

ANN ARBOR DOWNTOWN

STREET DESIGN MANUAL



ACKNOWLEDGMENTS

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1.1

INTRODUCTION

THE PURPOSE OF THE DOWNTOWN STREET DESIGN MANUAL

Downtown streets, which include the public right-of-way, sidewalks, and roadways, serve the needs of residents and businesses of downtown as well as the broader community. The Downtown Street Design Manual is intended to provide the public and private sectors with design standards and best practices for building and managing downtown streets. It addresses the key roles of the street and the public right-of-way in supporting multiple modes of transportation, economic vitality, environmental health, and community character.

What are “Streets”

Streets, for purposes of this manual, are defined as the entire public right-of-way between buildings, not just the roadway. Streets includes the roadway and travel lanes, parking lanes, the amenity zone (between the curb and sidewalk) sidewalks, and public alleys.

The street is divided into a number of different zones, which are described in section **1.2 Key Terms & Organization**.

WHY HAVE A DOWNTOWN STREET DESIGN MANUAL?

Ann Arbor’s downtown streets each have their own personality and needs. The 67 blocks of the Downtown Development Authority (DDA) District host a variety of uses including shops, offices, and residences. There are over 100 sidewalk cafes and other areas for public seating or gathering. Downtown streets are the location for many of the events for which Ann Arbor is known.

The streets serve many demands from different users. Infrastructure once built only to serve auto traffic is now changing to meet use and demand. Pedestrian volumes are heavy in many parts of downtown and bicycles use is increasing. On-street parking and loading is a prominent demand on the streets. Many bus routes converge on the transit center and transit ridership continues to grow.

The Downtown Street Design Manual recognizes the role that downtown streets play in transportation function and supporting land uses. The manual is intended to assist in developing designs that support and enhance these functions and deliver an overall system that provides for all modes of travel and uniquely responds to the local street context.

WHAT IS THE DOWNTOWN STREET DESIGN MANUAL?

The Downtown Street Design Manual is a unified set of best management practices to govern how downtown streets are designed, built, and maintained for all people. The manual seeks to balance the needs of all street users and ensure that the multiple goals for the street space are met in coordination with one another in order to create streets that are safe, equitable, affordable, inclusive, resilient, vibrant, implementable, maintainable, and that connect the community.

The manual places special importance on improving the pedestrian experience, recognizing that everyone is a pedestrian at some point in their downtown trip. Whether traveling to downtown by foot, bike, bus, or car, the pedestrian experience is critical to the success and vibrancy of downtown.

The Downtown Street Design Manual consists of the following chapters:

- Chapter 1 - Introduction:** A set of overall planning goals and targets derived from established and adopted metrics identified in other city planning efforts. These goals and targets are utilized in the design development process as metrics to weigh street design decisions and as metrics to track over time.
- Chapter 2 - Street Framework:** Presents the street typology framework specific to Ann Arbor's downtown streets. The typology reflects the existing and desired uses and activities along the street overlaid with the emphasized function of street corridors. The intent of the typology system is to design street segments to support the unique conditions and land use contexts along that street segment while still supporting the overall transportation function the corridor serves in the network.
- Chapter 3 - User Guide:** Describes a predictable and consistent process for street design and development to ensure that key agencies and partners are involved early and throughout the design process.
- Chapter 4 - Design Elements:** Guidance on downtown street design and appropriate treatments to serve a menu of transportation needs and create a quality street environment for accessing commerce and community life. The elements include maintenance considerations to enable them to perform well over the long-term and through all seasons of the year.

The Downtown Street Design Manual is intended to augment, supplement and tailor existing guidelines and standards for streets and sidewalks within the DDA District. It provides best practice recommendations and decision tools to assist the public and private sector in making informed street design decisions that supports a vibrant downtown context and the needs of multi-modal transportation systems.



WHO SHOULD USE THE DOWNTOWN STREET DESIGN MANUAL?

The manual is laid out in an easy to understand format to enable predictable, consistent and collaborative design implementation by:

- Private developers or utilities with projects that impact the public right-of-way;
- Utility Companies;
- City staff, DDA staff and consultants as they work on street construction, improvement, or maintenance projects.



HOW DOES THE DOWNTOWN STREET DESIGN MANUAL FIT WITH OTHER PLANS AND STANDARDS?

City Plans

The Downtown Street Design Manual builds on and compliments the goals, objectives, and intent of many existing plans developed and adopted by the City of Ann Arbor. These include:

- The City Comprehensive Plan Elements
 - » Downtown Plan (2009)
 - » City Transportation Comprehensive Plan (2020)
 - » Treeline Master Plan (2019)
 - » Sustainability Framework (2013)
- Downtown Development Authority Renewal Plan (2003)
- Downtown Design Guidelines (2011)
- Urban & Community Forest Management Plan (2014)
- TheRide’s 2045 Long-Range Plan (2022)
- Solid Waste Resources Management Plan (2019)

City Policies

The Downtown Street Design Manual advances other policies, resolutions, and initiatives underway. Notable policies include:

- **Green Streets Policy (2014):** Stormwater Management Guidelines for public street construction and reconstruction outlining the use of green infrastructure to infiltrate stormwater runoff.
- **Vision Zero Commitment:** The design of the City’s transportation network strives to achieve the goal of zero fatalities and severe injuries from traffic incidents by 2025.
- **A2Zero Carbon Neutrality / Climate Action Plan (2019):** A plan for achieving the goal of carbon neutrality by 2030 for the Ann Arbor community.

- **Affordable Housing Initiatives:** The Housing Affordability and Economic Equity Analysis for Washtenaw County (2015) was adopted by the City Council and set a goal of adding 140 new affordable units each year. To achieve this goal, residents voted to support a City Charter amendment establishing an Affordable Housing Millage.

Design Standards

The Downtown Street Design Manual utilizes national best practices, design guidance, and local standards and regulations to ensure that street projects improve the safety, comfort, and access and all users of downtown streets. Throughout this document, design direction or recommendations may refer to any of the following documents for further detail and clarity for how they are to be implemented in accordance with best practice.

- **Local Standards + Guidelines**
 - » **Standard Specifications (PSSS / “The Orange Book”):** Includes: General Specifications; Design, Material, Utility, Street, Streetlight, Soil Erosion, and Landscaping Standards; Pay Items; Standard Details.
 - » **Crosswalk Design Guidelines:** This document provides standards for the design of controlled (e.g. stop signs or signalized intersections) and uncontrolled crossing (e.g. mid-block crossings) for streets in Ann Arbor. These guidelines describe the desired use of crossing elements based on roadway characteristics and pedestrian volumes.
- **State Standards + Guidelines**
 - » **Michigan Manual on Uniform Traffic Control Devices (MMUTCD) (2013):** Specifies the design, installation, and use standards for traffic signs, road surface markings, and signals.
 - » **MDOT – Bicycle and Pedestrian Resources for Transportation Professionals (2016):** A resource with the latest research, resources, and guidance on pedestrian and bicycle planning, safety, and design.
 - » **MDOT – Best Design Practices for Walking and Bicycling in Michigan:** A toolbox of non-motorized improvements that have been shown to reduce crashes involving pedestrians and bicyclists.
- **National Guidelines + Design Resources**
 - » **NACTO – Urban Bikeway Design Guide (2012):** Guidelines for bicycle infrastructure including lanes, cycle tracks, intersection treatments, signals, signage, bicycle boulevards.
 - » **AASHTO – Guide for the Development of Bicycle Facilities (2012, new edition expected 2021):** Information on accommodating bicycle travel and operations in most riding environments.
 - » **NACTO – Urban Street Design Guide (2013):** Principles and practices of designing safe, multi-modal streets.
 - » **NACTO – Transit Street Design Guide (2014):** Guidance for the development of transit facilities on city streets.
 - » **FHWA – Separated Bike Lane Planning & Design Guide (2015):** Planning considerations for separated bike lanes, including a menu of design options covering typical one and two-way scenarios.
 - » **FWHA – Small Town and Rural Multimodal Networks (2016):** A resource for applying national design guidelines in a rural setting and highlights small town and rural case studies.
 - » **NACTO – Designing for All Ages and Abilities (2017):** Facility selection guide for a wide variety of urban street types to allow planners to determine how to best combine traffic calming tools to reduce fatalities and increase cycling rates and comfort.
 - » **FHWA – Bikeway Selection Guide (2019):** A resource to help transportation planners make informed trade-off decisions relating to selection of bikeway types, focusing on safety.
 - » **NACTO – Urban Street Stormwater Guide (2017):** National best practices for sustainable stormwater management in the public right-of-way.



1.2

KEY TERMS & ORGANIZATIONS

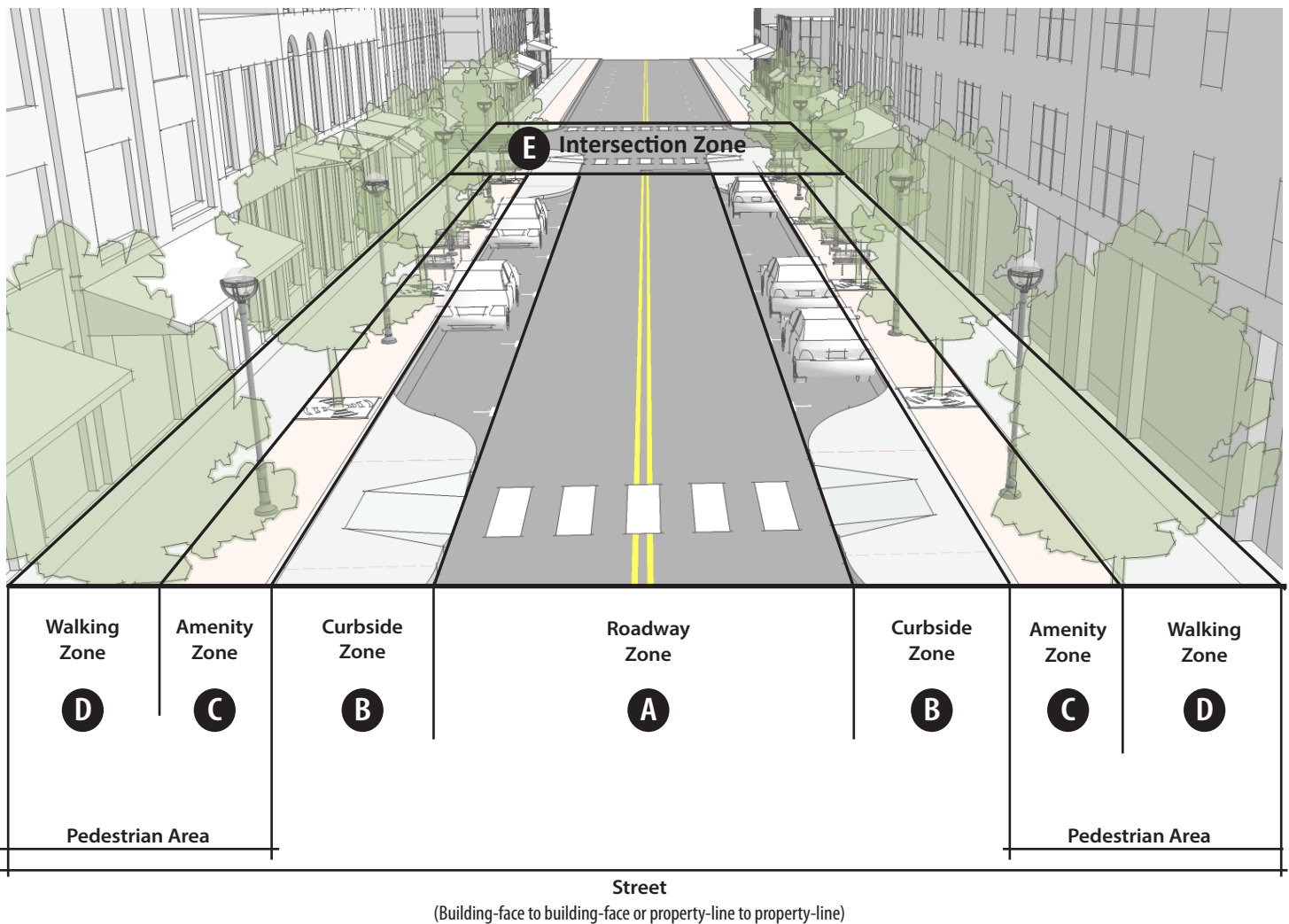
STREET CHARACTERISTICS

The Ann Arbor Downtown Street Design Manual uses a number of terms throughout the document for describing the street environment and its qualities and functions.

- **STREET:** Street are the entire public right-of-way outside of private property lines. Typically, this is from building face to building in the downtown where buildings are constructed up to their front property line.
- **SIDEWALK:** Sidewalks are paved areas of the street, typically 5 feet or more in width and located within the Walkway Zone.
- **RIGHT-OF-WAY:** Publicly owned property where streets are located.
- **STREET TYPOLOGY:** Each street is assigned a typology based on its Frontage Context and Functional Emphasis. See Section 2.1- Street Framework for more information.
- **FRONTAGE CONTEXT:** Refers the mix of land uses (e.g. retail, commercial, residential, office) and level of intensity of land use along a street. See Section 2.3- Frontage Context for full descriptions.
- **FUNCTIONAL EMPHASIS:** Refers to the transportation and street use mode (pedestrian, vehicle, bicycle, etc.) that is emphasized along a particular street. See Section 2.4.- Functional Emphasis for full descriptions.
- **DESIGN ELEMENT:** A design element is a specific built feature or other device that is located in the street. The applicability of design elements to downtown streets relate to the street's typology.

- **STREET ZONES:** A street is comprised of a number of zones that affect the uses and functions of the street. Refer to Section 2.1 - Street Framework for additional information. Street zones include the following:
 - A Roadway Zone:** The central portion of the street typically dedicated to travel lanes for vehicle, transit, and bicycle movement.
 - B Curbside Zone:** Area adjacent to the curb and commonly used for on-street parking and loading.
 - C Amenity Zone:** Area between the sidewalk and the curb. Commonly the location for street trees, light poles, road signs, and other street furnishings.
 - D Walkway Zone:** A clear, consistent, paved area dedicated to pedestrian movement.
 - E Intersection Zone:** The intersection zone occurs where two street meet.

Figure 1.2.1 - Street Zones



ORGANIZATIONS

A number of public organizations and other entities have a role or interaction in the design and management of Downtown Streets and are referenced throughout the Downtown Street Design Manual.

- **City of Ann Arbor (the City):** The City of Ann Arbor is the public municipality that owns the right-of-way in Downtown. A number of City Units are referenced in this document that have a relationship to the street:
 - » **Engineering Services:** Responsible for designing and constructing utility, roadway, and sidewalk projects; coordinating and inspecting utility and roadway work with development projects, and managing traffic flow throughout the city. Includes:
 - Transportation & Non-Motorized Planning
 - » **Public Works:** Combination of field-oriented maintenance and operations. Relevant responsibilities include: Water Utility, Forestry (street trees), Solid Waste (trash, recycling, and compost), and Street Maintenance. Includes:
 - Urban Forestry & Natural Resources
 - Solid Waste & Recycling Coordination
 - » **Planning & Development Services:** Responsible for construction and building permits, code enforcement, planning, zoning, and site plan review.
 - » **Systems Planning:** Multi-disciplinary department responsible for asset management and planning related to built and natural infrastructure. Includes:
 - Stormwater & Floodplain Coordination
 - Water Quality Management
 - » **Office of Sustainability & Innovations:** This office works with all Ann Arborites to ensure Ann Arbor is the most sustainable and equitable City in America. The OSI is guided by the Ann Arbor Carbon Neutrality Plan: AZZERO.
 - » **Community Standards:** Group within the Police Department responsible for enforcing city codes and ordinances.
- » **Customer Services:** Entity within the City responsible for issuing and managing many permits relevant to street use (e.g. sidewalk occupancy, street closures, special event permits, etc).
- » **Street Design Team:** Cross-agency working group established through the Downtown Street Design Manual to oversee and coordinate significant street investments and infrastructure projects.
- » **Communications Office:** Coordinates outreach and engagement efforts, notices related to construction.
- **Ann Arbor Downtown Development Authority (DDA):** Coordinates and implements public improvements and infrastructure projects to increase the economic vitality and attractiveness of downtown.
- **Ann Arbor Area Transportation Authority (AAATA or “The Ride”):** Operates transit bus service in Ann Arbor and surrounding municipalities.
- **Michigan Department of Transportation (MDOT):** State transportation department with jurisdiction over certain streets in Downtown (Huron and North Main). Coordination with MDOT is also required for railroad crossings and safety.
- **Michigan Department of Environment, Great Lakes, and Energy (EGLE):** Reviews and issues permits for projects within the floodplain.
- **WATCO Companies:** The owner of the north-south rail line through Ann Arbor, which is operated by Ann Arbor Rail. Coordination with WATCO is required for rail crossings.
- **DTE Energy:** Provides electrical and gas service to Ann Arbor. DTE operates, at the City’s expense, many of the street lights in Ann Arbor.
- **University of Michigan (UofM):** Major research institution and significant property owner downtown.
- **Boards & Commissions:** A number of local boards and commissions have a bearing on downtown streets:

- » **Historic District Commission:** Reviews and advises projects in historic districts and properties.
 - » **Design Review Board:** Advises private development projects on meeting the spirit and intent of the Ann Arbor Downtown Design Guidelines.
 - » **Planning Commission:** Advises and makes recommendations to City Council regarding continuance of the city's Comprehensive Plan, zoning, ordinances, and other applicable codes.
 - » **Transportation Commission:** The commission serves as an advisory body to the City Council and the City Administrator on transportation policy with a focus on accessibility, mobility, equity, and safety for all.
 - » **Downtown Development Authority:** The DDA Board sets values for DDA projects and approves construction contracts.
- **Downtown Merchant and Business Area Associations:** Numerous associations representing different districts in Ann Arbor, including:
 - » Main Street Area Association
 - » Kerrytown District Association
 - » State Street Association
 - » South University Association





1.3 VISION & VALUES

The Downtown Street Design Manual is derived from a multitude of plans, standards, guidance and policy adopted or supported by the City of Ann Arbor and the Downtown Development Authority (DDA). The City Comprehensive Plan is the foundational planning document for Ann Arbor and includes not only the Downtown Plan, but also the City’s Sustainability Framework, Transportation Plan, Non-Motorized Transportation Plan, Parks and Recreation Open Space Plan, and overall Land Use vision.

VISION

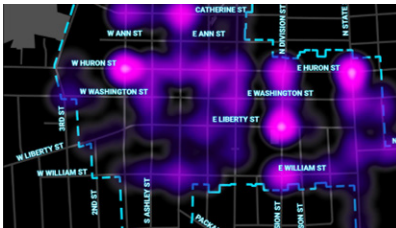
The Downtown Street Design Manual envisions a future network of streets that:

- Improve downtown resiliency — environmentally, economically, and socially
- Support and strengthen the uses and activities unique to the diverse blocks and areas of downtown
- Safely & equitably accommodate all modes of travel through and around the downtown



Community Alignment

Define what’s important
Align with other efforts



Desired Outcomes

Identify tangible improvements
Establish a method for measurement



Project Opportunities

Evaluate + prioritize based on potential outcomes
Measure and track outcomes

VALUES

Values frame what is important to a community and provide direction to guide the design, implementation, and evaluation of public projects. The DDA has adopted seven core values that are to be used to inform the decision-making process for DDA infrastructure projects.

Linking Values to Projects

The process of linking values to projects starts with aligning values with the community at large **“community alignment”**. For each project, the seven values can be linked to established plans and policies – such as Vision Zero, Green Streets, A2Zero, and the city’s climate action plan – in order to demonstrate how they relate to the broader community. **“Desired outcomes,”** which are measurable changes, can be identified and associated with each value. Finally, specific design elements and policies that will lead to the desired outcomes can be incorporated into specific **“project opportunities”** and pursued for implementation.



**Value 1:
Safe, Comfortable
Downtown Streets**

Streets must balance and accommodate a variety of modes of travel while prioritizing safety to eliminate death and serious injury from traffic crashes.



**Value 5:
Vibrant and Thriving
Local Economy**

Critical to the success and vitality of the local economy is having streets that support people's access to business, provide space for commerce, and promote a comfortable and attractive environment where people and businesses want to be.



**Value 2:
Equitable, Just Access for
All People**

Streets must serve the entire community regardless of ability, age, and mode of transportation. They must provide equitable connections to destinations, places of employment, housing, and basic needs.



**Value 6:
Responsible Design and
Implementation**

Streets projects and maintenance must use public funds wisely to achieve maximum impact at a responsible price.



**Value 3:
Affordable and Inclusive
Community**

To create an inclusive community, Streets must provide affordable transportation options to residents.



**Value 7:
Connected Community with
Streets as Civic Spaces**

The design of downtown streets needs to be flexible to allow for use as community space and reflect the local character, in order to help connect the community.



**Value 4:
Resilient and Energy Responsible
Downtown**

Streets must be designed to support improvements in air and water quality, efforts to become carbon neutral, and responsible energy use.



**Value 1:
Safe, Comfortable
Downtown Streets**

Streets accommodate a variety of modes of travel - people traveling on foot, bicycle and in mass transit or private vehicles. However, not every street can accommodate all modes to the same degree; every street needs to balance the needs and safety for every mode. For instance, dense commercial main streets may emphasize pedestrians over automobile. Less commercial streets may be ideal for bicycle travel. Streets with concentrations of bus stops may cater to transit riders, while other streets may facilitate necessary auto movements and services.

Regardless of the balance of transit modes, all streets need to prioritize the safety of people traveling by each mode to achieve the goal of Vision Zero: the elimination of death and serious injury from traffic crashes. To achieve Vision Zero, street design needs to incorporate physical design strategies that prevent traffic crashes, such as small turning radii to slow traffic at crossings, physical separations for bicycle lanes, and leading pedestrian and bicycle signals.

Community Alignment

- Vision Zero by 2025 policy: No Serious injuries or deaths
- Safe crossing guidelines and mid-block crossing policies
- Pedestrian visibility and crosswalk lighting

Desired Outcomes

- Eliminate fatalities and serious injuries caused by traffic crashes by 2025.
- Reduce crashes, especially for vulnerable users.
- Reduce speeds and speeding to a max of 25 MPH.
- Improve pedestrian and cyclist comfort and reduce level of traffic stress.
- Increase accessibility for all users.

Project Opportunities

- Redesign roadways to manage speeds and follow complete streets guidelines.
- Develop and redevelop bicycle infrastructure to fill in gaps, reduce traffic stress, increase safety and comfort.
- Prioritize improvements for vulnerable users.
- Improve comfort of non-motorized travel through shade, wide sidewalks, landscaping, and places to rest.
- Design for public health: improve air quality, promote active lifestyles, reduce injuries, provide access to necessities.
- Support public transit: improve reliability and trip times.





Value 2: Equitable, Just Access for All People

As streets are public space, they must serve the entire community regardless of ability, age, and mode of transportation. At the most essential level, downtown streets must be safe, comfortable, and welcoming to the most vulnerable — pedestrians, bicyclists, children, elderly, and those with disabilities. Many people may rely on transit, or may have mobility needs that necessitate accessible routes. Moreover, everyone who accesses the downtown is a pedestrian at some point during their trip, and improving the quality of the environment benefits everyone.

From a broader accessibility standpoint, the streets must be equitably accessible. To accomplish this, we must recognize that historically, decision-makers have not treated all modes and people equitably. Downtown should safely and comfortably serve all modes of travel. In addition, regardless of which direction you are coming from or mode of travel, downtown should be safely and comfortably accessed.

Community Alignment

- A2Zero Plan: identifies equity impacts from transportation
- City Transportation Comprehensive Plan: focuses on equity and safety for all users

Desired Outcomes

- Transportation infrastructure that's designed to protect the most vulnerable.
- Provide safe and efficient access to jobs, services, shops, school, and social spaces.
- Increase active transportation mode share and promote healthy lifestyle options for all people.
- Reduce emissions for streets & neighborhoods heavily impacted by the transportation system.
- Understand and integrate regional transportation needs & opportunities.

Project Opportunities

- Construct bicycle infrastructure that welcomes all ages, abilities, and comfort levels of biking near vehicles.
- Improve connections to areas of greater need and those that have not been historically prioritized, such as affordable housing.
- Engage those who have been historically excluded and have greater need in the design process and incorporate their specific needs.
- Incorporate universal design strategies into projects beyond minimum ADA regulations.





Value 3: Affordable and Inclusive Community

Ann Arbor strives to be a welcoming and inclusive community for all people. Affordability is a central aspect of living in the city that impacts the inclusivity of the community. Two issues within the downtown directly affect affordability: housing costs and transportation expenses.

Public infrastructure projects can help improve affordability by supporting greater density (more housing stock) and supporting affordable housing projects specifically. DDA plans, capital improvements, and other initiatives can support the creation of affordable housing in the downtown with access to a diverse range of employment and services. Additionally, street projects that improve mobility options and choices for people can lower their transportation costs – especially for people without reliable access to personal vehicles that are reliant on walking, biking, and riding public transit. Creating a safer environment for all modes of travel can support a more affordable and inclusive community.

Community Alignment

- Affordable Housing Initiatives: policies & actions increasing units in Ann Arbor
- Housing Commission Programs: Public Housing, Project Based Vouchers, Section 8

Desired Outcomes

- Use infrastructure to reduce, offset, and/or act as a match to housing commission projects.
- Position housing projects to be competitive for LIHTC funding and other opportunities.

Project Opportunities

- Upsize water mains to support affordable projects.
- Create a bank of sanitary sewer improvements to offset Housing Commission development costs.
- Manage building-side stormwater within the roadway.
- Provide safe public transit and non-motorized connections to those without access to vehicles.
- Support lower cost transportation initiatives (ebikes, rideshare, etc).





Value 4: Resilient and Energy Responsible Downtown

The City of Ann Arbor values the health and quality of its local environment and acknowledges its relationship to global sustainability and climate change. Ann Arbor has adopted a number of sustainable policy positions in order to improve air and water quality, become carbon neutral, and use energy responsibly.

The design and operation of public streets is a significant opportunity to help the city advance sustainability goals and meet adopted policies. Mobility projects can improve the comfort and attractiveness of non-motorized travel and reduce vehicle miles traveled, all while supporting more active lifestyles. Streetscape projects can use more energy-efficient lighting while improving visibility and reducing light pollution. Incorporating green infrastructure in street projects reduces runoff and pollution entering the Huron River, better protecting water quality.

Community Alignment

- A2 Zero Carbon Neutrality Plan: achieve by 2030
- Sustainability Framework: goals for a sustainable future
- LED Streetlight Program & Dark Skies Initiative
- Green Streets Policy

Desired Outcomes

- Reduce Vehicles Miles Traveled by 50% by 2030
- Mode shift towards non-single occupancy vehicles
- Infiltrate and/or retain stormwater in excess of required targets
- Reduce urban heat island
- Increase access to mobility hubs

Project Opportunities

- Support modes
- Specify environmentally responsible products, materials, and systems





Value 5: Vibrant and Thriving Local Economy

Downtown's are a place of interaction, commerce, and exchange, where people and ideas come together in supporting the city's economy and vitality. Critical to the success and vitality of the local economy is having streets that support people's access to business, provide space for commerce, and promote a comfortable and attractive environment where people and businesses want to be.

Street can support economic vitality by providing easy wayfinding and navigation for residents, visitors, and workers alike. They can establish a comfortable pedestrian environment, becoming a destination where people want to visit, shop, and dine. And streets support important business-supportive functions, like outdoor retailing/dining and commercial loading/delivery.

Community Alignment

- Economic Vitality (Sustainability Framework): Support a resilient local economy, diverse jobs across all sectors, create opportunity

Desired Outcomes

- Strengthen local business growth and ownership
- Design for flexibility in the streets
- Improve attractiveness
- Ensure all people feel welcome
- Increase diversity and supply of employment opportunities
- Support lower income employees

Project Opportunities

- Provide flexible curb-side lanes and uses
- Provide more sidewalk space for active commercial uses
- Create a comfortable, welcoming streetscape environment
- Increase access to businesses for all modes of travel
- Leverage unique assets / qualities to build a sense of place





Value 6: Responsible Design and Implementation

Public infrastructure and capital projects, like street and mobility projects, are an important use of public funds. But with this comes the responsibility to use public dollars wisely and where they can benefit the community in an equitable and cost-effective manner.

For street projects, responsible design and implementation means making use of best practices to protect public health and safety, to fully consider the long-term maintenance and operational costs of projects and seek to minimize those, to prioritize treatments that are durable with lower long-term costs. Responsible implementation also requires aligning improvements with other project opportunities, such that costs and impacts can be shared and minimized wherever possible.

Community Alignment

- Responsible resource use (Sustainability Framework)

Desired Outcomes

- Deliver improvements that are maintainable
- Coordinate construction with other projects and improvements

Project Opportunities

- Integrate equitable engagement strategies into design process
- Continue to build + implement education and communication strategies
- Build knowledge within local leadership
- Support workforce health and development through street and sustainability projects





**Value 7:
Connected Community with
Streets as Civic Spaces**

Streets serve communities in ways beyond transportation; they facilitate connections between people. They are places for people to meet, eat, recreate, and host events. The design of downtown streets needs to be flexible to allow for use as community space and reflect the aesthetics of the local character.

Community Alignment

- Active Living & Learning (Sustainability Framework): improve quality of life through diverse cultural, recreational and educational opportunities for all members of our community

Desired Outcomes

- Deliver improvements that respect neighborhood context and foster more connections between people
- Deliver improvements that encourage social interactions between people and the community around them
- Prioritize improvements that provide flexibility for civic uses and events, where appropriate
- Reflect local character through creative ideas, art, and collaborations

Project Opportunities

- Integrate local artists into the design / planning process
- Design streets for flexibility and easy adaptation
- Engage residents, business owners, and other street users to meet localized needs



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2.0 STREET FRAMEWORK

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FRONTAGE CONTEXT 42

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2.1 STREET FRAMEWORK

STREET DESIGN APPROACH

Traditional Street Design Approach

Traditionally, streets have been designed with a “centerline out” (Figure 2.1.1) approach and with a hierarchy of streets from interstates and highways down to arterials, collectors, and local roads. The functional needs of the roadway, primarily access and mobility, are considered and determined first. Then the land use context and activities “behind the curb” are considered, but only after determining road priorities. This is typically a highway engineering approach, rather than a street design approach.

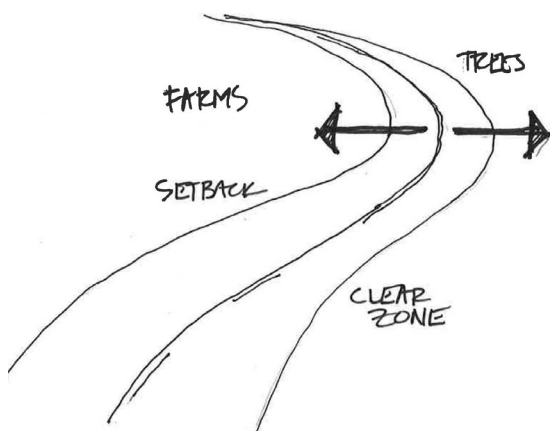


Figure 2.1.1 - Centerline Out

Context-based Street Design Approach

Downtown streets do not conform to the strict dichotomy of mobility versus access. While autos continue to be an important mode of travel, access and mobility by other modes are equally important and essential. Downtown streets must provide inviting environments for efficient movements of pedestrians, bicycles, and transit riders. Unlike the traditional methodology, context-based street design works from the built environment inward to the centerline of the street.

The land use and urban design context of the street is as critical as its transportation function. The primary objective of transportation is to achieve larger public objectives, not simply to move people around without any specific purpose. As a result, a more holistic approach for street design is to take a “building in” approach (Figure 2.1.2).

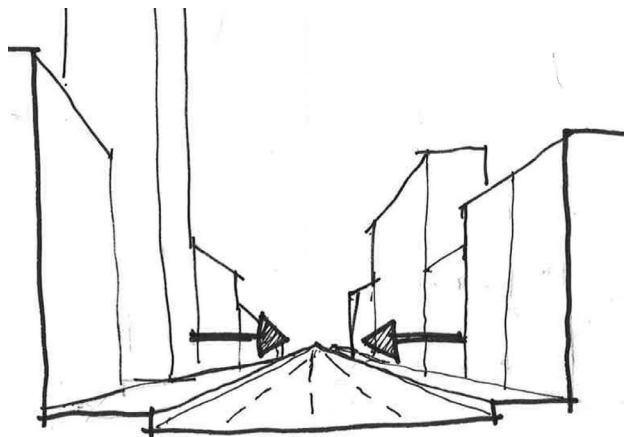


Figure 2.1.2 - Building In

Context-based street design examines the land use activity and urban design character along with the primary transportation function. It is a method for working from the built environment to the center of the street so that transportation is supporting and enabling the envisioned land uses both for local blocks as well as serving larger area mobility needs.

A context-based approach will benefit downtown Ann Arbor by:

1. Ensuring that the needs of all users of the street and adjacent properties are comprehensively considered in street design and management decisions.
2. Ensuring that single interests or modes of use do not dominate the street to the detriment of others interests.

All-Ages & Abilities Street Design

An accessible bicycle network is one where people of all ages and abilities feel safe and comfortable when riding a bike. While conventional bike lanes have been instrumental in advancing adoption of dedicated bicycle facilities in communities across the country, they often fail to provide a suitable facility for more cautious and/or less confident bike riders. As such, communities are placing increased emphasis on building “low stress” bike facilities that make critical connections using facilities that are welcoming are comfortable for a broader range of users.

Table 2.1.1 - All Ages & Abilities Bikeways (NACTO – Designing for All Ages and Abilities, 2017)

Contextual Guidance for Selecting All Ages & Abilities Bikeways				
Roadway Context				
Target Motor Vehicle Speed*	Target Max. Motor Vehicle Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations	All Ages & Abilities Bicycle Facility
Any		Any	Any of the following: high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts†	Protected Bicycle Lane
< 10 mph	Less relevant	No centerline, or single lane one-way	Pedestrians share the roadway	Shared Street
≤ 20 mph	≤ 1,000 – 2,000		< 50 motor vehicles per hour in the peak direction at peak hour	Bicycle Boulevard
≤ 25 mph	≤ 500 – 1,500	Single lane each direction, or single lane one-way	Low curbside activity, or low congestion pressure	Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane
	≤ 1,500 – 3,000			Buffered or Protected Bicycle Lane
	≤ 3,000 – 6,000			Protected Bicycle Lane
	Greater than 6,000			Protected Bicycle Lane
Greater than 26 mph†	≤ 6,000	Single lane each direction	Low curbside activity, or low congestion pressure	Protected Bicycle Lane, or Reduce Speed
		Multiple lanes per direction		Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed
	Greater than 6,000	Any	Any	Protected Bicycle Lane, or Bicycle Path
High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts		Any	High pedestrian volume	Bike Path with Separate Walkway or Protected Bicycle Lane
			Low pedestrian volume	Shared-Use Path or Protected Bicycle Lane

As facilities are designed for a broader range of users, they become accessible to more people and encourage greater adoption of non-motorized means of travel. This can help realize a greater range of benefits - through positive public health outcomes, reduced transportation costs, improved safety for all roadway users, and equitable access to transportation choices.

The 2017 NACTO design guide “Designing for All Ages & Abilities” provides guidance on the types of bicycle facilities that should be considered based on roadway conditions and achieving an all ages and abilities goal. Table 2.1.1. provides a decision-making tool that considers the speed of the roadway, traffic volumes, numbers of vehicle lanes, and other critical considerations. These considerations inform a minimum level of facility that should be used to serve all ages and abilities.



STREET TYPOLOGY

A street typology is a context-based approach for systematically assigning individual streets to a particular “street type” in a way that respects adjacent land areas and functions as part of a broader transportation network.

The typology presented here is unique to Ann Arbor. It began with a comprehensive evaluation of the street land use context along each block in the downtown area as well as the multi-modal needs of the broader transportation network. This evaluation described two factors for defining street types: street Frontage Context and transportation Functional Emphasis.

- **Frontage Context** includes consideration of ground floor activities, urban design and street wall conditions, unique characteristics of place and history, and general aesthetics and atmosphere of the human experience. The Frontage Contexts assigned to blocks of downtown are *forward leading*. They may not reflect what currently is, but rather provide a context to support and enable a desired future condition.
- **Functional Emphasis** includes the unique role a multi-block corridor plays in the overall transportation networks. It establishes a prioritization of modes that is not uniform for every street, but rather uniquely identified by corridor to provide for comfortable mobility and efficient access of all modes.

When combined (Figure 2.1.3), the overlay of Frontage Context with transportation Functional Emphasis results in 12 different street types specific to downtown Ann Arbor. These street types guide holistic street design by identifying key considerations like lane configurations, modal priorities, traffic operations, and maintenance considerations. Street types also address placemaking and land development concerns such as street character, connections, materials and furnishings and environment.

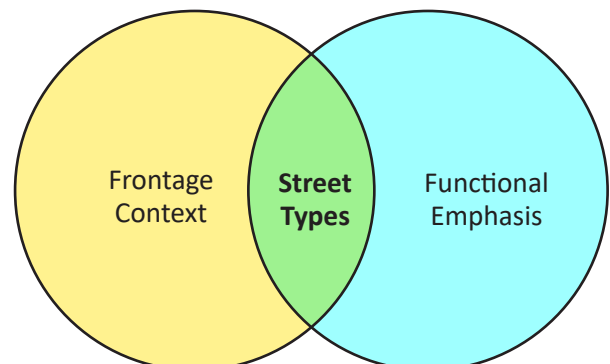


Figure 2.1.3 - Street Types

Street Frontage Context

Street Frontage Contexts are aspirational. While in many instances, downtown blocks have already achieved the desired land use context, there are some areas where downtown continues to evolve. This manual designates street with the envisioned rather than existing street Frontage Context in order to encourage street design that supports this continued evolution.

Street Frontage Context and associated activity varies widely in downtown from blank walls of parking ramps to lively commercial destinations to quaint residential dwellings. This rich tapestry of frontage uses was simplified down to five primary types of street frontages:

- Destination Commercial
- Commercial
- Mixed
- Civic & University
- Near Neighborhood

Functional Emphasis

Streets and public rights-of-way are typically 66 feet wide (Main Street is a notable exception) in Ann Arbor's downtown, requiring trade-offs in how streets are designed. Not all streets can serve all modes equally and still provide an efficient, reliable and easy-to-navigate system. While Frontage Contexts may vary from block to block, the transportation Functional Emphasis of a street generally remains consistent along long segments of a corridor to make a logical system for multi-modal circulation and travel.

The Functional Emphasis facilitates predictable and consistent street design by identifying when and where certain transportation modes or activities are emphasized over others. The Functional Emphases addresses the four primary modes of transportation – walking, bicycling, transit, and auto or truck travel. The five major Functional Emphasis types are:

- Pedestrians & access
- Bicycle
- Transit
- Vehicle
- Balanced street

In addition to the five Functional Emphasis street types, two other street types are included that provide secondary linkages and access and service not along the primary road corridors:

- Alleys
- Pedestrian connectors

Transportation is multi-dimensional. Although streets may emphasize and enhance one or more particular modes, each and every street in a downtown such as Ann Arbor must accommodate all modes comfortably. The transportation types address not only travel through downtown by common modes such as walking, bicycling, driving and transit, but also address the transportation function of getting to downtown destinations.

In some instances, the desired street frontage requires a consistent approach to transportation function. This is the case for Destination Commercial areas that must be supported by a transportation function that emphasizes business access by foot and vehicle. However in most cases, the street Frontage Zone may have different transportation emphasis in different areas. Similarly, a transportation type – such as bicycle emphasis – may traverse a variety of different street Frontage Contexts. In these cases, street design may be subtly (or significantly) modified over the length.



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FUNCTIONAL EMPHASIS

Pedestrian & Access

The pedestrian and parking emphasis is reserved for areas with high concentrations of pedestrian activity. In these segments, the priority is placed on ensuring adequate space in the right-of-way for both through pedestrian travel as well as gathered pedestrians window shopping, sitting or waiting.

Transit

Transit emphasis corridors prioritize the efficient and reliable travel of transit vehicles (i.e. transit operations).

Bicycle

Bicycle emphasis corridors are those few streets where bicycles are afforded a generous space in the public right-of-way to provide for dedicated and comfortable bicycle travel.

Balanced

Balanced streets do not default to any particular modal emphasis, but instead balance the needs of many different travel demands on the corridor.

Public Alley

The primary purpose of alleys is to provide access to properties for services including loading and deliveries and waste removal.

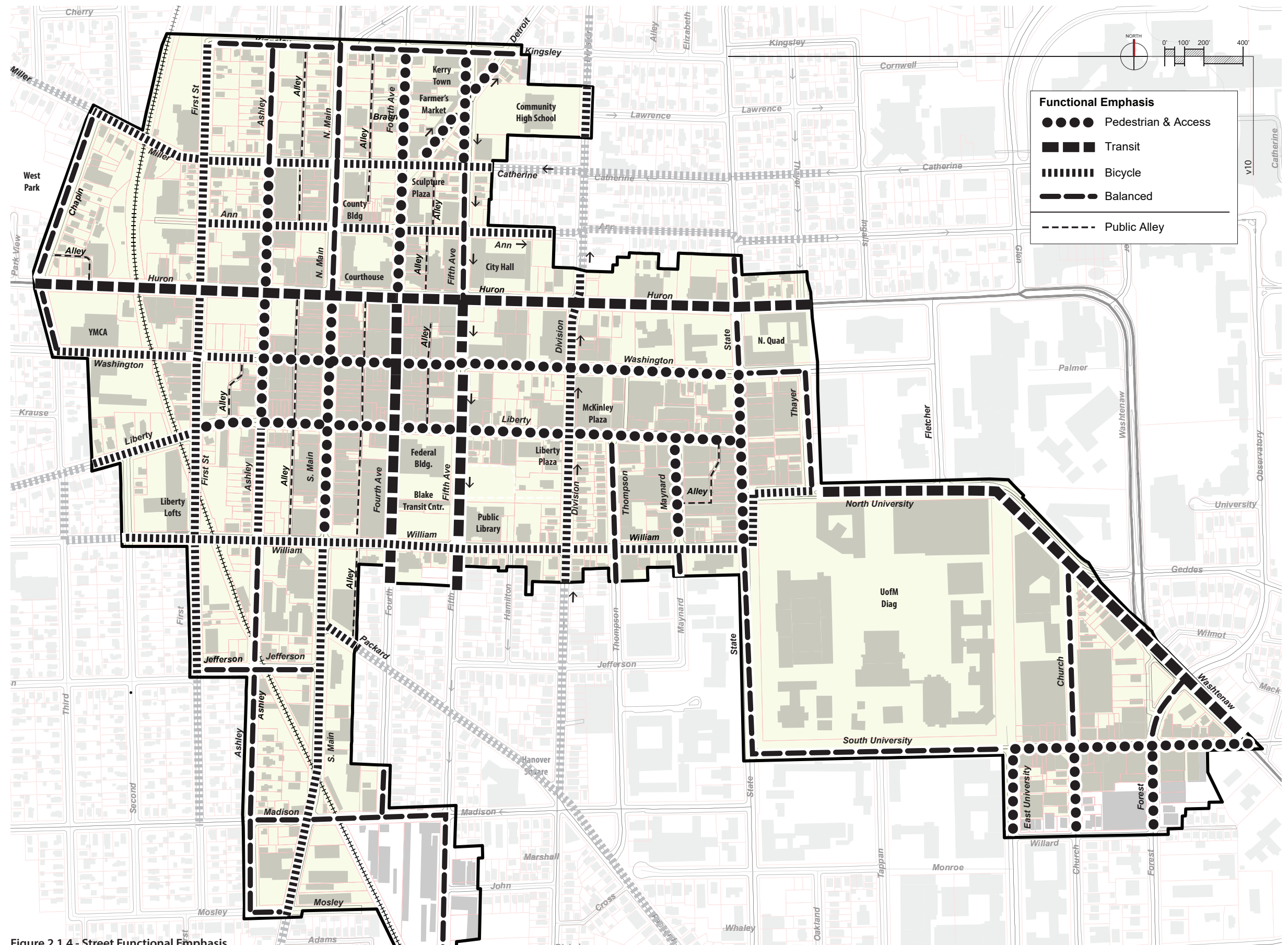


Figure 2.1.4 - Street Functional Emphasis

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FRONTAGE CONTEXT

Destination Commercial

Streets with a concentration of the highest attraction destinations that create an active commercial ground floor use, including dining, shopping, theaters, and major civic spaces. Pedestrians are the priority users as they move between destinations as well as sit, socialize, or stroll.

Commercial

Commercial blocks are only slightly less intense than “Destination Commercial,” they are characterized by a rich mix of high-activity uses such as retail, dining, major office, and multi-family residential. Pedestrians are the highest priority user in order to support commercially oriented land uses.

Mixed

Mixed frontages have a diversity of uses that range from low scale, single use buildings to higher intensity uses. These blocks may also have some or all of their frontages occupied by less active uses such as parking ramps, public services, or the occasional blank wall.

Civic / University

Civic & University Frontage Context blocks are blocks that are anchored by major civic uses. These are well-known public destinations and icons such as city hall, court buildings, or the public library.

Near Neighborhood

Near Neighborhood blocks are predominantly residential but often include low-intensity commercial or service uses.

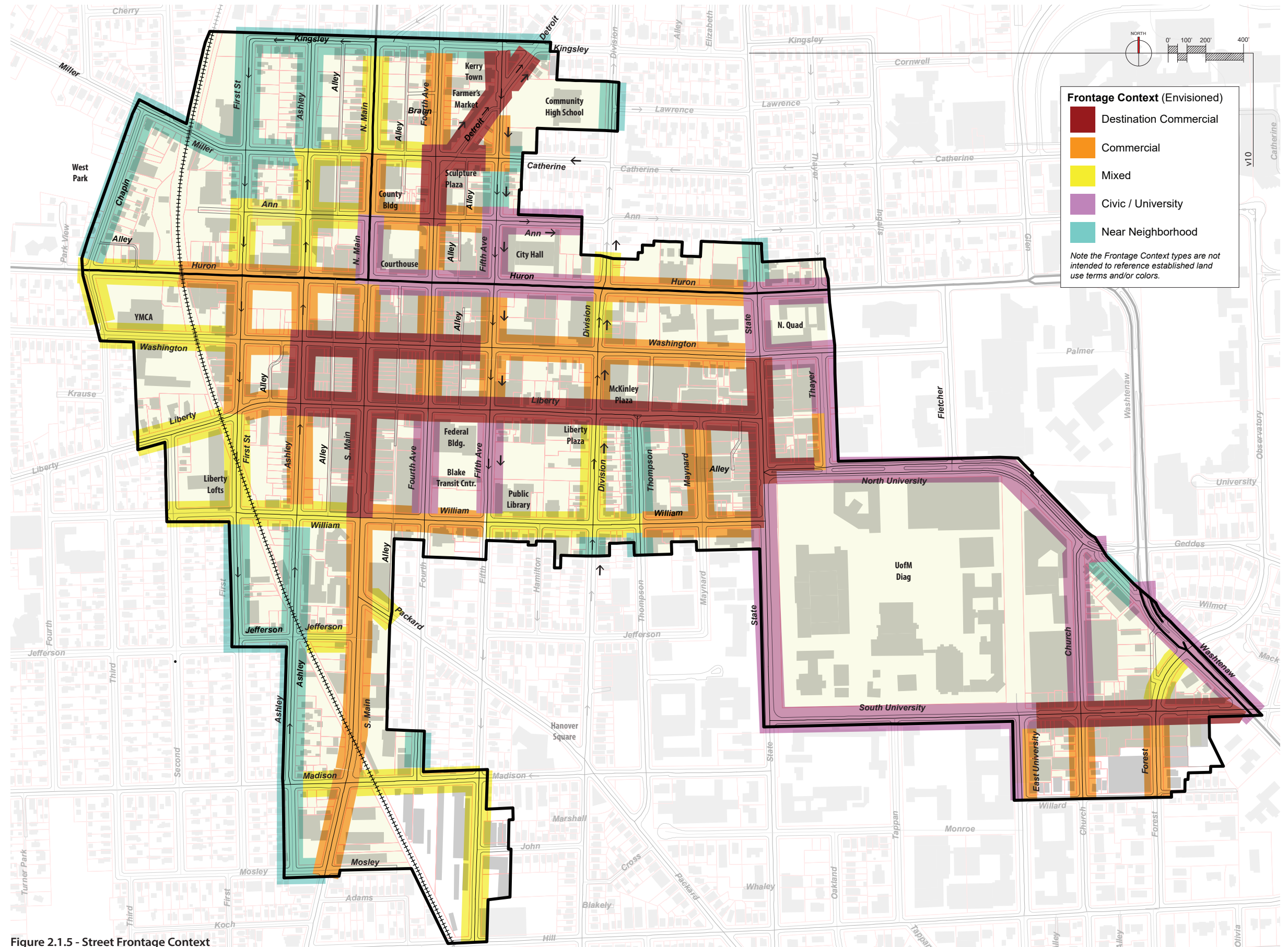


Figure 2.1.5 - Street Frontage Context

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STREET TYPOLOGY MAP

The **Street Typology Map** shows each street's assigned Frontage Context (background colors) and Functional Emphasis (black dashed lines) across the downtown area.

Detailed descriptions of the Frontage Context types are provided in section 2.2, and detailed descriptions of the Functional Emphasis types are provided in section 2.3.

Note that the Frontage Contexts are informed by existing and envisioned land uses but are not intended to depict actual land use patterns, existing or in the future.

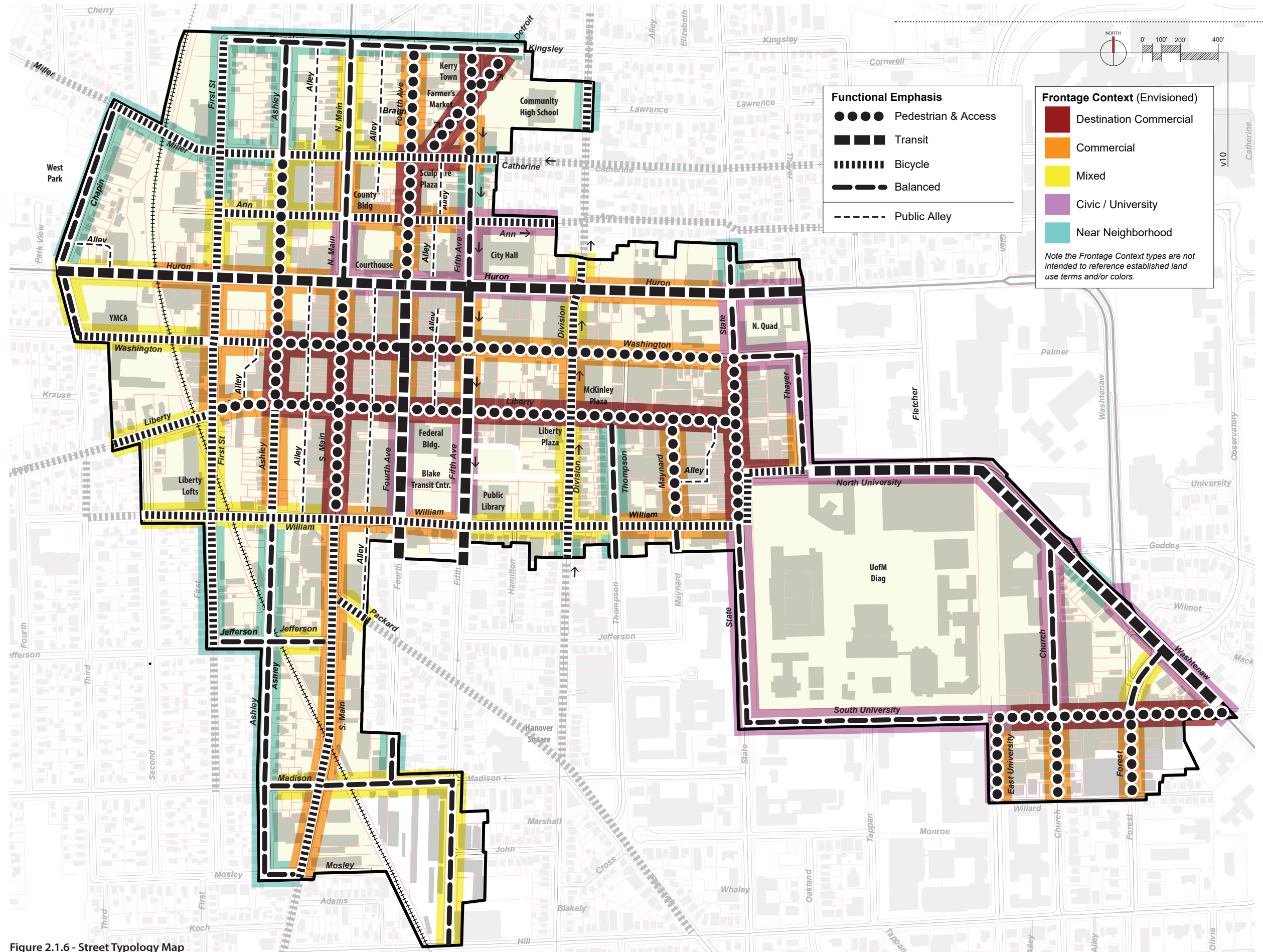


Figure 2.1.6 - Street Typology Map

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SPECIAL DISTRICTS

Ann Arbor’s Downtown is not a uniform urban landscape, but is instead comprised of many different districts, each with their own character and unique features, in addition to a number of Historic Districts.

Character Districts

Nine Character Districts are recognized in downtown as part of the City of Ann Arbor Downtown Design Guidelines (2011). The chart inset on the map at the right lists the nine Character Districts. While the Character Districts were established primarily to guide development and building architecture, through project review by the Design Review Board, the physical design of the street can reinforce the unique character of each district through certain design elements. For example, using a particular street light exclusively within a given district can help emphasize that district’s identity.

Many design elements, described in Chapter 4, have an opportunity to reinforce district character and a special note will be made under the element’s design guidelines. These elements include, but are not limited to: street furnishings (benches and waste receptacles), street lighting, roadway paving materials, Sidewalk and Amenity Zone materials, landscape planters, street trees, bicycle parking, public art, and wayfinding.

The Street Design Team and Design Review Board may be consulted for guidance concerning the design of certain elements within established character districts.

Historic Districts

In addition, the map at the right identifies areas that are part of local Historic Districts. If historic features are identified that exist within the street right-of-way and might be impacted by street projects, the Historic District commission may be consulted to provide additional guidance.

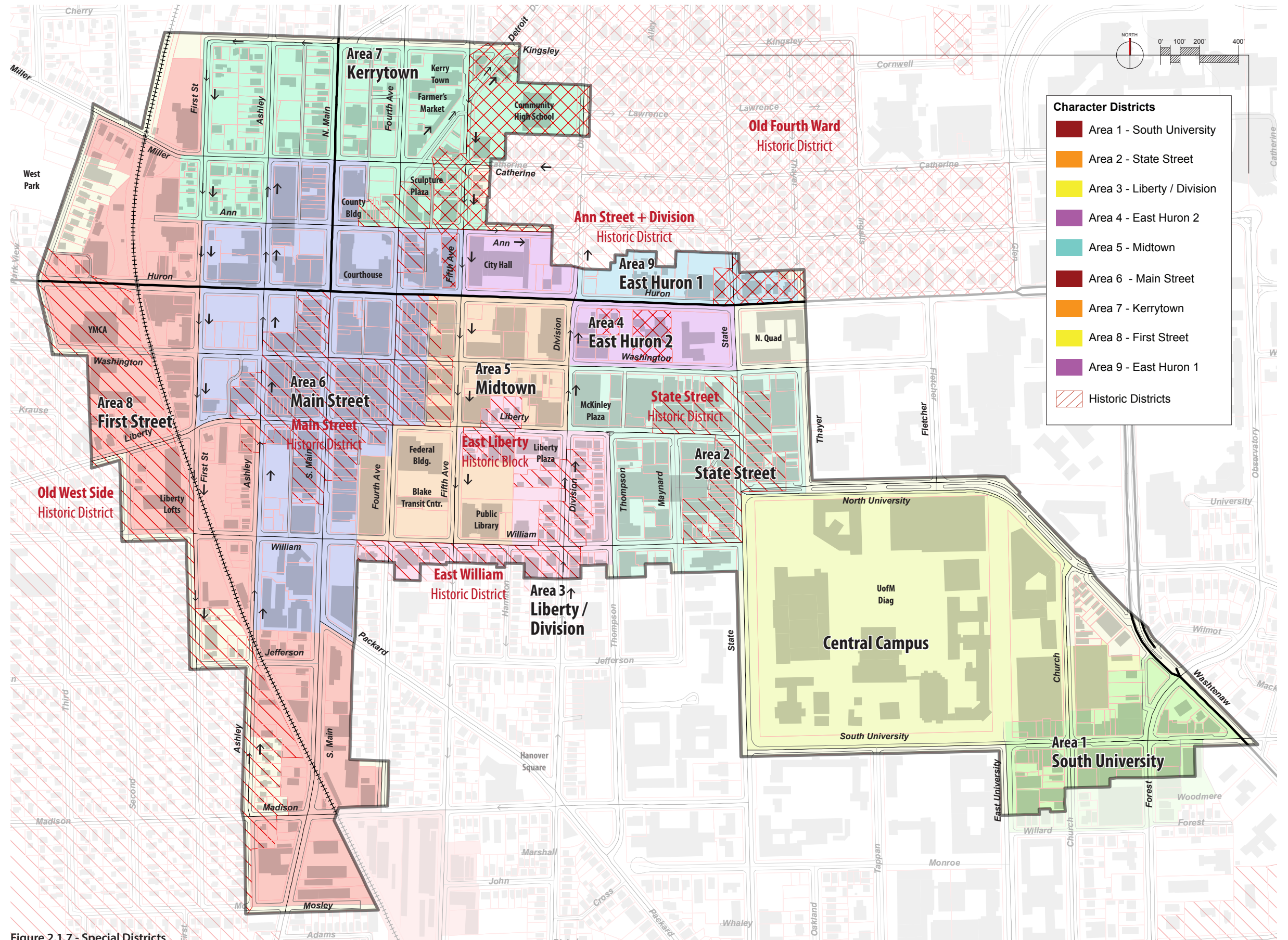


Figure 2.1.7 - Special Districts



2.2

DESIGN ELEMENT PRIORITIZATION

The Design Element Priority (Table 2.2.1) lists street design elements across five categories. For each combination of street Frontage Context and Functional Emphasis, the table identifies what elements are important to incorporate into the street design and to prioritize above other elements.

The Design Element Priority table provide a decision making tool for evaluating trade-offs between what elements to include or exclude from a particular street design.

For example, on bicycle emphasis streets, buffered bicycle lanes are recommended whereas on-street parking is listed as an opportunity. Hence, bicycle facilities need to be accommodated first before on-street parking, provided there is any remaining space for parking.

The priorities, from highest to lowest, are defined as follows:

- ✓ **Required:** These design elements should be incorporated into this street design and must meet the design requirements listed within the design guidelines section for that element.
- ⚠ **Recommended:** These design elements are critically important to the design of this street type. Street design must include these elements unless technical feasibility issues or other significant constraints exist. Not meeting recommended design elements requires approval of the Street Design Team.
- **Opportunity:** These design elements may be appropriate to the street design and are permitted for use provided they do not conflict with required, recommended, or restricted elements.

✗ **Restricted:** These design elements are not generally desirable for this type of street and should not be used unless a justification can be presented and approved by the Street Design Team.

Critical Elements Required on All Streets

A number of design elements are critical to the integrity and function of all streets and are required elements. This includes:

- Sidewalk and Amenity Zone
- Crosswalks with curb ramps (ADA accessibility)
- Travel lanes and appropriate corner geometry
- Street lighting
- Street trees
- Stormwater management (per city Green Streets Policy)

Chapter 4 provides detailed descriptions of all design elements and is organized according the chart below.

(1) Adjustment to sidewalk width is most likely to occur as part of a public street reconstruction project. Private projects may be required to adjust sidewalk widths when they are narrower than the rest of the street section and/or where a block or more of right-of-way is impacted.

(2) The need for new loading zones shall be reviewed within the context of the larger block or neighborhood.

Table 2.2.1 - Design Elements Priority

LEGEND Required Recommended Opportunity Restricted

◆ Design elements marked with an orange diamond box are those commonly impacted by private projects and are of special note for private projects.

Frontage Context	Destination Commercial	Commercial					Mixed			Civic / University		Near NBH	
	Functional Emphasis	Pedestrian	Pedestrian	Transit	Bicycle	Balanced	Transit	Bicycle	Balanced	Transit	Balanced	Bicycle	Balanced

Section	Street Zone	Ped	Ped	Tran	Bike	Bal	Tran	Bike	Bal	Tran	Bal	Bike	Bal
Section 4.1 - Pedestrian													
◆ Sidewalks + Pedestrian Areas (1)	Pedestrian Area												
	Crosswalks												
◆ Curb Ramps	Intersections												
	Pedestrian Signals												
	Countdown Pedestrian Signals												
	Waste & Recycling Receptacles												
◆ Benches & Seating	Amenity Zone												
	Wayfinding												
◆ Bumpouts	Curbside Zone												
	Mid-Block Crossings												
	Pedestrian Refuge Island												
	Public Art												
Section 4.2 - Commercial Support													
◆ On-Street Parking	Curbside Zone												
◆ Café Seating & Outdoor Retailing	Amenity/Frontage												
◆ Loading Zones (2)	Curbside Zone												
◆ Short-Term Parking & Drop-Off	Curbside Zone												
◆ Alleys	-												
Section 4.3 - Bicycle													
◆ Bicycle Facility Selection	Amenity Zone												
◆ Separated Bike Lanes	Roadway Zone												
	Buffered Bike Lanes												
	Conventional Bike Lanes												
	Advisory Bike Lanes												
	Sharrows												
	Bike Boxes												
	Two-Stage Turn Queue												
	Bicycle Signal												
	Bicycle Parking												
	Bike Corral												
Section 4.4 - Transit													
Bus Stops & Shelters	Amenity Zone												
Bus Bulbs	Curbside Zone												
Transit Lanes	Roadway												
Bus Queue Jump Lane	Roadway												
Section 4.5 - Vehicle													
Travel Lanes	Roadway Zone												
◆ Fire Access Lane	Roadway Zone												
Corner Geometry & Design Vehicle	Intersection Zone												
◆ Driveways & Curb-Cuts	Pedestrian Area												
	Medians												
	Mini Roundabouts												
	Signals: No Turn on Red												
	Signals: Leading vs. Lagging Left												
	Signals: Leading Pedestrian Interval												
	Signals: All-Walk Signal Phases												
	Signals: Traffic Signal Priority												
Section 4.6 - Infrastructure & Landscape													
◆ Street Lighting	Amenity/Frontage												
◆ Street Trees	Amenity Zone												
◆ Landscape Planters	Amenity Zone												
◆ Lawn Extensions	Amenity Zone												
◆ Stormwater Management	Amenity Zone												
◆ Utilities	Amenity Zone												



2.3

FRONTAGE CONTEXT

Destination Commercial	44
Commercial	46
Mixed	48
Civic & University	50
Near Neighborhood	52



This section describes the five different Frontage Contexts used in the typology framework. For each Frontage Context, the general intent, design objectives, priority users, and key design elements are listed.



DESTINATION COMMERCIAL

FRONTAGE CONTEXT

DESCRIPTION

Destination Commercial is a designation applied to only a handful of blocks in downtown. Designating a smaller and focused number of blocks as a destination strengthens adjacent blocks. “Destinations” are strongest and most catalytic when clear and concentrated. A downtown may have several Destination Commercial areas – each unique, separated and distinct.

Destination Commercial blocks bear both the benefit and burden of concentrated activity. These areas typically experience the highest level of congestion from all modes and struggle most with conflicting demands for limited street space and public rights-of-way.

DESIGN OBJECTIVES & VALUES

- Support and facilitate access **to** and **being at** designated blocks.



Equitable, Just Access for All People

- Clear connections to and from major through travel corridors and off street parking.



Safe, Comfortable Downtown Streets

- Distinct character and identity with continuous street edge. Curb-cuts should be avoided entirely on Destination Commercial blocks.



Connected Community with Streets as Civic Spaces



Vibrant & Thriving Local Economy

- Flexible and adaptive street design.



Responsible Design & Implementation

PRIORITY USERS

- Pedestrians moving between destinations as well as sitting, socializing or strolling.
- Service vehicles (loading and deliveries) and short-term, transactional parking.

DESIRED ACTIVITIES

- High attraction destinations and active commercial ground floor use.
- Dining, shopping, theaters, and major civic spaces.
- Outdoor retail and cafe seating.
- Seating and gathering areas (e.g. green landscaped areas or small plazas).

Applicable Functional Emphasis Types
Pedestrian and access emphasis

Example Street Segments
Main Street (William Street to Washington Street)
South University Street (East University Avenue to Forest Avenue)
State Street (William Street to Washington Street)
North Fifth Avenue (at Detroit Street)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements
Sidewalks (minimum 6-8 feet Clear Walk Zone)
Loading zones on street or on nearby streets
Space for cafe dining and outdoor retail
Bi-directional travel lanes, encourage low speed vehicle travel
Pedestrian scaled lighting
Street trees in tree pits or planters
Sharrows (or bicycle lanes)
Short, frequent, well-marked crosswalks (with curb ramps)
Short-term parking and drop-off zones

Typically Recommended Design Elements
Bicycle parking (racks or corrals) and bike share
On-street parking (may convert some parking spaces to alternate uses, e.g. bike corrals or parklets)
Frequent seating, benches, or seat-walls
Landscape planters that provide a pedestrian buffer
Bumpouts
Public art
Mid-block crossings
Wayfinding

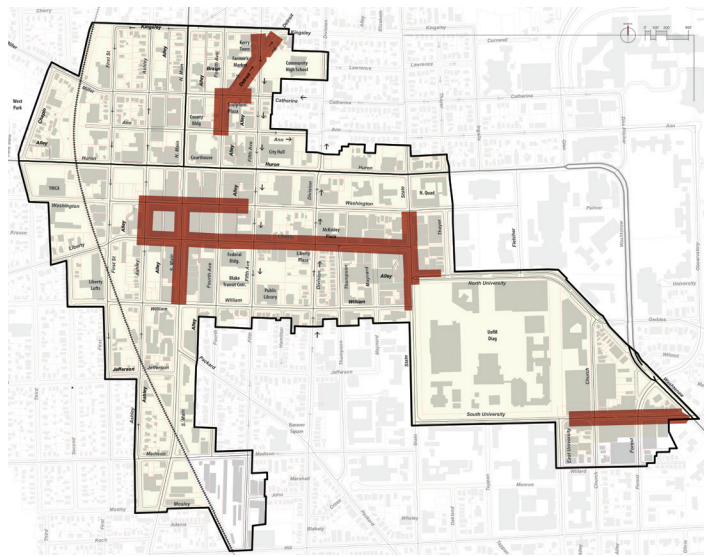


Figure 2.3.1 - Destination Commercial Key Map





COMMERCIAL FRONTAGE CONTEXT

DESCRIPTION

Commercial blocks are the most typical Frontage Context in downtown. Only slightly less intense than “Destination Commercial,” Commercial blocks are characterized by a rich mix of high-activity uses such as retail, dining, major office, and multi-family residential. Commercial blocks may also have lower activity uses such as banks, ground floor office uses and commercial lobbies. Commercial block types, like Destination Commercial, are highly active places with abundant pedestrian activity.

DESIGN OBJECTIVES & VALUES

- Support for higher intensity land uses. Commercial blocks add tremendous value to the city and downtown and their design should support and strengthen this objective.



Vibrant and Thriving Local Economy



Affordable and Inclusive Community

- Strong connections to Destination Commercial areas.



Safe, Comfortable Downtown Streets

- Active ground floor uses with a high degree of ground floor transparency and frequent doorways. Minimal curb-cuts and driveways – access should utilize alleys where they exist.



Vibrant and Thriving Local Economy

- Slow travel speeds to increase safety and visibility.



Safe, Comfortable Downtown Streets

- Balanced accommodation of both “to” and “through” travel for all modes.



Safe, Comfortable Downtown Streets

PRIORITY USERS

- Pedestrians are the highest priority user. Pedestrians support commercially oriented land uses and other modes of travel (bicycling, transit or driving) transition to the pedestrian mode in order to access business or other amenities.
- Accommodating service vehicles (loading and deliveries) and short-term transactional parking are also priorities on commercial streets.
- Commercial streets may have different Functional Emphasis including pedestrians and access, bicycles, transit, or through vehicular movements.

DESIRED ACTIVITIES

- Active ground floor use.
- Outdoor retail and cafe seating.
- High use building entrances and lobbies.
- Seating and gatherings areas such as green landscaped areas or small plazas.

Applicable Functional Emphasis Types
Pedestrian and access
Bicycle
Transit
Vehicle
Balanced street

Example Street Segments
Liberty Street (Fourth Avenue to Division Street)
Washington Street (First Street to Ashley Street)
William Street (Thompson Street to State Street)
Huron Street (First Street to Main Street)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements
Sidewalks (minimum 6-8 feet Clear Walk Zone)
Pedestrian-scaled lighting
Well marked crosswalks and curb ramps
On-street parking for pedestrian and vehicle emphasized streets
Street trees in a landscape strip
High quality transit stops/shelters (on transit emphasized streets)
Bicycle parking (racks or corrals)
Sharrows or higher level bike facility
Wayfinding (vehicular and pedestrian)
Loading zones
Short-term parking & drop-off zones

Typically Recommended Design Elements
Space for cafe seating and outdoor retail
Amenity Zone uses that provide a pedestrian buffer
Public seating (green space or plazas)
Bi-directional travel lanes
Wayfinding

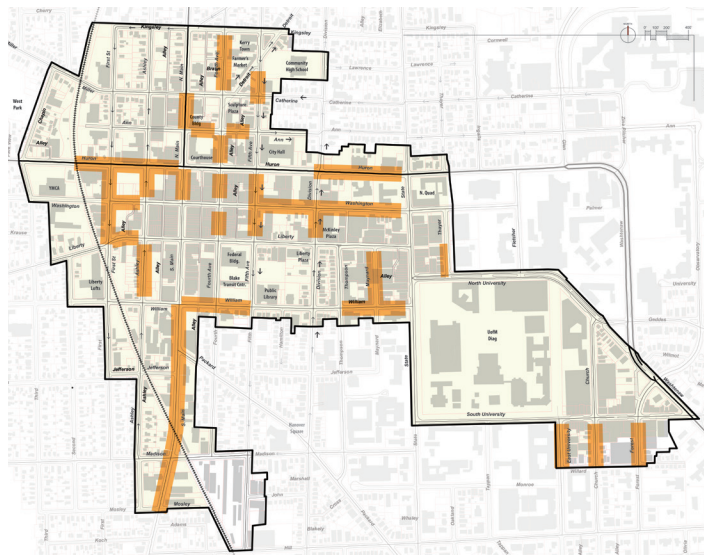


Figure 2.3.2 - Commercial Key Map








MIXED

FRONTAGE CONTEXT

DESCRIPTION

Mixed context blocks are a very common Frontage Context in the downtown area. These areas have a diversity of uses that range from low scale, single use buildings to higher intensity uses. These blocks may also have some or all of their frontages occupied by less active uses such as parking ramps, public services, or the occasional blank wall.

DESIGN OBJECTIVES

- Create a quality and inviting pedestrian place with well designed ground floor uses and landscaping.
 -  Connected Community with Streets as Civic Spaces
 -  Equitable, Just Access for All People
- Support, service and augment Commercial and Destination Commercial areas.
 -  Vibrant and Thriving Local Economy

PRIORITY USERS

- Pedestrian through travel, circulation and access to land uses and transportation services such as bus stops and bicycle stations.
- Vehicular access to properties – curb-cuts are not uncommon.
- Multi-modal through travel.

DESIRED ACTIVITIES

- Lower intensity uses such as commercial office, single- and multi-family residential, public services (fire station, utility structures, etc.).
- Residential and commercial lobbies and recreational uses.
- Quality landscaping including stormwater management and green infrastructure.

Applicable Functional Emphasis Types
Bicycle emphasis
Transit emphasis
Through vehicle travel
Balanced street

Example Street Segments
Miller Avenue (First Street to Fourth Avenue)
William Street (Second Street to Thompson Street)
Ashley Street (Huron Street to Miller Avenue)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements

Sidewalks – minimum 6 feet Clear Walk Zone

Pedestrian-scaled lighting

Marked crosswalks

Bicycle parking (racks or corrals)

Street trees in a landscape planter or tree trench

Bumpouts

Sharrows or higher level bike facility

Typically Recommended Design Elements

Loading zones, drop-off zones, and other temporary parking

Amenity Zone uses that provide a pedestrian buffer

On-street parking on most streets

Bike parking on most-streets

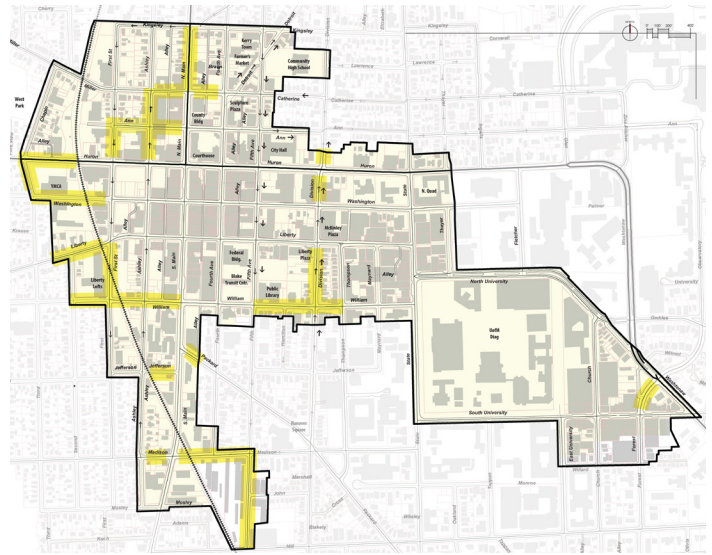


Figure 2.3.3 -Mixed Key Map





CIVIC & UNIVERSITY *FRONTAGE CONTEXT*

DESCRIPTION

Civic & University Frontage Context blocks are blocks that are anchored by major civic uses. These are well-known public destinations and icons such as city hall, court buildings, or the public library. Civic & University frontages also encompass the campus environment bordering The University of Michigan. Buildings are often set well back from the street with large gaps in the street wall, but landscaping that frames iconic buildings and institutions contributes to street character.

Pedestrian activity is episodic with a steady stream of activity through much of the day but high concentrations at varying times throughout the day, week and/or year.

DESIGN OBJECTIVES

- Highlight the character, presence and identity of anchor institutions.



Connected Community with Streets as Civic Spaces

- Provide safe and comfortable pedestrian circulation.



Safe, Comfortable Downtown Streets



Equitable, Just Access for All People

- Ensure public access, via a multitude of modes, to these important institutions.



Safe, Comfortable Downtown Streets



Resilient, Energy Responsible Downtown

PRIORITY USERS

- Pedestrian through travel, circulation and access to institutions.
- Multi-modal travel (as designated by Functional Emphasis) both to and through Civic & University areas.

DESIRED ACTIVITIES

- Small public spaces that permit sitting or gathering.
- Entrance plazas or walks to civic or university buildings.
- Landscaping and other softscaping.
- Public art, fountains or other anchoring features in the public realm.

Applicable Functional Emphasis Types

Transit

Vehicle

Balanced street

Example Street Segments

State Street (William Street to South University Avenue)

Huron Street (Main Street to Division Street)

North University Avenue (Thayer Street to Church Street)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements

Sidewalks (minimum 6-8 feet Clear walk Zone) - Wider if possible
Pedestrian - scaled lighting
Well marked, regular, and high visibility crosswalks
Bicycle parking (racks or corrals)
Street trees (in pits or landscape planters)
Regular waste receptacles
Sharrows or higher level bike facility
Enhanced transit stops on transit emphasized streets

Typically Recommended Design Elements

Wayfinding
Curbside uses that provide a pedestrian buffer
Wayfinding and public art
Public seating and/or mini plazas
Medians
Larger and high image landscape planters

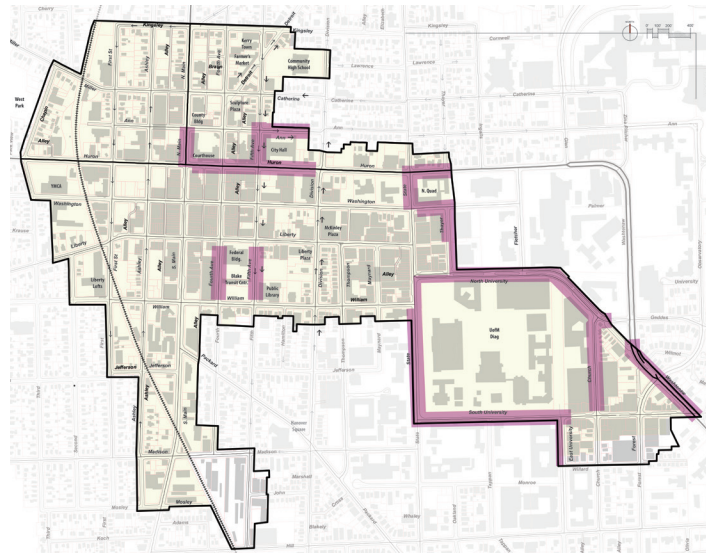


Figure 2.3.4 - Civic & University Key Map





NEAR NEIGHBORHOOD

FRONTAGE CONTEXT

DESCRIPTION

Near Neighborhood blocks are predominantly residential but often include low-intensity commercial or service uses. Lawn extensions, porches, large shade trees, and other uses provide for the interface between the public street and the private land.

Buildings are set far back from the street edge with frequent gaps between them. Driveways are not uncommon and provide access to garages and small parking areas, unfortunately not the way we are set up in Ann Arbor.

Pedestrian activity is lower in these areas and is characterized by neighbors engaging in social exchange or travelers proceeding to other nearby districts and destinations. Vehicle traffic should travel at modest speeds respectful of the residential communities through which they are traveling.

DESIGN OBJECTIVES

- Safe and quiet residential community.



Safe, Comfortable Downtown Streets

- Quality streetscape with robust landscaping and tree canopy.



Connected Community with Streets as Civic Spaces

- Short, logical, and multi-modal connections to nearby Commercial Districts.



Resilient, Energy Responsible Downtown

PRIORITY USERS

- Local pedestrian travel along and across streets with particular awareness of the needs and abilities of children and senior residents.
- Multi-modal travel (as designated by transportation type overlay) through the Near Neighborhood areas.

DESIRED ACTIVITIES

- Yards, porches, large shade trees, and other transitional features between the public street and private properties.
- Low fences or landscaping (below waist height) to define the street edge.
- Community uses such as schools, churches, and recreational uses.

Applicable Functional Emphasis Types

Bicycle emphasis

Balanced street

Example Street Segments
Thompson Street (Liberty Street to William Street)
South Ashley Street (William Street to Madison Street)
East Kingsley Street (First Street to Main Street)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements
Sidewalks – minimum 5 feet Clear Walk Zone
Marked crosswalks
Street trees in lawn strips or landscape planters
Street lighting
Sharrows or bicycle lanes (or higher level bike facility)

Typically Recommended Design Elements
Street trees in landscape strip
On-street parking
Stormwater management via green infrastructure
Landscape planters or lawn strips
Driveways and curb-cuts carefully designed

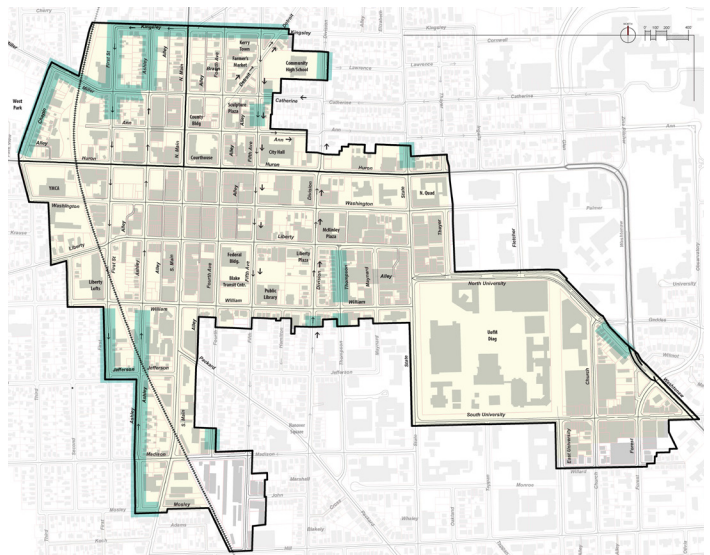


Figure 2.3.5 - Near Neighborhood Key Map





2.4

FUNCTIONAL EMPHASIS

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This section describes the four different Functional Emphases used in the typology framework as well as alleys. For each type, the general intent, design objectives, priority users and key design elements are listed.



PEDESTRIANS & ACCESS




FUNCTIONAL EMPHASIS






DESCRIPTION

The pedestrian and parking emphasis is reserved for areas with high concentrations of pedestrian activity. In these segments, the priority is placed on ensuring adequate space in the right-of-way for both through pedestrian travel as well as gathered pedestrians window shopping, sitting or waiting.

Curbside uses should meet the access needs of the adjacent businesses – particularly frequent and short duration transactional activities, such as loading and very short-term parking.

TRANSPORTATION OBJECTIVES

- Safe and comfortable pedestrian travel and gathering.
 -  Safe, Comfortable Downtown Streets
 -  Equitable, Just Access for All People
- Support to businesses – particularly loading and very short-term vehicle parking.
 -  Vibrant and Thriving Local Economy

- Slow travel speeds to enhance both safety and visibility.
 -  Safe, Comfortable Downtown Streets
- Accommodation of through and circulating vehicles.
 -  Safe, Comfortable Downtown Streets
- Safe bicycle travel and adequate bicycle parking.
 -  Safe, Comfortable Downtown Streets
 -  Equitable, Just Access for All People
 -  Resilient, Energy Responsible Downtown

Applicable Frontage Contexts
Destination Commercial
Commercial

Example Street Segments
Main Street (Huron Street to William Street)
East Liberty Street (Division Street to State Street)
South University Avenue (East University Avenue of Forest Avenue)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements

Sidewalks – minimum 6-8 feet Clear Walk Zone

Pedestrian-scaled lighting

On-street parking

Bicycle parking (racks or corrals)

Bumpouts

Low speed vehicle travel

Short, frequent, well-marked crosswalks

Travel lanes

Street trees in tree pits or planters

Vehicle travel lanes

Sharrows (or higher level bike facility)

Typically Recommended Design Elements

Public seating

Loading zones, short-term parking and drop-off zones

Landscape planters to buffer pedestrian areas

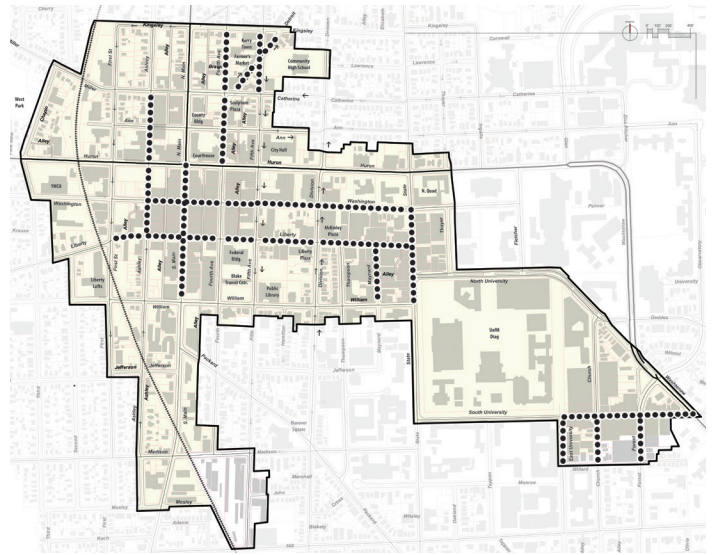


Figure 2.4.1 - Pedestrians & Access Key Map





BICYCLE

FUNCTIONAL EMPHASIS

DESCRIPTION

Bicycle emphasis corridors are those few streets where bicycles are afforded a generous space in the public right-of-way to provide for dedicated and comfortable bicycle travel. While bicycles are permitted and must be accommodated on all streets of downtown, bicycle emphasis streets prioritize bicycle travel. These streets are uniquely designed to make even the least confident cyclists – parents with children, youth, or seniors – can feel comfortable and be safe traveling through the core of downtown.

Bicycle streets in downtown are still pedestrian streets and concurrently support strong commercial activity. To concurrently address land use demands and bicycle emphasis needs, street design may need to transition between different bicycle facility types.

TRANSPORTATION OBJECTIVES

- Safe and comfortable bicycle facilities that accommodate the broadest range of users including cyclists from eight years old to (and beyond!) 80 years old.



Safe, Comfortable Downtown Streets



Equitable, Just Access for All People



Resilient, Energy Responsible Downtown

- Support to adjacent land uses including access and loading.



Safe, Comfortable Downtown Streets

- Quality public realm and inviting pedestrian environment.



Safe, Comfortable Downtown Streets



Connected Community with Streets as Civic Spaces

- Accommodation of through and circulating vehicles.



Safe, Comfortable Downtown Streets

Applicable Frontage Contexts

Commercial
Mixed
Near Neighborhood

Example Street Segments

William Street
First Street
Ashley Street (except between Washington Street and Liberty Street)
Miller Avenue/Catherine Street (west of Fourth Ave)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements

Dedicated bicycle facility: Bicycle lanes required at a minimum but higher level facilities may be used instead (buffered bicycle lanes or protected bicycle lanes)
Sidewalks – minimum 6 feet Clear Walk Zone
Street lighting
Street trees in tree pits or planters
Bicycle parking (racks or corrals)
Bicycle-oriented wayfinding
Travel lanes
Short, frequent, well-marked crosswalks

Typically Recommended Design Elements

Bike boxes and/or bicycle signals
Bike share stations
Public art
Two-stage turn queues
Transit bumpouts
Landscape planters

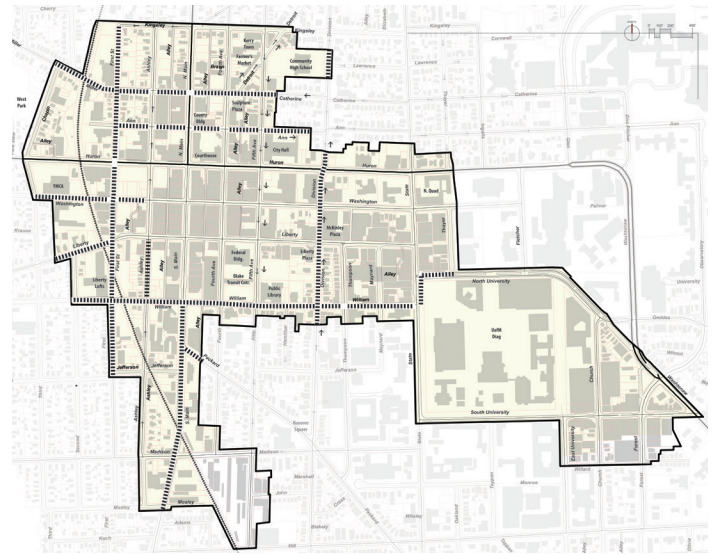


Figure 2.4.2 - Bicycle Key Map





TRANSIT

FUNCTIONAL EMPHASIS






DESCRIPTION

Transit emphasis corridors prioritize the efficient and reliable travel of transit vehicles (i.e. transit operations). Transit emphasis corridors also include streets with high activity transit and bus stops that need to provide adequate space and comfortable passenger amenities such as transit shelters and seating.

Transit emphasis corridors may employ traffic signal priority (TSP) technologies that permit a bus to progress more rapidly down the corridor. In rare instances, transit queue jump lanes are used at congested intersections to permit buses to bypass passenger cars. Bus bulbs enable buses to stop in the travel lane and hold traffic behind them, which reduces transit travel time, enhances reliability, and improves the passenger experience.

Quality pedestrian accommodation is critically important on transit emphasis segments because every transit rider is a pedestrian at the beginning and end of their transit trip.

TRANSPORTATION OBJECTIVES

- Efficient and reliable travel of transit vehicles down the corridor.
 -  Safe, Comfortable Downtown Streets
 -  Resilient, Energy Responsible Downtown
- Safe and comfortable passenger waiting, boarding and alighting at transit stops.
 -  Safe, Comfortable Downtown Streets
- Quality and inviting pedestrian environment.
 -  Connected Community with Streets as Civic Spaces
- Accommodation of through and circulating vehicles and bicycles.
 -  Safe, Comfortable Downtown Streets

Applicable Frontage Contexts

Commercial
Mixed
Civic & University

Example Street Segments

Washington Street (Fifth Avenue to Thayer Street)
Fourth Avenue and Fifth Avenue (Huron Street to William Street)
North University Avenue (Fletcher Street to Geddes Road)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements
Sidewalks – minimum 6 feet Clear Walk Zone
Street lighting and pedestrian-scaled lighting
Well marked crosswalks
Transit signs and seating at bus boarding stops
Travel lanes wide enough for transit vehicles
Street trees
Sharrows or higher level bicycle facilities

Typically Recommended Design Elements
Bus bulbs, queue jumps and/or signal priority
Transit shelters
Bicycle parking (racks or corrals)
Bumpouts
Dedicated transit lanes
Trash and recycling receptacles close to bus stops

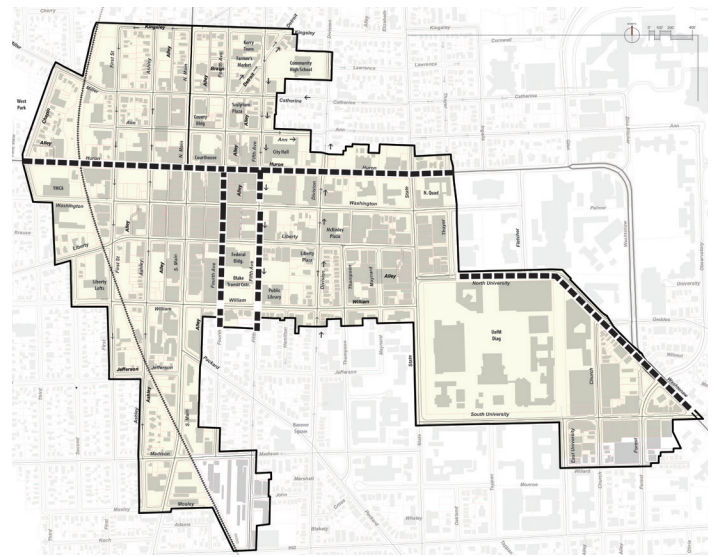


Figure 2.4.3 - Transit Key Map





BALANCED

FUNCTIONAL EMPHASIS

DESCRIPTION

Balanced streets do not default to any particular modal emphasis, but instead balance the needs of many different travel demands on the corridor.

Balanced streets are complete streets. They provide safe and comfortable accommodation for bicycles and pedestrians while concurrently providing reliable progression of vehicle traffic including transit vehicles.

Balanced streets are not, however, identical in their design or approach. For example, some balanced streets may provide a higher quality bicycle facility while others enhance transit accommodation.

All balanced streets are quality streets for walking and local pedestrian activity as this is the foundation of downtown and the vitality of the area.

TRANSPORTATION OBJECTIVES

- Provide for safe travel of all travel modes, preferably enhancing both the efficiency and attractiveness of high volume, sustainable modes.



Safe, Comfortable Downtown Streets



Resilient, Energy Responsible Downtown

- Ensure a walking environment and legible pedestrian network that provides for all residents of the area from the very old to the very young of all physical abilities.



Safe, Comfortable Downtown Streets



Equitable, Just Access for All People

Applicable Frontage Contexts

Commercial

Mixed

Civic & University

Near Neighborhood

Example Street Segments

South Main Street (south of William Street)

Kingsley Street

Division Street

Thompson Street

State Street (south of William Street)

DESIGN ELEMENT PRIORITIZATION

The full design element prioritization chart provides the complete reference for design elements. Some critical design elements for this street type are listed below:

Typically Required Design Elements
Sidewalks – minimum 6 feet Clear Walk Zone
Street lighting
Marked crosswalks
Travel lanes
Street trees
Sharrows or higher level bike facility
On-street parking

Typically Recommended Design Elements
Bike parking
Bus stops
Curbside uses that buffer the pedestrian ways
Loading zones, short-term parking, and drop-off areas
Benches and seating
Mid-block crossings

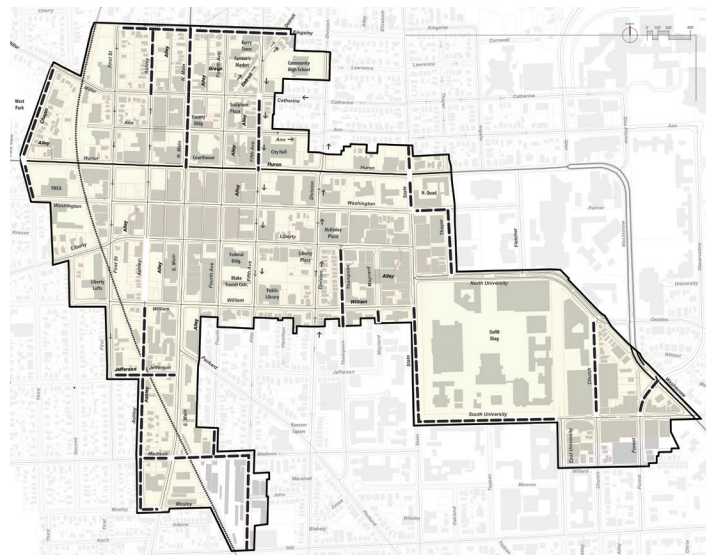


Figure 2.4.4 - Balanced Key Map





ALLEYS

DESCRIPTION

Alleys provide valuable access to multiple parcels and properties without requiring multiple curb-cuts that interrupt the pedestrian way, conflict with bicycles, and hinder the progression of vehicles in the street.

The primary purpose of alleys is to provide access to properties for services including loading and deliveries and waste removal. New alleys must be designed wide enough to facilitate maneuvering of larger service vehicles and must be well managed to minimize blockage or constrained passageways.

Pedestrians and bicycles will utilize alleys either to access properties or to travel through the middle of a block; however, alleys generally do not have any designation of space to separate non-motorized users from the heavier vehicular traffic. Therefore, caution is advised to pedestrians and bicyclists when traveling through an alley. Since many residents access their downtown home through an alley, alley design and improvements should acknowledge this and consider opportunities to make alleys safer and more inviting while first and foremost meeting service needs.

TRANSPORTATION OBJECTIVES

- Provide efficient access and servicing of properties on a common square/block.



Vibrant and Thriving Local Economy

- Provide space for service functions; keeping them out of view and reducing competition for valuable street and sidewalk space.



Connected Community with Streets as Civic Spaces

- Minimize curb-cuts, driveways, and other vehicular access drives.



Safe, Comfortable Downtown Streets

- Integrate art.



Connected Community with Streets as Civic Spaces

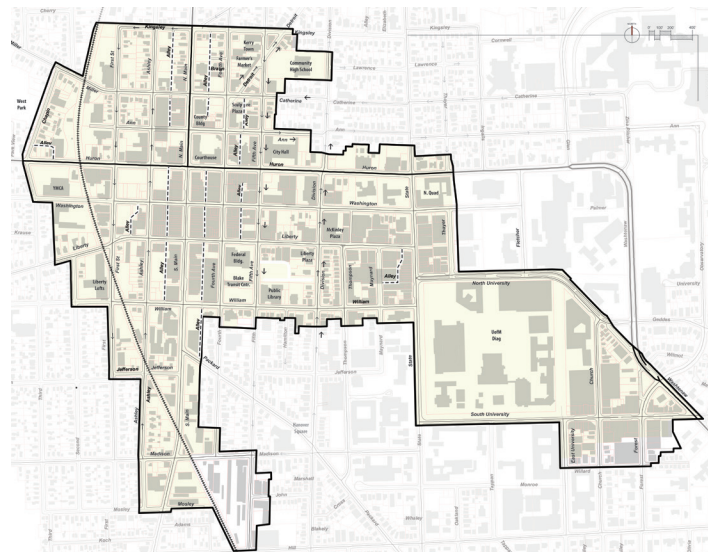


Figure 2.4.5 - Alleys Key Map

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3.0 USER GUIDE

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3.1

STREET DESIGN PROCESS

OVERVIEW

Regardless of origin and whether public or private, every project that impacts the street is required to follow the Downtown Street Design Manual. Small- and large-scale projects should be examined and considered for opportunities to advance the vision and goals of the Downtown Street Design Manual.

The Street Design Team

Central to ensuring that street projects are designed, constructed, and maintained in accordance with the Downtown Street Design Manual is the Street Design Team. The Street Design Team is an interdisciplinary group comprised of DDA staff and City staff from multiple city departments, including: Systems Planning Department, Engineering Department, Public Works, Planning and Development, and AAATA (TheRide).

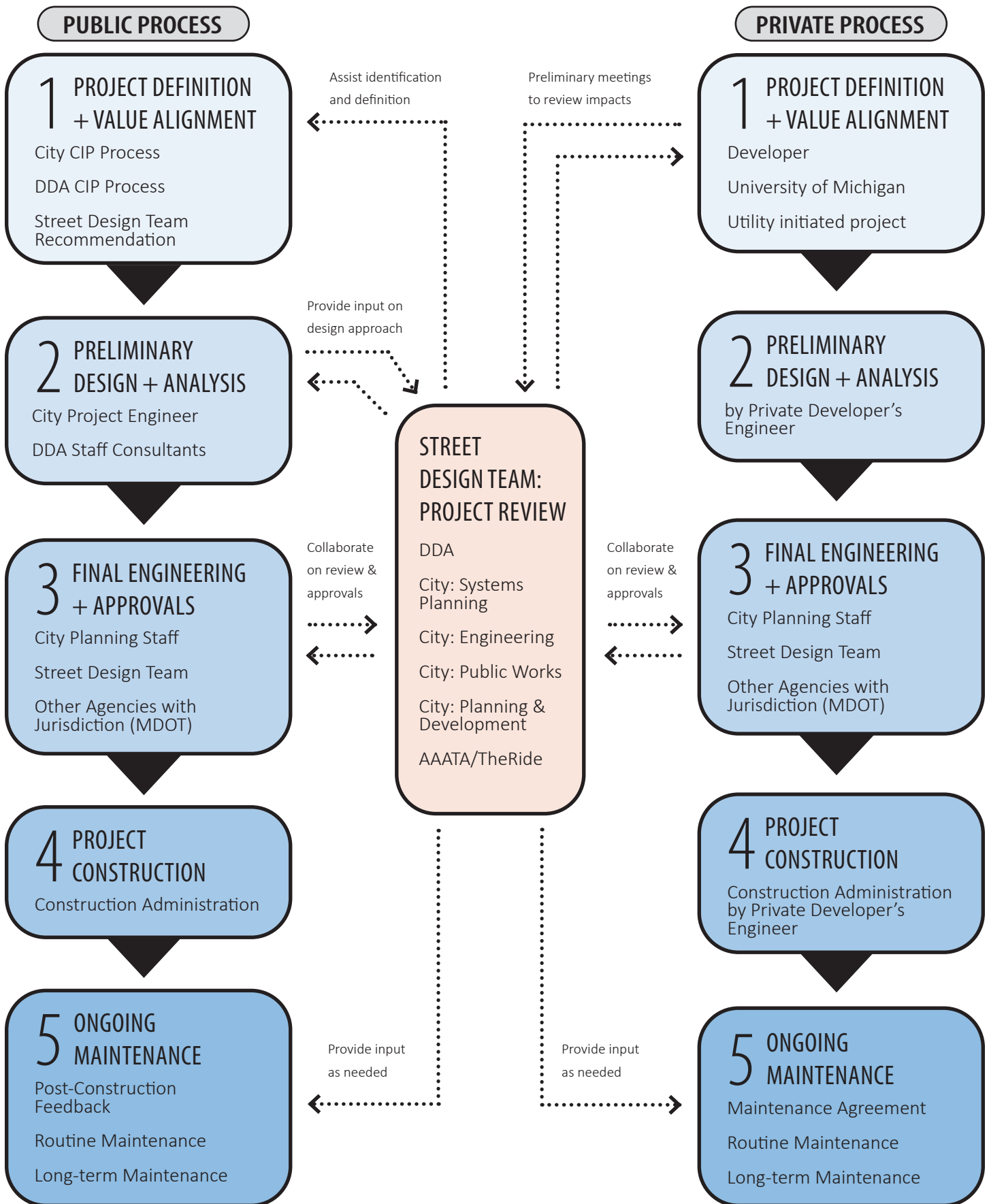
The Street Design Team is responsible for coordinating and assisting with street design and planning decisions for major street projects as well as significant maintenance activities on an as needed basis. The Street Design Team can assist project designers and engineering to verify that design decisions and allocation of uses within the right-of-way fit with the vision and goals of the Downtown Street Design Manual.

Street Design Process

Public and Private Street projects typically proceed through a five step process with input from the Street Design Team at key milestones (Figure 3.1.1). The entities responsible for executing the work associated with each step differs between Public and Private projects.

1. Project Definition + Value Alignment
2. Preliminary Design + Analysis
3. Final Engineering + Approvals
4. Project Construction
5. Ongoing Maintenance

Figure 3.1.1 - Project Street Design Process



STEP 1

PROJECT DEFINITION + VALUE ALIGNMENT

Street design projects typically initiate from one of three project types: maintenance and operations projects; capital improvement projects, or private development projects. Each of these project types has a different set of needs and opportunities that informs physical changes in the street design. Once a project is initiated, the street design process begins by developing the scope of improvements, which includes identifying specific design elements and establishing project budgets. Decisions made during the definition and value alignment process should align with the seven values, as described in Chapter 01.

- **Maintenance and Operations Projects:**
 - » These projects arise from routine maintenance needs, safety interventions and/or operational changes. Maintenance and operations projects are the majority of street work done in any city.
 - » These projects are generally limited in scale, have relatively small budgets, and generally do not involve major construction.
 - » Despite these limitations, simple street improvements, such as pavement markings, can often be incorporated at relatively little additional cost.
 - » Projects of this type may include, but are not limited to: street resurfacing, pavement markings/re-striping, landscaping, street tree plantings, signage/signalization changes, street furnishings, sidewalk repairs, curb repairs.
- **Capital Improvement Projects:**
 - » Capital projects typically provide the most profound change in street environment and function, but are also less frequent. Unlike maintenance or operations projects, capital improvements projects typically encompass a large segment of the street or district.
 - » Requirement for a Capital Improvement Plan (CIP) is per the State Planning Enabling Act. Projects supported by local public dollars must be reflected in the City CIP. In 2013, City of Ann Arbor ordinance was changed to reinforce that DDA projects must be in the City CIP. This includes infrastructure projects over \$100,000 and studies that will inform infrastructure improvements over \$50,000.

- » The CIP is intended to be used as a tool to implement the City’s Comprehensive Plan goals and assist in the City’s financial planning. Staff planning meetings to define projects and coordinate scope and schedules take place annually August – November. The CIP outlines public expenditures for a six-year period.
- » Designs evolve through an intensive public engagement process and broad coordination across city units. Given the typically higher cost and greater complexity of these projects, capital projects may take several months to years to be fully planned, designed, and implemented.
- » All street design projects should coordinate with other street/road or major construction projects to ensure there are no major issues due to concurrent construction activities, such as simultaneous disruptions to traffic patterns. Whenever possible, capital projects should be phased to coincide with maintenance needs.
- » Projects of this type may include, but are not limited to: full street reconstruction, major utility improvements (e.g. sanitary, storm, or water

Table 3.1.1 - Street Design Elements Common to Private Projects

Section 4.1 - Pedestrian	Street Zone
◆ Sidewalks + Pedestrian Area	Pedestrian Area
◆ Curb Ramps	Intersections
◆ Benches & Seating	Amenity Zone

Section 4.2 - Commercial Support	Street Zone
◆ On-Street Parking	Curbside Zone
◆ Café Seating & Outdoor Retailing	Amenity/Frontage
◆ Loading Zones	Curbside Zone
◆ Short-Term Parking & Drop-Off Zones	Curbside Zone
◆ Alleys	-

Section 4.3 - Bicycle	Street Zone
◆ Bicycle Parking	Amenity Zone
◆ Bike Corral	Curbside Zone

Section 4.5 - Vehicle	Street Zone
◆ Driveways & Curb-Cuts	Pedestrian Area
◆ Fire Access Lane	Roadway Zone

Section 4.6 - Infrastructure & Landscape	Street Zone
◆ Street Lighting	Amenity/Frontage
◆ Street Trees	Amenity Zone
◆ Stormwater Management	Amenity Zone
◆ Lawn Extensions	Amenity Zone
◆ Landscape Planters	Amenity Zone
◆ Utilities	Amenity Zone

main replacement or upsizing), comprehensive streetscaping (including new lighting and amenities), lane and/or curb reconfigurations.

- **Private Development Projects:**

- » All private development projects that undergo site plan review must conform to the Downtown Street Design Manual. The exceptions to this are 1) A remodel/addition that does not impact the public ROW through construction or equipment staging and 2) Where a capital project is proposed and budgeted in the near future..
- » When planned, coordinated and reviewed properly, these provide yet another opportunity to ensure that improvements are made in alignment with community goals. While improvements may occur in only segments of a block, they contribute to the incremental transformation of the street.
- » Projects of this type may include, but are not limited to: repair or reconstruction of the sidewalk and amenity zones, changes to curbs or curb-cuts, utility infrastructure, landscaping, lighting, street furnishings, repair or reconstruction of the roadway, sidewalk, parking and/or lane closures for construction.
- » Table 3.1.1 lists Design Elements most commonly related to private development projects. Refer to Table 3.1.1 in Section 3.1- Street Typologies, for the full listing of design elements and their priority.

STEP 2 PRELIMINARY DESIGN + ANALYSIS

Analyzing the existing conditions within a project area allows for an understanding of the necessary considerations to create a successful street design. Typical analyses include multi-modal data collection, bicycle and pedestrian crash data review, sidewalk occupancy permits, parking and loading conditions, non-motorized network review, and community plans (such as the City of Ann Arbor's Transportation Plan, various non-motorized plans).

Findings from the analysis leads into Preliminary Design, which is an exercise in balancing priorities with trade-offs, and aligning desired outcomes with community values. The high activity paired with constrained right-of-way width of downtown streets make it nearly impossible to include every element, every time, everywhere. The street typology approach, presented in Chapter 2, recognizes that all street user needs must be met by the system and district as whole, but individual streets may emphasize certain uses over others as a necessary design balance. Examples of trade-offs include: choices between wider sidewalks or a dedicated turn lane; meeting the needs of trees or the need of transit; parklets or parking; bicycles or bus ways; vehicle volumes or sidewalk vitality.

This manual strives to ensure that street improvements serve the context of adjacent uses and improve access in alignment with city goals. The guidelines of this manual will increase predictability for all users such as: public agencies, private developers, utilities, or members of the public.



To use this manual in street design and decision making, use the following steps:

1. Determine the applicable street type for the project (see Street Framework- Section 3.1).
 - » Understanding the context of the street and its critical role in both the transportation system and development plan of Ann Arbor.
2. Identify required and appropriate street design elements for the project (see Design Element prioritization in Section 3.1).
3. Follow the guidance of Section 3.4, Street Corridor Assembly to determine typical road cross-sections and layouts.
 - » Identifying conflicts between elements and street dimensions.
 - » Exploring modifications to sidewalk width, space allocation, and other alternatives to meet the greatest number of needs.
 - » Evaluate against the performance criteria for both location and function based on the street's typology (see Frontage Context- Section 3.2, and Functional Emphasis - Section 3.3).
 - » Selecting a preferred alternative through the review process outlined in section 2.1.
4. Engage the public and stakeholders to address user needs, such as equity opportunities, safety concerns, and desired uses for the streets.
5. Design and locate specific individual design elements as detailed in Chapter 4.

STEP 3 FINAL ENGINEERING + APPROVALS

Projects will be reviewed to ensure they are both compliant with all city standards and advancing the objectives of this manual. The origin of project identification determines the method of project review.

- **Projects originating from a maintenance, safety or operational need** will generally be identified and prioritized by maintenance and operations staff, which will coordinate with the Street Design Team for opportunities to further align with the manual/meet the goals of the manual.
- **Capital projects** will be reviewed and refined through the Street Design Team which includes both City and DDA staff who consult with maintenance and operations units.
- **Private development projects:**
 - » Project will be reviewed by the City's site plan review staff.
 - » City staff will consult with the Street Design Team as needed.
 - » Project owners are responsible for identifying and following the Downtown Street Design Manual requirements as part of the site plan review process.

After reviews and approvals, projects proceed to complete the Final Engineering. During this step the project designers create Construction Documents for contractors to execute the work.



STEP 4

PROJECT CONSTRUCTION

Successful street projects require significant coordination during the construction phase to ensure that critical services and access are maintained during construction, and that businesses, residents, and other users along the affected corridor are well-informed about construction sequence and activities.

Construction should be coordinated in close collaboration with the project owner, designers/engineers, construction contractors, DDA staff, and city staff. The following types of activities are essential to clarify in advance and during construction:

Construction Planning & Phasing:

Consider the following elements as you develop the MOT, construction phasing, and finalize construction documents. Begin 6-12 months prior to construction:

- Changes in traffic patterns for pedestrians, bikes, and vehicles. Maintenance of Traffic (MOT) plans should be reviewed to ensure critical access. Considerations include construction detouring, decisions about closing full blocks or partial blocks, and timing of closing intersections.
- Coordination around special events, especially the Ann Arbor Art Fair, may require a pause in construction activities or a postponement of street / sidewalk closures. Construction is typically halted in the downtown during Art Fair, regardless of the project location.
- Identify parking, loading, and curbside uses and where impacts to those can be mitigated. Work with DDA parking operator and the City Signs & Signals Unit to create temporary curb-side use zones as needed. Traffic Control Orders (TCOs) may be required if curb side uses are changing. Account for access to solid waste containers and collection operations.

- Determine allowed staging areas and impacts outside of the direct construction zone.
- Coordination of changes to intersection controls (i.e. converting signals to all-way stops). A 90-day flashed red period is required when converting to an all-way stop.
- Coordination with utility providers (DTE, Telcomm) to coordinate any relocations/adjustments of utility lines.
- Coordination with building owners where underground sidewalk vaults may be present and impacted by construction activities.

Ongoing Construction Coordination & Communications

Begin 6-12 weeks ahead of construction:

- Maintain access to the front door of business and avoid closing sidewalks outside of the most critical construction activities (i.e. replacement of sidewalks or when hazardous conditions are present). Coordinate provisions for signage and wayfinding to direct people to businesses.
- Communication protocol for reaching out to businesses, residents, and property owners along the corridor to answer questions, respond to issues, and inform them of upcoming disruptions to traffic patterns.
- Public outreach and communication about the status of construction, schedule, and disruptions due to construction activities.

STEP 5

ONGOING MAINTENANCE + PERFORMANCE EVALUATION

Ongoing maintenance after the construction of a project is essential to the performance and longevity of the street. No matter how well the street is designed, routine maintenance, such as snow and ice removal, is critical to ensure the safety and performance of streets.

Monitoring and measurement are critical components of street design. Follow-up monitoring is important not only for verifying that street designs function consistent with their design but also as a basis for informing future design and planning decisions.

Performance metrics should be identified during the initial project definition process and should relate to the purpose of the project and specific desired outcomes. Methods for measurement should be clearly defined. Some metrics may be quantitative (e.g. number of cyclists, valuation of building permits, etc.) while others may be qualitative (e.g. consumer preference surveys, intercept surveys, etc.). Baseline data should be recorded prior to implementation and an appropriate period(s) for post-assessment defined.

This data is invaluable in estimating the value of improvements and guiding future similar projects.

Common challenges faced in measurement and monitoring can be overcome by:

- **Define time-lines and methods for data collection**
 - For two data points to be compared, they must be collected in the same way both times. However, given the long lag time between project identification (when baseline measurement should occur) and project delivery (when post assessment should occur) it is common for staff to change or methods to be overlooked. As part of creating a system for data management, create details time lines and procedures for monitoring.
 - » The DDA's Downtown Benchmarking project could be used as a model for monitoring and measurement.
- **Building capacity data collection.** Public agencies do a lot with limited resources. Post-project data collection is often a task that is sacrificed among other needs and demands. When data must be collected from multiple sources (e.g. sales tax information, crash data, and consumer preferences) it makes the task of data collection even more complicated and subject to delay. Create a role for project data collection among City and/or DDA staff to help alleviate these challenges.
- **Establish a system for data management.** Even if data is collected, it may be retained by individual project managers or units without institutional knowledge or the ability to access for future projects. Create a standard set of spreadsheets for projects that can be tailored to fit specific project needs but still allow for equivalent comparisons. Ensure that data is distributed back to City and/or DDA staff for collection.



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3.2

DESIGN STRATEGIES

Designing streets is a complicated process and must balance the need of many different street users across a diversity of land use contexts. As public or private development projects are identified, designed, and reviewed, a number of key strategies can be utilized to aid the design process and make informed, holistic decisions regarding the future of downtown streets.

- 1. Be honest about trade-offs.** We are so used to thinking about streets as places to move cars that we often fail to notice when the trade-offs we are negotiating are only between the other elements. We often make tough choices between quality pedestrian facilities, trees, parking/loading, bicycle facilities or transit accommodation while failing to scrutinize vehicle demands to the same extent. While vehicles are an important and even vital user of downtown streets, giving equal consideration to each street user type will lead to a more balanced network and better streets overall.
- 2. Integrate street and urban design.** The best streets compliment what is on the pavement and what is along the block. High vehicle volume is kept out of quiet neighborhoods, adequate lighting is provided on heavy pedestrian streets, large canopy trees are provided on high speed streets, crosswalks are on all streets, on-street parking is available for storefront commercial, driveways are restricted along destination commercial streets. Street and urban design must compliment one another.
- 3. Strive for consistency.** Consistency in facility design increases the legibility of a street and makes it more predictable and inviting for travelers. However, the context of a street commonly changes as it transitions from one area of downtown to another. The street design may also change along the corridor. If implementation is incremental, as through maintenance or development projects, ensure transitions are logical and intuitive.
- 4. Understand the circulation network.** Streets do not exist in isolation. They are part of networks, such as stormwater drainage, bus routes, parking/loading, Shopping District, bicycle routes. If a particular element does not “fit” on a particular street, perhaps it can be moved to another. Conversely, some elements are necessary to complete a network. Working in multiple scales helps to understand a street and its network.
- 5. Consider maintenance.** Each of the elements includes consideration of maintenance, but good street design must consider the maintenance of the total street design as a whole. Does it introduce any complications for snow removal? Will it add additional cost when the street must be repaved? How many pavement markings, signs, signals and lights are there that must be kept up? Are there opportunities for efficiencies? Are there partnerships in place to maintain landscaping, art or other unique elements?

Maintenance Tasks include: snow clearing, sweeping, waste management, repairs, patching, utility maintenance, cleanouts, landscape care, furnishings upkeep, pavement markings repainting.

6. Phase in funding. Streets are expensive and budgets are limited, but with strategic phasing, collaboration, and creative approaches to design, budget constraints do not have to preclude street improvements. Pavement markings and non-permanent fixtures (e.g. bike corrals, planters, and rubber curbing) dramatically change the character of a street quickly and at relatively low cost. More permanent improvements can be phased over time as development projects come on line, utility upgrades are conducted, or routine maintenance projects advance.

7. Try before you buy. Pilots, temporary installations, are a great way to test street concepts and evaluate the trade-offs empirically rather than theoretically. Most pilots can be safely and attractively implemented with minimal cost. Additionally, pilots can generate and engender positive public outreach. Keys to a successful pilot include:

- » **Clear communication.** Make sure all stakeholders and the public know about the pilot, its objectives, its duration, and who to contact with any comments or concerns. Provide stakeholders and the public with the post-pilot findings and recommendations.
- » **Defined measures for evaluation.** A pilot is a test of a concept and as such requires evaluation. Relate evaluation measure to the objectives for the street as defined in the Street Type section. Establish clear methodology and accountability for data collection prior to the pilot.
- » **Finite duration.** Pilots are temporary and may only last for a couple of days over a single weekend or for months. Communicate to all stakeholders the duration of the pilot and ensure the pilot does not exceed this period, unless it is made permanent.

Potential issue: The limited timeframe is a potential problem with pilot studies, as some use scenarios may not be tested. For example, a temporary installation will not be tested in all seasons and may miss special events.

8. Design for future adaptation. Wherever possible, streets should be designed with flexibility and adaptability in mind. Where safety, accessibility, and other project goals can be achieved, minimizing permanent improvements and/or designing flexible spaces that respond to changing needs overtime can reduce infrastructure costs and allow for greater resilience.

9. Control traffic stress based on the target users. The amount of traffic stress influences the way people use streets and the modes by which they travel. Streets should be designed to control traffic stress for the target users. Refer to Table 2.1.1 and Section 2.1 for information on All-Ages & Abilities Street Design.





3.3

CORRIDOR ASSEMBLY GUIDE

This Corridor Assembly Guide provides guidance for establishing overall cross-section widths for a street in the downtown in consideration of the pedestrian area, curbside lanes, bike facilities, and roadway elements. Chapter 4 provides additional detailed guidance for design elements that should also be referenced and used.

STREETS AND RIGHT-OF-WAY WIDTH

Ann Arbor Downtown street rights-of-way are typically 66 feet wide, although some corridors are wider. Right-of-way width should be verified at the start of project through a survey. GIS or property records may be used at the preliminary design stages.

Critical Elements

Streets in the downtown should be designed with the following minimum characteristics:

- One vehicle travel lane in each direction of travel. One-way streets currently exist that may deviate from this pattern. Creation of one-way streets should be avoided.
- Curbing to separate the roadway and vehicle space from pedestrian traffic.
- Continuous, ADA accessible sidewalks on both sides of the street.
- Additional street elements affecting overall assembly may include: dedicated bike lanes, on-street parking (and loading) zones, amenity zones, additional vehicle lanes (left/right turn lanes), medians, and landscaped areas.



KEY TERMS

- **Standard Dimensions:** The starting point for roadway assembly based on preferred dimensions.
- **Truck / Bus Routes:** Where there is frequent bus / truck traffic additional widths may be provided where challenges are anticipated.
- **Constrained Conditions:** Applies to lower volume, secondary streets where existing roadway space is limited and standard dimensions cannot be achieved.

- **Face of Curb:** Line where the curb rises at a near-vertical angle from the roadway.
- **Edge of Gutter:** Line where the gutter (concrete) transitions into the asphalt area of the roadway. Concrete roadways may be designed with integral gutters.
- **Center of Pavement Marking:** Line along which pavement markings are centered, whether it is a 4" or 6" marking.

PEDESTRIAN AREA

Table 3.1.1	Min. Overall Pedestrian Area Width		Sidewalk / Walking Zone	Amenity Zone
	Next to curbside lane or bikeway	Next to vehicle travel lane	Minimum Standard	Minimum Standard
Destination Commercial	16'	19'	8'	8'
Commercial	14'	19'	6'	8'
Mixed	14'	19'	6'	8'
Civic / University	14'	19'	8'	6'
Near Neighborhood	12'	19'	5'	7'

- The width of the clear sidewalk zone should be driven based on the street typology as well as anticipated pedestrian volumes, as shown in Table 3.1.1.
- The sidewalk clear zone shall be located adjacent to the outside edge of the right-of-way / property line and be consistent along the length of the block.
- The overall width of the pedestrian zone (sidewalk to the road curb) should provide adequate space for the sidewalk and amenity zone uses while providing separation from the roadway. A wider pedestrian area is appropriate when directly adjacent to the vehicle travel lane. The desired overall width of the pedestrian area in these contexts is 19 feet where possible.
- The minimum sidewalk and amenity zone widths may be modified at the discretion of city and DDA staff in cases where they are in conflict with zoning setback lines and/or maintaining a consistent street wall.

Figure 3.3.1 - Sidewalks

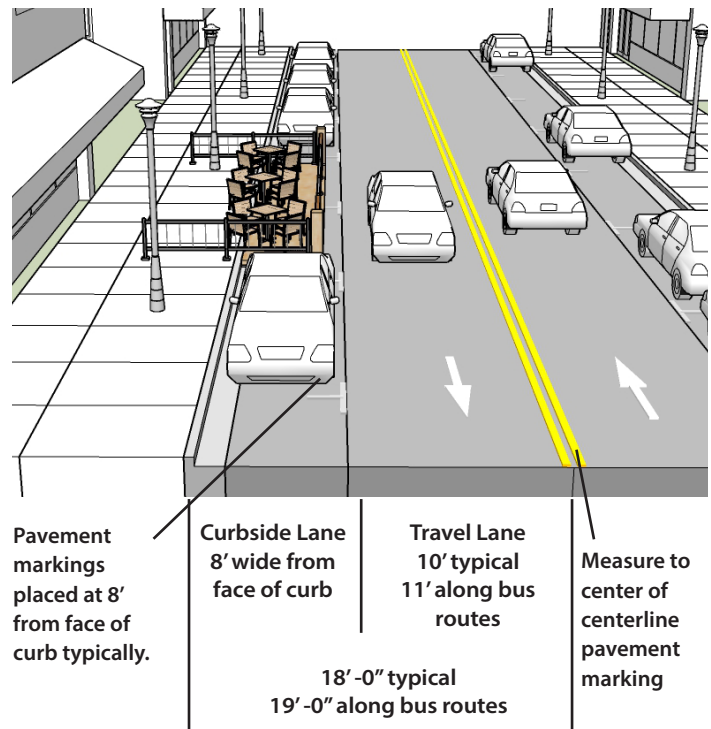


TRAVEL LANES AND CURBSIDE LANES

Table 3.1.2	Standard	On Bus / Truck Routes	Constrained Condition	Point of Measurement
Travel Lane Width (1) (including dedicated turn lanes)	10'	11'	10'	Center of defining pavement markings and/or to the edge of asphalt.
Curbside Lane Width (2)	8'	8'	7'	Face of curb to center of curbside pavement marking
Combined Travel + Curbside Width (3)	18'	19'	17'	(see above)
Curb & Gutter Width (4)	2' (5)	2'	0.5-1.5'	Back of curb to the edge of gutter (aka "edge of metal" line).

1. When a travel lane is adjacent to a curb and no gutter is present, widen travel lane by 1-foot.
2. Wider curbside lanes may be used where there is excess space in the roadway and/or where larger commercial vehicle loading is anticipated.
3. Where parking tighter to the curb is desired, parking lane width can be reduced to 7-feet with the adjacent travel lane widened by the corresponding amount.
4. Constrained locations, with approval, may utilize 12" wide gutters and/or straight curb sections without a gutter with correspondingly smaller drainage inlet structures.
5. For curbless street designs, 2-foot wide valley gutters should be used.

Figure 3.3.2 - Curbside Lanes

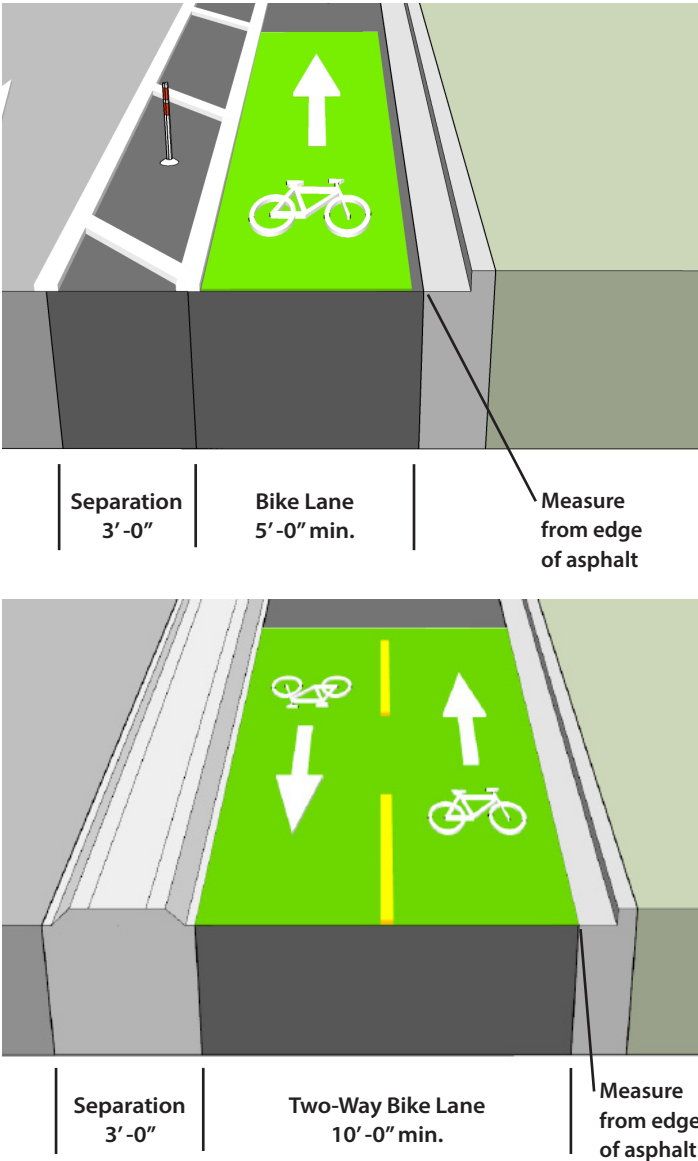


DEDICATED BIKE FACILITIES

Table 3.1.3	Standard	Maximum	Constrained Condition	Point of Measurement
Bike Lane Width (1, 2, 3) (for 1-way bike lanes or as a part of 2-way bikeway)	5'	8' (4)	4'	Center of defining pavement markings and/or to the edge of asphalt.
Bike Buffer - Painted (5)	3' (6)	10'+ (7)	1'	Center of defining pavement markings.
Bike Buffer - Curbed Median (or other vertical treatment is used)	3' (8)	10'+	2' (9)	Edge to edge of the curbed median (including any integral gutters).

1. Lane widths should not include the width of adjacent gutters. The presence of gutters can provide additional flexibility and clearance from adjacent obstructions (e.g. vertical curbs)
2. When directly adjacent to a curb, provide an additional 1' of bike lane width for clearance from curb
3. Bike lanes adjacent to parking (without a buffer) should be widened by at least 1' if space allows.
4. 7' to 8' wide bike lanes can allow for passing within the bike lane itself.
5. Painted buffers may incorporate surface mounted vertical delineator posts to create a separated bike facility.
6. When on-street parking is present, buffers should be prioritized between the bike lane and parking to provide separation from the door zone. Width should be at least 3'.
7. If a wide (10'+) buffer may result, consider incorporating other roadway uses (e.g. curbside lane) and/or wider bicycle lanes.
8. Buffers should wide enough to accomodate any needed signage without signage encroaching outside of the raised portion of the buffer.
9. Where buffers must accommodate waste carts, the flat area on top of the buffer should be least 2'-6" wide.

Figure 3.3.3 - Bike Lane Configuration Preferred Widths



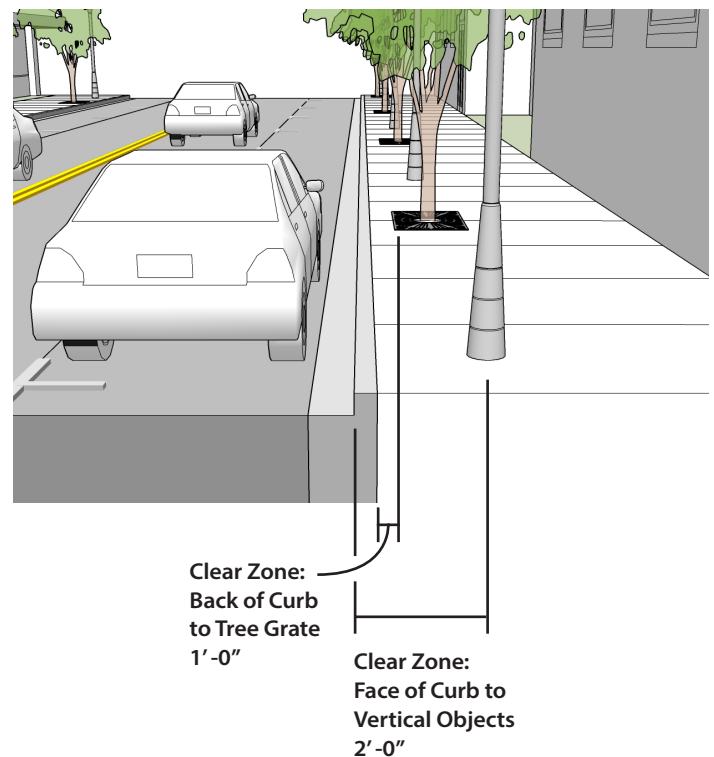
OTHER DETAILS / ITEMS

- **Excess Roadway Width**
 - » If there is excess roadway width, look to incorporate on-street bike lanes and/or widen and buffer existing bicycle lanes further.
 - » If roadway curbs are scoped to be relocated, excess width can be allocated to the pedestrian area.
 - » If providing or widening bicycle facilities is not desired, curbside lanes may be widened.
 - » If no curbside lanes are present or they would be excessively wide (10-feet or more in width) consider zebra striping along the curb edge to maintain narrower lanes or incorporate a roadway median.
- **Clearance Behind the Curb**
 - » The center of parking meter posts, street lights, signage, and other vertical objectives should be at least 2' from the back of curb.
 - » Tree grates should be placed at least 1' away from the back curb.

AMENITY PLACEMENT & CLEAR ZONES

- Tree grates should be offset 1'-0" away from the back of curb at a minimum to allow for proper mounting of tree grates and clearance from the roadway and opening doors.
- Signs, parking meter posts, street lights, and other vertical objects must be at least 2'-0" away from the face of the street curb.

Figure 3.3.4 - Amenity Placement & Clear Zones



PROJECT PLANNING & DESIGN CHECK-LIST

This check-list should be utilized throughout the street design process- including during project scoping and budgeting- to ensure that goals, values, and critical needs are addressed and fully considered. Work through the check-list and answer each question to the extent possible, and note which questions require follow-up or should be addressed a later stage in the design process.

Roadway Uses

- Who are the primary roadway users?
- Is the street a high pedestrian traffic area? Are there gaps in the sidewalk network?
- Are there businesses along the street that want to conduct commercial activity on the sidewalk (e.g. outdoor dining or retailing).
- Is the street part of the city's non-motorized network? Is it a target for a low-stress connection?
- Does the street carry or allow truck traffic?
- Does the street have designated bus routes? Are buses turning onto or off of the roadway?
- Is the street part of an emergency access route or snow plow route?
- Is the street a non-local right-of-way (i.e. MDOT)?
- Is the road currently or anticipated to be used for special events, street closures, festivals, etc.?

Intersection Controls

- How is the intersection currently controlled?
- Are there improvements that can be made to signalization to improve safety (e.g. countdown timers, leading pedestrian intervals, protected left turns)
- Should the intersection be evaluated for conversion from a signalized to a stop-controlled intersection?
- Are there any sight distance and/or visibility concerns at the intersection? What, if any, obstructions are there to clear visibility?
- Does signal infrastructure need to be upgraded, replaced, or modified?
- Does the project include any railroad crossings?

Roadway Operations & Safety

- Are there areas of excess pavement (e.g. overly wide travel lanes, over-sized turning areas)?
- Can excess pavement areas be repurposed (e.g. converted to additional sidewalk space)?
- Are there safety issues and concerns along the corridor? What is the nature of these concerns and what are possible mitigation measures?
- Are additional turn lanes warranted and/or is there an opportunity to repurpose turn lanes?
- Is there an opportunity to advance a road diet or lane narrowing project?
- How does traffic flow, generally, through intersections? Is there evidence for frequent disruptive backups?
- Do sidewalk curb ramps meet ADA requirements?
- Does the sidewalk width meet ADA requirements?

Bike Facility Design

- What is the target level of comfort / accessibility for potential bike facilities?
- Is a separated facility desired (2-way bikeway or separated 1-way bike lanes?)
- What intersection controls will be needed (2-stage turn queues, bike boxes, bike signals, etc.)
- What type of maintenance resources are available for maintaining separated facilities?
- Are special accommodations for curbside uses next to bike facilities needed (e.g. transit stop access, loading zones, etc.)
- Is there adequate bike parking? Is there more bike parking needed?
- Are there micro-mobility and/or bike share facilities that need to be accommodated?
- Does parking need to be removed for the bike facility?
- Does this project require City Council approval?

Curbside Uses & Management

- How are parking zones being used? What type of metered/non-metered spaces exist?
- Is there adequate commercial loading/unloading zones?
- Is there evidence of regular illegal parking/loading (e.g. encroachment into bikeways, parking on the pedestrian zone, blocking travel lanes)
- Are accessible parking spaces available nearby or needed along the corridor?
- Where is waste management occurring (e.g. picking up trash, recycling, and compost bins)? What types of waste management are occurring (e.g. street pedestrian receptacles, private owner's curbside carts)? What is the frequency of pick up? Do bins block the sidewalk or other roadway use zones?

- Are the amenity zone materials suitable given curbside uses (e.g. is there lawn used in areas with frequent curbside foot traffic).
- Is there a need for passenger pick-up / drop-off, or short-term parking?
- Is there a desire or need for outdoor seating? How frequent?

Materials

- What is the condition of the roadway paving? Can it accommodate new pavement markings?
- What resurfacing treatments/methods would be used to restore the pavement condition to an acceptable level?
- Are there special existing materials (paving, historic curbs, markers, plaques, etc.) that need to be maintained, salvaged, or re-installed?

Lighting & Electrical

- Is the project in a location where more consistent and/or brighter pedestrian-level lighting needed?
- Can existing lighting circuits be used for supplying power? Are new electrical supply connections needed?
- Is the project identified by the city's IT infrastructure plan? Does IT conduit need to be provided?
- What overhead utilities (power lines, telecom, etc.) are present? Does the project provide an opportunity to bury overhead lines?
- Are there opportunities and/or a desire for specialty lighting?

Utilities: Water, Hydrants, Sanitary

- What is the condition of water mains?
- Do water mains need to be upsized and/or is there an opportunity to upsize?
- Do existing fire hydrants provide proper coverage? Are new fire hydrants needed? How do these impact the layout and/or curb side uses?
- Are there improvements that need to be made to the sanitary sewer infrastructure?

Green Infrastructure & Stormwater

- Will the project be affected by the city's Green Streets Policy (i.e. is the roadway being fully reconstructed?)?
- What is the target level of stormwater management that is needed? What level is desired and what was budgeted?
- Are there improvements that need to be made to the stormwater infrastructure (catch basins, manholes, pipes, etc)?
- Is the project in the floodplain? Will it require a floodplain permit through EGLE?
- What type of soils are present? What is the infiltration rate?
- Is the project an opportunity for above ground, below ground, or both types of green infrastructure?
- What is the condition and extent of tree canopy along the corridor?
- Are there trees that will be impacted and/or removed by construction? Are any of these landmark or otherwise protected trees?
- What sizes and types of new street trees are suitable for the project?

Signage, Wayfinding, and Public Art

- Is there a desire for banner poles and banners to be used along the corridor?
- Is there a need for banners to stretch across the street?
- Is there special signage (beyond required regulatory signage) that is needed or desired?
- Are there special wayfinding signs that are needed?
- Is there existing public artwork on the corridor that must be protected and/or relocated?
- Are there opportunities for new public art installations to be explored?
- Has the Public Art Commission identified the project for the inclusion of public art?

Implementation

- What cost share agreements are needed with the City of Ann Arbor or other agencies?
- Does the project connect to affordable housing opportunity sites?
- How does the project align with other CIP projects on the corridor or on nearby streets?
- What TCO (Traffic Control Orders) will be needed?
- How will the project affect adjacent properties? What construction easements or grading permits are needed?
- What is the anticipated construction phasing and timeline?
- What property, business owners, and residents need to be involved in the process (planning, design, review, implementation correspondence?)

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SIDEWALK / AMENITY / FRONTAGE ZONE

SIDEWALKS & PEDESTRIANS AREAS

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Pedestrian	✓	✓			
Transit		✓	✓	✓	
Bicycle		✓	✓		✓
Balanced		✓	✓	✓	✓

DESCRIPTION & INTENT

The pedestrian area is the portion of the street right-of-way set aside for use primarily by pedestrians. This area is typically from the curb edge to either the building wall or property line. The pedestrian area has two distinct zones, each running parallel to the right-of-way (figure 4.1.1):

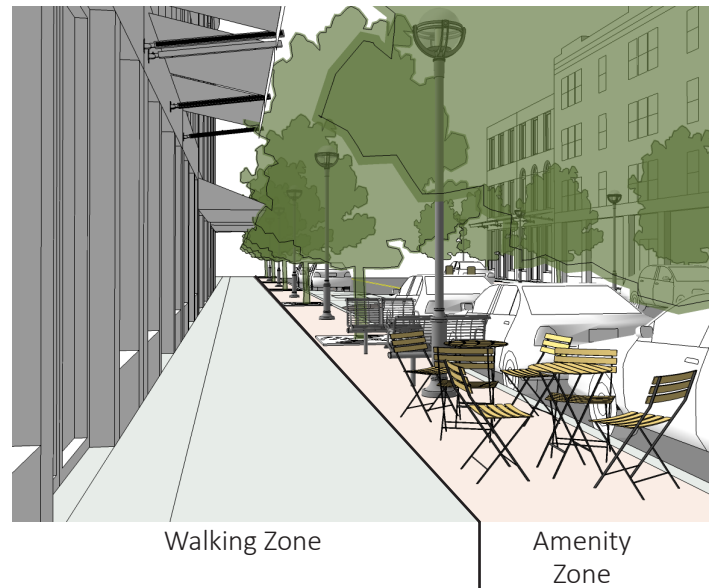
- **Walking Zone:** This is the portion of the pedestrian area dedicated to through pedestrian travel and where sidewalks are typically located. Sidewalk refers specifically to the paved, continuous, walking area for use by pedestrians. Typically the walking zone and the sidewalk are one and the same.
- **Amenity Zone:** This area is located adjacent to the street curb. It is a location for street fixtures such as street lights, street trees, parking meters, bicycle racks, newspaper boxes, bus stops and shelters, signage, signal poles, and landscaping. Cafe seating is often located in the Amenity Zone. The Amenity Zone is often used for depositing snow cleared from roadways during winter months. The Amenity Zone is the point of transfer between pedestrians and transit vehicles, bicycles parking at racks, or autos parked at the curb.

Pedestrian areas should be inviting places. Pedestrian areas are usually set several inches above roadway grade and have a curb designed to deflect vehicles back into the vehicular travel way. Adequate light and shade create a more comfortable pedestrian environment. Ground floor activities, transparent windows, and frequent doors promote observation of and interaction with the sidewalk

giving the perception of many “eyes on the street” which, in turn, enhances the sense of safety.

Sidewalks, the paved areas designed for through pedestrian movement, are used by people of all ages and abilities and for a variety of purposes. Well-designed sidewalks support and enable walking as an appealing form of urban transportation. Sidewalks must, at a minimum, provide a clear, unobstructed pathway sufficient to accommodate persons with disabilities. The best sidewalk design is wide enough to enable small groups to walk side by side engaging in conversation and pass oncoming pedestrians without significant conflict. Walking in a downtown is inherently a social activity and adequate sidewalk width supports this objective.

Figure 4.1.1 - Pedestrian Areas



USE & APPLICATION

Location

- In a downtown area, sidewalks must be provided on both sides of every street, regardless of type or transportation priority. Few conditions and justifications warrant the omission of a sidewalk.
- Pedestrian areas have a total assumed width and an actual effective width. Typically the total assumed width is the width of the paved portion between the curb and property line.
 - » The effective width, however, is the width of the sidewalk (walking zone) itself. The effective width is typically calculated by drawing two lines. The first line is drawn straight, parallel to the curb, from the center-most fixed objects or occupied areas (e.g. cafe seating or retail displays) down the length of the block. The second line is drawn at the building face or inside edge of the Walking Zone.
- Pedestrians are the priority users of the sidewalk. While bicycling on the sidewalk is not prohibited in Ann Arbor, it should largely be discouraged for all but the most vulnerable cyclists. When cycling on the sidewalk, cyclists must travel at a very low rate of speed, provide pedestrians a comfortable buffer, always yield to pedestrians, and call out or signal that they are approaching.
- Sidewalks should not be used for parking or travel by any motorized vehicle except assistance devices for persons with disabilities.



Policy References

- The City of Ann Arbor Comprehensive Transportation Plan (2021) provides guidance on policies, programs, and priority investments.
- The City of Ann Arbor Non-Motorized Transportation Plan (2013 Update) provides policy for pedestrian accommodation and level of comfort evaluation.
- The Downtown Ann Arbor Design Guidelines (2011) provide guidance on ground floor design where buildings engage the sidewalk.
- The Recommended Vision & Policy Framework for Downtown Ann Arbor (2005) provides urban design guidance to improve the pedestrian experience in downtown.
- Sidewalk occupancy permits typically require maintaining a 6-foot wide clear walking area to accommodate pedestrian traffic. The required clear width may be wider for some street types.

DESIGN & OPERATIONS

Design Requirements

- **Continuous:** Sidewalks shall be continuous throughout downtown, connecting to one another via well marked crosswalks with curb ramps.
- **Sidewalk Width:** Sidewalks shall have a minimum clear, unobstructed Walking Zone width as indicated in Table 4.1.1A.
- **Height Clearance:** Objects overhanging the sidewalk, such as signs, banners, planter boxes or baskets, or other features shall provide at least 7.5 feet of clear vertical height.
 - » City and building codes may require additional overhead clearances.
- **Materials:** The sidewalk shall be paved concrete, 6 inches thick or thicker where vehicles may encroach (such as at driveways or alley ways). The sidewalk must be smooth, stable, non slippery, and free from tripping hazards. Materials may vary in the Amenity Zone. Acceptable materials include brick, concrete, neither stamped nor stained, or landscape. Any pavers used in the Amenity Zone must also be non slip. See Table 4.1.1B.
- **Separation:** Pedestrian areas shall be separated from the vehicular travel way via a raised curb. Exceptions may occur where the street is specifically designed to share space freely between all street users including vehicles and pedestrians.
- **Lighting:** Pedestrian areas shall be well lit, preferably with pedestrian-scaled lighting rather than relying on ambient light from roadway lighting systems or building windows. Reliance on privately owned buildings to light the sidewalk via building-mounted lights is not a desirable alternative to pedestrian lighting. *See Lighting Section for more details.*
- **Cross-slope:** Sidewalks must have adequate cross slope to facilitate stormwater run off, but not so great as to introduce a noticeable and uncomfortable slope to sidewalk users. ADA requirements limits cross slopes to a maximum of 2%. The cross slope of the Amenity Zone shall not exceed 5%.
- **Street Tree Accommodations:** Amenity zones shall provide adequate space for street trees to provide shade and buffer for pedestrian comfort. *See Street Tree Design Element for more details.*



Table 4.1.1A	Min. Overall Pedestrian Area Width		Sidewalk / Walking Zone	Amenity Zone
	Next to Parking or Bikeway	Next to Vehicle Travel Lane	Minimum	Minimum
Destination Commercial	16'	19'	8'	8'
Commercial	14'	19'	6'	8'
Mixed	14'	19'	6'	8'
Civic / University	14'	19'	8'	6'
Near Neighborhood	12'	19'	5'	7'

Table 4.1.1B Sidewalk & Amenity Zone Materials

	Sidewalk (Walking Zone)		Amenity Zone	
	Standard	Optional	Standard	Optional
Destination Commercial	Concrete	Porous concrete; Special District Paving *	Concrete	Brick or precast pavers; Special District Paving *
Commercial				
Mixed				
Civic / University				
Near Neighborhood			Concrete; Lawn Strip	

• **Achieving Overall Pedestrian Area Widths:**

- » Overall pedestrian area widths are identified in Table 4.1.1A, as measured from the outer edge of the pedestrian area to the face of the roadway curb.
- » When streets are reconstructed and curbing is replaced, moving the curb line to achieve the minimum overall pedestrian area widths should be assessed and pursued to extent feasible. This may require narrowing and/or removal of vehicle travel lanes and the feasibility of this change may require a traffic analysis investigation.
- » Where new development along the street is planned, buildings shall be set back from the lot line in order to achieve the minimum overall pedestrian area width. Exceptions may be granted, per city staff discretion, where changes are planned to the roadway that can achieve the minimum pedestrian area width within the roadway and/or where setting back the building face would negatively impact the overall character and consistency of the street wall.
- » The width of the sidewalk (walking zone) should be sufficient to achieve a minimum Pedestrian Level of Service D (Figure 4.1.2) throughout most of the day. Occasionally times of Level of Service E in the densest areas is acceptable, but not desired.
- » A wider pedestrian area is appropriate when directly adjacent to the vehicle travel lane. The desired overall width of the pedestrian area in these contexts is 19 feet where possible.
- » Where minimum overall pedestrian area width cannot be achieved, due to (a) existing building configurations, (b) existing curb lines that cannot be relocated, or (c) limited space in the public right-of-way, the minimum sidewalk width should first be achieved and the remaining space allocated to the amenity zone.

*** Special District Paving:** Use of pre-established special district paving materials is encouraged to reinforce the identity of the Downtown Character Districts, such as historic brick materials or porous pavers that are unique to a specific district.

The Street Design Team is responsible for reviewing and approving special paving materials and details for suitability within the Character Districts.

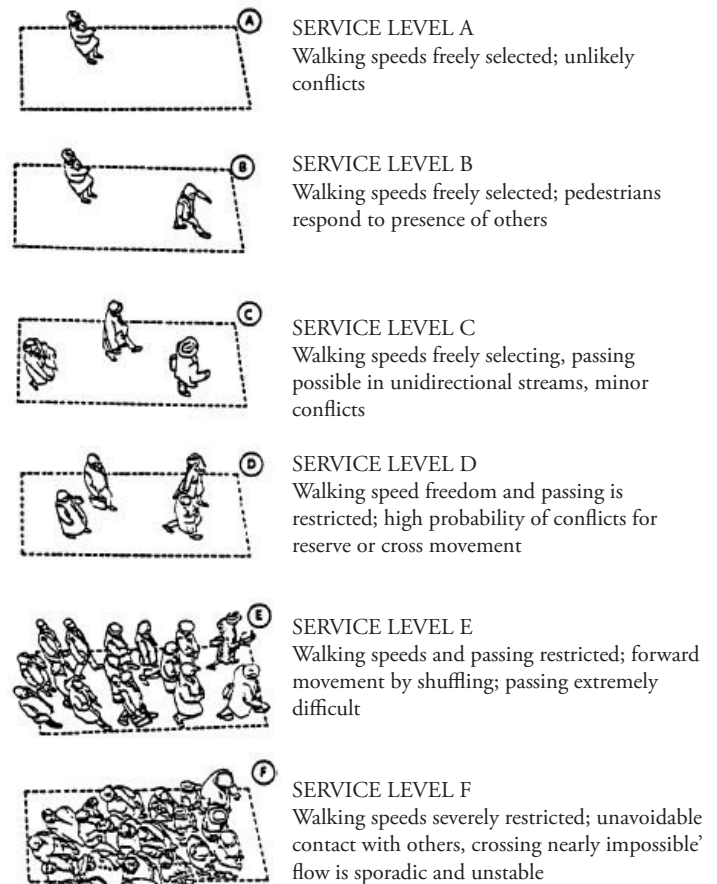


Figure 4.1.2 - Pedestrian Level of Service

- **Pedestrian Buffer:** Pedestrian areas should be adequately buffered from roadway traffic. This buffer may be provided via curbside parking, curbside bicycle facilities, or landscape strips. If landscape strips are the only buffer, the width necessary to provide pedestrian comfort on the sidewalk increases proportional to vehicle travel speeds in the roadway.
- **Construction Impacts:** Continuous pedestrian accommodation and connectivity should be maintained where feasible. Refer to applicable City and Building code documents for further information on sidewalk protections and closures.
- **Street Wall:** Where private property abuts the pedestrian area, landscaping and fencing should be kept below 42 inches to maintain the panorama of the right-of-way and enjoyment of the linear park-like character. Landscaping, fencing, and structures at the corner must preserve minimum sight distance standards.
- **Standard Paver Detail & Specification:** Pavers should be installed in accordance with the DDA's standard paver details and specifications to ensure performance and design consistency.

Utility Considerations

- Utility vaults should be avoided in the Walking and Amenity Zones. Where vaults cannot be avoided, they should be located in the Amenity Zones. Vaults should be discrete and, where possible, screened by landscaping. If a vault must be located in the Walking or Amenity Zone due to site restraints, it must be ADA compliant. The tops of vaults must be solid and cannot be slippery when wet or during cold conditions.

Sustainability Considerations

- May explore permeable sidewalk materials. Grass strips, low impact design (LID) features, or pavers in the Amenity Zone can increase permeability and lower impervious surface. Specific maintenance plans and commitments must accompany non-standard applications.
- Sidewalk material that increases the reflectivity, and thereby lowers the urban heat island effect, may be considered and utilized.
- Amenity Zones provide opportunities for landscaping and stormwater management features. The pedestrian area may also provide space for landscaping and

stormwater management where buildings are set back from the right-of-way and there is adequate space available for landscaping.

- Street trees can dramatically lower the urban heat island effect and retain stormwater.

Design References

- The City of Ann Arbor Public Services Standard Specifications, also known as the Orange Book, provides detailed requirements for materials, design, and construction of sidewalks in downtown.
- The National Association of City Transportation Officials (NACTO) Urban Street Design Guide provides guidance on urban sidewalk design to support downtowns.
- The American Association of State Highway and Transportation Officials (AASHTO) "A Policy on Geometric Design of Highways and Streets," 6th Edition, (2011), also known as the Green Book, offers detailed guidance on the appropriate placement and configuration of sidewalks.



MAINTENANCE & MANAGEMENT

General Maintenance

- Day to day sidewalk maintenance is generally the responsibility of the property owner.
- The City of Ann Arbor repairs and replaces sidewalks as a component of the sidewalk millage.
- The DDA repairs brick pavers in the Amenity Zone.

Seasonal Use & Maintenance

- **Special Uses:** Sidewalks are utilized year round. The Frontage and Amenity Zones of the sidewalk may have seasonal variations in use including outdoor cafes, parklets or platform dining, and/or bicycle corral parking in spring/summer and temporary snow storage in winter months.
- **Snow Removal:** Efficient removal of snow and ice from the sidewalk is critical. *See Ann Arbor Sidewalk Snow/Ice Ordinance for more information.*

Special Maintenance

- Sidewalks are prone to many incidences that degrade accessibility and the quality of the walking environment. Sidewalk heaving due to tree roots and shifting sidewalk pavers, including historic bricks, are two very common special maintenance needs. Providing adequate soil volume, quality non-compacted soil, and sufficient growing space can minimize the potential for adverse impacts on sidewalk pavement.
- Sidewalk pavers, even in historic areas, may be reset to smooth sidewalk surfaces. Quality workmanship at installation is essential.
- Innovative materials, such as porous concrete or rubber pavement blends, provide some distinct advantages but require special monitoring and maintenance. Maintenance plans and commitments must be in place prior to the use of these materials.

Reviews & Approvals

- Sidewalk materials and dimensions are reviewed and approved by the Ann Arbor Engineering Unit.
- Sidewalk Occupancy Permits may be obtained to allow for special uses within the Frontage or Amenity Zones. *See Cafe Seating and Outdoor Retail Design Element.*
- Special paving materials in the Amenity Zone are reviewed and approved by the DDA.





INTERSECTION ZONE

CROSSWALKS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
Transit			✓	✓	✓	
Bicycle			✓	✓		✓
Balanced			✓	✓	✓	✓

DESCRIPTION & INTENT

Crosswalks are the portion of the roadway zone designated for pedestrian use while crossing the roadway. Marked crosswalks provide pedestrians a safe, clear, place to cross the street on foot, while requiring motorists to stop for pedestrians entering or about to enter the crosswalk. Crosswalks signal to other road users, especially motorists, that pedestrians are, or may be, present. Frequent crossings support a walkable place, and encourage more walking.

State law generally provides that when a pedestrian pathway meets a roadway and continues on the other side, pedestrians may cross legally regardless of the provision of a crosswalk or not. In Ann Arbor, code requires a vehicle to stop for a pedestrian standing “at the curb” at a crosswalk location or “within the crosswalk.” Pedestrians entering an unmarked crosswalk must yield to vehicles¹. While they are not the only legal place to cross, marked crosswalks guide pedestrians to the safest crossing locations and increase predictability for motorists and other road users.

Supporting a walkable downtown and making pedestrian connectivity logical, safe, and convenient relies on well-designed crosswalks.

¹ Michigan Uniform Traffic Code “Pedestrians must yield the right-of-way to vehicles when crossing outside of a marked crosswalk at an intersection.”

USE & APPLICATION

Location

- Crosswalks are appropriate and necessary in all Frontage Contexts and Functional Emphasis corridors. Crosswalks may be located at either signalized intersections or unsignalized (e.g. stop controlled, uncontrolled or roundabout) crossings. Crosswalks may be utilized at mid-block locations.
- Marked crosswalks should be provided on streets with traffic volumes above 3,000 Average Daily Traffic (ADT), speeds higher than 20 mph, or corridors with multiple travel lanes. Additionally, crosswalks should be provided in the vicinity of schools, parks, senior centers or other facilities that have concentrations of more vulnerable pedestrians.
- Marked crosswalks should be provided across all legs of all intersections, except those with very low volumes. Pedestrians desire direct crossings wherever sidewalks lead to and continue from an intersection.
- Space crosswalks frequently, ideally every 300 to 400 feet, as pedestrians may choose unsafe and unprotected crossing points if marked crosswalks are too far out of the way. Typically, crosswalks closer than 200 feet are unnecessary unless they need to link important pedestrian destinations or corridors.
- Safe pedestrian crossings require more than just marked crosswalks. Comprehensive street design is necessary to manage driver speed, promote visibility, minimize exposure, and maximize safety for all users.

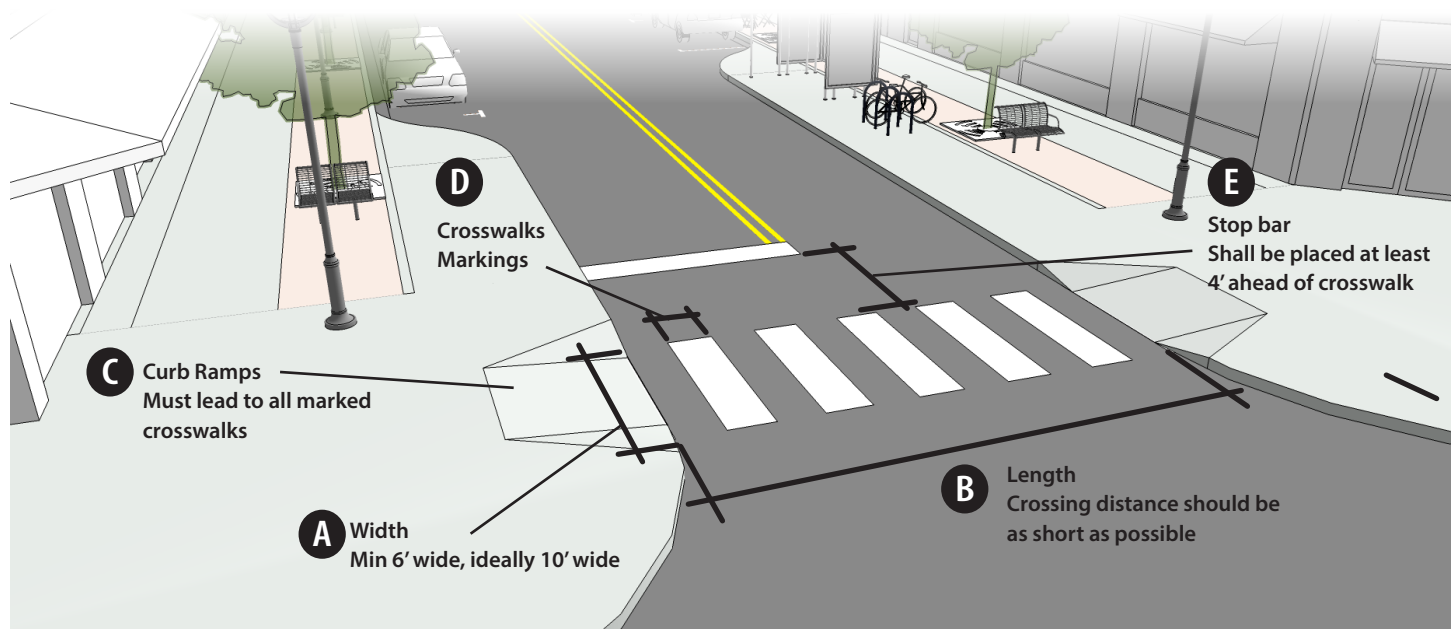
Related Design Elements

- **Bumpouts:** Bumpouts reduce the length of crosswalks, and thus the crossing time for pedestrians. Use bumpouts with crosswalks either at intersections or at mid-block crossings.
- **Signals:** At high volume or high concern crossings where there is no signal or other traffic stop controls, use other appropriate means of highlighting crosswalks, such as hybrid beacons, rapid flash beacons, raised crossings, medians, and other safety measures.
- **Medians:** Where median refuges are used, the crosswalk should “break” through the median with a level, walking surface flush with the crosswalk itself. Detectable warning surfaces should be placed where the crosswalk enters the median refuge to let pedestrians with visual impairments know they are entering a different portion of the crosswalk. A raised “nose” should extend beyond the crosswalk, protecting pedestrians from traffic within the intersection.
- **Bike Boxes:** On streets with a bicycle emphasis, place a bike box between the crosswalk and stop bar. Crosswalks should allow between 10 and 16 feet for bike boxes.

Policy References

- The City of Ann Arbor Public Services Standard Specifications provides multiple recommendations to improve pedestrian crossings.

Figure 4.1.3 - Crosswalks



DESIGN & OPERATIONS

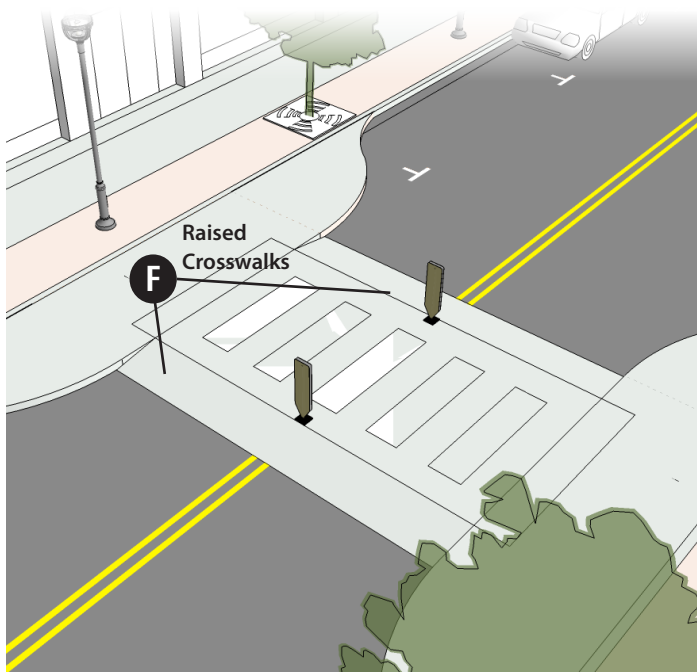
Design Requirements

- A Width:** Crosswalks shall be as wide, if not wider, than the walkways they connect. Crosswalks shall be at least 6 feet wide and ideally 10 feet wide.
- B Length:** Crossing distance shall be as short as possible to minimize exposure and risk. Utilize bumpouts, medians, or crossing islands where appropriate.
- C Curb Ramps:** Curb ramps shall lead to all marked crosswalks to meet accessibility requirements.
- D Crosswalk Pattern Markings:** Markings shall be clear and legible. The standard crosswalk marking in downtown Ann Arbor adheres to the MDOT standard, which is the “continental” design (See Figure 4.1.2). The crosswalk is a series of lines perpendicular to the vehicle travel lane proceeding from curb ramp to curb ramp. Lines shall be of reflective material 12 inches wide and spaced 24 inches apart, extending the width of the crosswalk. In the downtown, the width is typically 8 feet however 10 feet is preferred. Recess markings below finish grade.
- E Stop bars,** solid white bars 12 inches wide that extend across all lanes approaching a crosswalk, should be placed at least 4 feet ahead of the crosswalk line.
 - » If a bike box is present, the stop line should be at least 8 feet behind the crosswalk.

Additional Design Considerations

- **Refuge Islands:** Where the crossing involves four or more lanes (roughly 40 feet), crossings should include refuge islands, which make it easier for pedestrians, especially those with limited mobility, to cross safely. Refuge islands allow pedestrians to make a two-stage crossing improving safety and ease.
- **Signals:** Signalized crosswalks should include pedestrian signals with pedestrian countdowns. Where pedestrian signals are not provided, pedestrians should follow vehicular traffic signals. *See Pedestrian Signals Design Element*
- **F Raised crosswalks** may be used. Raised crosswalks elevate the crosswalk slightly above the typical grade of the street and provide a ramp up and down for vehicles. Raised crosswalks are used at high volume pedestrian crossings or at locations that have demonstrated a significant safety risk. Place bumps at the edges of the raised section to alert pedestrians with visual impairments of where the crosswalk ends.
- **Special Paving:** Projects can utilize temporary decorative crosswalk treatments to enhance place making or introduce public art elements (e.g. such as crosswalk tattoos). These modifications, however, must not degrade the visibility nor the legibility of the MMUTCD compliant crosswalk markings. Glow in the dark paint materials may be contemplated, but require coordination with approving agencies.

Figure 4.1.4- Raised Crosswalks



- » Stamped or colored asphalt or concrete crosswalk treatments can increase maintenance requirements and decrease night time visibility and legibility. These treatments are typically discouraged.

Utility Considerations

- There should be a clear path from the crosswalk to the curb ramp and onto the sidewalk. Ensure that utility infrastructure, such as signal boxes, signal poles, light fixtures, or fire hydrants are outside of the Walking Zone at the end of the crosswalk to create a clear path.

Design References

- The City of Ann Arbor Public Services Standard Specifications provides guidance on crosswalk design and materials.
- MMUTCD specifies crosswalk dimensions, spacing, markings and signage including stop and yield lines.
- The U.S. Access Board and the FHWA provide guidance for designing crosswalks to meet the needs of persons with disabilities.

Figure 4.1.5- Crosswalk Pattern Markings



MAINTENANCE & MANAGEMENT

General Maintenance

- **Signalization:** Use countdown signals and shorter cycle lengths to increase compliance, as pedestrians are less likely to comply with crosswalks with delays over 40 seconds at a signalized crosswalk (or 20 at an unsignalized crosswalk). However, signal cycles should be long enough that all pedestrians can cross in a single cycle. Countdown signals are the preferred treatment and shall be installed wherever possible wherever possible to tell pedestrians how much time they have to cross.
 - » Refer to the Pedestrian Signals Design Element for additional guidance.
- **Crosswalk Re-striping:** Crosswalks are in the travel way of the roadway. As such, they are subjected to substantial wear and tear and fading. Crosswalk markings should be refreshed at regular intervals.
- **Street Resurfacing:** After repaving, crosswalks should be remarked as soon as possible. Use repaving as an opportunity to install higher-visibility patterns.

Seasonal Use & Maintenance

- **Snow Removal:** Crosswalks must be cleared of snow and ice. Crosswalk curb ramps should not be blocked by obstacles of snow, ice or large pools of water.

Reviews & Approvals

- The Ann Arbor Engineering Unit in collaboration with the Ann Arbor Systems Planning Unit are responsible for determining where crosswalks are installed.



INTERSECTION ZONE

CURB RAMPS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
Transit			✓	✓	✓	
Bicycle			✓	✓		✓
Balanced			✓	✓	✓	✓

DESCRIPTION & INTENT

Curb ramps are a short ramp cutting through a curb or built up to it.¹ Curb ramps provide the transition from the sidewalk to the street, and benefit all users, especially those in wheelchairs, people pushing strollers or luggage, and children on bicycles.

USE & APPLICATION

Location

Curb ramps are appropriate, encouraged, and required on all streets of all street types. Curb ramps are required to be installed during road resurfacing projects or corner construction impacts. They are also required by law with any sidewalk construction or reconstruction at intersections or other crossing points.²

Curb ramps should be provided at every marked crosswalk.

Curb ramps should be used along a sidewalk length if the sidewalk is cut by vehicle paths located below the grade of the sidewalk, such as alleys. However, in general, driveways and curb cuts should maintain the sidewalk at grade across them.

Curb ramps, including temporary ones, should be provided when a pedestrian detour is needed to maintain access during sidewalk closures.

Related Design Elements

- Curb ramps should be designed as an integral part of an overall intersection. They should work in concert with crosswalks, pedestrian refuge islands, stormwater drainage and all other features of the intersection.

Policy References

- Title II of the Americans with Disabilities Act (ADA) requires state and local governments to provide access for persons with disabilities to utilize pedestrian crossings. The U.S. Access Board provides detailed guidance on the use, design and location of curb ramps.³

¹ 28 C.F.R. Part 36, Appendix A, § 3.4.

² Michigan Public Act 8 of 1973

³ <http://www.ada.gov/pcatoolkit/chap6toolkit.htm#fn1>

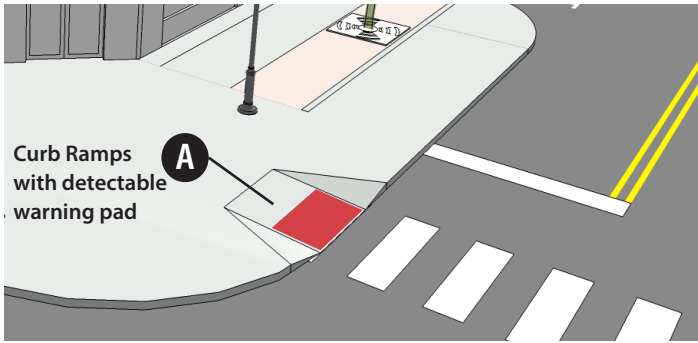


Figure 4.1.6- Curb Ramps

DESIGN & OPERATIONS

Design Requirements

- A Standard Design:** Curb ramps shall adhere to standards established by the Michigan Department of Transportation (MDOT) in compliance with Public Right-of-way Accessibility Guidelines (PROWAG).
- **Crosswalk Alignment:** The curb ramp shall lie within the area of the crosswalk. Side flares may extend beyond the width of crosswalk if necessary.
 - » Wherever possible, curb ramps should be constructed in such a manner that provides an individual ramp in each direction that is oriented perpendicular to the path of travel along the centerline of the crossing.
- **Crosswalk Accessibility:** Where curb ramps provide access to a crosswalk, they shall be provided at both ends of the crosswalk to prevent entrapment within the intersection. Additionally, detectable warning pads are required per ADA code.
- **Refuge Islands:** At crossings that pass through pedestrian refuge islands or medians crossings, 2 feet of detectable warning strips shall be placed at each end of the refuge island.

Additional Design Considerations

- Curb ramps should be designed to avoid pooling of water at the base of the ramp along the gutter pan.
- Increase the width of the curb ramp in areas of high pedestrian volume and crossing activities. Curb ramps facilitate the movement of all pedestrians and their benefit is not limited only to pedestrians with mobility impairments.

- Strengthen the curb section and curb ramp to handle heavy vehicles (e.g. trucks and buses) that may frequently mount the curb during turning movements.
- Do not use pedestrian actuated signals at downtown crossings. Frequent pedestrians crossings should be common and expected.

Utility Considerations

- Provision of ADA curb ramps take precedence and utilities should be moved to permit the provision of the ramp.

Design References

- Public Right-of-way Accessibility Guidelines (PROWAG).
- The FHWA has developed detailed guidance on the design and installation of curb ramps.⁴
- The City of Ann Arbor follows MDOT standards regarding the provision and design of curb ramps.⁵

MAINTENANCE & MANAGEMENT

Seasonal Use & Maintenance

- **Special Events:** When seasonal events take place – such as festivals or street closures – temporary curb ramps should be installed to provide access and circulation throughout the event space.
- **Snow removal:** Perpendicular curb ramps on tangent or directional ramps on radius of corner aid snow removal because plows are traveling straight along the edge of the ramp. Ramps that are located on the radius of the ramp are more susceptible to plows leaving a wedge of snow in front of ramp from traveling past.
 - » Snow clearance of sidewalks should also include clearing of curb ramps to ensure that snow does not block access from the sidewalk to and across the street at crosswalk locations.

⁴ http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/sidewalks207.cfm

⁵ MDOT Ramp Details R-28-F dated October 20, 2008.



INTERSECTION ZONE

PEDESTRIAN SIGNALS

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis					
Pedestrian	✓	✓			
Transit		✓	✓	✓	
Bicycle		✓	✓		■
Balanced		✓	✓	✓	■

DESCRIPTION & INTENT

Pedestrian signals, like vehicle signals, tell people when to cross the street and when to stop and wait. Pedestrian signals, also called “pedheads,” consist of a white “WALK” symbol and a flashing and/or steady “DON’T WALK” symbol.

Intersection operations in a downtown should anticipate the presence of pedestrians, ensure that pedestrian crossings are logical and predictable to all users, and provide adequate time for pedestrians to fully cross the street.

In downtown Ann Arbor, pedestrian count downs and/or accessible pedestrian signals enhance basic pedestrian signals. “Pedestrian count downs” provide information on the number of seconds remaining in a pedestrian cycle. Accessible Pedestrian Signals (APS) are “an integrated device that communicates information about the “WALK” and “DON’T WALK” intervals at signalized intersections in non-visual formats (e.g. audible tones and vibrotactile surfaces).”¹ Signals aid pedestrians with visual impairments and are generally required retrofits when improvements are made to a signalized intersection.

MMUTCD permits pedestrian signals to be fixed (a.k.a. “pre-timed”) or actuated. Pre-timed signals provide a pedestrian walk phase for every leg of an intersection during every cycle, whether pedestrians are present or not. Actuated signals provide a walk phase only when pedestrians are present. Most actuated signals require the pedestrians

to explicitly request the phase by pushing a button. Downtown Ann Arbor is a pedestrian place. Actuated signals are not desirable in the downtown core and should not be used.

USE & APPLICATION

Location

- Pedestrian signals should be installed at all signalized intersections with crosswalks. In some cases, such as mid-block crossings, signals for pedestrians only may be warranted. In high-volume locations, a new traffic signal may be warranted due to pedestrian volumes.
- Crossings in Near Neighborhood crossings may not need to be signalized (e.g. at four-way stops) where pedestrian and traffic volumes are both much lower.

Related Design Elements

- Please see the crosswalk section for details on crossing dimensions, which will affect necessary pedestrian crossing time.
- Required pedestrian crossing time is dependent on the total distance of pedestrian exposure. This is the distance where a pedestrian is off the curb and in the vehicle zone. Pedestrian crossing distances, and therefore required pedestrian crossing times, may be reduced through the use of curb extensions.

¹ Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), Advisory R209

DESIGN & OPERATIONS

Design Requirements

- **Signal Type:** Provide pedestrian signal heads for every leg of a signalized intersection.
 - » **Countdown pedestrian signals** provide greater information and predictability to pedestrians, motorists and cyclists. *See the Countdown Pedestrian Signal Design Element for additional guidance.*
 - » **“Actuated” pedestrian signals** require pedestrians to push a button in order to request crossing are undesirable in downtown and shall not be used.²
- **Timing:** In the DDA District, pedestrian crossings shall be pre-timed. Pre-timed signals ensure that pedestrians are provided sufficient time to cross every leg of an intersection every cycle.
 - » Pedestrian crossing time shall, minimally, meet the current MMUTCD standard, but additional pedestrian time may be needed or desired, especially at crossings with high pedestrian volumes or crossings used by a number of children, seniors, or persons with disabilities.
- Install accessible signals at newly constructed or reconstructed intersections where visual pedestrian signals are installed.
- Clearly mark crossings and provide curb ramps for accessibility.

Additional Design Considerations

- **Longer Crossing Time:** Pedestrian time should be increased at areas with significant volumes of pedestrians or where pedestrians are the dominant users and/or areas where leisurely pedestrian speeds are welcomed or desired.
- **Accessible Pedestrian Signals (APS):** The standard practice for downtown is for pedestrian signals to be pre-timed (i.e. on recall) as part of normal signal phasing. APS that is activated with a push button may be used in combination with the normal pedestrian signal timing to assist pedestrians with visual and/or auditory disabilities in crossing safely.

² Accessible pedestrian signals (APS) should not be confused with actuated signals, although both may appear physically similar. Both commonly feature a push button, however actuated signals must be accompanied by a sign indicating that the pedestrians must push the button in order to cross. Accessible signals may not have signage and provide a walk phase when the button is not pushed.

- » APS signals should be used in locations where there are unique circumstances and/or additional concerns related to pedestrian crossings for those with disabilities.
- » The APS push button must be located such that it meets ADA guidelines for push-button access.
- » The APS auditory messaging should emanate from the push button box itself, and be oriented to provide audio detection for the intended crossing direction and minimize it for non-intended crossings.
- » The APS push button box should indicate through tactile surfacing the direction of crossing, and provide a vibro-tactile feature to assist those with hearing disabilities.

Sustainability Considerations

- Use of light-emitting diodes (LED) or other low energy signal fixtures to lower energy use.

Policy References

- The MMUTCD provides standards for the design and operation of intersection signals.
- The draft PROWAG provides guidance on the use of accessible pedestrian signals.

MAINTENANCE & MANAGEMENT

Special Maintenance

- Pedestrian crossing time should be routinely monitored and adjusted, especially when there is a change in land use near the intersection.

Seasonal Use & Maintenance

- Pedestrian signals should be clear of snow buildup. Clear snow at curb ramps and sidewalks to provide clear access to APS push buttons.

Reviews & Approvals

- The City of Ann Arbor controls all signals on city streets. MDOT oversees signal timing and maintenance on state routes.



INTERSECTION ZONE

COUNTDOWN PEDESTRIAN SIGNAL

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
Transit			✓	✓	✓	
Bicycle			✓	✓		■
Balanced			✓	✓	✓	■

DESCRIPTION & INTENT

Traditional pedestrian signals have symbols for WALK (a white “walking man”) and DON’T WALK (a red hand). Ann Arbor, along with many other communities are adopting enhanced pedestrian signals that also display the number of seconds remaining for pedestrians to cross the intersection.

Pedestrian countdown signals provide greater predictability to the traffic signals in addition to walk phases for pedestrians, cyclists and motorists alike. The additional information provided by pedestrian countdowns enables pedestrians and other travelers to make more informed decisions.

USE & APPLICATION

Location

- Use pedestrian countdown signals anywhere that regular pedestrian signals are used. Pedestrian countdown signals are particularly effective in downtown Ann Arbor.

Related Design Elements

- Pedestrian countdown signals are part of a safe, consistent crossing environment, which also includes crosswalks, curb ramps, pedestrian signal guidance, and sidewalks.
- If pedestrian crossings exceed 90 feet, increase the height of the numerical display to ensure visibility and legibility.

DESIGN & OPERATIONS

Design Requirements

- Activate pedestrian countdown displays at the beginning of the pedestrian change interval together with the flashing “DON’T WALK” symbol.
- Adhere pedestrian countdowns to the current version of the MMUTCD. This requires that numbers must be immediately adjacent (below or beside) to the “DON’T WALK” symbol. Countdown display should be dark at all times except during the pedestrian clearance phase.

Additional Design Considerations

- If signal preemption is utilized, such as by emergency or transit vehicles, the pedestrian countdown display should go dark upon activation of the preemption sequence.

Sustainability Considerations

- Use LED or other low energy signal technologies for more energy efficient countdown displays.

Design References

- The MMUTCD provides standards for the design and operation of intersection signals.

MAINTENANCE & MANAGEMENT

Special Maintenance

- Pedestrian countdown signals introduce no more maintenance needs than other signal devices.

Seasonal Use & Maintenance

- All crosswalks should be kept clear of snow and other obstacles in the pedestrian’s path.

Reviews & Approvals

- The City of Ann Arbor controls all signals on city streets. MDOT oversees signal timing and maintenance on state routes.



AMENITY ZONE

WASTE & RECYCLING RECEPTACLES

DESCRIPTION & INTENT

Waste and recycling receptacles keep downtown environment as clean as possible and free from loose trash and refuse. Waste and recycling receptacles should be provided regularly throughout downtown so that pedestrians encounter them frequently when walking. Receptacles should be durable, visible, and placed conveniently. In addition, receptacles should be easy for maintenance workers to access and empty.

USE & APPLICATION

Location

- Recommended in all areas of downtown. Located within the Amenity Zone, Frontage Zone or the equivalent in the Intersection Zone but set back from all crosswalks.
- Waste and recycling receptacles must be placed such that they do not block major pedestrian movements (sidewalk clear zones), building entries, loading zones or other street functions.
- Place receptacles in locations accessible to curbside pickup and maintenance crews.

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
	Transit		✓	✓	✓	
	Bicycle		✓	✓		■
	Balanced		✓	✓	✓	■

- The frequency of waste receptacles is as follows depending on the street Frontage Context:

Frontage Context	Waste Receptacle - Placement Frequency
Destination Commercial	Each corner of an intersection. Mid-block for blocks longer than 400 feet in length
Commercial	At least two corners of an intersection (diagonally opposite corners)
Mixed	At least one per intersection
Civic/University	At least two corners of an intersection (diagonally opposite corners)
Near Neighborhood	Not required - opportunity only
Near Neighborhood	At least one per intersection when transitioning between Near Neighborhood and a different Frontage Context.

- Separate recycling receptacles should be considered in all locations where waste receptacles are installed to encourage recycling behavior and practices. However, the following minimums are provided:

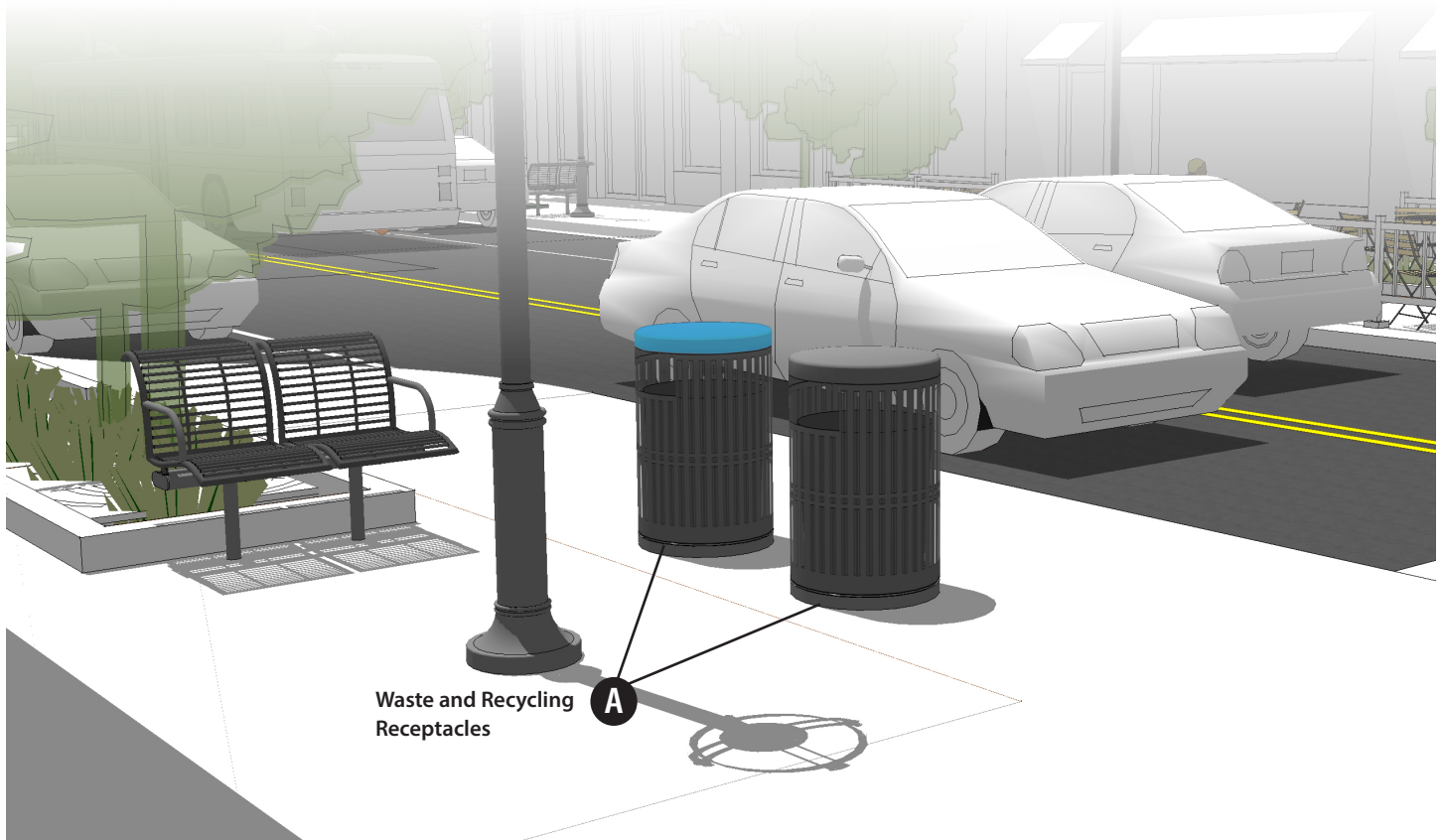
Frontage Context	Recycling Receptacle Placement Frequency
Destination Commercial	At least two corners of an intersection (diagonally opposite corners)
Commercial	At least one per intersection
Mixed	At least one per intersection
Civic/University	At least one per intersection
Near Neighborhood	Not required - opportunity only

DESIGN & OPERATIONS

Design Requirements

- A Durability:** Waste and recycling receptacles shall be constructed out of durable materials (metals) and finishes with a minimum standard warranty of 3-years.
 - **Style:** The style and character of the selected receptacles shall convey a sense of quality consistency with the character of downtown.
 - » Solid plastic receptacles shall not be used in downtown.
 - **Functional Design:** Receptacles shall be closed on the top or otherwise covered such that rain, snow, and other precipitation does not enter the receptacles and mix with refuse.
 - » Where recycling receptacles are provided, separate receptacles are required with a different design style and/or coloration to clearly signify the receptacle for recyclable refuse.
- » Recycling receptacles shall indicate the types of refuse that are recyclable.
 - **Security:** Ideally, receptacles shall be secured to the ground and be designed with an inner container or other mechanism that can be removed to facilitate collection of refuse.
 - » Receptacles shall be able to be unlocked and relocated when needed to accommodate special events or maintenance activities.
 - **Special Character Districts:** Selection of specific street furnishings shall consider the style of established or preferred site furnishings within downtown Character Districts and/or Historic Districts and chose a style that matches or is deemed compatible.
 - » The Street Design Team shall approve selections for consistency with the different Character Districts in downtown.

Figure 4.1.7- Receptacles



Waste and Recycling Receptacles

- **Manufactured Furnishings:** Selected receptacles shall be standard manufactured designs that are readily replaceable. Custom designs and other special order receptacles should not be used due to replacement challenges.

Utility Considerations

- Do not place receptacles directly on top of utility covers, vaults, or infrastructure elements that require access.

Sustainability Considerations

- Use receptacles made from recycled, reclaimed, or salvaged materials when possible.
- Receptacles that increase the efficiency of collection (e.g. smart receptacles like the BigBelly) can minimize energy consumption by collection vehicles.

MAINTENANCE & MANAGEMENT

General Maintenance

- **Public Container Waste Collection:** Responsibility of City of Ann Arbor waste collection crews
- **Receptacle Maintenance:** Ownership and responsibility for receptacle maintenance and replacement is on the City of Ann Arbor.

Seasonal Use & Maintenance

- **Snow Removal:** Snow should not be piled or stored on top of receptacles, both to prevent damage as well as to keep receptacles accessible and usable throughout the year.
 - » The ground below and access to receptacles should be kept clear and free of snow and ice to facilitate efficient collection.

Review & Approvals

- **Private Development Projects:** Private development projects can propose public waste and recycling receptacles in association with development projects that are likely to significantly increase foot traffic.. Selected receptacles, their location, and orientation must be included on proposed Site Plans and approved by the City. All receptacles that serve the waste needs of the private building shall be located outside of the public right-of-way.
- **Public Streetscape Projects:** The selection, location and orientation of receptacles should be coordinated with both City and DDA staff.

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AMENITY ZONE

BENCHES & SEATING

DESCRIPTION & INTENT

Street furnishings include benches, chairs, seat-walls, and other fixed structures that provide places for pedestrians to sit and rest. Street furnishings make using the public streets more accessible for all users and especially those with mobility challenges. By providing places to stop and rest, to wait for services, or just to pause and relax and enjoy the street environment.

Street furnishings include the following types of fixtures:

- Benches (with or without backs)
- Single seats (with or without backs)
- Seat-walls (typically integrated with landscape planters)

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	⚠	⚠			
Transit			⚠	■	■	
Bicycle			⚠	■		■
Balanced			⚠	■	■	■

USE & APPLICATION

Location

- Site furnishings are appropriate and recommended in most areas of downtown outside of the Near Neighborhood areas. In areas with higher volumes of pedestrian traffic (e.g. Destination Commercial and Commercial), site furnishings can be particularly beneficial although they should be so they do not block major pedestrian movements, building entries, loading zones or other street functions.
- In Mixed and Near Neighborhood areas, seating locations should be carefully evaluated to ensure that they will be visible, and regularly used.
- Street furnishings are to be located within the Amenity Zone. Furnishings may be located in the Frontage Zone where adequate width exists for placing the furnishing and accounting for a clear zone for seating that does not encroach into the Walking Zone (typically 5' is required necessary). Furnishings and their clear zones should never impact the Walking Zone.
- Ideally, seating should be placed below street trees or other shading elements.

DESIGN & OPERATIONS

Design Requirements

Refer to the Downtown Bench Specifications for more information on design requirements.

- **Durability:** Construct street furnishings from long-lasting and durable materials and finishes that are backed by a minimum 3-year standard warranty.
 - » Allowable materials include metal (with galvanized and powder-coated steel or stainless steel finished) or composite lumber. Seating walls must be constructed from concrete.
- **Number of seats:** When seating is provided, at least two seats shall be provided adjacent to each other. Single seats placed in isolation are not permitted.
- **Clear Zones & Placement:**
 - » A 3-foot minimum clear zones shall be provided to the sides and front of the seat to provide ADA accessibility and clearance for wheelchairs.
 - » Benches shall have a 5-foot minimum distance from fire hydrants and 1 foot minimum distance from other street fixtures.
- » Seating must not be placed in such a way where people's legs would hang into planting beds or landscape areas.
- » Free-standing seating (not integrated into a landscape bed) should be purchased from a catalog and easily replaceable. Custom furnishings would require a maintenance agreement with the City.
- **Seating Depth:** Benches and seats shall have a seating depth of at least 18 inches.
- **Installation:** Street furnishings shall be cast-in place or otherwise fixed into the street to prevent unauthorized removal.
- **Special Character Districts:** Selection of specific street furnishings shall consider the style of established or preferred site furnishings within downtown Character Districts and/or historic districts and choose a style that matches or is deemed compatible.
 - » The Street Design Team shall approve selections for consistency with the different Character Districts in downtown.





- **Manufactured Furnishings:** Selected furnishings shall be standard manufactured designs that are readily replaceable. Custom designs and other special order receptacles should not be used due to replacement challenges.
- **Seat-walls:** Refer to the Landscape Planter Design Element for dimensional guidance on seat-wall design.

Additional Design Considerations

- Provide a mixture of seating types, where multiple street furnishings are used in close proximity, to accommodate different users needs. Include both backed and backless bench seating and seating both with and without armrests.
- Cluster groups of seating to face each other to allow for small groups to converse.
- Seating can be integrated into building facades or other street elements provided clear zones remain open.
- Concrete seat-walls can integrate metal banding or obstructions to discourage use for recreational activities (e.g. skateboarding) but shall still allow use as seating.

Utility Considerations

- Placed seating on top of utility covers, vaults, or infrastructure elements that require access.

Sustainability Considerations

- Use site furnishings made from recycled, reclaimed, or salvaged materials whenever possible.

MAINTENANCE & MANAGEMENT

General Maintenance

- **Ownership:** The DDA and Public Works maintain public seating and benches in coordination. Benches and seating should be regularly inspected for damage to ensure that provided seating is safe and comfortable for all users.

Seasonal Use & Maintenance

- **Snow Removal:** Do not pile or store snow on top of street furnishings, both to prevent damage to the furnishings as well as to keep them accessible and usable throughout the year.
 - » Sidewalk snow removal is the responsibility of adjacent property owners; care should be take to keep the ground below and leading up to seating free of snow and ice. The ground below and leading up to seating should be kept clear and free of snow and ice.

Review & Approvals

- **Private Development Projects:** Private development projects can propose street furnishings in association with development projects. Selected street furnishings, their location, and orientation must be included on proposed Site Plans and approved by the Ann Arbor Engineering Unit (for conflicts with utilities, ADA, etc.).
- **Public Streetscape Projects:** The selection, location and orientation of site furnishings should be a coordinated effort; recommended by City or DDA staff with final approvals of DDA and the Ann Arbor Engineering Unit (for conflict with utilities or ADA).



AMENITY ZONE/FRONTAGE ZONE

WAYFINDING

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis		!!	!!			
Pedestrian		!!	!!	!!	!!	
Transit			!!	!!		!!
Bicycle			!!	!!	!!	!!
Balanced			!!	!!	!!	!!

DESCRIPTION & INTENT

The most basic form of wayfinding is the street sign. Although often forgotten, street signs are essential for locals and visitors alike to get around the city efficiently. Missing, blocked or unreadable signs are a source of frustration for travelers.

However, Ann Arbor has gone far beyond the standard street sign in aiding wayfinding in the city. In 2009 and 2010, the DDA installed over 200 wayfinding signs to provide guidance to the four commercial districts of downtown - Kerrytown, South University, State Street and Main Street. The wayfinding signs are designed for both motorists and pedestrians. Directional signage provides a convenient path to reach destinations. Informational signage provides local area maps and other local information.

Ann Arbor conducted an intensive design process to develop the unique signage system in place today. Signs feature clean lines and simple styling. Name plates are interchangeable to permit updating and modification as needed.

USE & APPLICATION

Location

Vehicle-Oriented Wayfinding:

- Vehicle-oriented wayfinding is used on key corridors of entry into the Downtown District to guide motorists from surrounding highways or other access points and combined with signage in downtown to lead the driver to their destination. Parking wayfinding accompanies destination wayfinding in Ann Arbor to seamlessly guide motorists to the closest public parking facility from which they can walk to their final destination.

Pedestrian-Oriented Wayfinding:

- Pedestrian-oriented wayfinding is generally concentrated within the commercial areas of downtown. Pedestrian wayfinding leads to the various commercial districts and key landmarks, cultural assets and other destinations within them.
- On-street maps give pedestrians an opportunity to orient themselves and discover other destinations in downtown.
- Wayfinding systems enable travelers to navigate downtown independent of mobile devices or physical maps. Visitors, in particular, benefit from wayfinding systems. The information they provide increases visitor level of comfort and confidence in visiting and traveling around downtown.

Related Design Elements

- Consistently locate street signs throughout downtown to be easily and reliably identified. Signs should be visible from both sidewalk and travel ways from all legs of an intersection approach.
- Locate community wayfinding signs proximate to intersections and crosswalks. Pedestrian wayfinding directional signage must lead to safe pedestrian crossings.

Policy References

- The Ann Arbor Downtown Wayfinding Project is the basic reference guide for community wayfinding in downtown.
- The MMUTCD provides standards on street signs and community wayfinding sign design and installation.

DESIGN & OPERATIONS

Design Requirements

- **Clarity:** Wayfinding signs shall be clear and concise with limited text in order to be quickly read, comprehended and react.
- **Pedestrian vs. Vehicle Wayfinding:** Signs shall be designed for use by the intended audience. Vehicle-oriented signs shall have larger letters while pedestrian-oriented signs may have smaller font size. Pedestrian-oriented signs shall be mounted at pedestrian eye level while vehicle-oriented signs will be mounted higher. Vehicle signs should be retro-reflective to increase legibility at night while pedestrian-oriented signs may be otherwise illuminated.
- **Required Signage:** Wayfinding signs shall not obstruct nor take the place of wayfinding signs required in the MMUTCD. Likewise, community wayfinding signs should not themselves be obstructed.
- **Accuracy:** Wayfinding signs shall be accurate and kept up to date. Inaccurate or outdated signs serve as a detriment to downtown navigation.



Additional Design Considerations

- Follow the guidelines and design for wayfinding signs developed by the DDA in the DDA Wayfinding Standards Manual.
- Install wayfinding signs in the Amenity Zone of the sidewalk and may not impede the Clear Walk Zone.
- Signs intended only for pedestrians, should be inconspicuous to motorists in order to avoid confusion. Pedestrian signs may indicate a route available to pedestrians that is precluded for motorists due to one-way street operations or other factors.
- Do not use logos of individual businesses on wayfinding signs. Signs should focus on providing direction to public institutions, transportation facilities, hospitality services, and cultural and entertainment venues. Only recognized iconic private businesses should be included on vehicle wayfinding signs with Street Design Team and DDA approval.

Utility Considerations

- Signage shall not be placed above utility vault, close to fire hydrants, or other infrastructure access points.

Sustainability Considerations

- Green opportunities for wayfinding are generally limited.

Design Reference

- DDA Wayfinding Standards Manual.

MAINTENANCE & MANAGEMENT

General Maintenance

- **Ownership:** The DDA maintains signs installed as part of the Ann Arbor Downtown Wayfinding Project.
 - » Maintaining the currency of wayfinding signs can be a challenge. Signs must reflect current destinations and current traffic operations. Adjusted signs during temporary construction lasting longer than a few days.
 - » Wayfinding signs are a unique structure in the right-of-way, and special protocols or procedures may need to be established to guide sign restoration in the event of a knock-down or need for replacement.
 - » Wayfinding signs are frequently altered by street users. Directions may be changed, additional informal signage added, stickers or paint applied. These should be promptly removed to avoid confusion and maintain the quality image of downtown.

Seasonal Use & Maintenance

- Snow should be cleared around pedestrian wayfinding maps to ensure that pedestrians can access the maps.
- The DDA maintains signs installed as part of the Downtown Wayfinding Project

Reviews & Approvals

- The Ann Arbor Downtown Wayfinding Project is an initiative of the DDA. Additional wayfinding signage in downtown should be coordinated through the DDA which will, in turn, coordinate with the appropriate City units for design, permitting and installation.

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CURBSIDE ZONE

BUMPOUTS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
	Transit		⚠	⚠	⚠	
	Bicycle		✓	✓		⚠
	Balanced		✓	✓	✓	⚠

DESCRIPTION & INTENT

Bumpouts, also known as curb extensions or bulb-outs, visually and physically narrow the street by extending the sidewalk, reducing pedestrian crossing distance, and increasing pedestrian visibility and line of sight.

At signalized locations, reduced crossing distance enables shorter walk phases and greater flexibility in signal timing. At intersections, the narrower street profile, coupled with the tighter turn radii, can encourage slower driving, calm traffic, and increase safety for everyone.

USE & APPLICATION

Location

Bumpouts are appropriate on all streets and required on all types of streets other than transit emphasis streets. Bumpouts on transit streets will need to carefully consider turner radii of transit vehicles. Regardless of street type, curb extensions may only be used where a curb lane is present and used for parking or loading, not travel.

Bumpouts are particularly beneficial in destination commercial and commercial Frontage Contexts where pedestrian volumes are high and activity concentrated, where traffic calming is desired, on very wide streets, and/or where sidewalks are narrow.

Bumpouts increase safety and pedestrian comfort by increasing visibility and shortening pedestrian crossing

distance. They help increase the visibility of pedestrians at unsignalized crossings, or near large institutions that generate a lot of foot traffic, such as schools.

Multiple types of bumpouts exist and have different applications.

- **Corner bumpouts**, located at intersections and typically wrap around the corner extending the curb into both intersecting streets, are the most common type of curb extension. While generally required, the exact extent and feasibility of installing corner bumpouts must be examined at each corner of the intersection. Corner bumpouts on some, or all, corners may not be feasible or desired in the following cases:
 - » Where there is a loading zone immediately on the far side of an intersection and larger trucks need to pull straight into the loading zone.
 - » Where the specific geometries of the bump-out (considering the needed corner radius) result in a minimal reduction (i.e. 4-feet or less) to the overall crossing distance, the value of the bumpout may be limited.
- **Mid-block bumpouts** are installed in the Curbside Zone along a block. Mid-block bumpouts can be used to narrow a street for traffic calming, additional sidewalk space, or in conjunction with a mid-block pedestrian crossing. Mid-block bumpouts also provide space for street trees. *See Mid-block Crossing Design Element.*

- **Transit bumpouts**, also known as bus bulbs, extend the sidewalk to enable buses to board and alight passengers from the first travel lane. Bus bulbs provide critical space for a quality transit stop with amenities and modestly decrease transit travel time. Transit bumpouts typically occur at the far corner of intersections and appear to be an elongated corner bumpout; however, they may also be used for near-side or mid-block locations. *See Transit Bumpout Design Element.*

Related Design Elements

- **Curb Ramps:** Bumpouts intended as pedestrian crossings must include curb ramps and marked crosswalks.
- **Bicycle lanes or buffered bicycle lanes** should bend toward the bumpout so that they are against the extended curb at the intersection. This makes cyclists more visible to both pedestrians and motorists. Ideally, bike boxes should be placed at intersections with bumpouts to give cyclists a place to wait.
- **Parklets and Platform Dining:** Bumpouts may be used in conjunction with sidewalk platforms, which can temporarily expand the sidewalk in the parking lane. Sidewalk platforms should be the same width as bumpouts, and should create a flush ground plane with the bumpout for safety and accessibility.

- **Travel Lanes:** Bumpouts should not be used on streets where the curb lane is used as a travel lane during any part of the day.
- **Street Trees:** Street Trees placed in corner bumpouts must be positioned and installed such that they do not create visibility issues at the corner.

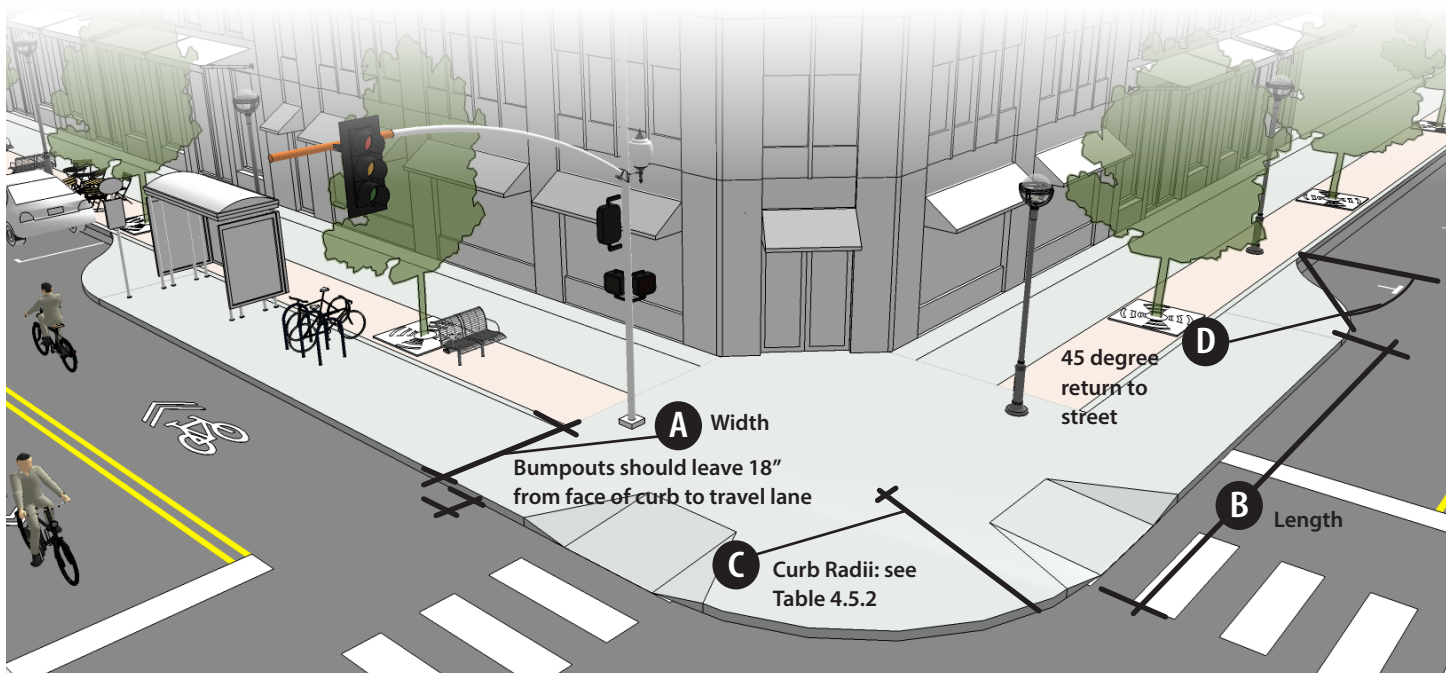
DESIGN & OPERATIONS

Bumpouts are a tool for increasing pedestrian safety, enhancing the pedestrian experience, and creating additional sidewalk space and calming traffic. Bumpouts may only be used on streets where the curbside lane is not used for travel (e.g. reserved for on-street parking or loading at all hours of the day).

Design Requirements

- A Width:** Bumpouts shall not narrow any bike or general traffic lanes to an unsafe width. When adjacent to a travel lane, the face of the bumpout curb should be set back 18" from the edge of the travel lane. This width accommodates the city standard gutter width of 18." When applied to streets with on street parking, bumpouts are typically 6 feet wide.
- B Length:** Corner bumpouts or mid-block bumpouts with crosswalks shall be at least as wide as the crosswalk, and ideally extend to the stop bar. The curve of bumpouts must fit outside of any crosswalks.

Figure 4.1.8- Bumpouts



- » Bumpouts are an effective way to restrict parking near intersections and maintain or increase visibility at corners. Consider making bumpouts at least 20 feet long, from the intersection side of the crosswalk back, to prevent motorists from parking within 20 feet of an intersection.

C Corner Radius: Bumpouts are intended to narrow pedestrian crossing distance and slow traffic speeds. To accomplish this, a tight curb radius of 20' is preferred. However, the curb radius may be larger than 20' in order to meet the Design Vehicle's effective turning radius as shown in Table 4.5.2.

D Returns: Bumpouts shall have a 45-degree return to the street.

- **Sight Lines:** Any street furniture or landscaping in a bumpout shall maintain clear pedestrian paths and access to ramps. Any objects located in the bumpout such as furnishings or landscaping, must not interfere with corner sight triangles.

Additional Design Considerations

- **Turn Restrictions:**
 - » At corners with turn restrictions, use the turning radii of the bumpout to make that turn more difficult, ensuring that transit vehicles or through traffic is not delayed by motorists turning.
 - » Carefully designed bumpouts at intersections where turning movements by transit vehicles or long wheel base trucks are common. Curb radii may need to be adjusted wider to accommodate the tracking patterns of these vehicles and/or other design or management solutions explored.
 - » Where vehicles may frequently mount the curb during turning, stronger concrete materials should be used to ensure durability.
- **Stormwater:** Bumpouts must be cognizant of stormwater drainage and avoid pooling of water at the curb. Trench drains are not generally permissible stormwater drainage solutions in Ann Arbor. Where bumpouts conflict with storm drains, storm drains must be relocated and/or additional inlets provided to enable proper drainage.
- **Temporary Installation:** Bumpouts can be a temporary installation, using low-cost materials such as paint, bollards and planters. This may be useful for a location where a more expensive installation may not be

warranted, or as a trial for a permanent solution.

- **Bicycle Parking:** Bumpouts may be ideal locations for bicycle parking. Ensure parked bicycles do not obstruct pedestrian paths nor block the sight triangle at corners.
- **Outdoor Space Use:** Bumpouts may be used for public seating or outdoor dining, again with careful attention paid to paths of movement and required sight lines.
- **Curbside Uses:** Bumpouts may have an impact on business loading, delivery access, garbage removal, and street sweeping. If well-managed and designed, bumpouts serve as a location to consolidate business waste for removal where alleys do not exist.
- **Flexibility:** Bumpouts may limit the ability to change the street design in the future, such as the location of bus zones, lane layout, and crosswalks. Bumpouts also make the street less flexible for construction routing. While considerations, none of these concerns negate the value of bumpouts to downtown districts.

Design References

- The City of Ann Arbor Non-Motorized Transportation Plan Update provides recommendations on the use of bumpouts. Additional locations in downtown are possible.
- The NACTO Urban Street Design Guide provides additional guidance on how to design a bumpout.
- The Institute of Transportation Engineers "Designing Walkable Urban Thoroughfares: A Context Sensitive Approach" describes in detail how to design a bumpout as part of a complete street.

Sustainability Considerations

- Combine bumpouts with stormwater management features, such as rain gardens or bioswales, to absorb and collect rainwater and reduce impervious surface area.
- Create opportunities for additional plantings through bumpouts, particularly mid-block bumpouts. Plantings at corner bumpouts must not block driver or pedestrian vision. Plantings at bus bumpouts must not conflict with bus doors or transit operations.
- All green applications in bumpouts should have well developed and committed maintenance plans prior to installation.

Utility Considerations

- Bumpouts may require relocating utilities or storm drains. They may also require moving a fire hydrant closer to the extended curb to ensure emergency vehicle access, which may increase cost. If a bumpout impacts a storm drain, the storm drain must be moved.

MAINTENANCE & MANAGEMENT

Seasonal Use & Maintenance

- **Temporary Use:** Temporary bumpouts defined by rubber curbing, flexible posts or similar, should be removed in winter months to facilitate snow removal.
- **Snow Removal:**
 - » Bumpouts may make snow removal more complicated, though special equipment should not be necessary if bumpouts are designed with return radii adequate to accommodate snow removal vehicles.
 - » Bumpouts may be appropriate locations for temporary snow storage if pedestrian pathways and crossings remain clear. Bus bulbs are not generally appropriate locations for snow storage.

Reviews & Approvals

- The Ann Arbor Engineering Unit is responsible for permitting the construction of bumpouts. The Systems Planning Unit, Engineering Unit, and the DDA (for impact to on-street parking, loading, etc) will coordinate review in the case of a private development project.



ROADWAY ZONE

MID-BLOCK CROSSINGS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis						
Pedestrian		■	■			
Transit			■	■	■	
Bicycle			■	■		■
Balanced			■	■	■	■

DESCRIPTION & INTENT

Mid-block crossings allow pedestrians to safely cross the street away from the intersection. These crossings are used where there is a destination or gap in the street network that generates demand for a crossing. Marking mid-block crossings indicates to both pedestrians and motorists where to cross and tend to concentrate pedestrian activity in that location thus decreasing jaywalking. Mid-block crossings increase predictability and safety for both pedestrians and motorists.

USE & APPLICATION

Location

- Mid-block crossings should be located wherever there is significant pedestrian demand, such as at mid-block bus stops, parks, building entrances to major destinations, or mid-block passageways.
- Mid-block crossings are ideal for corridors with a pedestrian and access or bicycle transport emphasis, but are an opportunity on all street types.
- AASHTO recommends mid-block crossings where there are already a substantial number of uncontrolled mid-block crossing movements, where a new development is expected to produce many mid-block crossings, or where the nearest intersections are at least 660 feet (1/8 mile) apart.

- The City of Ann Arbor Non-Motorized Transportation Plan Update identifies a number of such conditions in Ann Arbor. The plan distinguishes between a minor mid-block crossing (limited infrastructure modification needed) and a major mid-block crossing (which requires more Related Design Elements).

Related Design Elements

- **Raised Crosswalks:** Raised crosswalks (*See Crossings Design Element*) can increase the visibility of the mid-block crossing. At crossings without signals, raised crosswalks can encourage greater compliance on roads where average traffic speeds may exceed posted speeds.
- **Lighting:** Use high-visibility lighting that achieves positive contrast and markings to highlight unsignalized mid-block crossings.
- **Curb Cuts:** Crossings should be carefully placed when close to driveways or loading zones due to potential for conflicts with motor vehicles.

Policy References

- The City of Ann Arbor Non-Motorized Transportation Plan Update recommends crossing islands at all unsignalized marked crosswalks that cross three or more lanes. The plan also recommends active crosswalk warning systems, with a flashing beacon, for mid-block crossings.

DESIGN & OPERATIONS

Design Requirements

- **Crosswalk Marking:** Mid-block crossings shall conform to the requirements of the Crosswalk Design Element for markings. Mid-block crossings shall feel like a deliberate part of the pedestrian network and should show where pedestrians have priority and where motorists should yield. Crossings shall be visible and easily distinguished from other street features. They are an opportunity to calm traffic and reduce speeds.
- **Visibility:** Mid-block crossings can be used to increase visibility, restrict parking or extend the curbs around a crossing (See *Mid-block Bumpout Design Element*) at least 20 feet to either side of the crosswalk.
- A Width:** Mid-block crossings shall be at least 8 feet wide but ideally 10 feet in width.
- B Stop bars** may be provided at mid-block crossings. Stop bars shall be between 12 and 24 inches wide.
- C** Stop bars or yield lines should be set back 20 to 50 feet back from the crossing to increase the visibility of pedestrians. PEDSAFE 2013 advises

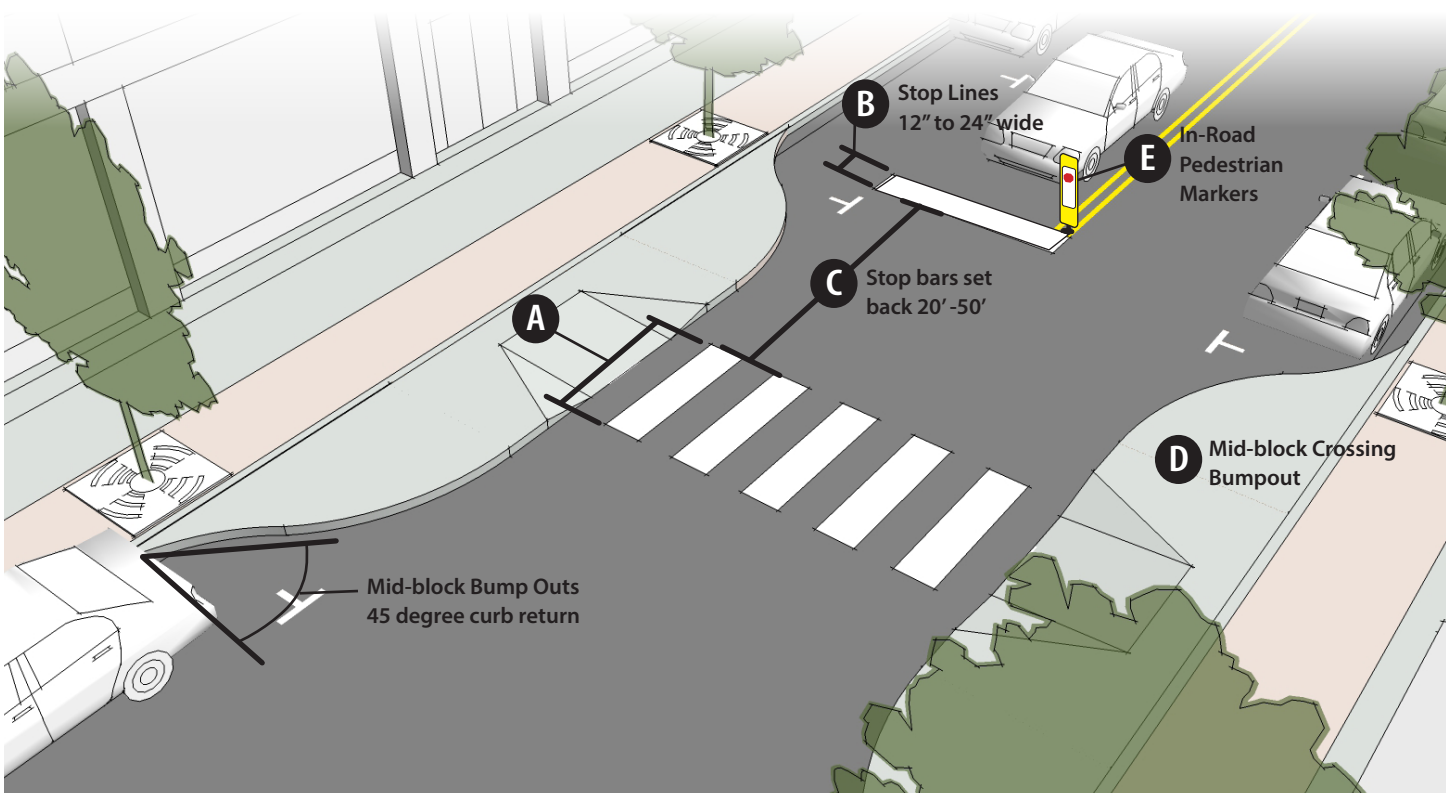
that a setback of 30 feet is appropriate for most unsignalized mid-block crossings. At signalized mid-block locations, the 2009 MMUTCD recommends the stop line be placed a least 40 feet from the nearest signal indication.

- D Mid-Block Crossing Bumpouts:** Mid-Block crossings occurring in a gap between on-street parking / loading areas shall provide a mid-block bumpout to provide a narrower crossing distance and increase the visibility of pedestrians waiting to cross.
- E In-Road Pedestrian Markers / Gateway Treatment:** In-road pedestrian markers indicating that vehicles must stop for crossing pedestrians, per local ordinance should be used where space allows. Markers shall be placed on the centerline of the roadway and on the edges of the vehicle travel lanes.

Additional Design Considerations

- Mid-block crossings may be signalized or unsignalized. There are many options for pedestrian signalization:
 - » The **standard pedestrian signal** gives oncoming motorists the red light long enough for pedestrians to clear the crossing.

Figure 4.1.9- Mid-Block Crossing



- » The **HAWK signal**, or High-intensity Activated crossWalk, is a lighted beacon that displays a flashing yellow signal to motorists when a pedestrian attempting to cross the street pushes a button. The beacon runs through a series of cycles ultimately giving approaching motorists a red light. This allows pedestrians to safely cross on their own cycle. A separate pedestrian signal provides information to pedestrians. This type of signal is dark to the roadway users when not in use, which may be confusing for motorists. It typically shows a “DON’T WALK” signal to pedestrians when not activated.
- » **Rapid flashing beacons** (RRFBs), which are being used extensively in Ann Arbor, are a pedestrian activated light that flashes brightly and rapidly to alert drivers that a pedestrian is waiting to cross at a mid-block location and should yield to crossing pedestrians. RRFBs are typically mounted onto the standard pedestrian crossing signage.
- **Refuge Islands:** Where the crossing involves three or more lanes, mid-block crossings should include Pedestrian Refuge Islands, which make it easier for pedestrians, especially those with limited mobility, to cross safely. Refuge islands in the middle of a crossing allow pedestrians to make a two-stage crossing, which is both safer and easier. Refer to Pedestrian Refuge Island design element for more information.
- **Special paving** materials or markings can visually highlight the crossing and alert motorists that pedestrians are present. They can also be used to extend streetscape elements from the sidewalk.

Utility Considerations

- Maintain a clear path from the crosswalk to the curb ramp and onto the sidewalk. Ensure that utility infrastructure, such as signal boxes, signal poles, light fixtures, trash receptacles, and fire hydrants are outside of the Walking Zone at the end of the crosswalk.

Sustainability Considerations

- Mid-block bumpouts and refuge islands that are part of a mid-block crossing provide an opportunity to incorporate stormwater management facilities into the street design.

Design References

- The City of Ann Arbor Public Services Standard Specifications provides guidance on crosswalk design and materials and lists specifications for allowable soil mixtures, mulches, and staking methods for landscaping in median refuge islands.
- The MMUTCD recommends providing a signal at mid-block crossings where pedestrian demand is high.

MAINTENANCE & MANAGEMENT

General Maintenance

- Ann Arbor Public Works is responsible for maintaining mid-block crossings on public streets. Monitor crosswalks for any damage to paint or markings that could reduce their visibility and repair them quickly. Crosswalks should be visible to all road users at all times.

Special Maintenance

- Re-stripe crosswalks as soon as possible after repaving.
- Use repaving as an opportunity to install higher-visibility markings.

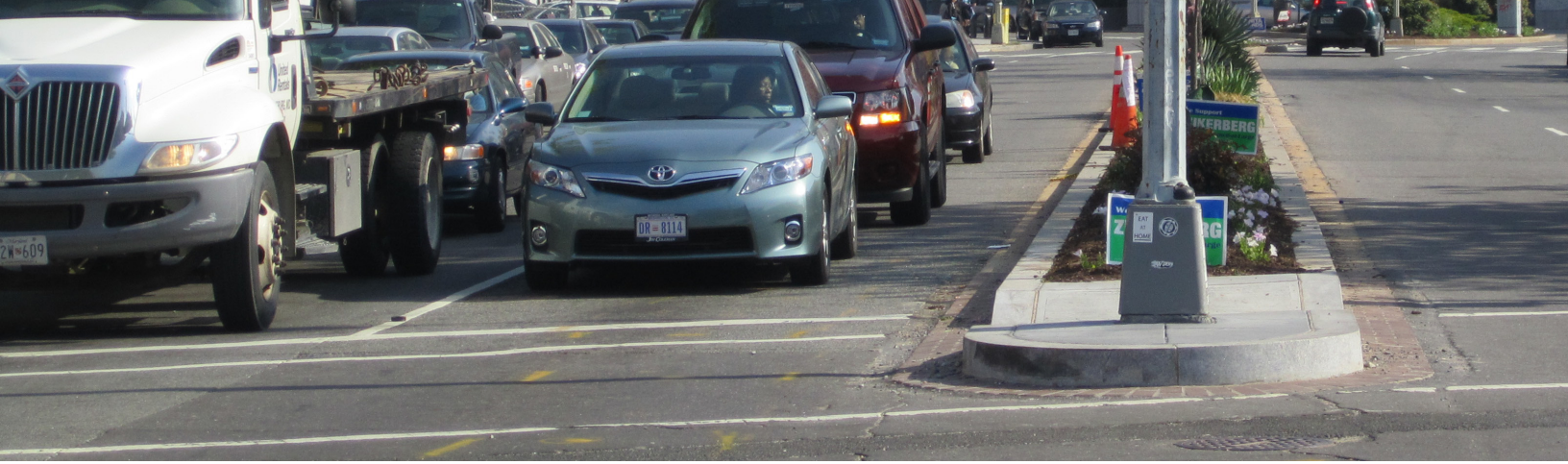
Seasonal Use & Maintenance

- Keep crosswalks and curb ramps clear of snow to facilitate pedestrian movement after a snowfall.

Reviews & Approvals

- Ann Arbor City Engineering Unit, in collaboration with the Systems Planning Unit, is responsible for determining where crosswalks are installed.

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ROADWAY ZONE

PEDESTRIAN CROSSING ISLAND

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis		■	■			
Pedestrian		■	■			
Transit			■	■	■	
Bicycle			■	■		■
Balanced			■	■	■	■

DESCRIPTION & INTENT

Pedestrian crossing islands, also called pedestrian refuge islands, are raised sections within the roadway that provide a safe landing zone for pedestrians to use while crossing a street with multiple travel lanes. These protected spaces reduce pedestrian risk by reducing the crossing distance and breaking up longer crossings into two or more stages. Because the pedestrian is crossing fewer lanes of traffic, pedestrians more easily find gaps to cross at unsignalized crossings. At signalized crossings, it provides a safe place to wait between cycles. Median pedestrian refuges are a sub-category of pedestrian islands.

Pedestrian refuge islands also function as a traffic calming device. The Pedestrian and Bicycle Information Center, a FHWA project, reports that “crossing islands have been demonstrated to decrease pedestrian-vehicle incidents by 46% at marked crossings, and by 39% at unmarked crossings.”¹

USE & APPLICATION

Location

- Pedestrian refuge islands are appropriate on streets with any Frontage Context or transportation emphasis.
- Pedestrian refuge islands are most often used on multi-lane roadways where a pedestrian must cross 40 feet or more of continuous roadway, and their use is further recommended on vehicle emphasis streets. Pedestrian refuge islands are already in place in some of the larger street corridors of downtown (e.g. North University and Huron Street).
- Pedestrian refuge islands may also be used as a channelization device, often in concert with mini roundabouts or acute angle right turns. While most intersections in the downtown area join at right angles, the tool is included here for information.

Related Design Elements

- **Mid-Block Crossing:** Pedestrian refuge islands may occur in the middle of the street, as on Huron Street near the University, as part of a mid-block crossing.
- **Bumpouts:** Pedestrian refuge islands may be used in conjunction with bumpouts, raised crossings or other applications as a traffic calming device.

¹ Pedestrian and Bicycle Information Center, Facility Design, http://www.ped-bikeinfo.org/planning/facilities_crossings_islands.cfm Accessed December 2014

DESIGN & OPERATIONS

Design Requirements

- A Crosswalks:** Pedestrian refuge islands shall have marked crosswalks leading to and from them. The pedestrian walk should continue at-grade through a pedestrian island. Use detectable warnings such as raised bumps, where crosswalks intersect islands.
 - B Elevation:** Pedestrian refuge islands shall be raised above the level of the roadway and protected with a vertical curb.
 - C Width:** Pedestrian refuge islands shall be at least 6 feet wide and preferably 10 feet wide in order to comfortably accommodate single pedestrians, pedestrians with strollers or assisted mobility devices, or pedestrians with bicycles.
 - D Signage:** Shall include placement of MMUTCD “Stop Here for Pedestrians” signs and stop bars as needed per crosswalk requirements.
- **Landscaping:** Landscaping on pedestrian refuges shall be less than 18 inches, so as not to impeded sight-lines and visibility.

Utility Considerations

- Pedestrian refuge islands should be carefully coordinated to minimize conflicts. Do not place utility vaults in pedestrian islands with subsurface utilities.

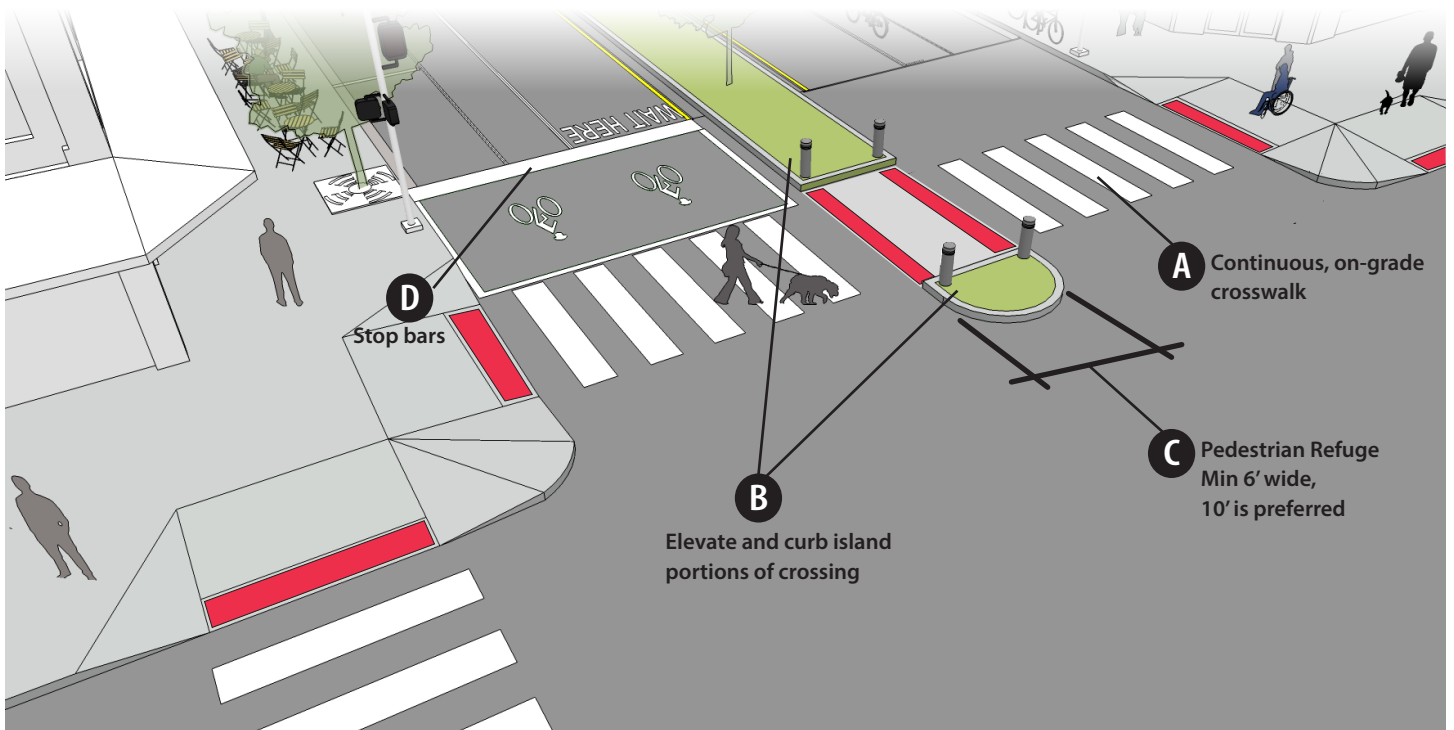
Sustainability Considerations

- Pedestrian refuge islands provide opportunities to introduce stormwater management systems such as infiltration pits, rain gardens, or pervious areas in the roadway.
- Pedestrian refuge islands also provide an opportunity for public art, provided it does not introduce any hazard or safety risk to roadway operations.

Design References

- The NACTO Urban Street Design Guide provides additional guidance on the design of pedestrian islands.
- The MMUTCD provides standards for the design of pedestrian islands and refuges.
- The AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities provides additional guidance.

Figure 4.1.10- Crossing Island



MAINTENANCE & MANAGEMENT

Special Maintenance

- **Repaving:** Pedestrian refuge islands will introduce some additional costs to routine maintenance such as street repaving.
- **Landscape:** Landscaped pedestrian refuge islands will need regular landscape maintenance and may need irrigation.

Seasonal Use & Maintenance

- **Snow Removal:** Pedestrian refuge islands can introduce some complications for snow removal if not properly designed.
 - » Islands should accommodate the turn radii of snow clearance equipment. Pedestrian refuge islands that are lane diverters or channelization features must provide adequate width from curb-to-curb to enable snow plows to proceed through the gap.

- » Pedestrian refuge islands should not generally be used for snow storage; however, portions of the island not used for walking surface may accommodate some temporary snow storage as long as it does not impede sight lines.
- » Clearly assign responsibility for removing snow from walking surfaces on pedestrian islands.
- » Walking surfaces should be designed for adequate drainage to avoid the pooling of water and propensity to ice over. Walking surfaces should be wide enough to accommodate snow removal equipment.
- » Use vertical reflective delineators to alert snow removal crews to the presence of the island, median or refuge.

Reviews & Approvals

- As with other features in the road travel lanes, pedestrian refuge islands will be reviewed and approved by the Ann Arbor Engineering Unit and the Systems Planning Unit. If facilities are proposed on a state route, MDOT will govern approvals.







VARIES

PUBLIC ART

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis		■	■			
Pedestrian		■	■			
Transit			■	■	■	
Bicycle			■	■		■
Balanced			■	■	■	■

DESCRIPTION & INTENT

Public art in downtown can create more vibrancy and interest for pedestrians and other users of the public right-of-way. Public art can assume many different forms, from murals on the sides of buildings, to fixed sculptures, artistic crosswalks, to temporary exhibits and installations. Incorporating public art into other street elements, such as light post banners, the sides of waste receptacles, and signal boxes, can transform common street elements into unique features. Public art helps activate less intensely used areas and fosters care and investment in downtown.

USE & APPLICATION

Location

- Public art can be incorporated in any place downtown and is appropriate to all street types and contexts.
- Public art can be freestanding works in the Amenity Zone or Frontage Zone, visible to pedestrians and road travelers alike. Artwork can also be horizontal surface treatments on walking surfaces, parking surfaces, or travel lanes provided it does not cause hazards or confusion for street users. Public art can also be incorporated into building facades.

DESIGN & OPERATIONS

Design Requirements

- Works of public art shall not infringe or impede on the free flow of pedestrian traffic in the Walking Zone.
- A minimum clear zone in the sidewalk of 6 feet shall be maintained. This minimum clear zone may be wider in certain locations where wider sidewalks are stipulated. *See the Sidewalk and Amenity Zone Design Element.*
- Public art shall not interfere or obstruct the safe use and operations of the public streets for vehicles, pedestrians, cyclists, and other users of the street.
- Artwork on horizontal surfaces, such as sidewalks, crosswalks, or roadways, should be temporary installations, recognizing that street projects and general wear will degrade the art work overtime.

Utility Considerations

- Works of public art cannot impede access to utility access panels, vaults, or other infrastructure services areas.

MAINTENANCE & MANAGEMENT

General Maintenance

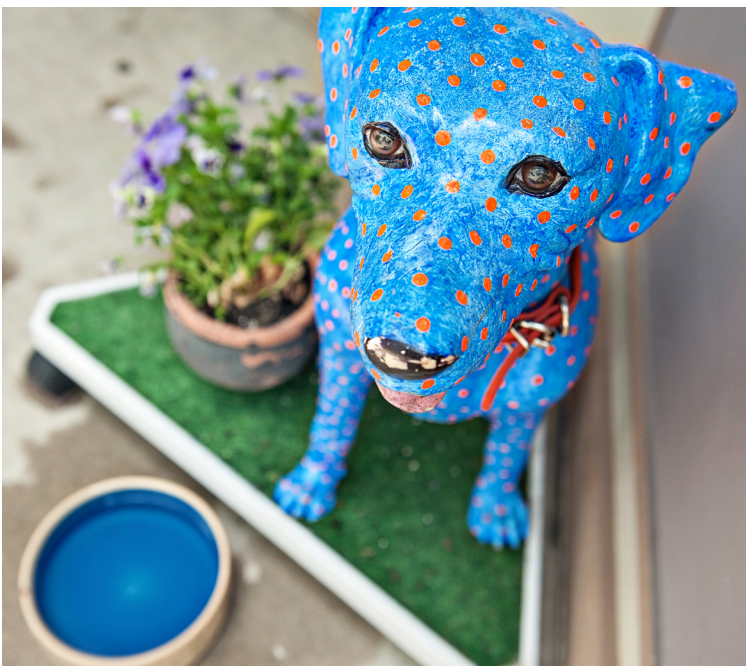
- Works of public art are required to be maintained for the duration of their installation by the entity responsible for sponsoring art. Public art must be maintained so that it does not pose on-going safety concerns or other nuances on uses within downtown.

Seasonal Use & Maintenance

- Temporary works of public art are allowed.
- Sponsors of public art are responsible for maintaining the condition of installed works during the winter months.

Review & Approvals

- Permanent works of art occupying any part of the street right-of-way must be approved by the Ann Arbor Engineering Unit and a maintenance agreement may be required.
- If permanent works of art are gifted to the City or DDA (and accepted), the accepting unit or agency will be responsible for maintenance.
- Sidewalk occupancy permits are required for temporary art installations that are within the Frontage, Sidewalk, or Amenity Zones of the street.
- Temporary works of art intending to occupy parking spaces must be approved by the DDA, and the parking meter must be rented consistent with other alternative uses in parking spaces (e.g. construction closures, platform dining, bike corrals).







4.2

COMMERCIAL DESIGN ELEMENTS

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CURBSIDE ZONE

ON-STREET PARKING

DESCRIPTION & INTENT

On-street parking, also referred to as curbside parking, is permissible space in the public right-of-way in which drivers may leave their car, motorcycle, or other vehicle and visit the shops, offices, and residences of downtown. Curbside parking has a profound influence over the character, operation, and comfort of downtown streets.

Public curbsides are in high demand for a wide variety of uses including curb bumpouts or sidewalk extensions, vehicle parking and loading, commercial deliveries, waste and recycling removal, bicycle parking and in some cities public seating, mobile vending and/or cafe dining. In higher intensity Commercial or Mixed use areas on-street parking is typically limited to short-term, higher turnover parking activities. Longer duration stays are better accommodated in off-street lots or parking ramps.

Where parking demands are high, metering (pay to park) is a best practice management strategy to optimize use of the spaces and encourage the balanced use of both on- and off-street parking resources.

Parking may be permitted at all times of day or only during non-peak travel hours. On-street parking can be used as a buffer for other street uses including protecting sidewalks and/or bicycle facilities from traffic moving in the travel lanes, and on-street parking can have a traffic calming effect. This protection generally increases the sense of comfort and enjoyment of these street spaces and modes of travel. Permanently reserving curbsides for on-street parking enables flexibility for future street design strategies (e.g. bumpouts and bike lanes). When parking is restricted

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	⚠	✓			
Transit		⚠	⚠	⚠	⚠	
Bicycle		■	■	■		■
Balanced		✓	✓	✓	✓	✓

and the curb lane is converted to a travel lane or solid waste removal site, even for a few short hours of the day, future use is constrained.

USE & APPLICATION

Location

- On-street parking is appropriate and beneficial to most street types and contexts. Vehicle emphasis corridors may prohibit on-street parking or restrict it during peak travel hours in order to increase vehicle capacity.
- On-street parking can be designated or managed to provide curbside access for persons with disabilities. In the State of Michigan, people who need handicap parking can apply for a disability parking placard. People meeting certain criteria can apply for a free parking sticker.
- Increasingly cities are adopting Ann Arbor's approach and designating metered, curbside spaces reserved for drivers displaying valid disability placards concurrent with installation of accessible, multi-space payment machines. Regardless of the method, curbside parking for persons with disabilities should be proximate to major destinations including principal commercial areas and civic buildings.
- Metered (paid) curbside parking is most appropriate in or adjacent to areas with high curbside demand and a high level of activity throughout most hours of the day. Curbside parking need not be metered in areas of

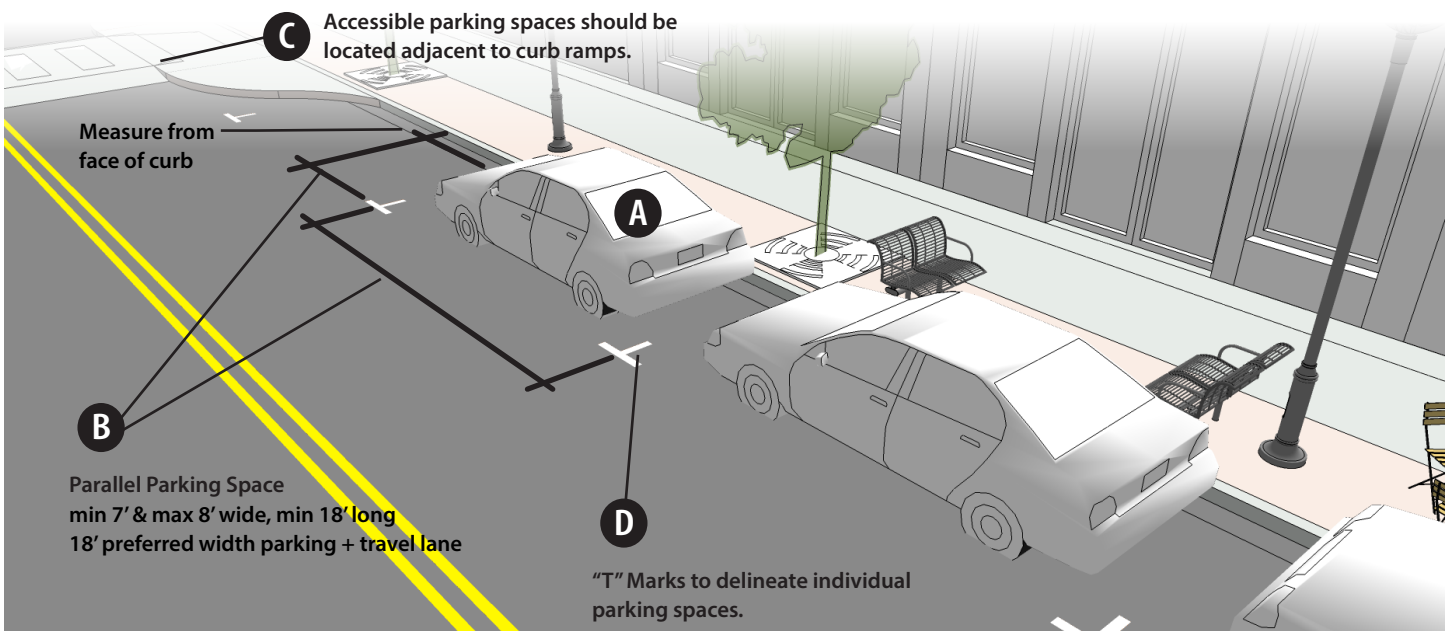
lower demand (e.g. Near Neighborhood contexts), and parking can be managed to provide a sufficient level of access to those who need it (e.g. through Residential Parking Permits).

- While beneficial, on-street parking is only one use of the public curbside. Alternative uses of the curbside may provide a greater public good in appropriate areas, including conversion to bicycle facilities, transit lanes, bumpouts, bicycle parking or other uses. The use of the public curbside must weigh the needs of the uses on that block face against the role and necessity of the street as a link in a larger networked system.

Related Design Elements

- **Bicycle Lanes:** Curbside parking conflict with cyclists within the first 2 to 3 feet of a parked car. This is known as the “dooring zone,” the area where vehicle drivers or passengers may inadvertently open their door into a passing cyclist. Parking lanes and adjacent facilities should be designed with adequate space, such as a 2 to 3 feet wide buffer zone between the parking lane and the bicycle lane, to minimize this risk.
- **Cafe Seating and Outdoor Retail:** Access into and out of vehicles parked at the curbside may conflict with cafe seating in the Amenity Zone of the sidewalk. Similarly bicycle racks, parking meters, street light poles, and other fixtures in the Amenity Zone should provide sufficient space to enable access and egress from vehicles parked curbside. Typically 18 to 24 inches is sufficient clearance between parked vehicles and Amenity Zone elements.

Figure 4.2.1- On-Street Parking



- **Curbside Zone Uses:** On-street parking may be combined with bumpouts, parklets, platform dining, bike corrals or other Curbside Zone uses to enhance the pedestrian experience, safety and multi-modal access.
- **Waste Collection:** The on-street parking lane is not suitable for solid waste collection. New private developments consisting of more than 2 units shall not place solid waste in parking lane

DESIGN & OPERATIONS

Design Requirements

- A Parking Angle:** On-street parking shall align parallel to the curb. While perpendicular or angled parking are also acceptable configurations, in narrow street rights-of-way like downtown Ann Arbor parallel parking provides more benefits and fewer conflicts with other street users.
- B Parking Space Size:** Parallel curbside parking spaces shall be a minimum of 7 feet of width and 20 feet of length. Width shall be measured from the face of curb to the center of the parking lane markings. The length of spaces may be reduced down to 18 feet in constrained locations.
- C ADA Accessibility:** Parking spaces designated for use by persons with disabilities should be located adjacent to curb ramps to facilitate access to and from the sidewalk space by persons of all abilities.

- **Intersection Clearance:** Parking spaces shall not be located within 20-feet of the nearest edge of a crosswalk.
 - **Meters:** When parking is metered, standard Ann Arbor multi-space, pay by space, metering system shall be utilized.
 - » **Pay Stations:** The metering system shall use centralized pay stations.
 - » **Space Number Signs:** The space number for each individual space shall be marked with a fixed sign. Signs should be in between parking spaces and identify the two adjacent spaces.
 - **Special Parking Zones:** Temporal curbside parking, parking that is restricted for some periods of the day, and/or converted to a travel lane, shall require additional signage and enforcement.
- D Parking Space Pavement Markings:** Individual parking spaces may be marked with “T” pavement markings at their outside edge. Alternatively parking may be defined with a solid white line to discourage encroachment of parked vehicles into adjoining travel ways.

Design References

- The U.S. Access Board Draft PROWAG provides guidance for on-street accessible parking spaces.¹
- The DDA establishes policy for on-street metered parking in downtown Ann Arbor. The City of Ann Arbor oversees the Residential Permit Parking Program.

Sustainability Considerations

- Alternative uses of on-street parking, such as bike corrals, can encourage other modes of transit and reduce vehicle emissions and fuel consumption.

Utility Considerations

- Ensure that curbside parking elements (meters, stall markets, and pay-stations) do not obstruct access to underground utilities or electrical transformer vaults.

¹ <http://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/background/access-advisory-committee-final-report/x02-6-vehicular-ways-and-facilities>

MAINTENANCE & MANAGEMENT

Seasonal Use & Maintenance

- **Snow Removal:** Snow should be removed from curbside parking areas as they provide vital access to the businesses and activities of downtown.
 - » The City of Ann Arbor clears snow from curbside parking spaces.
 - » Snow can be temporarily stored in curbside parking spaces, but for no more than 24 hours.



Reviews & Approvals

- The City of Ann Arbor Customer Services Unit is responsible for issuing permits for residential permit parking.
- The DDA is responsible for managing curbside space and permitting uses in the DDA Parking Area.
- Private Development and UM Projects:
 - » Projects that impact on-street parking spaces will be evaluated under the City Council Resolution to Approve a City Policy Regarding Removal of On-street Metered Public Parking Spaces and DDA Policy Regarding On-street Meter Removal.
 - » Projects should not impact an on-street parking meter space unless a compelling, broad community benefit can be established.
 - » If a proposed project impacts on-street parking, DDA staff will evaluate the need for removal.
 - » If removal is approved, the project will be charged \$45,000 and 10 years of lost revenue per space unless there is a community benefit as defined by the above policies.



AMENITY ZONE / FRONTAGE ZONE

CAFE DINING & OUTDOOR RETAIL

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
	Transit		⚠	⚠	■	
	Bicycle		⚠	⚠		■
	Balanced		⚠	⚠	■	■

DESCRIPTION & INTENT

Sidewalks and the adjacent Frontage and Amenity Zones are important spaces within the street environment for pedestrian and commercial activity.

Cafe dining and outdoor retail allows private business owners to occupy a portion of the public right-of-way in front of their business or commercial operation for purposes of economic activity. Cafe dining enables restaurants, bars, and other establishments to provide outdoor seating space to serve patrons. On the retail side, outdoor retail enables the display and sale of retail goods within the public right-of-way.

USE & APPLICATION

This Design Element relates to providing well-designed space and accommodation for cafe dining and outdoor retail to occur within the public realm downtown; but does not require such activities to occur.

Location

- Space for cafe dining and outdoor retail is encouraged within areas of downtown with relatively high levels of pedestrian and commercial activity. *See Pedestrian & Access Emphasis Streets.*
- Adequate space for outdoor commercial activity is recommended on all other Commercial and Mixed Frontage Context streets.
- In Civic & University and Near Neighborhood areas, providing space for cafe dining and outdoor retail can be an opportunity on a case-by-case basis in consideration of the specific land use-mix on the street. In general, cafe dining or other potentially loud activities should be limited when close to residential housing.

Related Design Elements

- **Curbside Occupancy:** Parklets or platform dining, that extend the pedestrian space temporarily into the parking lane can be combined with cafe dining and outdoor retail to provide additional space for public seating and/or commercial use. *See the Policy & Management chapter for additional guidance.*
- **Parking Spaces and Meters:** Public access to parking meters, pay stations, and from parking spaces to the sidewalk needs to be considered in the layout and design of any sidewalk occupancy activities.

Policy Guidance

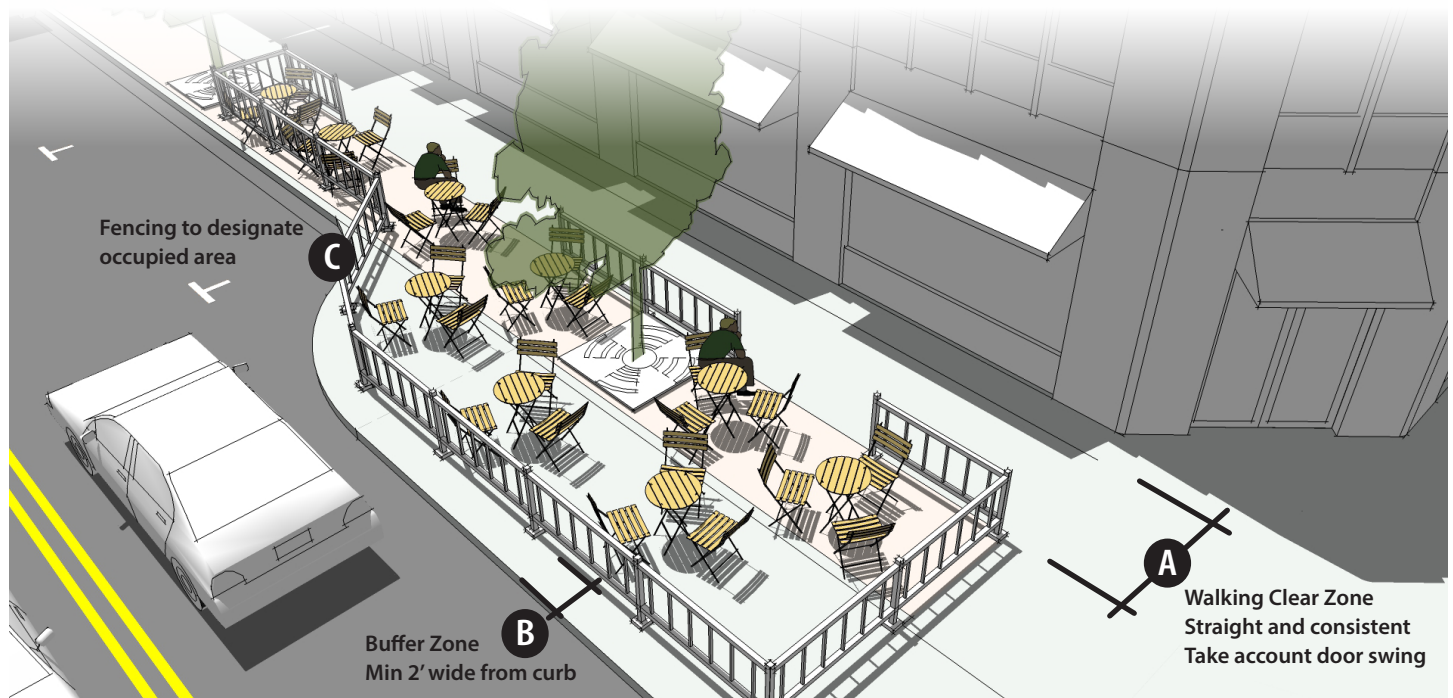
- The Sidewalk Occupancy Permit documentation contains additional guidance and permitting requirements for cafe dining and outdoor retail within the public right-of-way.

DESIGN & OPERATIONS

Design Requirements

- A Clear Walk Zone:** A clear Walking Zone / Sidewalk within the Pedestrian Area shall be maintained with absolutely no encroachments in a straight, consistent alignment along the entire block face. The minimum width varies depending on the Street Frontage Context, see Table 4.1.1.A for the required widths. The clear walking zone shall be free of any encroachments such as tables, chairs, fencing, planters boxes, sales racks, signs, or any other physical obstructions.
 - » In locations where doors into buildings swing out into the clear zone, the clear zone shall take into account the door swing areas and provide additional clearance.
- B Curb Clearance:** A minimum of 2 feet from the edge of curb shall be kept clear at all times from occupancy uses to buffer against parked cars or travel lanes or to maintain parking meter access or other needs for the immediate curb areas, unless the entire street is closed as part of a larger special event and street closure.

Figure 4.2.2- Cafe Dining





- **Location:** All cafe seating and outdoor retail activities shall be located within the Amenity Zone of the street to provide a clear and straight Walking Zone.
 - » Occupied areas must provide free and clear access to parking meters and parking pay stations.
 - » Activities may occur in the Frontage Zone provided that the specific street segment has been designed specifically, and with Street Design Team approval, to accommodate occupancy in the Frontage Zone.

C Fencing Requirements: For cafe dining occupancy uses serving alcohol, a ridged fence enclosure with at least two horizontal stringers along the entire run shall be used to define the edges of the occupied zone. Fencing shall run completely along the curbside edge of the occupied area, maintain in the 2-foot clear zone off the curb, and along the ends of the occupied area. Fencing is encouraged along the edge of the sidewalk to maintain clear separation between sidewalk traffic and the occupied area, although it is not required.

- » Fencing must be made of durable materials and construction. Fencing must be self-standing and may not be attached or bolted to pavement surfaces, landscape planters, buildings, or other street fixtures.
- **Plan Requirement:** Areas designated for dining and outdoor retail must submit a scaled graphic plan indicating the area designated for sidewalk occupancy. Must conform to other requirements identified in the permit application.

Additional Design Considerations

- **Amenity Zone Width:** Streets where cafe dining and outdoor retail is recommended should consider providing a wider Amenity Zone to accommodate outdoor retail. *See Sidewalk & Amenity Zone Design Element.*
- **Heaters:** Outdoor heaters may be used within occupied areas provided they are free standing, do not generate noise, and do not require cables, wires, or other hookups to cross the clear Walking Zone.

Utility Considerations

- Provide ready access to utilities if needed for maintenance or other utility operations. Occupied areas must make note of where utility access panels, vault covers, and other utility connection points are located.

MAINTENANCE & MANAGEMENT

General Maintenance

- Sidewalk occupants are required to ensure that their occupancy conforms to the layout stipulated in their permit at all times. Fencing, seating, sales racks, or other features must be maintained and checked to ensure that no encroachment into clear zones occur.
- Sidewalk occupants are required to keep areas free from trash, debris, food scraps, or other refuse on a daily basis.

Seasonal Use & Maintenance

- Sidewalk occupancy permits are valid from May 1 to April 30. Most sidewalk occupancy uses are not well-suited during the winter months, and Amenity Zones used for sidewalk occupancy often provide snow storage functions during the winter. Permit holders may continue occupancy provided the occupied area is kept free from snow, ice, and other seasonal hazards.

Review & Approvals

- Business, property owners, or other individuals wishing to occupy a sidewalk for commercial purposes are required to submit a Sidewalk Occupancy Permit to the City of Ann Arbor Community Services Permit Desk.
- Permits are issued by the City of Ann Arbor Community Services Unit.



CURBSIDE ZONE

LOADING ZONES

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
Transit			✓	⚠	⚠	
Bicycle			✓	⚠		■
Balanced			✓	⚠	⚠	■

DESCRIPTION & INTENT

A loading zone is a dedicated space at the curbside intended for short duration use to directly service nearby businesses or properties. In this context, loading zone primarily refers to use of the curbside space for material deliveries. Zones for the loading and unloading of passengers are addressed in the “drop-off zone” section; however, loading zones may serve both purposes.

Loading zones help promote a strong economy and a vibrant retail environment. A sufficient number of loading zones, appropriately located and designed, can dramatically improve the safety, operation, and vitality of a street. Loading zones may reduce the incidence of truck double-parking and the cost of goods delivery borne by local businesses and their consumers. However, loading zones also take up space that could otherwise be used for parking, pedestrian, or transit space and therefore should be well managed to optimize use.

USE & APPLICATION

Location

- Loading zones are generally used by a number of businesses or properties on a block and are a shared resource. The need for new spaces should be reviewed in the context of a block or neighborhood.
- Loading zones can be located wherever curbsides are not used as travel lanes.
- Loading zones are appropriate and necessary in Commercial and Mixed use contexts and may be used on all Functional Emphasis corridors, though special caution should be used on pedestrian, bicycle and transit emphasis streets.
- Loading zones should be considered carefully in Near Neighborhood areas such that truck traffic is not encouraged on quieter residential focused streets.
- Loading zones are intended for short duration parking – typically 30 minutes or less. Loading zones are typically reserved for only a portion of the day and used for general parking or travel at other times. If loading zone installations impact on-street parking, parking removal may be subject to meter removal and loss revenue fees.
- Alleys should be used for loading whenever possible. Off-street loading facilities are generally required for new developments and should be designed and managed to facilitate their use. Despite the presence of alleys and/or off-street loading, on-street loading zones may still be required.

Related Design Elements

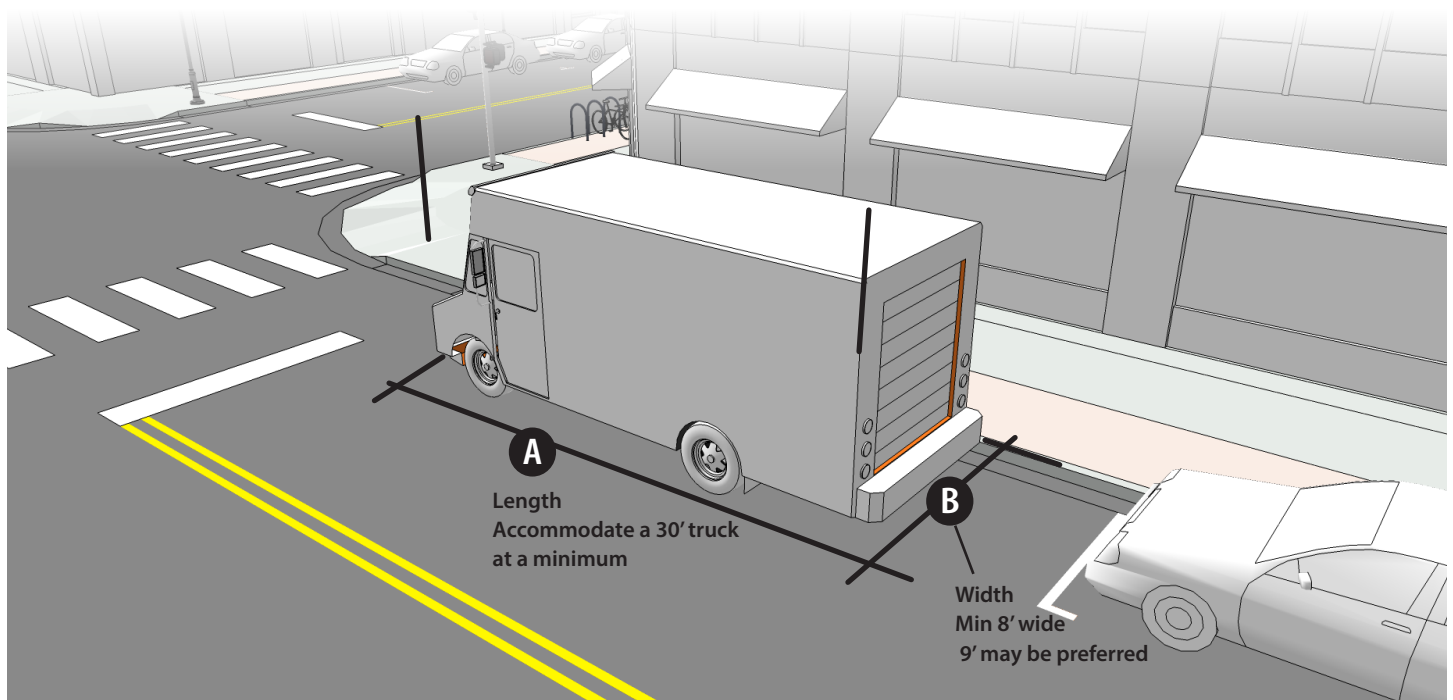
- **Sidewalks:** Sidewalks near loading zones should be wide enough to accommodate delivery people moving items from the vehicle to the business without disrupting pedestrian traffic.
- **Bicycle Lanes:** Loading zones should not block any part of an adjacent bicycle lane.
 - » Adjacent travel lanes should be wide enough to permit passing a commercial vehicle parked at curbside.
- **Bumpouts:** On-streets where a parking lane may no longer be warranted, consider bumpouts or flexible use of parking lane around the loading zone to expand pedestrian space.
- **On-Street Parking:** If loading zone installations impact on-street parking, parking removal may be subject to meter removal and loss revenue fees.
- **Cafe Seating and Outdoor Retail:** Cafe seating should not be placed near loading zones, as movement from deliveries may negatively impact dining activities.
- **Transit/Protected Bicycle Lanes:** Do not use loading zones on curbsides where a transit lane or protected bicycle lane is present.

DESIGN & OPERATIONS

Design Requirements

- A Length:** Loading zones intended for material deliveries shall be designed to accommodate, at minimum, a single unit 30-foot delivery vehicle (SU-30).
- B Width:** Loading zones shall be a minimum of 8 feet wide; however, 9 feet is desirable. If 9 feet cannot be accommodated, travel lanes on streets with loading zones should anticipate potential affects from loading vehicles.
- **Markings and Signage:** Use MMUTCD standards for appropriate loading zone signage. Loading zones shall be well-marked to indicate to other drivers that they cannot park there.
- **Pedestrian Access:** Loading zones shall not be located within 30-feet of the nearest edge of a crosswalk on the approach side, or within 20-feet of the nearest edge on the far side of a crosswalk.
- **Street trees:** Carefully consider the selection and placement of street trees to avoid conflicts with larger delivery vehicles. Ensure there is adequate space and/or use narrower tree species.

Figure 4.2.3- Loading Zones



Additional Design Considerations

- **Intersection Clearance:** Parking spaces shall not be located within 30-feet of the nearest edge of a crosswalk.
- **Location:** Place loading zones near intersections, and preferable on the far side of intersections to facilitate access to and from the rear of trucks and to have close access to curb ramps for moving materials into buildings.
- **Sidewalk Obstructions:** Sidewalk space adjacent to loading zones should be reasonably clear of furnishings, landscaping and other obstacles.
- Operations & Timing:
 - » **Use Time Limit:** Restrict deliveries in the loading zone to 30 minutes maximum to ensure turnover and prevent double-parking from other delivery vehicles. Consider metering loading zones to encourage turn over.
 - » **Coordination:** Encourage collaboration among businesses to coordinate and/or stagger delivery times to discourage double-parking if multiple businesses are sharing the loading zone.
 - » **Off-Peak Loading:** Encourage loading during off-peak hours (typically early morning or late evening). Consider reserving zones for loading only during these preferred times.
- Non-Loading Uses:
 - » **Parking, Taxi-Stands, Valet:** Permit use of loading zones for other uses during non-delivery hours. Typical uses include curbside parking (after normal metered hours), taxi stands, or valet parking operations.
 - » **Passenger Drop-Off:** Loading zones may be used for passenger drop-off provided trucks are not actively seeking access.

Design References

- The MMUTCD provides standards for pavement markings and signage in loading zones.

MAINTENANCE & MANAGEMENT

General Maintenance

- **Enforcement:** Enforcement can be a significant concern and challenge for loading zones. Clear signage is necessary, but reliable enforcement is also required to ensure loading zones are not used for auto parking or longer duration parking by commercial vehicles.

Seasonal Use & Maintenance

- **Snow Removal:** Clear loading zones of snow. Do not use for snow storage.

Reviews & Approvals

- The DDA is responsible for overseeing curbside uses/programming through the parking contract with the City.
- The Ann Arbor Engineering Unit coordinates to issue Traffic Control Orders for enforcement purposes.
- New private or The University of Michigan developments that require new loading zones as a result of building use and activity will be subject to meter removal fees and revenue replacement if preexisting on-street parking spaces are impacted.



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CURBSIDE ZONE

SHORT-TERM PARKING & DROP-OFF ZONES

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
Transit			✓	⚠	⚠	
Bicycle			✓	⚠		■
Balanced			✓	⚠	⚠	■

DESCRIPTION & INTENT

A short-term drop-off zone is a dedicated space at the curbside for vehicles to drop-off or receive passengers. Drop-off zones can receive taxicabs or private vehicles, and increase the accessibility of a pedestrian-oriented district, accommodating visitors with limited mobility who may not be able to walk long distances. Drop-off zones are generally open to the public and are sometimes used for brief loading as well.

Drop-off zones may also accommodate short-term parking, typically 15 minutes, allowing people to pick up goods (e.g. carry-out orders) without having to park in a more remote location or search extensively for an open parking space.

USE & APPLICATION

Location

- Drop-off zones are suitable for all Frontage Zones and all Functional Emphasis street types.
- Short-term parking located in the curbside lane is suitable for all Frontage Zones and all Functional Emphasis street types to provide greater access for quick pickups from nearby businesses and to reduce congestion and safety conflicts, especially near dense residential and retail.
- Drop-off spaces are located in the curbside parking lane. Given high and competing demand for curbside

space, the need for and benefit of drop-off spaces must be clearly demonstrated. Common criteria include greater access for more people and where need cannot be otherwise met. Drop-off zones established to serve a particular property will be subject to fees and/or revenue replacement.

- Drop-off zones are appropriate near buildings that may receive a large number of visitors, particularly visitors with limited mobility, or a high number of short-term trips such as medical or institutional buildings, hotels or large residential buildings.
- Drop-off zones and the vehicles entering and exiting them must not degrade safe and efficient operation of the adjacent travel lanes, including bicycle facilities, and Walking Zones.
- The curb should be reserved for drop-off for the shortest duration possible. Drop-off zones may be used for other purposes during the balance of the day. Common uses include commercial loading, taxi stands, and metered parking.

Related Design Elements

- **Cafe seating** should not be placed near loading zones due to conflicts between diners and passenger loading.
- **Drop-off zones** should not be placed on curbsides where a transit lane or protected bicycle lane is present.

Policy References

- The MMUTCD provides standards for pavement markings and signage in drop-off zones.

DESIGN & OPERATIONS

Design Requirements

- **Intersection Clearance:** Parking spaces shall not be located within 30-feet of the nearest edge of a crosswalk.
- **Length:** Drop-off zones shall be at least 25 feet long and located in front of the building entrance where the zone is requested. If multiple buildings on a block request a drop-off zone, consider a single, common loading area.
- **Width:** Drop-off zones shall be the width of adjacent on-street parking, else a minimum of 8 feet wide. Parking lanes with drop-off zones may need to be wider to accommodate people with special needs. Consider a minimum 8-foot parking lane on-street parking areas with drop-off zones.
- **Sidewalk Clearance:** Maintain an 8-foot wide clearance zone on the sidewalk adjacent to loading zones restricting site furnishings to allow passengers to enter and exit vehicles. Exceptions can be made for benches, which allow passengers to sit and wait for their ride.
- **Location:** Passenger drop-offs should generally be located at the curb line. Exceptions may be made where the curb lane is used for travel.
- **Time Limits:** Limit drop-offs to 15 minutes to encourage turnover and discourage double parking.
- **Markings and Signage:** Drop-off zones should be well-marked to indicate to drivers that they cannot park there. MMUTCD provides standards for appropriate drop-off zone signage. For city standard signage, refer to the Standard Specifications (PSSS / “The Orange Book”).

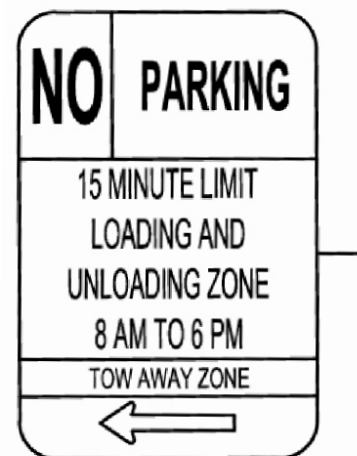
MAINTENANCE & MANAGEMENT

Seasonal Use & Maintenance

- **Snow Removal:** Loading zones do not require any special equipment for snow removal. The adjacent property owner is responsible for snow removal in the Walking Zone. Drop-off zones should not be used for snow storage.

Reviews & Approvals

- The DDA is responsible for overseeing curbside uses/programming through the parking contract with the City.
- The Ann Arbor Engineering Unit coordinates to issue Traffic Control Orders for enforcement purposes.
- New private or The University of Michigan developments that require new drop-off zones as a result of building use and activity will be subject to meter removal fees and revenue replacement if on-street preexisting parking spaces are impacted.



Standard loading zone sign



ALLEYS

DESCRIPTION & INTENT

Alleys are an important part of the downtown transportation network, providing space for loading, waste removal, and circulation away from the street. They reduce or eliminate the need for driveways that can create conflicts with people walking or cycling on the street, and free up sidewalk and curb space for other uses.

While alleys are often considered unattractive and unpleasant places to be, they can provide valuable opportunities to expand public space. As the number of downtown residents increases, alleys function as an entry door and backyard. Due to their low speeds and typically intimate scale, alleys may offer safe, comfortable pedestrian and bicycle circulation, or “shared streets” that accommodate landscaping and outdoor seating. Good alleys have extensive, pedestrian-oriented lighting, good sight lines, and allow loading and utility functions to continue while inviting other uses.

Although alleys can be attractive, low volume, low speed intra-block connectors the primary function of alleys is to service buildings off the public street.

Alleys may be public, private or a combination of both, with multiple owners sharing different segments of an alley. Access, use, and maintenance of an alley may vary widely based on ownership and governance; however, safety and efficiency remain common priorities across all alley ownership types.

USE & APPLICATION

Location

- Alleys are appropriate for all Frontage Contexts, and are especially important in Destination Commercial and Commercial areas. Alleys should provide through-connections between streets where possible.
- Where alleys are present, loading and unloading should take place there and not in the street or sidewalk. Where alleys do not provide adequate room for loading, set aside a designated loading zone on the curbside and an appropriate place(s) for container storage. As new development occurs, projects should be required to service solid waste on site or in a public alley and avoid placement of carts or dumpsters in the public street or sidewalk space.
- While not the primary user, pedestrian and bicycle traffic may occur in alleys that provide through-connections, thus they should be designed and regulated as shared environments.

Related Design Elements

- **Lighting:** Focus lighting into the alley and away from building windows.
- **Crosswalks** should be provided wherever an alley intersects a street. Use pavement markings or a change in pavement materials to denote the area where pedestrians and motorists may cross paths.
- **Curbside Loading:** Do not provide curbside loading zones on streets where the adjacent buildings have access to alley service; loading should occur in the alley.

Policy References

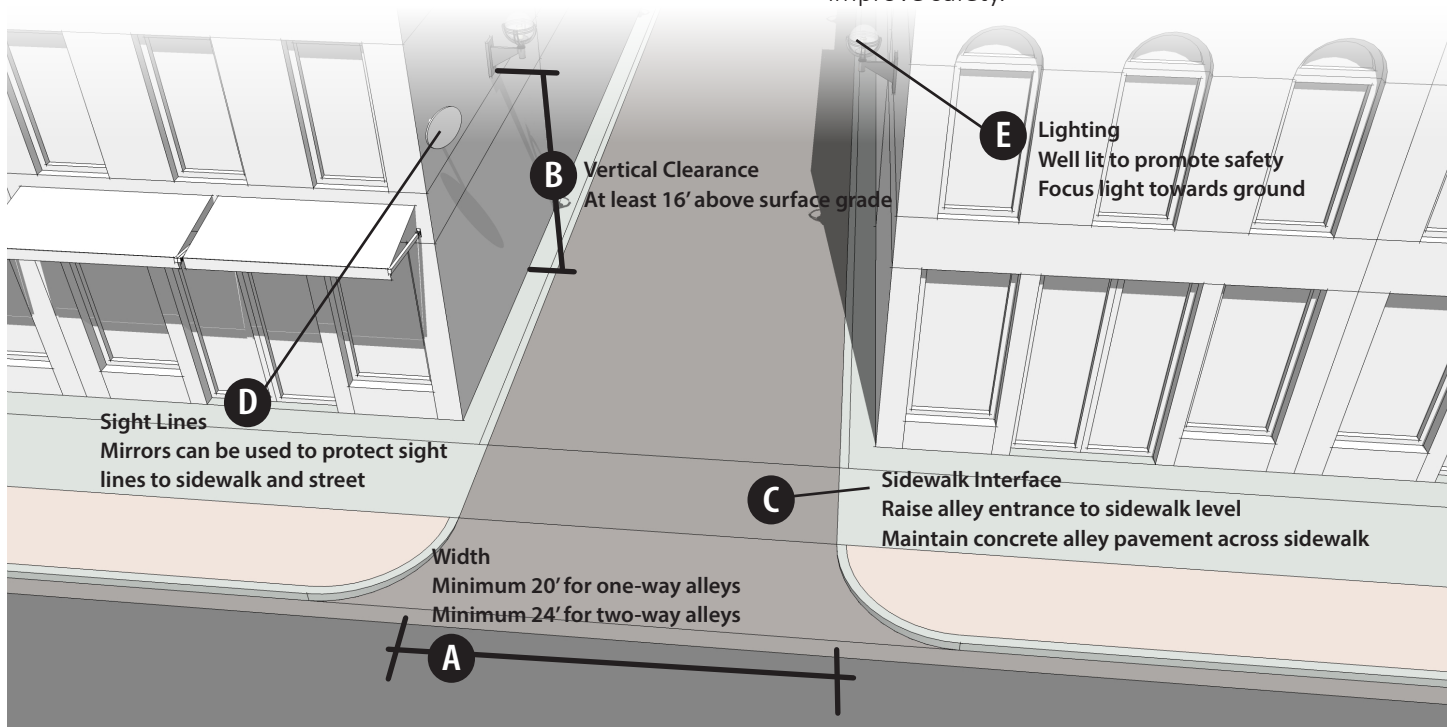
- The NACTO Urban Street Design Guide provides guidance on how to design alleys as shared streets in both residential and commercial environments.

DESIGN & OPERATIONS

Design Requirements

- A Alley Width:** The following minimum widths apply for new alleys, recognizing that opportunities for new alleys are sparse.
 - » One-way alleys shall be a minimum of 20 feet wide, allowing travel around vehicles stopped in the alley for loading or other commercial purposes.
 - » Two-way alleys should be a minimum of 24 feet wide to allow vehicle passage. New alleys are unlikely to be constructed.
- B Vertical Clearance:** Maintain a clearance of at least 16 feet above surface grade of the alley to ensure trucks can pass through safely.
- C Sidewalk Interface:** Intersections between alleys and sidewalks can create conflicts between vehicles entering or exiting the alley and people walking on the sidewalk.
 - » Raise alley entrances to sidewalk level to make motorists aware of on-coming pedestrians.
 - » Maintain concrete alley pavement across sidewalk to signal to pedestrians an alley entrance.
 - » Provide adequate signage and visual cues to improve safety.

Figure 4.2.4- Alleys



- **Turning Movements:**

- » Maintain easy access for trucks and other delivery vehicles. Ensure that the placement of street furniture, landscaping, or curbs leaves a clear zone for freight vehicle movements entering alleys.
- » Carefully design corners within an alley system to ensure large vehicles can complete turns without damage to vehicle or property. Avoid blind turns.

D Sight Lines: Protect sight lines to the sidewalk and public street at alley egress points. Mirrors and/or audible signals can be used to alert motorists and pedestrians about potential conflicts.

E Lighting: Well light alleys to promote safety. Focus lighting into the alley and away from building windows. Lighting should be overhead and higher than 16 feet to allow for truck clearance.

Additional Design Considerations

- **Access and Egress:**

- » Ensure alleys at least two points of access and/or egress in combination, preferably on two different block faces. Dead-end alleys shall be avoided.
- » Streamline movement and reduce congestion in alleys through one-way alley operations.

- **Alley Use Designation:** Use bollards, signage, and pavement markings to denote alley right-of-way from adjacent properties. Such fixtures can ensure parking and other uses in the alley are kept clear of the alley through zone.

- **Service Hours:** Restrict/reserve hours of use to facilitate essential services like waste removal. Separate hours for waste removal from deliveries.

- » Restrict traffic during non-delivery hours allowing alleys to operate as more of a shared space, creating room for outdoor seating.

- **Materials:** Design alleys as shared spaces by using higher quality pavement treatments (e.g. concrete, brick pavers), distinctive lighting, and providing public amenities such as seating or plantings.

Utility Considerations

- Alleys are appropriate places for utility lines, particularly above-ground electrical wires, as long as they are at least 16 feet above ground to allow for adequate clearance. Design alleys not to interfere with loading movements or to impede pedestrian or bicycle circulation.

Sustainability Considerations

- Use low-impact paving materials, such as pervious pavers, to reduce heat island effects, eliminate puddles, and collect and filter stormwater. Special consideration should be given to weight bearing and durability.



MAINTENANCE & MANAGEMENT

General Maintenance

- Ann Arbor Public Works is responsible for maintaining public alleys.
- The users of the alley are responsible for waste receptacles and access. Adjacent property owners who use the alley for solid waste storage or grease receptacles are responsible for proper container placement, disposal, cleanliness, and service access.

Seasonal Use & Maintenance

- Alleys may not be used for snow storage. Ensure that clear paths to properties, trash receptacles, and loading zones are maintained. Snow removal responsibilities depend on ownership. Alley users who have trash service in an alley may need to clear snow adjacent to the trash receptacles, if it impedes service access.

Reviews & Approvals

- Ann Arbor Planning and Development Services is responsible for approving private alleys created by new developments as part of the site plan review process.
- The City's Solid Waste Coordinator approves trash collection alleys.





4.3

BICYCLE FACILITY DESIGN ELEMENTS

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BICYCLE FACILITIES

BICYCLE FACILITY SELECTION

DESCRIPTION & INTENT

Important to the vitality of the downtown is that streets, business, residences, and other destinations be accessibly by all modes of transportation, including bicycles. However, downtown is a busy and complex urban environment, so providing bicycle facilities that create an intuitive network and that are safe and comfortable is essential.

There are two important considerations for the downtown bicycle network. First, each roadway is unique and how cyclists can be accommodated safely and comfortably given site constraints will vary from street to street. Second, not all bicycle riders have the same level of comfort and risk tolerance when cycling on streets, which means that a facility that works for one type of cyclist may not work for another. Taken together, there is not a one-size fits all solution.

When implementing bicycle facilities, it is important to consider connectivity and the overall routes. More specifically, determining which type of facility is appropriate given project's target audience and its role within the bicycle network is critical. Bicycle facilities fall broadly into two categories:

- **Low Stress Bicycle Facilities:** Low stress facilities, sometimes called “all ages and abilities” facilities, are those that are designed to be safe, comfortable, and welcoming to the majority of the bicycle-inclined populace. This includes people are that “interested but concerned” with riding their bicycles on major roads, the youth, elderly, and other less confident but willing riders. This typically reflects 50% or more of a

city's willing bicycle riding population. Selecting the appropriate low stress facility depends on the roadway conditions and context, intersection treatments, and careful attention to the overall route.

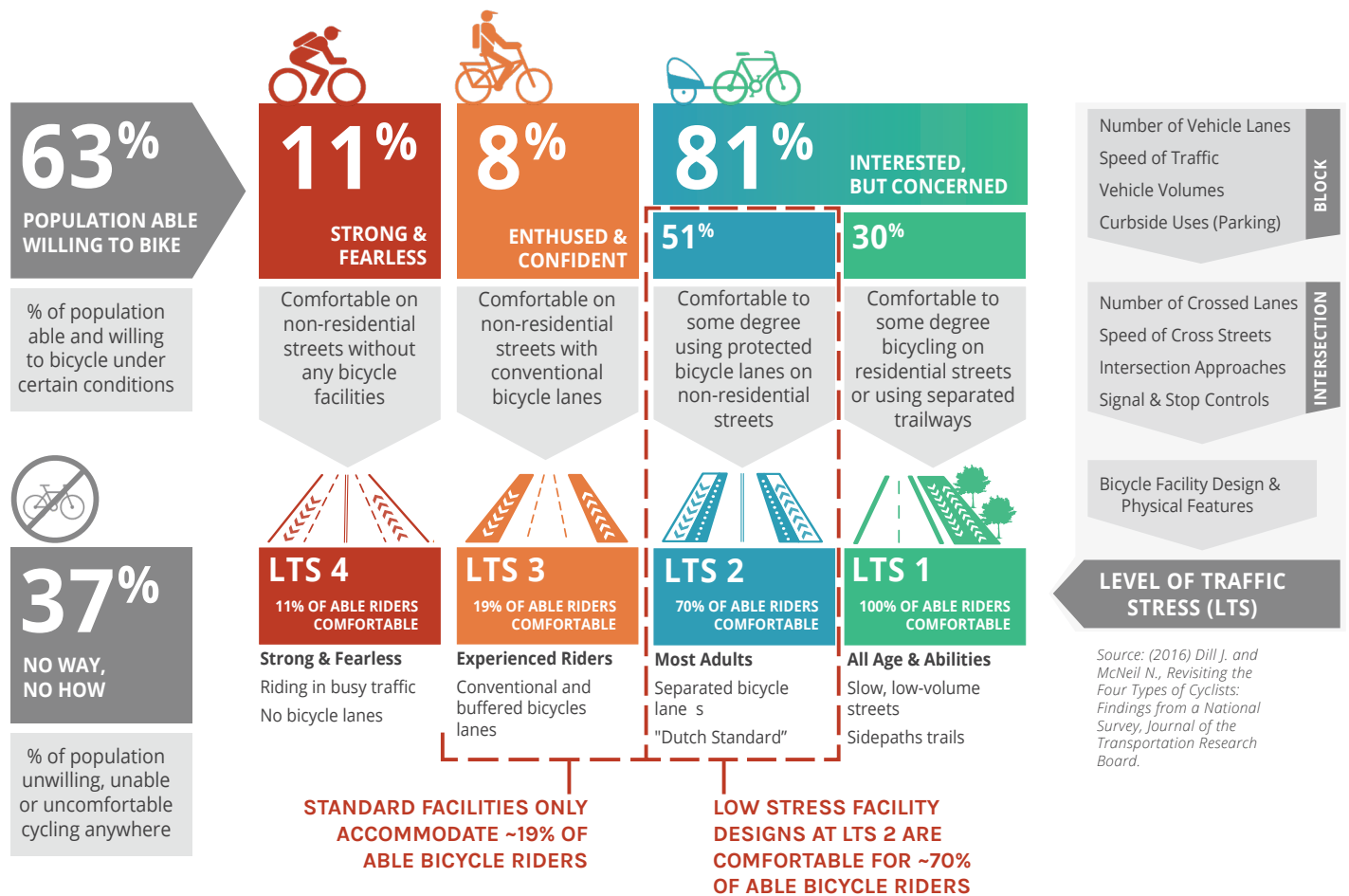
- **Standard Facilities:** Standard bicycle facilities are those where the design treatments seek to reduce stress and maximize safety and comfort to the greatest extent possible. Yet, due to site conditions or right-of-way constraints, the facility may not be comfortable for the majority of riders. Standard facilities on major roads typically serve only about 19% of the willing bicycle riding population. In addition, standard bike lanes may not adequately deter illegal parking in bike lanes in areas with high demand for curbside space (Destination Commercial and Commercial Contexts).

The graphic on the next page summarizes the relationship between type of bicycle rider and their Level of Traffic Stress (LTS) tolerance and associated facility types.

USE & APPLICATION

- How cyclists are accommodated on streets must be assessed on every street project. Even simple resurfacing and re-striping projects can be an opportunity to improve bicycle access, comfort, and safety, through the following methods:
 - » Providing more dedicated space for bicycles to travel by creating dedicated facilities;

STANDARD VS LOW STRESS BICYCLE FACILITIES & RIDER ALIGNMENT



- » Raising the visibility and awareness of bicycle rider presence to drivers through pavement markings, signage, and other treatments; and,
- » Creating calmer, safer street environments for all users but employing best practices for safe roadway design (e.g. appropriate lane widths, speed management techniques).
- Non-motorized network or connectivity plans in the city (i.e. Transportation Comprehensive Plan) should identify bicycle routes and a desired level of traffic stress. Determining which routes should be “low stress” versus which are “standard” is important for guiding facility selection.
- The level of stress of a bicycle route may be perceived by its potential users only as stressful as its most stressful location. Intersections design is vitally important for achieving low stress routes.

BICYCLE INFRASTRUCTURE TOOLS & REFERENCES

- FHWA (2019) Bicycle Selection Guide provides guidance on selecting appropriate bicycle facilities for the road condition.
- Designing for All Ages & Abilities: Section 3.2 provides a chart (NACTO, 2017) for aligning roadway conditions (traffic volume, speed, lane configuration, curbside uses) with potential facility types.
- Southwest Michigan Region Non-Motorized Transportation Plan 2020: Identifies regional trails and connections.
- The City of Ann Arbor Transportation Comprehensive Plan provides guidance planned bicycle routes, facility type, and other safety strategies.

FACILITY SELECTION GUIDANCE

The chart below (Table 4.3.1A) identifies the functional emphasis of typologies in the downtown and indicates a typical “low stress” versus “standard” facility that should be considered.

- This chart should be used as a starting point for establishing a baseline approach for accommodating bicycles and in consideration of the street’s network role.
- Depending on the available right-of-way space, scope of the street project (e.g. full reconstruction versus repaving and re-striping), and specific roadway conditions, different facilities may be used to achieve the desired stress target.

Bicycle Facility Types

Detailed design guidance for each of the listed facility types are described subsequently in this section. The chart on the next page (4.3.1B) shows some additional criteria that can be used to help identify appropriate low stress bicycle facilities. Briefly, these facility types include the following:

- **Sidepaths:** Sidepaths are shared-use facilities for non-motorized use, mixing both bicycle and pedestrian traffic. Sidepaths are separated from the roadway and are typically located in the sidewalk zone of the street, often being substituted for normal sidewalks.
- **Separated Bicycle Lanes:** Separated bicycle lanes are either one-way or two-way dedicated bicycle lanes which are separated from vehicle travel lanes by a physical, vertical buffer, such as delineator posts, raised curbing, bioswales, landscape medians or decorative planters.

- **Buffered Bicycle Lanes:** Buffered bicycle lanes are one-way dedicated bicycle lanes with a painted buffer zone in between the bicycle lane and vehicle lane, providing additional separation and clearance between bicycle riders and motor vehicles.
- **Bicycle Lanes/Conventional Bicycle Lanes:** Conventional bicycle lanes are dedicated one-way bicycle lanes that are typically positioned between the curb and a vehicle travel lane. There are no buffers between the bicycle and vehicle lanes, so the level of comfort for cyclists can vary significantly based on vehicle speeds, traffic volumes, and the proximity of passing vehicles.
- **Advisory Bicycle Lanes:** Advisory bicycle lanes are one-way bicycle lanes demarcated with a dashed line and combined with shared bi-directional vehicle lanes. The advisory bicycle lane is periodically shared with motor vehicles during passing operations. Advisory bicycle lanes are typically used on low volume and low speed (25 MPH or less) neighborhood streets to help raise the visibility of cyclists and manage vehicle behaviors.
- **Sharrows:** Sharrows or “share the road” markings are pavement markings placed within a vehicle travel lane to indicate the potential presence of cyclists.

GENERAL BICYCLE FACILITY DESIGN CONSIDERATIONS

Pavement Markings

Bicycle facilities, particular more elaborate ones such as separated bicycle lanes, requires additional pavement markings and the maintenance of such markings should be considered during project development.

Table 4.3.1A

Street Functional Emphasis	Typical Low Stress Facility (1)	Typical Standard Facility	Notes
Pedestrian & Access Emphasis	Separated Bicycle Lanes or Shared/slow street designs	Bicycle Lanes or Sharrows	
Transit Emphasis	Separated Bicycle Lanes	Buffered Lanes, Bicycle Lanes or Sharrows	Low speed/volume or shared space streets
Bicycle Emphasis	Separated Bicycle Lanes or Sidepaths	Buffered Bicycle Lanes	
Balanced	Separated Bicycle Lanes or Sidepaths	Conventional Bicycle Lanes	Separated bicycle lanes vs. sidepaths depends on overall connectivity and curbside uses.
Public Alley	N/A	N/A	

- (1) Exact selection of low stress facilities should utilize NACTO (2017) *Designing for All Ages & Abilities* chart “Contextual Guidance for Selecting All Ages & Abilities Bikeways” See chart on next page.

- Where bicycle facility markings cross between vehicle travel lanes, consider recessing pavement markings so that snow plows traverse over them and do not wear them down more quickly.
- Durable markings materials should be used. Avoid using waterborne paint products. Polyurea, MMA, epoxy, and polymer cement surfacing (e.g. Endurablend) should be used.
 - » Green paint markings used in larger solid areas (such as within bike boxes, turn boxes, or intersections) should be specified with materials that reduce loss of traction for cyclists.

- Where bicycle facilities incorporate curbed medians, planters, concrete medias/dividers, or other linear vertical elements, the design must address stormwater flows and ensure that drainage can be maintained.

Parking & Loading

- Preserve a parking and loading lane on one side of the street to maintain access for delivery and businesses where it is feasible within the right-of-way.
- Assess curb conditions to understand spillover effects on adjacent streets from removing a parking and loading lane.

Utilities

- Where the bicycle lane must travel over inlet structures, use bicycle-friendly grate designs, such as Type-L vane inlet covers or ADA accessible inlet covers. Must ensure that selected inlet covers meet required drainage criteria in consideration of stormwater flows.

Contextual Guidance for Selecting All Ages & Abilities Bikeways			
Roadway Context			
Target Motor Vehicle Speed	Target Max. Motor Vehicle Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations
Any		Any	Any of the following: high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts [‡]
< 10 mph	Less relevant	No centerline, or single lane one-way	Pedestrians share the roadway
≤ 20 mph	≤ 1,000 – 2,000		< 50 motor vehicles per hour in the peak direction at peak hour
≤ 25 mph	≤ 500 – 1,500		
	≤ 1,500 – 3,000	Single lane each direction, or single lane one-way	Low curbside activity, or low congestion pressure
	≤ 3,000 – 6,000		
	Greater than 6,000		
	Any	Multiple lanes per direction	
Greater than 26 mph [†]	≤ 6,000	Single lane each direction	Low curbside activity, or low congestion pressure
		Multiple lanes per direction	
	Greater than 6,000	Any	Any
High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts		Any	High pedestrian volume
			Low pedestrian volume

Table 4.3.1B

The chart at left provides guidance on potential bicycle facility selection in consideration of the roadway configuration (i.e. # of travel lanes), roadway speeds and traffic volumes.

* While posted or 85th percentile motor vehicle speed are commonly used design speed targets, 95th percentile speed captures high-end speeding, which causes greater stress to bicyclists and more frequent passing events. Setting target speed based on this threshold results in a higher level of bicycling comfort for the full range of riders.

† Setting 25 mph as a motor vehicle speed threshold for providing protected bikeways is consistent with many cities' traffic safety and Vision Zero policies. However, some cities use a 30 mph posted speed as a threshold for protected bikeways, consistent with providing Level of Traffic Stress level 2 (LTS 2) that can effectively reduce stress and accommodate more types of riders.¹⁹

‡ Operational factors that lead to bikeway conflicts are reasons to provide protected bike lanes regardless of motor vehicle speed and volume.



ROADWAY

SEPARATED BICYCLE LANES

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	■	■			
Transit			■	■	■	
Bicycle			⚠	⚠		⚠
Balanced			■	■	■	⚠

DESCRIPTION & INTENT

Separated bicycle lanes, also known as cycle tracks or protected bicycle lanes, are exclusive bicycle facilities that are physically separated from general traffic. Separated bike lanes provide a vertical barrier of some type, commonly a curb, parked vehicles, planted medians, or flexible posts. These physical protections distinguish separated bicycle lanes from buffered bicycle lanes.

Separated bicycle lanes may be one directional on one or both sides of a street or bi-directional in the center or on either side.

The physical protection increases the sense of safety and comfort for cyclists. Separated bicycle lanes correlate positively with increased cycling activity, as separated facilities improve comfort for more timid, less experienced, and/or more vulnerable cyclists. Separated facilities dramatically reduce the risk of bicycle/vehicle conflicts, as well as the risk of “dooring” from parked cars.

Separated bicycle lanes may be one directional with one separated lane on each side of the street, or may be designed as a two-way facility with both directions in a combined facility.

USE & APPLICATION

Location

- Separated bicycle lanes are appropriate where there are high levels of bicycle activity (or where cycling activity is expressly desired to be concentrated or accommodated).
- Separated bicycle lanes are recommended on bicycle emphasis streets and/or as a common facility type where low stress (all ages & abilities) bicycle connections are desired. Separated bicycle lanes have the most attraction and impact when implemented for multiple contiguous blocks.
- While separated bicycle lanes offer more protection and attraction than standard on-street bicycle lanes, they also require a greater amount of street space. Separated bicycle lanes often require the conversion of curbside parking or a travel lane for implementation. Accommodation and relocation of loading and drop-off spaces must be accounted for. See Loading and Short-Term Parking Design Elements for more details.

Related Design Elements

- **Crosswalks:** Separated bicycle lanes are exclusively for bicycle travel and should not be used as pedestrian walkways or waiting areas. Pedestrian medians may be provided in near the separated area to provide additional refuge opportunities for pedestrians when crossing the street.

- **Two-stage turn queues** should be used to facilitate left turns from separated bicycle lanes to other bicycle corridors or facilities.
- **Bicycle Parking:** Provide bicycle parking regularly along separated bicycle lanes.
- **Sidewalk Furnishings:** Place sidewalk curbs and furnishings in such a way to discourage pedestrians from walking on the separated bicycle lane.
- **Wayfinding** systems will allow separated bicycle lane users to navigate the bicycle network and find their way to local destinations.
- **Traffic Signals:** Due to the increased likelihood of bicycle activity where separated bicycle lanes are used, traffic signals should be timed cognizant of bicycle speeds. Reducing delays for cyclists will increase the likelihood that cyclists using the separated bicycle lane will comply with the traffic signal.
- **On-Street Parking:** On-street parking may be used as a form of separation, but must provide clearance for door swing into the bike lane (e.g. a 3-foot wide buffer) and should utilize curbing or other vertical elements to prevent vehicles from parking with the bikeway or buffer. These features can create additional obstacles for pedestrian access.
 - » Installation of separated bikeway may also require the removal of on-street parking to create right-of-way space. Consider using a two-way facility to save space and still provide parking on one side of the road.

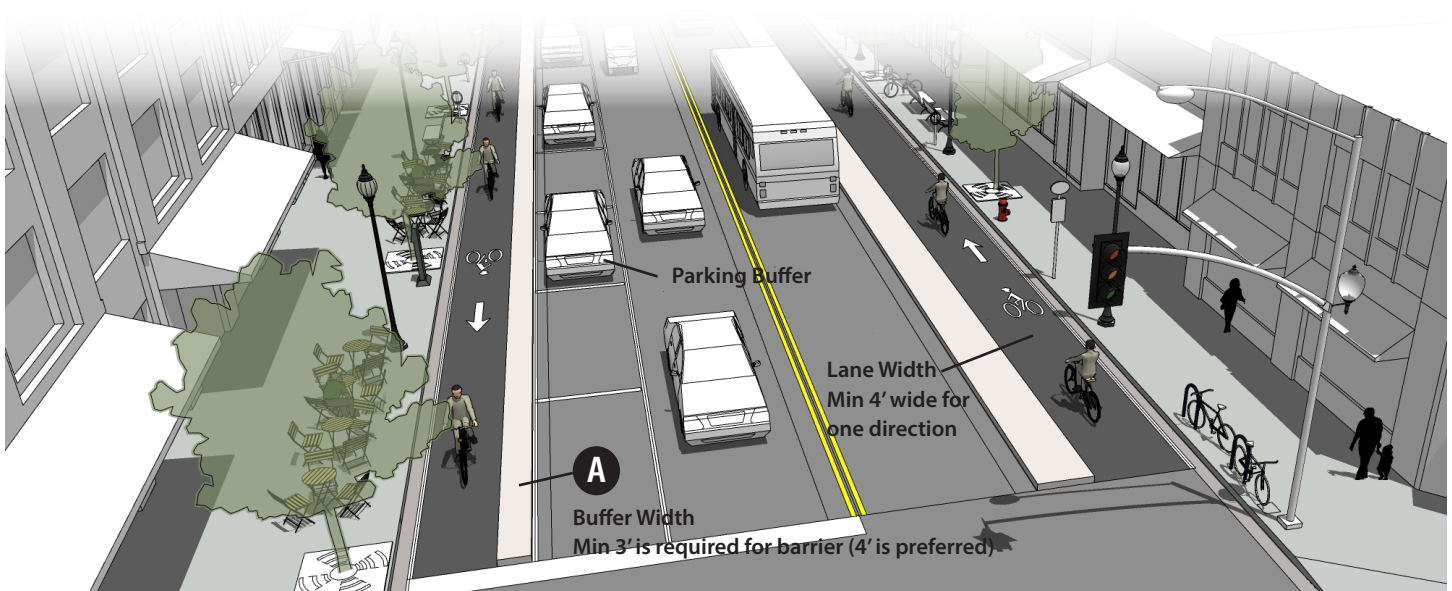
- **Curb Cuts:** Driveways, alleys, curb cuts and frequent loading activity introduce conflict into a separated facility. Separated bicycle lanes work best on corridors with minimal conflicts.
- **Mid-block pedestrian crossings** may introduce conflict between bicycles and pedestrians. Design solutions should be sought where this condition is necessary.

DESIGN & OPERATIONS

Bike Lane Separation

- **Separation Method:** Separated bicycle lanes shall be separated from vehicle traffic and clearly distinct from pedestrian zones.
 - Ⓐ A minimum of 3-feet is desired for the buffer (4-feet is preferred) between the bicycle lanes and travel lanes. 2-feet is allowed under constrained conditions for limited lengths.
 - » Separation should use delineators and painted buffers, curbing, planters, and/or raised medians. Gaps in the buffer should be minimized to the extent possible.
 - » Where bike lanes are adjacent to a curb face, provide an additional 1-foot of lane width and/or lower curb height to less than 3" and/or provide an angled curb face to reduce pedal strikes.

Figure 4.3.1- Separated Bicycle Lanes



One-Way Separated Bicycle Lanes

- **Lane Width:** Separated bicycle lanes shall have a minimum of 4-feet of width for a one-directional facility. 7-feet of width should be considered where higher bicycle volumes are anticipated to allow for bicycles to pass.

Two-Way Separated Bikeways

Where available right-of-way width precludes using one-way separated bicycle lanes, two-way separated bicycle lanes (called bikeways) may be used. Two-way bikeways introduce additional complexities in the design and operations and should be considered carefully.

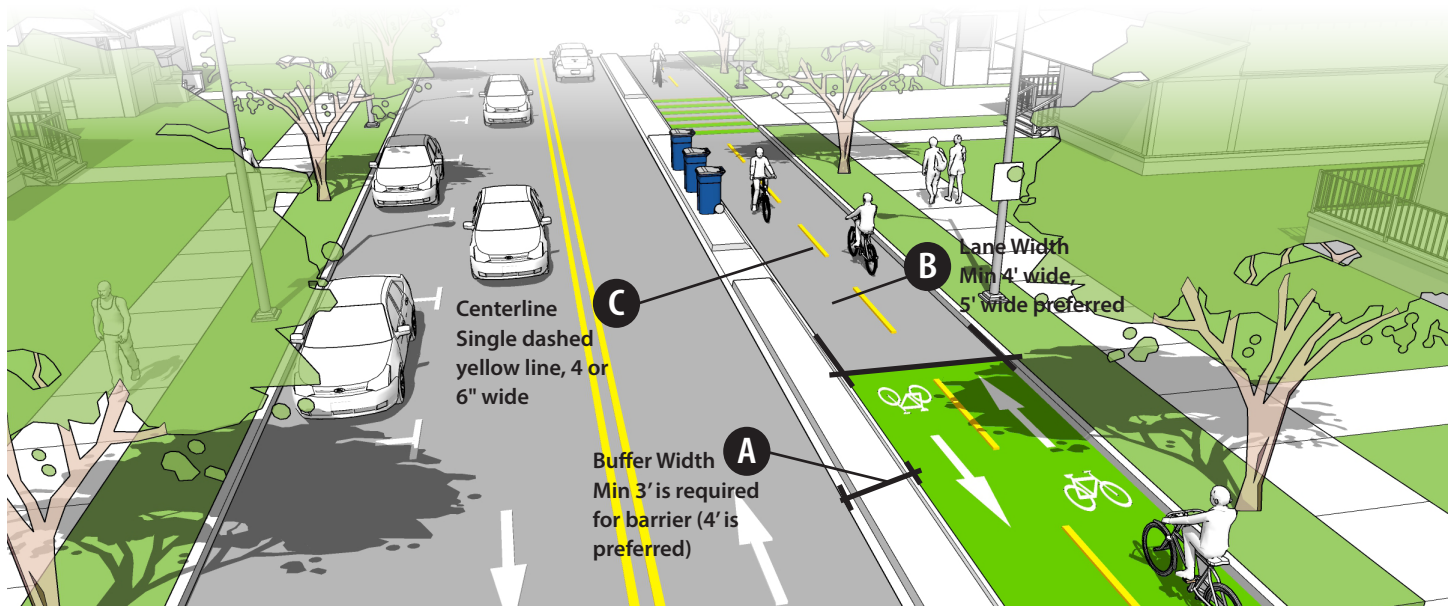
- B** **Lane Width:** Each direction of bicycle travel in the bikeway shall be a minimum of 4-feet wide (8-feet total width). 5-foot wide lanes are preferred (10-feet total).
- C** **Centerline:** The centerline of the bikeway shall be a single dashed yellow line, 4 or 6 inches wide. When approaching intersections, the centerline shall be solid within 20-feet from the stop bar.
- **Bicycle Turning Movements:** For two-way bikeways, turning movements into and out of the bikeway require careful consideration. Use two-stage turn queues located in a manner clear from cross street traffic where cyclists can wait for a signal change (see Two-Stage Turn Queues for additional guidance).
- **Vehicle Management:** Encroachment by vehicles into the wider two-way bikeway must be discouraged.

- » Use delineator posts placed on the centerline of the bikeway at the start of each block or at larger gaps in the buffer to prevent vehicles from entering. Specifications, below:
 - » Pexco City Post (Surface Mount). Color: Yellow. Height: 28 inches. Part #8SM28YEL235 (Yellow Tape) 2 Wraps of 3 inches.
 - » Where delineators are installed in Art Fair zones, posts shall be installed with a 4-inch embedded anchor cup to allow removal during Art Fair.
- » If delineators are used to provide separation, where there are concerns about vehicles parking in the bikeway, they shall be placed 10-feet apart.
- » **No Turn on Red:** No Turn on Red signage shall be used where right turning may cross over the two-way bikeway and/or turn queue boxes.

Pavement Markings and Signage

- Pedestrian Crosswalks shall pass through buffers or barriers to provide a continuous ADA accessible path of travel for pedestrians.
- **Intersection Markings:** To raise visibility of bicycle riders in intersections, separated bicycle lanes shall be painted solid green traversing through an intersection and within 20-feet of the approach.
 - » One-way facilities shall include dashed white lines highlighting the edge of the bikeway.

Figure 4.3.2- Two-Way Separated Bikeways



» Two-way facilities shall use “elephant feet” (12x12 or 18x18) white squares along the edge of the painted crossing zone.

- **Driveways and Curb Cuts:** Use dashed green bars where the bicycle lanes cross driveways, alleys, curb cuts, or minor street crossings.

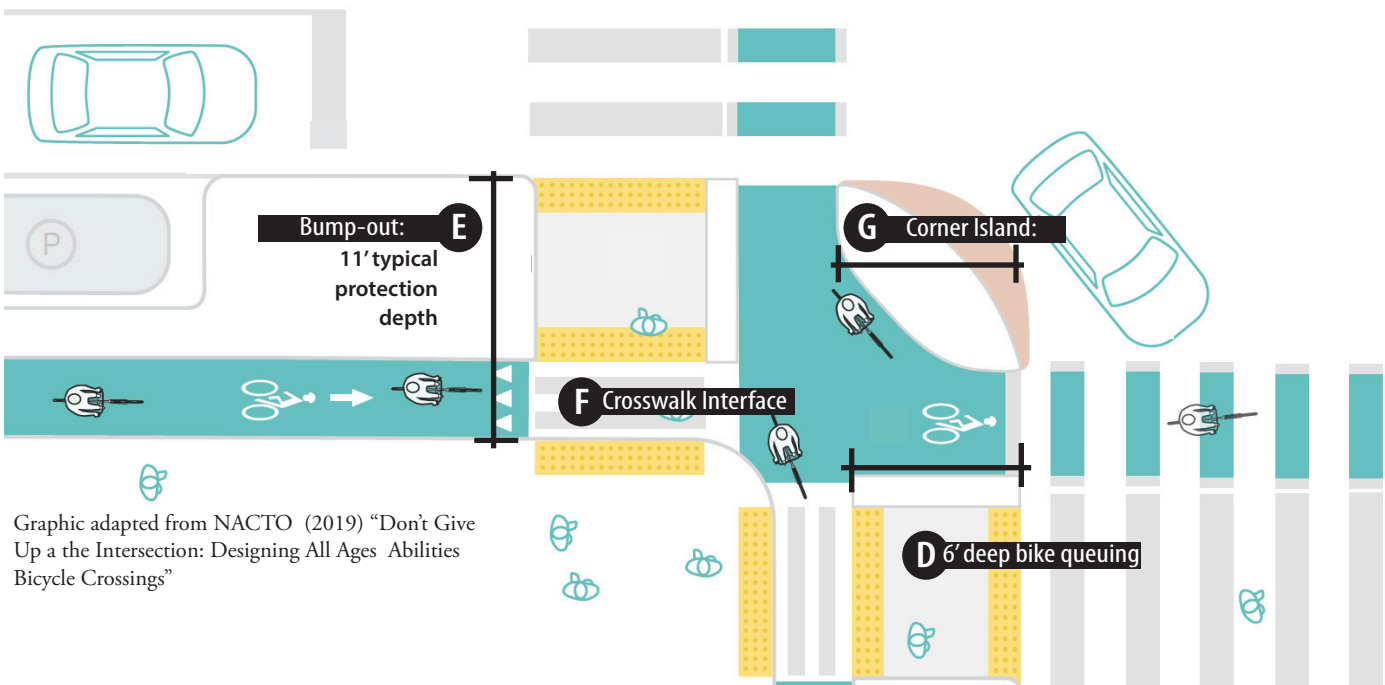
Raised Bikeways

- Separated bicycle lanes may be flush with the street-level, raised to the sidewalk-level, or at an intermediary-level between street and sidewalk.
 - » When used at an intermediary-level, use sloping curbs/transitions (1:4 max slope) between the bikeway and the sidewalk level.
- For sidewalk-level bicycle lanes, use different colors, materials or pavement markings to differentiate the bicycle lanes from pedestrian space. At conflict points, use yield-marks and “Bikes Yield to Peds” signage to indicate that pedestrians have the right-of-way.
- Two-way bikeways can be raised up to the sidewalk-level, using ramps to transition back down to street-level at intersections.

Intersections

Separated bicycle lanes require careful design at intersections to minimize conflicts with turning vehicles

Figure 4.3.3- Separated Bicycle Lanes at Intersections



Graphic adapted from NACTO (2019) “Don’t Give Up at the Intersection: Designing All Ages Abilities Bicycle Crossings”

and improve legibility, visibility, and predictability for all travelers.

- **Protected Corners:** Separated bike lanes should utilize protected corner treatments wherever space allows to create comfortable, separated spaces for bicyclists to wait.
- D Bicycle Queuing Area:** The bicycle queuing area should be at least 6-feet deep to provide space for cyclists to wait and be clear from cross traffic. This also provides adequate width for a pedestrian waiting zone between the roadway curb and bicycle lanes.
- E Protection Depth:** The overall depth will depend on the queuing depth plus the width of the incoming bicycle lane. This should be a minimum of 11-feet (6-feet for the bicycle queuing area plus 5-feet for the bicycle lane width).
- F Crosswalk Interface:** Approaching bicycle lanes should use yield markings and signage ahead of pedestrian crosswalks. Crosswalks should use detectable warning pavement flanking the bicycle lane crossing and at the normal edge of the roadway.
- G Corner Island:** The corner island should be designed to accommodate the roadway design vehicle based on an appropriate effective turning radius. Where larger vehicles must be accommodated, use a mountable apron adjacent to the curb to accommodate larger turning radii.

- » On-Street Parking Used as a Buffer shall be stopped at least 30-feet back from nearest crosswalk edge to provide visibility to bicyclists approaching the intersection.
- **Bicycle Signals:** Bicycle signals may be necessary for two-way separated bicycles lanes. A traffic and signal analysis should be conducted to determine the necessity for bicycle signals (see Bicycle Signals).
- **Sight Lines:** Maintain visibility and sight triangles at driveways, alleys, or intersections.
- **Traffic Signal Timing:** On streets where signals are coordinated, consider adjusting timing to account for bicycle travel times to encourage continuous bicycle movement.

Additional Design Considerations

- **Curbing:** The face of new curbs directly adjacent to the bikeway should be designed with a chamfered 45-degree angle to reduce pedal strikes.

Utility Considerations

- Configure gutter seams, drainage inlets, and utility covers so they do not impede bicycle travel. Make the separated lane wider where gutter seams extend more than 12 inches from the curb. Barriers should be designed as not to impede effective roadway drainage.

Sustainability Considerations

- Curbed medians or buffer areas can be designed to capture stormwater runoff and provide additional storage or infiltration capacity.

Design References

- FHWA (2015) Separated Bike Lane Planning & Design Guide: Provides detailed guidance on the design of separated bike lanes.
- FHWA (2019) Bikeway Selection Guide: Provides guidance on whether separated bicycle lanes may be an appropriate design treatment.
- NACTO (2019) Don't Give up at the Corner: Provides detailed guidance on designing protected corner treatments.
- The NACTO Urban Bikeway Design Guide provides additional guidance on how to design separated bicycle lanes and where to use them.
- The MMUTCD offers standards on signage and pavement markings for separated bicycle facilities.



MAINTENANCE & MANAGEMENT

General Maintenance

- Separated bicycle lanes require street sweeping and should be designed to accommodate existing equipment.

Seasonal Use & Maintenance

- Design separated bicycle lanes to accommodate snow removal equipment (or enter into special maintenance agreements to independently remove snow from bicycle facilities).
- Removable barriers such as flexible posts or rubber curbing should be removed prior to the winter snow season. Do not store snow in bicycle facilities.

Reviews & Approvals

- The Ann Arbor Engineering and Systems Planning Units oversee bicycle lane installation. For public projects, the project manager should coordinate with the Ann Arbor Engineering and Systems Planning Units.
- Ann Arbor Public Works is responsible for maintaining bicycle lanes.





ROADWAY

BUFFERED BICYCLE LANES

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis					
Pedestrian	■	■			
Transit		■	■	■	
Bicycle		⚠	⚠		⚠
Balanced		■	■	■	⚠

DESCRIPTION & INTENT

Buffered bicycle lanes are on-street bicycle facilities with separation between the bicycle facility and other roadway uses. Buffered bicycle lanes are distinct from separated bicycle lanes in that no physical separation or protection is provided. Buffering is provided by a flush, painted zone between the bicycle facility and vehicular travel lanes.

Buffered bicycle lanes, or other bicycle facilities offering an enhanced level of comfort and safety, are an important tool in creating a bicycle network that meets the needs and demands of cyclists of all abilities from young novices, to casual cyclists, experienced riders and cautious older bikers.

Buffered bicycle lanes increase comfort over conventional bicycle lanes by providing greater separation from conflicting uses. Buffered bicycle lanes may not offer the same level of comfort as separated bicycle lanes, but may be installed at a lower cost, offer lower maintenance challenges, and require a modestly smaller cross-section.

Buffered bicycle lanes increase the distance between vehicles and cyclists. The additional buffer may also reduce the risk of cyclists getting “doored” by parked cars and allows cyclists to pass one another without entering the general traffic lane. Buffers significantly reduce driver encroachment on bicycle facilities increasing safety, operations, and comfort; in turn, helping increase the appeal of cycling and share of bicycle trips for people of all ages and abilities.

USE & APPLICATION

Location

- Buffered bicycle lanes are most appropriate on bicycle emphasis streets and should be used over conventional bicycle lanes if there is sufficient room. Buffered lanes should be considered as an alternative to conventional bicycle lanes whenever bicycle lanes are proposed.
- Buffered bicycle lanes may be used on one- or two-way streets with or without on-street parking. Buffered bicycle lanes require more space than conventional bicycle lanes. Implementing them may require reduction of other street elements such as narrowing or converting a travel or parking lane.
- Buffered lanes are more effective and appealing on streets with longer blocks and few interruptions, such as driveways or transit stops. Buffered facilities should ideally extend for several contiguous blocks along a corridor.

Related Design Elements

- **Intersections:** Buffered bicycle lanes require additional considerations in the design of intersections and associated pavement markings.

DESIGN & OPERATIONS

Design Requirements

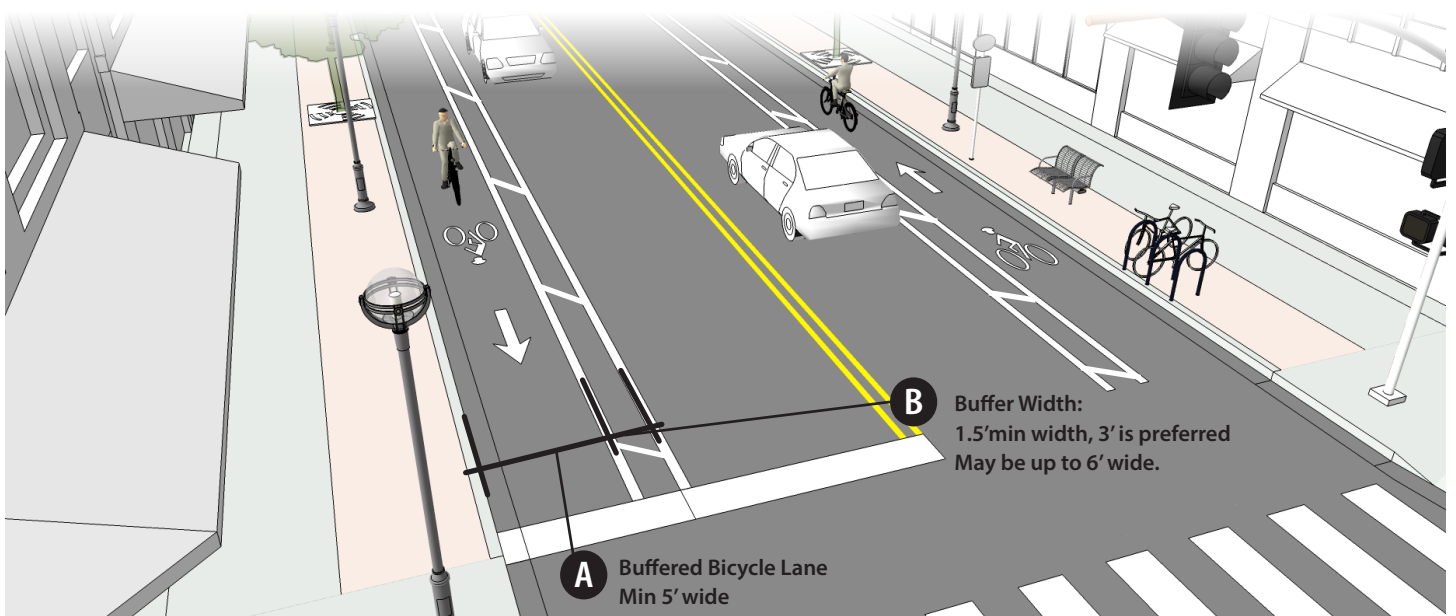
- A Lane Width:** The bicycle travel way or lane shall be at least 5 feet wide, clear from any gutters or longitudinal lines in the pavement.
- B Buffer Width:** The buffer shall be a minimum of 1.5 feet wide measured from the center of the bicycle lane stripe. 3-foot width is preferred. Buffer may be up to 6 feet wide.
 - » Buffered area consists of two solid painted lines (6-8 inch outside line, 4 inch inside line) with diagonal stripes in between at 30- to 45-degrees and spaced 10' to 40' apart on center.
 - » When adjacent to on-street parking, consider placing a 2- to 3-foot wide buffer against the parking side to protect against “dooring” instead of or in addition to the travel lane side buffer.
 - » The total width of the bike lane and buffers should not be less than 7-feet.
- Intersection Transitions:** Address transition and/or conflicts at intersections. Treatments may include conversion to a conventional curbside bicycle lane, cross-over through lane, or shared space, among other applications.

- **Bike Boxes:** Consider using a bike box at intersections to give cyclists in the buffered bicycle lane additional protection.
- **Bicycle signals** can provide cyclists with their own signal phase, giving them a conflict-free path across the intersection.
- **Traffic Signal Timing:** Due to the increased likelihood of bike traffic where buffered bicycle lanes are used, consider timing traffic signals to accommodate bicycle speeds.

Incompatible Elements

- **Bus Bulbs:** Buffered bicycle lanes can conflict with bumpouts, especially at transit stops. When approaching a bus bulb, a buffered bicycle lane should move between the sidewalk and bus bulb so cyclists do not cross paths with passengers stepping on or off the bus. *See Bus Bulb Design Element for Additional Guidance.*
- **Mid-Block Crossings:** Buffered bicycle lanes may conflict with mid-block pedestrian crossings.
- **Curb cuts** and driveways can erode the attraction and operation of buffered bicycle facilities. Curb cuts should be avoided or minimized wherever possible.

Figure 4.3.4- Buffered Bicycle Lanes



Additional Design Considerations

- **Marking Recess:** Recess marking to minimize maintenance requirements and maintain reflectivity.
- **Parking Lane Markings:** Use “T” markings or solid lines next to a parking lane to show where parked cars should be placed.
- **High Visibility Paints:** Green paint may be used along the buffered bicycle lane as follows:
 - » **Roadway and driveway/curb-cut crossings:** Use 2-foot wide bars (with 2-foot wide gap between) and aligned with dashed white lines at the edge of the bike lane.
 - » **Intersection Approaches:** Use solid green zone in the bike lane at least 20-feet long, at the approach to an intersection.
- Delineator post can often be installed readily as part of the buffer installation or added onto the facility later. This can help transition the buffered lane into a separated bicycle lane, accessible for lower stress riders.
 - » When delineators are added, they should be placed in a sufficiently wide buffer such that the bicycle lane and portion of the buffer can accommodate street sweeping and snow clearing operations.
- **Advanced Stop Bars:** Where a bicycle lane carries through an intersection, the bicycle stop bar should be positioned adjacent to the crosswalk and 4-feet or more in advance of the vehicle stop bar. This allows bicycles to be positioned with better visibility to drivers.

Design References

- FHWA (2019) Bicycle Selection Guide provides guidance on selecting appropriate bicycle facilities for the road condition.
- NACTO (2017) Designing for All Ages & Abilities
- The City of Ann Arbor Non-Motorized Transportation Plan Update provides guidance on buffered bicycle facilities and priority bicycle corridors.
- MMUTCD provides standards on markings and signage associated with buffered bicycle facilities.
- The NACTO Urban Bikeway Design Guide provides additional guidance on how to design buffered bicycle lanes and where to use them.

Utility Considerations

- If trenching is done in a buffered bicycle lane, repair the entire width of the bicycle lane to avoid an uneven surface, which can be dangerous for cyclists.

Sustainability Considerations

- Buffered bicycle facilities may offer an opportunity for porous concrete or asphalt treatments; however, use of non-standard materials in the roadway must be carefully reviewed and specifically approved.

MAINTENANCE & MANAGEMENT

Special Maintenance

- Buffered bicycle facilities introduce additional pavement markings that must be maintained. Buffered bicycle facilities should be swept of debris.

Seasonal Use & Maintenance

- Providing a flush painted buffer facilitates snow removal. Bicycle lanes of any type should not be used for snow storage.

Reviews & Approvals

- The Ann Arbor Engineering and Systems Planning Units oversee bicycle lane installation. For public projects, the project manager should coordinate with the Ann Arbor Engineering and Systems Planning Units.
- Ann Arbor Public Works is responsible for maintaining bicycle lanes.

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ROADWAY ZONE

CONVENTIONAL BICYCLE LANES

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	⚠	⚠			
Transit			⚠	⚠	⚠	
Bicycle			⚠	⚠		⚠
Balanced			⚠	⚠	⚠	⚠

DESCRIPTION & INTENT

Bicycle lanes are dedicated bicycle facilities delineated by striping, signage, and pavement markings. Distinct from buffered or separated bicycle lanes, conventional bicycle lanes are typically immediately adjacent to a motor vehicle travel lane.

On-street lanes alert motorists to the presence of a bike route, allow cyclists to use the street with less interference from traffic, and increase comfort for cyclists and predictability for all roadway users. The provision of bicycle lanes or other dedicated bicycle facilities may reduce the incidence of cyclists riding on sidewalks in downtown Ann Arbor. However, conventional bicycle lanes alone may not provide a high enough level of comfort for the most risk intolerant or vulnerable cyclists who desire a higher level of separation from traffic.

Bicycle lanes are typically located on the right-hand side of the street running in the same direction as motor vehicle traffic, but alternative configurations are possible. See *Left-Side Bicycle Lane and Contra-flow Bicycle Lane*.

USE & APPLICATION

Location

- Bicycle lanes are appropriate for all Frontage Contexts and Functional Emphasis streets but may be most common on balanced and bicycle emphasis streets.
- Conventional bicycle lanes, given the traffic volumes of most down streets, are not likely to function as a low-stress bicycle facility.
- Bicycle lanes require the least amount of space of any dedicated on-street bicycle facility, but in the narrow corridors of downtown, installation of bicycle lanes may only be possible with the removal of parking or travel lanes. This must be weighed against other needs and priorities for unique Frontage Context areas.
- On bicycle emphasis streets, dedicated bicycle lanes are required at a minimum unless a higher level dedicated facility is used (i.e. buffered bicycle lanes, separated bicycle lanes, or side paths). On non-bicycle emphasis streets, other competing space uses (e.g. parking lanes) may be a priority where space is limited.

¹ http://safety.fhwa.dot.gov/ped_bike/univcourse/pdf/swless19.pdf

Related Design Elements

- **Transit:** Buses and bicycles may conflict at curbside bus stops. Sensitive design and/or location may reduce conflicts.
- **Roadway Widths:** Wider bicycle lanes may improve cyclist comfort and safety, but may also contribute to wider pedestrian crossings or encourage illegal parking or travel in the bicycle lane.
- **Intersection Treatments:** Using bike boxes or two-stage turn queues at signalized intersections with high bicycle usage or turn demand may increase the comfort and attraction of cycling in downtown.
- **Bumpouts:** Additional consideration is required where bicycle lanes intersect with bumpouts, both at corners and mid-block, due to potential conflicts with pedestrians. Bumpouts should not extend into the bicycle lane. *See Bumpouts.*
- **Driveways and Curb Cuts:** Motorist entering or exiting may not see approaching cyclists. Pavement markings can identify conflict zones. Pavement markings should use a dashed line when crossing driveways and curbcuts to alert drivers and cyclists to the conflict.
- **Diagonal Parking:** Front-in diagonal parking conflicts with safe and comfortable use of a bicycle lane and should be avoided where bicycle lanes are provided. Parallel parking is preferred in downtown.

DESIGN & OPERATIONS

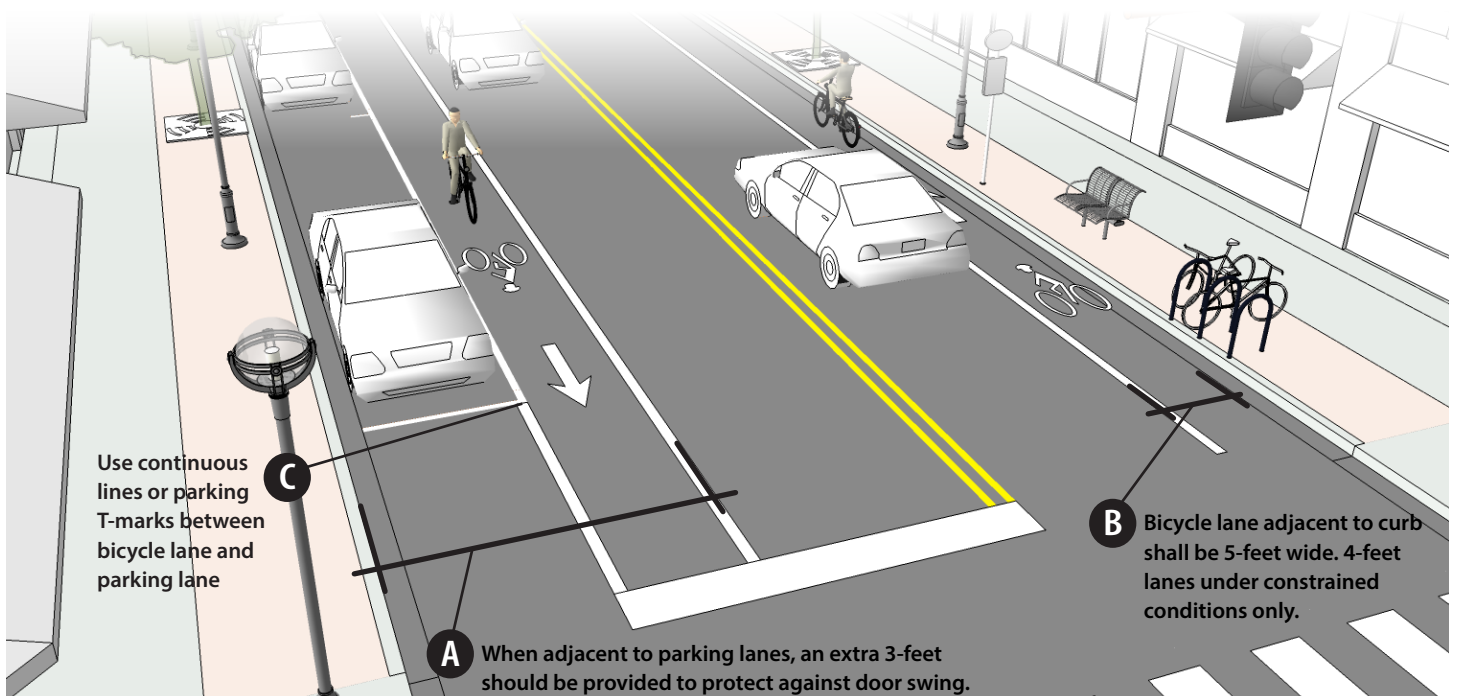
Design Requirements

- **Lane Width:**

- **A** The preferred width of bicycle lanes shall be 5-feet wide for clear operational width, exclusive of any gutters or longitudinal pavement lines. This may be reduced to a minimum of 4-feet wide under constrained conditions.
- **B** When adjacent to curbside parking or loading zones, bike lanes should incorporate an additional 3' foot wide buffer to protect against door swing where space allows (see **Buffered Bike Lanes**)
 - » Provide a 3-foot shy zone adjacent to bicycle lanes when directly adjacent to guardrails, walls or other vertical barriers.

- **Markings:** A solid white 6" wide line shall be used to differentiate the bicycle lane from the general traffic lane.
 - » **Intersection Crossing Markings:** Use two dashed white lines to indicate the sides of bike lanes when they carry through and across an intersection.
- **C** **Parking Lane Marking:** Use a continuous solid line or place "T" marks between the bicycle lane and the parking lane to mark the inside of the bicycle lane and discourage motorist from encroachment.

Figure 4.3.5- Conventional Bicycle Lanes



- **Location:** Bicycle lanes shall be placed on the right-hand side of the street, between the travel lane and the parking lane, or between the travel lane and the curb.
 - » Avoid placing bicycle lanes to the right of a right-turn lane or the left of a left-turn lane unless a separate bicycle signal is provided.

Additional Design Considerations

- **Lane Markings:** Use dotted/dashed lines to indicate areas of bicycle/vehicle conflict, such as bicycle lane markings continuing through intersections or where right turning lanes cross bicycle lanes.
- **Surface Transitions:** Make gutter seams, drainage inlets, and utility covers flush with the ground to prevent conflicts with bike tires. Ensure openings in grates are perpendicular to the bicycle direction of travel to avoid trapping bicycle tires.
- **High Visibility Paint:** Use green paint to further distinguish bicycle lanes in areas where there is a particular need.
 - » **Roadway and driveway/curb-cut crossings:** Use 2-foot wide bars (with 2-foot wide gap between) and aligned with dashed white lines at the edge of the bike lane.
 - » **Intersection Approaches:** Use solid green zone in the bike lane at least 20-feet long, at the approach to an intersection.
- **Signs:** Additional signage may be used to indicate presence of bicycle lanes.
- **Advance Stop Bars:** Where a bicycle lane carries through an intersection, the bicycle stop bar should be positioned adjacent to the crosswalk and 4-feet or more in advance of the vehicle stop bar. This allows bicycles to be positioned with better visibility to drivers.

Design References

- The MMUTCD provides standards for bicycle lane design.
- The City of Ann Arbor Non-Motorized Transportation Plan Update provides guidance on bicycle lanes and locations for recommended installation in downtown.
- The NACTO Urban Bikeway Design Guide provides additional guidance on the use and design of conventional bicycle lanes.

Utility Considerations

- If trenching is done in the bicycle lane, repair the entire width of the bicycle lane so there is not an uneven surface.
- Avoid locating manholes in bicycle lanes.
- Ensure any utility or vault covers are flush with the road surface and properly set and maintained.

Contra-Flow Bike Lanes - Design Considerations

In some situations, primarily on one-way streets, it may be desired to provide bike lanes that go in the opposite direction of the adjacent travel lane. These can help complete gaps in a bicycle network where routing would otherwise be much longer for cyclists.

Location:

- Contra-flow bicycle lanes should only be considered where this a clear observed need for the connection and where lane widths and separations can ensure adequate safety and comfort for cyclists and visibility for drivers. Contra-flow lanes should be as short as possible to complete the connection, even if just a single lane.

Design Considerations (in addition to those for conventional bicycle lanes):

- Contra-flow bicycle lanes should be positioned outside of the vehicle travel lanes and separated with a double-yellow line.
- Contra-flow lanes shall be a minimum of 5-feet wide, clear of any gutters lines and longitudinal pavement lines. Wider lanes are encouraged to provide better separation for bicyclists from oncoming traffic.
- Use high-visibility green paint markings along the entire length of the contra-flow bicycle lane.



Left-Side Bike Lanes - Design Considerations

Left-side bicycle lanes are conventional bicycle lanes placed on the left-hand side of a one-way street. Left-side bike lanes may be considered where it reduces conflicts with loading zones, curb cuts, turning vehicles, and/or better aligns with desired routes for bicycle traffic. However, since they are less common, it is important that they be visible and signed to alert roadway users to the unusual configuration.

Location:

- Shall only on one-way streets where conventional bicycle lanes would otherwise be an appropriate bicycle facility type.
- Can be especially suitable where there is frequent transit service occurring on the right-side of the road that would interfere with a bicycle lane.

Design Considerations (in addition to those for conventional bicycle lanes):

- Use high-visibility green paint markings along the entire length of the contra-flow bicycle lane.
- Consider using signage alerting drivers and pedestrians to watch for bicycles on the left side of the road, especially for left turning vehicles that will be turning across the bicycle lane.



MAINTENANCE & MANAGEMENT

General Maintenance

- Bicycle lanes and associated signs and symbols are additional markings that will require maintenance and replacement.

Seasonal Use & Maintenance

- Bicycle lanes should always be plowed during snow events and should never be used for snow storage.

Reviews & Approvals

- The Ann Arbor Engineering and Systems Planning Units oversee bicycle lane installation. For public projects, the project manager should coordinate with the Ann Arbor Engineering and Systems Planning Units.
- Ann Arbor Public Works is responsible for maintaining bicycle lanes.



Green paint used to make a conventional bicycle lane more visible.



Bicycle lane markings, with green paint, carrying through an intersection.



ROADWAY ZONE

ADVISORY BICYCLE LANES

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis					
Pedestrian	■	■			
Transit		✗	✗	✗	
Bicycle		✗	✗		⚠
Balanced		■	■	■	⚠

DESCRIPTION & INTENT

On lower volume neighborhood streets without lane markings, vehicles tend to drive in the middle of the roadway (staying clear of any on-street parking). When vehicles approach in opposing directions, they both slow down and bear right to pass each other.

Advisory bicycle lanes are a way to formalize the above behavior through pavement markings while incorporating a designated zone for cyclists to ride. When vehicles traveling in only a single direction are present, bicycles effectively have dedicated lanes in which to travel. When opposing car traffic is present, vehicles will slow down and share a portion of the bicycle lane (yielding to cyclists if they are ahead of the vehicle) until the vehicles pass each other.

Beyond formalizing roadway behaviors on such neighborhood streets, the use of a narrow defined travel lane can incite vehicles to drive at calmer speeds and help raise the visibility of cyclists along the corridor, putting drivers on the alert.



USE & APPLICATION

Location

- **Usage:** Advisory bicycle lanes are only appropriate on streets that do not have delineated and marked travel lanes. Typically this will be on lower volume and lower speed (25 MPH or less) residential streets.
- Advisory bicycle lanes should be considered along low stress neighborhood routes, and as part of neighborhood greenways or bicycle boulevards. Advisory bicycles lanes are a treatment that can go beyond merely signing “designated bike route” in that the pavement markings can change driver behavior and create a street condition where the priority of cyclists is elevated.

Related Design Elements

On-Street Parking: Advisory bicycle lanes can be designed alongside on-street parking on one or both sides of the street.

Bumpouts: At intersections with bumpouts, the approach to the intersection should transition to more conventional demarcated travel lanes with sharrow markings or kept wide enough to allow the bicycle lane to carry through the intersection in a conventional manner.

DESIGN & OPERATIONS

Design Requirements

A Vehicle Lane Width: The shared travel lane for vehicles should be a minimum of 10-feet and a maximum of 18-feet wide, with a preferred range of 13.5- to 16-feet ⁽¹⁾.

- » Narrower shared lanes (closer to 10-feet) have a greater impact on controlling vehicle speeds.
- » Widths wider than 18-feet should consider using narrow but fully delineated separate travel lanes.

B The overall clear width between the edge of any parking lanes or gutter lines, including both the shared travel lane and the bicycle lanes, should not be less than 20-feet, in order to allow the full range of vehicles to pass each other.

C Advisory Bicycle Lane Width: The advisory bicycle lanes should be a minimum of 5-feet wide.

- » Where space allows, provide a 2-foot buffer adjacent to on-street parking to reduce dooring risk.
- » Excess vehicle lane width can be allocated to bicycle lanes to provide greater passing space.

D Pavement Markings:

- » The line separating the vehicle travel lane and the bicycle lane should be a white dashed line (3-foot segments with 6-foot gaps) ⁽¹⁾.

- » For the shared vehicle lane, do not use centerline markings during the mid-block portions of the roadway. When approaching an intersection that is stop or signal controlled, terminate the advisory lanes 30- to 50-feet from the stop bar and use sharrow markings (see Sharrows) with a normal vehicle lane centerline on the approach.
- **Signage:** Use signage (see example on prior page) to indicate the proper yield behavior for drivers. Using two-way traffic signs can also help reinforce that the roadway is intended for two-way travel.

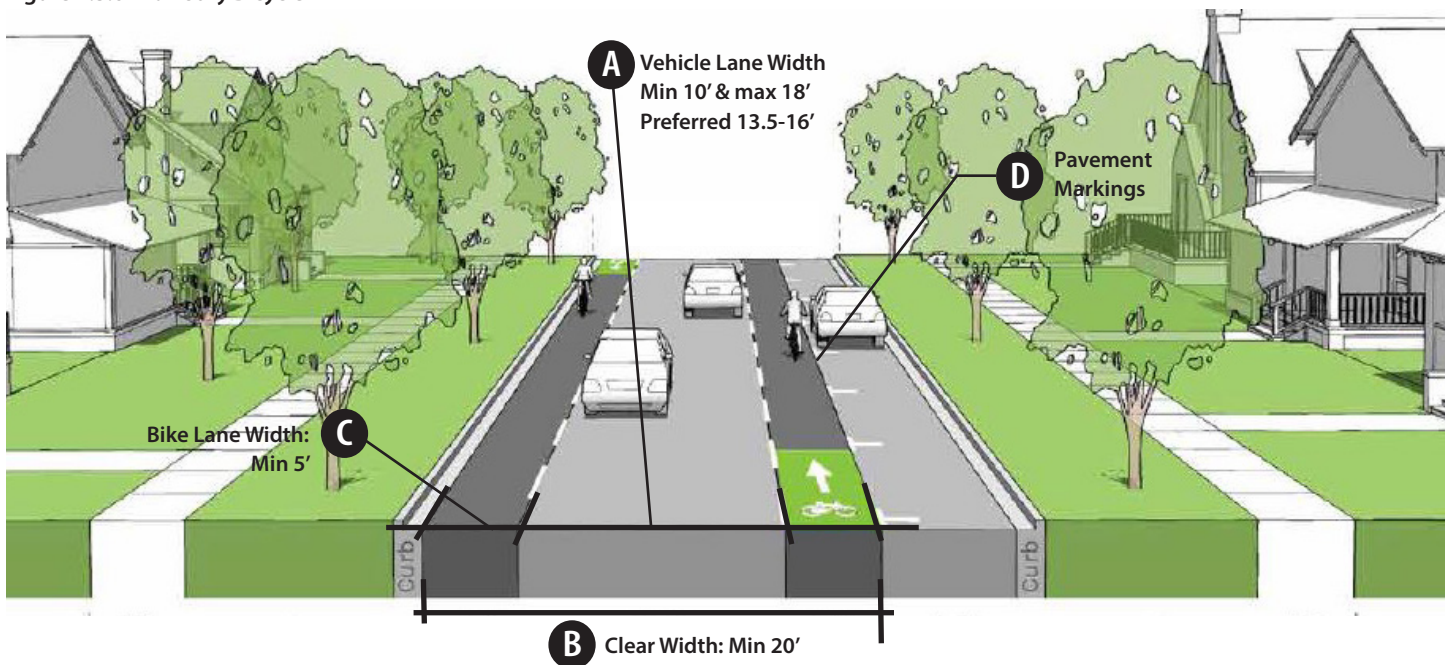
Design References

- Small Town and Rural Multi-modal Network (FHWA, 2016) document provides additional design and geometric guidance on “advisory shoulders,” which are advisory bicycle lanes.
- Advisory Bike Lanes in North America (Alta, 2017) provides extensive review of case studies and findings, supporting effective design and implementation of advisory bicycle lanes.

MAINTENANCE & MANAGEMENT

- The Ann Arbor Engineering and Systems Planning Units oversee bicycle lane installation. For public projects, the project manager should coordinate with the Ann Arbor Engineering and Systems Planning Units.
- Ann Arbor Public Works is responsible for maintaining bicycle lanes.

Figure 4.3.6- Advisory Bicycle





ROADWAY

SHARROWS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
Transit			✓	✓	✓	
Bicycle			✗	✗		✗
Balanced			✓	✓	✓	✓

DESCRIPTION & INTENT

Sharrows, or shared lane markings (SLMs), are pavement markings that indicate a lane explicitly intended to be shared by motor vehicles and significant numbers of cyclists. Sharrows alert motorists to expect cyclists, remind motorists of the legitimacy of cyclists to use the roadway, and orient bicycles to the preferred line of travel outside the dooring zone. Sharrows also remind cyclists to ride with traffic, not against it.

Sharrows are not a dedicated bicycle facility and not all cyclists will be comfortable riding in travel lanes and relying on sharrows to alert motorists.



USE & APPLICATION

Location

- Sharrows may be used on all street types where road width is too narrow to accommodate a bicycle lane, except for bicycle emphasis streets which require dedicated bicycle facilities (e.g. bicycle lane, buffered bicycle lane).
- When sharrows are used, they should be used in conjunction with the narrowest feasible travel lane width, ideally 10-feet. Sharrows in wider lanes encourage vehicles to try and pass bicyclists, which is not a safe behavior.
- Because cyclists remain in mixed traffic, sharrows generally do little to enhance comfort for the most vulnerable or risk intolerant cyclists and should be used cautiously on streets with high traffic volumes and higher speeds, such as vehicle emphasis streets.
- Sharrows are most appropriate for streets with modest traffic volumes and slower travel speeds. Sharrows are not appropriate on streets with high traffic volumes and higher speeds, and dedicated bike facilities should be used or bike traffic routed onto other streets.
- Sharrows typically are not used on roadways with very low vehicle volumes and speeds, such as Near Neighborhood residential streets, except when part of a bicycle emphasis route.

Related Design Elements

- **Travel Lanes:** Sharrows are applied in otherwise typical vehicle travel lanes and do not affect overall dimension or assembly of the typical section.
- **Intersection Treatments:** Bike boxes or two-stage turn queues may be used in conjunction with sharrows.
- **Street Lighting:** Streets with sharrows should be adequately lit to enhance safety.

Policy References

- The City of Ann Arbor Non-Motorized Transportation Plan Update is the city policy document on bicycle accommodations.

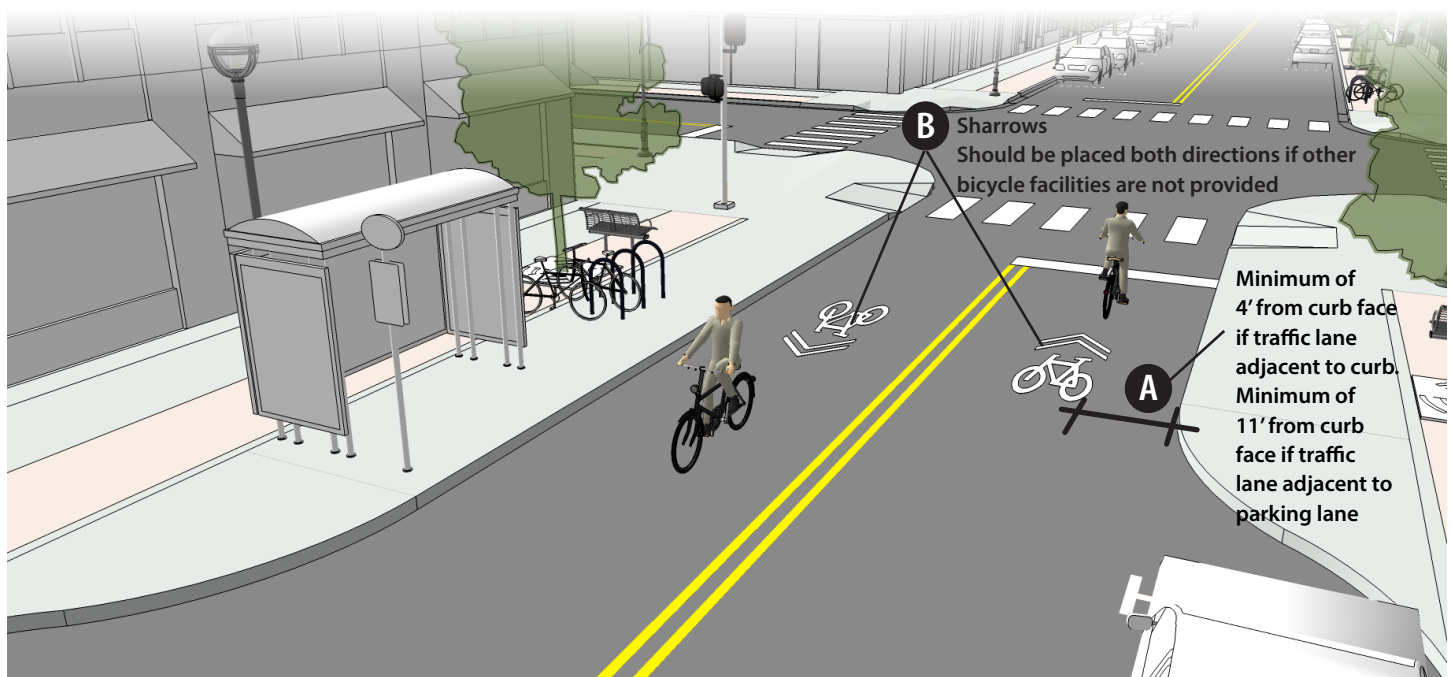
DESIGN & OPERATIONS

Design Requirements

- **Marking Pattern:** Sharrows markings are two chevrons positioned above a bicycle symbol. See MMUTCD for detailed marking design.

- A Position from Curb:** Sharrows should be positioned within the center of the travel lane to reinforce that bicycles are able to utilize the full lane width and that cars should not pass the bicycle. Alignment in the center also provides additional buffering from “door swing” when on-street parking is present.
- » MMUTCD notes that sharrows must be a minimum of 4-feet from the curb (and can be more further away) where there is no on-street parking, and a minimum of 11-feet from face of curb (and can be further away) when on-street parking is present.
- B Placement along Street:** Sharrows shall be placed in both directions of travel (unless other dedicated lanes are provided on just one side of the street). Sharrows should be placed at the start of a lane after an intersection, and spaced at 250-foot intervals or less (down to a minimum of 100-feet)

Figure 4.3.7- Sharrows



Additional Design Considerations

- Sharrow use is not affected by seasonal variations.
- Additional street signage, such as a “Share the Road” signs, may be used in conjunction with sharrow markings to further reinforce the shared use of the road for motorist.

Utility Considerations

- Locate manholes outside of identified bicycle lines of travel as they can produce a rough, slippery, and uncomfortable ride.

Sustainability Considerations

- Because sharrows are located in an otherwise typical vehicle travel lane, they do not present any obvious opportunities for green street treatments.

Design References

- The MMUTCD provides standards on shared lane markings.
- The NACTO Urban Bikeway Design Guide provides additional guidance on designing and using sharrows.

MAINTENANCE & MANAGEMENT

Special Maintenance

- Sharrows are additional pavement markings in the roadway that need additional maintenance to ensure they remain highly visible. Use of dotted lines and/or colored paint add further maintenance requirements.
- Placing sharrows toward the center of the lane may reduce wear and fading because the sharrows are located between the primary wheel track of vehicles.

Seasonal Use & Maintenance

- Shared lanes do not require any unique snow removal procedures. The travel lane and parking lane (where provided) should be cleared of snow for the full width to reduce vehicle encroachment onto the line of travel established by sharrows.

Reviews & Approvals

- The Ann Arbor Systems Planning Unit in collaboration with other units determines appropriate use of sharrows. For public projects, the project manager should coordinate with the Ann Arbor Engineering Unit and Systems Planning Unit.

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INTERSECTION ZONE

BIKE BOXES

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis						
Pedestrian	■	■				
Transit		■	■	■	■	
Bicycle		⚠	⚠	⚠		⚠
Balanced		■	■	■	■	⚠

DESCRIPTION & INTENT

A bike box is a dedicated area for cyclists at the front of a traffic lane at a signalized intersection. Bike boxes make cyclists more visible to motorists by positioning them at the head of a queue during a stop cycle. They provide a space for cyclists to queue outside of crosswalk areas. Bike boxes enable cyclists to safely position for a left turn during a stop cycle at an intersection. On corridors of high bicycle activity, bike boxes cluster multiple cyclists and enable them to progress forward at the onset of the green signal cycle. This clears a bicycle lane more quickly allowing for a sooner progression of right turning vehicles. Bike boxes can improve safety by reducing or eliminating the need for bicycles to weave across travel lanes to make a left turn and reducing conflicts with right turning vehicles, “right hooks.”

Bike boxes can significantly increase the visibility and appeal of bicycling in a downtown area and support increased bicycling activity.

¹ “High bicycle volume” is a subjective measure. Precise warrant thresholds for bike boxes do not presently exist. Typically bike boxes are applied at locations where several cyclists (5 or more) may queue in a bicycle lane during the peak hour, though bike boxes may also serve an important purpose at lower volume locations and should not be precluded based on volumes alone.

USE & APPLICATION

Location

- Bike boxes are used only at signalized intersections.
- Bike boxes must be used in conjunction with “No Right Turn on Red” (and “No Left Turn on Red”) restrictions. This limitation must be considered when determining appropriate locations for the use of bike boxes.
- Bike boxes are most beneficial on streets with high bicycle volumes¹ (5 or more in queue during peak hours), locations with significant left turn bicycle activity, and/or intersections where conflicts between right turning vehicles and bicycles are common.
- Bike boxes may be appropriate in any street type but generally should be reserved for areas where high bicycle activity is anticipated or desired, such as on bicycle emphasis streets.
- Bike boxes may also be desirable in high pedestrian zone areas to protect crosswalks from encroachment by bicycles or vehicles.
- While relatively logical, straightforward and easy to use, education and outreach to motorists, cyclists and pedestrians may be necessary to ensure their safe and appropriate use.

Related Design Elements

Incompatible Elements:

- **Right on Red:** Bike boxes may not be used where a right-turn on red is permitted.
- **Unsignalized Intersections:** Bike boxes may not be used at unsignalized intersections.

DESIGN & OPERATIONS

Design Requirements

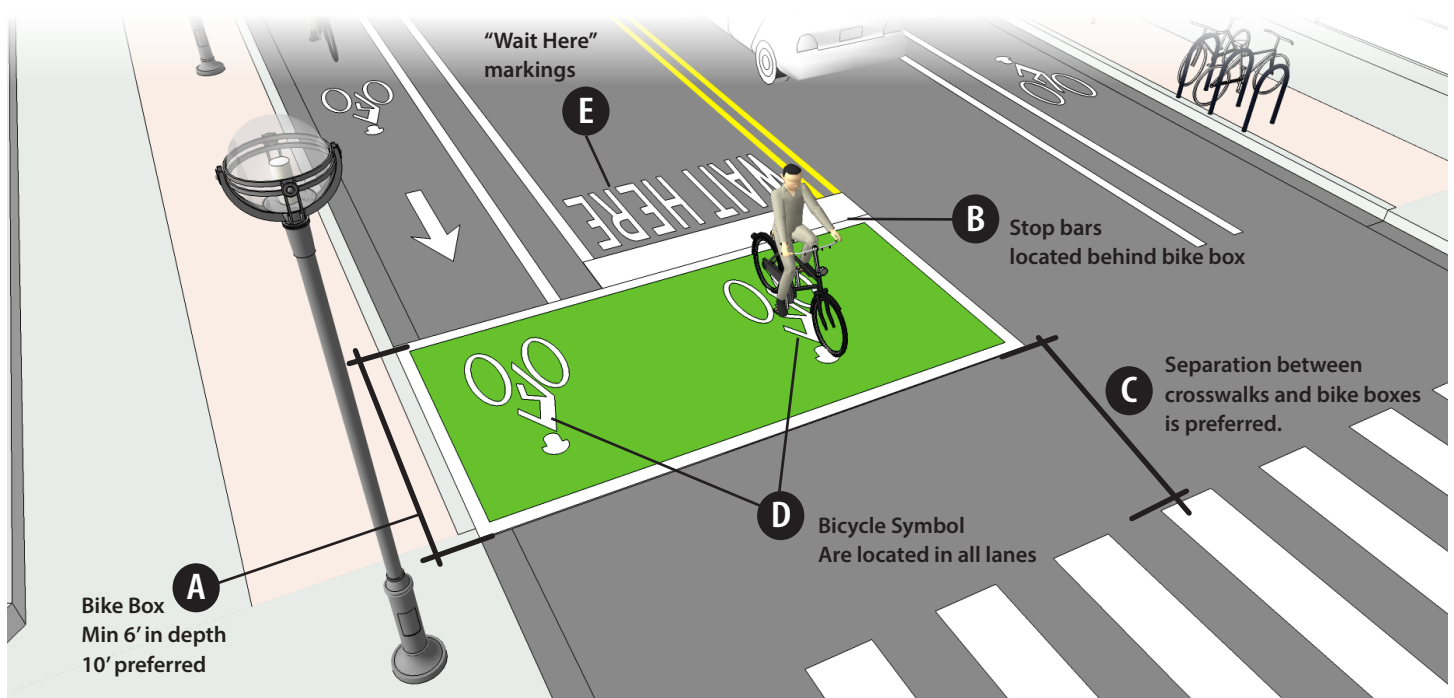
- A** **Box Size:** The bike box is formed by two parallel pavement marking lines at least 6 inches thick forming a box at least 6-feet in depth (10-foot preferred) and extending from the outside of the bicycle lane across all travel lanes in the direction of travel.
- **Placement:** Bike boxes are located between the crosswalk and the vehicle advance stop bar.
- B** » The vehicle stop bar shall be moved back to the rear of the bike box. Stop bars may be moved back up to an additional 7 feet to prevent encroachment into the bike box.

- C** » Bike boxes shall be separate and distinct from the crosswalk and may be moved further back from the crosswalk to create more separation and prevent cyclists from blocking the crosswalk.
- D** **Bicycle Markings:** Bicycle symbol pavement markings are located within the bike box in all lanes over which it extends.
- **No Right Turn on Red:** Right turn on red shall be prohibited where bike boxes are used and shall be signed accordingly.

Additional Design Considerations

- E** **“Wait Here”** pavement marking or signs may be used to indicate to vehicles where to stop to avoid encroachment on the bike box.
- **Special Pavement Markings:** Green pavement marking is commonly used in bike boxes but is not required.
- **Bike Boxes Without Bike Lanes:** When bicycle lanes are not present, bike boxes can still be used by providing a short ingress bike lane to provide bicycles access to the bike box as they approach the intersection. Green pavement marking may be used in the bicycle approach lane.

Figure 4.3.8- Bike Boxes



- Bicycle egress lanes may continue into the intersection to indicate the area of potential conflict between motorists and cyclists. Green pavement marking may be used.
- **Two-Stage Turn Queues:** While bike boxes facilitate the positioning of cyclists to make left-hand turns, lateral movement by a cyclist after the initiation of the green phase could introduce conflicts with motorists. Two-stage turn queues are an alternative to accommodate left turning cyclists.
- **Enforcement:** Driver encroachment into bike boxes is typically no more common than encroachment into crosswalks and typically requires no additional enforcement.

Design References

- Bike boxes are currently experimental treatments The National Committee on Uniform Traffic Control Devices (NCUTCD) Bicycle Technical Committee has proposed draft guidance for bike boxes to be adopted into the MUTCD.²
- The NACTO Urban Bikeway Design Guide provides further guidance on the use and design of bike boxes.

MAINTENANCE & MANAGEMENT

General Maintenance

- Bike boxes are additional pavement markings that will require maintenance.

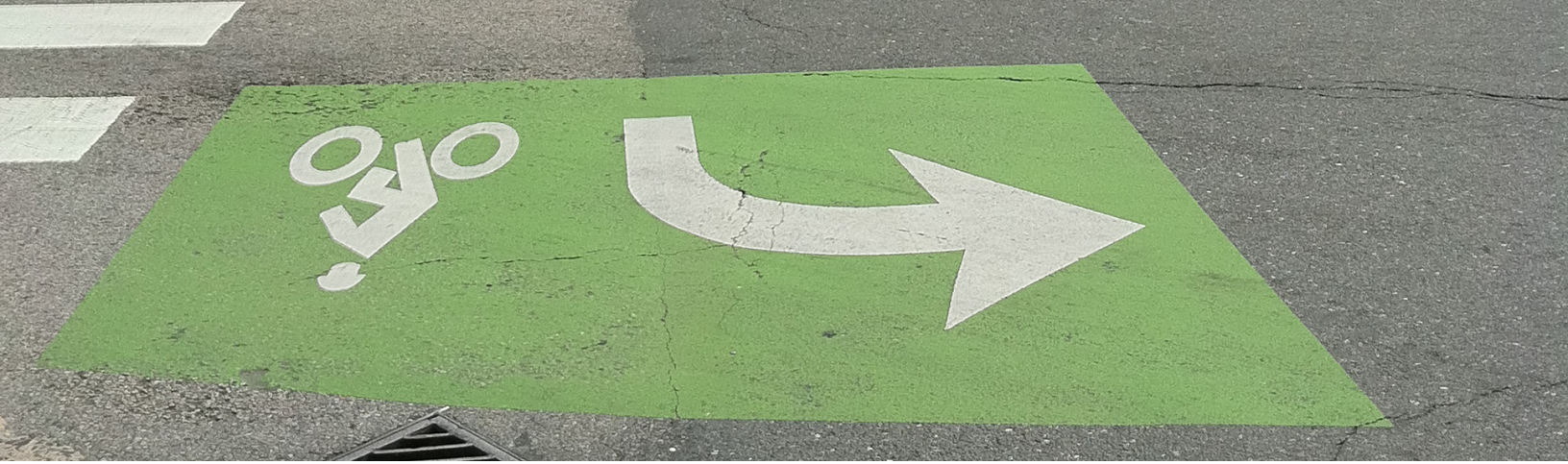
Reviews & Approvals

- The Ann Arbor Engineering and Systems Planning Units work collaboratively to determine locations for installation of bike boxes in coordination with the Street Design Team.³

² http://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/design_guidance/mutcd/bicycle_box.cfm

³ <http://nacto.org/cities-for-cycling/design-guide/intersection-treatments/bike-boxes/>

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INTERSECTIONS

TWO-STAGE TURN QUEUE BOX

DESCRIPTION & INTENT

A two-stage turn queue box provides a protected area for cyclists to move out of the through traffic lane on the right hand side of a street and wait for the green cycle of the intersecting road before proceeding across to complete the turn.

Left turns can be a difficult challenge for cyclists who typically travel along the right side of a roadway. Merging across travel lanes can be dangerous and stressful, particularly for novice or concerned cyclists. Two-stage turn queues reduce bicycle/vehicle conflicts and provide a less stressful left-turn option.

While two-stage turn queues increase bicycle comfort and accommodation at multi-lane intersections, they do require two separate stages for a cyclist to complete a left-turn (first proceeding across, then proceeding through to the left). This may increase travel time for cyclists, although the benefit of comfort outweighs the time penalty. This makes two-stage turn queues a net positive in expanding cycling in downtown and making cycling more accessible to a broader range of cyclists.

Even where two-stage turn queues are provided, their use is optional. Cyclists may still lawfully complete a left turn from the left-most travel lane where vehicular left turns are also permitted.

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis					
Pedestrian	■	■			
Transit		■	■	■	
Bicycle		⚠	⚠		⚠
Balanced		■	■	■	⚠

USE & APPLICATION

Location

- Two-stage turn queues may be used on any street type, but are especially appropriate where there are significant volumes of turning cyclists, along preferred travel routes where the City wishes to encourage cyclists, and/or where accommodation of less confident cyclists is needed.
- Two-stage turn queues are beneficial where traffic volumes can make it difficult to get into a normal left-turn position and/or where cyclists frequently need to pause in the intersection to wait for on-coming traffic to clear before turning. This is a common situation on many downtown streets in congested Destination Commercial and Commercial areas.
- Two-stage turn queues are particularly beneficial on multi-lane streets (e.g. streets with more than one travel lane in any one direction including turn lanes).
- Two-stage turn queues are commonly used to provide left turns where cyclists typically travel on the right-hand side of the street but may similarly be used to accommodate right turns from a left-side bicycle facility.
- Two-stage turn queues are generally used in conjunction with other bicycle facilities, such as bicycle lanes or separated bicycle lanes, but may be used on any corridor where safe and comfortable accommodation of left-turning bicycles is needed.

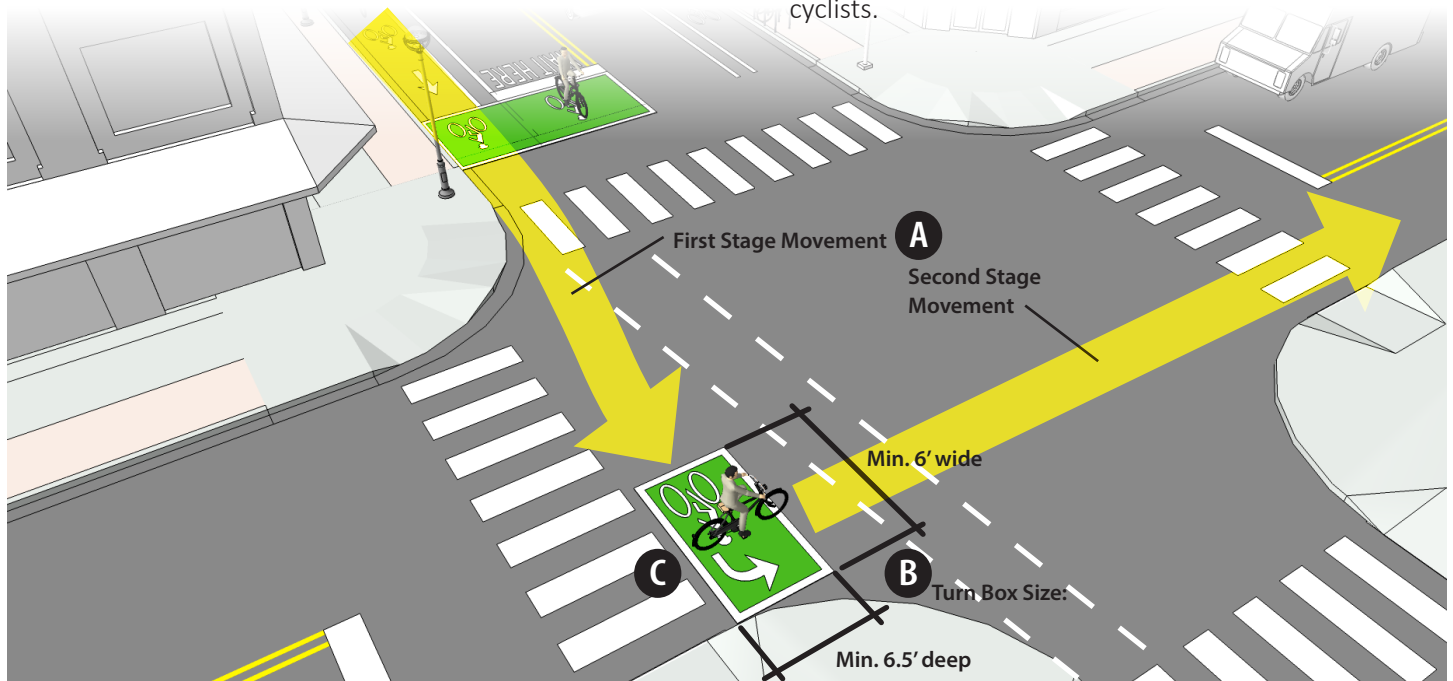
Related Design Elements

- **Intersections:** Two-stage turn queues rely on a safe and protected location for bicycle queuing prior to completing the turn. Two-stage turn queues must be considered in the complexity of an intersection and must not block through travel during the first stage crossing (including through bicycle travel).
- **Curbside Uses:** Two-stage turn queues work well on streets with on-street bicycle parking (corrals), bumpouts or other reserved curbside use, but may be used elsewhere as well.
- **Signals:** Two-stage turn queues may be used at signalized or unsignalized intersections. While typically unnecessary at stop-controlled intersections, they may be used. If signals are actuated, locate detectors and/or turn queues where bicycles will be detected.

Incompatible Elements

- Two-stage turn queues should not be placed in front of right-turning vehicle lanes when right turns on red are allowed.
- Two-stage turn queues should not be placed adjacent to transit stops, as there may be a conflict between passengers boarding and cyclists waiting in the queue.

Figure 4.3.9- Two-Stage Turn Queue Box



DESIGN & OPERATIONS

Design Requirements

- A Bicycle Movement:** A two-stage turn queue shall consist of a “first stage” bicycle travel facility, a bicycle lane, and a “second stage” queue box that accommodates cyclist waiting for the signal prior to completing the turn.
- B Turn Box Size:** The turn box shall be at least 6.5-feet deep in the direction of egressing travel. The turn box shall be at least 6-feet wide, but may be widened out to the width of aligned travel lane and/or where space permits.
- C Turn Box Location:** The turn queue box shall be positioned on the intersection side of the crosswalk and clear from any through bicycle movements from the receiving direction, to allow cyclists progressing through the intersection to avoid those using the turn queue box.
 - » Relative to the cross-street, the turn queue box should be positioned in alignment with the cross-street bicycle lane or, if none is present, in alignment with the thru-vehicle travel lane.
- **Pavement markings** in the two-stage turn queue shall include a bicycle signal and an arrow indicating the proper ingress and turning direction.
- **Right on red turn** shall be prohibited where turn boxes are used to avoid conflicts with queued and waiting cyclists.

Additional Design Considerations

- **High-Visibility Markings:** Use green pavement to increase visibility and legibility of the two-stage turn queue.
- **Bicycle Lane Markings:** If bicycle lanes are present, use dashed lines to indicate bicycle lane through the intersection and ensure queued cyclists stay clear of this travel facility.
- **Signal Detection:** If detectable/actuated signals are used, ensure bicycles will be detected in the two-stage turn queue. Bicycles should not be required to use pedestrian actuation to gain crossing.
- **Crosswalks and Bike Boxes:** Under constrained circumstances, crosswalks may be adapted to enable space for bicycle queuing. Alternatively a standard bike box (see Bike Box) may be used; this, however, requires cyclists to cross the pedestrian line of travel and should only be used where pedestrian volumes are low.

Design References

- MMUTCD provides standards on pavement marking and signage standards.
- The NCUTCD Bicycle Technical Committee has proposed draft guidance for two-stage turn queues to be adopted into the MUTCD.¹
- The NACTO Urban Bikeway Design Guide provides additional guidance on the use and design of two-stage turn queues.²

¹ <http://www.ncutcd.org/sponsors.html>

² <http://nacto.org/cities-for-cycling/design-guide/intersection-treatments/two-stage-turn-queue-boxes/>

MAINTENANCE & MANAGEMENT

General Maintenance

- Two-stage turn queues result in additional pavement marking that will require maintenance. The use of green markings may add additional maintenance complexity.
- Placing markings between vehicle tire tracks may reduce wear and tear.

Seasonal Use & Maintenance

- **Snow Removal:** Two-stage turn queues should be cleared of snow concurrent with all other street snow removal activities. Bicycle facilities should not be used for snow storage.

Reviews & Approvals

- The Ann Arbor Engineering and Systems Planning units work collaboratively to determine locations for installation in coordination with the Street Design Team.



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INTERSECTIONS

BICYCLE SIGNAL

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	■	■			
Transit			■	■	■	
Bicycle			⚠	⚠		⚠
Balanced			■	■	■	■

DESCRIPTION & INTENT

Bicycle signals are separate traffic signals used to guide and direct cyclists at intersections. Instead of the standard circle or arrow symbols, bicycle signal heads display a bicycle outline in each color phase. Bicycle signals are designed to reduce conflicts by separating bicycle and motor vehicle movements.

USE & APPLICATION

Location

Bicycle signals are used only at signalized intersections and when bicycle-only and/or leading bicycle intervals are required during a signal cycle. This may occur:

- Where contra-flow bicycle lanes join or cross an intersection.
- Where bicycle and pedestrian volumes are sufficiently high that a bicycle leading interval would be advantageous to safety and/or operations.
- Where two-way separated bicycle lanes are used.
- At intersections with high bicycle volumes, a significant number of vehicle/bicycle crashes and/or geometrically complex intersections.

At present, there are no nationally established thresholds or warrants for bicycle signals. The California MUTCD is a leading state example that provides warrants for volume and collision and volume and geometric thresholds (at least 50 bicycles per peak hour, two or more bicycle/vehicle collisions within a 12-month period of types that could be reduced by a bicycle signal, and/or a movement or connection not open to vehicles is required).¹

Some jurisdictions have adopted signs instructing cyclists to follow pedestrian signals in lieu of bicycle signals.

Use of bicycle signals will generally be limited to bicycle emphasis street intersections. At present, few, if any, intersections in downtown Ann Arbor exist where bicycle signals are necessary. However, with enhanced bicycle facilities and anticipated increased bicycle activity, installation of bicycle signals may be desired.

Related Design Elements

- Bicycle signals shall not be used in conjunction with sharrows.
- Bicycle signals and their associated stop zone should not impede the Sidewalk or crosswalk zone.
- Bicycle signals may necessitate prohibition of right on red.

¹ State of California Department of Transportation. California Manual on Uniform Traffic Control 11 Devices. State of California Department of Transportation; 2010. Pp. 831.

DESIGN & OPERATIONS

Design Requirements

- **Orient signal heads** to be clearly visible to on-coming cyclists.
- **Signal Activation:** Automatic detection is preferred. If manual activation is required, push buttons shall be located where cyclists can easily access them without leaving the bicycle facility. If the bicycle signal is not programmed into each light cycle actuate bicycle signal manually (e.g. push button) or automatically (e.g. in-pavement loop detector).

Additional Design Considerations

- **Right-Turn On Red:** If the bicycle signal separates bicycle movements from motor vehicle turning movements, right turn on red should be prohibited.
- **Signage:** Bicycle signals may be accompanied by unique signage targeted at the cyclist to explain the function and use of the signal. This is particularly valuable if bicycle signals are uncommon or if the movement governed by the signal is unique to bicycles.
- **Signal Timing:** The introduction of bicycle signals may require overall signal re-timing and periodic timing reassessment. There is no specific established guidance at present as to bicycle clearance intervals or other phasing.
- **Bicycle Symbol Face:** Use of the bicycle symbol face inside of the signal head requires obtaining FHWA interim approval. Alternatively, solid color signal faces may be used in conjunction with a sign next to the signal indicated that it is a "BICYCLE SIGNAL."

Design References

- MassDOT (2015) Separated Bike Lane - Planning & Design Guide: Provides guidance on the installation and application of bicycle signals.
- The FHWA has provided interim approval for the optional use of a bicycle signal face (December 2013).¹
- The NACTO Urban Bikeway Design Guide provides additional guidance on the use and design of bicycle signals.²
- MMUTCD provides standards for traditional traffic signals, however not all guidance may be applicable specifically to bicycle signals.

MAINTENANCE & MANAGEMENT

General Maintenance

- Bicycle signals will require additional infrastructure and maintenance and long-term maintenance will be the same as other signalized intersections.

Seasonal Use & Maintenance

- Bicycle signals do not demand any special snow removal protocols.

Reviews & Approvals

- The Ann Arbor Engineering Unit, in collaboration with Systems Planning and Public Works, will review proposed signals and recommend installation if needed.

² http://mutcd.fhwa.dot.gov/resources/interim_approval/ia16/index.htm

³ <http://nacto.org/cities-for-cycling/design-guide/bicycle-signals/bicycle-signal-heads/>



AMENITY ZONE

BICYCLE PARKING

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	⚠	✓			
	Transit		✓	✓	✓	
	Bicycle		✓	✓		■
	Balanced		✓	✓	✓	■

DESCRIPTION & INTENT

Bicycle parking provides cyclists with a safe, secure, and reliable place to park bikes whether commuting, running errands, or patronizing downtown businesses. Bicycle parking is an essential component of the downtown’s multi-modal transportation network.

Ann Arbor city code establishes requirements for bicycle parking¹ and identifies three types of bicycle parking (A, B and C):

- Long-Term Bicycle Parking (A):** Long-term bicycle parking is typically fully enclosed, secured and sheltered storage intended to accommodate a personal bicycle for a period of several hours or days. Spaces may be individually assigned and reserved and often require prearranged authorization to access (for example via a code, card or key). Long-term bicycle parking is generally necessary at places of work or residence, and most appropriately accommodated on private property. Typical means of providing for long-term bicycle parking include bicycle lockers, bicycle cages, sheds, or rooms.

- Mid-term Bicycle Parking (B):** Mid-term bicycle parking accommodates daily bicycle parking demands, such as parking during typical work shifts, school days, or other activities of two to eight hours in duration. Mid-term bicycle parking is not intended for bicycle storage. This parking is sheltered, but full enclosure is not necessary as parking should be accessible to, and shared by, many uses. Mid-term bicycle parking is best located on private property but immediately accessible and visible from the public street. Mid-term bicycle parking is typically satisfied by bike racks located within a parking structure, under an eave or overhang, or fitted with a stand-alone roof.
- Short-Term Bicycle Parking (C):** Short-term bicycle parking supports quick trips to destinations around downtown. Short-term bicycle parking is typically appropriate in the public right-of-way either in the Amenity Zone of the sidewalk or in the Curbside Zone of the street. It should be dispersed across downtown and easily accessible to every property on a commercial block. This type of parking is most often accommodated by bicycle hoops provided singly, in clusters of two or three, or in a public bike corral.

¹ Ann Arbor City Code, Chapter 59, section 5:167 Required Parking

USE & APPLICATION

This design element section primarily considered Short-term bicycle parking (type C) provided by bike racks located within the street right-of-way.

Location

- Bicycle parking is potentially needed in any frontage type, but is particularly necessary in Commercial, Civic & University, or Mixed use areas.
- In Destination Commercial areas, there may be competing demands for use of the Amenity Zone (e.g. for cafe dining & outdoor retail) and bicycle parking should be located to keep those areas open. Consider placing bicycle parking closer to intersections and not immediately in front of potential occupancy areas.
- Bicycle parking should be plentiful, dispersed, visible and conveniently located.
- Bicycle parking should facilitate transfers between modes. It should be accessible to major transit stops, transfer points and the Blake Transit Center.
- Locating bicycle parking near to corners improves visibility, access to curb ramps, and accessibility to more block frontages. Parking should be located far enough away from the corner to avoid conflicts with curb ramps or sight lines.



Related Design Elements

- **Pedestrian Area:** Bicycle parking must be located and aligned in a way that does not impede the pedestrian clear zone or block access between the curbside and clear Walking Zone.
- **Bicycle lanes:** Bicycle parking complements bicycle travel facilities and should be amply located along bicycle routes, lanes, separated bicycle lanes, and trails.
- **Bumpouts:** Bicycle parking works well in bumpouts or bike corrals that extend the pedestrian environment into the parking lane, freeing up space on the sidewalk for circulation or other amenities.

Policy References

- The Association of Pedestrian and Bicycle Professionals (APBP) Bicycle Parking Guidelines.

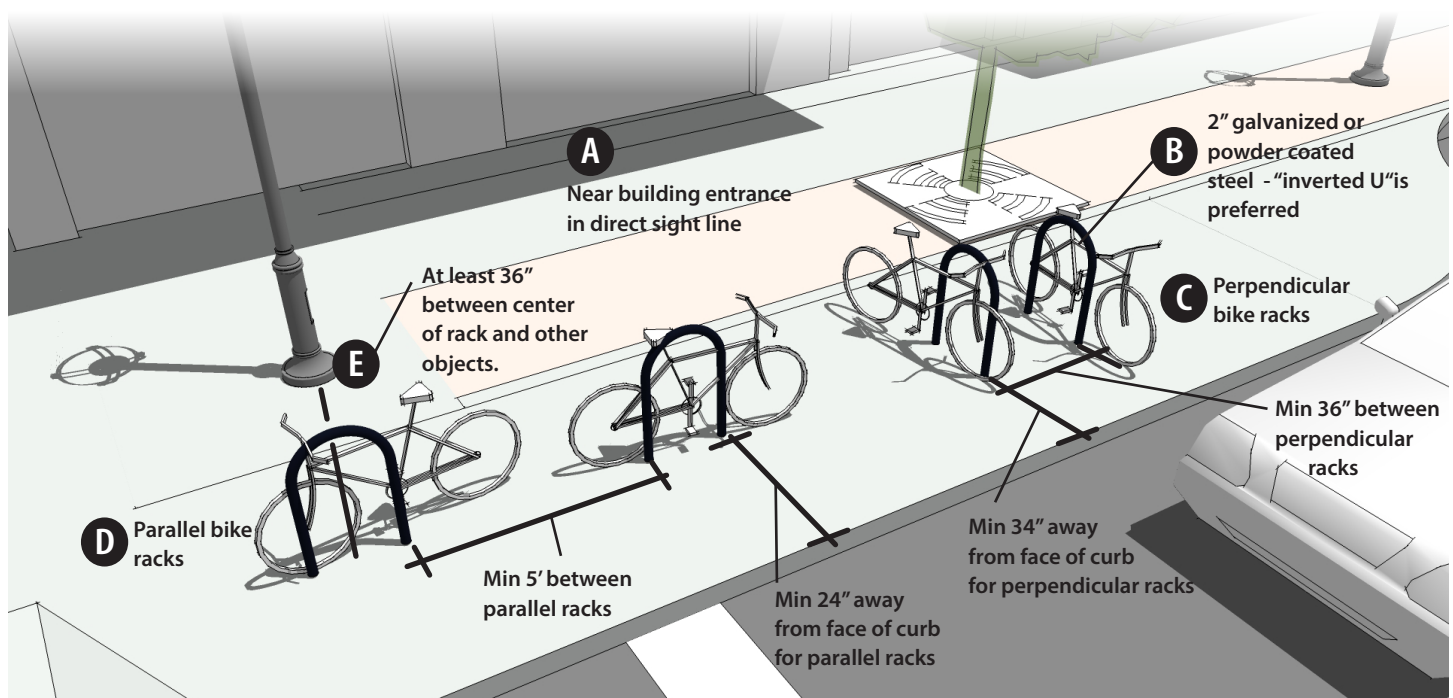


DESIGN & OPERATIONS

Design Requirements

- A Location:** Locate bicycle parking near building entrances in direct line of sight to the point of entry. Bicycle parking should be in areas that are well lit and have many eyes on the street to improve safety, comfort, and security. Avoid placing bicycle parking along blank walls where there is limited visibility from inside the building to the racks.
- **Bike Rack Durability:** Racks shall provide secure parking for a bicycle. Bolted down racks (utilizing anti-theft bolts) are preferred. In brick environments, embedding is necessary. Racks shall resist cutting, damage, or disassembly with typically available implements.
- B Bike Rack Design:** A 2 inch galvanized or powder coated steel “inverted U” is the preferred bicycle rack design in Ann Arbor. Other styles, including custom or artistic designs, are acceptable provided they meet the below requirements. Maintenance responsibilities must be clear when using any non-standard bike rack ; an encroachment permit or licensing may be required.
 - » Racks shall support a bicycle in an upright position, supporting a bicycle frame in at least two places for common bicycle frame types.
- » Rack design and installation shall enable bikes to be easily, intuitively, and securely locked. If artistic bicycle rack designs are used, ensure that U-locks or other typical locking devices can be conveniently used securing both wheels and frame of a bicycle.
- » Racks should permit locking of both tires and accommodate “front in” and “back in” bicycle parking.
- **Bike Rack Orientation and Clearance:** Bicycle racks may be placed parallel, perpendicular or at an angle to the curb line singly or in groups of two or more.
- C** When perpendicular to the curb, racks shall be at least 36 inches apart on center and shall be at least 34 inches from the face of curb and edge of the sidewalk.
- D** When placed parallel to the curb, racks shall be at least 5 feet apart at their nearest point. Bike racks shall be at least 24 inches from the face of curb (30 inches is preferred where width permits) and 18 inches from the edge of the sidewalk.
 - » When at a 45 degree angle, hoops should be at least 42 inches apart at center and shall be at least 34 inches from the face of curb at the closest point.

Figure 4.3.10- Bicycle Parking



- **Clearance From Other objects:**

- » Install racks with a minimum clearance of at least 36 inches between the center of the rack and any other fixed object.
- » Bicycle racks adjacent to bus stops shall be located at least 5 feet in front of a bus flag mounted on a post or shelter or 30 feet behind it.
- » Racks must be located to maintain the clear pedestrian zone when bicycles are parked.

Additional Design Considerations

- Short-term bicycle parking is typically accommodated in the Amenity Zone of the sidewalk. Other acceptable locations include bumpouts and the Frontage Zone.
- Bicycle parking may be integrated with other street features such as parking meter posts, light poles, planters, parklets or tree guards.
- **Lighting:** Adequate lighting around bike parking is important for safety and security. Illuminate areas around bike parking to a minimum of 0.4 foot candles and max uniformity ratio of 10 to 1.
- Consider unobtrusive ways to provide cover or shelter to bicycle parking.

Utility Considerations

- Ensure that bicycle racks do not block access to utility boxes or hand holes.

Sustainability Considerations

- Bicycle parking promotes and enables human-powered, emission-free travel options providing a number of environmental benefits.
- Bicycle parking should be located proximate to street trees to avoid the temptation to lock bicycles to street trees and to reduce damage to the tree.
- Where bicycle parking is covered, consider incorporating solar panels, green roofs, and white roofs.

Design References

- The APBP Bicycle Parking Guidelines provide recommendations on the design and location of bicycle parking.²
- The City of Ann Arbor Bicycle Parking Manual for Businesses provides design guidelines for placement and lighting of bike parking.

MAINTENANCE & MANAGEMENT

Special Maintenance

- Durable material and quality installation can significantly reduce maintenance demands. The DDA cooperates with the City of Ann Arbor Community Services Unit to track and remove abandoned bicycles.

Seasonal Use & Maintenance

- Bicycle parking should be available year-round and in all types of weather. Covered bicycle parking can promote year-round cycling.
- Property owners are responsible for snow removal adjacent to their property; bicycle parking should be kept clear after a snow event.
- Avoid snow storage that precludes the use of bicycle racks.

Reviews & Approvals

- The City of Ann Arbor Engineering Unit oversees permanent infrastructure installations on public sidewalks and coordinates with the DDA regarding bicycle parking. The two agencies evaluate proposed bicycle parking in the public right-of-way as part of site plan review.
- The City of Ann Arbor Planning and Development Services review compliance with city code requiring bicycle parking on private property for all new construction projects.
- The DDA supports maintenance of standard bicycle hoops in the public right-of-way. The AAATA manages activities on transit authority property, including the Blake Transit Center.

² <http://www.apbp.org>



CURBSIDE ZONE

BIKE CORRAL

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	⚠	⚠			
Transit			⚠	⚠	⚠	
Bicycle			⚠	⚠		■
Balanced			⚠	⚠	⚠	■

DESCRIPTION & INTENT

A bike corral is a designated area for short-term bicycle parking. Bike corrals provide parking for a number of bicycles in a compact area. Bike corrals may be located on sidewalks, in parking lots, or other areas behind the curb, but are often placed in the curb lane of the street. By converting a parking space into space for a bike corral, cities can accommodate parking for 12 to 20 patrons on bicycles in the space typically used to park one automobile.

Bike corrals can replace bicycle hoops, bike racks, freeing up sidewalk space for other uses such as additional pedestrian space or cafe dining. Bike corrals are an excellent solution for accommodating a large number of bicycles near specific activity areas and in areas with narrow sidewalks.

Bike corrals are often highly valued by ground floor businesses. Despite removing a valuable curbside parking space, many businesses have found that bike corrals improve accessibility and visibility to their establishment(s) in addition to relieving pressure on limited sidewalk space.

In downtown Ann Arbor, the DDA provides bike corrals and the use of the on-street parking space free of charge to businesses that request a corral and show demand (as can be accommodated).

USE & APPLICATION

Location

- Bike corrals should be used in areas of high volume of bicycle traffic, or near significant destinations such as business districts, schools or civic buildings.
- Bike corrals are suitable for all functional emphases and frontages contexts but demand for bicycle parking is likely to be highest in Destination Commercial, Commercial and Civic & University areas.
- Bike corrals are unlikely to be necessary in Near Neighborhood contexts.
- Bike corrals placed in the street may only be utilized in streets with reserved curbsides. Typically this means they will only be used on streets with on-street parking.
- Bike corrals in a northern climate like Ann Arbor may be temporary installations removed during the winter months to facilitate snow plowing activities. For this reason, additional bicycle parking alternatives may be necessary in areas where bike corrals are commonly used to continue to meet the need for bicycle parking even during winter months.

Related Design Elements

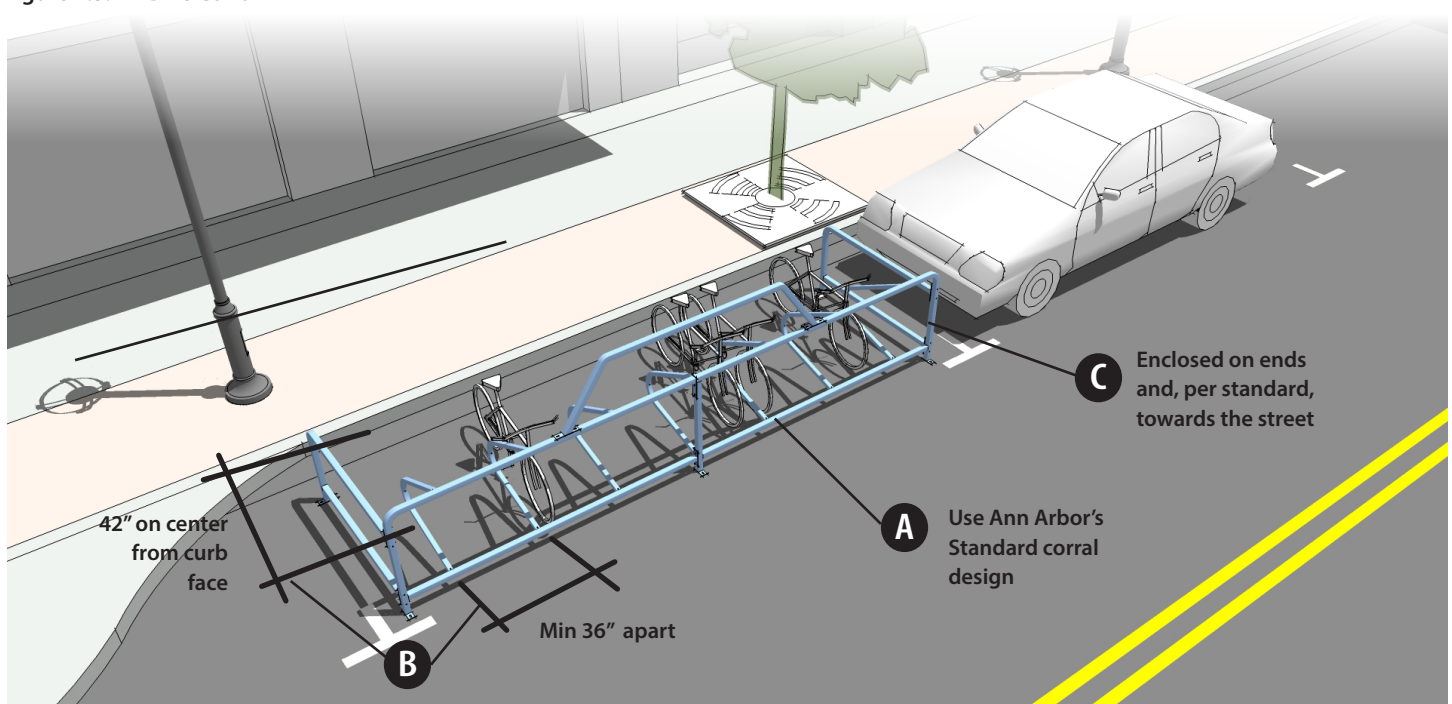
- **Bicycle Lanes:** Bicycle parking complements bicycle travel facilities and should be amply located along bicycle routes and facilities proximate to major generators or destinations.
- **Bicycle Parking:** Bicycle parking works well in bumpouts or bike corrals that extend the pedestrian environment into the parking lane, freeing up space on the sidewalk for circulation or other amenities.
- **On-Street Parking:** On-street bike corrals may only be used on streets where the curb lane is not used for travel.
- **Loading Zones:** While bike corrals convert an on-street parking space, they should not be located in spaces reserved for loading.

DESIGN & OPERATIONS

Design Requirements

- **A Corral Design:** Ann Arbor has a standard bike corral design. To facilitate maintenance, this standard corral shall be used. Alternative designs may be possible with specific sponsorship and maintenance agreements and with Street Design Team approval.
- **B** » Racks shall be oriented perpendicular to the curb, placed 36 inches apart, and provide 42 inches between the rack and the face of curb.
- » Bike corrals shall be immovable once placed, but capable of being removed and stored during winter months.
- **Location:** Bike corrals shall be placed within a standard on-street parking space. Corrals placed at the end of a bank of parking can prevent parked cars from creeping too close to the intersection area.
- **C Corral Enclosure:**
 - » Provide protection on either end of the bike corral to prevent damage by autos parking or traveling.
 - » The Ann Arbor standard is to have the enclosed side of the standard bike corral toward the travel lane of the street with access from the sidewalk side.

Figure 4.3.11- Bike Corral



Additional Design Considerations

- **Alternate Corral Designs:** There are many types of bike corral designs. Alternative designs are possible provided the design complies with above guidelines and provides protection from the travel lane (per Ann Arbor standards), and provides protection on either end of the bike corral. DDA manages and maintains since we are the only one who puts them in.
 - » An alternative design, used in many cities, is an open design permit bicycle parking access from either the street or sidewalk side.
- **Shelters:** Bike corrals with roofs may provide sheltered bicycle parking as long as they do not interfere with sight lines..
- **Bumpouts:** Bike corrals may be located on bumpouts or where there is adequate space.
- **Bicycle Repair Stations:** Consider placing a bicycle repair station adjacent to or integrated with the corral. A repair station is an outdoor frame that contains tools for fixing a bicycle, such as a tire pump. Individual tools can be secured to the station with a flexible band that allows cyclists to use them on their bike without the potential for theft. There is a bicycle repair station located at city hall.

Utility Considerations

- Do not locate bike corrals over vaults.
- Consider stormwater facilities when siting.

Sustainability Considerations

- Bike corrals not only accommodate demand for bicycle parking but also promote the visibility of this low-emission form of travel.
- If bike corrals are covered, consider incorporating solar panels, green roofs, and white roofs.

MAINTENANCE & MANAGEMENT

Special Maintenance

- Durable material and quality installation can reduce maintenance demands for bike corrals.
- The DDA cooperates with the Ann Arbor Community Standards Unit to track and remove abandoned bicycles.

Seasonal Use & Maintenance

- On-street bike corrals are typically removed and stored during winter months to facilitate snow removal.

Reviews & Approvals

- The DDA is responsible for installation and maintenance of standard parking corrals in on-street parking spaces. Outside of parking lanes or parking facilities, placement of bike corrals should be coordinated through the Ann Arbor Engineering Unit, Systems Planning Unit, and the DDA.



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4.4

TRANSIT

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AMENITY ZONE

BUS STOPS & SHELTERS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	⚠	⚠			
Transit		✓	✓	✓		
Bicycle		⚠	⚠	⚠		⚠
Balanced		⚠	⚠	⚠	⚠	⚠

DESCRIPTION & INTENT

Bus stops are designated places where riders can board or alight the bus. Bus stops may be as simple as a signpost along a curb edge or may be a distinct sub-place that includes distinct features such as a shelter, seating and/or public art.

Bus stops typically occur in the pedestrian zone of the street. Bus stops may be located at the curb line or may be accommodated on a bus bulb, an extension of the curb that permits the bus to safely board passengers from the travel lane. The location and design of bus stops depends on passenger volume and available space, among other factors. Bus stops typically share space on the sidewalk with other uses and should be considered in the overall context of the sidewalk area.

Bus stops should be located proximate to designated crosswalks since riders often cross the street to get to or return from the transit stop. Transit stop design should also consider cyclist access to the stop including bicycle route connections and bicycle parking.

Bus stops are most successful when they are appropriately scaled to the volume of riders, provide comfortable places to wait, and deliver sufficient information to transit riders to understand the services provided. A well-designed stop calls attention to the availability of transit service, explains how it works, and makes transit an appealing travel option.

USE & APPLICATION

Location

- Bus stops are appropriate and recommended for all street types and are essential to provide access and mobility for downtown users.
- The type of bus stop (sign only or shelter) and provided amenities will depend largely on the number of passengers utilizing that location (primarily waiting to board), as well as the width and pedestrian volume of the adjacent curbside and sidewalk areas, whether the space can accommodate transit amenities.
 - » On transit emphasis streets and in locations with high ridership, stops should provide an enhanced waiting environment, such as covered waiting shelter, formal seating, informal seating, rider information, and real-time information.
- Bus stops may be located at near-side, far-side, or mid-block locations.
 - » Where buses operate in mixed traffic and stop at the curb line, far-side stops are generally considered preferable unless located at a stop-controlled intersection or if a bus bulb is utilized.
 - » The location of the bus stop will be the result of multiple factors including operations, routing and transfers, and local land use and right-of-way context.

Related Design Elements

- **Sidewalks:** Bus stops must be co-located with continuous sidewalks and adjacent crosswalks connecting them to the larger pedestrian network. Transit stops should be accessed by ample sidewalks and wide, well-marked crosswalks in appropriate locations. Bus stops are complemented by a lively public realm with active building fronts and street activity. On multi-lane streets, pedestrians traveling to and from transit stops should have median refuges at the crosswalk.
- **Bus Bulb:** In locations where sidewalk space is tight, buses have difficulty re-merging into travel lanes, and/or large volumes of pedestrians wait, bus bulbs may be used.
- **Bicycle Parking:** Where possible, bus stops should include bike racks to accommodate bicycle access. Bike share stations should be located proximate to bus stops and/or provide wayfinding to nearby transit stops.
- **Bicycle Lanes:** On bicycle priority streets, bus stops should be designed to minimize conflicts with cyclists. This may include routing bicycle lanes onto the sidewalk and behind the transit stop to reduce conflicts between cyclists and transit passengers.

Policy References

- The AAATA follows guidelines promulgated by the Transit Cooperative Research Program (TCRP) for transit stop location and design (Report 19).
- The Downtown Ann Arbor Design Guidelines require that transit “be considered in the design of streetscapes” and that transit patrons have a “comfortable environment” at transit stops. The guidelines recommend providing trash receptacles and seating or leaning walls for waiting passengers, as well as nearby bicycle racks.
- The Non-Motorized Transportation Plan Update recommends that the walking distance to transit stops not exceed 1,300 feet (1/4 mile), that transit stops be located close to the main entrance of activity generators, and not areas with high numbers of transit users, particularly the elderly and persons with disabilities.

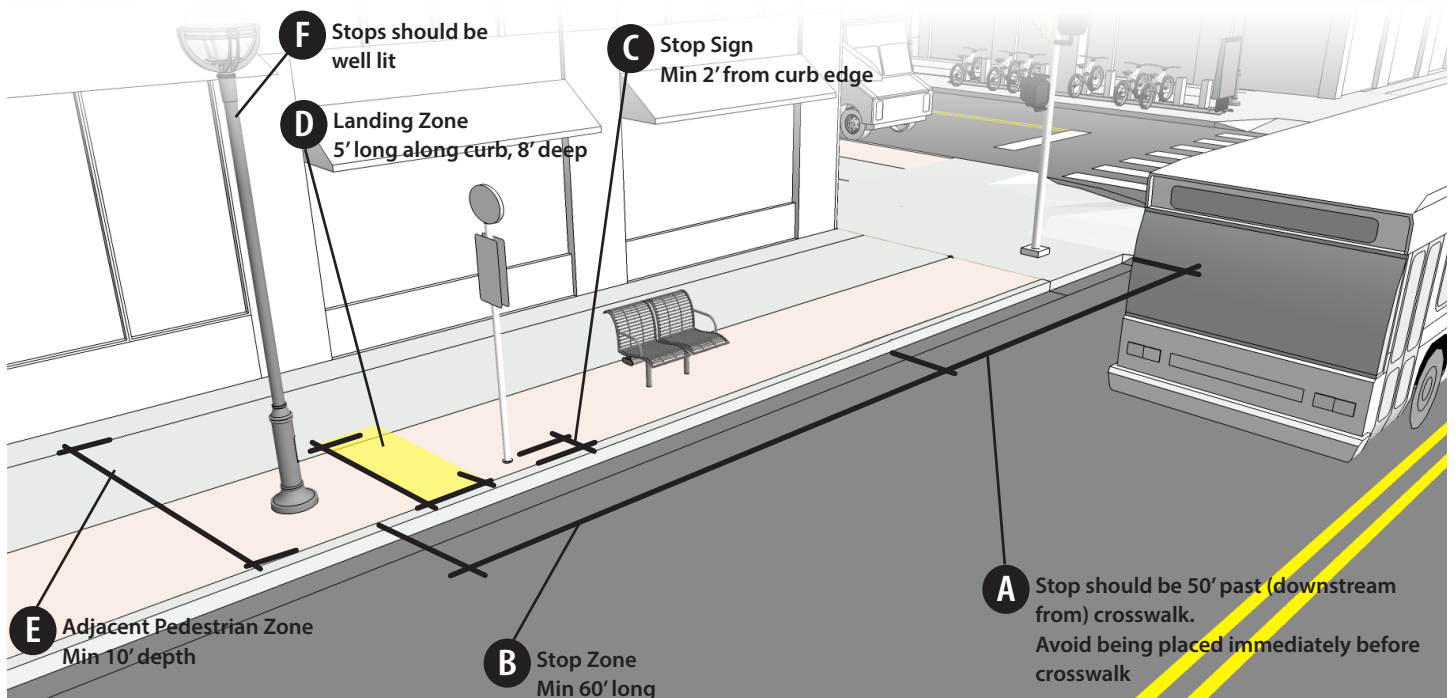


DESIGN & OPERATIONS

Design Requirements

- A Stop Location:**
- » Stops shall be at least 50 feet past (downstream from) a crosswalk whenever possible.
 - » Bus stops should not be placed immediately before (upstream of) a crosswalk as the stopped bus can prevent pedestrians and traffic from seeing each other.
 - » Bus stops should be located at least 100 feet from alleys or frequently used curb cuts, such as those servicing parking decks, to minimize conflicts with vehicles entering and exiting, however in dense urban contexts such as Ann Arbor, this is not always possible.
- B Stop Length:** Bus stops shall be at least 60 feet long.
- » Longer stops may be necessary if articulated buses are used and/or there is a high volume of buses utilizing a stop location. The bus zone is longer than the bus to accommodate buses maneuvering to the curb and/or back into the travel lane.
- C Signage Location:** Bus stops should have a flag sign on a sign post embedded in the sidewalk a minimum of 2 feet from the curb edge.
- » At far-side or mid-block stops, the sign should be located 25 to 35 feet from the front edge of the bus zone to give the bus room to pull out from the stop and reenter traffic from its stopped position
 - » Basic route information shall be provided including service operator, route(s) servicing that stop, schedule information, and major stops serviced.
- D Landing Zone:** Bus stops shall have a landing zone at every door that is at least 5 feet wide parallel to the curb and 8 feet deep. This allows enough room for the bus to extend its ramp for riders with mobility impairments.
- » Landing zones shall be clear of any curbside obstacles, such as street trees, planters, planting beds, light poles, or sign posts.
 - » In Near Neighborhood areas where the Amenity Zone may be a planting strip, using a hard paving surface for the landing zone is encouraged.
- E Pedestrian Area:** Adjacent pedestrian areas (Amenity Zone and Walking Zone) shall be at least 10 feet in total depth. 10 feet provides adequate space for passenger waiting while still providing comfortable room for pedestrians to travel through the bus stop zone.
- » Along sidewalks with greater pedestrian density, the width may need to be larger.

Figure 4.4.1- Bus Stops



F Lighting: Bus stops shall be well lit by the surrounding street light system. See Section 4.6- Street Lighting Design Element for recommended light levels.

» The City of Ann Arbor Bike Parking Manual for Businesses recommends illuminating areas around bike parking to a minimum of 0.4 foot candles and max uniformity ratio of 10 to 1. This light level would benefit transit stop locations as well.

- **Sidewalk Connectivity:** Bus stops shall be contiguous with a continuous sidewalk network.
- **ADA Accessibility:** Bus stops shall meet accessibility requirements including providing a smooth, level, and clear zone for boarding, alighting, waiting, and access and egress from the bus stop.

Additional Design Considerations

- **Safety:** Bus stops should be located and oriented to promote real and perceived personal safety for passengers waiting for transit service.
- **Shade:** Ideally bus stops will have some degree of shade, whether provided by adjacent buildings, street trees, or bus shelters.



- **Bus Shelters-Design:** Bus shelters may be provided at higher volume stops where sidewalk space permits.
 - » Shelters are typically 10 to 12 feet wide and between 5 feet deep.
 - » Shelters can be fully or partially enclosed on one or more sides to provide protection from wind and rain.
 - » Transit shelters should use transparent materials like glass, to improve security and reduce sight obstructions.
 - » Bus shelters provide the opportunity for additional information such as real time bus arrival displays, advertising panels, and larger maps of the stop area and/or transit system.
- **Bus Shelter - Position & Clearances**
 - » Shelters should be located in the Amenity Zone, with at least 4 feet of clear space between the shelter and the curb.
 - » Alternatively, shelters may be placed in the Frontage Zone at least 1 foot from a blank building face and/or be integrated features of the building wall, such as an alcove or awning.
 - » Shelters can be oriented facing out to the street or out to the sidewalk. When located close to the curb, sidewalk facing shelters can provide pedestrian protection against vehicle splashes.
 - » Shelters should be located 10 feet, parallel to the curb, from any vertical obstructions such as street trees, street lights, and utility poles.
 - » Transit shelters should not be utilized where they would result in less than 6 feet of pedestrian through zone for the adjacent sidewalk.
 - » Use of a bus bulb may be an appropriate treatment to provide for shelter siting and sufficient sidewalk clear space.
- **Amenities:** Bus stops may include additional passenger amenities such as waste or recycling receptacles, benches or leaning rails, wayfinding signs, street trees, and/or special lighting.
 - » Fixtures should be at least 18 inches from landing zones and 3 feet from benches to accommodate circulation.
 - » Trees should be planted no closer than 10 feet from landing zones.

- **Information Displays:** Increasingly, major bus stops are designed to be “mobility hubs” provide information on the range of area transportation services, including nearby bike share and car share services, information for taxis and ride sharing providers, and wayfinding to local civic destinations or businesses.
- **Special Materials:** Stops may use special paving patterns, plantings, public art, or street furniture to further highlight and distinguish the bus stop. This would be most common on transit priority corridors or at the most significant bus stops.

Utility Considerations

- Coordinate bus shelters, tree pits, and any amenities anchored in the pavement of the sidewalk with underground utilities.
- Locate bus shelters at least 1 foot from manholes and other utility access and 10 feet from fire hydrants.
- Do not locate utility vaults in bus stop areas.

Sustainability Considerations

- Consider green roofs, white roofs, or include solar or wind generators to power advertising displays or real time information.

MAINTENANCE & MANAGEMENT

General Maintenance

- Simple bus stops introduce few significant maintenance needs.
- Bus stops are used year-round. Bus stops may be temporarily relocated to accommodate seasonal events such as festivals or other street closures; however, significant advance notice should be provided to riders and signage placed at the stop indicating the location of the temporary stop.
- Bus shelters require rapid repair if glass panels are broken or damaged. The shelter must also be regularly washed and any litter accumulating in and around the shelter should be removed.
- If waste or recycling receptacles are provided, clear responsibilities for waste removal must be established.

Seasonal Use & Maintenance

- **Snow Removal:** Bus stops must be cleared of snow and ice both in their landing zones as well as clear pathways provided to cleared sidewalk paths. Adjacent property owners are responsible for snow and ice clearing at bus stop.
 - » A pathway from the landing zone to the cleared roadway space must be maintained at a width sufficient to enable deployment of wheelchair lifts. This can be particularly challenging as roadway plowing tends to pile snow up at the curb line. This berm of snow must be cut through to enable a clear path for passenger boarding and alighting.

Reviews & Approvals

- Bus stops are approved and located on a case-by-case basis by the AAATA and the City Engineering Unit.
- City Code requires the city traffic engineer to approve bus stop locations. Citing a bus stop depends on several, sometimes competing, factors including available space, sidewalk width, traffic and pedestrian volumes, street width, turning movements, sight distances, and the presence of parking, bicycle facilities, crosswalks, impacts on adjacent property owners, nearby transit trip generators, and public input.

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CURBSIDE ZONE

BUS BULBS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis		■	■			
Pedestrian		■	■			
Transit			⚠	⚠	⚠	
Bicycle			■	■		■
Balanced			■	■	■	■

DESCRIPTION & INTENT

Bus bulbs extend the bus stop space into the roadway space for the length of the bus stop. Bus bulbs provide additional space for passenger waiting and queuing and transit amenities. They are generally used to address one or more conditions:

- Where sidewalk space is constrained and insufficient space is available to adequately accommodate both transit passenger and through pedestrian needs.
- On corridors where buses have difficulty re-merging into travel lanes after stopping for passengers.

USE & APPLICATION

Location

- Bus bulbs may be warranted on any street type where sidewalk space is constrained given the volume of pedestrians (transit riders and walkers) and where bus operations are reduced due to difficulty re-merging into travel lanes.
- On transit emphasis streets, bus bulbs are recommended to increase the visibility and efficiency of transit service.
- Bus bulbs should only be used in association with on street parking and/or dedicated on street bicycle facilities.
- Bus bulbs, like bus stops, may be located at near-side, far-side or mid-block locations. Bus bulbs located at near- or far-side locations are typically integrated with and appear as elongated bumpouts.

Related Design Elements

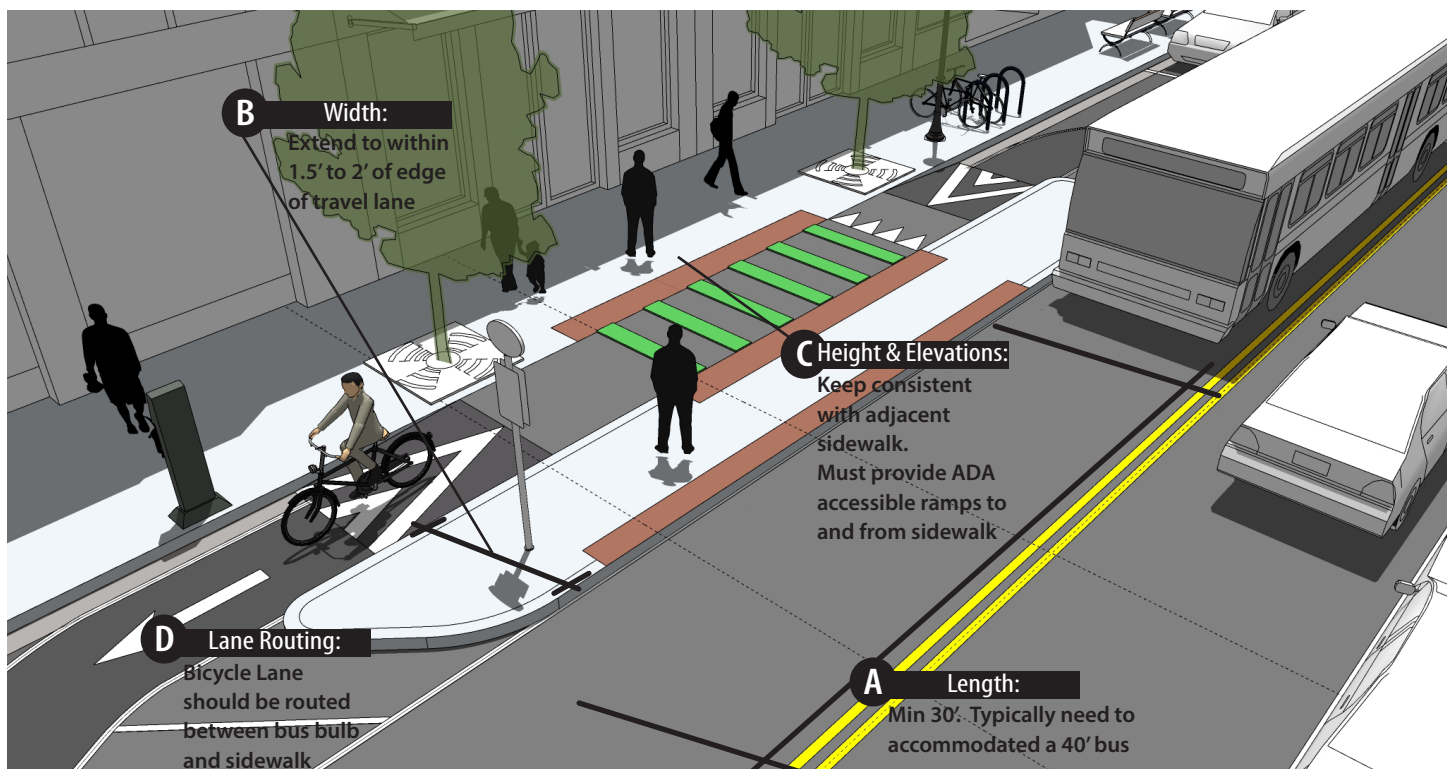
- **Bicycle Lanes:** Bicycle facilities should be routed behind the bus bulb and transit stop area. If bus bulbs are used at near-side locations, careful design is necessary to ensure safe bicycle progression through the intersection.
- **Travel Lanes:** Bus bulbs should not be utilized on two-lane roadways that have only one travel lane in each direction.
- **Traffic Impact:** Because buses stop in the travel lane of a roadway while boarding and alighting passengers, bus bulbs can reduce the vehicle flow of that lane. Therefore study of traffic operations is advised before the installation of bus bulbs.
- **Street Lighting:** As with all transit stops, bus bulbs should be well lit and proximate to safe pedestrian crossings and bicycle parking.
- **Bike Share:** Bus bulbs are typically only applied on higher volume routes and thus benefit from co-location with bike share stations.

DESIGN & OPERATIONS

Design Requirements

- A Length:** The length of bus bulbs depends on the type and volume of buses using the stop. For Ann Arbor bus bulbs will typically only need to accommodate a single, standard 40-foot bus. Bus bulbs shall extend from the front of the vehicle to beyond the back door, at least 30 feet in length.
- B Width:** The width of a bus bulb will depend on the typical curbside use of the street and outside travel lane. A bus bulb shall extend from the curb edge out to within 1.5 feet to 2 feet of the outside of the travel lane.
- C Height and Elevations:** Bus bulbs shall be designed at a curb height consistent with the rest of the street and level with the adjacent sidewalk.
 - » Bus bulbs may also be designed at a greater height to facilitate level bus boarding. In this case, railings may be required at the back of the bus bulb and ADA accessible ramps must be provided for access to and from the adjacent sidewalk.
- **Bus Stop Design Requirements:** Bus bulbs are typically utilized with near-side or mid-block bus stops. Bus bulbs shall follow other design guidance required of typical bus stops.

Figure 4.4.2- Bus Bulbs



D Bicycle Lanes Routing: Bicycle lanes should be routed behind the bus bulb so that bicycle traffic can be maintained and separated from the roadway.

- » Bicycle lanes should be raised and ramped up ahead of the bus bulb to provide a level surface for pedestrians. The ramps will help slow bicycle speeds as they enter a pedestrian area.
 - » Use color pavement markings throughout the length of the bicycle and pedestrian mixing area (green bars or checkered patterns).
 - » Use “BIKES YIELD TO PEDS” and yield markings on the bicycle lane to give pedestrians the priority.
- **Returns:** Design bus bulbs with a 45 degree return angle to facilitate street sweeping and snow plowing around the bulb.

Additional Design Considerations

- **Amenities:** Because bus bulbs provide additional pedestrian space, bus shelters and other passenger amenities should generally be provided. Bus bulbs may include bicycle racks, provided they do not conflict with clear landing zone requirements.
- **Curb Cuts:** Bus bulbs may be located adjacent to driveways, alleys and other curb cuts provided that adequate space and return angle is provided for their access and egress.

Utility Considerations

- Bus bulbs should be designed not impede stormwater drainage from the street.
- Bus bulbs may introduce utility conflicts and must be carefully coordinated.
- Utility vaults should not be located in bus bulbs.

Sustainability Considerations

- Bus bulbs may include pervious pavement and landscaping. Landscaping may include opportunities for stormwater retention and/or filtration provided it does not conflict with transit landing zones.

Design References

- The NACTO Urban Street Design Guide provides additional guidance on how to design a bumpout.
- The AASHTO Green Book offers guidance on the appropriate placement and configuration of transit bumpouts.
- More information on bus bulbs can be found in the TCRP Report 65 “Evaluation of Bus Bulbs” sponsored by the Federal Transit Administration.



http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_65-a.pdf

MAINTENANCE & MANAGEMENT

Special Maintenance

- Bus bulbs, like other curb extensions, may complicate street repaving and other maintenance activities.

Seasonal Use & Maintenance

- Like bus stops, bus bulbs will need to be cleared of snow in such a way that maintains clear passenger access to and from bus doors, including providing for the deployment of wheelchair lifts.
- Bus bulbs should be designed with roadway snow removal and storage in mind and ensure that the design angles do not inhibit plowing or street sweeping.

Reviews & Approvals

- Bus bulbs, like bus stops will be approved the AAATA and the Ann Arbor Engineering Unit.



Case Study: Seattle Dexter Avenue

Transit bumpouts can improve the transit riding experience while increasing space for pedestrians. Built in 2011, the reconstruction of Dexter Avenue in Seattle turned a three-lane street into a two-lane street with bus bulbs and buffered bicycle lanes. A shared parking/bicycle lane, as well as a center turn lane, were reconfigured to create the bumpouts and 6-foot wide bicycle lanes with 2-foot buffers. 10 of the 12 bus stops along the 1.5 mile long corridor have bus bulbs, which allows buses to stop without pulling out of traffic. Each bus bulb is 10 feet wide and approximately 80 feet long.

Since the project was implemented, the street has become a primary transit and bike corridor. Over 300 cyclists use the lanes going southbound towards downtown Seattle, more than one-third the number of motorists. While bus travel times have not changed significantly, ridership increased by 30% between 2010 and 2013.



ROADWAY

TRANSIT LANES

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis					
Pedestrian	✗	✗			
Transit		⚠	⚠	⚠	
Bicycle		■	■		■
Balanced		✗	✗	✗	✗

DESCRIPTION & INTENT

Transit may operate in lanes shared by general traffic or in dedicated facilities. Dedicated bus lanes are used to speed up bus service on busy streets with frequent transit service. A single bus can carry 40 or more passengers, allowing a bus lane to drastically increase the amount of people a street can move.

Transit lanes reduce traffic delays and increase the reliability of high-quality transit service. Transit lanes are an important part of encouraging transit use, making the service faster, more reliable, and more enjoyable.

Transit lanes can occupy several different places on a street, depending on the type of service offered and the available space. The variety of options are described here, though curbside and offset lanes are the most likely in the DDA District.

- **Curbside lanes** are immediately adjacent to the curb on the right-hand side of the street. They work best on streets with few driveways and high volume right turns.
- **Offset lanes** operate outside of a parking lane. Bus stops are located in bumpouts in the parking lane. Offset lanes are compromised by vehicles entering, exiting, and waiting for curbside parking.
- **Median lanes** occupy the center of the street. They may operate within a median, typically then separated from general traffic by median islands, or adjacent to a median with doors on both sides of the transit vehicle to permit left and right side boarding. Given the narrow

right-of-way typical of most downtown Ann Arbor streets, median lanes are unlikely and therefore not discussed.

- **Contra-flow bus lanes** are generally implemented on one-way streets where the transit lane operates in the opposite direction of general traffic and is located adjacent to the curb.
- **Transit streets or plazas** are street segments that prohibit private vehicle traffic and reserve the entire travel way for transit vehicles only. Bicycles and pedestrians are generally permitted. Transit plazas are typically used where transit services are extremely frequent, transit use is concentrated, and right-of-ways are severely constrained.

USE & APPLICATION

Location

- Transit lanes are used only on corridors where transit service is very frequent (10 minutes or less), ridership is high, and traffic congestion significantly and routinely impedes transit operations.
- Transit lanes are recommended on transit emphasis streets and can be an opportunity on vehicle emphasis streets where there is room. Transit lanes are generally discouraged on other street types, particularly destination commercial and commercial streets.

- Transit lanes may be permanent or temporal – reserved for transit vehicles only at peak hours of the day and permitted for other uses (such as parking or general traffic) at other times. They may be reserved exclusively for the use of transit vehicles or may have shared use.

Related Design Elements

- **Auto Travel:** Transit lanes may be exclusive for transit use or may be in mixed traffic. Although high-occupancy vehicle (HOV) facilities are not common in Michigan at present, MDOT continues to explore their use. In some instances bus lanes are shared with HOV vehicles to provide advantage to both.
- **Transit Signals (Bus Queue Jump Lanes):** Implementing transit signal priority in conjunction can provide even further advantage to transit service.
- **On-Street Parking:** Offset bus lanes where the curbside is used for parking can cause conflicts with drivers entering and exiting the parking lane. Drivers parking can cause significant delays to the bus service, reducing its reliability and efficiency.
- **Loading Zones:** Removing parking for a bus lane can make loading access difficult for commercial buildings. Assess curb conditions to understand spillover effects on adjacent streets from removing a loading lane and/or parking.

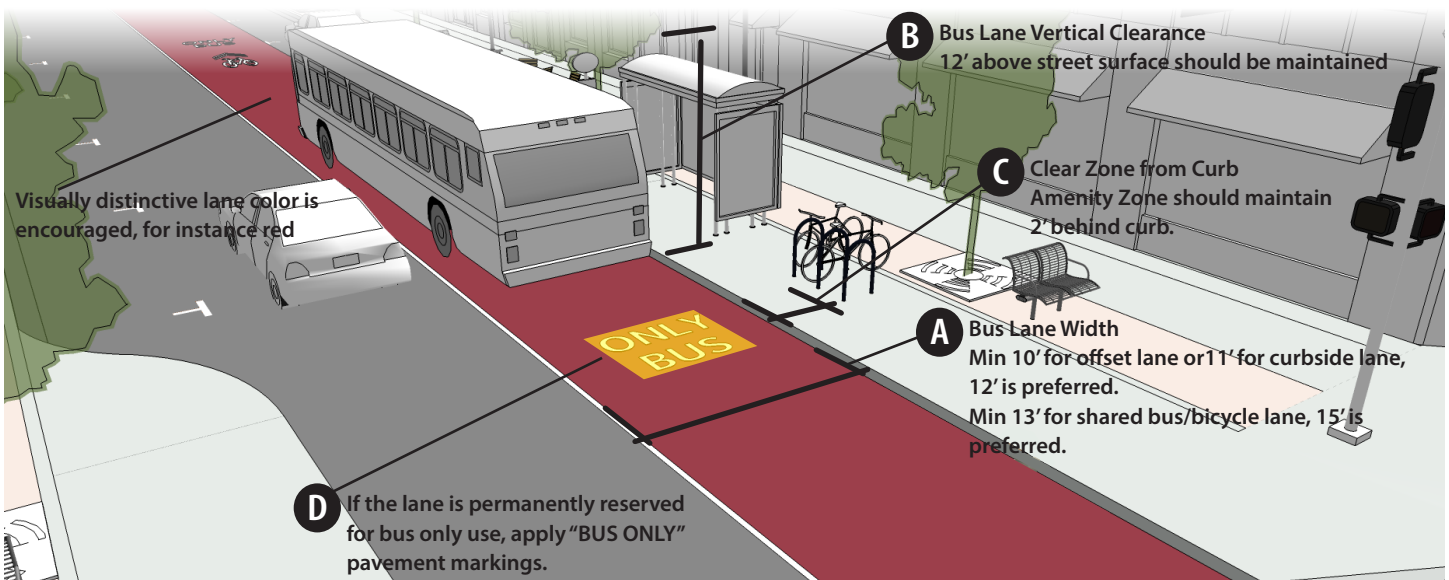
- **Bicycle Facilities:** Transit lanes should generally not be shared with bicycle facilities. The benefit of transit lanes is in allowing buses access to unencumbered lanes, which would be impacted by the presence of cyclists sharing the lane.

DESIGN & OPERATIONS

Design Requirements

- A Lane Width:** The minimum acceptable width for a bus lane is 10 feet for an offset lane or 11 feet for a curbside lane. 12 feet is preferred.
 - » Shared bus/bicycle lanes shall be at least 13 feet wide. 15 feet is preferred to allow room for passing.
 - » Gutters may be included in the calculated dimension of a curbside transit lane.
- B Vertical Clearance:** The street shall be clear for a vertical distance of 12 feet above the street surface. Banners or trees overhanging a Curbside Zone used for bus travel shall be maintained above this height.
- C Horizontal Clearance:** Fixtures or plantings in the Amenity Zone shall maintain a 2-foot clear zone behind the curb where buses or other vehicles travel in the curb lane.
- D Pavement Markings:** If the lane is permanently reserved for bus only use, apply “BUS ONLY” pavement markings. If the Transit Lane is shared for HOV or bicycle use, include appropriate markings.

Figure 4.4.3- Transit Lanes



Additional Design Considerations

- **High Visibility Marking:** Making bus lanes visually distinctive may discourage encroachment by other road users. Red paint can color dedicated transit lanes, but is not required.
- **Right Turn Lanes:** At intersections, bus lanes may become right-turn only lanes. Use a dotted line to denote where private vehicles may enter the bus lane.
- If the dedicated lane is only in effect for certain hours, consider restricting right turns to keep the lane clear.
- **Barriers:** Transit lanes may be separated from general traffic by soft barriers, such as rumble strips or physical barriers like concrete curbs or rubber bumpers. Given the narrow dimensions of Ann Arbor streets, physical separation is not generally expected.

Utility Considerations

- When utility work requires occupying part or all of a dedicated transit lane, have a plan in place to prevent a significant disruption of transit service. Consider re-purposing a general traffic lane temporarily, signal changes, or other efforts to reduce delays.

Design References

- The NACTO Urban Street Design Guide provides recommendations on how to design bus lanes and necessary considerations for installing them.
- The AASHTO Green Book describes how to design transit lanes, including operational issues, dimensions, and metrics for measuring success.
- The TCRP Report 19 provides guidance for roadway design factors for bus service.



MAINTENANCE & MANAGEMENT

General Maintenance

- Colored pavement may require more frequent maintenance than regular pavement.

Seasonal Use & Maintenance

- **Snow Removal:** Transit lanes should not be used for snow storage.
- Keep access to transit lanes and transit stops clear for both the vehicles and riders.
- Physically separated transit lanes may require additional or special equipment for snow removal.

Reviews & Approvals

- The Ann Arbor Engineering Unit is responsible for permitting bus lanes on city streets, while MDOT is responsible for permitting transit facilities on state-owned roads. The AAATA would most likely determine which corridors are most appropriate for bus lanes, based on where significant bus routes are located and where existing and projected ridership is highest and coordinate identification and designation of such lanes.





ROADWAY

BUS QUEUE JUMP LANE

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✗	✗			
	Transit		⚠	⚠	⚠	
	Bicycle		✗	✗		✗
	Balanced		✗	✗	✗	✗

DESCRIPTION & INTENT

A bus queue jump lane, also known as a bus bypass lane, is a short bus lane located at the approach to a traffic signal. Buses use a bus queue jump lane to bypass waiting traffic queues, significantly improving transit travel time.

In a compact downtown area like Ann Arbor, right turn bays may be used as a bus queue jump lane. While other vehicles must turn right, the bus is allowed to proceed straight through from the turn lane to the bus lane. These facilities may need to be combined with a dedicated transit signal, such as an advanced green light for buses, and a merge lane to permit transit vehicles to reenter general travel lanes on the other side of the intersection.

There are three configurations of bus queue jump lanes that may be appropriate for Ann Arbor:

- **Transit Exemption for Right-Turn Lanes:** The bus queue jump lane shares space with the right-turn lane, but transit vehicles are allowed to proceed straight through the intersection.
- **Advanced Stop Bar:** In this configuration, the main stop bar is pushed back several car lengths and a transit-only or “right and transit” lane is placed along the curb ahead of the stop line, so that transit vehicle can pull ahead of other traffic.
- **Shared Right-Turn/Bus Lane:** The entire curbside lane is reserved for transit vehicles, but drivers are allowed to use it for right turns at intersections. This gives buses even more priority, but requires the removal of parking or travel lanes.

Bus queue jump lanes can contribute to faster, more reliable transit service that increases ridership and supports the development of a more vibrant public realm in downtown Ann Arbor. However, they also may require additional street space for buses, which may mean narrowing general traffic lanes or re-purposing general traffic lanes or parking, which may have a negative effect on the street environment.

USE & APPLICATION

Location

- Bus queue jump lanes are only applicable on transit emphasis and vehicle emphasis streets at congested intersections where transit vehicles are likely to experience significant delays.
- Bus queue jump lanes will generally have very limited applicability in downtown and should only be used in conjunction with well developed transit priority plans.

Related Design Elements

- **Traffic Signals:** To be fully effective, use transit signal priority alongside a bus queue jump lane to speed buses through the intersection.
- **Transit Lanes:** Where right-of-way is available, consider upgrading bus queue jump lanes to full transit lanes, which increase the speed and reliability of transit and reduce the risk of drivers encroaching on the lane.

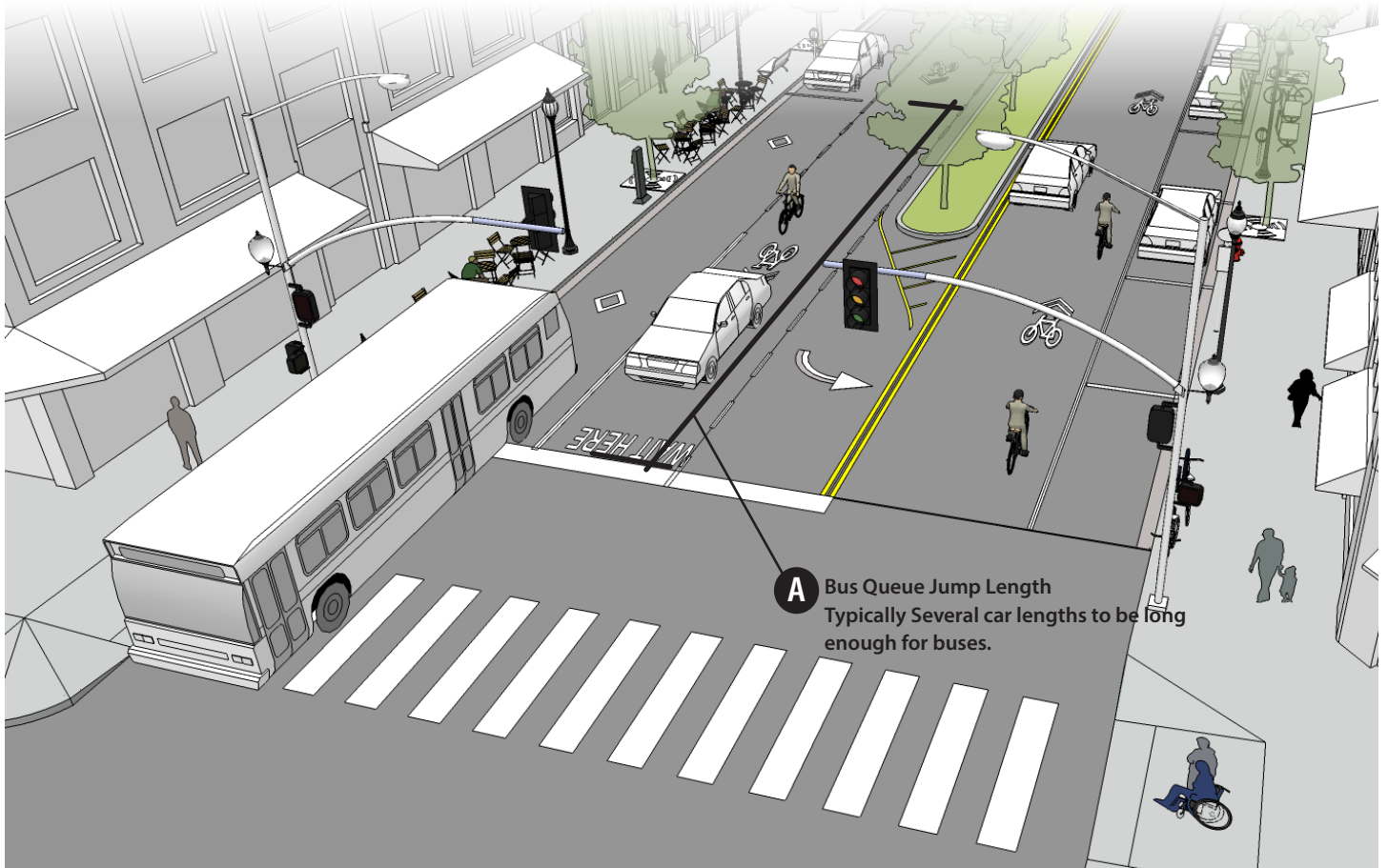
- **On-Street Parking:** Place bus queue jump lanes in a parking lane, which preserves parking space while creating an opportunity to give transit priority over other vehicles.
- **Bus Stops and Shelters:** Provide substantial bus stops with shelters, seating areas, and real-time information. Consider instituting other elements of bus rapid transit, such as off-board fare collection that can reduce wait time at stops.

DESIGN & OPERATIONS

Design Requirements

- A** Design bus queue jump lane long enough so that buses can move ahead of vehicles stopped at an intersection.
- Place an advanced stop bar in the bus queue jump lane to give buses a head start. The stop bar shall be placed at least 2 car lengths ahead of the main traffic stop bar, depending on the length of the queue.
- Consider special pavement markings for the bus queue jump lane to indicate that the space is exclusively for transit vehicles.
- Provide space on the other side of the intersection for the bus to reenter traffic.
- Place bus stops at the far-side of the intersection to allow buses to take advantage of the bus queue jump lane on the near-side of the intersection. If the bus stop is on the near-side, place it behind the bus queue jump lane.

Figure 4.4.4- Bus Queue Jump Lane



- Use signal timing to allow right-turning drivers to clear the bus queue jump lane in order for transit vehicles to use it. This may require an additional right-turn signal phase. Shorter traffic phases may also help to reduce backups at the intersection, making transit signal priority more efficient.

Additional Design Considerations

- Bus queue jump lanes can give priority to both transit vehicles and cyclists. However, if the bus queue jump lane is physically separated from the rest of the street, bikes should not be allowed to share the lane due to the higher speeds transit vehicles will be able to achieve.
- Exercise caution when placing bicycle lanes next to shared bus queue jump lane/right-turn lanes due to conflicts with drivers merging in and out of the lane. Use colored pavement markings to identify the conflict zone.
- Parking or other uses of the curbside lane should be set back a far distance from the stop line, depending on the typical length of the traffic queue, to ensure that transit vehicles are able to enter the lane.

Utility Considerations

- Ensure that the construction of a bus pad does not interfere with underground utilities. Bus queue jump lanes may require a bus pad or other strengthening of the road surface to support standing or waiting transit vehicles.

Design References

- The NACTO Urban Street Design Guide provides guidelines on how to design a bus queue jump lane.

MAINTENANCE & MANAGEMENT

General Maintenance

- Frequent police enforcement is required to ensure that drivers do not attempt to use the queue jump lane.

Special Maintenance

- Maintain signage and markings for bus queue jump lanes to ensure visibility and encourage driver compliance.

Seasonal Use & Maintenance

- Bus queue jump lanes can be cleared of snow using regular snow equipment. Bus queue jump lanes should never be used for snow storage.

Reviews & Approvals

- The Ann Arbor Systems Planning Management Unit, in close consultation with the AAATA, will determine when and if queue jump lanes are advised.
- The Ann Arbor Engineering Unit is responsible for permitting the construction of queue jump lanes.

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4.5

VEHICLE DESIGN ELEMENTS

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ROADWAY ZONE

TRAVEL LANES

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis		✓	✓			
Pedestrian		✓	✓			
Transit			✓	✓	✓	
Bicycle			✓	✓		✓
Balanced			✓	✓	✓	✓

DESCRIPTION & INTENT

Travel lanes are the portion of the roadway marked for the movement of vehicles. The width of travel lanes is a critical dimension that affects many aspects of the street including vehicle speed, pedestrian crossing distances, signal cycles, and the amount of roadway impervious surface.

In most cases, the minimum acceptable lane width should be used in urban street design. This minimum dimension may vary depending on the street type and the type and frequency of vehicles using the lane.

Travel lanes may be used by both motorized vehicles and bicycles. Lanes intended for travel are not to be used for loading or parking.

Turn lanes provide a space for vehicles to move out of the general flow of traffic into a dedicated space to wait for a gap in pedestrian and/or on-coming vehicle traffic in order to complete a turn. Turn lanes, particularly center-turn lanes, significantly improve vehicle flow. Often, reducing four-lane, bi-directional streets one-lane in each direction with a center-turn still maintains vehicle capacity and creates space for other uses such as bicycle facilities, wider sidewalks, or a parking lane.

USE & APPLICATION

Location

- Travel lanes are required on all street types irrespective of Frontage Context or Functional Emphasis to allow public and privately owned vehicles transportation access through the public right-of-way.

Related Design Elements

- Travel lanes must be assembled together with other roadway elements, such as additional lanes in the same or opposing directions, turning lanes, parking lanes, bicycle facilities, transit lanes and/or stops, and sidewalk facilities.
- The assemblage of travel lanes can have a substantial effect on the street experience, especially for pedestrians. Although a “typical section” taken at a mid-block location may result in a relatively narrow cross-section, inclusion of right- and/or left-turn lanes at intersections can dramatically increase the total roadway width and pedestrian crossing distances.

DESIGN & OPERATIONS

Design Requirements

- The width of travel lanes varies based on the type of street, land uses, and typical vehicles expected to use them. Research has shown that narrower lane widths reduce traffic speeds without decreasing safety, and that wider lanes are not correlated with safer streets.

A Travel Lane Width: The width of travel lanes shall be 10-feet on all streets, with the following deviations allowed as described below:

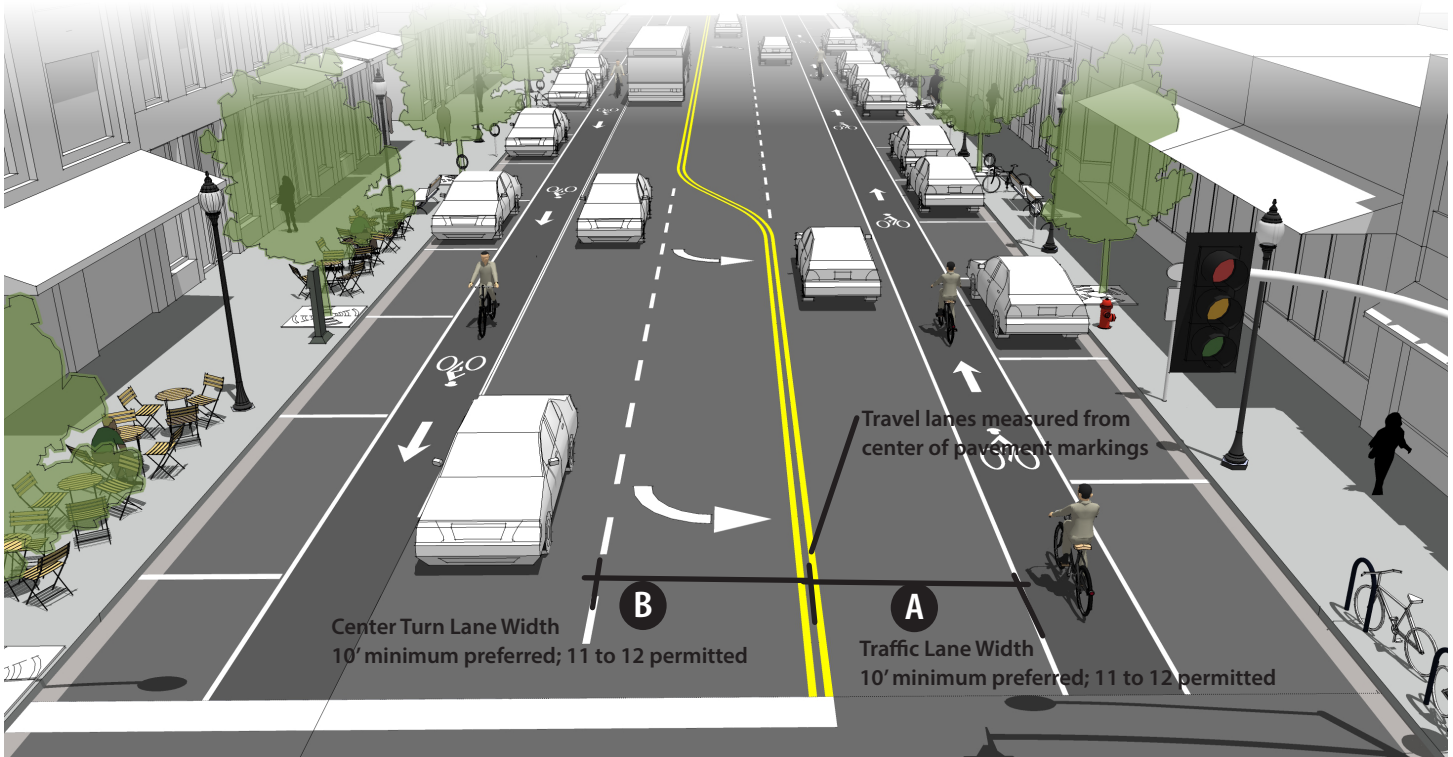
- » For designated transit and truck routes, the outermost travel lane in each direction may be widened to 11-feet to accommodate larger vehicles. Wider lanes for trucks and transit should be evaluated on a case-by-case basis and considers trade-offs with other modes of travel and the overall street context.
- » Wider travel lanes may be necessary at tight turns as vehicles require more horizontal space while turning than while traveling straight.

- » Travel lane widths need to be considered within the assemblage of the full street. When adjacent to parking or curbside lanes, the total width of the combined travel lane and curbside lane shall be at least 18-feet. This shall be increased to 19-feet where frequent transit or truck traffic needs to be accommodated.

B Center Turn Lane Widths: Center-turn lanes can vary from 10 to 12 feet in width. 10 is generally preferred but may be increased to 11 or 12 feet where transit and/or truck traffic is frequent.

- **Lane Width Measurement:** Travel lanes should be measured from the center of lane markings on either side of the travel lane (including where on-street parking is present). When a travel or turn lane is adjacent to a curb and gutter, measure to the nearest edge of the gutter (i.e. “edge of metal”). If no gutter is present, measure to the face of curb, adding 18 inches to required lane width to account for drainage inlets and clearance from the curb face.

Figure 4.5.1- Travel Lanes



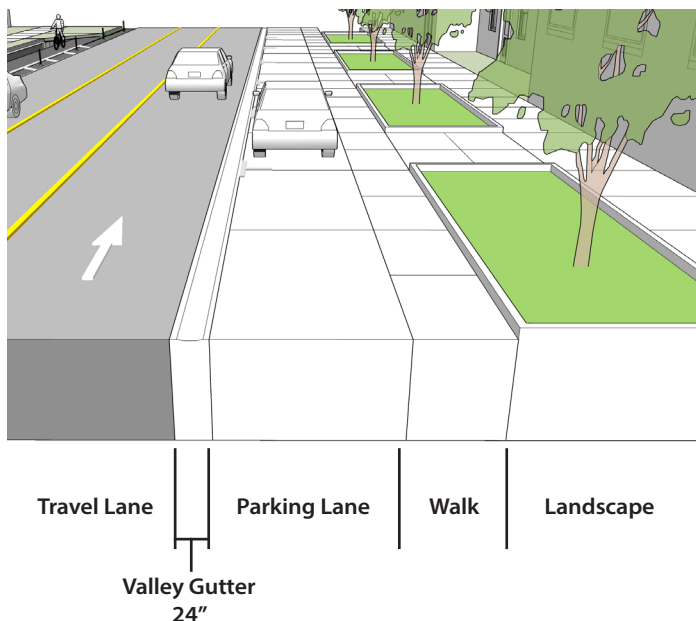
Additional Design Considerations

- **Special District Materials:** Established Downtown Character Districts may require or recommend certain paving materials be used in lieu of standard asphalt treatments. For example, reinstalled and/or continuing the extent of historic brick paving in the Kerrytown district may be recommended for street projects in that character district.

Smooth / Curb-less Streets

- Streets that are intended to be used frequently for special events may consider the use of flush curbs, roll curbs, or special material treatments to delineate roadway uses and facilitate drainage in lieu of vertical curbs. In such cases, also consider the following:
 - » Use of bollards, signs, light posts, planters and/or other physical elements to prevent vehicles from entering sidewalk spaces.
 - » Where on-street parking is present, the gutter line / drainage lines may be placed outside of parking lane (next to the travel lane)
 - » Positive drainage away from buildings must be maintained until at least the edge of the pedestrian zone (12'-14' away from property line typically).

Figure 4.5.2 - Curbless Street



Utility Considerations

- Utilities will often be located under travel lanes. Manholes and access portals must be flush with the roadway surface. Utility work in a travel lane should resurface the whole of the travel lane for a smooth travel surface.

Sustainability Considerations

- Minimizing lane widths minimizes overall paved and impervious surfaces, which contribute to stormwater runoff and water quality.

Design References

- Policy guidelines recommend travel lane widths in the range of 9 to 12 feet, with 9-foot lanes only used on very low volume residential local streets. The AASHTO Green Book recommends 10 to 12-foot travel lanes and 10 to 12-foot turn lanes.
- A number of states have endorsed narrower lanes. The Florida Department of Transportation found that narrower lane widths do not impact street capacity "So long as all other geometric and traffic signalization conditions remain constant, there is no measurable decrease in urban street capacity when through lane widths are narrowed from 12 feet to 10 feet."
- The Institute of Transportation Engineers "Designing Walkable Urban Thoroughfares: A Context Sensitive Approach" recommends a range of 10 to 12 feet for travel lanes on urban arterial and collector streets. Narrower travel lane widths are recommended on lower volume and lower speed streets.
- The MMUTCD provides standards and specifications on travel lane marking and signage.

MAINTENANCE & MANAGEMENT

General Maintenance

- Travel lanes require periodic sweeping and pavement marking re-stripping.

Seasonal Use & Maintenance

- **Snow Removal:** Travel lanes, together with bicycle lanes and sidewalks, are the top priority for snow removal and may not be used for snow storage. Black ice and other dangerous conditions are common in Michigan. Pavement surfaces are designed and treated to minimize these risks.
- **Special Events:** Travel lanes may be used for seasonal events such as the Ann Arbor Art Fair and other street closures. Design of the assembled roadway width may wish to take layouts of special events into account.

Reviews & Approvals

- The Ann Arbor Engineering Unit determines appropriate travel lane number, design and operation on city-owned streets. MDOT governs these decisions on state routes.



ROADWAY ZONE

FIRE ACCESS LANES

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✗	✓			
Transit			✓	✓	✓	
Bicycle			✓	✓		✓
Balanced			✓	✓	✓	✓

DESCRIPTION & INTENT

Fire access lanes (aka Fire Lanes) are locations proximate to buildings that enable fire trucks and other emergency vehicles to quickly access buildings in case of emergencies. Fire access lanes may be designated and marked zones within the public right-of-way or on private property, or alternatively the roadway travel lanes themselves may serve as a fire access lane. In Ann Arbor’s downtown, the roadway itself frequently serves as the fire access lane, as development patterns and limited alley way width typically precludes use of fire access lanes outside of the right-of-way.

Aerial fire apparatus access roads (sometimes referred to as an “Aerial access lane”) are a specific type of fire access lane that is adjacent to buildings where the highest roof surface exceeds 30-feet in height. Aerial fire apparatus access roads are wider and provide the needed clear space for larger fire ladder trucks to deploy their stabilizers and outriggers.

Providing adequate fire access lanes is important for maintaining the safety and health of the public in downtown Ann Arbor. Unobstructed roads and intersections help maintain effective response times and efficient emergency operations.

USE & APPLICATION

Location

- **Fire access lanes** are required on all downtown streets. When streets are reconstructed, resurfaced, and/or pavement markings are refreshed, compliance with the fire access lane requirements (see Design & Operations below) shall be achieved. Fire access lanes can be achieved on most downtown streets without trade-offs with other street design values.
- **Aerial fire apparatus access roads**, which requires additional fire lane width, are required when adjacent to new buildings where the roof surface exceeds 30-feet in height. At least one face of the building must be accessible by an aerial fire apparatus access road, either within the road right-of-way itself or on private-property.
 - » The additional width required for fire apparatus roads may pose challenges for meeting other street design requirements. This design trade-off may result in value trade-offs as well, particularly those correlated to street width and curbside use. For this reason, aerial fire apparatus access roads are prohibited on Destination Commercial Street Typologies. Private development with multiple frontage streets shall locate their aerial fire apparatus access road accordingly. Those without an approved Street Type adjacent, shall work with the Street Design Team staff reviewers to determine the most appropriate solution.

Related Design Elements

- **On-Street Parking & Loading Zones:** Vehicles occupying the curbside lanes are obstacles to fire access lanes and should not be factored into the required width of a fire lane (including aerial access lanes).
- **Bicycle Facilities:** Bicycle facilities, including curb-separated bike lanes, may be counted towards the required width of fire access lanes and aerial apparatus roads if the curb, gutter, and bike lane are designed with the same load bearing capacity of a standard roadway (in order to support the weight of the fire apparatus).
- **Sidewalks & Pedestrian Areas:** The pedestrian area (primarily the amenity zone), may be counted as part of the required width for a fire lane if the amenity zone has been designed to support the weight of the fire apparatus and it is contiguous with roadway portion of the fire lane. The portion of the pedestrian area that can be counted must be free of vertical obstructions such as street lights, street trees, sign posts, outdoor dining tables, etc.

DESIGN & OPERATIONS

Design Requirements

- **Width – Fire Access Lanes:** Fire access lanes shall be 20-feet wide. Typically, a two-lane road with 10-foot wide travel lanes will meet this requirement. One-way streets or residential streets without center-lane markings shall still meet this requirement.
- **Width – Aerial fire apparatus access roads:** The width of a fire lane adjacent to buildings with a roof surface over 30-feet in height shall provide a 26-foot wide fire lane in order accommodate aerial access.
 - » **Setback:** Aerial fire apparatus access roads shall be setback 15- to 30-feet from the face of the building (and/or the building setback from the fire access lane).
 - » **Overhead Obstructions:** There shall be no overhead utility or power lines over the roadway or between the roadway and building face where the aerial access lane is required. Other overhead obstructions, such as trees or street lights, must be placed with input from the Fire Marshal and other corresponding department.
 - » **Achieving Required Aerial Access Lane Width:** The chart below indicates the first and second priority treatments that should be used to achieve the required width for aerial access fire lanes.

Table 4.5.1		
Street Typology	New Building	Existing Condition to Remain
Pedestrian & Access Streets	Widen Pedestrian Area or Curbless Street Design	Maintain curbside lanes
Transit Streets	Widen Pedestrian Area	Maintain curbside lanes
Bicycle	Bicycle Facilities	Bicycle facilities
Balanced	Widen Pedestrian Area	Maintain curbside lanes

- » **Widen Pedestrian Area:** This may be achieved by removing curbside lanes or excess roadway pavement areas, relocating the curb, and providing additional pedestrian area width that is free from obstructions.
- » **Curbless Street Design:** Curbless street designs may be appropriate for certain streets (e.g. Destination Commercial) and the use of valley gutters adjacent to the roadway can provide sufficient width for aerial access lanes. This should only be considered when a curbless design is supported broadly by the project for other reasons as well and can be implemented for multiple blocks (e.g. flexibility needs of the street for events, commercial activities, etc.).
- » **Bicycle Facilities:** The specific type of bicycle facility used shall be determined using the Bicycle Facility Selection process (see Bicycle Facility Selection design element) and in consideration of the overall bicycle network. Curbed, concrete buffers and gutters, if designed with the same load bearing capacity as the roadway, can be included in the aerial access lane width. Curbed, concrete buffers must not exceed a width of 3 feet. Any utilized delineators or other vertical separation elements shall be flexible and sacrificial so as to not impede emergency vehicle operations.
- » **Maintaining Curbside Lanes:** Maintaining the existing curbside lanes is only acceptable when part of a pre-existing roadway or when the required access width can be achieved with keeping the curbside lane in place.
- **Length – Aerial Fire Apparatus Access Roads:** When the face of a new building comprises 50% or more of the block face, any required right-of-way treatments must be applied to the entire block face.
- **Access to Building Fire Department Connection (FDC):** Access to FDCs shall provide a 3-foot radius clear zone directly around the FDC, and shall be directly accessible from the fire access lane.
- **Fire Aisles –** Where static uses occur within the curbside zone and/or pedestrian area (e.g. outdoor dining or event booths), a 10-foot wide break in these uses shall be provided every 75-feet to provide emergency access from the fire lane to building uses.
 - » Fire Aisles are in addition to providing access to FDCs and Fire Hydrants from the fire lane normally required.

Design References

- Ann Arbor adopted fire code – International Fire Code (2015 Edition)

MAINTENANCE & MANAGEMENT

Seasonal Use & Maintenance

- It is important that snow and ice buildups be cleared from the roadway and curbside lanes so that the road doesn't "pinch in" during the winter and reduce the available width of fire access lanes.

Reviews & Approvals

- The Ann Arbor Fire Marshall is typically responsible for reviewing development plans as part of the site plan review process, and will also participate in reviews of publicly-initiated street projects for compliance with fire code and this design manual. When compliance with the fire access requirements results in the removal of/inhibits the installation of another required street element, the corresponding department shall be consulted for additional review and input.

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INTERSECTION ZONE

CORNER GEOMETRY AND DESIGN VEHICLE

DESCRIPTION & INTENT

Every element of a street influences and affects how travelers behave on the street and the comfort, safety, and operational efficiency of the street. Lane widths and corner turn radii significant impact driver behavior and their interaction with other users.

As discussed in the travel lane section, wider travel lanes do not necessarily correlate with fewer crashes and improved flow. In fact, research has found that lanes as narrow as 10 feet have little to no discernible affect on vehicle flow but these narrower lanes have substantial positive effects in reducing vehicle speed. Slower travel speeds are positively correlated with reduced severity of crashes and reduced pedestrian crossing distance which making walking safer and more pleasant.

Corner curb radii also directly affect pedestrian crossing distances and vehicle turning speeds.

Corner curb radius refers to the arc of the curb protecting the sidewalk at an intersection. For comparison, a 5-foot curb radius is a very tight corner that comes almost to a point where two streets intersect, while a 50-foot curb radius is a wide sweeping curb.

Three factors play the greatest role in determining the geometry of corner curb radii:

- **Intersection Angle:** Where two streets meet at an angle, the acute angle corners of the intersection commonly have very tight curb radii, while the obtuse angle corners have much larger curb radii. Angled intersections may result in very long pedestrian crossing distances. Downtown Ann Arbor is fortunate that the majority of

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
Transit			✓	✓	✓	
Bicycle			✓	✓		✓
Balanced			✓	✓	✓	✓

intersections join at near 90 degree angles and permit short crossing distances.

- **Roadway and Distribution:** Roadway refers to only that portion of the street between the typical curb lines. Distribution refers to how that roadway space is allocated, for example a roadway may be distributed between parking lanes, bicycle lanes, and travel lanes. The point in the roadway from which a vehicle begins to make its turn and the width and function of the receiving street determine how wide (or not) a vehicle may safely swing in order to complete the turn without adversely affecting other roadway operations.
- **Design Vehicle:** Larger vehicles make wider turns. Large vehicles include municipal and school buses, tractor trailers, and larger fire trucks. The largest vehicle routinely using a turn is referred to as the “design vehicle.” See table 4.5.1 for Design Vehicles based on Frontage Context.

There are two measures of curb radius – the actual curb radius and the effective curb radius. The actual curb radius is the actual radius of the built curb at an intersection. The effective curb radius is the arc that is possible for a vehicle to follow from the departing travel lane to the receiving lane. Because vehicles may begin their arc from a travel lane located outside of a bicycle facility and/or a lane of parking, it is common that the effective curb radius is significantly larger than the actual curb radius.

Curb radii directly affect pedestrian crossing distances. Larger actual curb radii, without bumpouts, result in wider crossings and reduce the amount of pedestrian space at a sidewalk corner. This forces pedestrians to wait further from the motorist’s line of sight.

Corner radii affect the location and design of accessible curb ramps. Small radii typically permit the ramp and both flares on the straight edge curb. As radii size increases, ramps either become integrated into the corner or crosswalks must be moved back.

Using the smallest possible curb radii helps manage vehicle turning speeds and increase. Wide corner radii may facilitate smoother and faster turns by large vehicles but concurrently permit or even invite private autos to take turns faster.

Although corner bumpouts typically have larger curb radii than the underlying natural curb, they nonetheless help to manage vehicle turning speeds by establishing a tighter effective radius. Corner bumpout radii are designed to accommodate the necessary design vehicle.

USE & APPLICATION

Location

- Corner geometries exist wherever two streets intersect. They are ubiquitous throughout downtown.

Related Design Elements

- **Intersections:** Curb radii and corner geometries are critical in the assemblage of intersections. Radii affect pedestrian crossing distances, traffic turning speeds, and overall safety and operation of the intersection.

DESIGN & OPERATIONS

Determine Design Vehicle

- **Design Vehicle:** A frequent user of a given street that dictates the minimum required turning radius. The design vehicle can turn using one incoming and one receiving lane
- **Accommodation Vehicle:** An occasional user of a street. The vehicle may need to turn partially from or onto an adjacent lane as a minor encroachment (typically 5' or less overlap).
 - » May require moving stop bars further back from intersections to accommodate turns.

A **Minimum Effective Turning Radius:** The effective turning radius should be based on the Design Vehicle. The effective turning radius is impacted by a variety of factors, including: lane width, lane configuration, ROW width, curb radius. See Table 4.5.1.

- » At signalized intersections, larger vehicles may be permitted to use all available receiving lanes to complete their turn. This should be reflected in turn modeling. If so, large vehicles may not turn right on red. Vehicles must complete turn into the nearest receiving lane.

Table 4.5.2 - Curb Radii and Design Vehicles

STREET TYPOLOGY	DESIGN VEHICLE	ACCOMMODATION VEHICLE	MIN. CURB RADIUS	MIN. EFFECTIVE TURNING RADIUS
NEAR-NEIGHBORHOOD STREETS	PASSENGER CAR 15' inside radius min. 26' outside radius min.	SU-30 20' inside radius min. 42' outside radius min.	20'	26'
NOT NEAR-NEIGHBORHOOD STREETS	SU-30 20' inside radius min. 42' outside radius min.	WB-40 / CITY BUS 20' inside radius min. 40' outside radius min.	20'	42'
STREETS WITH DESIGNATED TRANSIT ROUTES	WB-40 / CITY BUS 20' inside radius min. 40' outside radius min.	WB-50 20' inside radius min. 45' outside radius min.	20'	40'

B Minimum Curb Radius: The curb radius should be kept to a minimum while accommodating the largest possible vehicle. See Table 4.5.1.

» Curb radii may be simple or complex curves.

Design Requirements

C Reinforced Corners: Corners can be designed to accommodate heavier vehicle loads where transit vehicles or trucks may occasionally mount the curb.

D Stop Bars: Vehicle lane stop bars shall be positioned a minimum of 4-feet back from the nearest edge of a crosswalk.

» Stop bars may need to be moved further away in order to allow larger vehicles to complete turns where space is limited. Stop bars may also be moved further back in order to accommodate bike boxes or to provide advanced stop bars for bike lanes.

» Stop bars shall be 2-feet wide and extend across the full width of the travel lane.

• **No-Turn Corners:** Corners where no legal turn is possible, such as from a one-way street onto another one-way street, can have a very minimal curb radius.

• **Parking Lane:** On-street parking permits tighter actual curb radii as no vehicle will be turning directly from curb lane to curb lane along the actual curb radius, vehicles will be turning from outside the parking lane to outside the parking lane. Where permanent on-street parking exists on both streets, bumpouts may be utilized.

Utility Considerations

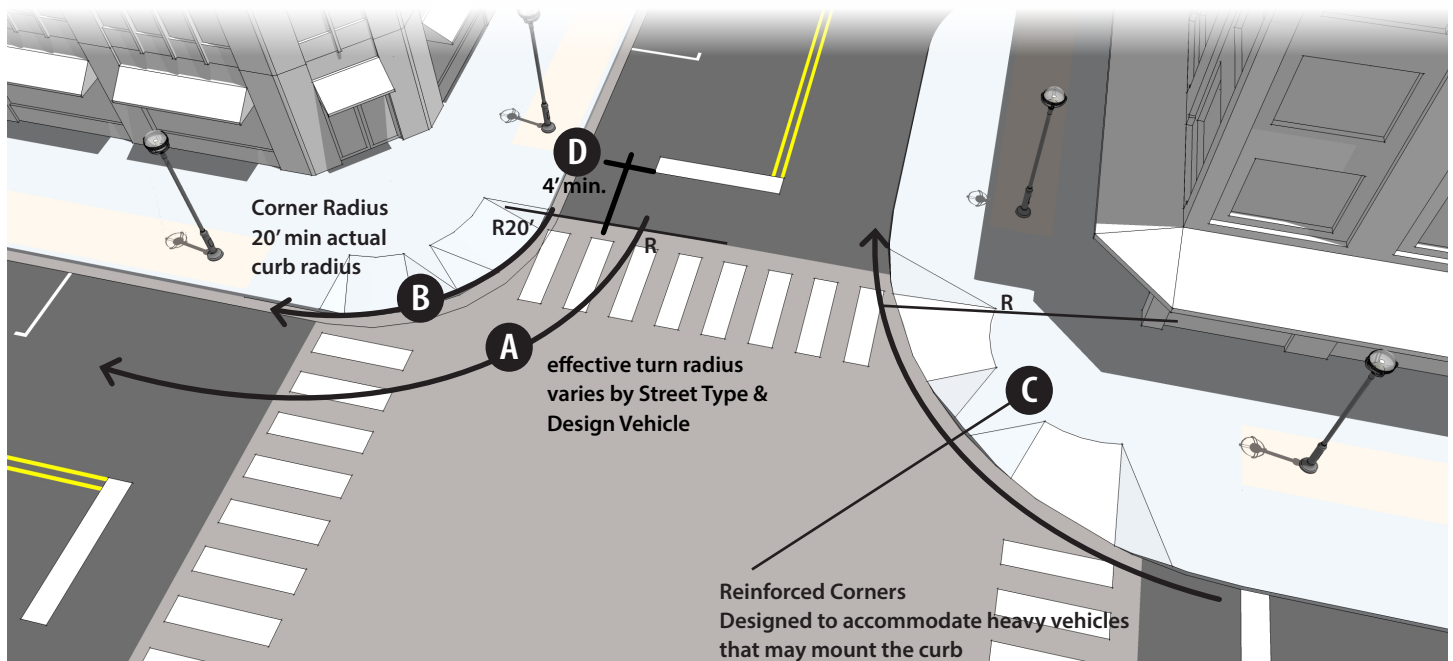
• Keep utility cabinets, hand holes and other fixtures off corner curb areas to the extent possible. Where utility cabinets are necessary, they should be in subsurface vaults or in nearby locations clear from the intersection.

• Locate stormwater inlets to effectively drain the street while not precluding curb ramps and corner bumpouts.

Design References

• The NACTO Urban Street Design Guide provides additional guidance on corner geometries.

Figure 4.5.3- Corner Geometry



MAINTENANCE & MANAGEMENT

Seasonal Use & Maintenance

- Snow should be removed all the way to the vertical curb face of a corner.
- “Sneckdowns” are tracks in fresh snow that reveal precisely the actual turn radii and frequency of turning vehicles and may inform locations where tighter curb radii and/or bumpouts are viable.

Reviews & Approvals

- The Ann Arbor Public Management Unit designs and/or approves corner geometries.



PEDESTRIAN AREAS

DRIVEWAYS & CURB CUTS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✗	✗			
Transit			✗	✗	✗	
Bicycle			✗	✗		✗
Balanced			✗	✗	✗	✗

DESCRIPTION & INTENT

Driveways provide access in and out of private property. While they are an important part of the public realm, too many driveways create an unpleasant pedestrian environment and increase conflicts between motorists and other street users. They also take away space that may otherwise support planting, street furniture, and curbside parking. Coordinating the design of driveways together with the sidewalk contributes to a higher-quality pedestrian realm and reduces dangerous conflicts.

USE & APPLICATION

Location

- **Restricted:** Driveways and curb cuts generally conflict with the safe and comfortable operations of downtown streets, and are restricted on all street types in the downtown. The following conditions and exceptions may apply, pursuant to city staff discretion:
 - » Mixed-use and multi-family buildings with alley access should utilize alleys for building services (e.g. waste handling, deliveries) and access to on-site parking.

- » Where no access to an alley exists, exceptions may be granted to allow curb cuts, consistent with the City of Ann Arbor Unified Development Code, in order to provide access to building services and/or where access to publicly accessible parking is needed.
- » Curb cuts onto pedestrian emphasis streets is strictly prohibited and exceptions shall not be granted. Curb cuts on these streets would have a detrimental impact on pedestrian comfort and commercial operations of the street.
- » Curb cuts may not be located where it would create a break in a separated bikeway. Exceptions may be granted per city staff discretion.
- » On near neighborhood streets, curb cuts may be permitted at city staff discretion.

Related Design Elements

- **Traffic Calming:** As a location where vehicles frequently enter and exit a street, driveways are excellent opportunities to introduce traffic calming elements to the street (e.g. mid-block bumpouts) to ensure that motorists are aware of their surroundings and do not drive in a way that endangers other road users.
- **Bumpouts:** Driveways can be used in conjunction with bumpouts. Move the driveway apron out to the bumpout and make it flush with the sidewalk level.”

Policy References

- The Downtown Ann Arbor Design Guidelines provide guidance on how to manage driveways on public streets. It recommends providing a continuous street edge at street level to reduce the number of interruptions by driveways.
- Ann Arbor Unified Development Code, Chapter 55, Article IV, Section 5.21.2 provides requirements on curb cuts and driveway approaches, including the number of openings allowed based on the total street frontage.

DESIGN & OPERATIONS

Design Requirements

While driveways are often necessary for building access and loading, their design should indicate to motorists that pedestrians, cyclists, and through vehicle traffic have the right-of-way across a driveway. Driveway entrances and curb cuts are an opportunity to provide traffic calming to reduce the potential for conflicts.

A Driveway Width:

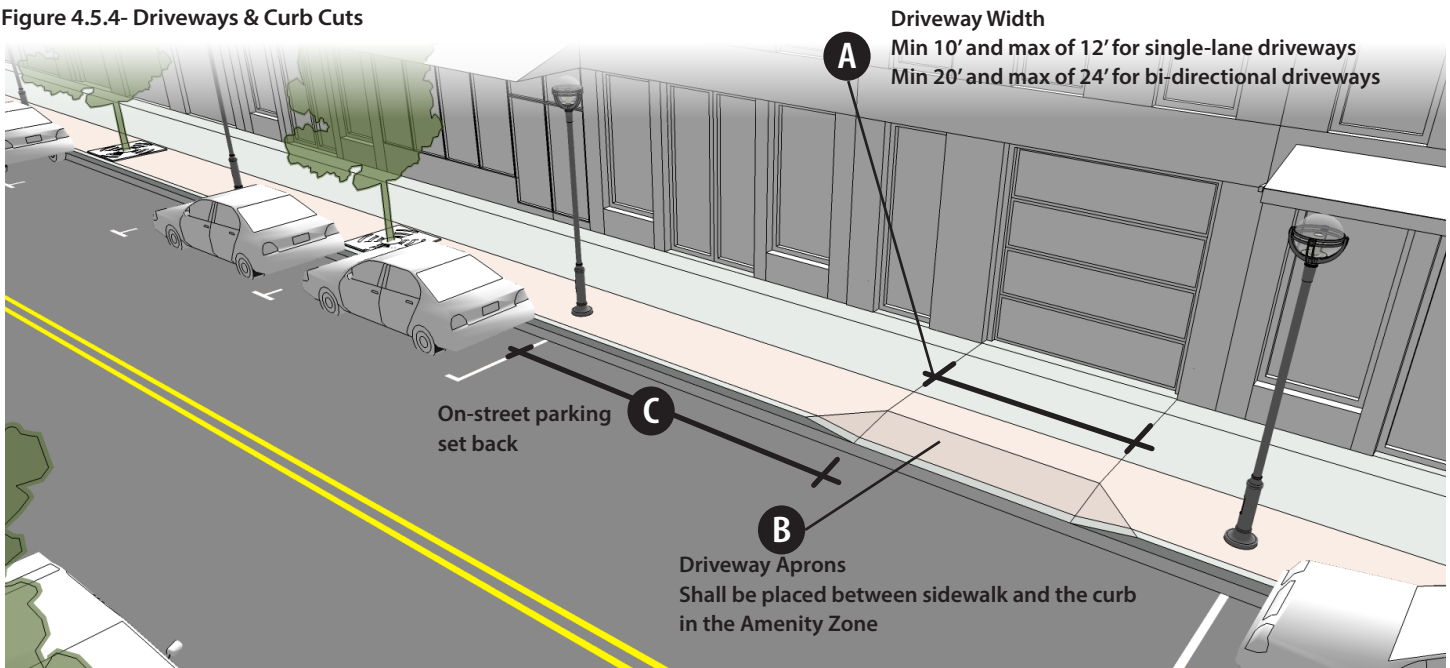
- » Single-lane driveways shall be at least 10 feet wide, but no wider than 12 feet.
- » Bi-directional driveways shall be at least 20 feet wide and no wider than 24 feet.

B Driveway aprons shall be placed between the sidewalk and the curb in the Amenity Zone. The apron should not encroach on the clear sidewalk (walking zone). If there is a bumpout or parking lane planter, the apron should lie within the bumpout. Bumpouts should be used if the sidewalk is too narrow to accommodate a safe driveway intersection.

- **Sidewalk Interface:** Driveways shall be flush across the sidewalk to maintain a level and consistent walking path.
- **Sidewalk Materials:** Continue sidewalk paving material across the driveway to indicate that pedestrians will be crossing this space.
- **Visibility Sight Lines:** Curb cuts shall provide adequate visibility to and from the sidewalk and street. Ideally, vehicles should not need to block the sidewalk while gaining clear lines of sight, but this may be unavoidable.
 - » Where sight lines are limited, include appropriate signage indicating where the driver is to stop and wait.
 - » Mirrors, audible signals, or other devices to assist with visibility of pedestrians are encouraged.

C On-Street Parking: On-street parking shall be set back which ever distance is greater: (a) least 5-feet from the nearest edge of a driveway or (b) where the driveway curbing radius meets the straight segment of the road curb.

Figure 4.5.4- Driveways & Curb Cuts



- **Curb Cuts:** Curb cuts shall be located a minimum of 40-feet back from the nearest edge of a crosswalk to reduce interference with intersection operations.

Additional Design Considerations

- **Alley Access:** Curb cuts are not appropriate where alleys can provide rear access to residences and businesses. Where large new development occurs along a significant portion of a block face, provide a central alleys to reduce the need for multiple driveways and curb cuts.
- **Bike Lane Markings:** Where a driveway crosses a bike facility, paint bicycle markings on the pavement to indicate where there is a conflict.
- **Major Driveways:** Ensure driveways that function as an intersection, such as onto private alleys or drives, contain all of the features of a conventional intersection, including crosswalks, tight corner radii, and a signal, if deemed necessary.

Utility Considerations

- Design new curb cuts as to not impede drainage from the street.

Sustainability Considerations

- Consider using permeable materials for driveways, which can reduce stormwater runoff and improve water quality.

MAINTENANCE & MANAGEMENT

General Maintenance

- Driveway aprons with special paving materials may need additional maintenance from property owners.

Seasonal Use & Maintenance

- **Snow Removal:** Property owners in Ann Arbor are required to shovel their sidewalks, including where sidewalks cross a driveway, within 24 hours of a snow event.
 - » Snow from driveways should never be stored in the street and doing so is illegal in Michigan. While snow removal vehicles clearing the street may pile snow into a driveway apron during plowing operations, sidewalks crossing a driveway should never be used for snow storage.

Reviews & Approvals

- The Ann Arbor Planning and Development Services office is responsible for reviewing the creation of new driveways as part of the site plan review process.

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ROADWAY ZONE

MEDIANS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis		✘	✘			
Pedestrian		✘	✘			
Transit			⚠	⚠	⚠	
Bicycle			⚠	⚠		⚠
Balanced			⚠	⚠	⚠	⚠

DESCRIPTION & INTENT

A median divides lanes of traffic. In a downtown, medians are generally in the center of the right-of-way, dividing opposing directions of traffic. They may also be located on the side, separating local access or special purpose lanes such as dedicated travel ways.

Medians increase safety and enhance roadway operations by reducing vehicular movement conflicts, limiting turning movements, and providing a refuge for pedestrians crossing the street.

Medians take on many forms. They may be flush with the pavement and consist of painted markings, a space protected with bollards, or a raised curb. Striped or painted medians may precede more permanent improvements, providing localities an opportunity to test travel behaviors before making a significant capital investment. Raised medians within the travel zone provide opportunities for landscaping, street trees, and two-stage pedestrian crossings.

USE & APPLICATION

Location

- Given the relatively narrow dimensions of streets in downtown Ann Arbor, limited opportunities for the incorporation of medians into the street exist. Medians are generally applied to vehicle emphasis streets as a means to reduce conflicts and facilitate flow while providing an attractive streetscape environment.
- Medians are not well suited to pedestrian & access emphasis streets as they can impede visibility of businesses and make commercial support activities (e.g. deliveries) more challenging.
- Medians may be used as an access management tool, a means to limit vehicle conflicts on a corridor to facilitate traffic flow and safety. Medians may also be used as a traffic calming and beautification device.

Related Design Elements

- Traffic Calming:** Used in isolation, roadway medians do not have a significant impact in reducing vehicle speeds. For the purpose of slowing traffic, medians are generally used in conjunction with other traffic calming measures, such as bumpouts or roadway lane narrowing.

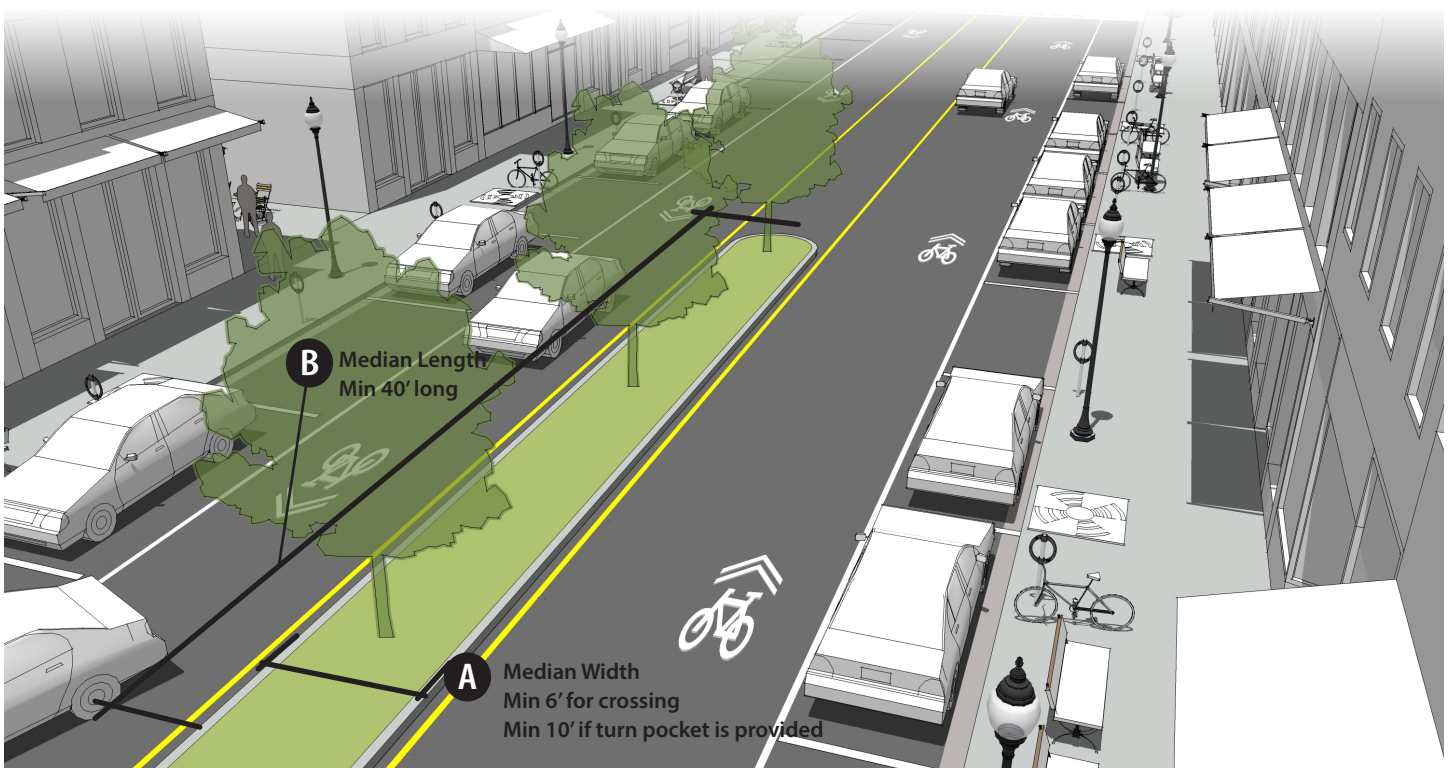
- **Pedestrian Crossings:** Medians provide an important refuge, but do add to the overall width of the Roadway Zone. While providing a median can shorten each leg of a crossing, a wide median increases the total street crossing distance, which adds time to the signal sequence and causes traffic delay. Two-stage pedestrian crossings should be avoided whenever possible. Consider foregoing a median in order to narrow the pedestrian crossing width and enable safe single-stage crossing.
- **Sidewalks and Bicycle Lanes:** Do not remove or narrow sidewalks or bicycle facilities to provide medians or pedestrian refuges. Medians should not compromise the ability to accommodate other street uses. It may not be possible to add medians to streets with narrow driveways.

DESIGN & OPERATIONS

Design Requirements

- **A Median Width:** Medians should be a minimum of 6 feet wide to provide adequate width for pedestrians crossing with strollers, bicycles or wheelchair devices.
 - » Medians must be at least 10 feet wide if they are to provide turn pockets at intersections.
 - » Where a 6-foot median width cannot be provided, a narrower raised median can still improve crossing safety. In these instances, signals should be timed so that pedestrians can cross in one signal phase.
- **B Median Length:** Medians should be a minimum of 40 feet long.
 - **Crosswalks:** Crosswalks should cross medians at street level. The resulting cut-through should equal the width of the crosswalk and be wide enough to accommodate snow removal.
 - » Provide a median nub at crosswalks to buffer and protect pedestrians from traffic in the intersection. See Pedestrian Refuge Island for additional guidance.

Figure 4.5.5 Medians



- **Planting:** Design plantings to avoid blocking sight lines for pedestrian, cyclists, and motorists near intersections and crossings.

Utility Considerations

- Do not locate utilities below planted medians as plantings may impact utility lines and repair or replacement is challenging. Utilities under striped, painted or paved medians are easier to access with minimum disruption to roadway operations.

Sustainability Considerations

- Landscaping medians reduce the impervious surface area in the roadway, allowing stormwater infiltration or retention in the exposed soil. Curbed medians more than 4.5 feet wide, should be landscaped and used for stormwater management where possible. To support street trees, medians should be at least 6 feet in width and a minimum of 15 feet in length per tree. Refer to Street Tree design elements (Section 4.6) for additional information.
- Providing vegetation helps motorists identify medians. Varying the types of plantings or trees can give motorists a clue to the type of environment they are passing through, leading them to adjust their behavior and speed accordingly. Street trees located within the intersection should avoid blocking sight lines to ensure safety.

Design References

- The NACTO Urban Street Design Guide provides further information on the design of medians and pedestrian crossing islands in urban environments.
- The Institute of Transportation Engineers offers guidance on medians and other traffic calming devices.

MAINTENANCE & MANAGEMENT

General Maintenance

- **Landscape Care:** Planted medians will require landscape stewardship to ensure well maintain planting beds. Ann Arbor has an “Adopt-a-Median” program coordinated through the Adopt-a-Park program.
 - » In the early years, it may be necessary to irrigate or water by hand, any planting, especially trees, established in the median.

Seasonal Use & Maintenance

- **Snow Removal:** Medians should be designed with snow removal in mind. Medians can be used for snow storage when necessary, although this may negatively impact planted materials, can block sight lines along the roadway, and can trap pedestrians trying to cross at unmarked locations.
 - » Medians should allow adequate width in the adjacent travel lane to accommodate snow removal vehicles, as well as turn radii that facilitates snow clearing and removal.

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INTERSECTION ZONE

MINI ROUNDABOUTS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis						
Pedestrian		■	■			
Transit			■	■	■	
Bicycle			■	■		■
Balanced			■	■	■	■

DESCRIPTION & INTENT

Mini roundabouts, also referred to as mini circles or neighborhood traffic circles, are small diameter traversable or protected islands¹ in the middle of an intersection. Mini roundabouts subtly deflect the path of traffic, slowing traffic speeds while maintaining vehicle progression. The slower speeds and angle of the vehicles provide greater visibility to pedestrians as well as a safer, easier crossing. Mini roundabouts have demonstrated significant safety benefits and reduction in the number and severity of crashes.

Mini roundabouts can be attractive focal points in a streetscape environment and some communities, like Seattle, WA, even have competitions between neighborhoods for the most attractive mini roundabout design and maintenance.

USE & APPLICATION

Location

- Mini roundabouts are appropriate in all Frontage Contexts, and pedestrian and bicycle emphasis streets, as well as balanced street types.
- Use mini roundabouts at the intersection of lower speed, bi-directional streets with only one lane of traffic per direction.

- Mini roundabouts may be used at physically-constrained locations as they can generally be accommodated in the existing bounds of most streets.
- Mini roundabouts are commonly used as an alternative to four-way stop signs but may also be used in lieu of two-way stop controls.
- Mini roundabouts may be used at isolated locations or may be applied in sequence along multiple intersections of a corridor.
- Mini roundabouts may be used to improve safety and flow at intersections like Fourth Avenue and Catherine Street where the mixing of drivers, pedestrians and cyclists cause confusion at the four-way stop.
- Mini roundabouts may be piloted and tested as temporary installations through the use of paint and/or temporary flexible curbing, sand bags, or other acceptable materials.²
- Mini roundabouts typically do not adversely affect bicycle facilities, emergency responders, or other special vehicles. Any unique challenges can typically be addressed through design adjustments.

¹ <http://safety.fhwa.dot.gov/intersection/roundabouts/fhwasa10007/>

² The "Living Preview" of the Yellow Brick Road project in Richmond, CA is a great example of a temporary and test installation of a mini roundabout. <http://richmondconfidential.org/2014/10/24/residents-test-yellow-brick-road-and-proposed-walkable-streets-within-the-iron-triangle/> (Accessed January 2015)

Related Design Elements

- **Crosswalks:** Place crosswalks across all approaches so motorists know where to look for pedestrians and pedestrians know where to cross safely.
- Carefully design bicycle facility approach as entering the mini roundabout. A bicycle lane may be provided around the mini circle; however, it is more common that bicycles share the lane in a mini roundabout.
- Mini roundabouts on emergency vehicle framework streets or transit routes must be designed to accommodate the sweep of these vehicles.

Policy References

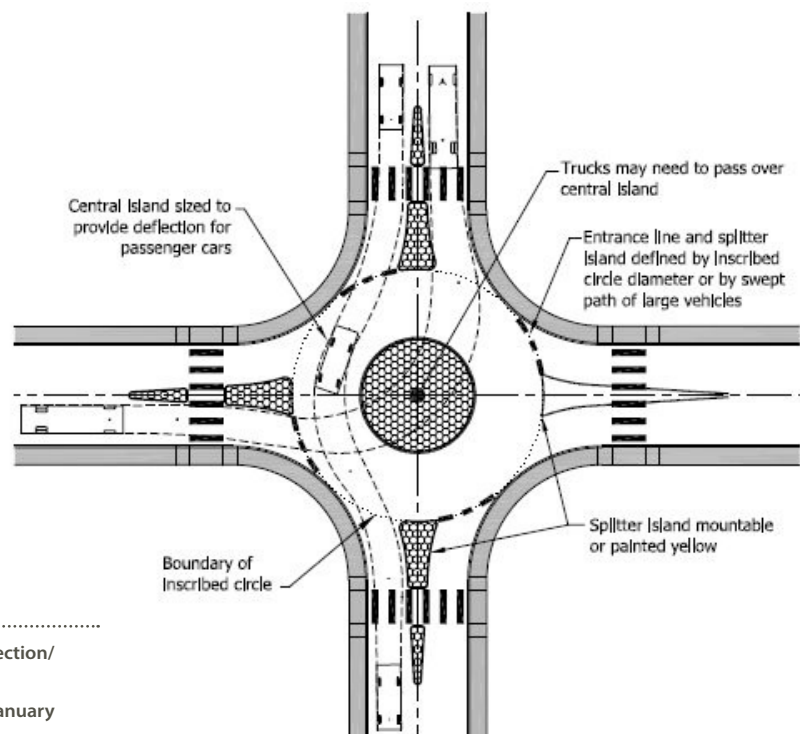
- The FHWA, through its Office of Safety, has developed guidance for the design and use of mini roundabouts.³
- The Seattle Department of Transportation Neighborhood Traffic Control Program is one of the most extensive and mature in the nation providing robust resources for peer communities, including standard specifications for construction.⁴

DESIGN & OPERATIONS

Design Requirements

- **Geometry:** Make mini roundabouts as large as possible. Design the inscribed circle with radii large enough to deflect travel lanes, but small enough to stay within the existing curb lines. Properly designed, mini roundabouts should not require the realignment of existing street curbs.
- **Mountable Apron:** Create a protected area in the center surrounded by a mountable apron that accommodates the larger turning radii required by trucks, buses, and other larger vehicles.
 - » Design the mountable apron to accommodate and withstand snowplow blades. The City of Seattle standard is for a 2-foot wide concrete ring no more than 4 inches high.
- **Signage:** Use yield control on all entries.
- **Approaches:** Use raised channelization to guide approaching traffic into the circle. Pavement markings may be used as an alternative.
 - » Rumble strips should be used in advance of any integrated crosswalks to alert pedestrians of on-coming cars.

Figure 4.5.6 - Mini Roundabouts



³ Report number "FHWA-SA-10-007" <http://safety.fhwa.dot.gov/intersection/roundabouts/fhwasa10007/> (Accessed January 2015)

⁴ <http://www.seattle.gov/transportation/trafficcircles.htm> (Accessed January 2015)

Additional Design Considerations

- **Center Landscape Area:** The central island may be fully traversable (typically with a paved circle) or may permit landscaping inside of a wide apron.
- **Stop Controlled Entry:** Some communities use stop controlled entries which is then more appropriately called a neighborhood traffic circle, rather than mini roundabout.

Utility Considerations

- Ensure mini roundabouts do not conflict with sub-surface utilities, particularly if landscaping beds or curbs are provided as elements of the roundabout design.
- Do not locate utility vaults in mini roundabouts.

Sustainability Considerations

- Mini roundabouts can provide a unique opportunity for street greening and the removal of impervious surfaces. Place landscaping in the center portion of the mini roundabout. Ground cover should remain low, though trees may be used if the line of sight through the mini roundabout.

MAINTENANCE & MANAGEMENT

Special Maintenance

- Any landscaping in mini roundabouts should be regularly maintained and potentially irrigated. If community partners participate in landscape maintenance, clear safety protocols must be put in place and maintenance agreements should be adopted.
- Mini roundabouts may complicate street repaving projects.
- Roundabouts require both additional signage and pavement markings, which also must be maintained.

Seasonal Use & Maintenance

- If mini roundabouts are planted, seasonal landscape care is required.
- Mini roundabouts can introduce some challenges to snow removal. A mountable apron on the roundabout allows snowplows to maneuver around them. The center island of mini roundabouts may be used for temporary snow storage.

Reviews & Approvals

- The Ann Arbor Systems Planning and Engineering Units will review and approve mini roundabout applications in the city.

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INTERSECTION ZONE

SIGNALS: NO TURN ON RED (LEFT AND/OR RIGHT)

DESCRIPTION & INTENT

“Right on Red” operations permit vehicles to complete a right-hand turn even when the signal governing their leg is displaying red. Vehicles may only proceed when the intersection is clear of on-coming vehicles and pedestrians in the crosswalk.

Conversely No Right on Red operations prohibit vehicles from making this turn. All vehicles must wait for the appropriate green signal.

In Michigan, vehicles are permitted to make a Left on Red, but only onto a one-way street.

Right on Red operations are generally used to aid in progressing vehicle traffic. The reduced idling time can have modest air quality benefits but, Right on Red may increase conflicts with and risk to pedestrians in a concentrated downtown area where pedestrians are common.

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis		✓	■			
Pedestrian		✓	■			
Transit			■	■	■	
Bicycle			■	■		■
Balanced			■	■	■	■

USE & APPLICATION

Location

- Right on Red is specifically prohibited at most signalized intersections in downtown Ann Arbor.
- No Turn on Red is typically employed at locations with relatively high pedestrian volumes. This treatment is advised for intersections in Destination Commercial street types and should be considered at all other Commercial street types.
- Where separated bicycle facilities are used and/or where two-stage turn queue boxes or bike boxes are used, No Turn on Red must be used.
- Right on Red can be temporal, prohibiting right turns only during peak hours of pedestrian activity (for example 7AM to 7PM). Right on Red may be further qualified with signage that indicates “No Right on Red When Pedestrians Present.”
- Priority users like public transit operators may be exempted from No Turn on Red restrictions at intersections that are specifically signed.

Policy References

- The MMUTCD is the definitive guide for all signal operations and design.¹



INTERSECTION ZONE

SIGNALS: LEADING VS. LAGGING LEFTS

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis					
Pedestrian	■	■			
Transit		■	■	■	
Bicycle		■	■		■
Balanced		■	■	■	■

DESCRIPTION & INTENT

Designated signal phases for left turns are common in many locations. Left turns may be accommodated through an exclusive signal phase, where only opposing left turns are permitted, or as an early or elongated period for the through green time for one approach of the intersection. These left turns are known as “leading lefts” if they occur at the beginning of the through vehicle phase or “lagging lefts” if they occur at the end of the phase.

Leading lefts tend to be less intuitive to pedestrians accustomed to being given a walk phase at the conclusion of the red phase for opposing traffic. Pedestrians may jump the signal and find themselves in direct conflict with left turning vehicles. Pedestrian/vehicle conflict have been found to be almost six times higher with leading lefts as compared to lagging left signal operations.¹

USE & APPLICATION

Location

- Leading or lagging lefts allow time for turning vehicles to clear the intersection. They are generally used in locations that have a high volume of pedestrians or through traffic that inhibit the completion of the left-turn.
- Lagging lefts are generally preferred for pedestrian progression. Leading lefts are generally preferred for vehicle progression.

Policy References

- The MMUTCD is the definitive guide for all signal operations and design.²

DESIGN & OPERATIONS

Design Requirements

- Intersections with leading left phases should provide more generous sidewalk space to accommodate pedestrian queuing. Pedestrians are generally at their greatest concentration at the beginning of any signal cycle. Lagging lefts permit the majority of pedestrians to clear the intersection before left turns proceed.
- Leading Pedestrian Intervals (LPI) may not be used in conjunction with leading left signal operations, but may be combined with lagging left signals.

¹ Hummer, J. E., Montgomery, R. E., and Sinha, K. C. Guidelines for Use of Leading and Lagging Left-Turn Signal Phasing, Transportation Research Record, No. 1324, TRB, National Research Council, Washington, D.C., 1991.

² <http://mutcd.fhwa.dot.gov/hm/2009/part4/part4e.htm>



Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis					
Pedestrian	⚠	⚠			
Transit		■	■	■	
Bicycle		■	■		■
Balanced		⚠	■	⚠	■

INTERSECTION ZONE

SIGNALS: LEADING PEDESTRIAN INTERVAL

DESCRIPTION & INTENT

A leading pedestrian interval (LPI) is a brief time at the beginning of a signal phase that permits pedestrians to enter the crosswalk before any other traffic is permitted to advance. LPIs improve the visibility of pedestrians by putting them more clearly in the sight of right and left turning vehicles. Studies show that LPIs reduce pedestrian/vehicle collisions by up to 60%.¹

USE & APPLICATION

Location

- LPIs are appropriate for use on any street type; however, are typically used at intersections with significant pedestrian volumes and high volumes of conflicting turning vehicles, such as Destination Commercial and other Commercial areas and areas of high student concentrations.
- LPIs may also be used on streets approaching vehicle flow corridors to improve the visibility of pedestrians crossing parallel to high volume, higher-speed streets.

Policy References

- The MMUTCD is the definitive guide for all signal operations and design.”

DESIGN & OPERATIONS

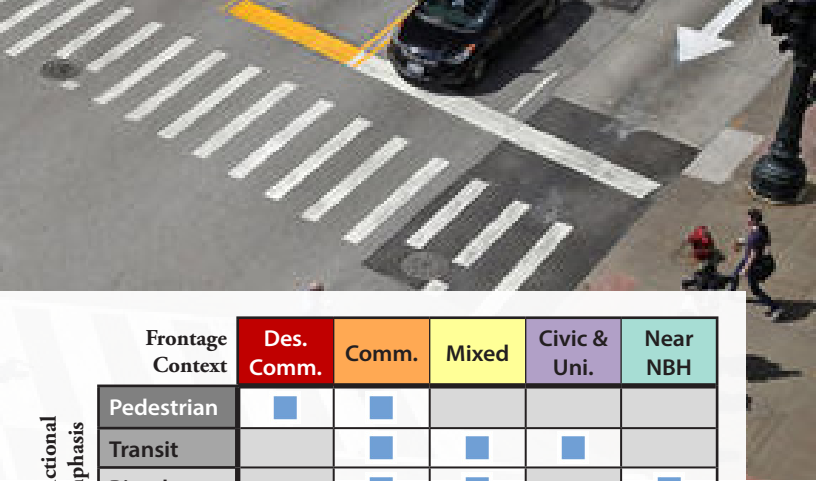
Design Requirements

- Require the concurrent use of pedestrian signal heads.
- May not be used with leading left turns.
- Must be a minimum of three seconds in duration, but more commonly provide five or more seconds to permit pedestrians to cross at least one lane of vehicle traffic.
- Should be accompanied by audible and/or vibrotactile signals for visually impaired pedestrians.

Optional Design Considerations

- Eliminate Right on Red at locations where LPIs are used. Right on Red is generally undesirable at intersections with high and regular pedestrian volumes.
- At locations with extremely high pedestrian volumes, combine the LPI with signal timing that displays the “DON’T WALK” signal for pedestrians even while the green phase is still shown for parallel traveling vehicles. This brief period at the end of the cycle provides an opportunity for vehicles to complete turns after the majority of pedestrians have completed their crossing.
- Combine LPIs with bumpout to further increase pedestrian visibility and safety.
- Bicycles may also benefit from LPIs and clear an intersection to permit vehicle turns.

¹ A.C. Fayish and Frank Gross, “Safety effectiveness of leading pedestrian intervals evaluated by a before–after study with comparison groups,” Transportation Research Record No. 2198 (2010): 15–22.



	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis						
Pedestrian		■	■			
Transit			■	■	■	
Bicycle			■	■		■
Balanced			■	■	■	■

INTERSECTION ZONE

SIGNALS: ALL-WALK SIGNAL PHASES

DESCRIPTION & INTENT

All-walk signal phases, also called pedestrian scramble lights, diagonal crossing or Barnes Dance, stop all vehicle movements on all legs of an intersection and permit pedestrians to cross in any direction – including diagonally across the intersection. Conceived by Flint, MI native Henry Barnes, the pedestrian scramble was first used in Denver, CO.¹

All-walk signal phases may be the only opportunity in a signal cycle when pedestrians are permitted to cross since pedestrians are held during all other phases to remove their conflicts with turning vehicles. All-walk signal phases may also serve as an additional phase, with pedestrians still permitted to cross concurrent with parallel traffic during typical signal cycles.

- All-walk signal phases are generally unfamiliar operations to most pedestrians and may take some time for motorists and pedestrians to adapt.

USE & APPLICATION

Location

- All-walk signal phases should only be used where high volumes of pedestrians are expected on a routine basis.
- All-walk signal phases may also be used at locations where there are a high number of conflicting movements between crossing pedestrians and turning

vehicles. In this case, the all-walk phase may be the only time when pedestrians are permitted to cross the intersection. Pedestrians are held on the sidewalk during vehicle phases. Although the all-walk phase permits movements in all directions and single-cycle crossings, it may also decrease pedestrian level of service as pedestrians must wait through two or more signal cycles before getting permission to cross.

Policy References

- The MMUTCD is the definitive guide for all signal operations and design.²

DESIGN & OPERATIONS

Design Requirements

- Instructive signage is generally necessary at all-walk signal phase locations, as this is a non-standard traffic operation.
- All-walk signal phases should be accompanied by audible and vibrotactile indicators for visually impaired pedestrians.
- Sidewalks should be large enough to comfortably provide space for queuing pedestrians waiting to cross.
- All-walk signal phases should be routinely monitored and reassessed. Given the longer delays for both vehicles and pedestrians, there may be reductions in signal compliance.

¹ Jeremy Meyer, "Denver to eliminate diagonal crossings at intersections," The Denver Post. April 06, 2011 http://www.denverpost.com/ci_17780418 (Accessed January 2015)

² <http://mutcd.fhwa.dot.gov/hm/2009/part4/part4e.htm>



INTERSECTION ZONE

SIGNAL: TRAFFIC SIGNAL PRIORITY

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis					
Pedestrian	■	■			
Transit		■	■	■	
Bicycle		■	■		■
Balanced		■	■	■	■

DESCRIPTION & INTENT

Traffic signal priority (TSP) prioritizes the progression of select vehicles, typically transit or emergency vehicles, over the standard progression of typical transit. TSP may be active or passive.

Passive TSP times traffic signals and corridor progression to the average bus speed rather than vehicle speed.

Active TSP is an Intelligent Transportation System (ITS) that enables an approaching bus to communicate with a traffic signal and alter the signal timing to improve transit progression. Active TSP may extend the signal green time, truncate the red phase, swap signal phases, insert a transit-only phase, or skip signal phases. The margin of signal time prioritized for transit is typically made up in modifications to the remaining signal phases with the overall signal cycle length remaining generally unchanged and fully recovered in the following cycle. TSP uses transponders on buses that communicate with traffic controllers. Prioritizing transit at intersections creates more reliable and efficient service. This makes transit a more attractive mode of transportation for users and reduces operating costs for the City and service area.

Ideally, TSP should be deployed in concert with, and as an integrated component of, an overall ITS Comprehensive Plan for the city as a whole.

USE & APPLICATION

Location

- TSP is generally used on high frequency, high ridership transit corridors, and transit emphasis streets.
- TSP should be installed only when there is documented schedule adherence issues.

Related Elements

- **Traffic:** Active TSP modifies pre-timed signals. Industry practice indicates that TSP generally has minimal disruption on vehicle traffic; however, may briefly interrupt traffic progression on intersecting corridors with synchronized lights. The benefits and potential effects of TSP should be examined and considered before deploying this technology.
- **Transit:** Active TSP requires that surface transit vehicles or emergency vehicles be equipped with signal communication devices.
- **Queue Jump Lanes:** TSP is often used in conjunction with bus queue jump lanes, though they are not a prerequisite for use.
- **Bus Stops:** Far-side bus stop locations tend to benefit the most from TSP systems, as they reduce delays from buses waiting at the near-side of the intersection for a green signal.

Policy References

- Transit Signal Priority: A Planning and Implementation Handbook (May 2005) funded by the U.S. Department of Transportation and published by ITS America provides comprehensive guidance on TSP for transit.
- The FHWA Traffic Signal Timing Manual (Publication Number: FHWA-HOP-08-024) includes a section on planning and implementing traffic signal priority.

DESIGN & OPERATIONS

Design Requirements

- TSP does not require any physical modifications to the intersection, but it is often utilized in conjunction with bus queue jump lanes.
- TSP may be implemented at individual intersections, along a continuous corridor or route, or throughout the signal system.
- TSP typically cannot be activated for more than two signal cycles in a row and then cannot be activated until two to three additional signal cycles have passed to enable overall intersection and network recovery.

Sustainability Considerations

- TSP does not introduce any unique opportunities for green infrastructure installation, although it can increase transit service and use and this minimize vehicle traffic and idling.

MAINTENANCE & MANAGEMENT

Special Maintenance

- TSP does require both on-board vehicle equipment and signal system components. ITS does not normally, introduce any additional maintenance burdens than standard signal maintenance. Typically the TSP will maintain on-board equipment while the city or state will maintain signal equipment, though both must work in concert.

Reviews & Approvals

- TSP systems would be deployed in collaboration between the AAATA and the City of Ann Arbor and/or MDOT.





4.6

INFRASTRUCTURE & LANDSCAPE DESIGN ELEMENTS

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STREET LIGHTING

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
	Transit		✓	✓	✓	
	Bicycle		✓	✓		✓
	Balanced		✓	✓	✓	✓

DESCRIPTION & INTENT

Lighting is an essential element of street design and safety. Street lighting is used to illuminate the street, sidewalks, and bike facilities. Street lighting is critically important at intersections and crosswalks.

Lighting levels are important. Lighting should be sufficient for people to see comfortably and correctly distinguish persons and objects in the street, but lighting should not be so great as to create deep shadows or pronounced areas of light and dark.

Street lighting should be efficient in both energy use and direction of light. Consistent with Ann Arbor’s endorsement of the Dark Skies Initiative, street lights should minimize sky glow (casting or reflecting light up into the night sky).

Street lights are important elements of street character during all hours. The verticality of light poles helps to distinguish the curb line of the street and establishes a particular rhythm to the street edge. The spacing of light poles often dictates the spacing of other street elements as well, notably street trees. In dark conditions, warm color temperatures promote an inviting ambiance.

There are two broad categories of street lights used in downtown:

- **Roadway lighting** is typically mounted higher (18 to 24 feet above the roadway) and poles have an arm that extends the streetlight over the travel way.

- **Pedestrian-scale lighting** is typically mounted lower (12 to 16 feet above the sidewalk) and is primarily used to illuminate the Walking Zone, although on the narrow streets of Ann Arbor, light from pedestrian lighting may be sufficient to serve as both roadway and pedestrian lighting.

USE & APPLICATION

Location

- Street lighting is required on all street types although the type and intensity of lighting may vary.
- Pedestrian-scale lighting is generally desired in areas with more intense pedestrian activity in Destination Commercial, Commercial, and Civic & University frontages, which makes up the majority of downtown.
- Typical roadway lighting may be sufficient and desirable for both Roadway and the Walking Zone in the Near Neighborhood context, as light is focused towards the roadway and causes less light to enter homes.

Frontage Context	Preferred Lighting Scale
Destination Commercial	Pedestrian-scaled, with roadway lighting at intersections as needed
Commercial	Pedestrian-scaled, with roadway lighting at intersections as needed
Mixed	Pedestrian-scaled, with roadway lighting at intersections as needed
Civic & University	Pedestrian-scaled, with roadway lighting at intersections as needed
Near Neighborhood	Intersection and Roadway lighting

DESIGN & OPERATIONS

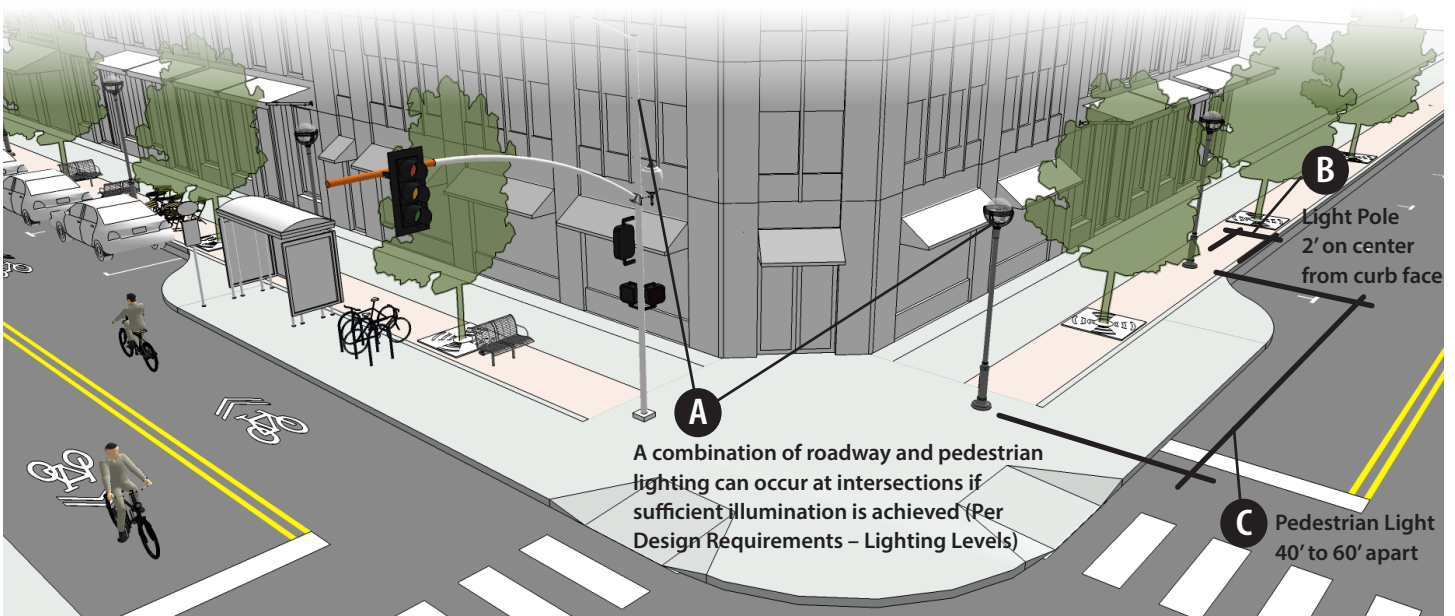
Design Requirements

- A Light Levels:** Street lighting shall be used to provide sufficient illumination, particularly at crosswalks and intersections. The target light levels for roadway luminance and intersection / pedestrian area illumination shall be based on the ANSI/IES RP-8 standards as indicated in the table below.
 - » Higher levels of lighting may be desired at bus stops, bicycle share stations, or other areas of concentrated pedestrian activity. Supplemental lighting may be provided by sources other than street lights, such as from lit bollards, building-mounted lighting, or other accent lighting.

- » Adaptive Control: New installations of street lighting may be regulated with adaptive controls.
- B Placement:** Light poles shall be placed in the Amenity Zone of the street at least 2-feet back from the face of curb and from the walking zone of the sidewalk.
 - » Where bumpouts are present, light placement should typically be consistent with the curb line outside of the bumpouts.
 - » **Positive Contrast Lighting:** Positive contrast lighting should be utilized at mid-block crossings. This is usually achieved by placing lights in advance of the crosswalk from both directions to provide vertical illumination of pedestrians at the crosswalk.

TABLE 4.6.1 Street Typology	Average Roadway Luminance (cd/m ²)	Target Light Level (average foot candle)			
		Signalized Intersections	Unsignalized Intersections	Pedestrian Area / Sidewalk	Mid-Block Crossings
Destination Commercial	1.2	3.2	3.2	2.0	3.2
Commercial	1.2	3.2	3.2	2.0	3.2
Mixed	1.2	3.2	3.2	2.0	3.2
Civic & University	1.2	3.2	3.2	2.0	3.2
Near Neighborhood	0.6	1.7	1.5	1.0	1.5 (same as for unsignalized intersections)

Figure 4.6.1- Street Lighting



C Spacing: Lighting placement and levels should be sufficient for personal safety, permitting recognition of people and objects while avoiding the creation of excessive shadows. Exact spacing will depend on the selected light fixture and target light level to be achieved. The spacings below can be used for planning purposes:

- » Pedestrian scale lighting is typically placed 30-60 feet apart, depending on the design of the fixture and arrangement of intervening street features (e.g. street trees).
- » Where roadway lighting is used, lights are placed at intersections and typically every 150 to 250 feet between, although this may be less depending on the desired light level.
- **Energy Efficiency:** Ann Arbor pioneered the use of LED light fixtures as a means to reduce energy consumption and costs. Effective, high efficiency lighting is required using LED lighting and/or the best available technology.
- **Light Color:** Lights shall have a Correlated Color Temperature of no greater than 3000K and shall have a minimum Color Rendering Index (CRI) of 70.
- **Illuminance:** In D1 Downtown Core and D2 Downtown Interface districts, the Illuminance shall be measured facing up, at a distance three feet above the ground. In any other district, the illuminance shall be measured facing the Luminaire and measured at any point within the receiving property, including at any height above grade at the property line.
- **Light Shielding:** Street Lighting in the downtown should be partially or fully shielded in order to minimize up-light.
 - » Pedestrian lighting shall be fully or partially shielded. Where lighting illuminates features on an above grade or vertical target, including but not limited to architectural features, signs, landscaping, fountains, and sculptures, Luminaires shall be Partially Shielded and shall be installed and aimed to minimize their output past the object being illuminated, skyward or otherwise. Such lighting shall not cause Light Trespass as specified in this Section, or Glare.
 - » Roadway lighting shall be fully shielded. Where lighting targets primarily the ground or horizontal targets, including but not limited to parking areas, loading docks, recreational areas, and site entrances, Luminaires shall meet Fully Shielded criteria, so that no light will cause Light Trespass.

» All lighting on streets in exclusively residential zoned areas shall be shielded to minimize light trespass into residences.

- **Materials and Finishes:** Light poles and fixtures should use durable metal material (galvanized and powder-coated steel, aluminum or stainless steel finishes).

Additional Design Considerations

- **Light Fixture Style:** A variety of light fixtures are found throughout downtown. Since 2019, a focused effort has been made to standardize all pedestrian scale lighting. Specifications, below.
 - » The ornamental “globe” light is the most common pedestrian light and standard fixture for downtown streets in all non-Near Neighborhood streets. Exceptions to using this standard will be considered at staff discretion based on the road and specific design criteria that is needed. Poles with multiple globe luminaires may be used as needed to achieve target light levels.
 - » Ornamental Pedestrian Globe light specification: Lumecon Thirty-Five West, 54 watt, Type V Distribution, 120v- 277v, 3000k, Cut-Off Litelid, Black. Model number: L35W-1-1-OW-B-C. Equipped with a Phillips programmable driver.
 - » Ornamental Pedestrian Pole specification: catalog number: SPSCCD-SC4-18-13.00-TN3.50/6.00-PP-GFWI-CU, style: Center City with Steel Shaft Assembly, height: 13’-0”, base: 18”, finish: powder coated gloss black. Must include a GFI outlet.
 - » Ornamental Pedestrian Pole Cross Arm specification: Catalog number: AARANN-2S-22-TN2.88/3.00-CU, style: Ann Arbor Twin, height: 10”, width: 22”, material: fabricated aluminum, finish: powder coat gloss black, tenon: 2 7/8” dia. x 3” height.
 - » Roadway light fixtures may be used on dedicated poles and/or on traffic signal masts/posts in order to achieve intersection/mid-block crossing light levels when such lighting can not easily be achieved with the use of globe fixtures alone. Shall meet all design requirements as described on pages 251-252.

² RP-8-21 is the most current report issued November 2021 and available at www.ies.org/store. The last two digits of the report correspond to the year of publication. Go to www.ies.org/store to find the latest version.

³ <http://www.a2gov.org/departments/engineering/Pages/Engineering-and-Contractor-Resources.aspx>

⁴ “Ann Arbor Streetlights: Past, Present, Future.” Report prepared by the Systems Planning Unit. September 2013. http://www.sabrabriere.org/Ann%20Arbor%20Streetlights%20Whitepaper_%209-12-13.pdf

- » Consistent light fixtures within a character district will reinforce the image of the place, facilitate maintenance and provide more uniform lighting.
- **Arrangement:** The type and arrangement of light fixtures can reflect the character and hierarchy of the street. Light poles may be arranged in an “alternate” or “opposite” configuration.
- **Accessory Functions:**
 - » Brackets for banners, hanging baskets, or other ornamentation may be affixed or integrated into the light pole.
 - » Light poles shall provide electrical outlets to support downtown activities or seasonal displays.
 - » Street signage, bicycle parking and/or parking meter markers may be integrated into light poles to reduce sidewalk clutter.
 - » EV charging in conjunction with streetlighting is being explored.
- **Specialty Lighting:** Specialty and/or decorative accent lighting, such as festoon lighting, catenary lighting, light wands, lighted bollards/seating, or artistic installations may be permitted at city staff discretion. Specialty lighting should be shielded and is most appropriate in gathering or pedestrian plaza areas.

Sustainability Considerations

- Shielded lights reduce light pollution and allow lower wattage.
- Solar-powered or other emerging technology lights offer additional alternatives to consider.
- Lighter street surfaces and/or higher levels of reflectivity may lower lighting requirements and associated costs.

Design References

- The Illuminating Engineering Society of North America (IES) authors the nationally recognized “Recommended Practice for Roadway Lighting” – the standard for roadway, pedestrian and bicycle facilities approved by the American National Standards Institute (ANSI).²
- The City of Ann Arbor Public Services Standard Specifications provides design and construction specifications for street lighting.³

- FHWA Lighting Design for Mid-block Crosswalks (2008) provides guidance on lighting and visibility considerations at crosswalks to improve pedestrian safety.

MAINTENANCE & MANAGEMENT

General Maintenance

- The majority of pedestrian scale lighting is city-owned and maintained by the Signs and Signals group.
- The majority of roadway lights in Ann Arbor are owned and maintained by DTE with operation paid for by the City of Ann Arbor.

Seasonal Use & Maintenance

- **Snow Removal:** There are no special requirements for snow removal associated with street lighting.

Reviews & Approvals

- Street lighting should be coordinated through the Public Services Administration but may involve multiple other city units and Detroit Edison (DTE).
- It may also be necessary to engage Washtenaw County and the Michigan Department of Transportation (MDOT) in certain circumstances.





STREET TREES

Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Pedestrian	✓	✓			
Transit		✓	✓	✓	
Bicycle		✓	✓		✓
Balanced		✓	✓	✓	✓

DESCRIPTION & INTENT

Street trees are critical component of the downtown environment and part of the City’s overall green infrastructure system. Street trees provide a broad range of benefits, such as managing stormwater volumes, providing shade for pedestrians, making streets safer and more appealing, enhancing the aesthetic character of the street, and reducing the urban heat island effect. Maintaining healthy street trees is a challenge in dense urbanized environments, but proper consideration of the growing environment yields large and healthy street trees that provide maximum benefit.

USE & APPLICATION

Location

- Street trees are required on all streets in the downtown environment unless an exception is granted due to technical in-feasibility of planting trees. *See Minimum Planting Area in Design Guidelines Below.*
- Trees are especially important to locate near seating, bus stops, and other locations where pedestrians may be sitting, resting, or waiting and can take advantage of the shade trees provide.
- Limited space at the curbside on urban streets may not allow for street trees in all desired locations. Streets need to balance space for trees with a bus stop, on-street parking, seating, and other uses.

Street trees can be planted in one of two different conditions:

1. **Within a Landscape Planter (Curbed) or Lawn Extension:** Landscape planters are curbed or raised planting beds with exposed soil/mulch within the Amenity Zone. *See Landscape Planter Design Element for More Information.* Lawn extensions are on-grade, typically lawn, planting areas in the Amenity Zone used primarily in Near Neighborhood zones. *See Lawn Extension Design Element for More Information.*
 - » Open landscape planters are the preferred method for accommodating trees downtown as they provide more soil surface for water and air to access to tree roots. Curbed landscape planters also help reduce salt during the winter from running off into the tree planting area.
2. **Within a Covered Tree Trench:** Tree trenches use a combination of grates and covered soil areas within the Amenity Zone to provide an area for root growth beneath a hardscape surface.
 - » Covered Tree Trenches are best-used in locations where significant foot traffic – such as high on-street parking turnover, loading/unloading zones, bus stops, taxi stands, and other intense uses compete for limited space, such as in Destination Commercial, Commercial, and some Civic & University frontage areas.

Requirements and graphic representations for each condition are provided in the Design Guidelines below.

Table 4.6.2 - Street Tree Character Goals

Frontage Context	Street Tree Character Goals
Destination Commercial	Street trees are important for providing shade for shoppers, outdoor dining/ retail and making an attractive pedestrian environment. However, it is also important that street trees minimize obstructions to business signage wherever possible. Larger street trees should be used, with larger initial plantings, to more quickly provide bigger and taller canopy coverage. Healthy tree pruning and maintenance is critical in high use areas.
Commercial	As with Destination Commercial streets, Commercial streets also benefit from larger street tree plantings where trees can provide shade while minimizing obstructions to business signage.
Mixed	Mixed streets afford greater flexibility in street tree plantings due to generally lower pedestrian volumes and less retail/ storefront visibility concerns. While larger trees and a larger canopy is generally preferred wherever possible, small trees and ornamental species may also be incorporated into the street tree planting, especially when selected species can provide attractive foliage or flowering to enhance the visual quality of mixed streets. Many mixed streets also include service access to building (utilities, loading docks, etc.) and street trees can be used to screen less visually appealing features.
Civic & University	Civic & University streets generally have minimal commercial activity yet provide a high quality pedestrian experience for people accessing institutional uses. Street tree plantings should complement the scale and articulation of Civic & University buildings create a more cohesive streetscape character. Larger groupings of species should be considered to create a stronger “promenade” feel. Both larger canopy trees and ornamentals can be appropriate, and should be placed to provide shade for seating nodes or plaza spaces along the Civic & University streets.
Near Neighborhood	Near Neighborhood streets are primarily residential in nature, and larger canopy trees should be utilized whenever possible over smaller tree types. The tree canopy is important for shading smaller scale residential buildings and providing a more calm residential street feeling.

Tree Species Selection and Application

- Street Character:** Selecting the right tree for a given street type is important and must consider the overall Frontage Context of street as well as specific conditions, space, and growing environment for the planting itself. Trees play a critical role in defining the street character, as such congruency with the street Frontage Context is critical.
 - » Table 4.6.2 describes intended character goals for street tree plantings depending on the street’s Frontage Context.
- Site Selection:** Trees grow in many different sizes and forms, and not all trees are appropriate to all types of streets. Proper selection of tree species for a given site shall consider:
 - » Size of available growing areas and growing medium (soil and drainage).
 - » Width and height of the tree relative to the distance between trees (tree spacing) and between trees and adjacent building faces.
 - » Presence of other street elements that would adversely impact trees or be adversely impacted by trees, such as signs, light posts, and overhead or underground utilities.
- Tree Sizes:** Table 4.6.3 provides tree sizes and placement recommendations.
 - » These recommendations should be utilized in a flexible manner, recognizing that specific design conditions and constraint may require deviation (with approval of Ann Arbor Urban Forestry & Natural Resources staff) in order to accommodate street tree planting. For example, parking meters, street signs, utility vaults/connections, building entrances, and other fixed street elements may require adjusting street tree placement and spacing.

Table 4.6.3 - Street Tree Size and Placement

	Small Trees	Medium Trees	Large Trees
Typical on-center spacing	20’	25’	30’
Minimum distance from curbs or clear Walking Zone	2’	2.5’	3’
Minimum distance from edge of driveways / alleys	10’	10’	10’
Minimum distance from light poles and hydrants	5’	5’	5’
Minimum horizontal distance from nearest edge of crosswalks	10’	10’	10’

- **Species Selection:** The tree species must be on the City of Ann Arbor’s list of Approved Street Trees by Size. The list classifies trees by size class, including Small Trees (mature height under 30’), Medium Trees (mature height 25-40’), and Large Trees (mature height >40’). Note that Small Trees are suitable for streets constrained by overhead utility lines.
- **Planting Design:** Trees should be planted in a sequence of two to three of the same species in a row to provide a consistent character for a given segment of the street. Where conditions allow, planting trees for symmetry across the street should be considered (e.g. the same sequence of two to three trees repeats on the opposite side of the street) .
 - » Street tree planting downtown should coordinate with any specific tree plantings identified in street tree comprehensive plans that are part of the Urban and Community Forestry Management Plan.

DESIGN & OPERATIONS

Design Requirements – Soil Volume

- Trees typically need 2 cubic feet of growing soil for every square foot of canopy area for healthy growth (see: Urban, Jim. Up By Roots, Healthy Soils and Trees in the Built Environment. International Society of Arboriculture, Champaign Illinois. 2008). In the downtown environment, the following approximate canopy sizes are anticipated for street trees:
 - **Small Trees** = 10-foot diameter canopy (approx. 150 cubic feet of soil)
 - **Medium Trees** = 15-foot diameter canopy (approx. 350 cubic feet of soil)
 - **Large Trees** = 20-foot diameter canopy (approx. 600 cubic feet of soil)
- The soil volume for a tree can be achieved through a combination of the primary planting area in which the tree is placed and open access to surrounding soil areas that extends under the amenity zone, sidewalk, or roadway.



Design Requirements – Trees in Landscape Planters or Lawn Extensions

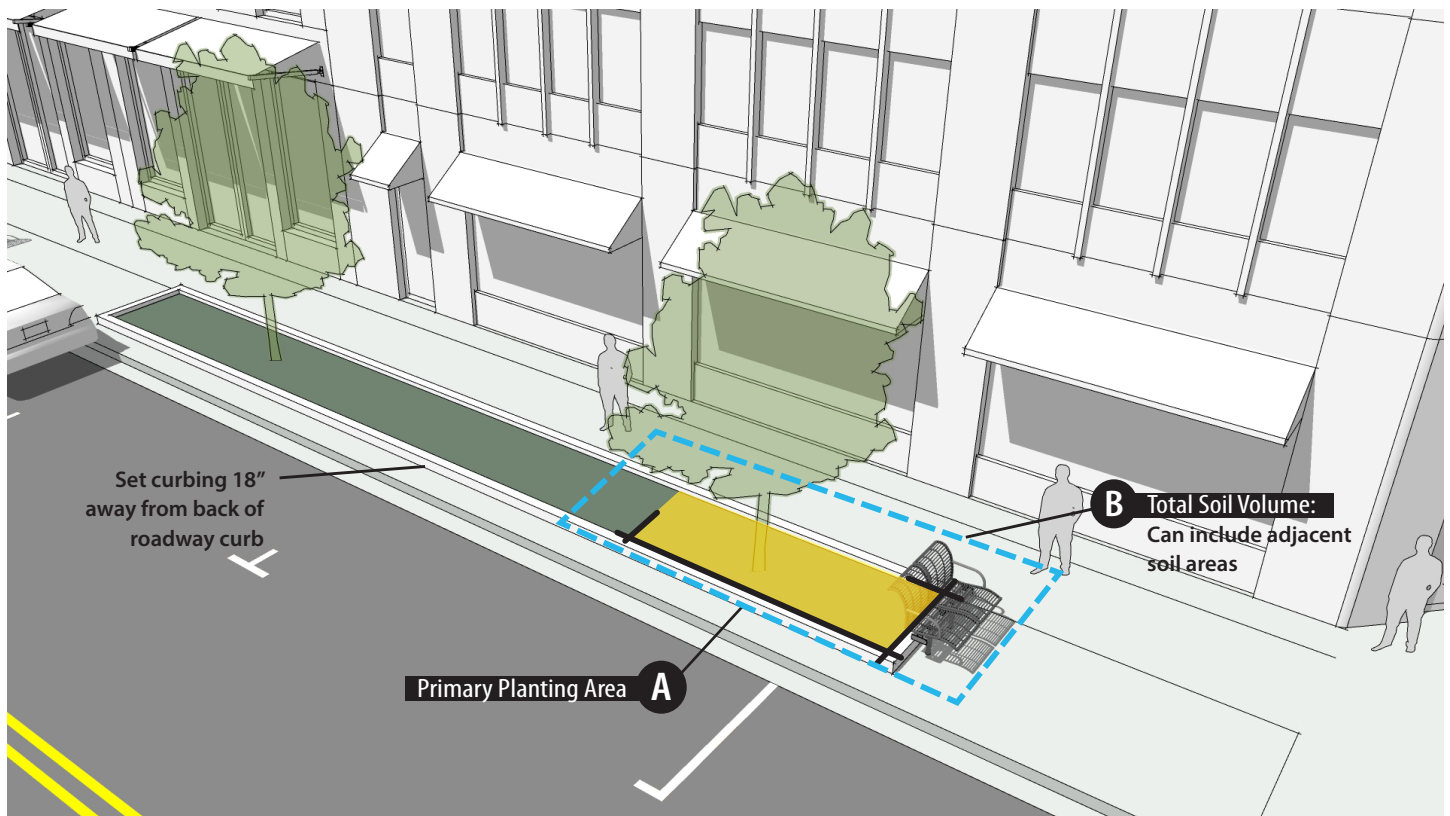
Landscape planters are areas within the streetscape with exposed soils and mulches for trees and other vegetation to be planted and contained within a curbed perimeter and/or raised seating walls. *See Landscape Planters Design Element and Lawn Extension Design Element for additional guidance on the design, layout, and construction details for landscape planters.*

- A Primary Planting Area:** Trees planted within an open planting area (planters and lawn extensions) shall have a minimum soil surface area of approximately 30-square feet around the tree.
- B Total Soil Volume:** The desired soil volume for trees depends on the size of the tree used in the planters (see Soil Volume). Trees should be planted in the middle of their allocated soil volume.
 - » Depth of the soil is based on the size of the root ball, with the top of the root ball flush with the finished grade of the planter (absent of mulch cover) and accounting for a 6 to 12 inches of compacted planting soil below the root ball. Do not place root ball directly on undisturbed grade.

» For trees up to 3 inches in caliper, a minimum of 12 inches of new planting soil mix must surround the root ball (e.g. 2-foot diameter root ball requires a minimum 4-foot diameter area of planting soil). For trees 3 inches in caliper or larger, 18 inches of planting soil mix must surround the root ball. These minimums may determine the minimum possible width for the planter based on the specific size of the root balls for specified plant materials. *See Planting Detail Below for Additional Information.*

- **Drainage:** Provide subsurface drain lines connected to the stormwater system in areas with poorly drained surrounding soils.

Figure 4.6.2- Trees in Landscape Planters

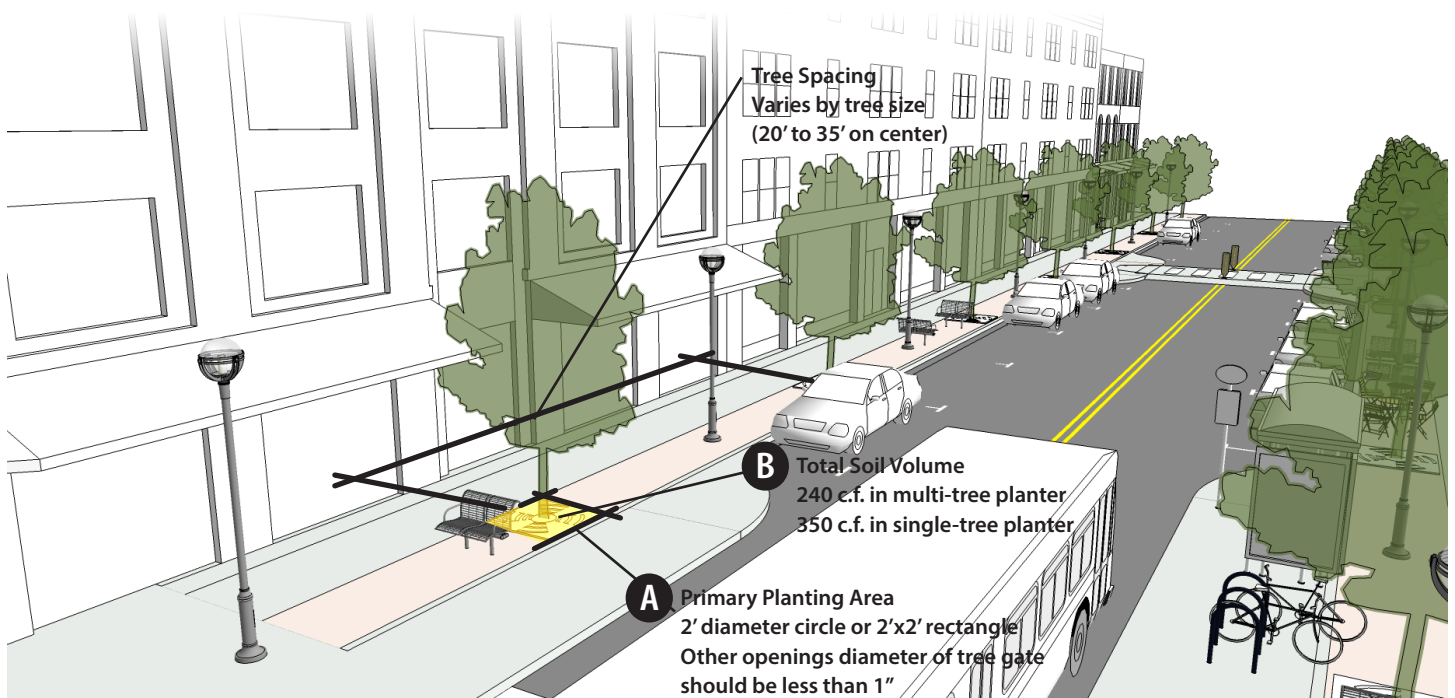


Design Requirements – Covered Tree Trenches

Covered tree trenches provide a method for growing trees in the higher intensity urban environments. Covered tree trenches combine a primary planting area of soil covered by a grate and an extended soil zone comprised of additional grate-covered planting soil and/or accessible soils below paved surfaces.

- A Primary Planting Area:** Primary planting area shall be sized as follows:
- » The primary planting area covered by the tree grate should be as large as feasible to encourage air exchange and a large growing area for the tree. Tree grates shall have a minimum surface area of 30-square feet (e.g. 4' x 8' grate). Grates narrower than 4-feet or that provide less than 30-square feet of surface area should only be considered under constrained conditions.
- **Tree Grates:** The primary planting area shall be covered by a tree grate with the following characteristics:
 - » Tree grates shall be constructed out of solid steel or cast iron and able to meet the load bearing capacity and requirements of the surrounding sidewalk area.
 - » Tree grates should provide regular holes and openings to allow for water and air to pass through.
- These holes or openings should have gaps no wider than 1/2" in order to provide a usable surface for walking and/or cafe dining.
- » Tree grates shall be able to be locked in place to prevent vandalism, but still removable in order to provide maintenance access below the tree grate.
 - » Tree grates shall provide a 18" diameter circular or 18" x 18" rectangular opening around the tree trunk to allow for tree growth. The grate system shall be able to be removed and replaced with a larger opening grate in the event the tree trunk grows too large for the opening.
 - » Tree grates shall provide openings within the tree grate to allow air and water to enter the planting soil. These other openings should not allow an object greater than 1 inch in diameter to pass through (e.g. a chair leg).
 - » The distance between the finished soil grade and the top of the tree grate may not be no more than 6 inches in height.
 - » Tree grates should be offset from the back of road curbs by at least 12"
 - » For Ann Arbor's standard Tree Grate detail, see the Standard Specifications (PSSS / "The Orange Book").

Figure 4.6.3 - Trees in Covered Tree Trenches



- **Drainage:** Provide subsurface drain lines connected to the stormwater system in areas with poorly drained surrounding soils.

B Extended Soil Zone The total soil needed volume should be achieved through a combination of the primary planting area and an extended soil zone (see Soil Volume). This volume can be achieved by extended the grated surface area with additional tree grate panels, using a geo-engineering system, or providing access to surrounding soil areas.

- » **Grated Surface:** Use additional grated area with normal planting soil. Grates must meet the same requirements as those listed above for the primary planting area – with the exception of the opening for the tree trunk.

OR

- » **Geo-Engineering:** Use structural soils and/or other geo-engineering solutions (e.g. Silva Cells) to provide a load bearing sub-grade suitable for root growth and supporting the surface pavings. Consider using porous surface pavement material such as porous concrete or pavers (see sidewalks) for areas above structural soils. Geo-Engineering is optional.
- » Use of structured soils or other geo-engineering solutions is a non-standard treatment and requires special permission of the City of Ann Arbor Urban Forestry and Natural Resources Coordinator and Engineering Unit.

Design Requirements – Tree Installation

- Where street trees are placed within landscape planters with curbs or seat-walls, the undisturbed ground may be concrete or other hard surfaces forming the planting pit area.
- Planted street trees must be approved with a two-year warranty period and maintenance contract providing tree care (watering, etc.) for the first two years following installation.
- At least 20-gallons of water should be provided to each tree immediately following planting. Regular watering shall be maintained over the two-year maintenance period to ensure that the tree is successfully established.

Additional Design Considerations

- Hybrid designs containing part open landscape planters and part covered tree trenches may be utilized with approval of the City’s Urban Forestry & Natural Resources Coordinator.
- The sides of landscape planters and covered tree trenches should be open to existing sub-grade wherever possible to provide for additional root zone space. Expanded use of structural soils or other treatments around tree plantings is highly desirable.
- Provide water connection spigots in close proximity to tree planting areas.

Utility Considerations

- Do not plant trees directly on top of major utilities, utility leads, vaults, access panels, or other utility infrastructure that are within the soil growth zone.

Sustainability Considerations

- Explore opportunities for using structural soils below existing paved Sidewalk and Amenity Zone areas when they can be connected to the growing zone of tree roots.
- Use permeable pavements to encourage infiltration of stormwater into the root zone around trees.

Design References

- City of Ann Arbor Standard Specifications (PSSS / “The Orange Book”)
- City of Ann Arbor Urban & Community Forest Management Plan.
- Boston Complete Streets.
- City of New York Department of Parks and Recreation Street Tree Planting Standards (2014).

MAINTENANCE & MANAGEMENT

General Maintenance

- For the first two years following tree installation, trees must be maintained as required by a tree maintenance agreement.
 - » Trees must be watered throughout the growing season (May 15th to October 31st) at two-week intervals. Each watering must provide at least 20-gallons of water for each tree. Watering frequency may be adjusted based on drought or excessive rainfall conditions.
 - » Weeding, trash removal, and mulching must be maintained to keep the tree area free from weeds, trash, and other debris.
- After the first two years following tree installation, the City oversees tree maintenance responsibilities. The City and DDA are collaborating to create programs to engage citizens and businesses in tree care, including volunteer and business outreach programs. These maintenance activities include:
 - » Tree pruning and disease/pest management. Tree pruning in Destination Commercial and Commercial areas for storefront and signage visibility is important.
 - » Regular watering, especially during drought conditions

- » Mulching around the tree
- » Weed and litter removal

- Use of Gator Bags for tree watering should refer to Ann Arbor Urban Forestry & Natural Resources staff for current practices.

Seasonal Use & Maintenance

- **Snow Removal:** Snow should be cleared from landscape planters and grated tree areas as soon as possible to minimize salt and other pollutant loading from entering exposed soil areas. Snow should not be stored on top of landscape planters and grated tree areas.

Reviews & Approvals

- Public street trees are reviewed by the Ann Arbor Urban Forestry & Natural Resources Planning Coordinator.
- Private projects planting new public street trees must have their plans and planting details reviewed and approved by the Ann Arbor Urban Forestry & Natural Resources Planning Coordinator.



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LANDSCAPE PLANTERS

DESCRIPTION & INTENT

Landscape planters are curbed or raised soil areas designed to accommodate decorative plantings in a clean and clearly maintained fashion within the streetscape. Landscape planters soften the urban environment and provide foliage and flowers to make the street environment more appealing and engaging for all types of users.

Landscape planters typically contain a variety of suitable and tolerant perennial plant species and may be used to accommodate street tree plantings. Annual plants can be suitable for landscape planters provided that arrangements for their maintenance and replacement have been made.

Landscape planters are either curbed or raised in order to deter pedestrian traffic from moving through the landscaped area and harming or impacting plant materials. Curbing landscape planters provides a strong edge for the planter, improves soil and mulch containment, and discourages pedestrians from cutting through the planting beds. Raised planter designs provide an opportunity to incorporate informal seating areas into the streetscape design.

The use and abundance of landscape planters within the Amenity Zone must be carefully considered alongside other competing uses.

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis		!!	!!			
Pedestrian		!!	!!			
Transit			!!	!!	!!	
Bicycle			!!	!!		!!
Balanced			!!	!!	!!	!!

USE & APPLICATION

Location

- Landscape planters are well suited to the downtown environment and are recommended on all types streets. Near neighborhood streets often utilize lawn extensions as an alternative to landscape planters, as they may better fit a residential character.
- Landscape planters occur primarily within the Amenity Zone between the sidewalk and the curb.
- Where buildings are setback from the sidewalk, landscape planters are also appropriate in the Frontage Zone, and can be incorporated into building facades.

Related Design Elements

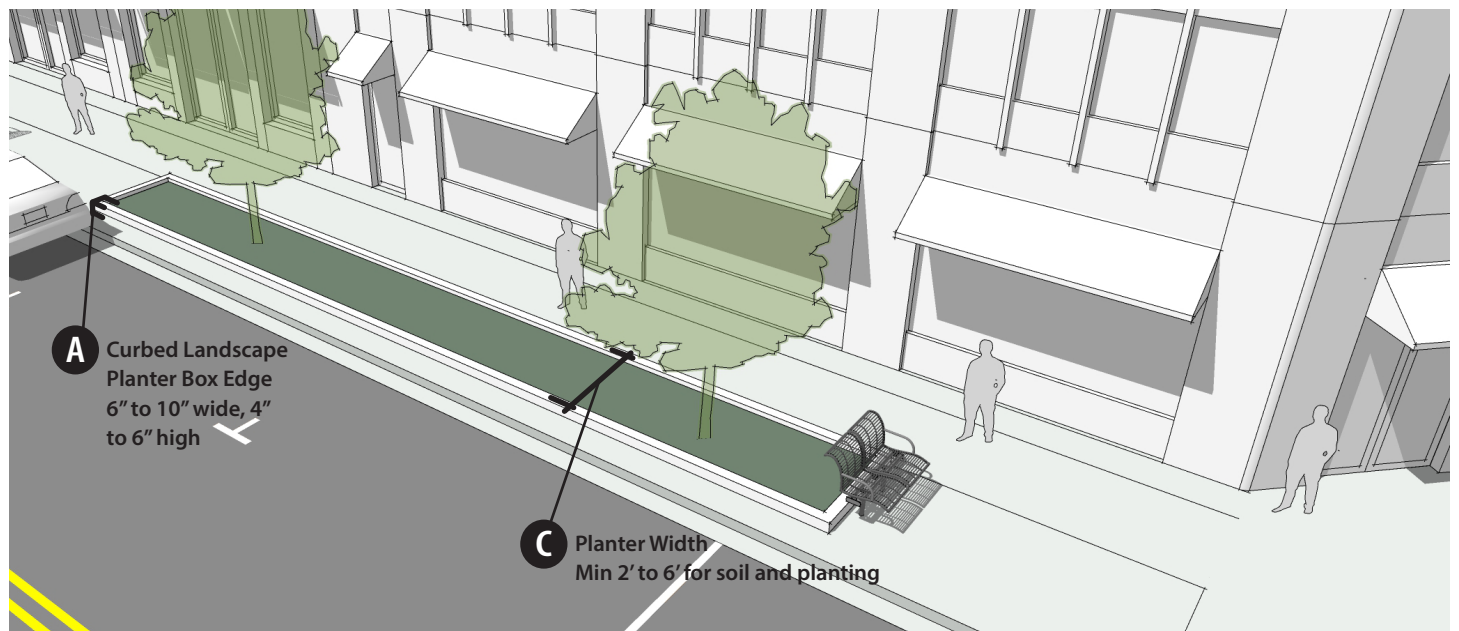
- **Amenity Zone Uses:** Locate landscape planters in coordination with street lighting, signs, parking meters, and other elements within the Amenity Zone that may need to be present. In destination commercial areas, café dining, outdoor retailing, and other uses in the Amenity Zone competes for space with landscape planters. Street design in these areas should accommodate both elements by utilizing planters that support commercial activity, such as raised seatwall planters.
- **Public Seating:** Incorporate landscape planters within seat-walls. Seat-walls are especially beneficial at intersections and when used in conjunction with bulb outs at the corner or in a mid-block location to provide a seating zone close to intersections.

DESIGN & OPERATIONS

Design Requirements

- **Planter Type:** Design landscape planters as either a curbed planting bed, a raised planter, or a hybrid design.
 - A Curbed Landscape Planters:** For a curbed planting bed, edge the planter box with a 6 inch to 10 inch wide and 4 inch to 6 inch high concrete curb with chamfered edges following the grade of the Sidewalk and Amenity Zone.
 - B Raised Landscape Planters:** For a raised planter, surround the planter box by a 12 inch to 16 inch wide and 15 inch to 22 inch (18 inches preferred) tall concrete seat-wall with chamfered edges. Design seat-walls to provide a level surface for seating.
 - » **Hybrid Landscape Planters:** Design hybrid planters as a curbed planter except with one, two, or three sides of the landscape planter designed with seat-walls.
- C Width:** The width of landscape planters must provide at least a 2-foot 6 inch wide zone for soil and plantings, not accounting for the width of curbing or seat-walls.
 - » Street trees require a minimum soil area width of 4 feet. Refer to the Street Tree design element for additional information.
- D Curb Strip:** Provide a minimum 18" wide offset from the back of the existing street curb to the face of a landscape planter to provide adequate clearance from the roadway. This paved zone provides a place for people to walk around the planter to access on-street parking and/or provide clearance for vehicles to pull against the curb.
 - » Where space is limited, the surface of the planter and associated curbs may be tapered down to a flush level to match the existing road curb height.
- **Planting Mulch:** Provide a minimum a 1 inch thick mulch surface for all exposed planting soils.
 - » Keep mulch surfaces for planting between 2 inches and 6 inches below the edge of and curbs or seat-walls to prevent mulches from spilling outside of the landscape planter.
- **Plantings:** Planters use a combination of herbaceous plants and street trees.
 - » Select perennial species suited to specific site conditions, including sun/shade, water availability, and salt tolerance for plantings within landscape planters.
 - » Suitable herbaceous annuals may be planted by private entities but only with a maintenance agreement and approval of the Urban Forestry and Natural Resources Coordinator.

Figure 4.6.4- Landscape Planter



- » Street Trees are required on all streets and can be incorporated into landscape planters. Refer to the Street Tree design element for more information.

Additional Design Considerations

- **Seat-walls:** Raised landscape planters with seat-walls, if space is available, should be setback at least 1' from the through sidewalk areas so that people sitting on the seat-wall minimize impacts to the flow of pedestrian traffic.
- **Special Character Districts:** In historic or other character districts, the concert curb or seat-wall design may use other materials appropriate to that character areas. In all cases, use materials that are ridged, mortared together, and set in a concrete base to create a solid curb or seat-wall unit.
- **Street Trees:** Consider locating street trees in landscape planters. See *Street Tree Design Element Section for Additional Detail*.

Utility Considerations

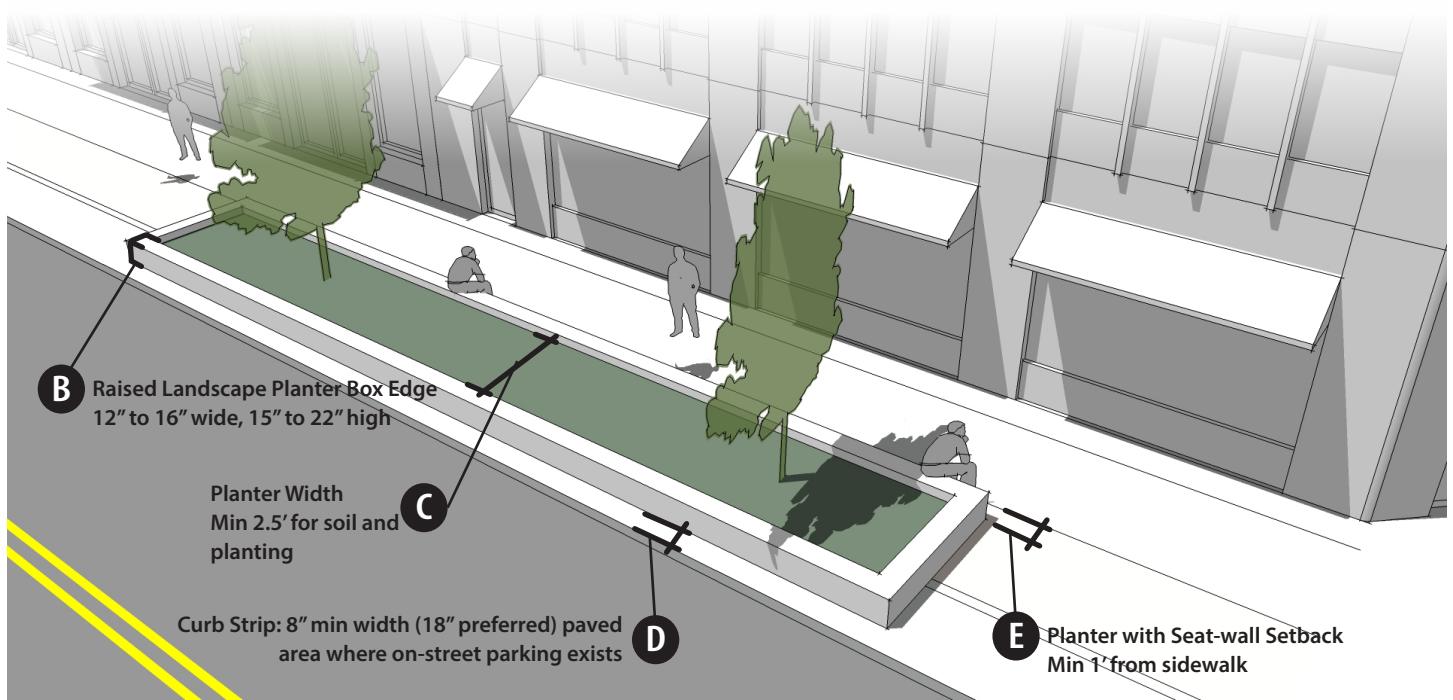
- Landscape planters should not be located in areas where utility access panels, vaults, or other regular utility maintenance and access occurs.

- Street lights may be set within curbed landscape planters when the width of the landscape planter is at least three times the needed width of the street light base and footing to still provide sufficient soil volume and planter width.

Sustainability Considerations

- Consider drought tolerant plant materials that do not require extensive watering outside of their establishment period (typically two years).
- Design landscape planters into stormwater infiltration planters. Lower the soil surface elevation to below the sidewalk and/or street grade and provide a break in the curb or seat-wall with an inlet structure to divert stormwater into the planter. Design the planter to handle anticipated rainfall and water quantity volumes. See *Stormwater Management Design Element Section for Additional Guidance*.

Figure 4.6.5- Raised Landscape Planter



MAINTENANCE & MANAGEMENT

General Maintenance

- **Plant Care:** Plant materials shall be maintained in accordance with a maintenance agreement established as part of the planter design and construction process. As with lawn extensions, plantings in adjacent landscape planters (except for street trees) should be maintained and cared for by the adjacent property owner.
 - » Maintaining at least a 1 inch mulch cover over the landscape planter.
 - » Weeding, removing litter, and maintaining plants (deadheading, cutting, et.)
 - » Clearing, sweeping, and removing mulch and other materials that spill outside of the landscape planter.
 - » Regular watering, especially during dry periods.
- **Establishment Period:** Following new landscape planter construction, water new plant materials regularly during the growing season for the first two-years during plant establishment.

Reviews & Approvals

- For private projects, the Ann Arbor Urban Forestry & Natural Resources Planning Coordinator is responsible for reviewing and approving plant materials used in landscape planters.
- For public projects, the Ann Arbor Urban Forestry & Natural Resources Planning Coordinator and the Street Design Team are responsible for reviewing and approving landscape planter designs and plant materials.



LAWN EXTENSIONS

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✗	✗			
Transit			✗	✗	✗	
Bicycle			✗	✗		✓
Balanced			✗	✗	✗	✓

DESCRIPTION & INTENT

Lawn extensions are panels of grass lawn in the Amenity Zone between the sidewalk and street curb. Lawn extensions are characteristic of detached housing residential areas where pedestrian volumes are general low and a desire for more greenery to soften the street edge experience exist. Lawn extensions are not generally suited to highly urban environments, such as Ann Arbor’s downtown, since heavy pedestrian traffic can quickly wear down and erode lawn surfaces. In addition, lawn extensions require regular maintenance (watering, mowing, weed control) that is more suited for private residential landowners to maintain. Nevertheless, in many downtown locations lawn extensions are a viable street design element.

USE & APPLICATION

Location

- Lawn extensions are restricted in all areas of downtown outside of a Near Neighborhood Frontage Context areas.
- In Near Neighborhood locations, lawn extensions shall only be used in situations where the fronting property owners or occupants acknowledge responsibility for proper care and maintenance.
- In addition, lawn extensions should be a minimum of 3 feet wide in order to provide sufficient room for lawn to establish. Narrower lawn extensions are more susceptible to erosion and wear and should use a hard surface treatment instead (i.e. concrete or pavers).
- Lawn extensions should occur along the majority of the block side where they are being used to provide a cleaner and more consistent look for that portion of the street.

DESIGN & OPERATIONS

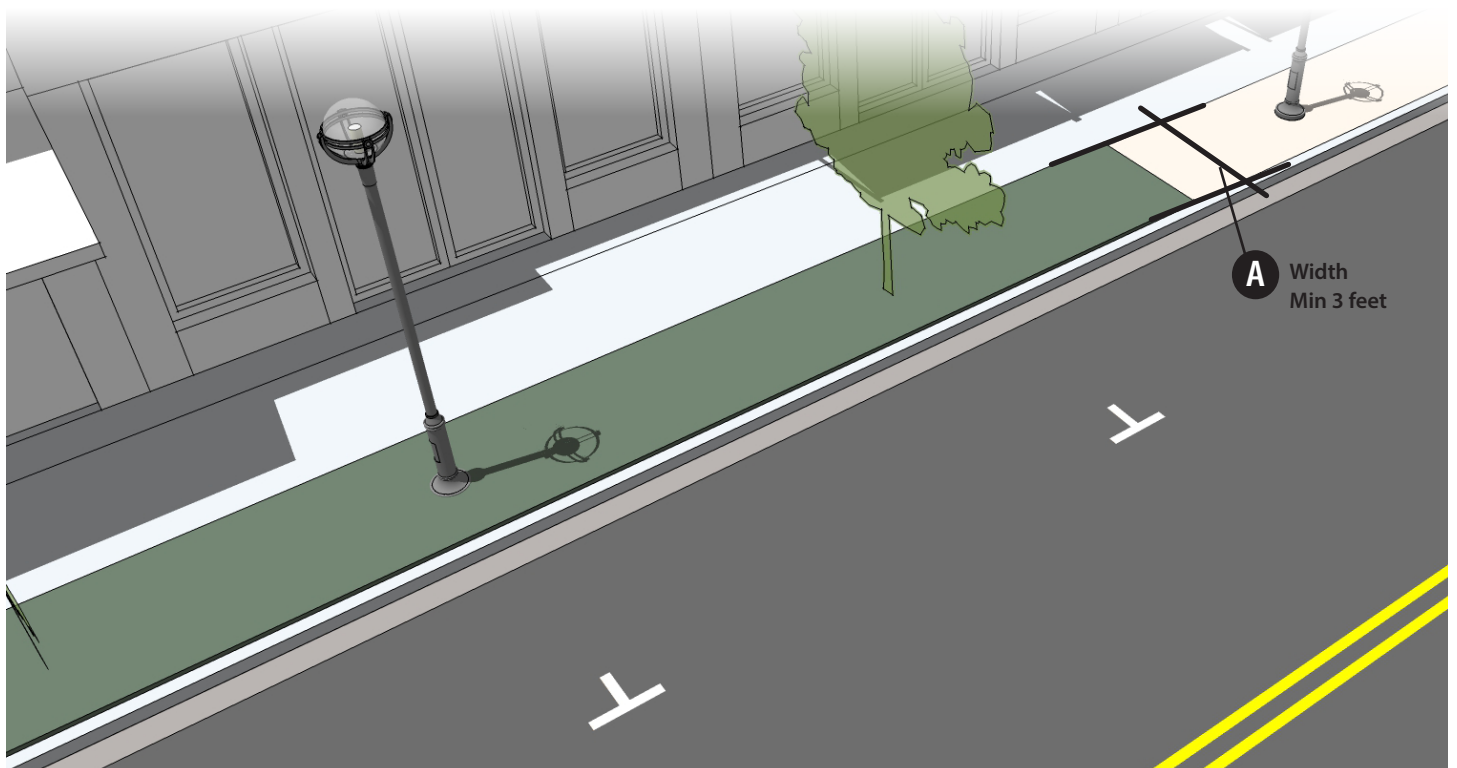
Design Requirements

- A Width:** Lawn extensions shall be a minimum width of 3 feet between the back of the street curb and edge of the sidewalk.
- Lawn Seeding:** Lawn areas shall be seeded or sodded with a species mix suitable for Ann Arbor’s climate region and consistent with the sun/shade availability of the specific planting site.
 - » When installing lawn extensions with seeding, a straw cover shall be used to minimize soil runoff and pedestrian traffic.
- Soil:** Lawn areas shall contain at least 4 inches of topsoil and the topsoil or soil surface for sod applications must be flush to the edge of the sidewalk and back of curb. Lawn extensions shall be smooth and not result in water pooling or ponding on their surface or on the surface of adjacent sidewalk areas.

Additional Design Considerations

- Plantings:** Lawn extensions may be planted with perennials beds or ground covers in addition to or complimenting lawn areas. These plantings shall not be in excess of 36 inches above the adjacent road surface, or as permitted by Ann Arbor City Code. Shrubs or other low woody plants may not be used.
 - » Where perennials and ground covers are used, periodic clear zones or pathways connecting from the street edge to the sidewalk are important where on-street parking occurs to minimize foot traffic impacts on ornamental plantings. Gaps should be provided at least every 40 feet.
 - » Where perennials and ground covers are used, at least 1 inch of mulch should be applied to cover and protect exposed soil areas. Stone, cobble, pea gravels, and other hard mulches should not be used as mulching materials.
- Street Trees:** Larger lawn extensions are ideal locations for planting street trees. Street trees are required on all streets. *See Street Tree Design Element for more Information on Street Tree Plantings.*

Figure 4.6.6- Lawn Extensions



Utility Considerations

- Lawn extensions may be located on top of most utilities. Identify and avoid placing soil and lawn planting on top of water valves or other utility access panels that may be found in the utility zone.

Sustainability Considerations

- Pursue use of “no mow” plant species as an alternative to traditional lawn turf species can be pursued. Such alternatives should be selected based on their ability to withstand foot traffic when used as a lawn substitute.
- Use xeriscaping and other low water need plants to conserve water compared to typical lawn plantings.
- Avoid the use of synthetic fertilizers and herbicides to avoid impact on water quality and pollutant exposure to people touching lawn areas. City Code prohibits the use of phosphorous fertilizers.

MAINTENANCE & MANAGEMENT

General Maintenance

- **Plant Care:** Lawn extensions and any plantings within that zone must be maintained by the fronting property owners. Regular maintenance includes mowing to maintain lawn areas , watering, weeding, and maintaining mulch.
 - » Lawn extensions covered in turf grass must be maintained with an average height not in excess of 12 inches.
- **Street Trees:** Street trees are maintained by Public Works.

Reviews & Approvals

- Installation of lawn extensions in areas that were not previously lawn extensions is discouraged unless part of a comprehensive street reconstruction or design process. Outside of this context, lawn extensions for public and private projects can only be created with approval of the DDA, Street Design Team, and the Ann Arbor Urban Forestry & Natural Resources Planning Coordinator.







STORMWATER MANAGEMENT

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	✓	✓			
Transit			✓	✓	✓	
Bicycle			✓	✓		✓
Balanced			✓	✓	✓	✓

DESCRIPTION & INTENT

Managing stormwater in the urban environment is critical for protecting water quality and reducing the volume of stormwater entering rivers and other water bodies. In Ann Arbor, managing stormwater within the right-of-way is guided by the City’s Municipal Separate Storm Sewer System (MS4) Permit and the City’s Green Streets Policy (“Stormwater Management Guidelines for Public Street Construction and Reconstruction”).

Stormwater management techniques, often referred to as Green Infrastructure, include many different types of facilities designed to infiltrate, store, and filter runoff. Within the downtown environment, a variety of stormwater management techniques may be applied in order to achieve the management targets identified in the Green Streets Policy. Typically, these techniques will include infiltration planters and underground infiltration and/or storage systems.

USE & APPLICATION

Location

- All public street construction and re-construction projects are subject to the Green Streets Policy, with maintenance and street resurfacing projects exempt from the Green Streets Policy. Regardless, any projects which impact a significant portion of the street environment should still consider stormwater management improvements.

- The Green Street Policy establishes specific infiltration management goals:

Site Conditions	Infiltration Standard management goal)
<ul style="list-style-type: none"> Within the floodplain, or Slopes > 20%, or Soil infiltration < 0.6in/hr 	First 1 inch
<ul style="list-style-type: none"> Not in the floodplain, and Slopes < 20%, and Soil infiltration rate between 0.6in/hr and 2.0 in/hr 	50% annual change, 24 hour event (2.35 inches)
<ul style="list-style-type: none"> Not in the floodplain, and Slopes < 20%, and Soil infiltration rate >2.0in/hr 	10% annual chance, 24 hour event (3.26 inches)

- Stormwater management facilities in the right-of-way can use a variety of Stormwater Best Management Practices (BMP) to reach the management goals. The Southeast Michigan Council of Governments (SEMCOG) “Low Impact Development Manual for Michigan” identifies a number of structural BMPs to consider within urban environments.

Stormwater BMP	Typical Location	Example
Infiltration Planters	Amenity Zone, Curbside Zone	Bioswales, rain gardens, bioretention
Subsurface Infiltration	Underground: Amenity/ Curbside Zones, Roadway Zone	Infiltration or storage vaults, infiltration trenches

- Multiple stormwater BMPs can be used in an integrated system to accomplish the management goals. Any proposed BMP must be approved by the City to ensure sustained maintenance.

- Private development projects that impact the street right-of-way or require reconstruction of portions of the public right-of-way are subject the Green Streets Policy for those right-of-way areas at the discretion of the Ann Arbor Water Quality Manager.
- Coordinating private development projects and public street projects should be explored to provide as much stormwater management as possible. Managing additional stormwater runoff from private property, such as buildings or parking lots, with BMPs located within the public right-of-way may be allowed provided that the minimum management targets for private and public land areas are both met appropriately.

DESIGN & OPERATIONS

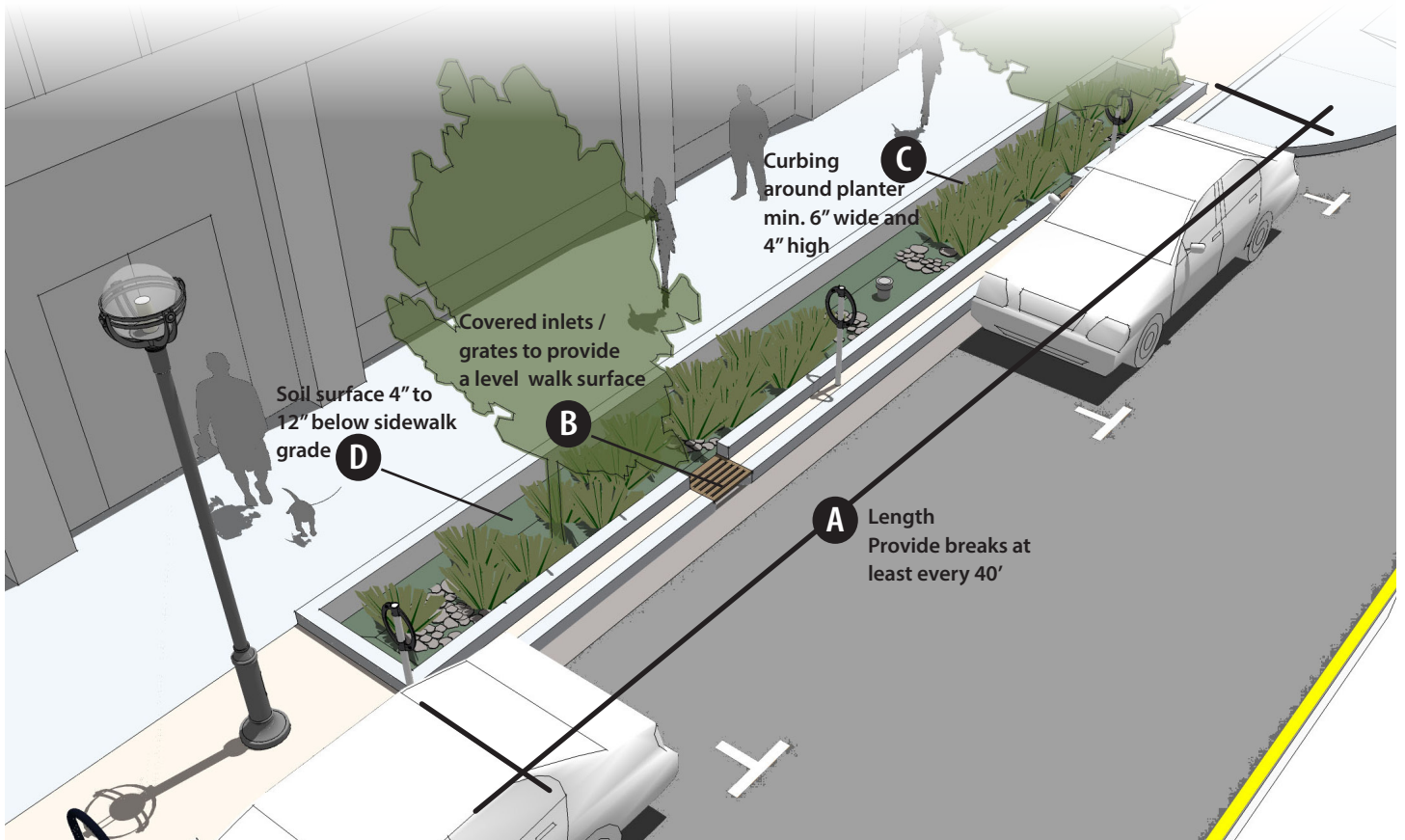
Design Requirements – Infiltration Planters

Infiltration planters are open landscaped areas typically in the Amenity Zone of the street. They may also be located in other zones depending on the overall design of the street. Infiltration planters are designed to capture runoff from the roadway and other impervious areas of the street. Captured water is filtered through plants and soil and infiltrated completely through the planter or into an overflow under-drain and can be treated in a secondary stormwater system.

- **Management Volume:** Infiltration Planters shall be designed, in conjunction with other stormwater systems to infiltrate the required stormwater quantities per the Green Streets Policy.

- **A Length:** Stormwater planters may line the entire street length, however where on-street parking is provided, breaks shall be provided at least every 40 feet (approximately two car lengths) to allow access from parked cars to the sidewalk.

Figure 4.6.7- Stormwater Management



B Inlets: When water runoff is captured from the street, it must be brought into the infiltration planter through a covered flow inlet structure that does not break the top surface of the curb or walkable pavement surfaces.

C Curbing: Infiltration planters must be curbed with a minimum of 6 inches wide and 4 inches high curb when adjacent to Sidewalk and Amenity Zone areas. When adjacent to the road curb, this additional curbing is not required along that side of the infiltration planter.

D Soil Surface: The finished soil height must be recessed at least 4 inches but not more than 12 inches below the grade of the surrounding Sidewalk and Amenity Zone areas.

- **Soil Mix:** Soil mix must be specified to infiltrate stormwater and have sufficient depth to store and infiltrate the targeted water volume.
- **Drainage:** Infiltration planters must include a positive overflow drain to divert water accumulation in excess of the infiltration rate of the planter to another treatment system such that areas adjacent to the landscape planter do not get flooded or eroded.
 - » For infiltration planters unable to drain collected water within 12 hours of the end of rain event, under-drains must be provided to drain excess water into the storm sewers.
- **Plant Materials:** Plant materials must be tolerant of salt and other common runoff pollutants.

Design Requirements – Subsurface Infiltration

Subsurface infiltration can take a number of forms, including underground infiltration vaults, infiltration trenches, and dry wells. These systems can be used to provide stormwater infiltration and constrained urban areas with limited surface area available for landscape planters and/or in conjunction with surface treatments to add additional storage and infiltration capacity.

- **Management Volume:** Subsurface infiltration systems must be designed, in conjunction with other stormwater systems to infiltrate the required stormwater quantities per the Green Streets Policy.
- **Load Bearing:** Subsurface infiltration system must be designed to accommodate the load bearing requirements of the roadway or other accessible surfaces above the infiltration system.
- **Conveyance:** Water shall be conveyed to the subsurface infiltration systems through piping and conventional

curb and gutters and/or through a grated inlet channel system.

- **Pre-treatment:** Water being conveyed into a subsurface infiltration system shall be pre-treated through a sump, stormwater flow-through planter, or comparable facility to remove large debris and materials.

Design Requirements – Porous Pavers

Porous pavers may be utilized within the amenity zone and/or the curbside lane of the roadway as part of the overall stormwater management system. Porous pavers provide opportunities for infiltration and filtration before water enters the stormwater management system.

- **Load Bearing:** Porous pavers and the constructed base materials shall meet the load bearing specifications consistent with the areas where they are to be applied (i.e. vehicle loads within the curbside lane and pedestrian / light vehicle loads in the amenity zone).
- **Base material** should facilitate infiltration. Under drainage should be provided to supplement storage and conveyance of stormwater.
- **Proximity to Basements / Vaults:** Porous pavements installations must be mindful of the proximity to building basements and/or underground building vaults. Infiltration in close proximity to basements and vaults can cause seepage.
- **Maintenance needs** of porous paver installations should be reviewed and approved by the DDA and Public Works.

Additional Design Considerations

- Locate pre-treatment material, such as cobble and stone, to capture debris just inside the inlet point and provide easily access to clean out.
- Incorporate appropriate trees into the infiltration planter to enhance the stormwater benefits. Trees must be approved by the Ann Arbor Water Quality Manager.
- Incorporate stormwater planters with traditional landscape planters, and integrate seat-walls and other vegetation into the design.
- Consider locating special signage along the street at key locations to tell people there is an underground stormwater management facility present and educate them about their operation and benefits.

Utility Considerations

- Consider the location and condition of existing utility infrastructure and access points.
- Ensure overflows into existing stormwater pipe infrastructure do not result in additional flooding or bottlenecking.
- Install water proof vault covers or other utility access points if located within an infiltration planter.

Design References

- SEMCOG Low Impact Development Manual for Michigan (2008)
 - » See: Planter Boxes, Native Vegetation, Constructed Filters, and Bioretention sections for more specific design guidance.
 - » See: Infiltration Practices, Constructed Filters

MAINTENANCE & MANAGEMENT

General Maintenance

- Regularly (quarterly, at a minimum) remove excess sediment, litter, and debris, particularly within any pre-treatment facilities, to maintain a clean appearance and preserve effective functioning.
- Quarterly Inspection of inlets, sumps and outlet points to ensure there are no blockages or impediments to designed water flows (including sediment buildup and excess debris).
- Sumps or pre-treatment areas should be cleaned out at least once per year unless excess debris and sediment build up occurs requiring more frequent service.
- Regular landscape maintenance, such as deadheading, weeding, and leaf removal is important to maintaining the health and attractiveness of infiltration planters.

Seasonal Use & Maintenance

- **Winter Conditions:** Inspect inlet and outlet points more frequently in winter to ensure they are clear of excess snow and ice and remain open, particularly positive overflow drains.

Reviews & Approvals

- Ann Arbor Water Quality Manager.
- Site Plan Review for private projects.
- Ann Arbor Engineering Unit.



SITE UTILITIES

	Frontage Context	Des. Comm.	Comm.	Mixed	Civic & Uni.	Near NBH
Functional Emphasis	Pedestrian	■	■			
	Transit		■	■	■	
	Bicycle		■	■		■
	Balanced		■	■	■	■

DESCRIPTION & INTENT

The public right-of-way is home to the utilities that serve the buildings and uses of downtown, and their presence is typically unremarkable to the average downtown visitor. The location and design of public utilities in the streets of downtown is regulated through the City of Ann Arbor Public Services Standard Specifications. The intent of this section is to supplement the Orange Book standards and provide guidance for locating private and public utility services, particularly as they relate to the pedestrian environment.

USE & APPLICATION

Location

Almost all public streets projects impact utilities mains and services in some way. A few examples include:

- Sidewalk reconstruction and streetscape improvements which impact utility service lines, hand holes and valves, and catch basin inlets.
- Utility main replacement and subsequent service line adjustments.
- Utility repairs to mains and service lines.
- Street resurfacing, which may impact manholes and catch basin inlets.

Private Development

Private development projects that impact the street right-of-way or require reconstruction of portions of the public right-of-way will typically impact public and private utilities in the following ways:

- Installation of new water and sanitary service leads from existing mains.
- Connection to the stormwater system.
- Replacement or upsizing utility mains to provide for the new development's needs. When replacement or upsizing is required to address new use patterns, mains must be replaced or upsized across the full property frontage.
- Streetscape reconstruction, which may include new lighting.
- Electrical and communication service connections.

DESIGN & OPERATIONS

Design Requirements – Manhole, Valves, and Hand Holes

Access to utility service junctions through manholes, hand holes and water service valves are critical to the maintenance, emergency management, and safety of the utility systems. The cover of these access points are typically flush with adjacent pavement.

- Hand holes are used for electrical and communications cable junctions and have specific design requirements. Constructed hand holes should be polymer concrete rated for light duty traffic.
- Size hand holes to be as small as necessary for the number of wires passing through and junctions being made.
- Locate hand holes as follows:
 - » Conduits should be located at least 12 inches from the planting soils of the beds and trees. Where handholes and lights are located in landscape planters, care should be taken to limit the area of the planter impacted, and in any case conduits should not be located within 48 inches from the center of any proposed tree.
 - » In streets with tree grates or walk openings for trees, the conduit should be located 12 inches beyond the limits of the urban street tree soil treatment or the edge of the tree grate or sidewalk opening.
 - » Avoid placing hand holes on barrier-free ramps or at grade breaks in the sidewalks, as the long rectangular shape of most hand holes makes it difficult to pour the concrete in these situations without grade issues.
 - » Place the top of the conduits at least 30 inches below the proposed sidewalk grade, 72 inches below the grade of the tree planting area, or as directed by the City and DDA.
- Where electrical junctions occur in vehicular traffic areas use precast concrete structures and cast iron frames and lids designed to carry heavy traffic loads, in lieu of hand holes.

- Locate manholes and water main valves within vehicular travel lanes, where new main construction allows.

Design Requirements – Storm Inlets

The placement of stormwater inlets/catch basins at crosswalks and intersections is important for efficient storm drainage as well as providing an accessible street environment. Of particular concern is ensuring universal access, avoiding the puddling of water at the base of curb ramps and on sidewalks during the snow season, and providing for maintenance of the drains, inlets, and catch basins.

- Place Inlets/catch basins at the point of curvature (spring point) of each intersection, thus requiring two inlets/catch basins for each corner.
- Adjust the location of inlets/catch basins so that they are:
 - » Not within the travel lane of curb ramps.
 - » Placed on the higher elevation side and directly adjacent to curb ramps so that ice and snow are less likely to block drainage to the inlets and to catch water before crossing a curb ramp.
- Locate inlets/catch basins directly adjacent to mid-block crossing curb ramps on the higher elevation side of the curb line from the curb ramp.
- If inlets/catch basins must be placed in the travel lane of curb ramps, design the cast grate of the structure to accommodate universal access.
- **Trench Drains:** The use of trench drains is highly discouraged and they should not be used unless there is no adequate storm drainage alternative. While the use of trench drains and sidewalk inlets should be avoided, where they are deemed necessary they should meet the following design requirements:
 - » The accessible body of all trench drains and sidewalk drains must be a minimum of 8 inches wide for maintenance purposes.
 - » Trench drains and sidewalk drains must be rated for light duty traffic. Non-metal drain grates are not allowed.
 - » The grate of the structures must accommodate universal access.

- » Lateral pipes draining the trench drains and sidewalk inlets must be a minimum of 8 inches in diameter, and be no longer than 40 feet before tapping into a City standard inlet/catch basin or manhole.

Design Requirements – Fire Hydrants

Providing for fire safety is critical to protecting historic architectural resources and providing for new development and growth. Providing adequate number and spacing of fire hydrants is an important element in ensuring for adequate fire protection. Given that the typical block length on downtown Ann Arbor is less than 300-foot long, hydrant spacing standards are generally met with hydrants located at each intersection; however, downtown corners are often crowded with lights, pedestrian amenities, cross walks, bicycle parking and other elements, which may impede access to the hydrants.

- The City of Ann Arbor Public Services Standard Specifications requires a clear 20-foot access path to each hydrant and no parking within 15 feet of a hydrant when locating behind the curbside lane. The center line of hydrants must be a least 4, but not more than 10, feet back from the curb.
- Each fire hydrant shall have a 3-foot clear zone around it for access. Fire hydrants may not be hidden or covered.
- The typical pattern found in downtown is for two hydrants per intersection, located on opposite corners across the diagonal of the intersection.
- Hydrants located closer to the short end of the range allowed from the curb will allow more flexibility in the design and use of the intersection, and will typically place the hydrants outside of the Sidewalk Zone, and in the Amenity Zone.
- Ann Arbor’s Orange Book requires a hydrant within 100 feet of a Fire Department Connection to a commercial building’s fire suppression system.

Design Requirements – Above Ground Utility Appurtenances

New building construction and electrical and communications services often require above grade utility boxes, panels and transformers.

While these appurtenances provide for important private utility service, they can hamper the pedestrian use of downtown streets and sidewalks.

- Where such appurtenances are required for a specific private development, they should be located on private property.
- If appurtenances are serving public amenities and/or multiple properties and private buildings, they should still be located on private land, alleys, or parking lots. If this is not technically feasible, as determined by the Ann Arbor Planning and Development staff during the site plan review process, they should be located in the Amenity Zone and out of the primary pedestrian flow.
- Co-locate surface mounted utilities and share boxes or pedestals wherever possible.

Additional Design Considerations

- City of Ann Arbor Public Services Standard Specifications
- City of Ann Arbor Approved Materials List for Utilities and Roadways.
- City of Ann Arbor Code of Ordinances Chapter 47-Streets and Chapter 49-Sidewalks.

Sustainability Considerations

- Coordination of utility main upgrade and the need for street or streetscape reconstruction is itself a technique of sustainability as it minimizes the use (and expenditure for) construction materials and the energy and resources used to install them.
- The City of Ann Arbor currently coordinates the need for utility upgrades with street and streetscape improvements through the Capital Improvement Process and collaboration with the DDA, and this approach should be continued and streamlined as needed.

MAINTENANCE & MANAGEMENT

General Maintenance

- Complete inspection of the condition of hand hole and valve covers annually, particularly after the winter snow removal season, to assess any damage or impact to the walkability of the sidewalk surfaces.

Reviews & Approvals

- Michigan Department of Environmental Quality (MDEQ)
- Site Plan Review for private projects
- Ann Arbor Engineering Unit