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COMPLETE STREETS: THE NEXT GENERATION

Andrew Crozier, AICP, Angela Biagi, Lisa Nisenson, and Roxann Read, AICP

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ABOUT THE AUTHORS

Andrew Crozier, AICP, has over 10 years of experience in planning and urban design, spanning the municipal, federal, and private sectors. As a senior urban designer with WGI, he has worked on mobility initiatives, complete streets, placemaking, comprehensive planning, and urban design projects nationwide.

Angela Biagi, PLA, LEED BD+C, is the director of planning at WGI and leads the firm's strong focus on design excellence and complete streets. With 25 years of experience in landscape architecture and planning, she brings a design-forward approach to shaping streets, corridors, and public spaces that prioritize safety, mobility, and placemaking.

Lisa Nisenon has 25 years of experience in innovating land use and mobility planning at the national, regional, and local levels. A pioneer in new mobility and an industry leader in future-forward urban and transportation planning, at WGI she leads development of next-generation planning, smart city technology strategies, emerging mobility, autonomous vehicles in transit, and integrated placemaking.

Roxann Read, AICP, has 15 years of experience in the planning field, having worked for local governments in Florida and Missouri in both long-range and current planning. She currently serves as chair of the Orlando Metro Section within the Florida Chapter of the American Planning Association and was awarded the Distinguished Contribution to the Chapter award in 2020 and 2022.

ON THE COVER

Artist's interpretation of the next generation of complete streets, where people, mobility, and technology safely coexist (WGI, Inc.)

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EXECUTIVE SUMMARY

Since cars began rolling off assembly lines in the early 20th century, street design has been based largely on one mode: the automobile. The complete streets movement—an approach to planning, designing, building, operating, and maintaining streets that enables safe access for all people who need to use them, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities—emerged to challenge this approach. It has steadily spread across the United States, with the number of complete streets policies growing from less than 60 in 2010 to more than 1700 today.

The practice and evolution of complete streets over the past two decades offer opportunities to update details and incorporate new trends, formulate lessons learned, and undertake course correction. As the number and extent of complete streets programs have grown, so too has the base of research and case studies. This information is valuable not only for evaluating individual projects, but also in continuing to make the case for complete streets.

This PAS Report is a planner's guide to incorporating new recommended practices, lessons learned, and evolving trends into complete streets efforts. Whether readers are just learning about complete streets or managing long-term complete streets programs in their communities, this report will help them better understand how to design and develop transportation infrastructure that accommodates the needs of all road users while achieving a wide range of broader community goals.

The purpose of this report is to present the most up-to-date information on complete streets. It seeks to accelerate the adoption of infrastructure design and operations that support community goals related to mobility, access, equity, the environment, economic vitality, and physical and mental well-being. The report offers guidance to help planners create more inclusive, multimodal, and sustainable transportation networks. It explores how complete streets can continue to meet the changing needs of communities, promote resilience, prioritize safety, and create accessible and vibrant urban environments. Research, resources, and citations are provided throughout the report to provide readers with information and examples from communities across the

country and beyond to inform local programs and projects. Appendices provide additional resources for readers.

KEY ELEMENTS OF COMPLETE STREETS

Chapter 2 of this report examines 10 key elements, both traditional topics and emerging issues, that planners must consider when planning, designing, and implementing complete streets:

- **Multimodal transportation.** The number and types of mobility options have multiplied over the last two decades, adding to the complexity of accommodating all transportation modes within complete streets.
- **Complete networks.** Complete streets link important destinations through networks composed of blocks, segments, and intersections, a concept that becomes even more important when financial or physical constraints make it impossible for all streets to incorporate infrastructure for all modes.
- **Context.** Context was initially defined in terms of land use and intensity, but this concept has evolved over the last decade to encompass socioeconomic, environmental, and cultural elements.
- **Safety.** Complete streets must continue to create safer conditions for pedestrians and cyclists while incorporating safety measures for new mobility options, including e-bikes, e-scooters, delivery drones, low-speed shuttles, and autonomous vehicles.
- **Equity and access.** Complete streets must provide all users with mobility options they can access and use to get

to and from important destinations, regardless of ability, car ownership, or financial status.

- **Economic development.** Years of implementation have shown that complete streets produce tangible economic benefits, including higher property values, more foot traffic, higher employment levels, better access to opportunities, increased retail spending, and reduced transportation costs.
- **Environment and climate.** Complete streets are an important tool in reducing pollution and building community resilience to the impacts of climate change, from decarbonizing transportation by supporting walking, biking, transit, and vehicle electrification to incorporating green infrastructure elements and mitigating extreme heat.
- **Public health.** Complete streets promote physical activity and mental health in daily life by making walking and biking safer, more inviting, and more accessible. Recent years have also shown that streets can help communities respond to public health emergencies.
- **Technology.** New visualization, data management, and communications technologies can augment complete streets planning, design, analysis, and public outreach processes, but planners must critically evaluate emerging technologies and tools against their potential risks.
- **Programming and management.** Streets are more than static physical infrastructure. Flexible design and programming allow streets to meet a wider array of community goals and provide benefits beyond mobility.

ENGAGEMENT AND COMMUNICATIONS FOR COMPLETE STREETS

Public engagement is a cornerstone of complete streets. Because roadway design and function affect a multitude of stakeholders, planners must employ robust and equitable public engagement processes that consider a community's full range of concerns, issues, needs, and solutions.

Chapter 3 of the report explains the importance of public engagement in successfully implementing complete streets programs and projects. It covers the evolution of public engagement, legal requirements for engagement, the shortcomings of conventional public outreach approaches, and steps to overcome exclusionary practices. It explores how to identify and analyze stakeholders and how to create messaging and engagement strategies and techniques. It shares recommended practices, research, guides, toolkits, and templates addressing effective, efficient, and equitable ways to conduct public engagement for complete streets. Finally, it describes recommended practices for recording and reporting on public engagement efforts. Appendixes A

and B of the report offer a collection of talking points and additional references to help planners make the case for complete streets in their communities.

COMPLETE STREETS POLICIES

Successful complete streets policy outcomes encompass more than concrete and asphalt. With heightened attention to mobility and access, planners can link an array of community goals to the design and operation of streets. Key elements of effective complete streets policies include prioritizing projects in communities lacking multimodal infrastructure investments, applying complete streets designs to all new or reconstruction projects, limiting exceptions, mandating coordination, adopting the latest and best design criteria, and linking streets and land use.

Chapter 4 of the report describes the general aspects of policy and policy-setting for complete streets. It looks at how complete streets policies have evolved over the past two decades as changing conditions, critiques, and ever-increasing crash rates have affected active transportation and forced a reevaluation of the traditional approach to complete streets policy and implementation. This chapter provides an overview of the elements of complete streets policy as defined by the National Complete Streets Coalition and highlights notable complete streets policy examples at the state, regional, and local levels.

MULTIMODAL PORTFOLIO

The quest for complete streets began with a short list of transportation modes: driving, walking, biking, and transit. Today, that list has expanded to encompass a wide range of new mobility options. Planners and engineers need to consider how all of these modes will function and interact within complete streets when designing roadways that ensure the safety and effectiveness of these mobility systems. In addition to new modes, travelers have new alternatives for trip-making through shared-use mobility, fleets, and new transit service lines, such as microtransit. These new offerings affect infrastructure by changing travel patterns in ways such as altering demand for parking and increasing demand for pick-up and drop-off areas.

Chapter 5 reviews a taxonomy of transportation modes—pedestrians, personal and shared motorized vehicles, micromobility, minimobility, delivery vehicles, and transit vehicles—and explains their implications for complete streets programs, and it describes how different mobility choices can be prioritized by establishing mode hierarchies.

STREET DESIGN AND INFRASTRUCTURE ELEMENTS

Complete streets are, as the name implies, largely about infrastructure. Working with engineers, planners can assist in choosing projects that provide the right infrastructure in the right place and influence options that link context, mobility, and land use. Design standards and guides establish the possibilities, and planners should also consider street typologies and network approaches that affect roadway infrastructure. Complete streets alternatives are often optional, and traffic and transportation engineers may feel obligated to use standard practices to avoid risk. In such cases, planners need to be conversant to some degree in technical design to make the case for complete streets. With an understanding of the guidance and contexts that shape infrastructure, planners can play a constructive role in the choice, location, and design of complete streets components.

Chapter 6 describes the major complete streets infrastructure elements—sidewalks, roadways, intersections and crossings, and bikeways—and provides real-world examples of those elements, along with additional resources for further guidance.

PROGRAMMING STREETS

Today's complete streets are not a static resource, but an asset that can be managed dynamically in real or near-real time. Programmable streets optimize the changeability and use of travelways, curbsides, and sidewalks. Tools such as flexible street design standards, innovative community planning techniques, modular infrastructure, and new technologies allow planners to schedule use changes, manage traffic operations, and reconfigure space.

Chapter 7 introduces the new paradigm of multimodal, multiuse programmable streets and their design, finance, and operations. It explores engineering and design standards that support flexible use and enable temporary, iterative alteration of physical parameters, as well as programming streets for different uses using physical, financial, and technological tools.

DATA PLANNING AND MANAGEMENT

Data systems and emerging technologies represent a new facet of complete streets planning and programming. Their evolution has expanded planners' abilities to evaluate how a transportation system is performing based on the community's expectations of its mobility system. The increased infusion of data into planning processes, however, brings risk. Topics of concern that merit deeper discussion within

planning practice include identifying and correcting discrimination and bias within datasets and algorithms, the ethical concerns of artificial intelligence (AI) in planning, and obligations to safeguard data protection and privacy.

Chapter 8 provides an overview of the role of data in complete streets projects, the elements needed to establish or improve a data program, the use of data for complete streets projects, and how complete streets policies might overlap with performance-based planning. The spotlight on performance elevates the role data and metrics play in planning and monitoring complete streets. Appendix C of the report compiles performance metrics and data sources relevant to transportation, infrastructure, access and accessibility, equity, and climate goals for complete streets.

FUNDING COMPLETE STREETS

Among the biggest challenges to realizing the myriad benefits of complete streets is funding their construction. Over the past two decades, the funding landscape for complete streets projects has evolved as awareness of multimodal transportation and community-centered design has grown, though recent years have seen wide fluctuations in federal support. State and local governments fund projects identified through complete streets policies and plans, and nonprofits and public-private partnerships also provide funds for complete streets through community development agreements and grants. Projects that address factors such as safety, accessibility, and community transportation goals are now being prioritized within funding documents.

Chapter 9 provides a primer on how complete streets are funded and offers an overview of federal, state, regional, and local funding sources for complete streets projects at the time of this report's publication, with the caveat that current funding uncertainties are likely to persist. It also explains the role of planners in identifying, applying for, and managing funding streams for complete streets projects.

IMPLEMENTATION AND MONITORING

Implementation is the culmination of complete streets program development and project initiation. Successful implementation begins with complete streets policies that detail public involvement and process. It can be achieved by establishing a complete streets program to oversee stakeholder and team management, internal and external engagement, policy adoption and updates, planning, project implementation, and program monitoring.

Chapter 10 focuses on the importance of complete streets programs in creating a structure for effective

complete streets implementation. It examines the process required to plan and deliver a complete streets project and offers guidance on the rapid implementation of demonstration and quick-build projects as an alternative approach. Finally, the chapter discusses the role of monitoring and evaluation in determining the success of a complete streets program and guiding its evolution and improvement.

THE FUTURE OF COMPLETE STREETS

Over the last two decades, the complete streets movement has reshaped transportation and community planning by expanding the inclusion of multimodal transportation into infrastructure planning, design, and performance goals. Creating safe, complete streets for all users to support equitable, accessible, and sustainable mobility is more important today than ever before. The evolution of complete streets continues to unfold, and planners still have key roles to play in realizing the myriad community benefits of complete streets.

Planners are essential to complete streets because complete streets are more than roadways, curbs, and sidewalks. They encompass safety, access to destinations, robust engagement, and stewardship of the public interest—interlinked topics that planners address every day. Equity, climate resilience, and active transportation will remain core community concerns, no matter the political climate. Planners can connect these local goals to infrastructure and transportation systems. They have the skill sets for creating complete streets programs that integrate mobility, access, health, equity, environmental protection, economic development, and other locally important issues. They can encourage their engineering colleagues to make use of the flexibility written into updated roadway standards and guidance, and they can provide constant reminders that streets are so much more than just spaces for automobile movement and storage.

This PAS Report is a comprehensive resource for planners helping their communities envision the future of complete streets and realize goals that transform infrastructure projects into community assets. Whether they are just starting to explore complete streets or are fine-tuning a long-standing complete streets program, planners can use the information and guidance provided in this report to help their communities achieve the next generation of complete streets.



11 About This Report

01 THE EVOLUTION OF COMPLETE STREETS

Since cars began rolling off assembly lines in the early 20th century, roadway engineering has been based largely on one mode: the automobile. Streets and intersections were designed to enable unimpeded traffic flow. The [complete streets](#) movement—“an approach to planning, designing, building, operating, and maintaining streets that enables safe access for all people who need to use them, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities” (SGA and NCSC n.d.b.)—was created to challenge this approach.

For over half a century, advocates have called for better streets. In *The Death and Life of Great American Cities* (1961), Jane Jacobs deconstructed city life to frame the importance of streets and sidewalks. In 1981, scholar Donald Appleyard published *Livable Streets*, tying in the social and psychological effects of traffic and infrastructure. In 2003, a collection of advocates for incorporating bicycles into transportation planning, led by America Bikes, the League of American Bicyclists, and Smart Growth America, used the term “complete streets” for the first time (McCann 2010). By 2005, they had convened a diverse range of stakeholders with clear interests in improved street design, and the [National Complete Streets Coalition](#) was born.

In subsequent years, more calls for better street design and function emerged. In 2012, urban planner Jeff Speck published *Walkable City: How Downtown Can Save America, One Step at a Time* as a call to action for reviving urban spaces. The next year, urban designers Victor Dover and John Massengale literally wrote the book on street design with *Street Design: The Secret to Great Cities and Towns*. Over the next decade, additional authors built a library of resources that tackled complete streets and related topics in ways that were both technical and approachable. The advocacy groups Smart Growth America and StrongTowns went further, sharing detailed information on the engineering roots of modern roadway design failures to empower local advocates. In the early 2020s, with traffic-related pedestrian and cyclist deaths spiking, the U.S. Department of Transportation (USDOT) initiated a holistic “[Safe System](#)” approach focusing on five elements: safe road users, safe vehicles, safe speeds, safe roads, and post-crash care (USDOT

n.d.). Through it all, the National Complete Streets Coalition has led the broader complete streets movement, advocating for policy change, establishing standards, documenting best practices, and training practitioners.

The American Planning Association published PAS Report 559, [Complete Streets: Best Policy and Implementation Practices](#), in 2010 (McCann and Rynne 2010). A joint research project of APA and the National Complete Streets Coalition, this report examined case studies from communities across the country related to different aspects of complete streets, including adopting effective policies, planning for change, handling costs, and designing for safety of all users. Since that time, the complete streets movement has steadily spread across the United States. In 2010, Smart Growth America’s tracking effort recorded nearly [60 complete streets policies](#) (Okafor 2010). Today, more than [1700](#) complete streets policies have been passed in U.S. cities, towns, counties, regions, states, territories, and reservations (SGA and NCSC n.d.d.).

From this impressive body of work, a framework for the elements of complete streets emerged. Recent years have heightened attention to equity, emerging technologies, resilience strategies to address climate change, and flexible uses of street space. The practice and evolution of complete streets over the past two decades offer opportunities to update details and incorporate new trends, formulate “lessons learned,” and undertake course correction. As complete streets programs have grown, so too has the base of research and case studies. This information is valuable not only for evaluating individual projects, but also in continuing to make the case for complete streets.

This PAS Report is a planner's guide to understanding how to incorporate the latest recommended practices, lessons learned, and evolving trends into complete streets efforts. Whether planners are just learning about complete streets or managing long-term complete streets programs in their communities, this PAS Report will help them better understand how to design and develop transportation infrastructure that accommodates the needs of all road users while achieving a wide range of broader community goals.

ABOUT THIS REPORT

The purpose of this PAS Report is to present the most up-to-date information on complete streets based on research, lessons learned, and best practices. Its mission is to accelerate the adoption of infrastructure design and mobility programming that supports community goals related to mobility, access, equity, sustainability, economic vitality, and well-being. The report offers guidance to help planners create more inclusive, multimodal, and sustainable transportation networks. It explores how complete streets can continue to meet the changing needs of communities, promote sustainability, prioritize safety, and create accessible and vibrant urban environments.

Methodology

In formulating the report's structure and contents, the authors engaged experts through several events and channels:

- In 2022, the authors held preliminary meetings in Washington, D.C., with complete streets experts to discuss the overall framing and structure of the report.
- In 2022 and 2023, the authors held complete streets-related events in West Palm Beach, Florida; Washington, D.C.; and Arlington, Virginia, to gather ideas and examples of complete streets projects and policies.
- The authors used displays at conferences to discuss the report and gather information.
- In 2023 and 2024, the authors contacted over 40 organizations and practitioners to obtain images and content via email and telephone calls.
- The authors used desktop research to gather research manuscripts and reports, with an emphasis on studies conducted in the past five to seven years.

The authors tested but did not pursue the use of generative artificial intelligence (AI) for research, finding the

results to be overgeneralized or incorrect. In developing original content, the authors used AI to improve grammar or suggest options for shortening passages.

One of the biggest challenges was writing amid substantial swings in national policy and funding that took place during the report's creation. Writing and research began as funding began to flow from the Bipartisan Infrastructure Law (BIL). Cities around the country began to refocus their infrastructure priorities around several programs' selection criteria that elevated equity, climate, and safety outcomes. In 2025, however, those criteria and others related to active transportation were removed by the incoming administration. Federal websites regarding complete streets have been deleted, including the USDOT's complete streets landing page, which has been replaced with a smaller site on [complete streets resources](#). Federal memorandums and executive orders have called for the removal of equity, climate, and active transportation considerations from policy and funding programs. Federal and state authorities have also issued rules against decorative crosswalks, which limits the use of tactical urbanism techniques popular with the public.

Many of these actions have been challenged in court and are, as of publication, under litigation. Despite these disruptions and uncertainties, this PAS Report maintains the planning profession's commitments to equity, climate mitigation and adaptation, active transportation, and the goal of safer, more complete streets.

How to Use This Report

This PAS Report is written primarily for urban and transportation planners, though it is also intended to support the wider array of stakeholders involved in decisions related to infrastructure and mobility. The authors mined the large and still-growing body of research and resources developed since the 2010 PAS Report to present information on tried-and-true practices, lessons learned, emerging trends, and promising approaches likely to affect mobility and infrastructure. The report focuses on research and examples from the United States to resonate with U.S.-based stakeholders, but it includes images and examples illustrating international best practices worth emulating.

Research, resources, and citations are provided throughout the report to provide readers with best-practice examples from communities across the country and information to incorporate into local programs and projects. References are listed at the end of the report and are intended to be a rich source of information and evidence-backed solutions. Appendices provide additional resources for readers.

ACRONYMS USED IN THIS REPORT

AASHTO: American Association of State Highway and Transportation Officials

ADA: Americans with Disabilities Act

AI: Artificial Intelligence

APP: Areas of Persistent Poverty

BEVs: Battery Electric Vehicles

BIL: Bipartisan Infrastructure Law

BTS: Bureau of Transportation Statistics

BUILD: Better Utilizing Investments to Leverage Development funding program

CIP: Capital Improvement Plan

CMAQ: Congestion Mitigation and Air Quality Improvement Program

FDOT: Florida Department of Transportation

FHWA: Federal Highway Administration

FTA: Federal Transit Administration

HAWK: High-Intensity Activated Crosswalk

HDC: Historically Disadvantaged Community

HSIP: Highway Safety Improvement Program

HUD: U.S. Department of Housing and Urban Development

IoT: Internet of Things

ITE: Institute of Transportation Engineers

ITS: Intelligent Transportation Systems

ITRE: Institute for Transportation Research and Education

LRTP: Long-Range Transportation Plan

MUTCD: Manual on Uniform Traffic Control Devices

ML: Machine Learning

MPO: Metropolitan Planning Organization

NACTO: National Association of City Transportation Officials

NCMM: National Center for Mobility Management

NCSC: National Complete Streets Coalition

NEPA: National Environmental Policy Act

NHTSA: National Highway Traffic Safety Administration

NOAA: National Oceanic and Atmospheric Administration

NOFO: Notice of Funding Opportunity

PROWAG: Public Right-of-Way Accessibility Guidelines

RRFB: Rectangular Rapid-Flashing Beacon

SFMTA: San Francisco Municipal Transportation Agency

SGA: Smart Growth America

STBG: Surface Transportation Block Grant Program

STIP: Statewide Transportation Improvement Program

TA: Transportation Alternatives Program

TDM: Transportation Demand Management

TIF: Tax Increment Financing

TIP: Transportation Improvement Plan

TMA: Transportation Management Association

UP or UPWP: Unified Planning Work Program

USDOT: U.S. Department of Transportation

USEPA: U.S. Environmental Protection Agency

USGS: U.S. Geological Survey

Finally, as this report is intended to be a desk reference to assist planning throughout the entire life cycle of complete streets program development and updates, and planners are encouraged to refer directly to the particular chapters most relevant to their needs, certain chapters contain some repetition by design. The following list of contents summarizes the key topics and information provided in this PAS Report.

Chapter 2, **The Elements of Complete Streets**, covers the underlying factors for next-generation complete streets: eight long-standing elements of multimodal transportation, complete networks, context, safety, equity and access, economic development, environment and climate, and

public health, plus two emerging elements of technology and programming and management.

Chapter 3, **Engagement and Communications**, explores the importance of community engagement in developing complete streets policies and programs and the special communications challenges that complete streets presents for planners. It offers a comprehensive overview of how to prepare for and implement complete streets public engagement, including stakeholder identification and analysis, messaging, engagement techniques, and public input reporting practices.

Chapter 4, **Complete Streets Policies**, examines the evolution of complete streets policies, outlines the 10 ele-

ments of a complete streets policy as established by the National Complete Streets Coalition, and offers policy guidance from national, state, regional, and local perspectives.

Chapter 5, **Multimodal Portfolio**, describes the wide variety of travel modes that must compete for space on today's streets: from cars, bicycles, and buses to new forms of micromobility, minimobility, and transit, as well as delivery vehicles. It also discusses different options for mode prioritization.

Chapter 6, **Street Design and Infrastructure Elements**, explores design factors and standards, and offers a catalog of complete streets infrastructure elements encompassing sidewalks, roadways, intersections and crossings, and bikeways.

Chapter 7, **Programming Streets**, discusses ways to change the uses and functions of streets, from flexible design standards to new options for physical, digital, and financial programming.

Chapter 8, **Data Planning and Management**, provides a background on the data needed to plan for and evaluate effective complete streets. It describes the many public and private data sources available, summarizes the various types of data employed in monitoring and analyzing complete streets performance, and explains the basics of good data management.

Chapter 9, **Funding Complete Streets**, describes various sources for complete streets funding at the federal, state, regional, and local levels, including private and nonprofit funding sources, and explains the planner's role in pursuing project funding.

Chapter 10, **Implementation and Monitoring**, emphasizes the importance of developing a complete streets implementation program and walks readers through the typical project delivery process, highlighting planners' roles at each step. It notes key areas to consider for ongoing maintenance and offers guidance on post-construction monitoring and evaluation of complete streets to determine project success.

Chapter 11, **The Future of Complete Streets**, emphasizes the importance of the planner's role in complete streets planning and implementation and takes a look at what might lie ahead for complete streets practice.

Appendix A, **Making the Case for Complete Streets**, offers talking points for planners that cover the many benefits of complete streets, from access and land use to safety and traffic calming.

Appendix B, **Complete Streets Resource Compendium**, provides links to online resources and guidance for all aspects of complete streets planning, design, and implementation.

Appendix C, **Complete Streets Metrics and Datasets**, presents tables of data types, sources, and performance metrics for six key aspects of complete streets: transportation and travel, infrastructure and development, access to destinations, accessibility, equity, and climate.



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02 KEY ELEMENTS OF COMPLETE STREETS

The concept of complete streets has been evolving since its inception in the early 2000s. Recent advances in technology and the world-changing impacts of the COVID-19 pandemic have accelerated this evolution. More than 20 years of complete streets policy development and program implementation offer an abundance of information about the first generation of complete streets.

In 2010, the American Planning Association and the National Complete Streets Coalition published PAS Report 559, [*Complete Streets: Best Policy and Implementation Practices*](#), to document findings from the successes and struggles of pioneering complete streets communities (McCann and Rynne 2010). Now is a fitting time to re-evaluate the many aspects of complete streets to ensure that the next generation of complete streets remains relevant, effective, and responsive to new challenges.

This chapter explores 10 key elements, both traditional topics and emerging issues, that planners must consider when planning, designing, and implementing complete streets:

- Multimodal transportation
- Complete networks
- Context
- Safety
- Equitable access
- Economic development
- Environment and climate
- Public health
- Technology
- Programming and management

The authors derived these elements from observation, documentation, assessment, and evaluation of implemented complete streets projects, as well as an analysis of planning and engineering literature. The intention is to offer a framework for understanding the myriad factors that together make our streets more complete. Drawing on more than two decades of real-world applications, this chapter describes

these elements of complete streets, highlights lessons learned from implementation in real-world scenarios, and explores how they have evolved—and must continue to evolve—to meet goals, improve performance, and respond to rapidly changing social, economic, and environmental conditions.

MULTIMODAL TRANSPORTATION

Today's concept of multimodal transportation is considerably different from our understanding in the early 2000s. The number and types of mobility options have multiplied over the last two decades. Public rights-of-way are now being used by a profusion of vehicle types traveling at different speeds and performing different functions, with varying degrees of rider and driver protection. Planners must update their understanding of transportation modes to meet the challenge of incorporating these new mobility options into our streets.

Early Understandings and Evolution

The complete streets movement originated in improving pedestrian and bicycle facilities on roadways. Beyond the mere presence of sidewalks, advocates called for quality, connectivity, and compliance with the Americans with Disabilities Act (ADA). For cyclists, engineers were tasked with adding bike lanes and trail extensions. For transit users, advocates campaigned for installing shelters at bus stops and improving wayfinding. The result was a focus on street designs that incorporated protected bike lanes, adequate sidewalks, street trees, crosswalks, transit shelters, and bike racks.

Over time, planners encountered the complexity of translating complete streets concepts and designs into imple-

mentable projects. Due to car-centric transportation regulations and standards, planners learned that introducing new forms of street infrastructure would entail more than passing local ordinances or updating streetscape standards. To successfully execute their complete streets projects, planners had to work with other fields and departments to find workable solutions for new roadway designs, including fire safety, emergency services, and engineering standards.

At the local level, widespread support for the concept of multimodal travel often [unraveled](#) as actual projects materialized (Moore 2022). Planners faced pushback from politicians, traffic engineers, fire departments, businesses, special interests, and the public. In one example, the San Francisco fire department [challenged](#) streetscape improvements, insisting that all roads be 30 percent wider than the code allowed, which would reduce sidewalk widths and traffic-calming elements meant to protect bicyclists and pedestrians (Wiener 2014).

Today and Into the Future

Complete streets advocates have built support and reduced opposition by addressing these issues head-on. For example, in response to concerns about complete streets principles, Montgomery County, Maryland, developed its [Fire Department Access Performance-Based Design Guide](#) in 2019 to help resolve conflicts and gain the support of local fire departments (Montgomery County DPS 2019). But the ongoing challenge is epitomized by a [2018 study](#) of Florida's state-level complete streets policy, which found that though policies had resulted in reduced traffic fatalities, they failed to change the car-centric transportation planning culture in the state, with pedestrian and bike infrastructure tacked onto projects that were still primarily focused on moving motor vehicles (Schmitt 2018).

Looking ahead, the continuing primacy of U.S. car culture means that pedestrians, cyclists, and other nonautomobile users must continue to be a key focus of complete streets efforts. The rise of new mobility options has added to the complexity of complete streets, as traditional roadway users such as cars, transit, pedestrians, and bicycles now compete for space with e-bikes, scooters and e-scooters, microtransit, paratransit, rideshare vehicles, delivery drones, and increasingly, autonomous vehicles. As such, planners will need to expand the definition of multimodal transportation to address new vehicle types—especially low-speed electric vehicles—in the next generation of complete streets. Chapter 5 of this report takes a deeper dive into multimodal transportation.

COMPLETE NETWORKS

Complete streets link important destinations through networks composed of blocks, segments, and intersections. Planners must envision the network as a whole as they navigate planning and capital improvement processes that, by their nature, are traditionally considered one project at a time. According to PAS Report 559, the creation of a complete transportation network for all modes is “the ultimate intent” of complete streets (McCann and Rynne 2010, 27). The concept of the network becomes even more important when space constraints make it impossible for all streets to incorporate infrastructure for all modes.

Early Understandings and Evolution

As complete streets programs expanded, it became clear that success should be defined by the ability of travelers to connect safely and conveniently to everyday destinations. Early implementation efforts of individual projects, however, led to a patchwork of improved segments, intersections, and trails. This often created [unsafe conditions](#) of discontinuous bikeways and sidewalks (FHWA 2016a).

The benefits of creating a holistic system instead of taking a piecemeal approach are exemplified by the Indianapolis Cultural Trail. This raised cycle track, separated from vehicular and pedestrian traffic, is integrated into the streetscape design of several prominent downtown streets and connects six downtown cultural districts and neighborhoods (Figure 2.1, p. 17). A [2015 assessment](#) showed that more riders used the Cultural Trail than most other bike trails and greenways in Indianapolis. Recreation was the primary driver of use (41 percent), with fewer riders using it to commute to work (17 percent) or school (five percent) (Majors and Burow 2015). To better connect job centers, residential neighborhoods, and local commercial areas, [three expansions](#) of the trail to the west and south were added in 2020 (Indianapolis Cultural Trail n.d.).

Today and Into the Future

Experience has shown that not all streets can be complete streets. Improvements may be financially or physically infeasible, and on many streets, walking and biking are inherently unsafe. Mobility network analysis must not only consider infrastructure but also activity centers that cyclists and pedestrians visit. Complete streets provide routing options and safe facilities removed from high-speed traffic, as well as first- and last-mile connections for transit stations and stops.

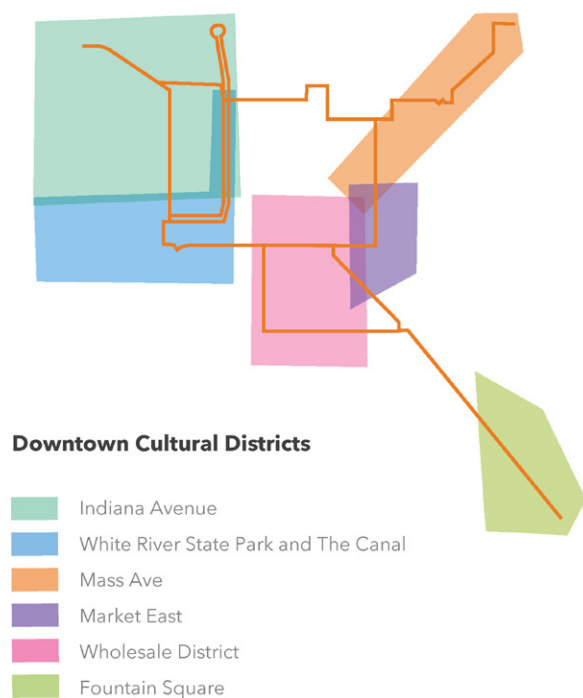


Figure 2.1. The Indianapolis Cultural Trail bike path connects six downtown cultural districts and neighborhoods ([Indianapolis Cultural Trail](#))

One helpful approach is the concept of [low-stress networks](#) (Mekuria, Furth, and Nixon 2012). Planners can assess connectivity across the street network and evaluate existing or proposed bike routes based on levels of traffic stress caused by traffic speed, topography, and missing links. Network analysis has improved with technologies that allow desktop review of video, satellite images, and advanced imagery (e.g., Google Earth, lidar, photogrammetry), making it easier to document existing conditions and understand traffic flows for all modes. Chapter 6 covers how to work with engineers in identifying and establishing complete networks.

Real-time direction apps, such as Waze and Google Maps, are now providing routes for cycling and walking in addition to driving and transit. These apps enable users to assess different routes to destinations based on time, traffic, construction, and other factors, using real-time information to make the best use of the network. The built-in redundancies of a comprehensive network improve a system's resiliency and reliability by allowing travelers to use other routes when one segment is out of service or overly congested.

Today, a growing number of “mobility hubs” are integrating facilities for transit stops, biking, bike parking, and shared-use scooters and bicycles. Larger nodes incorporate land uses such as day care facilities and convenience retail. With multiple modes in one place, transfers between modes become more seamless for users. And electric bikes and scooters are expanding access to transit beyond the traditional half-mile. Given the range of these vehicles, the complete network for transit access can now be measured in miles. When planning the next generation of complete streets, planners must understand their importance in creating interconnected mobility systems for the future.

CONTEXT

Complete streets design and function are driven by the surrounding environment. What is appropriate in a dense urban core may not be applicable in a rural setting. Context was initially defined in terms of land use and intensity. Today, this concept has evolved to encompass socioeconomic, environmental, and cultural elements. This includes anticipated users and mobility modes, the street's place in the transportation network, local culture, and environmental constraints. As such, planners must take a context-sensitive approach when establishing policy and guidance.

Early Understandings and Evolution

PAS Report 559 highlighted the importance of context, stating that “sensitivity to the community context is essential to an effective complete streets policy” (McCann and Rynne 2010, 31). The authors also noted a growing emphasis on street typologies and plans that clarified appropriate facilities for different contexts. Aligning with this evolving understanding, the Federal Highway Administration (FHWA)'s 2016 report [Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts](#) emphasized the importance of context-based street design (FHWA 2016a). Half of the 24 topics addressed in the document focus on the need for flexibility in design instead of adopting a one-size-fits-all approach.

That same year, FHWA revised its controlling criteria for design to give state and local engineers more authority in designing lower-speed nonfreeway roadways in contextually appropriate ways. One state that has used this opportunity is Florida, where the Florida Department of Transportation (FDOT) issued a context classification system and [guide](#) (FDOT 2024). This system allows FDOT to evaluate street

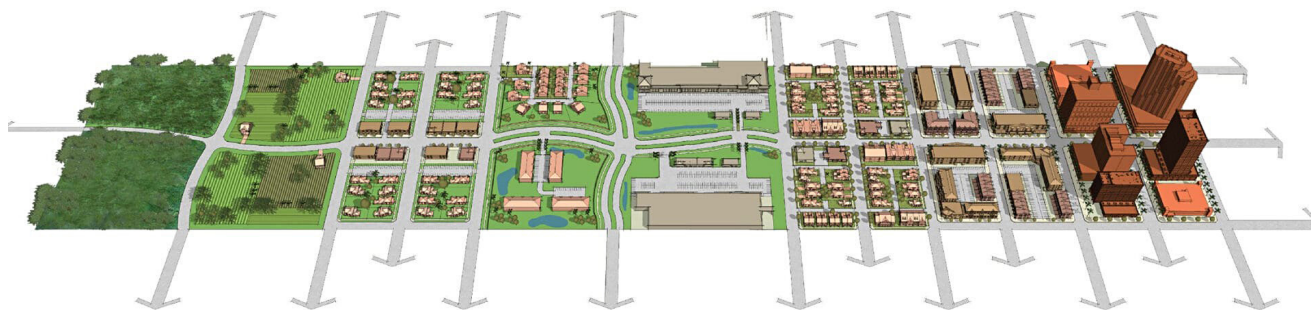


Figure 2.2. FDOT's context classification system enables street design based on surrounding land-use patterns (Florida Department of Transportation)

design based on surrounding land-use patterns (Figure 2.2) to put the right street in the right place for state-funded roadway improvements. On its [complete streets resource page](#), the Institute of Transportation Engineers also notes that context directs which modes should be accommodated in design (ITE n.d.a.).

A local example of successful context-sensitive design planning comes from [Charlotte](#), North Carolina, which adopted a comprehensive complete streets policy in 2007 (Coleman 2014). The policy and subsequent action plan enable context-sensitive design for street sections and intersections by considering surrounding land uses and the needs of multiple mobility modes. By 2014, the city had constructed over \$400 million of complete streets road and intersection projects, including over 60 miles of bike lanes. A city analysis of the effectiveness of these new context-sensitive complete streets showed positive results, including reduced speeds and fewer crashes. Building on program successes, the City developed the [Charlotte Streets Manual](#), which incorporates many of the context-sensitive design elements used in the complete streets policy (Charlotte 2023).

Today and Into the Future

Shifts in how people used public rights-of-way during the COVID-19 pandemic have shown the social, cultural, and communal potential of these spaces, highlighting the importance of context beyond physical infrastructure. Economic, historical, and cultural contexts recognize the community's experience and relationship with the larger area, including investment decisions. Because streets have a history of both connecting and dividing neighborhoods, context can inform where to redress harm from past decisions or underinvestment.

Streets are not just about mobility; they are about community, and complete streets need to reflect this. As asserted

by Stephen Zavestoski and Julian Agyeman in their 2018 essay, [“Incomplete Streets: Who’s Missing from ‘Complete Streets’?”](#):

We ought to push planners and policymakers, academics, activists, and laypeople to think more critically about streets, not just as physical and material amenities that function to move people and goods, but as significant social and symbolic spaces where users are linked to intersecting economic, transportation, food, cultural, and governance systems, as well as personal, group, and community histories and experiences. (Zavestoski and Agyeman 2018)

The expansion of socioeconomic context was embedded within the 2021 Bipartisan Infrastructure Law (BIL) and its funding programs. Diversity, equity, and inclusion (DEI) and environmental justice (EJ) were prioritized and became ranking factors for awarding project funds. In 2025, the Trump administration terminated DEI- and EJ-related activities, scrubbing these terms from policies and grant programs via [Executive Order 14151](#) (The White House 2025). However, the socioeconomic context for prioritizing projects was not completely eliminated. For example, the 2025 Safe Streets for All (SS4A) [Notice of Funding Opportunity](#) lists “equitable investment in the safety needs of underserved communities” as a grant priority, defining “underserved community” as equivalent to “areas of persistent poverty” as denoted in Census maps (USDOT 2025).

Culturally, the COVID-19 pandemic and protest movements created systemic shifts in how society views our streets. The Black Lives Matter movement illuminated inequities, highlighting the dangers Black and Brown community members encounter in the streets of their own

neighborhoods. Street design plays a role in personal safety and sense of belonging. Creating streets that feel safe and welcoming requires inclusive decision-making processes. The next generation of complete streets should be places of community as resources shared by all.

SAFETY

Safe travel options should be available for all travelers, regardless of mode. However, with the emphasis on car travel in the United States, safety has historically been defined in terms of vehicle occupants—not people walking, biking, and taking transit. To get people to walk and bike, they must feel safe, and complete streets are part of the solution.

Early Understandings and Evolution

The first generation of complete streets championed safety for pedestrians and cyclists. Planners proposed traffic-calming and safety measures, such as narrow travel lanes, side-walk bump-outs, high-visibility crosswalks, protected bike lanes, and protected intersections retrofitted with extended curbs and pedestrian refuge areas. But while conceptual designs emphasized safety, project managers often opted for minimal measures, such as unprotected bike lanes, in the final design and construction process, even as cyclist and pedestrian deaths continued to rise. This has inspired “paint is not protection” advocacy to increase support for physically protected bikeways.

Increasingly, advocates and designers are pointing to the role of conventional street design, which prioritizes automobile throughput, in creating unsafe conditions for all road users. Smart Growth America’s report *[Dangerous by Design](#)* highlights this systemic problem (SGA and NCSC 2024b). Dangerous environmental risk factors include high-speed roads, poor visibility, wide roads, high traffic volume, and the absence of pedestrian facilities such as crosswalks, signals, and refuge islands (Figure 2.3).

These risks are demonstrably higher in certain communities. [Research](#) from the University of Iowa College of Public Health has shown that pedestrian injuries are worse for most Black, Hispanic, and multiracial groups in the United States, a racial disparity that points to inequities in access to safe transportation (Hamann, Peek-Asa, and Butcher 2020). Researchers have also connected risks with income levels. Affluent households walk mainly for leisure and to avoid unpleasant or unsafe conditions, while lower-income households walk principally for utilitarian reasons. This puts



Figure 2.3. A conventional unprotected bike lane on this eight-lane arterial road illustrates the risks of bicycle travel on U.S. roadways (WGI, Inc.)

them at [higher risk](#) when destinations are located in unsafe environments, such as commercial areas along high-speed roadways (Dumbaugh and Stiles 2025).

Today and Into the Future

Today, vehicle crashes and related fatalities have grown alarmingly high. U.S. [pedestrian deaths](#) in the first half of 2024 were nearly 50 percent higher than in 2014 (GHSA 2024), and that same year, U.S. cyclist deaths increased to a new record of 1,166 (McLeod 2025).

The 2021 BIL raised the profile of reducing roadway casualties within federal programs and funding criteria. The [Safe Streets for All](#) (SS4A) grant program requires states and jurisdictions to develop safety action plans that include priority projects promoting safety for all road users, not just vehicle occupants (USDOT 2025). The BIL also required USDOT to review policies and standards that could impede safety goals. FHWA’s [Proven Safety Countermeasures](#) initiative promotes strategies, equipment, and infrastructure that address safety focal areas, such as speed management, intersections, and pedestrians and bicyclists (FHWA n.d.). Proven countermeasures have been tested and assigned quantitative safety ratings; many grant programs specifically fund items on the countermeasures menus. Further, the USDOT’s recent shift to a [Safe System Approach](#) seeks to prevent crashes from happening in the first place and to minimize harm caused to those involved when crashes do occur. The Safe System approach encompasses five objectives: safer people, safer roads, safer vehicles, safer speeds, and post-crash care (USDOT n.d.).

Fremont, California, offers a good [case study](#) of how complete streets elements can successfully improve safety (Hendershot 2021). The city adopted a [Vision Zero Ordinance](#) in 2015 and began reimagining how streets should

function (Fremont 2023). The Fremont Public Works Department used inexpensive quick-build techniques to construct protected intersections, upgrade crosswalks, reduce lane widths, reduce the number of lanes, and reduce speeds. It also restriped 47 percent of the city's arterial roads. Many projects focused on high-risk crash locations and school routes. By 2021, the number of major crashes in the city had decreased by 45 percent.

Going forward, complete streets must continue to create safer conditions for pedestrians and cyclists, while also incorporating safety measures for new mobility options, including e-bikes, e-scooters, delivery drones, low-speed shuttles, and autonomous vehicles. Deconflicting the growing number and types of transportation modes competing for limited right-of-way will become a priority in streetscape design. The next generation of complete streets must be designed and implemented to achieve safety for all users.

EQUITABLE ACCESS

For complete streets, the term “access” has a dual meaning. First, access can refer to a person being able to enter and use a space, regardless of ability. The complete streets movement embraced this concept by advocating universal design: environments designed to be accessible to all people. The second meaning of access addresses a person's ability to travel to desired destinations. Together, this means that all users must have mobility options to get to and from important destinations, regardless of ability, car ownership, or financial status.

Our current transportation system has been designed and built to allow travel from one point to another by personal vehicle, but not everyone can easily access a car. The results are an inequitable transportation system in which access is achievable primarily through automobile use and streetscapes that render other modes less convenient and more dangerous. As such, equity is a fundamental aspect of creating supportive infrastructure through complete streets.

Early Understandings and Evolution

Early complete streets accessibility efforts addressed the requirements of the [Americans with Disabilities Act of 1990](#) (ADA) (USDOJ n.d.). This led to much-needed installations of curb ramps at intersections, equipment modifications for those with physical disabilities, and ADA-accessible transit shelters. Even so, a 2020 [assessment](#) of U.S. pedestrian infrastructure identified persistent barriers making the built en-

vironment inaccessible to people with disabilities (Eisenburg et al. 2020). One major challenge is a piecemeal approach that adds accessibility elements to new construction but does not retrofit adjacent streets, resulting in discontinuities that make pedestrian paths unsafe or unusable by people with disabilities. Other issues reported by pedestrians included broken or uneven sidewalks (Figure 2.4), intersections without walk signals, unsafe crosswalks, overly steep curb ramps, and fast-moving traffic.

Failure to comply with ADA requirements has legal consequences. In 2002, individuals with mobility and vision disabilities sued the City of Sacramento, arguing that the city's failure to maintain its sidewalks amounted to an ADA violation. The decision in [Barden et al. v. City of Sacramento](#) cost the city \$80,000 in damages and \$750,000 in court fees, and it required the city to allocate 20 percent of its transportation budget toward improving accessibility for the next 30 years (FindLaw 2002). This set a [nationwide precedent](#) requiring cities and other public entities to make all public sidewalks accessible to people with mobility and vision



Figure 2.4. Uneven and broken sidewalks pose barriers to accessibility (Kirkikis/Getty Images)

disabilities (DRA n.d.). But noncompliance persists, as continuing legal actions attest; in 2024, the City of Baltimore entered a [settlement](#) to invest \$44 million in sidewalks and ramps (Yeager 2024).

Over time, a broader understanding of access has encompassed “access to opportunities.” [Access](#) to schools, health care, fresh food, and jobs is essential to advancing economic success and social participation (Bhusal, Blumenberg, and Brozen 2021). Yet, one-third of people living in the United States do not have a driver’s license (Zivarts 2024). A 2024 Pew Research Center [study](#) found that one in 10 adult Americans seldom or never drive a car, and six percent do not drive at all (Schaeffer 2024). For nondrivers, the transit and multimodal infrastructure of complete streets is [critical](#) for gaining skills, finding employment, and getting health care (Litman 2023).

In recent years, equity considerations have shifted our thinking about roadway users and their needs. Pedestrians, bicyclists, and drivers are not monolithic user groups. For example, pedestrians include children, families, seniors, adults lacking a driver’s license, people with disabilities, and people who do not speak or read English. An area with a large senior population requires different design elements to ensure accessibility than a school route. For fully accessible complete streets, planners need to break down general user categories to identify the wide range of needs of all potential users.

Researchers have also studied the intersections of gender, access, and complete streets. A 2021 [USDOT report](#) raised the importance of factoring in the needs of women using mobility systems (McAndrews et al. 2021). Traditional safety and security streetscape features have been designed from a male-centric point of view. Planners must ensure they engage stakeholders of all genders to determine and design for the mobility needs of all people as workers, caregivers, and civic organizers.

Though the complete streets movement seeks to advance equity by providing safer, varied, and more affordable travel options, questions have arisen about whether complete streets solutions have created inequitable outcomes. Critics have pointed to planners’ narrow focus on street design and inattention to redressing the harmful roadways installed in the first place. Some have raised a [larger question](#) (Zavestoski and Agyeman 2018): who gets to define the solution? What looks like a complete streets improvement to an advocate may be viewed as a gentrification catalyst by a neighbor.

Today and Into the Future

The importance of equitable access to both mobility and opportunity is clear. Planners must consider these issues when planning and designing complete streets. The University of Illinois at Chicago research report [Prioritizing Transportation Equity through Complete Streets](#) offers guidance on policy language, communications, funding mechanisms, and evaluation criteria for integrating equity into complete streets (Thrun, Perks, and Chriqui 2016).

Planners must also rewrite existing mobility policies that disproportionately impact and harm Black and Brown communities. For example, common rules banning midblock pedestrian crossings, penalties for riding bicycles on sidewalks, and equipment requirements for bike lights and helmets sound well-meaning, but they may raise barriers to travel for lower-income communities, as described in the Equitable Cities report [Arrested Mobility](#) (Brown, Rose, and King 2023).

Planners should also determine the distribution of infrastructure investment throughout the community and identify neighborhoods where underinvestment needs to be corrected by [measuring key equity and access indicators](#) (Sundquist, McCahill, and Brenneis 2021). Howard County, Maryland, uses a [vulnerable population index](#) that measures the percentages of poverty, non-Hispanic/nonwhite, Hispanic, limited English proficiency (LEP), disabled, elderly, and carless households in county census tracts to prioritize complete streets projects (Howard County 2020). At the state level, Caltrans’ [Transportation Equity Index](#) uses safety and access-to-destinations data to identify transportation-based priority populations at the Census block level (Caltrans n.d.). Infrastructure distribution analyses must also encompass new mobility options, such as bike-sharing programs. To better serve all residents, the City of Philadelphia focused on equity in the planning stages of its [bike-share program](#), Indego (McNeil et al. 2017).

Looking ahead, new land use and mobility analysis tools will allow a finer-grained examination of supply and demand to inform land use planning, transportation, and economic programming. For example, planners could use artificial intelligence (AI) in processing large data sets to better understand and model origin-destination patterns or identify disparities in pedestrian and bike infrastructure quality around activity centers, schools, and transit stations. The next generation of complete streets must continue to increase access in all its forms for all users while emphasizing planners’ roles in complementing complete streets plans with plans for everyday destinations.

ECONOMIC DEVELOPMENT

Streets are a primary driver of economic activity, providing access to homes, jobs, shopping, and recreation. Years of implementation have shown that complete streets provide tangible [economic benefits](#), including higher property values, more foot traffic, higher employment levels, better access to opportunities, increased retail spending, and reduced transportation costs (SGA and NCSC 2015). However, planners need to be more proactive in mitigating the unintended negative impacts of complete streets, such as gentrification and displacement in low-income communities.

Early Understandings and Evolution

Economic growth and revitalization have long been identified as major benefits of complete streets. As streets became safer and more attractive, the argument went, foot traffic and the larger economy would thrive.

The body of research linking complete streets and economic activity is now quite robust. [Research](#) shows that economic activity on complete streets remains the same or increases depending on the types of businesses and other factors (Rogers 2024). A recent [study](#) of 26 complete streets projects in 16 counties between 2012 and 2019 found that an estimated \$600 million in project construction yielded about \$6 billion in total economic and community development activity (Figure 2.5) (Nelson and Hibberd 2023, 2024).

A trend that has further augmented the economic benefits of complete streets is the wider adoption of tactical interventions and portable infrastructure, such as planters, gates, and attractive barriers. Communities are using these structures to help meet the needs of multiple street users and uses, including space for festivals, markets, on-street dining, and events. The goal is to monitor and adapt to business and

marketing opportunities through flexible regulations and adaptive infrastructure options. Chapter 7 provides a deeper dive on the topic of programming streets.

Time has also revealed the potential for complete streets improvements to have unintended negative economic impacts on underserved low-income neighborhoods and communities of color. Researchers and advocates have [debated](#) whether and how complete streets elements such as [bike lanes](#) and street trees have contributed to gentrification trends and displacement of long-term residents (Cobb 2018; Soria et al. 2021). Black queer feminist urbanist Kristen Jeffers notes that [road gentrification is good gentrification](#) insofar as improvements allow all modes—and, by extension, the people traveling—to thrive (Jeffers 2015). However, if complete streets improvements attract development demand, economic pressures will result (Nelson and Hibberd 2024).

Today and Into the Future

Even though it has been established by an arsenal of data, the economic case for complete streets may still be met with skepticism. Business owners may fear that fewer on-street parking spaces or reductions in vehicular traffic will cause revenue loss. Going forward, planners must continue to communicate the economic benefits of complete streets and work with business owners early in the process to mitigate disruption and gain their support. Appendix A includes information on making this case. Planners must also appreciate that any construction, including complete streets improvements, poses disruption and inconvenience to local businesses. Signage, clear communication, and due diligence to minimize construction delays can help mitigate temporary negative impacts.

Planners also must identify the impacts that economic revitalization initiated by complete streets improvements may have on historically under-resourced communities and establish frameworks to prevent displacement, so that current residents can remain in their neighborhoods and enjoy the benefits of complete streets. For the next generation of complete streets, forward-looking policies are needed that mitigate potential unintended consequences while still prioritizing streets that serve everyone.



Figure 2.5. The economic ripple effects of complete streets on new jobs, wages, households, and development (WGI, Inc., adapted from Nelson 2024).

ENVIRONMENT AND CLIMATE

Complete streets are an important tool in preventing pollution and building community resilience to the impacts of climate change. From decarbonizing transportation by sup-

porting walking, biking, transit, and vehicle electrification to incorporating green and blue infrastructure elements, complete streets are multifaceted investments for building a more sustainable future.

Early Understandings and Evolution

When the complete streets movement was forming, the United States was tackling air pollution related to automobile emissions. Updates to the Clean Air Act in 1990 had focused heavily on vehicle standards for tailpipe emissions. Bicycle and pedestrian advocates, recognizing the power of prevention, began to promote active transportation's role in meeting air quality requirements. With the threat of climate change looming, environmental advocates promoted multimodal transportation systems to reduce this sector's contribution to greenhouse gas (GHG) emissions.

In the early 2000s, the U.S. Environmental Protection Agency (EPA) began to address the link between impervious surfaces and stormwater pollution, further linking street design and environmental impacts. The practice of [green infrastructure](#) has grown due to its ability to meet urban stormwater regulations and mitigate a range of environmental concerns (USEPA n.d.). While most transportation infrastructure is “gray,” referring to the concrete and asphalt used, a green infrastructure approach integrates trees, rain gardens, and swales to absorb and clean runoff. In Philadelphia, for example, the city's [Green City, Clean Waters](#) initiative has installed more than 2,800 green elements at nearly 800 sites throughout the city, keeping more than 2.7 billion gallons of stormwater runoff and sewer overflow out of local rivers (Philadelphia Water Department n.d.a.).

Because streets and related infrastructure can comprise up to [30 percent](#) of a jurisdiction's land area (Millard-Ball 2021), street design has become a key climate adaptation response. Permeable pavements and green infrastructure-based stormwater management systems can help complete streets better handle climate change-driven storms. Adding tree canopy to urban streets supports urban forestry programs and provides cooling during extreme heat conditions (Figure 2.6). Incorporating drought-tolerant vegetation and xeriscaping in complete streets design can avoid exacerbating water shortages in times of drought.

A good example of this shifting focus to climate resiliency is Boston's [Green Infrastructure Streets Policy](#), adopted in 2022, which complements the city's complete streets policy by addressing the [green infrastructure components](#) of streets (Boston 2022; White 2022). The policy aims to increase climate change resiliency and grow the urban tree

canopy via small-scale street installations. To address the increasing frequency and severity of extreme heat, municipalities in Arizona and California have been experimenting with cool pavement programs and seeing positive results. In 2021, Phoenix released preliminary results for its [Cool Pavement Program](#) showing that treated roads were systematically cooler than nontreated roads by approximately 10°F–12°F at noon (Phoenix 2025). The [Cool Roadways Partnership](#) aims to scale the study, testing, and deployment of cool roadway options in cities across the U.S. (Smart Surfaces Coalition n.d.).

Today and Into the Future

Given the likelihood of continued global warming, the complete streets of the future must not only help reduce emissions and pollution levels, they must also help communities mitigate and adapt to the extremes of climate change: powerful storms, large flooding events, extreme heat, megadroughts, and sea level rise. Climate change affects the infrastructure being built today and into the future, so planners need to anticipate and account for those impacts in policy decision-making and design phases. Coastal communities will also need to consider how future sea level rise may impact their roadways decades from today. Though in early 2025 the term “climate change” was [deleted from federal websites](#) under presidential executive orders, national and state guidance continues to promote resilient infrastructure through concepts of fortification and risk reduction (Yoder 2025).

Today, the transportation sector is still the [leading contributor](#) to U.S. greenhouse gas (GHG) emissions, accounting for 33 percent of U.S. emissions in 2024 (USDOT 2024b). As



Figure 2.6. Green infrastructure elements, such as trees and other vegetation, mitigate stormwater runoff and provide cooling shade (Evening_T/Getty Images)

electric vehicle sales rise and cities decarbonize through fleet electrification, the next generation of complete streets will need to consider [infrastructure](#) and [land use policy](#) to support battery electric vehicles (BEVs), electric buses, shuttles, e-bikes, and e-scooters (Lubinsky 2023; Ross 2022). But simply swapping gasoline-powered vehicles with electric models will do little to curb congestion, parking pressure, and inefficient land use. Electric vehicles are [heavier](#) due to battery weight, which may cause appreciable road damage (Bubbers 2023). Worse, the extra weight makes these vehicles [more deadly](#) to people biking and walking (Arbelaez 2023). And recent research has revealed further environmental damage caused by car usage. Seventy-eight percent of ocean microplastics are [synthetic tire rubber](#) (Pew Charitable Trust and SYSTEMIQ 2020), and a common binder used in tires is associated with [fish mortality](#) in the U.S. Pacific Northwest (Tian 2021).

Clearly, vehicle electrification is not a silver bullet for climate solutions. Sustainably transforming our transportation system requires [reducing personal vehicle use](#) (Winkler et al. 2023). That said, planners will continue to be involved with planning for EV charging stations, some of which are located along public rights-of-way (Figure 2.7). The American Planning Association’s *PAS Memo 115*, “[Planning for On-Street EV Charging Infrastructure](#),” offers guidance (Lubinsky 2023). Effective climate response relies on well-executed complete streets efforts that create safe conditions for walking, biking, and transit. Planners must work to maximize the environmental benefits of next-generation complete streets and keep them safe and comfortable to support active transportation.

PUBLIC HEALTH

Public health was one of the original pillars in the complete streets framework. The first generation of complete streets coincided with the establishment of the Safe Routes to School movement and public health officials’ calls for more active living to combat rising obesity levels. Research has [documented the link](#) between physical health and access to walking and biking paths, higher rates of physical activity, and lower obesity levels (Sallis et al. 2009). Complete streets promote physical activity in daily life by making walking and biking safer, more inviting, and more accessible.

Early Understandings and Evolution

Over the past 20 years, researchers have built a compelling argument linking activity and health. According to the



Figure 2.7. On-street EV charging station in Hillsboro, Oregon (Visitor7/Wikimedia Commons CC BY-SA 3.0)

[U.S. Centers for Disease Control and Prevention](#), just 10 minutes of moderate to vigorous physical activity per day could prevent nearly 110,000 premature deaths each year in the United States, and inadequate levels of physical activity are associated with \$192 billion in annual health-care costs (USCDC 2022). Incorporating active transportation into people’s everyday lives has been identified as a primary strategy to improve public health.

Years of real-world implementation have allowed planners to observe how complete streets affect people’s health and well-being. [Health impact assessments](#) of complete streets projects predict improvements to both physical and mental health by encouraging active transportation and exposure to trees and greenery (Florida Department of Health in Hillsborough County and Hillsborough MPO 2017). Research has shown that complete streets reduce stress, improve mental health, and foster community cohesion and social networks. A 2014 [study](#) of a transit-oriented development in Austin, Texas, found that its walkability improved both physical and mental health—especially for residents who moved there from auto-centric communities (Zhu et al. 2014).

Over the last several decades, researchers have examined what deters people from walking and biking. The [main reasons](#) people don’t ride bikes include driver aggression, poor quality of dedicated bike lanes, bad weather, and negative perceptions of cyclists (Wilson 2022). A little more than half of the population can be considered “[interested but concerned](#)” potential cyclists who have a low tolerance for traffic stress (Figure 2.8, p. 25); they require bicycling infrastructure that meets their needs for safety and com-

fort (FHWA 2019). Both real and perceived hazards deter walking. In one [investigation](#), researchers found pedestrians' overall perceived safety was significantly affected by their perceptions of both traffic characteristics and the quality of walking infrastructure (Kim et al. 2024).

Transportation choices affect public health in other ways: air pollution from vehicle emissions worsens asthma and triggers respiratory illnesses, with sometimes fatal outcomes. A 2019 [study](#) linked vehicle tailpipe emissions with 385,000 premature deaths globally in 2015, with 70 percent of those deaths occurring in the four largest vehicle markets: China, India, the European Union, and the United States (Anenberg et al. 2019). By creating space for active transportation users, complete streets can reduce the number of cars on the road, allowing communities to reap the resulting public health and environmental benefits.

Today and Into the Future

For the next generation of complete streets, safe and convenient transportation infrastructure remains a fundamental success factor for realizing physical and mental public health benefits. The growing use of electric bikes and other micro-

mobility modes offers new active transportation options that provide substantial aerobic and cardiovascular exercise. A 2019 [study](#) found e-bike riders get more exercise minutes per week than those who ride regular bikes, due in part to longer trip distances made on e-bikes (Castro et al. 2019). But these new mobility modes must compete for limited space within the right-of-way. Complete streets planning must evolve to address these new challenges. The impacts of the growing number of mobility modes are further discussed in Chapter 5.

Recent years have also shown that streets can help communities respond to public health emergencies. During the COVID-19 pandemic, [streets provided space](#) for people to safely line up outside to access grocery stores, markets, and essential services (NACTO and Global Designing Cities Initiative 2020). Streets also provided space for social services, such as pop-up medical and testing locations and distribution points for food and water, as well as wifi hotspots enabling students to attend school and employees to work remotely. Beyond users and mobility modes, flexibility in function is emerging as a key consideration in planning the next generation of complete streets. Chapter 7 examines this aspect of complete streets in more detail.

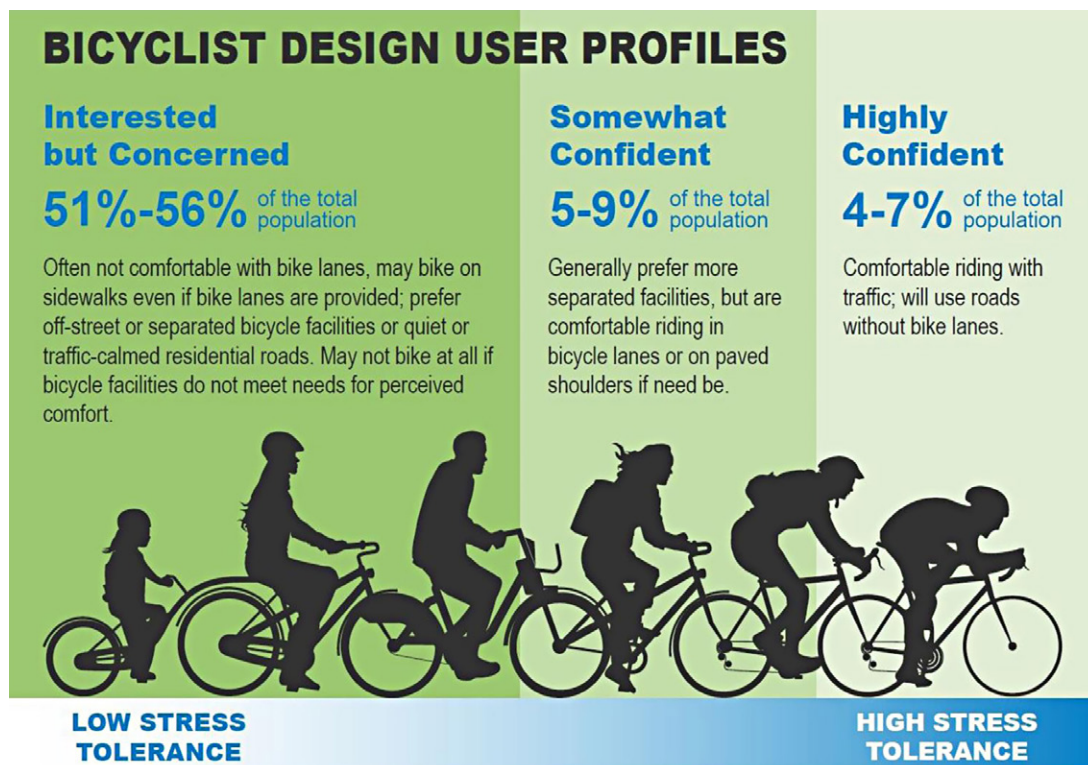


Figure 2.8. To increase cycling rates and accompanying health benefits, planners will need to provide infrastructure that makes “interested but concerned” riders feel safe (FHWA 2019)

TECHNOLOGY

The advent of new technologies since the early 2000s and the rapid acceleration of this sector in the last few years represent some of the biggest changes since the beginning of the complete streets movement. This chapter has already touched on technology changes in transportation modes. However, planners can also tap an array of new visualization, data collection, data analysis, and communications technologies for transportation and infrastructure planning, design, analysis, and public outreach. These technologies can become integral elements of the design, application, and implementation of complete streets.

Early Understandings and Evolution

The first generation of complete streets used technologies such as GIS and traffic counts to replace manual tasks with digital systems. Since that time, cameras, sensors, and the Internet of Things (IoT)—in addition to smartphone apps capturing location data and user inputs—have created vast amounts of data that artificial intelligence (AI) can turn into insight and action. The development of AI-enabled [computer vision](#) and [reality capture](#) now allows planners to quickly and cost-effectively extract spatial data from lidar surveys and drone footage (Wasserman 2025; Buck 2025). This data can further be used in [virtual reality](#) applications in the built environment to support community engagement (Mendez 2022). Through handheld devices or headsets, users can become immersed in a proposed streetscape, allowing a more interactive, digital hands-on approach for planners to showcase proposed complete streets designs. [Research-ers](#) in Norway found higher public acceptance of design alternatives with 3D digital visualization models compared to standard drawings (Skaaland and Pitera 2021). Chapter 3 dives deeper into technology’s potential for community engagement around complete streets.

Over the last decade, virtual infrastructure has become the backbone of modern mobility. People can now use their smartphones to hail ride-share services, access real-time transit tracking, use digital transit passes, and plan trips (Figure 2.9). As one example, Pittsburgh launched its [Move PGH](#) pilot program in 2021 to make it easier for people to get around the city without a car (Pittsburgh 2023). The user-friendly app consolidated all available mobility options in one place and allowed users to plan their trips using a combination of mobility modes. Schedules and payment options were also consolidated in the app, making it easy for users to access multiple modes.

To help planners and other stakeholders understand the evolution of technology options for local roadways, the report [Digital Local Roads: Realising the Full Potential of Local Roads](#) examined connected digital technologies for streets in the United Kingdom (ADEPT et al. 2022). The guide highlights potential solutions for meeting the challenges of climate change, budgetary pressures, and the pace of technological development, which in turn support greater collaboration and data sharing between authorities, improved asset management, social benefits, better user experiences, and environmental improvements.

Today and Into the Future

In 2019, the American Planning Association launched [APA Foresight](#) to help planners navigate change, understand trends, and develop tools for incorporating uncertainty into planning policies and projects (APA 2019). Technology is proving to be one of the most disruptive drivers of change affecting planning, and by extension, complete streets, adding a new element for planners to consider in their work on complete streets.

Data-driven processes will continue to enhance planning practice. New AI-powered tools will help planners identify new areas for complete streets interventions and track the performance of existing complete streets policies and projects. The challenge will be in determining what data is needed, how to collect data in cost-effective ways, how to analyze multiple data sets, and how to communicate and apply results. Chapter 8 and Appendix C discuss data management and metrics for complete streets in further detail. Planners will need to familiarize themselves with digital infrastructure, such as mobility apps, real-time tracking



Figure 2.9. Mobile apps make use of virtual infrastructure that supports multimodal travel planning and payment, making transit, walking, and biking convenient and intuitive (CC BY-SA 4.0)

systems, and online or digital payment options for services, to understand how it will inform the designs and functions of complete streets.

Planners must also consider the implications of technology use for the physical world. Infrastructure such as 5G antenna systems, wifi, advanced sensors, fiber optics, dynamic signage, smart streetlights, e-bike- or e-scooter-share docking stations, EV chargers, and interactive kiosks will all compete for limited real estate in a municipality's rights-of-way. Planners will need to determine how to incorporate these features in next-generation complete streets projects. The [33 Smart Mobility Corridor](#) in Columbus, Ohio's Beta District, created to test connected vehicle technology, offers a glimpse into a possible future. Developed as part of the city's USDOT Smart City Challenge Grant, the corridor's network of fiber-optic cables enables high-speed communication between roadside traffic monitors and vehicles to transmit warnings to drivers, such as inclement weather or hazardous conditions, and improve efficiency by reporting traffic counts, congestion, or delays (Beta District n.d.).

While technology offers opportunities, planners should not [use technology](#) for technology's sake, but rather for meeting people's mobility needs and solving their challenges (Hurtado 2021). In some cases, technology has solved one barrier to mobility while exacerbating others. For example, [transportation network companies](#) (TNCs) such as Uber and Lyft have expanded transportation choice but have increased congestion, vehicle miles traveled, and emissions (Sheldon and Dua 2024). Likewise, the enthusiasm over connected vehicle technology is spilling over to active travel. [Vehicle-to-pedestrian \(V2P\) technology](#) is touted as a solution for making motorists (or autonomous vehicles) and pedestrians more aware of each other's presence to prevent crashes and fatalities (Mahdinia, Khattak, and Mohsena Haque 2022). However, ongoing [V2P challenges](#) include accurate positioning and information exchange, cellular network congestion, impacts on smartphone battery life, unreliable pedestrian and cyclist recognition by these systems, and the need for travelers to have devices that are always on (Kabil et al. 2022). Planners should critically evaluate emerging technologies and tools for their ability to support the next generation of complete streets planning, design, and implementation.

PROGRAMMING AND MANAGEMENT

Streets are more than static physical infrastructure. The last few years have highlighted the benefits of programming

and managing streets for purposes beyond mobility, adding another new element to consider when planning, designing, and managing complete streets.

Early Understandings and Evolution

The concept of using streets to serve multiple objectives and support different functions at different times is not new. Communities have long closed streets for markets and special events. Street signs traditionally direct street use throughout the day, providing information on which activities (e.g., parking, loading) are allowed and when.

Alongside early complete streets efforts that integrated alternative modes and additional users within car-centric streets, the last two decades have seen growing movements to expand the functionality of streets. The first "[Park\(ing\) Day](#)" event in 2005 turned on-street parking spots into temporary "parklets" (Figure 2.10), which in some cases became seasonal or permanent installations (Rebar Group n.d.). The [tactical urbanism](#) movement expanded the practice of installing flexible, short-term projects in public rights-of-way, bringing street art and placemaking to the fore (Street Plans Collaborative 2016).

In addition, local governments have begun to view [streets and curbs](#) as real estate assets that can be programmed depending on demand (Nichols and Dorsett 2021). And in the early 2020s, the onset of the COVID-19 pandemic forced the use of public rights-of-way for new purposes. In [New York City](#), repurposing streets for social distancing and outdoor dining helped keep businesses open



Figure 2.10. "Parklets" turn on-street parking spaces into temporary public spaces (Wagner Tamanaha/Wikimedia Commons CC BY-SA 2.0)

and created a robust foundation for economic recovery (NYCDOT 2022), though [maintaining these programs](#) post-COVID has proven challenging (Duggan 2025).

Today and Into the Future

With the advent of new technologies and ways of thinking about public space, the next generation of complete streets should be fluid in function, changeable over time to meet the demands of their users. The concept of programmable streets highlights streets as flexible and dynamic social spaces that help meet a community's wider set of social, environmental, and economic goals.

As shown with the “[slow streets](#)” and curbside dining movements spearheaded during the pandemic (Glandorf 2020), streets can be programmed to perform economic, cultural, and social functions, such as hosting festivals, farmers markets, and community events. Planners can now program streets physically, digitally, and financially through modular infrastructure, flexible street designs, digital infrastructure, and curb management strategies. Likewise, traffic engineers have new abilities to dynamically change speed limits, parking parameters, curbside uses, and traffic flow using real-time monitoring and traffic pattern data to match supply and demand for streets, transitways, curbs, and cycling infrastructure. Programming can also enhance safety when and where needed, as with morning and afternoon slow zones for schools. Streets can also be programmed as evacuation or alternative routes during emergencies.

The increasing use of streets for functions besides transportation will require additional safety considerations, which was demonstrated by the January 1, 2025, [truck attack](#) in New Orleans on Bourbon Street (Bowman 2025). Because the driver was able to evade barricades and police cars, cities are now increasing security by using large vehicles such as trash trucks to block off streets, expanding perimeters for special events, and investing in more secure bollards and barriers.

Clematis Street in West Palm Beach, Florida, is one example of how a street can be programmed differently on a daily and weekly basis (Figure 2.11). The curbsless design allows for easier pedestrian navigation between the sidewalk and roadway. Retractable bollards are used to open and close off specific areas, depending on the time of day. On-street parking spaces are used by visitors and delivery vehicles during the day and are repurposed for outdoor dining patios in the evening. On the weekends, entire sections are pedestrianized for weekly block parties and farmers markets.

Planners will need to learn how to maximize the potential of next-generation complete streets through flex-

ible design and programming as streets move beyond mere mobility spaces. Programming streets is discussed in further detail in Chapter 7.

CONCLUSION

As the complete streets movement enters its third decade, a retrospective reveals success and areas for improvement. The movement's success lies in contributions from a varied array of stakeholders who recognize the power of multimodal infrastructure to achieve wider community benefits.

Much has changed since the beginning of the complete streets movement in the early 2000s. The factors that inspired the movement are still critical, while complexity has grown. The next generation of complete streets must consider a burgeoning number of new modes and users in the limited space of the public right-of-way. Creating complete



Figure 2.11. Clematis Street in West Palm Beach, Florida, combines a curbsless design and retractable bollards to facilitate programming (WGL, Inc.)

COMPLETE STREETS PROCESS ELEMENTS

The 10 topical elements discussed in this chapter offer planners a comprehensive yet nuanced understanding of the multiple functions and benefits of complete streets. The following six aspects can help planners think more holistically about approaching complete streets planning and implementation.

Paradigm: The complete streets movement was born as a new approach to thinking about infrastructure and the way people travel in their towns, cities, and counties; in other words, a paradigm shift. Planners should think about complete streets as an overarching concept that drives multiple objectives for street design and encompasses different agencies, departments, and stakeholder engagement efforts.

Policy: Policy is a set of rules for decision-making typically enacted by a governing body. Complete streets policy can take many forms. For example, a local complete streets effort may begin with a resolution that outlines purpose and need. From there, a jurisdiction or agency can craft a policy framework outlining goals, alignment with other regulating documents, roles and responsibilities, outcomes, and overarching process or methodology. Policies can also be detailed to target specific goals or priority actions, such as implementation requirements or directions on future policy review and modification. Chapter 4 examines complete streets policy.

Program: Municipalities and agencies develop programs to link policies to work plans and projects. Complete streets may be housed within existing programs (i.e., transportation, mobility, or planning) or stand alone. A complete streets program establishes schedules and actions to achieve policy outcomes. Those steps may be laid out in a plan and typically include goal setting, an assessment of existing conditions and gaps, identification and prioritization of potential infrastruc-

ture and program needs, and a framework for implementation, including funding and performance tracking. An organization may have specific rules for establishing and operating programs, including items such as staffing, budget processes, and reporting.

Project: A project can be [defined](#) as a sequence of tasks that must be completed to attain a certain outcome (Gutterman 2023). For complete streets, the term “project” may refer to physical infrastructure installations, such as bike lane segments or intersection improvements, as well as education, outreach, and training. Communities may also refer to plan or program development as a project. As such, the term may be applied to a wide range of activities.

Performance: An important aspect of implementation is determining whether complete streets policies and projects meet expectations. This entails establishing goals and target metrics that allow managers to adjust policy when implementation falls short of expectations. Thinking early on about how to measure success enables planners to build a strong data strategy that follows plans into implementation and produces more in-depth and accurate results. Chapter 8 takes a closer look at complete streets and performance metrics.

Preparedness: Planners must deal with a wide range of changing conditions and priorities that inject uncertainty into planning processes. Shifts around climate change, technology, equity, and federal actions are impacting mobility and, by extension, complete streets. Planners may encounter the term “future-proofing” to describe this process of understanding and preparing for change. The American Planning Association has formalized [foresight](#) as a practice area, recognizing the importance of factoring trends and uncertainty into community and transportation planning (APA 2025).

networks for all modes remains a key goal. Designing streets that match their built environment context has become easier as federal guidance has incorporated these principles, but an expanded understanding of context must also address economic, social, and cultural considerations.

Though the number of traffic-related deaths and injuries has plateaued, casualties continue to be unacceptably high,

and planners must work to ensure the next generation of complete streets improves safety for all users. The meaning of access has expanded from usable by all, regardless of ability, to encompass getting all users to where they need to go. The economic benefits of complete streets improvements have been proven many times over, but planners must also guard against the unintended consequences of gentrification and

displacement. The environmental and public health benefits of getting travelers out of their cars and using active transportation modes are ever more important, so planners must ensure that complete streets remain safe, comfortable, and resilient in the face of climate change and extreme weather impacts. Finally, advances in technology offer new tools for planners designing, implementing, and managing complete streets, while recent societal shocks such as the COVID-19 pandemic highlight the importance of programming streets to serve more functions than just transportation.

In addressing all of these elements of complete streets today and into the future, planners will need to combine skills that address the “tried and true” approaches that have proven successful over time with the flexibility to anticipate and incorporate trends into complete streets programs, plans, policies, and projects. The following chapter will discuss how to identify the stakeholders needed to move forward, as well as engagement techniques for reaching varied stakeholder groups.



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- 40 Messaging
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03 ENGAGEMENT AND COMMUNICATIONS FOR COMPLETE STREETS

Public engagement is a cornerstone of developing complete streets policies and implementing complete streets projects. [Meaningful public involvement](#) in transportation decision-making is key to project success, as opposition to infrastructure projects and resulting delays can often be traced back to poor communication (USDOT 2022). Because the design and function of streets affect a multitude of stakeholders, planners must employ robust and equitable public engagement processes that consider a community's full range of concerns, issues, needs, and solutions.

The interaction between the public and the local government implementing a complete streets program, or the entities sponsoring a complete streets project, goes by many names. The choice of phrasing matters. Terms such as *outreach* and *education* imply a one-way relationship, while terms such as *participation*, *involvement*, and *engagement* imply the public has a substantial role in the decision-making process. This PAS Report uses *stakeholder engagement* or *public engagement* to describe the interaction between complete streets program managers or project sponsors and community members.

Complete streets poses specific public engagement challenges. These relate to the technical nature of street design, growing competition for roadway space, and an [entrenched car culture](#) rooted in American history, language, regulations, and engineering standards (Kreps 2019). A fallback position of “we’ve always done it this way” can result in transportation agencies treating public involvement as a one-time event or a box to check in the project life cycle, as opposed to an intentional, dynamic process that continues throughout all stages of project development.

Furthermore, because every stakeholder has a different idea of what success looks like, complete streets projects will have multiple factions in conflict over what will make the street “complete.” To mitigate this conflict, planners need to understand what makes streets “incomplete” for different people. As Steven Zavestoski and Julian Agyeman, in their essay “[Incomplete Streets: Who is Missing from ‘Complete Streets’?](#)” (2018), ask: are all street users, in fact, gaining safe access to streets “regardless of age, ability, income, ethnicity, or mode of travel”?

A street that is complete in terms of technical criteria can still fall short because the right people were not involved in defining success or completeness. When considering diversity, planners must go beyond types of users and modes of travel to include the larger dynamic of streets as places rooted in contexts of history, injustice, and social meaning.

This chapter explains the importance of public engagement in successfully implementing complete streets programs and projects. It analyzes the evolution of public engagement, legal requirements for engagement, the shortcomings of conventional public outreach approaches, and steps to overcome exclusionary practices. It explores how to identify and analyze stakeholders needed to address the range of complete streets opportunities and challenges. From there, it covers the creation of effective messaging and engagement strategies and techniques using both “tried and true” and novel tools. The chapter offers best practices, research, guides, toolkits, and templates based on extensive research and fieldwork addressing effective, efficient, and equitable ways to conduct public engagement for complete streets. Finally, it describes recommended practices for recording and reporting on public engagement efforts.

PREPARING FOR PUBLIC ENGAGEMENT

The public engagement process needs to begin [early](#), often before a complete streets program or project is officially listed in a work program (Public Agenda 2007). When preparing to initiate a complete streets effort, developing a public engagement plan, or PEP, is a vital first step.

THE FUNDAMENTALS OF PUBLIC ENGAGEMENT

The concept of equitable public participation was formalized in Sherry Arnstein's 1969 "Ladder of Citizen Participation" (Arnstein 1969). Arnstein encouraged planners to move away from one-sided relationships with the public that sought to merely inform stakeholders. Instead, she urged them to shift towards a more democratic process in which the public had delegated power and real influence on plans and projects.

The International Association for Public Participation (IAP2) later refined the major elements of Arnstein's Ladder into the IAP2 Spectrum of Public Participation (Figure 3.1). The Spectrum was designed to assist planners with selecting the level of participation that defines the public's role in the public participation process. It is commonly used in public participation plans and is a powerful resource for planners developing their public engagement strategies (IAP2 2018).

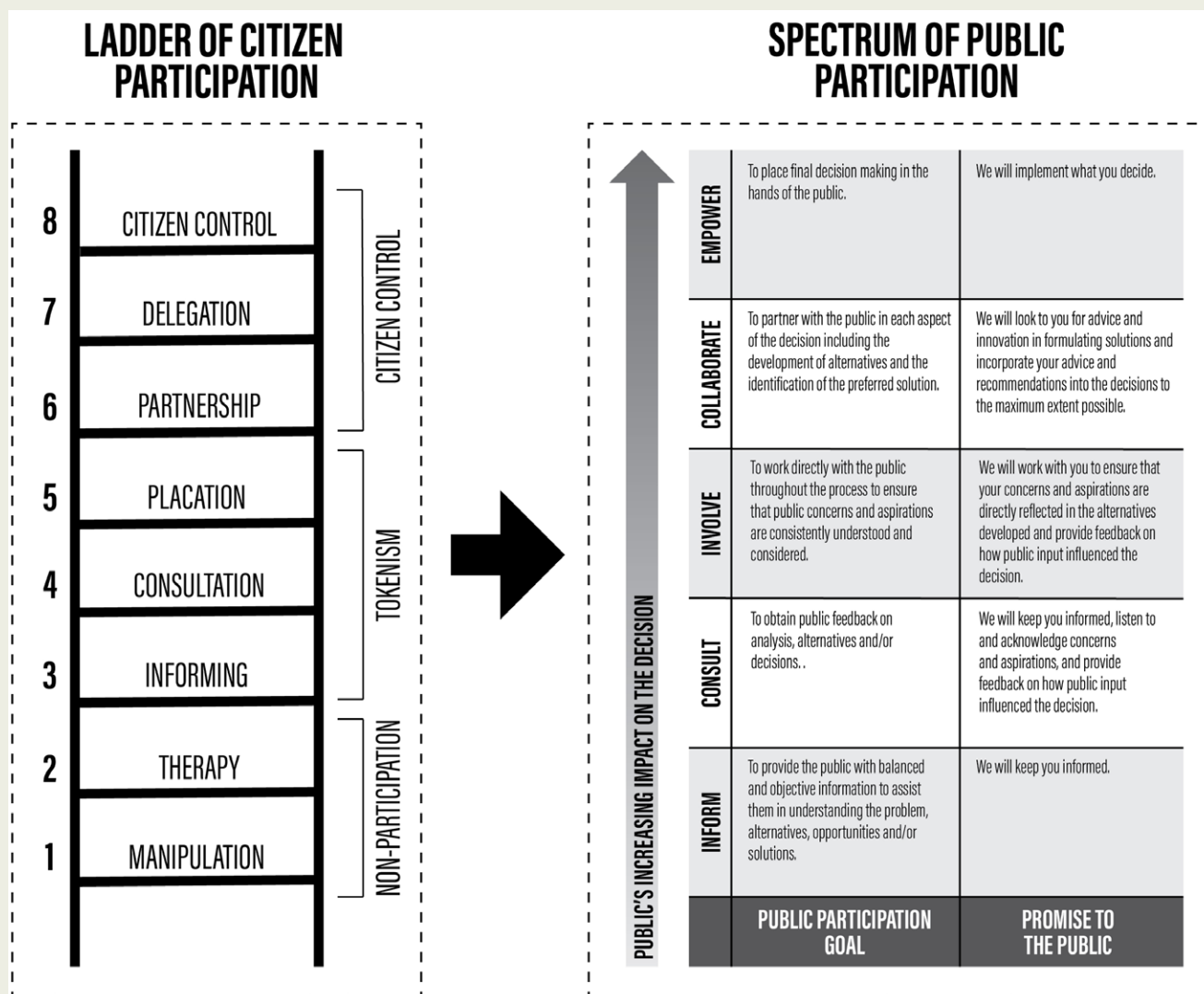


Figure 3.1. The framework for public engagement has evolved from Arnstein's Ladder to the IAP2 Spectrum of Public Participation (adapted by WGI, Inc.)

CREATING THE PUBLIC ENGAGEMENT PLAN

A complete streets public engagement plan (PEP) should be a shared, “living” document for team members. Contents should include the following, though a co-creation process with engagement partners might generate additional items:

- Project vision, goals, and objectives
- Engagement performance metrics and measures
- Branding (logo, colors)
- Accessibility standards
- Regulatory and legal requirements or guidelines
- Project process
- Data collection plan
- Website
- List of written collateral to create
- Social media guidelines and messages
- Key messages (or cross-reference to a messaging guide)
- Steering committee (or equivalent) names and contact information
- Stakeholder identification process and lists
- Engagement tools and techniques
- Schedule and engagement calendar of events
- Meeting preparation checklist
- Appendices: meeting preparation checklist, post-event summary, glossary of terms, maps

A PEP is often used within government-funded plans and projects to establish principles and processes for engagement, create processes for stakeholder identification and involvement, define goals and objectives, and identify specific approaches and tools. Depending on jurisdiction and funding parameters, a PEP is often legally required. Planners should know whether a PEP is mandated for their projects and what regulations and requirements apply. Additional guidance and resources for creating a PEP are provided in the sidebar above.

The National Complete Streets Coalition likewise emphasizes the importance of community engagement. In [evaluating and scoring](#) complete streets policies, Smart Growth America gives the highest points for implementation policies that include a community engagement plan with specific strategies for public engagement throughout the project selection, design, and implementation process,

Planners can consult the following resources and examples when developing an engagement plan for planning, transportation, and complete streets projects.

- [“Creating a Public Engagement Plan,”](#) Institute for Learning & Brain Sciences, University of Washington (I-LABS) and Center for Advancing Research Impact in Society (ARIS) (2022)
- [Integrated Public Involvement: The MPO Guide to Best Practices Across Traditional and Virtual Methods](#), Public Input (2021)
- [A Six-Step Public Engagement Guide for Capital Projects](#), Arlington County, Virginia (2022)
- [Public Engagement Guide](#), City of Fort Collins, Colorado (2011)
- [Public Engagement Plan](#), Michiana Area Council of Governments (2019)
- [Public Engagement Plan](#), Richmond Regional Transportation Planning Organization (2020)
- [Public Engagement Toolkit](#), North Jersey Transportation Planning Authority (n.d.)

including strategies to engage underrepresented communities (Hanzlik and Davis 2023).

Key Tools and Considerations for Public Engagement

In reviewing the literature related to improving public engagement, the following elements emerge as important components in developing a public engagement program and preparing for its implementation.

Situation assessments

Situation assessments use early fact-finding to identify the conditions necessary for a productive public process. The outcome is a high-level inventory of both internal and external factors that could affect project success.

The results of an internal assessment establish (1) who has authority over project approval, (2) problem definition,

(3) preliminary stakeholders, (4) available resources, and (5) the level of public engagement expected. An external assessment uses short interviews to determine stakeholder views on a project’s “need and purpose” statements, thoughts on how to shape public input, and issues and constraints. The U.S. Environmental Protection Agency’s [Public Participation Guide](#) offers further guidance in developing a situation assessment (USEPA 2025b).

Advisory groups

An advisory group is a structured team that allows participants to share opinions and perspectives, study issues, and develop recommendations. Establishing an advisory group with ties to community members, especially those who have not been well represented in previous community design conversations, is a good way to begin a complete streets public engagement process.

For more complex projects, planners can incorporate multiple advisory groups with different insights and perspectives. This strategy allows the planning team to target specific demographics and provide a more focused and deeper analysis of complex issues. For example, Tucson, Arizona’s complete streets program convened a “[brain trust](#)” of local advocates to explore the intersection of transportation infrastructure and challenges facing low-income communities of color (Ingram et al. 2020). These efforts resulted in specific equity language being included in the policy.

Guiding principles

Guiding principles define the decision-making process. Planners need to establish initial guiding principles to properly manage the range of viewpoints, conflicting demands, and variable expectations involved with infrastructure investment. This is similar to establishing community ground rules for public forums.

Guiding principles establish processes for resolving disputes and reinforcing the importance of diverse viewpoints. They should address and emphasize wider community values, such as neighborhood vibrancy and public health. For instance, Tucson adopted [guiding principles](#) of safety, accessibility, equity, diversity and inclusivity, land use, environment, and economic vitality for its complete streets program (Tucson 2019).

Stakeholder identification, analysis, and relationships

Given the importance of equity in complete streets, planners must identify a wide range of stakeholders for the greatest diversity in representation. Stakeholder identification is

discussed in detail below, but an important way to begin is by asking [three essential questions](#) about a complete streets program or project: Who is helped? Who is harmed? Who is missing? (Ezell 2022). It is also prudent to conduct a deep analysis of opinions and potential impacts, both positive and negative, among stakeholder groups.

Identifying stakeholders is only the beginning. Engagement also includes organization, communications, monitoring, and relationship-building throughout the planning process and beyond. Stakeholders should also be appropriately compensated for their time and expertise.

Messaging

A growing body of work demonstrates the effectiveness of complete streets projects and policies and refutes statements used in opposition to new street designs and policies. Researchers have compiled evidence on the types of messaging that resonates with the public and elected officials. Appendix A offers talking points for complete streets on a wide range of relevant topics.

Managing expectations is another facet of effective messaging. Planners must convey realistic boundaries for what can and cannot be considered for a project based on engineering standards, safety rules, and legal constraints. Messaging for complete streets is addressed in further detail below.

Engagement and communication techniques

Many traditional communication techniques—brochures, flyers, and meetings—are still popular with the public. However, the internet and social media have revolutionized the way we communicate, adding new channels for content delivery and stakeholder input. Innovators are continuing to revamp in-person engagement to better meet people where they are, both physically and along the community design learning curve. Planners need to embrace new digital tools and meeting formats to ensure that communication remains a powerful force to drive positive change. Engagement techniques are covered in detail later in this chapter.

Regulatory Requirements for Public Engagement

Planners need to be aware of regulatory requirements at the federal and state levels governing public engagement for complete streets planning and capital projects.

Any project using federal funds will require adherence to several key federal statutes for “[meaningful public involvement](#),” defined by the U.S. Department of Transportation (USDOT) as the creation and implementation of equi-

table programs and plans using a diverse and inclusive range of communications and engagement tools and methods throughout the project or program lifecycle (USDOT 2022).

- **Civil Rights Act, Title VI.** [Title VI](#) of the Civil Rights Act of 1964 prohibits discrimination in programs and activities receiving federal financial assistance. The USDOT Title VI program requires that USDOT operating administrations develop comprehensive community participation requirements through a community participation plan that applicants and recipients must satisfy as a condition of receiving federal financial assistance.
- **The National Environmental Policy Act.** [NEPA](#) requires organizations to examine and publicly disclose the environmental effects of major federal actions significantly affecting the environment. Agencies must provide meaningful opportunities for public participation at two stages: when beginning the NEPA analysis and when publishing the NEPA draft document for review and comment. NEPA applies to federal projects and programs that are entirely or partially funded by federal agencies

and that require a federal permit or other regulatory decision, which may include larger complete streets projects.

Appendix A in USDOT's [Promising Practices for Meaningful Public Involvement in Transportation Decision-Making](#) offers planners a comprehensive collection of suggested practices to promote meaningful engagement (Figure 3.2). This guide was published in 2022 to help transportation agencies develop more meaningful public involvement and participation under Title VI of the Civil Rights Act of 1964, NEPA, and other requirements (USDOT 2022).

Planners should also be aware of any state-level requirements for stakeholder engagement for complete streets projects located on state roadways. As one example, the [Ohio Department of Transportation](#) provides extensive guidance on public involvement requirements and practices for state transportation system projects, including a toolbox of templates and resources (ODOT n.d.).

At the local level, public engagement requirements may be embedded in the comprehensive plan, transportation plans, or an agency's operating policies. Planners



Figure 3.2. USDOT's features of meaningful public involvement (USDOT 2022)

should review any relevant local documents to determine applicable requirements.

STAKEHOLDER IDENTIFICATION AND ANALYSIS

Transportation and infrastructure issues will always be of interest to a core group of stakeholders in complete streets projects. However, as wider issues of equity, access, and mobility have become more prominent, the constellation of interested parties affected by infrastructure design has grown. As such, stakeholder identification and analysis are essential to the planning process.

Public engagement fails when it is limited to a small group of stakeholders familiar with public processes. Obtaining diverse views from affected populations requires a targeted approach, especially when reaching out to historically underserved communities. The sidebar on p. 38 delves deeper into such efforts.

The three main steps in the stakeholder identification and analysis process are (1) stakeholder identification and classification, (2) stakeholder impact and interest, and (3) stakeholder mapping to determine shared interests or conflicts among stakeholder groups.

The Stakeholder Identification Process

The stakeholder identification process is intended to ensure robust representation of people and organizations with a stake in decisions related to complete streets. It consists of three main steps:

- **Developing a stakeholder list.** The first step is to develop a list of internal and external stakeholders, both individuals and organizations. A situational assessment, mentioned above, can provide a good starting point. This list may change over time depending on project length and community members' mobility needs. Planners should look beyond traditional complete streets stakeholders to engage communities and people familiar with other neighborhood mobility and access issues.
- **Forming a working group.** The second step is to form a working group, whether a steering committee, advisory board, sounding board, or focus group. This group will provide valuable expertise and feedback on documents and presentations before they are made publicly available. Make sure to understand whether such a group is subject to [sunshine laws](#) (LII 2025), which could determine whether public meeting procedures apply.

- **Categorizing stakeholders.** The third step is to classify stakeholder individuals and groups. Traditional categories of complete streets stakeholders include property and business owners, active transportation groups, public health officials, city department representatives, and groups interested in safe routes to school. Together, these groups should reflect community diversity.

Once stakeholders are categorized, planners can better analyze their interest levels in and needs for complete streets.

Documenting Stakeholder Interest and Impact

Once planners have identified and classified stakeholder groups, they can document their key issues and concerns. For all meetings with stakeholders, planners should take thorough yet succinct notes and share meeting records promptly with all stakeholders to identify and address any misunderstandings.

Community members may hold a variety of views on complete streets projects. For example, while some residents might welcome a road diet to calm traffic, their neighbors may oppose interventions on the grounds of potentially slower travel times. Renters may fear possible displacement more than homeowners, viewing infrastructure improvements as the first step in [gentrifying](#) the neighborhood (Zavestoski and Agyeman 2018).

Gathering this information will help planners determine stakeholders' levels of interest and likely involvement



Figure 3.3. Segmentation of stakeholders relative to support or resistance (WGI, Inc.)

ENGAGING HISTORICALLY UNDERSERVED COMMUNITIES

Communities are seeking more effective methods for setting up two-way conversations with the public, particularly with historically underserved communities. Community-based organizations (CBOs) that operate at local or grassroots levels can be good partners, as they often work in underserved communities.

[Researchers](#) at the University of California Institute of Transportation Studies interviewed leaders of CBOs representing communities of color, juveniles in the justice system, and low-income communities (McCullough and van Stokkum 2021). Through the interviews and research on successful efforts, 10 key themes of working with CBOs emerged:

- **Trust is crucial.** Residents will show up and engage because people or organizations they trusted invited them. Cities can build partnerships and trust to engage with historically marginalized communities.
- **CBOs should be treated as equal partners.** CBOs are not consultants, but equal partners with unique expertise and power.
- **Pay community partners fairly.** CBOs provide valuable access and sophisticated local cultural knowledge. They should be paid as experts, and community members should be compensated for their participation. This should be accounted for within the stakeholder outreach budget.
- **Let CBOs decide what good community engagement is.** CBOs know their constituencies and what will get them to them show up. Let them take the lead in planning engagement processes and events.
- **Translate technical jargon.** Planners must translate bureaucratic processes and technical details into plain language to ensure that community members have full information to support decision-making.
- **Engage in community concerns beyond the scope of the project.** Planners must be willing to engage in ongoing conversations beyond infrastructure and transportation.
- **Address major community concerns such as displacement, policing, and youth development.** George Floyd's murder raised national attention to the fear and danger experienced by Black residents when encountering law enforcement in public spaces. In this context, the notion of complete streets takes on new meaning, as does the definition of safety. Researching community concerns

ahead of time and being prepared to address them in a meaningful way will help define and achieve goals.

- **Know local histories of transportation injustice.** The United States has a history of using transportation infrastructure and planning to harm Black communities (Archer 2021). Planners should enter into public engagement processes knowing this history and local examples of injustice, and they should be prepared to formulate new projects in ways that amend these past harms.
- **Include the community in the final reporting process.** When documenting the community engagement process in final reporting, planners should include the community in the process. Give credit for their contributions and ask them for feedback on report drafts. Consider how final recommendations can support the work of partner CBOs.
- **Follow up on planning with timely implementation.** While involvement in the planning process means a lot, immediate follow-through on community recommendations means even more. Consider setting aside funds for quick-build or pilot projects. Update CBOs regularly to let them know the status of implementation plans.

PAS Report 593, [Planning With Diverse Communities](#), offers further information on understanding inequality, planning challenges, and tools for planning with diverse communities (Garcia, Garfinkel-Castro, and Pfeiffer 2019). The Ohio Department of Transportation's [Active Transportation Plan Development Guide](#) is another helpful resource that summarizes the cost and reach of common engagement strategies to assist planners in reaching underrepresented communities (ODOT 2021). Cities may also have community advisory committees dedicated to equitable engagement, such as Ann Arbor, Michigan's Equitable Engagement Initiative, which developed a [report](#) offering recommendations for more equitable engagement practices (Ann Arbor 2023).

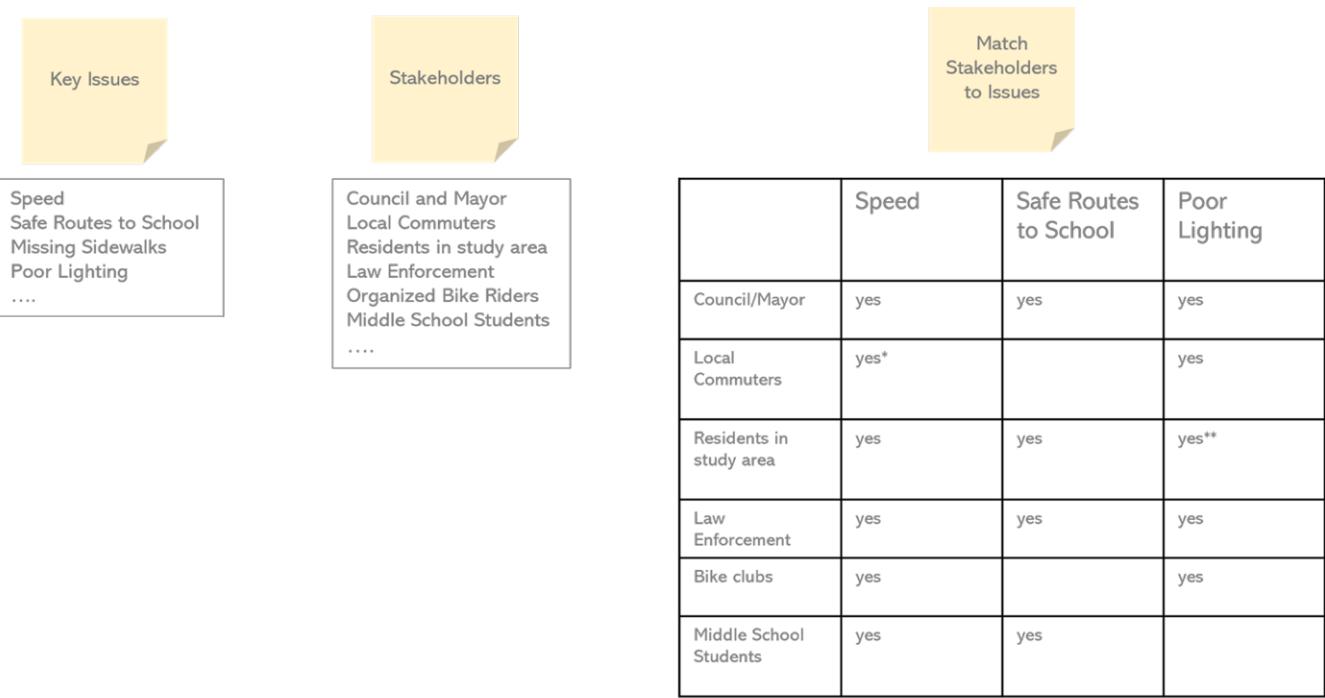


Figure 3.4. Charting stakeholders to facilitate analysis and reveal the potential for alliances across diverse groups (WGI)

* Some commuters may object to traffic calming
** Some residents may object to additional lighting

throughout the process. Once planners have a list of key stakeholders, they can develop a chart of key concerns. In early planning stages, planners may draw on anecdotal or background knowledge, though it is important to build and verify information through public engagement events and online surveys.

Next, a recommended practice is to translate stakeholder information into a support/resistance matrix, as shown in Figure 3.3 (p. 37). This matrix helps identify champions and potential opponents who will require specialized listening, communications, and engagement. In doing so, planners can better understand and craft responses to criticism and opposing views.

Stakeholder Mapping

Another useful exercise is stakeholder mapping (not to be confused with identifying stakeholders geographically on a map). This approach graphically organizes stakeholder groups and issues to facilitate analysis and shape targeted engagement strategies. Though it requires additional time and resources, this detailed analysis allows planners to better target messaging and engagement methods.

Figure 3.4 shows one approach to stakeholder mapping, in which a list of stakeholder groups is charted against a list of key issues to identify common areas of interest and reveal the potential for alliances across diverse groups.

The final step is creating a stakeholder analysis matrix (Figure 3.5, p. 40) that combines the information needed to develop a working document for the engagement strategy and plan. The main pieces of information for stakeholder analysis include the following:

- **Stakeholder name and contact information.** This will keep contact information in one document. This column can be groups, individuals, or both.
- **Impact.** This column provides a snapshot of impacts and whether they are high, medium, or low. In a more rigorous analysis, planners can provide more depth and details, as in some cases impact will depend on circumstances.
- **Influence.** This column is a snapshot of level of influence. Note that while a stakeholder group may be deemed low in influence, certain members of the group may have high influence. Be sure this analysis includes both.

- **What is important to this group?** Within this column, summarize key issues.
- **How can this group contribute?** Documenting this information helps identify how a stakeholder group can turn interest into action.
- **How can this group obstruct?** Likewise, it’s important to understand potential points of conflict.
- **Strategy for this stakeholder group.** This final column will assist in building targeted messaging and engagement techniques.

This matrix can later be adapted in the larger engagement plan to inform messaging, plan key events, and maintain a record of communication.

For more information and variations on stakeholder analysis for transportation and infrastructure projects, see the section on [stakeholder analysis](#) in the Institute for Transportation and Development Policy’s BRT Planning Guide (IDTP 2017) and the Idaho Transportation Department’s Procedures Manual chapter on [working with stakeholders](#) (Idaho Transportation Department 2017).

MESSAGING

The importance of messaging is demonstrated by the origins of the complete streets movement, which came about

because cycling advocates recognized the need to replace the term “routine accommodation” with a term having wider appeal. Barbara McCann of America Bikes and David Goldberg of Smart Growth America began to promote the term “[complete streets](#)” as a replacement in 2003 (McCann 2010).

At the time, a growing coalition of cyclists, pedestrians, transit users, health professionals, and aging population activists joined the complete streets movement to shape local, state, and federal policy. Due to the wide range of interests among complete streets activists, promotional materials touched on a cornucopia of benefits associated with multi-modal street design, such as better health, a cleaner environment, and increased mode choice.

Crafting a simple, overarching message about a subject as complex as complete streets that resonates with each faction of a diverse coalition (as well as the general public) can be a major challenge to planners. Today, the movement has identified a handful of effective and overarching frames and techniques to help planners advocate for complete streets.

- **Reframing the roles of streets.** With their message that streets are no longer just for moving cars, advocates have greatly expanded streets’ roles and functions. This has led to the concepts of reframing “[streets for people](#),” which expands the diversity of uses, and “[streets as real estate](#),” which invokes new management techniques (NYC Comptroller 2025; Swope 2010). Following these con-

Stakeholder Name	Contact (phone, email, address for mailers)	Impact (High/Med/Low)	Influence (High/Med/Low)	What is important to this group?	How can the group contribute?	How can the group obstruct?	Strategy for this stakeholder group
Council/Mayor		High	High	Voter satisfaction, liability, funding	Be a champion	Over-reliance on narrow band of input	Show broad support for project
Local Commuters		Medium	Medium	Travel time, congestion, safety	Support for projects and lighting	Oppose redesign	Research results, speakers
Bike clubs		Medium	Low	Quality bike facilities, lower speeds	Email blasts, meeting attendance	Slow process to get quality bike facilities	Trade off analysis
Middle School Students	School PTA	Medium	High	Safety, Lighting, Safe Routes to School funds	Be a champion, emails, meeting attendance	Some parents may oppose if interferes with car drop off	Research, examples of other PTA involvement

Figure 3.5. Example of a stakeholder analysis matrix (WGI, Inc., adapted from Tools4Dev.org 2022)

cepts, municipalities are redesignating on-street parking for higher and better uses, including outdoor dining, bike infrastructure, ride-share pick-up/drop-off zones, and space for delivery vehicles.

- **Equity and investment.** Communications regarding equity must address how projects remedy historic underinvestment in a community. Ample research shows how urban highway construction and suburban zoning codes with historical links to [redlining](#) have created a spiral of disinvestment and hazardous roadway conditions (Rothstein 2018). Messaging and framing must highlight the lingering harms and explain how inclusive engagement leads to infrastructure projects that redress those harms and build access and opportunity.
- **Capacity building.** Education is an important aspect of complete streets, but it needs to be paired with purpose. *Capacity* describes how a community turns learned material into action. Action requires knowledge of legal frameworks, regulations, funding mechanisms, and the decision-making process. Within a complete streets framework, capacity extends to the ability to monitor and intervene when needed. The Chicago-based nonprofit organization and racial equity movement Equiticity builds capacity through its [Community Mobility Rituals](#) program (Equiticity n.d.). In contrast to one-time events, Equiticity offers community bike and scooter rolls, walking tours, public transit excursions, and street festivals on a continuous basis.
- **Research.** Planners can now rely on two decades of research on complete streets' effects on traffic, safety, and economic development. This research is particularly valuable for topics that, in the public's view, seem counterintuitive. For example, residents may assume converting a four-lane roadway to three lanes would generate traffic congestion due to the lane elimination, but [research](#) shows this type of redesign generally leads to smoother traffic flow (FHWA 2022b). Sharing case studies and peer-reviewed research is critical to showcasing complete streets benefits and understanding the conditions and factors that affect a project's success or failure. Appendix A offers talking points drawn from this body of research.
- **Storytelling.** Planners who consistently work with the public are beginning to understand that the traditional public relations approach can produce inauthentic and ineffective engagement. Denver's chief storyteller, Rowena Alegría, explains that [storytelling](#) provides opportunities to listen and learn from one another in a relatable format (Alegría 2023).

Planners will need to carefully consider messaging throughout the life cycle of complete streets projects, from making the initial case to developing communications plans and engaging with stakeholders through project implementation.

Making the Case for Complete Streets

Complete streets have evolved over the past two decades from a niche design option to an established practice backed by successful case studies and ample research. However, skepticism and opposition still exist within agencies responsible for designing safe, multimodal streets, despite [research and testimonials](#) on the benefits of multimodal street design (Moore 2020). This is why making the case for complete streets is so important to building support.

General messaging provides an “elevator speech” for wide audiences that appreciate nontechnical phrasing. The Minnesota Complete Streets Coalition identified safety, choice, accessibility, and health as [strong leading topics](#) with broad appeal, and cost effectiveness, affordability, community development, and the environment as good supporting messaging topics (Minnesota Complete Streets Coalition 2010).

Examples of general messages from the American Heart Association's [Streets Built to Share](#) campaign include the following (American Heart Association n.d.):

- We all want and deserve to live in safe, healthy communities.
- Complete streets are about choice and installing the infrastructure needed to give people the option to walk, bike, or drive—even for short everyday trips.
- When children can walk to school, parks, and playgrounds, they are more likely to be healthy and do better in school.
- A complete street is designed for all roadway users, whether they're driving, riding, walking, bicycling, or rolling (e.g., pushing a baby stroller, using a wheelchair).

Planners should create messaging statements, talking points, and statistics to communicate the benefits of complete streets. An important aspect of messaging is providing evidence-based information to counter misinformation. The “myth and fact” topics in Table 3.1 (p. 42) address some of the most common points raised in public discourse about complete streets. Appendix A contains further examples of statistics and research describing complete streets benefits for transportation, economic development, health, equity, and safety that planners can use to craft their message.

TABLE 3.1. COMMON MYTHS AND FACTS ABOUT COMPLETE STREETS

Myth	Facts
Complete streets are anti-car	One-third of Americans do not or cannot drive (Zivarts 2024). Cars are part of the multimodal mix included in complete streets designs. Multimodal planning allows travelers to choose the most efficient mode for each trip: walking and bicycling for local trips, public transit on busy urban corridors, and driving when it is truly optimal. Each mode has a role to play in an efficient and equitable transport system.
Cyclists and pedestrians cause safety problems	A study from Denmark showed that less than five percent of cyclists break traffic laws while riding in bike lanes and 14 percent break laws when no bike infrastructure is present (Danish Road Directorate 2019). When cyclists do break traffic laws , more than 70 percent of the time they do so because they feel they must to stay safe. In contrast, drivers break traffic laws 77 percent of the time to save time (Marshall, Piatkowski, and Johnson 2017).
Removing a travel lane will increase cut-through traffic	The NCHRP Research Report 1036, Roadway Cross-Section Reallocation: A Guide , cites 10 case studies of U.S. roadway reallocation projects that showed safety benefits for all modes, minimal changes to vehicle travel times, and little evidence of vehicle diversion from reallocation streets to parallel streets (Semler et al. 2023).
Road diets (lane eliminations) slow down cars and create congestion	A study of road diets on high-volume roadways in Los Angeles found an average speed reduction of 11 seconds per mile traveled. In other words, a vehicle traveling at a speed of 25 miles per hour on a corridor subject to a road diet would travel at about 26.75 miles per hour on a similar corridor without a road diet (Venegas 2022). In Alexandria, Virginia , a controversial road diet has reduced crashes by 41 percent and extreme speeding (more than 35 miles per hour) from 11 percent to seven percent. Peak period travel time decreased by 35 seconds westbound and 60 seconds eastbound. Cycling increased 75 percent during peak times, while pedestrian volumes decreased by 22 percent (Alexandria 2022).
Complete streets delay emergency response	According to FHWA's Traffic Calming ePrimer , studies from the mid-1990s from various cities show a one- to 10-second emergency response delay with traffic circles (FHWA 2017b). New designs such as mountable or roll curbs, which are sloped to allow emergency vehicles to smoothly drive over them, can improve response times. Road diets can improve emergency response travel time by allowing emergency vehicles travel down the middle lane as drivers retreat to the outside lanes (FHWA 2016b). For speed control , speed cushions and offset speed tables are considered preferred traffic-calming countermeasures to accommodate fire vehicles (FHWA 2017a).
Bike lanes are bad for business	The National Street Improvements Study , conducted by Portland State University in conjunction with PeopleForBikes, researched the economic effects of bicycle infrastructure on 14 corridors across six U.S. cities. The study found that improvements such as bicycle and pedestrian infrastructure had either positive or nonsignificant impacts on the local economy as measured through sales and employment (PeopleForBikes et al. 2020).

Developing Initial Messaging

Attention to messaging is important during the early stages of a complete streets program or project. In documenting benefits and “myths and facts,” themes will emerge and form the messaging framework. Overarching themes may relate to safety or health, and more localized themes may address neighborhood infrastructure or municipal initiatives related to mobility. The following activities are commonly useful for crafting complete streets communications.

Branding

Branding establishes a consistent, distinctive look that allows the public to recognize and connect to an initiative—in

this case, complete streets (Figure 3.6, p. 43). Common branding elements include a logo, color scheme, fonts, and graphics that form a consistent brand standard used consistently across printed and digital materials. Within complete streets projects, branding and graphics standards can also apply to signage and wayfinding.

Media

Planners will need to tailor messaging around a variety of media. Traditional media is still an important outlet for disseminating information on community matters. The following channels are commonly used to transmit this information:



Figure 3.6. Example of local complete streets program logo from Tigard, Oregon (City of Tigard)

- **In-house municipal media channels.** Some municipalities have their own video studios and equipment for government programming and short video clips. These can be posted on YouTube channels and the city website.
- **Local radio.** According to media consulting firm Nielsen, [ad-supported radio](#) reaches over 67 percent of Americans every month (Nielsen 2025). Local news programs that report on public-interest stories may offer avenues for complete streets engagement.
- **Podcasting.** Podcasts are a modern take on the radio station, delivering on-demand, on-air content. Nielsen reports that [podcasting](#) reaches 18 percent of Americans each day (Nielsen 2025). In 2022, Providence, Rhode Island’s City Planning Department released 11 podcast episodes on community development topics, including “[Complete Streets 101](#)” (Providence City Planning 2022). If establishing a podcast series is impractical, reach out to podcasters who might host a session on complete streets.
- **YouTube.** Videocasts are an excellent means for explaining complete streets in a highly graphic format. A local government can host a channel or launch individual videos to get the information out into the community.
- **Social media.** As discussed later in this chapter, social media channels will be a key tool in launching and testing initial messages.

Message testing

Message testing is the process of analyzing marketing messages to ensure they resonate with target customers. Planners can test messages by convening focus groups or conducting surveys that ask participants to identify which phrasing works best through multiple-choice or A/B testing (asking an audience to pick one of two choices).

Some key messages to test relate to safety, mode choice, the environment, equity, and health. Locally, planners may need to address hot-button issues such as cost, community

development, and gentrification. Planners should test alternatives for terms with negative connotations, such as “road diet” or “lane elimination.” Instead, determine how test groups react to terms such as “street rightsizing” or “space reallocation” to gauge any difference in public perception. Louisville, Kentucky, has adopted “[rightsizing](#)” as its official term for roadway reconfigurations (Louisville 2025).

Managing Expectations

One of the top lessons learned from complete streets research is the importance of proactive communications about process and expectations for community members seeking transparency and assurance about when and how public feedback will be incorporated.

Planners need to clearly communicate to the public when and why an infrastructure or transportation project is governed by preset engineering and regulatory design requirements. This will help prevent the public from interpreting standards as an arbitrary basis for rejecting public ideas or limiting community feedback. Planners also need to be transparent about how they will incorporate the public’s comments and concerns. This strategy will help prevent community members from rejecting the entire planning process because they do not see their comments carried through.

The following process elements are important to share:

- Project schedule and milestones
- Funding sources
- Guiding engineering specifications (this may include the use of newer design guidelines keyed specifically to complete streets, such as those from the National Association of City Transportation Officials (NACTO), as discussed in Chapter 6)
- Legal and regulatory requirements, including those relating to environmental impacts, equity, and environmental justice
- Evaluation and metrics
- Engagement plan (or outline—it can be helpful to have the public co-create methods, dates, and venues)

Planners may find it useful to create a messaging guide to organize messaging, talking points, and graphics for general use and targeted audiences. This strategy helps maintain consistency when large teams are interacting with multiple stakeholders. The Broward Metropolitan Planning Organization (MPO) created a complete streets [messaging guide](#) to provide consistent and proactive communications for the MPO and its member cities and counties in Florida

(Broward MPO 2020), while Utah’s Wasatch Choice Vision created a [public engagement guidebook](#) with conversation starters and key messages (Wasatch Choice Vision 2023).

ENGAGEMENT TECHNIQUES

Engagement for complete streets should consist of a variety of tools and techniques, from traditional meeting formats to new digital tools to hands-on methods that bring engagement into communities.

First, planners should consult with their organization’s communications team, which may have predetermined procedures, rules, and templates. States and MPOs may also have useful resources, toolboxes, and technical assistance for developing and conducting engagement activities. The New Jersey Bicycle and Pedestrian Resource Center’s 2020 report, [Evaluating Complete Streets Public Engagement Practices: Results of a National Survey](#), documents both traditional and creative methods as well as new partnerships and tools to reach diverse audiences (Jain et al. 2020).

In choosing techniques, planners must determine the desired level of engagement and the public’s shared role in decision-making. The IAP2 Spectrum of Public Participation, discussed in the sidebar on p. 33, can help planners evaluate the best options, which include kick-off workshops and activities, surveys and questionnaires, printed materials, digital engagement, public meetings, and demonstration projects (Figure 3.7).

Kick-Off Workshops and Activities

In kicking off projects, planners face the challenge of gathering meaningful input while simultaneously educating the

public about technical material. Several types of innovative kick-off workshops and activities can accomplish both, equipping participants to grasp the details of individual projects with a better understanding of the larger context. These activities, which can also be hosted in virtual formats, enlist the public to help with mapping, forecasting, and existing conditions analysis.

Context-setting exercises

One of the first tasks is addressing the big picture to help community members grasp how complete streets meshes with wider regional and jurisdictional planning processes. Without a wider context-setting exercise, members of the public may immediately focus on the details of individual projects at the expense of understanding the larger mobility system and the needs of its users.

Mapping activities

People have a natural affinity for places, and [participatory mapping exercises](#) can be a valuable engagement tool (Kahila-Tani, Kytta, and Geertman 2019). The growth of [participatory GIS](#) (PGIS) accelerated during the COVID-19 pandemic as communities sought interactive yet socially distanced tools while stay-at-home orders were in effect (Institute of Development Studies n.d.).

Interactive mapping tools allow stakeholders to attach comments to specific locations. These maps are increasingly popular in complete streets engagement plans and can be used with digital engagement platforms. Portland, Oregon’s TriMet used a [virtual open house](#) in developing its pedestrian plan, which included an interactive map allowing users to adjust factors of equity, safety, and demand and submit their preferences, as shown in Figure 3.8 (p. 45) (TriMet 2020).

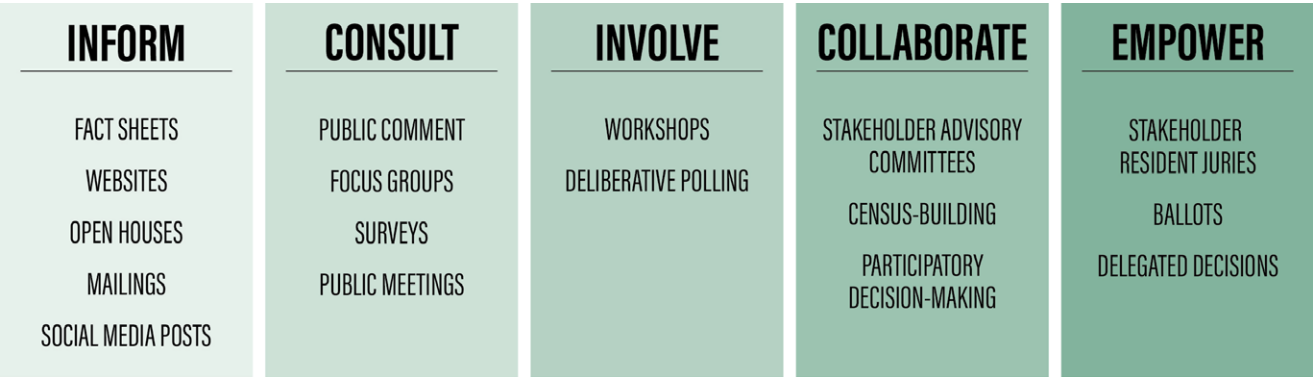


Figure 3.7. The IAP2 Spectrum of Public Participation can help planners evaluate appropriate engagement strategies (adapted by WGI, Inc.)

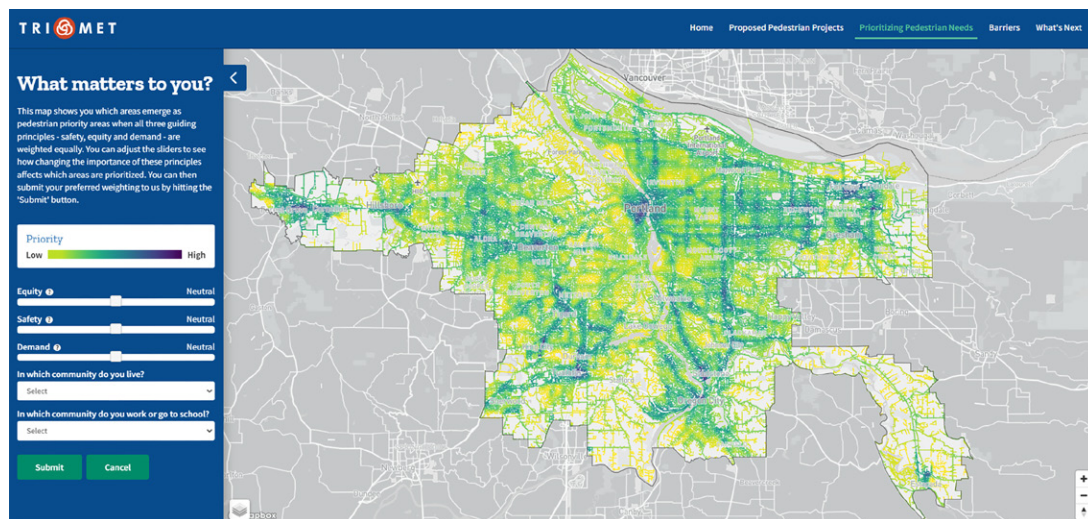


Figure 3.8. Interactive mapping tools are increasingly used for complete streets engagement efforts, such as TriMet's virtual open house for its pedestrian plan (TriMet 2020)

Within a digital mapping application, community members can provide input, such as information on hazardous travel conditions, network gaps, or ideas for other improvements. [WalkRollMap](#) is a useful open-source app for mapping microbarriers to accessible walking and rolling. These tools also allow the community to help identify community assets otherwise missed through the development of traditional map layers.

Shortcomings of this approach can include limitations in reaching a broad audience, variations in participants' mapping skills, and low analytical value of collected input. In a 2022 [study](#) from Latvia, participants using a digital platform were disappointed when the mapping platform only served one function: noting places on a map. They expected a multifunctional tool that also provided background information, comment fields, and collaboration with other participants (Kizika and Akmentiņa 2022).

Walk and roll audits

A walk audit is an activity during which groups survey popular walking routes for deficiencies, hazards, and gaps. AARP has created a [Walk Audit Tool Kit](#) with information in English and Spanish on planning and conducting a walk audit (AARP 2022). AARP recommends having local leaders participate to experience firsthand the problems sidewalk travelers face. Training walk audit participants on terminology can also help spot problems and stimulate discussion of solutions.

Walk audits can be particularly useful when assessing conditions in and around schools, transit station areas, and areas frequented by senior citizens. When conducting an au-

dit, bring wheelchairs, strollers, and scooters to include a “roll audit” as well. Walk audits are typically conducted in person; however, planners may want a videographer to document and post key content and interviews for online viewing.

SWOT analysis

As planners kick off a complete streets project, it's important to understand and document challenges, opportunities, and changing conditions that could affect project success. A SWOT (strengths, weaknesses, opportunities, and threats) analysis (Figure 3.9, p. 46) involves reviewing the status of financial, environmental, political, process, regulatory, and other factors with a potential relationship to complete streets activities.

In Venango County, Pennsylvania, the Sugarcreek/Franklin Complete Streets Study project incorporated a community complete streets-oriented SWOT analysis. Participants in the exercise brainstormed ideas with a focus on elements such as infrastructure and traffic conditions, safety, and right-of-way constraints (Sugarcreek/Franklin Complete Streets 2011).

Scenario planning

Scenario planning is a public engagement activity that examines drivers of change, explores alternative futures, and evaluates a wide range of potential solutions. The results of a SWOT analysis can be fed into scenario planning to determine which courses of action work best under multiple scenarios.

For example, a complete streets team may want to explore how climate change and emerging transportation modes might affect infrastructure investment. If

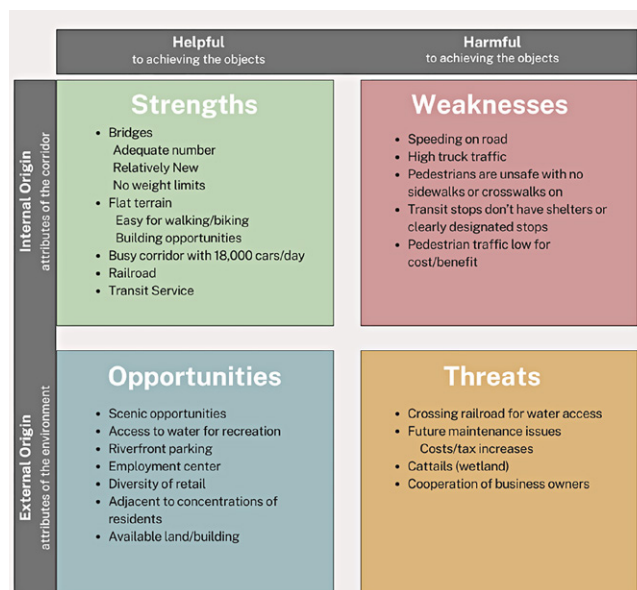


Figure 3.9. An example SWOT analysis for a potential complete streets project (WGI, Inc.)

the community wants to expand cycling, the team can compare potential routing scenarios, given likely flooding or increased heat. If the community is reluctant to adopt any modifications, participants can explore a “no action” scenario that maintains the status quo. The American Planning Association hosts a [scenario planning collection](#) in its Research KnowledgeBase with more information on how to structure scenario planning as part of public engagement (APA 2023).

Forums and speaker series

Hosting a complete streets forum or speaker series, in person or virtually, can be an effective method to introduce topics and encourage open discussion about complex topics in a casual setting. Speakers should be experts on one or more aspects of complete streets, such as safety, implementation, or research.

Several considerations, however, can affect the effectiveness of this approach. Researchers studied a “Science on Tap” series to assess changes in attitudes and knowledge of various scientific topics among participants. They found that the series [produced little change](#) in those who attended, mainly because the audience was already familiar with the material (Ocobock and Hawley 2020). For complete streets, planners can maximize the value of this tool by inviting non-transportation-related organizations and audiences.

Personal stories

The art of storytelling, referenced earlier in the chapter, is gaining traction as a technique for building emotional connections and understanding complex topics. This method is particularly effective for topics such as traffic safety and climate change, for which [political party alignment](#) has been shown to affect whether individuals will be open to change or oppositional (Klein et al. 2021).

In North Carolina, researchers used radio to air a sportsman’s personal account of how climate change has already affected the places he loves. They then polled political moderates and conservatives and found that hearing firsthand stories about the reality of climate change and risk [created effective shifts](#) in their perceptions (Gustafson et al. 2020). As an early task in engagement, planners should seek out stories from those affected by poor street design and those with few transportation options, or interview stakeholders involved in successful complete streets projects. Stories can be posted on the project’s main website, the organization’s video channels, and social media.

Surveys and Questionnaires

Surveys are often among the first steps for gauging public sentiment and gathering ideas that can be incorporated into program or project design. Surveys can be formal (scientifically designed and administered for statistical relevance) or informal. Formal surveys are created and administered by professionals who can ensure that the questions, recruitment, sample size, and analysis will generate valid data that can be generalized to represent the total population.

Decisions on whether to launch formal or informal surveys will depend on schedules, budgets, staff capacity, and use of survey results. Surveys can be distributed on paper, through digital channels, or by using creative in-person methods that also serve as engagement events. Creative methods include visual preference surveys, games or trivia, and short-answer submissions. Phone surveys are still used, though their usefulness has been falling; the Pew Research Center found a [continuing decline](#) to a current six- to seven-percent response rate (Kennedy and Hartig 2019).

A [study](#) by the online survey site SurveyMonkey of surveys up to 30 questions in length offers several insights regarding optimal survey length (Chudoba 2018):

- Respondents take just over a minute to answer the first question in a survey, which includes reading instructions.
- Respondents took about five minutes in total to answer a 10-question survey.

- The longer the survey, the less time respondents devoted per question, especially those at the end of the survey.
- Survey abandonment rates increased for surveys that took more than seven or eight minutes to complete.

These findings suggest aiming for a 10–12 question survey that lasts eight minutes at most. In the past, planners have tended to avoid asking open-ended questions (where respondents enter their own text to answer questions). However, artificial intelligence (AI) tools can reduce the time needed to compile and analyze such responses, which provide valuable details that cannot be gleaned from structured responses.

Variables that affect a survey respondent's tolerance for time and accurate reporting include the type of survey, the audience, and the relationship of the respondents to the surveyor. The [Pew Research Center](#) offers resources and best practices for writing survey or questionnaire questions (Pew Research Center n.d.).

As with all engagement efforts, planners should ensure surveys and questionnaires are available and accessible to the entire community, including historically underserved populations. USDOT offers several tips for improving survey response rates from underserved areas:

- Distribute surveys in multiple ways and provide multiple ways to participate, such as prepaid return mail, online, and in person.
- Oversample in areas that have hard-to-reach populations.
- Provide surveys in multiple languages to engage people who use languages other than English.
- Test the survey with representatives of the group you are trying to reach. Include options for people with a range of disabilities and for those who use nonspeoken languages, including ASL and other sign languages, to participate.

For more information on gathering public input, see [*Promising Practices for Meaningful Public Involvement in Transportation Decision-Making*](#) (USDOT 2022).

Printed Materials

Handouts, both printed and digital, are an important means to educate and engage at the same time. Planners should continue to plan and budget for paper outreach and education materials. Research on the neuroscience of exposure to print and digital formats shows that [each has its own advantages](#) regarding content recall, comprehension, and emotional response (Dooley 2015). Paper elicits an emotion-

al connection and increased comprehension, while digital formats offer instantaneous access and ease of personalization. Planners can use several types of printed materials for events, public meetings, mailers, and displays.

Fact sheets, postcards, flyers, and brochures

No matter what the project is, stakeholders need accessible information on project background, study area boundaries, timelines, project contact, and other pertinent information.

Door hangers

Door hangers are an effective method for reaching target geographies (e.g., affected neighborhoods and businesses). They are also a low-contact communications method for outreach workers who are uncomfortable in larger crowds. Generally, the distribution of public information is not considered solicitation, but check with local sources on any sensitivities related to door-to-door distribution.

Infographics

Based on the idiom “a picture is worth a thousand words,” infographics are useful to visually depict multiple complete streets practices within the community context. A complete streets infographic should show the variety of local (or potential) modes and complete streets design elements with clear labels. Infographics can also be used to highlight the benefits of complete streets or to show who has jurisdiction over the various rights-of-way, which can be helpful when numerous agencies are involved. As a best practice, choose graphics that most resemble your location and include roadway users of all ages, abilities, and ethnicities to emphasize safe streets for all. Figure 3.10 (p. 48) shows an example of a complete streets infographic with labeling.

Display boards

A common tool for charettes and workshops, poster-sized printouts displayed on easels can showcase maps, infographics, and other visual materials. Foamboards are commonly used for mounting due to low cost but are prone to damage. Stronger materials include Gatorboard or blank, framed canvases available at any craft store.

Digital Engagement

In today's increasingly digitalized world, digital assets and approaches will be a key component of complete streets engagement efforts. The ubiquity of social media has opened new communication channels for planners but also brings challenges, as discussed in the sidebar on p. 50.



Figure 3.10. Infographics are effective ways to show the components of complete streets (WGL, Inc.)

Moving forward, planners will have a growing number of education and engagement techniques for visioning, design alternatives, pilot projects, trade-off assessment, and street operations. This new era of [virtual engagement](#) offers proven methods to take these activities to the public, innovative methods using technology and lessons learned, and an expanded lens for understanding and addressing inequities of past infrastructure decisions and their operation (Dougald and Williams 2022). Planners should consider the following digital engagement options for complete streets outreach.

Webinars

Project sponsors can use webinars to host speakers from across the country presenting information on complete streets. Whether it's an introduction or a deeper dive into specific practices and examples, a mini-course can boost the public's knowledge of street design.

Website

Creating a complete streets website boosts the effort's brand while consolidating information, meeting minutes, publications, videos, and calendars.

Electronic polls

Polling can be conducted during live events through smartphone apps such as [Poll Everywhere](#) webinars, a complete streets project webpage, or via QR codes on paper or screens

in presentations. Polls are typically shorter than surveys and can be used for audience engagement, instant feedback, research, and obtaining information about the audience prior to a presentation. Polls can also be embedded into websites and social media.

Interactive maps

As noted previously, interactive digital maps allow the public to attach a comment to a specific location, which helps identify hotspots and areas of concern. Planners should look for platforms or applications that combine mapping with engagement input options, such as [Esri's ArcGIS StoryMaps](#). The Town of Manchester, Connecticut, created a [StoryMap](#) for its downtown complete streets project with a "guided tour" of proposed improvements, project presentation videos, and information on complete streets principles and elements (Manchester Main Street Team 2023).

Digital preference surveys

Digital preference surveys offer more capabilities than their paper analogues. In addition to rating various images, digital platforms can be programmed to let users add features to a streetscape, such as street furniture or additional street trees. In studying the role of simulators in public engagement settings, [researchers](#) found that participants reacted positively to simple tools, such as [Streetmix](#) (a web-based tool to create and visualize street design), but faced chal-

lenges with more advanced and complex simulators (Gower, Hotker, and Grodach 2023). However, these more complicated simulators were [successful](#) in public charrettes when a technical expert was available to make changes based on stakeholder input (Smith et al. 2017).

Videos

Short explainer videos can help the public better visualize how complete streets components are arranged and used by travelers using multiple modes at once. [Research](#) suggests that explainer videos should be 60–90 seconds, which is enough time to convey content before losing audience attention (Oentoro 2023).

The cities of [Baltimore](#) and [Tucson, Arizona](#), created one-minute videos with animations of how streets could be redesigned (Baltimore City Department of Transportation 2021; Tucson 2021). Longer videos can dive deeper into project details and share personal stories. In Rochester, New York, a six-minute YouTube [video](#) captured a complete streets makeover community event in the city’s El Camino neighborhood (Reconnecting Rochester 2025). Search “complete streets” on YouTube for dozens of example videos.

Extended reality

[Extended reality](#) (XR) refers to various ways of digitally visualizing the physical world (Mendez 2022). Augmented reality (AR) allows users to “see” improvements or street design changes in the actual setting (Figure 3.11), while virtual reality (VR) immerses users completely within a virtual world. Inexpensive cardboard viewers and free AR and VR apps make these technologies available to anyone with a smartphone.

[Research](#) shows that these virtual approaches significantly boost public engagement (van Leeuwen et al. 2018). In Santa Cruz County, California, the Regional Transportation Commission’s [Visualizing Sustainable Transportation](#) project used AR to demonstrate potential future sustainable transportation and land-use options at two locations. Once design options were finalized, the renderings were once again installed in AR viewers so the public could view the improvements (University of California Santa Cruz Public Affairs 2017). Planners can also use VR to create more [accessible](#) engagement opportunities for individuals with disabilities (Know-the-ADA.com n.d.)

Public Meetings

Public meetings are a standard feature of public engagement and are often required by statutes and regulations. However, these standard meetings are ripe for reinvention and aug-

mentation. For attendees, work obligations, travel barriers, and childcare needs create obstacles, despite planners’ best efforts to optimize participation. Planners should consider these improvements to the standard public meeting.

Virtual meetings

Most public agencies record and broadcast their meetings. During the COVID-19 pandemic, public entities turned to interactive platforms to mimic some of the benefits of in-person social interaction and public input. Post-pandemic, virtual meetings still play a large role in reaching community members who otherwise could or would not attend an in-person meeting, especially in [rural communities](#) (Uddin, Bright, and Foster 2022). Platforms such as Zoom can be useful for complete streets activities in which participants are separated into smaller groups and add comments to shared whiteboards and maps.

Open houses

Open houses allow for a “drop-in” experience as an alternative to highly structured public meetings. Staff and consultants are situated at stations to answer questions and accept comments. Planners should carefully consider the location of these open houses to welcome all community participants. An informal setting, such as a neighborhood community room, library, church, or space at an indoor mall, can help parents feel comfortable attending with their children. For children, planners can design interactive mapping activities or provide other methods to gather their input.

Design charrettes

Design charrettes invite participants with a range of capabilities to the design table. These events bring stakeholders and



Figure 3.11. Augmented reality (AR) can help users visualize improvements to transportation infrastructure (Kittelson & Associates, Inc.)

PUBLIC ENGAGEMENT IN A MEDIA-SATURATED WORLD

The prevalence of social media has made its use in public engagement efforts indispensable. [Research](#) has documented the popularity of using social media platforms to expand reach and the amount of information conveyed (Morse and Carty 2017). The COVID-19 pandemic further heightened the value of social media as a low-contact, high-impact communication tool.

Local governments are finding value in [mining social media posts](#) to improve public services and governance (Jobe 2024). Sentiment analysis is commonly used to assess the degree of support or opposition for proposed projects. This can be as simple as screening posts on Nextdoor, X, and Facebook. For more detailed analysis, social media mining allows planners to examine engagement patterns from community members who use social media posts instead of public comments to document transportation challenges. For example, a post on sidewalk conditions may draw comments from others that provide further insight on the extent and location of needed improvements.

While social media offers new opportunities and tools for engagement, its proliferation also creates challenges for planners. Reliance on social media can miss those community members who are [not digitally engaged](#) with mobile apps or websites (GovFacts 2025). In addition, social media can be a breeding ground for false narratives and disinformation around urban planning. One such example is [conspiracy narratives](#) regarding the concept of the 15-minute city (Steuteville 2023). When the local council in Oxford, England, enacted new traffic rules to reduce congestion, local skeptics equated the rules with the 15-minute city concept and cast them as a loss of freedom. This message was widely disseminated on Instagram, even though the original post was marked as false information.

Planners must understand how to use social media, especially in municipal contexts, in ways that maximize effectiveness and minimize risk. The International City/County Management Association's 2025 webinar, "[Strategic Management of Social Media in Local Government](#)," offers valuable insights on communicating through social media (ICMA 2025).

design experts together to co-develop solutions for built environment problems. [Charrettes](#) can build trust and provide space for people to work together to discuss divisive issues and create successful projects (Madill, Lennertz, and Beyea 2018). For complete streets, participants can help design networks, corridors, or street cross-sections.

Demonstration Projects

Temporary complete streets installations have gained traction as an effective catalyst for gaining buy-in, testing, and iterating design. Demonstration projects use impermanent, low-cost materials that are generally more durable than those used in pop-up installations. Examples include improving pedestrian and bike safety by temporarily widening sidewalks, painting crosswalks, adding bike lanes, and testing roundabouts. Temporary installations also include parklets and "streateries" that have the effect of slowing traffic and stimulating economic and social activity (Figure 3.12, p. 51). These approaches are intentionally flexible to let the public "try it before you buy it," which can [reduce resistance](#) to new designs (Dunkak 2022).

For engagement purposes, planners can combine a demonstration with an all-day event or hold a kick-off event to showcase longer-term projects (e.g., up to one month). In 2013, the City of Santa Monica hosted [Pop-Up MANgo](#), a temporary greenway installation and community festival (131 Media 2013). Organizers blended engagement and art-related activities to gather input from residents about desired roadway improvements, using landscaping supplies to create roundabouts and chicanes on a street that needed calming measures. For several years, Smart Growth America's Complete Streets Leadership Academy has assisted communities across the country in implementing quick-build complete streets [demonstration projects](#) that planners can learn from (SGA and NCSC 2022).

Demonstrations can also be held with emergency responders to test how vehicles can operate under various configurations, including improved intersection proposals with tight turning radii. [Tactical Urbanist's Guide to Materials and Design](#) presents detailed information on how to design demonstration and pilot projects (Street Plans Collaborative 2016).

PUBLIC INPUT REPORTS

As a final step, planners must compile and publish all efforts undertaken as part of the engagement process. This is re-



Figure 3.12. Temporary installations, such as parklets and “streateries,” offer flexible ways to show community members how public rights-of-way can be reimaged and repurposed (Salt Lake City)

quired when using grant dollars for project funding, but it is also a recommended practice to provide documentation and transparency within a complete streets program.

Typical elements of municipal and regional agency public input reports include detailed information on each event (minutes, attendance records, presentations, videos, feedback content), as well as the following:

- Overview of the complete streets plan and guiding principles
- Summary of overall engagement (typically in graphic formats, such as maps and word clouds)
- Approach to expanding inclusivity and reach
- A summary of key messages heard and themes
- Survey results and priorities
- Alignment with related transportation plans
- Reference to any federal or state engagement requirements

Two examples of complete streets public engagement reports from regional agencies are the Denver Regional Council of Government’s [Regional Complete Streets Toolkit Engagement Summary](#) (DRCOG 2021) and MetroPlan Orlando’s [2045 Metropolitan Transportation Plan Public Participation Report](#), which substantially integrated complete streets and multimodal transportation (MetroPlan 2020).

CONCLUSION

Over the past decade, public engagement has evolved in several ways. Communities are moving from one-way communications on projects to more collaborative models of engagement. In addition, project managers are developing detailed engagement plans to better understand stakeholders and their concerns, develop messaging, and identify effective communications channels. Today’s public engagement planning also entails a concerted effort to identify and engage populations that historically have been underrepresented in public engagement efforts. This level of meaningful public engagement is required when complete streets projects are funded with federal and state dollars.

The introduction of new technologies, the use of which accelerated during the pandemic, has increased the reach of engagement and the ability to communicate information in new ways. Mapping, visualizations, and simulations provide a more relatable experience for community members who want a more accurate depiction of a project in situ. At the same time, low-tech, low-cost methods are powerful tools for reforming how projects are imagined, tested, and scaled. Complete streets prototypes for bike lanes, roundabouts, and bike parking are proven methods for engaging the public by providing physical facsimiles of planned projects.

As the number of topics and relevant stakeholders related to complete streets continues to expand, planners will need to work with internal and external stakeholders on revising the larger policy framework driving decisions on infrastructure and mobility. The next chapter delves into complete streets policy development.



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04 COMPLETE STREETS POLICIES

The complete streets movement began as a call to integrate active transportation and transit into transportation and infrastructure policy. The journey from idea to reality would require understanding, and then transforming, the thicket of government policy, rules established by standard-setting organizations, and criteria directing project prioritization, selection, and funding.

[Good public policy](#) should define issues and implement strategies that produce measurable and positive results (Pepperdine SPP 2020). According to the U.S. Department of Transportation (USDOT), “a [Complete Street](#) is safe, and feels safe, for everyone using the street” (FHWA/FTA n.d.a.). Successful complete streets policy outcomes encompass more than concrete and asphalt. With heightened attention to mobility and access, planners will be leading discussions to link an array of community goals to designing and operating streets.

This chapter describes the general aspects of policy and policy-setting for complete streets. It looks at how complete streets policies have evolved over the past two decades as changing conditions, critiques, and ever-increasing crash rates have affected active transportation and forced a reevaluation of the traditional approach to complete streets policy and implementation. Given the large existing body of work on complete streets policy, this chapter provides an overview of the elements of complete streets policy as defined by the National Complete Streets Coalition and highlights complete streets policy examples at the state, regional, and local levels that link policy to action.

THE EVOLUTION OF COMPLETE STREETS POLICIES

The complete streets movement has its roots in policy, and its evolution is shaped by the constant evaluation of outcomes. By studying not only outcomes, but also the conditions under which policies are developed and implemented, planners can better position their programs and projects for success.

Original complete streets policies mainly focused on bicycle and pedestrian infrastructure. The state of [Oregon](#) is recognized as passing the first complete streets–like policy in 1971 with two components: routine accommodation of bicyclists and pedestrians and a directive for state and local investment in facilities in public rights-of-way (Mapes 2024). [Florida](#) became the second state to adopt a statewide routine accommodation law in 1984 (FDOT 2024).

A turning point in the effort to create more complete streets came in [2003](#) when the movement’s founders realized the path to wider implementation required a bigger tent of interested parties (McCann 2010). In that year, America Bikes reached out to groups including AARP, the American Planning Association, the American Public Transportation Association, the American Society of Landscape Architects, and the American Heart Association to form the Complete Streets Task Force. As the complete streets movement has grown, the [National Complete Streets Coalition](#), managed by Smart Growth America, has become the national convenor on all things complete streets as well as a resource repository.

In 2010, the National Complete Streets Coalition [analyzed](#) existing complete streets policies and identified 10 elements that comprised an “ideal” complete streets policy (NCSC 2010). But despite the growing numbers of complete streets programs nationwide, pedestrian and cyclist fatalities continued to rise, particularly in lower-income communities. In evaluating the program years later, Smart Growth America found shortcomings in the original list of accountability measures intended to convert policy to action. Its audit found that resolutions and ordinances adopted by local elected officials were often inadequately integrated into stan-

dards used by governmental departments overseeing street design, engineering, construction, and maintenance.

As a result, Smart Growth America and the National Complete Streets Coalition [updated](#) the complete streets policy framework in 2018 with stronger, more inclusive language (Davis 2023). The updated framework encompasses the following 10 elements:

1. **[Establishes commitment and vision:](#)** Creates a statement of the intent to create a complete and connected network of multimodal streets.
2. **[Prioritizes underinvested and underserved communities:](#)** Improves equity by serving the most vulnerable travelers and prioritizing projects in the most underinvested and underserved communities.
3. **[Applies to all projects and phases:](#)** Applies complete streets principles to all roadway projects, rather than a small set of road segments.
4. **[Allows only clear exceptions:](#)** Establishes a clear procedure for granting exceptions that requires high-level approval and public notice.
5. **[Mandates coordination:](#)** Requires interagency coordination between internal departments and affiliated agencies and requires real estate developers to comply with complete streets mandates.
6. **[Adopts excellent design guidance:](#)** Uses the latest and best design criteria and guidelines applicable to local contexts.
7. **[Requires proactive land-use planning:](#)** Considers the greater context for every project, including the surrounding community's current and expected land-use and transportation needs.
8. **[Measures progress:](#)** Matches performance measures to goals of the broader vision, measurably improves disparities, and regularly reports progress to the public.
9. **[Sets criteria for choosing projects:](#)** Creates clear criteria for prioritizing complete streets projects in transportation investment decision-making processes.
10. **[Creates a plan for implementation:](#)** Includes specific, achievable steps for implementing the policy.

These 10 elements were developed and then updated based upon decades of collective expertise in transportation planning and design in tandem with stakeholders, planners, engineers, researchers, and advocates. They provide planners with a holistic roadmap of what to consider when developing a complete streets policy and help set expectations for what a successful policy will include.

Other entities have also examined how to better implement complete streets principles to improve roadway safety. In its [report](#) on the 2021 Department of Transportation Appropriations Bill, the U.S. House of Representatives noted increasing rates of cyclist and pedestrian fatalities. It directed the Federal Highway Administration (FHWA) to review its current policies, rules, and procedures to determine their impact on safety for road users, particularly those outside automobiles, and to disseminate best practices for complete streets to state and local highway partners (U.S. House of Representatives 2020). FHWA's response to Congress, [Moving to a Complete Streets Design Model: A Report to Congress on Opportunities and Challenges](#) (2022a), offers several relevant insights:

- Concentrated attention to safety, tied to funding, is needed to reduce pedestrian and cyclist conflicts. Unfortunately, rules prioritizing congestion reduction and unimpeded auto travel can conflict with bicycle and pedestrian projects, which are seen as “reducing capacity” or impeding level of service (LOS) scores instead of reducing VMT.
- Because not every street can serve all modes, complete networks and connectivity are essential design features to reduce conflicts and add network resilience while still providing routes that are as direct as possible.
- Though USDOT has steadily adopted performance-based planning and management for federal and regional program development, there remains a lack of pedestrian and cycling network volume data to support modeling and quantify benefits.
- Amending or adopting new design standards lies at the base of new street design. However, getting agreement on new design standards along the chain of federal, state, regional, and local decision-makers is a big hurdle because of liability, the novelty of new standards, and uneven adoption of new standards among neighboring jurisdictions.

The report affirmed a federal policy directive for “widespread adoption of the Complete Streets design model as a critical safety improvement strategy...to have a positive impact on the safety of all roadway users—reversing the trend of increasing fatal and serious injuries and creating a healthier, greener, and more equitable surface transportation system” (FHWA 2022a, 51–52).

Also of significance, the 2021 Bipartisan Infrastructure Law (BIL) presented a new definition of complete streets to

“ensure the safe and adequate accommodation of all users of the transportation system, including pedestrians, bicyclists, public transportation users, children, older individuals, individuals with disabilities, motorists, and freight vehicles” (Sec. 11206(a)). The BIL included dedicated funds and directs metropolitan planning organizations (MPOs) to use 2.5 percent of their planning and research funds for complete streets (Sec. 11206(b)(2)). This may change, however, with the BIL’s 2026 reauthorization.

COMPLETE STREETS POLICY GUIDANCE

Polymaking for complete streets takes place at the federal, state, and local levels. To help inform complete streets policy development, planners can review guidance provided by Smart Growth America and the National Complete Streets Coalition, as well as other resources referenced throughout this report and listed in Appendix B. Helpful steps for complete streets policy reform are described in the sidebar on p. 56.

State Complete Streets Policies

State-level complete streets programs are important, given state agencies’ roles in policy and funding. Many federal funds are allocated to individual states; state departments of transportation (DOTs) then disburse funds to regions and cities. Moreover, many important local streets are owned and operated by state DOTs. Notable examples of state agencies driving advanced complete streets policy development include the following:

- **California Department of Transportation (Caltrans).** Caltrans’ [Complete Streets Action Plan 2024-2025](#) (2022a)

represents a commitment to implementation and cross-collaboration with state agencies to address climate change, safety, and equity. It is notable for its integrated framework for data collection, analysis, and project prioritization.

- **Florida Department of Transportation (FDOT).** FDOT’s groundbreaking [Context Classification Guide](#) lists eight different development-based contexts that direct street design, as shown in Figure 4.1 (FDOT 2024). The guide was updated in 2024 and is now accompanied by digital tools such as the Context Classification Explorer, available on FDOT’s [complete streets website](#) (FDOT n.d.a.).
- **Minnesota Department of Transportation (MnDOT).** MnDOT updated its complete streets policy in January 2025. Its [complete streets website](#) is a good example of how to present policy to the public. The site lists the main policy statement; the reason for the policy and its updates; applicability to planning, scoping, project development, construction, operations, permitting, and maintenance for all nonexempt projects; and roles and responsibilities (MnDOT 2025).
- **Louisiana Department of Transportation and Development (DOTD).** In 2022, DOTD [updated](#) the state’s complete streets policy by adding a comprehensive list of performance measures for goals of accommodating all road users, creating a balanced road network, and leading partnerships for implementation (Louisiana DOTD 2022). This state also engaged researchers from Louisiana State University to review practices and projects in 2021. Similar to findings by Smart Growth America, the [review](#) found changing transportation practices to be a long-term process, suggesting the need for continuous staff training and periodic performance reviews (Bian and Tolford 2023).

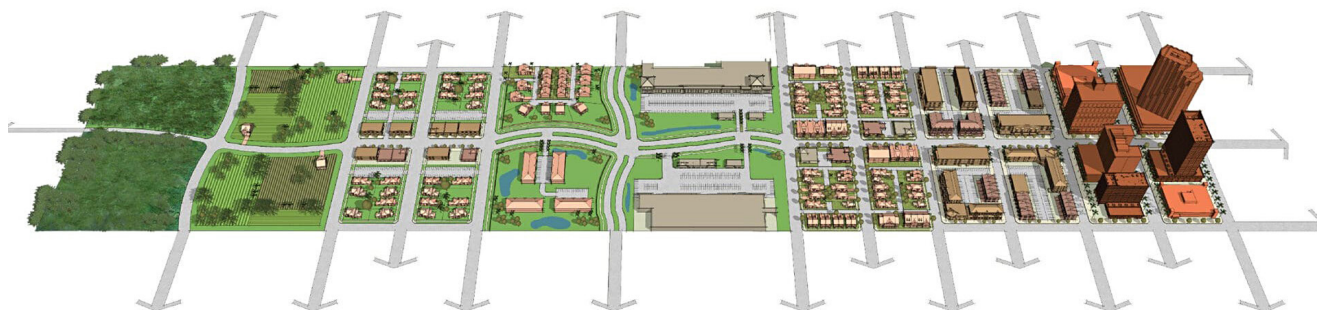


Figure 4.1. FDOT’s Context Classification guidelines establish eight development-based contexts that direct street design (FDOT).

SEVEN STEPS TO COMPLETE STREETS POLICY REFORM

Policy reform can be daunting, leaving exasperated staff wishing they had easy instructions on what to do and in what order. The National Complete Streets Coalition suggests the [following steps](#) (SGA and NCSC n.d.a.):

11. **Change procedures and processes.** Agencies must review and update all of their existing procedures, plans, regulations, and processes to accommodate all users on every project. This might include incorporating complete streets checklists or other tools into the decision-making process.
12. **Review and revise design guidance.** At many transportation agencies, the street design manual is the go-to reference for all projects. Agencies need to develop new design policies and guides or revise existing ones to reflect the current state of best practices in transportation design. Communities may also elect to adopt national or state-level recognized design guidance. As such, the strongest policies will include binding language on adopting best-in-class design guidance.
13. **Train agency staff and community members.** Offer workshops and other training opportunities to transportation staff, community leaders, and the general public so that everyone understands the importance of the complete streets vision—and how to implement it.
14. **Establish new performance measures.** The strongest policies measure their own progress by creating new performance measures that the public can easily access. These measures (number of roadway fatalities and injuries, quality and quantity of community engagement, improved access to resources, and others) need to be agreed upon as a policy is institutionalized, so that local governments can track success and measure impacts on the community.
15. **Begin transforming the project selection process.** Every community—local, county, metro area, state—has a process in place for selecting projects for funding. A strong policy changes the selection criteria to prioritize complete streets projects.
16. **Create a committee to oversee implementation.** This is a critical accountability measure to ensure the policy becomes the norm. The committee should include public agency staff and residents, as well as representatives from advocacy groups, underinvested communities, and vulnerable populations such as people of color, older adults, children, low-income communities, non-native English speakers, those who do not own or cannot access a car, and those living with disabilities.
17. **Create an inclusive community engagement plan.** Create a community engagement plan that prioritizes equity by focusing outreach efforts on underrepresented and underinvested communities. The best community engagement doesn't require people to alter their daily routines to participate.

Planners can use the National Complete Streets Coalition's [10 Elements of a Complete Streets Policy](#) (SGA and NCSC n.d.b.) and [Complete Streets Policy Evaluation Tool](#) (SGA and NCSC n.d.c.) to help draft or evaluate existing local, regional, or state-level complete streets policies.

- **Washington State Department of Transportation (WSDOT).** In 2022, the Washington legislature passed legislation requiring all WSDOT projects routed over city streets with an estimated cost of \$500,000 or more to incorporate complete streets design to fill network gaps. Through a 2022 [project delivery memo](#) on complete streets implementation (Gaines 2022), the WSDOT state design engineer issued specific policy and instructions for projects implementing complete streets. In October 2025, WSDOT published its [2022–2025 Implementation Report](#), featuring highlights of completed

projects and those for which complete streets elements were deemed infeasible.

Like USDOT, state agencies may be reevaluating the effectiveness of their processes, programs, and policies, and planners should be aware of their state's approach to complete streets.

Regional Complete Streets Policies and Guidance
Along with states, regional metropolitan planning organizations (MPOs) are authorized to suballocate federal funds,

mainly through the Surface Transportation Block Grant (STBG) and Transportation Alternatives Program (TA).

MPOs craft their own policies, which largely mirror language found in federal and state regulatory and policy documents, and execute projects through several plans, including five-year Transportation Improvement Plans (TIPs) and annual work plans. Local planners should work with their MPO to prioritize complete streets projects for inclusion in these plans. The Safe Routes Partnership guide [Influencing Complete Streets at the Regional Level](#) offers tips on working with MPOs on complete streets (Pedroso 2020).

In addition to funding, MPOs often develop guides, toolkits, and technical assistance programs. As part of its 2050 Regional Transportation Plan, for example, Wisconsin's Greater Madison MPO developed a [pedestrian facilities toolbox](#) describing different types of pedestrian facilities and their design considerations (Greater Madison MPO 2022).

Local Complete Streets Policies

Local complete streets policies should be tailored to meet the unique characteristics, needs, and desires of the community. In contrast to the more overarching general policy found at the national and state levels, more detailed and context-sensitive guidance, design details, construction drawings, and implementation steps are typically found in local complete streets policies.

Policies can be instituted through a variety of mechanisms and housed within many documents, as described in the sidebar on p. 58. As demonstrated by the wide array of elements discussed in Chapter 2, many policy topics relate to complete streets. Communities have integrated complete streets policy language into their comprehensive plans, where it might appear in transportation, environment, climate, sustainability, health, or economic development elements. Cross-referencing complete streets within these policy areas in the comprehensive plan can create synergies to strengthen local complete streets efforts.

The most comprehensive summaries of best practices for complete streets policies are the reports on the [best complete streets policies](#) produced by Smart Growth America and the National Complete Streets Coalition (Smart Growth America and NCSC 2025). These reports provide community characteristics, best practices, and lessons learned for each city or county best-practice policy identified. Recent write-ups address policy evolution concerning equity, implementation, stakeholder engagement, and climate change.

All complete streets policies are tailored to their local contexts, but one policy of particular note is that of [Howard](#)

[County, Maryland](#), which received the first perfect score from Smart Growth America's annual review of complete streets policies. The policy's attributes include the following (Cole 2023):

- The policy prioritizes equity with binding language and performance measures, which is important given the County's diversity and historic transportation challenges. It is built around "vulnerable street users" and areas of underinvestment. The County chose seven categories to identify census tracts with vulnerable street users and added map layers for safety and public health, place, access, and economy.
- The policy clearly defines exceptions to the complete streets requirements. With vague policy language, traffic engineers can readily justify decisions to bypass multimodal improvements.
- The County uses a design manual to communicate and direct infrastructure project development.

The County began public engagement around complete streets in 2016, three years before enacting its first complete streets policy. To build a strong coalition, staff convened a collection of community partners that included AARP Maryland, the American Heart Association, and representatives from the local realtors' association, a PTA, an autism association, and a bike shop. Of note, the [Horizon Foundation](#), a community organization focused on improving health and wellness in Howard County, formed Streets for All, an advocacy group that could speak to both the vision and details of complete streets. With coordinated advocacy, the groups were better prepared to assist in wider public outreach (Horizon Foundation 2017).

Two additional examples from Wisconsin highlight how local complete streets policies can intersect with other important community goals. In 2022, the City of Madison augmented its 2009 complete streets resolution with a Vision Zero Action Plan and a new Complete Green Streets Guide. The Guide uses six overlays to identify neighborhoods, networks, and corridors for priority treatments. The overlays represent priority areas for equity, transit, tree canopy, green infrastructure, bike networks, and higher-traffic streets. Madison's [Complete Green Streets](#) approach includes the following elements (Madison Transportation n.d.a.):

- A set of street values for (1) putting people first, (2) supporting community, (3) fostering sustainability, and (4) centering equity

COMPLETE STREETS POLICY MECHANISMS

In addition to standalone complete streets policies, multiple types of local government documents can serve as complete streets policy vehicles.

Policies and Plans

- **General planning documents.** At the highest level, comprehensive and strategic plans provide overarching goals and direction used to fine-tune statements on objectives and policy. Because complete streets touch on many interlinking policy areas, complete streets policy language may appear in multiple elements of a plan.
- **Sector or subarea planning documents.** In addition to general planning documents, jurisdictions often craft plans for specific sectors, geographic areas, or initiatives that overlap with complete streets policy interests, such as active transportation, corridor, and safety action plans. These documents typically provide greater detail for policy, street design parameters, project identification, and funding.
- **Design guidelines.** Design guidelines often combine policy and design in one document. This ensures that policy is aligned with the technical specifications for street cross-sections and constructability reports.
- **Jurisdictional policies.** Cities and counties may adopt ordinances and rules directing the details of public engagement, public noticing, and interdepartmental coordination that come into play with complete streets projects. Planners should review these process requirements before scheduling internal and external meetings.
- **Capital improvement plan (CIP).** The CIP identifies and prioritizes capital improvement projects. Therefore, complete streets projects that require CIP funding must be included in these plans.

Regulatory Documents

- **Resolution.** A resolution is a formal expression of opinion, will, or intent voted on by an official body or assembled group. Resolutions are typically used to signal a policy position for new ideas. A complete streets resolution is adopted by a municipality to express support for the concept of complete streets.
- **Ordinance.** Ordinances are more formal and significant actions enacted by authorities into local law. Ordinances may describe detailed requirements for funding, regulations, roles and responsibilities, applicability, and intergovernmental relationships. A complete streets ordinance is enacted by a municipality to set a legal framework for complete streets regulations and requirements.

Directives

- **Departmental policy.** While uncommon, policies issued by a department head can be helpful when adopting new procedures to “give cover” to planners and engineers who are using new standards and design options.
- **Executive order.** Executive orders issued by the President of the United States, state governors, mayors, or other government executives can help to define a problem and direct department heads to make the necessary changes. The advantage of an executive order is its power as a directive to staff. The disadvantage is that it may only last as long as the current executive sits in office.

Complete streets policies can also be shaped and implemented via voter-initiated actions, such as ballot measures to adopt a complete streets ordinance or to establish dedicated funding for infrastructure.

- A process centered in community values
- Clear direction on priorities
- Defined street types to use as a starting point for design
- An explicit equity framework and associated process
- Flexible tools that will evolve over time
- A focused engagement program called “[Let’s Talk Streets](#)” (Madison Transportation n.d.b.)

- A modal hierarchy for prioritization and ranking (Figure 4.2, p. 59)

Elsewhere in Wisconsin, in 2018, the [City of Milwaukee](#) passed a complete streets policy that requires annual collection and reporting of specific health and equity data (Milwaukee Department of Public Works n.d.). Because health

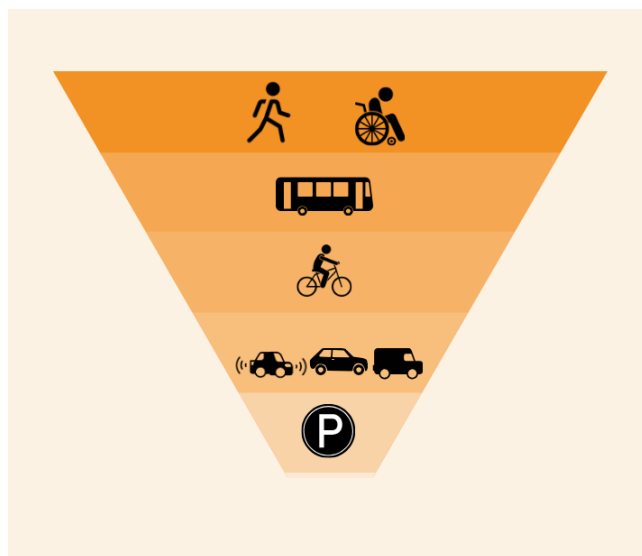


Figure 4.2. Madison, Wisconsin, uses a modal hierarchy to prioritize pedestrians and people with disabilities, with transit and bicycles next in line (adapted from Madison Transportation n.d.a.)

In addition to the references cited in this chapter, planners can draw from a wide array of federal, state, and regional guidance documents in Appendix B to inform the development of complete streets policies specific to their communities. They must also become familiar with emerging trends and policy issues, such as the growing array of mobility modes competing for space on our streets. The next chapter will discuss these transportation modes and their value for complete streets programs.

and equity benefits are entwined with other important goals, this provides a broad summary of the transportation system, project delivery status, and performance. The reports specifically evaluate the performance of the city's low-stress bikeway network and green infrastructure and provide data on user counts and safety statistics.

CONCLUSION

The past two decades have demonstrated the importance of sound policies and associated accountability measures intended to convert policy to action. The [National Complete Streets Coalition](#), a program of Smart Growth America, has been the lead organization developing policy guidance for practitioners and advocates. It continues to assess and update complete streets guidance and related materials.

In recent updates, the Coalition has highlighted key strategies for linking successful policies to successful mobility. These include prioritizing projects in communities lacking multimodal infrastructure investments, applying complete streets designs to all new or reconstruction projects, limiting exceptions, mandating coordination, adopting the latest and best design criteria, and linking streets and land use. Most important are strong policies on implementation and performance monitoring.



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05 MULTIMODAL PORTFOLIO

The numbers and types of vehicles being used for transportation in U.S. cities has grown considerably over past decades. This multiplicity of modes has important implications for complete streets planning. As will be discussed in Chapter 6, complete streets must account for a variety of modes in multimodal infrastructure design. In some cases, planners will need to manage increasing competition for the right-of-way among a complex mix of traditional and new modes. In other cases, planners will need to use design and policy to encourage drivers to use lower-impact modes.

In addition to different modes, travelers have alternatives for trip-making through shared use mobility, fleets, and new transit service lines, such as microtransit. These new offerings affect infrastructure by changing travel patterns in ways such as altering demand for parking and increasing demand for pick-up and drop-off areas.

When planning for complete streets, planners should do the following:

- Develop a shared understanding and vocabulary of modes that are currently on the road or could be in the future. This is a valuable and engaging exercise during public engagement to raise stakeholder interest in complete streets.
- Work with their communities to develop lists of modes to consider and rank for inclusion in planning and project prioritization. This can be done through community workshops, surveys, and listening sessions. Information gleaned from community members can then be researched, explored, and investigated for inclusion in a complete streets program.
- Pay attention to developing networks for various modes. Being complete does not mean that every street is expected to accommodate every single mode and the growing variation in modes.
- Analyze competition for space and develop infrastructure design options and management tools applicable to roadways, curbsides, and sidewalks.
- Consider the potential of new smaller vehicles to increase access to transit, including a larger access-shed. A complete streets program should now extend access-sheds to

at least one mile, if not more, to recognize the range and opportunity of micromobility.

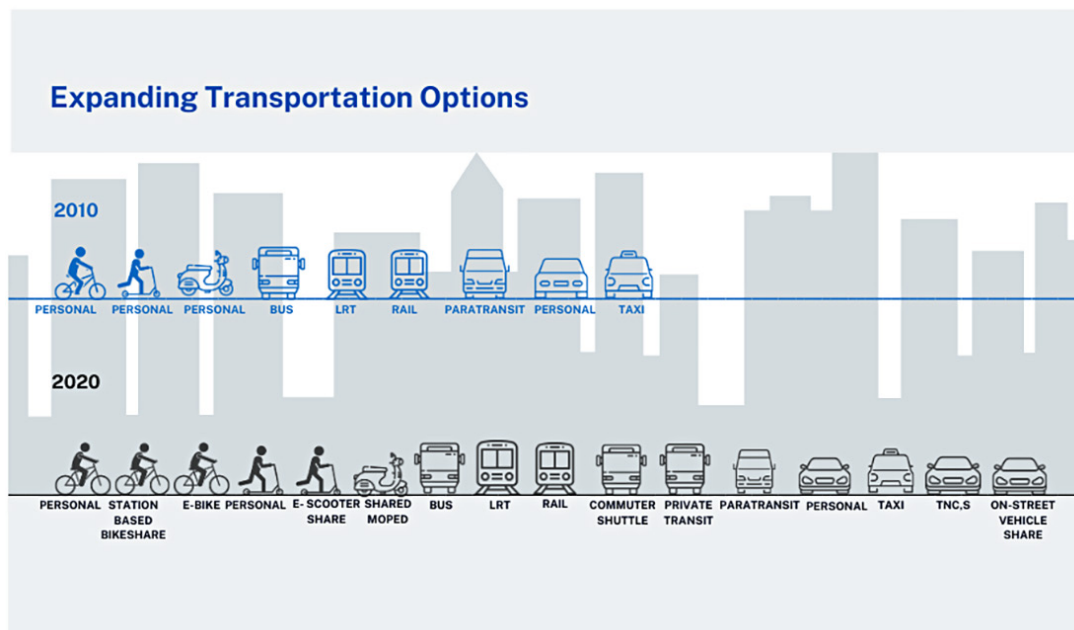
This chapter reviews the various transportation modes and their implications for complete streets programs, followed by information on establishing mode hierarchies. This prioritization process is based on context, which in turn drives design and policy.

MODES

Since the release of the 2010 PAS Report [*Complete Streets: Best Policy and Implementation Practices*](#), the number and types of vehicles planners need to consider have grown considerably (Figure 5.1, p. 62) (McCann and Rynne 2010). The growth in *new mobility*, a term to describe shared-use mobility and electric models of traditional modes, calls for an expanded taxonomy. Even traditional modes have been affected by mobility trends and heightened attention to access, urban design, supportive infrastructure, and the need to address climate change.

The rapid growth and innovation in mobility and vehicle design have given rise to new terms and, in some cases, the redefining of existing terms. For example, the term *scooter* has traditionally applied to small mopeds, but today it is used for two-wheeled electric vehicles. *Micromobility*, a term created to describe electric shared bikes and scooters, has expanded to include all motorized or nonmotorized bikes and scooters, whether personally owned or part of a larger shared program. And the term *minimobility* is emerging to describe

Figure 5.1. Transportation options and types have grown over the years, as this comparison of San Francisco's transportation options in 2010 versus 2020 shows (WGI, Inc., adapted from SFMTA 2020)



modes that travel faster than micromobility, but not as fast as automobiles and motorcycles (Figure 5.2).

This diversification of mobility modes and the increased range of speeds associated with these modes is forcing planners to rethink how they are incorporated into the wider mobility network. As mobility modes continue to diversify, cities can maximize their potential by creating new low-speed connectivity street networks for people opting to travel by e-bikes, scooters, and neighborhood electric vehicles.

This chapter presents a mobility mode taxonomy encompassing pedestrians, automobiles, micromobility, minimobility, delivery vehicles, and transit.

Pedestrians

Walking is a valuable element of any community's transportation system due to its array of benefits for space efficiency,

economic activity, environmental performance, health, and social cohesion.

Pedestrians should garner the most attention in transportation planning for several reasons. Most trips include a walking segment, and among all travelers, pedestrians are the most vulnerable to collisions and the most sensitive to distance and infrastructure quality. As such, complete streets should feature pedestrian-first designs that enhance pedestrians' visibility, safety, and directness of routes.

Pedestrian-first design also applies to supporting technology, such as traffic signals. [Studies](#) show that leading pedestrian intervals (LPIs), a method that illuminates the "walk" sign several seconds before the light turns green for automobiles traveling in the same direction, are one of the most effective practices for reducing crashes, in some studies by as much as 60 percent (Fayish and Gross 2010). Chapter 6 provides a comprehensive catalog of complete streets infrastructure and design elements.

For those who need walkers and wheelchairs, street and sidewalk design are guided by the Americans with Disabilities Act (ADA) and associated standards. The U.S. Access Board (n.d.) finalized its updated [Public Rights-of-Way Accessibility Guidelines](#) (PROWAG) in 2024. Though the U.S. Department of Transportation (USDOT) has adopted the new rules, the U.S. Department of Justice must also adopt them before they become enforceable. PROWAG establishes

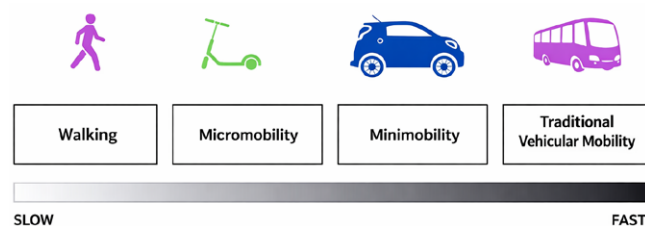


Figure 5.2. Mode classifications in relation to speed (WGI, Inc.)

THE COMPLETE AND ACCESSIBLE TRIP

According to the [National Center for Mobility Management](#) (2016),

An individual's journey in his or her community, whether using public transportation or a blend of public and private options, is now recognized as being much more complex than simply boarding and alighting from a vehicle. To have a successful journey, there are several actions that an individual must initiate before and after the trip.

This concept of the “complete trip” includes trip planning, payment, wayfinding and navigation, travel time, safe crossings, transfers, and arrival (Figure 5.3). An accessible transportation system delivers seamless transportation on every link between home and a destination. If any link is inaccessible, the trip cannot be completed.

The complete trip concept provides a necessary framework for assessing transportation network navigability for travelers with disabilities, but in practice it describes the travel process for all travelers and all modes. It is especially apt for transit trips, which typically involve multiple modes and tend to be more complex than driving. Planners should carefully consider the roles of infrastructure design and quality—and new technologies—in making a trip accessible.



Figure 5.3. Elements of a complete trip for a blind traveler ([USDOT 2020](#))

national guidelines to ensure that sidewalks and pedestrian facilities in the public right-of-way, including shared-use paths, are accessible and usable by individuals with disabilities. The sidebar to the left further discusses accessibility in the context of the “complete trip.”

Personal and Shared Motorized Vehicles

While cars will continue to be a significant part of the local mode mix, planners must work with engineers to craft policy and design standards that balance the needs of multiple modes within the local and regional mobility system. Complete streets can help achieve this balance.

New automobile vehicle types and ownership models are changing the planning relationships among automobile travel, infrastructure, and urban design. The new framework includes the following.

Personally owned vehicles with internal combustion engines

Passenger vehicles, sport utility vehicles, and light-duty trucks dominate the current U.S. fleet. Sales of larger cars and trucks have risen over the past several decades, posing [safety hazards](#) for people outside the vehicle due to vehicular weight and blind spots in some models (Barry 2024). The main planning-related lever for safety improvements lies in street design options that lower speeds and minimize the harms of higher speeds and larger, heavier vehicles.

Electric vehicles

Electric vehicle (EV) sales have been strong in recent years, but U.S. tax incentives for these vehicles expired in September 2025. Experts expect a period of [uncertainty and recalibration](#) in the U.S. EV market, but continued global advances in EV technology and sales will continue to drive uptake (Levin 2025).

While EVs solve tailpipe pollution problems, parking demand and congestion impacts remain as community planning challenges. In addition, the availability and equitable distribution of publicly accessible charging facilities are growing concerns. In a [2022 survey](#), the EV charging advocacy group Plug In America found only 15 percent of EV purchases were made by residents in multifamily housing (Price and Fitzgerald 2022). Publicly accessible charging stations will be an important new element of complete streets infrastructure for “[garage orphans](#),” people without private garages or other options to charge their EVs at their homes (Lubinsky 2023).

Motorcycles and high-speed scooters

Within a complete streets framework, motorcycles and high-speed scooters (similar in frame to mopeds, but with larger motors that allow speeds up to 75 mph) mix with automobile traffic in travel lanes. They are included in the taxonomy here with automobiles and personal vehicles based on common speeds, regulations, and use of roadway infrastructure.

One recent trend for this mode is the legalization of *lane splitting* (motorcycle travel between cars moving in the same direction) and *filtering* (motorcycle travel between slow-moving or stopped cars moving in the same direction). Six states have [legalized](#) lane splitting and filtering based on studies showing reduced rear-end collisions and improved traffic flow (Rothbard 2025).

Car share

In the United States, [car sharing](#) debuted at scale in 2000 through Flexcar and Zipcar (Urbanism Next n.d.). Unlike rental cars used for multiday excursions, car-share vehicles can be leased by the hour and are popular on college campuses and in city centers. Car-share models include round-trip (the driver picks up and drops off the car at a designated space), free-floating (the driver can pick up and drop off a car anywhere within a zone), and peer-to-peer (car owners use a third party to lease out personal cars by the hour or day). In 2023, New York City [expanded](#) its on-street car-sharing program after a five-year pilot showed that for every one car-share vehicle, four personal vehicles were either not purchased or sold (NYC DOT 2023b). In addition to membership car-share programs, amenity car-share fleets provided for a development's residents are gaining traction.

Ride-hailing and transportation network companies

Though taxis have long been a local mobility option, app-powered transportation network companies (TNCs) such as Uber and Lyft now dominate the ride-hailing (also referred to as ride-sourcing) market. They have transformed travel patterns, with both positive and negative outcomes. [Adverse impacts](#) on streets include increased vehicle miles traveled, increased double parking to pick up or discharge riders, and displaced transit rides (Schmitt 2019). For policies and plans, cities have mainly turned to designated pick-up and drop-off spaces to reduce double parking and congestion for both traditional taxi companies and app-enabled rides.

Autonomous vehicles

The deployment of autonomous vehicles (AVs) on public roads has been slower than predicted, as achieving com-

pletely autonomous operation has proven to be more complicated than initially envisioned. 2025 marked a milestone in [robotaxi](#) operations, with several commercial entities operating in four U.S. cities and multiple service providers planning to expand service into additional cities in 2026. But deployment is still in the early stages, and safety concerns persist for people both inside and outside of AVs (Ruiz 2025). Looking forward, planners should follow how autonomous cars, taxis, trucks, and transit perform. In the near term, cities may seek [interventions](#) to limit robotaxis' potential to poach transit passengers (Cities of the Future 2024).

While AV companies have developed their technologies to operate within existing roadways, planners may be involved with [infrastructure](#) modifications (Crute et al. 2018). As data show driverless taxis have lower crash rates in controlled environments, cities may consider establishing dedicated or semidedicated infrastructure to expedite driverless transit. AVs rely on sophisticated communications equipment, some of which will be embedded along roadsides and mounted on vertical infrastructure such as light poles. Road maintenance is critical for the various objects that AV detection systems "read" for [navigation](#), such as signage and striping (Partida 2025).

Micromobility

As noted above, micromobility is an umbrella term encompassing bicycles and personal mobility devices such as skateboards and scooters, as well as electric versions of these devices. Sometimes referred to as "rideables," micromobility devices generally have travel speeds between five and 20 miles per hour.

Micromobility's role in mobility, planning, and design is substantial and still unfolding. Research suggests these small vehicles can replace cars for trips covering [five miles or less](#) (Şengül and Mostofi 2021), which represents approximately [60 percent](#) of all car trips in the United States (USDOT 2022). A 2022 [study](#) estimated a potential 18 percent shift from cars to micromobility; that estimate rises to 29 percent when cargo bikes are added to the mode mix (Fan and Harper 2022). In dense urban settings, micromobility both [replaces and complements](#) public transit (Wang et al. 2022).

Micromobility's market-share growth adds credence to projections on micromobility trip substitution. Experts predict the [global market](#) for micromobility will reach \$327.8 billion by 2033 (The Brainy Insights 2024). According to the National Association of City Transportation Officials (NACTO), [total trips](#) on shared micromobility in 2023 increased by 20 percent from 2022, surpassing the pre-pandemic

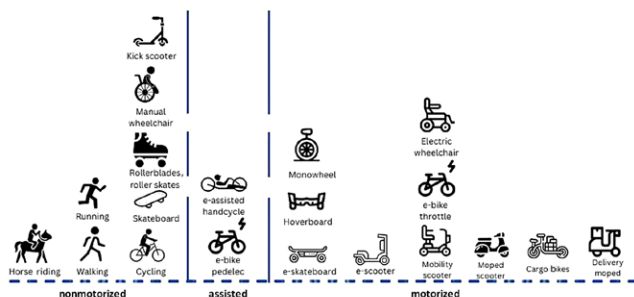


Figure 5.4. Classification of active travel modes and related categories (WGI, Inc., adapted from Cook et al. 2022)

2019 peak of 147 million trips across the U.S. and Canada (NACTO 2024a). The North American Bikeshare and Scootershare Association reported 31 percent [ridership growth](#) among all shared micromobility vehicles in 2024, reaching a new high (NABSA 2025). Demonstrating the importance of complete streets, a [2025 study](#) from the League of American Bicyclists and e-scooter provider Lime showed that U.S. micromobility trips increased on streets with dedicated bike infrastructure. Compared to baseline conditions, the installation of new bike lanes increased micromobility counts on streets by 35 percent in Phoenix, 39 percent in Nashville, and 207 percent in Baltimore (Cruse et al. 2025).

Given the expected growth in micromobility and its impact on mobility networks, complete streets planning will require more concerted attention to these low-speed travel modes. Figure 5.4 categorizes the various micromobility modes; the following are most relevant for planners.

Skateboards (human-powered and motorized)

Skateboards, which offer near-bicycling speeds with the flexibility of walking, are popular on college campuses and can be [effective](#) for first/last mile access to transit. In Los Angeles, transit riders use skateboards 30,000 times each day to get to and from bus stops and train stations (Fang 2018). However, skateboarding often falls into a regulatory black hole, as cities overregulate their use. Negative perceptions of skateboarders have prompted rules that prohibit riding on sidewalks and within roadways. Complete streets practitioners should determine where skateboarders should be allowed to travel and regulate accordingly.

Owned scooters (human-powered and motorized)

Like skateboards, scooters offer speeds and flexibility comparable to cycling. Foldable models are especially convenient

for travelers connecting to transit. E-scooters are replacing some transit trips, mainly where transit takes longer or involves transfers. [Researchers](#) found that e-scooter riders are willing to travel distances 59 percent longer to access bikeways, 29 percent longer to access multiuse paths, and 12 percent longer to access one-way roads (Aarhaug, Fearnley, and Johnsson 2023).

This willingness to travel extra distance to reach more favorable infrastructure should affect how planners [design](#) complete streets networks when incorporating micromobility assets (Zhang et al. 2021). Most of the data on average trip distance has been collected from shared systems, though trips on owned scooters are likely longer because riders are not paying by the minute.

Shared e-scooters

Shared e-scooter systems continue to evolve as cities learn from early rapid deployments. The National Association of City Transportation Officials (NACTO) offers [regulatory](#) and [planning](#) guidance for planners regarding e-scooters, including infrastructure investments, robust operational requirements (fleet size, relocation policies, maintenance, and customer service), safe parking rules, equity, and data management (NACTO 2019; NACTO 2022a). The Transportation Research Board report [E-Scooter Safety: Issues and Solutions](#) contains additional resources for planners (Sandt et al. 2022).

Electric personal assistive mobility devices

These devices, which include electric wheelchairs and mobility scooters, are used by travelers who have difficulty walking. Laws regarding the use of mobility scooters can be adopted by states as well as localities. While most [states](#) allow use on sidewalks, there are varying legal standards for roadway travel (Mobility METRO 2024).

Owned bicycles and e-bikes

While bikeways are still a major component of complete streets toolkits, the growth in the number and types of micromobility vying for bikeway space adds complexity to infrastructure planning. With their increased range and speed, e-bikes have the potential to replace car trips, even in suburban settings.

Following Colorado's lead in launching e-bike incentives, additional [states and cities](#) are developing programs (Bennett and MacArthur 2024). [Denver's](#) e-bike rebate program increased ridership, which led to increased demand for biking infrastructure; the city is now [building bike lanes](#)

ELECTRIC BIKES: A GAME CHANGER?

The [global market](#) for electric bikes is booming and shows no signs of slowing down (Josh 2025). In 2024, an estimated 1.7 million e-bikes were imported into the U.S., and [experts](#) predict annual sales of seven million e-bikes by 2030 (Benjamin 2025).

There are three categories of e-bikes. Class 1, also known as pedal-assist, can reach speeds up to 20 mph. Class 2 e-bikes are also limited to 20 mph and feature a throttle that can power the bike when the rider is not pedaling. Class 3 e-bikes can operate at speeds up to 28 mph and are often subject to additional regulations, such as being prohibited on trails.

E-bikes can be owned or deployed within bike-share fleets. While bikeshare fleets faced reduced ridership during the early phases of COVID lockdowns, the addition of e-bikes helped [bike-share](#) operators bounce back. In New York City, nearly half of the Citi Bike system's rides are on e-bikes, which only account for one-fifth of the fleet. Operators from Washington, D.C., to Omaha, Nebraska, have seen the same e-bike boom (Plotch 2024).

E-bikes are of interest to planners for an array of [benefits](#) (Brown 2022). They have the potential to reduce congestion, improve air quality, mitigate greenhouse gas (GHG) emissions, benefit local economies, and reduce car dependence. They can improve mobility equity by offering affordable and reliable transportation at low cost. E-bikes allow the [elderly](#) to continue biking, improving senior mobility, health, and social engagement (Leger et al. 2019). Compared to conventional bicyclists, [e-bike riders](#) use 87 percent of the energy conven-

tional bike riders use, which means e-cycling still translates to a moderate workout. Furthermore, cyclists report more enjoyable experiences when riding e-bikes (Hughey 2022).

The [average e-bike trip](#) is just under 10 miles, making it a candidate for commuting trips even in hilly terrain and warmer climates (MacArthur et al. 2018). However, there are still several barriers to e-bike use. Cost is one, as e-bikes are pricier than their analog counterparts, along with the same [lack of bike-supportive infrastructure](#) that conventional bike riders face (Mayer 2020). Another concern is battery fires, typically caused by overcharging or by poorly made, damaged, or modified batteries.

As with other cyclists, e-bike riders are vulnerable to crashes. The heavier weight and faster speeds pose [added risks](#), especially for young riders (Maa et al. 2024). Some communities are beginning to offer safety programs for these riders. In southern California, the [Carlsbad Unified School District](#) (2024) requires students to register and attend a training course before riding bikes or e-bikes to school.

With e-bike numbers on the rise, planners are likely to encounter growing demand for cycling infrastructure, trails, and complete streets designs that facilitate safe and convenient travel for both conventional and electric bicycles. In the future, planners will likely also address supportive urban design for these modes. One such holistic approach is being explored in the city of Zurich, Switzerland, where public university ETH Zurich's ongoing [E-Bike City](#) project has laid out a vision for transportation system planning and design that prioritizes cycling and public transit (E-Bike City Team 2025).

to accommodate safe e-bike use (Toll 2022). As personal e-bikes become more common, planners will need to ensure that the mobility network is designed for this mode and can absorb future public demand for e-bikes. The sidebar above dives deeper into e-bikes.

Shared bicycles and e-bikes

According to the [North American Bikeshare and Scooter-share Association](#), in 2024, riders took nearly 140 million trips on shared bicycles, with average trip distances of 1.5 miles for pedal bikes and 1.9 miles for e-bikes. Thirty-five percent of shared micromobility trips replaced a car trip

(NABSA 2025). Bikeshare vendors have increased the number of [e-bikes](#) in their systems to meet demand; most see e-bikes as the future (Plotch 2024). Lyft introduced [new docking and charging stations](#) for its e-bike and scooter fleets in 2023 to solve the problems of recharging and errant parking, though the docks take up more space than prior designs (May 2023). In addition to municipal e-bikeshare programs, new models offer private e-bike fleets as amenities for urban luxury apartments and condos, as well as large gated communities.

A growing concern with e-bikes is battery fires. According to the New York City Fire Department (NYFD), recharge-

able lithium-ion batteries caused more than 800 [fires](#) between 2021 and early 2025, resulting in over 450 injuries, 34 deaths, and damage to hundreds of structures. In 2024, there were 279 e-bike and e-mobility device battery fires in the city, compared to 44 in 2020 (Scanland 2025). In response, the city has developed an [electric micromobility action plan](#) that acknowledges the need to regulate vehicles, improve infrastructure, and support delivery workers who need affordable and flexible transportation options (NYC 2023).

Cargo bikes

Cargo bikes and e-bikes are becoming popular for delivery services and as family vehicles. In a 2016 [study](#), researchers found 68.9 percent of recent cargo bike buyers changed their travel behavior, reducing auto trips by one to two trips per day, or half of their auto travel prior to ownership (Riggs 2016). Subsequent [research](#) has explored factors hindering adoption, finding a need for larger parking spaces, wider paths, and more research on how families are substituting car trips with cargo bikes (Marincek, Rérat, and Lurkin 2024). The University of Washington Urban Freight Lab's 2023 report [Biking the Goods: How North American Cities Can Prepare for and Promote Large-Scale Adoption of Cargo E-Bikes](#) offers actionable strategies for encouraging adoption (Dalla Chiara et al. 2023).

Minimobility

Golf carts were once the only vehicle in the “minimobility” category, but a growing number of three and four-wheeled low-speed vehicles are fueling market growth. A 2022 [report](#) by the McKinsey Center for Future Mobility describes minimobility as vehicles that fall between cars and bicycles (Grausam et al. 2022). They typically weigh between 220 and 1100 pounds, with maximum speeds of up to 55 miles per hour. While their use is limited to short distances on local roads, the McKinsey report cites lower purchasing and operational costs, as well as ease of parking in urban areas, as key benefits.

Planners should monitor market adoption for minimobility, as this has implications for mode mix and related infrastructure design. Mainstream adoption of these vehicles could necessitate a new classification of low-speed networks with a 35-mph limit. This can work in neighborhoods with low-speed streets, but cities may need to rethink how to connect suburban residential and commercial areas for these vehicles.

To manage the jumble of mid-speed modes, some municipalities have begun redesignating bike lanes as “[mobility](#)

[lanes](#)” to recognize the growing number of vehicles traveling between 18 to 25 miles per hour (Alter 2019). Chapter 6 discusses mobility lanes in more detail. Further adoption of minimobility vehicles will also affect how planners design and designate on-street parking. For example, microcars are about as long as on-street parking spaces are wide, unlocking additional capacity for on-street parking of these small vehicles (Figure 5.5). Planners should be aware of the following types of minimobility.

Low-speed vehicles and neighborhood electric vehicles

Golf carts have been traveling on local roads for decades (Figure 5.6, p. 68), and new models of such low-speed vehicles (LSVs) and neighborhood electric vehicles (NEVs) are enclosed and look more like small cars. Rules on their design and roadway use are governed at the national level by the National Highway Traffic Safety Administration (NHTSA), with additional rules set by states and localities. In general, LSVs can travel no faster than 25 mph on roadways, with a top speed limit of 35 mph (or up to 20 mph for golf carts). Drivers of LSVs and NEVs may cross higher-speed roads but are not allowed to operate on high-speed (greater than 35 mph) roadways.

Minicars and microcars

These “medium-speed” (up to 60 mph) vehicles from Europe and Asia are gaining popularity abroad. In the United States, transportation policies will need to be revised to allow their operation, as they are not yet recognized by NHTSA. Their small size and lower speeds make them ill-suited for long-distance trips, but their maneuverability provides advan-



Figure 5.5. A microcar parked perpendicularly in an on-street parking space (WGI, Inc.)



Figure 5.6. Neighborhood electric vehicles are increasingly part of the mode mix on city streets (WGI, Inc.)

tages for short urban trips. As exporters increasingly target the U.S. market, manufacturers will need to cap top speeds to align with rules on NEVs.

Mopeds

The first mopeds were motorized bicycles. Today's mopeds are fully motorized vehicles with a step-through frame, engines no larger than 50 cubic centimeters, and maximum speeds of about 30 mph.

Delivery Vehicles

Global [e-commerce sales](#) continue to climb, with expected U.S. e-commerce sales totaling \$1.47 trillion in 2025 (CapitaOne Shopping 2025). This has expanded the role delivery vehicles play in getting goods to consumers, as well as their [negative impacts](#) (Kraft 2020).

Greater numbers of delivery vehicles are changing the dynamics of roadway and curbside use, particularly in urban areas with narrow streets and high volumes of mul-

timodal traffic. When truck drivers circle the block to find parking or double-park, this causes congestion and unsafe conditions for pedestrians and cyclists. [Researchers](#) studying urban freight-related crashes in North Carolina and Tennessee found vulnerable road users are particularly at risk when trucks are backing up or parking, with heightened risk at mid-block locations. Freight-related nonfatal injury rates increased by 45 percent from 2009 to 2015, and freight-related fatality rates in urban areas increased by 17 percent (Wang et al. 2022).

The delivery vehicle sector is seeing rapid innovation. Entrepreneurs are building autonomous trucks, shuttles, drones, and robots that operate on the ground and in the air. Cities are promoting the use of lower-impact small electric vehicles, including e-cargo bikes, for local deliveries in urban areas. All trends point to growing delivery vehicle activity on local streets. As such, planners should be aware of the following delivery vehicle typologies and their relationship to complete streets.

Traditional delivery vans and trucks

The largest delivery tractor-trailer trucks are generally 48–55 feet in length. Mid-sized delivery, or box, trucks are 25–35 feet long. Cities tend to regulate off-street [loading requirements](#) through zoning codes tied to gross floor area, mainly for commercial buildings. On-street loading requirements are less likely to be codified or regulated within on-street parking rules and signage (McDonald and Yuan 2021). In these cases, deliveries are managed through loading zone regulations, designated delivery hours, and enforcement. For complete streets, the main issue tends to be illegal parking in rights-of-way, blocking travelways, bike lanes, and parking spaces.

Small delivery vehicles

Small and medium-sized vans and trucks serve last-mile delivery routes and are designed for multiple stops and rapid delivery. Cities are seeking smaller vehicles and low-emission models to meet climate goals. For example, [Seattle](#) is pursuing zero-emission freight and e-cargo bike delivery programs (Bancroft 2023). Because smaller vehicles carry smaller loads, fulfillment patterns must shift from a few larger trucks with one load to more smaller vehicles carrying small loads, usually in higher-density neighborhoods. This system is built on last-mile or microfulfillment centers located in existing stores, vacant retail spaces, or designated sidewalk areas. New York City is experimenting with [micro-hubs](#) as part of the city's freight strategy (NYC DOT 2023a).

For complete streets, planners may need to help identify and mitigate conflict points among pedestrians, delivery vehicles, and other curbside users. Planners may also be called upon to design or designate urban delivery transfer zones for large trucks transferring loads to smaller delivery vehicles.

Delivery robots

Small sidewalk [delivery robots](#) are now appearing in some neighborhoods and college campuses (Appleton 2022). A 2022 [study](#) found delivery robots' travel was stymied by fractured and poor-quality infrastructure, however, and recommended further exploration of the potential for pedestrian conflict (Howell, Steckler, and Larco 2022). Depending on ultimate market adoption, planners may need to consider how these vehicles may compete with other modes and travelers for space on complete streets. The Urban Robotics Foundation's [Executive Guide to Public-Area Mobile Robots](#) offers insights on managing the operation of these vehicles in public rights-of-way (Grush and St. James 2025).

Transit Vehicles

Public transit is an integral part of complete streets. The numbers and types of transit vehicles and services have grown over the last 20 years, affecting complete streets outreach, policy, and design.

Transit use [decreased significantly](#) during the COVID-19 pandemic, and though ridership is slowly rebounding, reduced fare revenue is threatening transit agencies and operations across the United States (FTA OBP 2024). [Research](#) from Canada suggests that pandemic disruptions offer opportunities for transit agencies to rethink and improve systems for a post-pandemic “new normal,” though significant ongoing financial and operational challenges will make this difficult (Pezeshknejad, Palm, and Rowangould 2025). Planners should consider how current transit uncertainties may affect long-term planning and design for local transportation systems and complete streets.

Passenger rail

Rail service is considered the highest level of transit, given its fixed guideway (rail) and ability to carry the largest number of passengers within a system. Rail can be underground (subway), on the surface, or elevated. Service types include intercity passenger rail, regional commuter rail, and light rail systems. For complete streets, planners will need to consider station area design, transit-oriented development, and multimodal access.

Bus

Conventional bus service includes intercity bus systems and local buses. [Bus rapid transit](#) (BRT) systems are growing around the country, offering less costly and more flexible alternatives to fixed-rail systems (FTA n.d.). The Institute for Transportation and Development Policy (ITDP) has developed a [BRT standard](#) and scorecard based on international best practices; 12 U.S. systems qualify for certification (ITDP 2024).

Because transit operates more efficiently and effectively when in its own lane, installing dedicated or semi-dedicated busways is recommended if space allows. Where separation is not feasible, cities are installing “bus only” lanes and using [automated enforcement](#) to keep lanes clear, though not without glitches (Rose 2024).

Microtransit

Smaller transit vehicles are increasingly being used to provide a “missing middle” option for small-scale shared passenger service. Private-sector entities such as hotels and airports use shuttles successfully, and public transit agencies have long offered paratransit services for mobility-impaired riders.

Today's [microtransit](#) services use ride-hailing technology to manage fleets of on-demand transit vehicles that seat six to 12 passengers (NCATT 2022). Microtransit companies typically work with cities to set a target wait time for passengers (e.g., 10 minutes or less) and then optimize the service area and number of vehicles accordingly. These standards vary in rural areas, where wait times and travel distances are longer.

Some transit agencies and downtown development authorities, as in [Delray Beach, Florida](#), are now partnering with microtransit companies to expand services and provide first- and last-mile access to transit stations (Delray Beach n.d.). The Shared-Use Mobility Center offers a [learning module](#) on microtransit (SUMC 2025).

Autonomous shuttles

As with other autonomous vehicles, the complexity involved with safe autonomous operation limited early deployment of autonomous transit shuttles. Despite challenges, a growing number of autonomous shuttle programs are operating on private and public roadways.

Columbus, Ohio, piloted autonomous shuttle routes in [2018](#) and [2020](#) as part of a USDOT Smart City Grant (Wiley 2018; Crowe 2020). [Jacksonville, Florida](#), is currently building the first public transit system using autonomous vehicles, completing the first project phase in 2025 (JTA n.d.). As these technologies are further tested and put into service,

planners can expect incremental advances with the potential for both fixed-route and flexible shuttle transit service.

MODE PRIORITIZATION

With all the transportation modes described in this chapter competing for limited space on local roadways, planners will need to establish use prioritizations, or hierarchies, based on policy objectives and context.

Some cities have incorporated mobility hierarchies into their complete streets manuals. As noted in Chapter 4, Madison, Wisconsin’s complete streets approach prioritizes pedestrians and people with disabilities, with transit and bicycles next in line before cars and parking. Baltimore has established a four-tiered [modal hierarchy](#):

1. Walking
2. Cycling/public transit/micromobility
3. Taxi/commercial transit/shared vehicles
4. Single-occupant automobiles

The hierarchy guides decision-making related to project funding, prioritization, design, operations, and maintenance (Baltimore 2021, 6).

Planners should work with transportation departments to gather input from interested community stakeholders and residents on their needs and priorities through listening sessions. A community’s priorities should drive its complete streets program. For instance, a rural tourist destination may seek to expand and prioritize shuttles or e-bike tours to build new experiences, while an urban main street district might prioritize pedestrians to boost foot traffic for local shops and restaurants.

That said, most complete streets projects begin with prioritizing the most vulnerable roadway users. The needs of pedestrians, people using mobility-assistance devices, and cyclists should drive design, as they are less protected than occupants of motorized vehicles.

In addition to vulnerability, cities may use other approaches to develop mode hierarchies. A sustainability approach prioritizes modes based on transportation-related emissions. Figure 5.7 shows mode prioritization based on greenhouse gas emission levels, with carbon-neutral modes on the top and carbon-intensive modes on the bottom.

Congestion management offers another way to prioritize modes. Congestion is chiefly an imbalance of roadway supply and driver demand. Because infrastructure expansion

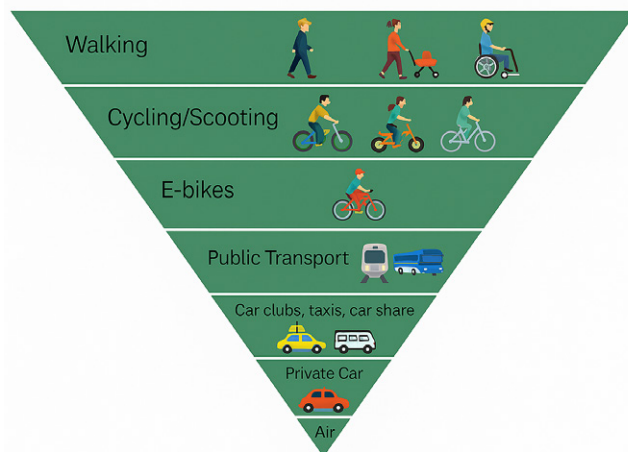


Figure 5.7. Example of a mode hierarchy based on the sustainability goal of reducing transportation emissions (WGL, Inc., adapted from [Surrey County Council n.d.](#))

is often impracticable or impossible, transportation agencies are beginning to frame congestion and solutions in terms of space efficiency. Single-occupancy vehicles are the most prevalent travel mode, yet they are the least efficient in roadway space consumption per traveler; transit and nonmotorized transport can be up to [20 times](#) more space-efficient (Will, Cornick, and Munshi 2020). While advocates promote the [space-saving effect](#) of connected-car technology that allows cars to follow each other more closely (Loller 2022), the best way to optimize travel space is by shifting automobile trips to walking, micromobility, and transit.

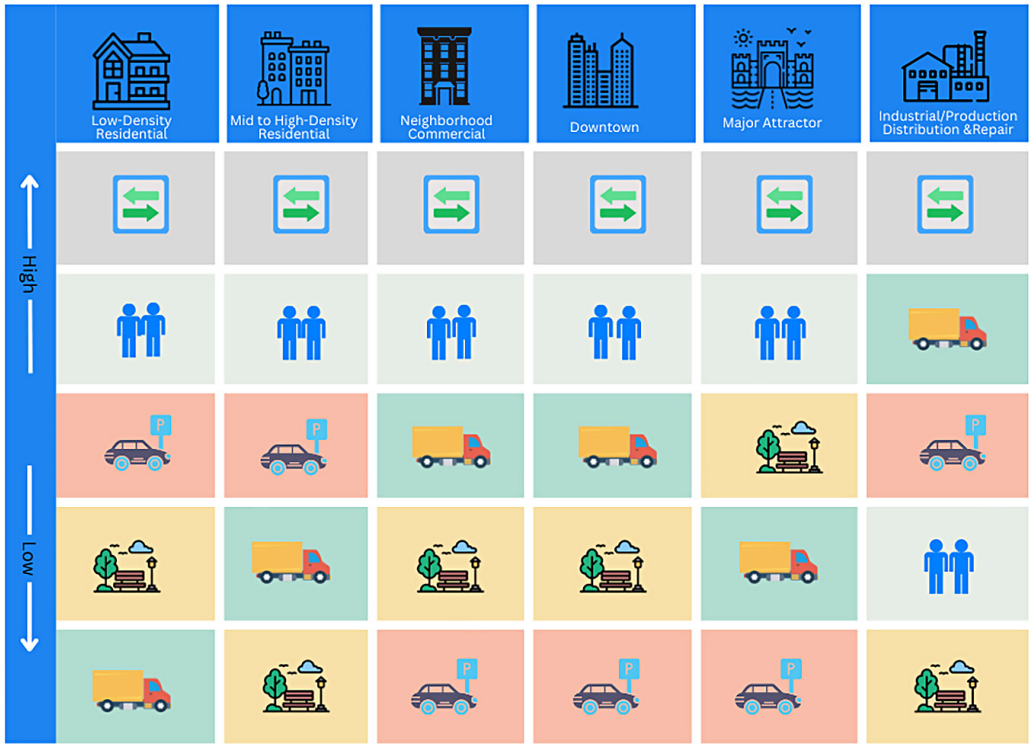
Some cities are giving curbs their own prioritization hierarchies. Though [curbs](#) have traditionally been designated as on-street parking and loading zones, increases in e-commerce and shared-use mobility means they are emerging as a separate and distinct infrastructure element with specific design, signage, and operational needs (Barth 2019). Post-COVID, cities have begun reimagining curbsides, sidewalks, and parking spaces as public space by turning pavement into parklets and outdoor dining spaces. New plans focus on [managing curbside space](#) (Nichols and Dorsett 2022). Figure 5.8 (p. 71) is adapted from the San Francisco Municipal Transportation Agency’s [Curb Management Strategy](#), which identifies curb users by function and prioritizes curb access by context within the city (SFMTA 2020). Chapter 6 provides design details for curbs and sidewalks.

Mode prioritization within a complete streets system changes the traditional criteria of traffic and functional clas-



Figure 5.8. Curbside users (top) and prioritization matrix (bottom) (WGI, Inc., adapted from [SFMTA 2020](#), 9–10)

Curb Functions Prioritized by Land Use



sification assigned to individual roadways. Instead, network and context-based needs, together with activity patterns, shape design imperatives. Activity overlays and special districts may also inform mode priorities. For example, a corridor plan may feature different overlays for school zones, proximity to transit, and a shopping district. The school and transit zones prioritize students and others who walk, bike, and access transit, while the infrastructure serving retail is designed to prioritize short-term loading zones.

CONCLUSION

The quest for complete streets began with a short list of transportation modes: car, walk, bike, and transit. Today, that list has expanded to encompass a wide range of new mobility options. Planners and engineers need to consider how all of these modes will function and interact within complete streets. These new modes will also affect how planners and engineers design roadways and ensure the safety and effectiveness of these mobility systems.

Pedestrians must be given special treatment in infrastructure design. This is due to their heightened vulnerability, but also because those using bicycles, transit, and cars are pedestrians at both trip ends. Understanding these links within a journey is critical when factoring in accessibility. If one link fails, the entire trip is affected.

Trends in vehicle design and ownership models have subtle yet important implications for planning and design. Technology-enabled vehicle sharing tends to lower some share of car ownership, which in turn changes the amount, location, and configuration of parking. Owned vehicles are experiencing two countervailing trends. On the one hand, trucks and SUVs are getting ever larger, posing higher risks to other roadway users. The heavier weights of electric cars and trucks—as well as e-bikes—likewise make collisions more harmful. On the other hand, the use of smaller vehicles, such as minicars and micromobility devices, is growing.

After early years of uneven performance and high-profile incidents, autonomous robotaxis are expanding commercial service. This may improve mobility by lowering costs, increasing trip frequencies, and expanding coverage, but may also result in more vehicles on the road and greater vehicle miles traveled.

Once planners map out the transportation modes being used on local roads, they can help identify a balanced mode split to meet a variety of community goals. This requires discussions about how to prioritize mode splits and design supportive infrastructure to create a balanced system. Chapter 6 examines the various infrastructure elements typically included in complete streets.



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06 STREET DESIGN AND INFRASTRUCTURE ELEMENTS

Complete streets are, as the name implies, largely about infrastructure. While community planners may not be conversant in the technical details of street design, they can still create and influence options that link context, mobility, and land use. Working with engineers, planners can assist in choosing projects that are the right infrastructure in the right place.

Over the past decade, planners and safety advocates have called attention to how conventional engineering standards can result in streets that are “dangerous by design,” as described further in the sidebar on p. 76. Smart Growth America regularly [reports](#) on this link between roadway design and traffic-related casualties (SGA and NCSC 2024b), and the advocacy group StrongTownns has coined a new term for such infrastructure. “[Stroads](#),” a combination of “streets” and “roads,” describes a mismatch of land use and roadway design in which fast-moving cars are mixed with retail and commercial activity (StrongTownns 2018).

In large part, the complete streets movement was created not only to install new multimodal infrastructure, but also to address hazardous conditions. Over the past two decades, practitioners have developed a toolbox of complete streets practices for sidewalks, roadways, intersections, bicycling facilities, and sidewalks.

This chapter provides examples of major complete streets infrastructure elements, shows real-world examples of those elements, and provides resources for additional detail. One of the emerging roles for planners in improving infrastructure is advocacy for the use of flexible street design standards. Complete streets alternatives are often optional, and traffic and transportation engineers may feel obligated to use standard practices to avoid risk. In such cases, planners need to be conversant to some degree in technical design to make the case for complete streets.

STREET DESIGN FACTORS

Before diving into individual infrastructure elements, planners first need to understand the factors driving design deci-

sions. Design standards and guides establish the possibilities, and planners should also consider street typologies and network approaches that affect roadway infrastructure.

Design Guides and Standards

Design standards emerged in the 1920s to govern design for highways and suburbs and establish uniform traffic signs. Over time, the U.S. Department of Transportation (USDOT) tapped professional organizations to develop the guides, manuals, and standards governing transportation-related infrastructure. The following is a summary of the most commonly used references and their relevance to complete streets. Note that there can be confusion over which design standards apply and whether they are mandatory or optional. This list is intended as background to help guide conversations with engineers on street and infrastructure design options.

AASHTO Green Book

The American Association of State Highway and Transportation Officials (AASHTO) publishes [A Policy on Geometric Design of Highways and Streets](#), also called the “Green Book” due to the manual’s green cover (AASHTO 2018a). Though the Green Book does not set required standards, engineers often treat its [directives](#) as mandatory to support design decisions (Kostelec 2018).

The Green Book is widely criticized for applying highway-based specifications to urban and suburban areas with many pedestrians and bicyclists. This results in excessively wide streets and turning radii, which allows drivers to undertake relatively high-speed turning maneuvers. In contrast, sharper turns force drivers to slow down at intersections, a common conflict point for travelers using all

modes. In addition, the Green Book's lack of context-driven solutions and reliance on rigid level-of-service standards [stifle flexibility](#) (SGA 2019).

To address calls for safer multimodal streets, AASHTO released the [7th edition](#) of the Green Book in 2018 with new provisions for flexibility and consideration of multiple modes (AASHTO 2018b). As of spring 2026, AASHTO is working on the [8th edition](#), which is expected to add even more flexibility for context sensitivity (Knudsen 2018). Planners can play an effective role in highlighting this flexibility within the Green Book to support complete streets design.

ITE recommended practice

The Institute of Transportation Engineers (ITE) publishes many street design resources, including a context-sensitive guide for walkable urban communities that better incorporate complete streets. [Designing Walkable Urban Thoroughfares: A Context Sensitive Approach](#) (ITE 2010) is an approved ITE recommended practice with special attention to urban arterials and collector streets. This guide contains detailed specifications and was produced with the explicit intent of helping engineers use the flexibility within the Green Book. For planners, this guide can be a helpful resource when talking to engineers about the flexibility inherent in AASHTO's design standards.

MUTCD

The [Manual on Uniform Traffic Control Devices](#) (MUTCD) is typically recognized as the standard directing the shapes, colors, and content of roadway signs. Less well-known are its consequential impacts on multimodal transportation. As an example, the MUTCD sets a standard for how localities establish speed limits. The "85th percentile" rule has allowed 15 percent of speeding drivers—[not safe speeds](#)—to determine what appears on speed limit signs (McLeod 2023).

In December 2023, the Federal Highway Administration (FHWA) released the 11th edition of the manual, which has several [changes](#) related to complete streets: (1) improved and expanded criteria for setting appropriate speed limits in differing contexts and environments, (2) changes in warrants for traffic signals and colored pavements for bike lanes and transit lanes, and (3) a completely new specific service sign category for electric vehicle charging (FHWA 2023c). However, the National Association of City Transportation Officials (NACTO) notes several [shortcomings](#) in the 2023 update, including the continued prioritization of motor vehicles, weak pedestrian safety provisions, and design directives that are beyond the MUTCD's purview (NACTO 2024b).

NACTO guides

In 2011, the newly formed National Association of City Transportation Officials (NACTO) published bikeway designs customized for urban roadways, followed in 2013 by its [Urban Street Design Guide](#). NACTO members wanted standards reflecting the complexity and needs of urban areas, which at the time were not included in prevailing roadway design standards. In 2025, NACTO released an updated third edition of its [Urban Bikeway Design Guide](#). USDOT has officially approved the use of NACTO guides as alternatives to traditional street design manuals.

ADA and PROWAG

Public and private transportation agencies are required to comply with the Americans with Disabilities Act (ADA) requirements, including those directing infrastructure design. The main components of roadway projects are sidewalks, street crossings, pedestrian pushbuttons, curb ramps, detectable warnings, landscaping, and signage. As covered in Chapter 2, communities that do not adhere to ADA can face lawsuits and consent decrees with large settlements and penalties.

On September 7, 2023, the U.S. Access Board's [Public Right-of-Way Accessibility](#) (PROWAG) final rule took effect (U.S. Access Board 2023). When the rule is adopted by both the Departments of Justice and Transportation, the new design standards will be fully enforceable; [USDOT](#) issued its final rule adopting the standards on December 18, 2024 (USDOT 2024a). These design guidelines provide engineering details to implement ADA requirements in public rights-of-way. PROWAG addresses sidewalks, curbsides (ramps and on-street parking), and crossings with pedestrian facilities, but it does not mandate pedestrian facilities ([Wilson 2023](#)). Cities must continue to install ADA-compliant infrastructure upgrades to achieve complete streets objectives.

Other guidance

Planners should be aware of other guidance relevant to safer, more inclusive street design. [Universal design](#) is a concept that ensures that all people can access, understand, and use any building, product, or service in any environment (Universal Design Project n.d.). The American Society of Landscape Architects has assembled a [list](#) of universal design components appropriate for complete streets (ASLA n.d.). In 2023, New Jersey Governor Phil Murphy directed the NJ Department of Transportation to update its complete streets policy to integrate design practices for [neurodivergent people](#), including those with autism or intellectual and developmental disabilities. Research is underway to deter-

DANGEROUS BY DESIGN

Design controls establish parameters describing the physical form, safety, and functionality of a transportation facility. This is at the heart of Smart Growth America's recurring report, [Dangerous by Design](#) (SGA 2024). Speed is a key factor that has multiple—and often controversial—facets:

- **Posted speed** is the legal speed limit that is displayed on road signs.
- **Design speed** is the selected speed used to determine the geometric features of the new or redesigned street.
- **Target speed** is the speed at which drivers feel comfortable and safe to travel on a particular road or section of road under prevailing conditions, regardless of the posted speed limit.
- **Operating speed** describes the speeds at which vehicles are observed operating during free-flow conditions.

Understanding the difference between design speed and posted speed will help planners understand why many streets seem to encourage speeding. To illustrate, suppose drivers consistently travel at 45 miles per hour (mph) or above along a roadway with a posted speed limit of 35 mph. They are likely reacting to a roadway design that feels safe at faster speeds because the road is straight with wide lanes. As planners engage in complete streets conversations, they can explain how such roadways encourage speeding and the need for design solutions. Other engineering concepts linked to higher speeds include the following:

85th percentile rule. Transportation safety advocates have long sought the removal of the “85th percentile rule” for setting speed limits. The rule stipulates that speed limits be set to the nearest five-mph increment of the 85th-percentile speed, or the speed at which 85 percent of traffic is moving. For example, if 100 vehicles are measured and 85 vehicles are traveling at 47 mph or less, the speed limit for the street would be set at 45 mph—even if the current limit is 35 mph.

This policy is controversial because it sets the speed limit based on prevailing traffic speed, not safety.

In its December 2023 [update](#) to the *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD), FHWA did not rescind the rule but reiterated the flexibility to use other factors (FHWA Office of Public Affairs 2023). In an AAA Foundation for Traffic Safety [survey](#) of traffic professionals, though 98 percent considered the 85th percentile rule, only six percent relied solely upon it when setting speed limits. Instead, most agencies rely on local standard operating procedures and context (AAA 2019).

Forgiving design. Intended to lower the crash severity for drivers who run off the road, forgiving design features include broad shoulders and roadsides without “fixed objects” that pose a crash risk. While this is appropriate for interstate highways, these principles encourage speeding in urban and suburban locales. The fixed objects along roadsides in these areas include trees, signs, and street furniture that typically frame complete streets. Moreover, forgiving design typically refers to protections for those traveling inside a vehicle, with no regard for bicyclists or pedestrians along roadways. When traffic engineers invoke this term in urban areas, planners should be prepared to identify roadway sections where the concept is not appropriate and provide complete streets features that [reduce risk](#) for all travelers (Dumbaugh and Li 2011).

Turning radius. The turning radius refers to the angle of the curve at a street corner. The smaller the radius, the tighter the curve, which forces drivers to slow down while turning. Cities often determine this curvature based on the “design vehicle” that the road will be designed to accommodate. Emergency response vehicles, namely fire trucks, are often used as the design vehicle, and engineers will design wider turns with reducing response times in mind. However, that poses higher risks for pedestrians and cyclists. For further information, see “[Design Vehicle](#)” in NACTO's *Urban Street Design Guide* (NACTO 2013b).

mine travel needs and how they relate to complete streets components (NJDOT 2023).

Complete streets guidance often addresses urban contexts, but rural communities experience different challenges and needs on their roadways. FHWA's [Small Town and Rural](#)

[Multimodal Networks](#) 2016 guide focuses on the needs of rural communities, highlighting national design standards and case studies that specifically apply to small towns, low-volume facilities, and rural areas.

Street Typologies

Traditionally, traffic engineers chose designs from a small menu of roadway types categorized and defined by FHWA as the [Highway Functional Classification System](#) (FHWA 2023b). This is a hierarchy of freeways, higher-speed major arterials, minor or secondary arterials, medium-speed collectors, and low-speed “local streets” (Figure 6.1).

This system, while simple, overemphasizes auto flow at the expense of travelers using other modes, neighborhood functions, and placemaking. It also largely ignores the importance of a gridded network to distribute traffic. Instead, it funnels traffic to increasingly larger streets. This has resulted in a series of bottlenecks, rather than connected systems, that plague metropolitan regions with congestion to this day.

As an alternative to this hierarchy, cities have developed new street terminology and typologies. Table 6.1 (p. 78) illustrates several cities’ new typologies that cross-reference traditional standards while supporting multimodal travel. For more information on typologies, refer to the Global Designing Cities Initiative’s [Global Street Design Guide](#) (Global Designing Cities Initiative 2016).

Street Networks

The sum of a community’s streets forms its roadway network. A key lesson from early complete streets projects was the need to consider the network as a whole to prioritize segments linking important destinations. The growing emphasis on connectivity and access has made network analysis an important first step in designing complete streets. Planners have a growing number of tools, such as GIS and traffic models, for quickly analyzing street patterns to identify gaps and reduce conflicts among modes.

The FHWA’s [Guidebook for Measuring Multimodal Network Connectivity](#) describes five steps for network analysis:

1. Identify the planning context
2. Define the analysis method
3. Assemble data
4. Compute metrics
5. Package the results

Though network analysis, typically performed by traffic planners or engineers, is technically complex, planners have important roles to play (FHWA 2018a):

- **Articulating a network vision.** Planners’ skills in visioning and developing comprehensive plans can enhance transportation network planning.

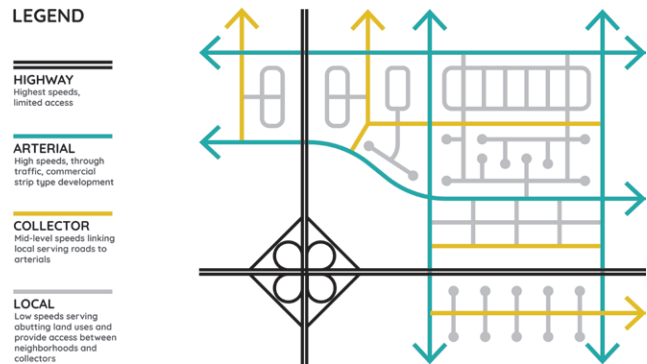


Figure 6.1. Roadway hierarchy types and terms (WGI, Inc.)

- **Network analysis.** Comprehensive network design requires extensive data that may not be available. Limiting study to the segments or areas where data exists can defeat the purpose of assessing the network as a whole. In this case, planners can play a role in comparing, prioritizing, deciding among different design options, and highlighting the pros and cons of each option. Similarly, planners can develop a phased approach that delivers near-term priority projects while building towards a full network over time.
- **Multimodal data collection.** Planners can advocate for increased investment in collecting the bicycle and pedestrian data needed to assess existing conditions and network gaps.
- **Testing network analysis tools.** Planners can work with transportation engineers and data analysts to determine which tool(s) will be the best fit for a community.

Among multimodal network tools, the Bicycle Low-Stress Network approach has become a popular tool for formulating a community’s bike network. The Mineta Transportation Institute report [Low-Stress Bicycling and Network Connectivity](#) established this method for assigning the levels of stress that cyclists experience on a street network (Mekuria, Furth, and Nixon 2012). It has been used to create state, regional, and local street analysis tools, such as the Delaware Valley Regional Planning Commission’s [LINK](#) tool (DVPRC n.d.). In another approach, the Los Angeles County Metropolitan Transportation Authority (LA Metro) has used the frame of a [slow-speed network](#) to create networks for an array of low-speed modes, including neighborhood electric vehicles (e.g., golf carts) and bicycles (LA Metro 2017).

TABLE 6.1. LOCAL EXAMPLES OF STREET CLASSIFICATION SYSTEM VARIATIONS

Local Example	Major Arterial, Primary Arterial	Secondary Arterial, Minor Arterial	Major and Minor Collectors	Local	Other
Miami Dade County (FL) Complete Streets Design Guidelines (2016)	Thoroughfare, Feeder Road	Thoroughfare, Feeder Road	Feeder Road, Civic Street	Neighborhood Street, Service Way, Paseo	Gateway Street, Historic/Scenic Street, SMART Plan Corridor
Orange County (CA) Council of Governments Complete Streets Initiative Design Handbook (2016)	Movement Corridor, Mixed Land Use Cor- ridor/Hub, Industrial/ Business Park Street	Mixed Land Use Cor- ridor/Hub, Industrial/ Business Park Street, Downtown Street, Neighborhood Main Street	Neighborhood Main Street, Downtown Street	Alley, Residential Street, Shared Street	
Des Moines (IA) Move DSM: Transportation for Everyone (2018)	Regional Mixed Use, Industrial/Business Park, Regional Resi- dential	Regional Mixed Use, Community Residen- tial, Industrial/Business Park, Regional Resi- dential, Community Mixed Use	Regional Mixed Use, Neighborhood Resi- dential, Community Residential, Regional Residential, Commu- nity Mixed Use	Neighborhood Resi- dential, Local Streets	
Sweet Streets Salt Lake City (UT) Street Typologies (n.d.)	One and Two-Way Thoroughfare (Grand Boulevard), Destina- tion Thoroughfare	Destination Thor- oughfare, Industrial/ Business Park Thor- oughfare	Destination Street, Urban Green Street, Urban Village Main Street, Neighborhood Corridor, Neighbor- hood Center	Commercial Shared Street, Urban Village Street, Industrial/ Business Park Street, Neighborhood Street, Neighborhood Green Street, Neighborhood Shared Street	

Researchers from McGill University developed a [frame-
work](#) for prioritizing future bicycle improvements under
budget constraints, as many communities lack the resources
for sophisticated network modeling. The framework offers
three strategies for quantifying network conditions to better
align bicycle network development with other community
goals: (1) a connectivity-focused strategy, which consolidates
bicycle networks and improves network connectivity, (2) an
equity-based strategy, which increases bicycle networks and
favors cycling equity goals, and (3) a modal-shift strategy,
which builds a bicycle network that would appeal to prospec-
tive bicycle commuters. With this simple framework, a com-
munity can choose a bicycle project prioritization method
that best meets their needs (Zhao and Manaugh 2023).

For more information on multimodal networks, see
FHWA's [Bikeway Selection Guide](#) (FHWA 2019) and the
previously cited [Small Town and Rural Multimodal Networks
Guide](#) (FHWA 2016c).

COMPLETE STREETS INFRASTRUCTURE ELEMENTS

With an understanding of the guidance and contexts that
shape infrastructure, planners can play a constructive role in
the choice, location, and design of complete streets compo-
nents. Table 6.2 (p. 79) summarizes the main categories of
complete streets infrastructure elements, with correspond-
ing examples and resources presented in the sections that
follow. This nonexhaustive list is intended to present a useful
overview for community and transportation planners.

Sidewalks

Sidewalks serve as transportation infrastructure, loading
zones, extensions of commercial spaces, and neighborhood
places. They need to be accessible, as every traveler walks or
rolls at some point. Because national manuals and standards
only address roadways, the ADA technical specifications

for public rights-of-way are the closest example of national policy and design directives for sidewalks. Sidewalk design, however, is largely driven by local policy and planning objectives that can include economic factors, environmental conditions, emergency response needs, and community design elements. As such, cities have varying policies and departments that share control over design, management, and maintenance.

Planners play a critical role in documenting the sidewalk’s role as both place and link. Firsthand observation at different times of day will reveal how streets are used and the best design to meet the needs of the people who use streets. This “public life” approach to planning, revolutionized by Jan Gehl and Birgitte Svarre, added people to the otherwise technical study of streets and cities (Gehl and Svarre 2013). As one example, Seattle has established a [Public Life Program](#) that combines observations and data to make investment decisions (SDOT n.d.). The city’s [guide](#) for data collection in the public realm provides checklists for documenting people’s movement through space, visitor details, and local conditions that may affect how visitors use space (SDOT 2018). Planners will also need to evaluate how local design guidelines and zoning codes help or hinder activity. These assessments should not only document streets as they are, but also their potential for added value.

As infrastructure, sidewalks can be broken out into zones: a frontage zone (at a building’s front), a pedestrian clear zone, and a landscape/furniture zone. Figure 6.2 illustrates sample dimensional guidelines and components of these zones for different corridor contexts. Sidewalks should be designed to meet the needs of all user types (e.g., seniors,

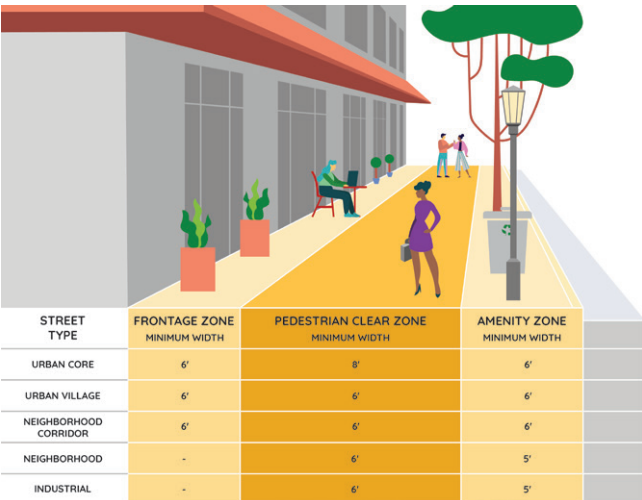


Figure 6.2. Example standards for sidewalk frontage zone, pedestrian clear zone, and landscape/furniture zone in different streetscape contexts (WGI, Inc.)

youth, families) and serve multiple functions (e.g., walking, rolling, outdoor dining, multimodal charging, micromobility parking). Sidewalk design standards can be part of neighborhood or small area plans, but are also referenced in comprehensive plans, bicycle and pedestrian plans, and the capital improvement program.

As noted earlier in the chapter, ADA requirements shape sidewalk design. While the ADA has been law since 1990, many agencies and cities have not yet fully retrofitted buildings and infrastructure. State and local governments are required to adopt ADA transition plans, which need to be updated periodically until all accessibility barriers are removed. Planners should determine the status of any local transition plan and whether there is overlap with complete streets projects. *PAS Memo 117, “[Planning Accessible Communities](#),”* offers more information on evaluating and improving local infrastructure for ADA compliance (Godwin 2023).

Complete streets are not just about installing infrastructure but also maintaining that infrastructure. Sidewalk maintenance is a large and growing discussion: should the costs be borne by taxpayers at large or adjacent landowners? A recent [study](#) of 30 U.S. cities representing 12 percent of the U.S. population showed that 77 percent assigned sidewalk maintenance to abutting property owners (Messier 2025). The equity implications are substantial, as repairs can cost thousands of dollars. Cities routinely dedicate funds for street maintenance but fail to recognize the value of well-maintained pedestrian infrastructure for nondrivers. Poor

TABLE 6.2. COMPLETE STREETS INFRASTRUCTURE ELEMENT CATEGORIES

Sidewalks	Roadways	Intersections	Bikeways
Bike parking	Travel lanes	Crosswalks	Buffered bike lanes
Transit stops	Turning lanes	Curb extensions	Protected bike lanes
Wayfinding/signage	Curbs	Roundabouts	Shared-use paths
Lighting	Traffic calming		Shared transit lanes
Landscaping/green infrastructure	Traffic control		Bike trails
Utilities			

sidewalk conditions often occur in lower-income neighborhoods; this [finding](#) aligns with a broad portfolio of studies on other types of infrastructure, such as tree cover and roadways (Corning-Padilla and Rowangould 2020).

Denver, Colorado, has wrestled with the “who pays” question. It created a publicly funded system that assesses property owners \$150 per year for sidewalk repair; owners with larger lots have higher assessments. The [program](#) is expected to amass \$40 million per year, which will be used to finance \$850 million in debt for fast-tracking sidewalk maintenance (Zipper 2025).

Wayfinding and signage

Wayfinding is a primary factor in how people navigate and use the built environment. This is especially true for complete streets, which typically serve a variety of users and mobility modes. Wayfinding networks have continued to evolve, incorporating new technologies and strategies to maximize their effectiveness in providing clear guidance to all users. This requires serving people who may be visually impaired or color blind, or who may not speak the local language.

In the last decade, smartphones with GPS applications such as Google Maps and Waze have changed how people navigate a city and discover new things. Cities have also begun experimenting with digital and virtual additions to their wayfinding systems, such as interactive wayfinding



Figure 6.3. Interactive wayfinding digital kiosk in Tampa, Florida (WGI, Inc.)



Figure 6.4. DIY wayfinding sign in Atlanta (StreetsPlan Collaborative)

kiosks (Figure 6.3), making navigation more user-friendly and interactive.

At the other end of the spectrum, planners are experimenting with low-cost measures. In 2012, graduate student Matt Tomasulo designed lightweight, inexpensive [wayfinding signs](#) in Raleigh, North Carolina, that could be attached to telephone poles or streetlights with zip ties (Garcia and Lydon 2015). Other cities have followed suit (Figure 6.4). Other measures include street stickers or appliques with wayfinding information.

Lighting

Good lighting is essential for safe complete streets. Recent [data](#) shows that more than 75 percent of pedestrian fatalities occur after dark (GHSA 2023). Well-designed [lighting](#) as part of crosswalk visibility enhancements is among the FHWA’s proven safety countermeasures (FHWA n.d.a.).

Planners can help determine how to evaluate and manage lighting needs for proposed complete streets projects. This may be through lighting gap assessments, co-benefit identification (such as wayfinding or public art), developer contributions, permitting, utility coordination, or public engagement. Considerations for prioritizing lighting installations can include pedestrian volumes, crash history, and 311 calls. Other details to consider include public safety, cost, maintenance, environmental impacts, site conditions, and local support or opposition to increased lighting. To improve safety, planners also need to address [lighting needs](#) for midblock crossings and roundabouts (Markowitz and Schwendinger 2023).

Lighting can also be an aspect of smart city initiatives. In addition to LED light conversion, cities are installing [smart poles](#) outfitted with sensors, counters, and wifi transmitters. Sensors help adjust the timing and intensity of adaptive lighting (Hurtado, Hitchings, and Rouse 2021). With the ability to control lighting, cities can track hazards and, where needed, reprogram lighting to improve pedestrian and bicyclist safety. To alleviate light pollution, planners should ensure that fixtures provide adequate lighting for safety but do not create undue glare or light trespass. DarkSky International offers [resources](#) on responsible outdoor lighting practices (DarkSky 2023).

Landscaping and green infrastructure

Cities use sidewalk landscaping for both aesthetic and sustainability purposes, including cooling and stormwater management. For complete streets, one of the biggest landscaping design challenges is the competition for space in the public right-of-way. [Considerations](#) related to landscaping include the following (Miami-Dade County 2016):

- Tree canopy and shade for comfort
- Buffers between moving traffic and sidewalk users
- Adequate space and design for healthy trees
- Plant selection to minimize maintenance

Landscaped areas require [maintenance](#) for plant health and public acceptance, as community support can be diminished when plants are not maintained (Meenar, Heckert, and Adlakha 2022).

Landscaping can be a key piece of demonstration projects, as shown in Figure 6.5, to add visual appeal and help the public envision a future landscaped roundabout or chicane (discussed further below). For more on using landscaping in demonstration projects, see [Tactical Urbanist's Guide to Materials and Design](#) (Street Plans Collaborative 2016).

A growing trend is green complete streets, which incorporate green infrastructure to manage stormwater and provide other environmental benefits while creating inviting streetscapes. Municipalities from [Nashville](#) (O'Connell 2024) to [Providence](#), Rhode Island (Providence 2021), have adopted policies and ordinances for green and complete streets.

Green infrastructure may be addressed in local plans. Before working on a complete streets project, planners should review comprehensive plans, transportation plans, utilities and public works plans, urban forestry and tree canopy plans, watershed and stormwater management plans, sustainability and climate-related plans, and relevant

corridor or small-area plans to identify preexisting policies and standards. This is especially important for projects intended to satisfy regulatory requirements for water quality and stormwater management.

Further information on green infrastructure and green complete streets can be found in NACTO's [Urban Street Stormwater Guide](#) (NACTO 2017) and [The Green & Complete Streets Guidebook](#) (Tufts University Devens Field Project Team 2022). The Philadelphia Water Department offers an online [green stormwater toolbox](#) with detailed illustrations and street cross-sections (Philadelphia Water Department n.d.b.).

Appropriate green infrastructure treatments will depend on the context and street typologies. Table 6.3 (p. 83) summarizes the applicability of common greening approaches for different roadways. Common green infrastructure [elements](#) include the following (USEPA n.d.c.).

Rain gardens. These bioretention areas are shallow surface depressions planted with vegetation chosen to retain, infiltrate, and filter stormwater runoff and pollutants. Curb cuts intercept water from the curb gutter and direct it into the rain garden.

Bioswales. Bioswales are typically larger than bioretention areas and act to convey rather than fully infiltrate stormwater. They are typically located in rights-of-way or parking lots to receive flow from adjacent impervious areas and are good choices along larger roadways.

Curb extensions. Located within streets and sidewalks, stormwater curb extensions (or bump-outs) can perform



Figure 6.5. Portable planters add visual interest to quick-build installations (Andy Clarke, Toole Design)

TABLE 6.3. APPLICABILITY OF GREEN INFRASTRUCTURE ELEMENTS BY ROAD TYPE

Road Typology	Rain garden	Bioswale	Curb Extension	Planter	Trees	Pervious Pavers
Arterial	Medium	High	Low	Low	High	Low
Collector	High	Medium	High	High	High	Low
Local Roads	High	Medium	High	Medium	High	High
Alleys	Low	Low	Low	Low	Low	High
Intersections	High	High	High	High	Low	Medium
Trails	High	Medium	Low	Low	Medium	Low

(Adapted from USEPA 2021)

multiple duties as traffic calming, landscaping, and stormwater capture areas. In areas with high pedestrian traffic, curb extensions should have fencing, bollards, or other barriers for safety, in addition to low-profile plantings that will not obstruct views.

Planters. Planters are narrow, flat-bottomed landscaped areas between sidewalks and the street that are typically rectangular in shape (Figure 6.6). They are often built as retrofit projects in urban areas and require curbs or fencing in areas with high pedestrian traffic.

Pervious pavers. Pervious or permeable pavers manage rainwater by directing runoff to the surrounding joints and by infiltrating water that seeps directly to the ground below. Pavers are typically used in low-traffic situations and in parking lots.

Trees. Stormwater tree systems feature specialized pits for stormwater capture and infiltration. They typically receive road runoff through curb cuts, catch basins, or stormwater inlets. Landscape architects are turning to enhanced tree pit options, such as tree boxes and cells that guide root growth, to prevent sidewalk buckling. Tree trenches are longer pits with multiple trees.

Trees offer additional environmental benefits, such as urban cooling and noise attenuation. However, engineers are sometimes hesitant to allow tree plantings along roadways as their root systems can damage underground utilities, interfere with overhead wires, and buckle pavement. New technologies and techniques like the [Stockholm tree pit](#) have mitigated some of these concerns, allowing street trees and utilities to coexist more harmoniously while improving tree health (Yeung 2025).

Though roadside trees are [fixed objects](#) that pose risks to drivers who run off the road, planners can advocate for

risk-reduction approaches other than tree removal that factor in context and the broader benefits of urban trees (Wolf and Bratton 2006). Choosing the right tree species for urban streetscapes is key. One such guide is the Minnesota Local Road Research Board’s [Best Practices for Boulevard Tree Selection](#), which highlights characteristics such as hardiness, tree size, and pest and climate vulnerabilities to help communities make appropriate tree list selections (Miller and Siro 2024).

Micromobility parking

As bicycle parking is a common element found on sidewalks, planners need to be aware of issues and design nuances. The most important design parameters are (1) providing



Figure 6.6. Green infrastructure elements, such as planters, collect, filter, and convey stormwater in the urban streetscape (USEPA)

enough sidewalk area to accommodate parking, (2) locating parking close to building entrances while not blocking pedestrian passageways, and (3) making sure cyclists can easily lock bike frames and front tires securely to racks with U-type bike locks. Codes commonly require a six-foot clear zone, which may require adding additional sidewalk space or installing racks at an angle (Figures 6.7 and 6.8). Some communities have begun using sidewalk bump- or bulb-outs near intersections to host bike parking while preserving daylighting sight lines. For design basics, see the Association of Pedestrian and Bicycle Professionals' guide [Essentials of Bike Parking](#) (2015).

Planners will need to be aware of recommended practices for siting shared micromobility (bike and scooter) parking stations in high-density areas along routes that safely connect points of interest. Safe designs include lighting and placement that is close to curb cuts and does not obstruct walkways. Planners must also consider visibility and access for riders, maintenance personnel, and truck drivers who rebalance bikes among stations daily.

Emerging issues related to sidewalk bicycle parking include parking needs for e-bikes and cargo bikes. Riders can typically park e-bikes in racks designed for regular bikes. However, the higher cost of e-bikes and concerns over exposure of electric components to the elements have created demand for more secure parking options, such as modular parking pods and hubs. For charging docks for e-bikes and e-scooters, access to electricity must be provided through hard-wired stations or solar recharging, which re-

quires landscaping and shading pattern analysis. NACTO's [Bike Share Station Siting Guide](#) is a good resource on design details (NACTO 2016a).

Because of their larger frames and greater weights, cargo bikes need longer spaces and secure lock-to racks (Figure 6.9, p. 84). Cargo bikes are often used for transporting children or carrying larger loads. Planners living in cities with growing use of cargo bikes should determine areas where demand for these racks will be high, such as supermarkets, parks, and schools.

When weighing the need to install micromobility parking or docking stations, planners must be aware of the negative outcomes associated with dockless (or free-floating) e-scooters. Dockless scooters allow users to park vehicles closer to a destination than any other vehicular mode, but parking scooters in ways that block sidewalks creates safety hazards and impairs accessibility.

A 2021 [study](#) investigating problematic scooter parking found that riders were largely unfamiliar with local scooter parking rules, but that signage, additional racks, and in-app notifications to instruct riders on how to park dockless vehicles can help (Brown, Nicholas, and Thigpen 2021). In a related [study](#), researchers found ridership declined by 72 percent overall on the Virginia Tech campus after the school installed parking corrals that students felt were too far from destinations (Buehler et al. 2023). Planners need to ensure that on complete streets, vehicle corrals are located close enough to the destinations served by those vehicles to meet the preferences and expectations of riders.



Figure 6.7. On-street bike parking within a bulb-out in Corvallis, Oregon (Toole Design, Andy Clarke)



Figure 6.8. Angled on-street bike parking in West Palm Beach, with paver design helping to demarcate bike parking alignment (WGI, Inc.)



Figure 6.9. Modular cargo bike parking (Mickael Colville-Andersen, [CC BY 2.0](#))

Transit stops

For complete streets, design considerations for transit stops include their physical location on the street relative to intersections and other features, as well as design elements such as platform length and height, shelter, and accessibility. For accessibility, transit agencies are beginning to design for level boarding that eliminates steps onto vehicles. Modifying the built environment to enable wheelchair and walker users to roll onto transit vehicles speeds boarding times for all passengers.

[Well-designed](#) transit infrastructure elevates the experience of riding transit, supporting successful systems that help create safer, healthier, and more equitable mobility (APTA 2013). Human-centered transit stops should protect riders from wind, rain, and sun. Value-add amenities include information-sharing kiosks and public artwork. Cities often reserve space for advertising to help underwrite installation and maintenance costs. For in-depth detail on the design of these elements in the context of complete streets, refer to NACTO's [Transit Street Design Guide](#) (NACTO 2016b).

One challenge with transit stops within a complete streets context is the potential for physical conflicts among transit vehicles, passengers, and cyclists. Where space exists, some cities have installed floating bus stops (also called bus bypass lanes), which “float” on the other side of a dedicated cycle track installed against the curb (Figure 6.10). Floating bus stops eliminate the problem of buses blocking bike lanes when picking up passengers; however, they can introduce [conflicts](#) between bus users and cyclists, as bus users must cross the cycle track to access the bus stop (Halford 2024). This can be especially challenging for bus users with vision or physical [disabilities](#) (Opfell 2019).

Roadways

Even as the scope of complete streets elements expands, roadways are still a focal point. Recent innovations in street design include increased flexibility and iterative concepts for testing new ideas.

Travelways

Roadway lanes are a primary street feature. However, underlying their design are complex engineering concepts that affect mobility, safety, and durability. Planners do not need to delve into engineering details, but knowing how design relates to speed, access, traffic flow, and placemaking can be helpful when advocating for multimodal transportation.

One critical area of street design as it relates to multimodalism is lane and roadway widths. Under car-centric designs of the past, engineers assumed wider lanes were safer to give drivers an operating buffer in case of lane departures. While this reasoning is appropriate for highways, it does not work for local streets. Years of research shows that extra maneuvering space induces higher speeds and greater safety risks for drivers and those traveling outside of vehicles alike. A comprehensive 2023 [study](#) of lane widths and safety found that wider lanes and higher speeds increased crash risk, while narrow lanes decreased risk and had co-benefits: they

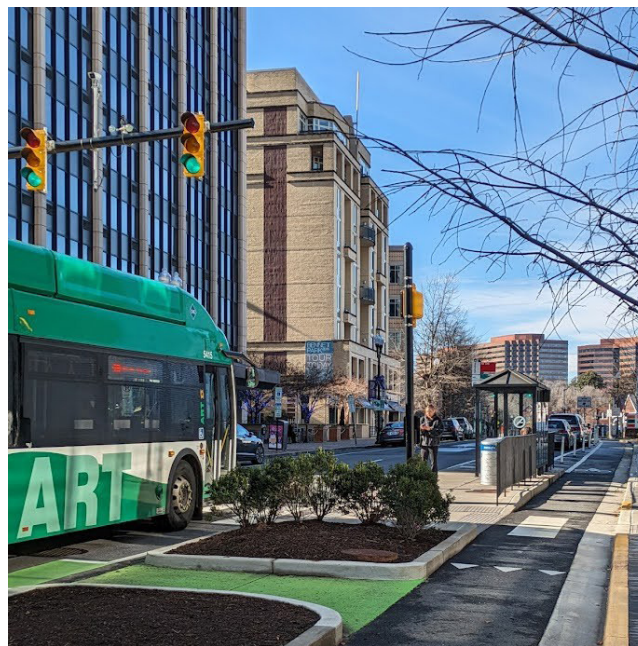


Figure 6.10. A floating bus stop in Arlington, Virginia, located on the travelway side of a dedicated bike lane adjacent to the sidewalk (WGL Inc.)

accommodated more users in less space, used less asphalt pavement with less land consumption, and had smaller impervious surface areas (Hamidi and Ewing 2023). The study also found that property values and business activity were higher along right-sized travel lanes. For more information on appropriate lane widths, see “[Lane Width](#)” in NACTO’s *Urban Street Design Guide* (NACTO 2013c).

In seeking space for biking infrastructure (discussed further below), planners often look for wider streets with space that can be reallocated to bike lanes or wider shoulders that can serve as bikeways. As such, complete streets design options may call for a “[road diet](#)” to replace car lane space with cycling facilities or sidewalks. Road diets are an FHWA proven safety countermeasure that can be implemented at low cost (FHWA n.d.c.).

Though reducing traffic lane widths is a common traffic-calming design feature, planners must also consider the needs of delivery trucks, emergency response vehicles, and other large trucks operating on local streets. Standard-setting organizations have recognized this need and developed design criteria to accommodate intersection and driveway turning movements for larger vehicles. In 2018, for example, the New York State Energy Research and Development Authority (NYSERDA) created a [manual](#) illustrating infrastructure and management options for accommodating freight and emergency vehicle operations within multimodal streets (NYSERDA 2018). The sidebar on p. 86 provides more detail on emergency vehicles and complete streets design.

Curbs

“[Curbside management](#)” is a relatively new planning term, though cities have long managed competition for space where the street meets the sidewalk’s edge (Nichols and Dorsett 2022). Curbs have traditionally been allocated to on-street parking and loading and managed with parking meters, designated zones, and signage. As e-commerce and on-demand ride-hailing grow, however, these simple [management schemes](#) no longer suffice (ITF 2018). Curb management also involves safety as cyclists, micromobility users, and pedestrians mix with curb and sidewalk activity.

Curb design is straightforward for most streets. The visible part of the curb, also known as the *reveal*, is usually six inches high; the base is called the *gutter*. Curb reveal can be increased to eight inches, which is an additional deterrent for errant drivers and helps control stormwater flow during heavy storms (one of the most important functions for curbs is stormwater drainage, which can be a factor when redesigning streets). Higher curbs are more expensive, however,

and the resulting greater slope required for curb cuts can impede accessibility at intersections.

Planners should be conversant with several curb design concepts:

- **Curb cuts at driveways.** These concrete or asphalt aprons provide a smooth transition from the street to parking lots and driveways. Planners are typically involved not in driveway design details, but rather the number and spacing of curb cuts for access management.
- **Curb cuts at intersections.** As noted in this chapter, ADA access influences intersection design. The quest for accessible curb cuts has a rich [history](#) dating back to the 1970s in Berkeley, California, as covered on the podcast *99% Invisible* (Gorney 2021). One of the main jobs of planners will be public engagement regarding the need for accessible intersections. Walk-and-roll audits are a good tool for ADA-focused improvements; the AARP [Walk Audit Tool Kit](#) is a helpful resource (AARP 2022). Planners may also play a role in quality control to make sure final designs do not include obstructions, such as signs and signal control boxes. This can be a flashpoint when working with other agencies, such as state departments of transportation, that prioritize convenience over accessibility for utility poles and traffic control cabinets.
- **Rolled curbs.** Also referred to as mountable curbs, these sloped edges are appropriate where large vehicles, such as fire and rescue trucks, need room to turn around corners or roundabouts.
- **Designated pick-up and drop-off points.** With the increase in deliveries, microtransit, valet services, and ridesharing, designated pick-up and drop-off points can enhance safety and predictability. Ideally, these points are located on side streets or along pullouts that remove vehicles from travel lanes. On-demand ride services are nudging passengers to use designated pick-up points rather than random pick-up locations. Designs should minimize stops in traffic lanes and address appropriate accessibility and visibility for ease of use.
- **Curb maintenance.** Like roadways, curbs need to be maintained to prevent trips and falls and improve aesthetics. In cities that paint curbs to denote uses, regular repainting will be needed for smooth curb operations.

Some roadways do not have curbs at all. Typically used in rural areas or low-speed downtown areas, curbless streets (also referred to as shared streets, festival streets, or the Dutch term *woonerf*) are designed to support a mix of trav-

EMERGENCY RESPONSE VEHICLES AND COMPLETE STREETS

The relationship between complete streets and emergency response is synergistic. Reducing automobile crashes is among the top shared goals of both complete streets and emergency response, and reducing congestion allows quick passage for emergency medical services (EMS), police, and firefighters.

The relationship can also be conflicting when considering maneuvering space for emergency vehicles. Fire departments have opposed traffic-calming measures that slow response times or limit access for fire trucks. This includes reduced turning radii (redesigning intersections to create tighter turns to slow speeding vehicles), raised infrastructure that blocks travel (medians and separated bike lanes), and speed bumps. Fire departments have also opposed curbside bike and bus lanes that increase the distance between a parked fire truck and building facades.

U.S. cities have increasing [options](#) for urban and neighborhood-scale emergency vehicles that are common in

Europe (Rogger 2021). Mountable curbs (a sloping curb that allows vehicles to safely mount the curb without damaging the vehicle or curb) or certain flush curb designs (a curb that is level with the roadway surface) allow separation from daily traffic while allowing larger vehicles to navigate through an intersection. Mountable curbs are also used in roundabouts. [Bike boxes](#) (a designated area at a signalized intersection that provides a safe space for bicyclists to wait ahead of motor vehicle traffic) create more maneuvering space as cars queue farther from intersections (NYSERDA 2018). Some municipalities have created design guidelines that deconflict complete streets design and fire operations. Montgomery County, Maryland’s 2019 [Fire Department Access Performance-Based Design Guide](#) (Montgomery County DPS 2019) analyzes complete street strategies and provides workable solutions to make them more compatible for fire apparatuses. Table 6.4 summarizes complete streets solutions to meet multiple safety goals and mitigate negative effects on emergency vehicles.

TABLE 6.4. DECONFLICTING COMPLETE STREETS AND FIRE DEPARTMENT OPERATIONS

Complete Streets Strategy	Fire Department Concern	Solutions
Reducing turning radii	Fire apparatus can’t navigate narrowed intersection	Relocate stop bar further from the intersection; increase no-parking zone near intersections
Bike lanes, transit lanes	Increases distance between the building and fire apparatus	Ensure bike lanes are built to be load-bearing for heavy vehicles; install mountable curbs
Speed bumps	Slows down fire apparatus and reduces response times	Use smaller speed bumps or speed tables that slow smaller vehicles but are less obtrusive for large fire apparatuses
Trees and landscaping	Blocks hydrants and limits apparatus access to the sidewalk	Establish clear zones around hydrants

elers and uses within a single-plane right-of-way. In a [study](#) of curbless streets, the City of Minneapolis found several common design features: traffic-calming elements, textured pavement materials, well-defined entrances and transitions, shared-street signage, furnishings, stormwater management, programming, and maintenance regimes (Minneapolis

2019). More information on street programming is presented in Chapter 7.

Traffic-calming elements

Transportation planners apply a variety of treatments to manage all modes of transportation for a variety of objec-

tives, such as speed management, visibility, connectivity, and travel flow. Traffic-calming elements include vertical structures and alignment strategies specifically designed to slow traffic. Calming traffic relates to planning objectives regarding quality of life, safety, and livability of communities.

As an interface between the public and projects, planners can expect a variety of positions regarding traffic calming. While some neighborhoods actively petition local governments for calming, there can also be opposition. Appendix A offers research and messaging regarding traffic calming. Planners should strive for “self-enforcing” systems in which street designs and features help drivers obey traffic laws and avoid conflicts with law enforcement, as described in the sidebar on p. 90.

Vertical elements. Vertical speed-reduction elements vary in size and shape. Common vertical elements are *speed bumps*, *speed humps*, and *speed tables*, which vary in height and length (Table 6.5). Speed tables are often used on streets with emergency and service vehicle traffic. Placing vertical elements in automobile travel lanes and leaving space next to the curb and gutter allows for drainage and room for cyclists to navigate smoothly. FHWA’s [Traffic Calming ePrimer](#) includes a module on vertical traffic calming design as it relates to nonmotorized users (FHWA 2017).

Speed cushions are another option for roadways with high levels of emergency response vehicle traffic. These consist of two or more raised areas, typically 12 feet wide and three inches high, with cutouts to accommodate emergency



Figure 6.11. A raised intersection in Lima, Peru (Andrew Crozier)

response vehicles, trucks, and buses. Travel speeds typically slow to 20–25 miles per hour.

A variation on the speed table is the *raised crosswalk*. These are typically three to six inches above street level to be level with the street curb for accessibility. They can be installed midblock or at intersections; in some cases, the entire intersection may be raised (Figure 6.11). They are typically suitable for streets with speed limits of 30–35 miles per hour.

Alignment strategies. A second traffic-calming category features roadway alignment strategies. Because long,

TABLE 6.5. COMMON VERTICAL TRAFFIC-CALMING ELEMENTS

Element	Dimensions	Vehicle Slowed Speed	Illustration
Speed bump	12" wide, 3–6" high	15–20 miles per hour	
Speed hump	12' wide, 3–4" high	15–20 miles per hour	
Speed table	6' approach and 10' top, 3–4" high	25–35 miles per hour	

Source: [City of Boca Raton, Florida](#)



Figure 6.12. A chicane with three landscaped diverters requires drivers to perform two turning maneuvers on this otherwise straight street (Flickr/Richard Drdul CC BY-SA 2.0)

straight roadways and corners with wide turning radii are associated with higher speeds, roadway alignment strategies seek to slow traffic by forcing drivers to maneuver around diverters or through new roadway alignments.

Diverters can be permanent installations, such as raised islands, or semipermanent features created with flexposts and modular infrastructure. There are several types of realignment options. A *lateral shift* introduces small shifts in the direction of an otherwise straight street using paint, islands, or other diverters. The expected level of speed reduction is a function of the degree of lateral shift and the angle of deflection (i.e., how much the driver needs to steer to follow the travel lane). Diverters and restriping cause drivers to slow down and steer slightly to follow the travel lanes.

In contrast to a lateral shift, *chicanes* add diverters to create a series of two or more alternating curves or lane shifts that force a motorist to steer back and forth (Figure 6.12). Chicanes are appropriate on roads with posted speeds of 35 miles per hour or less on roads with low to moderate traffic.

A *realigned intersection* replaces straight approaches with curves in T (or three-way) intersections where speed is a concern. With this type of design, a conventional T intersection can be modified with a half-moon-shaped raised section of street (Figure 6.13). The stop bars are moved away from the intersection to improve visibility and the newly curved streets slow traffic traversing the intersection.

Medians and islands. Medians and islands are installations in the middle of a street to separate and slow bi-directional traffic. They also provide a refuge for pedestrians

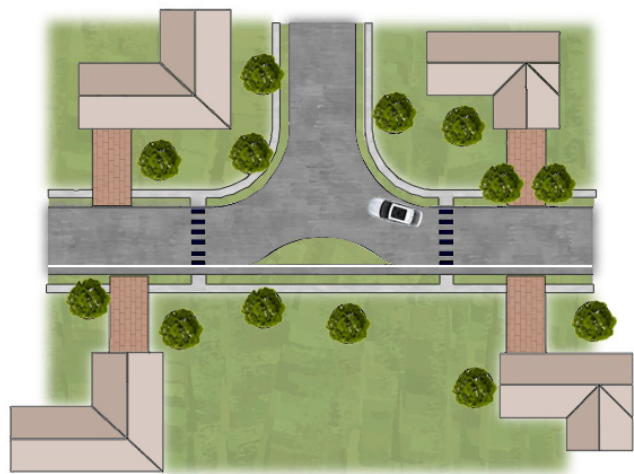


Figure 6.13. A realigned three-way intersection adds curves to slow car travel (WGL Inc., adapted from [DelDOT 2025](#))

along with space for landscaping and, in some instances, transit stops.

A *median* is the area between opposing lanes of traffic, excluding turn lanes; it typically runs the entire block length. Islands are smaller installations used to control traffic movements, though the terms are often used interchangeably. *Islands*, or medians with marked crosswalks, as shown in Figure 6.14 (p. 89), have been shown to [reduce pedestrian crashes](#) by 46 percent (FHWA n.d.).

Limiting access to vehicle traffic. In certain cases, diversion techniques can prevent through traffic or turning movements on residential neighborhood streets. Limiting traffic access should only be considered when other calming methods have failed to control traffic. While residents on several blocks will experience less traffic, the trade-off is [reduced access](#) within the street network and longer emergency response times (Burden and Zykofsky 2000).

Where needed, diverters can be designed to give access to bicycles and emergency response vehicles. Figure 6.15 (p. 89) depicts an intersection in which a diverter directs cars to a right-hand turn but allows bicycles to continue straight. For more information on traffic calming measures and implementation guidance, see the California Department of Transportation's [Traffic Calming Guide: A Compendium of Strategies](#) (Caltrans 2022b).

Traffic controls

Technology for controlling traffic modes is advancing rapidly, offering new signalization and signage for all

modes. Early smart city investments focused on smart traffic signals, supported by an array of sensors installed on roadsides, on streetlights, or within vehicles. Traffic planners use collected data to manually adjust operations, or, increasingly, use machine learning to optimize signal operations for improved flow.

Determining what defines optimized traffic signals is important. Emergency vehicle preemption is among the top reasons to have smart signals. Signal technology can also help when there is light cross-traffic flow, such as at night or in rural areas, by activating for an approaching vehicle, so drivers are not stuck at a red light when there is no crossing traffic. A variation on this is “[rest in red](#)” timing used during late-night and early-morning hours to encourage safer traffic speeds (Portland Bureau of Transportation n.d.).

However, planners should ensure that signal optimization considers all transportation modes. Traffic technology companies tout the benefits of automated signals to reduce car idling at red lights and better use roadway capacity by giving drivers a “green wave” of successive green lights when driving at the speed limit. Setting signal timing at or below the speed limit can help to slow traffic as drivers become attuned to driving speeds that match green lights. However, this can [exacerbate traffic flow](#) on intersecting routes and induce more driving along main signal-timed routes that gain a reputation for improved traffic flow (Bloder and Jäger 2021). Moreover, transit can suffer when lights are timed for personal vehicles that do not need to make numerous stops, unless transit vehicles are outfitted with the same signal-pre-



Figure 6.14. Example of a raised median island with a midblock crosswalk (Dan Burden/www.pedbikemages.org)



Figure 6.15. A diverter directs cars to a right-hand-only turn but allows bicycles and pedestrians to continue straight (Adam Fukushima/pedbikemages.org)

emption technology as emergency vehicles. The timing for cars also affects [cyclists](#), who are not traveling at the vehicle design speed (Cesme and Urbanik 2021). Thus, signal timing is a multimodal issue.

Pedestrian push-button controls. These controls, sometimes called “beg buttons,” require pedestrians to push a button at a traffic signal to get a “walk” signal with the next cycle. Their use can be controversial. [Advocates](#) point to their potential to optimize mobility for both vehicles and pedestrians (Hinners 2022), while [detractors](#) assert that they signal the prioritization of vehicular movement over pedestrian mobility (Repetski 2021). Furthermore, the buttons may be [artifacts](#) of older traffic systems and no longer work (Winkless 2017).

Planners should be aware of technological advances and best practices to optimize traffic signal performance without negatively impacting pedestrians and bicyclists. The National Cooperative Highway Research Program research report [Traffic Control Signals for Pedestrians and Bicyclists](#) is a valuable resource (National Academies of Sciences, Engineering, and Medicine 2022b). When used, push-button

SELF-ENFORCING ROADWAYS

Research shows that there is a [direct correlation](#) between streetscape design and driving behavior (Eggermond et al. 2025). As explained in the FHWA guidance report [Self-Enforcing Roadways](#), designers can create “self-enforcing” or “self-explaining” streets using features such as narrowed lanes and raised crosswalks. This approach encourages appropriate driving speeds in harmony with the roadway’s design speed (FHWA 2018b). Safer driving results in safer conditions for cycling and walking.

Automated enforcement of speeding or red-light violations via cameras and sensors is a related approach. [Studies](#) show that the presence of cameras results in lower speeds (McCahill 2024). Red light and speed detectors are [control-versal](#) measures, however (Fegan 2021). Some communities have built support by addressing the most hazardous locations first, while also addressing equity issues so cameras are not concentrated in low-income areas. Programs have the best chance of earning community support if they are designed to improve safety, not generate revenue. Constant monitoring and communications are also key. The [Automated Enforcement Program Checklist](#), produced by a consortium of traffic safety groups, can help communities develop successful programs (IIHS 2021).

The transportation organization Transportation Alternatives (2020) recommends several [strategies](#) for self-enforcing streets:

- Increase funding for the design and construction of self-enforcing street features, including but not limited to protected intersections, protected bike lanes, protected bus lanes, narrowed roadways, bulb-outs, leading pedestrian intervals, and accessible curb ramps.
- Prioritize the redesign of curbs with loading zones to lessen the need for parking enforcement.
- Include a report on street design and conditions in crash reports to inform the local department of transportation about needed infrastructure solutions.
- Pilot sliding-scale fines for unlicensed or dangerous driving and alternatives to payment for low-income drivers, such as permission to forgive fines and a grace period to bring violations into compliance.

Planners can help incorporate self-enforcing design elements into complete streets for safer and more equitable transportation networks.



Figure 6.16. Rectangular rapid flashing beacon (RRFB) at a crosswalk (Michael Frederick/www.pedbikeimages.org)

controls should be paired with audible and vibrotactile indications as required by ADA. The new PROWAG standards include specifications for their placement and operations.

Leading pedestrian interval (LPI). LPI is a timing adjustment at a crosswalk signal that allows pedestrians to enter the crosswalk three to seven seconds before vehicles are given a green light. As a result, crossing pedestrians are more visible to drivers. This relatively low-cost solution is listed as an FHWA proven [countermeasure](#), shown to reduce pedestrian-vehicle crashes at intersections by 13 percent (FHWA n.d.b.).

Rectangular rapid flashing beacon (RRFB). RRFBs are flashing lights that accompany a pedestrian crossing sign (Figure 6.16). These are useful in areas where a crossing needs additional visibility to drivers and can be helpful at midblock crossings, where it may be difficult for drivers to judge a pedestrian’s location. The use of [RRFBs](#) has been shown to increase motorist yielding rates up to 98 percent (FHWA n.d.e.).

High-intensity activated crosswalk (HAWK). Also called pedestrian hybrid beacons (PHB), HAWKs are traffic signals that operate when a pedestrian pushes the button to cross. They bring vehicles to a complete stop, allowing pedestrians to cross safely, and then allow traffic to resume immediately when the crosswalk is clear.

Bicycle signal heads. Some cities with heavy bicycle traffic have installed separate bicycle signals (Figure 6.17, p. 91). These bicycle-only signals give bicycles priority movement and direction through complex intersections.



Figure 6.17. Traffic light with bicycle signal (Toole Design Group)

Intersections and Crossings

Intersections—where two or more roadways come together—are a conflict-ridden environment. According to [FHWA](#), roughly one-quarter of traffic fatalities and about one-half of all traffic injuries in the United States occur at intersections (FHWA 2024a). Complete streets programs must address intersection-level risk factors and provide appropriate and effective interventions. Protected intersections combine multiple safety elements to separate nonmotorized from motorized traffic, as described in the sidebar on p. 94.

Crosswalks

Crosswalk design standards are generally governed by the MUTCD and AASHTO's Green Book. Alternatively, communities can adopt the design guidance in NACTO's [Urban Street Design Guide](#) (2013d) and the [Urban Bikeway Design Guide](#) (2025). These guides include sections on intersections, intersection design elements, and midblock crossings. Crosswalks can be signalized or unsignalized, and their markings



Figure 6.18. A scramble intersection, in which all traffic is stopped while pedestrians cross in all directions, including diagonally (Kamala Parks/pedbikeimages.org).

can vary from simple double white lines to high-visibility zebra stripes depending on the type of intersection and anticipated pedestrian activity.

A scramble (or “[Barnes Dance](#)”) intersection allows pedestrians to cross the intersection from any corner, including diagonally (Figure 6.18) (Jaffe 2012). Auto traffic is stopped in all directions and “no right on red” signage prohibits turns. These are most useful in high pedestrian traffic areas where significant numbers of pedestrians are crossing. The exclusive pedestrian phase increases [safety](#), with a crash reduction factor of 34 percent (FHWA 2008).

Crosswalk safety can be further improved by “[daylighting](#),” or the removal of parking spaces closest to intersections (SFMTA 2025). Restricting parking within 20 feet of an intersection increases the visibility of pedestrians to drivers before they arrive at the intersection. However, recent [research](#) in New York City has found that though “hardened” daylighting (using physical infrastructure such as planters or bollards) had statistically significant pedestrian safety benefits, it was not as effective as other street treatments, and universal daylighting may have negative impacts on safety (NYCDOT 2025).

To increase visibility and enhance the built environment, some cities employ artistic designs in crosswalks and



Figures 6.19–21, left to right). A raised curb extension (Dan Burden/pedbikeimages.org); a painted bulb-out supplemented with flexposts (Kittelson); a mountable curb extension (WGL, Inc.)

intersections. While these artistic crosswalks have been well-received by pedestrians and local communities, their use has drawn criticism. As the popularity of crosswalk art has grown, the federal government has [objected](#) on the grounds that all crosswalks must be painted white for traffic safety (DiMeceli 2019). These efforts have intensified under the Trump administration, as discussed in the sidebar on p. 93.

Turning speeds also affect intersection safety and should be considered in complete streets design. Higher turning speeds make conflicts more hazardous. As such, designing tighter corners, also referred to as reducing curb radii, is a common best practice. In general, standard curb radii are 10 to 15 feet. The lower the number, the slower the turning speed. Adding bulb-outs and curb extensions can reduce speeds while also reducing pedestrian crossing distances, increasing pedestrian visibility, and preventing illegal parking near crosswalks.

Curb extension choices depend on design and engineering needs, vehicle turning movements, and available funding. A [raised curb extension](#) (Figure 6.19) is the most effective type of bulb-out if vehicle turning movements and budget permit (Montgomery County Planning 2021). Painted bulb-outs (Figure 6.20) are the simplest form and can be supplemented with flexposts. Mountable curb extensions (Figure 6.21) offer an alternative when vehicle turning radius requirements (such as for a bus or emergency vehicle) require the full use of the pavement area. For more information on how to design curbs, refer to “[Corner Radii](#)” in NACTO’s *Urban Street Design Guide* (NACTO 2013a).

Roundabouts

Roundabouts are a type of circular intersection that can provide safety, traffic flow, and efficiency benefits (Figure

6.22). This is due to slower and consistent travel speeds when entering and traveling through the roundabout, a continuous flow of traffic, and one-way travel that eliminates the possibility of head-on collisions. [Costs](#) are also reduced as there is no need for signalization installation or maintenance (WSDOT n.d.), and operations are therefore not affected by power outages or equipment malfunctions.

Roundabouts can have one or more lanes; in the latter case, drivers must choose a lane before entering, depending on where they will be exiting. Incoming traffic must yield to vehicles already in the roundabout. Pedestrian crosswalks are located so that drivers encounter the crosswalks before entering or exiting the roundabout. [Bicyclists](#) may choose

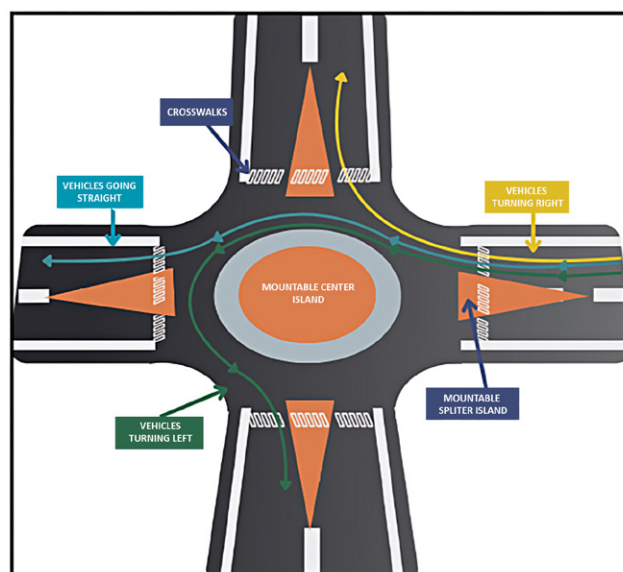


Figure 6.22. Example of a roundabout design and elements (WGL, Inc.)

PAINTED CROSSWALKS: DISTRACTION OR SAFETY MEASURE?

On July 1, 2025, U.S. Transportation Secretary Sean Duffy sent [a letter](#) to U.S. state governors to announce a new safety initiative that includes dictates on crosswalk design: the Safe Arterials for Everyone through Reliable Operations and Distraction-Reducing Strategies, or SAFE ROADS, initiative (Duffy 2025). The letter calls for clearing distractions from crosswalks and intersection markings on nonfreeway arterials to make them easier for pedestrians, vehicle operators, and autonomous vehicles to interpret and navigate. The distractions, according to a [press release](#), include “political messages of any nature, artwork, or anything else that detracts from the core mission of driver and pedestrian safety” (FHWA Office of Public Affairs 2025). Green paint used in bicycle lanes and curb bulb-outs is not prohibited under this directive and is fully MUTCD compliant.

Prior FHWA guidance regarding street art include a 2024 FHWA response to a [Frequently Asked Questions \(FAQ\) posting](#) regarding the applicability of the MUTCD to intersection murals, which stated, “Aesthetic surface treatments and intersection murals are not considered traffic control devices and, therefore, are not governed by the MUTCD, except where those treatments interact with and adversely impact official traffic control devices.” FHWA further [stated](#) that jurisdictions are responsible for ensuring road safety and should make decisions regarding aesthetic surface treatments accordingly (FHWA 2024c).

At this point, it’s unclear whether the reach of the 2025 SAFE ROADS directive extends to local streets that are not

nonfreeway arterials. This is important, as most examples of asphalt art occur on local streets. In [Florida](#), however, the governor and state department of transportation have mandated that localities must remove noncompliant pavement markings, including art associated with “social, political, or ideological messages,” and have threatened to withhold state funds for noncompliance (Matat 2025). In response, free-speech activists and LGBTQ+ communities are [protesting](#) the targeting of rainbow-painted crosswalks across the state (Pendrill 2025). At the time of publication of this PAS Report, this issue is still unfolding.

What does the research say about painted roadway markings? In addition to aesthetic benefits, studies have found that this type of art comes with safety benefits. The [Asphalt Art Safety Study](#) examined 17 painted crosswalk sites across the country and found a 50 percent decrease in crashes involving pedestrians or cyclists, a 37 percent decrease in crashes leading to injuries, and a 27 percent increase in the rate of drivers yielding to pedestrians in the right-of-way (Sam Schwartz 2022). Some disability groups have criticized such crossings, however, arguing that pedestrians with visual impairments or neurodiversity challenges may have problems associating the art with an official road crossing. In London, the city conducted an [equalities impact assessment](#) and made the crossings more accessible by limiting text, using large color blocks, and limiting mural installation to signalized crossings (Taylor 2021).

to dismount and walk their bike across the crosswalk or share the lane with vehicles (FDOT n.d.b.), though a [study](#) from Europe found that roundabouts posed a higher risk for cyclists who used the full lane (Poudel and Singleton 2021).

While roundabouts offer numerous benefits, they are not suitable for all intersections. Unlike traditional intersection design, [roundabout design](#) is an iterative process requiring comprehensive analysis of site-specific factors, operational analysis, and safety evaluation that can take time (FHWA 2000). Successful implementation requires careful planning, consideration of local traffic patterns, and community engagement. Educating the public about how to navigate roundabouts is also essential for their effective integration into the transportation network.

Roundabouts are listed as an FHWA [proven countermeasure](#), as they have been shown to reduce fatal and injury crashes up to 82 percent compared to traditional intersections (FHWA n.d.f.) An FHWA [study](#) showed that roundabouts reduced injury collisions by 75 percent, fatality collisions by 90 percent, and pedestrian collisions by 40 percent (WSDOT n.d.). However, [research](#) has shown that roundabouts can increase low-severity crashes, such as rear-ending (Burdett et al. 2016).

For intersections with low speeds and volumes, mini-roundabouts can replace stop signs. They are small, with one lane in each direction, and feature a small planted or mountable area in the center. The splitter islands may be painted or slightly raised. For more information on circular inter-

sections and their applications, see the NCHRP Research Report [Guide for Roundabouts](#) (National Academies 2023).

Bikeways

Bicycle infrastructure includes bike lanes, shared-use paths, and shared facilities on low-speed neighborhood streets, along with “bicycle boulevards” or parallel routes that offer

a lower-stress cycling experience. Higher-quality bike lanes are linked to increased ridership, so planners should follow the research on bicycle infrastructure design and best practices for safety and effectiveness. With the increasing use of electric mobility options, some communities are re-envisioning their bike lanes as “mobility lanes” to accommodate a mix of vehicle speeds, as described in the sidebar above.

PROTECTED INTERSECTIONS

A protected intersection provides physical separation of pedestrians and cyclists from motorized traffic (Figure 6.23). The goal is to minimize conflicts between different modes of transportation, enhance the safety of vulnerable road users, and create a more comfortable and accessible environment for walking and cycling. Design elements may vary but include many of the infrastructure elements discussed throughout this chapter.

The key components of a protected intersection typically include the following:

- **Corner refuge island:** A raised or level area at each corner of the intersection where pedestrians and cyclists can wait safely before crossing the roadway.
- **Curb extensions/bulb-outs:** Extensions of the sidewalk into the roadway at the corners of the intersection.
- **Separated bike lanes:** Dedicated and physically separated lanes for cyclists, which may include features such as bollards, curbs, or planters to protect cyclists from vehicular traffic.

- **Flare:** A gradual widening of the bike lane as it approaches the intersection, allowing cyclists to position themselves for a safer turn.
- **Forward stop bar for cyclists:** A designated stop area for cyclists positioned ahead of the stop line for motorized traffic, providing cyclists with improved visibility and reducing the risk of conflicts with turning vehicles.
- **Turning lane for cyclists:** Dedicated turning lanes for cyclists making left turns, separated from motorized traffic by a buffer zone or physical barrier.
- **Crosswalks:** Clearly marked and well-defined crosswalks for pedestrians, often raised or with additional signage to alert motorists.
- **Signal timing:** Signalization designed to prioritize the safety of pedestrians and cyclists, including leading pedestrian intervals (LPIs).
- **Signage and markings:** Clear and visible signage and pavement markings to guide all road users and communicate the design of the protected intersection.

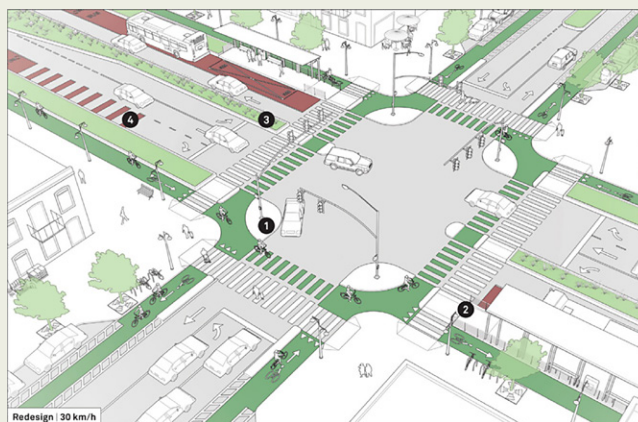


Figure 6.23. Before and after images of a protected intersection (Global Designing Cities Initiative 2016)

MOBILITY LANES

With the increasing use of e-scooters, e-bikes, and low-speed electric vehicles (golf carts, delivery vehicles, and low-speed transit vehicles), traditional lane designs may not accommodate all of these emerging modes. Transportation literature references low-speed and high-speed vehicle travel, but how can communities regulate a new “middle-speed” environment with vehicles traveling between 15 and 25 mph? Is there a need for a new type of lane? Attention to the safe mixing of these low- to middle-speed vehicles and rising interest in neighborhood-friendly travel options indicate the answer is yes.

In 2018, transit consultant Jarrett Walker proposed [speed](#), rather than mode, as a primary driver of infrastructure design, as it is infeasible to give every mode its own lane (Walker 2018). In 2019, Lloyd Alter of *Treehugger* expanded the concept to call for protected “[mobility](#)” lanes, noting the proliferation of alternative forms of transport, such as scooters, bicycles, and personal mobility devices (Alter 2019). The main design challenge is how to modify traditional infrastructure or create new designs for midrange speeds of mobility devices, electric scooters, and electric bicycles. Factors include design speeds, widths, consideration of passing lanes, and design alterations in constrained locations.

That does not mean communities are waiting. Following an [update](#) to its updated bike plan and shared scooter program, the City of Atlanta renamed bike lanes as light individual transportation, or LIT, lanes (Bottoms 2019). The Atlanta Police Department is part of this [program](#), responsible for ticketing personal and commercial vehicles illegally parked in LIT lanes (Atlanta Police Department n.d.). Fines for commercial vehicles

are \$1,000, while personal vehicle drivers face a \$100 fine. In California, the transition to multiuse lanes is being conducted with low-cost paint and new decals (Figure 6.29).



Figure 6.29. Micromobility lane using painted decals to designate space for both electric scooters and bicycles (Juan Matute)

Shared bikeways

This category of bikeways is designed such that bicyclists share a facility with travelers using other modes.

Sharrows. Sharrows, an abbreviation of “shared arrows,” are white pavement markings showing a bicycle symbol with two chevrons on top. They are used on roadways without space for dedicated cycle lanes and indicate that bicyclists are to share the travel lane with other vehicles.

Sharrows have become a hot-button issue among cyclists, advocacy groups, and roadway designers. Benefits include increased awareness, safety, and navigational benefits

to help cyclists position within lanes, but [research](#) has found that their use does not appreciably improve cyclist safety and may create hazardous conditions (Ferenchak and Marshall 2019). As noted by Dave Snyder, PeopleForBikes’ senior director for infrastructure, one of the most deleterious [consequences](#) of sharrows is that they allow local officials to take credit for bicycle safety without addressing the design factors contributing to hazardous conditions (Snyder 2023).

Sharrows are most effective on streets posted at 25 miles per hour or slower. The placement of these markings on the roadway surface is important: they must be evident to driv-



Figure 6.24. Fencing on a shared-use path slows cyclists who are nearing an intersection (Eric Jones/Wikimedia Commons [CC BY-SA 2.0](#))

ers and continue into and through intersections. Sharrows should be placed toward the center of the road (at least 11 feet from a curb) to be visible to drivers and remind cyclists to stay clear of door zones (where a motorist may open a car door in the path of an adjacent cyclist).

Shared-use facilities. Shared paths are paved off-road facilities designed for travel by a variety of nonmotorized users in urban, suburban, and rural areas. [Shared-use paths](#) should be physically separated from the roadway, have few access points or roadway crossings, offer adequate access to local streets and adjacent facilities, and provide path continuity with other bikeways throughout the corridor (FDOT 2025).

There is no definitive regulatory standard for shared-use facilities, though they are subject to accessibility rules (with the exception of unpaved trails). AASHTO reissued guidance on bicycle facility design with its [Guide for the Development of Bicycle Facilities](#), 5th edition (AASHTO 2024), and some states have developed context-specific guides for shared-use facilities. One example is Massachusetts' [Shared Use Path Planning and Design Guide](#), which offers information on planning, cost estimating, wayfinding, and coordination with other state agencies (MassTrails 2018).

An emerging trend with shared-use facilities is the growing presence of [e-bikes](#) and other micromobility devices (Crowther and Storck 2020). This changes the mix of speeds and creates a potential need for traffic calming on shared-use paths, using curving design or other physical measures to slow speeds (Figure 6.24).

Delineated bikeways

This category of bikeways establishes a defined space in the roadway for cyclists that is separated from motorized vehicles. Common strategies for creating space to add bike

lanes to existing streets include removing on-street parking and reducing lane widths.

Conventional bike lanes. Conventional bike lanes are marked by painted pavement markings and signage. Lanes flow in the same direction as motor vehicle traffic. Typically, the bike lane is outlined with white stripes, though some cities are now using green paint for greater visibility (Figure 6.25). These are the most common types of bike facility owing to their ease of installation on roadways where space permits.

Buffered bike lanes. Buffered lanes are similar to conventional painted bike lanes but are further separated from the travel lane by a space typically 18 to 36 inches in width (Figure 6.26). This distance, or [buffer](#), is intended to protect cyclists from traffic and car doors opening into the bike lane (BikeWalk KC n.d.). Where curbside parking is present, the bike lane is situated between parked cars and traffic.

Shoulders. In rural and scenic areas, transportation agencies may use [extended shoulders](#) to accommodate cyclists. Contrasting or colored pavement materials may be used to differentiate the shoulder from the adjacent travel lanes. Shoulders should be at least four feet wide (FHWA 2016c). Near intersections, rumble strips may be added between the shoulder and travel lane to alert drivers and reduce potential conflicts with turning cyclists.

Protected bikeways

Protected bike lanes, also called separated bike lanes or cycle tracks, have a physical barrier between the vehicle lane and



Figure 6.25. A conventional bike lane highlighted with green paint (WGL, Inc.)

the bike lane. Physical separation provides better protection for cyclists than a buffered bike lane. As defined by FHWA in the report [Separated Bike Lanes on Higher Speed Roadways: A Toolkit and Guide](#), a separated bike lane is exclusively for use by bikes and scooters, features a horizontal buffer from vehicle traffic, and has a vertical element in the buffer space (FHWA 2024b). The combination of vertical and horizontal elements is particularly important on roadways with speeds higher than 35 mph.

For complete streets, a key consideration for shifting automobile trips to active modes or increasing first-last mile access to transit is rider preference for protected bikeways. A 2018 [poll](#) conducted by bicycle advocacy organization PeopleforBikes found 63 percent would bike if they felt safer (Boudway 2022). Cities that have added protected bike lanes have seen increased ridership; in Philadelphia, ridership doubled.

Protection can take several forms depending on location, budget, and right-of-way availability. At the lowest-cost end, quick-build protected lanes often use delineators, which are highly visible cones or plastic flexposts intended to separate traffic and discourage encroachment by cars that leave little to no damage to vehicles when struck. Where sturdier materials are preferred, agencies can use separators or bollards, which are thick vertical posts made of plastic, metal, stone, or cement. Trends in bollards include reboundable plastic models that return to the original position when lightly struck by vehicles, which reduces replacement costs, and retractable models that can be lowered or raised based on street programming needs.



Figure 6.26. A bike lane with painted buffers from the travel lane and on-street parking (Kittelson)

FHWA [studies](#) show that the use of flexible delineator posts reduces total crashes, though effectiveness can vary based on land use and intersection conditions (FHWA 2023a). Flexible separators, such as the decorative ones shown in Figure 6.27, can separate bicycle and automobile traffic while enhancing streetscape appearance. For more information on choosing the right materials and design, the Minnesota Department of Transportation's [Guidance for Separated/Buffered Bike Lanes with Delineators](#) is a useful resource (Hourdos et al. 2021).

On-street parking can also be used to buffer cyclists from vehicle travel lanes. A parking-protected scenario places the bike lane against the curb, with parking located in the street (Figure 6.28, p. 98). In these cases, planners should be mindful of accessible parking space requirements. The best-case scenario is to place accessible parking around the corner from or on the side of the street opposite the bike facility. Where this is not possible, parking can be located at the end of the block closest to an ADA-compliant intersection ramp. The San Francisco Vision Zero Coalition's guide [Getting to the Curb](#) offers further information on maintaining accessibility for pedestrians and people with disabilities when building protected bike lanes (Opfell 2019).

Additional helpful resources for planners on bikeway design include [Rethinking Streets for Bikes: An Evidence-Based Guide to 25 Bike-Focused Street Transformations](#) (Schlossberg et al. 2019), [A Guide to Bikeway Classification](#) (Caltrans 2017), and the Montgomery County, Maryland, Planning Department's [Bicycle Facility Design Toolkit](#) (2018).



Figure 6.27. A protected bike lane with quick-build flexible separators and landscape elements (Kittelson)

CONCLUSION

Complete streets infrastructure includes a wide range of physical components designed to support multimodal transportation. As with other engineered structures, street design is heavily controlled by longstanding automobile-centric standards and regulations. Complete streets designs are an alternative for both new facilities and retrofits. The next generation of standards promises to offer flexibility for expanding complete networks and added safety, but only if communities and agencies opt to use them.

Understanding the various types of complete streets infrastructure can help planners become vital partners in determining the right infrastructure in the right place. As discussed in Chapter 3, stakeholder engagement and linkages within other community plans are key to ensuring equitable and sustainable outcomes.

While safety has always been a hallmark of complete streets plans, the nationwide spike in pedestrian and bicyclist casualties requires urgent attention to determining root causes and effective responses. Street design is a major contributor to roadway hazards, especially when it allows excessive speeds where multiple modes intermingle. Safety is at the foundation of complete streets because if pedestrians and cyclists do not feel safe, they will not walk and ride. Because access is such an important part of mobility, infrastructure planning for complete streets must revolve around safely serving all ages and abilities.

Another enduring aspect of complete streets is finding room for multiple modes in and along rights-of-way. As the numbers and types of transportation modes increase, the search for space is intensifying. Today's conversations center on reallocating space, which can be a tough sell with the public and public works. This is a space in which new planning strategies, such as tactical urbanism's use of low-cost pilots and tests, have come into play.

Such experimentation has opened alternatives to roadway infrastructure designed as immutable fixed assets. Communities around the country are realizing that streets do not have to perform the same function 24 hours a day, 365 days a year. Chapter 7 will discuss programming streets for multiple uses beyond vehicle travel.



Figure 6.28. Protected bike lane between the sidewalk and on-street parking on 15th Street in Washington, D.C. (Andy Clarke/Toole Design)



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Streets

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07 PROGRAMMING STREETS

Complete streets are designed to safely accommodate all modes of transportation and all travelers. The next generation of complete streets, however, will also use programming to support this design goal and further expand the uses of streets beyond transportation.

Programmable streets optimize the changeability and use of travelways, curbsides, and sidewalks, using tools to schedule use changes, manage traffic operations, and reconfigure space. This is not a new concept, as cities have used streets to host farmers' markets and special events for decades. The practice has accelerated, however, with new flexible street design standards, innovative community planning techniques, modular infrastructure, and technology.

Today's complete streets are not a static resource, but an asset that can be managed dynamically in real or near-real time. This can be achieved in two ways. First, design and engineering decisions can support multiple uses and multiple modes. Traditionally, once the concrete was set and signs installed, a street's function was locked into place. The growing popularity of curbless streets, however, reflects design options that facilitate interchangeable uses. Second, planners can use various tools to manage streets and curbs. For example, cities are developing [performance-based programming](#) to vary parking pricing or other policies based on the law of supply and demand (Pierce and Shoup 2013).

This chapter introduces the new paradigm of multimodal, multiuse programmable streets and touches on design, standards, finance, and operations. It examines the ability to test and adapt streets for physical changes. This involves engineering and design standards that support flexible use and enable temporary and iterative alteration of physical parameters to determine the best infrastructure solutions. The chapter also explores programming streets for different uses. This can be done through operational approaches, though it can involve readily changeable physical elements such as bollards and other barriers.

AN INTRODUCTION TO PROGRAMMING STREETS

After decades of auto-centric street planning and design, communities are rediscovering that a street's function can extend beyond moving and storing cars. This shift has its roots in Main Street programs and their community amenities to address economic decline. As regional malls drew retail away from city centers in the 1970s and 1980s, newly formed downtown associations created weekend programs and farmers' markets to breathe new life into downtown business districts of all sizes.

Beginning in the early 2000s, downtowns experienced a resurgence of activity as a younger, technology-based workforce sought alternatives to suburban lifestyles. Entrepreneurs and city leaders took notice of this [emerging market](#) and began investing in services, public amenities, and downtown housing (Jaffe 2016). New residents asked for parks and community spaces, posing challenges within built-out city centers. In the hunt for space, streets became a key target for community activities, from biking events to larger farmers' markets to a new breed of festival streets.

In 2007, New York City transportation commissioner Janette Sadik-Khan brought tactical urbanism to Times Square, formalizing a new approach of low-cost, quick-build methods within infrastructure design. Her early trials with pedestrian plazas eventually became permanent civic spaces and bicycle lanes. To make the case, Sadik-Khan relied on research and data, as detailed in her 2018 book, [Streetfight](#) (Sadik-Khan 2017).

When COVID-19 prompted lockdowns and social distancing in the spring of 2020, flexible streets were no longer just a community amenity, but an urgently needed [solution](#) allowing physical and social activity during a global

QUANTIFYING THE IMPACTS OF PROGRAMMING STREETS

One benefit of reprogramming streets temporarily is to determine where permanent installations are a good fit. In this case, data is key. The Barr Foundation conducted a study of how 23 Massachusetts municipalities reprogrammed streets in 2020 and 2021. It documented the following findings:

- In the town of Arlington, a traffic circle made of temporary cones and flexiposts dropped the number of people speeding by 65 percent.
- In the city of Salem, narrowing a road by installing new bike lanes encouraged safer driving behaviors (speeds of less than 40 mph) in a school zone by 61 percent.
- New painted lanes in the city of Everett made trips 35 percent faster for bus riders, many of whom were essential workers who relied on public transit.
- Across the municipalities studied, 57 percent of businesses reported increased revenue from outdoor spaces.

As a follow-up, the foundation released a toolkit on how to evaluate low-cost infrastructure projects. [Measuring Quick and Creative Street Projects](#) provides information on data collection methods and offers metrics for five objectives: making streets safe, supporting people who walk, increasing bicycle mode share, improving bus service through infrastructure changes, and increasing economic activity (Barr Foundation 2023).

pandemic (Wilson 2020). The Institute of Transportation Engineering (ITE) gathered [case studies](#) of quick-build approaches for opening up streets during the pandemic, sharing lessons learned (ITE 2023). In the post-pandemic years, the desire for streets as public spaces has remained, though not without familiar disagreements on parking, bike lanes, and access to small stores. Data from the impacts of pandemic-driven road reprogramming can help make the case for making temporary changes permanent, as discussed in the sidebar on the left.

Financial considerations also play a role in the emergence of multiuse streets. The UN-Habitat's Global Urban Observatories assert that streets should comprise 30 to 35 percent of a city's [land area](#) (Scruggs 2015), but [GIS analysis](#) reveals that streets may occupy more than 40 percent of U.S. cities' land area (Gardner 2015). In the search for new value, city administrators are beginning to see streets as an untapped source of new revenue, open space, and marketing power. Furthermore, flexibility in street use serves as a [resilience strategy](#), allowing infrastructure to be repurposed as needed (Lustberg 2021).

The concept of streets as community spaces for non-automobile uses goes by many names: open streets, flexible streets, play streets, festival streets, pop-ups. Bogota, Columbia, has gained fame for its [Ciclovía](#), 75 miles of interconnected city streets closed to cars for seven hours every Sunday morning (Figure 7.1). As noted in Open Streets Project's [The Open Streets Guide](#), flexible streets can be



Figure 7.1. Ciclovía in Bogotá, Columbia (Felipe Restrepo Acosta/Wikimedia Commons CC BY-SA 3.0)

funded and implemented using a mix of public, private, and nonprofit resources (Street Plans Collaborative and Alliance for Biking and Walking 2012).

Programming streets, by its nature, requires stakeholder negotiations to mitigate any negative effects of street closings. Whether street programming is periodic, seasonal, or permanent, stakeholders must navigate permitting, insurance, road closure protocols, and communications. Disruptions can affect business access, deliveries, emergency response, transit routes, and neighborhood traffic flows. The disruptions can be more than mere inconveniences, posing questions about fairness and equity. In 2020, the [Untokening Project](#) traced the equity considerations of COVID-inspired street reprogramming projects, noting how the hasty nature of the response perpetuated many of the same [injustices](#) associated with infrastructure writ large as it related to people of color (Lopez 2020). Those injustices stem from the inability of all populations to enjoy the benefits of flexible streets. For example, restaurant-driven street reprogramming effectively [privatized](#) public space, with limited benefits for low-income residents who could not afford restaurant meals. Converted sidewalks claimed space needed by those traveling in wheelchairs (Schindler 2022).

The COVID-19 pandemic has largely receded, but cities continue to face other forces of change. The changing economics of e-commerce and remote work are affecting demand for office and retail space. Given the uncertain track of these trends, it's even more important to harness the power of adaptable spaces in our communities, including streets.

WAYS OF PROGRAMMING STREETS

Cities currently program streets mainly through signs and enforcement. The effectiveness of prior approaches, however, is up for debate. Most planners are familiar with poles covered in so many parking instruction signs that it is almost impossible to tell when parking or loading is allowed or prohibited (Figure 7.2). Another traditional method of programming streets is through temporary closures for events such as farmers' markets, festivals, and block parties.

Generally, programming approaches can be categorized by time, as shown in Table 7.1 (p. 103). *Intermittent* changes in roadway use can be set by schedule or priority passage for certain vehicle types, such as buses. *Temporary* changes are nonpermanent and describe pilot projects or scheduled events. *Dynamic* management, also called active or demand-responsive management, is largely enabled by technology, al-



Figure 7.2. Confusing parking signs in Washington, D.C. (Dada1960/Wikimedia Commons)

lowing traffic managers to monitor and react to traffic flows or street uses in real time.

Growing interest in multiuse streets has generated entrepreneurship in supportive design, devices, and equipment. Next-generation approaches for programming streets can be classified into four categories: flexible standards, physical programming, digital programming, and financial programming.

Flexible Standards

One theme of this PAS Report is the slow but steady movement toward more flexible street design standards to support multiple modes and multiple uses. While national standard-setting organizations play a major role, as discussed in Chapter 6, local guidelines and regulations also come into play. In evaluating the support of local policies and regulations for flexible operations, there are several sources to examine:

TABLE 7.1. TIME-BASED APPLICATIONS OF STREET PROGRAMMING

Intermittent	Temporary	Dynamic
Reactive modifications of street space according to the position of a priority vehicle	Unpredicted life cycle but does not adapt constantly	Modifications of street space according to fluctuations of demands in defined periods
Does not consider traffic and urban dynamics	Does not consider traffic and urban dynamics	Considers traffic and urban dynamics
Constant adaptation of the system by using real-time data and vehicle detection	“Try and test” perspective	Adaptation of the system according to data (real-time or previous data)
Technologically dependent data-driven solutions, e.g., Intelligent Transportation Systems (ITS)	Slows down fire apparatus and reduces response times	Use smaller speed bumps or speed tables that slow smaller vehicles but are less obtrusive for large fire apparatuses
Cheap, quick, and rustic designs	Can use technology, but not totally dependent	Establish clear zones around hydrants

Source: Valença, Moura, and Morais de Sa 2023

- **The comprehensive plan.** Do goals or objectives address multiuse streets, pilot projects, tactical installations, or street events? Does the plan call for flexible or programmable streets?
- **Subarea plans.** Do neighborhood, district, or other sub-area plans identify streets that are candidates for multiple-use programming? Are there examples to build from?
- **Permitting.** Does the jurisdiction have a permitting system in place for closing or modifying streets? Are the permit requirements permissive or restrictive?
- **Parking authority.** Are there rules that prevent or permit the use of on-street parking spaces for other activities? Do parking rules, regulations, or contracts lock in a parking status quo?
- **Downtown associations.** Does a downtown (or similar) organization already have programming in place? Do they have programs encouraging the use of streets for nonautomobile uses, or standard operating procedures for events or other uses?

Planners should determine whether local regulations offer a pathway to safely and effectively build and manage streets in ways that optimize their use.

Physical Programming

Street construction has traditionally focused on long-lasting, fixed installations. This approach has undergone a transformative shift in recent years. In the past, any street modifica-

tions were limited to the placement of Jersey barriers for large-scale projects or temporary barricades for smaller projects, such as construction, street repair, or special events. However, the construction industry has introduced new modular systems over the last decade to manage infrastructure changes. Street design projects can incorporate modular infrastructure along a spectrum: from low-cost temporary installations to larger, more durable equipment.

Demonstration projects

Because of the growing number of street designs, communities are using demonstration projects or pilot projects to model and test options. This includes “quick-build,” an umbrella term for flexible, lightweight infrastructure applied as a demonstration, pilot, or semipermanent installation and often used to create parklets, bikeways, and pedestrian plazas. Chapter 10 presents additional information on quick-build implementation and resources.

While some demonstration projects are intended as one-day civic gatherings, others are created to prototype safer multimodal and multiuse projects, such as intersection reconfigurations, parklets, or temporary bike lanes. Prototyping, by its nature, can involve several rounds of iterative design and testing until the desired design is achieved.

Demonstration projects have also proven to be a good [strategy](#) for transitioning from streets for cars to streets for people (Bertolini 2020). A demonstration project provides a real-life “sketch” to view and test the proposed interven-



Figure 7.3. Pop-up roundabout in the Michigan Avenue Neighborhood Greenway in Santa Monica, California ([SMSpoke.org](https://www.smspoke.org))

tion, such as the prototype roundabout shown in Figure 7.3. While demonstration projects and pilot projects can be considered minor projects, planners should construct a detailed engagement strategy to ensure a full assessment of potential users. [Data collection](#) is also important to justify the decision to either terminate the project or continue to a subsequent phase (Carlson et al. 2019).

Good resources for planners on developing demonstration or pilot mobility projects include [Principles to Plan, Design, & Implement Innovative Mobility Pilot Projects](#) (SUMC, MIC, and FTA 2023), [“Shared Micromobility Permitting, Process, and Participation”](#) (NACTO 2022a), and [Fast-Tracked: A Tactical Transit Study](#) (TRB Transit Cooperative Research Program 2019).

Tools for flexible use

As noted above, cities are using new equipment and modular infrastructure to add flexibility to streets. In recent years, cities in the United States and abroad have hardened their flexible systems in response to deadly vehicular attacks on pedestrianized streets, such as the 2025 New Year’s Day [truck attack](#) on Bourbon Street in New Orleans (Bowman 2025).

Some of the methods for safeguarding open streets include the following:

- **Gates.** Gates can be permanent or portable installations, depending on the level of protection and flexibility sought.
- **Bollards.** Bollards are vertical posts used to block traffic. Permanent bollards are typically concrete or stone. Retractable bollards are installed in underground

encasements and can be raised and lowered manually or electronically to modify traffic flow.

- **Moveable planters.** Moveable planters designed to withstand vehicle collisions integrate landscaping with security features for aesthetic appeal. They are often used to delineate outdoor dining spaces, parklets, or pedestrian areas. For moveability, planters have slots to accommodate a hand truck or forklift.
- **Large trucks.** For temporary events, large [municipal vehicles](#) can be parked across streets at key access points to block erratic drivers (Friese 2025). Using wraps can soften the look, as shown in Figure 7.4. For certain events or locations, the city may block a larger area of streets as an added precaution.

In the United States, the ability to “flex” design for existing streets is catching on. New York City’s Meatpacking District developed a [guide](#) for flexible pedestrianized zones controlled by moveable infrastructure in response to COVID-19 (Meatpacking BID 2021). The business improvement district overseeing the city’s Lower East Side installed reimagined [Jersey barriers](#) for seating and bike parking in public space activation efforts (Totem 2022). Retractable bollards, which can be manually or remotely lowered and raised, and digital signage, discussed below, further enhance the ability to reset functions as needed.

In developing flexible streets, cities are recognizing the importance of the underlying street design as a help or hindrance to rearrangeable street elements. Shared streets (or woonerfs) offer advantages due to their curbsless con-



Figure 7.4. A large truck, decorated with an artistic wrap, parked to prevent vehicles from entering a pedestrian zone (WGI, Inc.)

figuration that blends the street and sidewalk (Figure 7.5). Woonerfs, by design, blur the distinction among street uses, whether for travel, parking, commerce, or social activities. The flat plane facilitates rearrangement, much like set changes during a play. Existing streets can be easily [reconfigured](#) as woonerfs (Santa Clara VTA n.d.b.).

Programming streets physically will require increased resources for moving, maintaining, and possibly storing equipment. Planners or downtown place managers may want to start small to determine logistics. While public works departments are traditionally tasked with street operations, streets that serve multiple roles will require multiple responsible parties. This can include multiple city or county departments, as well as third-party organizations, such as downtown organizations.

Digital Programming

Over the past two decades, the concept of dynamic (or active) management has been applied to transportation through variable tolling or synchronized signals on highways, tunnels, and bridges. The advent of continuous monitoring and data collection allows managers to “take the temperature” of their systems in real or near-real time and respond accordingly.

In recent years, traffic engineers have expanded managed systems, such as transit-only lanes and performance-based parking, to urban contexts. In the next iteration, cities can apply [active management](#) at local scales to manage the full range of demands for street, curb, and sidewalk

space in real, or near-real, time (Valença, Moura, and Morais de Sa 2021).

Though planners may not be using tools to manage street operations in real time themselves, they should understand the mechanisms behind common approaches. Data collection is the foundation of dynamic street, curb, and sidewalk management—from problem-solving to monitoring to operations. While planners need not know the intricacies of computer programming or coding, they have the expertise needed to link goals to metrics, and metrics to data sources. Chapter 8 addresses the details of complete streets metrics and associated data collection methods. Other areas where planners’ expertise is needed are managing digital signage and creating digital twins.

Digital signage

With data collection and monitoring comes the ability to adjust operations to meet complete streets performance objectives in real or near-real time. This is a new concept for cities. Traditionally, methods for changing operations along streets have been limited to using law enforcement to manage short-term events or revising curb regulations for long-term change.

Several technologies, used together, offer dynamic management of street and curb uses. Cameras and sensors provide information on street usage, while communications technology relays information to managers and users via apps, cell phones, websites, or digital signage. Managers can use this information to assess demand patterns and develop schedules that balance street and curb functions for travel, loading, parking, or other uses. The advent of connected car technology will add another channel providing real-time information on curb, street, and parking availability.

Digital signs are widely used in the United States to indicate space availability at parking facility entrances and to guide parking within multilevel garages. Cities can also install parking information signs at key locations leading to a central business district. These bypass signs can direct drivers to peripheral parking, lessening congestion caused by the search for parking. Digital signage can also be used for communicating allocations and pricing for [dynamic curb management](#), in which sensors detect vehicles and assign uses in real time, such as transit, parking, and loading, based on demand (National Academies of Sciences, Engineering, and Medicine 2022a).

Traffic signs are also being digitalized, allowing transportation system managers to change lane assignments, speed limits, transit priority, and signal timing. For com-



Figure 7.5. Clematis Street in West Palm Beach, Florida, a curbless street, can be reconfigured with interchangeable parking, dining, and civic spaces (WGL, Inc.)

plete streets, the shift to active management and associated technologies offers safety (e.g., lower speeds) and multi-modal travel benefits. However, these systems are expensive to install and maintain. Given the number and type of integrated systems, failure in one component can lead to incorrect information and system failure. Cities can start with pilot projects and smaller systems before advancing to a larger smart city platform.

For planners, one of the main challenges will be sign codes that limit or prohibit digital signs on both public and private property. Planners will need to review local land development codes to determine how digital signs are regulated in their jurisdiction, if at all. Common terms associated with digital signs in zoning codes include “digital,” “changeable copy,” “electronic,” or “animated.” Codes will also differentiate between on-premise and off-premise signs. Planners may need to educate decision-makers and the public about new digital traffic signage associated with

complete streets and street programming to support code updates allowing digital signage for street programming. Digital signage should be designed to integrate aesthetically into the urban fabric. Even centuries-old European cities are using models designed to fit aesthetically within the historic context of older downtowns (Figure 7.6).

Financial Programming

Historically, the main methods for assessing drivers a cost for infrastructure use have been charges for public parking and tolls along major highways. Fees, established by governing bodies, balance cost recovery and the public’s willingness to pay. Parking and transportation authorities have used various [models](#) for covering the costs of infrastructure and congestion (FHWA 2008b). Planners should be aware of the following practices.

Demand-responsive parking

Currently, financial programming related to complete streets comes most visibly in the form of demand-responsive parking (or performance-based parking). [Demand-responsive parking](#) uses parking spaces more efficiently, reduces congestion, encourages alternatives to driving, and improves quality of life (Krishnamurthy and Ngo 2018). Under this system, cities establish a goal of 80–90 percent occupancy for their public parking garages, lots, and on-street spaces. The aim is to price the most popular parking spaces, typically on-street spaces in business districts, at the highest level, while offering periphery parking at lower price points. Cities can change the pricing on demand; however, those prices shouldn’t change too often to ensure predictability for drivers.

In 2011, San Francisco was the first U.S. city to initiate a demand-responsive parking program. For the *SFpark* pilot project, the San Francisco Municipal Transportation Agency (SFMTA) leveraged emerging technologies to re-price 6,000 metered spaces in seven parking management districts and 12,250 spaces in city-administered parking facilities. SFMTA’s [evaluation](#) of data collected during the pilot found that *SFpark* improved parking availability. This made it easier for drivers to find a parking space, resulting in decreased greenhouse gas emissions, decreased traffic volume and peak period congestion, improved traffic speeds, reduced instances of double parking, and increased net parking revenue (SFMTA 2014). In 2017, SFMTA adopted its [Demand-Responsive Parking Program](#) for all on-street parking meters and surface parking lots (SFMTA n.d.a.). Other demand-responsive parking programs in U.S. cities include Los Angeles’ [LA ExpressPark](#) (LADOT



Figure 7.6. Integration of LED parking information signs into the historic downtown of Zurich, Switzerland, to direct drivers to open garage spaces (WGL, Inc.)

n.d.) and Seattle's [Performance-Based Parking Program](#) (SDOT 2025).

Curbside management programs

A variation on demand-responsive parking is [curbside management](#) programs, which seek to manage short-term parking and loading activity (Nichols and Dorset 2021). For pricing, the technology challenge is the ability to capture and collect micropayments charged by the minute, not the hour. In 2022, the City of Pittsburgh launched a [smart loading zone](#) pilot to test automated micropayments to optimize curb use. Data from the pilot program, which transitioned to a permanent program in December 2024, showed a 70 percent increase in turnover and a 60 percent decrease in average parking duration, meaning more vehicles used the zones while parking for less time (Pittsburgh n.d.).

The Institute of Transportation Engineers curates a curbside management [resource page](#) offering multiple technical reports, a curbside management tool and user guide, and case studies of best practices in assessing, gathering, and analyzing information to implement curbside management (ITE n.d.b.).

Variable tolls

Dynamic pricing also applies to roadways as a tool for congestion management. Typically used on larger highways, [variable tolls](#) can be set for specific lanes or for the entire roadway, with higher tolls set for peak travel times to encourage off-peak travel. In dynamic tolling systems, maximum tolls are established for different travel times, and actual rates are determined based on real-time traffic flow. Under congested conditions, higher tolls take effect, with tolls lowered once the target traffic flow speed is reached (FHWA 2008a).

Congestion pricing

An example closer to complete streets applications is congestion or cordon pricing, in which vehicles are charged tolls upon entering a pre-established area. First used in [Singapore](#) in 1975 (Kian Keong 2002), congestion pricing is now used in several European countries and in New York City.

New York's [Congestion Relief Zone](#) covers an eight-square-mile area in south Manhattan (MTA 2025) and is notable for both the level of controversy generated by its adoption as well as its immediate traffic reduction and safety impacts. Six months after the \$9.00 charge went into effect on January 5, 2025, traffic volumes had [decreased](#) by 11 percent (67,000 fewer vehicles per day) and travel delays

had decreased by 25 percent (New York State Governor's Office 2025). Pedestrian and bicyclist density [increased](#), with Citibike bikeshare use increasing by nearly 12 percent from the year before, and fewer people were injured or killed in motor vehicle collisions (Plotch 2025). Air quality also improved, with a [22 percent drop](#) in particulate pollution (Yale E360 2025). A variation on congestion pricing is the establishment of [zero-emission zones](#), in which zero-emission vehicles (along with pedestrians and bicyclists) are granted free access, while gas- and diesel-powered vehicles are either prohibited or must pay a fee (Xue and Chen 2024).

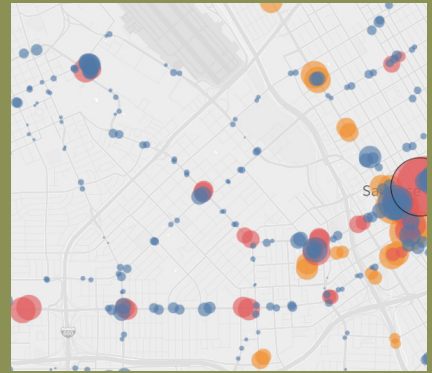
A further connection between congestion pricing and complete streets is that in most cases, money raised from congestion pricing is invested in transit, walking, and biking infrastructure. In its first six months, New York City's congestion pricing program was on track to raise [\\$500 million](#) for the Metropolitan Transportation Authority, funding improvements in bus, subway, and rail systems (New York State Governor's Office 2025). At the time of this PAS Report's publication, the congestion pricing program in New York City is under litigation, so the program's long-term viability is unclear. However, raising funds for transit and decreasing congestion are perennial transportation needs likely to remain in the national interest.

CONCLUSION

The next generation of complete streets will address not only multiple modes, but also multiple uses in areas where streets are valued for activities beyond travel flow. This shift is driven by increased demand for street-related infrastructure, including street space for placemaking. Within the spatial constraints of built-out environments, cities need to find ways to fit additional activities into public rights-of-way.

For cities of all sizes, the notion of programming space means a community does not have to choose among uses and lock in a singular function. Instead, managers can change uses throughout the day, week, or month based on demand or stakeholder needs. The evolution of physical infrastructure and technology offers multiple options for physical, digital, and financial approaches to adjusting street use and function.

Whether a street has one static use or is subject to frequent programming, evaluating success relies on information tracking, which requires data collection. Chapter 8 delves further into how to manage streets with data and analysis.



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08 DATA PLANNING AND MANAGEMENT

Data systems and emerging technologies represent a new facet of complete streets planning and programming. Transportation data needs have traditionally revolved around numbers such as speed, distance, and lane miles to answer the question “What is happening within the transportation system?” However, the evolution of data science and technology within the context of complete streets has led planners and engineers toward a different question: “How is the transportation system performing?” This requires additional information based on a community’s expectations of its mobility system.

Cities have long used traditional travel data and infrastructure inventories to evaluate the transportation benefits of complete streets, along with additional data to assess benefits in other areas. But as data and data science have become core features of planning, the increased infusion of data into planning processes is transforming how planners approach the various steps in a transportation system: process, planning, policymaking, programs, and project design. Planners need to learn about and adopt [new approaches](#) in their practice (Wasserman 2021).

With the promise of increased data-informed planning comes risk. Topics of concern that merit deeper discussion and integration into planning practice include identifying and correcting [discrimination and bias](#) within datasets and algorithms (Hammon 2015), the [ethical concerns](#) of artificial intelligence (AI) and generative AI in planning (Holub-Moorman 2025), and obligations to safeguard [data protection and privacy](#) (Gomez 2022). Another key consideration is rightsizing data and analysis to match a client or community’s needs and budgets.

This chapter provides an overview of the role of data in complete streets projects, the elements needed to establish or improve a data program, and the use of data for complete streets projects. It also explores how complete streets policies might overlap with performance-based planning. The spotlight on performance elevates the role data and metrics play in planning and monitoring complete streets. Appendix C compiles various types of performance metrics, along with data sources, for tracking the wide range of complete streets goals and benefits.

THE ROLE OF DATA IN COMPLETE STREETS PROJECTS

Transportation and community planners have become increasingly responsible for incorporating complex data into analysis, outreach, and implementation processes. In many ways, one of the key [roles](#) of planners is to simplify complex data applications and translate them into terms that resonate with multiple audiences (Bayer, Frank, and Valerius 2010).

The 2010 PAS Report [Complete Streets: Best Policy and Implementation Practices](#) (McCann and Rynne 2010) documented ways in which planners were using data in the complete streets movement’s early phase:

- Establishing existing conditions for infrastructure, mode splits, and travel patterns
- Quantifying problems and evidence to support policy development
- Aggregating data across multiple departments
- Conducting before-and-after studies
- Monitoring mode share

Advances in technology and the expansion of data collection and analysis now inform a wider array of complete streets goals that promote livability, economic viability, access, and equality. Data continues to create a foundation for understanding baseline conditions and is increasingly important for tracking and evaluating the implementation of complete streets projects. Chapter 10 delves further into evaluating and monitoring complete streets.

The Evolving Role of Data

The future of data in transportation and infrastructure is evolving, shaped by metrics and methods that better support forecasting, planning and policy development, asset management, traffic characteristics of all modes, reporting, and decision support. With the evolving role of data, planners can expect new approaches to project management and internal processes.

Three major technology disruptors, outlined in Table 8.1, affect how data can be used or collected in transportation planning: (1) advanced data collection and inventory, (2) geospatial (GIS) modeling and 3D visualization, and (3) AI and machine learning (ML). This list is not exhaustive and, due to the speed of innovation within this field, may quickly become outdated.

Several organizations are using [open-source datasets](#) to create highly detailed maps for roadways, curbs, and sidewalks using satellite imagery, street-view images, lidar data, crowdsourced GIS, and other remote sensing data (Plass and Youngs 2024). Open-source data is generally available to anyone to access, edit, and, in some cases, contribute. One

of the premier open datasets for complete streets is [Open-StreetMap](#).

Newer datasets provided by data companies include location-based service (LBS) data from cell phones and connected vehicles, which can produce valuable insights for transportation and urban planners alike. New mobility analytics platforms can aggregate [LBS data](#) to determine travelers’ origins and destinations based on data pings across an environment (Lee and Sener 2020). With LBS data, planners can quantify the popularity of routes and activity centers by time of day.

While useful, LBS data is not without [challenges](#). In assigning trips, analytics programs may have trouble differentiating between fast cyclists and slow cars (Lee and Sener 2020). The use of LBS data also presents ongoing [privacy](#) concerns. Multiple streams of location-stamped mobility data can make it easier to identify users, even when data is anonymized (Matheson 2018).

In addition to evaluating current system performance, data is key for predictive analytics. Transportation planning is largely an exercise in estimating and comparing future

TABLE 8.1. TECHNOLOGY DISRUPTORS AFFECTING DATA FOR COMPLETE STREETS PLANNING

Technology Disruptor	Applications for Complete Streets Projects	Technologies or Methods
Advanced data collection and inventory	Improved transit ridership information that increases effectiveness for first- and last-mile infrastructure	Digital mapping and monitoring of real-time transit rider information (Li, Batty, and Goodchild 2020)
	Support for demand-responsive tolling and parking fees	Analysis and data collection at toll and parking fee points to determine service periods and demand-responsive pricing (Fournier, Patire, and Skabardonis 2023)
	Scanning and processing data for Americans with Disabilities Act (ADA) compliance	Lidar data collection and sensor equipment positioned strategically to monitor ADA compliance and resources (Ai and Tsai 2016)
	Street infrastructure inventorying and data collection	
Geospatial (GIS) modeling and 3D visualization	Digital experimentation with different designs based on digital replicas of physical complete streets	Synthesis of multiple data types and GIS software to create a baseline model, or digital twin , of an existing roadway that can be extrapolated through GIS to create different scenarios for various potential solutions or projects (Jiang et al. 2022)
	Comparison of a finished project with planning documents to ensure that what was promised is what was constructed	
	Trade-off analyses	
Artificial intelligence (AI) and machine learning (ML)	Digitization of infrastructure and assets	Advanced feature extraction and identification from imagery and remote sensing of land cover (Wasserman and Flaxman 2022)
	Feedback and interpretation of traffic conditions and crashes to incorporate data-driven decision-making	Development and training of an ML model in conjunction with spatial mapping to produce predictive crash forecasts (Al-Mistarehi et al. 2022)
		Use of AI or ML to interpret and catalog street infrastructure using satellite images or street photographs (Exner, Nalbach, and Werth 2020)

system scenarios. Traditional forecasting models extrapolate future travel demand and patterns from historical data. However, this may produce inaccurate outputs given today's accelerating pace of change, as exemplified by the widespread disruption in travel patterns caused by new technologies and post-COVID workplace flexibility. With emerging data analytics, transportation authorities can collect and analyze large amounts of recent data to improve predictions over time. Some common applications of predictive analytics in transportation include optimizing service routes for transit and delivery fleets and identifying areas for preventative street maintenance. Planners can also use results to model and visualize alternative futures.

Data is also becoming a useful topic within stakeholder involvement, as planners can use it as a rallying point for interest and engagement. Data visualization is one of the best ways to communicate data-rich aspects of multimodal transportation and complete streets. Community-collected data is another example. Every first week in March, the Australian organization Bicycle Network holds "[Super Counts](#)" on Tuesday to count bike commuters and Sunday to count recreational pedestrian and cycle trips using trained volunteers (Bicycle Network n.d.). Planners can also invite users, such as university students and local technical experts, to discover hidden value in large or complex datasets. Each year, New York City celebrates [Open Data Week](#), inviting the public to engage with data from the city's open data portal (NYC OpenData n.d.).

The use of data in planning is evolving in parallel with the use in other disciplines working with big data, AI, and visualization. In recent years, AI has moved from a niche topic at the intersection of academia and technology to an everyday tool anyone can use through a growing list of generative AI platforms. Behind the scenes, however, is the issue of computational power (and energy use) needed to compose a letter or generate a video. For cities, the skills and resources needed to gather, clean, analyze, visualize, and store these enormous datasets are poised to become a barrier. These costs need to be accounted for in any project or program proposal. The sidebar on p. 112 describes some potential uses of AI in complete streets planning.

ELEMENTS OF A DATA PROGRAM

Data is not useful until it is applied. Establishing a data program helps create value with formal structures for collecting, analyzing, using, storing, and communicating data.

Planners should be familiar with the main components of a complete streets data program: data sources, data types, and data management.

Data Sources

For complete streets, data can come from a growing list of sources, including open-source repositories. Transportation agencies are constantly advancing their data collection efforts to capture information on evolving mobility systems. In the 1990s and early 2000s, federal and state governments focused on basic data collection for speed, traffic delay, and asset inventories. Over time, agencies have added vehicle miles traveled, safety statistics, and performance measures for multimodal transportation. Today, many federal and state agencies use source books or websites to store and [organize](#) data (FDOT 2019).

While agencies have been adding new types of datasets, politicization has also resulted in the scrubbing of certain types of data. In early 2025, federal government websites and datasets related to transportation justice, climate change impacts, electric vehicles, and even complete streets were taken off the internet. To preserve access to this information, a host of digital archivists, researchers, organizations, and individuals have been working to find and [save](#) key datasets and archived webpages (Catenacci 2025).

Examples of key data sources used in transportation and community planning include the following. Appendix B offers a list of additional data and data collection resources.

Federal government

One of the premier data sources for planners is the U.S. Census Bureau's [American Community Survey](#) for socioeconomic information and data on journey to work, income, housing, employment, and health. The U.S. Department of Transportation (USDOT)'s [Bureau of Transportation Statistics](#) (BTS) publishes data on passenger travel, freight movement, transportation and the economy, system reliability, safety, energy use, and the environmental impacts of transportation within the open-source [National Transportation Atlas Database](#). The Federal Highway Administration's [National Household Travel Survey](#) includes detailed data on travel patterns; use the Data Explorer Tool to search for modes including vehicles, transit, walking, biking, bike-share, and more.

State governments

Each state's department of transportation has established its own data inventory and methods for presenting that data.

ARTIFICIAL INTELLIGENCE AND COMPLETE STREETS

Artificial intelligence (AI) is now so ubiquitous that the question is no longer whether or not planners should use AI, but rather how planners can best use AI in ethical and practical ways to enhance planning processes and benefit communities. A full discussion of the different types and capabilities of AI is beyond the scope of this PAS Report; see instead PAS Report 604, [Planning With Artificial Intelligence](#) (Sanchez 2023). For complete streets, planners should be aware of the following [AI functions](#) (Wasserman and Flaxman 2022):

- **Digitization and mapping of infrastructure and assets.** Planners can use AI to quickly and efficiently convert remote sensing, lidar, aerial imagery, photographs, parcel records, and field-collected data to spatial datasets for mapping and analysis. In California, Contra Costa County used AI to convert aerial imagery into a [digital inventory](#) of the county's transportation infrastructure, including roadway and laneway widths, bike infrastructure, sidewalk infrastructure, and landscaping features. The County planned to use this data to support active transportation plan implementation and identify safety improvements to help achieve Vision Zero goals (Ecopia AI 2021). In addition, the new field of [GeoAI](#) combines AI and GIS, allowing planners to automate GIS-based tasks and expand their capabilities for analyzing spatial data, predicting community trends, and accessing geospatial information without needing specialized GIS skills (Cooke 2024).
- **Data collection and analysis.** Advances in machine learning and neural networks underpin [computer vision](#), which allows computers to detect and identify images and track their movement in photographs or video footage (Wasserman 2025). Rather than standing at an intersection counting traffic for hours at a time and then manually processing those counts, planners can use this AI capability to quickly analyze days of video to quantify and track pedestrian, bicycle, and traffic movement; understand safety conflicts; and evaluate the effectiveness of urban design and mobility interventions. For example, Bellevue, Washington, used AI to [analyze](#) traffic flows before and after installing Leading Pedestrian Intervals (LPIs) at designated intersections (Bandy and Tran 2022). It found that LPIs were effective in reducing vehicle-pedestrian conflicts while having negligible effects on traffic delays.
- **Visualization and public engagement.** Planners can use generative AI to create renderings, videos, and immer-

sive digital spaces showing street design and management alternatives for community feedback and interactive engagement. In 2023, the City of Helsinki, Finland, used the UrbanistAI platform in two community workshops to [co-design street improvements](#) for the city's annual Summer Streets events, in which three central streets are closed to cars and transformed for community use (UrbanistAI 2023).

In August 2024, USDOT announced the awarding of \$2.4 million in contracts under the [Complete Streets AI Initiative](#) to help small businesses develop AI-based decision-support tools for planning and implementing complete streets (USDOT 2024c). Though the status of this discretionary program is uncertain within the next transportation bill, topics addressed by the awardees offer a glimpse of the potential applications of AI to complete streets:

- AI-based image processing and machine-learning technologies to fill critical gaps in the data obtained from aerial imagery for Safe Routes to School.
- AI and computer vision algorithms to generate and analyze diverse datasets such as traffic volume, pedestrian infrastructure, and demographic representation, to support more equitable and effective urban planning.
- AI-driven decision support systems for identifying and prioritizing complete streets projects.
- AI-integrated imagery and geospatial data to identify unsafe street crossings, bike lane use, and network gaps.
- Computer-vision models to identify streetscape assets and define their impacts on a complete streets environment.

Planners have long been responsible for steering fair and open processes for making decisions that best serve the public interest. This role extends to the new world of AI. As such, planners and their associates will be expected to harness the benefits of AI while minimizing adverse effects. Those adverse effects include perpetuating biases, institutionalizing obscure decision-making processes, replicating misinformation and disinformation, and infringing on privacy. Table 8.2 (p. 113), adapted from the JAPA article "[The Ethical Concerns of Artificial Intelligence in Urban Planning](#)" (Sanchez, Brennan, and Ye 2024), summarizes several key challenges and potential solutions of importance to community and transportation planners, including those planning for complete streets.

TABLE 8.2. ETHICAL CHALLENGES OF ARTIFICIAL INTELLIGENCE IN URBAN PLANNING

Challenge	Solution
AI applications are outpacing the organization's ability to define opportunities and limit risk.	Establish clear ethical guidelines and standards addressing privacy, data security, transparency, and fairness. Develop robust privacy and data security policies.
Planners risk losing public trust, given the complex nature of how AI works and privacy concerns when using large data sets.	Prioritize transparency and accountability. Document AI algorithms and methodologies and state clearly when AI was used to produce documents, audio, and video.
AI may replicate bias, such as by using databases that underrepresent women and other historically underrepresented populations.	Use diverse and inclusive data sets that accurately represent the entire population and users. Bias removal can occur in several stages: when preprocessing data, reviewing results, or embedding appropriate and transparent rules as part of the data training process.
The complexity of AI makes it difficult to explain to the public.	Integrate discussions of AI and its use in planning into public engagement, surveys, and participatory design sessions.
The potential positive and negative effects of AI on local planning processes may be difficult to predict or understand.	Conduct regular ethical audits and reviews of AI systems to evaluate their ethical implications, effectiveness, and alignment with city and area goals. Invest in AI literacy and education for professionals and the public.

Source: Sanchez, Brennan, and Ye 2024

To find information on a particular state, the best approach is a web search for “data,” “data portal,” “open data hub,” or “data source book.” Information may be presented as GIS maps, tables, spreadsheets, and other formats.

Regional and metropolitan planning organizations

Metropolitan planning organizations (MPOs) offer data in various formats findable through a web search for “data,” “data portal,” “open data hub,” or “data source book.” Use USDOT’s [interactive map](#) and [database](#) to locate and learn about MPOs (USDOT BTS 2025; FHWA/FTA n.d.b). Councils of governments can also be data partners; one such example is the Metropolitan Washington Council of Governments and its work on big data, presented in the report [Big Data for Regional Travel and Mobility Analyses](#) (MWCOC 2021).

Municipal and local sources

Many local governments and nongovernmental organizations offer publicly accessible repositories of maps and data. Examples include Boston’s [Analyze Boston](#) website and Chicago’s [Data Portal](#) for transportation. The organization [Data Driven Detroit](#) is notable as a worker-owned coopera-

tive. It coordinates with state, regional, and other local open data programs as well as partners who consult on campaigns to address gentrification, housing, and health using maps and graphics (Data Driven Detroit n.d.).

Transit agencies may also provide data and dashboards on assets, operations, and performance. One such example is California’s Santa Clara Valley Transportation Authority, whose [open data portal](#) (Figure 8.1, p. 114) provides information on transit ridership over time and by stop, traffic volumes on major corridors, and web apps for bike and pedestrian access (Santa Clara VTA n.d.a).

Police reports are an important source of crash data. However, safety advocacy groups caution that bike and pedestrian crashes often go [unreported](#), given the emphasis on vehicle-related statistics (Bliss 2021). As part of efforts to provide open datasets for community problem-solving, the [Police Data Initiative](#) provides links to crash datasets for 14 U.S. police departments (National Policing Institute n.d.).

Private data companies

As discussed earlier in the chapter, several firms offer LBS and other data services for a fee. With the growing complex-

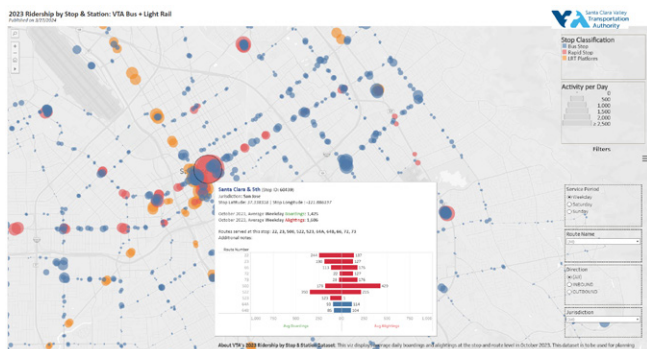


Figure 8.1. Screenshot of the VTA open data portal (Santa Clara Valley Transportation Authority 2024)

ity of collecting and analyzing data, these companies serve a market in streamlined, quality-controlled data and data storage. Examples of companies providing such data to analyze people and vehicle movement include [StreetLight Data](#), [Placer.ai](#), [Replica](#), and [UrbanSDK](#).

Universities and associations

Universities often offer general and specialized data portals and data directories. For example, Northwestern University maintains a list of [transportation data sources](#) for the Chicago region (Northwestern University n.d.). The University of California, Berkeley, hosts the SafeTREC program, which hosts several traffic crash datasets and mapping tools for California (UC Berkeley n.d.). Transportation associations also offer datasets and statistics; for example, the American Public Transportation Association’s [Ridership Trends](#) site provides ridership data for large, medium, and small transit systems through a partnership with the Transit app (APTA n.d.).

Crowdsourced data

Technology has enabled the crowdsourcing of information gathered from volunteers who use cameras, mobile apps, and web platforms to record and upload data. [OpenStreet-Map](#) is among the earliest examples of open-source map platforms updated and maintained by volunteers. Fitness apps, such as [Strava](#) and [MapMyRide](#), have become valuable sources of data from cyclists and pedestrians who opt in to reporting features.

Quantitative data collection

In some cases, planners will need to collect their own data in the field. For site-specific data collection, local governments can procure counters for trails, sidewalks, and paths. Some

regional associations host lending libraries for counters and radar guns for short-term data collection projects. The [West Virginia Local Technical Assistance Program](#) is one such example (WV LTAP n.d.).

Using smaller vehicles such as bicycles and Segways, communities can scan, map, and analyze sidewalks, bike paths, and trails. The Des Moines (Iowa) Area Metropolitan Planning Organization used “[data bikes](#)”—app-connected cargo bikes outfitted with cameras—to monitor pavement smoothness and identify areas requiring repair (Vock 2024). [Lidar](#) (light detection and ranging) tools, which use lasers and GPS to measure reflected light, can capture highly accurate information. This can be used to determine whether intersection ramps are APA compliant (Hanson 2023). Lidar can be mounted on drones, automobiles, and backpacks (Figure 8.2). The city of Irvine, California, has begun using [robots](#) with sensors and GPS connections to evaluate sidewalks for ADA compliance (Edinger 2025).

For communities that want to collect their own data, USDOT’s “[Data Collection and ITS](#)” briefing bulletin outlines various data collection tools and costs (USDOT 2025). The report [State-of-the-Art Approaches to Bicycle and Pedestrian Counters](#) from the Institute for Transportation Research and Education at North Carolina State University provides a menu of traffic-counting technologies, including information on costs and data integration (Ozan et al. 2021).

Local governments can also contract with companies that deploy counters. Companies such as [Quality Counts](#)



Figure 8.2. Data collection via Segway, with sensors mounted on the vehicle and lidar attached to the driver’s backpack (WGL Inc.)

and [The Traffic Group](#) offer traditional data collection services for car and bicycle traffic, while technology-forward companies like [MioVision](#) use video detection software.

Qualitative data collection

Collecting real-world user experiences is equally important. Members of the disability community have staged protests, sit-ins, and boycotts to call attention to inaccessible transportation systems. Planners can engage these community voices when conducting an Americans with Disabilities Act (ADA) [self-evaluation](#) (Godwin 2023). This involves identifying desired outcomes and existing barriers and improving communications to create a more inclusive environment. Another way to discover accessibility challenges is to conduct a [walking/rolling audit](#) to determine weather, transit, safety, and crosswalk and sidewalk barriers (AARP 2022). As noted in Chapter 3, storytelling is a powerful way to communicate the elements and benefits of complete streets.

Data Types and Metrics

Planners can use many types of data to analyze transportation system performance for complete streets. Transportation and infrastructure data are of primary concern, along with information on equity, health, and safety.

When researching applicable datasets for complete streets, planners must keep in mind the need to analyze and communicate performance via metrics. The distinction between the two terms is crucial: data points are pieces of information, while metrics allow the comparison of performance with stated goals. This enables the practice of performance-based planning, as described in the sidebar on p. 116, in which planners can use metrics to determine whether project outcomes are bringing a community closer to its stated goals. Data sources should be screened for usefulness in describing performance as defined by those goals.

Given the multimodal and multiobjective purposes of complete streets, transportation agencies and researchers should select metrics to measure progress towards their own multiplicity of goals. For example, if one of the community's top goals is mitigating climate impacts, the complete streets data program should include data related to greenhouse gas emissions reduction.

A valuable guide to performance measures and metrics for multiple transportation goals is the AARP/Smart Growth America 2015 report [Evaluating Complete Streets Projects: A Guide for Practitioners](#) (AARP and SGA 2015). It offers metrics for goals of access, economy, environment, place, safety, equity, and public health. More recently, the

2024 Smart Growth America report [From Policy to Practice: A Guide to Measuring Complete Streets Progress](#) offers more than 100 metrics categorized by process, implementation, and impact (SGA 2024). A recent report from USDOT, [Complete Streets Evaluation Best Practices](#), focuses on analysis, modeling, and simulation (AMS) approaches for mobility, safety, equity and accessibility, network connectivity, environmental sustainability, and public health (USDOT ITS JPO 2024). A local guidance manual from the New York City Department of Transportation is [Measuring the Street: New Metrics for 21st Century Streets](#), which reflects the growing use of streets as public spaces and offers six categories of metrics: crashes and injuries, volume, traffic speed, economic vitality, user satisfaction, and environmental and public health (NYCDOT 2012).

Based on a review of complete streets plans, the following categories of general data are typically used to assess existing conditions and track performance. Corresponding tables offering sample data types, examples of data sources, and related performance metrics and targets for each category are provided in Appendix C, pp. 159–67.

Transportation data

[Table 1](#), Appendix C (pp. 159–60) presents travel-related data. For detailed information on transit data, see [Making Transit Count](#) (NACTO 2018) and [Mobility Performance Metrics for Integrated Mobility and Beyond](#) (FTA 2020).

Infrastructure data

[Table 2](#), Appendix C (pp. 161–62) presents infrastructure-related data for complete streets. For a detailed discussion of metrics for transportation networks, see FHWA's [Guidebook for Measuring Multimodal Network Connectivity](#) (FHWA 2018a).

Access and accessibility data

As noted elsewhere in this PAS Report, the term “access” has two distinct, though related, definitions. [Table 3](#), Appendix C (p. 163), presents data and metrics for access to destinations and opportunity, which address land use components so that communities can determine whether people can readily access valued destinations. This entails short trips accessible by every mode and mode choices that deliver timely, reliable [access](#) to common destinations (Boisjoly and El-Geneidy 2017). For more information on access to destinations and data, see [The Why and How of Measuring Access to Opportunity: A Guide to Performance Management](#) (Governors' Institute on Community Design 2017). The

PERFORMANCE-BASED PLANNING FOR COMPLETE STREETS

With any investment, stakeholders want to know whether investments are performing as expected. As described throughout this chapter, data collection and analysis—along with the appropriate choice of metrics—allow planners to track implementation of complete streets projects and evaluate whether these investments are achieving community goals.

Traditionally, cities have used level of service, or LOS, as the main performance indicator for streets. LOS is largely a measure of automobile throughput. Letter grades of A through F, much like grades on school report cards, are assigned to categories representing seconds of delay at intersections and decreases in traffic speed below free-flow conditions, measured at the most congested time of day. The LOS approach should be used with [caution](#), however, as in the case of cities, grades can be deceiving (Dumbaugh, Tumlin, and Marshall 2014). For example, an LOS of F implies a failing system. However, slow-moving traffic on main streets is desired for both safety and economic returns. As an alternative, cities have developed LOS measures to assess the quality and performance of transit, bicycle, and pedestrian facilities, sometimes referred to as [multimodal LOS](#) (Dowling 2009). Alternatively, agencies can adopt a range of performance measures that better reflect the multifaceted nature of infrastructure.

While performance-based planning is enshrined by law in federal, state, and MPO planning for highways, its use at the local level is less formal. The general process for developing a performance-based plan is as follows: (1) establish goals, (2) assign metrics, (3) establish performance targets, (4) conduct monitoring, and (5) periodically analyze data to determine where improvements are needed.

U.S. Environmental Protection Agency hosts several [smart location mapping](#) tools to measure accessibility and location efficiency (USEPA n.d.b.).

Planners should consider the “complete trip” when evaluating both access and accessibility, as discussed in the sidebar on p. 117. [Table 4](#), Appendix C (p. 164) presents Americans with Disabilities Act (ADA)-related accessibility data.

Equity data

[Table 5](#), Appendix C (p. 165) presents equity-related data and metrics for complete streets. Complete streets embody a

Today’s complete streets need to balance competition among a growing number of uses and users. As such, managers should choose a set of metrics that reflect their communities’ goals; the examples provided in Appendix C, Tables 1 through 6 (pp. 159–67), are good places to start. For example, a goal for a city’s complete streets program could be tied to intersection safety. One of the main goals might be to reduce conflicts involving vehicles and pedestrians. The city could use a metric of crashes, but this is a reactive metric that only tracks when people have been harmed. Instead, the city may opt to study near misses and act once the number of near misses reaches a predefined level.

One of the more vexing questions involving performance-based plans is what happens when performance metrics are not met. By the time critical conditions emerge, it is often politically difficult to enact the most rigorous measures. This is now a common occurrence with [Vision Zero](#) plans, as pedestrian and cyclist deaths continue to rise in many cities due to a complex web of contributing factors that infrastructure changes can only partially address (Zipper 2022).

One approach that can help address this situation is to establish a series of action metrics that lead to a stated performance target. For each step, if the target is not met within the designated timeframe, the city can establish increasingly rigorous measures. For example, if a quick-build installation fails to slow speeds to a target level within a year, then the plan will call for more robust traffic-calming solutions. This stepwise approach forms a basis for public “check-ins” with a clear plan and built-in project justification for action.

set of values that extend beyond transportation and infrastructure. Legacies of racist policies and underinvestment have led to today’s inequities in urban infrastructure, and complete streets offers opportunities to address equity in mobility and accessibility, the built environment, and planning processes.

Equity analysis is an important transportation justice tool. One example of its use comes from the City of Baltimore, which in its annual [complete streets report](#) presents individual equity performance measures and an equity composite index score for each of the program’s 17 metrics

DATA AND THE COMPLETE TRIP

Chapter 5 presents the concept of the complete trip and its connection with multiple modes of transportation. In developing a focus on end-to-end trips, data is important. When describing a person's trip, transportation literature and data reporting often consider only the main leg. However, a transit ride includes other important links, such as trip planning, accessing stations or stops, navigating the station when ticketing and boarding, transferring between transit vehicles, and traveling from a transit stop to the final destination. As planners review transportation data, they must consider the complete trip and seek data for each link or risk incomplete analysis.

One of the first challenges is capturing data from travelers. Location-based (i.e., cell phone) data reveals origin-destination pairs, a valuable source of information for land use and transportation planning. However, the ethics of selling personal data and privacy concerns continue to hang over the industry. Data vendors argue that location data is anonymized, though [researchers](#) have found that individuals can be identified with as few as four data points (de Montjoye et al. 2013). Moreover, location-based data sheds little light on travel conditions.

This leads to a second challenge in tracking complete trips: infrastructure. For example, a housing development may be two blocks from a transit stop but lack a connecting sidewalk, forcing riders to walk through a vacant lot to reach the stop. If one link is broken because of infrastructure deficits, the entire trip will be affected. In this case, data is needed on sidewalk connectivity, which can be collected manually or digitally.

Fortunately, organizations are working on enumerating all the elements of an end-to-end journey. The National Center for Mobility Management has created a [brief](#) that presents several complete trip planning scenarios for a variety of travelers: a city dweller, an older traveler, a bike commuter, an adult with a cognitive disability, and a family making a multistep trip (NCMM 2016). The main objective is to help planners and mobility managers trace journeys to identify barriers and infrastructure gaps. Taking a complete trip approach to complete streets planning helps planners understand all the data required to ensure a community's transportation system is accessible to all users, regardless of ability.

(Baltimore n.d.). For an example of a transportation equity study, see the [Transportation Equity Study](#) conducted by the Tahoe Regional Planning Agency (TRPA 2023).

The preponderance of car-centric infrastructure, and conversely gaps in active transportation infrastructure, affect health. Physical activity associated with multimodal transportation has been shown to lower the precursors and health risks of disease. As such, data on health outcomes is an important input for equity analyses. For more information on health and complete streets, as well as additional resources on data and metrics, see [Public Health Engagement in Complete Streets Initiatives: Examples and Lessons Learned](#) (Sansone, Sadowski, and Chriqui 2019).

Climate data

[Table 6](#), Appendix C (p. 166) presents climate-related data and metrics for complete streets. Measures for environmental quality often overlap with equity and health-related issues. Research shows that low-income neighborhoods are more likely to suffer impacts from climate-induced stressors and shocks such as extreme heat, flooding, and elevated air pollution levels. The U.S. EPA report [Climate Change Indicators in the United States](#) offers links to databases and overviews indicators related to greenhouse gases, heat, extreme weather events, water scarcity, changing seasons, and sea level rise (USEPA 2024).

Data Management

Data is more than numbers. It describes important information about people and systems, some of which involves sensitive details about location and movement. As such, organizations need to develop policies and procedures for identifying, organizing, managing, and using data. While this level of information is typically handled within an information technology or related department, planners will need to adhere to overarching policies and procedures.

Data management is led by [data governance](#): a framework for collecting and handling data to ensure information is secure, private, accurate, and usable (Wright 2025). Key objectives of data governance are risk mitigation and instilling trust among the public and other stakeholders. [Table 9.2](#) (p. 118) summarizes data management components relevant to planners and their complete streets work. For more information on managing mobility data, see NACTO's [Policy on Managing Mobility Data](#) (NACTO and IMLA 2019).

One emerging area of data management is interoperability, or the ability to combine and analyze multiple datasets to glean additional insights. For example, real-time transit

TABLE 9.2. DATA MANAGEMENT COMPONENTS

Components	Relationship to Complete Streets Data Management
Data collection and documentation	Coordinate with IT for data subscriptions and verify data sources with vendors. For data collection via cameras or license plate readers, work with IT and your organization to vet hardware, software, data ownership, privacy protocols, and storage.
Data structure	Data structure is a specific method for standardizing, organizing, storing, and managing data so that it can be accessed efficiently. Planners may need to correct common problems such as incompatible formats, silos across departments, or lack of machine readability.
Data sharing and integration	Determine opportunities for data-sharing agreements among agencies and departments. Negotiate additional licenses for data subscription and analytics companies. If sharing data with other transportation agencies, check on data formats and standards. For the public, adopt policies that explain if or how data will be shared.
Data security	Follow data security policies established by IT.
Data retention or destruction	Establish limits on how long records are retained and establish data deletion or destruction time frames.

routing requires information from disparate data-collection devices covering transit vehicle locations, crashes, construction, weather, and traffic. These data are all in different formats, which must be “fused” to produce, assess, and assign routing options. The rising interest in [digital twins](#) for transportation operations and decision support is driving improvements in data fusion (Wu et al. 2025).

CONCLUSION

The successful planning and implementation of complete streets requires a broad range of data at every stage of project planning, engagement, design, and implementation. Data helps planners cohesively and strategically plan. However, the broad range of available data creates challenges. Planners

will need to forecast data needs for monitoring implementation and performance early in project planning. Some of that data will be readily available, though planners can expect to work with partners on identifying and filling gaps. Planners should also expect and be prepared for ongoing innovation and change with technological advances and disruptions, such as AI.

Planners play an important role in communicating the need and value of data and metrics to multiple audiences. As noted in other chapters, some information may be counterintuitive to the general public, such as slowing traffic to improve flow. In this example, data is vital for making the case. There is also value in qualitative data, such as the information gleaned from interviews with travelers about their cycling, walking, or rolling experiences.

The wide-ranging aspects of data call for an organized approach to data management. This starts with the ability to efficiently and effectively source and collect data for analyzing existing conditions, design options, scenarios, and performance. For performance, planners need to be adept at establishing metrics that signify the community’s expectations of success. These metrics include traditional transportation and infrastructure benchmarks, but they must also track complete streets contributions to meeting environmental, economic, accessibility, health, and equity goals.

Because data is so valuable to the process, and in some cases, related to sensitive information on location, destinations, and travel times, secure procedures for accepting, handling, sharing, and storing data are essential to reduce risk and assure the public that their information is safeguarded.

Finally, planners can expect continuing evolution in data and policy related to community design, infrastructure, and mobility. This will apply to internal organizational needs as well as public-facing programs. As covered throughout this report, technology and data are changing not only what we plan, but how we plan. Considerations such as first-last mile access to transit, curb management, and the complete trip all seek to improve service by exploring complex interactions among modes, land uses, and infrastructure. Heightened attention to equity and climate is likewise reshaping the traditional scope of transportation planning, and by extension, the types of data needed to develop lists of priority projects. The next chapter will explore how data and needs get translated into project selection criteria and funding.



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09 FUNDING COMPLETE STREETS

Among the biggest challenges to realizing the myriad benefits of complete streets is funding their construction. Over the past two decades, the funding landscape for complete streets projects has evolved as awareness of multimodal transportation and community-centered design has grown.

As described throughout this report, the complete streets concept has gained traction across the country, and federal funding opportunities have grown. Likewise, state and local governments are funding projects identified through complete streets policies and plans. Nonprofits and public-private partnerships also provide funds for complete streets through community development agreements and grants. The changes in funding resources coincide with the expansion of goals and priorities attached to multimodal systems and infrastructure. Projects that address not only mobility but also safety, accessibility, and community goals in transportation are now being prioritized within funding documents.

In the 2020s, complete streets funding has been subject to wide fluctuations in support, most notably at the federal level. The record amounts of federal transportation funding designated under the Biden administration were followed in 2025 by restrictions targeting active transportation programs under the Trump administration, as well as [cancellations](#) of grants for street safety because those projects were deemed “hostile” to cars (Mann 2025). Uncertainty over funding is likely to persist as Congress updates the five-year transportation bill, which is slated for adoption in 2026. Because federal policy tends to trickle down to state and regional funding decisions, what happens within federal agencies eventually touches local infrastructure priorities and funding.

This chapter provides a primer on how complete streets are funded and offers an overview of federal, state, regional, and local funding sources for complete streets projects. It also explores the role of planners in identifying, applying for, and managing funding streams for complete streets projects. Readers should note that this chapter highlights federal programs still active in early 2026 at the time of this report’s publication.

FUNDING 101

Traditional funding sources for complete streets projects include federal, state, regional, and local funding programs, as well as other smaller sources.

For local and regional roadways, transportation agencies typically use a mix of funding sources. Most funding originates in legislative actions that establish program parameters and revenue sources, such as general funds, dedicated sales-tax programs, or grants. Lawmakers, working with transportation agencies, establish program rules, guidelines, and priorities for program outcomes and project selection criteria.

At the local level, communities establish goals through visioning and updates to the comprehensive plan. To support funding for complete streets projects, it is essential to include complete streets goals, objectives, policies, and actions within the comprehensive plan’s transportation and public works plan elements. Planners may also find benefits in cross-listing complete streets goals, objectives, and policies in other elements to “connect the dots” among infrastructure and housing, economic development, public facilities, parks, schools, and transit.

For all communities, comprehensive plans and capital improvement plans (CIPs) drive the planning process. CIPs are annual work plans that include construction projects, such as transportation and roadway improvements. Planners can play a large role in ensuring [consistency](#) between the comprehensive plan and CIP. This can be a key success factor, as planners are all too often left out of the budgeting process (Mathur 2019).

For larger complete streets projects or those funded with federal dollars, communities often need to coordinate

with metropolitan planning organizations (MPOs) to align projects with regional goals and list them in the [Transportation Improvement Program](#) (TIP) (FTA 2022). MPOs are authorized by law to administer transportation planning and funding for communities with populations greater than 50,000. The TIP is the MPO's five-year list of upcoming transportation projects, which should include bicycle and pedestrian facilities. For smaller and rural communities, state departments of transportation and regional planning organizations also provide professional planning services for accessing grant funding.

Federal Funding Sources

Federal funds for transportation infrastructure are largely provided through the U.S. Department of Transportation (USDOT), which oversees infrastructure funding through two types of grants: formula and discretionary (or competitive) grants. USDOT provides an extensive list of current funding programs through its [DOT Navigator](#) and [Competitive Grants Dashboard](#).

The history of federal transportation funding begins in 1916 with the Federal Road Act. In the 1920s, the country saw increased federal spending on roadways, railways, and other large capital projects. In 1956, President Eisenhower signed the Federal-Aid Highway Act to build out a network of highways. Cars dominated the landscape as funding fueled the extensive changes associated with automotive infrastructure.

In the 1970s, reeling from the embargo on oil exports to the U.S., lawmakers and advocates began to press for increased accommodation of cycling and walking. USDOT responded with [programs](#) for bicycle and pedestrian infrastructure (USDOT 2010). As the complete streets movement has grown, so has the number and type of programs for larger-scale projects, such as regional trails, dedicated bridges, and networks of separated bikeways. In addition to USDOT, other agencies such as the U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Housing and Urban Development (HUD) began to recognize multimodal transportation as eligible funding activities.

As noted above, recent years have seen much change in federal transportation policy priorities. The sidebar on p. 122 delves deeper into the uncertainty of the current federal transportation infrastructure funding landscape as influenced by the 2021 Bipartisan Infrastructure Law (BIL) and subsequent changes that took effect beginning in early 2025.

Though the current federal funding landscape is one of uncertainty, federal transportation programs that address

multiple modes are likely to continue. Each transportation program, detailed below, has its own application process with schedules, deadlines, scopes of work, eligibility parameters, and required certifications and information. When considering federal funding sources, it is important to understand eligibility and other requirements, namely:

- **Priorities.** When announcing grants in the Federal Register, departments will list their priorities. Applicants will need to address how their project meets these priorities in the project narrative.
- **Eligible applicants.** Each program will list who is eligible to apply (or co-apply) for grants.
- **Eligible activities.** Each program will list the types of activities that are allowed. This can range from planning activities to construction activities and land acquisition.
- **Matching funds.** Applicants are typically responsible for providing a portion of the total project cost. Most federal programs require a 20 percent match; however, lower matching funds or exemptions are available. Some programs will count nonmonetary contributions, such as office space and labor, towards match requirements.
- **Post-award activities.** Some programs require periodic reporting or monitoring reports. Project work plans should include post-award activities to address these requirements.

The following federal funding programs have the strongest links to complete streets. Each program is identified as formula (based on a set [formula](#) (Mallett 2024), rather than using a competitive process) or discretionary (selecting recipients using a competitive process). For additional guidance, FHWA has posted a regularly updated [Pedestrian and Bicycle Funding Opportunities Table](#) detailing which programs fund specific pedestrian and cycling programs and infrastructure components (FHWA 2025b). Note these programs are likely to [change](#) over the next five years because of new administration priorities and growing concerns over deficit spending (Davis 2025).

Surface Transportation Block Grant Program (STBG)

This [formula program](#) provides flexible funding to address state and local transportation needs. It has been a substantial source of complete streets funding for pedestrian and bicycle transportation facilities. New eligibilities for this program in the BIL included wildlife crossing structures, retrofitting structures to eliminate or reduce crashes involving vehicles and wildlife, safety barriers and nets on

FEDERAL INFRASTRUCTURE FUNDING PROGRAMS: AN UNCERTAIN PATH FORWARD

The 2021 Bipartisan Infrastructure Law (BIL) represented a robust effort to allocate funds to transit, cycling, and walking. Some of the high-profile improvements included increased funding for trails programs, flexibility in state reallocation of funds among programs to support active transportation, and requirements to enhance safety. Other hallmarks were heightened attention to safety, climate change, equity, vehicle electrification, and redressing past harms.

Upon taking office in 2025, however, President Trump called for the review and potential elimination of federal programs and grant agreements that mentioned top priorities of the previous administration, including diversity, equity, and inclusion, climate change, vehicle electrification, and active transportation. In a separate [order](#), USDOT also called into question projects lacking a “proper Federal interest” or those primarily serving local or political agendas, instead identifying “communities with marriage and birth rates higher than the national average” as a national priority for impact mitigation (USDOT OST 2025).

But while prohibited terms are no longer used in 2025’s Notices of Funding Opportunities (NOFOs), in many cases their underlying concepts remain. For example, though the term “equity” is not included in NOFOs for the [BUILD](#) and [Safe Streets for All](#) programs, the administration has specified a project focus in Areas of Persistent Poverty (APP) and Historically Disadvantaged Communities (HDCs) as designated within Census data.

Planners should also be aware of two additional looming issues relating to infrastructure funding: the gasoline tax and reauthorization.

The gasoline tax. Consumers pay both federal and state gasoline taxes at the pump to fund transportation infrastructure and mobility. Due to increased fuel efficiency and vehicle electrification, the gas tax has been declining to the point where Congress must allocate money from the general fund to pay for infrastructure.

While this is not a key topic for complete streets at the current time, the urgency to replace or augment gas tax revenue is increasing given these trends. Some states are currently piloting vehicle miles traveled fees for drivers, though this approach is controversial in rural communities due to equity concerns about the increased distances driven in these areas. Oregon could provide a new template for roadway user fees with [OReGo](#), a voluntary program in which drivers pay two cents into the State Highway Fund per mile driven in exchange for incentives, including fuel tax credits and registration fee reductions (ODOT n.d.).

Reauthorization. Every five years, Congress reauthorizes the nation’s transportation plan. Transportation for America’s [Reauthorization 101](#) guide provides a detailed explanation of this process (T4A 2024). The current plan, the BIL, expires on September 30, 2026. In recent years, Congress has not met the deadline, which triggers an extension of the current plan.

Planners can expect some of the larger historic funding programs, such as the Highway Safety Improvement Program and Surface Transportation Block Grants, to endure. However, discretionary programs addressing climate, technology, equity, and safety will likely not be renewed under the current administration. Planners should stay informed as this process unfolds.

bridges, maintenance and restoration of existing recreational trails, installation of EV charging infrastructure, and capital projects for construction of bus rapid transit corridors or dedicated bus lanes.

Transportation Alternatives Program (TA)

This [set-aside formula program](#) within the STBG focuses on smaller-scale transportation projects, such as pedestrian and bicycle facilities, recreational trails, Safe Routes to School projects, community improvements such as historic preservation and vegetation management, and environmental

mitigation related to stormwater and habitat connectivity. A recent program update added new eligibility for vulnerable road user safety assessments. Funds are allocated by MPOs, which are required to obligate TA funds through a competitive process that allows eligible entities to submit projects for funding to achieve program objectives. This process must prioritize project location and impact in high-need areas as defined by the state, such as low-income, transit-dependent, rural, or other areas. Rural areas not covered by MPOs have access to TA funds through state DOTs.

Better Utilizing Investments to Leverage Development (BUILD)

Formerly known as Rebuilding American Infrastructure with Sustainability and Equity (RAISE) and Transportation Investment Generating Economic Recovery (TIGER), this [discretionary grant program](#) allows project sponsors at the state and local levels to obtain funding for multimodal, multijurisdictional projects that are more difficult to support through traditional DOT programs. BUILD provides funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, MPOs, or partnerships.

Safe Routes to School (SRTS)

This [formula and discretionary program](#) promotes walking and bicycling to school through infrastructure improvements, enforcement, tools, safety education, and incentives. SRTS is also an allowable activity within the TA program. The BIL expanded eligibility to projects near high schools for the first time. Because much of this federal funding is administered at the state level, check with state programs for details.

Grants for buses and bus facilities programs

Several [discretionary programs](#) of the Federal Transit Administration (FTA 2025) provide grants to local public transit systems, including buses, subways, light rail, commuter rail, trolleys, and ferries. This grant program provides funds for vehicle and nonvehicle purposes, including bus stop and shelter improvements. In general, FTA grants provide funding for capital activities at 80 percent federal/20 percent local, though operating expenses through the federal share may exceed 80 percent for certain projects related to Americans with Disabilities Act (ADA) improvements and the Clean Air Act.

Safe Streets and Roads for All (SS4A)

This [discretionary grant program](#) supports local initiatives to prevent deaths and serious injuries on roads and streets, commonly referred to as “Vision Zero” or “Toward Zero Deaths” initiatives. SS4A funds may be used to develop a comprehensive safety action plan; conduct planning, design, and development activities for projects and strategies identified in a comprehensive safety action plan; or carry out projects and strategies identified in a comprehensive safety action plan. In 2024, USDOT added a category for demonstration and quick-build projects. Eligible applicants are MPOs, political subdivisions of states, federally recognized Tribal governments, and multijurisdictional partnerships.

The 2025 NOFO reduced the percentage of funds allocated to planning from 40 percent to 30 percent and required communities to submit an action plan for USDOT review, rather than self-certify.

Recreational Trails Program (RTP)

This FHWA [formula program](#) provides state block funds to develop and maintain recreational trails and trail-related facilities for nonmotorized and motorized recreational trail uses. RTP funds benefit recreation, including hiking, bicycling, in-line skating, horseback riding, cross-country skiing, snowmobiling, and using off-road motorized vehicles.

Congestion Mitigation and Air Quality Improvement Program (CMAQ)

This Clean Air Act [formula program](#) is used to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (nonattainment areas) and for former nonattainment areas that are now in compliance (maintenance areas). Eligible projects, which must demonstrate an air quality benefit, include pedestrian and bicycle facilities, promotional activities that encourage bicycle commuting, and the construction of pedestrian walkways and bicycle transportation facilities. The USEPA [Green Book](#) lists areas of the country that are in nonattainment with air quality standards (USEPA 2025a).

Community Development Block Grant Program (CDBG)

HUD distributes these [formula program](#) funds to improve active transportation infrastructure, such as streets, sidewalks, and bikeways. CDBG funds are disbursed as block grants to states, which then tailor the program to needs. To qualify for CDBG funding, a project must meet one of the three national objectives: (1) provide benefit to low- and moderate-income (LMI) persons; (2) prevent or eliminate slum or blight conditions; or (3) address urgent community development needs that pose a serious and immediate threat to the health and welfare of the community for which other funding is not available. As a first step, planners should research local and state projects to see if there are precedents for using CDBG funds for multimodal infrastructure.

The CDBG program also funds infrastructure projects through its Disaster Recovery program ([CDBG-DR](#)). These funds are limited to jurisdictions listed under a disaster declaration. In addition to repairs, the program earmarks funds for mitigation upgrades that help projects withstand future storms.

Active Transportation Infrastructure Investment Program (ATIIP)

This new [discretionary program](#) was established in the BIL to develop plans and construction projects for active transportation networks and spines with the goal of integrating active transportation with transit services. It offers funding for planning and design and for project construction. In areas with a poverty rate over 40 percent, the local match requirement may be waived. Though this program continues to exist in statute, it did not offer a new round of grants in 2025.

Energy Efficiency and Conservation Block Grant Program (EECBG)

This [block grant program](#) provides both formula and competitive grants from the U.S. Department of Energy (DOE) for low-impact infrastructure, such as bike lanes, pathways, and pedestrian walkways. Local and Tribal governments can apply directly to DOE for funds. Though this program continues to exist in statute, it did not offer a new round of grants in 2025.

State Funding Sources

States fund infrastructure through taxes on motor fuel and vehicles, vehicle registration fees, license plate fees, toll fees, and certain levies on heavier vehicles, such as trucks. States also receive USDOT funding for two primary purposes: the construction and maintenance of state-owned roadways, and suballocation to MPOs and local governments.

While there are several separate formula funding programs, federal law allows states to transfer, or “flex,” dollars among programs. For example, states can flex money historically used for highways to the Surface Transportation Block Grant (STBG), a popular program for funding multimodal infrastructure. [Flexing funds](#) is one way to support complete streets programs, but only if the state chooses to take advantage of this flexibility (NACTO and T4A 2021).

As an example of how states structure programs, the Massachusetts DOT [Complete Streets Funding Program](#) provides three sequential stages of funding:

1. Funding to develop policy
2. Funding to develop project priorities
3. Funding for complete streets construction projects

This program is noteworthy for its comprehensive approach of aggregating program details, such as mapping, resources, and transaction portal resources, on one website (MassDOT n.d.). An example of support for small cities

comes from Florida, where the [Florida Small Cities Community Development Block Grant Program](#) funds, among other things, street and sidewalk improvements (FloridaCommerce n.d.).

Because each state is different, the best approach is to search for funding or grants using the terms “complete streets” and the state’s name. While programs are mainly housed within state departments of transportation (DOTs), funding for bikeways and trails may also be available within programs of the state’s departments of natural resources, parks, or environmental protection. Also, state programs that support low-impact development or “green streets” may be a source for funding biking and walking infrastructure.

As noted above, states suballocate funds to metropolitan and nonmetropolitan areas per specific population-based formulas. Urbanized areas with populations over 50,000 and Transportation Management Areas with populations over 200,000 are represented by MPOs that direct the transportation planning process. States also create programs for nonurbanized or nonmetropolitan areas. In all cases, states seek projects that align with the Statewide Transportation Improvement Program, or STIP. For an overview of how state DOTs distribute federal funds, see USDOT’s 2023 report, [Review of State DOT Approaches to Distribute Federal Metropolitan Planning Funds to MPOs](#) (USDOT 2023).

Regional Funding Sources

Localities represented by an MPO submit projects that the MPO ranks and selects according to selection criteria. The main program for multimodal infrastructure is the TA program, described earlier in the chapter, which is the nation’s largest dedicated source of funding for trail and active transportation projects. States establish a central program to suballocate federal and state active transportation funds to regions, and develop a list of project priorities and selection criteria aligned with federal rules and priorities in the STIP.

While MPOs are authorized to conduct the federally mandated transportation planning and funding process, other regional entities also engage in planning and funding support. These include regional planning commissions, regional planning and development commissions, regional planning agencies, councils of governments, or regional planning organizations. These organizations are particularly important for rural towns and counties outside urbanized areas. They can provide grant tracking, technical assistance, and training.

For communities outside MPO boundaries, states typically establish separate funds for urbanized and nonurban-

RESILIENCE FUNDING AND COMPLETE STREETS

“Climate change” is currently a politically charged term banned from many federal and state websites. However, the damages and associated reconstruction costs wrought by extreme weather are unavoidable. In 2024, Asheville, North Carolina, long thought to be a “climate haven,” experienced massive infrastructure damage from [Hurricane Helene](#) (Simon 2024).

A [report](#) on Helen’s impacts from the North Carolina Office of State Budget and Management estimated \$8 billion in roadway damage alone (NC OSBM 2024). The report also notes that federal [investments](#) in mitigation save \$6 per \$1 spent, and adopting national building code standards saves \$11 per \$1 spent (NIBS 2020). However, in 2025 FEMA [cancelled](#) its primary resilient infrastructure program, Building Resilient Infrastructure and Communities (BRIC) (Wolf 2025).

Even with cuts at the federal level, complete streets managers can still turn to state and regional funding sources. States that have taken public stances questioning climate change still have robust resilience preparation and funding programs; two examples are the [Resilient Florida Program](#) (FDEP n.d.) and the [Texas Infrastructure Resiliency Fund](#) (Texas Comptroller of Public Accounts 2025).

ized areas, as well as program funds for anywhere in the state. In addition, federal and state governments often offer separate grants specifically designed for rural areas.

Planners should consider the following actions related to regional funding:

- Contact your local MPO and request a meeting on the funding process in your community. If you are in a non-urbanized area, contact regional planning organizations to get information on funding for rural or exurban areas not covered by an MPO.
- Become familiar with the MPO processes that ultimately determine the list of funded projects. MPOs begin with the big picture through the Long-Range Transportation Plan (LRTP), which details a 20-year planning horizon. In addition, MPOs annually publish a Transportation Improvement Program (TIP) with a study horizon of five years. Based on the LRTP and TIP goals, the MPO will establish funding criteria for

MPOs are also on the front lines of mitigating the impacts of climate change on transportation infrastructure. A Florida Department of Transportation/University of Florida GeoPlan Center [report](#) found that all Florida MPOs addressed resiliency in their goals and objectives and identified best practices from their efforts (FDOT and UF GeoPlan Center 2022). The Chicago Metropolitan Agency for Planning (CMAP) engaged stakeholders in 2025 to gather feedback on [resilience strategies](#) for CMAP’s Transportation Resilience Improvement Plan (TRIP). For a 2021 Boston Region Metropolitan Planning Organization [study](#), staff reviewed resilience literature, surveyed resilience practices in Boston region municipalities, and developed potential resilience strategies for a local roadway segment vulnerable to flooding (Boston Region MPO 2021).

At the local level, planners should seek to align complete streets efforts with resilience goals and the capital improvement program (CIP), ensuring that project scoring sheets reflect this synergy for funding prioritization. The University of Maryland Environmental Finance Center’s guide, [Integrating Resilience into Local Capital Improvement Programs](#), offers best practices for this approach (UMEFC 2018).

scoring projects. MPOs also produce an annual Unified Planning Work Program (UP or UPWP) that contains schedules and construction details for adopted projects. Planners should watch for MPOs’ annual calls for projects to formulate funding lists.

- If your community is seeking federal funding for a complete streets project, that project must be on the MPO’s priority list. Federal funders often assess “project readiness” in scoring rubrics; having a project listed is one aspect of project readiness.
- When choosing projects to send to the MPO for consideration, determine how those projects help meet the MPO’s goals. This will help narrow the list to those projects with the most potential for funding.
- Ask your MPO if any of your projects can be bundled with those from other communities. Under certain programs, this can help advance a project. Eligible partners can include the state DOT, other cities and counties, partner agencies, and nonprofit organizations.

As examples, several regional funding assistance programs stand out. The Atlanta Regional Commission (ARC) developed an [Infrastructure Investment and Jobs Act \(IIJA\) website](#) with a searchable database, announcements, training, and other resources (ARC n.d.a). ARC also hosts the [Livable Centers Initiative](#) to provide technical support and funding for planning studies and the construction of transportation projects, such as sidewalks and intersection improvements, that reduce vehicle miles traveled and air quality improvements (ARC n.d.b). In Oregon, Portland's Metro has combined federal funding sources into the [Regional Flexible Fund](#) (Metro n.d.) This offers more flexibility and simplifies the application process for grant applicants.

Local Funding Sources

The most common source of local funding for local street, sidewalk, and bikeway programs is the capital funding process. According to the [Bureau of Transportation Statistics](#) (BTS), state and local government transportation revenue from all sources accounts for about three-quarters of total government transportation revenue (USDOT BTS 2023). Of highway and roadway [spending](#), roughly 57 percent is devoted to capital improvements, while 43 percent goes to operations and maintenance (Urban Institute 2024), often an overlooked facet of complete streets.

When developing capital and operational budgets, cities tap into their general or transportation funds, which come from local property and other taxes, as well as various fees (e.g., vehicle registration fees). Another source is benefit or improvement districts (Heller 2017), geographic areas in which a majority of property owners agree to levies that finance public improvements, which can include streets, bikeways, and sidewalks. Cities may also develop tax increment financing (TIF) districts to fund infrastructure. TIFs capture the increase in property values that occurs with infrastructure investments. The City of Burlington, Vermont, gained voter approval to create a [TIF](#) for its downtown district, including multimodal enhancements among the eligible uses for up to \$22 million in TIF funds (Burlington n.d.).

Many cities use developer proffers or [impact fees](#) to fund infrastructure upgrades (FHWA CIFS 2017). An impact fee (also referred to as a transportation or mobility fee) is a one-time charge levied on new development or redevelopment projects to offset the infrastructure and transportation impacts of the project. Projects funded by impact fees may not be near the development paying the fee, though most impact fee programs require some benefit or nexus. Localities develop criteria and a list of qualifying projects,

often identified in a transportation or capital improvement plan. Because the criteria often include multimodal infrastructure, planners should consult impact fee managers to determine whether project selection rules align with the community's complete streets program.

Planners should know whether their jurisdictions make residents responsible for the costs of public [sidewalk maintenance](#) or replacement in front of their properties. This can be a point of contention when developing and implementing a complete streets plan and could pose equity concerns in older low-income neighborhoods with extensive repair needs (FHWA 2015a).

One of the most impactful methods for dedicated funding is [ballot initiatives](#). Planners should know this is a high-reward but high-risk funding strategy. Voter-approved bonds, levies, income taxes, and sales taxes can generate significant funds for local infrastructure projects or as a federal project matching requirement, but a "no" vote can take this option off the table for future years, if not decades (Laybourn 2022). To tap into voters' willingness to approve such proposals, planners must build broad local support based on community values and ensure that residents understand the need for such funding sources and the community benefits that will accrue.

As an example of this approach, in 2017, voters in Pinellas County, Florida, approved a "[Penny for Pinellas](#)" initiative. The additional one-cent local sales tax was carefully designed to win approval. First, the \$2 billion raised would be split among the county and 24 cities, which expanded the appeal of needed infrastructure funding. In further making the case, the County noted that without the penny tax, homeowners would face a \$2.4 million property tax increase (Pinellas County n.d.a). Prior to the ballot initiative, the County issued a survey asking voters to rank priorities. The most popular category was "roads, trails, & bridges," within which respondents favored multimodal transportation and improvements to existing roadways and bridges. Since the ballot measure's passage, the city continues to engage the public by posting a [Penny for Pinellas Accomplishments Map](#) showing implementation progress (Pinellas County n.d.b).

Another example comes from Nashville, where voters approved a half-cent sales surtax in 2024 after an earlier defeat in 2018. The \$3.1 billion in added funds will go towards Nashville's "[Choose How You Move](#)" program, which plans to include improvements to existing bus services, additional transit centers, 86 miles of new sidewalks, 17 new park-and-ride stations, and 600 new and/or improved traffic signals (Nashville and Davidson County n.d.). To reverse the prior

failure at the ballot box, the [2024 effort](#) lowered the 2018 measure's price point and focused on improving current bus service and multimodal infrastructure instead of adding a costly new light rail system (Roman 2025). The lower cost and wider range of benefits led to a successful ballot initiative that included something for everyone.

Other Funding Sources

Other funding sources for complete streets include national organizations that have grant programs. One example is the [AARP Community Challenge Grant](#) (AARP 2025). These awards fund projects up to \$25,000 to build transportation solutions that benefit residents of all ages. One of the funding categories, Transportation and Mobility Options, supports projects that increase connectivity, walkability, bikeability, and access to public and private transit. The application portal for this program typically opens in January, with applications due in March.

As another example, the National Safety Council, in conjunction with USDOT, sponsors the [Road to Zero Community Traffic Safety Grant](#) program (National Safety Council n.d.). The program provides grants of between \$50,000 and \$200,000 for applications implementing evidence-based countermeasures to reduce traffic fatalities, address disparities in mobility safety and access, and improve overall traffic safety. Grant applications are typically due in January of each year.

Philanthropic foundations are another source of grant funding. This includes large corporations that have created philanthropic foundations or otherwise offer grant funding for community improvements. Some, such as the [Walmart Foundation](#), have quarterly grant cycles with funding areas that include community development and public safety (Walmart Foundation n.d.). Bloomberg Philanthropies also provides funds for streetscape projects. Its [Asphalt Art Initiative](#) began primarily as a public arts program. However, a [safety assessment](#) found that "street mural" installations resulted in 50 percent fewer crashes involving pedestrians and cyclists and 37 percent fewer crashes leading to injuries (Bloomberg Philanthropies and Sam Schwartz 2022).

Local community foundations play important roles in supporting community well-being and can be sources of philanthropic funding for complete streets. Check whether local community foundations fund mobility-related efforts that relate to equity, health, the environment, or access to opportunities. While they may not fund infrastructure, they may support advocacy groups for multimodal transportation and complete streets.

Foundations can contribute to complete streets efforts in different ways. In Howard County, Maryland, the [Horizon Foundation](#), which is focused on determinants of health, sponsored complete streets outreach at four community events (Schneider and Highsmith Vernick 2019). Foundations are also helping other philanthropic community members understand the case for making awards to mobility coalitions. The Funders Network has produced a transportation-related [guide](#) for foundations to make the connections among advocacy, philanthropy, and local mobility needs (TFN 2023). While focused on the Midwest, the guide's information can be applied nationwide and provides examples for funders whose mission includes mobility.

More recently, cities are beginning to use crowdsourcing platforms to raise funds, mostly for smaller-scale projects sponsored by advocacy groups, through sites such as [GoFundMe](#) and [Patronicity](#). Projects have included murals, pedestrian flags, benches, and funding for staff time. [Safe Streets Petaluma's](#) campaign on the former crowdfunding site [ioby](#) led to an invitation to participate in a national program by City Thread, which came with an additional \$50,000 in assistance (ioby 2022).



Figure 9.1. The Indianapolis Cultural Trail ([Indianapolis Cultural Trail](#))

RESOURCES ON COMPLETE STREETS GRANT WRITING

Planners can turn to several helpful guides detailing the life cycle of the grants process.

General Resources

[“Find the Right Funders: Where’s the Money?”](#) (2023). This guide from The Grantsmanship Center gives tips on how to identify funders that are a good fit for your project.

[“Planning and Writing a Grant Proposal: The Basics”](#) (2017). This guide from the University of Wisconsin–Madison Writing Center provides basics on planning and writing a grant proposal.

[Complete Streets Funding Toolkit](#) (2016). California’s Orange County Council of Governments produced this complete streets funding toolkit guide, which includes case studies of successful grant applications and drills down into budget preparation.

Finally, cities can use public-private partnerships (P3s) to fund complete streets projects. The [Indianapolis Cultural Trail](#) (Figure 9.1, p. 127), described in Chapter 2, was funded through P3s (FHWA CIFS n.d.). The trail’s construction was financed through community donations, which covered 46 percent of the costs, and a Transportation Investment Generating Economic Recovery (TIGER) grant (now BUILD grant). The trail’s popularity resulted in an expansion funded largely by local foundations.

THE PLANNER’S ROLE IN COMPLETE STREETS FUNDING

While a full discussion of the grant-writing process is beyond the scope of this PAS Report, there are several key steps for assembling a team, identifying grants, and writing a successful grant application.

As a first step, planners can assist in assembling a grant-writing team that can readily produce the required documents, studies, and financial information. Engineers with experience in civil engineering, utilities, stormwater management, and traffic can provide information to inform project feasibility, approach, and budgets. Staff with experi-

Federal Grants

[Federal Funding and Financing: Grants](#) (2020). This resource from USDOT’s *Rural Grant Applicant Toolkit for Competitive Federal Transportation Funding* explains the difference between discretionary and nondiscretionary (formula) USDOT grants and offers additional information.

[USDOT Grant Application Roadmap](#) (n.d.). This website explains the USDOT discretionary grant funding process.

[EPA Grants Overview for Applicants and Recipients](#) (2025). This webpage gives an overview of the EPA grant process and offers links to an online training course and basic information for applicants and recipients.

ence in project management, stakeholder engagement, and proposal writing are also valuable. Larger, more complex grant programs may require assembling matching funds, conducting required analyses, securing necessary permits, and aligning project outcomes with selection criteria.

Throughout the grant-writing process, planners may be called upon to serve several functions:

- **Researching relevant grants.** With the growing number and types of infrastructure grants, communities should look for the best fit based on project lists, grant requirements, selection criteria, and grant restrictions. Planners are well-positioned to evaluate and respond to the complex range of funders’ priorities. Subscribing to funders’ newsletters and social media sites is a good way to stay apprised of opportunities.
- **Finding new funding sources.** Most communities have more projects than funding sources. As such, planners may be tasked with finding additional funding sources, particularly for smaller quick-build or demonstration projects. Planners’ experience with tactical urbanism and innovative public engagement can be applied to these new methods for testing and scaling complete streets project types.

- **Finding matching funds.** Securing matching funds takes advance planning. Planners may be enlisted to research a locality's history of grants and matching funds or examples from peer communities. For grants that allow in-kind contributions, planners may be asked to develop creative options for supplying resources such as labor, office space, equipment, or other contributing assets.
- **Finding teaming partners.** Many funders prefer applications with multidisciplinary teams, including representatives of small businesses and women- and minority-owned firms. Planners' experience working with communities gives them a robust network of contacts needed to assemble a winning team and letters of support.
- **Conducting required analysis.** Most grants require applicants to demonstrate three main factors: (1) the scope and magnitude of need, (2) the strength of the approach, and (3) the efficacy of the proposed solution. To make a proposal stand out, planners can bring skills in GIS, forecasting, stakeholder engagement, and analytic methods for assessing economic, environmental, and transportation systems.
- **Developing the grant budget.** Any planner who works on projects will have firsthand knowledge of project and personnel costs, schedules, contingency planning, and reporting. These are important aspects of developing the budget justification statements commonly required within grant applications.
- **Writing the grant narrative.** In the project narrative, applicants clearly explain their understanding of the project described in the grant and their team's differentiators. Crafting a compelling narrative requires a mix of marketing and storytelling while meeting requirements. Whether a planner is writing or reviewing the narrative, their role is to find the messages and elements likely to garner attention—and points—to gain funding.
- **Completeness review.** One of the most frustrating outcomes of applying for grants is learning that a proposal package was deemed incomplete. As planners are often responsible for complex project submittals similar to grant applications, they can be an asset during the proposal review stage to ensure the required submissions are complete and accurate.
- **Grant management.** Any application will require a designated project manager. Planners may fill that role and be expected to keep the grant-funded project on schedule and budget, manage the project team, and stay in close contact with the funder.

The sidebar on p. 128 points readers to additional resources on grant writing for complete streets.

CONCLUSION

Funding is at the core of every complete streets project, regardless of size or location. Funding for larger projects typically flows through federal agencies, state DOTs, and MPOs based on funding formulas for both existing and new formula programs. For USDOT-funded projects, the Trump administration's second term has focused on regulatory [changes](#) to speed project approvals and infrastructure finance innovation (Strupp 2025). Changes to funding are likely to result from the BIL's reauthorization in 2026, so planners should track resources for multimodal infrastructure and new priorities affecting state and regional funding programs.

At the local level, cities and counties will continue to use capital improvement programs for street, sidewalk, and bikeway projects. Where a jurisdiction has complete streets plans and policies in place, planners need to ensure that the CIP process and priorities align with adopted policies, ordinances, zoning codes, and comprehensive plan directives for bicycle and pedestrian transportation projects.

Funding and implementation are entwined, as funding is essential for developing projects, and project selection can be driven by the funding source. Chapter 10 covers implementation steps to identify the right complete streets project for the right place.



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10 IMPLEMENTATION AND MONITORING

Implementation is the culmination of complete streets program development and project initiation. As covered in Chapter 4, a robust complete streets policy should address not only the technical details of infrastructure and multimodal transportation but also process and implementation.

Implementation is most often associated with roadway improvement projects, but the path to project delivery begins within a complete streets program that details public involvement and process. Projects can range from small demonstration installations to larger network and corridor buildouts featuring bikeways and trails. Though planners and engineers may approach implementation by working through a list of individual projects one by one, it is important not to lose sight of the wider holistic system and the need to meet multiple community goals.

This chapter focuses on the importance of putting a complete streets program in place to create a structure and framework for effective complete streets implementation. It examines the process required to plan and deliver a complete streets project and offers guidance on the rapid implementation of demonstration and quick-build projects as an alternative approach. Finally, the chapter discusses the role of monitoring and evaluation in determining the success of a complete streets program and guiding its evolution and improvement.

BUILDING AND IMPLEMENTING A COMPLETE STREETS PROGRAM

In any community, installing and managing complete streets requires a guiding structure to help overcome myriad challenges to implementation, enumerated in the sidebar on p. 132. This can be achieved by establishing a complete streets program to oversee stakeholder and team management, internal and external engagement, policy adoption and updates, planning, project implementation, and program monitoring.

Typically, a designated point person at the implementing organization oversees these activities. A program manager or coordinator may be housed within a designated complete streets program, or within transportation, public works, or active transportation programs. The manager is typically a planner or engineer responsible for leading the team and managing projects.

The multidisciplinary nature of complete streets makes coordination critical. A program manager should include representatives from the following agencies and stakeholder groups on their team:

- The jurisdiction's road authority (e.g., public works, transportation, or streets department)
- The planning department
- The communications department
- The local law enforcement community
- Elected officials
- Local transit owners/operators
- Local public health staff
- Community partners focused on safe transportation
- Other relevant agencies, such as parks and recreation departments, metropolitan planning organizations, data partners, and regional development organizations

A key factor for success will be champions inside and outside the implementing organization. These individuals must be able to successfully communicate the value of complete streets to elected officials and community leaders. Champions' roles include connecting projects to policy, building broad support, and prioritizing transportation funding. Champions can also work across agencies to ensure efforts taken by one agency complement the totality of work

CHALLENGES TO COMPLETE STREETS IMPLEMENTATION

Several factors can pose challenges to complete streets program implementation. Planners should be aware of these possible roadblocks.

Weak policy and/or political will. As detailed in Chapter 4, strong policy and energetic support from local leaders are two critical success factors driving implementation.

Outdated manuals. Even where complete streets policies are in effect, engineers still use state and federal roadway design standards. Though new national standards provide more flexibility for complete streets approaches, the process of incorporating changes to state, regional, and local standards and policies takes time, resources, and expertise. [Researchers](#) from the Louisiana Transportation Research Center found routine internal processes were a source of implementation delay, given the time needed to update guidelines, manuals, and forms. Often updates to one form uncovered the need to update other related paperwork (Bian and Tolford 2023).

Organizational misalignment. The participation of multiple departments and agencies in the complete streets process adds needed expertise but can introduce divergent views on implementation and construction. The results can lead to redundant work, funding disputes, or deviation

from plans as disagreement arises on project development. Cross-organizational misalignment can also hinder progress. For example, while transit operations may be run by state and regional entities, bike and pedestrian connections are local. Getting first- and last-mile access right is key to ridership, though this mutual dependence is not always enshrined in each entity's regulating plans.

Vague or countervailing directives. To satisfy multiple factions, policies for all modes are often [diluted](#), resulting in decisions based on drivers' speed (Lewyn 2023). Ambiguity can occur when terms are left undefined or when multiple terms are used.

Cost and budget. Though the Bipartisan Infrastructure Law provided an infusion of funding for active transportation and complete streets, much of that funding has been canceled, and decision-makers will likely still need to choose among projects due to budget constraints.

Opposition to individual projects. As detailed in Chapter 3, even where there is public support for the overall concept of complete streets, there may be opposition to specific complete streets projects. This can occur if stakeholders view the projects as impacting travel time or as precursors to neighborhood change.

needed to build infrastructure networks. Chapter 3 offers additional information on identifying and analyzing stakeholders for complete streets efforts.

Program Elements

With a team identified, the program manager will need to create program elements that lead to successful implementation.

Organizational structure

Organizational structure is key to aligning internal stakeholders on regulations, standards, planning, priorities, and project understanding. Similarly, alignment with external agencies is also important when street design and mobility networks are shared across entities.

A [report](#) from the National Association of City Transportation Officials (NACTO 2022b) indicates that agencies are most capable of effectively delivering transportation projects and policies when:

- Transportation is housed in a transportation-focused agency that is responsible for most or all transportation functions in a city;
- There is a transportation-focused champion with a direct line to the mayor or decision-making authorities; and
- The transportation agency has proactively established transparent internal processes for project delivery and can coordinate and communicate effectively, both internally and with the public.

Advisory groups

Planners should convene stakeholder and advisory groups early in a complete streets planning process, and their involvement should extend through implementation. A complete streets program may involve several groups or subgroups depending on its complexity and scale.

For implementation, a program manager may find it useful to convene an advisory subgroup with technical expe-

rience and expertise in design details and construction. For example, the Broward Metropolitan Planning Organization (MPO)'s [Complete Streets Advisory Committee](#) comprises representatives from the Florida Department of Transportation (FDOT), county departments (planning, school board, traffic engineering, highway construction), transportation sectors (airport, transit, seaport), municipalities, and health-oriented entities, such as the YMCA (Broward MPO n.d.).

Implementation tools

Some cities develop specialized tools for complete streets implementation, such as design guidelines, flow charts, decision trees, and checklists.

In Florida, Miami Gardens' [Complete Streets Guidelines](#) provide detailed design specifications for roadway, sidewalk, bikeway, and curb design (Miami Gardens 2024). Seattle uses a 17-page [checklist](#) to collect data and information in early project design stages with the goal of incorporating multimodal features for all street projects (Seattle 2020). San Leandro, a smaller California city, also uses a [complete streets checklist](#) during the preapplication phase and throughout the development and design of the project (San Leandro n.d.). At the state level, the Kentucky Transportation Center at the University of Kentucky, together with the Kentucky Transportation Cabinet, created a detailed [scorecard](#) to assess transportation needs and score projects. It evaluates benefits across seven categories: mobility, accessibility, connectivity, equity, safety, and effectiveness (Stavropoulou et al. 2024, 76).

Partnerships

While early partnership efforts are needed to build support, later efforts can focus on building capacity, matching funds, or conducting construction-related outreach.

One such example comes from Louisiana, where Louisiana State University AgCenter and the Louisiana Department of Transportation and Development (LaDOTD) revamped the [process](#) for implementing complete streets in rural areas. Prior to the partnership, communities were required to cover at least 40 percent of project costs, which resulted in few projects in smaller locales. Starting in 2023, rural communities with populations under 5,000 are only required to provide a five percent cash match when applying for safe streets funding from the state (Westling 2023).

In Colorado, the Denver Metro Chamber of Commerce joined a consortium of transportation agencies in 2019 to form the [Advanced Mobility Partnership](#). In addition to traditional projects, the coalition explores the

implementation of new technologies and the use of mobility data (DRCOG n.d.).

Points of intervention

As noted in the 2010 PAS Report [Complete Streets: Best Policy and Implementation Practices](#), complete streets can be considered at several points of [planning intervention](#) (Klein 2011).

Zoning is a key regulatory aspect of implementation that addresses the relationship among land uses, site design, and infrastructure. In 2016, [researchers](#) evaluated 10 complete streets-related zoning code elements for the effect on active transportation (Chriqui et al. 2016). The following six had the most influence on increased walking, biking, and transit use:

- Code reform zoning (e.g., form-based codes)
- Bike parking
- Bike lanes
- Bike-pedestrian trails/paths
- Other walkability features (e.g., traffic calming, pedestrian plaza)
- Mixed use

These and the other four elements—sidewalks, crosswalks, bike-pedestrian connectivity, and street connectivity—are important not only for complete streets but also for complete neighborhoods and should be addressed in zoning code audits and updates.

Once complete streets are formally adopted into plans, policies, and zoning codes, planners will need to continue their efforts into later stages of project development and construction. One important step is alignment and coordination of capital project planning across departments and agencies. This supports a “dig once” approach so travelers are not faced with multiple disruptive construction projects.

As noted in Chapter 9, the most common procedure for advancing complete streets projects is the capital improvement plan (CIP) process. This annual budgeting document establishes public works and streets projects for the fiscal year. Within the CIP, many cities add sidewalk and bike lane improvements to scheduled street resurfacing, repair, and replacement (also known as RRR or “triple R”) projects. In March 2024, Los Angeles voters approved [Measure HLA](#), which requires the City to implement the bus, bike, and walk improvements in the city's *Mobility Plan 2035* during street repaving (Linton 2024). Planners can also use the site plan and access management review process to recommend complete streets improvements.

Communications

As noted throughout this report, communication, engagement, and marketing efforts are key to complete streets success. A dedicated website for a complete streets program can serve as a one-stop information portal. Lincoln, Nebraska, hosts a [complete streets webpage](#) that includes background documents, infographics, maps, a bike rack request form, information on the complete streets committee, and a catalog of “before and after” profiles (Lincoln n.d.). A communications program should address social media postings and media announcements, as described in Chapter 3.

Complete Streets Implementation Plans

To reduce the risk of plans “collecting dust on a shelf,” cities can prepare detailed implementation plans to ensure projects are built to complete streets specifications. Such plans should identify common barriers and possible solutions.

In addition to covering traditional elements such as existing conditions, gap analysis, project selection and prioritization, cost estimates, and responsible parties, complete streets implementation plans highlight other elements, such as the following:

- **Complete streets network status.** Taking a network approach begins with a network vision, which is why Deerfield Beach, Florida, positioned a network vision as a planning first step in its [Complete Streets Implementation Final Plan](#) (Deerfield Beach 2015). A network approach is achieved by understanding the destinations that people want to access and the paths they take to get there within the city’s multimodal transportation network.
- **Funding options and priorities.** In planning for complete streets, funding may be sought near the end of the process. However, planners should consider funders’ priorities early in the process. For example, if an MPO emphasizes safety, the study team should define gaps and prioritize potential projects based primarily on safety needs. Chapter 9 addresses funding in greater detail.
- **Flexibility options.** As noted in other chapters, standard-setting organizations such as NACTO and the American Association of State Highway and Transportation Officials (AASHTO) are adding flexibility for multimodal transportation. This requires critical decisions about which guidance document to use and, once that decision is made, whether to use the conventional “status quo” standards or the optional provisions.
- **Tradeoffs.** Planners rarely encounter total agreement on policy and project options, and infrastructure projects

typically involve both benefits and impacts. A tradeoff analysis allows planners and decision-makers to consider the pros and cons of various project designs and options. Automobile travel speed or travel time is often the focus, though safety has become a top emphasis area. With complete streets, planners can bring skills in [evaluating](#) a wider range of factors, such as household transportation costs, land uses, health, and accessibility (Litman 2015). These analyses improve decision support, transparency, and designs to mitigate negative impacts.

- **Data collection.** Planners will be on the front lines of creating data collection plans to establish existing conditions, select metrics, match data collection methods to metrics and other important evaluation criteria, schedule data collection, analyze data, and develop reports. Note that data collection should continue after construction is completed to monitor and evaluate project outcomes. Chapter 8 and Appendix C present deeper dives into data collection and analysis for complete streets.
- **Phasing/scheduling.** Complete networks are rarely built all at once. Phasing is a deliberate approach to determine which projects should be constructed and in what order. In many cases, the ideal sequence of projects for mobility will run into budgetary or other constraints. In these cases, the quick-build approach discussed later in this chapter can be used as a low-cost phasing strategy to test and build out bicycle and pedestrian infrastructure.

One good example of a complete streets implementation plan at the state level comes from Florida. In 2015, FDOT worked with Smart Growth America to align and update its planning efforts with context-focused street design and updates to the traditional design manual. The resulting [Complete Streets Implementation Plan](#) charted a five-part process (FDOT and SGA 2015):

- Revise guidance, standards, manuals, policies, and other documents
- Update decision-making processes
- Modify approaches for measuring performance
- Manage internal and external communication and collaboration during implementation
- Provide ongoing education and training

MPOs can also play a role in developing implementation plans. The North Jersey Transportation Planning Authority and the Borough of Keyport jointly developed the [Complete Streets Implementation Guide](#) (NJTPA 2021).

The advantage of this collaboration is the MPO’s knowledge of funding and regulatory programs combined with the Borough’s familiarity with local conditions.

Transportation Demand Management

Complete streets project implementation involves not only physical projects, but also programming. [Transportation demand management](#) (TDM) is an important complement to complete streets (ACT n.d.). The goal of TDM is to promote travel options as an alternative to single-occupancy automobile trips. The better the complete streets network, the higher the likelihood of automobile trip substitution through walking, biking, and transit.

TDM is implemented through a variety of methods. The most robust programs are managed through a transportation management association (TMA) that communicates with travelers and employers and coordinates incentives and outreach. The San Diego Association of Governments (SANDAG) created a [reference guide](#) for its member cities detailing the relationship between TDM programs and complete streets (SANDAG and HNTB 2012). At the national level, the [Association for Commuter Transportation](#) serves as a clearinghouse for publications, plans, and news on TDM.

IMPLEMENTING A COMPLETE STREETS PROJECT

One important role of a complete streets program is directing the buildout of projects that make up the network. As noted previously in this chapter, cities develop annual CIPs for road work projects ranging from new construction to retrofits to maintenance activities, such as repaving.

How do communities build their project lists? Some projects reach the construction phase after years of planning. Others take advantage of funding availability or the opportunity to piggyback a complete streets project onto a related infrastructure or land development project. Some avenues for project list development include the following:

- Projects that are components of the complete network
- Corridor projects
- Intersection projects
- Safety interventions
- Opportunity projects (e.g., utilities construction, development proffers)
- Pilots and demonstrations

As covered in previous chapters, improving communications and adopting relevant plans, policies, and designs are all important in supporting complete streets integration with the annual project list.

Project Delivery Process

For the construction phase, a fixed process for project delivery drives public work. Planners can use the following process summary (Figure 10.1) to guide discussions with stakeholders and project engineers; identify steps, roles, and responsibilities; and consider how demonstration and quick-build projects may fit into the process.

1. Identify improvements

Through the comprehensive and infrastructure planning process, the community typically identifies needs and then

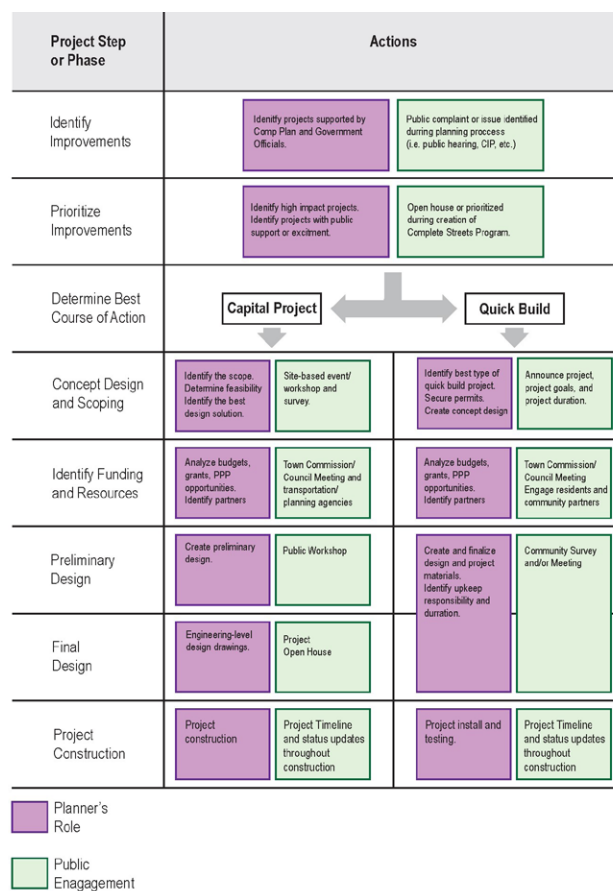


Figure 10.1. The project implementation process, highlighting the planner's role and public engagement activities (WGL, Inc.)

options for addressing those needs. For complete streets, needs may be characterized in several ways, such as unsafe conditions or network build-out. Once needs are established, transportation planners will present options for addressing those needs. For example, where traffic speed impedes biking and walking, planners will research various traffic-calming options and traffic engineers will recommend the best options based on context and conditions. For completing a network, planners will focus on missing links.

2. Prioritize improvements

Because budget is a primary constraint for complete streets implementation, it is important to prioritize projects that will have the most impact on meeting complete streets goals. In its [pedestrian master plan](#), the City of Bellingham, Washington, created a table with five project priority evaluation factors addressing safety, equity, accessibility, connectivity, and trip potential (Bellingham 2024, 104–105). For each factor, the city listed criteria and scoring. For accessibility, for example, projects prioritized in the city’s ADA transition plan received the highest number of points, showing the importance of cross-referencing priorities in other plans.

Prioritization can also factor in a project’s effectiveness. For prioritizing safety treatments, FHWA has quantified the effectiveness of countermeasures, such as lighting and roadway modifications. The FHWA’s [Crash Modification Clearinghouse](#) rates various complete streets treatments by comparing studies and effectiveness (FHWA 2025a).

3. Determine the best course of action

This step assesses implementation options and phasing. Stakeholders may identify a catalytic project that will spur the construction of subsequent links or improvements. In other cases, smaller segments may provide the best near-term benefits. As noted previously, there may be opportunities to piggyback complete streets projects onto other construction projects or contracts. This is also a good time to consider whether mobility benefits can be achieved outside the capital improvement process by using demonstration projects or quick-build techniques, described further below.

What determines the right project in the right place? This is an important question, as not all treatments are a good fit in all settings. In identifying improvements, transportation planners will be filtering recommendations based on several criteria that include the following:

- Roadway ownership (e.g., federal, state, county, or city roadway)

- Roadway type and speed
- Common crash types and severity
- Traffic volume (all modes)
- Land use context
- Available countermeasures and their effectiveness (i.e., crash modification factor)

In New Jersey, Montclair Township’s [Montclair SAFE](#) complete streets implementation plan includes a table of recommended pedestrian improvements (Figure 10.2) to help guide decision-making for different roadway contexts within the jurisdiction (Montclair 2017).

In some cases, bundling projects can be advantageous. A local government can bundle multiple projects in different ways—for example, by advancing several sidewalk improvements within its jurisdiction at the same time, or by coordinating improvement projects with multiple entities for a sidewalk that crosses jurisdictional boundaries. This is particularly helpful when an MPO or state acts as the [project lead](#) (McCann, Boutros, and Biton 2023).

4. Concept design and scoping

In this step, engineers develop a high-level conceptual design showing existing and proposed street improvements,

MONTCLAIR SAFE
COMPLETE STREETS IMPLEMENTATION PLAN

PEDESTRIAN IMPROVEMENTS: Recommendations

PEDESTRIAN IMPROVEMENTS	RECOMMENDATIONS FOR ALL STREET TYPOLOGIES (I, II, III, IV, V & VI)				
	Commercial / Retail	Residential	<1/4 Mile of Parks, Schools, Transit	History of Frequent Speeding	History of Ped / Bike Crashes
ROADWAY SEGMENTS					
Sidewalks and Curb Ramps	☒	☒	☒	☐	☒
Pedestrian-Scale Lighting	☒	☐	☒	☒	☒
Parklets	☒	☐	☐	☒	☐
Mid-Block Crossings	☒	☐	☒	☐	☒
Gateways	☒	☐	☒	☒	☒
ALL INTERSECTIONS					
Crosswalks	☒	☒	☒	☒	☒
Mini-Traffic Circles	☒	☒	☒	☒	☒
Curb Extensions*	☒	☒	☒	☒	☒
Pedestrian Refuge Islands*	☒	☐	☐	☒	☒
RRFB (Flashing warning lights)*	☒	☐	☒	☒	☒
In-Street Crossing Sign*	☒	☐	☒	☒	☒
AT SIGNALIZED INTERSECTIONS ONLY					
Pedestrian Countdown Signals	☒	☒	☒	☒	☒

Notes: This planning level table is developed primarily to recommend pedestrian improvements for Montclair and should not be followed without additional design and engineering analysis. Please refer to NACTO Guides, AASHTO and other state of the practice publications for additional guidance. * Except on local roads (Typology V)

Figure 10.2. The Montclair Township complete streets implementation plan’s pedestrian improvement recommendation table (Township of Montclair)

as well as an assessment of traffic operations. At this stage, engineers can also develop a project scoping study and budget. The scoping study can include a project feasibility assessment that considers costs, environmental constraints, subsurface conditions, and other uncertainties to screen out infeasible projects. Engineers also scope alternative designs for the project. The process is simpler but still necessary for quick-build projects.

5. Identify funding and resources

As the list of projects comes into focus, public works and roadway departments will program the project for funding. As advised earlier, the team should have scoped out funding early in the process to understand requirements and priorities. The capital improvement process and MPO funding, as described in Chapter 9, are some of the more common funding sources.

6. Preliminary and final design

For major construction projects, preliminary design and engineering (PD&E) moves to a more detailed design and alternatives analysis. The final report recommends a preferred design, which is shared with stakeholders before adoption.

7. Project construction

To begin the construction stage, transportation agencies will acquire rights-of-way (if needed), obtain permits, and coordinate utilities. Agencies commonly solicit bids from multiple contractors and award a contract to the winning bidder. One aspect of project design is mitigating the disruptive effects of construction. Planners should stay involved to secure alternative bicycle and pedestrian routes during construction. Likewise, planners can help design mitigation for projects near offices, shops, and residential areas.

8. Post-construction

Implementation does not end once the ribbon-cutting takes place. As with roads, sidewalks, bikeways, and transit stops need to be maintained for pedestrians and micromobility users. One approach is to incorporate complete streets elements, such as bike lanes and sidewalks, into a city's [pavement management system](#) (Roshani 2023). Another is to formulate a separate [asset management system](#) for bikeways and sidewalks (Gadsby, Tsai, and Harvey 2022). To maintain multimodal facilities, cities are now procuring specialized sweepers, trash collection vehicles, and snowplows for shared streets, sidewalks, and bike lanes (Figure 10.3).

Maintenance

Maintenance is a critical but often overlooked element of a complete streets program. Roadway maintenance is embedded within city and county budgets for activities such as street sweeping, restriping, and repairs. Sidewalks and bikeways may garner less attention and fewer resources, however, so establishing a maintenance policy for walking and biking infrastructure is essential.

As mentioned above, the street resurfacing, repair, and replacement (RRR) process is one way to increase bikeway miles. Maintenance of newly striped bike lanes should be included in routine maintenance budgets. Bikeway maintenance challenges include construction debris, overgrown vegetation, blocked storm drains, and curbside trash or yard waste collection.

Planners should be aware of the following areas of special consideration for maintaining complete streets. For more detailed information on how to integrate active transportation facilities into an agency's overall transportation maintenance program, please see FHWA's [Guide for Maintaining Active Transportation Infrastructure for Enhanced Safety](#) (FHWA 2024).

Separated bikeways

Bikeways with vertical separators (curbs, delineators) typically have smaller dimensions than roadways, which limits access by standard street-sweeping vehicles or snowplows. As such, FHWA [recommends](#) sizing the bike lane to equipment width at seven feet or more (FHWA 2015b, 77).



Figure 10.3. Specialized street sweeper for shared-use path in Miami Beach, Florida (MDV Edwards/Getty Images)

Using planters to separate bike lanes requires a landscaping maintenance budget. Plastic delineators are easy to install but are prone to damage. Replacements should be included in annual maintenance budgets based on damage history. Reboundable delineators that return to the original upright position after being struck by a vehicle can reduce replacement costs in low-speed environments.

Green streets

Green streets can include materials such as [porous pavement](#) and pavers that require special maintenance routines to address clogging, winter weather, and structural integrity (Annapolis n.d.). Maintenance is best considered in the planning phase to reduce costs over the long term. For nonroutine maintenance, setting [maintenance triggers](#) is a good way to anticipate and schedule maintenance (USEPA n.d.a.). Triggers include excess sediment accumulation, trash and debris, overgrown vegetation, dead or diseased vegetation, signs of erosion, structural damage, or standing water.

Lighting

The [nighttime fatality rate](#) on U.S. roadways is three times higher than the daytime rate, and 76 percent of pedestrian fatalities occur at night (FHWA CAI n.d.). Cities and counties can create lighting master plans to provide uninterrupted street lighting.

Lighting is a multifaceted issue that intersects with concerns over light pollution, public safety, economic development, equity, and historic preservation. Planners play a vital role in stakeholder identification, engagement, and tradeoff analysis. Where costs are a concern, new technologies such as LED and adaptive lighting can improve efficiency and decrease the life-cycle costs of street lighting.

Signalization

The increased use of pedestrian crossing signalization (rectangular rapid-flashing beacon (RRFB) and high-intensity activated crosswalk (HAWK) signal installations, discussed in Chapter 6, comes with maintenance responsibilities. This is particularly important for travelers with mobility or vision impairments. It can be difficult to tell if pedestrian-activated equipment (e.g., push buttons) is working, as light changes may require multiple cycles. Public works teams will need to test equipment regularly to maintain safety.

Demonstration and Quick-Build Projects

Implementing complete streets does not necessarily require large public works projects, which can take years to achieve. As

an alternative approach, cities are using lower-cost materials to more easily install demonstration or “quick-build” projects.

Quick-build projects are gaining in popularity due to the reduced time and complexity for implementation compared to regular street construction; they typically have an expected lifespan of one to five years. In most cases, planters, paint, flexposts, bollards, and concrete curbs are used to create bike lanes, reduce turning radii, separate lanes, and calm traffic (Figure 10.4). The San Francisco Municipal Transportation Agency has adopted this approach to meet its Vision Zero goals; its [Vision Zero Quick-Build Program](#) identifies key corridors and locations for rapid implementation of pedestrian and bicycle safety improvements (SFMTA n.d.b.).

While quick-build projects typically do not require roadway modifications, some may require construction. In these cases, transportation planners and engineers should review and, if needed, oversee traffic studies, drainage, construction plans, and maintenance plans. Stakeholder engagement is important, as quick-build projects reallocate public space.



Figure 10.4. A quick-build installation in Washington, D.C., that uses art and flexposts to reduce the speed of turning cars (Kittelson)

TABLE 10.1. ITERATIVE PROJECT DESIGN SPECIFICS

Project Elements	Demonstration	Pilot	Interim Design	Long-Term Capital
Timeline	1 day to 1 month	1 month to 1+ years	1 to 5+ years	20 to 50+ years
Cost	\$	\$\$	\$\$\$	\$\$\$\$
Project Leaders	Anyone (municipality, nonprofit, business owner, students, etc.)	Government or organizational leadership	Government or organizational leadership	Government or organizational leadership
Materials and Maintenance	Very low-cost, typically low durability. May be borrowed, easily made, or purchased; no maintenance required	Relatively low-cost, semidurable materials to maximize design flexibility while minimizing maintenance needs	Low- and moderate-cost materials designed to balance design flexibility, performance outcomes, and maintenance	Moderate- to high-cost materials, designed for durability
Public Involvement	Optional before project implementation; recommended during brief project lifespan	Required and frequent before implementation; frequent during evaluation period	Recommended and frequent before implementation; required during initial evaluation period, optional thereafter	Required before implementation; recommended during implementation and initial evaluation period, optional thereafter
Design Flexibility	High: organizers expect project to be adjusted and removed within a short timeline, typically one week or weekend	High: proponents expect project to be adjusted; it may be removed if it does not meet goals upon initial evaluation	Moderate: organizers expect project to be adjusted, but it is intended to remain in place until capital upgrades are possible	Low: project is considered a permanent capital upgrade that is unlikely to be adjusted significantly once installed
Data Collection/ Evaluation	Qualitative: optional Quantitative: optional	Qualitative: required Quantitative: required	Qualitative: recommended Quantitative: required	Qualitative: optional Quantitative: recommended

Source: Adapted from NJTPA n.d., 2

If a quick-build project is intended to become a more permanent infrastructure feature, estimating resource needs for both the pilot and permanent project is critical. Stakeholders who benefit from a demonstration project will react unfavorably if the pilot or subsequent installation is [discontinued](#) due to cost or other foreseeable factors (Fonseca-Sarmiento et al. 2022).

Once installed, quick-build projects require monitoring. While low-cost materials have many benefits, they are also easily damaged. The City of Orlando, Florida’s [Quick-Build Guide](#) (Orlando 2023) emphasizes maintenance throughout the project’s lifespan. A city can recruit local partners to take on maintenance responsibilities, such as caring for plantings, refreshing artistic elements, and notifying the city when larger engineering and maintenance tasks necessitate public works assistance.

Some complete streets advocates argue that quick-build should not be an end goal, but rather a [step](#) in the process to achieve permanent and durable improvements (PeopleFor-

Bikes 2016). Table 10.1 summarizes the spectrum of iterative project design approaches, from demonstration through quick-build to permanent. The iterative process allows a community to test design concepts, monitor results, and move to durable multimodal infrastructure. The sidebar on p. 140 provides additional resources on quick-build approaches for complete streets.

MONITORING AND EVALUATION

Monitoring and evaluating complete streets projects allow planners to assess project effectiveness, identify areas for improvement, and document achievement of project goals. The most important reason to monitor and evaluate a complete streets project is to ensure that the project has increased road safety and accessibility for all users. In some cases, project funding will come with requirements for post-construction monitoring and reporting.

RESOURCES FOR COMPLETE STREETS DEMONSTRATION AND QUICK-BUILD PROJECTS

Demonstration and quick-build projects are essential to test ideas and immediately implement safety improvements to support complete streets. The following resources dive deeper into these lighter, quicker, and cheaper projects.

[*Tactical Urbanist's Guide to Materials and Design: Version 1.0*](#)

(Street Plans Collaborative 2016) provides materials and design guidance for projects that advance street safety and enhance placemaking efforts in both the short and long terms.

[*Pandemic Quick-Builds: Lessons Learned and What Comes Next*](#)

(ITE 2023) details quick-build project case studies in Colorado, California, Wisconsin, and Washington, D.C.

[*Quick-Build Guide: How to Build Safer Streets Quickly and Affordably*](#) (California Bicycle Coalition and Alta Planning + Design 2020) outlines how to implement quick-build networks, addressing everything from engineering tips to political considerations.

[*Quick-Build Design + Materials Standards*](#) (Burlington Public Works 2022) provides design and materials guidance for the delivery of quick-build street redesign projects.

[*Complete Streets Leadership Academies Report*](#) (SGA and NCSC 2024a) shares valuable lessons learned and offers numerous case studies of local staff and community members collaborating to implement community-led quick-build projects on state-owned roads.

Monitoring requires data collection and data collection schedules. Chapter 8 presents five main categories of complete streets data: travel, infrastructure, access and accessibility, equity, and climate. Tables 1 through 6 in Appendix C (pp. 159–66) provide information on data types and sources along with performance metrics and targets.

While much of this data can be accessed digitally, planners will also need to collect field data to determine project outcomes. This will require data collection protocols and schedules. At minimum, planners will need to collect mode counts in and around complete streets project areas. One helpful resource is the [*Broward Complete Streets Evaluation Toolkit*](#), which provides step-by-step instructions, checklists, and worksheets for the data collection process to evaluate multimodal travel patterns, safety, level of service, health, sustainability, and economic performance (Broward MPO 2015). It covers the following steps:

- Developing a data collection and review plan
- Collecting baseline data
- Collecting qualitative data, such as user satisfaction
- Gathering stakeholder feedback
- Assessing performance (e.g., mode counts, speed, crashes, near misses, infrastructure condition, drivers yielding to pedestrians)
- Reporting results

With the increased availability of portable technologies, planners may be enlisted to collect speed data using radar guns or to use video to assess hazards. Video analyses to assess complete streets performance can be carried out in-house or by using companies that specialize in safety data and analytics, such as [Miovision](#) or [StreetLight](#). For detailed information on data collection, refer to Chapter 8.

The data collected by monitoring projects is also used in required reporting documents and progress reports, such as Honolulu's annual [complete streets progress report](#) to its city council (Honolulu 2024). This report outlines the city's complete streets policies and reports on the status of nearly 50 local complete streets projects.

An effective way to evaluate and communicate results to the public and decision-makers is to develop before-and-after profiles for complete streets projects. The City of Berkeley, California, conducted a [pre- and post-evaluation](#) of 19 metrics for a two-block complete streets project in 2017. Graphics demonstrated the project's success: vehicle flow remained unchanged and more drivers yielded to pedestrians (Rowley and McClain 2019).

A key component of project success is improved user experience. This can be evaluated using intercept surveys in which travelers at transit stations, on bike paths, or in pedestrian zones are stopped and asked a series of questions. The City of Toronto conducted a pair of intercept surveys in 2022

before and after the installation of a complete streets pilot program (TCAT 2022). The [report](#) identified nine key findings:

- Respondents felt the project created a more complete street.
- People were visiting more often.
- People were driving less and cycling more.
- New or returning cyclists were more likely to be diverse.
- Cyclists felt safer.
- Respondents reported mixed perceptions of congestion.
- Safety improved for food delivery workers.
- Accessibility features could be improved.
- Complete streets infrastructure was widely appreciated.

Over the past decade, practitioners have refined reporting of both outputs and outcomes. *Outputs* are the tangible and measurable results of a process, task, or activity. They often describe deliverables such as number of projects completed, number of outreach events, or miles of bike lanes built. For example, outputs for a complete streets project may be documented by reporting the number of people using new bike lanes or the number of pedestrians using the street with new walkability enhancements. In contrast, *outcomes* describe the impacts of a project, which often take time to manifest. The outcome of a complete streets project, for example, may be a better understanding by residents of why the complete streets network is important and how it improves the community they live in.

According to the Toronto Centre for Active Transportation (TCAT), outputs and outcomes have a cause-and-effect relationship. For its 2015 [evaluation of Toronto's complete streets](#), TCAT created a list of performance indicators to link complete streets goals to project outcomes, summarized in Table 10.2 (Mitra et al. 2015).

Evaluation of a complete streets program should not be left until a project's completion. Periodic check-ins can help identify intervention points for course corrections on policies, engagement, and project design. Demonstration and pilot projects are often intended to inform more permanent projects. Because subtle design factors may make or break a project, the use of flexible and modular infrastructure facilitates a test-and-learn approach. Similarly, documenting and communicating lessons learned can offer insights into complete streets project challenges.

Evaluation is not an end goal, but rather part of a cycle of continuous improvement. Elements of complete streets programs that should be reviewed for updates and improvements include the following:

- Complete streets policies
- Plans: comprehensive, transportation, capital improvement
- Communications: websites, social media, reports
- Grants and funding strategies
- Interdepartmental work plans: schools, law enforcement, public health, climate
- Intergovernmental coordination: regional and state work plans, funding schedules

The information gleaned from continuous monitoring and evaluation ensures that a complete streets program continues to evolve with the community's ever-changing needs.

Useful resources on complete streets evaluation include Smart Growth America's report [From Policy To Practice: A Guide to Measuring Complete Streets Progress](#), which describes 100 metrics for tracking implementation

**TABLE 10.2. COMPLETE STREETS
PERFORMANCE INDICATORS**

Complete Street Goal	Outcome Performance Indicator (with desired effects)
Active Transportation	Changes in pedestrian counts (increase)
	Changes in cycling counts (increase)
	Changes in transit ridership (increase)
	Changes in motor vehicle counts (decrease)
Level of Safety	Changes in collision severity (decrease)
	Changes in collision frequency (decrease)
	Changes in pedestrian/bike vs. car collision types (decrease)
	Changes in traffic speeds (decrease)
Level of Service	Changes in transit travel time (decrease)
	Changes in motor vehicle travel times and wait times (decrease)
	Changes in average delay for a motor vehicle to clear an intersection (decrease)
	Multimodal level of service (improve)
Surrounding Environment	Perceived safety and comfort (increase)
	Changes in local property values (increase)
	Changes in retail sales (increase)
	Changes in air quality (improve)
	Changes in physical activity duration and frequency (increase)

Source: Mitra et al. 2015, 2

(Thakkar, Robertson, and Valdetaro 2024); Smart Growth America and AARP's *Evaluating Complete Streets: A Guide for Practitioners*, which offers measures and metrics to address goals for access, economy, environment, place, safety, equity, and public health (AARP and SGA 2015); and *Assessing the Economic Effects of Context-Sensitive Main Street Highways in Small Cities* from the University of Minnesota, which presents 14 direct and nine indirect evaluation metrics to use for complete streets economic analysis (Fonseca-Sarmiento et al. 2022).

CONCLUSION

Complete streets project implementation is the culmination of a process that begins with initial aspirations to improve multimodal infrastructure. Planners can support the implementation phase in several ways.

First, planners can assist in building and managing a community's complete streets program, which provides the structure needed to coordinate multiple activities, communications, and projects. Planners often have the necessary skill set to oversee a complete streets program and can tap their community connections to find supporters and champions. Planners are also experts at public processes, policy development, and obtaining project approvals.

Planners can also help understand and address implementation challenges. These often echo those faced in other land development and planning endeavors, such as outdated or vague regulations, organizational miscommunication, and public opposition. As with sustainable development and smart growth, the public may voice support for the overall concept but disagree on individual projects. Planners can provide clear communication with decision-makers and the public, promote the facts related to the project, and be willing to answer questions that arise.

The path to project approval relies on good planning. Planners can help their communities develop specialized implementation plans with details on developing project lists, prioritization matrices, funding, and design documents, and they can identify multiple community goals to inform project prioritization processes. Funding is key for project implementation, and planners can add their input to capital budget requests and seek other funding sources. With experience in tactical urbanism, planners can also execute demonstration and quick-build projects that have become a popular first phase in project delivery.

Once constructed, all complete streets projects require monitoring and evaluation. Planners can help link goals to metrics and connect metrics to data collection and evaluation. They can translate evaluation results for multiple audiences, from the general public to decision-makers. And because evaluation results mean little if they don't lead to progress and improvements, planners can play a useful role in disseminating the results to municipal departments and stakeholders and leading the evolution of the complete streets program. The final chapter of this report summarizes the vital roles that planners will play in shaping the next generation of complete streets.



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Complete Streets

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Streets

11 THE FUTURE OF COMPLETE STREETS

Creating safe, complete streets for all users to support equitable, accessible, and sustainable mobility is more important today than ever before. The factors that will shape the next generation of complete streets, however, are not that different from the forces that led to the movement's creation. The evolution of complete streets continues to unfold, and planners still have key roles to play in realizing the myriad community benefits of complete streets.

THE PLANNER'S ROLE IN COMPLETE STREETS

In the 16 years since the publication of PAS Report 559, [*Complete Streets: Best Policy and Implementation Practices*](#) (McCann and Rynne 2010), the complete streets movement has reshaped transportation and community planning by expanding the inclusion of multimodal transportation into infrastructure planning, design, and performance goals. But car-centric policy and design continue to have an outsized influence on project prioritization and funding. Moving forward, planners will still face the challenge of implementing complete streets efforts within a culture that accentuates the automobile within design criteria and operations.

This PAS Report is a planner's guide to complete streets. It is also written for advocates who are not professional planners but are influential in promoting complete streets concepts. It supplies all complete streets supporters with tools to reframe discussions on streets and the need for multimodal transportation.

Planners are essential to complete streets because our streets are more than roadways, curbs, and sidewalks. The bigger picture encompasses safety, access to destinations, robust engagement, and stewardship of the public interest—interlinked topics that planners address every day. Equity, climate resilience, and active transportation will remain as core community concerns, no matter the political climate. Planners can connect these local goals to infrastructure and transportation systems. They have the skill sets for creating complete streets programs that integrate mobility, access, health, equity, environmental protection, economic development, and other locally important issues. They can encourage their engineering colleagues to make use of the flexibil-

ity written into updated roadway standards and guidance, and they can provide constant reminders that streets are so much more than just spaces for automobile movement and storage.

A LOOK AHEAD

Just as the past decade has added new elements to complete streets, planners will need to keep scanning the horizon for new challenges and opportunities. Looking forward, several emerging issues have the potential to affect planners' work on complete streets.

A key question is how artificial intelligence (AI) will impact planning tasks, workflows, and urban systems, not to mention the wider world. AI is already changing routine administrative tasks and writing. Researchers and entrepreneurs are seeking solutions related to image and video processing, data mining, and predictive analytics, tools that can all be used to support complete streets planning and implementation. To stay relevant and take advantage of these new capabilities, planning departments will need to carefully evaluate and appropriately invest in emerging technology and skills to effectively develop policy, create plans, and render site and infrastructure designs.

The combination of AI and advanced data collection can also enable a move from reactive to predictive dynamic management. Traditionally, the planning process has been structured to assess conditions, forecast trends, highlight gaps, propose recommendations, and chart implementation timelines. The main weaknesses in this workflow are the use of static (and often outdated) datasets and a reac-

tive approach built around what's broken. As noted in this report, real- or near-real-time data feeds are blurring the lines between planning and operations. New tools can speed response times and enable proactive, predictive planning. When data feeds reveal problems in urban systems, planners may be tapped to work with operational counterparts to determine policy and process options. For complete streets, this may look like implementing systems that monitor not just crashes but also near misses, followed by modeling different options to lessen crash risks.

Over the past decade, new technologies and techniques have joined meetings and face-to-face communications as go-to tools for public engagement. As discussed in Chapter 3, planners can expect greater use of animations and simulations, including augmented and virtual reality. Instead of relying on static options, planners and stakeholders will have tools to simulate multiple alternatives in dynamic, interactive formats. Realistic visions of projects and streetscapes can increase support for complete streets improvements from decision-makers and community members. Social media has emerged as a powerful tool for engagement, though outcomes can either support or tank a complete streets project. Community members can quickly share information—and disinformation. Generative AI has put sophisticated visualization tools in the hands of the public, so planners may begin to see community-generated presentations with complementary—or dueling—visualizations. Planners will need to stay on top of these rapid technological changes.

Another major theme in this report is the growing competition for space in the public right-of-way among new types of modes and new technologies. Micromobility devices can reach speeds of 30–40 miles per hour, raising the question of where e-bikes, e-scooters, and neighborhood electric vehicles belong. Planners may need to redefine bike lanes or create new “mobility lanes” to safely accommodate the new multiplicity of modes, as discussed in Chapters 5 and 6.

Another evolving issue for streets is redefining “complete” not only as it pertains to multiple modes, but also multiple uses. Like real estate, streets and sidewalks are subject to the laws of supply and demand, which require tools, policies, and pricing for demand management. New approaches for programming streets, as discussed in Chapter 9, allow for flexible operations and uses. Technology-driven curb management programs will become increasingly important for managing competing uses and users—and generating local revenue. Cities are realizing that parking spaces could otherwise be used for wider sidewalks, bike lanes, and economic activity, and a potential future of shared auto-

mous vehicle use could reduce overall parking demand and further evolve complete streets design. Planners have the skills to mediate differing needs and find solutions for constrained spaces.

Finally, implementation is often equated with funding, and trends in this area point to reductions in local revenues and federal grants. As discussed in Chapter 9, planners can expect to see more competition for funds in the future, and states, counties, and municipalities will need to become more creative in their funding approaches. This may mean greater use of quick-build projects supported by lower-cost modular infrastructure. Planners should also track resilience and adaptation needs and related funding possibilities. Climate change–driven extreme storm events, flooding, and heat will continue to take their toll on infrastructure, and complete streets have an important role to play in resilience and adaptation.

ACHIEVING THE NEXT GENERATION OF COMPLETE STREETS

The original complete streets movement sought to safely accommodate pedestrians and bicyclists alongside cars in public rights-of-way. Over the past two decades, the movement has evolved and expanded to include new mobility modes, new right-of-way uses and users, new technologies, and new community needs. Planners can help their communities envision the next generation of complete streets and realize the ambitious and multifaceted goals that transform infrastructure projects into community assets.

The expanded scope of complete streets efforts has brought increased complexity as new and different constituencies seek a place at the design and management table. Planners bring skills and experience to understand and manage this complexity, helping people make connections among policy, process, and place and visualize change. Whether just starting to explore this idea or fine-tuning a long-standing complete streets program, planners can use the information and guidance provided in this report to help their communities achieve the next generation of complete streets.

APPENDIX A. MAKING THE CASE FOR COMPLETE STREETS

The past and current state of complete streets is documented by a rich body of research published over the past two decades. Because planners often face questions about the efficacy of complete streets, this appendix provides a compendium of evidence-backed information on multimodal streets. Much of this material is found in the body of the report, and Table 3.1 in Chapter 3 provides a focused look at complete streets myths and facts.

Planners can use this appendix in the following ways, among others:

- Making the case for focused attention to complete streets in and around transit stations. Planners can assemble references from several dimensions, including walkability as a success factor for transit-oriented development (TOD) ([Tracey 2023](#)), the market demand for TOD ([Nelson and Hibberd 2024](#)), and the expanded range of TOD given e-scooters and e-bikes ([Zuniga-Garcia 2022](#); [NABSA 2025](#)).
- Characterizing the role of landscaping and tree canopy within complete streets designs due to the effects of greenery and shade on mental and physical health ([Crosson 2021](#)).
- Explaining the safety characteristics of both complete—and incomplete—streets ([Dumbaugh et al. 2020](#); [Alexandria 2022](#); [Transportation Alternatives 2025](#); [Sam Schwartz 2022](#); [GHSA 2025](#); [Younes 2024](#); [Barr Foundation 2023](#)).
- Assembling multiple methods to achieve the best complete streets outcomes. For example, separated bike lanes work better when there is horizontal and vertical separation ([FHWA 2024b](#)). While daylighting intersections increases pedestrian visibility, combining this approach with other intersection treatments may increase safety benefits ([NYC DOT 2025](#)).

ACCESS AND LAND USE

Urban arterials, arterial-oriented commercial developments, and big box stores are associated with higher numbers of traffic-related crashes and injuries, while higher-density communities with more traditional, pedestrian-scaled retail configurations are associated with fewer crashes. ([Dumbaugh and Rae 2009](#))

One way to improve the accessibility of a railway network is to expand station catchment areas by retrofitting or installing additional gates, treating entrances less as “points” and more as “places.” This decreases the amount of time it takes to enter the station, increasing accessibility. ([Lahoorpoor and Levinson 2020](#))

CONGESTION AND CARS

In a review of “what works” to reduce car use and congestion in city centers, researchers identified 12 effective transportation interventions, including pricing (congestion and parking pricing) and travel planning. ([Kuss and Nicholas 2022](#))

Car trips covering three miles or less account for more than 50 percent of all car trips in the United States. Approximately 28 percent of trips were a mile or less. ([USDOE 2022](#)).

New York City recently expanded its on-street car-sharing program after a five-year pilot showed that for every one car-share vehicle, four personal vehicles were either not purchased or sold. ([NYC DOT 2023b](#))

U.S. households located near a bus or rail line drive an average of 4,400 fewer miles annually than similar households with no access to public transit. ([SEPTA 2023](#))

A study found that only 15 percent of electric vehicle purchases were made by residents in multifamily housing. ([Price and Fitzgerald](#) 2022)

Research has shown that transit and nonmotorized transport can be up to 20 times more space-efficient than a typical car. ([Will, Cornick, and Munshi](#) 2020)

ECONOMICS

A recent study of 26 complete streets projects in 16 counties between 2012 and 2019 found that an estimated \$600 million in project construction yielded about \$6 billion in total economic and community development activity. That same study found that a complete streets investment of \$11.5 million in Lancaster, California, leveraged \$130 million in new private investment and nearly doubled sales tax revenues. ([Nelson and Hibbard](#) 2024)

Of 2,000 people surveyed across the country, 78 percent indicated they would pay more to live in a community with shops, parks, and restaurants within walking distance. ([National Association of Realtors](#) 2023)

Motor vehicle crashes cost American society \$340 billion in 2019. Those not directly involved in crashes pay for roughly three-quarters of all crash costs. ([NHTSA](#) 2023)

The research group TRIP estimates that in 2023, motor vehicle crashes had a \$1.85 trillion cost to society that included \$460 billion in economic costs and \$1.4 trillion in quality-of-life costs. ([TRIP](#) 2024)

According to the Bureau of Transportation Statistics (BTS), state and local government sources account for about three-quarters of total government transportation funding, while federal sources account for one-quarter of funding for local roads. ([Urban Institute](#) 2024)

The National Street Improvements Study, which examined 14 corridors across the country, found that complete streets improvements had either positive or nonsignificant impacts on the local economy. The study found that the food service businesses benefited most from the addition of bicycle and pedestrian infrastructure. ([Friedly](#) 2020)

For monetizing curbsides, demand-responsive parking uses parking spaces more efficiently, reduces congestion, encourages alternatives to driving, and improves quality of life. ([Krishnamurthy and Ngo](#) 2018)

EMERGENCY RESPONSE

In Danville, California, speed cushions caused no delay in emergency response time, compared to a 10- to 15-second delay observed with speed humps. ([FHWA](#) 2017b)

Law enforcement agencies are adding patrol bicycles to local fleets, resulting in positive community relations. ([Bennett and Becker](#) 2010)

The fire truck manufacturer Rosenbauer is selling its compact fire trucks to U.S. cities, including Los Angeles and Washington, D.C. ([Bellwood](#) 2022)

ENVIRONMENT AND CLIMATE

The transportation sector is the leading contributor to U.S. greenhouse gas (GHG) emissions, accounting for 33 percent of U.S. emissions in 2024. ([USDOT](#) 2024)

Left unshaded, surfaces absorb heat and release it slowly, resulting in higher morning temperatures that increase overall daytime temperatures. A 10 percent increase in tree cover can reduce ambient temperatures by three to four degrees Celsius. ([Westendorff](#) 2021)

A quantitative before-and-after analysis of a complete streets retrofit in Pittsburgh used multiple data sources to assess traffic and pollution levels. Results indicate that traffic volumes decreased by 11 percent to 31 percent; bicycle counts increased by 160 percent and 280 percent during the peak morning and evening hours, respectively; and average PM2.5 concentrations were reduced from 9.1 µg=m³ to 7.6 µg=m. ([Grahm et al.](#) 2021)

Streets and related infrastructure can comprise up to 30 percent of a jurisdiction's land area. ([Millard-Ball](#) 2021)

In Philadelphia, the city's Green City, Clean Waters initiative has installed more than 2,800 green tools at nearly 800 sites throughout the city, keeping more than 2.7 billion gallons of stormwater runoff and sewer overflow out of local rivers. ([Philadelphia Water Department](#) n.d.)

EQUITY

In a study of the 30 most populous U.S. cities, 77 percent have sidewalk policies that assign maintenance responsibility to the abutting property owner. ([Messier](#) 2025)

Poor sidewalk conditions often occur in lower-income neighborhoods; this finding aligns with a broad portfolio of studies on other infrastructure types, such as tree cover and roadways. ([Corning-Padilla and Rowangould](#) 2020)

Lower-income populations are three times more likely to be injured or killed on arterials, not because these populations fail to understand the potential hazards of these roadways, but simply because they are less able to avoid walking on them. ([Dumbaugh and Stiles](#) 2025)

While urban arterials are a risk factor for all areas, their negative effect on safety is profoundly greater in lower-income environments: for higher-income communities, each additional mile of urban arterial is associated with a nine percent increase in total fatal and injury crashes, but in lower-income communities, the increase is 30 percent. ([Dumbaugh](#) 2020)

Census tracts with higher concentrations of low-income and BIPOC populations have measurably higher levels of vehicle traffic and higher-speed arterials. ([GHSA](#) 2021)

Black Americans are killed by cars at double the rate of white Americans, in part because Black neighborhoods have more high-speed roads with a lack of pedestrian facilities. ([SGA and NCSC](#) 2024)

HEALTH

The 2012 Medical Expenditure Panel Survey of 26,239 U.S. adults found that those meeting the 150-minute-per-week guideline for moderate exercise (like brisk walking) saved

an average of \$2,500 annually in health-care costs. ([Valero-Elizondo](#) 2016)

In a similar 2022 study by the University of Washington School of Medicine of nearly 24,000 patients, those who were "sufficiently active" (walking 150 minutes or more per week) had 19 fewer hospital admissions, 34 fewer ER visits, and 38 fewer primary-care visits per 1,000 patient-years compared to inactive individuals. ([McCarthy](#) 2022)

A joint study by the University of Georgia and the CDC found that physical inactivity accounts for \$192 billion in annual U.S. health-care costs, representing approximately 12.6 percent of total national health spending. ([Matjasko](#) 2025)

The United States spends seven times as much money on medical costs to treat people killed or injured while walking and biking as it does on preventing those deaths and injuries through constructing sidewalks, crosswalks, bike lanes, and other infrastructure that keep people safe. ([Pedroso](#) 2017)

An almost two-decade-long study of the association between green space and depression risk found that street-view trees were associated with a lower risk of depression, suggesting street trees within street design as a public health strategy. ([Yi et al.](#) 2025)

Research from UCLA found that complete streets corridors showed a decrease in ultrafine particulates, the smallest and most dangerous particles that penetrate deep into the lungs, by approximately 1,300 particles per cubic centimeter compared to "incomplete" street locations. ([Zhu et al.](#) 2016).

MULTIMODAL TRANSPORTATION

One-third of people living in the United States do not have a driver's license. ([Zivarts](#) 2024)

A 2024 review of global studies on the effectiveness of active transportation improvements found five areas of insight and recommended practices. Two related to complete streets are the need for greater consistency in measurement tools and longer follow-up periods for active travel interventions, and consideration of population demographic features and context. ([Roaf, Larrington-Spencer, and Lawlor](#) 2024)

SHARED MICROMOBILITY

According to the North American Bikeshare and Scooter-share Association, in 2024 riders took nearly 140 million trips on shared bicycles, with average trip distances of 1.5 miles for pedal bikes and 1.9 miles for e-bikes. Thirty-five percent of shared micromobility trips replaced a car trip. ([NABSA 2025](#))

For shared bikes and scooters, studies show the average distance of an e-scooter trip is 0.45–1.5 miles, while the average e-bike trip is 1.9–2.8 miles. ([Sengül and Mostofi 2021](#))

Shared micromobility ridership in North America grew 31 percent in 2024, reaching a new high of 225 million trips. ([NABSA 2025](#))

In 2024, 74 percent of riders reported using shared micromobility to connect to transit, 66 percent of shared micromobility trips were on electric devices, and 79 percent of systems included e-devices. ([NABSA 2025](#))

In dense urban settings, micromobility both replaces and complements public transit. ([Wang et al. 2023](#))

ELECTRIC SCOOTERS

Researchers found that e-scooter riders are willing to travel 59 percent longer distances to access bikeways, 29 percent longer distances to access multiuse paths, and 12 percent longer distances to access one-way roads. ([Aarhaug, Fearnley, and Johnsson 2023](#))

E-scooter ridership declined by 72 percent overall on the Virginia Tech campus following the school's installation of parking corrals. Students considered a two-minute walk between parking and destination their threshold for scooter use. ([Zhang et al. 2021](#))

A study in Austin, Texas, found that 12 percent of e-scooter riders used transit to complement their trip. ([Zuniga-Garcia et al. 2022](#))

ELECTRIC BIKES

In Denver, the increase in e-bike riders resulting from its e-bike rebate program led to increased demand for biking infrastructure. ([Toll 2022](#))

A 2019 study found e-bike riders get more exercise minutes per week than those who ride regular bikes, due in part to longer trip distances taken on e-bikes. ([Castro et al. 2019](#))

The average e-bike trip is just under 10 miles, making it a candidate for commuting trips even in hilly terrain and warmer climates. ([MacArthur et al. 2018](#))

WALKING AND CYCLING

A walkability study conducted in Hong Kong using artificial intelligence (AI) and preference studies found that people preferred to walk in places with a higher proportion of basic streetscape elements, such as walls, benches, windows, shade trees, sidewalks, streetlights, and crosswalks. People were more likely to walk when those elements were provided in combination. ([Yang et al. 2025](#))

Sixty-three percent of polled individuals said they would bike if they felt safer. Cities that have added protected bike lanes have seen increased ridership; in Philadelphia, ridership doubled. ([Boudway 2022](#))

Bicyclists will deviate from a direct route for a perceived better route as long as it is not more than 25 percent longer. ([Winters et al. 2010](#))

Research shows that the main reasons people don't ride bikes include driver aggression, poor quality of dedicated bike lanes, bad weather, and negative perceptions of cyclists. ([Wilson 2022](#))

TRANSIT AND ACCESS TO TRANSIT

In Los Angeles, transit riders use skateboards 30,000 times each day to get to and from bus stops and train stations. ([Fang 2018](#))

Transit and nonmotorized transport can be up to 20 times more space-efficient than single-occupancy vehicles. ([Will, Cornick, and Munshi](#) 2020)

TRAFFIC CALMING

On streets with posted speeds of 35 mph or faster and motor vehicle volumes greater than 3,000 vehicles per day, shared lane markings (sharrows) are not a preferred treatment for cycling facilities. ([NACTO](#) 2025)

When Alexandria, Virginia, implemented a road diet on Seminary Road, average annual crashes decreased by 41 percent; extreme speeding decreased on the corridor; traffic volumes during peak travel times decreased between 11 and 17 percent; peak period travel times decreased by 35 to 60 seconds; and traffic did not appear to be diverting to neighboring streets. ([Alexandria](#) 2022)

In New York City, pedestrian fatalities rose 21 percent in 2024, from 100 to 121. Of those killed at intersections, 90 percent were killed at intersections without physical daylighting (the practice of removing on-street parking spaces closest to intersections to increase pedestrian visibility). ([Transportation Alternatives](#) 2025) With daylighting, the city found that hardened daylighting (physical separation) was more effective than signs; however, daylighting alone was not as effective as other street safety treatments. ([NYC DOT](#) 2025)

In 2022, speeding was the primary factor in 28 percent of fatal crashes, 12 percent of injury crashes, and eight percent of property-damage-only crashes. However, the rates were over 40 percent for Washington, D.C., Hawaii, New Mexico, North Carolina, and Wyoming. Eighty-seven percent of fatal crashes occurred on noninterstate roadways, with 52 percent occurring in urban areas. ([Blincoe et al.](#) 2023)

The Governors' Highway Safety Association reported 7,148 pedestrian fatalities on U.S. roads in 2024—down 4.3 percent from the year before, but 20 percent higher than in 2016. ([GHSA](#) 2025)

Between 2009 and 2023, deaths of people on foot rose 80 percent, while all other traffic fatalities rose 13 percent. ([GHSA](#) 2025)

In 2023, 65 percent of pedestrian deaths occurred in locations without a sidewalk. ([GHSA](#) 2025).

The nighttime fatality rate on U.S. roadways is three times higher than the daytime rate, and 76 percent of pedestrian fatalities occur at night. ([FHWA CAI](#) n.d.)

Roughly one-quarter of traffic fatalities and about one-half of U.S. traffic injuries for all modes occur at intersections. ([FHWA](#) 2024a)

Leading pedestrian intervals (LPIs) have been shown to reduce pedestrian-vehicle collisions from as much as 13 percent ([FHWA](#) n.d.b.) to around 60 percent ([NACTO](#) 2013e) at treated intersections. The benefits are increased with “no right turn on red” restrictions. ([Oregon DOT](#) 2022)

A study of 17 crosswalk mural installations across the country found a 50 percent decrease in crashes involving pedestrians or cyclists, a 37 percent decrease in crashes leading to injuries, and a 27 percent increase in the rate of drivers yielding to pedestrians in the right-of-way. ([Sam Schwartz](#) 2022)

After controlling for direction, hourly traffic flow, and vehicle behavior (i.e., moving or stopped at a red light), researchers found that the effect of a delineator-protected bicycle lane (marked with traffic cones and plastic delineators) was associated with a 28 percent reduction in average maximum speeds and a 21 percent decrease in average speeds for vehicles turning right. Painted-only bike lanes were also associated with a smaller speed reduction of 11 to 15 percent, but only for vehicles turning right. ([Younes et al.](#) 2024)

An FHWA study showed that roundabouts reduced injury collisions by 75 percent, fatality collisions by 90 percent, and pedestrian collisions by 40 percent. ([WSDOT](#) n.d.)

Using speed data, researchers found that single-lane roundabouts reduced average travel speed by seven mph. Other reductions included raised medians (3.1 mph reduction), depressed medians (1.3 mph), on-street parking (1.7 mph), crosswalks (1.3 mph), and curbs with gutters (1 mph). ([Savolainen et al.](#) 2024)

In 2024, New York City experienced a 60 percent drop in micromobility battery fire-related deaths from the previous

year (four deaths versus 14 in 2023), attributed to the city's ban on non-UL-compliant batteries and programs for delivery drivers who use electric bikes. ([Toll](#) 2024)

A study that used a virtual reality driving simulator to study the impact of road design on chosen speed found that complexity and risk perceptions influenced driver behavior. Road designs with trees lowered driven speed, while the presence of parking lowered prevailing speed. ([Van Eggermond et al.](#) 2025)

In a study of 23 Massachusetts municipalities conducted during and after COVID-19 lockdowns, researchers found that a temporary roundabout was associated with a 65 percent reduction in the number of speeding drivers in Arlington; painted bus lanes made bus trips 35 percent faster in Everett; and across the municipalities studied, 57 percent of businesses reported increased revenue from outdoor spaces. ([Barr Foundation](#) 2023)

APPENDIX B. COMPLETE STREETS RESOURCE COMPENDIUM

This appendix presents an annotated list of resources to support complete streets projects and programs, organized by theme.

ACCESS

[*Access to Opportunities Primer*](#) (UCLA Lewis Center for Regional Policy Studies, 2021). This primer explains why access to opportunity is an important concept, what its determinants are, and how it relates to adjacent issues and policies in housing and economic development.

[*"The Complete Trip: Helping Customers Make a Seamless Journey"*](#) (National Center for Mobility Management, 2016). This briefing paper explains how the concept of “the complete trip” can help people get to their destinations in the most efficient and least stressful ways.

[*The Why and How of Measuring Access to Opportunity: A Guide to Performance Management*](#) (Governors’ Institute on Community Design, 2017). This report explains the data, tools, and methodologies needed to measure access to opportunity and shows how to integrate these measures into planning and investment decisions.

ACCESSIBILITY

[*AARP Walk Audit Tool Kit*](#) (AARP, 2022). This toolkit guides users in conducting a walk audit to evaluate the walkability of a location.

[*Inclusive Walk Audit Facilitator’s Guide*](#) (Minnesota Department of Health, 2022). This guide explains how to better include people with disabilities and highlight disability in walk audits so that planning processes are more inclusive.

CHECKLISTS & SCORECARDS

[*Automated Enforcement Program Checklist*](#) (AAA, Insurance Institute for Highway Safety Highway Loss Data Institute (IIHS-HLDI) et al., 2021). This checklist offers best-practice considerations for establishing a red-light camera automated enforcement program.

[*Complete Streets Checklist*](#) (City of Seattle, 2020). This complete streets checklist project template is used in Seattle for projects over \$500,000.

[*Complete Streets Checklist & Guide*](#) (Metropolitan Transportation Commission, n.d.). This complete streets checklist project template and guidance is used to ensure local compliance with complete streets policies for projects over \$250,000.

[*Development Review Complete Streets Checklist*](#) (City of San Leandro, California, n.d.). This pre-application checklist assists applicants and staff in identifying and assessing a range of complete streets-related multimodal transportation needs near a proposed development.

“Proposed KYTC Complete Streets Scorecard,” Appendix C in [*Addressing Multimodal Transportation Needs Through Complete Streets Implementation*](#) (Kentucky Transportation Center College of Engineering, University of Kentucky, 2024). This report reviews established complete streets evaluation tools and practices and offers a scorecard template to evaluate the complete streets benefits of proposed projects.

DATA & DATA COLLECTION

[*52 Sources of Traffic Counts and AADT Data*](#) (Cubit’s Blog, 2021). This blog post offers a table of links to state DOT traffic count resources.

[*Big Data and Planning*](#) (APA, 2016). This PAS Report describes how planners can use big data to inform local planning efforts.

[*Big Data for Regional Travel and Mobility Analyses*](#) (Metropolitan Washington Council of Governments, 2021). This report explores the strengths, limitations, applicability, and acquisition costs of common big data products used by transportation agencies and outlines a pilot procurement plan.

[*“Data Collection and ITS”*](#) (USDOT ITS, 2025). This briefing paper discusses advancements in roadway infrastructure sensors and detection technologies, the types of data collected, common ITS applications, and use cases.

[*Digital Local Roads: Realising the Full Potential of Local Roads*](#) (ADEPT, Transport Technology Forum, TRL, Ringway, Vinci Highways, InnovateUK, Jacobs, and OS, 2022). This report from the UK explores the potential benefits of and barriers to using connected digital technologies on roadways.

[*Managing Mobility Data Policy*](#) (National Association of City Transportation Officials and International Municipal Lawyers Association, 2019). This document sets out principles and best practices for city agencies and private-sector partners to share, protect, and manage data to meet transportation planning and regulatory goals in a secure and appropriate manner.

[*State-of-the-Art Approaches to Bicycle and Pedestrian Counters*](#) (NCDOT, 2021). This research study evaluates bicycle and pedestrian counting technologies and offers guidance on matching technology types to nonmotorized volume data needs at the local, regional, and state levels.

[*Technology Pilot Lifecycle Toolkit*](#) (Center for Care Innovations, 2020). This toolkit offers a high-level overview of the technology pilot life cycle accompanied by a set of supportive resources.

[*Urban & Regional Planning Resources*](#) (American Planning Association Technology Division, 2025). The APA Technology Division maintains this GitHub of planning-related data resources.

ECONOMICS & LAND USE

[*“Complete Streets as a Redevelopment Strategy”*](#) (Cityscape 26(2): 311–82, 2024). This article analyzes 26 complete streets projects in 16 U.S. counties to present the first comprehensive assessment of the role of complete streets as a redevelopment strategy.

[*Economic Impacts of Bicycle and Pedestrian Street Improvements*](#) (PeopleForBikes, 2020). This research project analyzed before-and-after data for street improvements on 14 corridors in six U.S. cities (Indianapolis, Memphis, Minneapolis, Portland (Oregon), San Francisco, and Seattle) to demonstrate the economic impacts of bicycle and pedestrian street improvements.

[*Streets for Recovery: The Economic Benefits of the NYC Open Streets Program*](#) (NYCDOT, 2022). This report demonstrates that the NYCDOT’s Open Streets program played an essential role in supporting the restaurant and bar industry in New York City during the COVID-19 pandemic.

EMERGENCY RESPONDERS

[*Fire Department Access Performance-Based Design Guide*](#) (Montgomery County (Maryland) Department of Permitting Services, 2019). This design guide consolidates key fire department access requirements and performance-based design and balances them with the needs of pedestrian and bicycle safety and the protection of natural resources.

EQUITY

[*An Analysis of Traffic Fatalities by Race and Ethnicity*](#) (Governors Highway Safety Association, 2021). This report reviews research and data to better understand the impact of fatal traffic crashes on Black, Indigenous, and People of Color (BIPOC) communities and identify actions states and communities can take to advance equity in traffic safety.

[*Answers From the Margins: Participatory Planning With Disadvantaged Communities*](#) (University of California Institute of Transportation Studies, 2021). This report draws on four case studies of transportation planning processes to identify 10 key themes for successful community engagement with historically disadvantaged communities.

[“Equitable Bike Share Systems: Removing Barriers to Access”](#) (D.C. Policy Center, 2017). This study of Washington, D.C.’s Capital Bikeshare program analyzes challenges to access and suggests potential solutions.

[Go Human: Resilient Streets Toolkit](#) (Southern California Association of Governments, 2024). The toolkit promotes bike and pedestrian safety and traffic calming measures in the public right-of-way to help meet social and environmental challenges, while building community capacity to engage in a more inclusive and holistic process so that resilience actions are guided by fundamental community values.

[“Incomplete Streets: Who’s Missing from ‘Complete Streets’?”](#) (Urban Design Forum, 2018). This essay by Stephen Zavestoski and Julian Agyeman poses the question, “Complete for whom?” and asks whether all street users are, in fact, gaining safe access to streets.

[The Case for Self-Enforcing Streets](#) (Transportation Alternatives, 2020). This report makes the case for reallocating a portion of the NYPD’s budget to NYCDOT to implement self-enforcing streets designed for safer driving, expand automated enforcement programs, and take other steps to mitigate racial disparities in traffic enforcement.

[Transportation Equity Toolkit](#) (University of South Florida Center for Urban Transportation Research, 2021). This toolkit provides a framework for a transportation equity needs assessment and an equity-based project identification and prioritization process, including an equity audit and equity scorecard tool.

FUNDING

[Complete Streets Funding Toolkit](#) (Orange County (California) Council of Governments, 2016). This guide offers information on preparing grant applications for complete streets projects, including case studies of successful grant applications and details on preparing a grant budget.

[Midwest Transportation Landscape Assessment: A Roadmap for Funders](#) (The Funders Network, 2023). Though focused on the midwestern states, this overview of climate-focused transportation advocacy and funding offers widely applicable insights.

[Pedestrian and Bicycle Funding Opportunities: U.S. Department of Transportation Highway, Transit and Safety Funds](#) (FHWA, 2025). This table indicates likely eligibility for pedestrian and bicycle activities and projects under U.S. Department of Transportation surface transportation funding programs.

IMPLEMENTATION

[Introduction to the Role of Operations Strategies and Treatments in Complete Streets Projects](#) (FHWA, 2024). This primer assists transportation agencies with incorporating operations considerations during the planning, design, and implementation of specific complete streets projects that can help achieve complete streets objectives.

INFRASTRUCTURE

[Getting to the Curb: A Guide to Building Protected Bike Lanes that Work for Pedestrians](#) (San Francisco Vision Zero Coalition, 2019). Guidance on how to design separated bike lanes and cycle tracks that maintain easy access to the sidewalk for pedestrians, particularly people with disabilities and seniors.

[Guidance for Separated/Buffered Bike Lanes With Delineators](#) (Local Road Research Board, Minnesota Department of Transportation, 2021). This research gathered best practices to support guiding principles of safety, comfort, and connectivity when designing separated bike lanes as highest-quality bikeway facilities for streets.

[Guide for Maintaining Active Transportation Infrastructure for Enhanced Safety](#) (FHWA, 2024). This guide addresses maintenance of active transportation facilities for achieving mobility, accessibility, safety, and equity goals, focusing on common maintenance issues impacting pedestrians, bicyclists, and micromobility users.

[Guide for Roundabouts](#) (National Academy of Sciences National Cooperative Highway Research Program, 2023). This guide presents an updated version of a well-established national guide on roundabout planning, analysis, design, and construction.

[*Guide for the Development of Bicycle Facilities, 5th Edition*](#) (AASHTO, 2024). This guide provides information on the planning, design, and operation of bikeways along streets, roads, and highways, as well as on off-street paths in urban, suburban, and rural settings.

[*Next Generation Trails: New Mobility Trends in Shared-Use Path Design and Management*](#) (Alta Planning + Design, 2020). This guide offers six principles to guide decision-making for accommodating powered micromobility devices on shared-use paths.

[*On-Street Bicycle Facility Design Features: A Guide*](#) (National Academy of Sciences National Cooperative Highway Research Program, 2025). This guide presents state-of-the-art data-driven guidance for selecting context-appropriate design features for improving the safety of separated and nonseparated on-street bicycle lanes.

[*Pedestrian/Bicycle Facilities, Policies, and Street Standards: Review of Community Requirements in the Greater Madison MPO Planning Area and Recommended Best Practices*](#) (Greater Madison (Wisconsin) MPO, 2021). This report details locally adopted requirements along with national recommendations and best practices to help local planning and engineering staff and elected officials make informed decisions to make roadways safer for all users.

[*Safety Evaluation of On-Street Bicycle Facility Design Features*](#) (National Academy of Sciences National Cooperative Highway Research Program, 2025). This report presents data-driven guidelines for selecting context-appropriate design features for safer on-street bikeway designs.

[*Separated Bike Lane Planning and Design Guide*](#) (FHWA, 2015). This guide outlines planning considerations for separated bike lanes (also called “cycle tracks” or “protected bike lanes”) and provides a menu of design options covering typical one- and two-way scenarios.

[*Separated Bike Lanes on Higher Speed Roadways: A Toolkit and Guide*](#) (FHWA, 2024). This toolkit includes background information, agency policies, processes, and other resources and procedures that can help agencies overcome obstacles to implementing separated bicycle lanes on higher-speed roads.

[*Shared Use Path Planning and Design Guide*](#) (MassTrails, 2018). This toolkit for shared-use path planning and design includes a planning primer, cost estimating tool, and way-finding design guidelines.

[*Small Town and Rural Multimodal Networks*](#) (FHWA, 2016). This report is a resource and idea book intended to help small towns and rural communities support safe, accessible, comfortable, and active travel for people of all ages and abilities by developing safe and appealing networks for bicycling and walking in small towns and rural areas.

[*Urban Bikeway Design Guide, 3rd Edition*](#) (NACTO, 2025). FHWA-recognized design guidance for the development of bike facilities on city streets based on other design guidance, city case studies, best practices in urban environments, research and evaluation of existing designs, and professional consensus.

[*Urban Street Design Guide, 3rd Edition*](#) (NACTO, 2013). USDOT-endorsed guidance for the design of city streets and public spaces.

MICROMOBILITY

[*Charge Safe, Ride Safe: NYC’s Electric Micromobility Action Plan*](#) (NYCDOT, 2023). This municipal action plan offers initiatives to prevent loss of life and injury due to electric micromobility battery fires while promoting ridership growth and accounting for the needs of all riders, from delivery workers to commuters to families.

[*Shared Micromobility Report: 2023*](#) (NACTO, 2024). This report examines data on dockless bikes, dockless e-scooters, and station-based bike share systems in cities across North America, finding that trips on these systems reached an all-time high in 2023.

PERFORMANCE METRICS

[*A Guide to Measuring Complete Streets Progress: From Policy to Practice*](#) (Smart Growth America, 2024). This report explains how to measure complete streets policy

implementation through choosing and monitoring appropriate performance measures.

[*Complete Streets Evaluation Best Practices*](#) (USDOT, 2024). This report focuses on analysis, modeling, and simulation (AMS) approaches for mobility, safety, equity and accessibility, network connectivity, environmental sustainability, and public health.

[*Evaluating Complete Streets Projects: A Guide for Practitioners*](#) (AARP and SGA, 2015). This guide offers metrics for goals of access, economy, environment, place, safety, equity, and public health.

[*From Policy to Practice: A Guide to Measuring Complete Streets Progress*](#) (SGA, 2024). This guide from Smart Growth America offers more than 100 complete streets metrics categorized by process, implementation, and impact.

[*Guidebook for Measuring Multimodal Network Connectivity*](#) (FHWA, 2018). This guide describes a five-step analysis process and numerous methods and measures to support a variety of transportation planning and programming decisions.

[*Making Transit Count: Performance Measures that Move Transit Projects Forward*](#) (NACTO, 2018). This report offers example performance metrics for transit programs and proposes ways to use these metrics to improve transit service value and effectiveness.

[*Measuring the Street: New Metrics for 21st Century Streets*](#) (New York City Department of Transportation, 2012). This report details the metrics NYCDOT uses to evaluate street projects and illustrates how measuring results can show progress toward safe, sustainable, livable, and economically competitive streets.

[*Mobility Performance Metrics for Integrated Mobility and Beyond*](#) (FTA, 2020). This report presents mobility performance strategies and describes how to develop metrics to assess how well an integrated public/private mobility system meets the needs of individual travelers.

[*The Why and How of Measuring Access to Opportunity: A Guide to Performance Management*](#) (Governors' Institute on Community Design, 2017). This guide offers information on the data, tools, and methodologies needed to measure access to opportunity as provided by transportation systems.

POLICY GUIDANCE

[*Complete and Green Streets for All: Model Complete Streets Policy and Guide*](#) (New Jersey Complete Streets Working Group, 2020). This guide for New Jersey municipalities includes a model resolution of support, policy, and implementation checklists that integrate implementation, green infrastructure, and equity considerations into complete streets design.

[*Complete Streets: Supporting Safe and Accessible Roads for Everyone: Local Toolkit*](#) (Minnesota Complete Streets Coalition, n.d.). This toolkit explains the steps in creating a local complete streets resolution and policy and offers talking points about complete streets benefits.

[*Complete Streets Policy Action Guide*](#) (Cityhealth, 2024). This guide is a comprehensive resource for creating or improving a complete streets policy.

[*What Are Complete Streets?*](#) (National Complete Streets Coalition, n.d.). The National Complete Streets Coalition's website offers a comprehensive overview of complete streets elements and policy guidance.

PUBLIC ENGAGEMENT

[*Complete Streets Message Guide*](#) (Broward MPO, n.d.). This guide outlines opportunities and key messages for all audiences regarding the MPO's complete streets initiative to ensure accurate communication, clarify misconceptions, maintain credibility, and align with MPO principles.

[*IAP2 Spectrum of Public Participation*](#) (IAP2, 1999). This iconic framework overviews different levels of the public's role in any public participation process, from "inform" to "empower."

[*Public Engagement Guidebook*](#) (Wasatch Choice Vision, 2023). This guide offers resources regarding public engagement, one-on-one engagement, and messaging around post-COVID sustainable quality-of-life elements, including transportation choices.

[Public Participation Guide](#) (USEPA, n.d.). This guide offers best practices for planning, skills, and behaviors that government agencies can use to design and implement a meaningful public participation program.

[Stakeholder Analysis Matrix Template](#) (tools4dev.org, n.d.). This template can be used to identify the stakeholders for a project, their level of influence, which issues are important to them, and how they will be engaged.

[Streets Built to Share](#) (American Heart Association, n.d.). This two-page handout offers tips on and examples of messaging to support complete streets.

QUICK-BUILD AND TACTICAL URBANISM

[Pandemic Quick Builds: Lessons Learned and What Comes Next](#) (ITE, 2023). This technical brief offers five case studies of pandemic quick-build projects that highlight project outcomes and lessons learned.

[Pop-Up Placemaking Tool Kit](#) (AARP, 2019). This toolkit offers guidance for beginner, intermediate, and advanced pop-up demonstration projects in public spaces.

[Quick Build Design and Materials Standards](#) (Burlington Public Works, n.d.). This municipal guide offers standards for a range of project types and materials that create safer conditions for walking, cycling, and driving, while also supporting public and community placemaking opportunities.

[Quick-Build Guide and Webinar](#) (Alta Planning + Design, n.d.). This guide addresses how to quickly and inexpensively plan, design, and maintain quick-build projects to create safe spaces on streets for people to travel by nonautomobile modes.

[Quick Builds for Complete Streets](#) (North Jersey Transportation Planning Authority and the Borough of Keyport, n.d.). This guide defines quick-build projects and offers guidance on design tools, materials, and project planning for implementation.

[Safety Demonstration Projects: Case Studies from Durham, NC, Huntsville, AL, and Pittsburgh, PA](#) (Smart Growth America and National Complete Streets Coalition, 2024).

This report offers case studies of demonstration projects with short timeframes and small budgets through the Safe Streets, Smart Cities Academy program.

[Tactical Urbanist's Guide to Materials and Design v. 1.0](#) (Street Plans Collaborative, 2016). This guide provides high-quality design and materials guidance for citizen-led demonstration projects and city-led pilot and interim design projects.

[Vision Zero Quick-Build Program](#) (San Francisco Municipal Transportation Agency, n.d.). This website offers details on Muni's quick-build program for quickly implementing pedestrian and bicycle safety improvements on the region's Vision Zero High Injury Network.

RESILIENCE & ADAPTATION

[Adaptation Strategies for Transportation Infrastructure](#) (Caltrans, 2023). This resource describes the types of hazards and threats to roadways caused by different climate stressors and lists adaptation actions and strategies to avoid or minimize impacts.

[Building Resilient Infrastructure for Healthier, Safer Cities](#) (National League of Cities, 2024). This report explores the state of resilient infrastructure today; shares case studies from U.S. cities, towns, and villages; and provides best practices and considerations for policy and budget decisions for more resilient streets and transportation infrastructure, along with other city systems.

[Road to Resilience: Practical Insights to Enable More Resilient and Adaptable Road Networks](#) (Arup, 2024). This guide offers case studies from around the world in building resilient road networks that can withstand, or recover rapidly from, extreme events and increasing demand, as well as accommodate an ever-more diverse range of users and vehicles.

SAFETY

[City Limits: Quick Guide on Conducting a Safe Speed Study and Using the Risk Matrix](#) (NACTO, 2024). This guide demonstrates how to analyze a street's activity level and conflict density in determining a MUTCD-compliant posted speed limit for a speed zone.

[*Complete Streets—Safety Analysis*](#) (FHWA, 2024). This study identifies and describes current capabilities, best practices, and future data and analysis needs for quantifying the safety and performance effects of multiple safety treatments for complete streets.

[*Proven Safety Countermeasures*](#) (FHWA, n.d.). This online resource offers information on 28 countermeasures and strategies effective in reducing roadway fatalities and serious injuries by addressing speed management, intersections, roadway departures, or pedestrian/bicyclist accommodation.

[*Safety Action Planning Primer for Massachusetts Communities*](#) (MassDOT, 2024). This guide outlines the key elements of a safety action plan, which is a community-supported framework for reducing traffic fatalities, and offers guidance on the planning and implementation process.

[*Traffic Calming e-Primer*](#) (FHWA, n.d.). This online resource presents a thorough review of 22 types of traffic-calming measures, including implementation guidance, safety research, and case studies.

APPENDIX C. COMPLETE STREETS METRICS AND DATASETS

The following tables present data types, data sources, and examples of multimodal performance metrics and targets for six areas of complete streets goals and objectives: transportation and travel, infrastructure and development, access to destinations, accessibility, equity, and climate. Chapter 8 provides additional information and guidance on data planning and management for complete streets.

TABLE 1. TRANSPORTATION AND TRAVEL DATA FOR COMPLETE STREETS

Data Category	Data Types	Data Sources	Example Multimodal Performance Metrics and Targets
Crash and near-miss data	Information on the location, severity, time of day, environmental conditions, crash type, traveler behavior, and other details; field reports on contributing factors	USDOT's National Highway Traffic Safety Administration publications ; state crash data; field observations. For near-miss data: video analytics; self-reporting	Reduction in crashes (all modes); reduction in crash severity (all modes); reduction of crashes in focus neighborhoods; number of preventative installations based on near-miss analysis
Vehicle miles traveled (VMT) for automobiles, bicycles	Distances traveled; trends over time; land use efficiency	U.S. Department of Energy and Federal Highway Administration ; state data (e.g., FDOT Source Book ; VMTIndex); travel diaries; crowdsourced travel apps (e.g., Strava); subscription services (e.g., StreetLight)	Reduction in VMT; increase in bicycle miles traveled; VMT per capita; increased mode split for trips under three miles
Origin-destination	Travel patterns; economic activity; potential mode shift; site selection	Subscription services (e.g., StreetLight , AirSage , TomTom); connected car data; travel diaries	Increase in bicycle direct routes; increased number of complete neighborhoods (15-minute cities)
Average annual daily traffic (AADT), all modes	Number of vehicles traveling along a given point on a road on an average day in the year	Traffic counts (automobile, transit vehicle, bike, pedestrian); state resources (Carney 2021)	Increase in bicycle, pedestrian, transit vehicle travel; reduction in auto traffic; decrease in roadway wear and tear; decrease in congestion hotspots; reduction in single occupancy vehicle rates; target mode splits; number of pedestrian/bike counters deployed
Turning vehicle movement counts (TMC)	Number of vehicles turning at specific intersections	Traffic counts (auto, transit vehicle, bike, pedestrian)	Reduction in left-hand turn crashes (all modes); intersection LOS; reduced crashes from right-turn on red (RTOR)
Vehicle speed data	Traffic speed and flow across time periods	Local speed studies; subscription services (e.g., RITIS ; INRIX); connected car data; crowdsourced data	Reduction in percentage cars traveling more than x mph over the posted speed limit

Data Category	Data Types	Data Sources	Example Multimodal Performance Metrics and Targets
Travel time index (TTI) & travel time reliability (TTR)	Ratio of the travel time at peak period to the time required to make the same trip at free-flow speeds correlates to roadway performance and vehicle flows	Local speed studies; subscription services (e.g., RITIS ; INRIX); connected car data; crowdsourced data	Traditional level of service (LOS); multimodal LOS
Transit operations	Counts of riders per stop and transit types; travel times and frequency; schedules; on-time departures; fleet mix (including accessible vehicles); speed data	Federal Transit Administration National Transit Database (NTD), Bureau of Transportation Statistics transit data ; American Public Transportation Association Ridership Report ; rider surveys	Numbers of transit ridership; total person throughput (for streets); real and perceived wait times; bus speeds; decreased headways; increase in real-time signage; number of transit app users
Vehicle type data	Vehicles (internal combustion, alternative fuels); trucks, transit; micromobility	U.S. Department of Energy TransAtlas ; Bureau of Transportation Statistics bicycle and pedestrian travel ; state vehicle registration data; bicycle sales (Majidi 2025); League of American Cyclists data	Percentage increase in alternative fuel vehicles; increase in bicycle commuting; increase in walk and bike mode split; decrease in greenhouse gas emissions
Bike and pedestrian traffic data	Number of bicycle trips; number of pedestrian trips; speed data; origin-destination pairs;	Bureau of Transportation Statistics Bicycle and Pedestrian Travel ; state data on vehicle registration; bicycle sales (Statista 2025); League of American Cyclists Benchmarking Report ; BikePed Portal (limited cities)	Increase in bicycle, pedestrian, transit vehicle travel; reduction in auto traffic; target mode splits; increase in number of students biking to school
Shared-use e-bike and e-scooter traffic data	Origin-destination, speed; travel time; trip distance; cost per ride; parking location; number of trips per day per vehicle	Bureau of Transportation Statistics bike-share and e-scooter systems in the U.S. ; rider surveys; micromobility companies	Increase in bikeshare memberships; increase in reported replacement of car trips; increase in ridership in focus neighborhoods; increase in micromobility sales; reduced number of parking infractions; increased number of memberships; financial data

TABLE 2. INFRASTRUCTURE AND DEVELOPMENT DATA FOR COMPLETE STREETS

Data Category	Data	Data Sources	Example Multimodal Performance Metrics and Targets
Street/roadway characteristics	Classification, width, and number of lanes; centerline street miles; direction of travel; intersections; speed limits; available rights-of-way; quality; ownership and jurisdiction	Local GIS data (public works, transportation); OpenStreetMap	Decrease in number of road, bike-way, and sidewalk gaps; increase in percentage of roads with separated bike facilities; percentage of major roads with transit lanes; percentage of street miles that meet level of service, low-stress, or accessibility thresholds; increased number of protected intersections
Traffic signal information	Location of traffic signals by type, ownership, and control; number of automated traffic signal systems	Local data (public works, traffic operations); MPO; state; INRIX U.S. Signals Scorecard	Number of intersections with leading pedestrian intervals (LPIs); number of lights with transit and emergency responder prioritization; number of rectangular rapid-flashing beacon (RRFB) or high-intensity activated crosswalk (HAWK) signal installations
Sidewalk characteristics	Width, quality, and ownership/jurisdiction; connectivity; sidewalk ramp location and quality; number, type, and ownership of assets located in sidewalks; tree inventory	Local GIS data (public works, transportation); MPO; WalkScore ; USEPA Walkability Index	Decrease in sidewalk gaps; decrease in ADA-noncompliant sidewalk segments and intersections; reduced response time for sidewalk complaints; sidewalk condition ratings; increased number of projects within one mile of transit stops
Signage and wayfinding	Location and type of signage; wayfinding assets	Local GIS data (public works, schools, transportation); interviews	Number of sign replacements; reduced number of signage complaints; increased number of ADA signage upgrades
Bicycle infrastructure	Location and type of bicycle facility; location of crossings, beacons, signals, and dedicated lanes	Local GIS data (public works, transportation); MPO; state	Increase in lane miles of protected bike-ways; reduced number of bike network gaps; deferred maintenance corrected; increased ridership in focus neighborhoods
Transit	Location of bus/rail/shuttle stops; connectivity; condition of infrastructure within one mile of transit stops and stations; number of bus travel lanes; transit lane miles	Local GIS data (transit agency, public works, transportation); National Transit Database	Increased number of households and jobs within one mile of transit stations and stops; increase in number of covered bus stops; miles of transit-only lanes
Lighting data	Location and type of lighting fixtures	Local GIS data (public works, schools, transportation, transit agency); states	Reduced number of pedestrians injured in low-light conditions; reduced lighting-related complaints
Tree canopy data	Location and extent of tree canopy; shaded areas (infrastructure); tree species	USFS tree canopy cover data ; local data collection; crowdsourced data (see i-Tree tools); maintenance schedules	Increase in canopy projection area; reduced gaps in continuous canopy cover; target reduction in street level ambient air temperature; target mix of fast- and slow-growth canopy trees

Data Category	Data	Data Sources	Example Multimodal Performance Metrics and Targets
Curb and gutter information	Location, height, and length of curb and gutter; location and size of curb cuts; location and number of on-street parking and loading zones; location of storm drains	Local GIS data (public works, transit, transportation; crowdsourced data; subscription services (e.g., CurbIQ); field surveys	Reduced number of curb cuts; increase in curb productivity; percentage curbs in digital inventory; reduced number of citations for blocked curb lanes; reduced number of clogged storm drains
Parcel and building information	Maps with building and parking footprints and building height (3D); setbacks; parcel data (ownership, parcel dimensions); number and location of driveways	Local GIS data (planning, development); Google Open Buildings ; zoning code; approved site plans; tax assessor office; Microsoft Planetary Computer building footprints	Increased percentage of buildings with reduced setbacks; increased number of buildings with bicycle parking and showers; low driveway density
Parking supply	Location of on- and off-street parking (on street, in lots, in garages); number, type, and location of bicycle parking	Local GIS data (planning, development, approved site plans); local data (utilization, length of stay); zoning code; approved site plans; local transportation demand management plans	Increased number of flexible zones (multiple curb uses); parking funds reinvested in parking benefit districts; percentage parking utilization; total revenue; number of parking demand management strategies
Land use and zoning data	Uses and intensities of development; measures of economic vitality	Local GIS data (planning, development, approved site plans); local business receipts	Increased number of complete neighborhoods (15-minute cities); number of development projects post-complete streets installation; before-and-after study results

TABLE 3. ACCESS TO DESTINATIONS DATA FOR COMPLETE STREETS

Data Category	Data Types	Data Sources	Example Multimodal Performance Metrics and Targets
Land use (differentiate jobs and nonwork core services)	Mix of locally relevant destinations; density of destinations; jobs/housing balance; distance between destinations; location of “deserts” (food, childcare, parks); location of activity hubs	Local GIS data (planning, zoning, development); MPO data (regional jobs, transportation, and housing data); business development organizations; CUBE Access	Increased number of activity hubs (urban, suburban, rural areas); increased number of jobs in transit-accessible areas; increased number of households within one-half mile of jobs and core services; increased number of buildings with bike amenities
Transportation system performance	Road network and multimodal connectivity; travel speeds; transit routes and frequencies; person throughput; bicycle level of comfort; historic infrastructure investment; location of physical barriers to access	USEPA Access to Jobs and Workers Via Transit Tool , National Walkability Index ; see also Tables 1 & 2	Reduced VMT; increased development offering a one-seat transit ride to jobs and destinations; decrease in single-occupancy vehicle rates; increased distribution of transit and infrastructure investment in low-income neighborhoods; number of transportation barriers removed; number of projects completed to increase multimodal connectivity; increased share of bike and e-bike commuting
Demographics	Census block or similar level of information on population (age and gender, income, home ownership), number of zero-car households; number and location of climate stressors; number of households with a disabled person	U.S. Census data, Center for Economic Studies data; American Community Survey data; local GIS data (planning, development, sustainability, economic development); MPO	Increased number of low-income households living within one-half mile of quality transit; increased number of elderly residents living within one-half mile of quality transit; reduced commute times for low-income neighborhoods
Customer input	Opinions on safety, affordability, comfort, trip length, value of time	Customer satisfaction surveys; interviews, transit reliability reports; crowd-sourced app data	Number of survey responses; percentage of responses from focus neighborhoods; percentage of transit riders with positive experience; number of new projects gleaned from customer input
Process	Public input results; number and types of plans to align; infrastructure maintenance backlog; accessibility coalition partners	Number and diversity data on public input; list of plans; capital improvement plan; MPO plans; mobility plans	Percentage of responses from focus neighborhoods; number of plans in alignment; number of grant applications from multiple partners; number of projects that meet multiple goals removed from backlog; decreased number of complete streets exceptions granted
Scenario planning	Buildout scenarios (jobs, housing); transportation system scenarios; economic development data	State roadway projects; MPO projections (Long Range Transportation Plan process); public input; cost-benefit analysis; trends analysis	Percentage change in jobs accessible in 45 minutes or faster by proposed new transit; percentage increase in bicycle share with proposed trail connections

TABLE 4. ACCESSIBILITY DATA FOR COMPLETE STREETS

Data Category	Data Types	Data Sources	Example Multimodal Performance Metrics and Targets
Disability or vulnerability indicators	Individual or composite measures with number and location of households: households with zero car ownership; households below the poverty level; household members with a disability; household members greater than 65 years old; household members with low English proficiency; household members without health insurance	U.S. Census data; American Community Survey data; U.S. Centers for Disease Control and Prevention Disability & Health Data System ; EJScreen (Public Environmental Data Partners version); local data (health and human services); transit data	Decreased number and percentage of disabled households using paratransit services; increased percentage of focus populations' interactions with public engagement efforts on mobility
ADA-compliant infrastructure	GIS/maps showing ADA infrastructure deficiencies; curb ramps, intersections, public parking, transit stops, bike lanes; GIS/maps showing ADA equipment deficiencies (e.g., audible signals, tactile surfaces, signage)	Previous ADA studies, ADA transition plans; local data (public works, health and human services); capital improvement plans; ADA street audits and survey data (slope, dimensions)	Reduced number of ADA-noncompliant sidewalks, intersections, ramps, parking lanes, signs, and bike lanes

TABLE 5. EQUITY DATA FOR COMPLETE STREETS

Data Category	Data Types	Data Sources	Example Equity Performance Metrics
Demographics	See Table 3	See Table 3	See Table 3
Exposure to policing	Number of police encounters in focus neighborhoods/focus populations; number of arrests in focus neighborhoods/focus populations	U.S. Department of Justice Bureau of Justice Statistics ; Prison Policy Initiative data; local police records; codes/laws on mobility-related violations (e.g., requirements for bike lights, helmets)	Number of road design projects that limit the need for police traffic enforcement; decrease in percentage of mobility-related arrests involving people of color
Equitable investment	Transportation project types and locations over time; number and percentage of comments regarding poor or missing infrastructure from target neighborhoods	Local capital improvement project lists; Center for Neighborhood Technology's Housing and Transportation Index	Number and percentage of projects in historically underinvested neighborhoods; percentage of projects in focus neighborhoods over time
Equitable mobility services	Vehicle miles traveled; travel time per income brackets; number of high-frequency transit routes; paratransit service locations over time	USEPA Access to Jobs and Workers Via Transit Tool , National Walkability Index	Percentage of population served by high-frequency transit; decrease in travel time in focus neighborhoods
Health	Percentage and location of households without health insurance; prevalence of hypertension, obesity, and diabetes by race/income over time; exposure to air pollution and toxins	CDC PLACES ; EJScreen (Public Environmental Data Partners version); surveys, crowdsourced data	Increase in bike and walking counts in focus neighborhoods; increase in biking/walking to schools in focus neighborhoods; decrease in hypertension, obesity, and diabetes; decrease in air pollution indicators

TABLE 6. CLIMATE DATA FOR COMPLETE STREETS

Data Category	Data Types	Data Sources	Example Climate Performance Metrics
Greenhouse gas emissions	Mobility-related greenhouse gas emissions; vehicle miles travelled (VMT)	U.S. Dept of Energy Alternative Fuels Data Center	Percentage reduction of automobile-related CO2 car emissions from mode shifts; increase in miles of bikeways; number of projects that fill critical bike and pedestrian infrastructure gaps
Urban heat island	Location and extent of tree canopy and shaded areas near infrastructure; location of low-income neighborhoods with sparse shade/tree canopy; tree species	USFS tree canopy cover data ; local data collection, crowdsourced data (see i-Tree tools); real-time temperature monitoring	Increase in canopy in focus areas; reduced gaps in continuous canopy cover; target mix of fast- and slow-growth canopy trees; reduction in street-level ambient air temperature; surface temperature reduction
Flooding	Maps showing frequent inundation; infrastructure located in flood-prone areas	Local GIS flood map layer; FEMA Flood Map Service Center	Reduced number of affordable housing units damaged from flooding per year in target neighborhoods; number of flood mitigation projects in target neighborhoods

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Managing Shared-Use Micromobility

[PAS QuickNotes 86](#)

Shared-use micromobility is an accessible, user-friendly mobility option, but thoughtful planning is needed to maximize its benefits and minimize potential nuisance issues. Read this briefing paper to understand how to make sure that shared-use micromobility deployment supports community goals.



Planning Accessible Communities

[PAS Memo 117](#)

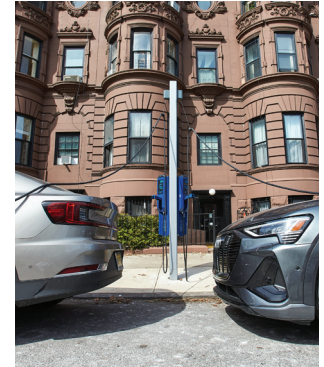
Planning with an accessibility mindset goes beyond ADA compliance in the built environment to encompass methods for inclusive community engagement. Read this article to learn how to engage people with disabilities and meet their accessibility and mobility needs.



Achieving Vision Zero in Practice

[PAS Memo 118](#)

Though many U.S. cities have adopted Vision Zero goals of zero traffic deaths, most are still struggling with rising injuries and deaths on their roadways. Read this article to learn how one city is using quick-build tools and a safe-system approach to achieve its Vision Zero goals for safer streets.



Planning for On-Street EV Charging Infrastructure

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