



Saint Paul

Street Design Manual

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Introduction





Introduction



Our streets define our city. From Snelling Avenue to Maiden Lane, they dependably offer safe passage to hundreds of thousands of drivers, riders, pedestrians and bicyclists living out their daily lives. They bring employees to work and customers to businesses and allow the delivery of goods and services essential to a thriving economy. They give shape - and identity - to our neighborhoods from Highwood to Lex-Ham. They are places where we come together on buses and trains, as well as, on front stoops and sidewalk cafes.

Today we are asking them to do even more. As a community concerned about our impact on the global environment, we are asking our streets to help us expand public transit, treat stormwater, and extend the city's tree canopy. As a community concerned about improving public health, we are asking our streets to be safe and attractive places for people of all ages to walk and bike. As a central city challenged to accommodate a greater share of the region's population, we are asking our streets to serve as gathering places for a more densely settled community.

The Street Design Manual provides tools to all those who want to ensure that our streets create high quality public spaces at the same time that they safely accommodate all modes of transportation. Made possible by a grant from the U.S. Department of Transportation, this manual represents an important next step in the on-going process of building and renewing our city for the future.

Sincerely,

Christopher B. Coleman

Mayor

Purpose of the Manual

Saint Paul has been pursuing an inclusive street design process to accommodate multiple transportation modes and there is a recognized need to refine and formalize the process by creating a manual that comprehensively defines the best street design practices for Saint Paul. The Saint Paul Street Design Manual (Manual) is intended to be a tool to implement complete streets policies and guide the design of all future street projects so that each will be a well-coordinated process and contribute as part of a balanced transportation network for the greatest over-all benefit to the public. The Manual proactively addresses all transportation modes to ensure safe, efficient, and equitable travel for all roadway users, and a maximum return on transportation investments well into the future. Specifically, the Manual:

- Establishes the central Street Design Manual for all City departments, as well as community stakeholders.
- Explains how projects proposed at the neighborhood level fit into citywide or regional multimodal networks.
- Illustrates various street improvements and explains how they will affect and benefit multiple transportation modes and users.
- Provides examples of what a multimodal project will look like once it is complete.



Credit: Toole Design Group



Credit: Toole Design Group

Audience

This Manual is intended to target a diverse audience that includes City engineers, planners, and decision-makers, as well as neighborhood groups and other advocacy organizations that are concerned with how Saint Paul streets accommodate a wide range of roadway users and positively enhance neighborhood livability and economic development. Because this Manual is intended to be used by a variety of individuals – both professionals and laypeople – information is presented in easy-to-understand language and visually supported by graphics and photographs to the fullest extent possible.

Guiding Principles

The guidelines and policies presented in this Manual are centered on the following principles which provide a framework for the planning, design, and management of Saint Paul's streets:

- 1. Accommodate All Modes of Travel:** Each street design process must consider the needs and characteristics of all modes of travel (driving, riding transit, walking, bicycling, moving freight) and users of all abilities and strive to identify win-win solutions for improving access and mobility of people and goods. Streets that perform multiple functions improve multimodal access throughout the city. While all modes may not ultimately be accommodated on all projects, over time, this approach will enhance livability, provide transportation choices, and encourage active living.
- 2. Ensure Safety for All Users:** The design process must take into account the safety of all roadway users, especially more vulnerable groups such as pedestrians, children, senior citizens, cyclists, and persons with disabilities.
- 3. Promote Neighborhood and Economic Vitality:** Streets help define and connect neighborhoods. A portion of each property's value in the city is supported by the access created from its proximity to a robust transit and street network. Streets that perform multiple functions support vital local economies by providing efficient access and mobility, enhancing the public realm, and creating unique places that attract people and commerce. Flexibility in street design can help to maintain, and preserve the historic areas, corridors, and buildings that make Saint Paul and its individual neighborhoods unique.
- 4. Integrate Placemaking and Public Art:** Streets represent the largest component of public space in Saint Paul and contribute greatly to the sense of place and community. Saint Paul streets can strengthen community cohesion through public art that is integrated into the early stages of street design and other placemaking elements that attract people and serve as focal points of neighborhood centers.
- 5. Incorporate Sustainable Design:** Street design has social, economic, aesthetic, and environmental impacts. Well-balanced design maximizes long-term transportation investments. Long-term environmental and financial sustainability depend on the long-term health of resources and predictable maintenance costs. As a winter city, all-season functionality is a critical consideration in street design. Emphasize design techniques that reduce maintenance costs, and integrate green infrastructure to improve street tree health, manage stormwater run-off, and improve environmental quality.

How to Use the Manual

The City of Saint Paul has developed the Saint Paul Street Design Manual to provide policy and design guidance to governmental agencies, consultants, private developers and community groups on the planning, design, and operation of roadways, sidewalks, and off-street paths in Saint Paul. The Manual is intended to ensure that Saint Paul's streets are safe for all users and to foster an efficient project development and review process.

Street design in Saint Paul is a complex endeavor and designs must respond to the varied conditions and site constraints. Design decisions require engineering judgment that balances the use of available guidance and with ongoing innovations in street design and technological advances. The Manual has been developed to supplement existing manuals and standards including the Manual on Uniform Traffic Control Devices (MUTCD), guidance issued by the American Association of State Transportation Officials (AASHTO), and the National Association of City Transportation Officials (NACTO).

The Manual is intended to be a living document which is periodically updated to reflect changes in best practices, guidelines, and standards, similar to the MnDOT State Aid Manual, MN MUTCD, AASHTO Green Book and Guide for the Development of Bicycle Facilities. It is anticipated that this document will require regular minor edits and a substantive update will likely occur every five years to coincide with the American Public Works Association reaccreditation effort of the Public Works Department. Regardless of what and how changes are made to this document it will be important to establish a process that ensures checks and balances among competing interests.

Individual Treatments

The discussion of individual treatments in each chapter is organized within the following three sections:

- *Definition*: Provides an overview and general description of the individual treatment.
- *Applicability and Use*: Describes under what conditions the treatment is appropriate.
- *Design Considerations*: Provides specific design guidance to help tailor the use of an individual treatment for varying contexts.

Chapter Layout

The layout and design of each chapter is organized in a hierarchy to guide readers from high level design principles to individual design treatments. In order to serve the diverse audience referenced above, the manual is organized so that general information related to planning treatments (definitions, applicability and use) occupy the first page on a topic, while more detailed design considerations occupy the following pages. Many of the treatments in the manual are connected to a variety of other treatments or regulations; in the interest of presenting a thorough resource, each treatment page includes links that direct users to relevant internal and external resources.

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Background





Background

Policy Support for Developing a Street Design Manual

Comprehensive Plan

The Saint Paul Street Design Manual builds upon and articulates recent policy commitments the City has made to develop a more balanced and complete transportation system that enhances neighborhoods. The Manual provides specific guidance on how to best accommodate all transportation modes in a safe and efficient manner and highlights opportunities for green infrastructure and public art integration. The City's most recent Comprehensive Plan update (adopted by the City Council in February 2010) contains several strategies and policies supporting the design approach presented in this Street Design Manual. Specifically, the Transportation Element of the Comprehensive Plan is built upon four strategies: provide a safe and well-maintained system; enhance balance and choice; support active lifestyles and a healthy environment; and enhance and connect neighborhoods. This Manual addresses many of the specific policies listed under each of the four transportation strategies either directly or indirectly. On the next page is a list of policies that support the development of this Manual and the design guidance it contains.

Complete Streets Resolution

In March 2009 the Saint Paul City Council unanimously passed a resolution supporting complete streets. The resolution highlighted the health impacts of improving walking and biking conditions and the environmental benefits of increasing the mode-share of active transportation and transit users and thus, reducing dependence on fossil fuels. The concept of complete streets has further policy support from the State of Minnesota complete streets legislation. The Manual builds upon this recent local and state policy support for complete streets.

In 2010 the Mayor created a Transportation Committee of the Saint Paul Planning Commission. This Committee is comprised of four Planning Commissioners, and up to eight additional community members, including representatives from the following areas of interest:

- Transit, including bus and passenger rail
- Pedestrian/walkability issues
- Bicyclists
- Freight and logistics industry; including trucking, rail operations, and airports
- Accessibility representatives or persons with disabilities
- Representatives of commercial corridors (i.e., small business owners)
- Downtown or business representatives

The Committee advises the Planning Commission on transportation related plans, policies, and projects and creates a transparent public forum for such discussions. The Committee's work helps the Planning Commission better integrate land use and transportation decisions as they relate to zoning, neighborhood and comprehensive planning, and infrastructure investments.

The City also added a Sustainable Transportation Planner to the Department of Public Works in January 2011 to facilitate a balanced and flexible transportation system for the City of Saint Paul. Currently, this planner focuses on bike and pedestrian issues, planning, projects and programs throughout the city.

SAINT PAUL COMPREHENSIVE PLAN POLICIES THAT SUPPORT COMPLETE STREETS

“Provide a Safe and Well-maintained System” Policies:

- 1.1 Complete the streets - The needs of all users of the transportation system – including pedestrians, cyclists, transit, freight, and motor vehicle drivers – should be accommodated and balanced to the extent appropriate to the function and context of the street.
- 1.2 Examine alternatives to enhance safety through right-of-way design, including narrowing or removing lanes on roads.
- 1.3 Evaluate existing crosswalk striping, design, and pedestrian-scale lighting standards.
- 1.4 Implement reconstruction projects for improved safety.
- 1.6 Design for improved accommodation of pedestrians and bicycles on bridges.
- 1.7 Minimize and consolidate driveway curb cuts on commercial streets as opportunities arise.
- 1.8 Support the completion of Residential Street Vitality Program (RSVP), an ongoing program to reconstruct and improve the appearance, function, and safety of Saint Paul streets.
- 1.12 Partner with schools, nonprofits, other government agencies, and businesses to educate people about bicycling and walking.
- 1.13 Establish freight corridors to enable the prompt delivery and transfer of cargo and to reduce noise and air pollution in adjoining neighborhoods.
- 1.14 Increase pedestrian, bicycle, and motorist safety through effective law enforcement, detailed crash analysis, and engineering improvements to reduce the risk of crashes.

“Enhance Balance and Choice” Policies:

- 2.1 Create true transportation choices for residents, workers, and visitors in every part of the city. The City should create places to live, work, play, and conduct business that do not depend principally on the automobile for access, but rather accommodate all modes of transportation.
- 2.4 Develop a strategy for investing in a broad range of infrastructure projects, including, but not limited to, street and traffic improvements to support the growth of existing employment, services, parks, and schools.
- 2.6 Focus on the improvement and extension of bus service and facilities on existing transit routes, and on new routes to serve proposed LRT stations in collaboration with Metro Transit.
- 2.11 Create more seamless connections between pedestrians, bicycles, transit, and automobiles.

“Support Active Lifestyles and a Healthy Environment” Policies:

- 3.1 Support cooperative efforts in streetscape design, landscaping, pedestrian-scale lighting, and other amenities for people.
- 3.2 Formalize citywide standards and above-standard options for pedestrian oriented streetscapes.
- 3.3 Strengthen pedestrian pathways between housing, transit, and neighborhood services.
- 3.4 Develop and maintain a complete and connected bikeway system.
- 3.6 Fill gaps in the bikeway system.
- 3.7 Create a comprehensive system of bicycle network and pedestrian path signage and wayfinding.
- 3.8 Promote “bicycle boulevards” as a new type of bikeway.
- 3.9 Adopt a citywide bicycle parking requirement.
- 3.10 Create public bicycle parking facilities to increase bicycling trips citywide.
- 3.11 Provide safe citywide connections to schools, libraries, parks, and recreation centers, with improved crossings and comfortable pedestrian environments at high demand destinations.

“Enhance and Connect Neighborhoods” Policies:

- 4.4 Coordinate with surrounding communities and jurisdictions to enhance regional bicycle and pedestrian networks, recognizing the importance of Saint Paul in regional and statewide connectivity.
- 4.7 Connect neighborhoods that have poor sidewalks or little access to trails and bike routes, especially east and north of Downtown.

Transportation Planning and Design Documents - National Standards and Guidelines

The following resources present a variety of transportation design resources and requirements. Some resources are standards while others are guidelines. All manuals and guides referenced are periodically updated to provide best practices. The active links in this manual provide the most recent versions of these manuals.

AASHTO Green Book

Issuing Agency/ Organization: American Association of State Highway Transportation Officials

Level of Authority: Guidelines

Overview: A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011, commonly referred to as the “Green Book,” contains the current design research and best practices for highway and street geometric design. The document provides guidance to highway engineers and designers who strive to make unique design solutions that meet the needs of highway users while maintaining the integrity of the environment. It is also intended as a comprehensive reference manual to assist in administrative, planning, and educational efforts pertaining to design formulation. Design guidelines are included for freeways, arterials, collectors, and local roads, in both urban and rural locations, paralleling the functional classification used in highway planning. The book, similarly, is also organized into the following functional chapters to stress the relationship between highway design and function: Highway Functions, Design Controls and Criteria, Elements of Design, Cross-Section Elements, Local Roads and Streets, Collector Roads and Streets, Rural and Urban Arterials, Freeways, Intersections, and Grade Separations and Interchanges.

Manual on Uniform Traffic Control Devices (MUTCD)

Issuing Agency/ Organization: Federal Highway Administration (FHWA), Minnesota Department of Transportation (MnDOT)

Level of Authority: Standards, most of which are requirements (“shalls”). Some standards are flexible in that there may be more than one option for implementation.

Overview: The MUTCD is issued by the Federal Highway Administration (FHWA) of the U.S. Department of Transportation (USDOT) to specify the standards by which traffic signs, road surface markings, and signals are designed, installed, and used. These specifications include the shapes, colors, fonts, sizes, etc., used in road markings and signs. In the United States, all traffic control devices must generally conform to these standards. The manual is used by state and local agencies and private design and construction firms to ensure that the traffic control devices they use conform to the national standard. While some state agencies have developed their own sets of standards, including their own MUTCDs, they must substantially conform to the federal MUTCD, and must be approved by the FHWA. The Minnesota Department of Transportation (MnDOT) uses the Minnesota Manual on Uniform Traffic Control devices for Streets and Highways, which is in substantial conformance with the federal MUTCD. Detail drawings for signs and traffic control devices along with supplemental details pertaining to standard signs and guide signs, can be found in the MnDOT “Standard Signs Manual” and the federal “Standard Highway Signs and Markings” book.

Highway Capacity Manual

Issuing Agency/ Organization: Transportation Research Board

Level of Authority: Guidelines

Overview: The Highway Capacity Manual is a publication of the Transportation Research Board (TRB). It contains concepts, guidelines, and computational procedures for computing the capacity and quality of service of various highway facilities, including freeways, highways, arterial roads, roundabouts, signalized and unsignalized intersections, rural highways, and the effects of mass transit, pedestrians, and bicycles on the performance of these systems. The latest edition of the Highway Capacity Manual (2010) significantly updates the methodologies that engineers and planners use to assess the traffic and environmental effects of highway projects. Most notably, the manual includes an integrated multi-modal approach to the analysis and evaluation of urban streets from the points of view of automobile drivers, transit passengers, bicyclists, and pedestrians. This multi-modal approach is known as Multi-modal Level of Service or Quality of Service. Building on previous research (NCHRP Report 616, NCHRP 3-70) the 2010 Highway Capacity Manual enables agencies to balance the level of service needs of auto drivers, transit riders, bicycle riders, and pedestrians in their street designs by providing agencies with a tool for testing different allocations of scarce street right-of-way to the different modes using the street. It is anticipated that quality of service analysis will continue to improve as the understanding of various roadway user characteristics and perceptions improves and microsimulation analyses are calibrated accordingly.

American Public Transportation Association (APTA) Recommended Practice: Designing Bus Rapid Transit (BRT) Running Ways Design Manual

Issuing Agency/ Organization: American Public Transportation Association (APTA)

Level of Authority: Standards, most of which are requirements (“shalls”). Some standards are flexible in that there may be more than one option for implementation.

Overview: The American Public Transportation Association (APTA) Recommended Practice: Designing Bus Rapid Transit (BRT) Running Ways Design Manual provides recommended practices for the design of running ways for bus rapid transit systems. The manual aims to provide guidance to transportation professionals, government agencies, developers and other interested parties in implementing or enhancing bus rapid transit systems. Included in the manual is a review of running way designs and guidelines related to busways on separate rights-of-way, separate busways or HOV lanes within freeways, or exclusive transitways on arterial streets. In addition, guidance is provided on bus rapid transit facility geometry, cross-section dimensions, drainage and other engineering considerations, and pavement design.

AASHTO Guide for the Development of Bicycle Facilities

Issuing Agency/ Organization: American Association of State Highway Transportation Officials

Level of Authority: Guidelines

Overview: The AASHTO Guide for the Development of Bicycle Facilities is a resource for the design, development, and maintenance of safe on- and off-street bicycle facilities. The Guide presents a set of best practices for designing roadways that comfortably accommodate a variety of user types. The information in the Guide is not intended to be strict standards nor is it all encompassing, rather it aims at providing guidance that should be used in conjunction with other regulations such as the Manual on Uniform Traffic Control Devices (MUTCD).

NACTO Urban Street Design Guide

Issuing Agency/ Organization: National Association of City Transportation Officials

Level of Authority: Guidelines

Overview: The purpose of the NACTO Urban Street Design Guide is to provide cities with state-of-the-practice solutions that can help to design complete streets in urban settings. The NACTO Urban Street Design Guide recognizes the direct relationship between street design and economic development and emphasizes safety for all traffic modes. The NACTO Urban Street Design Guide is not intended to be a comprehensive guide for the geometric design of the street, rather it covers design principles to meet the complex needs of cities. It builds off the street design manuals adopted by several cities since 2009. The NACTO Urban Street Design Guide references MUTCD.

NACTO Transit Street Design Guide

Issuing Agency/ Organization: National Association of City Transportation Officials

Level of Authority: Guidelines

Overview: The purpose of the NACTO Transit Street Design Guide is to provide design guidance for the development of transit facilities, and for the design and engineering of city streets to prioritize transit, improve transit service quality, and support other goals related to transit.

NACTO Urban Bikeway Guide

Issuing Agency/ Organization: National Association of City Transportation Officials

Level of Authority: Guidelines

Overview: The purpose of the NACTO Urban Bikeway Design Guide is to provide cities with state-of-the-practice solutions that can help create complete streets that are safe and enjoyable for bicyclists. Most treatments included in the NACTO Urban Bikeway Design Guide are not directly referenced in the current version of the AASHTO Guide for the Development of Bicycle Facilities, although they are virtually all (with two exceptions) permitted under the Manual on Uniform Traffic Control Devices (MUTCD). The NACTO Urban Bikeway Design Guide is not intended to be a comprehensive guide for the geometric design of bikeways, rather it covers certain types of on-road bikeway designs, specifically bike lanes and several new and innovative types of on-street bikeway design treatments, but does not cover shared use paths, signal design, and many other relevant topics. In most cases, the NACTO Urban Bikeway Design Guide should be used in tandem with the AASHTO Bike Guide.

Separated Bike Lane Planning and Design Guide

Issuing Agency/ Organization: Federal Highway Administration (FHWA)

Level of Authority: Guidelines

Overview: The MUTCD is issued by the Federal Highway Administration (FHWA) of the U.S. Department of Transportation (USDOT) provides guidelines for one- and two-way cycle tracks, including options for intersections, driveways, transit stops, accessible parking and loading zones. Recognizing this is a developing facility type, the guide provides case studies to aid in implementation. The guide also identifies data to collect before and after cycle track projects and potential future research to refine and improve the practice.

State of Minnesota Standards and Guidelines

Minnesota MUTCD

Issuing Agency/Organization: Minnesota Department of Transportation, FHWA

Level of Authority: Standards

Overview: This manual establishes uniform policies for traffic control devices that regulate, warn and guide road users along all roadways within Minnesota. This manual is in compliance with the federal Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) produced by the Federal Highway Administration. Much of the content of this manual is taken directly from the federal MUTCD, however several have been altered to better represent Minnesota regulations and conditions.

Minnesota Department of Transportation Road Design Manual

Issuing Agency/ Organization: Minnesota Department of Transportation

Level of Authority: Guidelines

Overview: The Minnesota Department of Transportation Road Design Manual establishes uniform policies and procedures for the Minnesota Department of Transportation. The design criteria included in the manual is applicable to the broader highway and street system within the state. The policy and criteria in the manual are largely adapted from the AASHTO publication, “A Policy on Geometric Design of Highways and Streets,” which itself has been adopted as the design standard for the National Highway System by the Federal Highway Administration. However, the manual is not intended as a legal standard. Rather, it presents vital information and guidance normally required in the design of a new or reconstructed facility. The City of Saint Paul applies the Manual’s design criteria to its street design projects while also using engineering judgment and balancing social, economic and environmental factors to yield appropriate designs suitable for unique circumstances.

Minnesota Best Practices Synthesis and Guidance in At-Grade Trail-Crossing Treatments

Issuing Agency/ Organization: Minnesota Department of Transportation

Level of Authority: Guidelines

Overview: The Minnesota Best Practice Synthesis and Guidance in At-Grade Trail-Crossing Treatments was developed by MnDOT in order to provide transportation professionals with a comprehensive resource for the design of safe at-grade trail crossings. While a variety of resources exist for the design of trails and their intersections with roadways, this document provides a comprehensive review of best practices on the state and national level. This document provides transportation professionals with a synthesized list of best practices in trail crossings from Minnesota, as well as nationally. The document examines a variety of safety issues associated with several trail crossing types and considers the wide range of trail users in Minnesota (e.g. people who travel by foot, bicycle, or snowmobile) and the varying needs of each mode at trail crossings.

Minnesota Department of Transportation Load and Resistance Factor Design (LRFD) Bridge Design Manual

Issuing Agency/ Organization: Minnesota Department of Transportation

Level of Authority: Guidelines

Overview: The Minnesota Department of Transportation Load and Resistance Factor Design (LRFD) Bridge Design Manual is a guide to MnDOT Bridge Office policies and procedures for the design, evaluation and rehabilitation of bridges. The most recent version of the manual (2013) presents MnDOT’s design practices in conformance with a new design methodology, Load and Resistance Factor Design (LRFD) and also contains fifteen comprehensive design examples.

Minnesota Bikeway Facility Design Manual

Issuing Agency/ Organization: Minnesota Department of Transportation

Level of Authority: Guidelines

Overview: The Minnesota Bikeway Facility Design Manual provides engineers, planners, and designers with a primary source to implement the Minnesota Department of Transportation (MnDOT's) vision and mission for bicycle transportation in Minnesota. This manual also provides citizens, developers and others involved in the transportation planning process guidance on the critical design and planning elements to promote bicycle safety, efficiency, and mobility.

The Bikeway Facility Design Manual was developed in 2007 and much of the design guidance it contains is based on the American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (1999) and the 2003 edition of the Manual on Uniform Traffic Control Devices (MUTCD) (see further below for explanation of the MUTCD). The AASHTO Guide for the Development of Bicycle Facilities has since been updated (the fourth edition was published in June 2012). A new edition of the MUTCD was published in 2009 and the newest edition of the Minnesota MUTCD was published in July 2012. The bicycle treatments included in this Manual reflect these newer guidance and standards documents, as well as current best practices, which, in some cases, differ from guidance provided in the Minnesota Bikeway Facility Design Manual.

State Aid Manual

Issuing Agency/ Organization: Minnesota Department of Transportation

Level of Authority: Procedural Requirements

Overview: The Minnesota State Aid program provides resources (monetary, staff, research) to assist counties and cities with construction and maintenance of community interest highways (i.e., highways and streets that function as an integrated network and provide more than only local access) and streets on the State Aid system. The State Aid Manual outlines the procedures, requirements, and certain design standards cities must follow when submitting their annual funding needs to the Commissioner of Transportation via the State Aid system. The State Aid Manual does not dictate design or construction of projects. Each year the City of Saint Paul submits the necessary information that explains the City's road, structure, and railroad crossing funding needs. The municipal screening board uses this information to make recommendations to the Commissioner regarding the money needs of each urban municipality.

MnDOT Guidance for Installation of Pedestrian Crosswalks on Minnesota State Highways

Issuing Agency/ Organization: Minnesota Department of Transportation

Level of Authority: Guidelines

Overview: MnDOT's Guidance for Installation of Pedestrian Crosswalks reflects the Department's mission of including the provision of safe and efficient transportation facilities for all modes. MnDOT reviewed the most recent research and best practices in order to determine when and where to provide pedestrian crosswalks. The guidance recognizes a range of elements that can affect the location of facilities including volume, speed, number of travel lanes, type of roadway and type of pedestrians. The objective of this publication is to establish a step-by-step procedure to evaluate the use of various pedestrian crossing treatments.

Minnesota Stormwater Manual

Issuing Agency/Organization: Minnesota Pollution Control Agency

Level of Authority: Guidelines

Overview: The Minnesota Stormwater Manual serves as a resource for professionals who work to manage stormwater. The manual is updated frequently to provide practitioners with best practice policies and resources. It provides evaluation measures for source reduction, checklists for visual inspections, simplified field measurements, and instructions for using simulated runoff and state-of-the-art monitoring. In addition to best practices, it provides a variety of case studies of BMP assessments.

Minnesota Pollution Control Agency (PCA) Plants for Stormwater Design

Issuing Agency/Organization: Minnesota Pollution Control Agency

Level of Authority: Guidelines

Overview: The PCA Plants for Stormwater Design provides guidance for urban landscape designers, installation practitioners, and stormwater managers. The guidance describes plant species' susceptibility to water-level fluctuations and landscape pollutants in order to provide better stormwater detention and treatment. The goal of the document is to provide practitioners with effective techniques to improve stormwater treatment and management practices through the use of native plants. 131 plant species are profiled with regards to their stormwater management uses, characteristics discussed include:

- Habitat and range
- Light exposure needs
- Normal water level
- Flooding/fluctuation tolerances
- General pollution sensitivities and tolerances
- Design considerations
- Wildlife use
- Nursery stock and seed availability
- Recommended planting techniques

Metropolitan Council Standards and Guidelines

Regional Transitway Guidelines

Issuing Agency/ Organization: Metropolitan Council

Level of Authority: Guidelines

Overview: The purpose of the Regional Transitway Guidelines is to provide technical guidance, based in best practices, that supports the development and operation of transitways (Commuter Rail, Light Rail Transit, Bus Rapid Transit) in a way that is consistent, equitable, efficient, and delivers an effective, integrated, and user-friendly transit system throughout the Twin Cities region. Transit modes not addressed by the Guidelines include Dedicated Busway, Express Bus with Transit Advantages, and Streetcar. The guidelines most relevant to the Street Design Manual pertain to station spacing and siting, station and support facility design, runningways (guideways), and vehicles.

The Guidelines are supplemented by three technical user guides intended to provide insight into implementing the guidelines for local transit and planning staff. These user guides address Station and Support Facility Design Guidelines, Runningway Guidelines, and Travel Demand Forecasting.

The technical guidance included in the Regional Transitway Guidelines has been taken into consideration in the development of the Saint Paul Street Design Manual.

Station and Support Facility Design Guidelines User Guide

Issuing Agency/ Organization: Metropolitan Council

Level of Authority: Guidelines

Overview: This User Guide for the Regional Transitway Guidelines includes guidance on right-of-way requirements, bus turning radius and staging requirements, street reconstruction standards, and station design, including streetscaping, public art, LRT platform configurations, and other considerations impacting street design.

Other Relevant Documents that Inform Street Design

ADAAG/PROWAG

Issuing Agency/ Organization: U.S. Department of Justice/ Access Board

Level of Authority: Guidelines

Overview: The Americans with Disabilities Act (ADA, 1990, Public Law 101-336) is a broad civil rights statute that prohibits discrimination against people with disabilities in all areas of public life. The Department of Justice's ADA Title II implementing regulations apply to state and local government services, activities and policy making. As part of FHWA's regulatory responsibility under Title II of the ADA and Section 504 of the Rehabilitation Act of 1973 (504), the FHWA ensures that recipients of federal aid and state and local entities that are responsible for roadways and pedestrian facilities do not discriminate on the basis of disability in any highway transportation program, activity, service or benefit they provide to the general public; and to ensure that people with disabilities have equitable opportunities to use the public rights-of-way system.

The Access Board has developed proposed guidelines for public rights-of-way (PROWAG) that address various issues, including access for blind pedestrians at street crossings, wheelchair access to on-street parking, and various constraints posed by space limitations, roadway design practices, slope, and terrain. The proposed guidelines cover pedestrian access to sidewalks and streets, including crosswalks, curb ramps, street furnishings, pedestrian signals, parking and other components of public rights-of-way.

Minnesota's Best Practices for Pedestrian/ Bicycle Safety (Report 2013-22)

Issuing Agency/ Organization: MnDOT

Level of Authority: Resource

Overview: This resource guide provides a useful summary of pedestrian and bicycle best practices. The document contains a summary including safety benefits and generalized cost of many of the design elements included in the Saint Paul Street Design Manual. This document may be particularly useful to planners and neighborhood organizations.

City of Saint Paul Standards and Guidelines

Saint Paul Standard Plates

All construction, development, repair, or adjustments affecting city infrastructure within the City of Saint Paul must adhere to current standards. The City of Saint Paul's Standard Plates are intended to provide guidance for the design, review, and construction of those public improvements in or under the public right-of-way and public easements. Standard plates address curb and gutters, pavement, sewers and appurtenances, lighting and electrical, and tree planting in the public right-of-way.

Street and Park Tree Master Plan

The Saint Paul Street and Park Tree Master Plan is a living document aimed to provide guidance on the proper selection, placement, and maintenance of trees in a variety of settings. The Plan provides a wealth of knowledge as well as links to other online resources to help City staff and residents to plan and maintain a healthy and diverse urban forest. The Plan is intended to be used as a comprehensive guide by City staff, public and private developers, and property owners.

Parks and Recreation System Plan

The Parks and Recreation System Plan provides a vision for maintaining the city's high quality parks and recreation system. It outlines challenges to keeping Saint Paul's parks vital, accessible, safe, environmentally sound and fiscally responsible, while also identifying opportunities for further improvement. The plan acknowledges the financial constraints it must operate under and that current conditions do not meet all users' needs. In order to remedy these situations the plan aims to help the city become "The Most Livable City in America," through effective long term planning. The Plan assesses the current park system, provides an overview of recreation trends, defines six goals, lists initiatives and actions that will help attain those goals, and provides tools designed to help implement the Plan.

Saint Paul Bicycle Plan

The City of Saint Paul is developing a citywide Bikeways Plan to guide the development of a safe, effective, and well-connected network of bicycle facilities to encourage and facilitate bicycle transportation. The primary objective of this plan is to designate corridors throughout the city for future development of bikeways. When completed, this plan will be adopted as an addendum to the City's Comprehensive Plan.

Saint Paul Street Lighting Policy

Citywide lighting is provided for the safe operation of roads and sidewalks in the City of Saint Paul. The Traffic & Lighting Division is responsible for light installation and maintenance on streets, bridges, paths and trails in the City of Saint Paul. The policy defines standard and above standard lighting fixtures, pole colors, and spacing guidelines. The city's lighting system includes more than 37,000 light fixtures on 32,000 light poles. Alley lights are installed and maintained by Xcel Energy at the request of adjacent property owners. Residents contact Xcel Energy directly for installation and maintenance of alley lights

Blooming Saint Paul

Blooming Saint Paul is a comprehensive initiative to revitalize Saint Paul's downtown and neighborhoods through lush and colorful landscape elements and public art. It focuses on creating an attractive, safe, and healthy city where people choose to live, work and play. Investing in Saint Paul's urban environment needs to go beyond basic engineered solutions for Saint Paul to succeed in becoming the 'Most Livable City'. Through Blooming Saint Paul, the community and City departments work together to make sure greening concepts are included and promoted in key public spaces and facilities, neighborhoods and private development. These include roadways, parkways, parks, plazas, pedestrian and bicycle ways, commercial corridors and public buildings. Private developments are encouraged to retrofit existing facilities. New developments are encouraged to include greening concepts in their design plans whenever possible.

Brick Street Policy

The Brick Street Policy identifies existing brick streets and allows City Council to assess benefitting property's 25% of the reconstruction costs.

Public Art Ordinance Program Guidelines

The Saint Paul Public Art Ordinance Guidelines establish the working methods to actualize the public art ordinance (discussed above). The Public Art Ordinance Program Guidelines are to be used city-wide – by City departments, agencies, district councils, neighborhood groups and artists. The purpose of the Guidelines is to provide administrative guidance for projects funded through the City's capital improvement budget on properties that will be owned and operated by the City. Guidance is also provided for temporary projects, exploratory projects, performances and events that are encouraged by the ordinance and may be funded by the City or others.

The types of projects within the public right-of-way that might include public art elements are identified in the Street Design Manual. Such projects include, but are not limited to, the construction or renovation of new or existing sidewalks, traffic calming elements, bridges and streetscape elements.

Historic District Design Guidelines

There are several Historic Districts in Saint Paul. Each district has design guidelines that may influence street design and should be understood as part of scoping a project. Existing historic district design guidelines include:

- Dayton's Bluff Historic District
- Irvine Park Historic District
- Lowertown Historic District
- Summit Avenue West Historic District
- University-Raymond Commercial Historic District
- Hill Historic District
- Jacob Schmidt Brewing Company Historic District

City Ordinances

Traditional Neighborhood District Regulations (Code of Ordinances Part II, Title VIII, Chapter 66, Article III)

Traditional neighborhood (TN) districts are intended to foster the development and growth of compact, pedestrian-oriented urban villages. There are four TN districts, each intended to encourage a compatible mix of commercial and residential uses within buildings, sites and blocks; new development in proximity to major transit streets and corridors; and additional choices in housing. The regulations most relevant to the Street Design Manual include:

- Off-street parking – placement in relation to principal buildings and minimizing total lot frontage for parking to be no more than 50 percent, and only if rear parking is impractical or insufficient.
- Block length – not to exceed 400 feet in mixed use areas, and 660 feet in residential areas.
- Street and alley network – Existing street and alley network is to be preserved and extended as part of any new development. Culs-de-sac are discouraged.
- Setbacks and front yard areas – allows first four feet of front yards (along University Avenue) to be paved similar to public sidewalk and include amenities such as benches, tables, and planters, otherwise requires landscaping.
- On-street parking – streets are to generally have parking on both sides to buffer pedestrians, calm traffic, and supplement off-street parking.
- Street trees – requires street trees at regular intervals to help define the street edge, buffer pedestrians from vehicles, and provide shade. Trees are to be planted in planting strip at least 5 feet wide between the curb and the sidewalk, or in a planter of a design acceptable to the city.
- Sidewalks – sidewalks are to be constructed on both sides of the street; 5 feet minimum width, and 6 feet or more in areas of high pedestrian activity, e.g., T4 district.

- Building entrances – requires primary pedestrian entrances to be oriented towards street, encouraging activation of the street.
- Street-level uses – encourages activation of the pedestrian zone by requiring a diversity of uses, entrances oriented towards street, lining of above ground parking structures with retail uses, minimization of residential uses at street-level in mixed use areas.

Architectural design – includes standards for building facades, building entrance location, screening of service areas, parking entrance design.

Subdivision Regulations (Code of Ordinances Part II, Title VIII, Chapter 69)

Articles V (General Requirements and Design Standards) and VI (Improvements) in Chapter 69 contain provisions and requirements addressing streets, blocks, alleys, and associated improvements. The regulations most relevant to the Street Design Manual include:

- Streets - standards including right-of-way and roadway width, alignment and connectivity of new streets, and intersection angle and offsets.
- Blocks - block width and length (not to exceed 1,000 feet in residential areas).
- Access - Lots shall not, in general, derive access exclusively from an arterial. Where driveway access from a major or secondary street may be necessary for several adjoining lots, the Planning Commission may require that such lots be served by a combined access drive in order to limit the possibility of traffic hazards on such street.
- Alleys – defines when alleys are required and alley widths for residential, industrial, and commercial uses.
- Street trees – tree spacing, placement, and species.
- Street lights – street lights are required at all intersections and along streets spaced no more than 200 feet apart.
- Sidewalks – public sidewalks are required along both sides of collector and arterial streets and in other locations required by the City Council.

Heritage Preservation Commission (Code of Ordinances Part II, Title IX, Chapter 73)

Chapter 73 establishes the Heritage Preservation Commission and its roles. The chapter also defines criteria for the designation of heritage preservation sites and the process by which permits are reviewed.

Historic Preservation Districts and Programs (Code of Ordinances Part II, Title IX, Chapter 74)

The City of Saint Paul has nine Heritage Preservation Districts and Sites. Several of these districts are sizable and contain numerous streets. The Street Design Manual recognizes that streets, in many cases, contribute to the character of these districts, and it provides sufficient flexibility to allow for the preservation or enhancement of unique historic attributes within the right-of-way. However, safety and accessibility are paramount considerations in all street design considerations.

Boulevard Planting (Part II, Title XII Chapter 105)

The City of Saint Paul allows property owners to plant and maintain boulevard areas adjacent to their property in a manner which enhances the aesthetic appearance of City streets. The boulevard area is defined as the space between the sidewalk and roadway, or where no sidewalk exists, between the property line and the roadway. This section of the City's code establishes permitted plantings, maintenance requirements for property owners, procedural guidelines, and compliance requirements.

Restrictions on Use of Sidewalks, Streets, etc (Part II, Title XII Chapter 106)

Chapter 106 provides regulations from the City of Saint Paul regarding the permitting, establishment and siting of sidewalk cafés. No person shall operate a sidewalk café without a license and a right of way obstruction permit issued by the City of Saint Paul Sidewalk café furnishings are defined as tables, chairs, plant tubs, planters, and fencing or barricades and associated equipment.

Permits for Driveways, Sidewalks, Curbs, Etc. (Code of Ordinances Part II, Title XII, Chapter 121)

Chapter 121 defines conditions and regulations regarding construction and repair between the curb and the property line within the right of way. The ordinance includes conditions for which a boulevard area may be paved.

Right of Way Permits (Code of Ordinances Part II, Title XII, Chapter 135)

Chapter 135 regulates obstructions of and excavations in the rights-of-way by providing, among other things, for the issuance of permits granting authority to obstruct or excavate therein and by providing for the subsequent restoration of the rights-of-way. The permitting process ensures that utilities and/ or their contractors working in the right-of-way are competent and qualified and that they conduct their work such that the public health, safety and welfare are maintained; that the property and safety of other users of the right-of-way are protected; and that the structural integrity of the right-of-way is protected and insured.

Street Vacations (Code of Ordinances Part II, Title XII, Chapter 130)

Chapter 130 of the City's code of ordinances establishes the terms and conditions for vacations of streets (the transfer of public right-of-way, which the City owns fee title). Street vacations are typically initiated by written petition of the majority of property owners of the property on the line of the street to be vacated, or by any number of owners of property on the line of the street to be vacated if it is determined that a hardship exists. Vacating of a public street results in the city being compensated a sum of money determined by the council. A Council resolution for a street vacation may reserve the City's right to install, maintain and operate any sewer, water, gas or electric main, pipe or conduit, or any other public utility.

Projections and Encroachments (Part II, Title XII, Chapter 134)

In certain cases the City may allow use of the public right-of-way by adjacent property owners for purposes that cannot be reasonably satisfied on private property and where it is determined by the Director of the Department of Public Works that the area of projection or encroachment cannot be vacated under Chapter 130 of the Legislative Code. An encroachment includes any above or below grade protrusion beyond the property line which extends into, upon, over, under or otherwise occupies any public street, alley, sidewalk, boulevard or right-of-way. Examples of encroachments include, but are not limited to, steam lines, conduits, lighting standards, areaways, tunnels, trapdoors, retaining walls, parking bays and nonstandard walks, and do not include awnings, business signs and certain building projections. Any encroachment requires a permit issued by the Director of Public Works. Permits may be revoked if they are not properly maintained or pose a public safety hazard, or the city may request an encroachment to be removed or relocated (at the owner's expense) because it interferes with a public improvement undertaken by the City within the public right-of-way.

Parkways (Code of Ordinances Part II, Title XIII, Chapter 145)

The City's code of ordinances identifies which roadways are parkways and establishes jurisdiction over these defined streets and avenues to both the Departments of Public Works and Parks and Recreation. This chapter also defines parkways where trucks (over 9,000 pounds) are prohibited.

Truck Route Ordinances (Part II, Title XIII, Chapter 146)

Chapter 146 establishes procedures for the movement of commercial vehicles along and between truck routes in Saint Paul. In addition the chapter provides exceptions in which deviating from these routes is permissible.

Block Parties and Community Festivals (Part II, Title XXIX, Chapter 366)

No person or organization shall use any public street, sidewalk or alley for a block party or community festivals in the city without a permit. However, it is the policy of the City to encourage the holding of small block parties or community festivals without a permit. Generally, a permit is not required for such events meeting the following characteristics:

- No food or beverages are sold to the public;
- The street, sidewalk or alley involved is totally residential in nature and does not cover an area greater than one (1) city block in length (two (2) block faces constitute one (1) block in length) and does not encompass an intersection;
- The event is held between the hours of 8:00 a.m. and sunset; and
- Application for a permit is made at least thirty (30) calendar days prior to the event; provided, however, that the time limit may be waived by the chief of police in his or her discretion upon a determination of hardship to the applicant and no adverse effect on public health, safety or welfare.

Public Art Ordinance (Code of Ordinances Part III, Title I, Chapter 12)

In 2009 the Saint Paul City Council passed an ordinance in the Municipal Code that established the City of Saint Paul public art program. The ordinance established the principle that artists should be involved from the earliest stages of conceptual planning, and continue through project design and implementation.

For all capital projects funded by eligible sources resulting in a property to be operated by the City, one percent of eligible project costs shall be used for public art. Maintenance and restoration costs for the City's public art collection shall be funded by one-half of one percent appropriated annually from the City's capital improvement budget maintenance costs.

Assessments (Part III, Title IV, Chapters 61-65)

Chapters 61 through 65 establish authority and procedures for the City to assess property owners for maintenance and improvements within the public right-of-way. Specifically, chapter 61 establishes an annual program and assessment procedures for tree maintenance; chapter 62 establishes an annual program and assessment procedures for street maintenance services; chapter 63 establishes assessment procedures for the installation of water pipes; chapter 64 establishes the process, procedures and calculations associated with establishing a local improvement district, including the combined sewer separation program; and chapter 65 establishes assessment procedures for certain improvements to designated heritage preservation buildings and certain improvements to public realm aspects of non-designated buildings in the B4 and B5 zoning districts.

Assessments (Part III, Appendices, Chapter A-8)

Chapters A-8 establishes special assessment policies for first time street construction and reconstruction. The policy establishes assessment rates by improvement type and defines exceptions and special cases.

3

Design Treatments





Street Design Treatments

Behind the Curb



This section includes:

- Sidewalks and The Zone System
- Boulevard Planting
- Street Tree Planting
- Rain Gardens
- Bio-Infiltration Systems
- Roadway Lighting
- Driveways
- Bicycle Parking
- Wayfinding
- Site Planning
- Off-Street Paths
- Stairways

Between The Curbs



This section includes:

- Travel Lanes
- Parkway
- Bridges
- Transit
- Access Management
- Bicycle Facilities
 - Bike Lanes
 - Buffered Bike Lanes
 - Counter-flow Bike Lanes
 - Shared Lane Markings
 - Climbing Lanes
 - Cycle Tracks
 - Bicycle Boulevards
- Bike Lanes at Intersections
- Traffic Calming
- Convertible Streets
- Alleys

Intersections



Regarding Dimensions Depicted in Cross-Sections:

Saint Paul rights-of-way are typically 60', 66' or 80' wide. In all cases, typical cross-sections must fit within existing right-of-way constraints. Ranges vary based on available right-of-way and existing curb to curb width. In addition, the cumulative relationship between lanes must be taken into account when selecting lane width. In general, multiple minimums should be avoided (i.e., minimum center turn lane, inside lane, curb lane and sidewalk).

This section includes:

- Corner Curb Radii
- Bump Outs
- Skewed Intersections
- Roundabouts
- Channelized Right Turn Lanes
- Marked Crosswalks
- Mid-Block Crossings
- Over and Under Crossings
- Pedestrian and Traffic Signals
- Rectangular Rapid Flash Beacon (RRFB)
- Leading Pedestrian Interval (LPI)
- High Intensity Activated Crosswalk (HAWK) Signal

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Sidewalks and the Zone System

Definition

Sidewalks provide pedestrians with space to travel within the public right-of-way that is separated from motor vehicles. Four zones make up the area between the edge of the outside travel lane and the edge of the right-of-way: the Curb Zone, the Boulevard Zone, the Pedestrian Zone, and the Frontage Zone. The width and character of the zones will vary depending on the adjacent land use, available right-of-way, and intended function.

Sidewalks provide access to destinations such as transit, schools, employment and shopping. They also serve as a place for social walking, physical activity, lingering, and people-watching. Narrow sidewalks do not support lively pedestrian activity, and may create dangerous conditions making people walk in the street. The preferred widths for each sidewalk zone are provided under “Design Considerations”.

Although the boundaries between the four zones can sometimes be blurred, each zone serves a distinct purpose.

The Curb Zone is the area between the roadway and the Boulevard Zone. Rolled or mountable curbs should not be used where motorists are not intended to park on the Boulevard Zone and sidewalk. The Curb Zone should be clear of any vertical elements to allow for access from parked vehicles. The curb zone is also where curb cuts are placed.

The Boulevard/Furnishing Zone is the area between



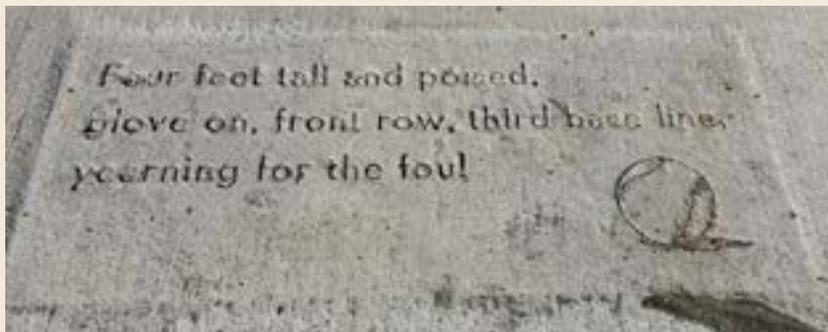
Credit: Michael Richardson

the Curb Zone and the Pedestrian Zone. This is where vegetation, utilities, bike parking and street furniture should be located. This zone organizes objects away from pedestrian flow, and simultaneously provides a buffer for pedestrians from the roadway, space for storm-water management, and snow storage. Sidewalk cafes and public art may also be placed within this zone. A buffer between pedestrians in the Pedestrian Zone and motor vehicle traffic creates greater levels of comfort and safety. Vertical objects in the Boulevard/Furnishing Zone must be strategically placed to not obstruct sight lines, prevent damage from vehicles on the street, and to allow for access to and from parked cars.

This zone should also be designed to accommodate snow storage in the winter to prevent snow from obstructing the Pedestrian Zone. Green infrastructure elements should be designed to make use of storm-water runoff from the sidewalk and/or the street.

Placemaking / Public Art Opportunity

Public art may be integrated into the sidewalk surface provided it does not create a tripping or slipping hazard and meets ADA guidelines.



Applicability and Use

General

The Pedestrian Zone is the area of the sidewalk corridor that is specifically reserved for pedestrian travel. It should function in all weather conditions. It is desirable that this zone should provide five feet minimum clear width free of any physical obstructions to allow for free pedestrian movement. In areas with higher pedestrian volumes (existing or anticipated) the width should be expanded. Generally, street furniture, plantings, outdoor seating, surface utilities, and other elements should not protrude into the Pedestrian Zone.

The Frontage Zone is the area between the Pedestrian Zone and building frontages, which may incorporate public right-of-way (where available) or private property (where building setbacks have been provided). The Frontage Zone provides a buffer for pedestrians from building entrances and architectural elements and may also provide space for sidewalk cafés, window shopping, or landscaping.

- Sidewalks with Boulevard/ Furnishing Zone should always be provided on both sides of the street. Curbside sidewalks should be provided only in extreme circumstances where right-of-way is constrained and adjacent property is built-out.
- For new developments and where opportunities are available to create additional setback, site designs should accommodate wider sidewalks with generous Boulevard/ Furnishing Zones.
- Where minimum Boulevard/ Furnishing Zone widths cannot be provided due to right-of-way constraints, parked cars and/ or bicycle lanes can provide an acceptable buffer between traffic and the sidewalk.
- Sidewalks should be present on both sides of all arterial streets.
- New sidewalks are currently 100 percent assessed to the adjacent property owners. Sidewalk replacement or repair are not typically assessed to adjacent property owners.

Sidewalks and the Zone System

Design Considerations

- The width and design of sidewalks will vary depending on street typology, demand, and available right-of-way, and should, to the extent possible, adhere to the dimensions in the table below.
- The Pedestrian Zone should, as much as possible, keep to the natural path of pedestrian travel parallel to the roadway. Ideally, they will be located in a position that naturally aligns with crosswalks at intersections.
- It may be desirable in some spot locations for the Pedestrian Zone to curve to form a more direct route to an intersecting walkway, to preserve significant trees, or to provide a greater degree of separation between the sidewalk and the roadway.
- The Pedestrian Zone must meet load-bearing, friction, and other requirements as per relevant standard plate and regulations.
- The Pedestrian Zone should be clear of any obstructions including utilities, traffic control devices, trees, and furniture. Permeable paving should be utilized wherever possible (i.e., where all applicable standards can be met).
- Refurbished, reused and recycled materials should be considered.
- The area within 24 inches of the face of curb should be kept free of all obstructions.
- When reconstructing sidewalks and relocating utilities, all utility access points should be relocated outside of the Pedestrian Zone, where possible.
- Refer to ADA requirements for sidewalk design. All new sidewalks and curb ramps shall comply with ADA regulations.
- In certain contexts (e.g., business districts, historic districts, major transit stops) above standard pavement materials such as brick, stone or textured concrete may be desired. In such cases a maintenance agreement that identifies the entity responsible for ongoing maintenance will be required.
- In historic districts, sidewalk scoring pattern may be regulated by the guidelines of the district.

Frontage Zone

- Where buildings are located against the back of the sidewalk and constrained situations do not provide width for the Frontage Zone, the effective width of the Pedestrian Zone is reduced by 1 foot, as pedestrians will shy from the building edge.
- The Frontage Zone should be maximized to provide space for cafés, plazas, and greenscape elements along building facades wherever possible, but not at the expense of reducing the Pedestrian Zone beyond the recommended minimum widths.
- The minimum width of the Frontage Zone necessary to accommodate sidewalk cafes is 6 feet.

Pedestrian Zone

- In high volume, high density pedestrian areas the Pedestrian Zone should be balanced with other zones to accommodate large amounts of pedestrian traffic.

Boulevard/ Furnishing Zone

- Utilities, street trees, and other sidewalk furnishings should be set back from curb face a minimum of 18 inches.
- Utility boxes should be placed as far from the intersection as possible to maintain sight triangles for pedestrians, cyclists, and motorists.
- The minimum width of the Boulevard/ Furnishing Zone necessary to accommodate sidewalk cafes is 8 feet (including 2 feet of clearance from face of curb).
- Permeable paving may be considered where appropriate. Refurbished, reused and recycled materials should be considered.
- Areaways and vaults may limit the possibility of having plantings and street trees.
- The area within 24 inches of the face of curb should be kept free of all obstructions.

Curb Zone

- The Curb Zone should be free from all objects, furniture, sign posts, etc.

Sidewalks and the Zone System

Zone Definition & Widths

STREET TYPE	Frontage Zone		Pedestrian Zone		Boulevard & Furnishings Zone		Curb & Gutter (varies)
	Pref.	Min. des.	Preferred	Minimum Desirable	Pref.	Min. des.	
Downtown Streets	2'	0'	12'	8'	6'	5'	Curb & Gutter (varies)
Mixed-Use Corridor Streets	2'	0'	8'	6'	6'	5'	
Residential Corridor Streets	2'	0'	5'	5'	6'	5'	
Neighborhood Streets	2'	0'	6'	6'	6'	5'	
Industrial Streets	2'	0'	5'	5'	6'	5'	
Parkways	Varies		6'	5'	10'	6'	

Table Notes: St. Paul is a built environment. These dimensions reflect ideals which may or may not be achieved.

Section

Introduction
 Street Design: Behind the Curb
 Street Design: Between the Curbs
 Street Design: Intersections
 Implementation

Street Type Application

Downtown
 Mixed Use Corridor
 Residential Corridor
 Neighborhood
 Industrial
 Parkway

Related Treatments

Boulevard Planting
 Roadway Lighting
 Off-Street Paths
 Travel Lanes
 Marked Crosswalks
 Pedestrian and Traffic Signals
 Bump Outs

References

MnDOT Design Manual
 State Aid Manual
 Comprehensive Plan
 Standard Plates

Boulevard Planting

Definition

Boulevard planting typically consists of turf grass located in the planting zone and are maintained by the adjacent property owner. Plantings may include other species when planted and maintained by adjacent property owners, residents or businesses.

Applicability and Use

All boulevards are public property and subject to the conditions stated in City Ordinance Chap. 105, "Care and Maintenance of Boulevards". Boulevard plantings are most appropriate on streets where there are fewer demands on the limited space within the right-of-way, less parking turnover, and more hospitable growing conditions, such as on residential corridor streets and on traditional neighborhood streets. Parkways may have plantings that are selected, planted and maintained by the Parks Department to create a unique aesthetic character for that street.

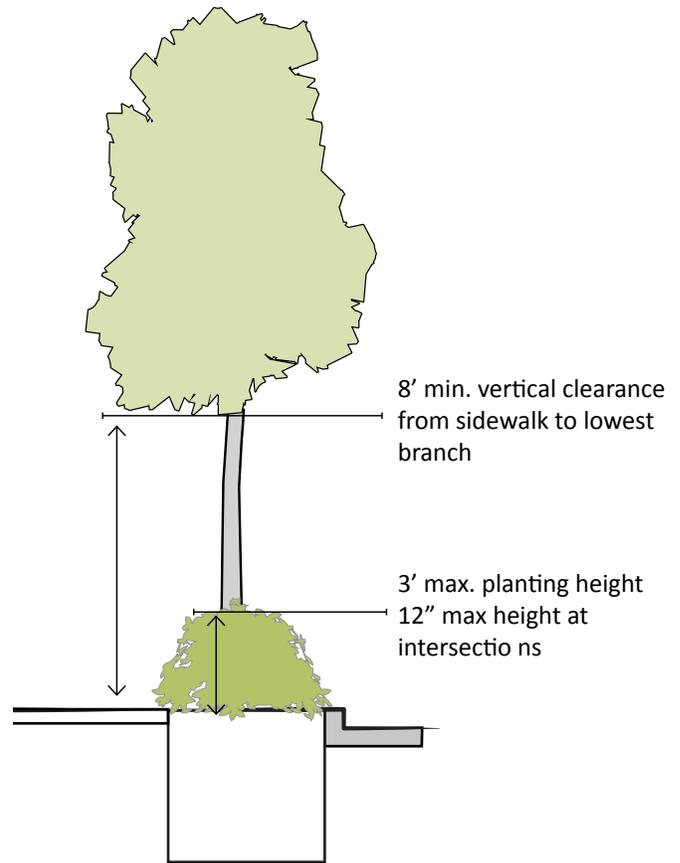


Credit: Gina Coffman

Design Considerations

The primary concerns regarding understory plantings are pedestrian access, security, visibility, and ongoing cost and ease of maintenance. Consequently:

- Plantings shall conform to zoning requirements, including:
- Within 30 feet of intersections and corners, plants must not exceed 12 inches.
- Other plants must not exceed a height of 36 inches.
- Plantings shall be maintained in such a way that there is no overhang or encroachment onto the sidewalk, curb or street area.
- Any structure, such as a raised planter, requires an obstruction permit.
- When placed adjacent to on-street parking, plants should be located away from 'door zone' of parked cars, typically 2 feet from the curb.
- Plantings should be salt and drought tolerant.
- Plantings should be selected and planted as to not interfere with street tree health.
- Irrigation may be considered in conditions where there is limited ability to capture adequate rainwater and will require an ongoing maintenance agreement.



Section

Street Design: Behind the Curb

Street Type Application

Downtown
Mixed Use Corridor
Residential Corridor
Neighborhood
Industrial
Parkway

Related Treatments

Street Tree Planting
Rain Gardens
Bio-Infiltration Systems
Bump Outs
Off-Street Paths

References

Blooming Saint Paul
Saint Paul Boulevard Planting Ordinance
Saint Paul Street and Park Tree Master Plan
Comprehensive Plan

Street Tree Planting

Definition

Street trees are those growing within the public right-of-way and are one part of the broader community forest. They are typically located between the curb and the sidewalk and or/ within medians. Trees provide many ecological benefits to the city and also help to define a street corridor.

Applicability and Use

Street trees offer the following environmental, economic, social, and health benefits:

- Experiential quality for pedestrians, such as sense of enclosure, shade, and protection from elements
- Energy conservation.
- Air quality improvements.
- Oxygen production, carbon sequestration and storage.
- Reduction of UV radiation and the heat island effect.
- Rainwater interception, infiltration, and improved water quality.
- Creation of visual friction that may discourage speeding.
- Buffering of pedestrians from travel lanes.
- Increase in economic activity and value of communities.
- Social, aesthetics, place-making and psychological benefits through their beauty and transformative potential.
- Habitat for birds and wildlife.

Urban environments, however, are a very challenging setting for the urban forest. Plantings are at risk from physical damage from vehicles and people, litter, air and water pollution, extreme temperature fluctuations and other weather conditions. Soil structure and volume are critical to tree establishment, growth, and health. Street trees often struggle to thrive due to inadequate soil volumes and poor or compacted soils which can limit available soil moisture, oxygen and nutrient exchange. Street trees may struggle to thrive due to limited soil volume, poor soils, soil compaction, and lack of oxygen, poor drainage or irrigation, and deicing salt. For these reasons, boulevard plantings must be thoughtfully selected, located, and provided with supportive growing conditions to achieve their intended objectives and allow plants to succeed.



Credit: Anton Jerve

Because boulevard areas also provide space for utilities and street furniture that serve both the street and the Pedestrian Zone, the extent and design of street tree plantings will vary from street to street.

The Street and Park Tree Master Plan identifies tree selection criteria and provides district tree planting maps to guide tree selection.

Design Considerations

Selection

Species diversity is important to the long term health of the community forest, and can be facilitated by selecting two or more tree types to plant along a street while coordinating species diversity at the neighborhood and city scale. Continuous rows of the same tree species can be susceptible to diseases and pests and should be limited in use.

General guidelines for tree selection and installation include:

- Tree species characteristics should be understood when selecting trees as these may influence maintenance requirements, sight lines, shading levels, and aesthetics. Species characteristics to consider include:
 - Form, texture, seasonal variation
 - Maintenance requirements
 - Foliage density including shading levels and the possibility of foliage to obscure buildings and signs
 - Leaf debris and fruit production.

Tree species must correlate to boulevard width and available soil volumes:

- Narrow planting spaces such as small streets, alleys, and medians call for trees with columnar form.
- Wider streets and medians, such as mixed-use streets can support larger trees with overarching canopies.
- Avoid utility conflicts, including overhead wires and underground utility infrastructure.
- Street classifications will influence species selection. For example, tree branching structure should be considered for truck routes.
- Tree selection should respond to adjacent land uses.

Spacing Recommendations

- Ornamental trees: 20-30 feet minimum on center
 - Trees that have a maximum height of 25 feet and can be used in restricted areas where overhead clearance is a factor (e.g., under power lines)
- Canopy trees: 30-40 feet on center
 - Trees that have a minimum height of 30 feet and provide a significant ‘canopy’ over the street and adjacent properties
- Street lights: Maintain 15 feet minimum between street lights and tree trunks
- Stop sign or other traffic control: Place trees 30 feet minimum from corner
- Hydrants, driveways, or utility poles: Place trees 10 feet minimum from object.
- Check standard lines of sight based on street classification.
- In historic districts, tree selection and spacing may depend on district guidelines and approval through the Heritage Preservation Commission.

Planting Environment

Street trees need adequate soils, soil moisture, and soil volume to support tree establishment and growth. Whenever possible, street trees should be planted in continuous beds rather than isolated tree basins to provide larger, shared rooting space. When large planting beds are not possible, the use of root trenches to connect separate soil volumes should be considered. Above all, tree basins should be sized to support the proposed tree at mature size; and tree species should be selected based on the proposed growth space and soil volumes.

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[Bio-Infiltration Systems](#)

References

[Blooming Saint Paul](#)
[Saint Paul Boulevard Planting Ordinance](#)
[Saint Paul Street and Park Tree Master Plan](#)
[Comprehensive Plan](#)

Street Tree Planting

Design Considerations Continued

Best management practices recommend that for every 1 square foot of mature canopy cover, 1.25 to 2 cubic feet of soil be provided to support tree growth and root development. The use of rock based structural soils may require an adjustment of total volume as the rock may account for up to 70 percent of the total soil volume. Planting bed design standards using structural soils are available from the City Forester.

Pedestrian traffic and vehicle access through the Planting/Furnishing Zone can cause soil compaction which impacts soil structure and tree health.

- Where traffic is minimal, boulevards should be covered with mulch, turf grass, or ornamental plantings. A mulch ring around the tree retains soil moisture, cools soils, prevents soil compaction, and reduces maintenance.
- Permeable hardscape, such as pavers, may be used in commercial area Planting/Furnishing Zones to limit soil compaction where there is higher pedestrian traffic. When using pavers, a structured soil must be used and an opening of several inches should remain around the trunk to allow for tree growth. Pavers are an above standard material and require an additional assessment and agreement with adjacent property owners for ongoing maintenance.

Adjustable tree grates are generally not considered a best practice, but may be considered in select situations with the approval of the City Forester.

A number of new practices are being employed to help trees succeed in urban environments. These include:

- Engineered or structural soils, modular structural armatures and suspended pavements.
- Permeable paving.
- Enhanced soil preparation and amendments.
- Stormwater infiltration practices.

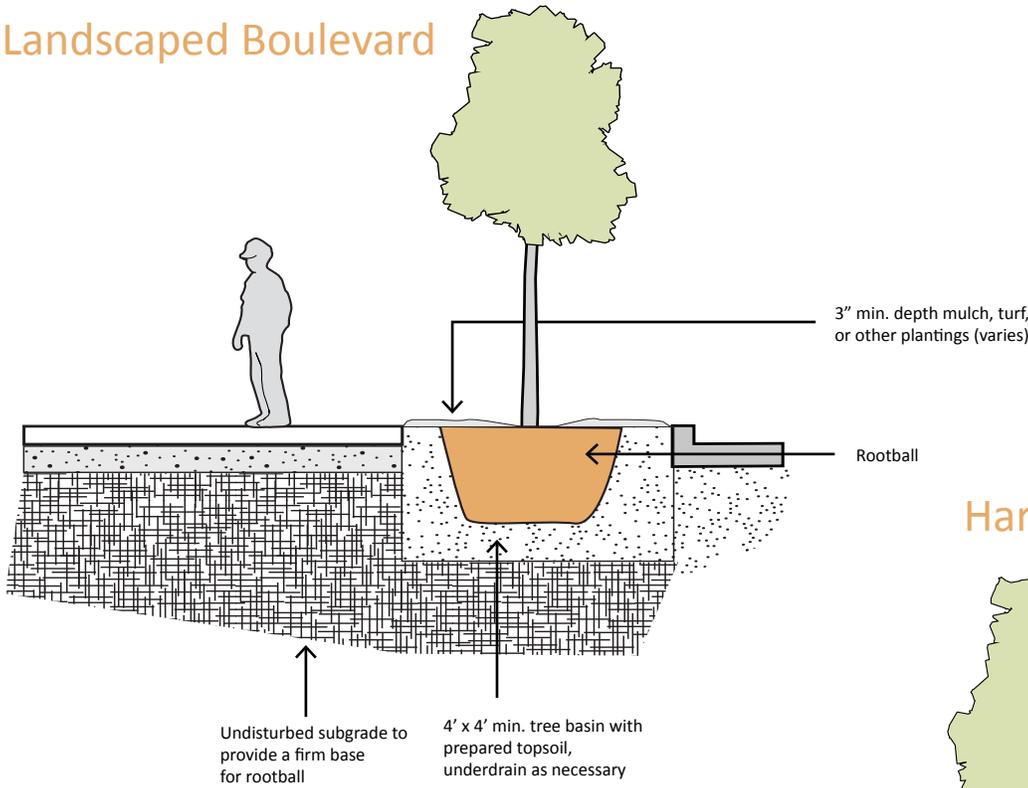
The prevention and mitigation of tree and soil damage during construction and street maintenance projects is critical to both the long term health and success of urban trees and reducing costs associated with tree replacement, corrective maintenance, and boulevard restoration.



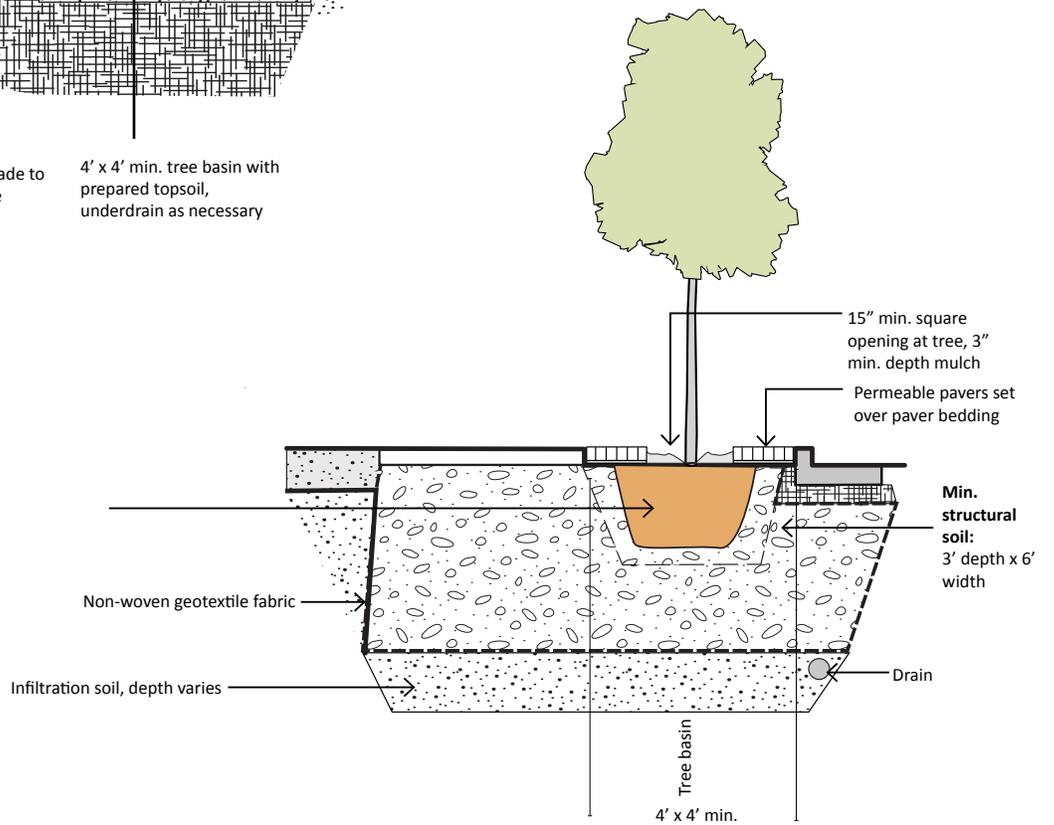
Maintenance

- The Department of Parks and Recreation-Forestry maintains public boulevard and park trees.
- The planting, pruning, treatment, or removal of trees in boulevards and street right-of-way requires a permit issued by the Department of Parks and Recreation-Forestry prior to the start of any work.
- Regular watering should be provided by adjacent property owners for newly planted trees.
- Consider ongoing ADA compliance and maintenance of surface treatments over the life of a tree.
- Where pavers, tree grates, or guards are used, maintenance must be provided to remove the pavers, inner rings of the tree grate, and adjust or remove the tree guard as the tree grows.
- Consider the use or design of tree protection measures that reduce unintentional injury to trees caused by turf maintenance, snow removal, and other activities that can impact tree growth and increase tree mortality.

Landscaped Boulevard



Hardscaped Boulevard



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Rain Gardens

Definition

A rain garden is a landscaped depressed area that can hold stormwater runoff from impervious surfaces (such as a street) while it infiltrates into the soil below. Native plants (forbs and/or grasses) are often a defining characteristic, increasing ecological value, aesthetics, and overall infiltration capacity. Rain gardens are created behind the curb by depressing (excavating) the boulevard below the flow line of the gutter and utilizing a curb-cut opening to allow stormwater runoff to enter from the street.



Credit: Michael Richardson

Applicability and Use

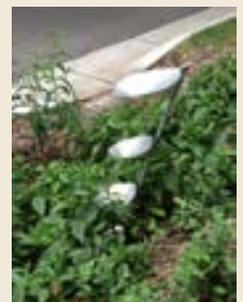
- Requires commitment from adjacent property owners for ongoing maintenance.
- Use in commercial areas should be carefully considered due to potential tripping hazards as well as high levels of litter and sediment that can frequently accumulate in the rain garden.
- May be considered during Residential Street Vitality Program (RSVP) design to plan for needed curb-cuts and associated excavation. Costs of plant materials, installation, and ongoing maintenance are typically provided by a third party and must be determined before including rain gardens in boulevard design.
- May be used to retrofit existing streetscapes to increase neighborhood aesthetics and enhance natural drainage. Property owners must obtain all proper right-of-way permits, as well as adhere to City rain garden maintenance policy and boulevard codes.
- May be used in areas with grade change of flat topography (typically 5 percent or less); use of retaining walls is discouraged and requires additional review.
- If designed and installed by a jurisdiction other than the City, then a license agreement is applicable.
- Rain gardens are not typically used to meet stormwater regulatory requirements.

Placemaking / Public Art Opportunity

Public art can add a focal point to rain gardens. Saint Paul Public Works and the City Artist in Residence Program have worked with artists to create art for rain gardens built as part of the RSVP program. Public art in rain gardens should be compatible with a wet environment.



Brad Kaspari



Brad Kaspari

Design Considerations

- Existing subsurface conditions should always be evaluated prior to design.
- Areas of shallow bedrock, high water table, and contaminated or poorly draining soils should be avoided. Utility conflicts such as water, sewer, gas, electric, fiber optic, etc. should be avoided.
- Where infiltration is constrained but the overall system is still warranted, impermeable liners and underdrains can be incorporated to allow the system to filter stormwater runoff before returning to the storm sewer system.
- Width will be dictated by space available between curb and sidewalk.
- Length will vary based on numerous constraints, Utilities, carriage walks, driveways, and lighting fixtures are typical structural constraints. Existing trees are ecological constraints; rain gardens should not be excavated within the drip line of an existing tree canopy.
- Side slopes should be no greater than 33 percent to allow for proper safety, access and maintainability. Railings are required for slopes steeper than 3:1 and must be reviewed per encroachment permit.
- A 2 foot flat buffer should be included adjacent to both a sidewalk and curb.
- The curb-cut inlet should provide a sturdy, stabilized path for stormwater to enter the rain garden from the street, in order to prevent erosion or damage.
- Plant selection can vary widely. A moderate diversity of native forbs and grasses is encouraged. Too many species can complicate weeding for those other than master gardeners
- Trees may be planted with the consultation and approval of the City Forester.

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Saint Paul Boulevard Planting Ordinance
Saint Paul Street and Park Tree Master Plan Comprehensive Plan
MN PCA--Plants for Stormwater Design Capitol Region Watershed District
Ramsey-Washington Metro Watershed District

Bio-Infiltration Basin Systems

Definition

A bio-infiltration basin stormwater system is a large-scale, depressed landscaped feature intended to hold a specified amount of stormwater runoff from moderate to relatively high amounts of impervious surface. Stormwater is retained while it infiltrates into the soil below. This system is distinguished from other similar “Behind the Curb” stormwater systems in that a bio-infiltration system may include a storm sewer inlet and/ or outlet, will hold a significant amount of runoff, and is typically maintained by a public agency, i.e., the City, a district council, or a watershed district.

Applicability and Use

A bio-infiltration basin is applied as an engineered system having a calculated storage volume to meet water quality design purposes. This part of the street infrastructure is typically implemented as an opportunistic retrofit to achieve noteworthy reductions in stormwater runoff. These are often part of a larger construction project and can be moderately to significantly expensive. While these can be developed to meet a regulatory purpose, because of their relatively large footprint, examples of this type of street infrastructure are somewhat rare citywide. This is a rapidly evolving facet of street design. (Note that street reconstruction projects required to meet stormwater rules typically construction infiltration ‘trench’ systems below the street pavement between curbs.)



Credit: Sarah Zorn

Placemaking / Public Art Opportunity

Public art may be integrated into the sidewalk surface provided it does not create a tripping or slipping hazard and meets ADA guidelines.



Troy Pillow

Design Considerations

- All bio-infiltration systems require a right-of-way permit.
- Existing subsurface conditions should always be evaluated prior to design.
- Utility conflicts (such as water, sewer, gas, electric, fiber optic, etc.), areas of shallow bedrock, high water table, and contaminated or poorly draining soils must be avoided.
- Where infiltration is constrained but the overall system is still warranted, impermeable liners and underdrains can be incorporated to allow the system to filter stormwater runoff before returning to the storm sewer system.
- Consider stormwater pre-treatment design options in order to prevent coarse sand and grit particles from prematurely clogging the system.
- Sunken portions of the feature adjacent to the sidewalk and/or on-street parking may require a railing to protect pedestrians from injury during winter months when snow can accumulate and obscure the abrupt drop-off.
- Bio-infiltration systems may require a negotiated maintenance agreement between the involved agencies.
- Use in commercial areas should be carefully considered due to high levels of litter and sediment, which can frequently accumulate in the bio-infiltration basin.
- May provide increased snow storage.
- May provide an opportunity for public art or corridor branding.
- Trees may be planted with the consultation and approval of the City Forester.
- All plants should be compatible with the system; often native plants (i.e., forbs) are suitable to these environments. Exposure to salt and the extreme conditions of wet and dry will dictate a narrow palette of plants that will succeed.

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Saint Paul Street and Park Tree Master Plan
Comprehensive Plan
MN PCA--Plants for Stormwater Design
Capitol Region
Watershed District
Ramsey-Washington
Metro Watershed District

Roadway Lighting

Definition

Street lighting is intended to prevent crashes and increase safety by improving visibility of roadways, intersections, crosswalks and other important activity zones in order to facilitate safe movement of motor vehicles, pedestrians and bicyclists during nighttime or low light hours.

Applicability and Use

- Illumination should supply a minimum light level along the segment with additional lighting to anchor and illuminate crossings.
- The amount of illumination required should be proportional to the width and classification of the roadway or intersection.
- Street lighting can be used to create an environment that feels safe and secure for pedestrians. Areas where personal security is an issue should be considered for enhanced lighting.
- Pedestrian-scale lighting may also be used to enhance and reinforce the character of the streetscape and facilitate neighborhood identity and wayfinding.
- Above standard illumination may also be targeted in areas with higher volumes of pedestrian traffic, a concentrated senior population, and land uses that generate pedestrian trips during evening hours. Examples include transit stops, major transfer points and routes, community facilities, and commercial areas. Costs are typically assessed to adjacent property owners.



Placemaking / Public Art Opportunity

Streets lights may provide opportunities for public art through poles, flags, or other installations or actual light installations.



Ross Lovegrove



James Brenner



Jack Sanders

Design Considerations

- The standard in Saint Paul is the single lantern lighting style. The use of consistent luminaire types creates a cohesive visual vocabulary and facilitates maintenance and replacement.
- A double lantern style light may be considered for above-standard lighting and would require special assessment and a maintenance agreement with adjacent property owners and/ or business association.
- In historic districts, other standards may be considered or required based upon the guidelines of the district and approval of the Heritage Preservation Commission.
- Large fluctuations between dark and light must be avoided as drivers' vision must continually adjust to varying light levels, thereby impairing vision.
- Light poles should be placed in the boulevard zone so as not to be blocked by tree canopies.
- Lighting levels, especially at intersections, should be periodically checked to ensure minimum lighting levels meet the need of the street based on the width, classification as well as for motorist, pedestrian and bicycle safety
- Light poles should be staggered, but spacing should be consistent with regard to trees and other street poles to the extent possible.
- White light (light emitting diode or LED, metal halide, induction, and fluorescent lamps) may be considered at intersections to improve pedestrian perception and sense of safety.
- Light poles should be placed in the boulevard and furnishing zone and located so that light isn't blocked by tree canopies.
- Where feasible, light poles should be located on the vehicle approach side (near side) of the crosswalk to enhance visibility of pedestrians for oncoming vehicles.
- Pedestrian-scale lighting can be used alone or in combination with roadway-scale lighting in high activity areas to encourage nighttime use and as a traffic calming device.
- Pedestrian-scale lighting should be closely spaced, allowing lower intensity illumination and avoiding large shadows.

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Sidewalks and the Zone System
 Street Tree Planting
 Marked Crosswalks

References

MnDOT Design Manual
 Comprehensive Plan
 Standard Plates
 FHWA Publication on Lighting

Driveways

Definition

Driveways provide access to properties from public streets.

Applicability and Use

Driveways occur wherever there are land uses that require vehicle access from the street network. Driveways often cross sidewalks, bike and parking lanes, and affect moving traffic. These crossings can create conflicts between various users. To the extent possible:

- The number of driveways should be minimized, particularly along commercial corridors, in order to minimize conflicts.
- As an access management principle, driveways should be avoided within the functional area of an intersection to reduce the potential for conflicts with turning vehicles and pedestrians in the crosswalk.

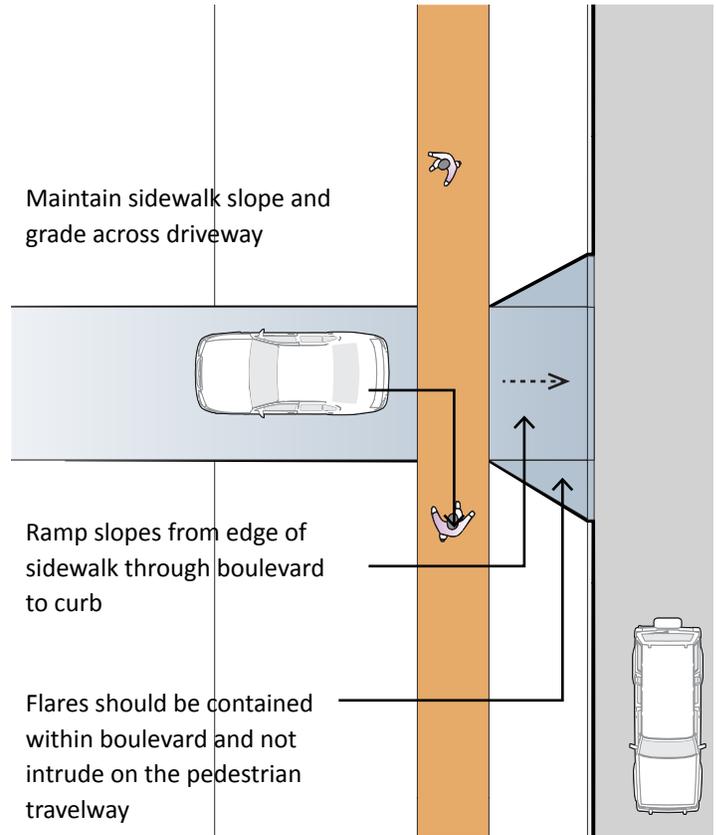


Credit: Anton Jerve

Design Considerations

As a general rule, driveways should be designed to look like driveways, not roadway intersections, and incorporate the following design principles:

- Sidewalks should be continuous across driveways at a continuous grade and cross-slope and the driveway flares should be contained within the boulevard space and not intrude on the pedestrian travel way.
- The pedestrian zone should be consistent with ADA guidelines to ensure that all pedestrians using wheeled mobility devices can safely cross the driveway.
- A standard driveway has a 4 foot flare on each side to prevent high speed turning movements.
- Driveway width should be minimized to the extent appropriate for traffic conditions, use, type and location.
- Driveways should be located outside the functional area of the intersection, with an absolute minimum of 100 feet from intersections in commercial corridors and 40 to 60 feet in residential corridors.
 - The functional area of an intersection includes areas upstream and downstream of the intersection. In contrast with the physical area of an intersection, the functional area varies depending on several site specific variables including: amount of queuing at an intersection; distance traveled during perception-reaction time; and declaration distance.
- In locations where a driveway must function as a leg of an intersection, it should be designed with pedestrian safety features such as crosswalks, small corner radii, and pedestrian signal indications if part of a signalized intersection.



- Truncated domes should not be used where driveways cross the sidewalk zone unless the driveway is functioning as a leg of an intersection and curb ramps are present.
- Site obstructions (signs, landscaping, decorative fencing, signal boxes, building features etc.) should be carefully located to maximize visibility between turning motorists and pedestrians at driveway.

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 Bump Outs
 Access Management
 Parking Enforcement

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MnDOT Design Manual
 State Aid Manual
 Comprehensive Plan
 Standard Plates

Bicycle Parking

Definition

Conveniently located bicycle parking is an important component of a multi-modal transportation system because it allows bicyclists to secure their bicycles at their intended destination, whether that is their place of work, a local business or attraction, or a transit station. Bicycle parking may be provided in a variety of forms depending on whether it is for short-term or long-term use (e.g., a brief shopping stop, or an all day event). Short-term parking may consist of individual or multiple bike racks placed within the furniture or building frontage zones of a street or high capacity corrals placed within the street itself (where there is a defined motor vehicle parking lane). Long-term parking may consist of racks or an array of racks that may be sheltered and placed in off-street locations such as parking garages/ lots or transit station entrances (e.g., cages, sheltered corrals). Long-term parking may be access controlled.



Credit: Michael Richardson

Applicability and Use

- Well-designed and placed bicycle parking promotes a more orderly streetscape, preserves the pedestrian right of way and prevents damage to trees and street furniture.
- It should be conveniently placed within close proximity to destinations such as businesses, parks, schools and other community facilities, and major transit stops and stations.
- Bump outs may present an opportunity for bicycle rack installation.
- In historic districts, bike parking design and placement may depend on district guidelines and approval through the Heritage Preservation Commission.
- In general, locating one or two racks at multiple locations along a block face are preferred to grouping all the racks at one location. In order to ensure there is adequate parking to meet demand, parking utilization should be periodically assessed, and additional parking should be provided where demand is high.
- In areas with high bicycle parking demand and limited space behind the curb and limited private bike parking, in-street corrals or other high capacity bike rack designs may be considered. In-street facilities require a right of way permit. Bump outs may present an opportunity for bicycle rack installation.

Placemaking / Public Art Opportunity

Bike racks present an opportunity for public art; however, the basic Design Considerations outlined on the next page should be adhered to.



Troy Pillow



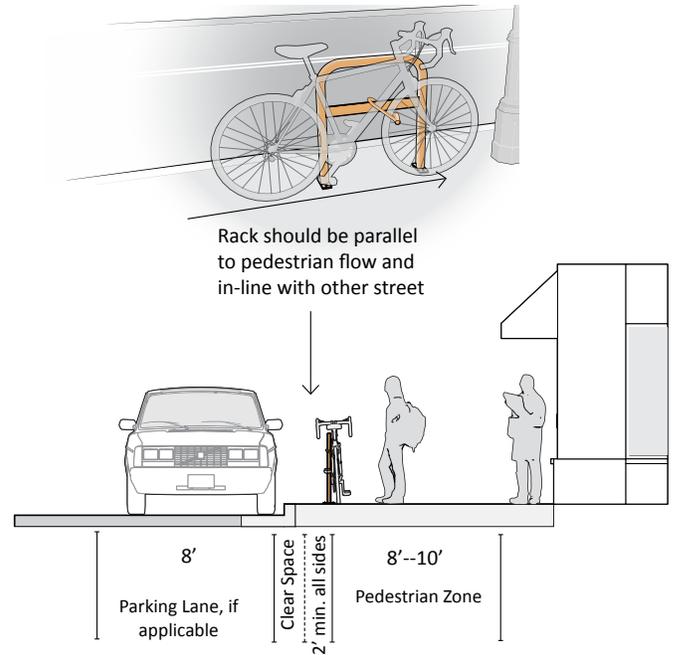
Kaylyn & Kyle Bancroft



Annaliese Bischoff

Design Considerations

- Bicycle racks must support the bicycle in at least two places to prevent it from falling over and allow locking of the frame and one or both wheels with a standard U-lock.
- Racks must be securely anchored to the ground and resist cutting, rusting and bending or deformation.
- A minimum 2 feet of clearance around the rack should be provided to allow users to access and securely lock the bicycle from the side. Adequate end clearance should also be provided to allow users to enter and exit the rack area.
- Bicycle racks must not interfere with bus loading/unloading areas.
- Generally, bicycle racks should be placed within the furniture or building frontage zones, where there is adequate room for a bicycle to be locked up without protruding into the pedestrian zone or the clear zone behind the curb.
- Bicycle racks should be placed on concrete or other similarly paved surface. Where bike racks are desired on a grass boulevard, a concrete pad or similar surface shall be provided.
- In-street bicycle parking (i.e., corrals) may be considered where there is on-street parking and high bicycle parking demand and limited other locations for public and private bike parking.
- In-street bicycle corrals require special consideration for street sweeping and snow removal and storage. Maintenance agreements may be required for in-street bicycle parking facilities to ensure they are cleared of snow and debris. In-street bicycle corrals may be seasonal, and may be removed during winter months to facilitate snow removal.”
- Bus stops, fire hydrants, turning bus movements, utility covers and sewer valves, parking meters, stormwater inlets, and adjacent landscaping obstacles should be considered when identifying a location for an in-street bicycle corral.



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Bump Outs
 Sidewalks and the Zone System

References

MnDOT Design Manual
 MN MUTCD
 APBP Bicycle Parking Guidelines
 AASHTO Guide for the Development of Bicycle Facilities
 Comprehensive Plan

Wayfinding

Definition

Wayfinding signs provide information about direction and distance to destinations, and may be focused on pedestrians, bicyclists, motorists, or oriented toward all user groups.

Applicability and Use

Wayfinding signs are part of a system of sequential destination information; thus, planning, placement, and maintenance are critical. Signs should be located only where they are needed. Pavement markings and public art can also be used as part a wayfinding system. The most effective wayfinding networks aim to achieve a balance between providing useful information, safety, and minimizing sign clutter.

Bicycle wayfinding signs should be posted on designated bike routes and shared-use paths to direct bicyclists around the citywide bike network and to major destinations. Pedestrian wayfinding should be limited to complex areas where a large number of pedestrians are routinely accessing similar destinations, such as downtown.

General Principles

- Messages must be clear and concise.
- Related signs should be combined to limit visual clutter.
- Signs should be limited in number and content as to not overpower the reader.
- Signs should be placed in such a way that primary regulatory signs are not overlooked.
- Groups of wayfinding signs should have a graphically standardized appearance.
- Signs must be maintained to ensure current information and adequate condition.

Placemaking / Public Art Opportunity

Public art in the form of route logos (see MUTCD) may be incorporated in the wayfinding signage provided it does not conflict with minimum horizontal and vertical clearance requirements.



Foster Willey



Brundith Phusombalert



Janet Zweg



Credit: Anton Jerve

- Destination names will be kept generic to the extent possible to avoid advertising.
- Private campus areas, such as a college campus, may provide a system of wayfinding to facilitate internal site circulation. These systems are developed independently from City wayfinding systems within the public right-of-way.

General Wayfinding

Primary signing may be accomplished through street name signs. The Saint Paul City Council determines street names. Street name signs follow MN MUTCD standards. Street name signs are posted on one of the quadrants at residential intersections. At collector and arterial street intersections signs are posted on diagonally opposite corners. Signs may be mounted on stand-alone posts, light poles, or on signal mast arms. The signs list the street name, generalized street address range for that block and, if on a bike route, a bike symbol. Street signs are installed in conjunction with street reconstruction and are replaced to maintain good visibility.

Design Considerations

Refer to Manual on Uniform Traffic Control Devices (MUTCD and MN MUTCD) standards for sign installation, such as mounting height, lateral placement from edge of path or roadway and other guidance.

- Mounting height should generally be above the eye of the intended user.
- Size of font should be legible to intended user.
- Signs should be combined horizontally or vertically, where possible.
- Lines of sight and visibility should be reviewed when placing signs.
- A sign should be as simple and as short as possible to convey the intended message.
- Pavement markings can also be used to assist with wayfinding in some locations and can also be a placemaking tool.
- Wayfinding may be part of a broader district wayfinding/ branding initiative.
- In historic districts, sign and structure design and placement may depend on district guidelines and approval through the Heritage Preservation Commission.

Pedestrian Wayfinding

- Pedestrian wayfinding is primarily provided near major attractions, such as theaters or event centers.
- Pedestrian wayfinding may be provided at key entry points to unique systems such as the downtown skyway system.
- Pedestrian wayfinding may be useful in areas where large volumes of pedestrians may be walking to transit stops, such as near light rail stations.
- Signs should meet all needs for public accessibility.

Bicycle Route Wayfinding

This guidance is appropriate for on-street bicycle routes or sidepaths adjacent to roadways.

- Route identification signs and/or wayfinding pavement markings may be placed generally every ½ mile, at the far side of intersections with major bike routes and at decision points.
- D11-1c series Bicycle Route Signs with route name, such as “CHARLES BIKEWAY,” in place of “BIKE ROUTE” or M1-8 series signs should be used to identify bicycle routes.
- Decision signs should be placed in advance of intersections with other major bike routes and at decision points.
- Decision signs should include destinations and directional arrows, and may include distance.
- D1-3 series Destination Supplemental Signs should be used and, where feasible, consolidated with route identification signs to minimize size and clutter.
- Destinations should be listed with the closest destinations towards the top of a sign assembly, with a maximum of three destinations used on any single sign.

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[AASHTO Guide for the Development of Bicycle Facilities](#)
[NACTO Urban Bikeway Design Guide](#)

Wayfinding

Design Considerations Continued

Trail Wayfinding

This guidance is appropriate for trails located on independent rights-of-way.

- Where bikeways managed by multiple agencies or from multiple systems share a common segment, wayfinding signs appropriate for both agencies or systems may be used.
- Wayfinding or route identification signs should be posted at all major decision points along the trail (feeder trail intersections, forks in the trail, etc.) and after all roadway crossings (local streets and arterials).
- Street name signs should be installed at all locations where trails intersect streets. This type of sign should have a sign blade for both the street name and the trail name.
- Wayfinding signs may be part of a larger regional network and/ or branding system.



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[MN MUTCD](#)
[Comprehensive Plan](#)
[AASHTO Guide for the Development of Bicycle Facilities](#)
[NACTO Urban Bikeway Design Guide](#)

Stairways

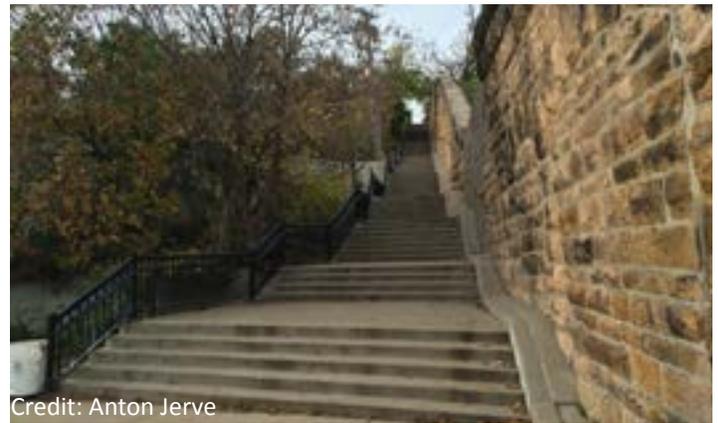
Definition

Due to the steep and sloping nature of some of Saint Paul's neighborhoods, some streets are connected by pedestrian stairways. The City of Saint Paul owns over 70 public stairways, most of which are in the street right-of-way. Many stairways in Saint Paul have been removed due to deterioration and insufficient funding to replace.

Applicability and Use

Stairways may be considered where the street network is discontinuous due to steep slopes in order to provide pedestrian connectivity.

Since stairways are not ADA accessible, great consideration should be given to other accessibility options for new or reconstructed facilities. ADA require the provision of pedestrian ramps, elevators, or other means. Existing stairways should be maintained as appropriate.



Credit: Anton Jerve

Design Considerations

- New stairways must meet all Americans with Disability Act Accessibility Guidelines (ADAAG) standards, such as for landings and handrails. Additional rest points with benches may be used for especially long staircases.
- Vegetation near stairs should be managed and maintained to improve visibility and light for safety.
- Public stairways may be historic or contribute to historic districts. Any improvements should be reviewed and considered based on applicable district guidelines and/or approval through the Heritage Preservation Commission.
- Signage is recommended to indicate that the pedestrian route utilizes the stairway and that it is a public facility.
- Periodic inspection should assess and prioritize stairways for repairs and/ or replacement. Repairs may range from replacing the handrail to removing and replacing the landings, treads, or concrete slabs. Repairs may trigger additional ADA requirements.
- The inclusion of bike wheel rails should be considered.
- Stairways should be augmented or replaced with ramps along bike routes or where no other alternative route exists.

Placemaking/ Public Art Opportunity

Stairways present an opportunity for public art; however, both the basic Design Considerations outlined on the next page should be adhered to.



Elizabeth Roy

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MnDOT Design Manual
State Aid Manual
Comprehensive Plan
Standard Plates
ADA Accessibility Guidelines (ADAAG)

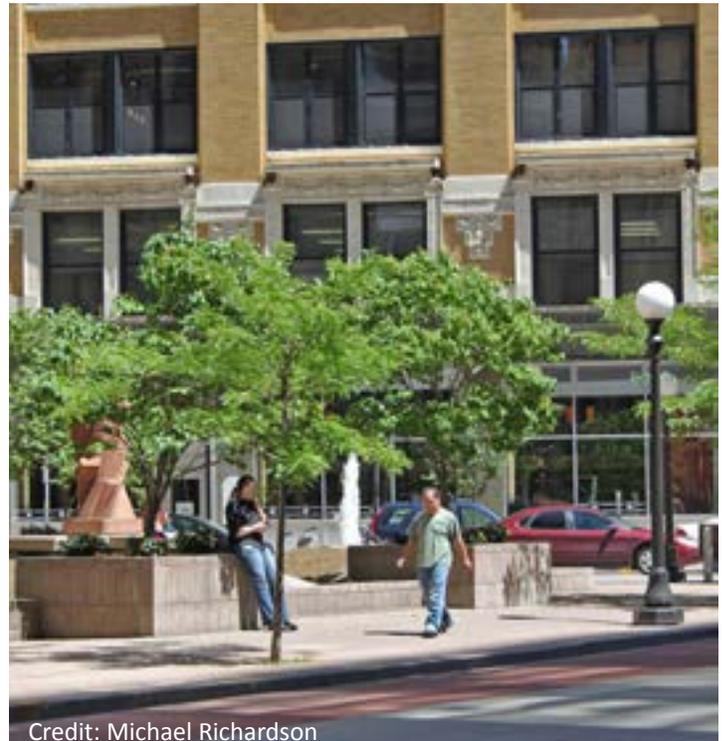
Site Planning

Definition

Site planning is the process of organizing and detailing specifics about or for proposed improvements (e.g., buildings, parking, utilities) to a given lot. Site planning considers how proposed improvements relate to the street and facilitate circulation between the street (and adjacent sidewalk) and the proposed uses. Review of accessibility and impact to the right of way are part of the site plan review process and Traffic Studies and Transportation Demand Management Plans may be required through the process.

Applicability and Use

A site plan is required for most development proposals within the city. Site plans must respond to requirements in the City's zoning code (Article IV), which varies by zoning district. Among the requirements in the zoning code that may impact the overall feel, safety and functionality of streets, and are addressed during the site planning process, are building (yard) setbacks and placement, minimum parking requirements, parking placement, plazas, and landscaping.



Credit: Michael Richardson

Placemaking / Public Art Opportunity

Public art may be incorporated into site plans in a number of ways, including within the building frontage zone or through visual connections from the sidewalk to the lot interior.



Susan Fiene



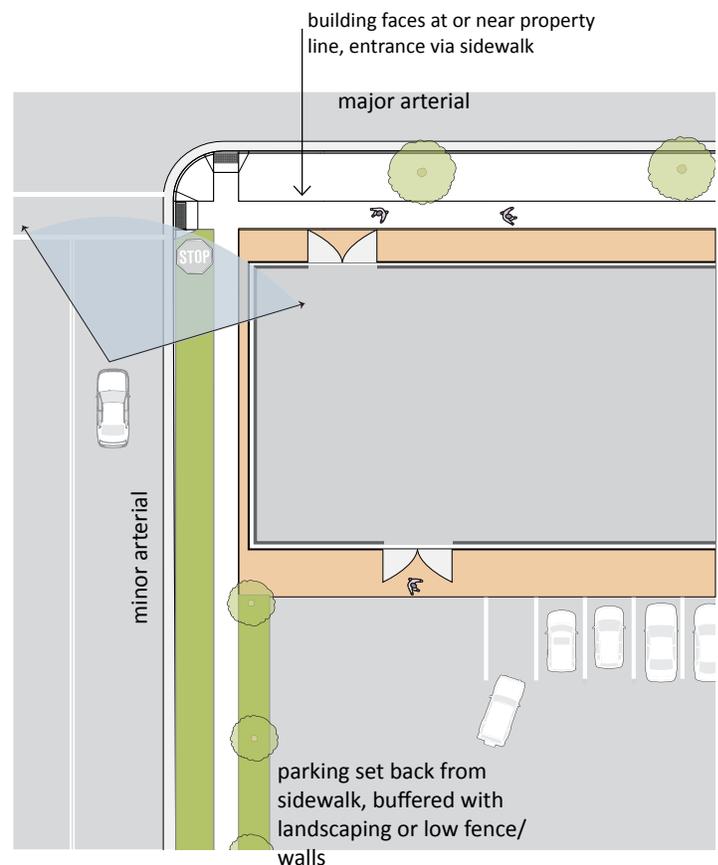
George Morrison



Joshua Cullaghan

Design Considerations

- New projects or buildings developed on large parcels should form new blocks and streets that create a comfortable and walkable block size to help complete the network of streets.
- On Downtown and Mixed Use Corridors where streets and urban form are envisioned to be more pedestrian-oriented, buildings should be placed in close proximity to the sidewalk allowing for pedestrian gathering space at corner or better sight lines, while providing for the preferred dimensions of each sidewalk zone and provide space for features such as sidewalk cafes.
- Off-street surface parking areas should preferably be located behind buildings (i.e., not abutting sidewalks) where feasible. Where surface parking areas must abut a sidewalk, it should be interior to the block where possible and should not generally comprise a majority of the lot frontage.
- Off-street surface parking areas abutting sidewalks should be buffered by landscaping and other features that serve to screen the parking use without impinging sight lines at driveways and activate the street frontage (e.g., seating areas). On other streets where pedestrian activity is lower (e.g., Residential Corridor) parking may be screened by landscaping and architectural elements.
- Structured parking that abuts the sidewalk on streets where pedestrian activity is high should incorporate high quality building materials and be screened by uses (e.g., ground-level retail), or other features (e.g., public art, seating areas) that activate the sidewalk area.
- The number of driveways should be limited and consolidated. They should be no wider than necessary and designed to allow motorists to see pedestrians on the sidewalk.
- Primary building entrances should be visible and directly accessible from the sidewalk.
- On-site bicycle parking should be conveniently located in relation to building entrances.
- Some sites in areas of poor connectivity may be required to have pedestrian and/or bike easements to improve access.



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Related Treatments

Sidewalks and the Zone System
 Driveways
 Access Management
 Bicycle Parking

References

MnDOT Design Manual
 Comprehensive Plan
 Standard Plates
 St. Paul Code of Ordinances:

- Chapter 63 (Off Street Parking)
- Chapter 66 (Zoning District Density and Dimensional Standards)

Off-Street Paths

Definition

Off-Street Paths are facilities that provide off-street space intended for use by bicyclists and/or pedestrians. They often parallel roadways and are typically separated from the roadway by boulevard space or a physical barrier. Off-street paths may be designated for one-way or two-way travel. Most off-street paths accommodate both bicyclists and pedestrians within the same space and are often referred to as shared-use paths. However paths may also be designated for exclusive use by bicyclists or pedestrians. A defining feature of off-street paths is that they place bicyclists and pedestrians in an off-street location, where they become subject to all applicable laws pertaining to pedestrian movement at intersections and driveways.

Applicability and Use

General

- Off-street paths are desirable along high volume or high speed roadways, where accommodating bicyclists within the roadway in a safe and comfortable way is impractical.
- Off-street paths typically have a lower design speed for bicyclists than in-street facilities do and may not provide appropriate accommodation for cyclists who desire to travel at greater speeds. In addition, greater numbers of driveways or intersections along a corridor can decrease bicycle travel speeds and traffic signals can increase delay for bicyclists on off-street paths compared to cyclists using in-street bicycle facilities such as bike lanes.
- Many cyclists express a strong preference for the separation from motorized vehicles provided by off-street paths when compared with on-street bike lanes. This may be especially true of less experienced or slower bicyclists. Off-street paths should not be considered a substitute to accommodating bicycles within the roadway.
- Off-street paths have a relationship with roadways similar to that of sidewalks to roadways, in that they function as parallel facilities located in close proximity to vehicle travel lanes. Conflicts with vehicles turning across the path of bicycles and pedestrians at driveways and intersections are an inherent drawback of off-street paths. Off-street paths are commonly used along recreational corridors, scenic corridors, or parkways, and may be part of a regional trail system.
- Off-street paths may be used to provide two-way bicycle and pedestrian travel adjacent to one-way roadways.



Credit: Michael Richardson

Placemaking / Public Art Opportunity

Public art may be placed alongside off-street paths provided it does not conflict with minimum horizontal and vertical clearance requirements.



Foster Willey

Design Considerations

General

- Off-street paths intended for use by bicycles should be designed to meet adopted guidelines. This includes widths, clearance, design speed, stopping and sight distance.
- Off-street paths intended for use by pedestrians must meet accessibility requirements under the Americans with Disabilities Act (ADA). Grades may meet but not exceed the grade of the adjacent roadway.
- Crossings must be designed in a way that facilitate sight distance for drivers, bicyclists, and pedestrians, provide stacking room for vehicles waiting to enter the roadway or cross the off-street path, and allow bicyclists and pedestrians to anticipate and react to vehicular turning movements.
- Off-street paths should be designed to maintain constant cross slope and running slope through driveways.
- The desired buffer width between the off-street path and the roadway is a minimum of 5 feet, with a desired minimum of 6 feet, and may be a planted boulevard. Plants must not exceed 36 inches or 12 inches within 30 feet of an intersection.
- One-way paths may be used in park settings to minimize conflicts between users where there are high volumes of bicyclists or pedestrians. Because pedestrians walk at relatively slow speeds, one-way pedestrian paths are generally not encouraged.
- When one-way paths for bicycles are desired, consideration should be given to discourage wrong way cycling.
- When one-way paths for bicycles are provided within roadway corridors, the paths in opposite directions should be provided in pairs. Generally a pair of one-way off-street paths will be provided on opposite sides of the roadway to allow bicyclists to travel adjacent to motorized traffic in the same direction.
- If an off-street path is for the exclusive use of bicyclists, a sidewalk or other pedestrian facility should be provided to ensure that pedestrians do not encroach into the facility intended for exclusive bicycle use.
- On a one-way path, an off-street facility may transition to an on-road bike lane or cycle track configuration in advance of an intersection or driveway. This allows cyclists to take advantage of the comfort of off-street paths in mid block locations with the operational benefits of in-street cycling at intersections.
- Enhanced traffic control devices such as bike signals at intersections may be appropriate in some locations.
- At intersections with low-volume minor roadways, the crossing of an off-street path and/or sidewalk may be raised, in the form a raised crosswalk, table or intersection to serve as a traffic calming feature for motor vehicles. Raised paths through intersections are more difficult to construct and maintain as grade present issues for ADA compliance and drainage.
- 12 feet is the minimum width for a shared use path.

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Related Treatments

Sidewalks and the Zone System
 Wayfinding
 Cycle Tracks
 Buffered Bike Lane

References

MnDOT Bicycle Facility Design Manual
 MnDOT Best Practices Synthesis and Guidance in At-Grade Trail-Crossing Treatments
 Comprehensive Plan
 MN MUTCD
 AASHTO Guide for the Development of Bicycle Facilities

Design Considerations Continued

- The following guidance may improve safety at minor intersection and driveway crossings:
 - Vehicle parking should be prohibited near an intersection to improve visibility.
 - Street or sidewalk furnishings should accommodate a sight triangle, or clear area at intersections, for vehicles attempting to cross a trail of:
 - 20 feet the from minor street crossings;
 - and 10 feet from driveway crossings.
 - Color, yield lines, and yield signage may be used to identify the conflict area and make it clear that trail users moving through the intersection have priority over entering and exiting traffic.
 - Motor vehicle traffic crossing the trail should be constrained or channelized to make turns at sharp angles to reduce travel speed prior to the crossing.

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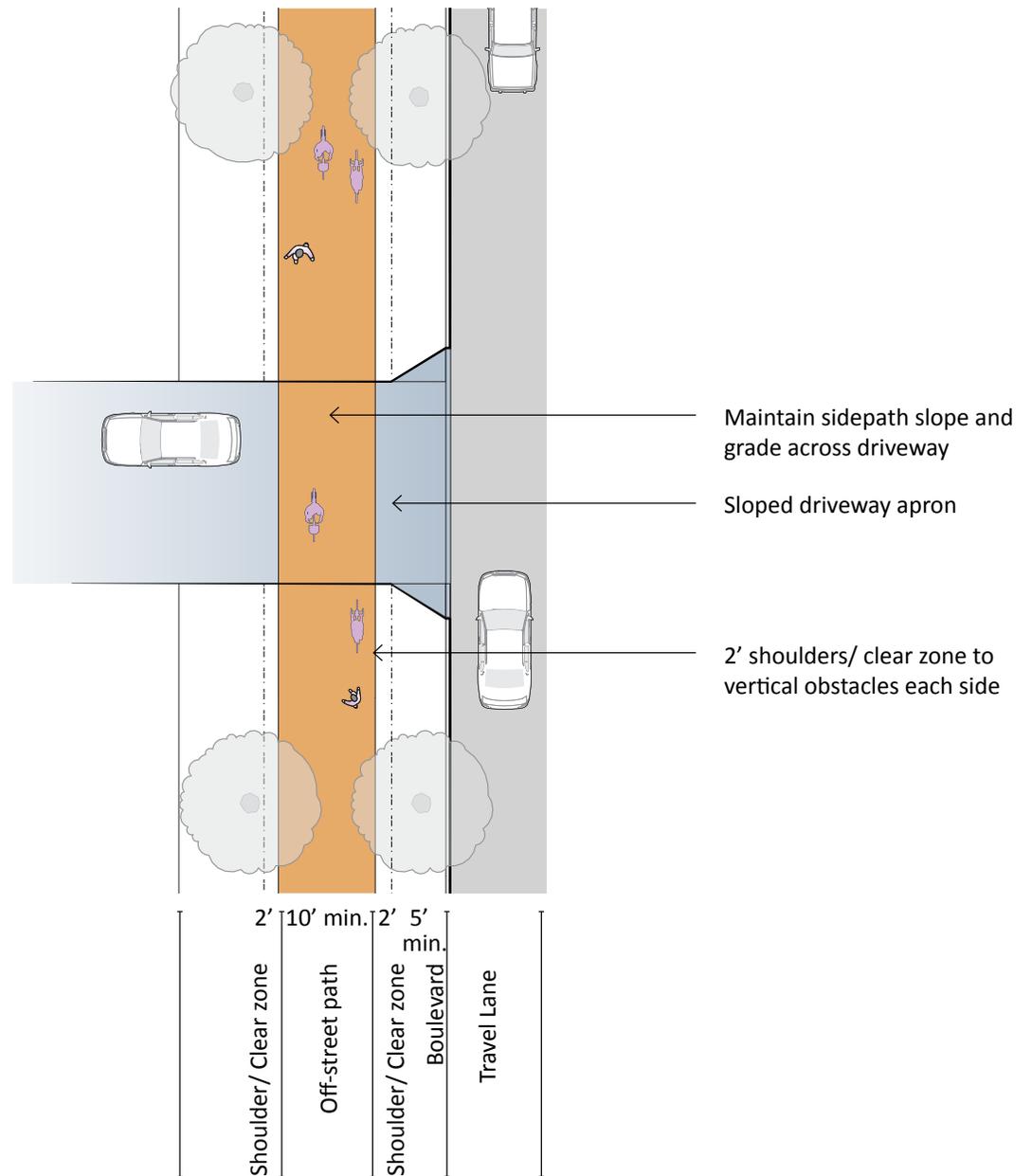
Related Treatments

Sidewalks and the Zone System
 Wayfinding
 Cycle Tracks
 Buffered Bike Lane

References

MnDOT Bicycle Facility Design Manual
 MnDOT Best Practices Synthesis and Guidance in At-Grade Trail-Crossing Treatments
 Comprehensive Plan
 MN MUTCD
 AASHTO Guide for the Development of Bicycle Facilities

Off-street Path at Driveway Crossing



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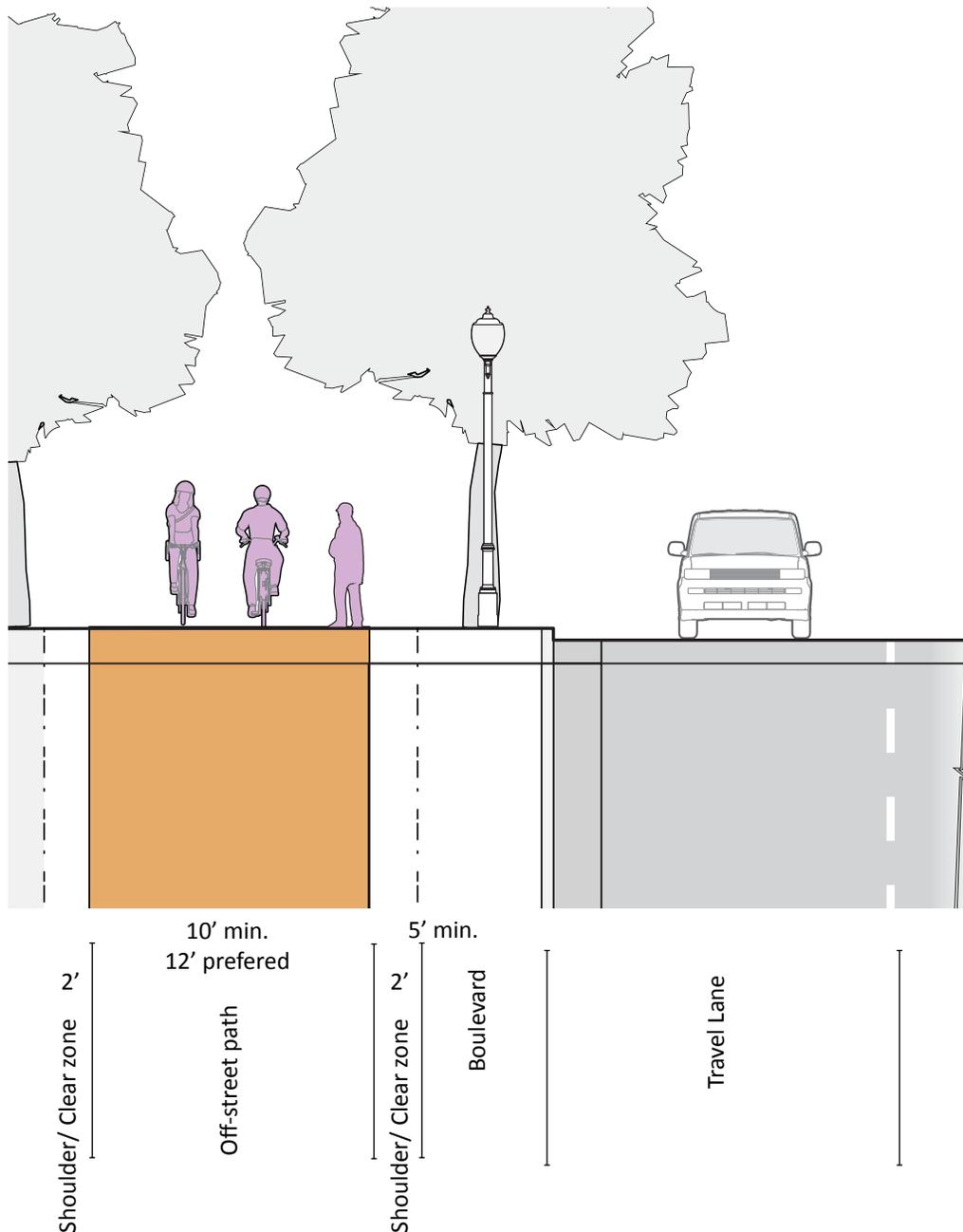
Related Treatments

Sidewalks and the Zone System
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References

MnDOT Bicycle Facility Design Manual
 MnDOT Best Practices Synthesis and Guidance in At-Grade Trail-Crossing Treatments
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Travel Lanes

Definition

The configuration and width of motor vehicle travel lanes and parking lanes has a great impact on the space available for other modes. Every foot of width between the street right-of-way lines is a precious commodity.

Application and Use

Lane widths should be considered minimums in design where trade-offs are required to meet the needs of all users. They should be applied to street reconstructions as well as projects where lane functionality is reallocated between existing curb lines.

A design exception may be required for some widths on federal or state-funded projects. State Aid requirements allow for travel lane widths of 10 to 12 feet, depending upon roadway classification, posted speed, and average daily traffic (ADT). Parking lane widths vary from 8 to 10 feet on the basis of daily volume and posted speed. State Aid requirements for streets without on-street parking include a curb reaction distance that varies from two feet to four feet, depending upon traffic volume, which is added to the minimum lane width. Conflicts with State Aid standards must be addressed on a case by case basis.

Due to coordination with other jurisdictions, minimum lane width values are categorized by the traditional highway based classification system. Decisions regarding lane widths in the city should support the desired characteristics of Saint Paul's future land use types.



Credit: Luke Hanson

Design Considerations

Considerations Regarding Lane Widths

- Narrowing lane widths and reclaiming space once dedicated for automobile traffic is an important tool in equitably dividing roadway space. In response to specific conditions on a given roadway, lane widths different from those prescribed below may be required. For information on how narrower lane widths impact capacity and average travel speeds see:

Potts, Ingrid B., Harwood, Douglas W., and Richard, Karen R. Relationship of Lane Width to Safety for Urban and Suburban Arterials. Washington, D.C.: Transportation Research Board, 2007.

- During reconstruction projects, space reallocated from vehicle lanes can be used to widen sidewalks, create bump outs, plant street trees or greenscape elements, install street furniture, implement bicycle lanes or cycle tracks, or provide on-street parking lanes through a lane diet.
- During resurfacing or restriping projects, installing minimum lane widths can provide additional space to install bicycle lanes or cycle tracks. On roadways with on-street parking, it is advantageous to provide additional width to either the parking lane or the bicycle lane, particularly in areas with high parking turnover, to reduce the likelihood that a bicyclist will be struck by a motorist opening a car door. This can provide additional benefit in winter when snow can narrow roadways.
- A capacity analysis is often necessary to evaluate the impacts of a proposed design on the operation of the roadway or the adjacent road network.

Multiple minimums

- The cumulative relationship between lanes and the sidewalk must be taken into account when selecting lane width. In general, multiple minimums should be avoided (e.g., minimum travel lane, bike lane and parking lane). The lane accommodating the most vulnerable mode should not be minimized.

Bus Lane

- A wider bus lane (14-16 feet) is preferred for shared bus and bicycle lane in order to allow for passing while staying in lane and to maximize bicyclists' comfort and safety.

Travel Lanes

- Wider lanes (11-12 feet) are appropriate in locations with high volumes of heavy vehicles (greater than 8 percent) or designated transit routes.
- Travel lanes immediately adjacent to on-street parking should provide a minimum combined parking and travel lane width of 18 feet.

Bicycle Lanes

- The preferred width for bicycle lanes is 6 feet in areas with high volumes of vehicles.
- Wider bicycle lanes (6 -7 feet) are preferred in locations with heavy parking turnover.
- Bicycle lanes 5 feet in width may be considered on non-arterial roadways when not adjacent to on-street parking, or where no vertical curb is present.

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[Bicycle Boulevards](#)
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[Off-Street Paths](#)
[Sidewalk and the Zone System](#)
[Roadway Lighting](#)
[Wayfinding](#)
[Traffic Calming](#)
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References

[Parks and Recreation System Plan](#)
[Blooming Saint Paul](#)
[Saint Paul Boulevard Planting Ordinance](#)
[State Aid Manual](#)
[MnDOT Design Manual](#)
[MnDOT Bicycle Facility Design Manual](#)

Travel Lanes

Design Considerations Continued

Parking Lanes

- In areas of low parking turnover, a 7 foot parking lane may be appropriate. In areas with high parking turnover and high volumes of bicyclists an 8 or 9 feet parking lane may be appropriate. 10 feet parking lane is required for heavy traffic (10,000 vehicles per day), high mix trucks, or turnover in parking.
- For lanes with peak hour parking restrictions 14 feet is the minimum width to accommodate shared use by parked vehicle and bicycles during off-peak times.

One-way vs. two-way streets

One-way streets are configured to allow for one direction of travel while two-way streets allow for two directions of travel. One-way streets may be configured to allow for the contra-flow of certain vehicles; usually transit or bicycles. One-way and two-way streets each provide advantages and disadvantages in terms of traffic operations, access, and pedestrian safety. In some cases existing one-way or two-way configurations may be reevaluated as part of an overall strategy to optimize street space and better accommodate all travel modes.

In terms of pedestrian safety, there are benefits of both one-way and two-way streets so the decision to convert a one-way street to two-way (or vice versa) is context-sensitive. Studies have shown that converting two-way streets to one-way generally results in fewer crashes involving pedestrians because there are fewer turning movements. However, one-way streets tend to encourage higher motor vehicle speeds, and may increase vehicular traffic if motorists are required to circle around to access destinations in a dense, urban environment. Two-way streets may reduce vehicle speeds due to increased turning movements and increased perceived friction along the

roadway. In addition, many one-way streets have multiple lanes, which may create a multiple-threat crash condition for pedestrians crossing the road.

One-way streets are often designed as part of a couplet system--a pair of one-way streets, typically separated by one city block--which often results in a higher vehicle capacity than an equivalent two-way street. In some cases developing a couplet system could be considered as an alternative to widening a two-way thoroughfare. This may be a beneficial option when trying to preserve pedestrian space, trees and other aesthetic features.

Converting one-way streets to a two-way streets may be an effective strategy for managing traffic patterns, reducing motor vehicle speeds, improving access to businesses, and changing the character of a neighborhood from being a 'pass-through' to a 'destination' for motorists. Many communities have found that local businesses benefit from one-way to two-way conversions because access is improved and motorists are more likely to stop and patronize businesses. Conversely, conversion of a two-way street to a one-way street may improve traffic operations while providing space for other street zone elements within the same right-of-way as the two-way option, such as a pedestrian plaza, bicycle facilities, or stormwater management features. If a street is converted to one-way, it should be evaluated to see if additional changes should be made. Potential changes include lane diets, road diets, bump outs, corner curb radius reductions, and signal timing that discourages higher vehicle speeds. Traffic circulation in the surrounding area must be carefully considered before converting streets to one-way or two-way.

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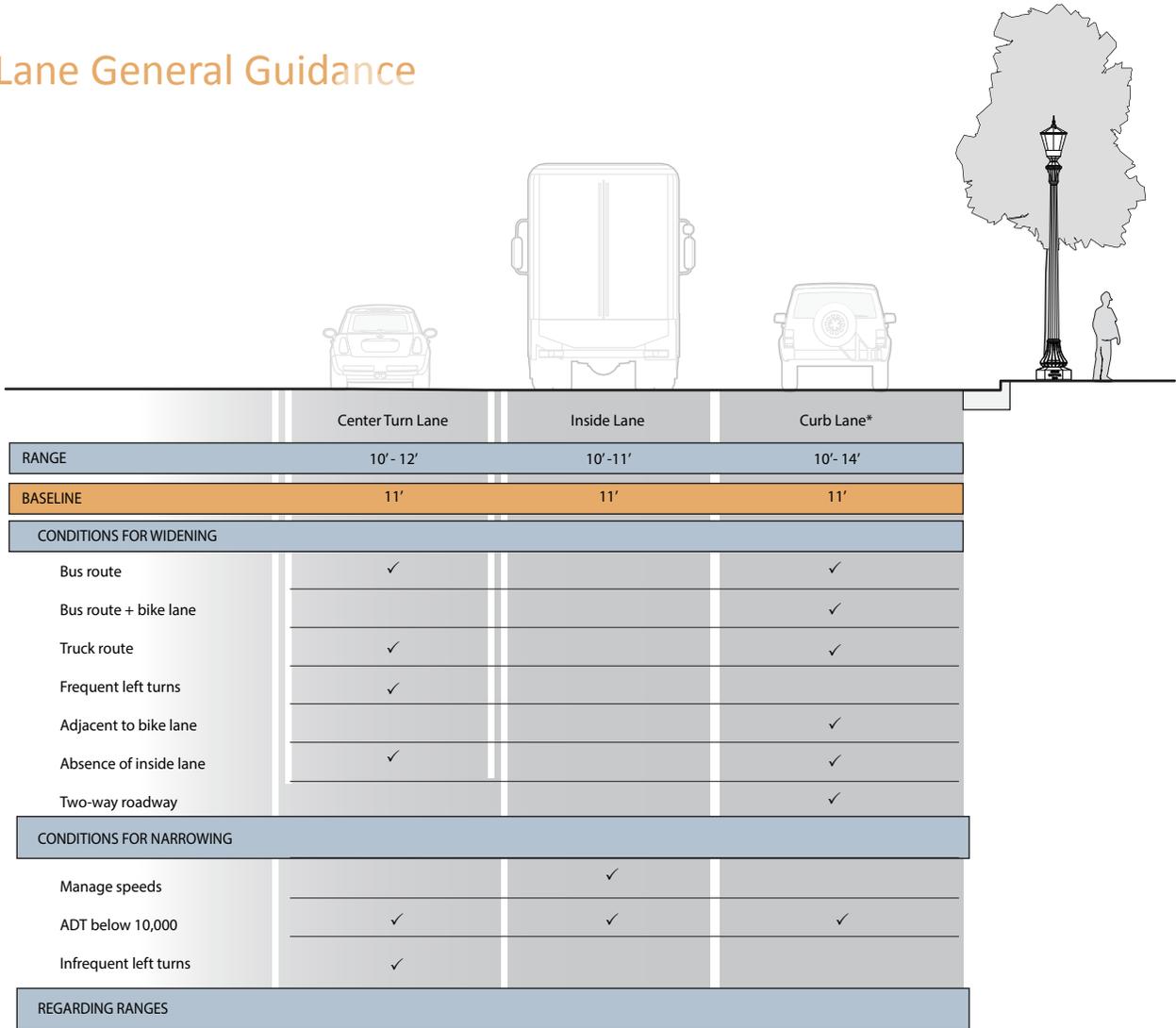
Related Treatments

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References

[Parks and Recreation System Plan](#)
[Blooming Saint Paul](#)
[Saint Paul Boulevard Planting Ordinance](#)
[State Aid Manual](#)
[MnDOT Design Manual](#)
[MnDOT Bicycle Facility Design Manual](#)

Travel Lane General Guidance



The cumulative relationship between lanes must be taken into account when selecting land width. In general, multiple minimums should be avoided (i.e. min. center turn lane, inside lane and curb lane).

*Curb Lane does not include gutter pan

Parking Lane
 RANGE width 7' - 8'
 BASELINE width 8' (includes gutter pan)
 CONDITION for 8'- Commercial street with high turnover
 CONDITION for 7'- Residential street with low turnover
 2' shy distance is preferred minimum

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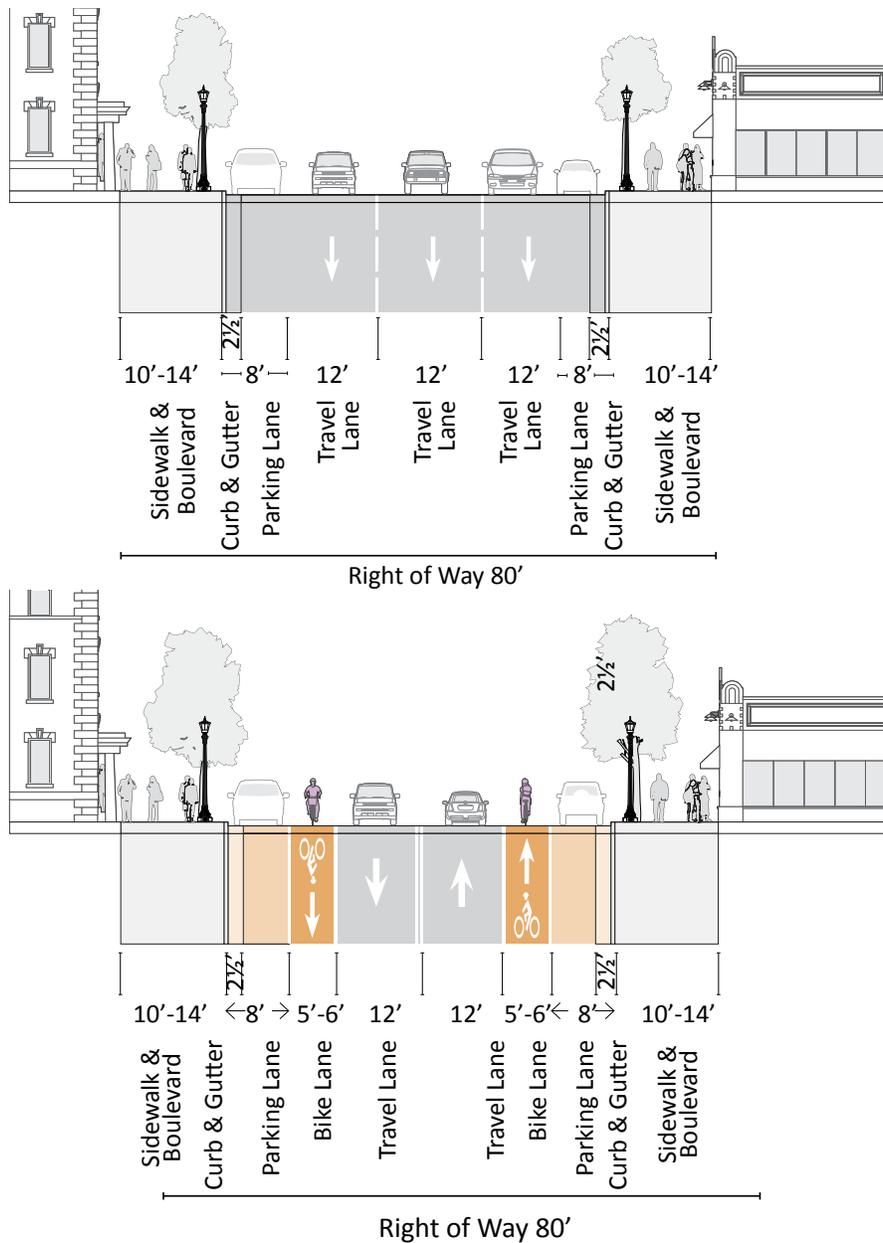
Related Treatments

Bike Lanes
 Bicycle Boulevards
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Parks and Recreation System Plan
 Blooming Saint Paul
 Saint Paul Boulevard Planting Ordinance
 State Aid Manual
 MnDOT Design Manual
 MnDOT Bicycle Facility Design Manual

One Way/ Two Way Directional Conversions



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Parks and Recreation System Plan
 Blooming Saint Paul
 Saint Paul Boulevard Planting Ordinance
 State Aid Manual
 MnDOT Design Manual
 MnDOT Bicycle Facility Design Manual



Parkways

Definition

Parkways are thoroughfares established to create connections between parklands across the city. Parkway are identified in the City Code. The Departments of Public Works and Parks and Recreation work together to design, maintain and regulate parkways.

As defined by the Park System Plan There are three types are parkways in Saint Paul, Class A, Class B, and Class C.

- Class A Parkways are those with existing off-road multi-use trails, or those on which trucks are prohibited by City Code and where right-of-way is sufficient for trail implementation and where multi-use trails are proposed.
- Class B Parkways are those on which trucks are prohibited by City Code or those where right-of-way limitations or urban design considerations, would limit trail implementation.
- Class C Parkways are those on which trucks are permitted by City Code.

Application and Use

- Each parkway is unique and is designed in partnership with the Departments of Parks and Public Works and, where applicable, Ramsey County. The design depends upon the available right-of-way width and context of the street. Parkway often have some the widest rights of way in the city.
- Conceptualized over 100 years ago, the Grand Round is a vision to connect the city's major parks and recreation destinations with a continuous scenic green parkway. The Grand Round has been designated, but not all portions have been constructed in the desired character.
- Improvements to some parkways, especially through Neighborhood Centers (as defined in the Comprehensive Plan), generally the community commercial districts, may include assessments for above standard streetscape improvements. These are typically developed in partnership with the business association, property owners, and/ or district council.



Credit: Emily Erikson

Design Considerations

- Commercial signs on parkways may be more strictly regulated than on other facilities and parkways may have their own wayfinding sign types.
- Setbacks may be different than those typically applied to that zoning district.
- Trees are often used to help create the character of the parkway.
- Parkway often have planted medians with trees and/or wider boulevards than on typical streets. The cross-section of a parkway may change by segment.
- Off-street paths may be located along the roadway or within the median.
- Parkway should be designed to enhance scenic and recreational experiences.
- Driveway access from parkways should be limited to the extent possible. Properties may be required to take access from alternate streets or facilities.

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Boulevard Planting
Street Tree Planting
Rain Gardens
Bike Lanes
Shared Lane Markings
Off-Street Paths
Sidewalk and the Zone System
Roadway Lighting

References

Parks and Recreation System Plan
Blooming Saint Paul
Saint Paul Boulevard Planting Ordinance
State Aid Manual
MnDOT Design Manual
MnDOT Bicycle Facility Design Manual

Bridges

Definition

Saint Paul has over 330 bridges spanning the Mississippi River, highways, railroads, and other barriers. These bridges provide critical connections between Saint Paul neighborhoods as well as the greater region. Design of roadway bridges should accommodate all transportation modes. Special attention should be given to bicyclists and pedestrians whenever bridges (underpasses in some cases) are constructed, reconstructed or improved so these facilities provide maximum safety and comfort for these users.

Applicability and Use

Bridges play a central role in improving connectivity for all roadway users between Saint Paul's neighborhoods and to the larger region. Many existing roadway bridges create barriers to walking and bicycling because they do not safely and comfortably accommodate these modes. As many bridge structures approach the end of their useful life there is an ever-growing need to reconstruct or replace them, presenting opportunities to integrate pedestrian and bicycle facilities and thus improving connectivity. In fact, the U.S. DOT's policy statement on bicycling and walking recommends "integrating bicycle and pedestrian accommodation on new, rehabilitated, and limited-access bridges" with connections to streets or paths. And Title 23 United States Code section §217 requires that bridges being replaced with federal funds include safe accommodation for bicyclists if this accommodation is not an "excessively disproportionate" cost (defined as exceeding 20 percent of the larger project).



- Options for retrofitting existing bridges to better accommodate bicyclists and pedestrians include narrowing travel lanes for the installation of bike lanes or sidewalks. Installing a cantilever structure or redecking the bridge, where feasible, may be considered where sidewalks are absent on bridges. Generally, retrofitting existing bridges can be very expensive and funding sources may be more limited for these types of improvements.
- Bridge approaches play an equally important role for improving connectivity from the point of view of bicyclists and pedestrians. The absence of a sidewalk or bicycle accommodation on the approach roadway should not prevent the accommodation of these users on the bridge.
- A dedicated pedestrian/ bicycle bridge may be needed in places where there are no existing roadway bridges and a new connection would greatly enhance connectivity, or where it is not feasible to accommodate these modes on existing or reconstructed bridges.

Placemaking / Public Art Opportunity

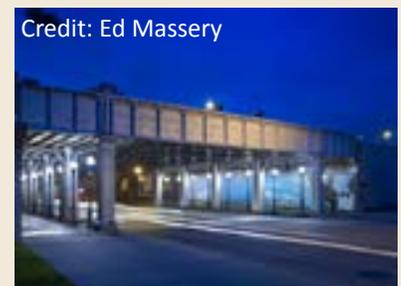
Public art on bridges may serve as a gateway feature that expresses the character and history of a neighborhood or district.



Michael Marcil



George Mason



Kim Beck

Design Considerations

- The type of bicycle and pedestrian accommodation on bridges should be determined with consideration of the road function, length of the bridge, and the design of the approach roadway.
- Bicycle and pedestrian accommodations should generally be provided on both sides of the bridge. An exception to this rule is where the cost is excessively disproportionate (20 percent of the larger project).
- Bicycle lanes and shared-use paths on bridges should follow adopted design guidelines and standards for bicycle lanes and paths.
- Special attention must be paid to crossing locations on either side of the bridges with a shared use path facility on one side of the bridge to ensure that users can cross to the shared use path facility in a safe, convenient and readily apparent manner.
- Pedestrian and bicycle bridges should include appropriate lighting.

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Sidewalk and the Zone System
Roadway Lighting
Wayfinding
Stairways
Over and Under Crossings

References

MnDOT Design Manual
MnDOT Bicycle Facility
Design Manual
LFRD Bridge Design Manual
State Aid Manual
Comprehensive Plan
Standard Plates

Transit Stop Placement

Definition

The placement of a transit stop depends on the operational characteristics of both the street and the transit system, and should provide comfort, convenience, safety and sufficient space for all transit users, including pedestrians, cyclists and people with mobility impairments.

Applicability and Use

- Stops are typically placed curbside, but may be placed within the center of the street where there are center running transit lanes or streetcars.
- Stops should be located in an area that is well-lit, with good site distance in close proximity to crosswalks.
- Stops should be located at intersections wherever possible because intersections are generally more convenient for passengers intercepting other transit connections, accessing crosswalks, and connecting to pedestrian routes and building entrances.
- Stop spacing is typically determined by the operator. Generally, local bus stops are usually spaced every two blocks, limited stop bus stops are usually spaced every 1/2 to 1 mile; and express bus stops may only be in downtown and at destinations with no intervening stops.



Design Considerations

- At signalized intersections, transit stops should typically be located at the far-side of intersections to facilitate bus operations, transit signal priority, and pedestrian movement. At stop controlled intersections, transit stops should typically be located near side. The table on the next page summarizes the advantages and disadvantages of near-side, far-side and mid block stop placement.

- At uncontrolled locations crossing enhancements such as high visibility crosswalks, rapid flashing beacons, center crossing islands, or mid-block pedestrian signals may be considered. At mid block transit stop locations the crosswalk should be placed behind the stop for visibility of approaching traffic.
- Where it is possible to still meet minimum stop spacing requirements, consider moving transit stops located at mid-block locations on multi-lane roads to signalized locations. If this is not possible, consider additional crossing treatments at these locations.
- Transit stops should not be located at driveways. New driveways should be discouraged at transit stops (and generally along major transit routes).
- Transit stop placement for Light Rail, Bus Rapid Transit, and Commuter Rail stations should adhere to the Regional Transitway Guidelines in addition to any local standards and guidelines that may apply.
- Non-traffic considerations, such as building entrances or narrow sidewalks, may be important when determining bus stop placement.

Placemaking / Public Art Opportunity

Transit stops, specifically shelters, may provide space for public art. Public art may also be integrated into the street furniture and other transit facilities.



Aaron Scales



Dennis Oppenheim



Kevin Berry

Location	Advantages	Disadvantages
Near Side	Minimizes interference when traffic is heavy on the far side of an intersection	Increases conflicts with right-turning vehicles
	Minimizes the number of stops for buses	Stopped buses may decrease sight distance of passing traffic, obscuring curb-side traffic control devices, and pedestrians crossing in front of bus
	Allows passengers to board and disembark while the bus is stopped at a red signal phase	Obscures sight distances for vehicles crossing the intersection from the right of where bus is stopped
	Allows for convenient access during winter months, as snow is already cleared at boarding points	Decreases roadway capacity during peak periods due to buses queuing in what may function as a right-turn lane
		Can delay buses that arrive during the green signal phase and finish boarding during the red phase
		Loading area access often requires additional snow removal during heavy snow events.
Far Side	Minimizes conflicts between right-turning vehicles and buses	Stacking buses may block the intersection during peak periods
	Optimal location for traffic-signal synchronized corridors	Stopping both at a signalized intersection and a far-side stop may delay bus operations, particularly where buses don't have signal priority
	Provides additional right-turn capacity by allowing traffic to use the right lane	Right turns on to bus route streets may cause traffic conflicts and divert such traffic into the left lane.
	Signalized intersections create traffic gaps for buses to reenter traffic lanes	
	Improves pedestrian safety as passengers cross in back of the bus	
Mid-Block	Boarding areas experience less congestion and fewer conflicts with pedestrian travel paths	Decreases on-street parking supply (may be partially mitigated with a bus bulb-out)
	Can be located adjacent to or directly across from a major transit use generator located midblock	Increases walking distance to intersections and encourages passengers to cross street at midblock (jaywalking)
		Stopping buses and mid-block pedestrian crossings may disrupt mid-block traffic flow
		May be less convenient for transit transfers

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 Marked Crosswalks
 Pedestrian and Traffic Signals
 Bump Outs

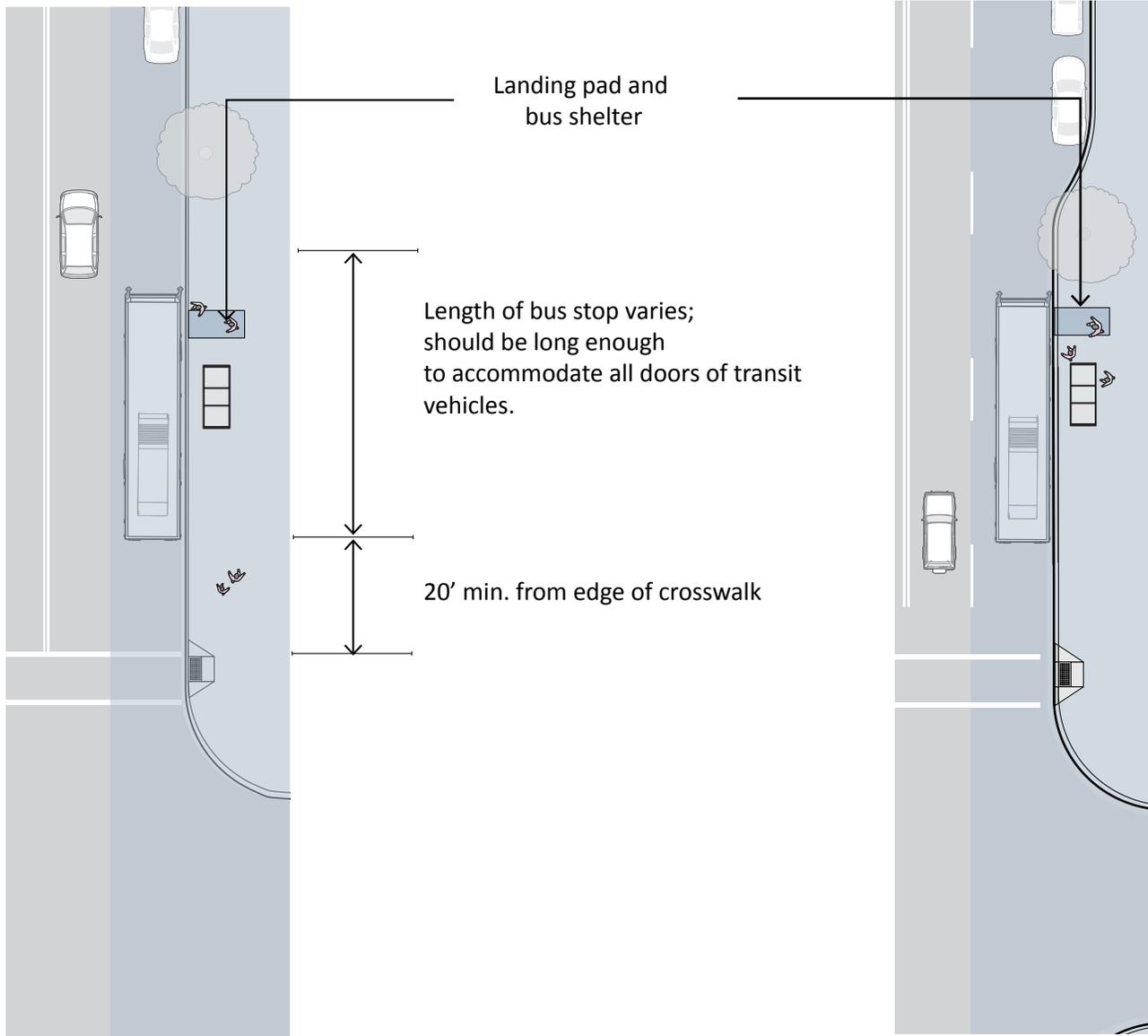
References

MnDOT Design Manual
 Metropolitan Council Regional Transitway Guidelines
 Comprehensive Plan
 APTA Recommended Practice: Designing BRT Transit Running Ways

Transit Stop Placement

Far Side In Lane Stop, 1 Lane with Parking

Far Side Bus Bump Out, 2 lanes with parking



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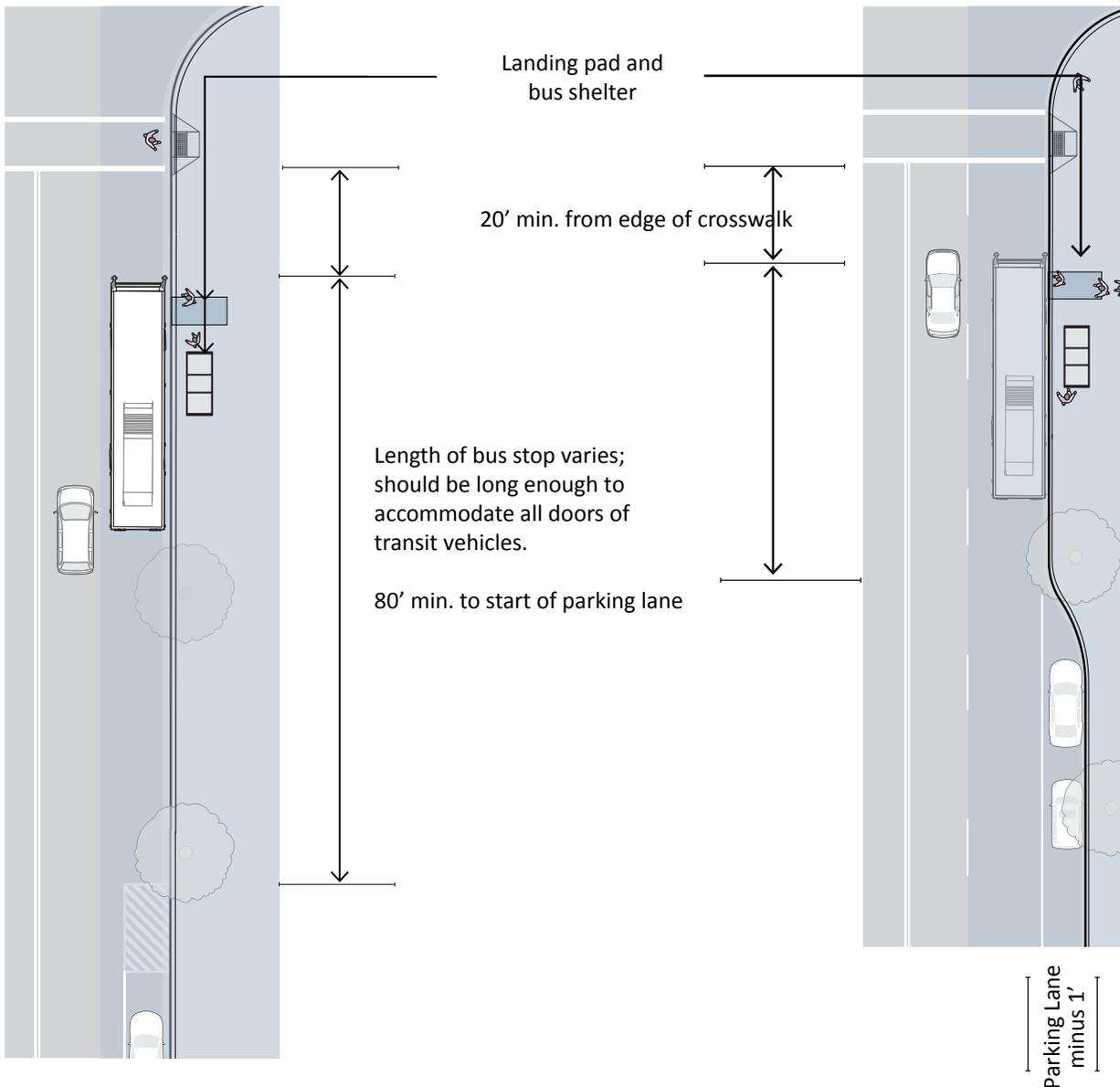
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References

MnDOT Design Manual
 Metropolitan Council Regional
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Near Side In Lane Stop, 1 Lane with Parking

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Transit Stops

Definition

Transit stops can be located adjacent to travel lanes where busses stop in-lane, or in parking lanes or bus bays that require buses to pull out of the travel lane. Their location is a major factor in transit speed and reliability and overall traffic operations. On corridors with high traffic volumes, or infrequent gaps in traffic, buses that have pulled out of the travel lane may be significantly delayed while trying to re-enter the flow of traffic. Conversely, in-lane bus stops may cause delay to other vehicles, particularly on streets where traffic cannot change lanes to pass. Impacts to traffic operations must often be weighed against transit reliability and speed. However, stop placement (in relation to intersection), signal design, and off vehicle fare collection are among the methods that may allow for a balanced approach that does not unduly impact any one roadway user.

Applicability and Use

In-Lane Stops

On corridors where improvements to transit speed and reliability are desired, in-lane stop configuration should be considered whenever feasible.

A bus bump out is an elongated bump out that serves a transit stop and allows for in-lane stopping on streets with on-street parking or shoulders. Bus bump outs should be prioritized at intersections or mid block where:

- In-lane stopping of bus vehicles is desired and on-street parking is present.
- Existing sidewalk width is too narrow to accommodate a transit shelter, or where pedestrian through travel is constrained.
- Transit performance is slowed significantly due to the time delays caused by reentering traffic flow, and a bus bump out will mitigate this problem.
- They may facilitate accessible boarding as the bus can align directly with the curb.
- They can be coupled with a crossing location that also function similar to bump outs, shortening crossing distances.
- They provide space for ADA compliant, directional curb ramps when placed at intersections where sidewalks are narrow.



Bus bump out should not be considered:

- On arterials that have peak hour parking restrictions, where there is a desire to have a bus lane, or at near side stops with heavy right turn movements.
- Where the turning needs of larger vehicles precludes the installation of bus bump outs at intersections.

Parking Lane Stops

- On corridors where traffic operations would be heavily impacted by in-lane bus stops, and where buses are able to pull into and out of traffic without significant delay, parking lane stops should be considered.

Bus Bays

- Bus bays should only be installed where there is adequate right-of-way and sidewalk width can be maintained.

Design Considerations

In-Lane Stops

- Bus bump out width should be no more than the adjacent parking lane minus 1 foot and should not encroach into bicycle lane where present.
- Bus bump outs on streets with one travel lane in each direction may be staggered to allow space for vehicles to pass a dwelling bus.
- Bus bump outs should be long enough to accommodate all doors of transit vehicles. Where there is frequent service of multiple routes, bus bump outs should be long enough to accommodate two or more vehicles with an additional 5 foot of maneuvering space.
- Bus bump outs may also impact underground utilities, curbside parking, delivery access and garbage removal, snow plows, and street sweepers. These impacts should be evaluated when considering whether to install a bus bump out.
- Bump out installation may require the relocation of existing storm drainage inlets.
- Bus bump outs may use special paving treatments to distinguish it from the adjacent sidewalk.

Parking Lane Stops

- Turn-out areas must be of sufficient length to allow for the longest bus vehicle to pull completely out of the flow of traffic.

Transit stop design for LRT, BRT, and Commuter Rail stations should adhere to the Regional Transitway Guidelines in addition to any local standards and guidelines that may apply.

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References

[MnDOT Design Manual](#)
[Metropolitan Council Regional Transitway Guidelines Comprehensive Plan](#)
[APTA Recommended Practice: Designing BRT Transit Running Ways](#)

Transit Zones

Definition

Transit zones include passenger waiting, queuing, and boarding activities in the sidewalk area. Transit zones should be easily identifiable, attractive, safe, accessible, and provide a comfortable waiting area for transit passengers while providing for unobstructed pedestrian circulation.

Applicability and Use

Good layout of a transit stop includes:

- Visual cues on where to wait
- A clearly defined transit stop
- Ease of access between the sidewalk and the transit vehicle
- Unobstructed path of travel on the adjacent sidewalk

Transit zones should be accessible. Americans with Disabilities Act (ADA) considerations will be given top priority in the siting and design of new and existing transit zones.

Transit zones deserve a higher than average level of streetscape amenities to serve waiting passengers. Transit zone improvements may include:

- Transit signs – must be provided at all stops and located at the preferred boarding location.
- Transit shelters—provided where existing sidewalk space allows or where a curb extension can be added to provide sufficient space, and demand warrants. They should not be provided where sidewalk width is insufficient to accommodate a shelter and at least the minimum required clear path of travel around the shelter or the ability to carry expected pedestrian volumes.
- Lighting—located to illuminate the transit stop area, particularly the front of the stop and the transit shelter (where present). Lighting may be integral to the transit shelter, or may be provided by standard pedestrian or roadway lighting, where sufficient.
- Special paving—may be provided to distinguish the transit stop area from the adjacent sidewalk. Special paving must meet accessibility requirements and may include a unique scoring pattern, a contrasting paving material, or a paving edge treatment delineating the edge of the transit stop. Special paving may be expensive, and is most appropriate at major stops on Light Rail, Streetcar or major transfer points.



Credit: Anton Jerve

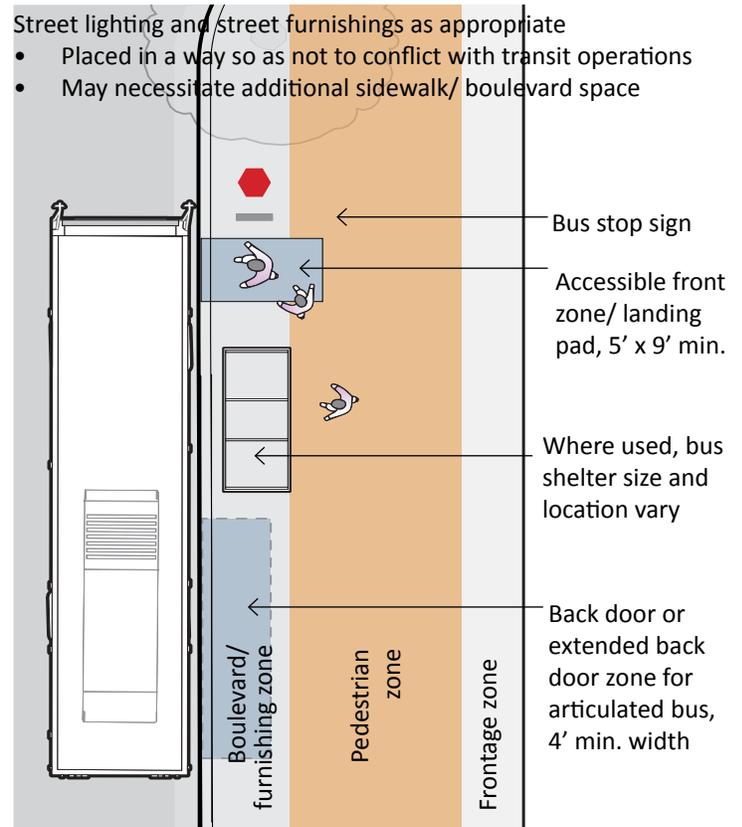
- Seating—located within the transit shelter (where present). Additional seating, either formal (benches, seats with armrests) or informal (bollards, low seat walls, leaning bars), may be placed outside of the shelter, provided it allows access to and from the transit shelter and boarding area.
- Trash cans—placed adjacent to the transit shelter (where present).
- Bike racks—where provided, racks should be placed to not conflict with the boarding areas of a transit stop. Bike-sharing stations, where provided, should be placed outside of but in proximity to the transit stop.
- Wayfinding information may be located within the transit zone, particularly in downtown and in neighborhood centers.
- Off-board fare boxes
- Electronic real-time schedule information and other premium elements should be added where demand and funding exist.

Overhangs, canopies, and arcades on buildings adjacent to transit zones may be used/created to provide weather protection for transit patrons, including leaning rails, benches and pedestrian-scaled lighting.

All transit zone amenities must be consistent with Metro Transit priorities, standards and criteria and authorized by Saint Paul Public Works.

Design Considerations

- Minimum clearance – While a 5 feet wide by 8 feet deep sidewalk area meets minimum ADA standards, a larger clear transit zone or bump-out is preferred to ensure front and rear door access and egress for most buses (30 feet of curb clearance is needed for rear door access of a 40 foot bus, 50 feet clear space is needed for a 60 feet articulated bus).
- The clear loading area should be where the bus doors typically open and accessible from the transit shelter (where present) and adjacent sidewalk. If a zone is designed for more than one bus, a clear loading area should be provided for each vehicle.
- The clear loading area should have a maximum 2% cross-slope.
- A 30 in by 48 inch clear floor wheelchair space should be provided within the transit shelter (where present). This space must be accessible from the sidewalk and the loading area. In some cases, this may necessitate modifying the transit shelter.
- Where boarding platforms are not level with the sidewalk, an accessible ramp must be provided from the sidewalk to the platform.
- Shelters should be located in the Furnishing/Boulevard Zone wherever possible. They should be located to provide at least 4 feet of clear space between the edge of the curb and the front edge of the shelter, where possible, or another accessible path to the shelter should be provided. Alternately, shelters can be placed in the frontage zone. In all cases, shelters must be placed to leave the minimum required clear sidewalk width.
- Transit shelters should be located toward the front of the stop to indicate where customers should wait to board the vehicle. The shelter should be placed



- Street lighting and street furnishings as appropriate
- Placed in a way so as not to conflict with transit operations
- May necessitate additional sidewalk/ boulevard space

approximately 25 feet behind the front of the stop to allow for an accessible boarding area (5 feet by 8 feet) and for the bus to pull out of the stop (approximately 20 feet). Where there is a bus bay or boarding island, the first 20 feet of setback is not necessary.

- The shelters and other street furniture should not impede sightlines for pedestrians waiting to cross at a crosswalk.
- Transit zone design for LRT, BRT, and Commuter Rail stations should adhere to the Regional Transitway Guidelines.

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 Metropolitan Council Regional
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 APTA Recommended Practice:
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Transit Lanes

Definition

Transit lanes provide exclusive or semi-exclusive use for transit vehicles to improve the system's travel time and operating efficiency by separating transit from general purpose travel lanes. Transit lanes can be located in an exclusive lane or a shared lane with other users, e.g., bicycles, high occupancy vehicles.

Applicability and Use

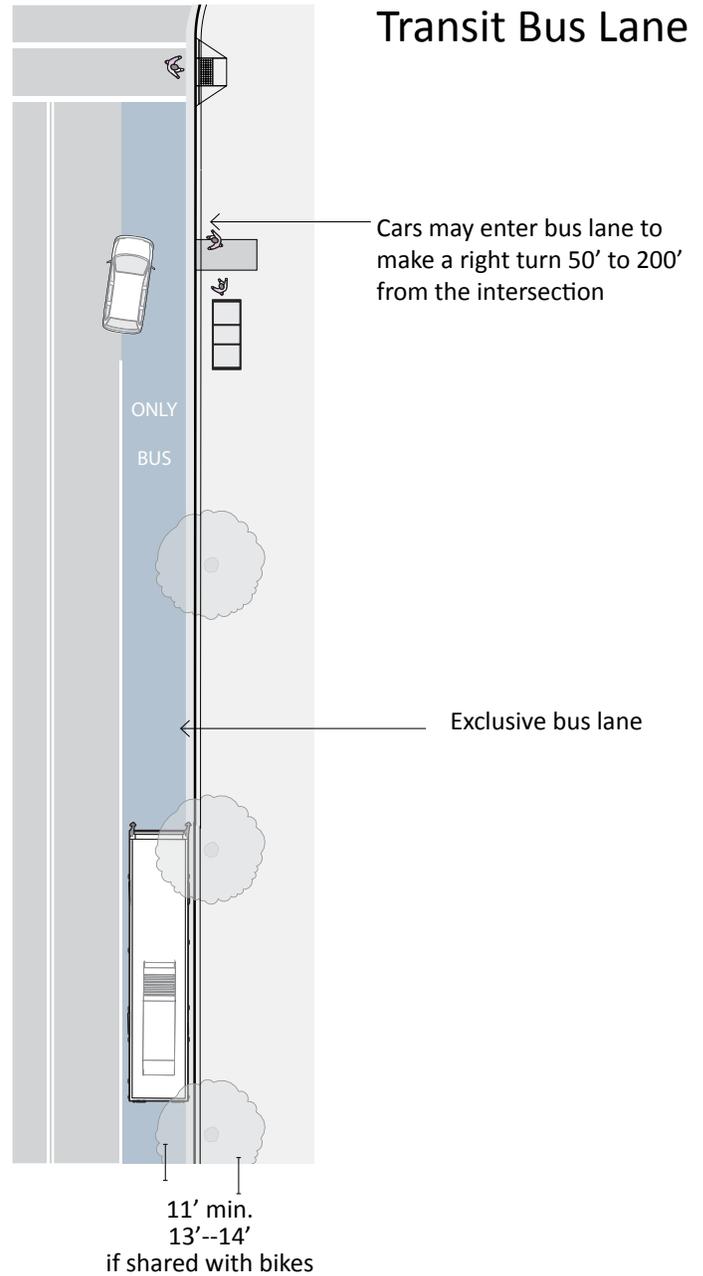
- Transit lanes are provided in corridors where faster or more efficient transit service is desired. This makes them well suited for corridors with high population densities and a concentration of major destinations, which support frequent headways (15 minute peak or less).
- Transit lanes may be provided curbside or within the center of multilane streets with stop platforms located on platform islands. Curbside transit lanes are generally open to private vehicles accessing and at intersection turn lanes.
- Curbside transit lanes work best in locations with no on-street parking, but can be placed adjacent to parking lane.
- Median transit lanes generally provide better service and have fewer conflicts with parking, stopping and turning vehicles, but have higher costs because of the need for island stop platforms, rechannelization of roadway, and possibly removal of raised medians.
- Median transit stops are generally spaced further apart (1/3 to 1/2 mile) to permit greater speeds and reduce trip times.
- Pedestrian access to median transit stops is more difficult than for curbside stops. Transit stop platforms should be located adjacent to, and accessed by, marked crosswalks or signalized intersections.
- Shared bike/bus lanes should be considered where there are street right-of-way constraints and where ways are sought to accommodate buses and bicycles for better multimodal service. Rail-based transit lanes are not appropriate for sharing with bicycles.
- Space for a transit lane is typically created by removing a travel lane, parking lane, or median.
- Enforcement may be required to ensure private vehicles are not traveling in the transit lane other than for turning movements.



Credit: Michael Richardson

Design Considerations

- Minimum width for transit lanes is 12 feet.
- Pavement markings and signage, or physical separation, may be used to deter encroachment by private vehicles.
- Signal priority may be considered on transit corridors to improve efficiency.
- Dimensions for median transit stop platforms vary depending on the peak passenger volume.



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MnDOT Design Manual, Ch 4-5
 MN MUTCD, Ch 3-D
 Metropolitan Council Regional
 Transitway Guidelines
 APTA Recommended Practice:
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Shared Bus/Bike Lanes

Definition

A shared bicycle/ bus lane (SBBL) is a traffic lane dedicated for exclusive use by buses, bicyclists and, usually, right turning vehicles.

Applicability and Use

SBBLs are usually implemented when or where the following conditions exist:

- There are street right-of-way constraints and where ways are sought to accommodate buses and bicycles for better multimodal service without increasing safety concerns.
- A street where a preferential bus lane already exists, and there is interest in allowing bicycles to use it.
- A street where a preferential bus lane already exists, and bicyclists are already using it illegally, even though it has not been designed with bicycle safety in mind.
- There is a desire to improve safety on a street that has substantial bus or bicycle traffic.

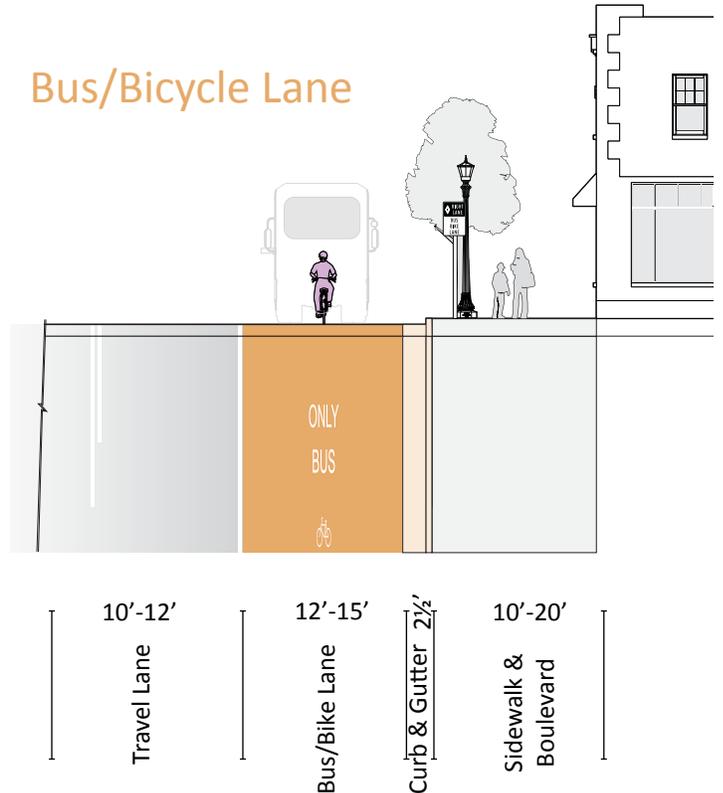


Credit: Mike Richardson

Design Considerations

- While staying in the lane to pass is not a necessary condition for a SBBL, it may be desired to enhance safety and operations. The minimum width needed for buses and bicycles to pass one another while staying in lane and providing minimum clearance and operating space is 15 feet. Additional width should be considered where there is a gutter pan or more operating space is desired.
- “Leapfrogging” describes a situation where a bicyclist and a bus repeatedly pass one another due to their different operating characteristics. In more urban contexts where bus stops are more frequent bicyclists are likely to be able to travel faster than buses, thus diminishing “leapfrogging”. In more suburban contexts leapfrogging may be more apparent. There are several options for managing conflicts between bicyclists and buses at bus stop locations:
 - Installing a bus stop island with a bike lane to the right of the island. Such a design may cause additional conflicts between pedestrians who are crossing over the bike lane to and from the bus stop. These conflicts may be mitigated by installing a railing on the island that directs pedestrians to a marked crosswalk location, or installing a raised crossing that encourages cyclists to slow down when approaching the crossing.
- If the SBBL is designated as a bus/right-turn-only lane, then shared lane markings can be used to guide bicycles to the left of buses at bus stops, or to the left side of the SBBL at intersections where buses and/or cars turn right. Standard “non-longitudinal” bike lane markings (bicycle or bicyclist, with arrow) could be used instead.

Bus/Bicycle Lane



- The lane can be designated as “BUS/ BIKE ONLY” using pavement markings (FHWA 2009, Section 3D.01, paragraph 7), and/or signs.
- Pavement markings within a SBBL may include a bicycle symbol or “BUS/ BIKE ONLY” symbol.
- A shared lane marking may be used, but only on roadways with a posted speed limit of 35 mph or less. Shared lane markings also can be positioned within the lane to guide cyclists where to ride. This may be particularly important where parking is permitted during off-peak hours and bicyclists are using the remainder of the lane, which creates a risk of collision with opening car doors.

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 Shared Lane Markings
 Climbing Lanes

References

MN MUTCD (Part 3 and 9)
 Metropolitan Council Regional
 Transitway Guidelines
 APTA Recommended Practice:
 Designing Bus Rapid Transit
 Running Ways
 Comprehensive Plan
 Standard Plates

Access Management

Definition

Limiting and consolidating vehicle access points (also known as access management) is proven to benefit pedestrians and bicyclists and can also improve traffic operations and safety for all modes by redirecting drivers to intersections with appropriate traffic control devices. Access management strategies include restricting turning movements, particularly left-turns; through median installation; increasing the spacing of, and reducing the number and size of driveways, particularly near intersections; and interconnecting parcels with service roads or internal connections.



Credit: Anton Jerve

Applicability and Use

Access management strategies should be considered:

- In corridors that have a relatively high number of crashes.
- Where numerous driveways or excessively wide driveways impede pedestrian travel or create unnecessary potential conflicts between drivers, bicyclists, and pedestrians.
- Where driveways are within the functional area of an intersection.
- Along four-lane undivided streets that have a high number of left turn movements into and out of driveways.
- Where improved transit speed and reliability are desired.

Driveway Consolidation

Research over the past several decades has consistently shown that crash rates for all modes increase as driveway density increases on a roadway (i.e., number of driveways per mile). Multi-lane roadways without medians present particular challenges to both pedestrians and motorists as motorists turning left into a driveway are focused on finding gaps in oncoming traffic. While focusing on gaps in traffic, the motorists' sight lines of potentially conflicting pedestrians (and bicyclists if present on a sidewalk or side path) are blocked by the approaching vehicles. Motorists often accelerate rapidly to clear a gap on multi-lane roadways, which puts the pedestrian at risk when crossing a driveway.

Placemaking/ Public Art Opportunity

Public art may be integrated into the sidewalk surface provided it does not create a tripping or slipping hazard and meets ADA guidelines.



Credit: Ines Hegedus-Garcia

Cracking Art Group

Driveway consolidation should be considered where:

- There are is a high number of pedestrian or bicycle crashes along a corridor.
- There are high levels of pedestrian and bicycle use.
- There is a redundant driveway with low usage.
- Driveways are spaced less than 30 feet apart.
- Driveways are less than 30 feet from the corner of a street intersection.
- There are opportunities to develop shared/reciprocal access and/or internal circulation between parcels.
- Driveways are within transit zones or improved transit speed and reliability are desired.

Medians

Medians are an area within the street separating different lanes or traffic directions. For the purposes of this manual, a median is raised rather than flush or painted. The width as well as design of medians can vary widely. They can range from narrow raised concrete islands to tree-lined promenades to intensively landscaped medians. Medians may also provide space for pedestrians at crossing locations and public art. In some environments, medians can be constructed in sections, creating an intermittent rather than continuous median.

Medians should be considered on two-way multilane streets and as part of a broader access management strategy, and may be most applicable in areas where there are a high number of driveways, or where there are a high number of crashes associated with turning vehicles.

Medians may be a good strategy to pursue along corridors targeted for pedestrian safety improvements. However, medians should not impede pedestrian access—median crossing islands should be provided at crossing locations.

- Corridors that are road diet candidates or with two-way center turn lanes present good opportunities for the installation of medians.
- On streets of limited width, it may be preferable to include other treatments (e.g., expanded sidewalks or dedicated transit or bicycle facilities) rather than a median if there is not adequate room for all treatments and travel lanes.

Access Management

Design Considerations

Driveway Consolidation

Site planning standards for new development should require driveways to be spaced a minimum of 30 feet apart and encourage or require internal circulation between parcels that directs motor vehicles to locations with appropriate traffic control. Fewer driveways result in more space available for other elements that can enhance the streetscape such as street trees, landscaping and pedestrian amenities.

- Motor vehicle access and any delay associated with driveway consolidation must be weighed against proven safety benefits.
- New and re-designed driveways must be at least 30 feet from the point of intersection of curb lines of 2 or more intersecting streets
- As an alternative to driveway consolidation (i.e. eliminating one or more driveways), restricting turning movements (i.e. right-in right-out or median installation) should be considered.

Driveway consolidation decisions should be informed by a comprehensive traffic impact analysis and pursued in cooperation with property owners to ensure impacts to businesses are minimized. Reduced access to businesses may require out-of-direction travel for all users, including walkers and bicyclists.

Medians

Design Considerations

- Medians must be wide enough to provide adequate space for pedestrians at crossings: 6 feet minimum. Wider medians (8 to 10 feet) should be considered in locations where high volumes of bicyclists are expected, i.e. a trail or bicycle boulevard crossing.
- Minimum width for landscaped medians is 8 feet.
- A median crossing must be at least as wide as the marked crosswalk, and should provide tactile cues to indicate border between the median and vehicle travel lanes.
- Medians must be designed with landscaping that maximizes sight triangles at crossing locations and allows pedestrians to see to the other side.
- Long continuous medians must accommodate emergency vehicle turnaround movements. This may be done by providing short segments with mountable curb and paved area designed to the appropriate load bearing specification. This can also be accommodated by designing intersections to easily accommodate u-turns.
- Medians must be designed with no more than normal curb height.
- Medians should extend beyond the crosswalk at intersections wherever possible, while accommodating motor vehicle turning movements; the “nose” of the median should not infringe on the crosswalk width at intersections.
- Street narrowing due to snow accumulation in the winter may be a consideration for median width on streets with bike facilities.

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References

[MnDOT Road Design Manual Comprehensive Plan](#)

- Crosswalks should extend through medians at intersections wherever possible, maintaining the width of the crosswalk while protecting pedestrians from motor vehicle turning movements.
- By separating opposing traffic flow and eliminating left-turns, continuous medians may increase traffic speeds by decreasing the traffic calming affect of oncoming traffic in close proximity. Adding street trees or other landscaping may increase visual friction and help to moderate vehicle speeds.
- Maintenance responsibilities of medians should be clearly defined. Trees and other plant species should be drought and salt resistant and hardy enough to withstand harsh urban conditions.
- Green infrastructure opportunities include the use of unpaved and permeable surfaces and the incorporation of other stormwater source controls. Roadways may be graded to direct storm water towards the median upon completion of an engineering study to determine capacity and retention limits; and if additional conveyance is required.

Right-in/Right-out Turning Restriction

Right-in/right-out (RIRO) is an access management technique that refers to a street or driveway where only right turns are permitted. RIRO configurations improve safety by reducing the number of conflict points between all roadway users. Research suggests that approximately 72 percent of crashes at a driveway involve left-turning drivers. These crashes are primarily due to outbound vehicles turning left across through traffic and to inbound, left-turning vehicle conflicting with opposite direction through traffic.

Applicability and Use

- RIROs are best used at the following types of locations:
- Locations with high pedestrian and bicycle volumes.
- High crash locations.
- Locations along arterial streets with speeds of 40 mph or greater.
- Locations with driveways in close proximity to intersections or other driveways.

RIRO restrictions may be an effective traffic management strategy for bicycle boulevards and may be part of a larger access management strategy.

Design Considerations

- When turn movements are restricted at driveways, consideration must be given to where turning movements are shifting along the roadway.
- Where there are sidewalks, pedestrians must be accommodated across the driveway. If raised diverters (vs. paint) are used to restrict left-turn movements and the driveway functions similar to a roadway intersection, a cut-through at least as wide as the crosswalk should be provided, and should have tactile cues to indicate border between the refuge and vehicle exit/entrance.

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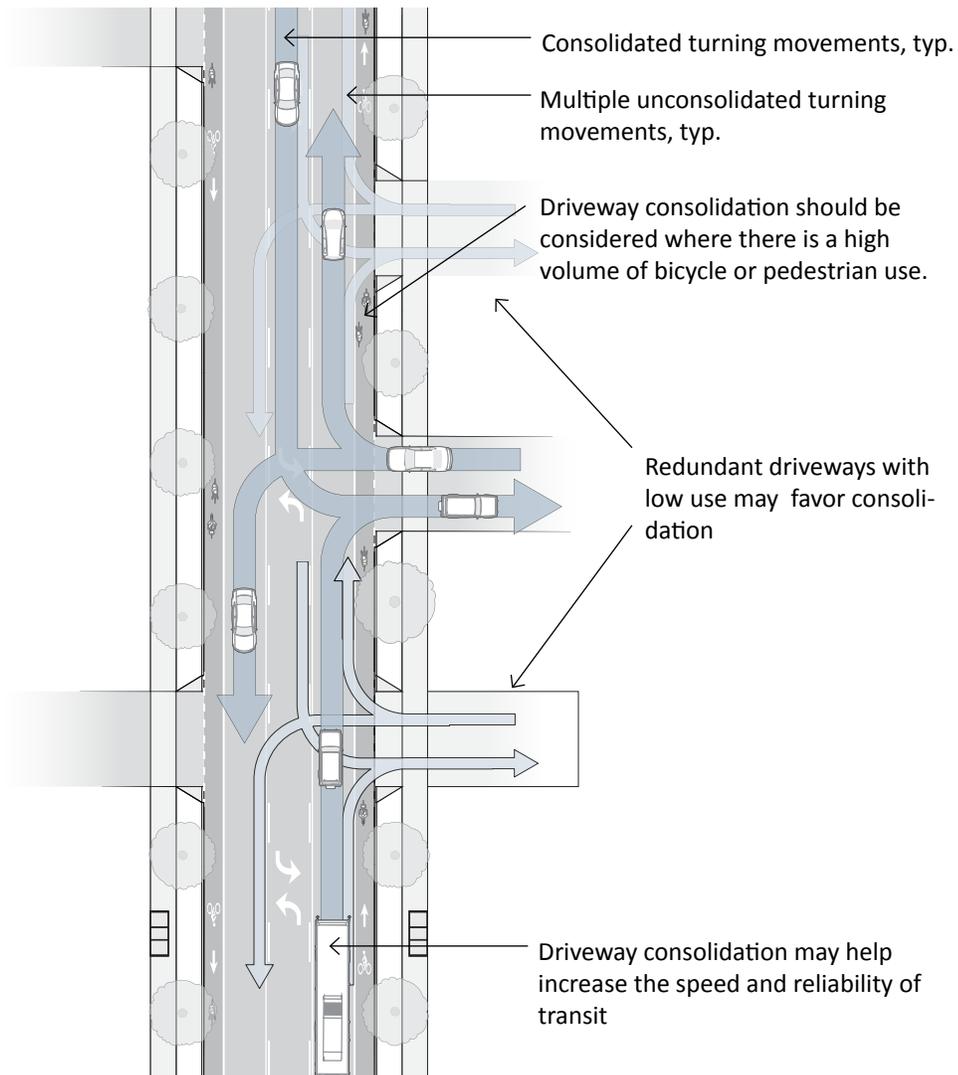
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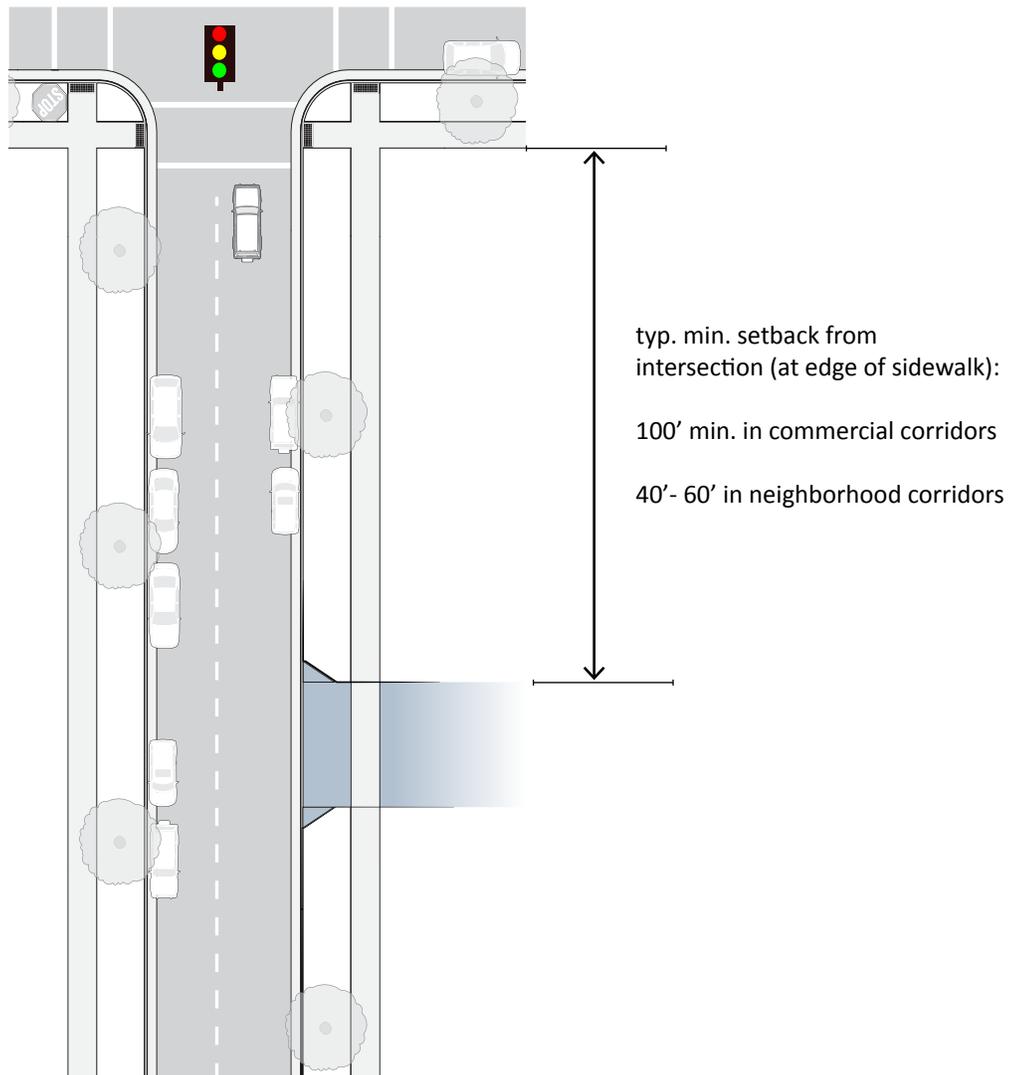
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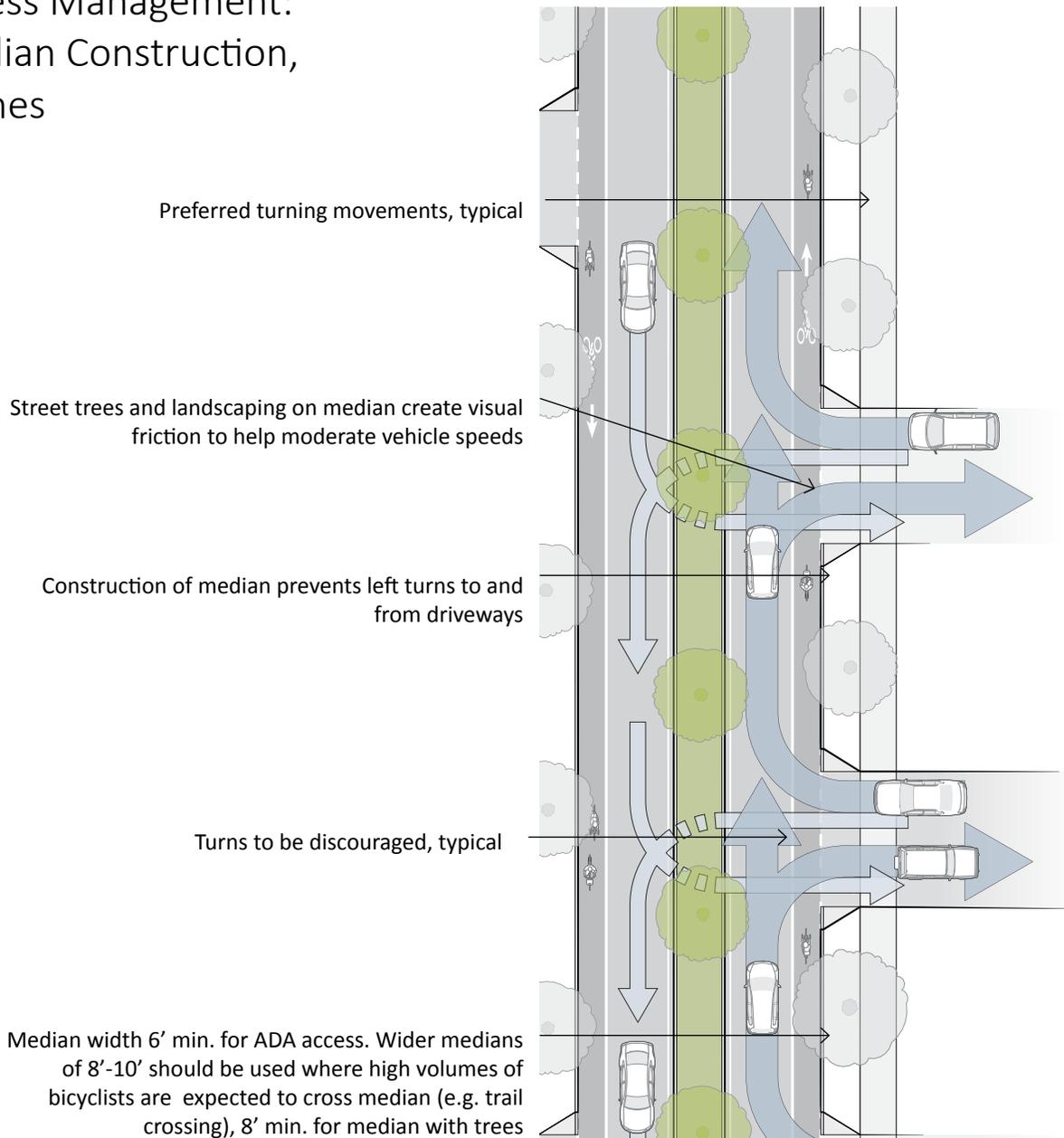
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Access Management: Median Construction, 4 lanes

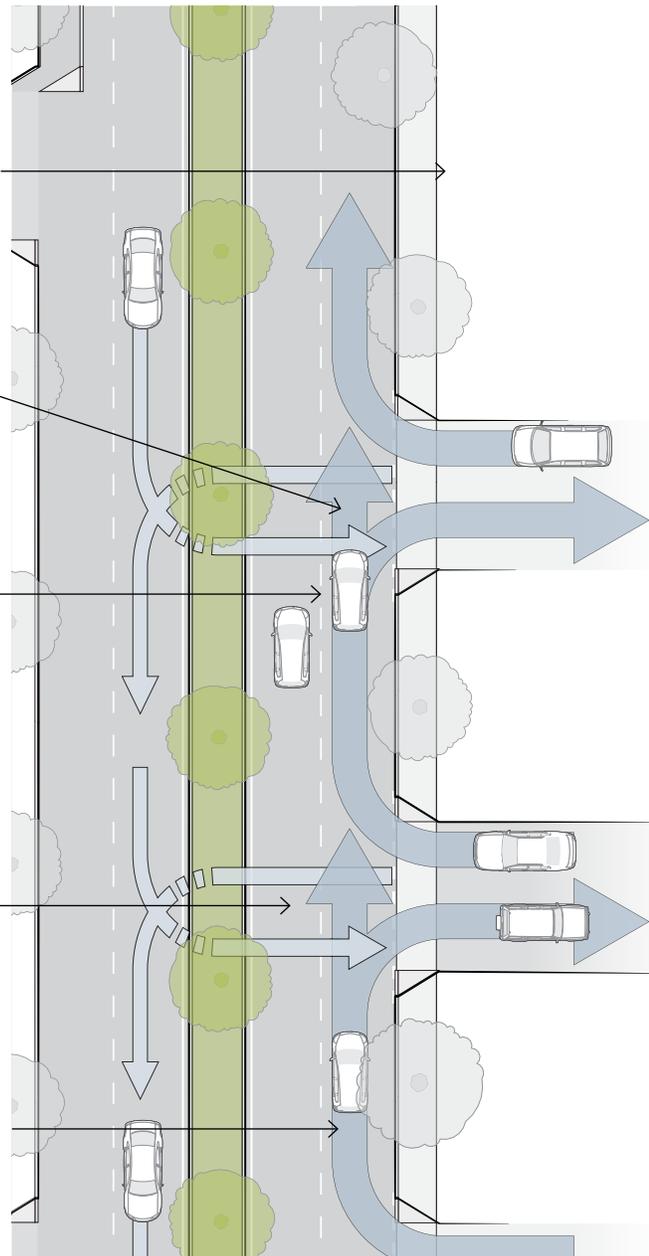
Preferred turning movements, typical

Street trees and landscaping on median create visual friction to help moderate vehicle speeds

Construction of median prevents left turns to and from driveways

Turns to be discouraged, typical

Median width 6' min. for ADA access. Wider medians of 8'-10' should be used where high volumes of bicyclists are expected to cross median (e.g. trail crossing), 8' min. for median with trees



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Bike Lanes

Definition

Bike lanes designate exclusive space for bicyclists through the use of lines and symbols on the roadway surface. Bike lanes are for one-way travel and are normally provided on both sides on two-way streets or on one side of a one-way street. Bicyclists are not required to remain in a bike lane when traveling on a street, and may leave the bike lane as necessary to make turns, pass other bicyclists, avoid obstacles within a bike lane, or to properly position themselves for other necessary movements. Bike lanes may only be used temporarily by motor vehicles accessing parking spaces, turn lanes and entering and exiting side streets, driveways and alleys.



Credit: Michael Richardson

Applicability and Use

- Bike lanes should be used on corridors where there is sufficient existing or anticipated bicycle ridership and where traffic volumes and speeds are such that the majority of bicyclists do not feel safe or comfortable riding in a shared lane.
- Bike lanes are typically installed on streets where there is a striped centerline or lane lines, e.g., arterial or collector streets. They can also be used on one-way or two-way streets, and on single or multilane roads.
- Bicycle lanes are normally placed on the right side of the road to reflect the general traffic principle that slower traffic keeps to the right.
- On one-way streets, consider a left-side bike lane where:
 - The majority of destinations (for bicyclists) are on the left-side of street
 - There are significantly more driveways on the right-side of the street
 - There are a high number of transit stops or vehicles on the right side of the street, i.e., a major transit corridor.
- Bike lanes may be placed adjacent to a parking lane, or against the curb gutter pan if there is no parking.
- Reallocating existing street space (narrowing other travel lanes, removing travel lanes, or reconfiguring parking lanes) is a way to create space for bike lanes.

Design Considerations

- Minimum width for bicycle lanes is 5 feet. Wider bike lanes (6-7 feet) are preferred in locations with high volumes of bicyclists, heavy parking turnover, higher vehicles speeds, higher traffic volumes, or a higher percentage of heavy trucks or buses.
- On State Aid Roads that allow 10 foot travel lanes, bicycle and parking lanes shall be 1 foot greater than minimum when travel lanes are reduced to less than 11 feet (see State Aid Rules reference).
- Where space is constrained, an integral bike lane and elongated gutter pan design may be used. The elongated gutter pan should be the same width as the desired bike lane.
- Where space is constrained, a modified curb design with a narrow gutter pan may be used. Gutter pans may be narrowed to as little as 6 inches in width.
- It is not desirable to include any portion of an adjacent gutter pan in a bike lane. However, in retrofit scenarios where bike lanes are being added to existing streets and space is constrained, up to one foot of the desired bike lane width may be gutter pan.
- Longitudinal (in the same direction as travel) joints are not desired within a striped bike lane. In a new construction scenario, strategies such as the elongated gutter pan, or the narrowed gutter pan should be considered to achieve desired placement of the joint. Where a longitudinal joint in a bike lane cannot be avoided, the joint should be located as far to the curb side of the bike lane as possible.
- If longitudinal trenching is to be done in the bicycle lane, the entire width of the bicycle lane should be trenched to avoid an uneven surface and/or longitudinal joints.
- Snow storage and removal should be considered when determining the width of a bike lane.
- Where additional space is available, consider providing a buffered bike lane.
- Green bike lanes meeting interim MUTCD conditions may be considered at conflict zones between bicyclists and motorists such as at intersection approaches and right-turn peel offs/slip lanes, or where there is an issue with parked vehicles in the bike lane.
- Slip bike lanes may be considered to the left of a right turn lane where bicycles continue through an intersection and there is a dedicated right turn lane.
- Bike lanes require periodic sweeping to clear debris and should be cleared of snow in the winter.

Bicycle Lane Widths General Guidance



CONSIDERATIONS/FACTORS	Preferred	Minimum
Adjacent to a parking lane	6'	5'
On roads with ADT < 10,000	5'	5'
On roads with ADT > 10,001	6'	6'
On roads with speeds > 35 mph	6'	6'

STRIPING WIDTH
4" outside stripe (adjacent to parking)
6" inside stripe

BUFFERS
2' min. horizontal for buffered bike lane

JOINTS/SEAMS
Preferred no joints in bike lane. If joints are unavoidable, grind and fill to create a flush surface.

GUTTER PAN
Acceptable to narrow to 6" to create space for bike lane.

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Related Treatments

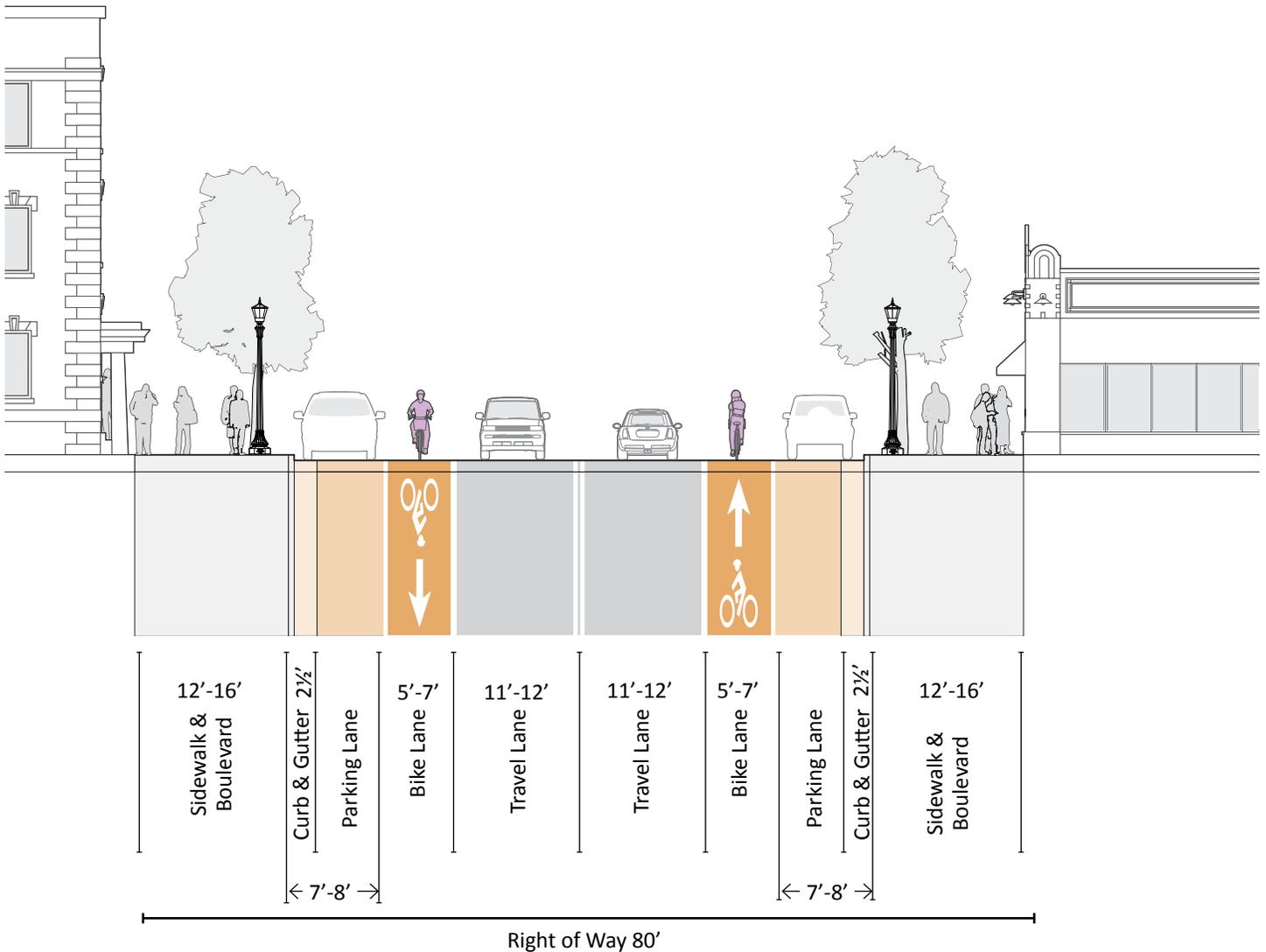
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Bike Lane with Parking



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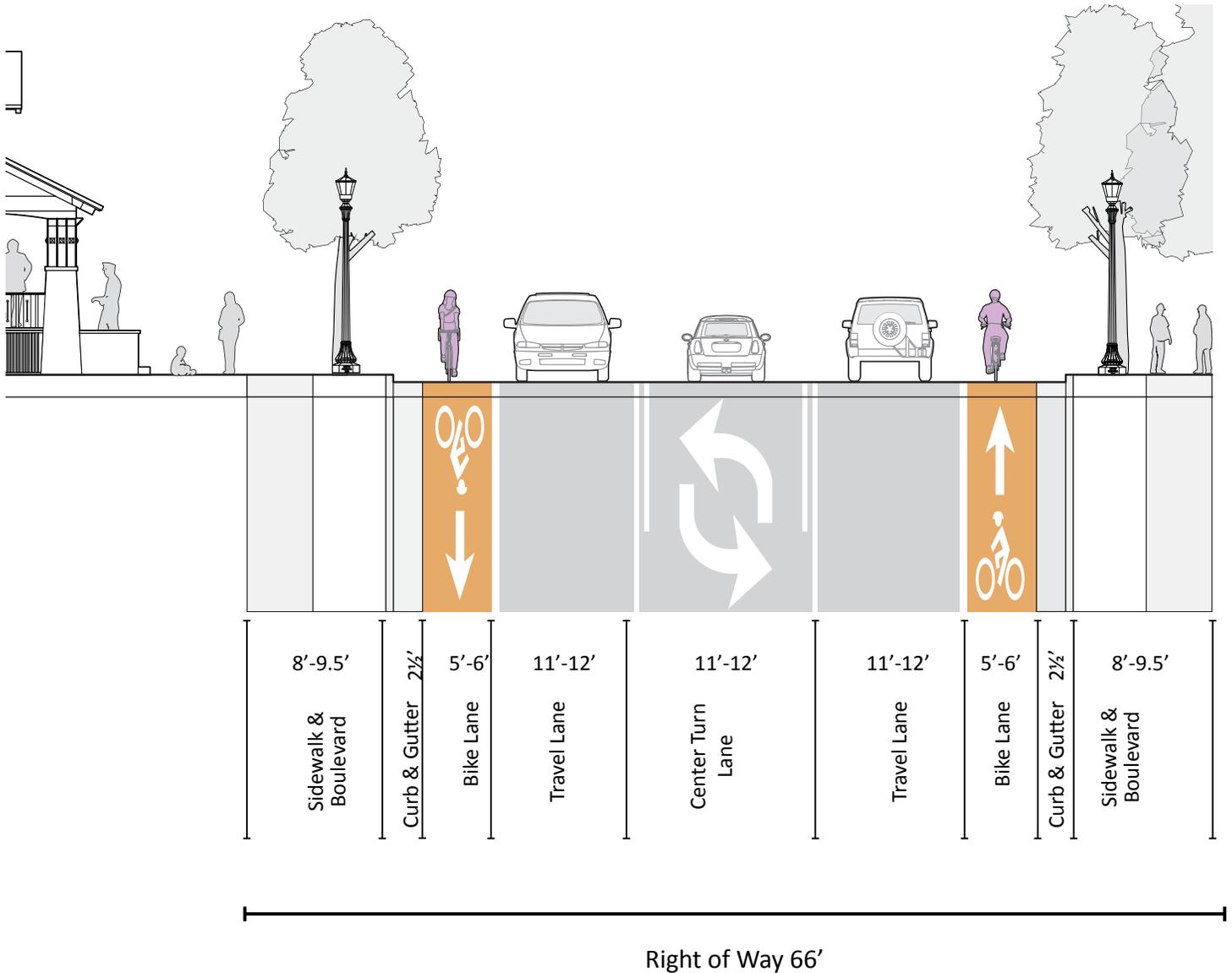
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Bike Lane without Parking, Typical Gutter Pan



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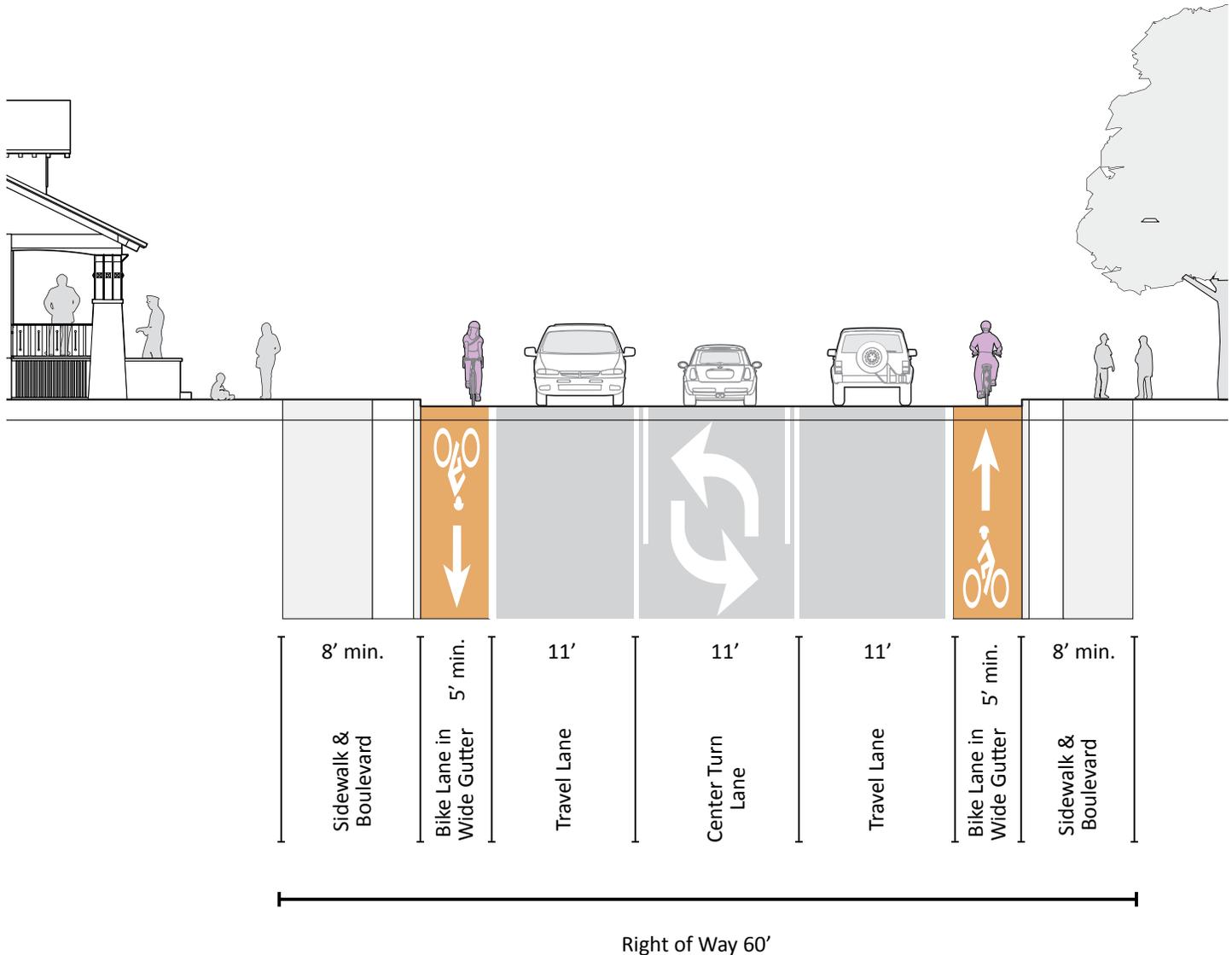
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Bike Lane without Parking, Wide Gutter Pan



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Buffered Bike Lanes

Definition

Similar to bike lanes, buffered bike lanes provide an exclusive space for bicyclists, with the addition of a buffer space separating the bicycle lane from the adjacent motor vehicle travel lane or parking lane.

Applicability and Use

Buffered bike lanes:

- Provide greater shy distance between motor vehicles and bicyclists.
- Provide space for bicyclists to pass another bicyclist without encroaching into the adjacent motor vehicle travel lane.
- Encourage bicyclists to ride outside of the door zone when the buffer is between parked cars and the bike lane.
- Provide a greater space for bicycling without making the bike lane appear so wide that it might be mistaken for a travel lane or a parking lane.
- Appeal to a wider cross-section of bicycle users.
- Encourage bicycling by contributing to the level of comfort among users of the bicycle network.

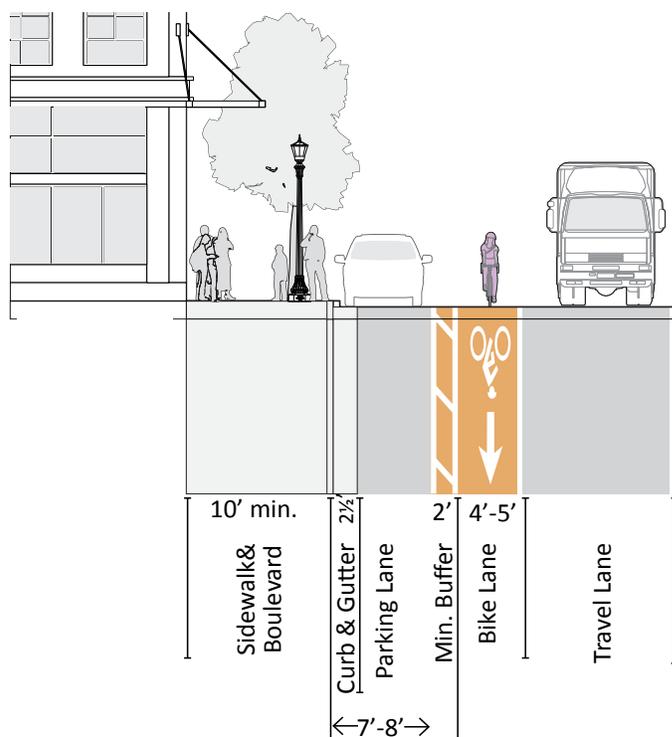
Design Considerations

- The minimum width for the buffer area is 2 feet. There is no maximum.
- Widths of buffered bike lanes are the same as for bike lanes without buffers
- Buffer striping will require additional time and materials for installation and maintenance when compared to conventional bicycle lane.
- Consider placing the buffer next to the parking lane where there is high parking turnover.
- Consider placing the buffer next to the travel lane where speeds are 35 mph or greater or when the ADT exceeds 10,000.

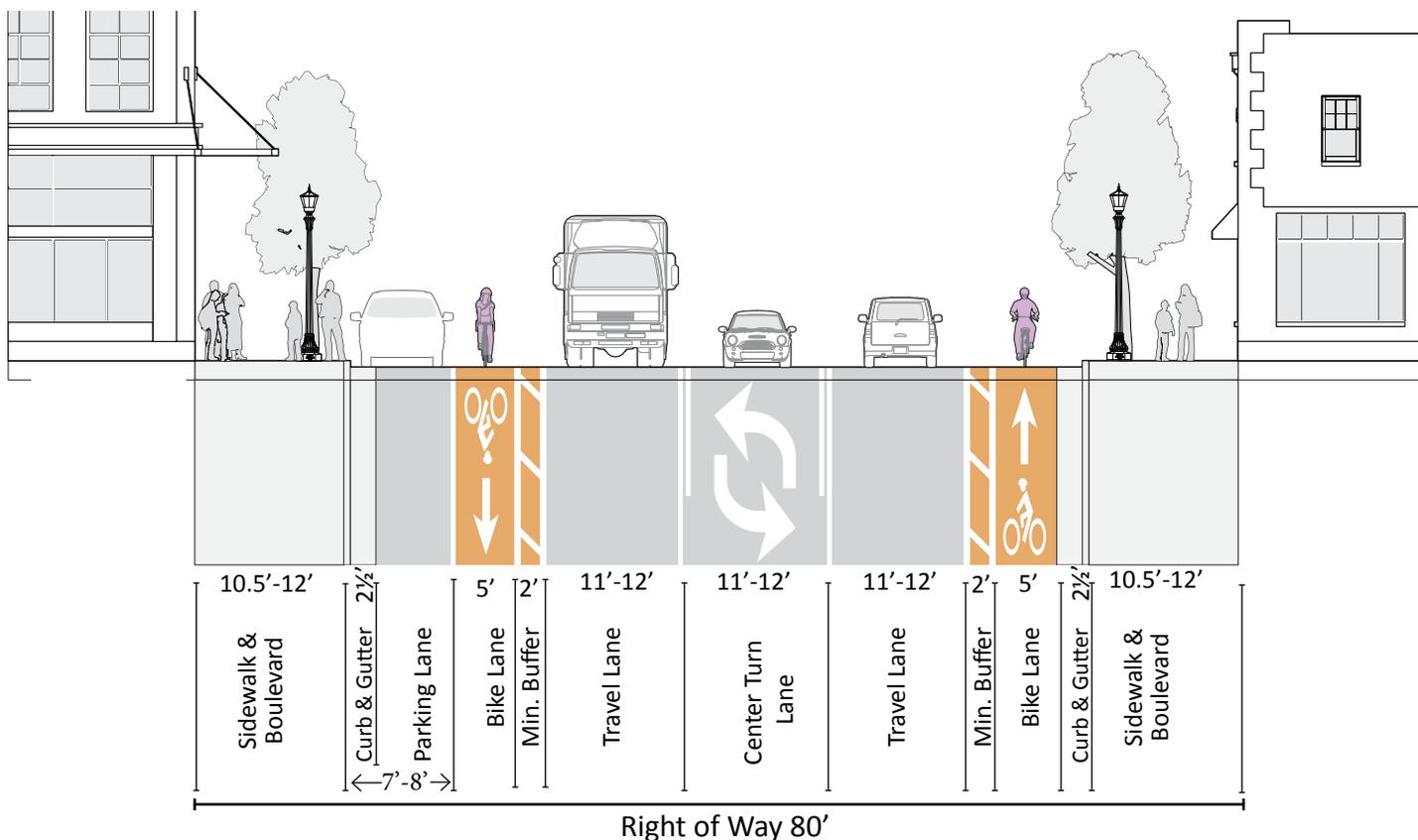


Credit: Toole Design Group

Buffered Bike Lane adjacent to Parking Lane



Buffered Bike Lane



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Counter-Flow Bike Lanes

Definition

Counter-flow bicycle lanes are bicycle lanes designed to allow bicyclists to ride in the opposite direction of motor vehicle traffic. Counter-flow bicycle lanes convert one-way traffic streets into a two-way streets: one direction for motor vehicles and bikes, and the other for bikes only.

Applicability and Use

Counter-flow bicycle lanes offer a number of benefits such as reduced sidewalk riding, reduced wrong-way riding, and elimination of out-of-direction travel through enhanced connectivity. Counter-flow lanes may be considered after careful review in the following situations:

- On streets where bicyclists are already commonly riding the wrong way.
- On corridors where alternate routes require excessive out-of-direction travel.
- On corridors where alternate routes include unsafe or uncomfortable streets with high traffic volumes or no bicycle facilities.
- On corridors where the counter-flow lane provides direct access to destinations on the street under consideration.
- Where two-way connections between bicycle facilities are needed along one-way streets.

This treatment works best on low-speed, low volume streets, unless buffer separation or physical protection is provided.

Combining both directions of bicycle travel on one side of the street to accommodate counter-flow movement results in a two-way cycle track (see related designs).



Design Considerations

- Bicycle lane text, symbol, and arrow markings (MUTCD Figure 9C-3) must be used to define the bike lane direction and designate that portion of the street for use by bicyclists.
- A “ONE WAY” sign (MUTCD R6-1, R6-2) with “EXCEPT BIKES” plaque must be posted along the facility and at intersecting streets, alleys and driveways informing motorists to expect two-way bicycle traffic.
- A “DO NOT ENTER” sign (MUTCD R5-1) with “EXCEPT BIKES” plaque should be posted along the facility to only permit use by bicycles. Intersection traffic controls along the street (e.g., stop signs and traffic signals) must also be installed and oriented toward bicyclists in the counter-flow lane.
- A solid double yellow lane line marking must be used to separate opposing motor vehicle travel lanes from the counter-flow bicycle lane.
- A counter-flow lane should always be installed with a bicycle facility (bike lane or shared lane marking) on the other side of the roadway. A counter-flow bike lane on one side of the roadway, without a complementary facility on the other side of the roadway, will result in wrong-way riding in the bike lane.
- Counter-flow bike lane markings may be extended across the intersection, as a way of alerting cross street traffic to look for counter-flow bicyclists.
- The counter-flow design introduces new design challenges and may introduce additional conflict points as motorists may not expect on-coming bicyclists. If sufficient space exists, a buffered bike lane design should be used. The buffer should conform to Figure 3D-4 of the MUTCD.

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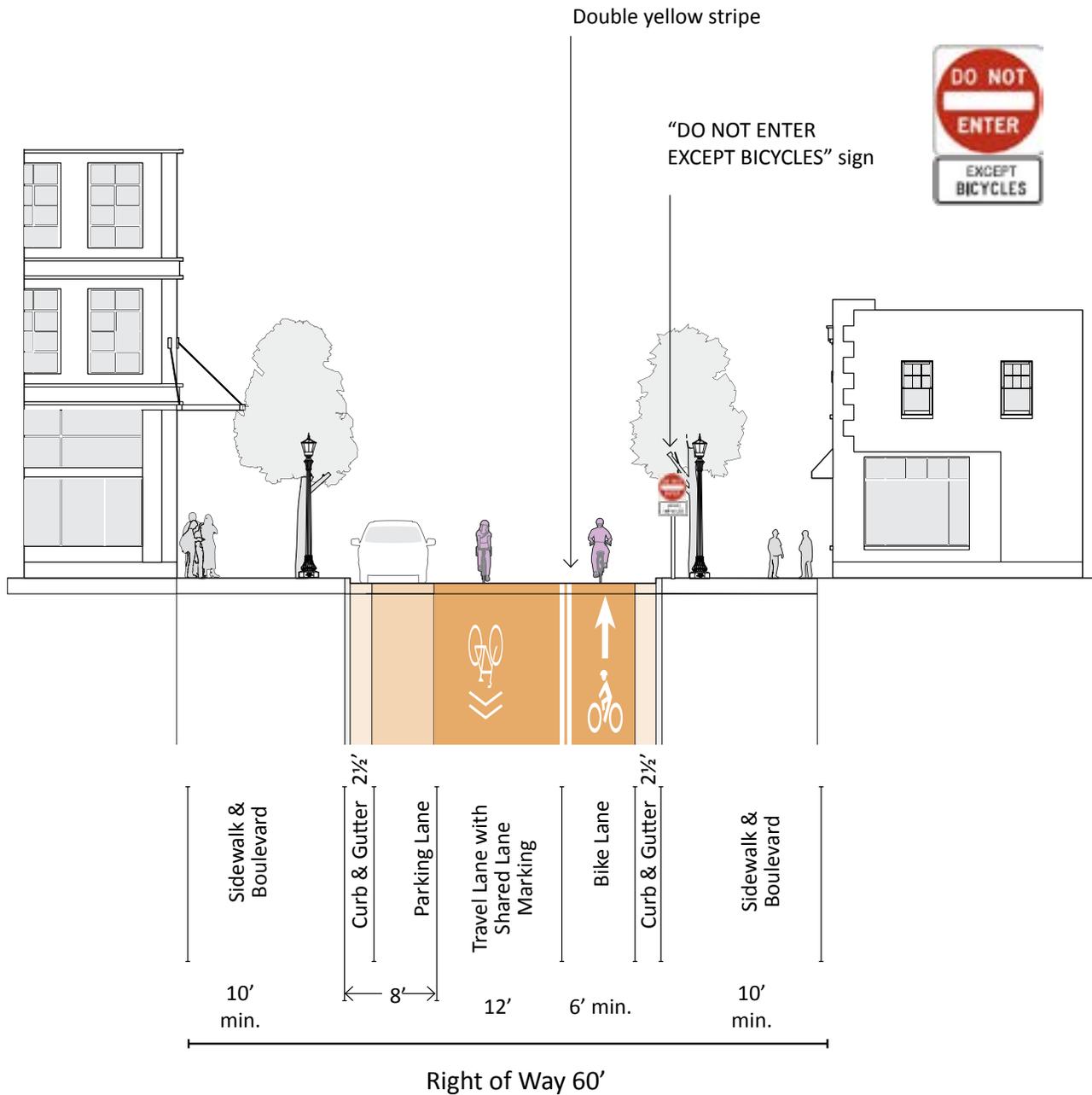
Related Treatments

Bike Lanes
 Bike Lanes at Intersections
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Counter-flow Bike Lanes



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Shared Lane Markings

Definition

All vehicle travel lanes within a street may be considered shared lanes except where bicycles are prohibited (e.g., limited access freeways). Shared lanes may be unmarked or marked using shared lane markings (commonly referred to as sharrows).

Applicability and Use

Shared lane markings alert motorists of the likely presence of bicyclists and show bicyclists where to position themselves within the travel lane. Shared lane markings may also be used as a wayfinding tool. Neighborhood streets, Mixed Use Corridors, Residential Corridors and Downtown streets may all provide comfortable and safe shared lane conditions. Shared lane markings may be considered in the following situations:

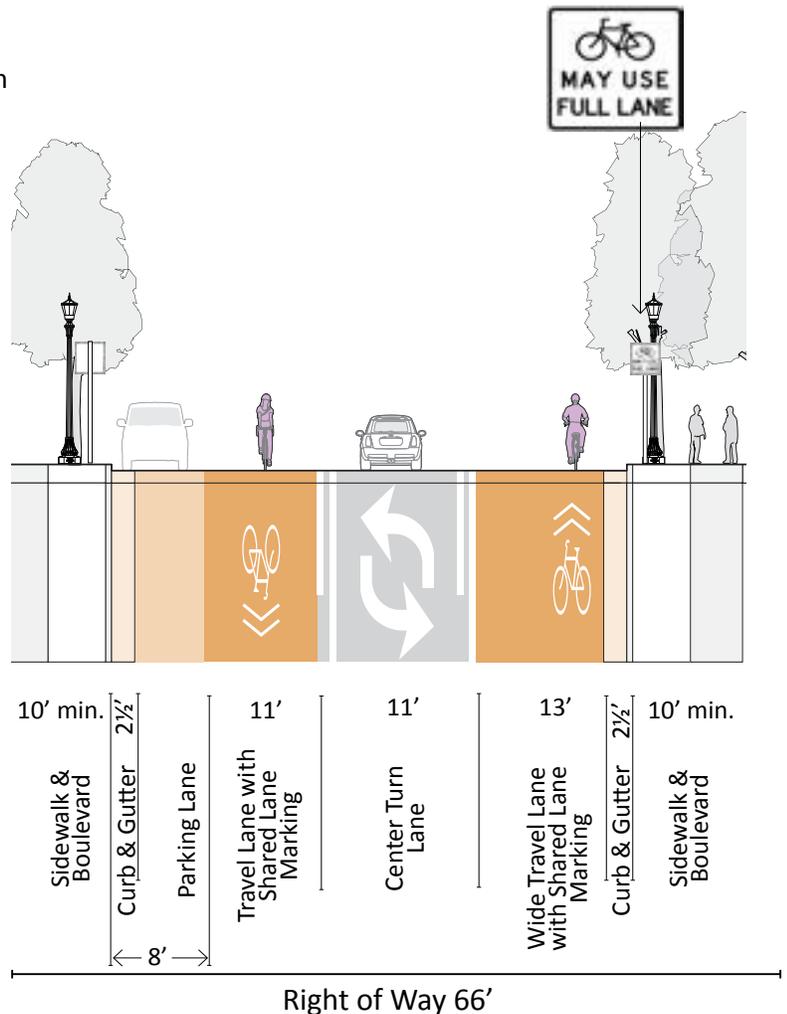
- On streets where space constraints and operations make it unfeasible to provide an exclusive facility such as a bike lane or cycle track.
- As a wayfinding element for continuity in the bicycle facility.
- On streets with on-street parking, so as to help bicyclists avoid collisions with car doors opening into the travel lane.



Credit: Michael Richardson

Design Considerations

- Shared lane markings must not be used on streets with speed limits higher than 35 mph.
- On streets with lanes that are 11 feet or less, the shared lane marking should be placed in the center of the lane to indicate that motorists must change lanes to pass bicyclists.
- Shared lane markings should be placed in a location that is outside of the 'door zone' of parked vehicles.
- On multilane streets, shared lane markings are placed in the outside lane.
- On one-way streets, shared lane markings may be placed in the curb lane on both sides of the street if there are high volumes of bicyclists turning left and right.
- Shared lane markings are typically placed at the beginning of each block, in each direction of travel.
- On streets with ADT over 5,000, shared lane markings may be used in select locations such as: downtown where speeds are typically slower than 30 mph; to connect gaps between bike lanes; or as a temporary measure where a bike lane is preferred in the long-term.
- When using shared lane markings to connect gaps between bike lanes, safety, speed, volume and mix of traffic should be considered to determine the acceptable distance.



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 Travel Lanes
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 Wayfinding

References

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Climbing Lanes

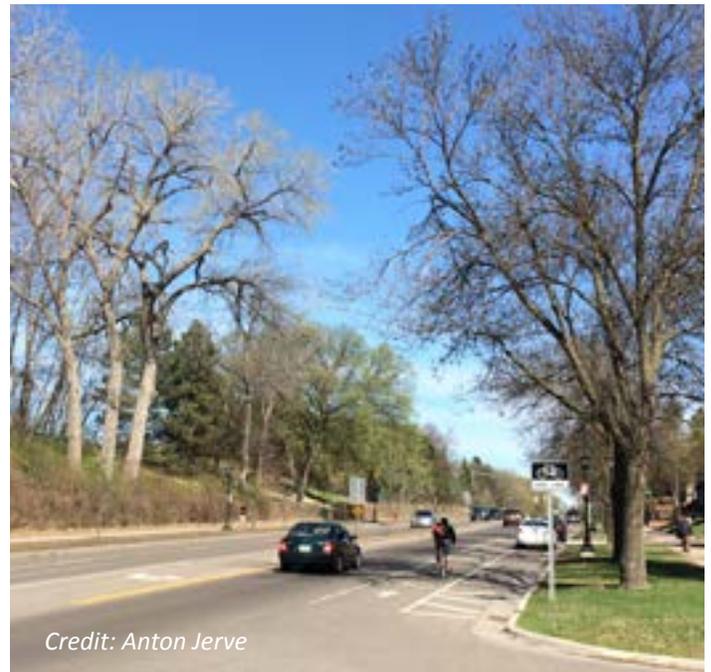
Definition

Climbing lanes are bike lanes that are provided only on the uphill side of streets. Bicyclists travelling in an uphill direction move at significantly slower speeds than adjacent traffic, and therefore benefit from the presence of a separated lane. In such cases, a bicycle lane is installed on the uphill direction, allowing motor vehicles to pass while providing operating space for bicyclists negotiating the hill.

Applicability and Use

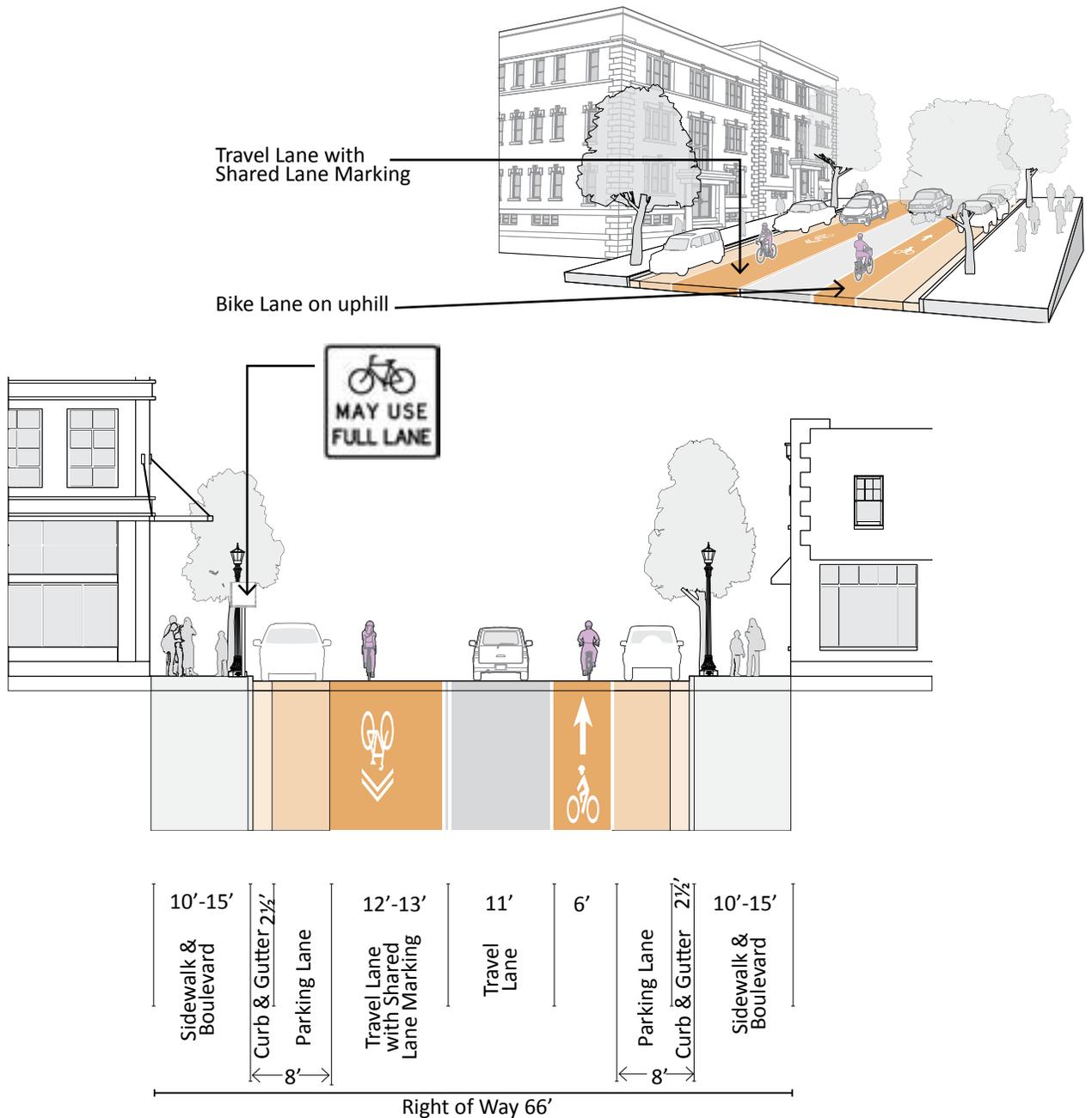
Climbing lanes may be used on any street with an appreciable grade and should be strongly considered where the grade is greater than 12 percent or sustained for a length greater than 1,000 feet, and there is insufficient space for bicycle lanes on both sides of the street. Climbing lanes are not appropriate on streets where there are short, rolling hills because the lanes would stop and start too often, possibly confusing bicyclists and motorists with the associated lane shifts and transitions. Climbing lanes are beneficial to bicyclists and motorists for the following reasons:

- Allow motorists to safely pass uphill riding bicyclists.
- Provide a dedicated space in the street for bicyclists who may tend towards weaving behavior as they negotiate the hill.
- Improves motorists' sight triangles at pedestrian crossings located on the hilltop.



Design Considerations

- Installation of climbing lanes may require vehicle lane striping to be shifted slightly in order to provide sufficient vehicle lane width.
- Wider (i.e., 6 feet) climbing lanes provide more operating space for uphill traveling bicyclists and should be considered.
- When travelling downhill bicycles pick up speed and can travel at similar speeds as motor vehicles, therefore shared lane markings may be used in the downhill direction to direct bicyclists away from potential hazards (e.g., doors of parked cars), which are more difficult to react to at higher downhill speeds. Downhill bicycle lanes should only be considered where there is sufficient space to provide buffers between the bike lane and parked cars.
- A bike lane on one side of the roadway, without a complementary facility on the other side of the roadway (e.g., shared lane marking) will result in wrong-way riding in the bike lane.
- Bike lanes may require periodic sweeping to clear debris and should be cleared of snow in the winter.



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Cycle Tracks

Definition

Cycle tracks have several different forms but share common elements—they provide space that is intended to be exclusively or primarily used for bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks. Cycle tracks may be one-way or two-way facilities. One-way facilities are also known as Protected Bike Lanes. Cycle tracks are generally located in the roadway, separated from adjacent travel lanes by a buffer, a median, a vertical element such as flexible posts, or a parking lane. A defining feature of cycle tracks is that they place bicyclists in the roadway, where they become subject to all applicable vehicle traffic laws as defined by the state of Minnesota, including at intersections.



Applicability and Use

By separating bicyclists from motor traffic, cycle tracks can offer a higher level of security than bike lanes and are attractive to a wider spectrum of bicyclists with a range of cycling abilities and preferences. Typical applications for cycle tracks include:

- Streets with high bicycle volumes.
 - Streets on which bike lanes would cause even the most skilled bicyclists to feel stress because of factors such as multiple lanes, high traffic volumes, higher speed traffic, high incidence of illegal parking in the bike lane, and high parking turnover.
 - Recreational corridors, scenic corridors, or parkways that are part of a regional trail system
- Cycle tracks may be one-way or two-way. One-way cycle tracks should be provided on both sides of a two-way street unless there is a parallel route or some other unusual situation. Two-way cycle tracks may be appropriate for the following situations:
- Streets with fewer conflicts such as driveways or cross-streets on one side of the street.
 - Streets where there is not enough room for a one-way cycle track on both sides of the street.
 - One-way streets where counter-flow bicycle travel is desired for connectivity purposes.
 - Streets where more destinations are on one side thereby reducing the need to cross the street.
 - To connect with another bicycle facility, such as a second cycle track on one side of the street.

Placemaking/ Public Art Opportunity

Public art may be used to separate the automobile traffic from the cycle track. Consideration should be made for sight lines in proximity to intersections.



Claudia Fitch

Design Considerations

- One-way cycle tracks typically range in width from 5 feet to 7 feet. The buffer between the cycle track and adjacent traffic should be a minimum of 2 feet.
- Two-way cycle tracks typically range in width from 10 feet to 12 feet. In constrained locations, an 8 foot, cycle track may be considered. The buffer between the cycle track and adjacent traffic should be a minimum of 3 feet.
- When protected by a parking lane, 3 feet is the desired width for a buffer between parking lane and cycle track to allow for passenger loading and to prevent dooring collisions.
- Streets with the least number of driveways or cross-streets provide the best opportunity for a quality cycle track.
- Cycle tracks should be installed only on streets for which conflicts at intersections can be effectively mitigated using parking lane restrictions, bicycle markings through the intersection, or other signalized intersection treatments.
- Special consideration must be given to available space and operational speed on two-way cycle tracks proposed on streets with sustained grades due to the heightened potential for conflict between uphill and downhill bicyclists, as well as turning vehicles.
- The buffer space may be emphasized with bollards, planters, signs or other forms of physical protection.
- At transit stops along cycle tracks, special consideration should be given to manage bicyclist, pedestrian and transit operator interactions.
- Bicycle lane word, symbol, and/ or arrow markings (MUTCD Figure 9C-3) shall meet the MUTCD guidelines for placement.
- If a two-way cycle track is configured on a one-way street, the addition of a “ONE WAY” sign (MUTCD R6-1, R6-2) with “EXCEPT BIKES” plaque is the appropriate sign treatment to be posted along the facility and at intersecting streets, alleys, and driveways informing motorists to expect two-way bicycle traffic.
- Special consideration should be given regarding the use of color or pavement markings to enhance locations of conflict, such as where cycle tracks cross intersections or driveways.
- Features such as a two-stage turn queue box may be considered to assist bicyclists in making turns from the cycle track facility.
- When providing accessible vehicle parking spaces alongside cycle tracks, there are a number of considerations for accommodating persons with disabilities in the design of one-way and two-way protected cycle tracks.

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Cycle Tracks

Design Considerations continued

- Driveways and minor street crossings are a unique challenge to cycle track design. The following guidance may improve safety at crossings:
 - If the cycle track is parking-protected, vehicle parking should be prohibited near the intersection to improve visibility. The desirable no parking area is 30 feet from each side of the crossing.
 - Street or sidewalk furnishings should accommodate a sight triangle, or clear area at intersections, for vehicles attempting to cross a cycle track of:
 - 20 feet from minor street crossings;
 - and 10 feet from driveway crossings.
 - Color, yield lines, and “YIELD TO BIKES” signage should be used to identify the conflict area and make it clear that the cycle track users moving through the intersection have priority over entering and exiting traffic.
 - Motor vehicle traffic crossing the cycle track should be constrained or channelized to make turns at sharp angles to reduce travel speed prior to the crossing.

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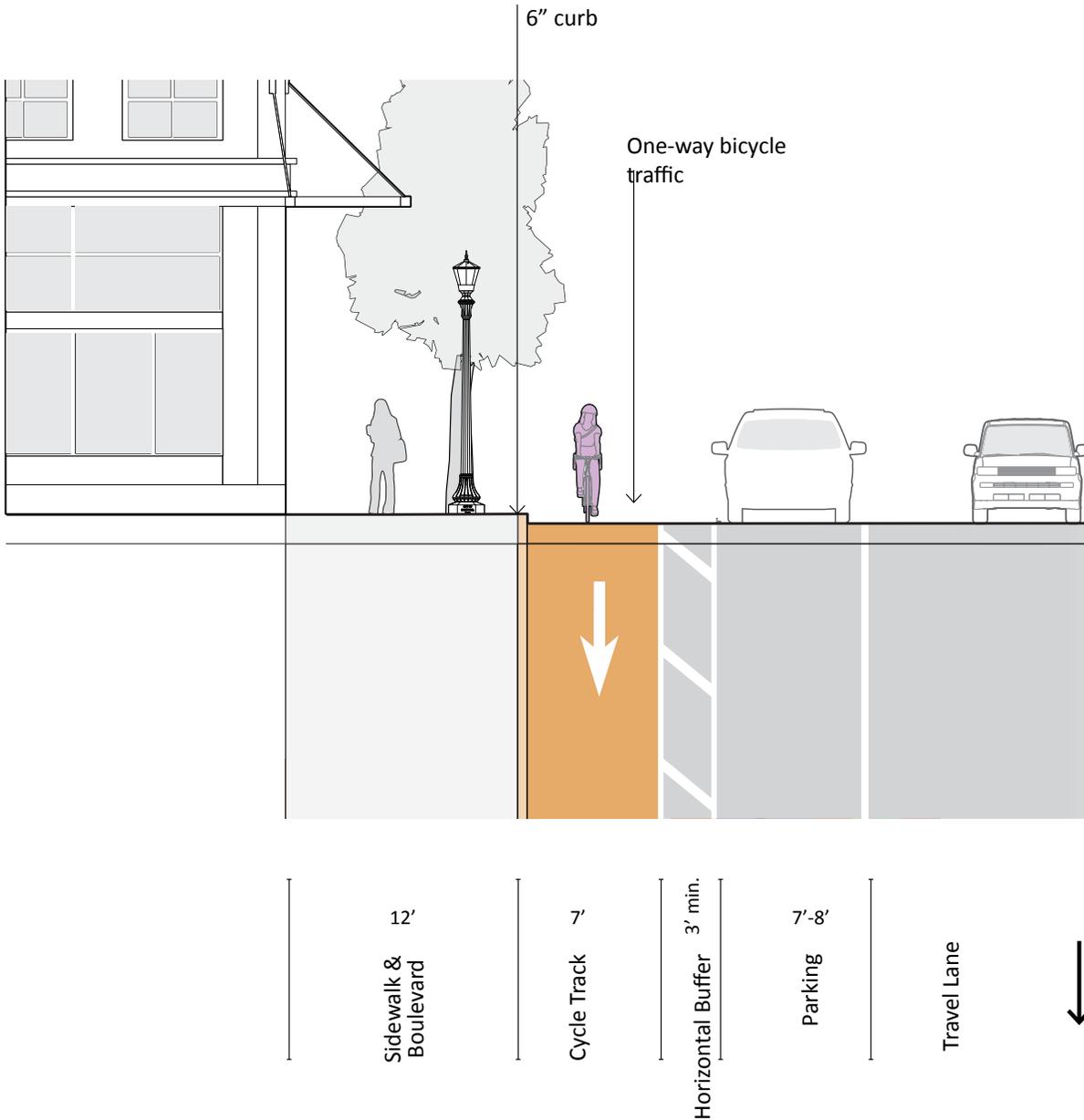
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Cycle Track, One-way with Floating parking



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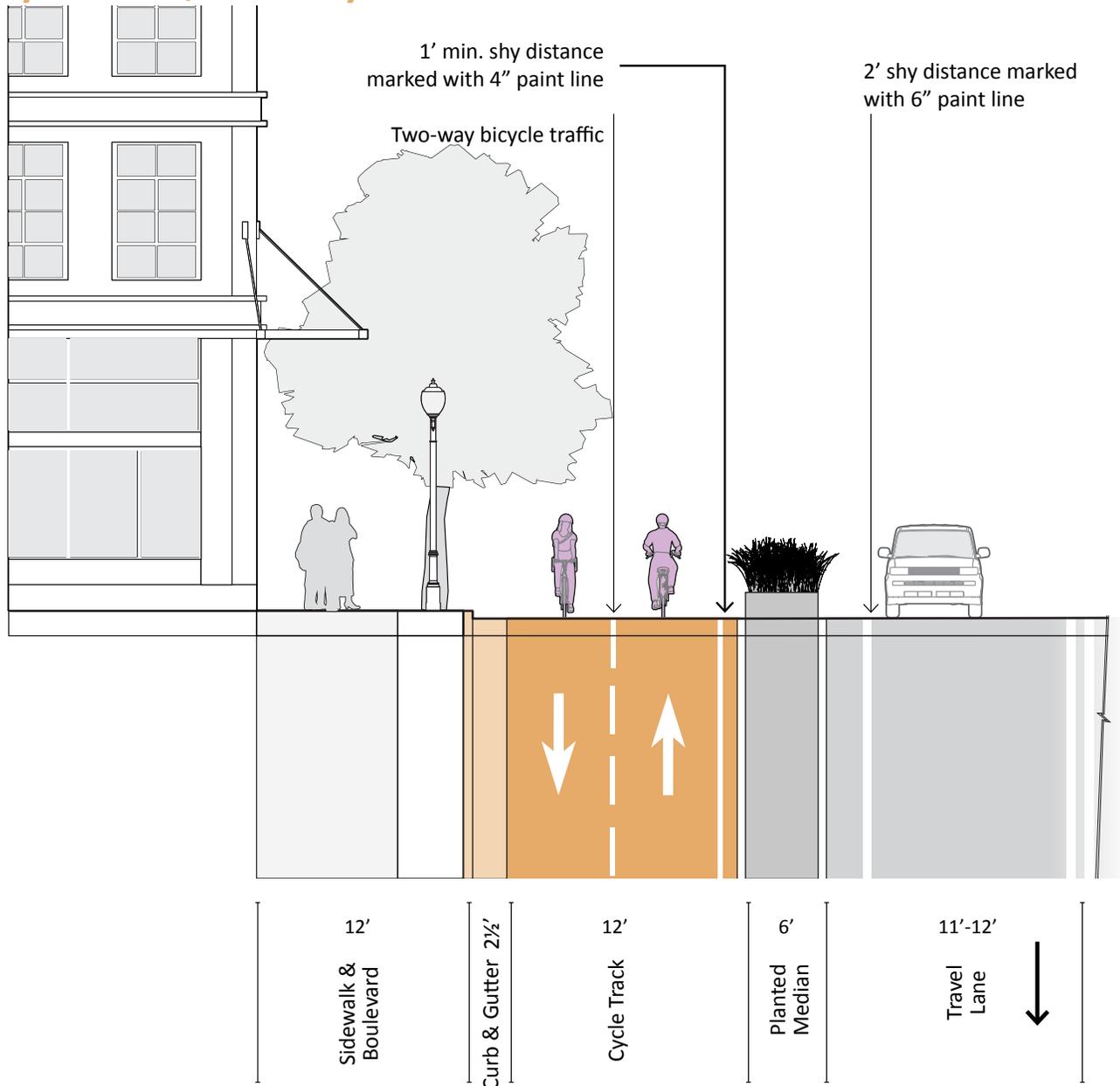
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Cycle Track, Two-way with Horizontal Buffer



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Bicycle Boulevards

Definition

A bicycle boulevard is a local street or a series of contiguous street segments that has been modified to function as a through street for bicyclists, while discouraging through automobile traffic but maintaining local access. Bicycle boulevards create favorable conditions for bicycling by taking advantage of neighborhood streets and their inherently bicycle-friendly characteristics, e.g., low traffic volumes and operating speeds. It is often necessary to make physical and operational changes, particularly where bicycle boulevards intersect a busy arterial street, to allow bicyclists to travel along a bicycle boulevard with relative ease.

Applicability and Use

- Bicycle boulevards are typically developed along neighborhood streets and may serve as cross-city routes, or as a component of a network of other bicycle facilities that offer comparable levels of comfort for the bicyclist, such as off-street trails or separated on-street facilities.
- A bicycle boulevard may also be developed as a parallel, alternative bicycle route to a busier street within the same corridor, but the alternative street should have the same connectivity and access to destinations.
- Bicycle boulevards can also provide a short segment on a route that might connect a neighborhood to a key destination such as a school.



Design Considerations

A neighborhood street may already have many of the desired characteristics that make it a comfortable and continuous riding experience, or may incorporate several of the following bicycle boulevard design elements to accommodate bicyclists:

- Traffic-calming features such as neighborhood traffic circles, bump outs, and chicanes that slow motor vehicle traffic but allow bicyclists to maintain momentum.
- At two-way stop-controlled intersections, priority assignment that favors the bicycle boulevard, so bicyclists can ride with few interruptions.
- Traffic diverters at key intersections to reduce through motor vehicle traffic while permitting passage for through bicyclists.
- Wayfinding signs and/ or pavement markings to guide bicyclists along the way and to key destinations.
- Shared lane markings or other markings where appropriate to alert drivers and cyclists to the recommended lane position for bicyclists on a shared roadway.
- Crossing improvements such as median crossing islands, bump outs, marked crosswalks, rapid flash beacons, or traffic signals where the bicycle boulevard crosses major streets.

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Travel Lanes

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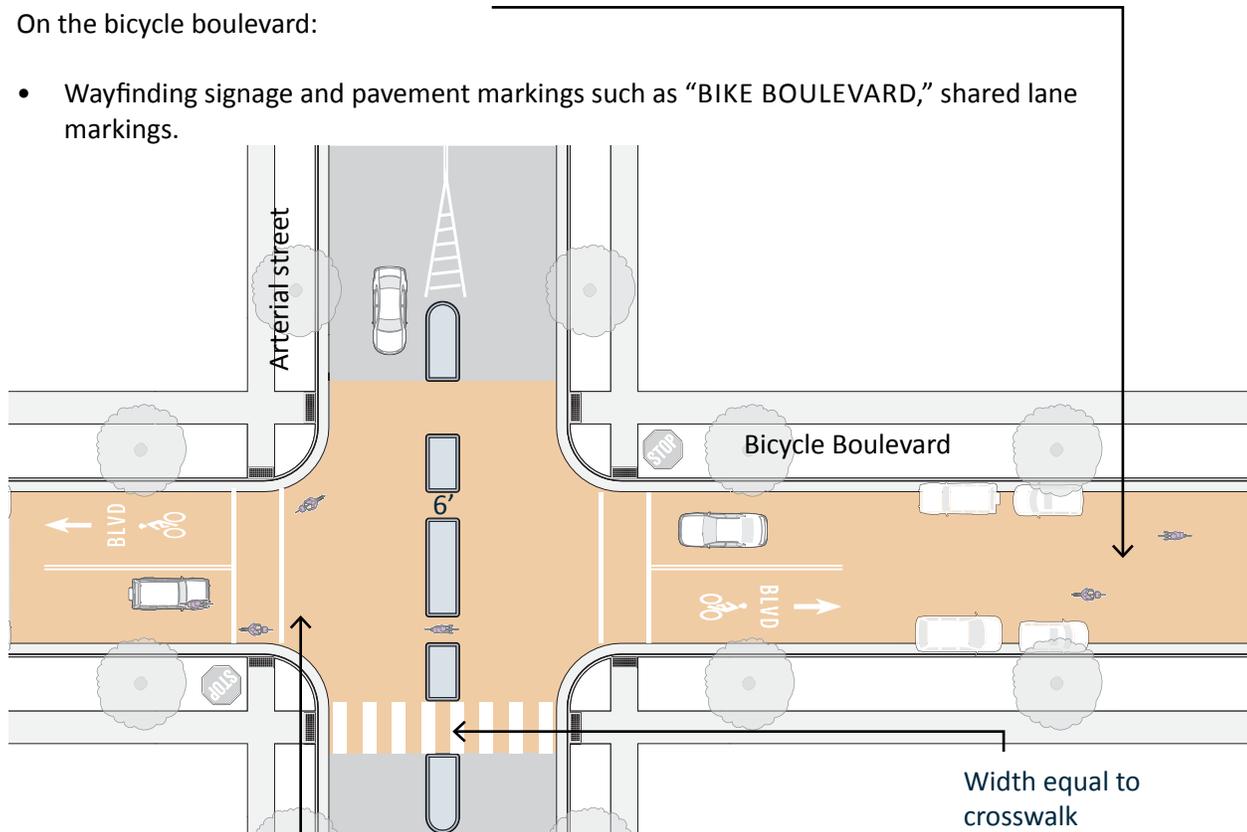
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Bicycle Boulevards

Bicycle Boulevard

On the bicycle boulevard:

- Wayfinding signage and pavement markings such as “BIKE BOULEVARD,” shared lane markings.



At arterial crossings, a variety of traffic control measures may be employed in order to:

- Facilitate bicycle crossing of the arterial
- Slow or limit through traffic on the bicycle boulevard

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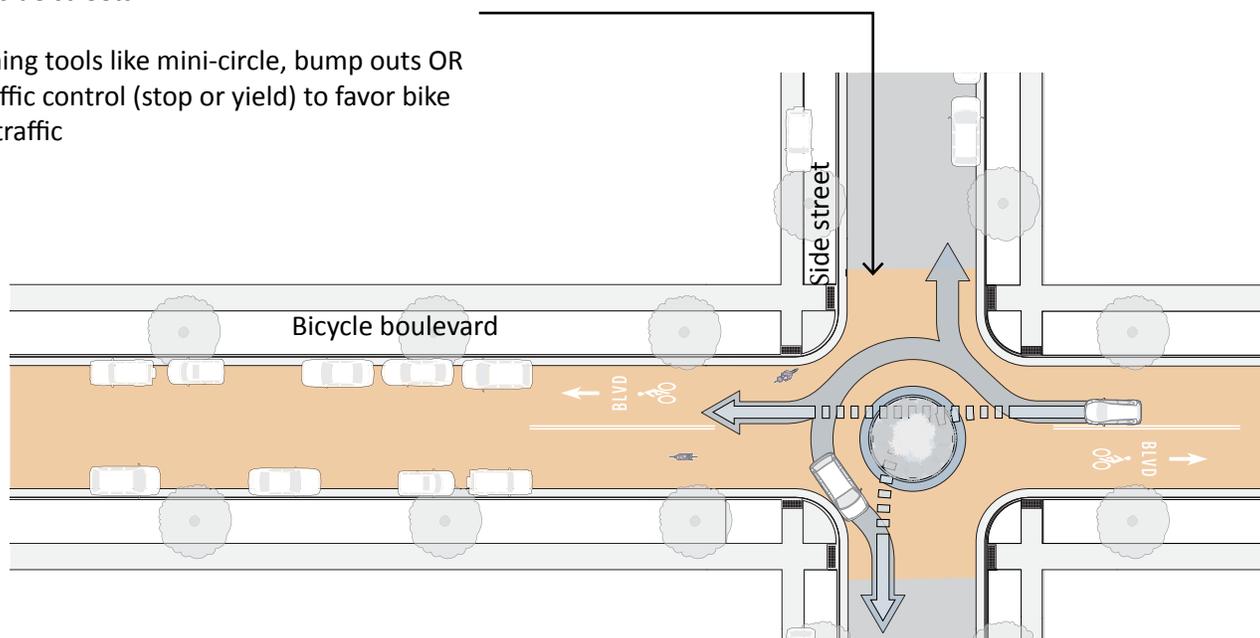
Traffic Calming
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At intersecting side streets:

- Traffic calming tools like mini-circle, bump outs OR
- Positive traffic control (stop or yield) to favor bike boulevard traffic



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 NACTO Urban Bikeway Design Guidelines

Bike Lanes at Intersections

Definition

Intersections are often where most conflicts between bicyclists and motorists occur. Particularly complicated intersections can be intimidating barriers to less confident bicyclists if not designed in a way that clearly indicates to bicyclists and motorists how they should traverse the intersection. Design innovations such as green bike lanes and bike boxes can make traveling through an intersection more comfortable for all modes.

Applicability and Use

Where there are existing or planned bike lanes, bicyclists may be accommodated by continuing the dedicated bike lane facility up to the intersection under MUTCD interim guidance. Shared lane markings may be used to indicate proper positioning where bicyclists must share the lane with motor vehicles, or to direct bicyclists through the intersection or a left-turn bike lane. Green bike lanes or a dashed stripe may also be used direct bicyclists through the intersection. Bike boxes (described elsewhere in this manual) allow bicyclists to move to the front of the queue, which improves their visibility and ability to safely execute a left turn or clear an intersection during the green phase.

Right Turns

Right turns are relatively easy for bicyclists, since they typically ride on the right side of the street. Where there is a right-turn only lane, right-turning bicyclists are typically encouraged to merge with right-turning motor vehicles.

Through Movements

Through-moving bicyclists may be vulnerable to right-turning motor vehicles crossing over the bike lane (often referred to as a “right hook” conflict). Where there is no designation of a right-turn only lane, the bike lane may be continued to the edge of the intersection.

Where there is a right-turn-only lane, there are several considerations:

- Where there is adequate width to continue the bike lane marking up to the intersection, the bike lane should be marked to the left of the right-turn only lane, enabling bicyclists and right-turning motorists to sort their paths by destination in advance of the intersection, avoiding last-moment conflicts.
- Where there is not adequate width to continue the bike lane marking up to the intersection, shared lane



markings may be incorporated at the left edge of the right-turn lane or in the through lane.

Additional treatments such as green bike lanes and signage may be used to raise both motorists’ and bicyclists’ awareness of potential conflict.

Left Turns

A separate bicycle left-turn lane should be provided where there are considerable volumes of left-turning bicyclists, or where a designated or preferred bicycle route makes a left turn. Left-turn lanes may also be appropriate at locations where left turns are allowed for bicyclists but not motorists (e.g., onto a bicycle boulevard or shared use path). A green bike box may be used at a signalized intersection to facilitate bicyclists making left turns, to provide storage if bicycle volumes are high, and to raise awareness of motorists that bicyclists may be present.

Design Considerations

Shared Motor Vehicle Through/Right-Turn Lanes

- On approaches to intersections that do not have right-turn-only lanes, bike lane lines may be dotted or temporarily dropped. The dotted line is intended to provide a reminder that merging movements can be expected, and should be used where there are a high number of right-turning vehicles, or where heavy vehicles frequently turn right.
- If dotted lines are installed, they should begin 50 to 200 feet prior to the crosswalk or edge of intersection if no crosswalk exists.
- Alternatively, rather than continuing a dotted bike lane marking, bike lanes may be dropped on an intersection approach. Dropping of a bike lane should occur 50 to 200 feet prior to the crosswalk or edge of intersection if no crosswalk exists. Shared lane markings may be used to indicate preferred positioning for bicyclists (e.g., in center of lane or off of curb so that they are more visible to right-turning vehicles).
- The bike lane line should resume with a solid line on the far side of the intersection (outside crosswalk area).

Right-Turn-Only Lanes

- Through bike lanes must be placed to the left of right-turn-only lanes.
- A dotted line should be used to indicate where right-turning motor vehicles are expected to cross over the bike lane. The dotted line should commence 80 to 200 feet and become solid 50 to 80 feet from the stop bar or crosswalk. Green pavement markings may be used within the dotted transition area (note – white dotted line must always be placed just outside both sides of the green bike lane).
- The “BEGIN RIGHT TURN LANE YIELD TO BIKES (R4-4)” sign may be used to remind motorists entering the turn lane of their obligation to yield to bicyclists who are continuing through the intersection in the bike lane. Other signs may be used as appropriate. Care should be taken to avoid over-signing intersections to avoid creating confusion.
- The use of dual right-turn-only and through/ right-turn lane next to a right-turn-only lane should be avoided where there is a through bike lane.

Left-Turn Lanes

- Where it is determined a bicycle left-turn lane is appropriate, it should be placed to the right of a dedicated left-turn lane on both two-way and one-way streets.

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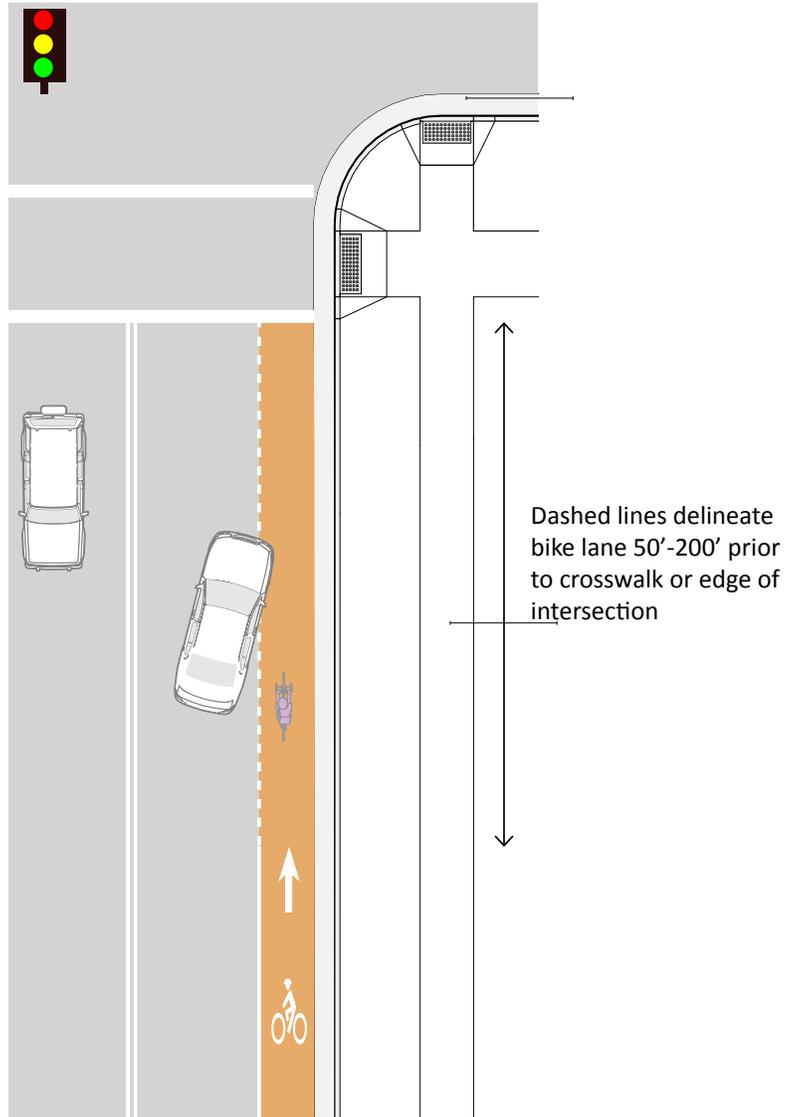
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Bike Lanes at Intersections

Bike Lanes adjacent to Through/Right-Turn Lanes, at Signals



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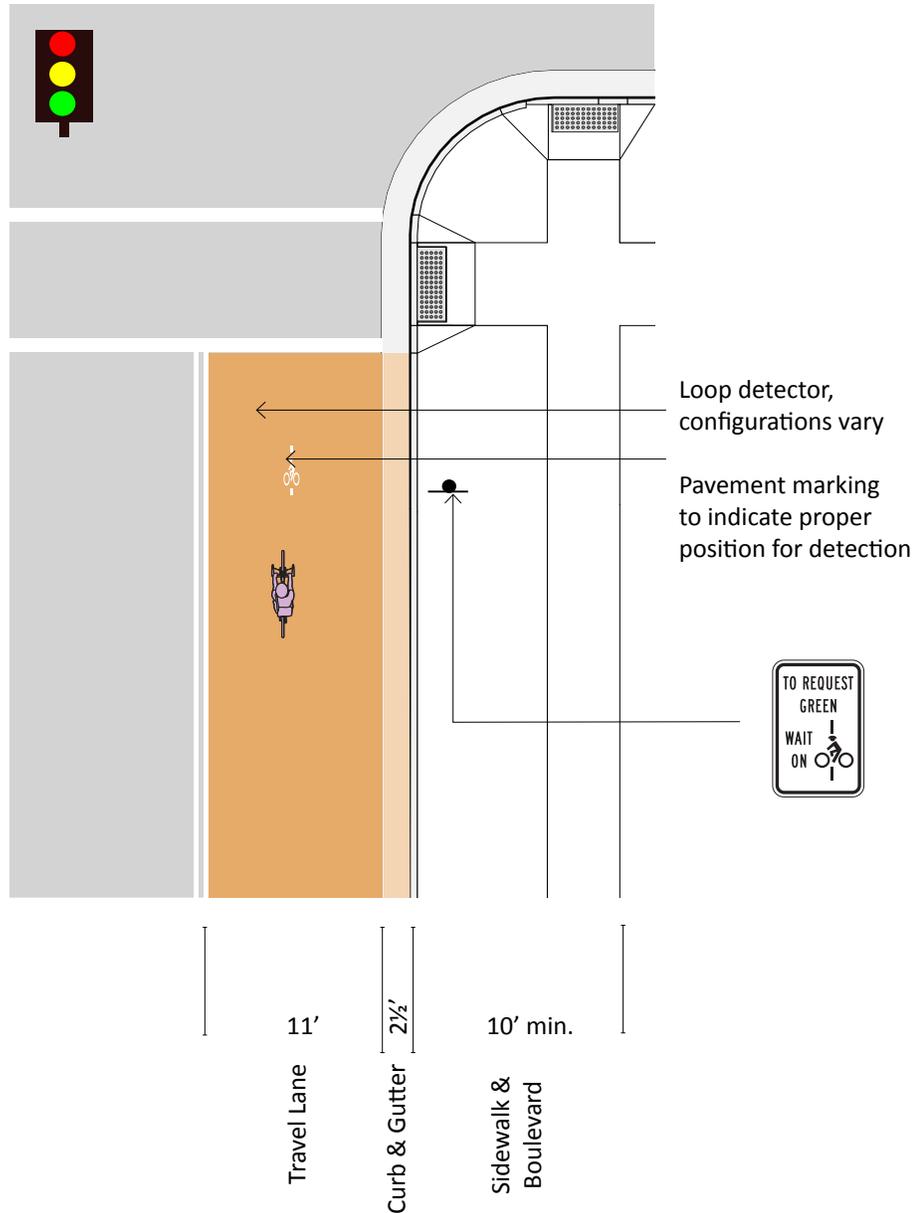
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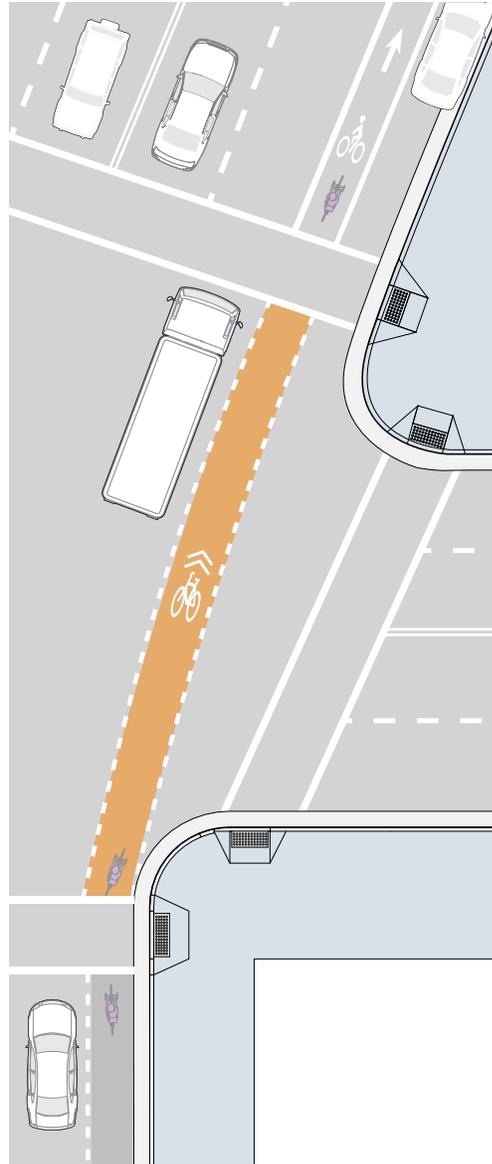
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Bike Lanes with Shared Lane Markings through Complex Intersections



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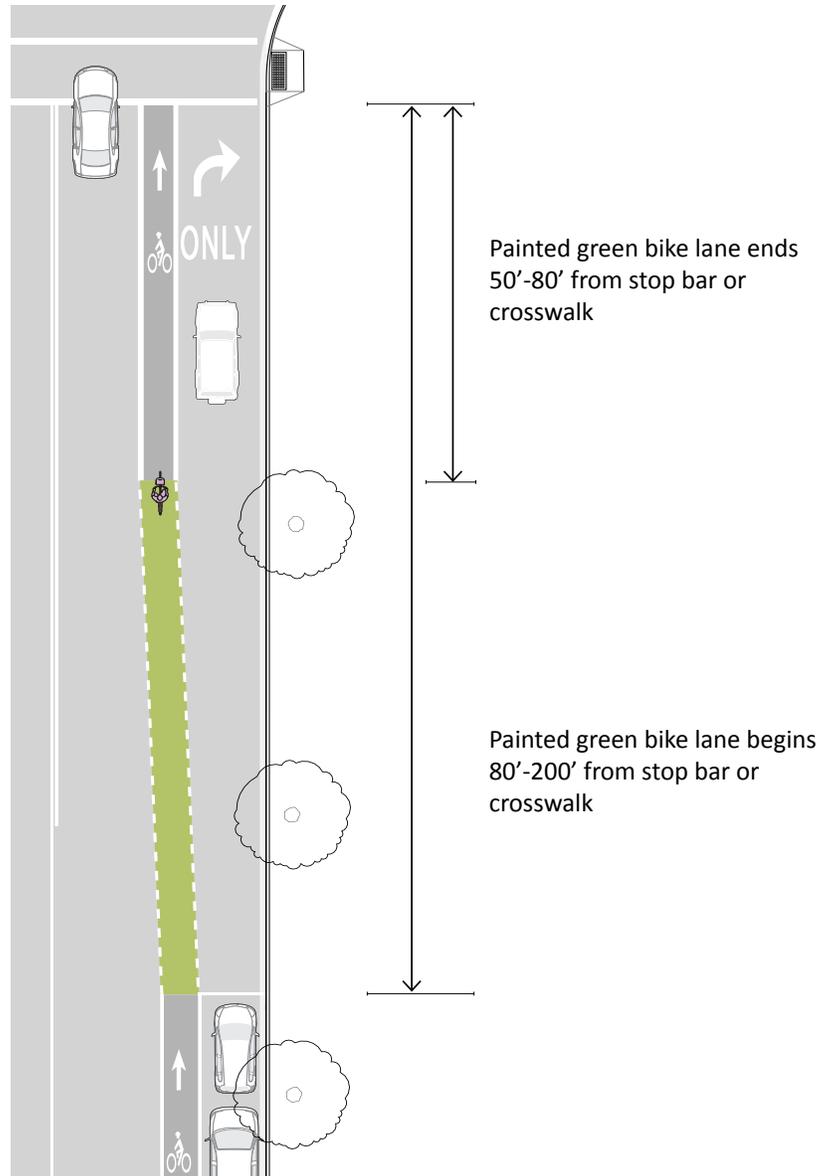
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Green Bike Lane with Slip Lane



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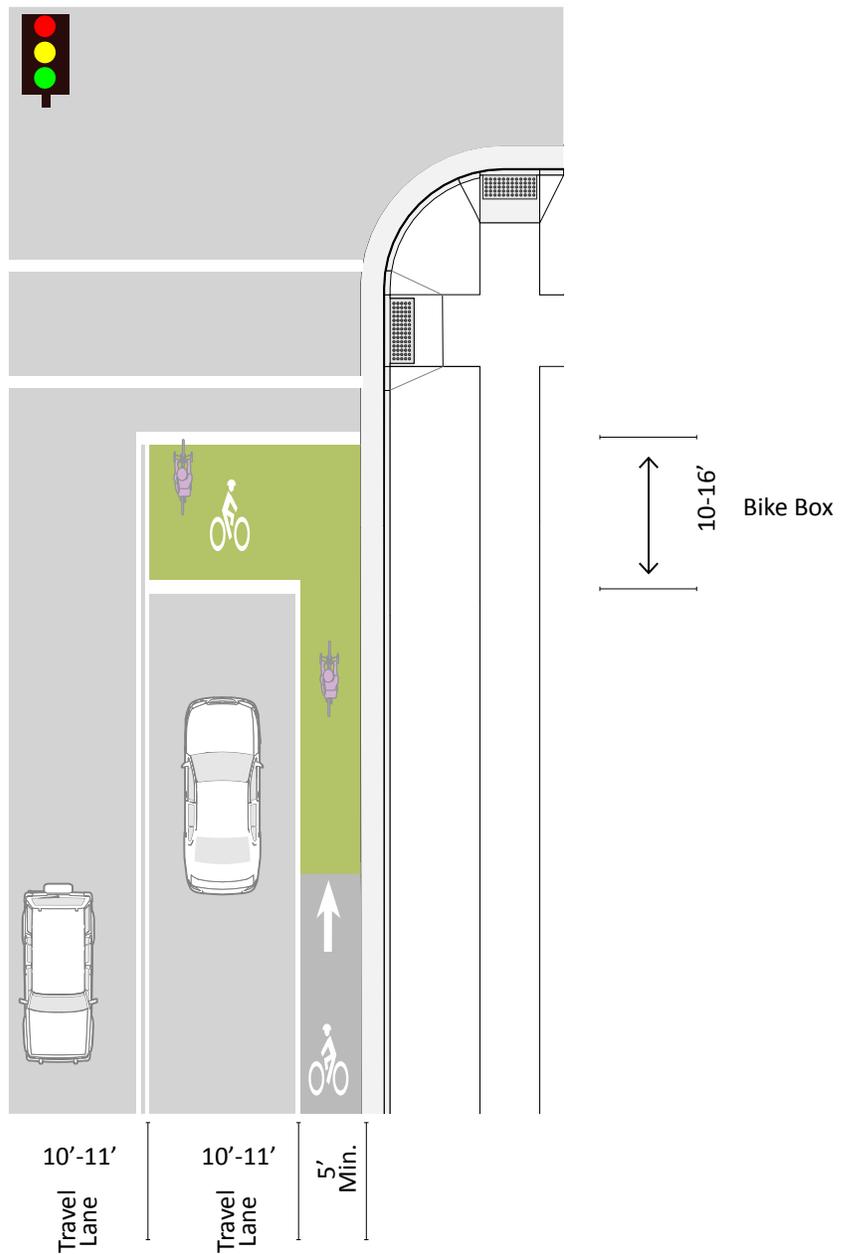
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Bike Box



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Traffic Calming

Definition

The term traffic calming is used to describe a range of strategies to slow vehicular traffic in order to enhance the safety, comfort and livability of streets for all users. Higher vehicle speeds decrease drivers' peripheral vision and their overall awareness of, and their ability to react to, the movement of all roadway users including bicyclists and pedestrians on roadways. While engineering strategies are the most visible, they are most effective when combined with strategies that incorporate education, enforcement, and encouragement elements.

Engineering approaches focus on physical measures—typically altered roadway geometry or devices that create vertical or horizontal deflection—to slow or limit a vehicle's path of travel.

Traffic calming changes require a review of street conditions and possible traffic study to ensure that proposed changes are appropriate.

Applicability and Use

There are both physical and visual elements that can help slow vehicle traffic. Visually narrowing a street, or changing its aesthetics can be effective traffic calming techniques, and can be more widely applicable than geometric measures. Treatments include:

- Curb and gutter, which defines the traveled part of the roadway
- Sidewalks, which indicate that motorists should expect to see pedestrians
- Outdoor cafes or other activities in the pedestrian zone, such as street furniture
- Street trees, which create a sense of enclosure
- On-street parking, which creates an activity zone to which drivers must pay attention
- Pavement type and road striping
- Buildings that are closer to the street (i.e., no parking or drive-through between the street and adjacent buildings)
- "Paint the Pavement" and other neighborhood signage and public art programs.

The physical narrowing of roadways is an effective way to slow traffic. Treatments depend on the roadway classification and traffic volumes, as well as the volume of large vehicles and include:



Credit: Michael Richardson

- Bump outs, either at intersections or mid block crossings, which also shorten pedestrian crossing distances
- Reduction in curb radii, in order to slow turning movements
- Lane diets or roadway diets, which reduce the number of lanes or amount of lane space and can result in slowed vehicle travel

Creating vertical or horizontal deflection of the vehicle path is a very effective way to slow traffic, and may be appropriate on residential streets. Horizontal deflection is typically most effective. Treatments include:

- Bump outs, either at intersections or mid block crossings.
- Traffic circles, which force drivers to slow at intersections and yield to users approaching from the left.
- Speed humps provide a gentle rise on the roadway. Speed humps are not appropriate on collector streets and require a speed study showing 85th percentile at least 5 mph over the speed limit. Speed humps can be a relatively easy retrofit but reduces on-street parking.
- Chicanes force drivers and bicyclists to navigate a narrowed "s" shaped pathway along the street created by the placement of bump outs that alternate from one side of a street to the other, typically in groups of three.

Design Considerations

Traffic Calming Intersection Treatments

Blocking or restricting access is highly effective, but can have the unintended effect of creating traffic problems on neighboring streets. Treatments include:

- Diverter Median Barriers, which restrict a driver's ability to cross an intersecting street.
- Diverter Islands restrict turn or through movements for vehicle traffic, and may allow bicycle and pedestrian traffic in all directions. Diverter islands are typically used at intersections to deter heavy vehicle volumes and eliminate cut-through traffic. They should be part of a larger traffic calming strategy that evaluates and handles accessibility through the adjacent street network and considers emergency vehicle response times. Effects are generally limited to the intersection; the street may require additional traffic calming in addition to the intersection treatments to be effective.
- Right In/Right Out restrictions, which restrict left turns into and left turns out of a street.

General considerations

Traffic calming measures that may be applied depend on the context of the street. Special consideration should be given to:

- Street classification
- Traffic operational analysis
- Mix of traffic, including consideration of bus, bike or truck routes
- Adjacent land uses
- First responder vehicle needs
- Effect on on-street parking

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Traffic Circle

Definition

Traffic circles are circular islands that are installed in the center of appropriate residential street intersections to reduce traffic speeds and collisions. Traffic circles require vehicles to reduce speed while allowing continuous traffic flow. Traffic circles should be accompanied by tight curb radii on the adjacent corners to reduce right turning vehicle speeds. Larger vehicles such as school buses that make wider turns can be accommodated by building traffic circles with mountable curbs.

Applicability and Use

Traffic circles may be considered in the following situations:

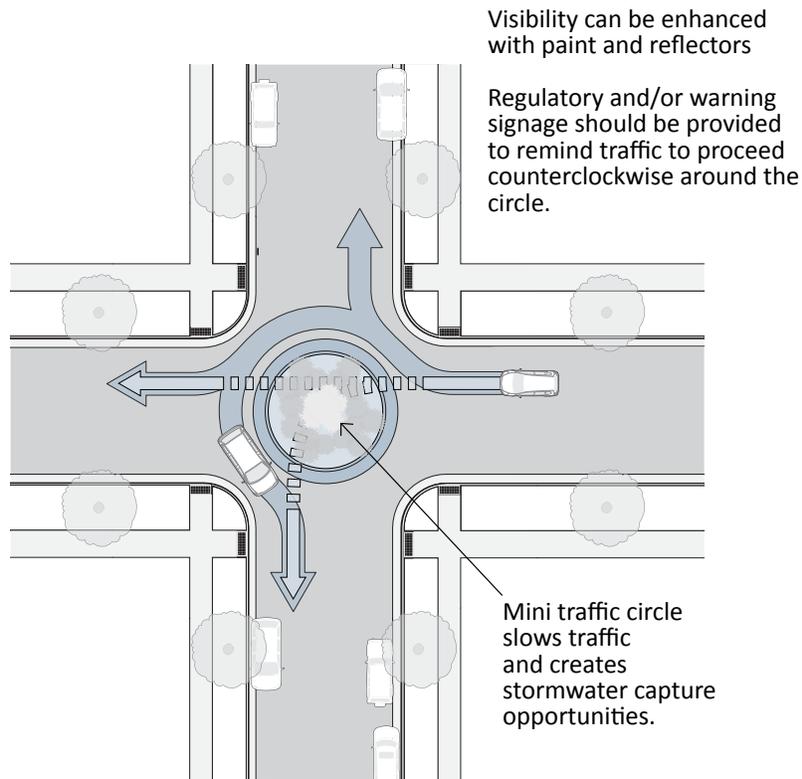
- At intersections of residential streets with high design speeds where there is a history of crashes
- Along bicycle routes (residential streets that are signed or otherwise designated as bicycle routes)

Design Considerations

- Traffic circles should be sized according to street width and allow for the passage of emergency vehicles and snow plows. Street narrowing due to snow accumulation should be considered when determining the circle diameter.
- Regulatory or warning signage should be provided to remind traffic to proceed counterclockwise around the circle.
- Landscaping in the circle should be kept below 18 inches to maintain clear visibility through the intersection.
- Visibility can be enhanced with paint and reflectors.
- Circles should be designed with mountable curbs to allow for emergency vehicle access.
- Fire and emergency vehicles, buses and other large vehicles may make left turns without going around the circle.
- Parking should be restricted parking 30 feet from intersections.



Credit: Michael Richardson



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Diverter Island

Definition

A diverter is an island built at a residential street intersection that restricts through or turning movements. There are a variety of diverter designs which are selected based on context and desired movement restrictions.

Applicability and Use

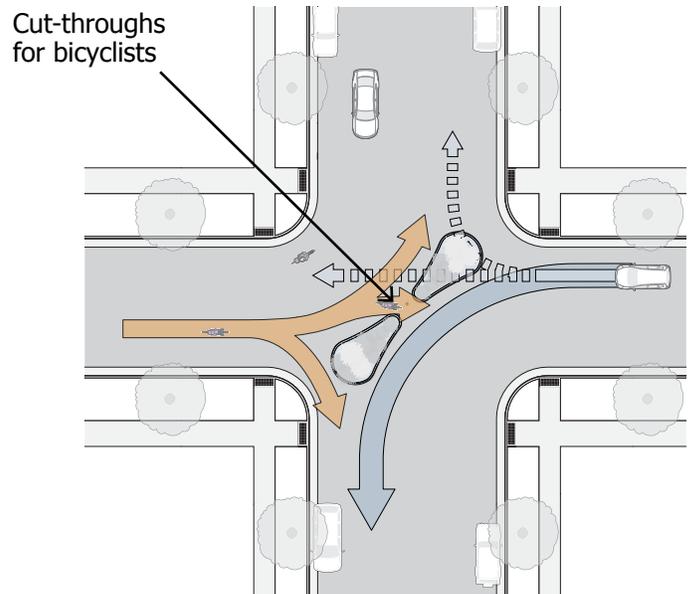
- Neighborhood residents experience the greatest effect from the installation of diverters. Therefore, diverters should be considered only when less restrictive measures are not appropriate.
- Diverters must be used in conjunction with other traffic management tools within the neighborhood street network.



Credit: Anton Jerve

Design Considerations

- Diverter islands should be designed to maintain bicycle and pedestrian access by providing cut-throughs.
- Preferred cut-through width is 6 feet.
- Islands can include a combination of planters, public art, or other materials, keeping a clear sight-window above 18 inches.
- Can incorporate green infrastructure principles by treating stormwater and using low-growing landscaping.
- Parking restrictions may be needed at corners to accommodate turns and improve sight distance



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Intersection Median Barrier

Definition

Intersection median barriers are raised curbs or islands that extend through an intersection along a main street. The purpose of this treatment is to prevent motor vehicle traffic on cross streets from making any movement other than a right turn onto or off of a main street. Intersection median barriers are primarily a traffic management technique used where there is significant cut-through traffic on a neighborhood street or where left-turn movements are a safety concern. The median barrier is typically placed within the higher traffic street, preventing motor vehicle left turn movements onto neighborhood streets, while ensuring safe and convenient bicycle and pedestrian access, often in conjunction with a bicycle boulevard.



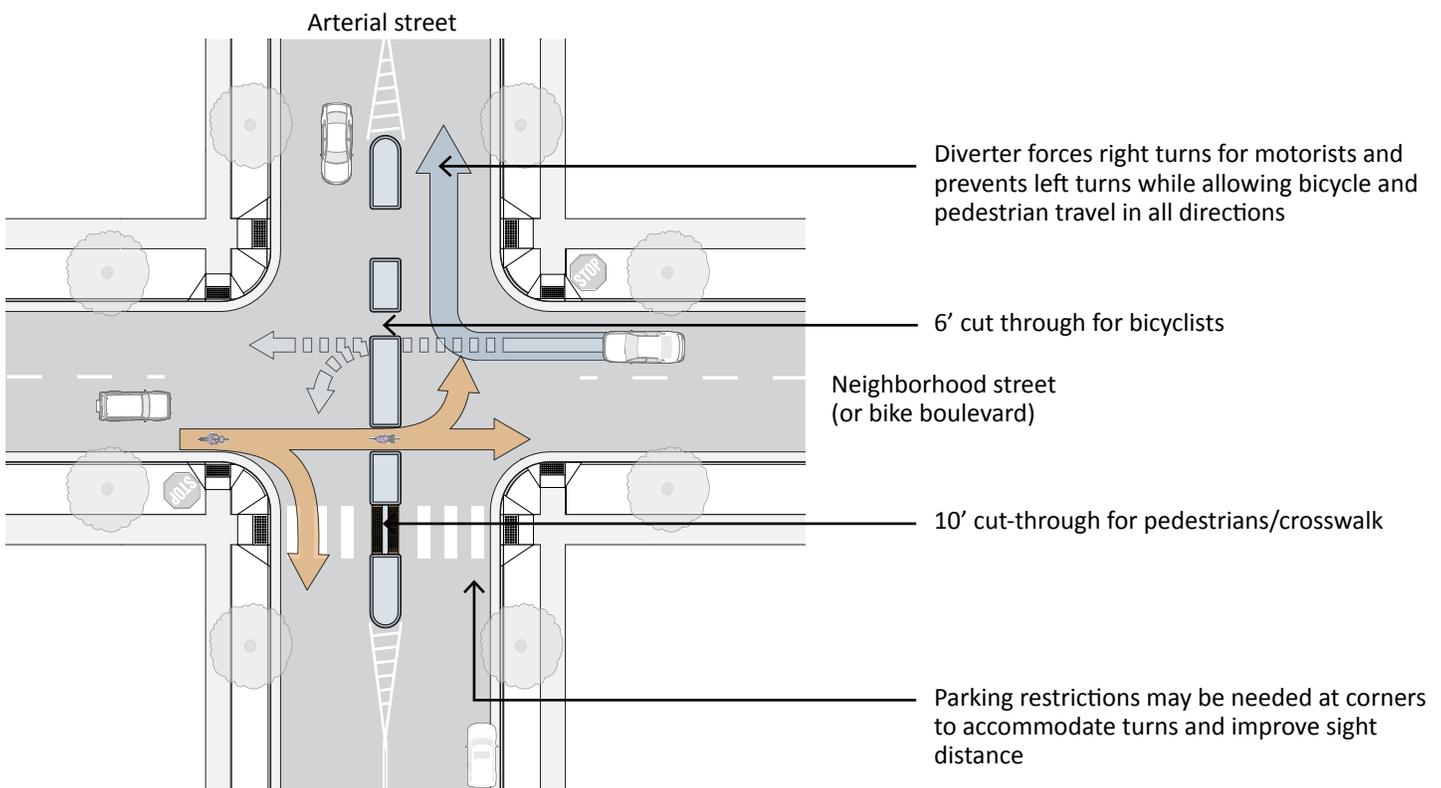
Applicability and Use

Intersection median barriers are a type of traffic diversion and should be used only after a complete traffic analysis. This treatment may be considered in the following locations:

- Where cut-through traffic on a neighborhood street has been observed to be a problem.
- Where analysis of traffic patterns in the area shows that cut-through traffic would not be diverted to a nearby street.
- Where local residents would not have to drive excessive distances to access their homes. Excessive distance may be defined during the planning process.
- Where there are bicycle/pedestrian priority routes (i.e., Bicycle Boulevards). Intersection median barriers reduce motor vehicle volumes on residential streets, reduce bike and pedestrian exposure and provide an opportunity to enhance crossings of higher volume and speed roadways.
- Where emergency response times are not negatively impacted (see Design Considerations).

Design Considerations

- The intersection median barrier must be a minimum 6 feet wide (8 to 10 feet preferred on primary bicycling routes) to provide sufficient area for multiple pedestrians and bicyclists waiting to cross the street, and for longer bicycles, or bicycle combinations (e.g., a bike with trailer is approximately 9 feet in length).
 - Alternatively, separate cut-through/crossing areas may be provided for bicycles and pedestrians. Pedestrian crossing areas should align with crosswalk while the bicycle cut-through may be placed in line with vehicle travel lanes.
 - At unsignalized locations pedestrian/bicycle crossing warning signs may be placed within the intersection median barrier, as well as on each side of the street. Other crossing enhancements may be considered as well.
- Street must be wide enough to accommodate a median. Excessive lane shifting to fit a median barrier is not desirable. In addition, there must be enough lane width to accommodate truck and emergency vehicular turning movements.



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Speed Humps

Definition

Speed humps are a roadway design feature that consist of raised pavement approximately 3 to 4 inches high at their center, which extend the full width of the street. The height of a speed hump tapers near the drain gutter to allow unimpeded bicycle travel. Speed humps should not be confused with speed bumps commonly found in parking structures.

Applicability and Use

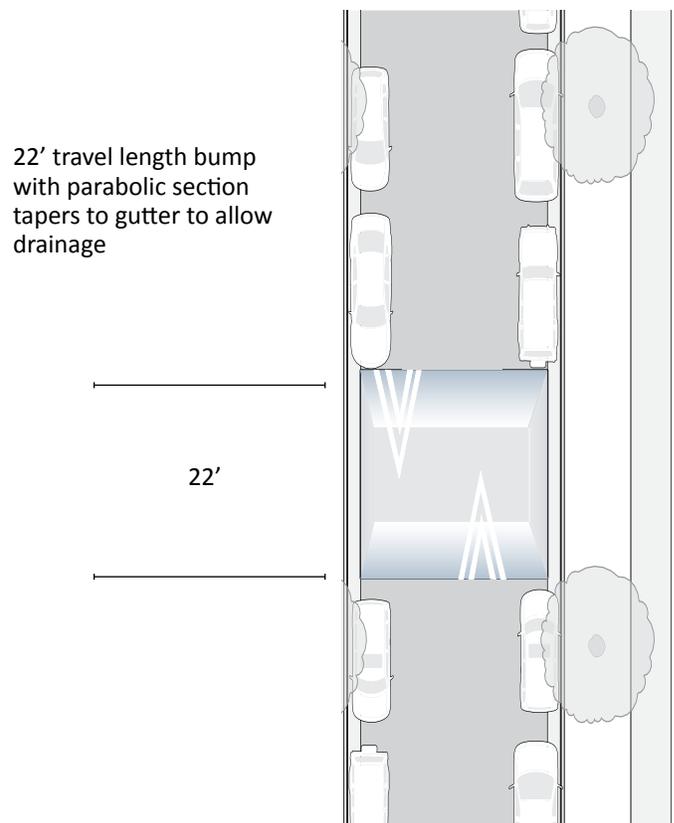
Speed humps may be considered on low volume neighborhood streets in order to control vehicle speeds. Streets that have high traffic volumes, are transit routes or have frequent freight travel are typically not good candidates for speed humps.

Design Considerations

- Speed humps should have a smooth leading edge, a parabolic rise, and be engineered for a speed of 25 to 30 mph, so they can be negotiated by large vehicles.
- Speed humps should be clearly marked with reflective markings and signs.
- Typically speed humps are 22 feet in length, with a rise of 6 inches above the roadway and should extend the full width of the roadway. They should be tapered at the edges to the gutter to accommodate drainage.
- Grade should be considered; do not use on roadways with greater than 5 percent grade.
- Do not use on collector or arterial streets.
- Parking must be restricted adjacent to humps.
- A speed study showing 85th percentile at least 5 mph over the speed limit required prior to implementation.



Credit: Michael Richardson



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Chicanes

Definition

Chicanes can take the form of curb extensions, center islands, or staggered on-street parking. These traffic calming features slow vehicles by compelling them to shift laterally or pass through a narrowed section of roadway.

Applicability and Use

Chicanes may be considered on residential streets where:

- There is a high volume of high speed cut through traffic
- Children frequently walk or bicycle to and from school
- A comprehensive neighborhood traffic calming program is present, particularly in neighborhoods
- Other traffic calming measures have been implemented.

Design Considerations

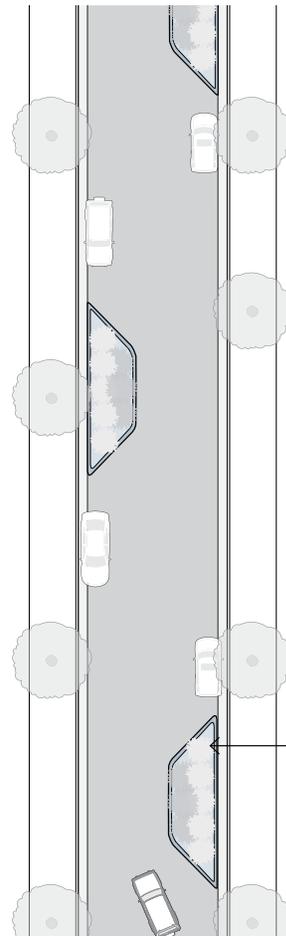
- The size of chicanes will vary based on the targeted design speed and roadway width, but must be 20 feet wide curb to curb at a minimum to accommodate emergency vehicles.
- Can incorporate stormwater treatment and low growing landscaping.
- Parking may be affected to a greater extent than other traffic calming measures.

Placemaking/ Public Art Opportunity

Public art may be placed on chicanes. Consideration must be given to sight lines.



colab studio



- Bump outs placed 50' - 80' apart, in sets of 3
- Shape, length and angle of bump outs depends on roadway configuration
- Bump outs may be used for stormwater management, green space
- 20' min. clearance required for fire vehicle access

Slotted design maintains existing gutter and allows drainage

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Convertible Streets

Definition

Convertible streets are rights-of-way that are used for multiple purposes where there is infrastructure that will allow all or some of the street is temporarily closed to traffic. A typical example would be a regularly occurring community event such as festivals, farmers markets or other activities. These streets are often civic and social community centers and should be designed to accommodate public gatherings.

Applicability and Use

- Convertible streets are often streets with prominent public institutions such as libraries or cultural institutions.
- Events may occur on a set schedule; such as weekly farmer’s market, seasonal events, annual community social events or they may be single use events.

Design Considerations

- Ensure permitting system is easily accessible and logical.
- Proposed street segments must be found to be appropriate for conversion and ensure that normal flow of traffic is not significantly encumbered.
- The frequency and recurrence of the event must be significant enough to justify the expense of permanent infrastructure.



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Alleys

Definition

Alleys are rights of way that connect two streets and provide access to the garages, backs of buildings, loading areas and parking areas. Alleys often accommodate utilities and garbage storage and collection.

Applicability and Use

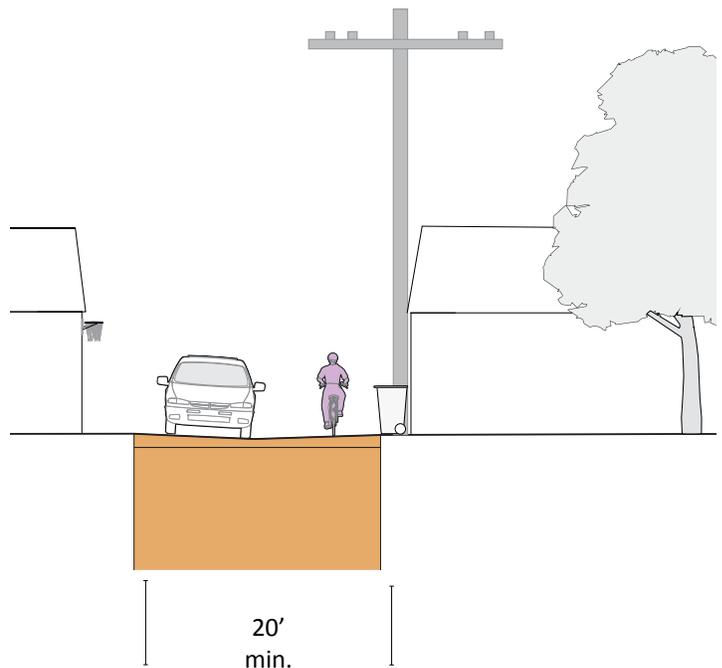
Many of the older residential and neighborhood commercial areas have a network of alleys. Waste collection, parking access and loading should occur in alleys to the extent feasible to lessen the demand for space in the street for features and functions that serve people accessing businesses and residences using a variety of transportation modes. Using alleys also reduces the number of curb cuts reducing the number of conflicts with pedestrians and increasing the potential number of on-street parking

Design Considerations

- Alleys should be a maximum 20 feet in width and have a clear zone of 16 feet to allow for service truck access and emergency vehicle access.
- Some Mixed-use Corridors may have adopted plans recommending commercial use of shared residential-commercial alleys to reduce potential conflicts with pedestrians.
- Where alleys intersect streets alley entrances shall have raised crosswalks to make the crossing easier for pedestrians, the sidewalk more visible to drivers, and physically require drivers to slow down while approaching the sidewalk.
- Pervious paving material may be considered when repaving or paving alleys.



Credit: Dan Haak



- In alleys shared by residential and commercial uses, above standard lighting may be considered to improve personal safety. Above standard lighting may require an assessment and maintenance agreement with adjoining property owners.

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Curb Radii

Definition

Curb returns or radii are the curved connection of curbs at the corners formed by the intersection of two streets, which guide vehicles in turning corners. The shape of a corner curb radius has a significant effect on the overall operation and safety of an intersection.

Applicability and Use

The shape and dimensions of curb radii vary based on street type, transportation context, and design vehicle (vehicle type used to determine appropriate turn radius at an intersection). Smaller corner radii increase pedestrian safety by shortening crossing distances, increasing pedestrian visibility, and decreasing vehicle turning speed. Smaller corner radii also provide better geometry for installing perpendicular curb ramps for both crosswalks at each corner, resulting in simpler, more appropriate crosswalk placement, in line with the approaching sidewalk. Factors to consider when designing curb radii:

- Curb radius: the actual radius proscribed by the curb line at an intersection.
- Effective radius: The radius available for the design vehicle to make the vehicle turn, accounting for the presence of parking, bike lanes, medians, or other features.

Curb radii can be designed:

- To allow for the selected design vehicle to complete a turn fully within its designated travel lane or lanes.
- To accommodate a vehicle turn by allowing for a particular vehicle type to complete a turn with some latitude to partially use adjacent or opposing lanes on the origin or destination streets.



Design Considerations

The effective turning radius (rather than the actual curb radius), should typically be used to determine the ability of vehicles to negotiate a turn. Determination of the design vehicle should consider and balance the needs of the various users of a street--from pedestrians and bicyclists to emergency vehicles and large trucks--considering the volume and frequency of these various users.

The design vehicle should be selected according to the types of vehicles using the intersection with considerations to relative volumes and frequencies. The designer should balance designing for a larger vehicle versus accommodating the needs of large vehicles, which may allow encroachment into another lane.

A typical curb radius of 20 feet (smaller radii may be considered) should be used wherever possible including where:

- There are higher pedestrian volumes
- There are few larger vehicles
- Bicycle and parking lanes create a larger effective radius.

Factors that may affect the curb radii must be taken into consideration:

- The street type
- The angle of the intersection
- Bump outs
- The number and width of receiving lanes
- Large vehicles
- Effective turning radius

Where there are high volumes of large vehicles making turns- inadequate curb radii could cause large vehicles to regularly travel across the curb and into the pedestrian waiting area.

See the table below for guidance on the location and design vehicle for different street types.

Vehicle Type	Location	Design Vehicle	Possible Accommodation
Transit Vehicles ¹	Corners with turning buses on bus routes or where buses start run or return to base. In locations where traffic volumes influence effective turning radii with lane encroachment.	CITY-BUS or WB-40 A-BUS, articulated bus	Turn partially from adjacent lane
	Corners with potential occasional turning buses due to detours	CITY-BUS or WB-40	Turn partially from adjacent lane
Emergency Vehicles ²	All intersections	Fire Vehicle Hook and Ladder with outriggers	Where feasible
Freight Vehicles ³	Per Comprehensive Plan	WB-50	Turn partially from adjacent lane

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[MnDOT Design Manual](#)
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[Comprehensive Plan](#)
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[MN MUTCD](#)
[AASHTO Guide for the Development of Bicycle Facilities](#)

Curb Radii

Design Considerations continued

¹ On corners along bus routes, where buses may have to make occasional detours, turns should accommodate a transit vehicle using the entire roadway, similar to an emergency vehicle.

² Because emergency vehicles have sirens and flashing lights and other vehicles must pull over, they can typically use the full right-of-way without encountering opposing vehicles. On busier streets, the ability of emergency vehicles to swing wide may be limited by queued traffic which may not be able to pull over.

³ Freight corridors are streets that are designated on Figure T-1 in the Transportation Chapter of the Comprehensive Plan. Freight corridors should be designed for WB-50 trucks. Larger WB-60 trucks may also be present on city streets, particularly on designated state highways, truck routes and in industrial areas. These may need to be accommodated in certain instances, though they generally do not fit well on the existing street network in most of Saint Paul.

Street Type	Design Vehicle	Accommodation Vehicle*
Neighborhood	Passenger car	School Bus
Residential Corridor	SU-30	WB-40
Mixed Use Corridor	SU-30	WB-40
Downtown	WB-40	WB-50
Parkway	School Bus	WB-40
Industrial	WB-50	WB-60

* Accommodations include: turning partially or entirely from adjacent lanes, turning from opposing lanes, or turning into opposing lanes.

A variety of strategies can be used to maximize pedestrian safety while accommodating large vehicles including:

- Adding parking or bicycle lanes to increase the effective radius of the corner
- Varying the actual curb radius (i.e., compound curb radii) over the length of the turn so that the radius is smaller as vehicles approach a crosswalk and larger when making the turn. Compound radii effectively shorten crossing distances and make pedestrians visible while accommodating larger vehicle turns; because they allow more sweeping turns and they do not slow turning vehicles.
- Painting a median: Where there is sufficient lane width on the destination street, a painted median can enable a large vehicle to complete a turn without turning into opposing traffic.
- Restricting access: Where there is a desire to keep curb radii small, restrictions on large vehicles making the turn may be considered. This should be considered in light of the overall street network.
- Installing advance stop lines on the destination street to increase the space available for large vehicles to make a turn by enabling them to swing into opposing lanes on the destination street while opposing traffic is stopped.

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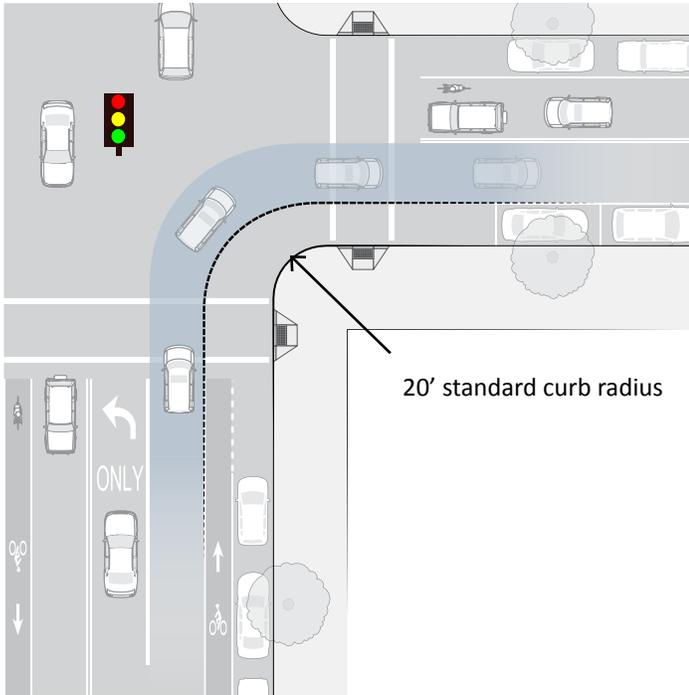
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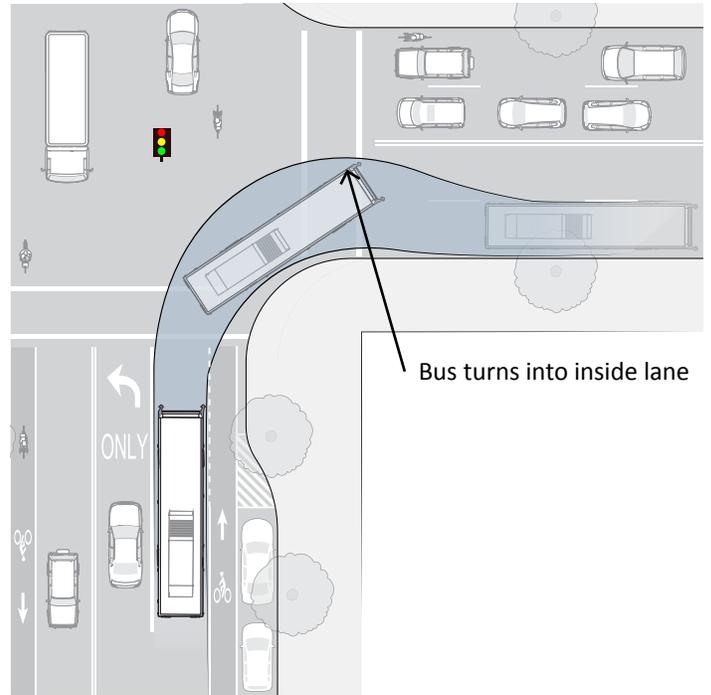
References

[MnDOT Design Manual](#)
[State Aid Manual](#)
[Comprehensive Plan](#)
[Standard Plates](#)
[MN MUTCD](#)
[AASHTO Guide for the Development of Bicycle Facilities](#)

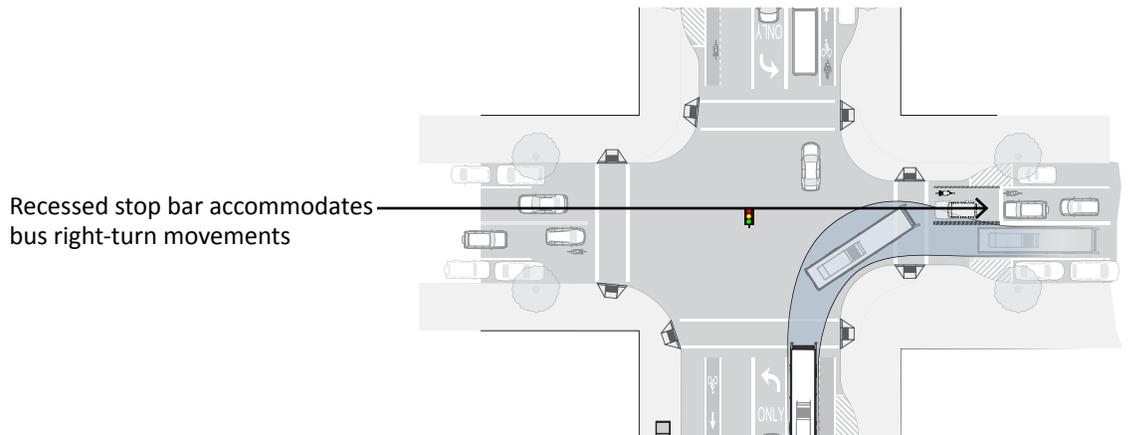
Typical Curb Radius - Signalized Intersection



4-lane Signalized Intersection



2-lane Signalized Intersection



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MnDOT Design Manual
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Bump Outs

Definition

Bump outs (or curb extensions) are created by extending the sidewalk or curb line into the roadway. Bump outs are intended to improve lines of sight and may improve safety and increase safety and provide extra space along sidewalks for pedestrians and amenities such as street furniture.

Applicability and Use

- Bump outs shorten crossing distances (exposure time) and increase visibility between roadway users: the waiting pedestrian can better see approaching traffic and drivers can better see pedestrians waiting to cross the road.
- Bump outs calm traffic, particularly for right turning vehicles.
- This treatment is particularly valuable in locations with high volumes of pedestrian traffic. Bump outs can be located at intersections or at mid block pedestrian crossings.
- Bump outs should only be considered where on-street parking is present.
- They cannot be used along arterials that have peak hour parking restrictions to move traffic more efficiently.
- They may provide space for ADA compliant, directional curb ramps where sidewalks are narrow.
- They may be used at transit stops (i.e., bus bump outs) to increase transit stop waiting area capacity and facilitate in-lane stopping of transit vehicles.



Credit: Toole Design Group

- Bump outs may provide space for utilities, signs and amenities such as bus shelters or waiting areas, bicycle parking, public seating, public art, street vendors, newspaper stands, trash and recycling receptacles and green infrastructure elements where they do not impede, pedestrian, cyclist, or motorist sight lines.

Placemaking / Public Art Opportunity

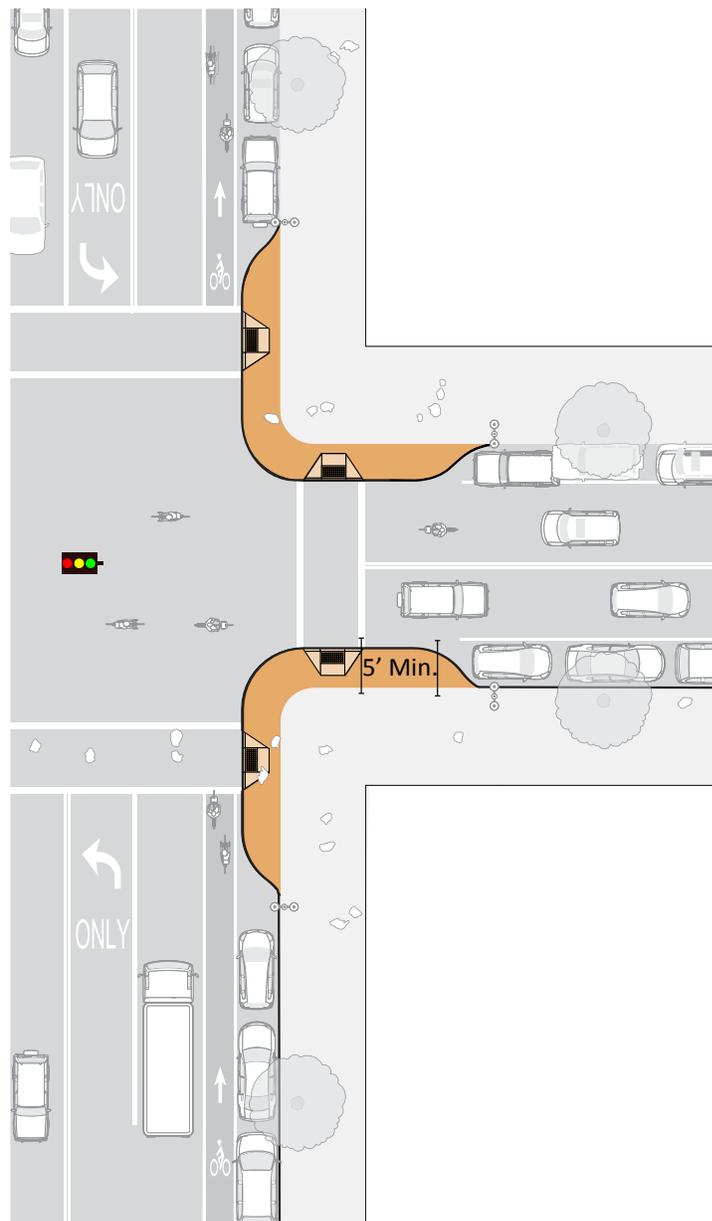
Bump outs may provide space for placemaking elements such as public art, seating, bicycle racks, and landscaping.



Kevin Berry

Design Considerations

- The turning needs of larger vehicles should be considered in bump outs design.
- When bump outs conflict with turning movements, they may be installed on only one side of a crossing, rather than eliminated.
- Minimum bump out width is 6 feet (the approximate width of a parked car).
- Bump outs should generally be 1 foot narrower than the parking lane to not encroach upon a travel lane or bicycle lane. The bump out should be sized so that the gutter pan joint is outside of the bike lane.
- The minimum length of a bump out shall be the width of the crosswalk, allowing the curvature of the bump out to start 5' after the crosswalk. The overall length of a bump out can vary depending on the intended use (i.e., stormwater management, bus bump out, restrict parking) and potential for sight line improvement.
- Minimum roadway width between bump outs is 26 feet, curb face to curb face for two-way traffic.
- The angled portion of the bump out should be 30 degrees from the main curb line with 5 foot radii to accommodate plows.
- Bump outs may also impact underground utilities, curbside parking, delivery access and garbage removal, snow plows, and street sweepers. These impacts should be evaluated when considering whether to install a bump out.
- Bump out installation may require the relocation of existing storm catch basins which can increase costs substantially. Catch basins should be centered at least 5 feet from the beginning of the bump out.
- Placing bump outs at corners with fire hydrants can also help to ensure fire access is not blocked by parked cars.



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Marked Crosswalks
Curb Radii
Transit Stop Placement
Transit Zones

References

MnDOT Design Manual
State Aid Manual
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MN MUTCD
AASHTO Guide for the Development of Bicycle Facilities

Skewed Intersections

Definition

Skewed intersections occur when streets intersect at angles other than 90 degrees.

Applicability and Use

Skewed intersections are generally undesirable and introduce the following complications for all users:

- The travel distance across the intersection can be greater, which increases exposure to conflicts and lengthens signal phases for pedestrians and motorists.
- Skews require motorists and pedestrians to crane their necks to see other approaching users, making it less likely that some users will be seen. Skews generally reduce visibility for all users on all approaches.
- Obtuse angles encourage high speed vehicle turning movements.
- Acute angles may cause complications for turning vehicles, particularly larger vehicles.

Every reasonable effort should be made to design or redesign the intersection closer to a right angle.

- Priority should be given to intersections with identified crash problems, on school walking routes, near transit stops, or with high pedestrian use.
- If major alterations are being done to an existing skewed intersection, consider whether it is possible to reconfigure the intersection so that the crossings are closer to perpendicular.
- In some cases, consideration should be given to acquiring right-of-way to allow for a redesign that results in a less complicated intersection. It may be possible to offset costs by selling back or swapping those portions of the right-of-way that are no longer needed for the intersection, or repurpose this area for a pocket park, rain garden or other streetscape enhancing feature.

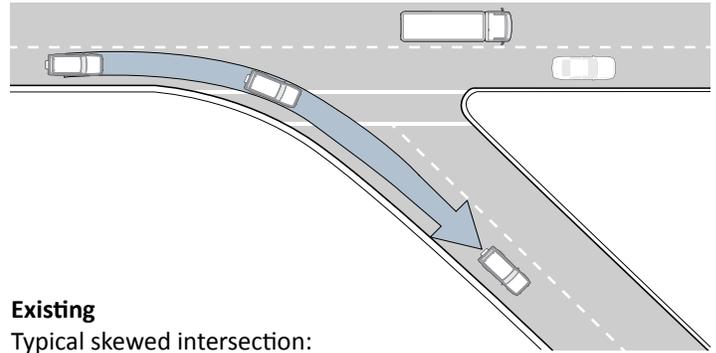


Design Considerations

Where it is not possible to reconfigure a skewed intersection due to placement of buildings or other constraints, the following design strategies should be considered:

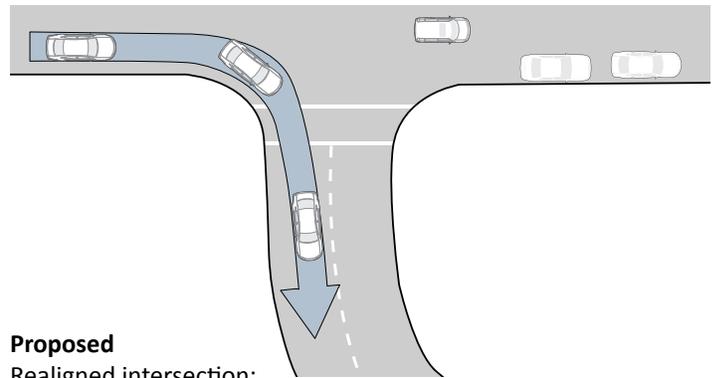
- Adjusting signal timing to allow for longer pedestrian crossing times.
- Providing high visibility crosswalks, as appropriate. Crosswalks should align with the pedestrian zone of the sidewalk and should not be pulled back from the intersection as a means to shorten the pedestrian crossing distance – such a strategy is counter to pedestrian or motorist expectations, and it can create problems for visually impaired pedestrians.
- Pedestrian refuges may be considered if the crossing distance exceeds approximately 40 feet.
- General-use travel lanes and bike lanes may be striped with dashes to guide bicyclists and motorists through the large undefined area that results from intersection skew.

Installation of a bump out on the obtuse side of the intersection can reduce the corner curb radius and reduce the amount of undefined space, thus reducing high speed turning movements. Bump outs also reduce pedestrian crossing distance and may accommodate green infrastructure such as rain gardens and vegetation or other streetscape enhancing features.



Existing

Typical skewed intersection: Wide turning radius results in higher speed turns and longer pedestrian crossing time/exposure



Proposed

Realigned intersection: Narrower turning radius encourages slower turns, shortens pedestrian crossing distance and improves sight triangles for all modes

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Marked Crosswalks
 Curb Radii
 Sidewalks and the Zone System
 Traffic Calming
 Bump Outs
 Pedestrian and Traffic Signals

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MnDOT Design Manual
 State Aid Manual
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Roundabouts

Definition

Roundabouts provide non-signalized traffic control at intersections. They typically include a one- or two-lane roadway that encircles a central island around which vehicles travel counterclockwise.

Note: Roundabouts should not be confused with traffic circles which are operationally similar to roundabouts but are generally used in lower speed and lower volume environments such as Established Neighborhood Streets and have different design considerations.

Applicability and Use

- Generally, multilane roundabouts are not recommended because of safety concerns for pedestrians, especially those with visual impairments, and bicyclists. Installing two or more sequential roundabouts may provide the opportunity to reduce the number of vehicle lanes between intersections.
- Can handle significant traffic volumes and may be used in place of signals at many types of intersections, including standard four-way intersections, intersections with more than four intersecting streets, high volume grade-separated intersections where there is desire to bring streets back to surface level, intersections with freeway on and off ramps.
- May have limited applicability in heavily built-out areas where right-of-way acquisition may be cost prohibitive as they can require more right-of-way than typical intersection designs.
- Due to a substantial reduction in vehicle speeds roundabouts have been shown to reduce all forms of crashes and crash severity. In particular, roundabouts eliminate the most dangerous and common crashes at signalized intersections.



Credit: Toole Design Group

Benefits of single-lane roundabouts include the following:

- Minimal to no delay for pedestrians, who have to cross only one direction of traffic at a time due to the splitter island.
- Improved accessibility through intersections for bicyclists through reduced conflicts and vehicle speeds.
- Reduced delay, travel time, and vehicle queue lengths.
- A smaller carbon footprint (no electricity is required for operation and fuel consumption is reduced as motor vehicles spend less time idling and do not have to accelerate as often from a dead stop)
- Reduced maintenance and operational costs (costs are primarily related to landscaping and litter control)
- Lowered noise levels
- Facilitated U-turns
- Constructed as a part of a new road or the reconstruction of an existing road, the cost of a roundabout can be comparable to or even cheaper than the construction of an intersection and the associated installation of traffic signals and additional turn lanes

Placemaking/ Public Art Opportunity

Public art may be placed on roundabouts. Consideration must be given to sight lines and maintenance access.



Manjit Sandhu

The primary disadvantage is that sight-impaired people can have difficulty navigating the uncontrolled crosswalks at each of the entry/egress points to the roundabout (see Design Considerations for mitigation solutions).

Design Considerations

Roundabouts can be more complex than standard intersections for persons with disabilities, particularly the visually impaired. There are several treatments that should be incorporated to mitigate these challenges, including:

- The draft Public Right of Way Accessibility Guidelines (PROWAG) requires (not adopted) detectable warning strips at all entry and exit points, including splitter island refuges.
- Setting sidewalks back from the edge of the circular roadway by at least 5 feet so that visually impaired can more clearly identify and follow designated crossing points.
- Building the roundabout to a design speed of 20 mph or less.
- The draft PROWAG requires accessible pedestrian signals to be installed at all crosswalks across any roundabout approach with two or more lanes in one direction. The PROWAG requirement does not specify the type of signal except that it must be accessible, including a locator tone at the pushbutton, with audible and vibrotactile indications of the pedestrian walk interval.
- Signage indicating the presence of the pedestrian crossing should be used to remind drivers that while they are only required to yield to traffic within the roundabout, they are required to stop for pedestrians that are in the crosswalk.

Roundabouts should feature the following elements:

- Splitter islands at all ingress and egress points that provide a crossing island for pedestrians, breaking up the crossing into two separate movements. Splitter islands should have a minimum width of 6 feet, and preferably 8 feet from curb face to curb face.

- Marked crosswalk through the center of the splitter island, set back one car length (20 to 25 feet) from the entry point into the roundabout, allowing motorists to focus on yielding to pedestrians in crosswalk before negotiating entry into roundabout traffic while also not forcing pedestrians too far out of direction. Sight distances should be maintained to the left as the motorist enters the roundabout so that motorists are aware of vehicles and bicyclists in the roundabout, as well as to the right as motorists are exiting the roundabout so they can see pedestrians in the marked crosswalk.
- Deflection that encourages slow traffic speeds, but allows for movement of larger vehicles.
- A landscaped visual obstruction in the central island, which obscures the driver's view of the road ahead, to discourage users from entering the roundabout at high speeds.

Other Design Considerations

- Continuing bicycle lanes through roundabouts has not been shown to improve safety. Rather, bicycle lanes should terminate in advance of crosswalks at roundabouts, providing sufficient space for bicyclists to merge with motor vehicles. Alternatively, bicycles may be accommodated on sidewalks. The AASHTO *Guide for the Development of Bicycle Facilities* provides detailed design guidance for both options.
- Ramps, angled between 20 and 45 degrees, should be provided 50 feet before and 50 after the pedestrian crossing of the splitter island, allowing bicyclist to exit before or reenter the roadway after the roundabout. Broken line bicycle lane markings should be provided.

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Roundabouts

Design Considerations continued

- 50 to 75 feet in advance of the ramps; shared lane markings may also be included. Signage to warn pedestrians that bikes may be joining them on the sidewalk may be needed.
- For a typical single-lane roundabout at a four-way intersection the center island will more or less be a circle that can vary in size from 12 feet to 90 feet to fit a wide range of intersections, achieve desired deflection, and accommodate through movements and different turn movements by various design vehicles. For intersections with an odd number of approaches or offset approaches the shape of the center island should be modified to achieve appropriate deflection.
- Including a truck apron (a paved, load-bearing area) around the edge of the central island is the typical approach for accommodating larger design vehicles. The truck apron is often paved with a fairly rough texture, and raised enough to discourage encroachment by smaller high-speed passenger cars and achieve desired deflection. The truck apron should have a three inch high rolled curb.
- Restricting or not accommodating turn movements by trucks and articulated buses may allow the construction of a smaller roundabout without acquisition of right-of-way and with all the benefits of roundabouts at the cost of forcing the occasional large truck to take an alternate route. Roundabouts may be constructed to accommodate through movements by large trucks, and restrict turn movements by these vehicles while accommodating turn movements by single unit trucks and transit vehicles.
- Signing and marking of roundabouts should be in compliance with the current version of the MUTCD, however roundabouts should be designed so their design and function are self-explanatory, and the need for signing is minimal. *NCHRP Report 672, Roundabouts: An Informational Guide, Second Edition, 2010* provides detailed design guidance on roundabouts.
- If traffic analysis determines that the capacity of a proposed single-lane roundabout is exceeded during one or two short periods during the day, consideration should be given to metering the roundabout rather than constructing a larger multi-lane roundabout. The result is a smaller, slower roundabout that is more appropriate for all users for most of the day.
- Delineators on the curbs at all ramp locations should be installed in the fall so that plow drivers will know where the ramps begin.
- The area at the base of the ramp closest to the curb may not get swept very well by street sweepers and may require supplemental sweeping.

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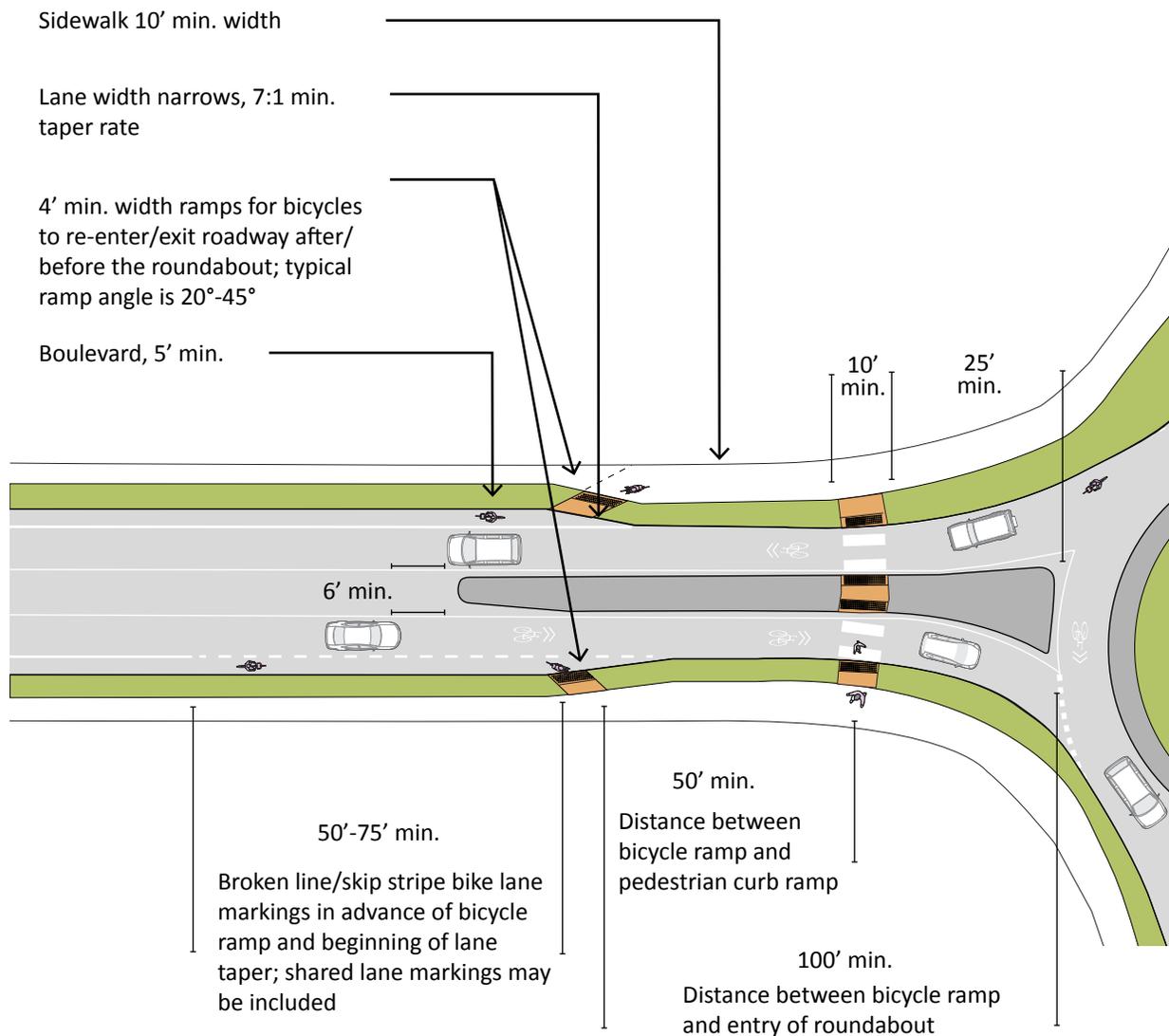
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Bicycle and Pedestrian Accommodation at Roundabouts



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MnDOT Design Manual
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Channelized Right Turn Lanes

Definition

Channelized right turn lanes (also known as ‘pork chop’ islands) are dedicated turning lanes that allow vehicles to make quick and easy right turns. Typically, they are not signal controlled but drivers must yield to pedestrians and on-coming traffic. Channelized right turn lanes can improve traffic flow and accommodate trucks and buses that might otherwise require a large turning radius. Designed correctly, they can reduce crossing distances for pedestrians, improve signal timing and reduce crashes involving motorists and pedestrians. However, they may result in uncomfortable and unsafe crossing conditions for pedestrians if they are designed with large turning radii that encourages high-speed turns. They can also present a challenge to through bicyclists since motorists will need to cross their line of travel to access the channelized right turn lane.



Credit: Michael Richardson

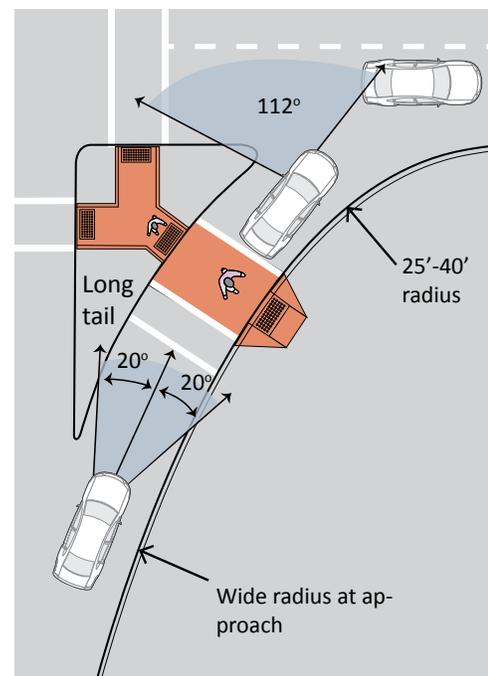
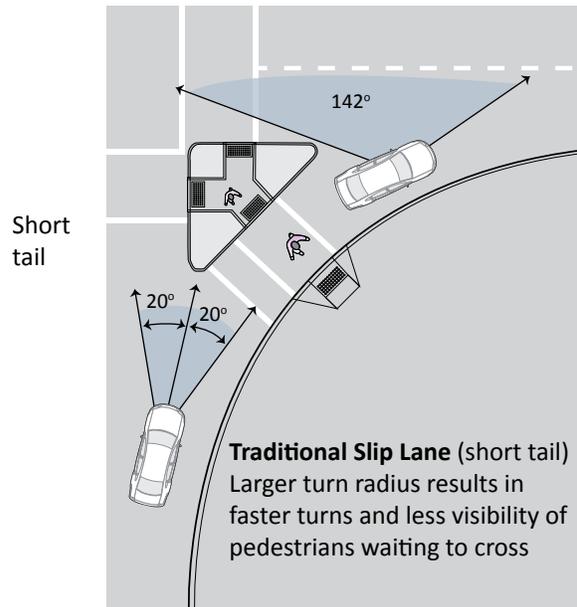
Applicability and Use

Channelized right turn lanes may be considered at intersections with high volumes of right-turning trucks and buses. A channelized right turn lane is often used in lieu of a large curb radius.

- New designs for channelized lanes with “long tails” make them function more like a conventional perpendicular intersection, while still enhancing efficiency for motorists. The new design has also been shown to reduce motor vehicle and pedestrian crashes over the traditional slip lane design.
- Traditional yield-controlled channelized right turn lanes may be more difficult for vision-impaired people to navigate because they are not able to easily assess whether or not a vehicle has yielded and because of non-standard intersection geometry.
- There may locations where channelized right turn lanes are inappropriate, such as areas of high pedestrian activity, or adjacent to an off-street bike trail or two-way cycle track.

Design Considerations

- If a channelized right turn lane is truly necessary, islands with long tails on the approaches will be more pedestrian friendly.
- Curb radii should be revised to create one long radius entering the channelized right turn lane followed by a short one of 25-40 feet maximum exiting the channelized right turn lane to slow turns and improve lines of sight, particularly for pedestrians and vehicles approaching from the driver's left
- Triangular 'pork chop' islands should be lengthened at a 2:1 ratio, with the tail pointed toward approaching traffic.
- Islands should be long enough to allow a car to wait for a gap in traffic without blocking the crosswalk.
- Crosswalks should be relocated for maximum visibility to a spot where the driver is looking ahead, at least one car length back from the intersecting roadway. Crosswalks should also be oriented at a 90 degree angle to the right turn lane to improve sight lines and reduce crossing distance.
- Edge lines with cross-hatching may be used to narrow the perceived width of the channelized right turn lane while still accommodating larger vehicles.
- Raised crosswalks may be used to improve yield compliance at the pedestrian crossing.



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Marked Crosswalk
Bump Outs
Pedestrian and Traffic Signals

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Marked Crosswalks

Definition

Crosswalks exist at every intersection whether marked or not. Marked crosswalks delineate the optimal or preferred location for a pedestrian to cross a street, and indicate to motorists where to expect pedestrians. Crosswalk pavement markings must follow one of the styles as shown in the MN MUTCD. There are a number of styles of markings outlined in the MUTCD. Markings can be installed using white paint, thermoplastic or other pavement marking material.

Applicability and Use

Minnesota Statute: “Where traffic-control signals are not in place or in operation, the driver of a vehicle shall stop to yield the right-of-way to a pedestrian crossing the roadway within a marked crosswalk or at an intersection with no marked crosswalk.”

Whether marked or unmarked, every corner of an intersection in Saint Paul is a legal crosswalk where vehicles must stop and yield the right-of-way to pedestrians that have entered the crossing area. The decision to mark a crosswalk depends on a number of factors, including vehicle volumes and speeds, pedestrian volume, number of vehicle lanes, intersection complexity, community input, and the need for a heightened level of motorist awareness, such as near a school. Marked crosswalks may be installed at signalized intersections, stop-controlled intersections, and uncontrolled intersections, as well as mid block locations (away from intersections). Marked crosswalks may be accompanied by additional pavement markings, signage, warning signals, and crossing treatments such as median crossing islands and bulb-outs.

Marked crosswalks may be installed in the following locations and may also include additional signing:

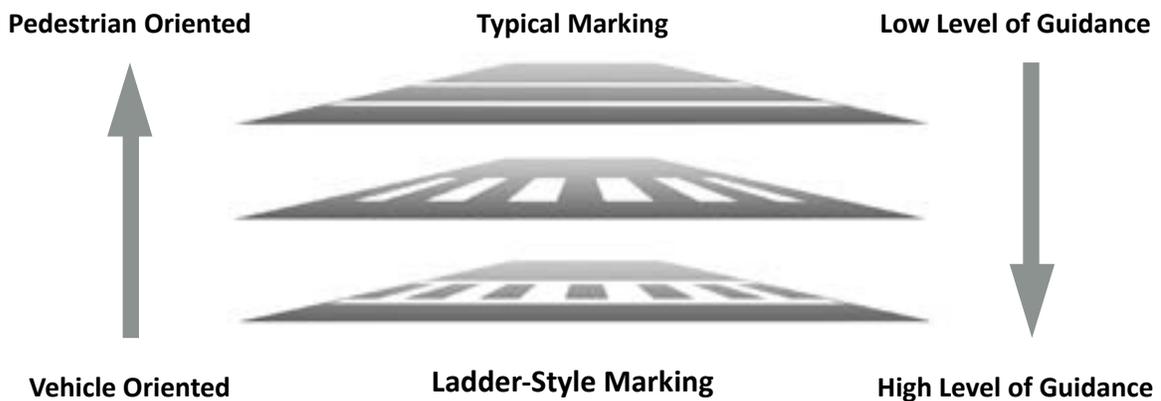
- Signalized intersection crosswalks are typically marked at all four crossings where there are sidewalks leading to the intersection. In some cases there may be specific reasons to direct pedestrians to a particular crossing, and therefore not mark one or more legs of the intersection or prohibit pedestrian crossing.
- At stop-controlled intersections all four legs may be marked or only two based on pedestrian routes, turning conflicts, intersection control, and identifying a preferred or optimal crossing.
- At school crosswalks, which may include special school crossing signs at uncontrolled or mid block locations to further communicate to motorists that children are likely to use the crossing.
- At mid block locations, including pedestrian or off-road path crossings. These crosswalks may be accompanied by warning signs, advanced stop bars or other crossing treatments depending on the roadway traffic conditions. Mid block locations must be marked to be a legal crossing.



Design Considerations

General

- Marked crosswalks should be aligned with the approaching sidewalk and should be located to maximize the visibility of pedestrians while minimizing their exposure to conflicting traffic. Crosswalk placement should balance the need to extend the desired pedestrian walking path with orienting the crosswalk perpendicular to the curb; perpendicular crosswalks minimize crossing distances and therefore limit the time of exposure.
- The style of marking is dependent upon the factors listed on the table on the following pages and range from two parallel lines to a high-visibility ladder style. The choice in marking should match the level of guidance needed per MUTCD, or the following table
- Marked crosswalks should be at least 10 feet wide or the width of the approaching sidewalk if it is greater. In areas of heavy pedestrian volumes such as downtown, crosswalks should be wider (e.g., 14 to 20 feet).
- High visibility ladder-style crosswalks consist of white longitudinal lines placed perpendicular to the path of pedestrian travel with markings installed so that the primary paths for vehicle tires are between crosswalk markings, which can reduce wear and maintenance.
- Standard parallel line markings are acceptable (per MN MUTCD), however they may be less visible to motorists.
- Use crosswalk marking materials that are non-skid and retro-reflective.
- Advanced stop lines at stop-controlled and signalized intersections, when used, should be striped no less than 4 feet and no more than 30 feet from the edge of crosswalk.
- The case of colored/textured pavement to identify a crossing must also include MN MUTCD compliant parallel markings demarcating the crosswalk extent.



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Related Treatments

Roadway Lighting
 Curb Radii
 Rectangular Rapid Flashing Beacon
 HAWK Signal
 Mid-Block Crossings
 Sidewalk and the Zone System
 Bump Outs

References

MnDOT Design Manual
 State Aid Manual
 Comprehensive Plan
 Standard Plates
 MN MUTCD

Marked Crosswalks

Design Considerations continued

Uncontrolled Crossing Locations

The design of marked crosswalks at uncontrolled locations should incorporate additional crossing treatments depending on the number of travel lanes, vehicle speed, and the volume of vehicles in a given location. The table below contains guidelines for intersection and mid block locations with no traffic signals or stop sign on the approach to the crossing. The guidelines do not apply to school crossings or other areas with a population that may require special design considerations. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor site distance, complex or confusing roadway geometry, substantial volumes of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices.

Adding crosswalks alone will not make a crossing safer, or necessarily result in more vehicles stopping for pedestrians. Whenever marked crosswalks are installed, it is important to consider other pedestrian facility enhancements, as needed, to improve the safety of the crossing (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic calming measures, bump outs).

- These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.
- Where speed limit exceeds 40 mph, marked crosswalks alone should not be used at unsignalized locations.

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MnDOT Design Manual
State Aid Manual
Comprehensive Plan
Standard Plates
MN MUTCD

General Guidelines for Installing Marked Crosswalks and Other Needed Pedestrian Improvements at Uncontrolled Intersections*

Number of Lanes	Vehicle ADT											
	9,000 or fewer			9,000 - 12,000			12,000 - 15,000			More than 15,000		
	Speed Limit			Speed Limit			Speed Limit			Speed Limit		
	30 mph	35 mph	40 mph	30 mph	35 mph	40 mph	30 mph	35 mph	40 mph	30 mph	35 mph	40 mph
Two Lanes	A	A	B	A	A	B	A	A	C	A	B	C
Three Lanes	A	A	B	A	B	B	B	B	C	B	C	C
Four or More Lanes with Raised Median	A	A	B	A	B	C	B	B	C	C	C	C
Four or More Lanes w/o Raised Median	A	B	C	B	B	C	C	C	C	C	C	C

A = Candidate site for marked crosswalk . Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to show whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volumes, vehicle speeds, sight distance, vehicle mix, etc., may be needed at other sites.

B = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

C = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased by providing marked crosswalks alone. Consider using other treatments, such as traffic signals with pedestrian signals, to improve crossing safety for pedestrians.

* Adapted from Zegeer, C.V., Stewart, R.J., Huang, H.H., and Lagerwey, P.A. *Safety Effects of Marked Vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines. FHWA-RD-01-075. Federal Highway Administration, Washington, D.C., 2002.*

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Median Crossing Island

Definition

Median crossing islands (also known as center islands, refuge islands, pedestrian safety islands) are raised islands installed in the center of a street at intersections or at midblock crossings. Median crossing islands reduce the exposure time experienced by a pedestrian crossing the street and allow pedestrians to deal with only one direction of traffic at a time by enabling them to stop halfway across the street in a protected space and wait for an adequate gap in traffic before crossing the second half of the street.

Applicability and Use

- Median crossing islands benefit children, the elderly, the disabled, and others who travel slowly, as well as bicyclists.
- Median crossing islands should be considered at all uncontrolled intersections and midblock crossings where vehicle speeds and volumes make crossing the street difficult due to lack of adequate gaps, or where three or more lanes of traffic make pedestrians feel exposed or unsafe.
- They should also be considered at crossings of two-lane roadways where there are a high proportion of young, elderly and other slower moving pedestrians.
- Median crossing islands may also be provided at signalized or stop controlled intersections, which are commonly done on streets with continuous or intermittent medians. At signalized locations pedestrians are expected to be able to cross the street in one movement rather than waiting in the median crossing island area.
- Median crossing islands should also be considered at midblock off-street path crossings or where bicycle routes on neighborhood streets intersect high volume/high speed streets or streets with two or more lanes in each direction.



Design Considerations

- Median crossing islands placed at crossing locations where a higher number of bicyclists are crossing or anticipated, or where pedestrian volumes are higher, should be large enough to accommodate groups of pedestrians and/or bicyclists, bicycles with trailers, wheelchairs, and baby strollers.
- Median crossing islands must be a minimum 6 feet wide, but have a preferred width of 8 to 10 feet, particularly where bicyclists or a higher volume of pedestrians are expected. Where a 6-foot wide median cannot be attained, a narrower island may still provide some benefit.
- Median crossing islands should be a minimum 20 feet long.
- A painted taper may be placed on either side of the island.
- Median crossing islands should be designed in accordance with the proposed Public Rights-of-Way Accessibility Guidelines (PROWAG).
- A cut-through design is preferred over a ramp design except where the median is wide enough to accommodate ramps and a minimum 5-footwide level landing in the center. The cut-through (or ramps) should equal the width of the crosswalk.
- The cut-through should be designed with a diagonal offset in order to provide additional storage space and direct pedestrian/bicyclist attention toward oncoming traffic. The offset should be angled towards the direction from which traffic is approaching.
- Median crossing islands may be enhanced using plantings. Plantings require maintenance and need to be selected to ensure visibility for drivers and pedestrians. Medians should be 8 feet wide for trees. Consider long-term maintenance access, as fewer lanes can make access for maintenance vehicles more difficult.
- At uncontrolled intersections and midblock crossing locations, additional crossing treatments may accompany a median crossing island, including advanced crossing warning signage, advanced stop markings and rectangular rapid flashing beacons.

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References

MnDOT Road Design Manual
 MN MUTCD
 MnDOT Best Practices Synthesis and Guidance in At-Grade Trail-Crossing Treatments
 MnDOT Bikeway Facility Design Manual
 Comprehensive Plan
 FHWA Information Report on AASHTO Guide for the Development of Bicycle Facilities (Section 5.3.2)
 PROWAG

Mid-Block Crossings

Definition

A mid block crossing is a marked crosswalk located between intersections. When installed, a mid-block crossings often incorporate enhancements such as high visibility crosswalks, advanced warning signage, median crossing islands, bump outs, pedestrian-activated warning signals, or in some cases traffic signals. All of these elements help to inform motorists that pedestrians are crossing or likely to be crossing at this location.

Applicability and Use

- The decision to install a mid-block crossing should be made on a case-by-case basis and based upon field observations of pedestrian behavior (e.g., desire lines), crash data analysis at the segment level, as well as other factors such as transit operations and the location of driveways.
- Refer to Crosswalks for additional details on pedestrian crossing thresholds.
- Mid-block crossings may be used where off-street paths intersect a roadway.
- When installed, mid-block crossings may be used where distances between the nearest intersections are significantly out of proximity in relation to major pedestrian attractors (e.g., transit stops, parks, school, retail) that are located mid-block.
- Where an off-street path intersects a roadway mid-block and it is not feasible or desirable to direct path users to the nearest intersection, a mid-block crossing may be provided.



Credit: Michael Richardson

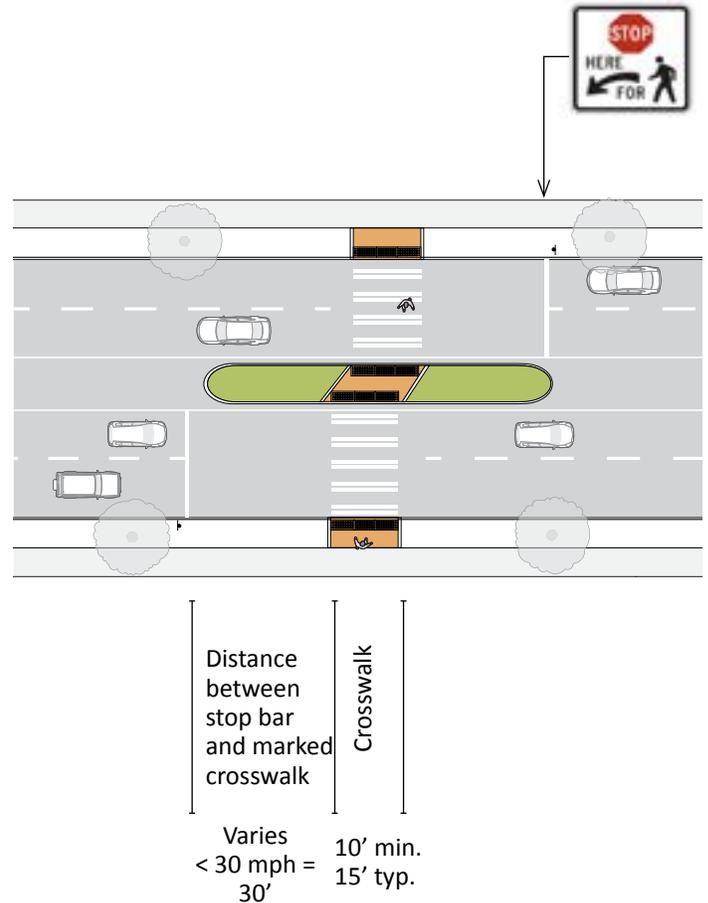
Design Considerations

The design of mid block crossings and incorporation of additional crossing treatments depends on the number of travel lanes, vehicle speed, and the volume of vehicles in a given location.

- The crossing should be outside the functional area of adjacent intersections.
- The crossing should be conspicuous to both road users and path users.
- Sight lines should be maintained to meet the needs of the traffic control provided.
- The crossing and approaches should be on relatively flat grades.
- The crossing should be as close to a right angle as practical, given the existing conditions.
- The least traffic control that is effective should be selected. MnMUTCD signs R1-6a, R1-6b, R1-9a, and R1-9b may be used.

For additional guidance on off-street path mid block crossings refer to the AASHTO Guide for Development of Bicycle Facilities and Best Practices Synthesis and Guidance in At-Grade Trail-Crossing Treatments, published by MnDOT.

Mid Block Crossing: 2 Lanes with Crossing Island or Median



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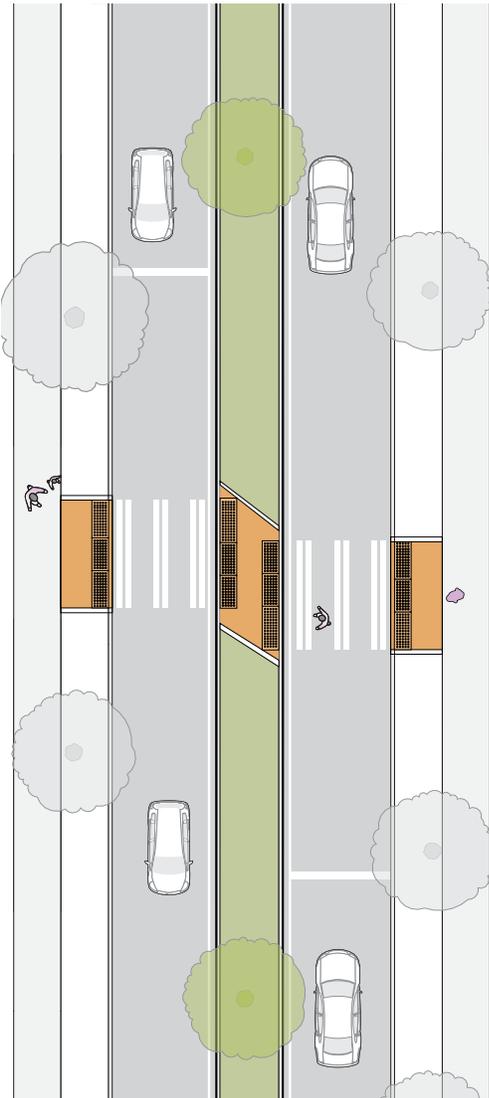
Marked Crosswalk
Transit Stop Placement
Pedestrian and Traffic Signals
HAWK Signal
Rectangular Rapid Flashing
Beacon
Intersection Median Barriers

References

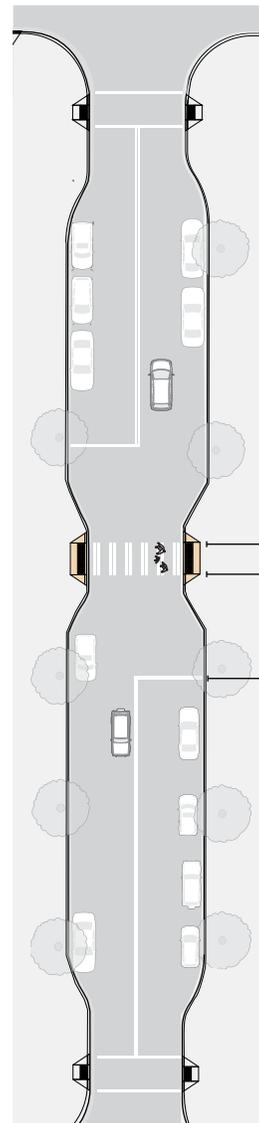
MnDOT Road Design Manual
MnDOT Bikeway Facility
Design Manual
MnDOT Best Practices
Synthesis and Guidance
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Treatments
FHWA Information Report on
Lighting Design for Mid-block
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Mid-Block Crossings

Mid Block Crossing: 4 Lanes with Crossing Island or Median, No Parking



Mid Block Crossing: Parking and Bump Out



Crosswalk, 10' - 15'

Distance between stop bar and marked crosswalk:
< 30 mph = 30'

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Overpasses and Underpasses

Definition

Overpasses or underpasses may be necessary in order to safely route pedestrian and bicycle traffic across natural or manufactured barriers. These facilities represent vital links for bicyclists and pedestrians and should transition seamlessly into on- and off- street facilities on both sides. Many situations may allow for existing bridges or roadways to be retrofitted in order to provide a bicycle/pedestrian crossing while some will require separate structures. This section provides several general guidelines; however, each crossing will present unique constraints and opportunities and should be assessed with an engineering and design analysis.

Applicability and Use

Overpasses and underpasses are very expensive and should not be used if they are not easily accessible. Crossings may not be advisable when:

- There is a more direct, easily accessible at-grade alternative
- Users are required to negotiate significant elevation changes
- The cost is unreasonably high.

Pedestrian/bicyclist overpasses or underpasses should be considered when:

- No direct and safe route can be provided on at grade on- or off-street facilities.
- Existing vehicular crossings are too narrow to accommodate a bicycle facility.
- The obstacle to be crossed is raised or depressed (e.g., freeway below grade of surrounding neighborhood).
- Alternative routes would require cyclists to negotiate significant elevation changes.
- The connection would link schools to neighborhoods over high-volume arterials.



Credit: City of Saint Paul

Design Considerations

Existing crossings may comfortably accommodate bicyclists and pedestrians, or allow for such conditions through retrofitting. When this is not the case, the following design considerations should be followed:

- The minimum width of crossings for bicycles and pedestrians is 12 feet, or width of the approach path plus 2 feet total, whichever is greater. Reduced widths may be considered when:
 - Only occasional pedestrian use of the facility is expected.
 - Bicycle traffic is expected to be low during all hours, including peak.
 - Alignment of facility will provide safe and frequent passing opportunities.
- Crossing approaches should provide maximum field visibility for bicyclists and pedestrians. Visual guidance/screening such as fencing or vegetation may be needed to help direct users to the crossing, and to ensure proper use.
- Short under-crossings may require little to no lighting. The length of the crossing will affect the need for lighting solutions to improve a feeling of safety and visibility.

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[Off-Street Paths](#)
[Bridges](#)

References

[MnDOT Road Design Manual](#)
[MnDOT Bikeway Facility Design Manual](#)
[MnDOT Roadway Lighting Design Manual](#)

Pedestrian and Traffic Signals

Definition

The federal Manual for Uniform Traffic Control Devices (MUTCD) establishes warrants for the use of most traffic control devices. Within the parameters of MUTCD, a Complete Streets approach to signalized intersection design includes good geometric design, convenience and ease of use of pedestrian push-button actuators, signal timing techniques that address pedestrians and other users, as well as techniques that reduce conflicts with turning vehicles, which can help address safety for all modes and ensure Americans with Disabilities Act (ADA)-compliance as part of a street design that is balanced with the conditions of the location.

Applicability and Use

Pedestrian Signal Timing Standards

Calculating pedestrian crossing times and programming signals in a way that accommodates all users is an important way to make signalized intersections more accessible. In all cases, pedestrian crossing times shall meet the minimum standards in the most current MUTCD. Providing additional time may be considered on a case by case basis, depending on pedestrian and vehicular volumes, user type and other safety factors as may be appropriate.

Pedestrian push-button actuators

Pedestrian push-button actuators are electronic buttons used by pedestrians to provide a walk interval during a signal phase. If they are present, pedestrians must push the button to get a walk interval; otherwise a walk interval will not be included in the next signal phase. Push-button actuators may be needed at some crossings, but their use should be based on best device applicability for conditions.

- In downtown, neighborhood centers and other areas of high pedestrian activity, pedestrian push-button actuators may not be appropriate. Pedestrians can expect and should get a pedestrian cycle at every signal phase.
- At more complex intersections (e.g., where there is more than one signal phase for each direction), where pedestrian volumes are lower, or uneven or variable volumes of users, push buttons should be provided.



Accessible pedestrian signals

Accessible Pedestrian Signals (APS) provide pedestrian signal information in audible and vibrotactile formats for hearing- and sight-impaired people. They benefit all pedestrians by providing redundancy and are useful to a wider range of the population – including people with cognitive impairments, children, and the elderly.

- APSs will be installed at all new signal installations in compliance with Minnesota MUTCD and as advised by NCHRP Best Practice and Draft PROWAG. Other locations will be evaluated on a case by case basis for inclusion within other projects or when signals are improved.

Protected and Permissive Phases

At signals, turning movements generally account for most pedestrian crashes. Permissive left-turns allow vehicles to make a left turn on green when oncoming travel lanes are clear. Often pedestrians are given a walk signal at the same time vehicles are permitted to turn left on a green light. Left-turning motorists are often focused on watching for oncoming traffic and may not look for pedestrians, which results in the potential for collisions with pedestrians in the crosswalk. Protected left turns, indicated by a green arrow, can be safer for pedestrians, because pedestrians cross before or after left-turning cars have moved through the intersection. Protected left turns can also help reduce vehicle-vehicle collisions. Because they add an additional signal interval, protected left turns may add a delay to all movements. Also, MUTCD has some signing applications that can be used in conjunction with traffic signals to enhance pedestrian crossing.

- A flashing yellow arrow during the steady green light may be provided to warn drivers to yield to pedestrians and oncoming vehicles.

Design Considerations

Pedestrian Phase Signal Timing Standards

MN MUTCD provides guidance on options for signal timing which allows the City to designate by ordinance specific pedestrian safety crossings where signal timing may be increased per MnMUTCD for senior citizen and disabled pedestrian crossings.

Pedestrian Push-Button Actuators

Buttons must be properly placed so that they are convenient and conspicuous to pedestrians and follow MnMUTCD placement.

Accessible Pedestrian Signals (APS)

Some key features of APS, which are integrated into the push button:

- Speakers at the push-button actuator with automatic volume adjustment so that tones are audible within 6 to 12 feet of the button
- A push button locator tone
- Audible WALK indications that feature a tone or speech message during WALK
- Vibrotactile WALK indications that feature a tactile arrow or other surface on the button that vibrates during the WALK phase.

The location of the APS is critical to the proper functioning. APS can be used during exclusive pedestrian phases of leading pedestrian intervals (LPI).

Protected/Permissive Phases

Manual for Uniform Traffic Control Devices sign R10-5, with a yield and a pedestrian symbol, can be used to remind drivers to yield to pedestrians.

Combination protected-permissive phasing should be provided by default, but should revert to protected-only when pedestrian push buttons are pushed, or based on the time of day.

A flashing yellow arrow during the steady green light should be provided to warn drivers to yield to pedestrians and oncoming vehicles.

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[Bump Outs](#)
[Channelized Right Turn Lanes](#)
[Rectangular Rapid Flashing Beacon](#)
[Leading Pedestrian Interval](#)
[HAWK Signal](#)

References

[MnDOT Road Design Manual](#)
[MnDOT Bikeway Facility Design Manual](#)
[MnDOT Roadway Lighting Design Manual](#)

Rectangular Rapid Flashing Beacon

Definition

A Rectangular Rapid Flashing Beacon (RRFB) is a pedestrian warning signal consisting of yellow LED lights in two rectangular clusters, or beacons, that employ a stutter-flash pattern similar to that used on emergency vehicles. The beacons are often mounted below a standard pedestrian crossing warning sign and above the arrow plaque used to indicate the crossing location. RRFBs are pedestrian actuated either by a push-button or passive detection.

Applicability and Use

- Cost-benefit analysis should be completed to evaluate need and cost of application against improvement on safety.
- RRFBs may be considered at uncontrolled intersections or at mid block crossings where additional measures are needed due to high volumes and speeds.
- They may be considered where there are high volumes of pedestrians, a high number of vulnerable pedestrians (e.g., near schools, senior centers), or at off-street path crossings.



Credit: Anton Jerve

Design Considerations

- RRFBs should be accompanied by pedestrian crossing signs (MN MUTCD W11-2) both at the signal and in advance of the crosswalk location. The assembly approaching the crossing should include a plaque that says AHEAD. The assembly at the location should include a downward arrow plaque (MN MUTCD W16-7P) placed at the crosswalk location.
- A STOP HERE FOR PEDESTRIANS (MN MUTCD R1-5b/R1-5c) sign with advanced stop bars should be placed a minimum 20 to 50 feet from the crosswalk based on visual distance and should be considered where RRFBs are installed. A Pedestrian Crossing (MN MUTCD W11-2) sign with an AHEAD or a distance supplemental plaque may be used in conjunction with and in advance of a MUTCD R1-5b/R1-5c sign.
- Beacons shall be placed on either side of roadway and visible from both directions of traffic. If a median exists at the crossing location, a third beacon may be placed in the median, which studies show, significantly increases motorist yield rates.
- In order to encourage pedestrians to enter crosswalk while the RRFB is active, passive or active actuation should trigger an immediate response.

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MnDOT Road Design Manual
MnDOT Bikeway Facility Design Manual
MnDOT Roadway Lighting Design Manual

Leading Pedestrian Interval

Definition

A Leading Pedestrian Interval (LPI) is a signal phasing strategy that may improve visibility of crossing pedestrians and reduce conflicts between turning vehicles and pedestrians entering the crosswalk area. During the LPI, motor vehicles expecting the next green phase are stopped for three to seven additional seconds while parallel-traveling pedestrians are given the WALK signal. The delayed movement of vehicles is designed to allow pedestrians to begin crossing in advance of vehicular turning movements, which allows them to clearly establish themselves in the crosswalk in a position that is more visible to the motorist.

Applicability and Use

- LPIs may be considered in locations with heavy volumes of turning traffic and frequent pedestrian crossings, particularly where there have been collisions between turning vehicles and pedestrians in the crosswalk, after careful evaluation to understand effects and effectiveness of LPI on conditions at the intersection.
- An LPI is particularly useful for intersections where school children and seniors cross the street.
- An LPI could be considered at intersections with counter-flow bicycle lanes, especially where the through movement of counter-flow bicycles happens at the same time as left-turning vehicles.
- LPIs can be complemented by geometric design changes to the intersection that shorten crossing distances and reduce the required duration for the WALK phase of the signal.



Design Considerations

- The LPI is most effective when accompanied by a No Turn on Red restriction for right-turning traffic on adjacent streets, but may need to be off-set with a longer green time after pedestrian movement ends to allow time for turning vehicles.
- An LPI should be at least 3 seconds in duration and should be timed to allow pedestrians to cross at least one lane of traffic.
- In the case of a large corner radius, the duration should be timed to allow pedestrians to travel far enough to establish their position ahead of the turning traffic before the turning traffic is released. MN MUTCD §4E
- The LPI is more effective when used with a high visibility crosswalk.
- Accessible pedestrian signals should be considered where a LPI is used.

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[MnDOT Roadway Lighting Design Manual](#)

HAWK Signal

Definition

“HAWK” stands for High-intensity Activated Crosswalk and is also referred to as a pedestrian hybrid beacon. A HAWK signal is a push button-activated pedestrian signal that increases pedestrian safety at crossings while stopping vehicle traffic only as needed. The following describes how a HAWK signal works:

1. The signal remains dark until a pedestrian activates the walk indication by pushing a button.
2. The signal will then flash yellow to warn drivers that a pedestrian will be entering the crosswalk.
3. A steady yellow indication follows advising drivers to stop if safe to do so.
4. The signal then turns solid red, requiring vehicles to stop at the stop line. The pedestrian will see the walk indication and proceed into the crosswalk.
5. Once the walk time is completed, the signal will flash red. This lets the driver know that once they come to a complete stop they may proceed through the intersection if there are no pedestrians in the crosswalk.
6. The HAWK will return to the dark or “off” position until the push button is activated again.



Design Considerations

HAWK signals must be accompanied by the following crossing treatments:

- Crosswalk pattern to match the intensity of the crossing, likely a higher-visibility crosswalk
- Advanced stop bar placed 20 to 50 feet from crosswalk
- MnMUTCD R10-23 signs mounted both on the mast arm and the supporting pole.

The HAWK Signal indicates a preferred crossing location and thus does not improve crossing at all quadrants of an intersection as a signalized intersection would. It does not improve movement through the intersection for cyclists in on-street lanes as they are subject to motor vehicle indications.

Applicability and Use

HAWK signals may be used at mid block crossings (including off-street path crossings) and intersections and should be considered where high traffic volumes and speeds (typically based on study of 35mph or less, per MUTCD) make it difficult for pedestrians to cross the street at locations that do not meet traffic engineering ‘warrants’ for a conventional signal. HAWK signals provide a protected crossing while allowing vehicles to proceed through a pedestrian crossing as soon as it is clear, thus minimizing vehicle delay. HAWK signals may also provide audible information as to when the WALK signal is on for visually impaired pedestrians.

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[MnDOT Bikeway Facility Design Manual](#)
[MnDOT Roadway Lighting Design Manual](#)
[MUTCD](#)



4

Design Treatments - How they Relate to Each Other



er



Design Treatment Introduction

Corridor Classification Types

The design of every street in Saint Paul is influenced by the context in the city. This includes the current traffic demands, long-term transportation and land use goals, right of way available and classification. The future land use represents the long term land use context for the street. This combined with the street classification and right-of-way provides a framework for the design of the street. Future land uses were established in the 2008 Comprehensive Plan, which organized land uses around corridors. The descriptions of these corridor types are as follows:

Downtown

This is the core of the city, lying solely on the east bank of the Mississippi River. It includes a broad mix of uses, including government facilities, and both residential uses and commercial office uses at the highest densities in the city.

Mixed-Use Corridor

This land use consists primarily of thoroughfares through the city that are served by public transit (or could be in the future). Mixed-Use Corridors include areas where two or more of the following uses are or could be located: residential, commercial, retail, office, small scale industry, institutional, and open space uses. The uses in these corridors may be within a building or in buildings that are in close proximity to each other.

Residential Corridor

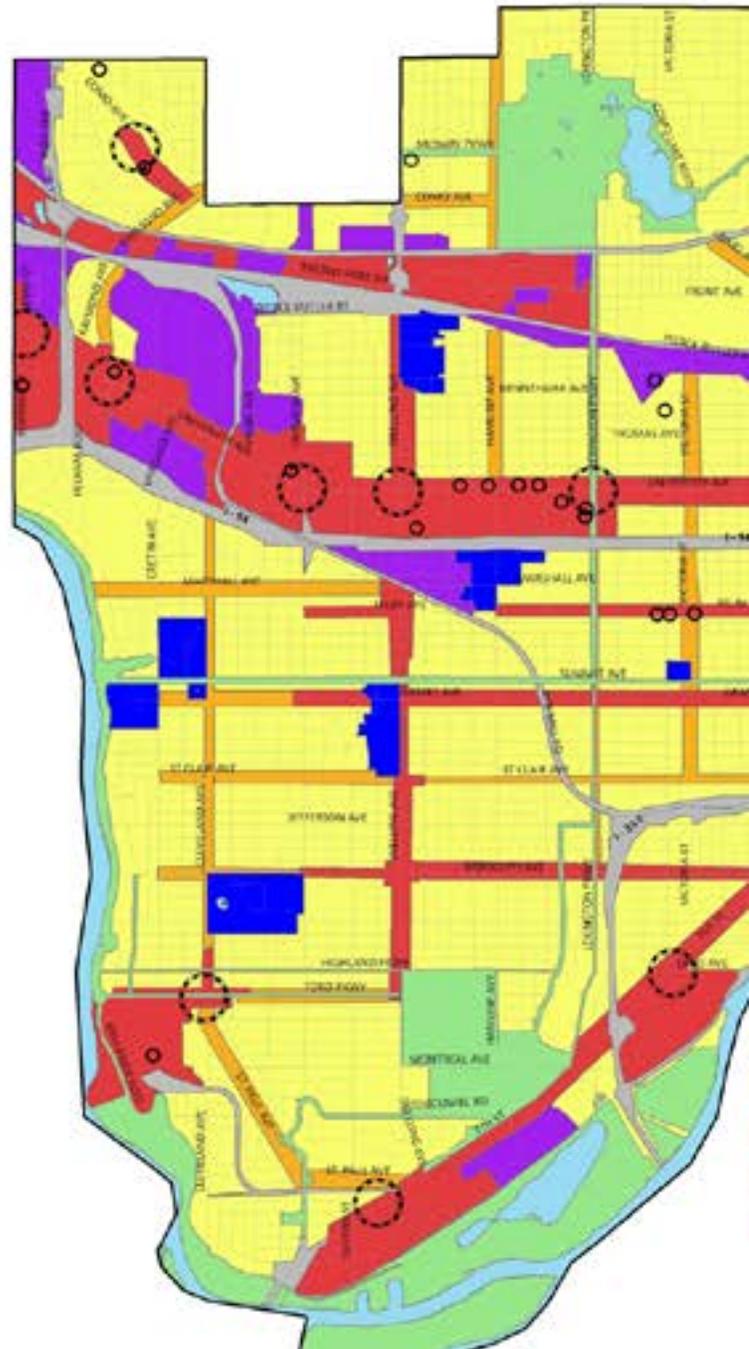
This land use includes segments of street corridors that run through Established Neighborhoods that are predominately characterized by medium-density residential uses. Some portions of Residential Corridors could support additional housing

Established Neighborhood

This land use includes predominately residential areas with a range of housing types. Single-family houses and duplexes predominate these neighborhoods, although there may be smaller scale multi-family housing scattered within these neighborhoods. Established Neighborhood also includes scattered neighborhood-serving commercial, service and institutional uses at the juncture of arterial and collector streets.

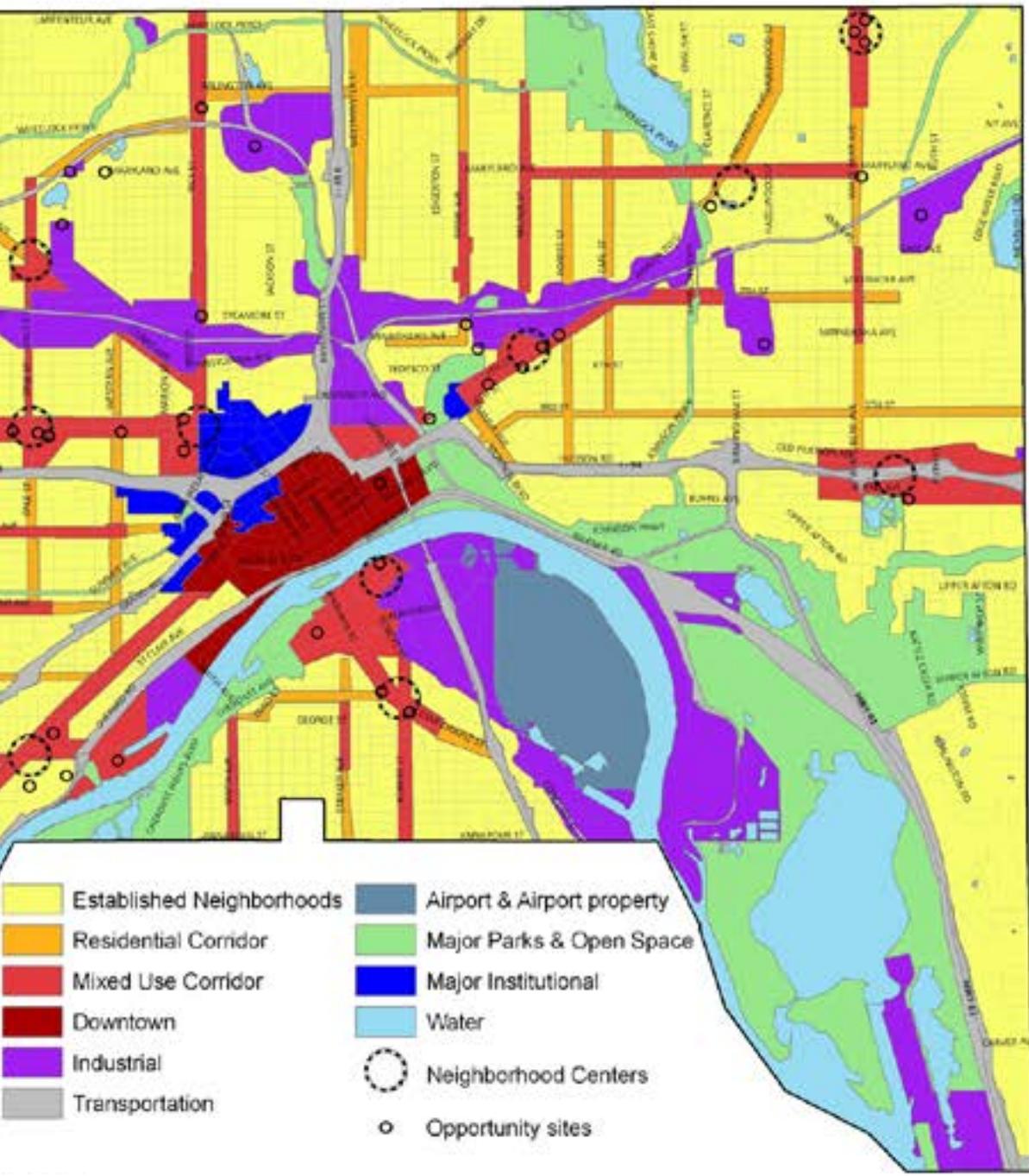
Industrial

This type of land use is primarily the location of manufacturing and/or processing of products. Industrial could include light or heavy industrial land uses, large warehouse facilities, and/or utilities.



The following pages describe in more detail design expectations of these street types and how the individual elements can be combined to create a complete street. Transportation Streets, i.e. highways are not included in this because these roadways are limited access, part of the interstate highway system, and outside the jurisdiction of the City. Parkway are

not included because the design of parkways varies so dramatically that they cannot be summed up in one illustration. Although the following streets are based on common right of way widths and conditions they are for illustrative purposes only and actual designs will be based on the precise conditions of the street.



Downtown Streets



Downtown streets host a wide range of high-density uses and provide access to a complex mix of office, retail, restaurants, arts and entertainment and growing residential uses. The density of activity relative the narrowness of downtown streets can provide an attractive environment to pedestrians, bicyclists and transit users while also accommodating motorists and freight delivery trucks. These streets are characterized by their extensive pedestrian zones that accommodate significant volumes of foot traffic and foster social interaction. Elements including street furniture, public art, vegetation, and sidewalk cafés help define the boulevard zone. Continuous building facades sited at or near the edge of the property line provide visual interest through architectural elements such as doorway details, awnings and window displays.



Behind the Curbs

Wide Pedestrian Zones dominate these streets and accommodate high volumes of pedestrian traffic and should encourage social uses. Continuous building facades and a mix of uses provide visual interest at ground-level, with the Frontage Zone announcing building entrances and the occasional café. The Boulevard/ Furnishing Zone is characterized by high-quality, above-standard materials and seasonal finishes, including hanging planters and holiday lighting. Street furniture, public art, wayfinding, street trees, sidewalk cafes and unobtrusive utility elements are featured in the Boulevard/Furnishing Zone.

Between the Curbs

On-street parking allows for bump outs which reduce crossing distances for pedestrians, improve signal timing (less time needed for pedestrian cycle) and improve the visibility of pedestrians entering the crosswalk. Transit stops are located on the far side of intersections so as not to block vehicular traffic flow and enable safe crossing opportunities for pedestrians behind the bus.

Intersections

Street corners defined by tight curb radii improve pedestrian safety by reducing crossing distances and slowing right-turning vehicles. Tight curb radii enable two curb ramps to be placed at each corner and marked crosswalks that align with the sidewalks for maximum pedestrian convenience and safety. Traffic signals are timed to meet ADA requirements as well as larger pedestrian volumes.



Behind the Curb

While sidewalks may be narrower than on Downtown streets, they provide similar elements, with a focus on providing access to the many entrances of small businesses and residences lining the street. The Boulevard/ Furnishing Zone should be as generous as possible and flexible in order to accommodate green infrastructure, public art, transit amenities, parking meters, sidewalk cafes, driveway aprons and snow storage in the winter.

Where surface parking lots are set back from the sidewalk, low walls, landscaping or decorative fencing screen cars from the view of pedestrians. Where buildings are set closer to the property line, sight lines are provided with angled building corners.

Between the Curbs

A turn lane provides for efficient traffic flow by accommodating left turns. Bicycle lanes and on-street parking provide a buffer for pedestrians on the sidewalk, and help regulate vehicular speeds. On-street parking supports businesses with short-term parking.

Intersections

Bump outs at corners enable safe and convenient pedestrian crossings which are facilitated by marked crosswalks, pedestrian lighting, well-located pedestrian push buttons and countdown signal heads. Bus stops are located to facilitate transfers to cross-street routes.

Residential Corridor Streets



Residential corridor streets support both through vehicular travel and transit as well as access for higher-density residential uses and commercial nodes along the street. Sidewalks are essential since transit trips start and end as pedestrian trips. Pedestrians need to cross the street to access parking, transit and occasional businesses. Physical buffers from travel lanes are needed since traffic speeds and volumes may be higher on these collector streets.



Behind the Curb

The sidewalks on these streets may be narrower to accommodate low to moderate levels of pedestrian activity as these streets primarily provide access to individual residences, subdivisions, or medium density multi-family residential developments. These streets may also serve as major transit routes and connectors between neighborhood commercial areas. A generous Boulevard/Furnishing Zone provides space for street trees, creating a canopy that shades the sidewalk, breaks up the visual plane of the street, managing speed and boosting the aesthetics for motorists, bicyclists and pedestrians. Grass boulevards allow for stormwater infiltration and snow storage during winter months.

Between the Curbs

On-street parking provides longer-term parking for residents and their guests. Parking may be time-limited at commercial nodes. Medians provide access management, facilitate pedestrian crossing and can be used as part of a cross-street bike boulevard.

Intersections

Transit stops are located on the near side of intersections to improve winter boarding. Stop controlled streets create an opportunity to install high visibility crosswalks at school crossings, or as appropriate.

Established Neighborhood Streets



Established neighborhood streets provide access for all modes to and from residences. Pedestrian and bicycle travel is an important part of the street function, both for access within, into and out of the neighborhood. Neighborhood streets also support bicycle boulevards, streets that are traffic calmed to accommodate less experienced bicyclists. Bicycle boulevards often cross arterial streets, requiring additional crossing treatments. There may be a high demand for on-street parking in neighborhoods without garages or alleys.



Behind the Curb

With slower speeds and a less populated sidewalk environment, sidewalk widths are typically 5 feet and the Boulevard/Furnishing Zone may be wider in order to accommodate green infrastructure, rain gardens and other neighborhood-supported features that add visual interest and contribute to neighborhood character. Street space for large canopy trees is provided by locating above ground utilities in alleys.

Between the Curbs

Narrower streets and lower vehicle traffic volumes and provide a quieter street for residents. On street parking is primarily used by residents and their guests and often serves to slow traffic.

Intersections

Tight curb radii reduce the speeds of turning motor vehicles and enables directional curb ramps to be installed in conjunction with high visibility marked crosswalks at school crossings. Traffic calming treatments at intersections, such as mini circles slow motor vehicles and median diverters limit through motor vehicle access, enabling the creation of bicycle boulevards.

Industrial Streets



Industrial streets serve businesses with greater freight and transportation needs. They have moderate to high volumes of trucks of all sizes. Some have railroad tracks within the street right-of-way; other streets are crossed by railroad tracks, often in unexpected locations and at obtuse angles. On-street parking may be infrequent, especially where space is needed for large trucks and off-street parking is provided. Driveways are used to accommodate large volumes of trucks.



Behind the Curb

The sidewalks in industrial districts should be utilitarian and uncluttered. Street furniture is mainly limited to street lighting, transit amenities and other essential elements. There may be significant opportunities to incorporate stormwater management strategies due to the fact that these areas often have higher-than-average sediment loading and may be pre-disposed to contaminated soil conditions. Street trees and plantings can help mitigate pollutants in the air and water, as well as provide a buffer to traffic. Wide driveways are designed for the movements of high volumes of large, heavy trucks while maintaining a continuous, clearly delineated sidewalk for pedestrian safety. Parking is located primarily off-street to enable movement of large trucks and screened with low walls, landscaping or decorative fencing adjacent to sidewalks.

Between the Curbs

Street lighting provides large pools of light that benefit all modes. Bike lanes separate bikes from truck traffic, buffer pedestrians on sidewalks and create a wider effective turning radius for turning vehicles.

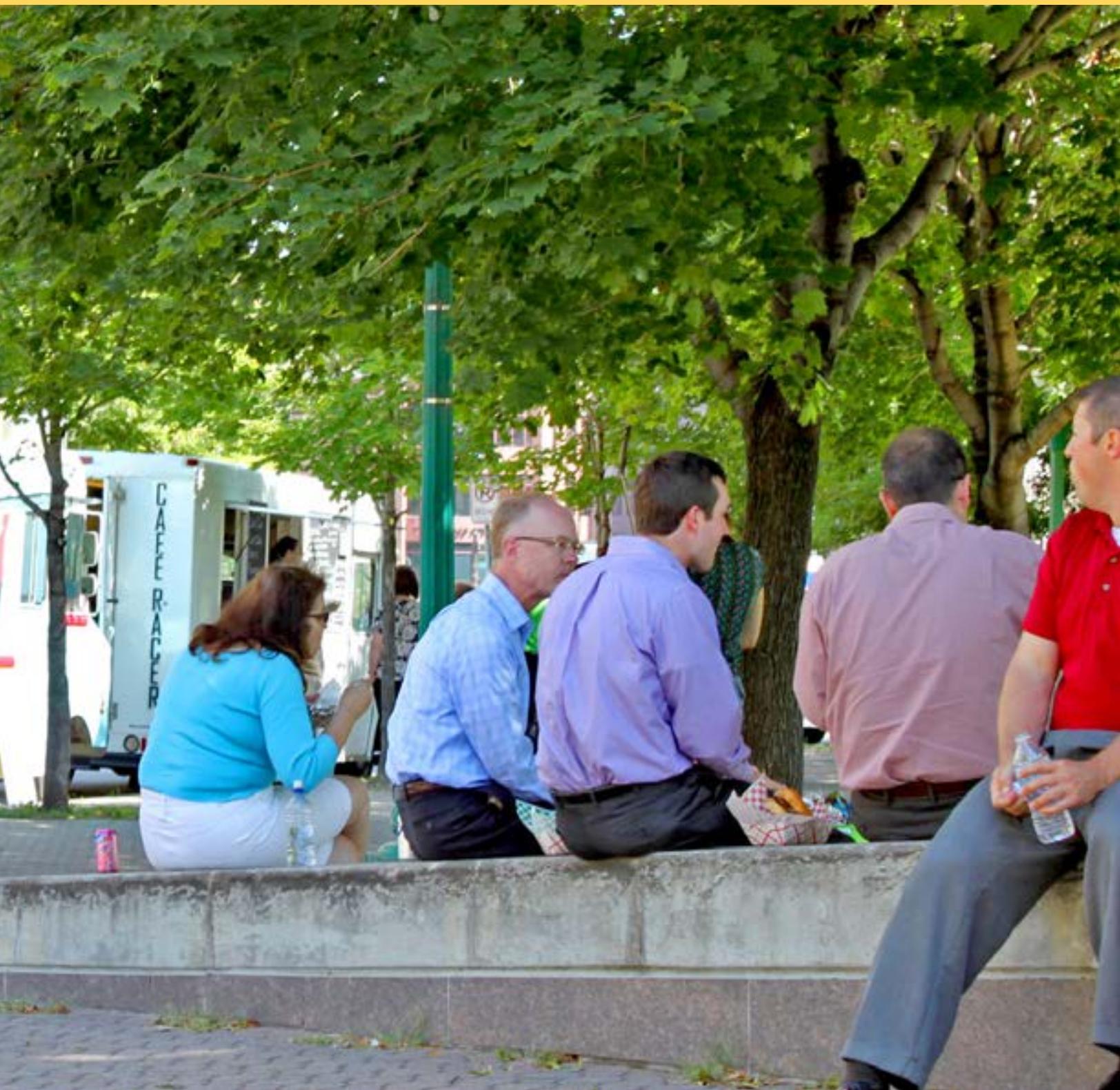
Intersections

Wide curb radii enable the turning movements of large trucks. Preferred crossing locations are marked.

5

Maintenance





Maintenance

Roadway surfaces are subject to deterioration and debris accumulation, if these go unmitigated, a facility that was in perfect condition may become unusable for bicyclists or pedestrians. It is important to consider that surface conditions that are satisfactory for motorists may cause complications for bicyclists who utilize narrower tires. Bicyclists face a variety of impediments that can be easily managed through an effective maintenance program. While safety of all roadway users is a top priority, a good maintenance program should also aim to protect public funds invested in bicycle and pedestrian infrastructure.

This section outlines responsibilities relative to the maintenance of Saint Paul right-of-ways owned assets in the public right-of-way. The Public Works Department (PWD) is the primary owner of and manages the reconstruction of city streets, sidewalks and bridges. The PWD is also responsible for installing and operating traffic and parking management devices and managing access for pedestrians, motor vehicles and bicyclists. Metro Transit (Metro) is responsible for maintenance of transit property such as bus shelters and stop signage. PWD owns the City's right-of-ways in coordination the Parks Department and Saint Paul Water Services (SPWS).

Maintenance Schedule

The City of Saint Paul aims to improve the life and sustainability of roadways and sidewalks in the most cost-effective and efficient way possible. Below is a breakdown of the typical life cycle of city roadways and sidewalks with respect to operations and maintenance. During the design of a project, an operations and maintenance plan should be developed to address all aspects of the life of a street, from daily, weekly, and seasonal requirements to routine maintenance. Note that maintenance practices are opportunities to incorporate Complete Streets principles.

The list below is a general guide for when maintenance practices typically occur; however, improvements may be needed at any time to address safety and access concerns.

Daily/Weekly/Seasonal Maintenance

- Trash/recycling pickup/removal
- Pothole repair, sealing of cracks in roadway
- Sidewalk repair
- Lighting (bulb replacements)
- Graffiti removal
- Tree inspection during warranty
- Tree pruning
- Boulevard planting
- Rain garden upkeep
- Seasonal plantings
- Cleaning of drainage infrastructure (power washing, silt removal, etc.)
- Snow removal

Restriping (Refresh Every Year)

- Reconfigure lane markings, including reducing lanes widths
- Install bicycle facilities
- Realign crosswalks (new curb ramps may be needed).

Resurfacing (every 10 – 20 years)

- Surface smoothness
- Curb ramps
- New or realigned crosswalks

In addition to the short term and routine maintenance needs outline above, long term maintenance of Saint Paul streets is required. During reconstruction, determining the cross section of street is the most critical task, including considering the feasibility of widening sidewalks, providing dedicated bicycle and transit facilities, reconfiguring intersections, and installing traffic calming devices such as curb extensions.

Public Art Maintenance

The City's Public Art Ordinance mandates that one half (½) of one percent of total Capital Improvement Budget capital maintenance projects shall be appropriated to support maintenance and restoration of the City's public art collection. The Ordinance also endorses the preservation or restoration of unique architectural features, ornamentation or details. The Public Art Ordinance Program Guidelines and Technical Manual (available online at www.stpaul.gov/publicart) detail procedures for public art accessioning, maintenance and care — for works commissioned with Ordinance resources, for works owned by the City that are on display in public places, and for works of art that are donated to the City. All City agreements with artists for new public art carry requirements for analysis by qualified professional conservators and maintenance planning. Saint Paul Parks and Recreation is the official record-keeper and steward of the City's public art collection and administers the Public Art Maintenance Program.

The non-profit Public Art Saint Paul is the City's partner in creating and caring for work in the public sphere. In the mid-1990's, Public Art Saint Paul secured grants from the national Save Outdoor Sculpture Program to inventory and assess condition of outdoor sculpture in the Twin City Metropolitan area and Outstate Minnesota. Over 200 volunteers were trained to catalog and report on sculpture condition. Many artworks were determined to be in critical or urgent need of conservation to survive. The data from the original inventory is accessible via the Inventory of American Sculpture database at the Smithsonian Art Museum. Public Art Saint Paul subsequently focused attention on outdoor sculptures within the City of Saint Paul deemed to be "at risk" and led restoration of important historic works with support of private foundations and individuals. Public Art Saint Paul also worked closely with the City's Department of Parks and Recreation to transfer the inventory of Saint Paul sculptures to City databases, to expand the survey to be more broadly inclusive of all works in Saint Paul's public sphere, and to institute ongoing database updates and annual condition surveys. A corps of volunteer stewards assists in these efforts.

Public Art Saint Paul continues to work with the City in public art stewardship efforts and assumes responsibility for regular maintenance of: (1) public sculptures which

the organization had restored, to assure their continued integrity and (2) public artworks owned or exhibited by Public Art Saint Paul that are installed in the public sphere, including works created through the International Stone Carving Symposium, the New York Life Eagle in Summit Lookout Park, and works in Western Sculpture Park.

Snow Removal and Storage

Cold winter weather with persistent snow is common in Saint Paul. Snow, slush, and ice impact all modes of transportation and timely clearance is essential to maintaining safe and accessible streets. Clear pedestrian paths are necessary for getting around as walking is part of all trips and pedestrians are the most vulnerable users of a transportation network. Street design should proactively incorporate provisions to facilitate snow clearance and storage for all modes, with pedestrians, bicyclists, and transit users given the same attention as motorists. Street crossings and sidewalks should be accessible for the elderly, young children, the disabled, and people pushing carts and strollers.

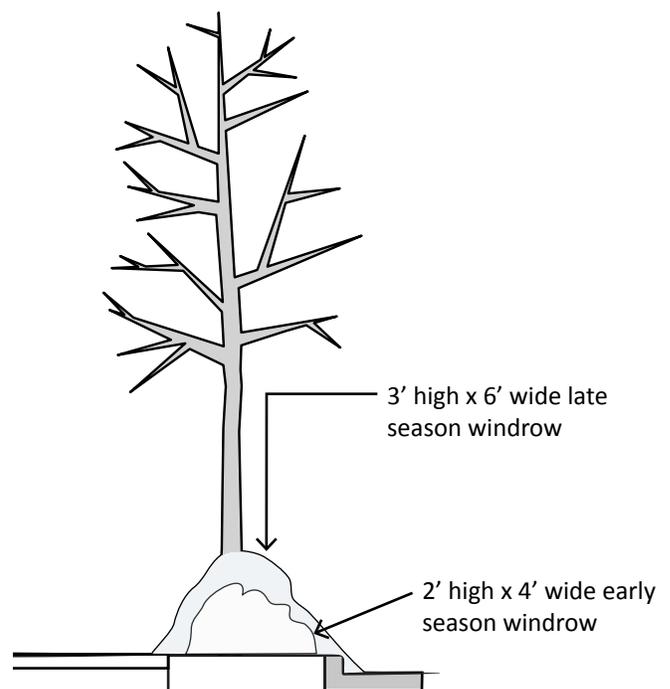
Public Works is responsible for plowing most streets while property owners are responsible for clearing snow and ice from sidewalks adjacent to their properties. Detailed snow plow information is available at stpaul.gov/snow. Snow clearance at bus stops, park-and-rides, and other public transit facilities is also the responsibility of the bus shelter owner or transit operator.

Sidewalks must have a clear unobstructed accessible pathway. Particular attention should be given to clearing curb ramps at crosswalks. Hydrants, catch basins, crossing islands, medians, and building entrances must also be accessible. Sidewalks should be cleared within three hours of snowfall ending (or three hours from sunrise if snow falls overnight). Violators will be subject to fines from the City.

On-street parking is not permitted during a declared snow emergency. After a snow emergency is declared, usually no later than 3pm, night plowing routes will be cleared beginning at 9pm. All night plow routes are marked with signage that indicates that either the entire street or half of the street is a night plow road. All other streets (or sides of streets) are day plow routes and will be cleared once night plowing is completed (typically 8am). Additional parking restrictions may be implemented during winters with heavy snow accumulation to ensure emergency vehicle access.

Considerations

- Bike lanes and center turn lanes do not get the heavy traffic to break up snow and ice. Special maintenance such as extra salt is needed to reduce snow and ice accumulation.
- Designers should model a typical snow plow windrow in their plans.
 - Early season windrow 2 feet high and 4 feet wide at base.
 - Later season windrow 3 feet high and 6 feet wide at base.
- Some in-street elements such as raised medians, traffic circles, pork chop islands, etc. may be obstacles to plowing and may need additional maintenance such as hand shoveling to fully clear snow from pedestrian pathways.



- Snow should not be shoveled from sidewalks or parking spaces into the street. Disabled cars blocking the roadway must be removed as soon as possible. Cars parked in driveways must not extend into the sidewalk or street.
- Parking restrictions and regulations are strictly enforced during snow emergencies, and violators are subject to ticketing and towing.
- When treating sidewalks and roadways with chemicals, the City of Saint Paul recommends using calcium chloride (CaCl₂) or potassium chloride (KCl). Sand should not be used because it can clog the drainage systems, and is difficult and expensive to clean.
- Designs that make it easier to clear snow and ice, and prevent ponding of water include:
 - Wide Boulevard/Furnishing Zones and curb extensions to provide space for snow storage. Both sidewalk and roadway snow clearance operations can take advantage of this storage area.
 - Permeable elements such as tree pits, rain gardens, and pervious materials also assist in accelerating the removal of snow and ice.
 - Catch basins located on the upstream side of curb ramps, with roadways pitched so that pooling does not occur at the ramps.
 - Smooth materials such as concrete, which are easier to shovel compared to bricks or pavers.
- Vertical elements such as pedestrian signal poles and hydrants located on curb extensions, which provide a visual cue to snow plow operators of the change in the curbline. All bump outs should have with tall markers during winter.
- Consider use of mountable curbs on medians, traffic circles, and other in-street elements to avoid plow impacts.

Pavement

A variety of special pavements may be implemented to achieve objectives such as increasing sustainability and improving stormwater management. This section provides an overview of maintenance needs for of these special materials which including permeable pavement, asphalt, concrete, and brick pavers. Hard surface is generally the least expensive to maintain – an hour our two of sweeping per site per year.

Permeable surfaces provide increased traction when wet because water does not pool, and the need for salt and sand is reduced during winter due to low/no black ice development. Nevertheless, permeable paving requires regular maintenance including:

- Annual inspection of paver blocks for deterioration
- Periodic replacement of sand, gravel and vegetation
- Annual vacuuming of pavements to unclog sand and debris (Note: The use of sand in ice prevention should be avoided because it will clog pavement pores.)
- Routine vacuuming of the surface may be necessary to maintain porosity.

Landscaping

Residents and business owners most often maintain landscaping on boulevards. Medians and Islands are most often maintained by the Public Works and/or Parks Departments.

Turf requires mowing once a week during summer months – 20 hours of mowing per site per year. If only weed control is needed, mowing can be reduced to 5 hours per site per year.

Native Grasses and Plants are actually very high maintenance in an urban setting. These plants can take three growing seasons to establish properly. The root systems need to grow very deep before the plants can survive the dry seasons of the summer. Controlled burning is desirable but not always possible and will require traffic control. Along with controlled burning, selective mowing, selective weed whipping and selective herbicides are necessary. These all require the assistance of a specialty landscape contractor. 80 hours to 150 hours of maintenance are required per site annually.

Median Landscaping

- Perennials and ornamental plantings need an annual budget to maintain them or be adopted by a neighborhood group.
- Consider maintenance costs and access and safety for maintenance crews when designing planted medians. Medians less than 20 feet wide should have two drive lanes adjacent to the median to allow maintenance vehicles to use the lane while maintaining a flow of traffic.
- For plantings other than trees and turf, a width of at least 8 feet wide is preferred to allow for adequate maintenance access.
- Irrigation should be considered where possible to maintain healthy plants in the median. Costs of irrigation should be weighed against the labor costs of trucking water to the median.

Rain Gardens

Rain gardens are an effective tool to decrease stormwater runoff as well as sediment and pollution loading in local waterways. Rain gardens are typically maintained by adjacent property owners or watershed districts. Even though rain gardens are low maintenance it is important to ensure that this maintenance occurs regularly to keep gardens functioning properly. Maintenance responsibilities for rain gardens vary depending on their locations. Publicly owned rain gardens are the responsibility of the Parks department in coordination with Public Works (when in a public right-of-way) and the Capital Region Watershed District. Rain gardens planted by residents within boulevards are subject to the requirements of the Boulevard Planting Ordinance. All boulevard plantings (including rain gardens) must be maintained by residents.

Weekly/Monthly:

- Water garden (in the 1-2 years until the garden is established)
- Weeding (more frequent weeding will limit the overall time you will have to spend)
- Sediment Removal as necessary, especially after high rain fall events

Seasonally:

- Inspect for weeds, invasive plants, plant health, and excessive sediment within gardens. Inspections should take place prior to the growing season, at the end of the growing season, and after large storms or extreme weather
- Ensure that rain gutters are clear of debris, if the flow of water is blocked rain water will have complications infiltrating the garden
- Pruning to improve health, increase production, and direct growth of plants

Annually:

- Replant as necessary, replacing dead or diseased plants
- Replace rocks or other obstacles diverting the flow of water
- Aerate areas of the garden that have consistent sediment buildup

Periodically:

- Soil should be tested on a periodic basis to ensure that the soil is neither too acidic nor basic.



6

Implementation





Implementation

This Manual presents design guidelines that are realistic and achievable because they are based on the existing standards, the latest best practices, and close coordination with City staff. As a complete streets design manual, the implementation of this document will require a collaborative effort between the various responsible departments and agencies. Progress on implementing the Manual should be monitored periodically to ensure effectiveness.

Institutionalization

Institutionalization is the progression of integrating design considerations into all Saint Paul policies and processes. The institutionalization of this manual means bringing complete streets design needs into the City's mission and culture. It will require internal work by staff and coordination among departments to make changes to policies, plans, and processes that guide the City and its decision makers.

City staff, Transportation Committee, Elected Officials

Project design, prioritization, budgeting, and maintenance of the complete streets are responsibilities that cross departmental lines. Coordination among departments is critical for ensuring there are no missed opportunities as projects are planned, designed and implemented. Key departments, agencies and individuals that should be involved in project coordination include:

- Saint Paul Public Works
- Saint Paul Planning and Economic Development
- Saint Paul Heritage Preservation Commission
- Saint Paul Parks and Recreation
- Saint Paul Department of Safety and Inspections
- Saint Paul Police
- Saint Paul Fire
- Saint Paul Regional Water Services
- Saint Paul Design Center
- Transportation Committee of the Saint Paul Planning Commission
- Elected Officials



- Metro Transit
- Ramsey County
- MnDOT
- Watershed Districts

Ensuring that all staff are afforded the opportunity to attend training workshops once or twice a year on the latest updates to the Manual, related guidelines and standards (e.g. AASHTO, MUTCD) is an important method for keeping staff engaged. In addition, trainings on state and federal guidelines may help identify sections of the Manual that need to be updated to reflect new federal and state guidance.

Code Adoption

This manual both reflects current standards and guidelines from a variety of resources, while also introducing new

best practices. While this Manual is an integral step in implementing complete streets policies in Saint Paul, it will only be successful if the practices it advances are integrated into the code and culture of the City's departments (or divisions within departments). As the Manual is adopted into the relevant Saint Paul code each department will need to ensure that its staff is given sufficient training on new design treatments and how they are codified. During and after code adoption it will also be necessary to confirm that all departments are receiving the same guidance and operating under the same practices.

Responsibilities

This section outlines public agency responsibilities relative to the ownership and management of City of Saint Paul owned assets in the public right-of-way. Public Works (PW) is the primary owner, and manages the reconstruction of city streets, sidewalks and bridges. PW is responsible for installing and operating traffic and parking management devices and managing access for pedestrians, motor vehicles and bicyclists. The matrix below summarizes implementation responsibilities in Saint Paul.

Integration of Design Specifications

This Manual covers a range of topics that are and will continue to be integrated into a variety of existing City documents including policy documents, planning documents, and roadway design specifications. The matrix below outlines how design treatments from this Manual relate to existing documents and manuals on a local, state, and federal level.

	PWD	Metro Transit	Parks Department	Water Services	Private
Roadway and intersection geometry and lane functionality including bus and bicycle lanes and crosswalk	X	X			
Sidewalk alignment and paving materials	X				
Traffic signals and traffic control cameras	X				
Regulatory, warning, street name and guide signs	X				
Street trees and plantings	X		X		
Stormwater management elements such as planters and rain gardens	X		X	X	
Street lights and banners	X				
Parking meters and sensors	X				
Bicycle share stations and bicycle racks	X		X		
Bus shelter and bus stop signs		X			
Trash and recycling	X		X		
Water and sewer system infrastructure	X			X	
Street furniture	X		X		
Boulevard Planting					X

Funding

To implement the street design guidelines proposed by the Design Manual in an efficient manner across the city, a significant investment must be made in complete streets projects. The City should aggressively pursue state and federal grant opportunities for projects. New funding sources including developer requirements, bond measures, and public/private partnerships should be considered. Additionally the City should pursue opportunities to combine capital street improvement projects in order to implement complete streets, such as stormwater and traffic calming projects or prioritizing streetscape improvements when major capital work take place.

Project funding can come from a variety of sources depending on the agency initiating the project. Often design and construction are funded separately by different entities.

- City of Saint Paul initiated projects are funded through the Capital Improvement Budget released biannually by Saint Paul’s Office of Financial Services.
- Developers fund, design, and construct on- and off-site sidewalks, roadways, and intersection improvements based on the limits of the site plan associated with their building and mitigation program.
- State and federally funded projects located in Saint Paul are listed in the annual Transportation Improvement Program (TIP) of the Metropolitan Council MPO. Typically, the TIP only includes construction funding with the expectation that design is funded by the City of Saint Paul.
- Federal earmarks and projects in various bond bills are also routed through the Metropolitan Council MPO.

Routine Accommodation

Implementation of treatments depicted in this manual will often come through routine accommodation. Among other practices, routine accommodation includes repaving, restriping, utility work, transit projects, and new development. By ensuring that the guidelines in this Manual are implemented in these processes costs will be reduced and projects will be completed more efficiently.

Complete Streets Checklist

The first step in planning for a complete street is to download the Complete Streets Checklist developed for this manual (download at <http://www.stpaul.gov/index.aspx?NID=4800> or see Appendix X) and fill it out as thoroughly as possible. In addition to specific project information, the information needed to fill out this form is available in this manual, or may be found on the City’s website.

Whether a proposed complete street project is initiated by the public sector or private sector, the Complete Street Checklist must be completed to the extent possible. The Checklist requests a range of information about existing and proposed conditions, project information, street operations, storm water management, and environmental conditions. The purpose of this checklist is to help identify the issues associated with the proposed street construction or development and ensure that appropriate City staff is involved with project design and construction facilitation.

Element	Standard	Above Standard
Lighting	Single Lantern	Double Lantern
Boulevard	Turf Grass	Permeable Pavers
Sidewalk	Concrete	Colored Concrete

Parking Enforcement

While not a design element, effective management of on-street parking resources is an important component of a comprehensive approach to street design for the simple reason that the cheapest way to provide more parking is to manage it in a way that balances the needs of its various stakeholders (residents, customers, and employees) and to insure that customer parking turns over in areas with high commercial demand. It is also the easiest way to maximize the use of off-street parking, to minimize residential and commercial conflicts that sometimes lead to the demolition of historic structures for commercial parking, to overcome the primary obstacle to denser, mixed-use, transit-oriented development, and potentially to pay for maintenance of the street and streetscape improvements suggested in this Manual. There are a variety of techniques that can be used to develop a sustainable integrated parking management strategy.

Parking stakeholder identification: The needs of all parking stakeholders in areas with high parking demand must be addressed if a comprehensive parking management strategy is to be accepted and sustained. These include customers of businesses on commercial strips, employees of those businesses, and residents in the surrounding residential neighborhoods.

- **License plate recognition technology:** Computerized License Plate Recognition (LPR) equipment provides the opportunity to automate the formerly labor-intensive enforcement of time limits, permit parking limits, and handicapped parking limits on the street. LPR has the potential to provide sustained on-street parking enforcement, which is essential in order to efficiently allocate supply and demand system-wide, on the street and in private parking lots.
- **Computerized pay parking kiosks:** Wireless pay-parking kiosks provide the opportunity not only to manage pay parking more efficiently, but to provide customers with pay parking receipts that can be validated by local businesses willing to absorb the cost of their customers' parking. It also provides a mechanism by which the City can count on-street parking towards the parking required by the Zoning Code.
- **Dedicated revenue from pay parking:** Pay parking has the potential to generate a new source of revenue (net of the cost of operating the pay parking equipment)

which some cities have returned to the area that generates it to pay for some amount of “free” parking in pay parking ramps, or other above-standard services which could include maintenance of streetscape improvements and, in northern climates, snow removal.

- **Permit parking management:** License Plate Recognition equipment, using an up-to-date database of permit holders, has the potential to automate the enforcement of permit parking. It also has the potential to allow some number of employees to park in permit areas, and to insure that they don't concentrate near the commercial strip but are dispersed throughout the permit zone.
- **Parking improvement districts:** On commercial strips with strong business leadership, the City can establish a Parking Improvement District (PID) where the City leases a centrally-located parking lot or ramp and assesses the benefitting property owners for all of the operating costs, including the rent.
- **Business improvement districts:** With a financial foundation that includes an assessment on the benefitting property owners and net revenue from pay parking, it is a small step to grow a Parking Improvement District into a full-fledged Business Improvement District that provides above-standard maintenance, cleaning, snow-removal, security, parking, promotion, and marketing services to the commercial area.

Business Districts

Some business districts create a unique identity by developing a unique streetscape plan for their commercial node or corridor. Improvements often include lighting, banners, special paving, fencing, bike racks, gateways and/or information kiosks. Business districts should work with Public Works to develop a design and get cost estimates. Property owners wanting streetscape improvements beyond the standard agree to an assessment for the cost of the infrastructure and ongoing maintenance. The table on the next page provides examples of above standard elements that may be included in streetscape design.

Updating This Manual

This Manual is intended to be a living document, updated and amended to reflect the changes in best practices and to conform to relevant external guidelines and standards. When complete street policies are not maintained they risk falling behind best practices, which may result in a lack of utilization by practitioners. To keep this Manual relevant it should be updated periodically so that it may continue to be an effective complete streets design tool. These updates should include all revisions and updates from relevant best practices applicable at the time of the new manual release. The new release will replace the previous version and will be available on the Saint Paul Department of Public Works website.

Keys to Implementation

Occasionally even the best implementation plans run into barriers. This section briefly identifies several common issues that occur during the implementation of complete streets projects.

Coordination Between Departments

The nature of complete streets projects make them interdepartmental and if departments are following different standards progress will be hard to come by. It is therefore vital to implement both consistent training and effective communication across department lines.

Training

If this Manual and other City of Saint Paul complete streets design guidelines, standards, and policies are not effectively communicated to staff in appropriate departments and bodies, they cease to be effective. Regularly scheduled trainings conducted by staff and outside experts, as well as webinars regarding complete streets design standards should be attended by all pertinent staff involved in the planning, design, and implementation of complete streets projects. These training sessions should occur on an annual or semiannual basis in order to ensure that all new staff are properly trained, principles are reinforced, and new practices are disseminated.

Visibility

If decision makers and practitioners are not aware that the City is actively making a change to how it views the design needs of the community there is little chance they will buy in. The Saint Paul Design Manual and other complete streets policies should be promoted as a part of the municipal culture.

Up to Date

One of the most common barriers to implementation is a lack of upkeep. When this is the case practitioners will often avoid guidance from these publications in favor of more up-to-date alternatives, and may not return even if updates are made at a later time. In order to avoid these issues all Saint Paul complete streets guidelines, standards, and policies must be kept up to date to reflect applicable state and federal documents as well as current best practices.

Oversight

In some cases where all staff are receiving proper training, departments are effectively communicating, and all complete streets policies are both up to date and visible there are still issues with implementation. When this is the case, a common barrier is a lack of oversight in the physical implementation (construction) of complete streets projects. Effective supervision prior to and during construction can help ensure that public dollars are effectively spent implementing accurate complete streets designs.

Performance Measures

Performance measures monitor the effectiveness of complete streets designs over time. Performance measures need to be measurable, using before and after data. The following are examples of measures that should be considered:

- The length of new sidewalks and bicycle facilities in the city
- The number of children who travel to school by walking or bicycling
- The mode share of transit, walking, and bicycling
- Traffic morbidity and mortality decreases for all modes and age groups
- Speeds of vehicles on local streets more accurately align with posted speeds
- Stormwater runoff is reduced
- Revenue increases for businesses in Saint Paul retail districts
- Residents' feelings of safety and comfort increase

