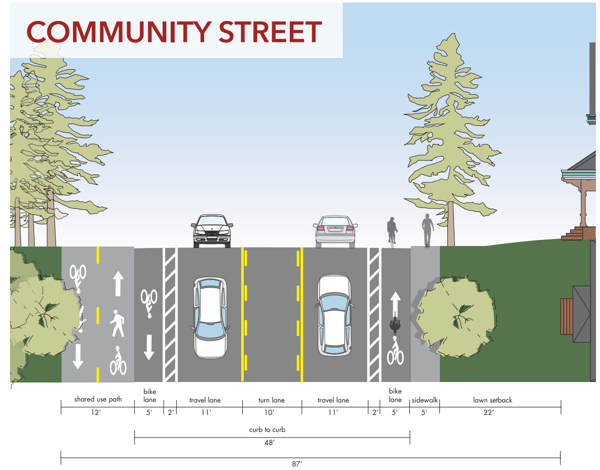
COMMERCIAL AVENUE - URBAN



	Residential Avenue - Urban	Commercial Avenue - Urban
Local Example	Turner Street (Auburn)	Inner Lisbon Street (Lewiston)
Conventional Street Type	Minor Arterial, Collector	Principal Arterial, Minor Arterial
Context Zone(s)	General Urban	General Urban, Urban Center
Travel Lanes	2 - 4 Travel Lanes	2 - 4 Travel Lanes + Median/Center-Turn Lane
Travel Lane Width	10 - 11'	10 - 11'
Target Speed	25 or 30 mph	25 - 30 mph
Parking	Parallel	Parallel, None
Transit	Local Bus	Local / Express Bus
Bikeway Type	Bike Lanes, Protected Bikeways	Protected, Buffered, Conventional Bike Lane
Walkway Type	Sidewalk	Sidewalk
Curb Type	Curb and Gutter	Curb and Gutter
Landscaping	Esplanade, Tree Well, Bioswale	Tree Well, Bioswale

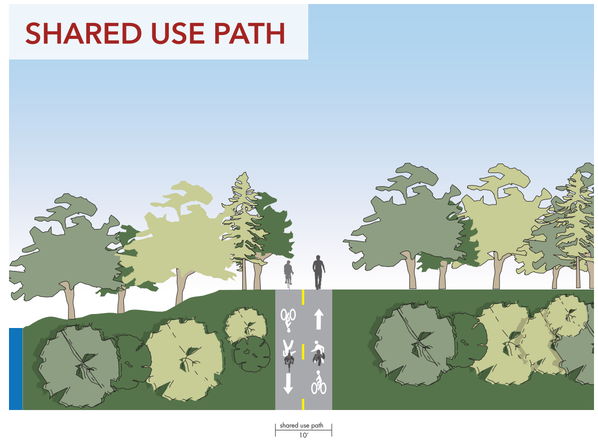
Lewiston-Auburn Thoroughfare Typology





	Boulevard	Community Street
Local Example	Union Street (Auburn)	East Avenue (Lewiston)
Conventional Street Type	Principal Arterial	Collector, Local
Context Zone(s)	Suburban, General Urban, Urban Center	Suburban
Travel Lanes	4 Travel Lanes + Median / Turn Lanes	2 Travel Lanes + Median / Center-Turn Lane
Travel Lane Width	10' - 11'	10' - 11'
Target Speed	30 mph	25 mph
Parking	None, Parallel	None
Transit	Regional / Local Bus	Local Bus
Bikeway Type	Shared Path, Buffered / Protected Bike Lane	Shared Use Path, Buffered Bike Lane
Walkway Type	Shared Path, Sidewalk	Shared Path, Sidewalk
Curb Type	Curb and Gutter	Curb and Gutter
Landscaping	Esplanade, Bioswale, Planted Median	Esplanade, Bioswale, Planted Median

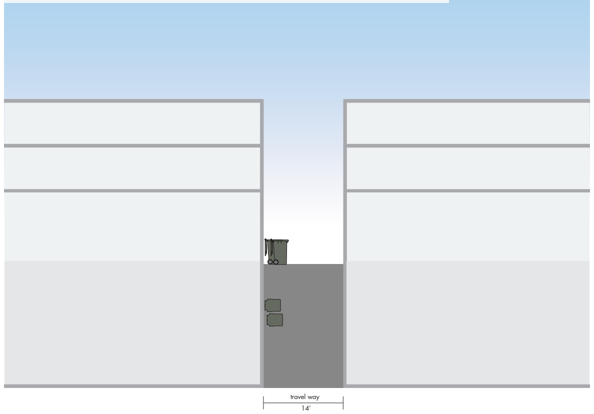
Lewiston-Auburn Thoroughfare Typology



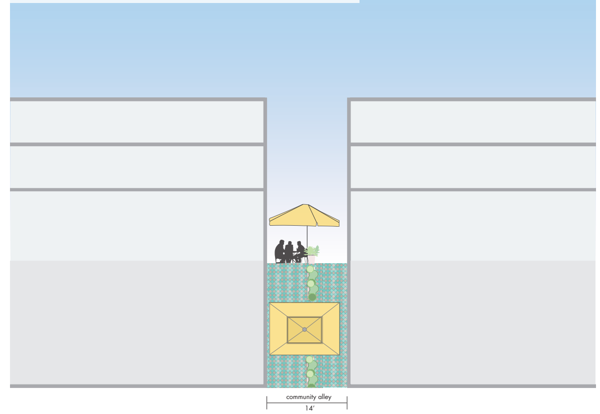
	Destination Street	Shared Use Path
Local Example	Main Street (Auburn)	Riverside Greenway (Lewiston)
Conventional Street Type	Minor Arterial	N/A
Context Zone(s)	Urban Center, Urban Core	Rural, Suburban, General Urban
Travel Lanes	1 Travel Lane	N/A
Travel Lane Width	10' - 11'	10'
Target Speed	20 mph	12 mph
Parking	Parallel, Angled Back-In	N/A
Transit	Local / Regional Bus	N/A
Bikeway Type	Sharrows, Bike Lanes	Shared Use Path
Walkway Type	Sidewalk	Shared Use Path
Curb Type	Curb and Gutter	None
Landscaping	Tree Well	Naturalistic

Lewiston-Auburn Thoroughfare Typology

COMMERCIAL ALLEY - UTILITY



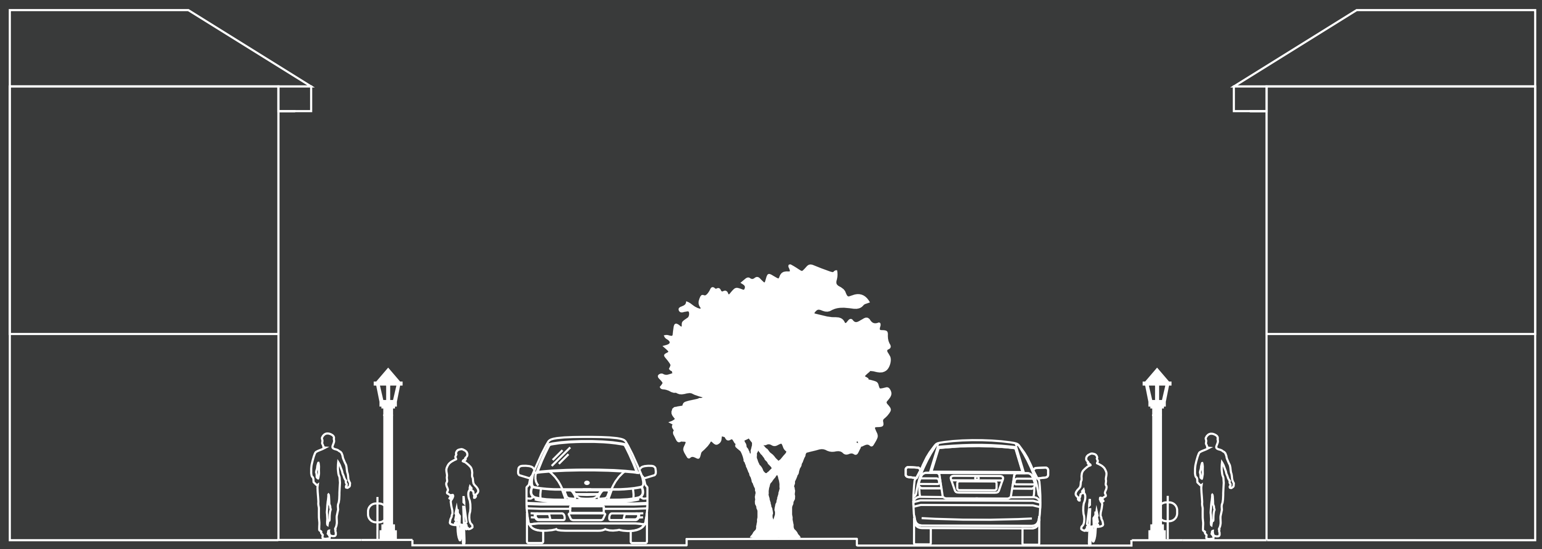
PEDESTRIAN PASSAGE



	Commercial Alley - Utility	Pedestrian Passage
Local Example	Park Alley (Lewiston)	Park Street / Lisbon Street Passage
Conventional Street Type	N/A	N/A
Context Zone(s)	Urban Core	Urban Center, Urban Core
Travel Lanes	N/A	N/A
Travel Lane Width	14'	14'
Target Speed	5 mph	N/A
Parking	N/A	N/A
Transit	N/A	N/A
Bikeway Type	N/A	N/A
Walkway Type	N/A	Pedestrian Passage
Curb Type	N/A	N/A
Landscaping	N/A	Planters, Tree Wells


ONE WAY

4. Best Practices



"A hundred years after we are gone and forgotten, those who never heard of us will be living with the results of our actions."

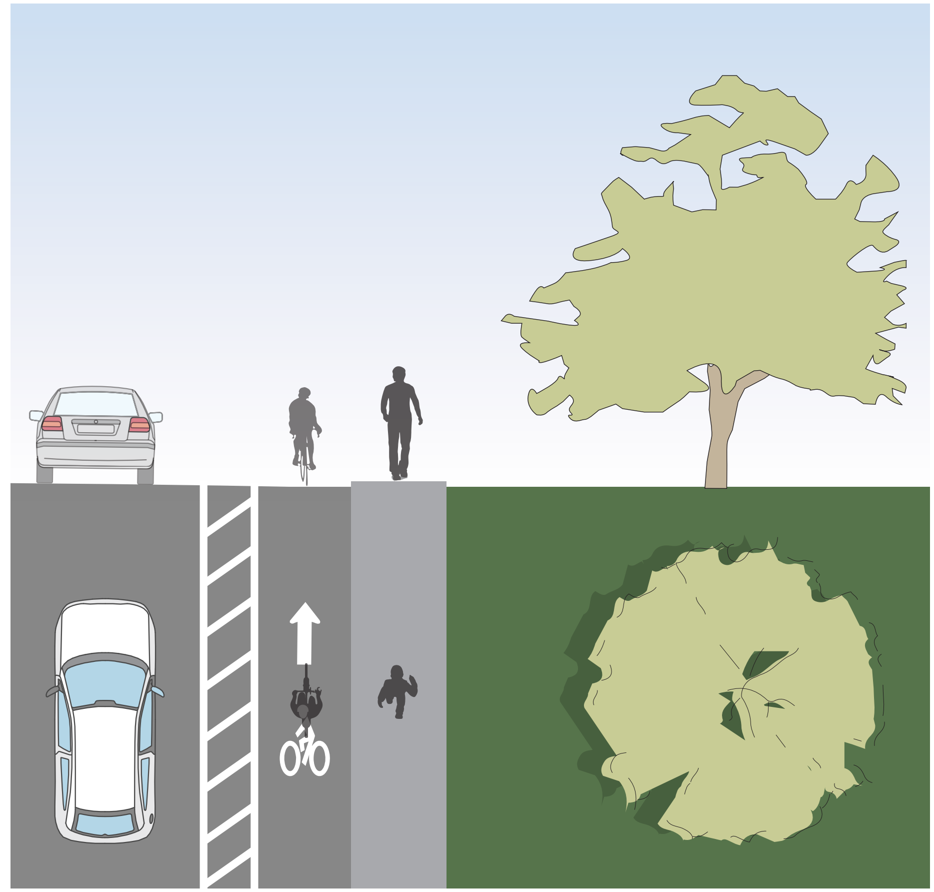
– Oliver Wendell Holmes

Introduction

This section of the Guide includes an "illustrated toolbox" for implementing Complete Streets. It includes 38 different infrastructure types organized into categories for Walking, Bicycling, Public Space, Transit, and Motor Vehicles. Each type includes a detailed discussion defining the type, a description of how/where it may be applied, information for how it should be designed, and any relevant maintenance recommendations. The section also includes more discussion about operational strategies for building and maintaining streets that work for all users, including signals, maintenance, and implementation techniques that support Complete Streets.

Best practices in Complete Streets are changing rapidly. Cities around the country are trying new types of infrastructure every year and learning from their success and implementation challenges. In additiion, new digital technologies that impact transportation systems are also evolving rapidly — ride hailing apps, digital wayfinding using smart phones, and the promise of self-driving vehicles are changing the way we relate to transportation, and by extension, our cities. Thus, it is important to note that the best practice toolkit included in this Guide is not an exhaustive or prescriptive list of tools — it is simply intended to provide a range of options that improve safety and comfort for street users of all ages and abilitities.

Where the the most current Street Design Guidelines do not provide enough guidance on the use of new tools, the two cities, ATRC, and the Maine DOT should consult the NACTO and ITE Walkable Thoroughfares manuals, FHWA's Separated Bike Lane Planning and Design Guide, and any new updates to AASHTO's green book and the MUTCD. Despite this rapidly-changing design landscape, the overarching goals of the Best Management Practices Design Guide remain constant: creating safer streets for everyone and making walking and biking a viable (and enjoyable) way to get around town.



Complete Streets Toolbox

STREET TYPES

FACILITY TYPES	RH	RR	RSS	NG	RAS	CAS	RYS	RSU	RAU	CAU	BLVD	CS	DS	SUP	CA	PP
WALKING																
High-Visibility Crosswalk			•	•	•	•	•	•	•	•	•	•	•	•		•
Curb Extension				•	•	•	•	•	•	•	•	•	•			
Raised Crosswalk			•	•	•	•					•	•	•	•		•
Pedestrian Refuge Island						•				•	•	•				
In-Pavement Crossing Beacon					•					•	•					•
HAWK Signal				•	•	•			•	•	•					•
Rectangular Rapid Flashing Beacon				•	•											•
Leading Pedestrian Interval				•	•	•			•	•	•	•	•	•		•
CYCLING																
Shared Use Bike Path	•	•			•	•			•	•	•			•		
Protected Bike Lanes					•	•			•	•	•	•	•			
Buffered Bike Lanes					•	•			•	•	•	•	•			
Conventional Bicycle Lanes			•		•	•		•	•	•	•	•	•			
Bicycle Priority "Super Sharrows"				•		•	•	•	•	•		•	•			
Shared Use Lane Markings				•		•	•	•	•	•		•	•			
Bicycle Box				•	•	•	•	•	•	•	•	•	•			
Two-Stage Turn Queue Box					•	•		•	•	•	•	•	•			
Bicycle Refuge Island			•	•	•	•	•	•	•	•	•					
Combined Bike / Turn Lane			•		•	•		•	•	•	•					
Cross-Bike Markings			•	•	•	•	•	•	•	•	•	•	•	•		
Colored Pavement				•	•	•	•	•	•	•	•	•	•	•		
Bicycle Signal				•	•		•	•	•	•	•	•	•	•		

KEY

- SPECIAL DISTRICT
- URBAN CORE
- URBAN CENTER
- GENERAL URBAN
- SUBURBAN
- RURAL

RH: Rural Highway
RR: Rural Road
RSS: Residential Street - Suburban
RAS: Residential Avenue - Suburban
CAS: Commercial Avenue - Suburban
NG: Neighborhood Greenway
RYS: Residential Yield Street - Urban
RSU: Residential Street - Urban
RAU: Residential Avenue - Urban
CAU: Commercial Avenue - Urban
BLVD: Boulevard
CS: Community Street
DS: Destination Street
SUP: Shared Use Path
CA: Commercial Alley
PP: Pedestrian Passage

STREET TYPES

FACILITY TYPES	RH	RR	RSS	RAS	NG	CAS	RYS	RSU	RAU	CAU	BLVD	CS	DS	SUP	CA	PP
PUBLIC SPACE																
Interim Design Pedestrian Plazas								•	•	•	•	•	•			
Parklets										•	•	•	•			
Pocket Parks			•	•	•	•	•	•	•	•	•	•	•	•		
Bioswales			•	•	•	•	•	•	•	•	•	•	•	•	•	•
TRANSIT																
Bus Shelter				•		•		•	•	•	•	•	•			
Bus Lanes						•				•	•					
Bus Bulb						•				•	•					
MOTOR VEHICLES																
Speed Table / Raised Intersection					•		•	•	•			•	•			
On-Street Parking			•	•	•	•	•	•	•	•	•	•	•			
Safe-Sized Travel Lanes	•	•	•	•	•	•	•	•	•	•	•	•	•			
Turn Radii				•	•	•			•	•	•		•			
Road Diet			•	•		•		•	•	•	•	•	•			
Roundabouts (modern, mini etc.)			•	•	•	•	•	•	•	•	•	•	•			
Daylighting Intersection			•	•	•	•	•	•	•	•	•	•	•			
Diverters			•	•	•		•	•	•							
Turn Aprons / Mountable Curbs				•		•			•	•	•	•	•			
Flush Medians				•		•			•	•	•	•	•			

KEY

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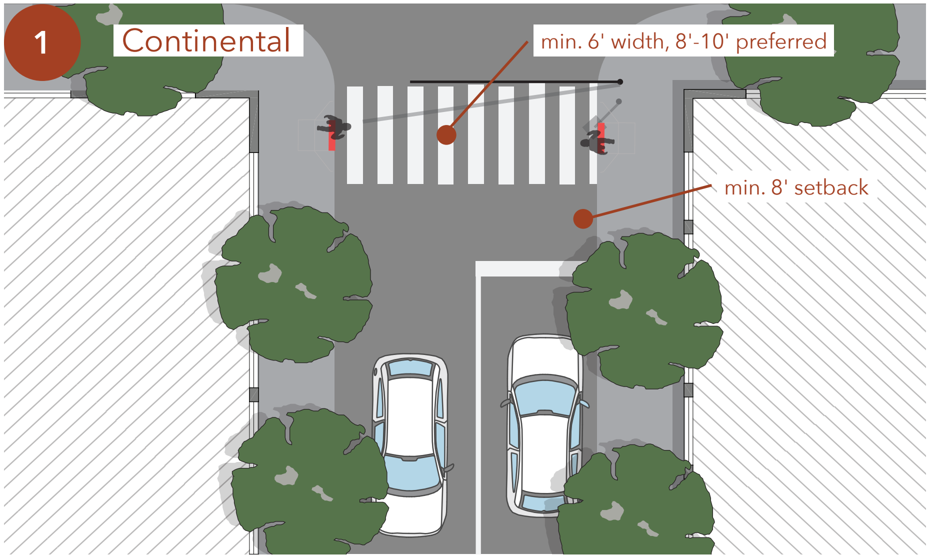
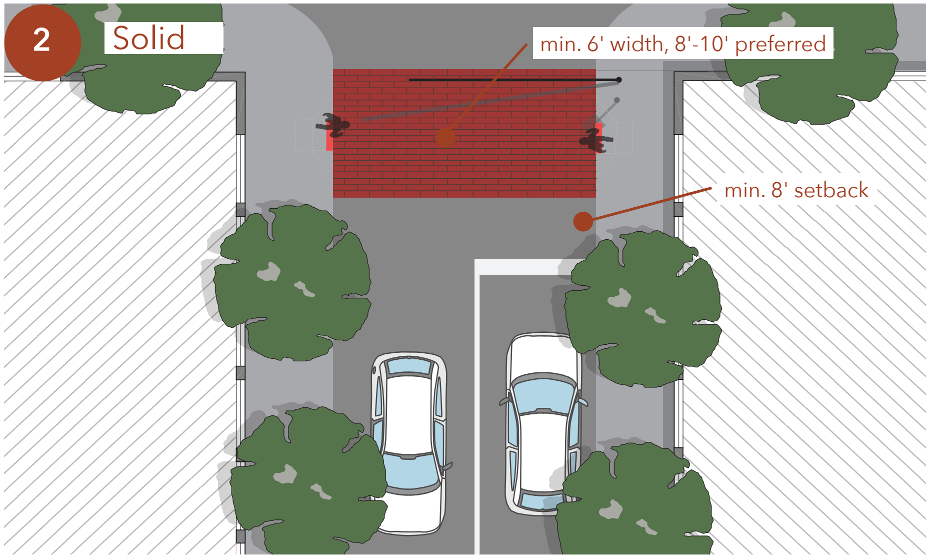
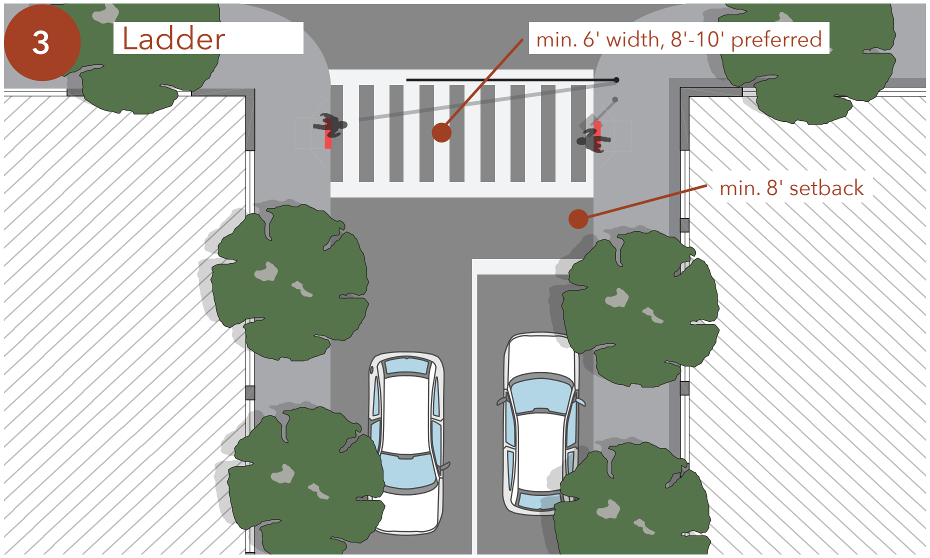
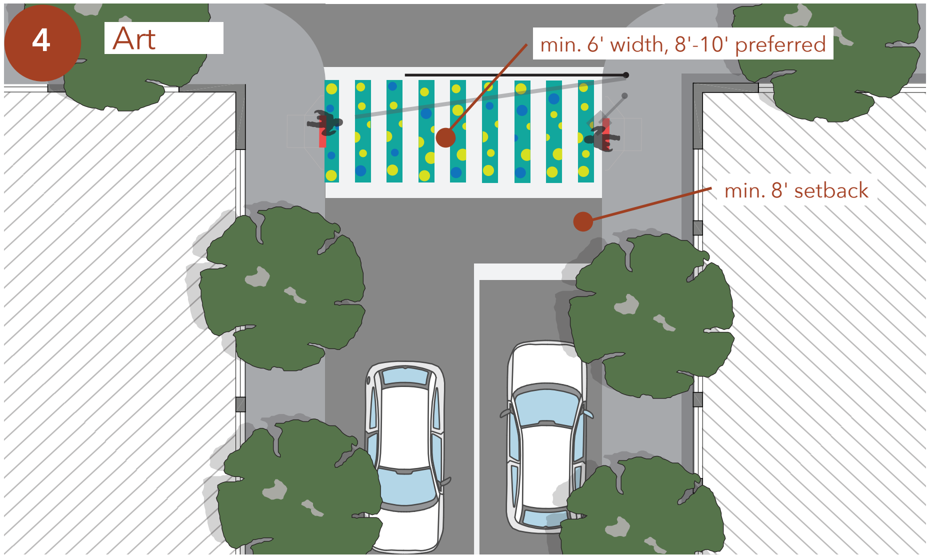
Walking

High-Visibility Crosswalk









Definition

High-visibility crosswalks use a variety of striping patterns, or contrasting pavement treatments, to significantly increase the visibility of a crosswalk to oncoming traffic. Conventional crosswalk markings consist of two parallel lines. However, an FHWA study found that continental (longitudinal stripes) markings were detected at about twice the distance upstream as the transverse markings during daytime conditions. In the study, this increased distance meant that drivers traveling at 30 mph had 8 additional seconds of awareness of crossing pedestrians. In some instances, "art crosswalks" include integrated colors, textures, and/or scoring patterns that may be instituted within existing, approved crosswalk markings.

Application

High-visibility crosswalks should be applied to controlled and select uncontrolled intersections with known conflicts between vehicular and pedestrian movements, areas with high volumes of foot traffic (like commercial business districts, college campuses, employment hubs), at mid-block crossings, and along and across high-volume roads.

Design Guidance

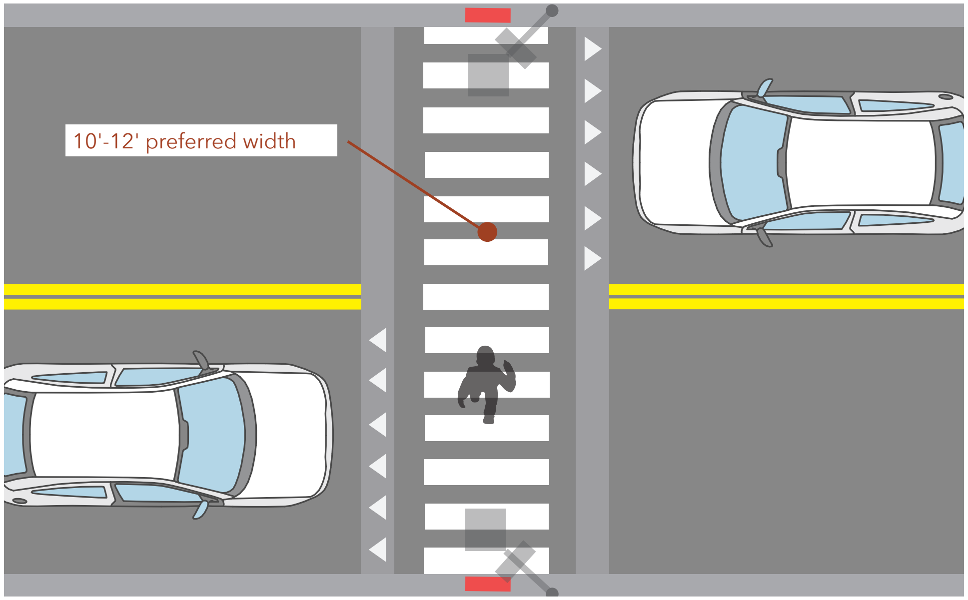
Many high-visibility crosswalk striping patterns exist, such as those depicted on the previous page. High-visibility crosswalks can also be implemented using different surface materials, like stamped asphalt or real brick to provide further contrast between the pedestrian crossing space and vehicular travel lanes. Brightly-colored "art" patterns may be applied to crosswalks so long as the pattern occurs between two standard transverse crosswalk markings.

Crosswalks should not be less than 6 feet wide, according to the MUTCD's basic standards. Longitudinal lines should be 12-24 inches wide, spaced 12 - 36 inches apart. All crosswalks should be brought into ADA compliance as they are upgraded or re-striped. Marked crosswalks generally should be designed to minimize crossing distances and should be straight and in-line with the sidewalk ramps to make crossing easier for children and adults with visual and/or physical impairments.

Maintenance

Longitudinal lines, like those of the ladder and continental pattern, are more costly to stripe than two simple transverse lines found in a conventional crosswalk. However, the increased visibility and safety of pedestrians in conjunction with longer-lasting, high-visibility crosswalk marking materials — like plastic or epoxy material embedded with reflective glass beads — are a better value over time, as they require less maintenance. Crosswalks that include alternative paving materials may require additional maintenance to ensure a high-quality, high-visibility walking experience is maintained. For communities in northern climates, like Lewiston-Auburn, recessed pavement markings combined with long-lasting treatments may stretch maintenance budgets further.

Raised Crosswalk



Design Guidance

Raised crosswalks should lift vehicles 3 - 4 inches above the pavement grade (about a 6-foot parabolic approach transition). The flat "table top" section should be 10-12 feet wide. As these crossings need to be highly visible, "shark's teeth" yield lines should be added when possible to both inform drivers of where to stop, and to bring attention to the sudden change in pavement grade. Unit pavers can also be used to increase the visibility of the crossing, and to contrast with the pavement. These crossings must be accompanied by pedestrian crossing signs and a sign alerting motorists of the pavement undulation, and should be ADA compliant.

Maintenance

As raised crossings can incorporate distinctive materials, like unit pavers, additional maintenance may be required. To ensure that the crosswalk remains extremely visible, frequent re-striping may be required. Although the cost is greater on the front end, longer-lasting, high-visibility crosswalk marking materials are a better value over time, as they require less maintenance.

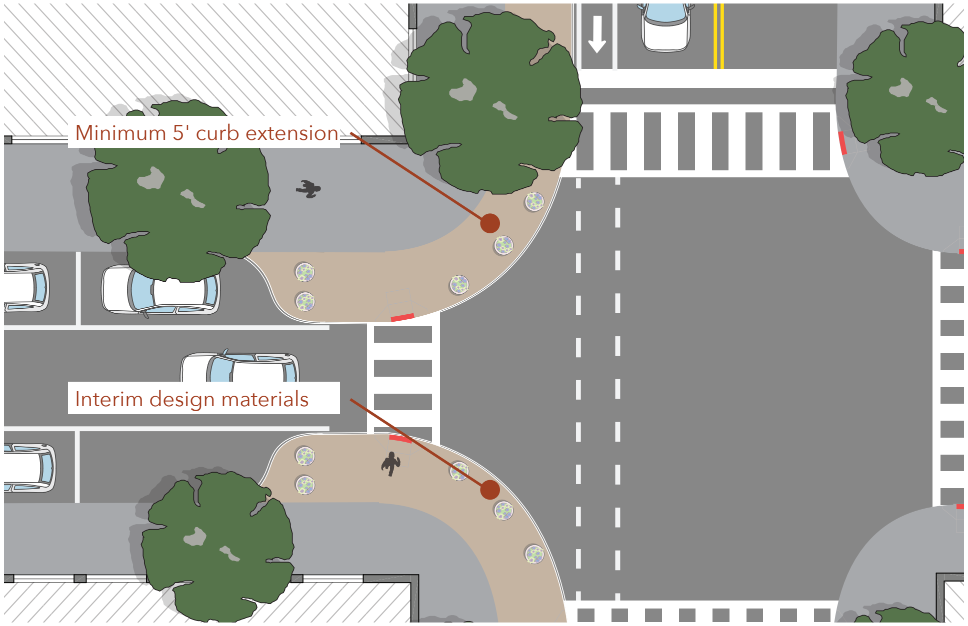
Definition

A raised crosswalk is a speed table, a traffic calming measure that raises the wheelbase of a vehicle to slow its speed, that functions as a mid-block crossing, or is used at an intersection.

Application

This type of high-visibility crossing is most suitable for low-speed, low-volume local streets, and especially where low-volume streets intersect high-volume streets (alley entrances, neighborhood residential streets, etc.). They are also appropriate where a street changes its function or type, at shared use path crossings, and at key civic, education, and employment hubs.

Curb Extension



Definition

Curb extensions, specifically the "gateway" treatment depicted above, visually and physically narrow streets to shorten crossing distances for pedestrians, and increase available space for street furniture and landscaping, like bioswales. These interventions increase the visibility of pedestrians by aligning them with the parking lane.

Application

Curb extensions may be implemented on commercial and residential streets, small and large. There are multiple applications for curb extensions, including mid-block pinchpoints, gateways (at the mouth of the intersection), chicanes (offset curb extensions on low-volume streets), and bus bulbs, and they can be applied on all types of streets, provided on-street parking exists.

Design Guidance

Curb extensions should be designed to maximize pedestrian space and minimize crossing distances as much as possible. The actual size depends on the width of the adjacent travel or parking lane: curb extensions are typically 1 - 2′ narrower than the parking lane and include an inner/outer radius of 20′ and 10′, which may be adjusted upward or downward so long as street sweeping and other operational turns can be made safely along the entire curbline.

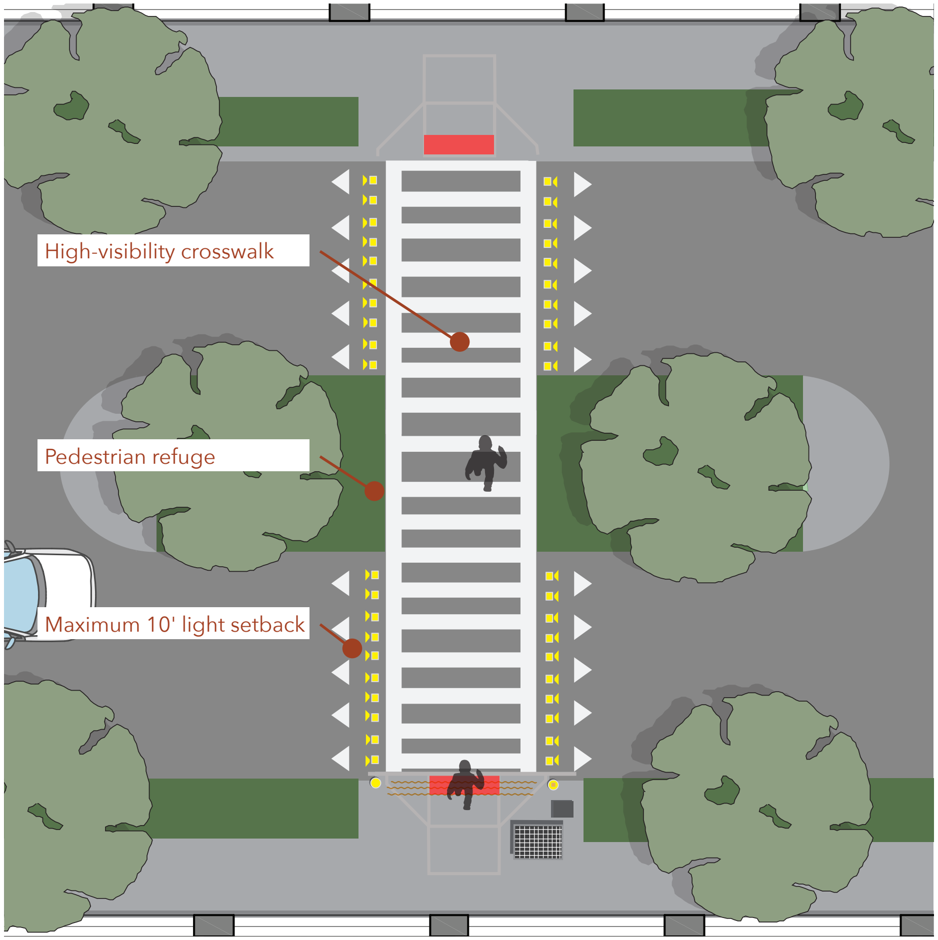
At a minimum, curb extensions should continue at least 5′ beyond the normal curbline. If the width of the extension is going to be less than 5′, consider less permanent materials, like planters or bollards, to reclaim roadway space in a less costly manner. Indeed, curb extensions can also be created using using low-cost materials, such as paint and/or striping, or epoxy-gravel, and serve as an interim treatment before capital funds are secured for more permanent construction. Per MUTCD, interim design curb extensions should be demarcated with double white 4″-6″ striping, indicating that motorists are not to cross into the pedestrian space.

Curb extensions designed for streets with bikeways must be designed carefully so as not to infringe upon the cycling space, and should be created with detectable warning pads and other standard ADA-compliant features.

Maintenance

Where curb extensions are created using low-cost, interim materials, required maintenance will be more frequent. Ensuring detectable warning pads are maintained, and that any paint treatments remain visible, are anticipated regular maintenance activities.

In-Pavement Crossing Beacon



Definition

An in-pavement crossing beacon uses amber lights embedded into the pavement on both sides of a raised or conventional crosswalk to alert motorists of crossing pedestrians. The lights flash in unison when a pedestrian activates or triggers the crossing signal, warning motorists to slow their speeds and stop for pedestrians.

Application

In-pavement crossing beacons are typically used at mid-block crossings on medium to heavy-flow thoroughfares to further increase the visibility of a crosswalk / shared use path crossing. (especially at night). While some studies have shown improved short-term vehicular yield rates, long-term impact on safe driving behavior is unknown.

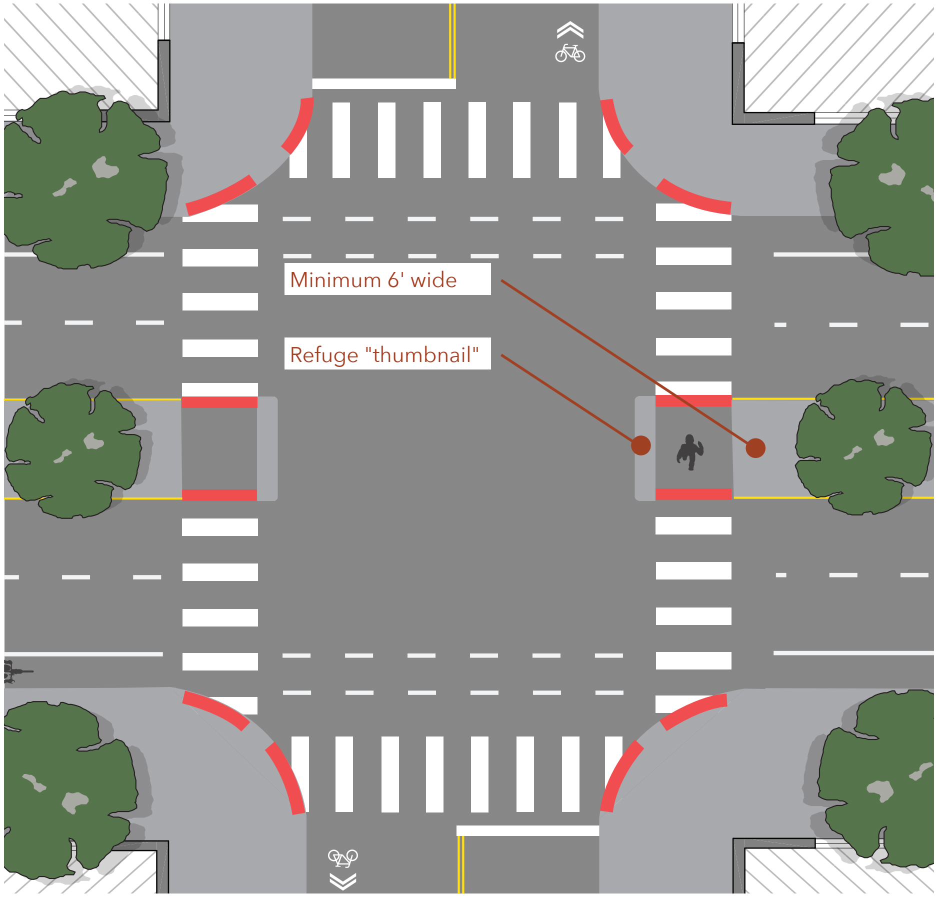
Design Guidance

In-pavement beacons may be most effective when combined with other pedestrian enhancements, such as pedestrian refuges, curb extensions, and high-visibility crosswalks. Beacons should be installed no further than 10 feet back from the outside of the crosswalk. When the lights are actuated or triggered, the flash rate should be no more than 60 flashes per minute to avoid excessive distraction.

Maintenance

Routine roadway marking and light maintenance will be required. Winter plow drivers must be made aware of their presence to avoid scraping the beacon lights off of the asphalt with the plow blade.

Pedestrian Refuge Island



Definition

Pedestrian refuge islands are physically protected areas where pedestrians can wait while crossing the street. At signalized intersections, they allow pedestrians to cross the street in two phases, which is especially helpful for seniors, childrens, and individuals with disabilities. At unsignalized intersections, they relieve pedestrians of the stress of finding a gap in traffic to cross multiple vehicular travel lanes.

Application

Pedestrian refuge islands are recommended where a pedestrian must cross three lanes of traffic or more in on direction, on either a 1-way or 2-way street. However, they may be implemented at narrower streets where space allows. They are also appropriate near and within neighborhood retail areas, civic and institutional uses, schools and senior facilities, and at large unsignalized intersections with large numbers of pedestrians.

Design Guidance

Refuge islands should be at least 6 feet wide to provide space for a bicycle or stroller, with a preferred width of 8-10 feet. The refuge island's length is ideally 40' long and includes landscaping, but may be much shorter given context and project needs. A narrower refuge is better than none where a 6-foot wide median cannot be achieved.

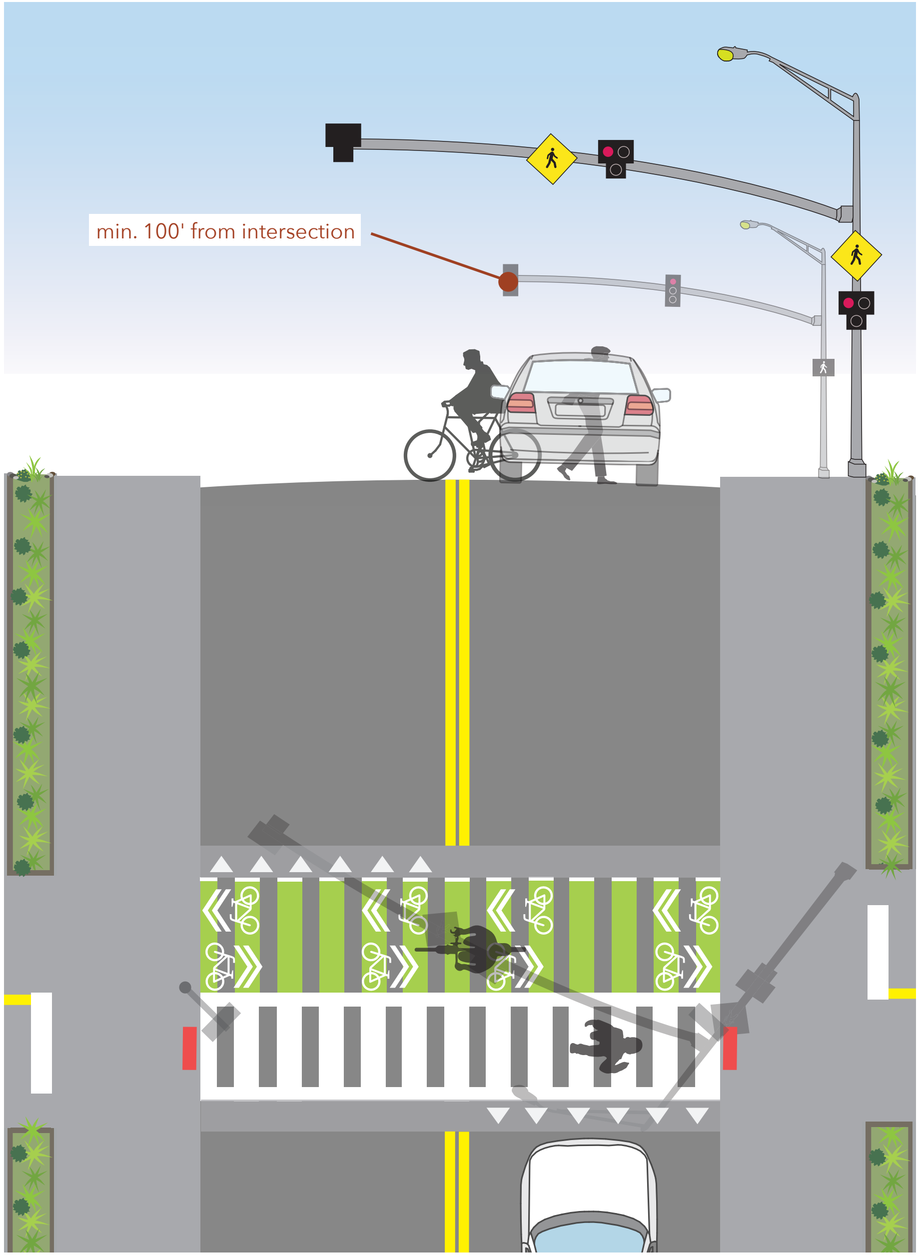
The refuge's cut-through pathway should equal the width of the crosswalk. If this cannot be achieved, crosswalks should be striped wider than the cut-through area.

At intersections, medians should have a "nose" or "thumbnail" that extends past the crosswalk, which slows turning drivers and protects waiting pedestrians. ADA-compliant detectable warning pads no less than 2 feet wide should also be placed at each end of the cut-through path. Bollards, landscaped features, and/or signs should be provided on the thumbnail to increase visibility. The cut-through area may be paved differently than the asphalt (or concrete) to provide visual contrast.

Maintenance

Beyond maintaining detectable warning pads and dealing with the general wear and tear of curb infrastructure, additional plantings, signs, bollards etc. may require occasional replacement/maintenance.

HAWK Signal (Not currently approved by Maine DOT)



Definition

Also known as a Hybrid Beacon, a HAWK (High-intensity Activated crossWalK), is a signal-head with two red lenses over a single yellow lens, intended to significantly increase the visibility of pedestrians and/or cyclists crossing major streets. A HAWK signal displays no indication (no lights are illuminated) when it is not actuated. When actuated, it will flash yellow, become solid yellow, followed by the two solid red lights to indicate that cars must come to a complete stop.

Application

HAWK signals are most appropriate on major streets where side street volumes do not support the installation of conventional traffic signals. They are also implemented where off-street bicycle or pedestrian facilities, such as neighborhood greenways or shared use paths, intersect major streets without existing signalized crossings, and are used at mid-block crossings of major thoroughfares.

Currently, HAWK signals are prohibited by the Maine DOT, but they should still be considered as inspiration for similar types of crossing signals, and advocated for as infrastructure that enhances pedestrian and cyclist safety.

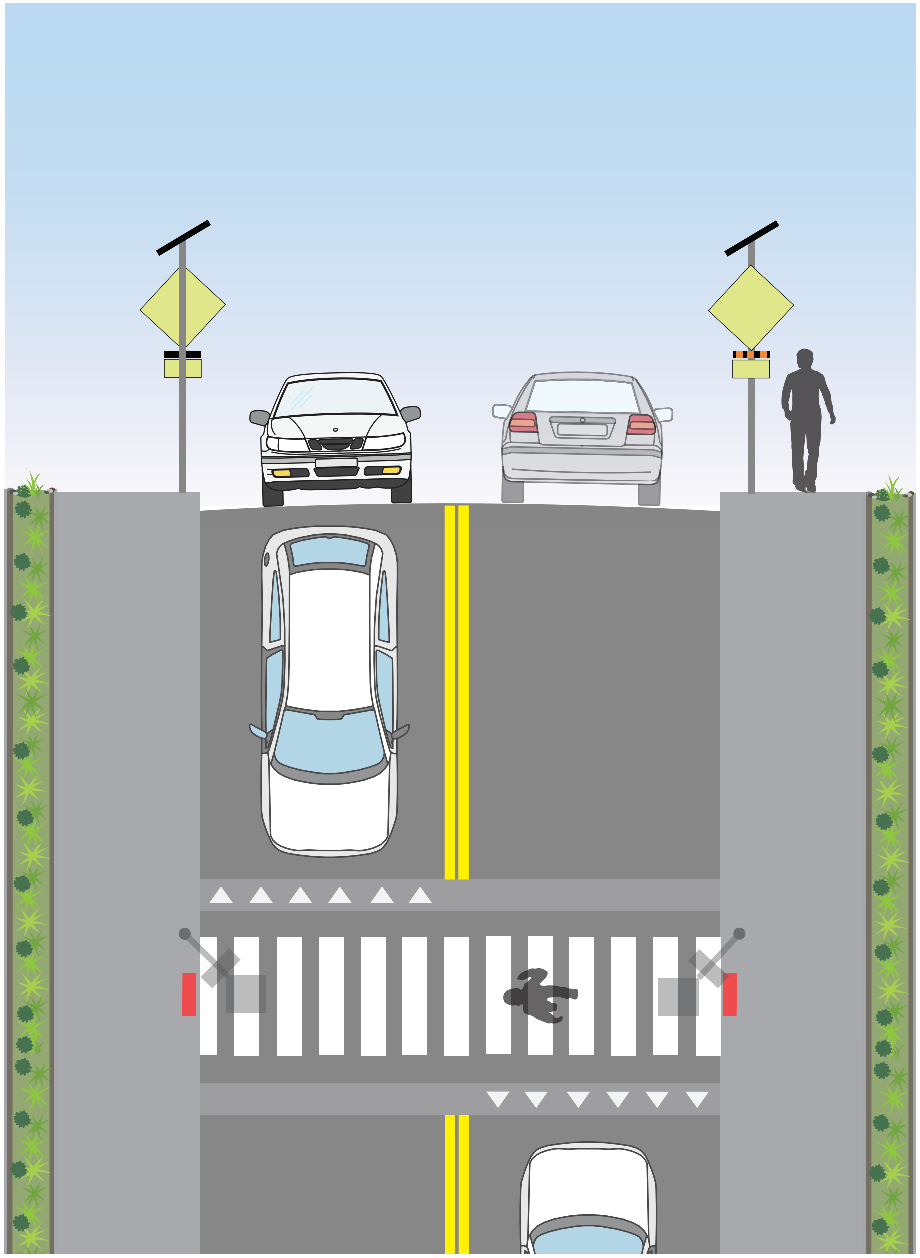
Design Guidance

HAWK signals should be used in conjunction with other signs and pavement markings to warn and control vehicular traffic, and they should only be installed at marked crosswalks. They should be placed at least 100 feet from an intersection and 100 feet away from on-street parking on either side. On-street parking should also be restricted within 20 feet from the crossing on the departure.

Maintenance

HAWK signals require the same maintenance as standard traffic signal heads, which includes replacing bulbs and responding to power outages.

Rectangular Rapid Flashing Beacon



Definition

Rectangular Rapid Flashing Beacons (RRFBs) are solar-powered, yellow LED lights placed on the sidewalk in conjunction with a crosswalk. They flash in a "wig-wag" pattern when activated by a crossing pedestrian, indicating the presence of a crossing pedestrian to motorists.

Application

RRFBs are most commonly implemented at intersections without existing signalized crossings, and at mid-block crossings of major streets. They can be installed on two-lane and multi-lane thoroughfares.

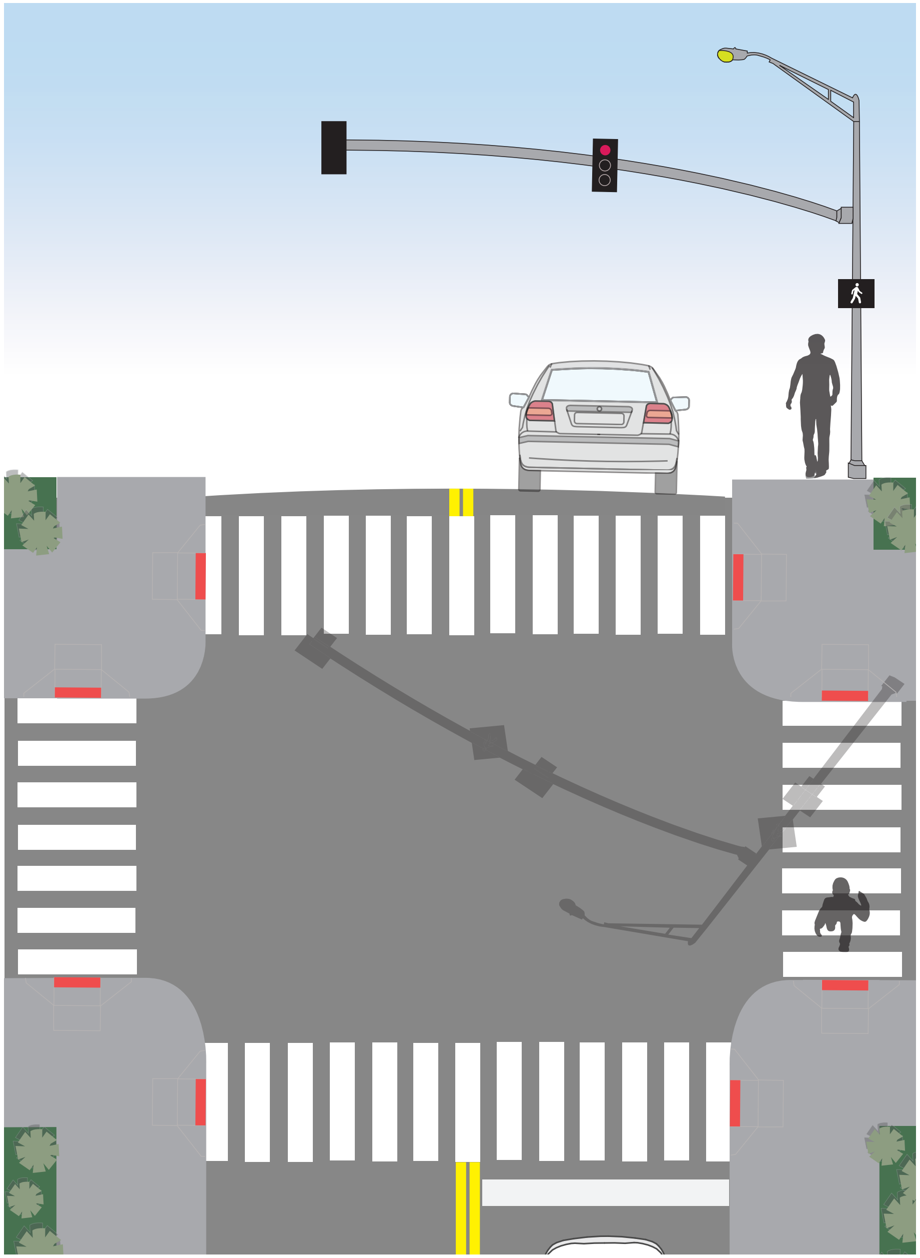
Design Guidance

RRFBs should be about 16′ from sidewalk level to the top of the solar panel, with the flashing lights between 6 and 8 feet above sidewalk level.

Maintenance

RRFB signals require the same maintenance as standard traffic signal heads, which includes replacing bulbs and responding to power outages.

Leading Pedestrian Interval



Definition

Leading pedestrian intervals (LPIs) display a WALK indication for pedestrians (and sometimes cyclists) while a red indication continues to be displayed to parallel through and/or turning traffic, affording pedestrians a headstart before vehicular turns are allowed to be made. LPIs give people walking more confidence and help reduce conflicts/crashes with people driving.

Application

Leading pedestrian intervals are most effective at signalized intersections with high pedestrian volumes and a moderate to high-volume of turning vehicles, crash history, or where known conflicts between pedestrians and vehicles exist. LPIs can be of particular relevance in and around schools, areas with high senior or disabled populations, college campuses, employment hubs, and/or downtown/commercial districts.

Design Guidance

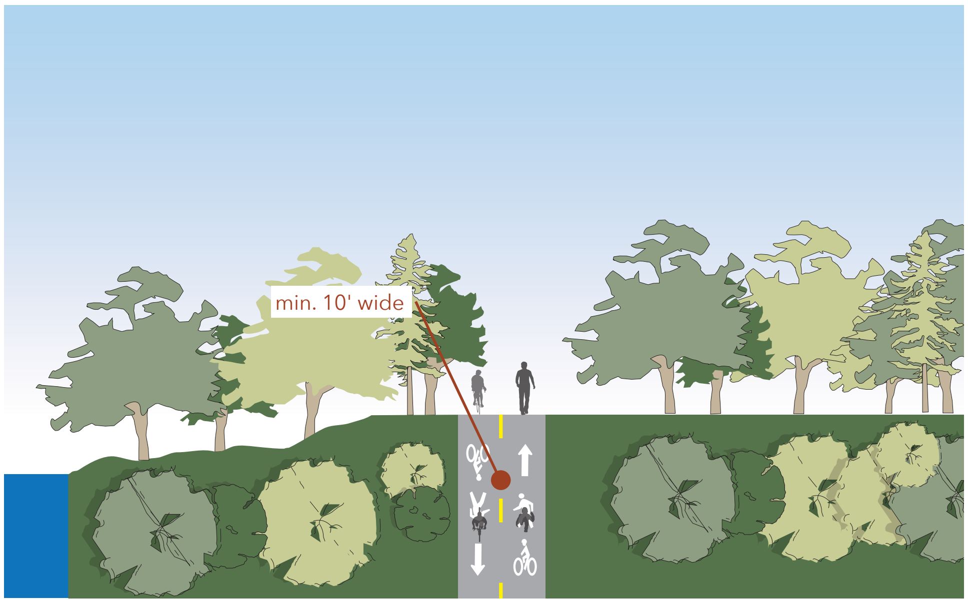
The pedestrian signal head is the same as in any signalized intersection, just the timing of its activation is advanced to provide people walking with a head start. Pedestrian signal heads should be located between 7 and 10 feet above sidewalk level, and be positioned and adjusted to provide maximum visibility at the beginning of the controlled crosswalk.

Maintenance

A leading pedestrian interval requires the same maintenance as standard traffic signal heads, which includes replacing bulbs and responding to power outages.

Cycling

Shared Use Path



Definition

Shared use paths, often referred to as greenways or trails, are a transportation and recreation facility physically separated from motorized vehicular traffic by an open space or barrier. Such facilities are designed for a wide variety of users, including pedestrians, cyclists, rollerbladers, joggers, etc. If well-located, shared use paths can function as the "arterials" of the bike and pedestrian network, connecting and building upon a municipality's on-street bikeway and sidewalk network.

Application

Shared use paths serve as a complement to, or extension of, thoroughfare networks and are typically located along linear rights-of-way, such as bodies of water, active or inactive rail lines, and large parks or parkways. However, they can also be integrated within the street right-of-way if physical separation is provided between users and vehicular traffic. Shared use paths are often used to connect neighborhoods where the street network is otherwise insufficient.

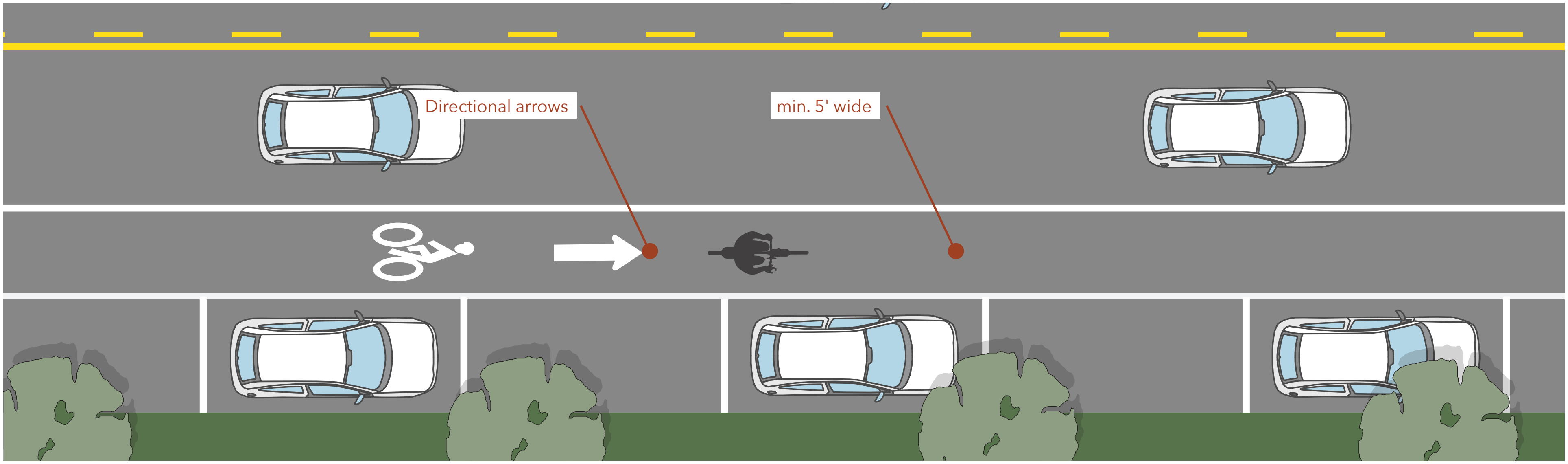
Design Guidance

A shared path should be a minimum of 10 feet wide, and ideally include 2 feet of grading on either side. In general, grades should not exceed 5 percent. Shared markings should be painted, and separate lanes should be designated with a dashed or solid yellow line in locations with moderate to high use patterns. Wayfinding and/or interpretive signs are optional, but further enhance the user experience. Wherever possible, shared paths should be paved with a firm, stable, and slip-resistant material (generally asphalt or concrete) to ensure the safety of a variety of users. Where paths are adjacent to roadways, a minimum of three feet should be maintained wherever possible between the edge of the path and the curb. Surface material and grading of a shared use path should always be ADA compliant.

Maintenance

Shared use paths should be kept clear of debris and be plowed during winter months. Regular surface maintenance should ensure that the painted markings are legible and potholes and other compromises to the surface quality are addressed.

Conventional Bike Lanes



Definition

Bike lanes designate an exclusive space for cyclists in the right-of-way, typically adjacent to vehicular traffic, through the use of pavement markings and signage. Bike lanes generally appeal to moderate or skilled cyclists, but will not encourage timid or beginner cyclists to ride because the level of traffic stress remains unappealing.

Application

Bike lanes are appropriate on thoroughfares with more than 3,000 motor vehicle trips per day, and on any street with a posted speed limit equal to or greater than 25 mph. They are also a good addition to streets with moderate to high amounts of truck or transit trips. Bike lanes are often striped by reducing the width of overly wide travel lanes and/or removing travel lanes from a multi-lane thoroughfare altogether. Where new bike lanes are implemented on Maine state roadways, and involve the adjustment of travel lane widths, a design exception is required from the DOT's engineering review board.

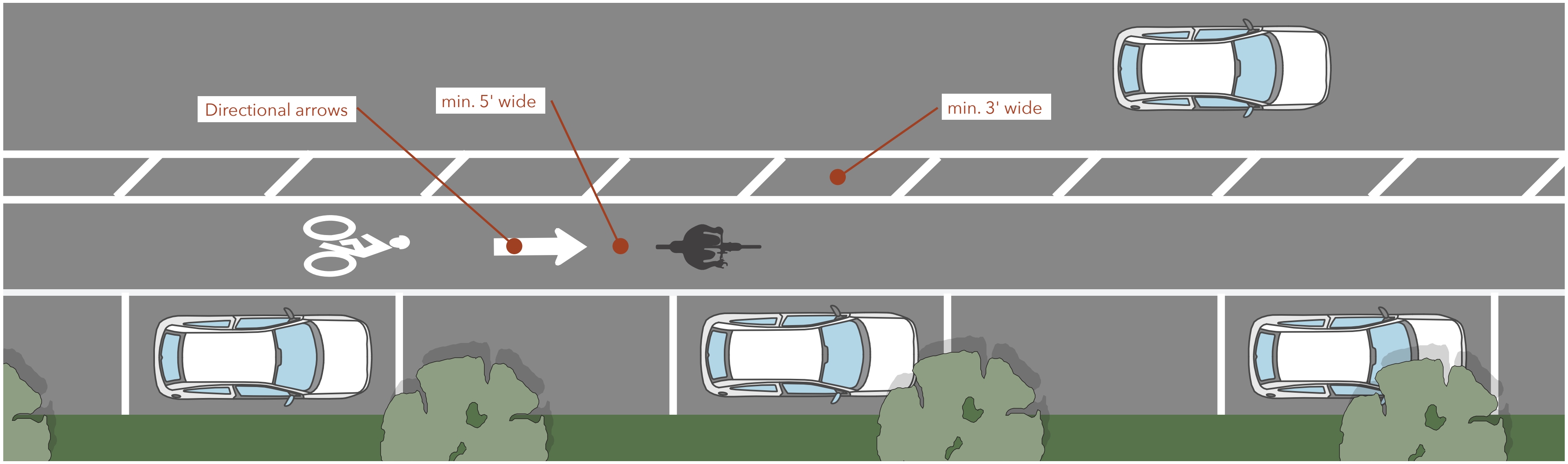
Design Guidance

Bike lane widths vary based on the posted speed, context, and configuration of the street. When curbside, the minimum width is 5 feet, with 6 feet being more desirable. When adjacent to parking, the bike lane should be at least 5 feet, with the minimum combined parking/bike lane width of 12 feet or greater wherever possible, as greater widths help keep cyclists out of the door zone. Bike lanes striped on streets with high speeds/volumes (in excess of 35 mph, or 10,000 vehicles per day) may be widened to 6 - 7 feet wherever possible. All bike lanes should include the word, symbol, and/or arrow markings to designate the bike lane as preferential to cyclists, and a solid white line to separate the bike lane from traffic. Directional arrows should accompany all bikes lanes to reinforce the legally required direction of travel. To emphasize its presence, the outside bike lane stripe may be 2 -4 inches wider than the inside stripe. Bike lanes may include cross-bike markings or colored paint treatments at intersections, curb cuts, or other known conflict points.

Maintenance

Bike lane markings should be maintained as needed to remain legible and be kept free of debris, potholes, and other obstacles. In the winter, bike lanes must be kept clear, to the same standards as vehicular travel lanes.

Buffered Bike Lanes



Definition

Buffered bike lanes are just like conventional on-street bicycle lanes, only they include a striped buffer space separating the bicycle lane from the adjacent travel and/or parking lane.

Application

Buffered bike lanes are appropriate wherever conventional bike lanes are being considered, especially on higher-speed or trafficked corridors, such as those with posted speeds and/or traffic volumes equal to or greater than 35 mph / 10,000 vehicles per day. Thoroughfares with excess capacity or multiple lanes with excess width are also ideal for buffered bike lanes, as existing travel lanes may be narrowed or removed with the excess space consolidated into buffered bike lanes. Where new buffered bike lanes are implemented on Maine state roadways, and involve the adjustment of travel lane widths, a design exception is required from the DOT's engineering review board.

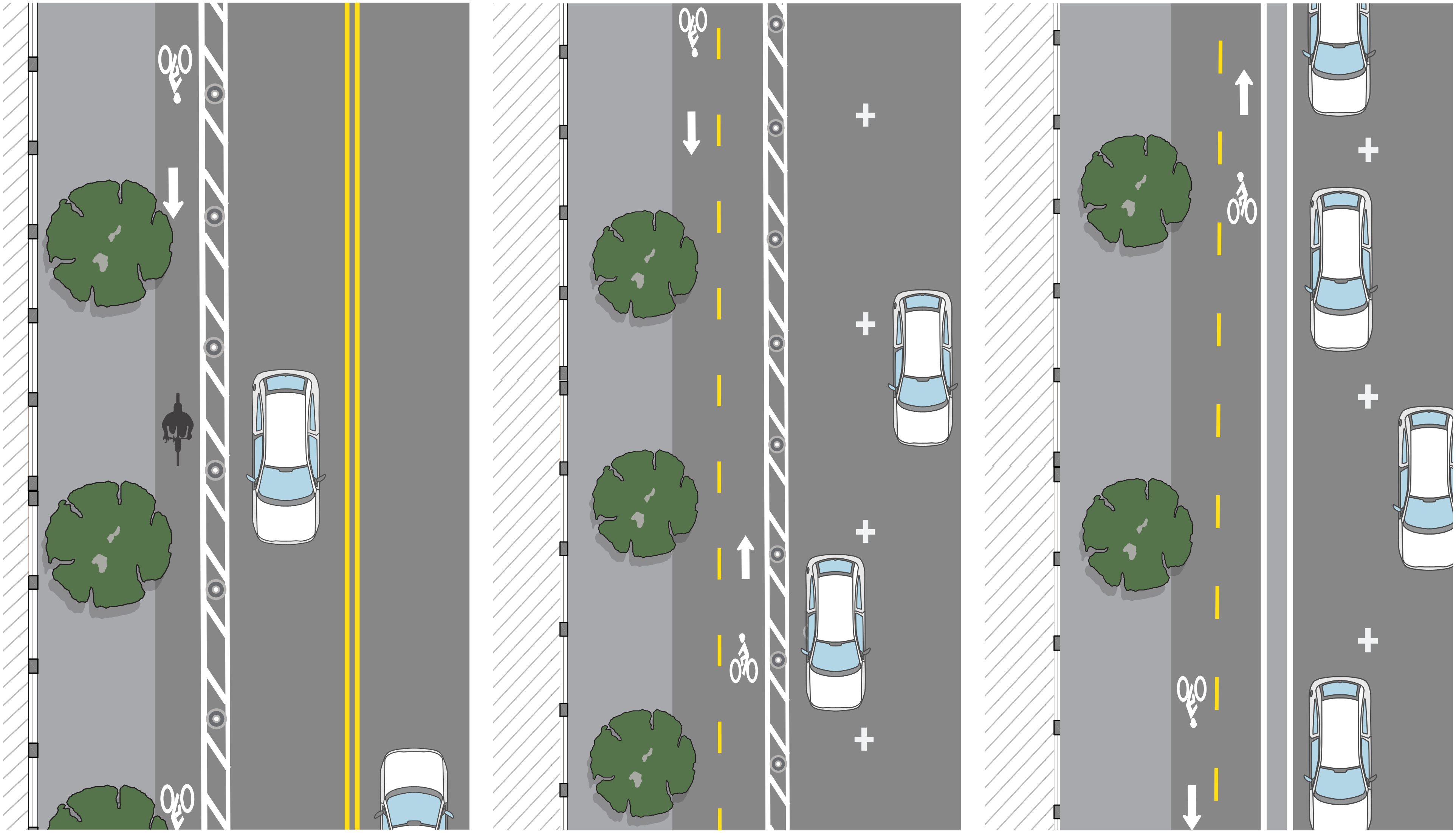
Design Guidance

Buffered bike lanes are allowed per MUTCD's guidelines for preferential lanes. Required design features include bicycle symbol and arrow markings, and at least two solid white lines between vehicular traffic and the bike lane. Directional arrows should accompany all bikes lanes to reinforce the legally required direction of travel. If the buffer zone is 3 feet or wider, chevron or diagonal hash pavement markings should be used. The buffer zone, however, is not recommended to be less than 18 inches wide. Like conventional bike lanes, buffered lanes may include cross-bike markings or colored paint treatments at intersections, curb cuts, or other known conflict points.

Maintenance

Buffered bike lane markings should be maintained as needed to remain legible and be kept free of debris, potholes, and other obstacles. In the winter, bike lanes must be kept clear, to the same standards as vehicular travel lanes. Buffer striping, especially the outside stripe, may need additional maintenance compared to a conventional lane.

Protected Bicycle Lanes



1 One-way protected bikeway

2 Two-way, parking protected bikeway

3 Two-way, parking protected bikeway, with mountable curb barrier

Definition

Protected bike lanes are bikeways located at the street, sidewalk, or an interim level that are physically separated from vehicular traffic using a variety of methods, such as raised curbs, bollards, parked cars, or concrete barriers. Like shared use paths, protected bike lanes enhance the perceived and real safety for the widest swath of people of all ages and abilities, and allow people to ride with confidence.

Application

Protected bike lanes are most suitable on streets with high volumes of bicycle and/or motor vehicle traffic, and on streets where cyclists feel unsafe due to high speeds, high parking turnover, and/or multiple uni- or bi-directional travel lanes. Wherever cyclists fear frequent conflicts with motor vehicles, protected bike lanes should be considered.

Where new protected bike lanes are implemented on Maine state roadways, and involve the adjustment of travel lane widths, a design exception is required from the DOT's engineering review board.

Design Guidance

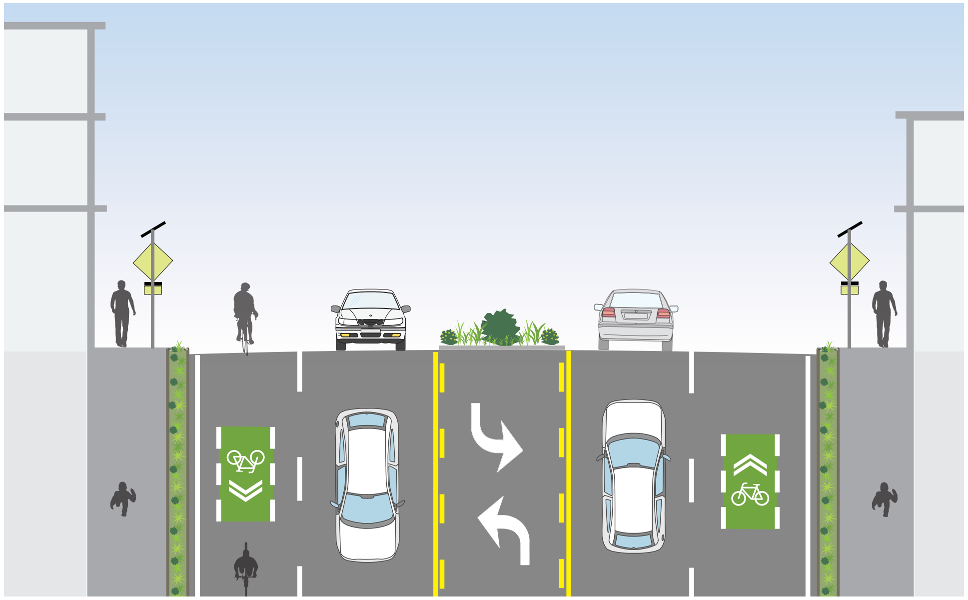
Protected bike lanes should comply with MUTCD's marking standards for both conventional and buffered bike lanes (if a buffer is to be used in combination with a physical barrier). The minimum width for a protected bike lane is 5 feet. If parking is used as the protective barrier, a 3-foot buffer zone should be provided so that cyclists are able to avoid conflicts with opening car doors.

Delineator posts, bollards, raised medians, and parking stops are commonly used barriers, which can be combined with other treatments like colored pavement and buffer markings. If the protected lane is bi-directional, the same marking standards apply for both directions. For single-direction protected bike lanes, directional arrows should be used to reinforce the legally required direction of travel. Some protected bike lanes may require additional signing or signalization to provide for safe operation.

Maintenance

Low-cost physical barriers used to separate the bike lane from vehicular traffic may require regular maintenance to replace vertical elements. Per other types of bike lanes, all markings should be maintained as needed to reach legible standards. The protected bike lanes must also regularly be kept free of debris, potholes, and other obstacles, and snow must be cleared during winter months.

Bicycle Priority "Super Sharrows" (Not Currently Approved by Maine DOT)



Definition

"Super sharrows" are shared lane markings combined with an underlying green paint or other treatment, to emphasize the bicyclist's right-of-way and positioning on busy streets.

Application

Bike priority "super sharrows" should be used on moderate to higher-volume multi-lane thoroughfares, where standard shared use lane markings are insufficient to clarify the recommended positioning of cyclists, both to drivers and cyclists. They may also be used along neighborhood greenways or other low-volume streets where the high-visibility markings underscore the priority movement of cyclists. In Maine, per AASHTO's guidelines, sharrows may not be used on roadways in excess of 35 mph travel speeds.

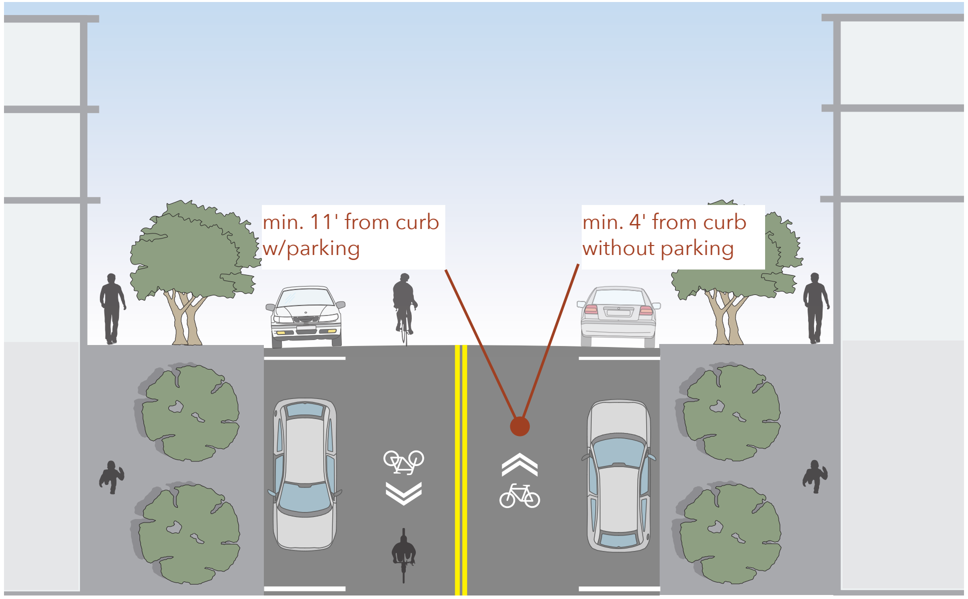
Design Guidance

Recently tested in a range of US communities, a "super sharrow" is a shared use lane marking painted over bright green colored pavement. Because shared use lane markings have been found to confuse drivers, the paint is meant to clarify where cyclists should be riding, and ideally reinforce drivers' need to share the road and be alert of cyclists.

Maintenance

The painted markings should be maintained frequently to ensure legibility. Wear from tire tread can be avoided by placing sharrows in the center of the travel lane. Longer-lasting, high-visibility marking materials, like plastic or epoxy material embedded with reflective glass beads within recessed pavement, may serve as a better value over time, as they require less maintenance.

Shared Use Lane Markings



Definition

Shared lane markings, or "sharrows," are painted road markings used to indicate a lane shared between cyclists and motor vehicles that legitimize bicycle traffic on the street, and recommend proper positioning so that cyclists avoid the door zone and/or other operational hazards. Sharrows generally appeal only to skilled/confident cyclists, unless used on very low-trafficked streets.

Application

Shared use lane markings are most appropriate on streets where the speed differential between bicycle and vehicular traffic is negligible, such as low-speed, traffic-calmed streets with a speed limit of 25 mph or lower. In Maine, per AASHTO's guidelines, sharrows may not be used on roadways in excess of 35 mph travel speeds. Sharrows are also useful for streets where a conventional bike lane cannot fit, or in conditions where the bike lane helps people climb uphill and the sharrow allows for close speed differentials between people driving and cycling. In limited applications, sharrows may be used to fill short gaps in an otherwise continuous bikeway network.

Design Guidance

The guidelines for the design of the sharrow marking are outlined by the MUTCD. These markings should not ever be placed within designated bike lanes, and are only appropriate for shared vehicular travel lanes.

Along busier streets, the MUTCD recommends that sharrows be placed every 50-100 feet. On slower streets, sharrows can be placed at a maximum of 250 feet apart. When a parking lane is present, sharrows should be placed a minimum of 11 feet from the curb to avoid "dooring." When sharrows are curbside, 4 feet from the curb is the standard.

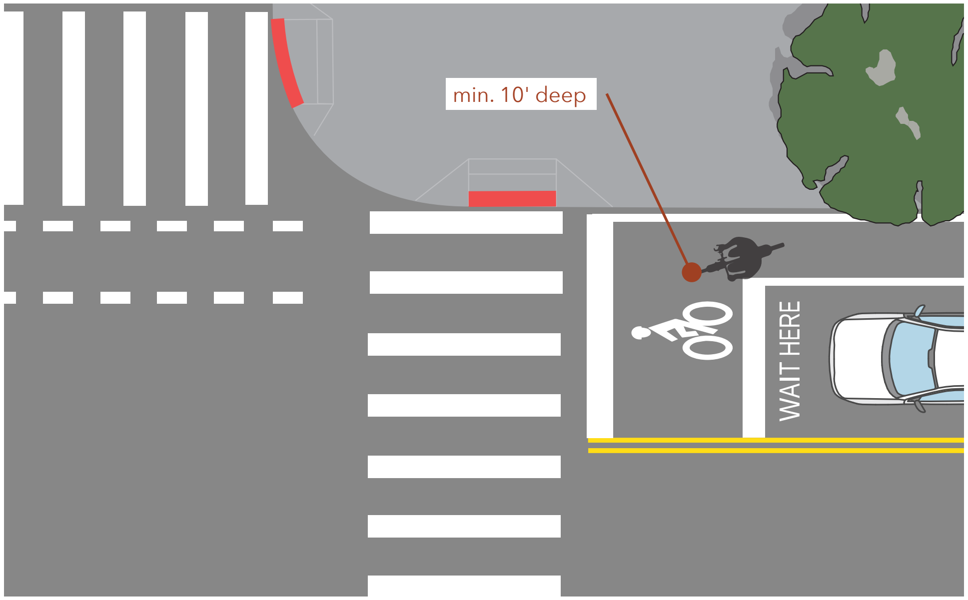
On 10- or 11-foot travel lanes with 25 mph speeds, sharrows should be placed within the travel lane.

Sharrows may also be coupled with cross-bike markings through intersections, and at curb cuts and other conflict points.

Maintenance

Frequent, visible placing of sharrows is essential to their proper function. Painted markings should be maintained frequently to ensure legibility. Wear from tire tread can be avoided by placing sharrows centrally in the travel lane.

Bicycle Box



Definition

A bicycle box is a designated area for cyclists at the head of a lane at a signalized intersection that provides a safe and visible way for cyclists to position themselves ahead of traffic during the red signal phase to either proceed straight through the intersection, or to make a left-turn to an intersecting bikeway facility.

Application

Bike boxes are typically applied at signalized intersections of one- or two-way streets with moderate to high bicycle/vehicle traffic, especially those where cyclists must make left turns (typically into an intersecting bikeway, shared use pat,h or where the bicycle lane moves to the leftside of the street) and motor vehicles make frequent right turns. Bicycle boxes may also be used in conjunction with shared use lane/″super sharrow″ markings and/or where pedestrian traffic is high, as the advanced vehicular stop bar discourages motorists from encroaching on the crosswalk.

Design Guidance

The bicycle box should be between 10 and 16 feet deep, and be accompanied by a stop bar to minimize encroachment by motor vehicles. The bicycle pavement marking should be centered between the stop bar and crosswalk to reinforce the bicyclist's priority. ″No Turn on Red″ signs (MUTCD R10 - R11, R10- R11A, R10 - R11B) should accompany the bike box to prevent vehicles from entering it and compromising the safety of cyclists with ″right hook″ turns.

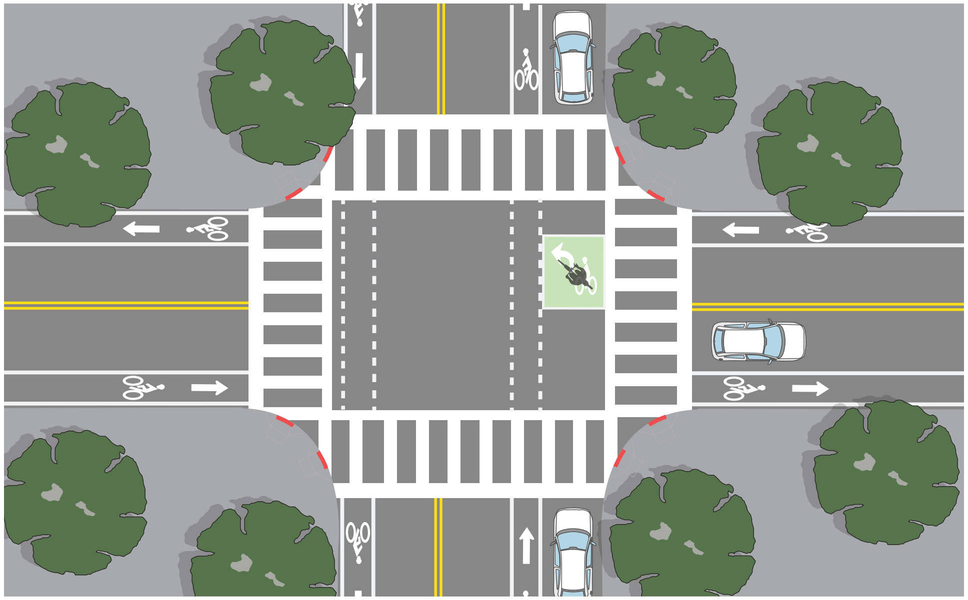
To enhance its visibility, the bike lane approach and bike box itself may be colored with green paint, include a ″Wait Here″ legend marking for motorists, and/or include a stop line 8 feet in advance of the actual bike box.

Bike boxes may also be paired with bicycle signals or leading pedestrian intervals to further reduce turn conflicts with motor vehicles.

Maintenance

To the degree possible, painted markings should be placed between the dominant path of vehicle tires to reduce wear as much as possible. Bike boxes that include green pavement would need to be maintained more frequently. Recessed pavement markings using high-quality thermoplastic and/or glass bead mixtures may cost more on the front end, but have been shown to last longer and require less frequent maintenance.

Two-Stage Turn Queue Box (Not Currenty Approved by the Maine DOT)



Definition

Bicycle queue boxes allow cyclists to make safe, "two-stage" left turns from a right side bikeway — typically a protected, buffered, or conventional bike lane — or right turns from a left side bikeway. They are intended to improve cyclists' ability to make left turn comfortably while reducing conflicts with motor vehicles and/or with pedestrians.

Application

Bicycle queue boxes are most appropriate at signalized intersections, on multi-lane thoroughfares with high traffic speeds, along protected bikeways where cyclists need to exit the lane to turn left, and especially at intersections where cyclists make frequent left turns for a known destination or for an intesecting bikeway. While the signal is green, cyclists enter the intersection and stop inside the green queue box. Once the signal in the other direction turns green, the cyclist then makes a left turn onto the intersecting street.

Design Guidance

Bicycle symbol and arrow markings are required for queue boxes. Additional signage is not required, but may be helpful for drivers to understand the queue box's function, and to enhance the safety of cyclists using it. The box should be placed in a safe, protected area within the intersection, such as in line with the parking lane, or between the continuing bike lane and a pedestrian refuge island.

"No Turn on Red" signs (MUTCD R10 - R11, R10- R11A, R10 - R11B) should accompany the queue box to prevent conflicts with motor vehicles.

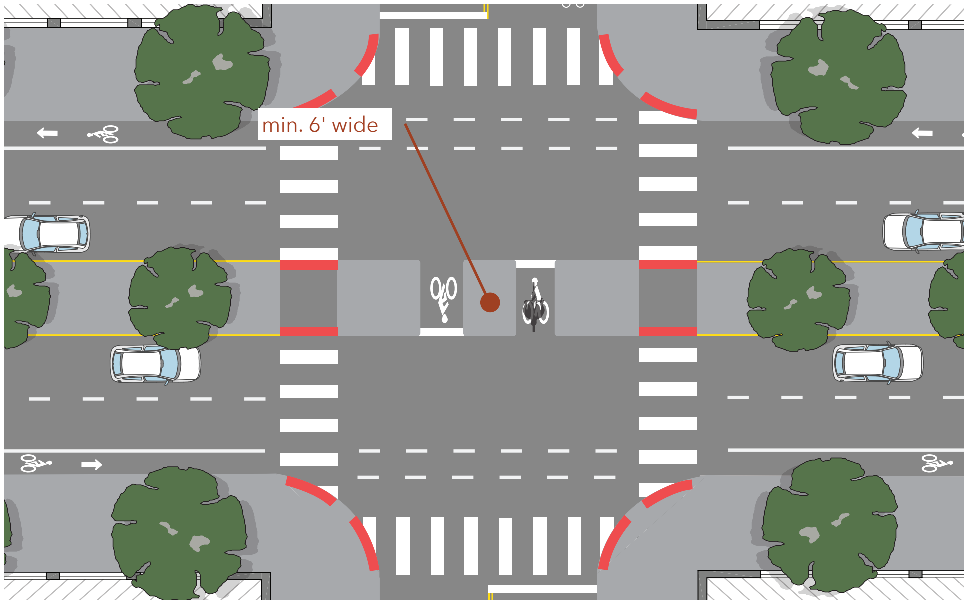
"Cross-bike" intersection markings should be used to aid bicycle positioning through the intersection and be accompanied by a bicycle signal, with a leading bicycle interval to improve the comfort and visibility of cyclists moving through the intersection.

Bicycle queue boxes are often combined with an underlying green paint treatment (pictured at left) for extra visibility and may also be placed laterally in the cross street parking lane (if it exists), rather than in front of the travel lane.

Maintenance

Green paint may be more difficult to maintain, especially during winter months, if it is used below the bike and arrow queue box markings.

Bicycle Refuge Island



Definition

Bicycle refuge islands are protected areas in the center of the street to facilitate bicycle crossings, allowing bicyclists to cross only one direction of traffic at a time. They can also be used to facilitate two-stage turns onto an intersecting bikeway facility.

Application

Refuge islands are especially applicable where bikeways cross moderate to high-volume thoroughfares, and in general on high-speed streets where there are limited acceptable gaps to cross both directions of traffic. They are also appropriate at signalized intersections. More commonly, they are being implemented where protected bike lanes or neighborhood greenways continue across major intersections.

Design Guidance

Median refuges should not be less than 6 feet wide, with 10 feet being the desirable width. When applied on a two-way street, the refuge should be placed in the middle of the two directions of traffic. The length of the median should always be longer than 6 feet, and should be at a height of 6 inches, like a standard curb. The cut-through area should be wide enough to accommodate two-way bicycle traffic if need be.

Reflective elements, like white or yellow paint, should be used outline the raised median on the approach edge.

Depending on the context, bicycle refuges may be accompanied by bicycle signals, hybrid signals, or active warning beacons.

Reflective delineators should also be used to help mark the island for snow plow operators.

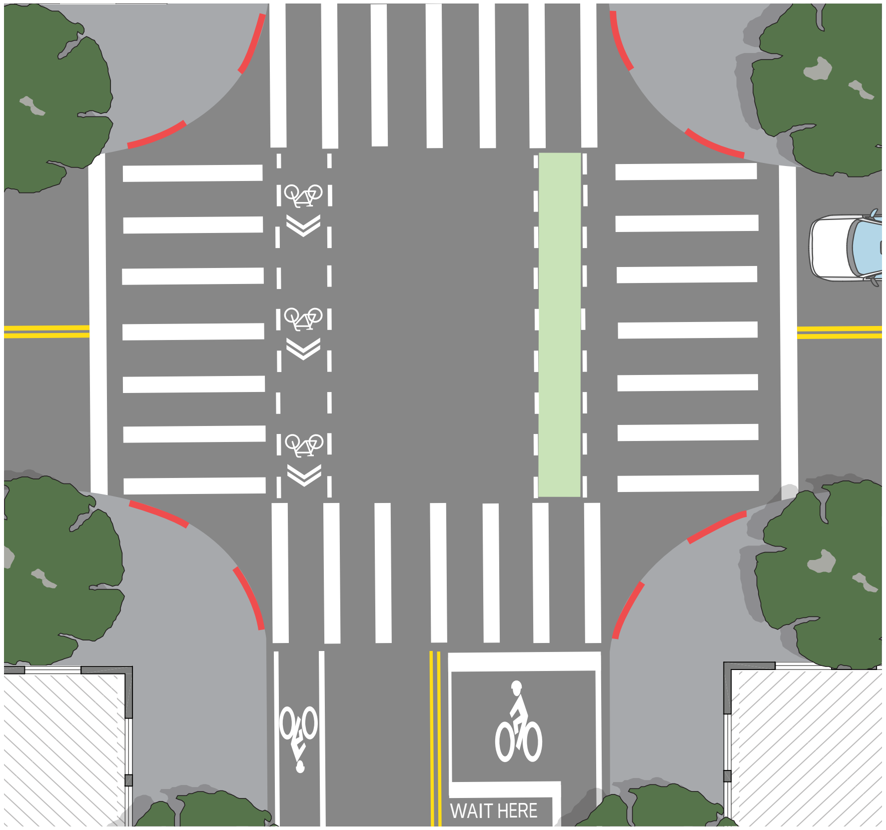
A 45 degree, angled median cut-through may be used to help bicyclists position themselves to face oncoming traffic.

Landscaping may improve median aesthetics but should not compromise visibility during the day or night.

Maintenance

Refuge islands may collect roadway debris and need to be swept with some frequency. Snow piles should not be placed within the refuge, meaning snow removal will be required during winter months.

Cross-Bike Markings



Definition

Cross-bike markings through intersections are used to highlight the intended path of bicyclists through an intersection or driveway curb cuts. The are intended to improve the visibility of bikeways and the cyclists who use them, and help motorists and cyclists predict each other's lateral positioning while moving through a given intersection or across a driveway.

Application

Cross-bike markings, which vary in design, are appropriate across signalized intersections, especially those that are wide or complex, and may be used in conjunction with protected bikeways, bike lanes, and even sharrows. They are especially appropriate where motor vehicles must encroach into the bike lane to access a ramp, driveway, or intersecting street.

Design Guidance

At a minimum, cross-bike markings are comprised of dashed painted lines, which are supported by Section 3B.08 of the MUTCD. The dashed markings are typically 2 - 3 feet in length, and 6 inches in width, spaced 2 - 6 feet apart.

The cross-bike width should match that of the bikeway leading into the intersection.

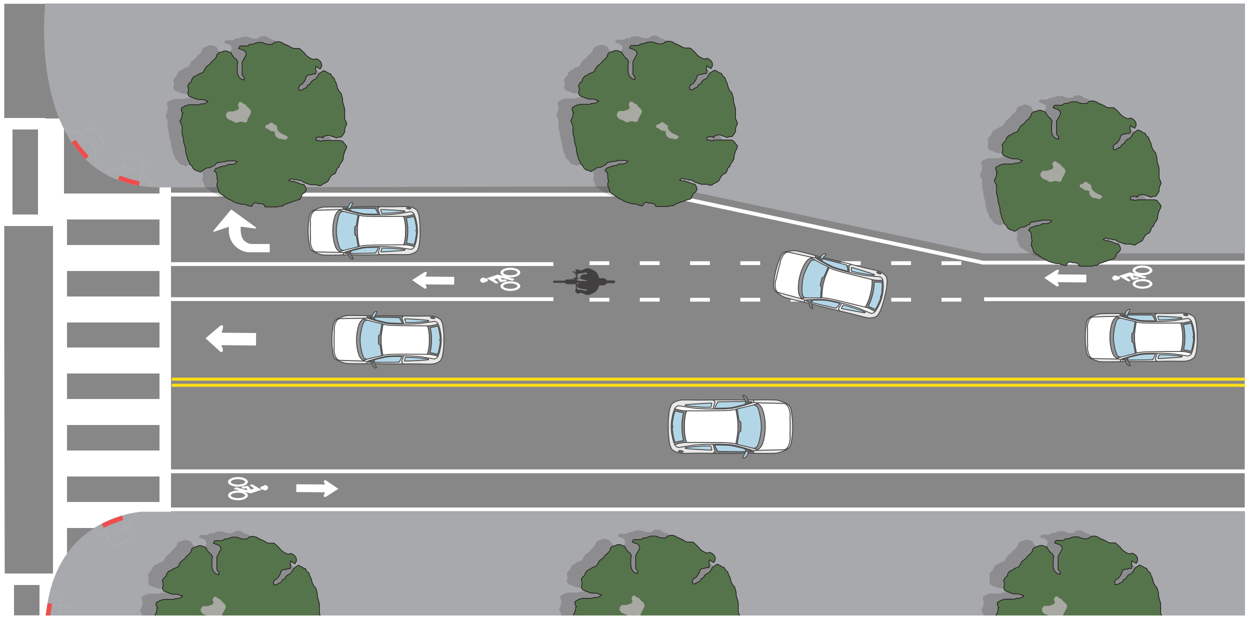
In addition to the dashed line treatment, cross-bikes may include chevrons, sharrows, or colored paint (see right), which may be used to differentiate the bike portion of the crossing from the pedestrian crosswalk. So-called "Elephant's feet" markings (14 - 20 inch square markings) are occassionally used to further emphasize the cross-bike treatment.

Maintenance

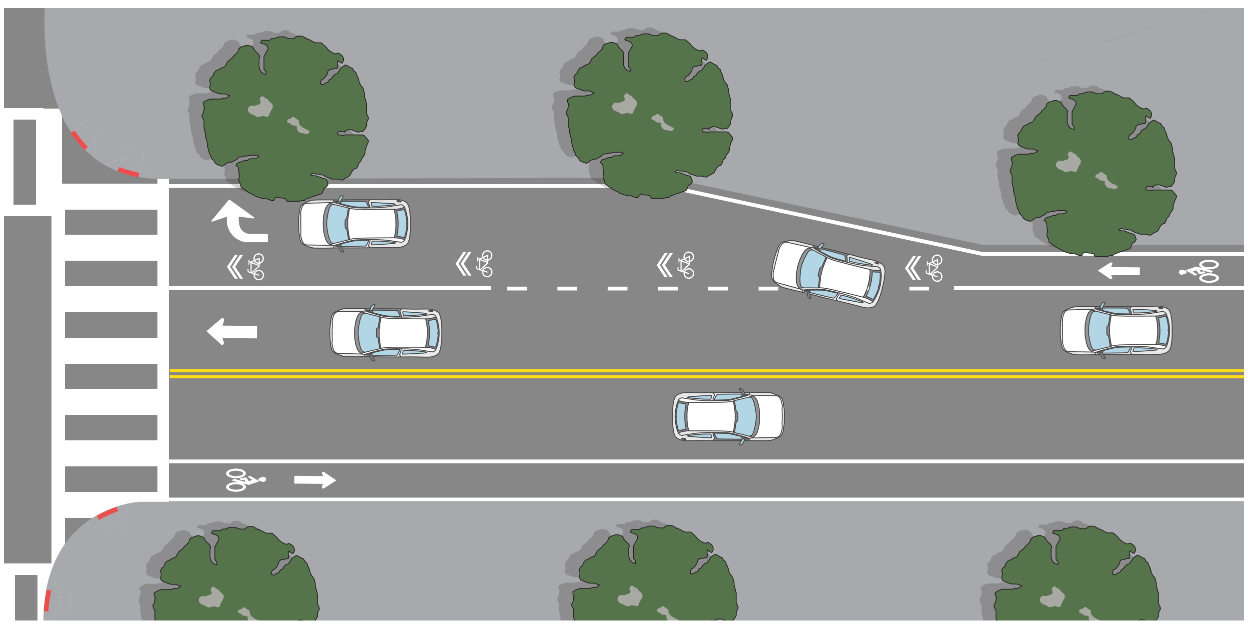
Maintenance is similar to that of pedestrian crosswalks, mostly maintaining the painted markings so that they continue to be legible.

Combined Bike Lane/Turn Lane

1 Solid Lane



2 Sharrows



Definition

Rather than dropping bicycle lanes with the introduction of a vehicular turn lane, combined bike lane/turn lanes include a bike lane within the inside portion of a dedicated motor vehicle turn lane — using either shared lane markings — or conventional bike lane markings with a dashed line. The suggested bike lane within the turn lane delineates the proper position for cyclists so as to minimize conflict with motor vehicles, while allowing motorists to cross over the bike lane to enter the vehicular turn lane.

Application

Combined bike/turn lanes are most typically applied on streets where there is a right turn lane, but not enough space to maintain a standard-width bike lane at the intersection, and in general at intersections with very high vehicle right-turn demand. They can also be implemented on streets where there is not a dedicated right turn lane, but on which high volumes of turning traffic may cause conflicts between vehicles and bicycles.

Design Guidance

Where the bike lane is continued into the turn lane with dotted lines, these lines must be at least 4 inches thick, and the lane itself shouldn't be any less than 4 feet. The width of the combined turn lane and bike lane should be between 9 and 13 feet. Standard bike lane markings should be used.

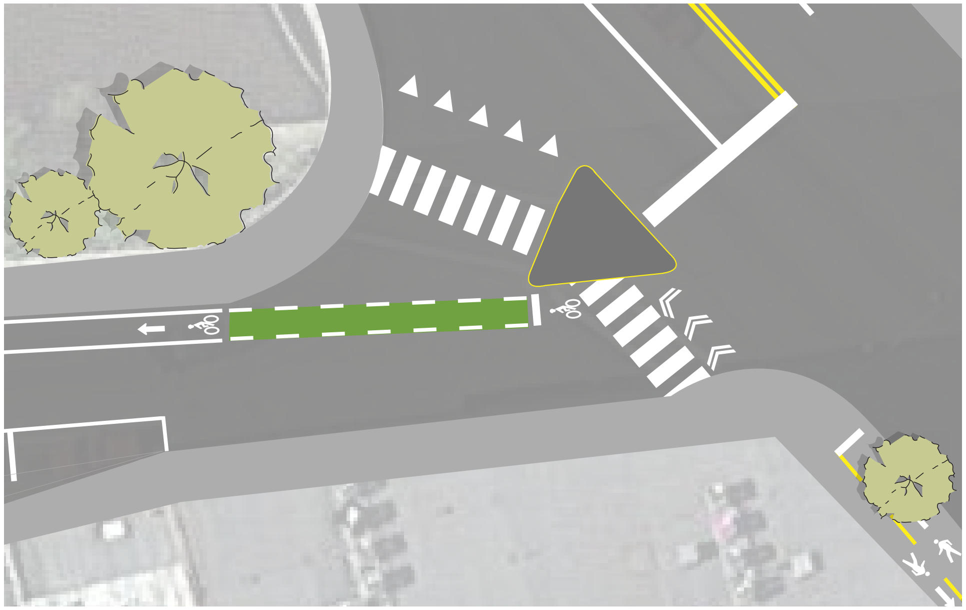
Shared lane markings (sharrows) may also be used as an alternative to clarify the cyclist's position within the combined lane. Regardless, some form of bicycle marking is required within the combined lane to help guide cyclists to and through the intersection.

Additional signage indicating that bicyclists have the right to travel straight through the turn lane is advised, as this will alert motorists and remind bicyclists how the design is intended to work.

Maintenance

Markings will require frequent maintenance, as they will endure frequent wear from vehicle tires. To increase their durability, recessed or inlaid thermoplastic is recommended for all markings.

Colored Pavement



Definition

Green colored pavement is used to increase awareness of cyclists on the road, to indicate areas of potential conflict between bicycle and motor vehicles, and prevent people driving motor vehicles from parking in the bicycle lane.

Application

Colored pavement is not a substitute for dotted white lines or other painted bike markings, and is typically applied in a number of scenarios, including mixing zones (possible areas of vehicular and bicycle conflict), bicycle boxes, two-stage turn queue boxs, and curbside bike lanes, or to extend a bike lane across an intersection.

Design Guidance

When used at intersections or other known conflict points, (not a bike or queue box) the green paint should only be applied between a pair of dotted line segments, which would make rectangles of colored pavement that are two feet wide. The entire length of the dotted area can also be painted green (as shown to the left).

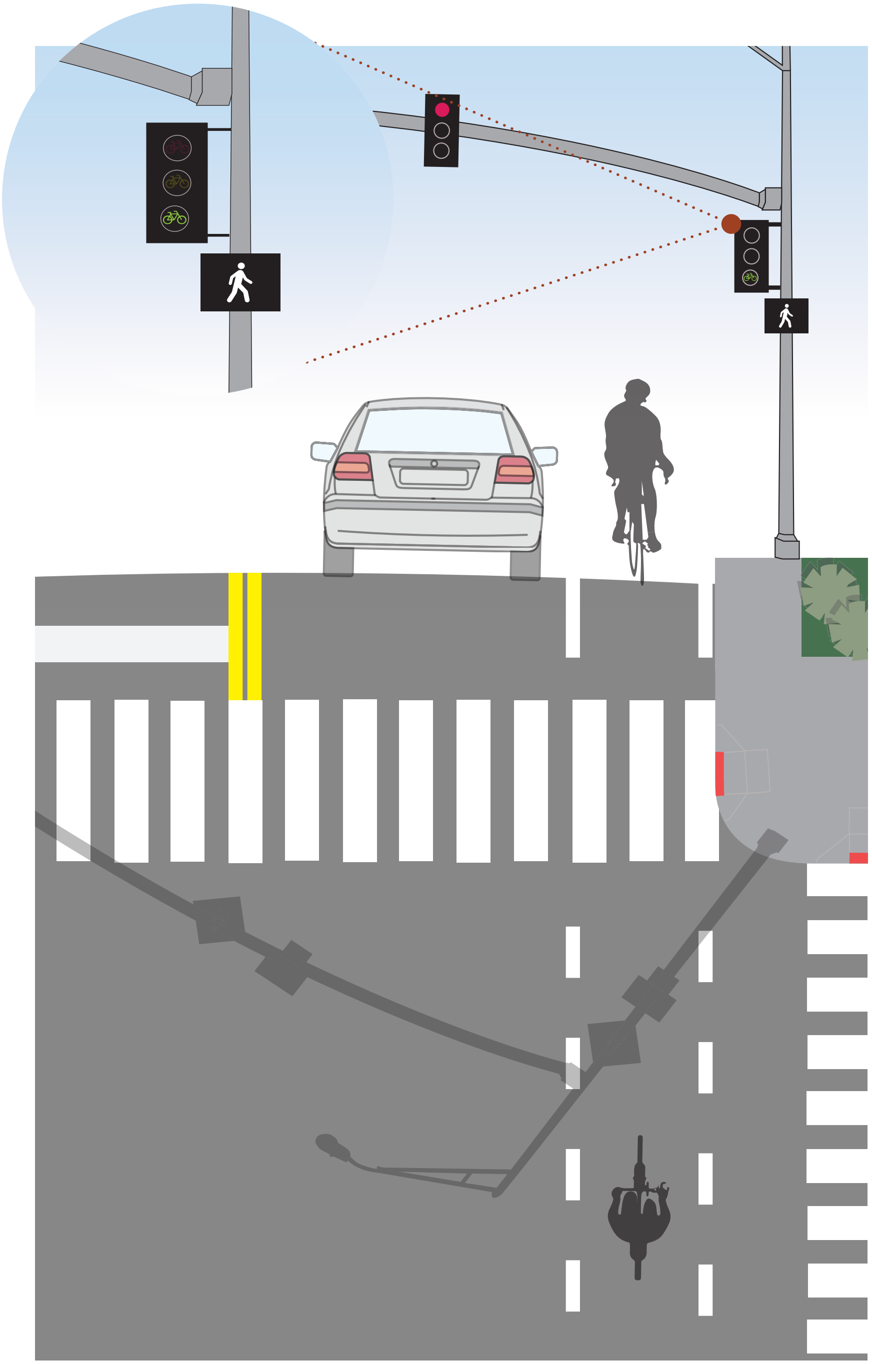
Green colored paint can also be placed underneath bicycle or shared use markings.

No matter where it is applied, green colored paint should be skid-resistant and retro-reflective so that it is visible at night.

Maintenance

Due to the application of extra paint, colored bike lanes or markings will likely increase the frequency of maintenance needed to ensure that it is vibrant and functional. Like all other bikeway facilities, colored markings should be kept free of potholes, major asphalt cracks, and roadway debris such as glass.

Bicycle Signal



Definition

A bicycle signal head is an electrically powered traffic control device that should only be used in combination with an existing conventional or hybrid signal. They help separate bicycle-specific movements from conflicting motor vehicles, rail, or pedestrian movements.

Application

Bicycle signals are typically used to improve identified safety or operational problems involving bicycle facilities, or to accomodate bicyclists at intersections where they have different needs than other roadway users. Such signal heads may be installed at signalized intersections to indicate bicycle signal phases and other bicycle-specific timing strategies. Like normal signal head lenses, bicycle signals make use of the conventional red, yellow, and green color convention.

Design Guidance

A bike signal head should be placed in a location clearly visible to oncoming cyclists, either adjacent to or above the pedestrian signal head, or in advance of the intersection as a supplement to far-sided signals. A "Bike Signal" sign is recommended, but not required, to reinforce the signal head. Where the bike signal is used to separate through bicycle movements from right-turning vehicles, a "No Turn on Red" sign is required. Intersection crossing markings are also recommended. The bike signal may also be timed to allow cyclists a head start through intersections of high-conflict (leading bicycle interval). Bike signals should be actuated automatically, through detection methods or on a regular cycle. If push button actuators are used, they should be installed so that cyclists do not have to dismount to activate them.

Maintenance

Bicycle signal heads require the same maintenance as standard traffic signal heads, which includes replacing bulbs and responding to power outages.


FREE SELFIE BOOTH
SELFIE BOOTH
FREE SELFIE BOOTH

Public Space

Interim Design Pedestrian Plazas

Definition

A traditional plaza is a public open space that is usually surrounded by urban buildings. Plazas typically include street furniture, like movable tables and chairs, and planters, and can be painted to feature colorful surface patterns to increase their visibility and appeal. Many plazas included various forms of public programming to create additional human activity.

Application

Pedestrian plazas are implemented where roadway space can be reclaimed for pedestrians, either on low-volume streets, or where the number and size of travel lanes are no longer needed to support the volume of traffic. Areas where there is a strong commercial and/or retail presence, and thus pedestrian activity, are also ideal for the location of plazas. For new plazas within state roadways, MaineDOT approval is required.

Design Guidance

Pedestrian plazas are typically constructed in two phases: Phase 1 includes a low-cost but durable surface treatment, like epoxy gravel or paint. Decorative painted treatments are also usually applied to the surface to make the space more inviting, and to define the plaza perimeter. Planters may also be used to help define the perimeter. If Phase 1 is a success, Phase 2 usually involves a more intensive capital investment involving more permanent materials and landscaping that respond to how the Phase 1 plaza was utilized. While the configuration of plazas will change depending on the context and existing roadbed, materials, furnishings, and safety elements can be applied almost universally. Design components, like movable tables and chairs, movable umbrellas, plants, and signage, are also meant to support programming of the plaza.

Maintenance

Weekly, if not daily, maintenance is needed to ensure that furniture, plants, and other design elements remain safe and functional. Surface treatments, like planting, may also need routine maintenance.

Pocket Parks

Design Guidance

Pocket parks should provide a variety of open space functions. Similar to plazas, they can feature furniture, outdoor exercise equipment, and play equipment.

Sidewalk pocket parks should be a minimum of 15 feet long and 20 feet wide. Specific dimensions, however, will depend on the existing right-of-way or parcel size. Median pocket parks should easily connect to the existing pedestrian network through safe pedestrian crossings, and their perimeter should be reinforced through bollards or other physical structures. Median pocket parks should ideally extend the full length of the block, or be a minimum of 24 feet long, and should be at least 12 feet wide. They should also have a minimum of 18 inches of buffer space on each side, either done through landscaping or bollards, and have at least 5 feet of seating, planting, or other amenities.

Maintenance

Pocket parks are often maintained by the fronting property owner or the city. Where pocket parks are community-built, the permit-holder is responsible for necessary upkeep and improvements. The more landscaping a pocket park has, the more costly and frequent maintenance will be.

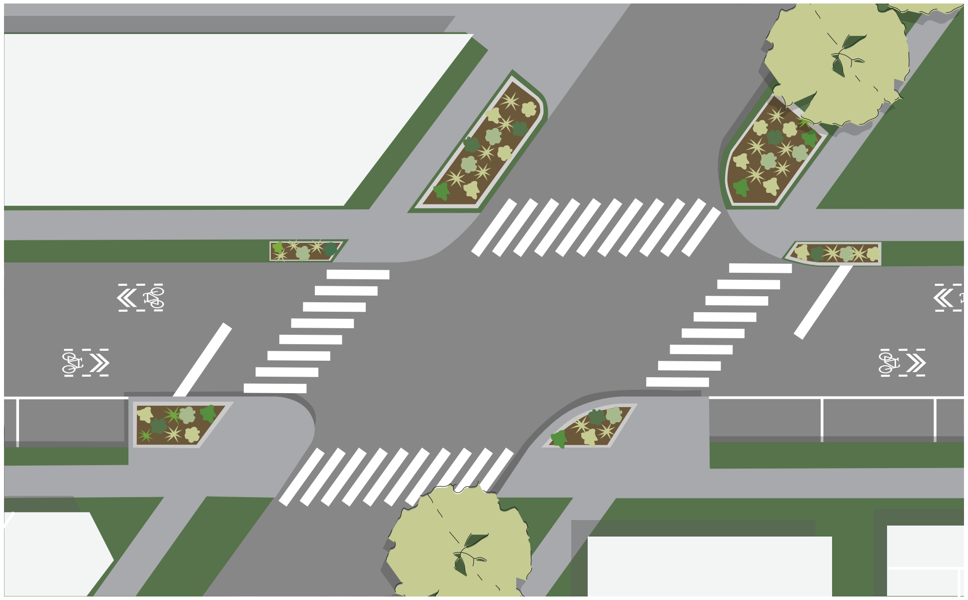
Definition

Pocket parks are small, active public spaces created in the existing right-of-way or within small urban parcels. These parks include landscaping, and can also include seating, play areas, community gardens, and other elements that contribute to the active use of space.

Application

Pocket parks are typically implemented as a part of other median or sidewalk-widening, vacant lot reclamation, or new development initiatives, or they can be the result of transitioning Phase 1 pedestrian plazas (see previous page) into more permanent public spaces.

Bioswales



Definition

Bioswales are planted areas along sidewalks intended to collect, absorb, and filtrate stormwater as it runs off of the sidewalk and along the curb.

Application

Bioswales are appropriate where there are high volumes of surface runoff, and minimal stormwater infrastructure. They are a form of "green infrastructure" that can accomplish multiple goals of streetscape beautification, and stormwater runoff/pollution reduction.

Design Guidance

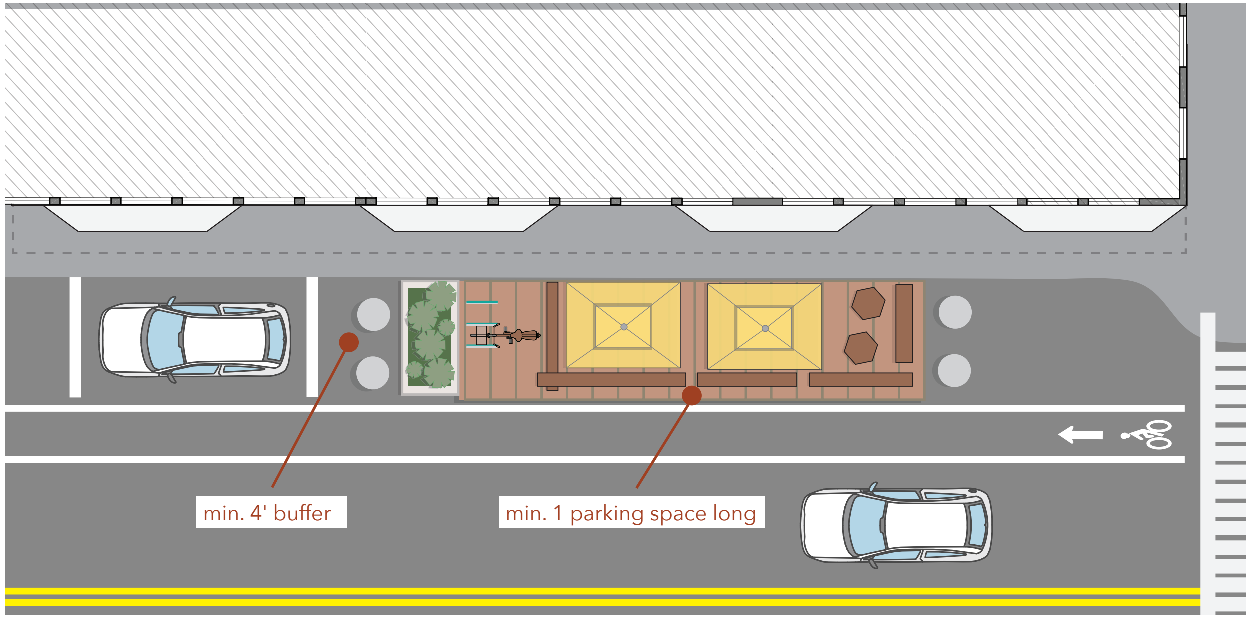
Bioswales should be placed uphill from storm drains to collect stormwater before it reaches the hard infrastructure. This is to reduce the likelihood of the stormwater system becoming overwhelmed during rain events. Bioswales typically include a planted above-ground area, with engineered soil and a stone base comprising the soil horizons. Native plants are often the best choice for bioswales, as they are resilient and therefore maximize filtration capabilities.

Maintenance

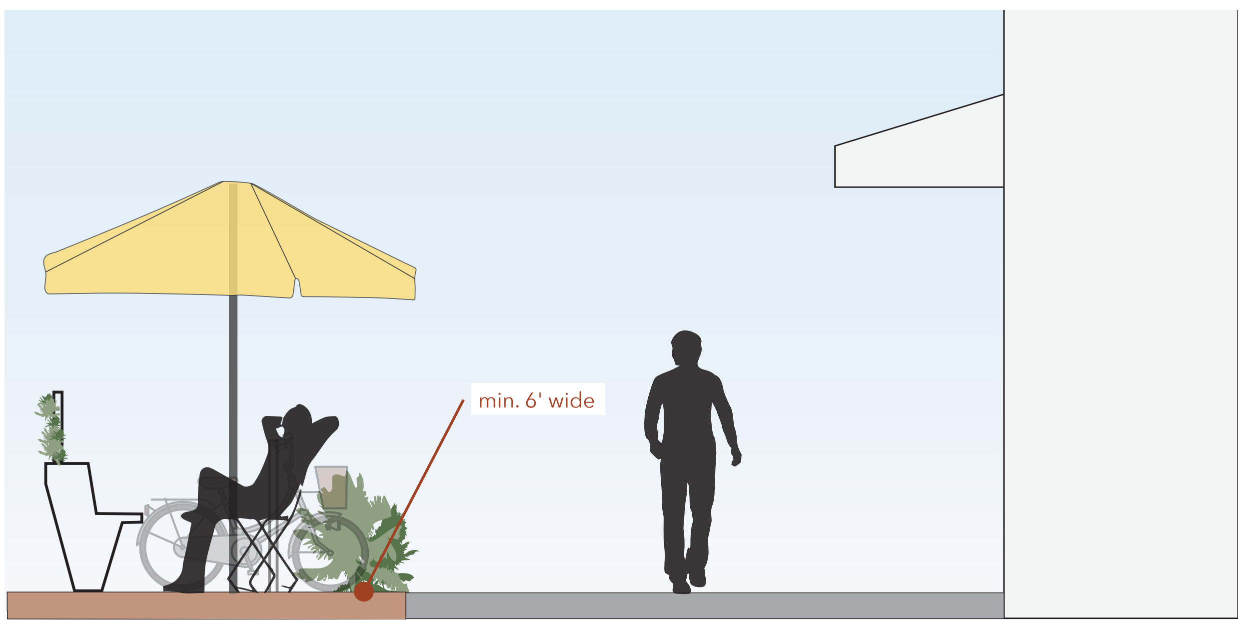
Native plants and shrubs should be used as much as possible to reduce maintenance and the need for excessive watering. Signs differentiating standard tree wells from bioswales, with details about the green infrastructure function of bioswales, should be used to limit vandalism or improper use of the planted areas.

Parklets

1 Plan



2 Section



Definition

Parklets convert one or more on-street parking spaces into people-oriented public spaces that provide aesthetic street elements. Parklets give the public a place to sit, rest, socialize, and engage in other activities like eating or drinking. That said, Parklets are public spaces and do not require their users to purchase food from an adjacent business to utilize the space.

Application

Parklets are typically applied where sidewalks are too narrow for traditional sidewalk cafes, or where property owners or residents see a need to expand the seating capacity or public space on a street. They are also typically successful along streets with commercial and retail activity, especially where coffee shops and restaurants have limited seating. In northern climates, Parklets are applied seasonally, generally April - October so as to not interfere with plowing and other winter street maintenance requirements.

Design Guidance

Parklets can be configured and designed in numerous ways. According to Los Angeles' People St Program, there are three main types of parklet functions: the sidewalk cafe, the sidewalk extension, and the landscaped lounge. The sidewalk cafe is the most robust design, and includes tables and chairs for sitting and eating. The sidewalk extension is mostly comprised of seating elements to provide pedestrians with a place to take a quick break or have a conversation. The landscaped lounge combines seating and plantings to create a unique and relaxing atmosphere.

Parklets can also be constructed using a variety of materials. Some cities have developed more precise standards for the construction of parklets, but materials generally vary from temporary to more permanent. For example, seating can be provided through re-used shipping pallets, and the perimeter of a Parklet can be outlined with wooden planting boxes.

In general, Parklets have a minimum width of 6 feet, and should include at least 4 foot buffers between the parklet platform and any adjacent parking stalls.

Parklets may be used as an interim design treatment where need is high, and eventually be replaced with a permanent sidewalk expansion as time, budget, and demand allows.

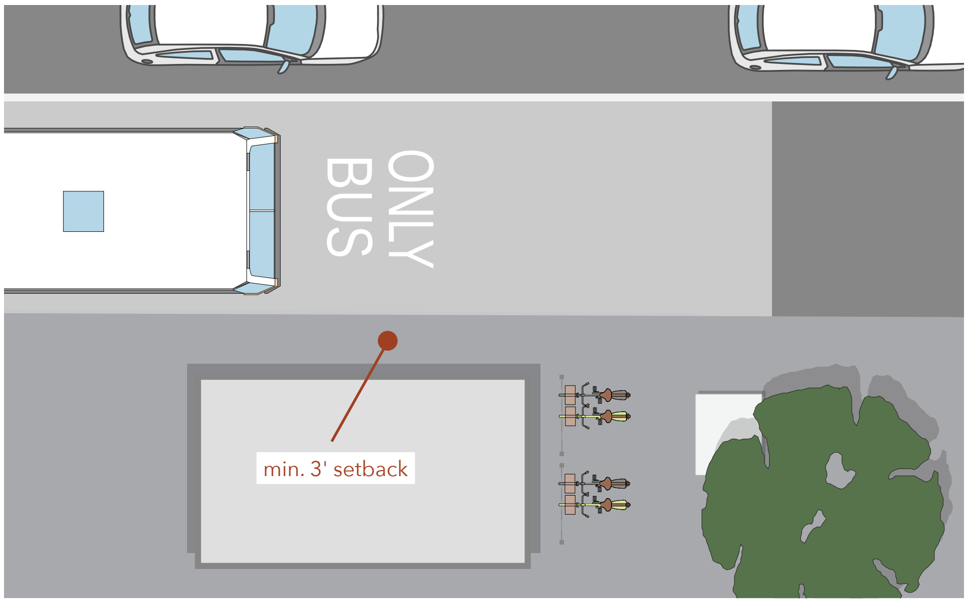
Maintenance

Parklets are often constructed as partnerships between city agencies and local businesses or community organizations/non-profits. In almost all instances, maintenance and programming is performed by the community partner rather than the city. Where there is no partnership, the city is responsible for installation and maintenance, similar to how traditional city public spaces are managed.

Image: AVCOG/LATC

Transit

Bus Shelter



Definition

A bus shelter is a covered bus stop that provides a place for bus riders to wait. High-quality shelters typically include comfortable seating, a bus route map and/or advertising kiosk, bus schedules, and real-time bus arrival information. The addition of bicycle racks recognizes that many people take multi-modal trips and most bus bike racks have limited capacity.

Application

Shelters should be required in neighborhoods where buses run infrequently, commercial areas with frequent service and high ridership, areas with security concerns, areas with frequent inclement weather, and neighborhoods with high numbers of elderly residents. They're also recommended near retail stores with products related to commuters' needs, like food and news, and in conjunction with other amenities like bike racks, food vendors, etc.

Design Guidance

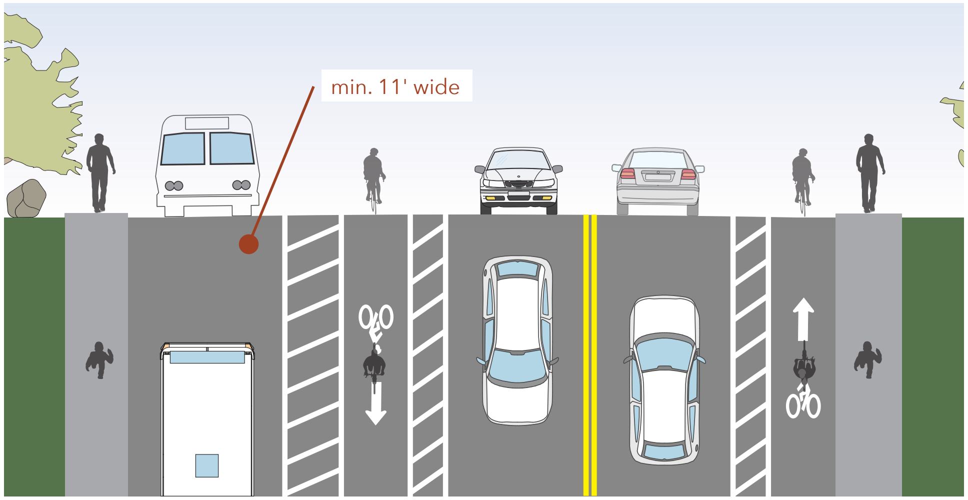
Bus shelters near intersections should be set back from the crosswalk at least 10 feet to avoid conflicts with crossing pedestrians. A distance of 3 feet should also be allowed between the shelter and the curb for ease of boarding and exiting the bus. The shelter should also be oriented to protect waiting riders from the wind, and be open enough to ensure that riders can see the bus coming. Shelters should also include bus route maps, and their specific design should reflect the context of the city and/or neighborhood where they are located.

Maintenance

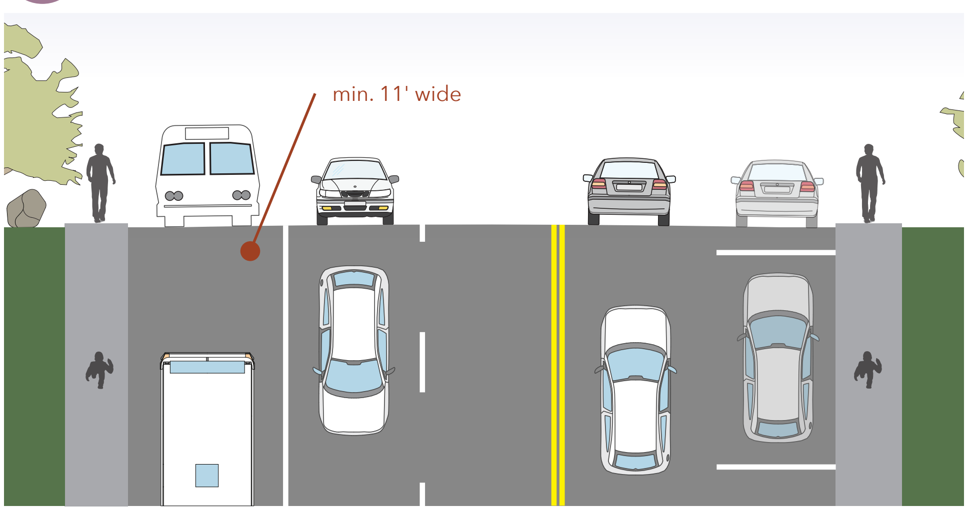
Routine maintenance should be conducted to clean out trash, replace system/route maps, and generally ensure each shelter is comfortable for users.

Bus Lanes

1 Bus Lane with dedicated bikeway



2 Bus Lane without dedicated bikeway



Definition

Bus lanes are curb-side lanes dedicated solely to public bus travel.

Application

Dedicated bus lanes are typically applied on major bus route corridors, with 10-minute peak headways, or where vehicular traffic congestion may significantly limit reliability. Where new bus lanes are implemented on Maine state roadways, and involve the adjustment of travel lane widths, a design exception is required from the DOT's engineering review board.

Design Guidance

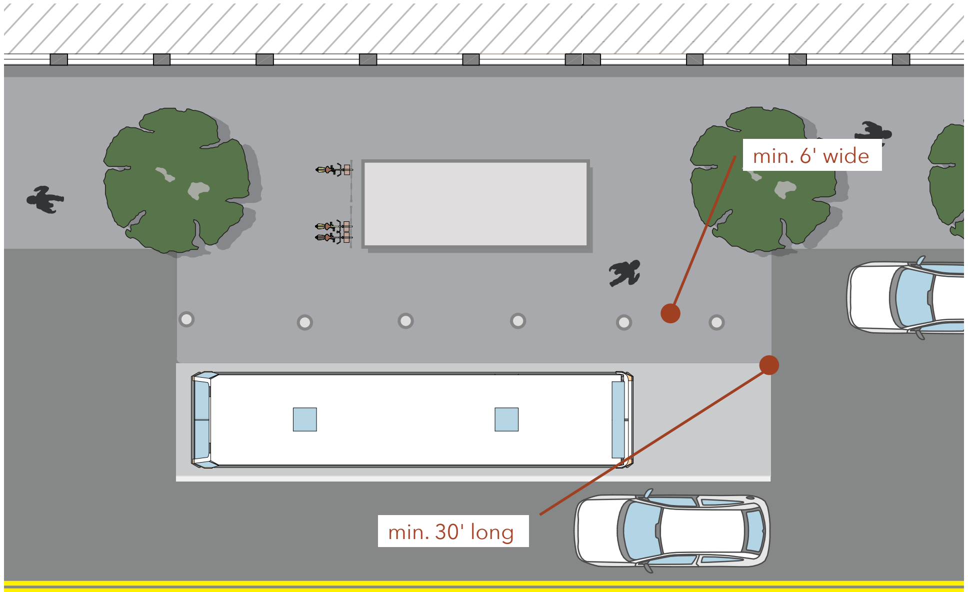
Bus lanes can either be located against the curb, or take the place of the right-most travel lane between the parking lane and the other travel lanes. Bus lane width depends on the availability of space in the thoroughfare, but the minimum width of a curbside bus lane is 11 feet, and the minimum width of an offset bus lane is 10'.

If a bus lane is offset, bus bulbs should be installed (see next page). Colored paint is recommended, but not required. BUS ONLY markings are required, however. Typically, the bus lane is also separated from other travel lanes by a painted buffer, and sometimes physical barriers like mountable curbs or bollards.

Maintenance

Bus lanes should be maintained to the same standard as all other vehicular lanes by being kept free of debris, snow/ice during the winter months, and have consistent, clear pavement markings.

Bus Bulb



Definition

Bus bulbs are curb extensions that align the bus stop with the parking lane, allowing the bus to stop and board passengers without pulling out of the travel lane.

Application

Bus bulbs are applied when adjacent parking inhibits the bus from being curbside, or along frequent or high-capacity routes where the boarding process should be accelerated and made to be more efficient.

Design Guidance

Bus bulbs along frequent routes should be as long as approximately two buses (about 140 feet in length). Bulbs that are along less frequent routes can be as long as the distance from the front of the bus to the back door (about 30 feet). The width of the bus bulb should reflect the need for efficient boarding, but should generally be no less than 6 feet, with 8-10 feet being the preferred width. They should have a return angle of 45 degrees, and feature bus shelters and other transportation amenities, like bike racks, where possible.

Maintenance

Like normal sidewalks, bus bulbs may need occasional maintenance to be kept in a state of good repair; shelters and other transportation amenities will need to be kept free of trash, snow, and other debris so that they remain useful and attractive to bus riders.

Motor Vehicles

Speed Table/Raised Intersection

Definition

Speed tables are traffic calming devices that raise the entire wheelbase of a car to the sidewalk level to reduce its speed. Speed tables are flat and longer — sometimes much longer — than typical speed humps. Raised intersections both reduce vehicle speeds, and are flush with the sidewalk for ease of pedestrian movement.

Application

Speed tables and raised intersections are typically applied on collector or local commercial streets, or where traffic calming measures are seen as necessary, like along main streets, at schools, or in other locations with high-foot and/or bicycle traffic. Speed tables are generally not to be applied on streets wider than 50 feet or with posted speed limits greater than 45mph. Speed tables may also be used as mid-block crossings.

Design Guidance

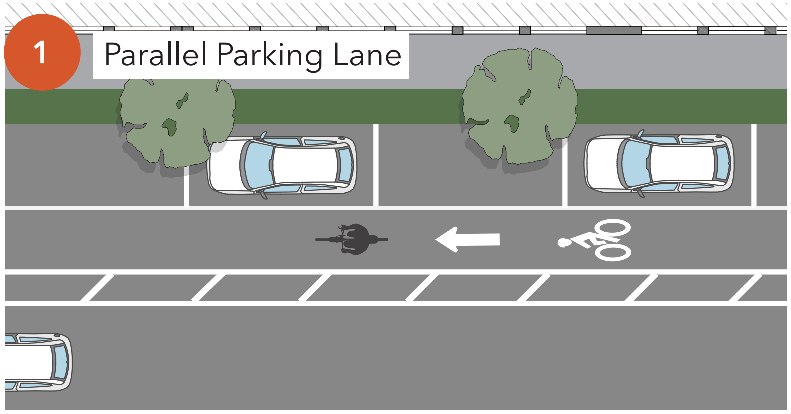
Speed tables should always be accompanied by signage alerting drivers, per MUTCD sign W17-1. Speed tables should be about 22 feet long (or the length of an intersection). The slope of a speed table should not exceed 1:10, and not be any less than 1:25. Side slopes on tapers should not exceed 1:6 and the vertical lip should not be more than a quarter inch.

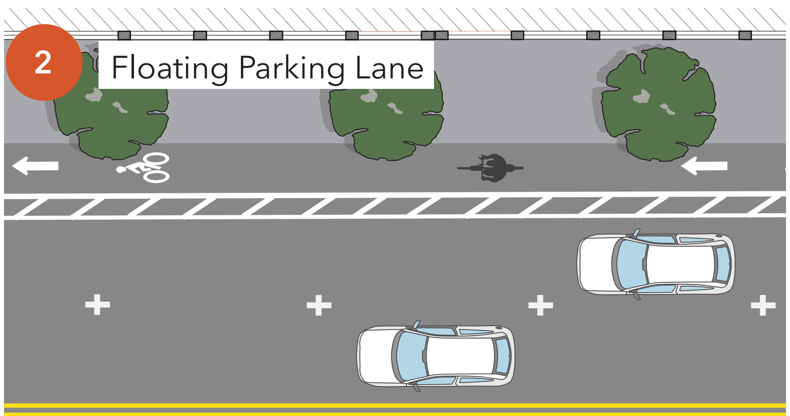
Raised intersections can be placed where there are adjacent pedestrian plazas, can be of a different surface material than asphalt (see right), and detailed as "shared space." Bollards should be placed along corners of raised intersections so vehicles don't encroach on the pedestrian space.

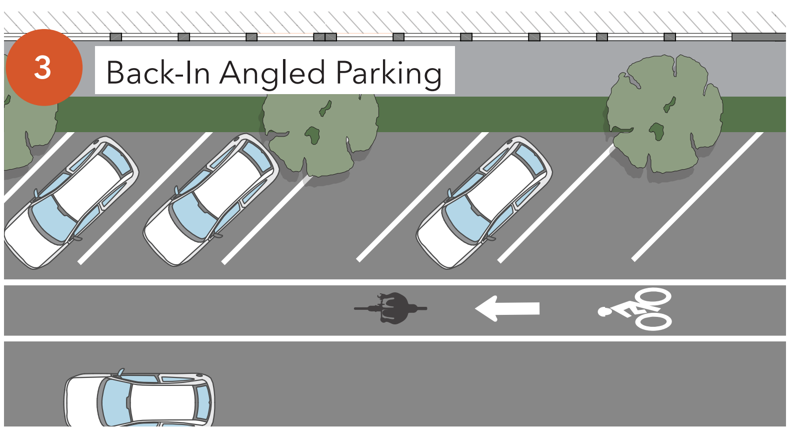
Maintenance

Some maintenance will be required, especially if specialty unit pavers are introduced. Snow plow operators should be alerted of their presence so that plow blades may be raised accordingly.

On-Street Parking







Definition

On-street parking, either in parallel or angled configuration, allows for the storage of motor vehicles within the street right-of-way.

Application

On-street parking is not needed on every street, but where present it provides an essential amenity that aids in speed reduction by increasing friction along the street, and provides a buffer between the sidewalk edge and traffic for pedestrians. On-street parking can also be used to protect bikeways from traffic with a floating parking lane (see previous page). On-street parking on commercial streets serves merchants by providing curbside access for customers and the delivery of saleable goods.

The addition of on-street parking to auto-oriented corridors can also help calm traffic and transition suburban land uses to a more urban form, generating more value per taxable acre than conventional car-oriented land use patterns. If the addition of parking involves changes to the width of travel lanes on state roadways, a design exception is required from the Maine DOT's engineering review board

Design Guidance

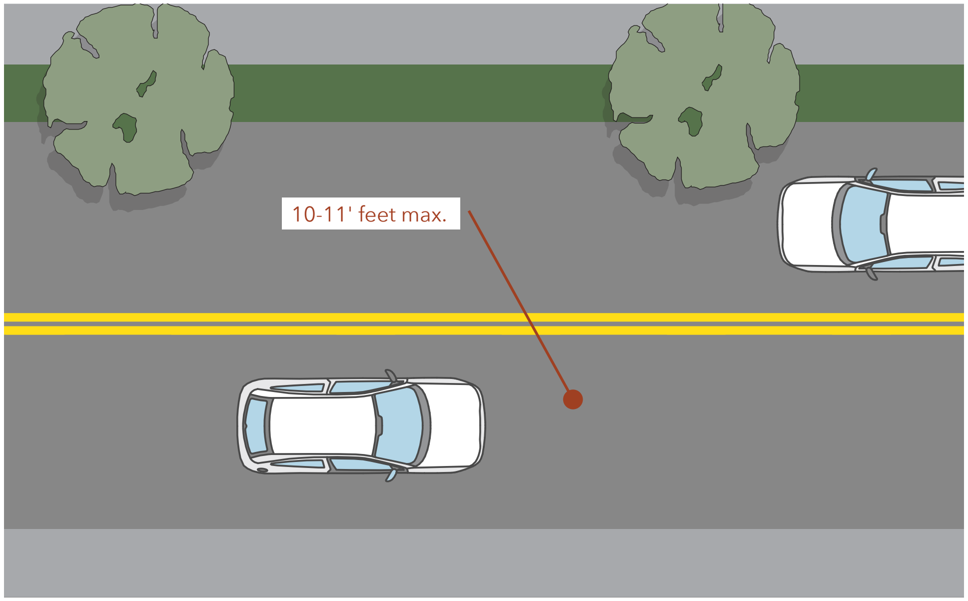
Parallel on-street parking spaces are typically 7 - 9 feet wide, and 18-20 feet long. Angled parking should always be designed with a "back-in" configuration, which enhances safety for pedestrian and cyclist safety, as well drivers and passengers. It's also more convenient, as it allows unloading to occur directly on to the curb.

In downtown, a high-demand location, parking should be variably priced to encourage turnover so that approximately 15% of spaces remain available for new users. Appropriate pricing schemes cut down on those circling the block looking for on-street parking, which cuts pollution and congestion.

Maintenance

On-street parking spaces will need to be re-striped periodically and generally kept free of debris. Meters will need to be kept in working order.

Safe-Sized Travel Lanes



Definition

Vehicular travel lanes less than 12 feet in width can help reduce speeds on high-volume thoroughfares and free up space for other valuable street users and uses. 10′ - 11′ lanes should be the standard to ensure safe multi-modal transportation is feasible for people of all ages and abilities, no matter the mode(s) they use to travel.

Application

Several studies have shown no reduction in safety or capacity as lane widths are reduced from 12 feet, to 11 or 10 feet. Thus, most downtown, residential, commercial, and rural roads should be sized for vehicular lanes no wider than 11′, with a preference for 10′ lanes wherever feasible. Applying these street width standards will accomplish speed reduction goals, and in multi-lane corridors allow for the introduction of other complete street amenities, like bike lanes, wider sidewalks, landscaping, and/or on-street parking. 12′ lanes should be considered only for rural roads and highways where posted speed limits exceed 35 mph.

Design Guidance

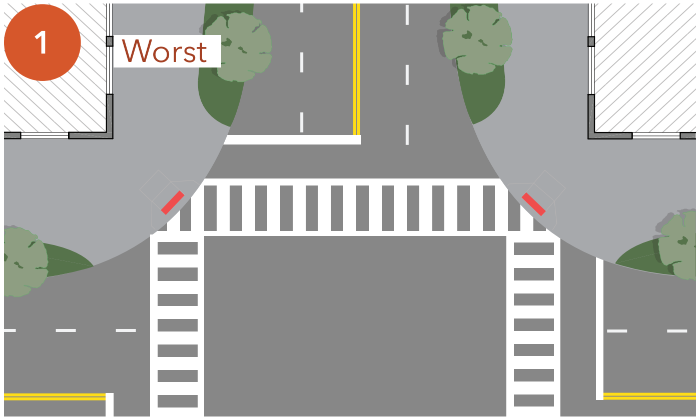
Lane widths generally should be determined within the overall assemblage of a street and the surrounding or desired land use/urban form. Cities may choose to implement 11 foot travel lanes on designated bus routes, for example. However, where transit warrants wider lanes, these should be the outermost lanes. Two-way streets with very low traffic could even reduce lane widths to less than 10 feet, with only a dashed yellow line — or none — separating the directions as in a residential yield street condition.

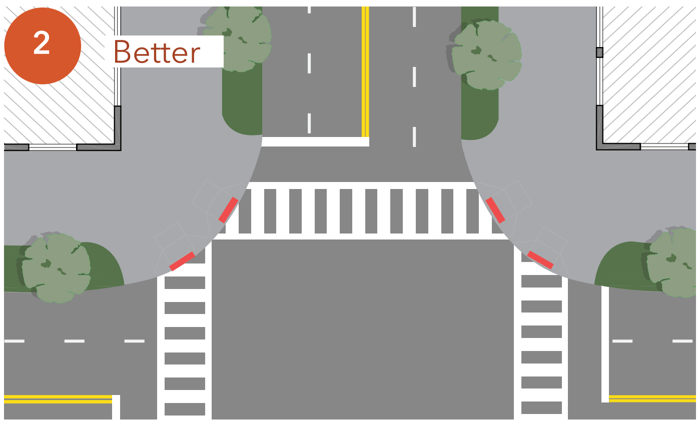
Reducing lane widths can be accompanied by the introduction of other street design elements explained throughout this Guide.

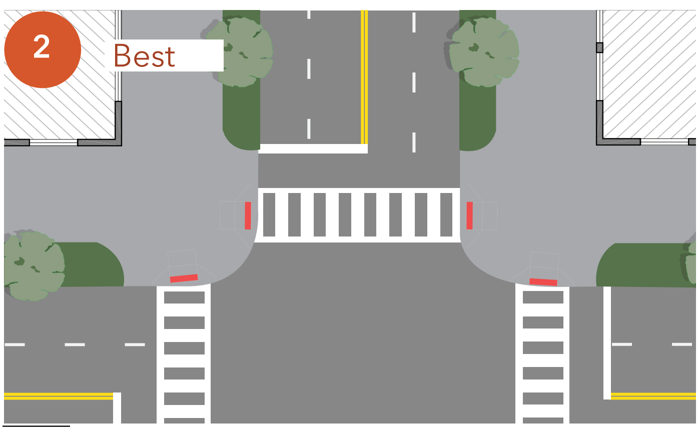
Maintenance

While safe-sized lanes require the same maintenance protocols as wide ones, they can require less effort overall as the amount of space to maintain is reduced and replaced with less impactful users who produce less wear and tear on street infrastructure.

Corner and Effective Turn Radii







Definition

The corner curb radius is the radius defined by two sidewalks on perpendicular streets that come together at a corner. Corner radii directly impact vehicle turning speeds and pedestrian crossing distances: the larger the radius (see left "worst"), the faster motor vehicles can make a turn and the larger the distance is for pedestrians to cross the street, exposing them to more crash risks. Conversely, smaller corner radii increase pedestrian safety by shortening crossing distances, increasing pedestrian visibility, and reducing vehicle turning speeds.

The effective turn radius is influenced by the presence of parking lanes, bike lanes, medians, and other traffic control devices and determines how motor vehicles actually make a turn through the intersection.

Application

Tighter curb radii should be pursued in residential neighborhoods, within pedestrian priority areas (downtown, school zones), wherever crashes indicate an unsafe driving or pedestrian crossing environment, and/or where shorter crossing distances are desired. Larger curb radii may be used to accommodate movements along designated truck routes. Treatments such as flush medians or curb extensions, refuge islands, and/or mountable curbs should be pursued wherever possible to mitigate large radii.

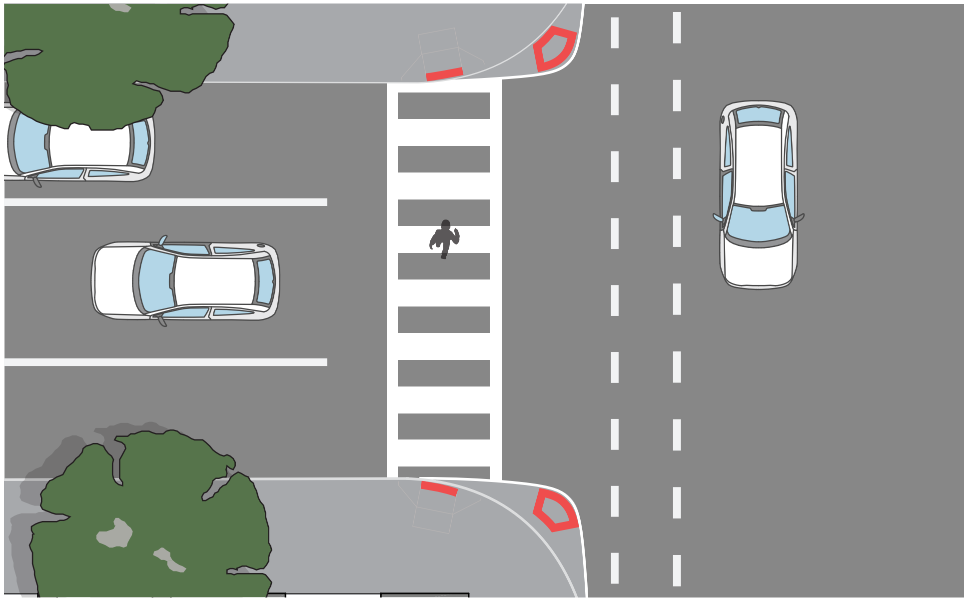
Design Guidance

Standard curb radii are 10-15 feet, but radii may be as small as 2 feet in compact urban areas. Even in more suburban areas, larger curb radii should not be implemented to facilitate a truck turning from the right lane into the right lane. Rather, intersections should be designed with the smallest possible design vehicle (see page 94) in mind and alternative design techniques, such as setting the stop bar further back, adding turn aprons (see next page), or restricting on-street parking near the corner (see page 84). Where a corner radius has resulted in an unsafe pedestrian crossing environment, but where funding is not available to reconstruct the curb immediately, a city can implement a new curb radius using interim materials, like bollards, planters, and epoxy gravel.

Maintenance

Standard street maintenance applies. There may need to be more periodic maintenance when interim materials are used (sweeping, re-painting/striping etc.)

Turn Aprons/Mountable Curbs



Definition

A turn apron is a corner design that provides a tighter radius for passenger vehicles, and a more generous curb for larger trucks. This treatment reduces the speed of passenger vehicles, but does not impede larger truck turns.

Application

Turn aprons are typically used when a city wants to decrease turning speeds and increase space for pedestrians, but still needs to accommodate the turning of larger vehicles along a select truck route or accommodate large emergency response vehicles.

Design Guidance

Turn aprons should start at even grade with the asphalt, but gradually slope to meet the top of the curb. This creates a ramp that will not affect the turning of larger vehicles, but will force passenger vehicles to make tighter turns.

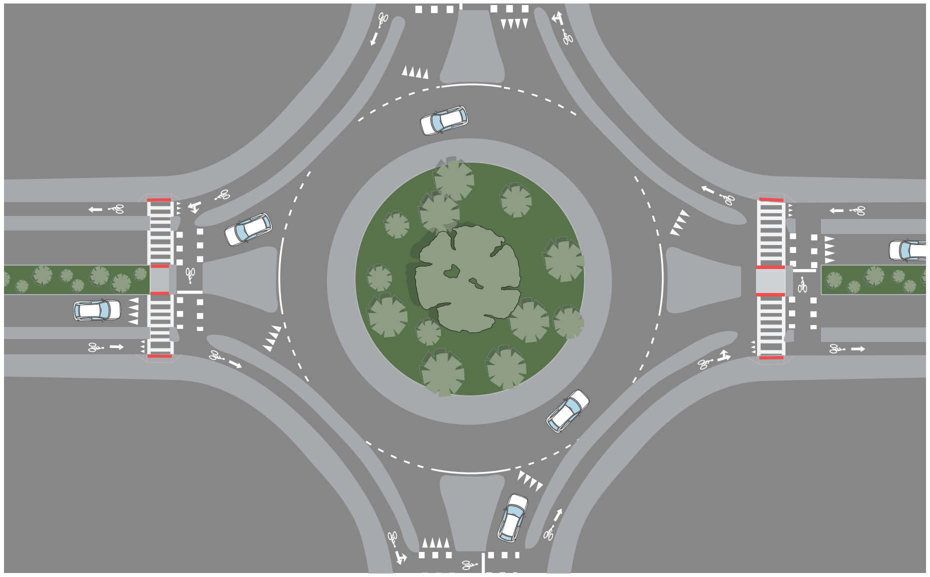
All turn aprons should be built to withstand large trucks with full loads.

Turn aprons are typically delineated with bright paint or other high-visibility surface treatment to be made visible to drivers.

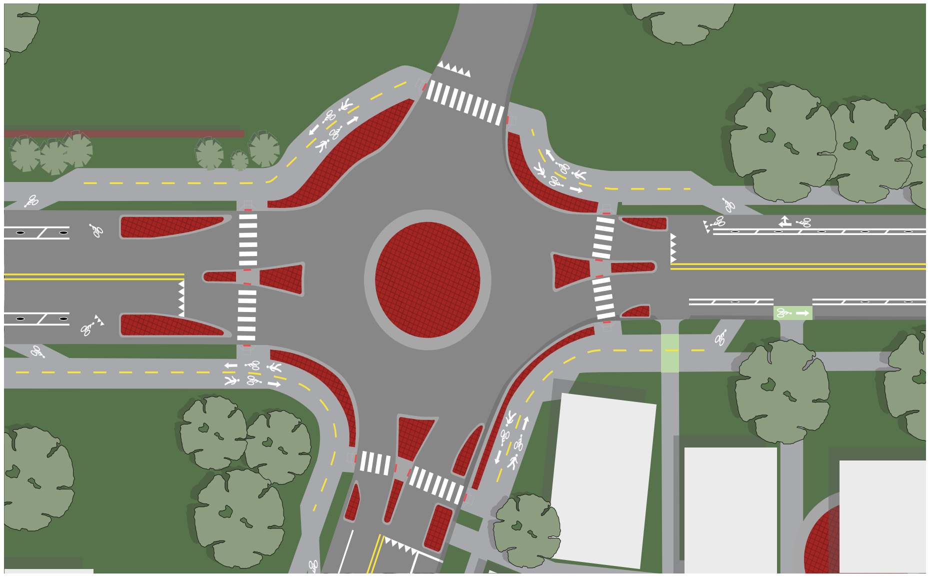
Maintenance

Keeping turn aprons free of debris and the curb/pedestrian ramps in good condition is of critical importance. Additionally, in colder months snow and ice should be cleared as soon as possible from turn aprons so as to not impede the turn movements of trucks.

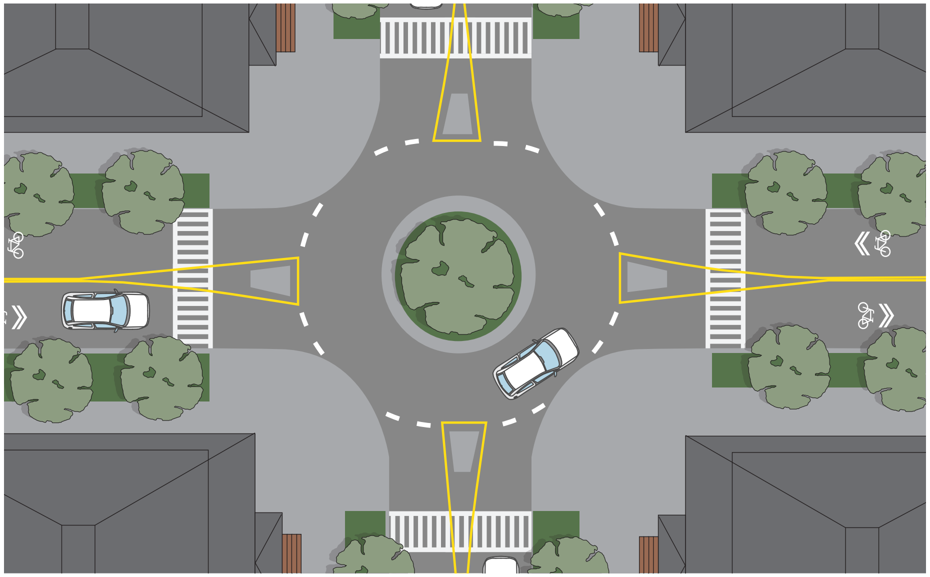
Roundabouts



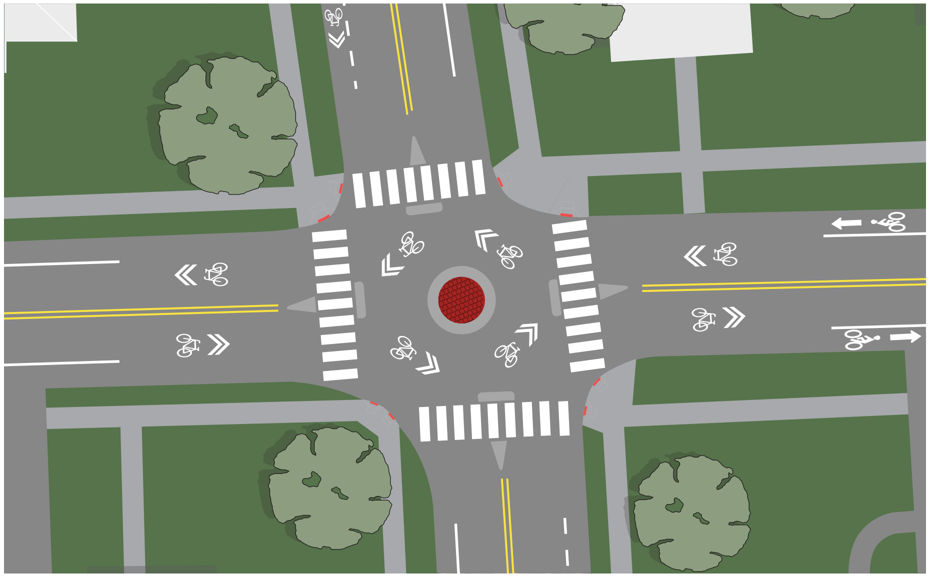
1 Modern Roundabout w/Protected Bikeway



2 Modern Roundabout w/Shared Use Path



3 Mini-Roundabout



4 Neighborhood Traffic Circle

Definition

Roundabouts — including modern roundabouts, mini-roundabouts, and neighborhood traffic circles — are circular intersections where drivers travel counterclockwise around a center island. Roundabouts are designed to reduce the number and severity of conflict points, and reduce vehicle travel speeds. Thus, roundabouts generally complement Complete Streets, multimodal networks, and corridor access management goals. Studies by the Federal Highway Administration have found that roundabouts can increase traffic capacity by 30 percent to 50 percent compared to traditional intersections and dramatically improve safety for all users.

Application

The various forms of roundabouts are appropriate for different contexts.

Modern roundabouts (see left) are designed to accommodate vehicles of all sizes, including emergency vehicles, buses, and truck and trailer combinations. They are most commonly applied to the intersections of high-capacity thoroughfares.

Mini-roundabouts (see left) are characterized by a fully mountable central island with a smaller diameter, but also include splitter islands. They are best suited to environments where vehicular speeds are already low and space constraints preclude the use of a larger roundabout with a raised central island. They are most commonly used at the intersection of moderate capacity thoroughfares.

Neighborhood traffic circles (see left) are much smaller than modern/mini-roundabouts and usually replace stop signs at four-way intersections. They are typically used in residential neighborhoods to slow traffic speeds and reduce accidents, but are typically not designed to accommodate larger vehicles.

Design Guidance

Roundabouts operate most safely when their geometry forces traffic to enter and circulate at slow speeds. Horizontal curvature and narrow pavement widths are used to accomplish a speed reduction to 15 - 20mph. It also reduces the likelihood of t-bone or head-on collisions. The size of the circular island will be larger when larger vehicles, like trucks, must be accommodated. If the roundabout is accommodating passenger vehicles only, the diameter of the roundabout may be smaller. The central island of many roundabouts includes a truck apron, a raised section of concrete that acts as an extra lane for large vehicles. The back wheels of the oversize vehicle can ride up on the truck apron so the truck can easily complete the turn, while the raised portion of concrete discourages use by smaller vehicles. In addition to the central island, roundabouts also feature triangular splitter islands designed to slow and direct traffic. The islands also provide a refuge for pedestrians. This means pedestrians can choose to cross one direction of traffic at a time and have a safe place to wait before crossing another direction of traffic.

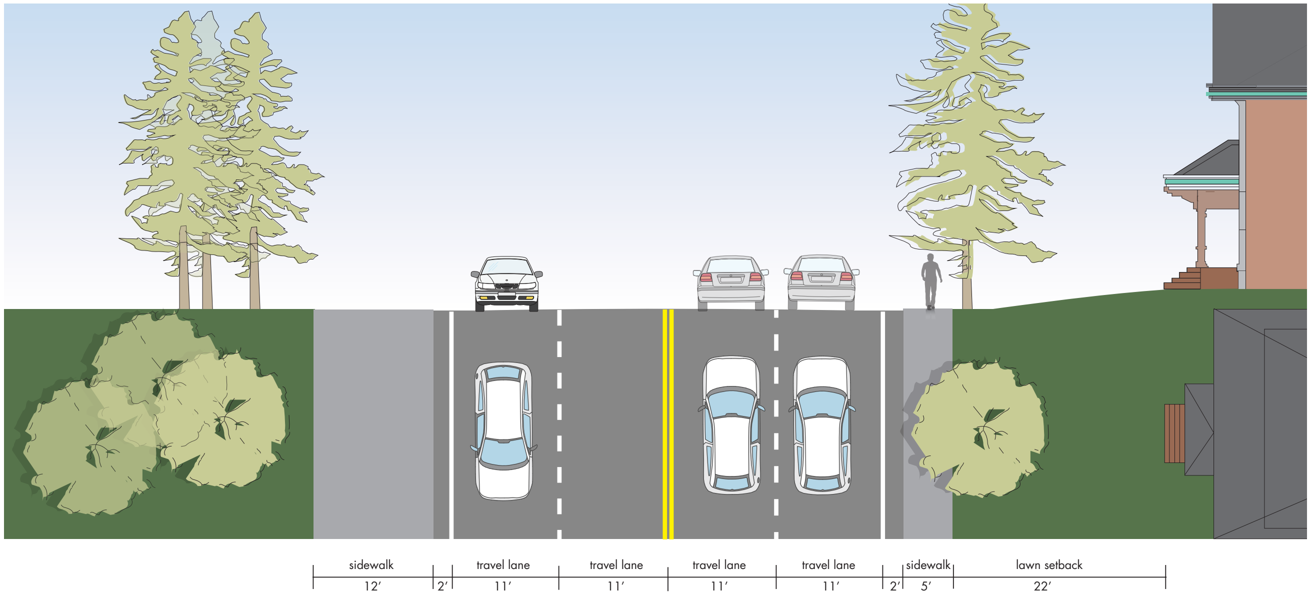
Landscaping or public art elements are often placed in the middle of the circular islands, and pedestrian and bicycle facilities should always be included. In modern and mini-roundabouts this may include protected bike lanes or shared use paths around the circumference of the roundabout, while for neighborhood traffic-circles, slow speeds and low volumes permit cyclists to cycle through the intersection without separate infrastructure.

Maintenance

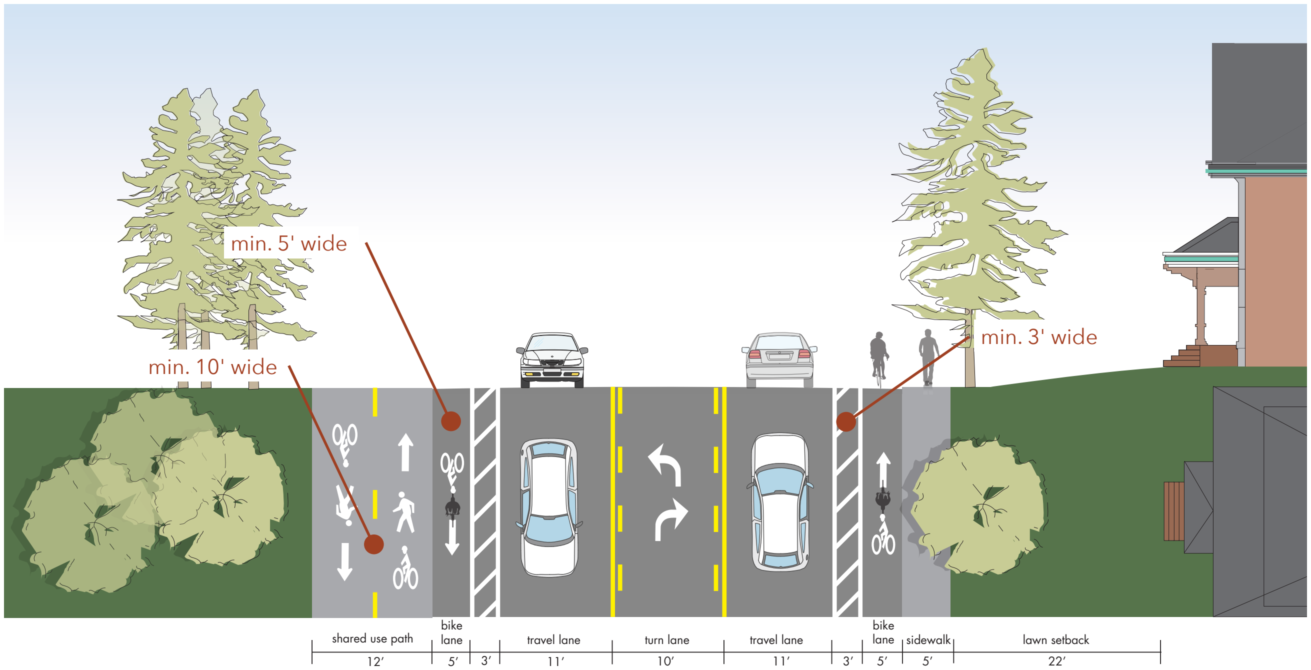
In the long-term, roundabouts are a deal, as they eliminate hardware, maintenance, and electrical costs associated with traffic signals, which can cost between $5,000 and $10,000 per year. Landscaping used will have some level of maintenance, but the placemaking aspect in combination with reduced collisions means societal benefits outweigh any maintenance costs.

Road Diet

1 Before



2 After



Definition

A "road diet" consists of reducing lane widths on a multi-lane road to make room for pedestrian, cyclist, and/or enhanced transit facilities, and for additional on-street parking. The most common road diet conversion is from a four-lane undivided roadway segment to a three-lane segment — consisting of two travel lanes and a center two-way turn lane —, although road diets can also be performed on roadways with differing lane numbers and configurations.

Road diets have been shown to reduce travel speeds, increase pedestrian or bicyclist safety by shortening crossing distances, and add amenities.

Application

According to the Maine DOT's new road diet policy, 4 to 3 road diets require a thorough "purpose and need" alternatives analysis, including a no-build option, before being considered for implementation. Purpose and need may include reducing crashes of various types, reducing vehicular speeds, mitigating turn queues conflicts with left-turning traffic, improve pedestrian quality/safety, and improving cycling accessibility/safety.

Road diets alone are not a comprehensive solution, but in conjunction with other various design and operational improvements can improve a thoroughfare's function. Road diets are generally appropriate where the thoroughfare(s) in question features less than 20,000 AADT. Thoroughfares carrying more traffic may be considered, but only in very specific instances. At present, it's worth noting that the Maine DOT does not allow road diets along thoroughfares that exceed four travel lanes in width.

Design Guidance

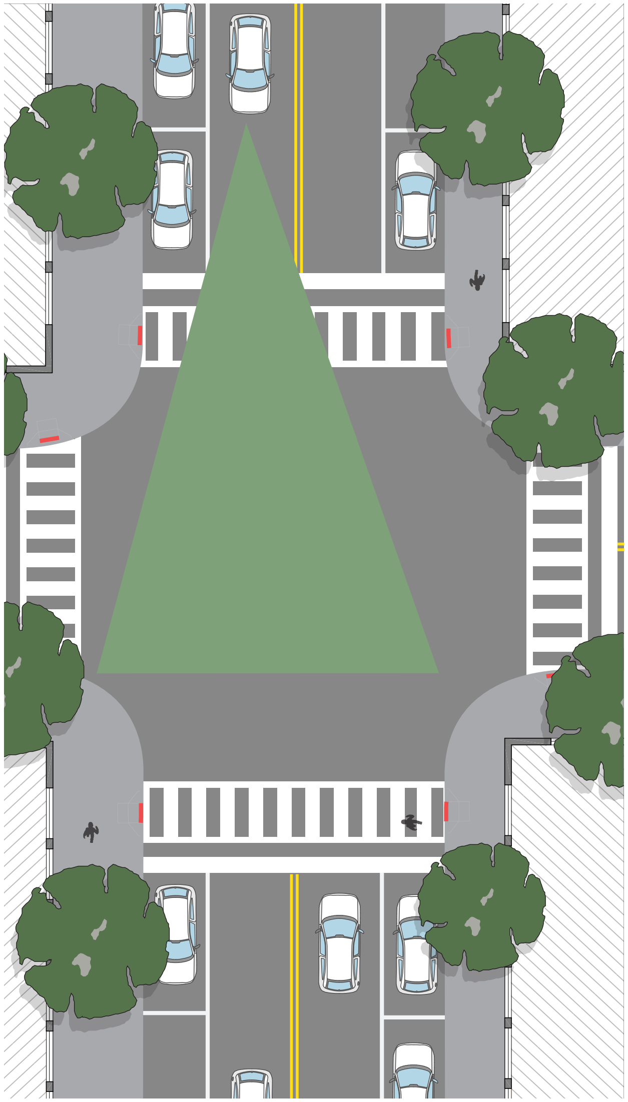
Once a road diet is introduced, its various amenities may include enhanced cycling, walking, transit, and motor vehicle improvements. The introduction of various road diet amenities (bicycle lanes, high-visibility crossings, pedestrian refuges, roundabouts, safe-size travel lanes etc.) are all included with more specific guidance in this guide.

In addition, numerous other resources exist, including AASHTO's A Guide for Achieving Flexibility in Highway Design, FHWA's August 2013 Bicycle and Pedestrian Facility Design Flexibility memo and Separated Bikeway Design Guide, NACTO's Urban Bikeway and Street Design Guide, ITE's Walkable Thoroughfares Design Manual, or other State DOT resources, such as the joint New Jersey and Pennyslvania Smart Transportation Guidebook, and the MassDOT Separated Bike Lane Planning & Design Guide.

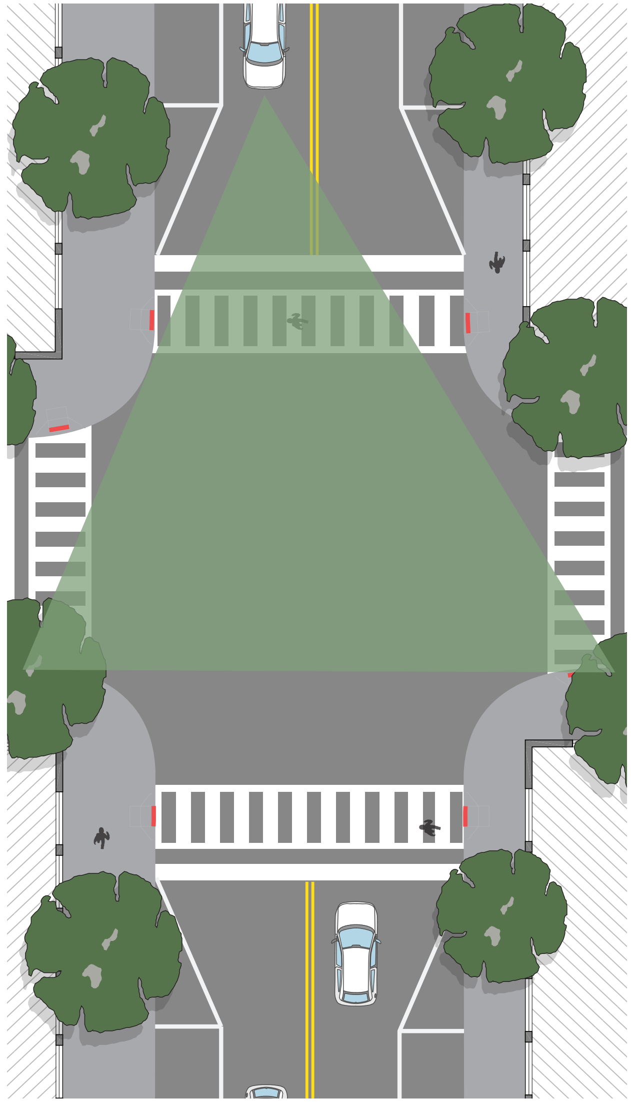
Maintenance

When introduced as part of a typical re-paving project, the most basic road diets do not need to add any additional construction or maintenance obligations. That said, long-term maintenance requirements will depend greatly on the various changes introduced to a given thoroughfare following the road diet.

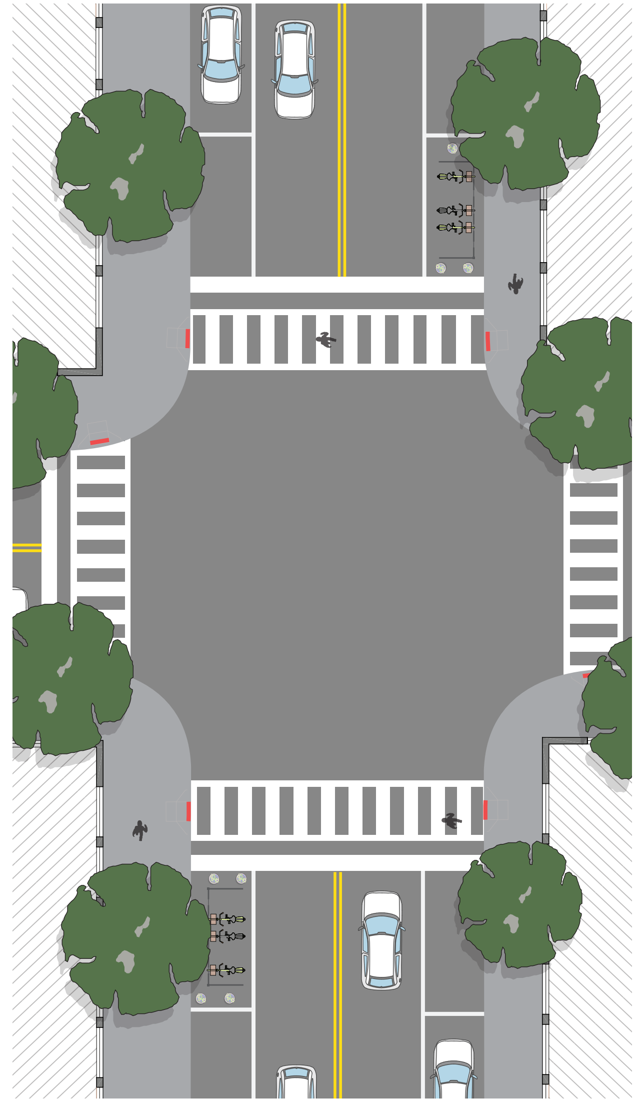
Daylighting Intersection



1 Before Daylighting



2 After Daylighting



3 After Daylighting, with the curbside amenity of bike parking (preferred).

Definition

"Daylighting" an intersection refers to the practice of removing on-street vehicular parking 20 - 25 feet from the intersection to increase visibility of and for pedestrians, cyclists, and approaching vehicles. Low-profile amenities may then be added in place of the vehicular parking so that pedestrian visibility/amenity is improved, while tacitly instructing motorists to drive slowly and cautiously through intersections.

Application

In walkable neighborhoods and commercial districts, designers and engineers should simultaneously aim to lower speeds near conflict points and ensure that sightlines are adequate and movements predictable, rather than widening the intersection or removing sightline obstacles, like street trees. The former approach will prevent wide setbacks and thoroughfare designs that increase speeds and endanger pedestrians at intersections, where they are most vulnerable. Daylighting is one such technique, but should be paired with additional design treatments to keep speeds low.

Design Guidance

Intersection visibility is directly related to the design and operating speed of a thoroughfare. Determining sightlines based on existing or 85th-percentile speeds, as is typical practice, is not sufficient in walkable residential neighborhoods and commercial districts. Thus, wide corner radii and intersections with large sight triangles may create visibility, but in turn may facilitate speeding by people driving, as little friction is perceived. This causes motorists to lose the peripheral vision they retain while driving at slower speeds. Intersection design should facilitate eye contact between all street users so that motorists, bicyclists, pedestrians, and transit vehicles intuitively expect conflict possibilities at intersections.

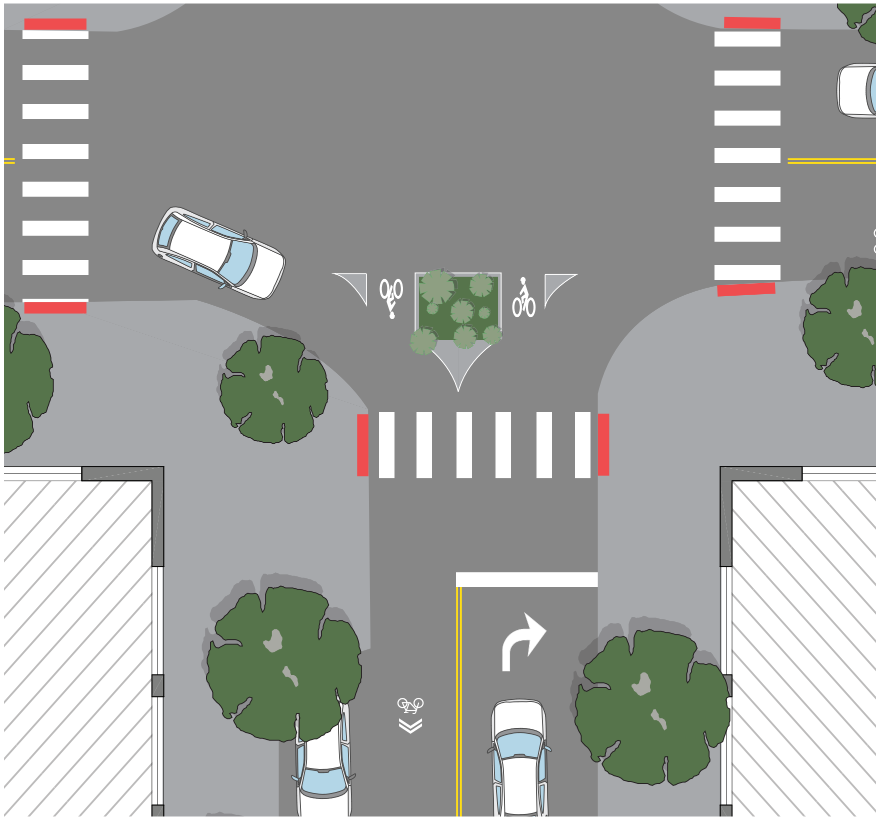
The removal of on-street parking space adjacent to the intersection can improve visibility, but also leaves a lot of excess space that can be put to an alternative use. For example, bicycle corrals or curb extensions — interim or permanent — can be used to make productive use of the space leftover from removed parking while maintaining, if not improving, site visibility and walkability.

In the evening hours, pedestrian-scale lighting is critical to the visibility of pedestrians, bicyclists, and approaching vehicles at intersections. Major intersections and those in high-pedestrian activity zones should be well-lit. Along with reflective markings at crossings, in-pavement or RRFB treatments may be used to improve the visibility of pedestrians at night.

Maintenance

Straightforward daylighting projects should not introduce any greater maintenance costs. However, small maintenance obligations will be incurred if additional amenities are introduced into the streetscape, like bike corrals or temporary pedestrian curb extensions. In some instances, community partners like a Business Improvement District, a non-profit, or individual business may be willing to take on the additional maintenance costs.

Diverters



Definition

Diverters are traffic-calming measures that create physical barriers designed to control movement of traffic in a particular direction, and can be used to prevent people driving from entering or exiting certain legs of an intersection.

Application

There are many diverter types, but all should be applied to primarily low-volume residential thoroughfares where traffic calming measures are still deemed necessary. Diverters can break up traffic grids while maintaining permeability for cyclists and pedestrians. Diverters are a common treatment used to reduce cut-through traffic along Neighborhood Greenways, or streets where residents desire to minimize through traffic. Special consideration must be taken for for the availability, capacity, and appropriateness of the alternative routes drivers might pursue if a diverter is constructed.

Design Guidance

Where emergency vehicle access is provided, an absolute minimum of 10 feet of clear space shall be maintained between a diverter's vertical features. Design features, such as mountable curbs, flexible or collapsible bollards, or restricted lanes may reduce these space requirements.

All diverter treatments should provide bicycle access, either through a 4-foot minimum contra-flow bike lane or a 5- to 6-foot opening, between vertical curbs/elements to allow free-passage. Clear widths sufficient for single-unit trucks to make turns without encroaching on opposing lanes should also be provided.

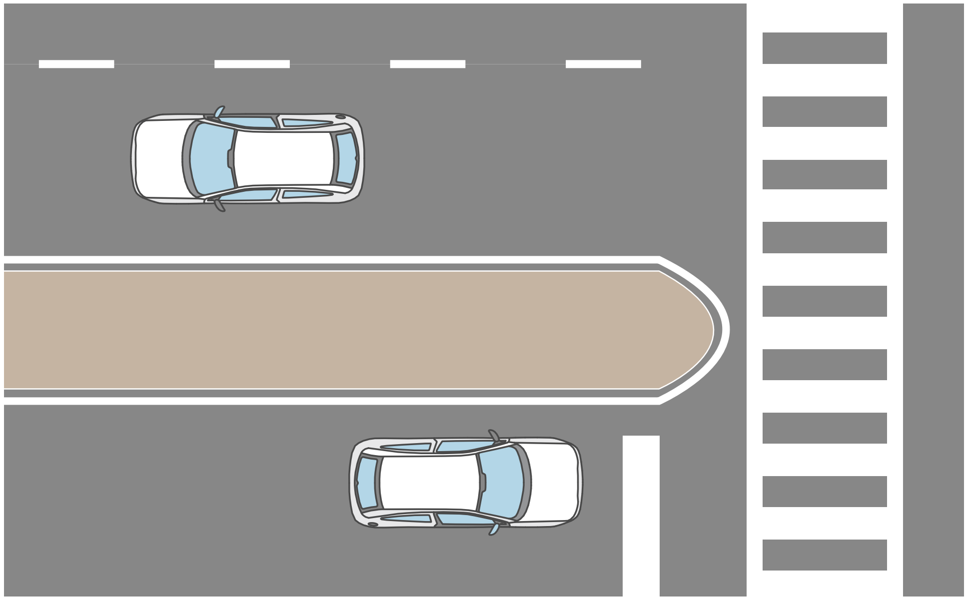
Appropriate signs and pavement markings should be used to prohibit undesired automobile movements and access while permitting desired bicycle or pedestrian access.

Temporary treatments may be used to measure impact and resident/business support prior to finalizing the design.

Maintenance

Diverters are relatively small expenditures and cost little to maintain on an annual basis. However, snow and ice removal, as well as maintenance for any landscaping elements, must be taken into account in the planning and design phase.

Flush Medians



Definition

Flush medians are center medians that exist at the same grade as the roadway surface.

Application

Flush medians are applied on roadways that cannot accommodate a full-size center turn lane, but where vehicular volumes and speeds still warrant separation between the two directions of traffic. Vehicles turning can wait in the flush median out of the way of traffic, but it is not considered a full travel lane.

Flush medians may also be used to help receive turn movements from larger emergency response or freight hauling vehicles without having to compromise wider travel lanes and/or curb radii. They are also used as a low-cost way to develop a temporary pedestrian refuge and may be used mid-block for snow storage in northern climates.

Design Guidance

Flush medians are distinguished from vehicular travel lanes with colored pavement or paint, diagonal striping, or a different surface material, like cobblestones, epoxy-gravel, brick, cement, or stamped asphalt. Solid and different materials, rather than diagonal striping, can improve the aesthetics of a street while maintaining a high-level of function.

The width of the flush median should be determined by the purpose it intended to serve. If intended to soley divide traffic, widths may be as low as 3 or 4′. If intended to serve as a temporary or interim pedestrian or bicycle refuge, medians should be a minimum of 6′ in width. Depending on context, greater widths may be needed, especially if intended to receive turn movements from large emergency response/freight hauling vehicles.

Maintenance

Flush medians should be swept/plowed and generally maintained like any other vehicular travel lane. Some temporary material treatments, such as paint or striping, may require frequent refreshing to ensure they are visible and function as intended.

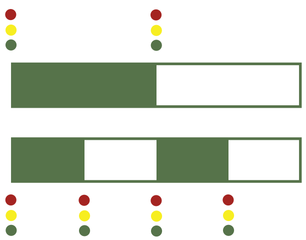
Image: Tom Morgan

Operational Strategies

Signals | Design Vehicle | Iterative Design | Maintenance

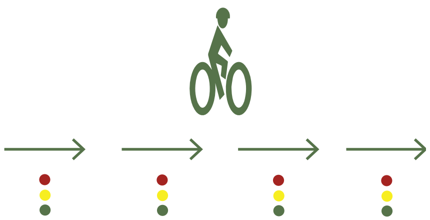
Signalization Principles

Traffic signals directly impact the quality of a transportation system. When retrofitting streets to include Complete Street enhancements, like bike lanes, improved crosswalks, and dedicated bus lanes, signal timing and type will also influence safety and mode choice. Indeed, if traffic signal timing is insufficient for a pedestrian to cross the street, the quality of the crosswalk is rendered irrelevant. Furthermore, pronounced traffic signal delays, especially for pedestrians, often encourage people to engage in risky behavior by violating the signal. Thus, bicycle and pedestrian safety and convenience must be taken into account, and the following 6 signalization principles will help increase the viability of walking, cycling, and transit use.



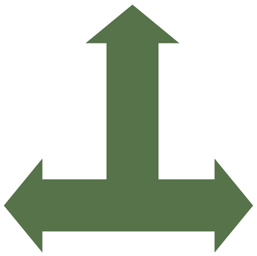
1. Shorten Signal Cycles

Short signal cycle lengths both reduce wait times in all directions, and create crossing opportunities at closer intervals. To minimize delays in the street network, avoid simultaneously adding multiple turn lanes and increasing turn phase signals. It's best to do one or the other, but not both. For more info, turn to page 91.



2. Prioritize Active Modes

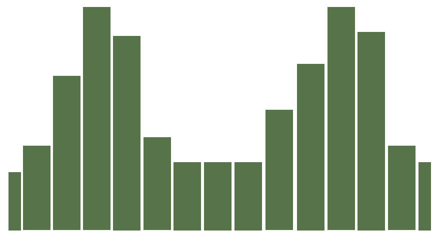
To accomplish multi-modal and Complete Streets goals, use signal tools like leading pedestrian intervals, synchronized bike signals, and transit signal priority.

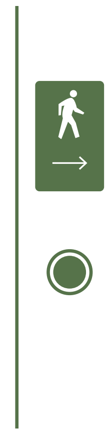


3. Minimize Signal Phases

Signal phases increase delay for all users. Instead, consider turn restrictions at select dangerous, high-volume intersections to speed up crossing opportunities. Or, where turn volumes require a dedicated turn phase, make it a protected left-turn phase.

Diagrams and content adapted from the NACTO Urban Street Street Design Guide





4. Time signals for safe speeds

To discourage speeding and maintain safe travel speeds, synchronize signals at or below the target speed, rather than the 85th percentile speed.

5. Create Dynamic Signal Timing

Signal timing should be adjusted to meet different levels of activity throughout the day, like for peak and off-peak traffic volumes, day, night, and weekends.

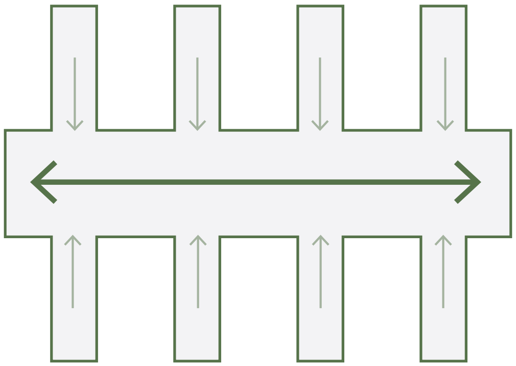
6. Use Fixed Signals in Walkable Areas

Fixed signals, not actuated signals, increase predictability and ensure consistent opportunities for both pedestrians and vehicular traffic.

Content and diagrams adapted from the NACTO Urban Street Street Design Guide

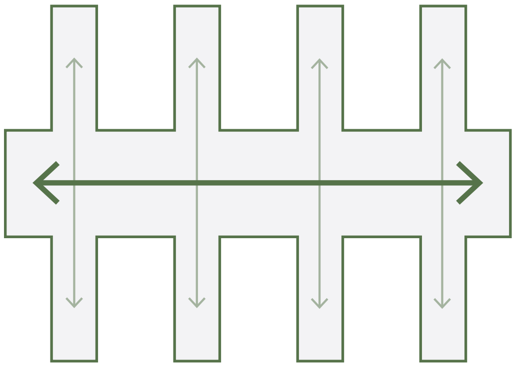
Signal Cycle Lengths

Traffic signal cycle lengths can limit pedestrian, cyclist, and transit vehicle opportunities to navigate safely through a street network. Long signal cycles over multiple intersections, for example, make it difficult for people walking to reach their destination. When this is the norm, streets become barriers as opposed to welcoming arteries that connect people to their daily needs.



Corridor-Based Signal Timing with Longer Cycles

Long signal cycles and corridor-based timing approaches turn major thoroughfares into mental and physical barriers that divide neighborhoods, rather than connect them. In the above diagram, the major corridor receives almost four times as much green time as the minor streets (96 vs. 24 seconds). People walking from side streets experience unpleasant delays, and a feeling that their connectivity is limited. The result is that people often cross without the signal, putting themselves and people driving in a compromised position. Drivers also then avoid side streets, which creates more congestion along main thoroughfares. Generally, cycle lengths should be coordinated with the pedestrian crossing distance on a given street. A minimum walk time of 7 seconds is required by the MUTCD.



Balanced Signal Timing with Shorter Cycles

Shorter signal cycles help individual thoroughfares function as a Complete Street network, rather than a collection of individual corridors. A more balanced scenario is presented in the diagram above, where signals are re-timed with 60 second cycles. The major street receives 36 seconds cycles, with the minor, intersecting streets 24 seconds. The shortened delay improves compliance by those walking and helps reduce congestion for the overall street network.

Content and diagrams adapted from the NACTO Urban Street Street Design Guide

Fixed vs. Actuated Signalization

Fixed signals are generally preferred in walkable areas due to their predictability, regularity, and for ease of network organization. Compared to actuated signals, they also incur less initial and ongoing maintenance costs. As long as fixed signal cycles are not too long, they can increase pedestrian compliance by giving them regular and adequate opportunities to cross the street. While actuated signals are generally not preferred due to maintenance requirements, there are environments in which they are appropriate. For example, in some areas with lower pedestrian traffic, actuation can be used along priority rapid transit corridors to increase the reliability of the transit service and reduce delays. Otherwise, semi- or fully-actuated signals should be limited to suburban arterials and rural roads. If used on these thoroughfares, they should be as responsive to actuation as possible (minimum of 5 seconds) to avoid delays.

In addition to choosing the type and duration of signalization cycles, designers need to consider the spacing between signals to ensure that crossing intervals are achievable for pedestrians (see previous page). Signalization also may not always be the best treatment for an intersection. Stop or yield control, using infrastructure like modern roundabouts, may be more appropriate depending on the size of the street, and pedestrian and vehicular traffic.

Fixed

Fixed signals are recommended specifically in pedestrian priority areas, like downtown and neighborhood business districts, and walkable urban neighborhoods where pedestrians are expected and desired, and travel speeds are low.

Actuated

Actuated signal control — requiring people walking to press a button to receive the WALK signal — is effective where vehicle and pedestrian volumes vary considerably throughout the day. This reduces delays by being responsive to multiple shifts in traffic volumes.

Content and diagrams adapted from the NACTO Urban Street Street Design Guide

Coordinated Signal Timing

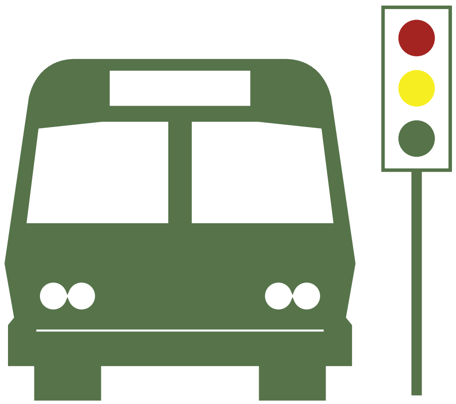
Coordinated signal timing manages traffic movement and speeds where uninterrupted flow is desired, and is typically applied on corridors with closely-spaced intersections (1/4 mile or less). This timing can either be used to increase vehicular flow and reduce peak-hour delays, or it can reduce vehicle progression speeds and create a more pedestrian-friendly environment. Generally, coordinated signal timing reduces the number of stops along a corridor and provides for a continuous flow of traffic at desired speeds. It can also increase the comfort and safety of other mode users by "platooning" motor vehicles, creating large gaps within the traffic coming from a certain direction. Where regular transit service is consistent, coordinated signal timing can be applied to coordinate transit headways along routes.

Cycling Streets

Bicyclists traveling at 12 – 15 mph receive a green indication at successive intersections, and therefore move uninterrupted down a corridor.

Downtown Areas

Where consistent pedestrian or bicycle travel is prioritized over vehicle travel in downtown areas, coordinated signal timing may reward reduced driving speeds of 15-20 mph.



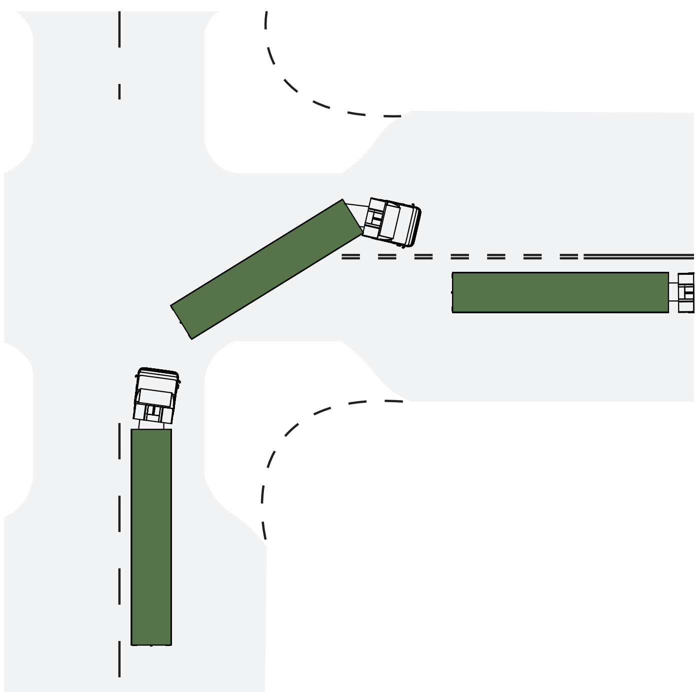
Coordinated with Transit

On transit routes, signal cycle lengths of 60 seconds are recommended to increase turnover and reduce side street delay. At intersections where there is transit signal prioritization, slightly longer cycle lengths provide an engineer with the flexibility to make modifications on a cycle-by-cycle basis.

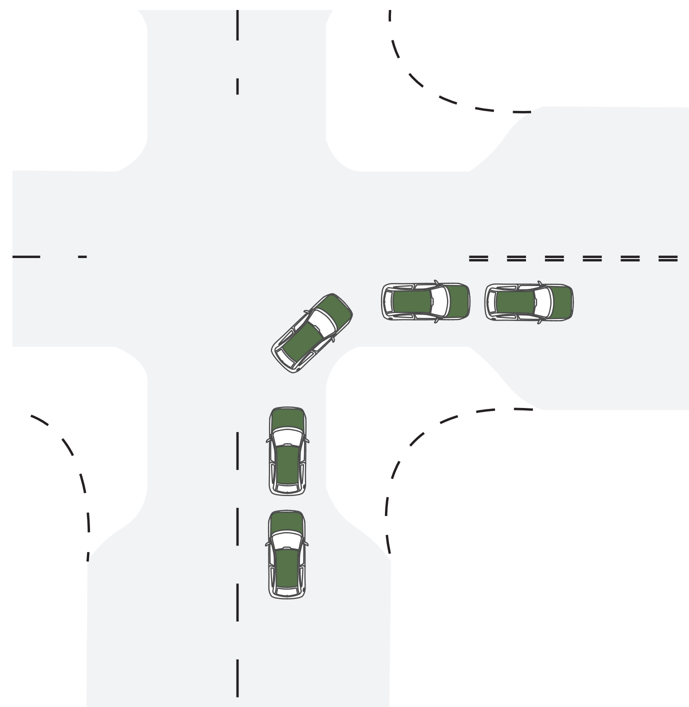
Operational Strategies

Signals | Design Vehicle | Iterative Design | Maintenance

When designing city streets, it is crucial to design for the accommodation of emergency vehicles. However, certain challenges that these and larger vehicles face should not be prioritized over designing safe streets overall, especially for the most vulnerable and frequent users. A design vehicle is a frequent user of a given street that dictates the street's physical design characteristics — like minimum required turning radius and curb width —, safety, and operations. On the other hand, a control vehicle is an infrequent, large user of a street that primarily dictates the design of intersections that could be fully used by them when making turns. Before choosing a design vehicle, it is important to consider the full context of an individual street's design and its role in the city so as to not inhibit the overall connectivity of the network. As shown below, large, infrequent vehicles (control vehicles) can be permitted to use the entire intersection when making a turn. In these cases, regular vehicles still have to make tighter turns, and slow to desired turning speeds of 10 - 15 mph. When designing intersections for design vehicles, use the "crawl speed" of turning vehicles, rather than their typical travel speed. This assumes that when small vehicles slow, they are more able to make tight turns.

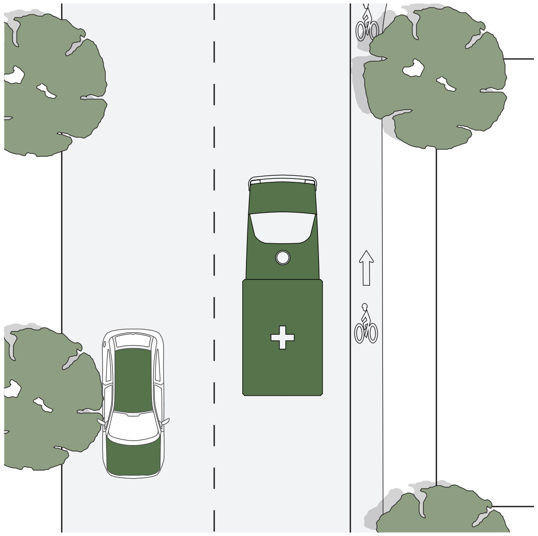


Control Vehicle

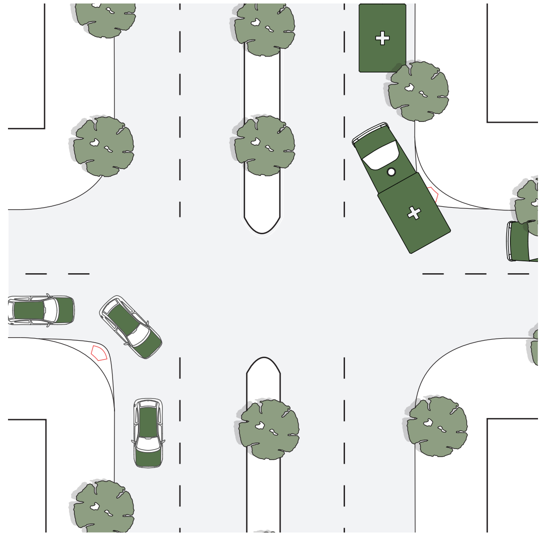


Design Vehicle

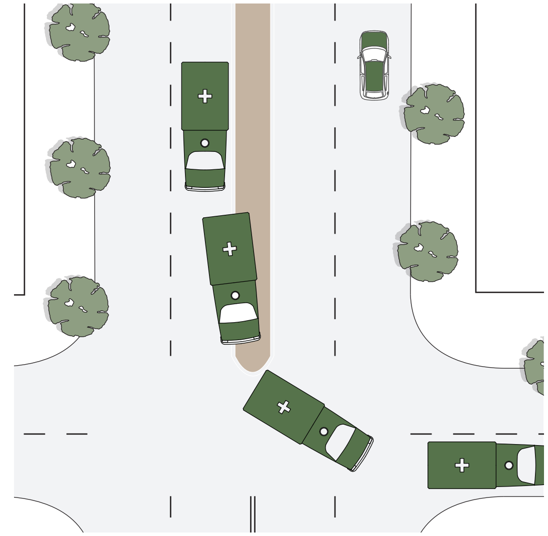
Diagrams adapted from the NACTO Urban Street Street Design Guide



Curbside Bike Lane



Turn Aprons



Flush Medians

There are a number of minor street design elements that can facilitate the travel of freight delivery, emergency response vehicles, and transit vehicles. It is important to communicate to stakeholders, for example, that adequate bicycle and pedestrian facilities can actually reduce the need for emergency response vehicles by creating safer, multi-modal environments. In general, a well-connected street network also can reduce the need for more fire and police stations to meet adequate response times, which further lessens taxpayer burden.

Among these minor street design elements are curb-side bike lanes, which remove the normal barrier of parked cars and allow emergency vehicles to enter into them. Just like vehicles in travel lanes, cyclists inhabiting bike lanes will still yield to passing emergency vehicles.

Curb radii designed solely for large vehicles actually worsen the pedestrian environment by lengthening crossing distances, and exposing pedestrians to vehicular traffic (see page 78). Mountable street corner curbs, or turn aprons (see page 79) can be used to still slow regular vehicles' travel speeds, while still accommodating larger vehicles and not sacrificing pedestrian safety or convenience.

Flush medians or curb extensions (see page 87) are another tool that can be used to accommodate emergency and larger vehicles without disrupting the street network, and reducing pedestrian safety. They narrow travel lanes and crossing distances, but still allow emergency, transit, and freight vehicles to cross over them when making turns. Other tools include pulling back the stop bars in advance of the intersection to allow for wide right turns and a very clear, well-enforced freight delivery route plan. Worth noting is that control vehicles, no matter infrequent, may damage local street infrastructure and should be considered to bolster the resiliency of curbs, telephone poles, and other streetscape elements.

Diagrams adapted from the NACTO Urban Street Street Design Guide

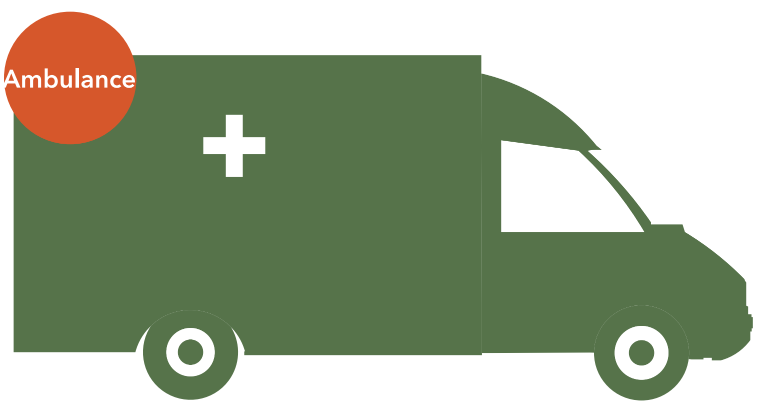
Common Vehicle Types

Package delivery trucks (DL-23) are very common on city streets, and have an inside turning radius of 22.5 feet, and an outside turning radius of 29 feet.

Moving and other freight trucks (SU-30) are most common on downtown and commercial streets. Oversized vehicles and trucks, like the WB-50, should be permitted to use the entire intersection when turning onto a receiving street, as long as it is designated as a select truck route.

Transit vehicles (BU-40) need larger effective turning radii. Where this cannot be accomplished, designers should consider removing parking spaces, or moving the stop bar back, on receiving streets.

Emergency response vehicles are permitted to use all of the right-of-way at any given time. On older or narrower streets, site-specific design and management solutions will allow walkability and emergency response needs to co-exist.



Operational Strategies

Signals | Design Vehicle | Iterative Design | Maintenance

Complete Streets project implementation can often be challenging for cities because of complex and drawn-out approval processes, lack of departmental coordination, budgeting processes, and construction timelines. Project delivery delays can be very frustrating for communities, and further leave urban issues without viable solutions.

Iterative design is a design/build process that can short-circuit the rigid project delivery process. Under the premise of "short-term action for long-term change,", iterative design is an approach to street design and activation that uses temporary, lower-cost, and flexible project interventions and policies with the intention of catalyzing future permanent infrastructure investment. This process allows cities to "test out" the effects of various Complete Streets design elements before fully committing to long-term implementation.

Examples of iterative design include highly-formalized efforts, like New York's Pavement to Plazas program, or San Francisco's Parklet program, both of which have been replicated in dozens of cities across North America. At a different scale, governments, non-profits, and grassroots groups are undertaking smaller "demonstration projects" to experiment with and gather input on potential street design changes. This approach promotes a high level of community engagement, as many demonstration projects involve community members serving in organizational and project implementation roles.

In summary, iterative design enables:

SHORT-TERM ACTION: Cities and residents can work together to more quickly install solutions to problems like lack of bike facilities and lack of third places.

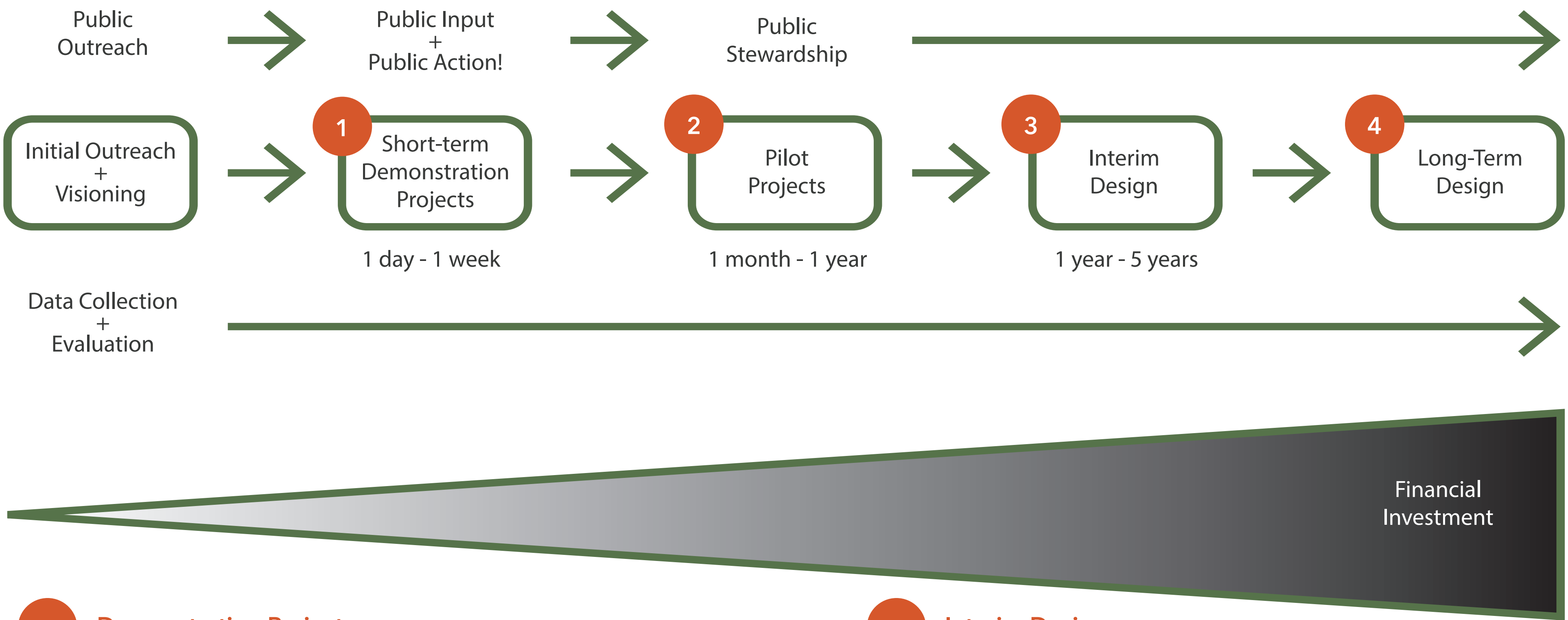
LOW-COST INVESTMENT: Demonstration and pilot projects require less time and funding, since formal construction is not needed.

TESTABLE SOLUTIONS: For a new protected bike lane, for example, re-striping the street or using temporary materials to create a physical divide allows the public to immediately test it, and planners and engineers to monitor it over one day, week, month, or year!

CITY-COMMUNITY PARTNERSHIPS: Iterative design can be carried out as a community event, incentivizing citizens to take ownership of changes happening in their neighborhoods.

LONG-TERM CHANGE: By using iterative design as an initial strategy, communities can evaluate in great detail the impacts of projects before committing more time and money. Gradual support for eventual long-term projects can also be built during the initial demonstration or pilot phases.

An Iterative Project Delivery Process



1 Demonstration Projects

Demonstration projects typically last from 1 to 7 days, and are often led by citizen or non-profit groups. Materials used are very low-cost, or comprised of found/recycled/donated objects to simulate a range of possibilities. The resulting aesthetic is often informal, but charming, allowing people to see and experience a design, while underscoring how inexpensive neighborhood improvements can be.

2 Pilot Projects

Pilot projects commonly last from 6 to 12 months, and may follow a successful demonstration project, or the completion of a formal study or master plan. They are typically installed by a local, regional, or state government, and include the use of relatively low-cost, semi-durable materials that seek to minimize maintenance costs, while also allowing a robust data set to be collected and analyzed.

3 Interim Design

Interim design projects are also installed under the authority of a city, regional, or state agency with the goal of providing ongoing benefits while funding for the long-term transformation is being secured. These projects last 12 months to several years, and require more durable, yet still flexible, materials that allow for adjustments if need be.

4 Long-Term Design

Following a successful pilot project and interim design, the long-term design is meant to last anywhere from 5 to 50 years, and significantly improve the urban environment. Reaching long-term projects with adequate investment after successfully testing them in the initial phases of iterative design is a very positive outcome.

Operational Strategies

Signals | Design Vehicle | Iterative Design | Maintenance

Maintenance Costs

Finding the resources for the construction and maintenance of Complete Streets for communities that have never built them can be a challenge. Although it is widely agreed upon that federal dollars should be spent on these types of infrastructure projects, cutbacks in spending have necessitated that communities get more creative about securing funding. Even communities with a great deal of enthusiasm and political will for Complete Streets can find it hard to implement them. The good thing is, Complete Streets projects can be less costly to build and maintain than projects related solely to vehicular travel. As shown through iterative design mechanisms, cost-effective projects can even be accomplished more quickly than relying on government funding and implementation. Additionally, Complete Streets have been shown to significantly increase economic, social, environmental, and health benefits, which eventually result in more funding that can be used toward maintenance and future construction of new projects.

Because Complete Streets projects can easily be integrated into existing thoroughfare networks, it is best practice for communities to budget for them every year. For projects that are more expensive, public-private partnerships, local tax options, and other creative funding mechanisms can be used to supplement, or entirely cover, construction and maintenance costs. Communities can also ensure that there won't be costs for these types of projects that are unaccounted for by developing robust bicycle and pedestrian plans that include realistic cost and maintenance estimates.

Image: Tom Morgan


Image: Tom Morgan


Image: D.C. Bicycle Advisory Council


Image: People for Bikes

Maintenance Logistics

Knowing the details of how and when to maintain Complete Streets projects can also be intimidating for communities who have never implemented them. Maintenance of these facilities is crucial for recapturing the benefits they provide.

For pedestrian and bicycle facilities, the top priorities are filling potholes and cracks routinely, and removing debris from roadways and sidewalks. Regular sweeping and plowing keeps leaves, rocks, vegetation, trash, and snow from harming the pedestrian experience. Facilities that primarily involve roadway striping need to be consistently maintained for legibility. Similarly, signals and signal actuators need to be regularly checked to ensure proper functionality. Although routine in-person maintenance is crucial, municipalities can also make phone or web-based interactive mapping tools available to community members to note maintenance issues with a specific geographic location.

To ensure maintenance is done routinely, and that all the burden isn't placed on one entity, local maintenance agreements between individual property owners, business improvement districts, and neighborhood associations are good strategies. Additionally, maintenance, as well as resurfacing and new roadway projects, should be factored into the life cycle costs for developing new facilities.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