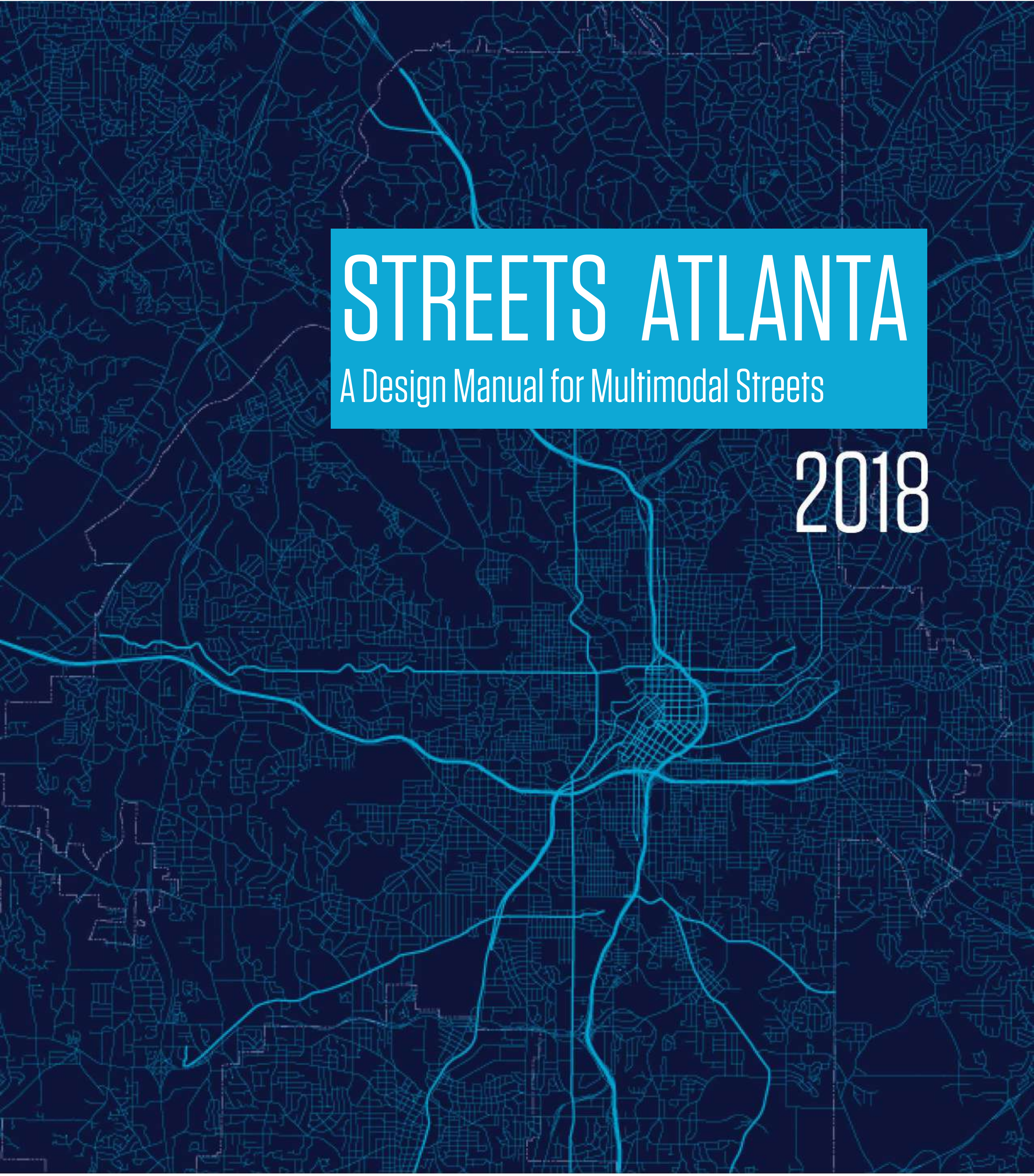


STREETS ATLANTA

A Design Manual for Multimodal Streets

2018

ATLANTA'S
TRANSPORTATION PLAN
The Access Strategy for Atlanta City Design

Table of Contents

Chapter 1

INTRODUCTION TO THE GUIDE

CONTEXT AND PURPOSE OF THE GUIDE

A growing number of communities are discovering the value of their streets as important public spaces for many aspects of daily life. People want streets that are safe to cross or walk along, offer places to meet people, link healthy neighborhoods, and have a vibrant mix of retail. More people are enjoying the value of farmers' markets, street festivals, and gathering places. And more people want to be able to walk and ride bicycles in their neighborhoods.

People from a wide variety of backgrounds are forming partnerships with schools, health agencies, neighborhood associations, environmental organizations, and other groups in asking their cities to create streets and neighborhoods that fit this vision.

Neighborhoods across the City of Atlanta have begun initiatives to make Atlanta streets and streetscapes more walkable, livable and economically vibrant. Street festivals such as Atlanta Streets Alive have demonstrated the potential of re-envisioning Atlanta streets for active transportation. Street food and farmer's markets show the increasing demand for local, nutritious food easily accessible to Atlanta neighborhoods. Atlanta City Design represents a new vision for how Atlanta can grow and the BeltLine is connecting neighborhoods to retail, greenspace and activity centers.

If the growth envisioned by Atlanta City Design is to be achievable, Atlanta must shift its transportation modal balance by taking advantage of the potential for increasing mobility and transportation options. In 2010, only 69% of Atlanta residents over 16 drove alone to work. 10.8% took public transportation, 8.4% carpooled, and 6.4% worked from home. 3.7% of residents walked to work in 2010, while 0.5% biked to work. In order to shift these numbers, it is necessary to make active, balanced and multi-modal streets design a priority to "make the healthy choice the easy choice."

An increasing number of cities are looking to modify the way they design their streets. They are often stifled by standards and guidelines that prevent them from making the changes they seek. Streets Atlanta: A Design Guide for Active, Balanced and Multi-Modal Streets provides an opportunity for the City of Atlanta to design its streets for health, safety, livability and sustainability.

Municipalities depend on street manuals for guidance to design their streets, to retrofit and to modify existing streets with new development, and when new subdivisions are built. Along with land use planning, street manuals play a large role in determining urban form. Street manuals, in effect, serve as the DNA for streets. As such, they help to determine how walkable and bicycle-friendly neighborhoods and communities are, how conducive cities are to transit use, and how livable communities become.

The manuals that many jurisdictions use today embody principles based on moving motor vehicle traffic as the primary role of streets. The result is many wide, high-speed streets that move cars but compromise other important community goals and work against present day community needs. Common direct outcomes of existing manuals include the following:

- Streets that are difficult and unsafe for pedestrians to cross
- Streets that are difficult or unsafe to bicycle
- Streets that discourage the use of alternative modes of transportation
- Streets that encourage unsafe motorist speeds, compromising safety and quality of life in surrounding neighborhoods
- Narrow sidewalks that are uncomfortable to walk along
- Streets that do not support intended land uses

These indirectly cause a number of problems for communities, including the following:

- Rising rates of diabetes, heart disease, cancer, and other negative health outcomes of sedentary lifestyles
- Lack of mobility and accessibility for low-income, carless households
- Unnecessary driving for short trips
- Overconsumption of energy and air pollution

ACKNOWLEDGEMENTS

Streets Atlanta is a project of the City of Atlanta Department of City Planning and is designed to accompany the Atlanta's Transportation Plan as a companion implementation document. The guide was produced in coordination and consultation with city and regional agencies and stakeholders, including:

- Department of City Planning
- Department of Public Works
- Department of Watershed Management
- Department of Parks & Recreation
- Mayor's Office of Cultural Affairs
- Mayor's Office of Sustainability
- Atlanta City Council
- Atlanta BeltLine, Inc.
- Buckhead Community Improvement District
- Atlanta Downtown Improvement District/ Central Atlanta Progress
- Midtown Alliance
- Metropolitan Atlanta Rapid Transit Authority (MARTA)
- Georgia Department of Transportation (GDOT)
- Atlanta Regional Commission (ARC)
- Georgia Regional Transportation Authority (GRTA)
- The PATH Foundation
- Trees Atlanta
- Atlanta Bicycle Coalition
- PEDS


FedEx

ORIGINS OF THE GUIDE

The guide began as the Streets Atlanta Design Guide and was adapted from the Model Street Design Manual, a project of the Los Angeles County Department of Public Health and funded through a Centers for Disease Control and Prevention Communities Putting Prevention to Work grant. A team including many of the top street designers in the United States produced the Model Street Design Manual. The team was comprised of experts from traffic engineering, transportation planning, land use planning, architecture, landscape architecture, public health, sociology, and other disciplines. The team also included experts serving in leadership roles for the following national and local organizations:

- American Association of Retired Persons (AARP) Public Policy Institute
- American Society of Landscape Architects
- Association of Pedestrian and Bicycle Professionals
- California Department of Health Services
- California Strategic Growth Council
- City of Long Beach
- City of Los Angeles Planning Department
- Council for Watershed Health
- Congress for the New Urbanism
- Federal Highway Administration
- Green Los Angeles Coalition
- Institute of Transportation Engineers
- Los Angeles Chapter of the American Institute of Architects
- Los Angeles County Department of Public Health
- National Complete Streets Coalition
- Project for Public Spaces
- Safe Routes to School National Partnership
- Smart Growth America
- UCLA Luskin Center for Innovation

The multidisciplinary nature of this team created concepts for streets that reflect viewpoints from various perspectives and lenses.

This guide is suitable for adoption by the City of Atlanta to guide the planning and design of streets. This is a necessary first step in properly incorporating the provisions of the street manual. However, departments and partner agencies will have to take additional steps to ensure that their implementation practices are modified to reflect the recommendations of this guide.

City agencies and partners will likely need to review their approach to street design through all stages of the process, from advance planning through preliminary design and construction. Critical points will include project identification, preliminary cost estimates for funding, and a multi-disciplinary approach to preparation of design drawings.

During adoption, as well as after adoption, the City of Atlanta will need to ensure that its various departments are all operating with the same practices. These include departments and agencies, such as, but not limited to, Department of City Planning, Department of Public Works, Department of Watershed Management, Atlanta BeltLine Inc., Renew/TSPLOST Atlanta and others.

SCOPE OF THE GUIDE

There are a wide range of design guidelines and standards that have been developed for projects within the public right-of-way at various levels of governance and by multiple professional organizations. The Streets Atlanta manual has been developed to clarify any potential conflicts between these various standards, and to condense them into a single, easily-referenced manual containing clear design guidelines for typical projects within the City of Atlanta's right-of-way. However, the Streets Atlanta manual is not intended to serve as an exhaustive compendium of all existing transportation design standards applied across all possible project scenarios. As such, Streets Atlanta contains references to other manuals that should be consulted for projects that require a higher degree of technical specificity. In short, this manual is intended to be the primary source of design guidance for the majority of projects impacting Atlanta's streets.

While the guidance and standards presented within this manual conform to established regulatory standards and reflect current best practices in transportation design, strict adherence to them is not intended to supersede sound professional engineering judgment.

LEGAL STANDING OF STREET MANUALS

The City of Atlanta generally follows established standards for designing streets. It may be necessary to clarify which standards the City should apply, what is considered guidance, when the City can adopt its own local standards, and when they can use designs that differ from existing standards. It is critical to understand how adopting this guide meshes with other standards and guides. The most important of those standards and guides are the following:

- The American Association of State Highway and Transportation Officials' (AASHTO): A Policy on Geometric Design of Highways and Streets ("Green Book")
- The AASHTO Guide for the Development of Bicycle Facilities
- National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide and Urban Street Design Guide
- The Georgia Department of Transportation Design Policy Manual
- The most recent edition of the Manual on Uniform Traffic Control Devices (MUTCD)
- The Georgia/International Fire Code
- The Georgia Code (Transportation, Vehicles and Traffic)
- Local manuals and street design standards (Standard Details for Work in the Public Right-of-Way)
- The City of Atlanta Code of Ordinances

A discussion of the federal-aid roadway classification system helps to frame the requirements of each of these documents. Local governments that wish to use certain federal funds must use a street classification system based on arterials, collectors, and local streets. These funds are for streets and roads that are on the federal-aid system. Only arterials and certain collector streets are on this system. In the City of Atlanta, many federal-aid roadways are state roads or highways, but also include some streets within the City's right-of-way.

Refer to the Georgia Department of Transportation (GDOT) Functional Classification Map for Fulton and DeKalb County for the most current Functional Classification maps.

American Association of State Highway Transportation Officials (AASHTO): A Policy on Geometric Design of Highways and Streets (i.e "Green Book")

The "Green Book" provides design guidance for geometric alignments, street width, lane width, shoulder width, medians, and other street features. The Green Book applies only to projects constructed along the National Highway Performance Program (NHPP) or state highway systems, and projects constructed with federal or state aid. These are generally interstate highways, freeways, principal routes connecting to them, and roads important to strategic defense. Although the Green Book's application is limited to these streets, some cities apply it unilaterally to all streets.

Further, the Green Book provides guidance that cities often unnecessarily treat as standards. The Green Book encourages flexibility in design within certain parameters, as evidenced by the AASHTO publication A Guide to Achieving Flexibility in Highway Design. For example, 10-foot-wide lanes, which cities often shun out of concerns of deviating from standards, are well within AASHTO guidelines.

NATIONAL AND STATE MANUALS AND POLICIES

GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT) DESIGN POLICY MANUALS

The GDOT Design Policy Manual (DPM) applies to projects along state highways and state bikeways, as well as transportation projects funded by GDOT. The DPM includes design specifications for public rights-of-way, such as sidewalk and lane widths, sight line requirements, acceptable motor vehicle level of service, etc. The DPM does not establish legal standards for designing local streets. However, like the Green Book, some cities apply it unilaterally to all streets.

AASHTO GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES

In order to facilitate accomodation of bicycle transportation in all roadways, AASHTO issues bicycle facility design guidelines, including some minimum criteria. These guidelines apply to projects along state highways and state bikeways, as well as transportation projects funded by GDOT and FHWA. Design guidelines include criteria for facility selection, designation of bicycle routes, and design details for roadways including bicycle facilities. The latest version of the guide was released in 2012.

NATIONAL ASSOCIATION OF CITY TRANSPORTATION OFFICIALS (NACTO)URBAN BIKEWAY DESIGN GUIDE

NACTO has developed a handbook for national and international best practices in urban bikeway design. The guide includes design details for local jurisdictions with treatments that are required, recommended, and optional. The City of Atlanta Department of City Planning and Department of Public Works offcially endorsed the guide in 2011. The Federal Highway Administration has recently released MUTCD guidance on bikeway treatments recommended in the Urban Bikeway Design Guide.

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)

The MUTCD provides standards and guidance for the application of all allowed traffic control devices including roadway markings, traffic signs, and signals. The MUTCD defines “traffic control devices” as signs, signals and markers intended to provide guidance in order to minimize traffic crashes.

The Federal Highway Administration oversees application of the MUTCD. Georgia cities must follow the MUTCD, as Georgia has adopted the 2009 MUTCD. Additionally, the City of Atlanta mandates adherence to the MUTCD in all official traffic control devices (Department of Public Works Public Right-of-Way Manual). Traffic control devices include traveled-way design (and bicycle facility design).

The rules and requirements for the use of traffic control devices are different than for street design criteria. Local agencies have limited flexibility to deviate from the provisions of the MUTCD in the use of traffic control devices due to the relationship between the MUTCD and state law. Agencies do not generally have the flexibility to develop signs that are similar in purpose to signs within the manual while using different colors, shapes, or legends. Agencies are also not authorized to establish traffic regulations that are not specifically allowed or are in conflict with state law. The provisions of the MUTCD and related state laws thus make it difficult to deploy new traffic control devices in Georgia. This can result in complications, especially in the areas of speed management, pedestrian crossings, and bikeway treatments.

The Federal Highway Administration has procedures that allow local agencies to experiment with traffic control devices that are not included in the current MUTCD. Such demonstrations are not difficult to obtain from the Federal Highway Administration for testing of new devices, especially pedestrian and bicycle facilities, but the requesting agency must agree to conduct adequate before and after studies, submit frequent reports on the performance of the experimental device, and remove the device if early results are not promising.

The MUTCD is amended through experimentation. After one or more experiments have shown benefit, the new devices are sometimes adopted into the manual. For example, several local agencies in Georgia participated in an experimental demonstration of Pedestrian Hybrid Beacon (PHB) signals, which have since been incorporated into the latest version of the MUTCD.

The MUTCD establishes warrants for the use of some traffic control devices. For example, stop signs, traffic signals, and flashing beacons are expected to meet minimum thresholds before installation. These thresholds include such criteria as number of vehicles, number of pedestrians or other uses, distance to other devices, crash history, and more. These warrants often prevent local engineers from applying devices that, in their opinion, may improve safety. For example, trail and/or pedestrian crossings of busy, high-speed, wide arterial streets may need signals for user safety, but they may not meet the warrants.

As with street design guidelines, cities may establish their own warrants or modify those suggested by the MUTCD to suit their context in order to use some traffic control devices. In special circumstances that deviate from their own warrants, cities need to document their reasons for the exception.

GEORGIA/INTERNATIONAL FIRE CODE

The Georgia Fire Code can impact street design in limited circumstances. The state legislature has adopted the International Fire Code with amendments. The International Fire Code is written by a private entity and has no official legal standing unless states or municipalities adopt it, as has been done in Georgia. The primary issue is the requirement for a minimum of 20 feet of unobstructed clear path on streets. To comply with this, streets with on-street parking on both sides must be at least 34 feet wide. This prevents municipalities from designing "skinny" and "yield" streets to slow cars and to make the streets safer, less land consumptive and more hospitable to pedestrians and bicyclists.

There are ways around this requirement. If the local jurisdiction takes measures such as installing sprinklers and adding extra fire hydrants, or the adjacent buildings are built with fire retardant materials, it may be able to get the local fire department to agree to the exception.

Alternatively, the state legislature could repeal its adoption of the 20-foot clear path requirement due to:

- The safety problems associated with the resulting excessively wide streets
- The contradiction that this provision causes with properly researched guidelines and standards by the Institute for Transportation Engineers, the Congress for the New Urbanism, AASHTO, and others for streets under 34 feet wide
- The potential liability that the 20-foot clear provision creates for designers who maintain, modify, or design streets that do not provide 20-foot clear paths

It is likely that the state legislature was unaware of these issues when it adopted the code.

THE GEORGIA CODE: PUBLIC TRANSPORTATION, MOTOR VEHICLES AND TRAFFIC

The Georgia Code (Title 32 and 40) includes laws that must be followed in street design. For example, the public transportation code includes provisions regarding the maintenance and construction of municipal streets, curb ramp construction standards, and road classification. The Motor Vehicles and Traffic code includes provisions regarding the use of traffic control devices and the "uniform rules of the road" (speed limits, pedestrian and driver right of way, etc.)

LOCAL STREET POLICIES

The City of Atlanta recognizes that the design of roads requires professional engineering judgment. As a result of concerns about litigation, designers may tend to be very conservative in their approaches to road design and avoid innovative and creative approaches to design problems. While it is important for design engineers to do their jobs as thoroughly and carefully as possible, certain problems may not respond to standard designs. Designers are encouraged to take the approach that their skills, experience, and judgment are still valuable tools that should be applied to solving design problems and that, with reliance on complete and sound documentation, liability concerns need not be an impediment to achieving good road design.

The reference most often used by road designers is the Green Book. Although the Green Book is often viewed as dictating a set of national standards, this document is actually a series of guidelines on geometric design within which the designer has a range of flexibility. While the Green Book provides guidance on the geometric dimensions of the roadway, including such considerations as: widths of travel lanes, medians, shoulders, clear zones, shape of medians and turning radii; not every aspect of design is directly addressed in the Green Book. Likewise, the DPM or the Urban Bikeway Design Guide cannot respond to every design problem which is only generally addressed by such broad guidance documents.

This guide may include certain practices, standards and guidelines that expand on criteria addressed in the Green Book, DPM and Urban Bikeway Design Guide and may include deviations from these guidelines, where permitted. This falls within the range of acceptable practice allowed by those nationally- or locally-recognized design standards referenced in this document and are supported by guidelines or recommended practices from other organizations such the Institute of Transportation Engineers (ITE), the Urban Land Institute (ULI) and the Congress for the New Urbanism ("CNU"). Please note however, that the adherence to the City's standards may or may not be dispositive with respect to establishing that a particular design meets the standard of care required for design engineers to any greater degree than adherence to any other standard. The City has developed guidelines and standards which more precisely address certain design criteria that are adopted for its local purposes and has based those guidelines and standards on a careful review of their reasonableness and general application. The City cannot guarantee that its local design standards will relieve a designer from potential liability even where the design for a particular project is approved by the City and installed as designed. No part of this guide is intended to relieve a designer from potential liability and cannot be construed as an offer to defend any design or designer or waive any right of the City to any immunity to which it may be entitled.

To solve a specific design problem, the City may, from time to time, implement or approve experimental projects when no guidance is provided by other standards. Often these experimental projects are conducted because the designer has reason to believe that the new or evolved design will be safer or otherwise more effective for some purpose than if the project was undertaken under prevailing standards. When an experimental project is proposed, it shall be undertaken using the best available information which shows that the design is reasonable even when there is no nationally or locally published guideline or recommendation to support it. However, such experimental projects shall be implemented or approved under a well documented and defined process that includes monitoring of its effectiveness so that it can be modified if necessary. As discussed elsewhere in this section, documentation of the rationale for any design is a key part of the process and with an experimental process; such documentation is likely to be more extensive. Such documentation is not only useful if the design is challenged but it may provide the basis for later adoption as a part of the local standards.

Adherence to accepted standard practices may not automatically establish that reasonable care was exercised. Conversely, deviation from the guidelines, does not automatically establish negligence. The best defense for a design engineer is to present persuasive evidence that the guidelines were not applicable to the circumstances of the project or that the guidelines could not be reasonably met. (It should be noted that an "economic defense" may not be the most effective.) It is highly recommended that designers document their rationales for decisions. If the justification documented by a designer completely describes the physical and environmental factors that make any design necessary, it is likely that this will be legally persuasive that the correct procedures were followed and ultimately the appropriate decision was made. In addition, it is helpful to have statements by other design experts who concur with the decision in the documentation.

The City has the obligation under state law to plan, designate, improve, manage, control, construct, and maintain an adequate street system and is responsible for all construction, maintenance, or other work related to its street system. The expected results of the design approaches presented in this document are intended to improve the safety, livability, and aesthetics of the street system and the City in general. Unfortunately, there is no way to prevent all crashes or lawsuits but the adoption of policies, guidelines and standards, including even experimental projects incorporating reasonable precautions is an approach that is believed to lessen the frequency and severity of crashes and that can be argued to decrease liability.

THE CITY OF ATLANTA CODE OF ORDINANCES

The City of Atlanta Code of Ordinances defines the subject matter of municipal law. For the purposes of this design guide, the applicable sections of the code are: Part 15-Land Subdivision Ordinance, Part 16 - Zoning, Chapter 138 – Streets, Sidewalks and Other Public Places, and Chapter 150 – Traffic and Vehicles. These sections of the Code provide requirements for the public right-of-way.

THE CITY OF ATLANTA PUBLIC RIGHT-OF-WAY MANUAL

The City of Atlanta's Public Right-of-Way Manual serves as a reference to anyone needing general information regarding activities conducted under a permit, franchise agreement, or special agreement within the City's public right-of-way. It attempts to address typical issues and frequently asked questions. It does not include a discussion or information concerning every issue arise regarding the City's public right-of-way. Additional information can be obtained from the City's Department of Public Works. Please refer to the Appendix of this Guide for the full Manual.

THE CITY OF ATLANTA STANDARD DETAILS - PUBLIC RIGHT-OF-WAY

The City of Atlanta requires certain rules and guidelines for all work in the public right-of-way. Permitted work in the City's public right-of-way must follow Standard Details approved and provided by the City of Atlanta. At the time of adoption, the City of Atlanta Standard Details - Public Right-of-Way were available electronically through the City's Department of Public Works. They can be found in downloadable PDF form or downloadable .DWG files to be used with the CAD software. They can be found at http://www.atlantaga.gov/index.aspx?page=895

This page is intentionally blank

Chapter 2

PROJECT DEVELOPMENT AND COMMUNITY ENGAGEMENT

Effective community engagement is critical when developing policies and projects that make a community's built form more livable and more supportive of active transportation. There are many benefits of effective community engagement in projects influencing the built environment.

This chapter outlines the transportation project development process for projects in the City of Atlanta. This chapter also includes guidelines for the project prioritization and project scoping phases to ensure active, balanced and multi-modal streets principles are incorporated. Additionally, this chapter reviews principles and strategies to engage communities, including developing a plan for reaching out to communities, broadening the list of community stakeholders, fostering cultural competence, and achieving informed consent.

STANDARDS FOR THE PROJECT

Project development often involves multi-party coordination between the City of Atlanta, Community Improvements Dstricts, Atlanta Regional Commission, GDOT and the general public (shown in flowchart on facing page).

The flowchart on the following page illustrates the actions and coordination by various parties during the project development process in the City of Atlanta. The arrows between the Department of City Planning and the Department of Public Works represent coordination actions during the project development process. In general, the Department of City Planning takes the lead during the planning, prioritization and scoping phases, whereas the Department of Public Works acts as the lead during the engineering, permitting, right-of-way acquisition, construction and maintenance/operations phases.

A project may be initiated by the Department of City Planning, Department of Public Works, City Council, citizens and/or transportation partners. Generally, projects identified for implementation are pulled from an adopted transportation plan, most likely the Atlanta's Transportation Plan. Exceptions to this rule are projects initiated due to maintenance or operational needs (i.e. poor pavement condition or outdated traffic signal equipment). Once a project has been identified for implementation, a project scope and planning level cost estimate is developed by the Department of City Planning with significant input from citizens and transportation partners. Typically, a public open house will be organized. After a final scope has been drafted, funding options are considered and a finance plan is developed. Funding for project implementation is often a mixture of local and federal funds routed through the Atlanta Regional Commission, Federal Transit Administration and/or GDOT. Generally, City Council approval is required as part of this process.

Once the project is scoped and the funding is secured, project management is assumed by the DPW. From this point onward, a concept report is drafted with assistance from the Department of City Planning and transportation partners.

Construction of the project is overseen by the Department of Public Works. In most cases, operations and maintenance is also overseen by the Department of Public Works. The Department of City Planning coordinates community involvement throughout the project development process. Community engagement efforts may differ depending on the potential impact and scale of the transportation project, the funding source, and the communities affected.

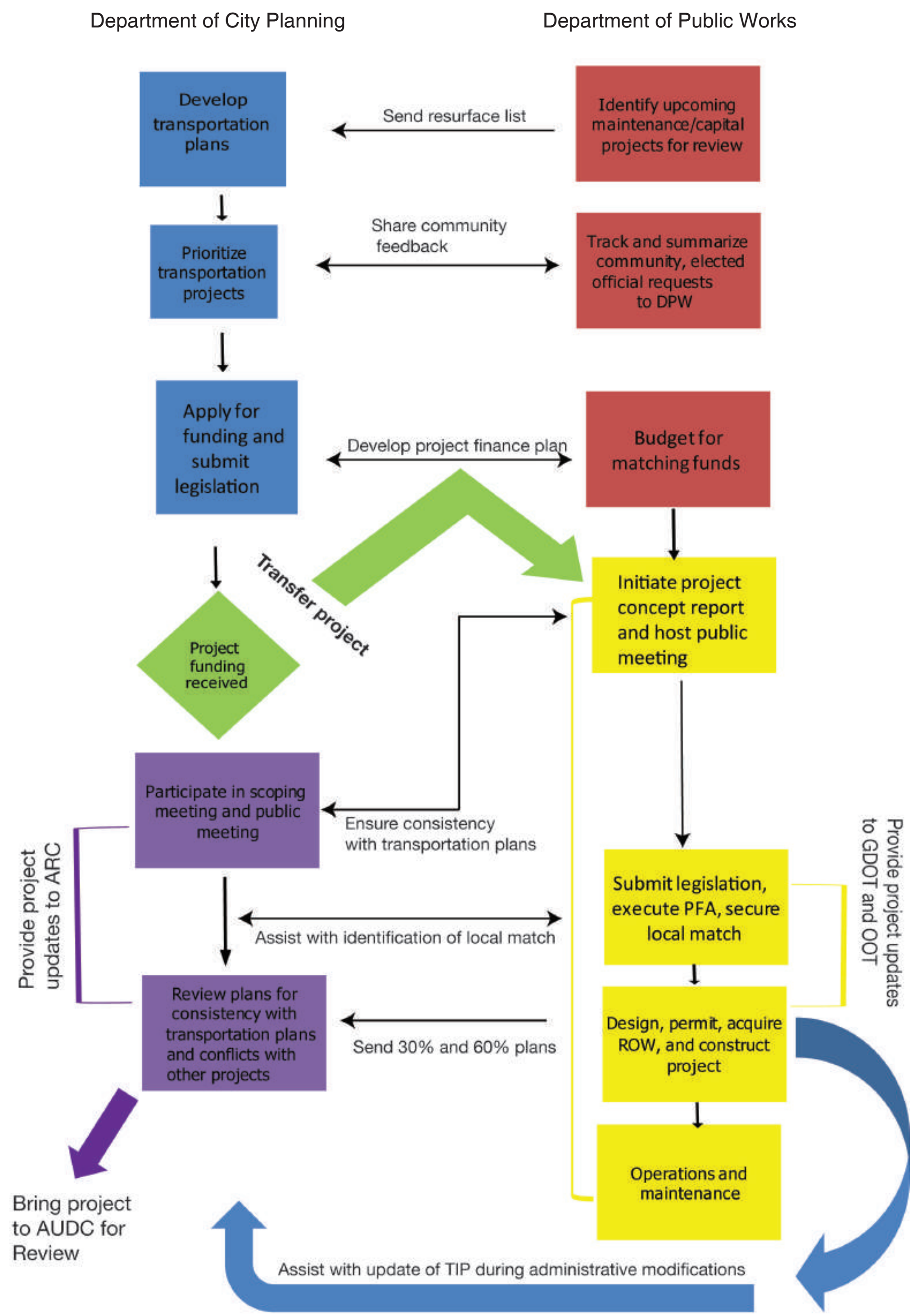


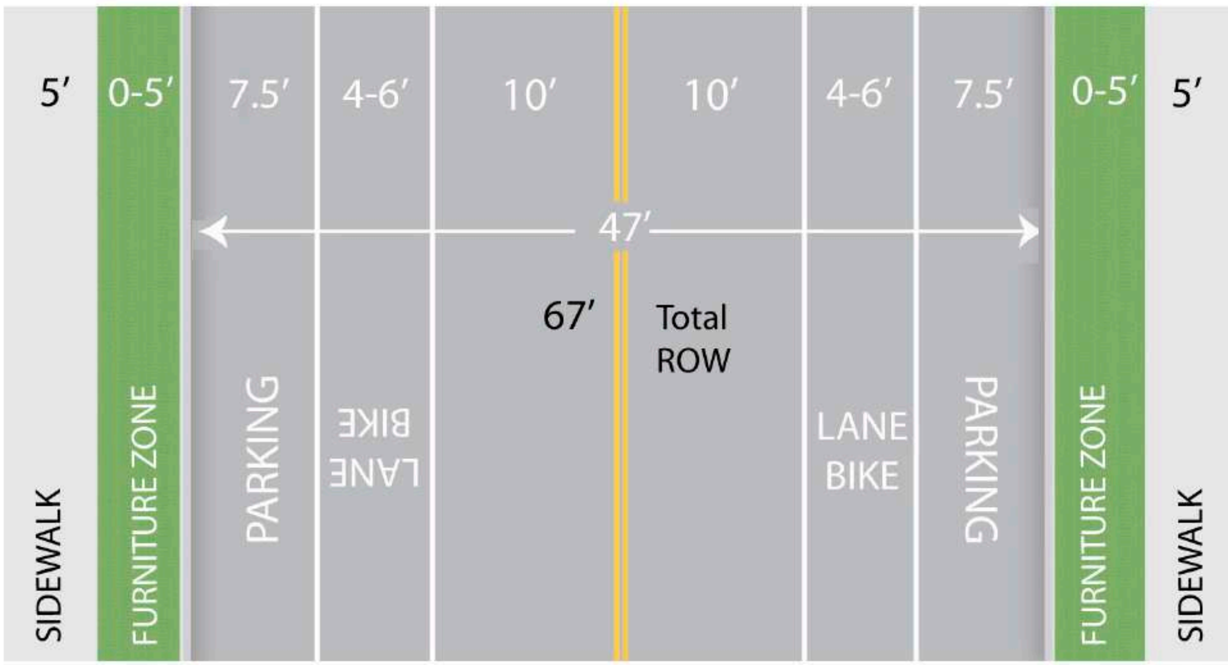
Table 2-1: Department Responsibility during Transportation Project Management

Tasks	DPD Department of City Planning	DPW Department of Public Works
Develop & amend transportation plans	Primary	Review & comment
Track community and City Council maintenance/operations requests	N/A	Sole
Identify upcoming maintenance/operations projects	Review & comment	Primary
Review upcoming maintenance/operations projects for leveraging opportunities	Primary	Supportive
Prioritize transportation projects	Primary	Supportive
Develop project scope & planning level cost estimate	Primary	Supportive
Manage public involvement	Primary	Supportive
Apply for outside funding	Sole	N/A
Budget for matching funds	Supportive	Primary
Receive & budget outside funding	Supportive	Primary
Secure engineering consultant	N/A	Sole
Consider parking modification & multi-modal street retrofit	Supportive	Primary
Draft project concept report	Supportive	Primary
Ensure that concept is consistent with adopted transportation plans & policies	Sole	N/A
Environmental permitting	N/A	Sole
Existing conditions survey (including detailed ADA & signage survey)	N/A	Sole
Engineering level cost estimate	N/A	Sole
30% Plans	Review & Comment	Primary
60% Plans	Review & Comment	Primary
90% Plans	Review & Comment	Primary
Submit request for additional outside funding	Primary	Supportive
Final Plans	Copy for files	Primary
Acquire ROW	N/A	Sole
Manage bidding process	N/A	Sole
Manage construction	N/A	Primary
Operations & Maintenance	N/A	Primary
Report on project progress to outside agencies (ARC, GDOT, etc.)	Primary	Supportive

BASIS OF DESIGN

For transportation projects to be active, balanced and complete, the basis of design must be pragmatic. Transportation projects consisting of an entirely new street should utilize the design bases and cross-sections laid out in the new roadway construction section explained in Chapter 4. Transportation projects consisting of a reconfiguration or reconstruction of the right-of-way should utilize the design bases listed below (in order of priority and illustrated below).

This Basis of Design may be modified due to right-of-way constraints, need for additional pedestrian facilities or motor vehicle capacity, topographical or stormwater management considerations. However, it is assumed that bicyclists, motorists and pedestrian facilities will be included in all active, balanced street designs as a default. As stated in the City of Atlanta Code of Ordinances, bicycle facilities may not be removed from a corridor without approval from the City Council.



The basis of design for the public right-of-way

1. **One 10'-wide vehicle travel lane** in each direction of legal travel (11'-wide for lanes designated as a City of Atlanta freight route and bus routes on arterials and collectors, and 12'-wide lanes for streetcars).
2. **Clear and level sidewalks** are necessary for all streets to be active, balanced and complete. Refer to the Sidewalk table in chapter 6.
3. **Streets identified as a bicycle route** should adhere to design standards found in NACTO's Urban Bikeway Design Guide and chapter 7 of this guide. The bicycle facility should be continuous and accommodate all users. Protected bicycle lanes are preferred on arterial and collector classified streets other facilities should consist of 6'-wide one-way bicycle lanes elsewhere.
4. **Furniture/tree planting zones** provide a buffer between the sidewalk/clear zone and roadway. It provides the opportunity to incorporate benches, trash receptacles, street lighting, bicycle racks, and other amenities. Refer to the Sidewalk table in chapter 6.
5. **On-street parallel parking lanes** provide an additional buffer between the roadway and other facilities. 7'-6"-wide on-street parking lane should be utilized on local streets (both sides preferred) and collector streets with posted speed limits of 25 MPH.
6. **Additional travel lanes, left-turn lanes or right-turn lanes** where warranted (on-street parking lanes may be tapered at intersections to provide for left-turn and right-turn pockets). Bicycle facilities should not be interrupted for turn lanes, nor parking.

STREET RETROFITS

A typical multimodal street retrofit project reduces the number of general purpose travel lanes to include a two-way left-turn lane, raised median, bicycle lanes and/or on-street parking. These retrofit projects also focus on providing ADA compliant sidewalks, safe and accessible crossing treatments, and safe crossings at bus stops.

The following will be used as standards that apply in developing and defining these projects.

NARROW TRAVEL LANES

10 foot travel lanes are acceptable for most city streets. At a posted speed of 35 mph or less, there is no documented difference in the safety of ten-foot travel lanes and twelve-foot travel lanes (Dumbaugh, E., Safe Streets, Livable Streets, Journal of the American Planning Association

71[3] 283-300).

REDUCE TRAVEL LANES

The following conditions will be considered acceptable bases of design for retrofits:

- Convert a four-lane undivided road to a two-lane roadway with a two-way left-turn lane and two bicycle lanes. This can typically handle up to 20,000 vehicles per day of average daily traffic (ADT), though in some cases capacity may be affected for roads with more than 15,000 ADT. The two-way left-turn lane may be replaced with medianettes and/or pedestrian refuge island in select locations. On-street parking can be substituted for turn lanes where context and conditions warrant
- Reduce seven-lane roads to five lanes for conditions with traffic volumes under 35,000 ADT.
- Remove a travel lane from one-way streets with more than three travel lanes, regardless of volume
- For all roads with greater than 10,000 ADT a corridor analysis should be conducted prior to implementing a road diet.
- Turn restrictions should be evaluated when converting three or four lane roadways to two lane roadways.

STANDARDS FOR TRANSPORTATION ENGINEERING STUDIES

Using motor vehicle LOS as a primary decision making tool encourages widening streets, flaring intersections, and other measures designed to improve traffic flow of motorists. Many of these changes are not appropriate within the City of Atlanta and do not support active and balanced street design. As a result, vehicular LOS within transportation engineering studies must be studied in conjunction with crash and safety data and consideration of all modes of travel appropriate to the street. The following specific standards are based on the Character Area Categories discussed in Chapter 3, "Street Networks."

TRANSPORTATION ENGINEERING STUDIES IN THE DOWNTOWN AND MIDTOWN REGIONAL ACTIVITY CENTER

- Study current year conditions only
- Inform design decisions, signal timing and operational changes
- Analyze the most recently available three years' worth of crash data

TRANSPORTATION ENGINEERING STUDY IN ALL OTHER CHARACTER AREA CATEGORIES

- Study future year conditions only
- Inform design decisions, signal timing and operational changes
- Analyze the most recently available three years' worth of crash data
- If future year conditions are studied, the projected growth rate should be based on the past ten years of GDOT AADT data from nearby survey locations and forecasted travel data from the Atlanta Regional Commission's regional travel demand model, provided the projected growth rate should never exceed two percent per year

Some of these changes can free up additional right-of-way, which can be used to improve neighborhood quality of life through:

The following guidance serves as general best practices for project development.

GUIDANCE FOR PROJECT DEVELOPMENT

NON-PHYSICAL CHANGES FOR STREET RETROFITS

In addition to physical retrofits, city staff should modify existing maintenance and operations programs to provide for active, balanced and multi-modal streets:

- Adjust signal timing to ensure comfortable crossing times for appropriate populations. In areas with aging populations, for example, crossing times may need to be lengthened.
- Signal timing should complement—and be consistent with—posted speed limit. Signal timing can also be used to satisfy operational and safety objectives that promote active, balanced and multi-modal streets. Signal operations can be frequently used to manage speeds via "rest in red", simple coordination to promote progression at desired speeds, and limited green time to dissuade cut through traffic.
- Work with transit agencies to improve bus operations
- Work with schools to support Safe Routes to School Programs

Many of these changes can be made through spot improvement programs. Many are relatively inexpensive. It is not necessary to wait for a full reconstruction project to create an active, balanced and multi-modal street. More substantial retrofits may require reconstruction. A planned resurfacing project is an excellent time to retrofit the corridor to improve aesthetics, comfort, convenience, economic value and safety.

SIGNAGE SURVEYS

When a transportation project includes work in the right-of-way, a survey of existing traffic control signage should be conducted. Unnecessary or non-compliant signage (per the 2009 MUTCD) should be adjusted/removed as part of the transportation project.

PARKING MODIFICATION

During the scoping phase of transportation project development, modification of the existing inventory of motor vehicle parking may be identified as a component of the project. On-street parking modification may be considered in certain street contexts in order to create space for bicycle lanes, wider sidewalks or space for transit (among other uses). Acceptable scenarios for parking modification may include underutilized on-street parking on collector or arterial streets that pass by the back fences of residences rather than the front side. Additionally, areas that have large surface parking lots adjacent to existing on-street parking may be eligible for parking modification.

PARKING DATA COLLECTION AND EVALUATION

An on-street parking modification study should be conducted prior to the removal of on-street parking. Data on the number of vehicles using on-street parking should be collected on four separate occasions, at four separate times (two daytime, one nighttime and one weekend day). If the street is an arterial or collector with no residential frontage, only two parking count and field checks should be performed (one evening and one day). The average number of motor vehicles parked on both sides of the street segment (i.e. block) under study should be calculated in order to justify the feasibility of the following parking configurations:

- Parking removal where utilization average is below 10% in non-residential and residential areas with off-street parking for residents during daytime and nighttime periods
- Single-side parking where average utilization is below 50% and street is wide enough for travel lanes, bicycle facilities, pedestrian facilities and parking on one side.
- Time-restricted parking where special demand or operations exist
- Back-in angle parking where head-in angle parking is present

Utilization average is determined by using the capacity and demand ratio for the street segment under study. For streets with parallel parking, capacity is determined by dividing the linear feet of the parking segments by twenty-two feet (22'). For streets with angled parking at 45 degrees, capacity is determined by dividing the linear feet of the parking segments by thirteen feet (13'). Demand is determined by conducting parking surveys on four separate occasions, at four separate times (two daytime, one nighttime and one weekend day) and averaging the counts for each, and two times (one daytime and one nighttime) on arterials or collectors with no residential frontage. Daytime is between 8:00am and 5:00pm, while nighttime is between 7:00pm and 6:00am. An on-street parking modification plan may be developed if the criteria above are met. If the study reveals the need to retain on-street parking and there is not enough pavement width to accommodate bicycle facilities, staff will analyze the feasibility of re-routing the bicycle route and initiate an amendment to the Atlanta's Transportation Plan.

ON-STREET PARKING MODIFICATION STUDY STEPS

After reviewing the study data, the Department of Public Works should develop alternative roadway cross-sections that optimize the right-of-way for all roadway users. A draft on-street parking modification study, which includes the capacity and demand data and a proposed cross-section, is subject to approval by the Commissioner of Public Works.

After the draft study is approved, the next step is to notify, by regular mail, all residents and NPUs adjacent to the street segment under study. This notification should contain the details of the on-street parking modification study, descriptions of the proposed cross-section, and contact information for the Department of Public Works. The notification should also set the date and location for an open house where the study will be discussed. The open house should occur at least 10 to 14 days after the notice is mailed. If the street is an arterial or collector with no residential frontage, no open house should be held and all comments may be addressed individually.

At the open house, the study will be discussed and feedback will be recorded. The stakeholders and Department of Public Works staff should work toward developing a cross-section that best meets the needs of all roadway users.

If the open house generates a significantly modified proposal, subsequent notices may be sent and a second open house may be held. This gives Department of Public Works staff an opportunity to receive feedback on the modified proposal.

If the proposed cross-section proves to be relatively non-controversial, the Commissioner of Public Works may choose to install the recommended cross-section 14 days or more after the notice is mailed.

If the proposed cross-section proves to be controversial, the Commissioner of Public Works may chose to present the draft study and proposed cross-section to the City Council Transportation Committee for comment. This will give stakeholders an additional opportunity to comment on the proposed cross-section. If the Transportation Committee recommends against proceeding with implementation of the proposed cross-section, Department of City Planning staff may need to amend adopted transportation plans to reflect the decision.

MOBILITY OR SAFETY CONCERNS

In the case where there are mobility or safety concerns, notification will not be mailed. Safety and mobility issues may include any of the following combined or independently: parking in active travel lanes, low parking counts, a roadway classified as an arterial with high operating speeds.

IMPACT TO ADJACENT STREETS

In the event that the on-street parking modification study causes an increase in on-street parking demand on residential, local, or collector streets that is greater than the capacity; the Department of Public Works will attempt to address the increase. This can be done by modifying the study segment cross-section and/or investigating the introduction of residential parking permits on the impacted streets.

GUIDANCE FOR COMMUNITY ENGAGEMENT

Effective community engagement improves the success rates of policies and projects affecting the built environment because it helps the City staff and transportation partners understand and respond to local conditions. Agencies that create true community engagement opportunities are more successful at adapting to socio-economic changes that may influence the effort than those that do not conduct effective outreach (Cogan, E. and Faust, S., Innovative Civic Engagement Tools and Practices in Land Use Decision-Making, April 2010). When people affected by a project are involved from the beginning of the planning process, the likelihood of unexpected or significant opposition when it comes time to implement the project is reduced. Community members also have unique knowledge of local contexts, including political, cultural, and geographic settings. By interacting with the public and gaining local insight, project leaders can shape and direct the project in keeping with the community's vision and needs. It is the policy of the City of Atlanta to ensure full compliance with Title VI of the Civil Rights Act. To ensure that, the public involvement process must be equal, fair, and accessible to all residents. Toward this end, Title VI anonymous demographic questionnaires shall be distributed at all open house and public meetings. Additionally, public meetings must be held at ADA-accessible locations within walking distance (<1/2 mile) of public transit, ideally a heavy rail station or a bus stop served by multiple frequent bus routes.

This chapter does not provide a template for a community outreach plan; it provides general guidance to help project leaders understand important principles and methods of achieving community engagement. With this guidance, a community outreach plan can be developed that utilizes best practices to accommodate local contexts and support community needs in working toward the goal of the project.

During the transportation project scoping phase, the Department of City Planning should develop community outreach plan that describes the project, lists the goals of the outreach effort (definition of success), issues, target audiences, messages that are meaningful and relevant to the audiences, distribution channels, key messengers or speakers, resources available, tools, timelines, desired outcomes, and methods of evaluation and adjustment.

Specific outreach tools may include NPU presentations, open houses, media outreach, paid advertising, surveys, print materials (such as flyers and brochures), PSAs, educational videos, slide presentations, charrettes, newsletters, websites and other online communications, social media, direct mail, letters to the editor or guest commentaries, councils, speakers' bureaus, partnerships, coffeehouse chats, meetings, interviews, demonstrations, bulletin boards, and more.

ACTIVE WORKSHOPS AND DESIGN CHARRETTES

Two tools being used by more and more communities throughout the country are active workshops and design charrettes. Active, or experiential, workshops get participants out into the community to explore firsthand what shortcomings exist and how to improve upon those conditions. Active workshops include educational presentations, but focus on active learning and firsthand experience. Active workshops don't have to be long events. A successful one can be as short as three hours, if planned well.

Charrettes are collaborative sessions to solve design problems. Charrettes usually involve a group of designers working directly with participants to identify issues and create solutions. A charrette can be one day, several days, or weeks. A charrette conducted as part of a public process for a street should include educational activities (such as short presentations and walking audits, sharing of expectations and desired outcomes, priority setting, mapping exercises during which participants break out into small groups and mark-up maps with potential challenges and opportunities) and building consensus or informed consent for a proposed solution or set of solutions. Charrettes create a collaborative planning process that harnesses the talent of residents, townmakers, community leaders, and public health officials alike. At the end of the charrette, project leaders present the outcomes and findings to stakeholder groups and to the public.

Getting all the right people together for a design charrette is essential to ensuring that the outcome reflects the values and goals of the community. People from all sectors of society with diverse backgrounds are needed at a charrette, including local government officials, planners and designers, landscape architects, transportation engineers, nonprofit managers, public health officials, and of course, residents.

Planning and conducting successful active workshops and design charrettes requires attention to the following details:

- Engage key partners early. Identify community-based organizations, government agencies, healthcare providers, employers, school boards, the media, and other organizations whose members or stakeholders may have an interest in the topic. Engage transportation, planning, emergency services, public health, and public works entities early in the planning process, and then enlist their help to conduct outreach and to issue invitations.
- Choose the right audit site. Work with the key partners to identify an audit site that captures the essence of changes needed throughout the community, or one that will have the greatest impact or has the potential to become a model project and serve as a catalyst for other projects.
- Consider comfort and abilities. Give careful consideration to participants' comfort and abilities. Everyone who wishes to take part should be able to do so, and any special needs should be accommodated. Also, if the event is held during hot or cold months, conduct outdoor portions during the most comfortable time of day. Accommodate the needs of participants: for example, providing food allows working people to attend a 7:00p.m. workshop; parents may need an organized play room for children too young to participate in the workshops.
- Encourage relationship-building and provide a next step. Effective workshops and charrettes will motivate and inspire those who take part, and many will be eager to contribute their energies toward enacting change. They will need to draw upon each other's strengths, stay in contact, offer each other support, and share information to undertake the important work to be done. Encourage them throughout the event to network with each other and exchange contact information. If possible, form a "working group" and decide upon a first meeting date; invite people to opt in.

STAKEHOLDERS

To build effective community engagement, city staff and transportation partners should involve a broad set of stakeholders and partners. The overarching goal should be to achieve diversity by involving a demographically and geographically balanced group of people representing various interests and backgrounds.

Stakeholders and partners commonly include city staff, transit operators, advocacy groups, residents, business operators, property owners, elected officials, community leaders, neighborhood safety groups, emergency responders, school representatives, health agencies, community improvement districts, charitable non-profit organizations, faith-based organizations, and regional employers. To be more effective, project leaders also should seek the early involvement of faith-based organizations, news outlets, potential opposition groups, and seasonal residents.

POTENTIAL OPPOSITION GROUPS

Special efforts should be made to identify and reach out to people and organizations that may be expected to oppose the project, to build their trust and involvement. Try to identify and address their concerns both as part of the public process and during special stakeholder interviews or meetings.

Whether internal or external, these concerns should be addressed early in the public process to give the potential opposition time to understand the project, become comfortable with proposed solutions, ask many questions, and decide whether to support the effort. Support is much more likely when these individuals and groups have been invited into the process early and have been included as key stakeholders. If participants feel as though the outcome is their plan, they are less likely to oppose it. By working side-by-side with other stakeholders, they learn to appreciate and accommodate others' points of view. Moreover, opposing groups often bring legitimate concerns to the design process. Through their involvement they can improve projects.

Conducting effective outreach to news outlets is important to the success of any community engagement effort. The news media are more than simply a means to get the word out about the project. Rather, project leaders should try to build capacity among news organizations, just as the outreach effort seeks to build capacity among community members; building relationships with reporters helps ensure the general public is receiving accurate, timely, and meaningful information about the project.

The lead agency's communications department should be consulted to provide guidance, expertise, and tools, but project leaders should remain very engaged in the media outreach effort. Project leaders should be committed to working within the agency's communications protocols, such as complying with a gatekeeper policy if one exists. If a communications department isn't available, the following paragraphs provide general guidance.

MEDIA AS A STAKEHOLDER

Conventional community outreach plans have treated the media as a means of simply disseminating information. A more effective approach is to engage members of traditional and non-traditional news outlets alike (newspapers, television, radio, online news services, bloggers, etc.) as stakeholders and seek their involvement early in the process. Just as project leaders should build capacity amongst residents and within the community, so too should they seek to build capacity with journalists and news outlets. The media can also help projects move forward with positive editorials and favorable reporting.

FOSTER CULTURAL COMPETENCE

Ensuring that programs and messages are designed to be relevant, appropriate, and effective in different cultures and different languages is vital to conducting successful community outreach. In fact, cultural competence has emerged as a key strategy to improving health and the quality of healthcare and social services for everyone in the U.S. regardless of race, ethnicity, cultural background, or language proficiency.

Translating important messages requires strong cultural knowledge, because "simply replacing one word with another won't do" (Zarcadoolas, C. and Blanco, M., Lost in Translation: Each Word Accurate, Yet...,Managed Care Magazine. August 2000). But reaching people of all backgrounds often requires more than simply translating messages. Even in urban communities, messages perceived to have been created by "outsiders" can actually do more harm than good by creating discomfort or mistrust.

When culturally adapting messages, consider the following:

- Start with strong cultural knowledge. Tap the knowledge of in-house staff or consultants who live, work, or grew up in the culture.
- Language doesn't equal culture. Although a shared language is important to culture, people who speak the same language often are from different cultures. Be sensitive to the differences and develop appropriate messages.
- Get feedback. Work directly with members of the audience to determine appropriate approaches. Use focus groups to screen messages before they are distributed.

ACHIEVING INFORMED CONSENT

The goal of informed consent is not compromise, where everyone must give up something. Informed consent is based on the assumption that most people will give their consent to a change, even when it is not in their personal best interest, after they have been engaged, become informed, and see the value to their community.

The steps of the informed consent process are as follows:

DESIRE

The public process comes about as a result of a community coalescing around a desire for a change in its built form. Though desire comes in different forms, it is the necessary energy and often passion used to steer the project towards a sustainable and community-oriented outcome.

DISCOVERY

Discovery is the process of developing a complete and common understanding of the situation, context, and the built vision by the design team and the stakeholders. Context is a short form for the physical, social, historical, fiscal, environmental, political, and climatic contexts. Good discovery is done by

- Listening, looking, and involving people
- Visiting, reading, and probing
- Educating and exploring physically and intellectually

DESIGN

Design is the employment of people, their related skills, and what they discovered to produce products that articulate, memorialize, and motivate people towards the consensus outcomes and the vision. It tends to be the most exciting part of the process. This is when collaborators can raise the bar in terms of creativity and sustainability.

DISCUSSION

Discussion happens throughout and requires the right people/stakeholders with the capabilities present at the right times in order to maximize short feedback loops. It is the discussion phase that builds and overcomes uninformed decision making. If grassroots planning is to work, people must become informed on what helps build a community. With the combination of a strong desire and community leadership the sense of frustration will be overcome, but this must come with an informed neighborhood. Discussion involves

- A series of presentations to raise stakeholders' knowledge
- Testing/viewing the design and parts of the design from a variety of perspectives
- Circling back to alter parts that need altering
- The project manager must prepare the community to "sell" its vision to others. True ownership of a vision comes from within.

DOCUMENTATION

Documentation starts at the beginning of the project but the effort is highest towards the end when the products are finalized. Example products include documents, posters, codes, speeches, agreements, construction drawings, and advice. This documentation works best when designers anticipate pushback. Messages must be clear, concise, comprehensive, and attractive to draw people in.

The strategies on the following page can be helpful in implementing projects.

GUIDANCE FOR IMPLEMENTATION STRATEGIES

SECURE AND LEVERAGE THE SUPPORT OF KEY PARTNERS EARLY

They may be members of the chamber of commerce, influential elected leaders, chief planners of agencies, or community advocates. Leverage their support by ensuring other key partners are aware of their buy-in.

USE DATA APPROPRIATELY

Too many communities don't implement projects because they lack data, or conversely, they rely on it too heavily. Presented with too much, people may argue over its meaning, leading to projects not being built and community members losing trust in project leaders. Some data is needed to ensure the context is properly understood. Thus, conducting research to collect basic data is necessary, but street design projects also should be driven by commonly held values in the community.

BUILD MODEL PROJECTS

Model projects can be examples of how streets can work better, especially when building something that is new for the community, such as a non-conventional crossing, a road diet, reverse-in angled parking, mini-circles, or roundabouts. Build model projects first in areas with strong backers and the greatest chances for success. If the vision is to have modern roundabouts in a dozen locations, start with the location with the most enthusiasm and support. Enlist local leaders to attend meetings, submit letters to the editor, and conduct other outreach that explains why the neighborhood wants the new feature.

EVALUATE BUILT PROJECTS

Don't just build a project: evaluate it. For example, a 30 percent increase in people walking, 20 percent more bicyclists, a reduction in vehicle speeds of 7 mph, 120 column inches of positive newspaper coverage, and other metrics can validate the project and build support for similar projects. Use other performance-based measures to evaluate success not only of the project, but also of the public process that led to it. Evaluations can assess the assumptions and the planning processes that lead to changes. Assessment of the planning process includes evaluations of how well the project performed. Evaluation can include the following:

- Did the project meet the commonly-held community vision?
- Important projects that benefit all members of the community are the first to be built. Did those built reflect the community's priorities?
- Did the project provide long-term benefits to all people?
- Did the process allow for adequate time to respond to plans?
- Were there any legal actions or complaints about the public process that could have been reduced or eliminated?
- How can the public process improve?

Community engagement is a vital part of the project development process and is particularly important for successful project implementation. Creating successful community engagement through effective outreach is a significant investment of resources, but many of those resources already exist in-house and simply need to be committed to the effort. For policy-making bodies, government agencies, health agencies, and community organizations that understand the value, benefits, and processes of creating successful community engagement, the effort provides a clear return on investment.

Chapter 3

STREET NETWORKS

A sustainable street network provides a pattern of multimodal streets that serves all community land uses and facilitates easy access to local, city, and regional destinations. It results in distribution of traffic that is consistent with the desired function of the street. One characteristic of this pattern is that it offers many route choices that connect origins with their destinations.

Interconnected streets improve traffic safety. Hierarchical street patterns (arterial-collector-local) with cul-de-sac subdivisions depending on arterials do not perform as well as sustainable street networks and cause more traffic crashes. Hierarchical street networks divert traffic to high-speed arterials that have large intersections. Most crashes occur at intersections. The speed at which motor vehicles move on these arterial streets increases the likelihood and severity of crashes.

SAFETY

A 2011 study of 24 California cities found a 30 percent higher rate of severe injury and a 50 percent higher chance of dying in cities dominated by sparsely connected culs-de-sac compared with cities with dense, connected street networks (Marshall, W. and Garrick, N., Does the Street Network Design Affect Traffic Safety? Accident Analysis and Prevention 43[3]: 769-781). A 2009 study from Texas found that each mile of arterial is associated with a 10 percent increase in multiple-vehicle crashes, a 9.2 percent increase in pedestrian crashes, and a 6.6 percent increase in bicyclist crashes (Dumbaugh, E., R. Rae, Safe Urban Form: Revisiting the Relationship between Community Design and Traffic Safety, Journal of the American Planning Association 75[3]:309-329).

1985 City of Atlanta Downtown Urban Design Plan Existing Conditions

Interconnected streets increase the number of people walking and bicycling and reduce motor vehicle miles traveled. Connectivity enables people to take shorter routes. It also enables them to travel on quieter streets. Shorter routes on quiet streets are more conducive to bicycling and walking. The California study cited above found that places with a dense, connected street network had three to four times more people walking, bicycling, or using transit to get to work. This in turn led to a 50 percent reduction in vehicle miles traveled per capita in these cities (Marshall, W. and Garrick, N., The Spatial Distribution of VMT Based upon Street Network Characteristics,"90th Meeting of the Transportation Research Board, Washington, D.C., January 2011).

Interconnected streets allow more effective emergency response. Studies in Charlotte, NC found that when one connection was added between cul-de-sac subdivisions, the local fire station increased the number of addresses served by 17 percent and increased the number of households served by 12 percent. Moreover, the connection helped avoid future costs by slowing the growth of operating and capital costs; most of the cost to run a fire station is in salaries. Furthermore, Congress for the New Urbanism's report on emergency response and street design found that emergency responders favor well-connected networks with a redundancy of routes to maximize access to emergencies. Emergency responders can get stuck in culs-de-sac and need options when streets are congested (Effect on Connectivity on Fire Station Service Area and Capital Facilities, 2009 presentation by the Charlotte Department of Transportation).

These studies and others provide strong evidence that the benefits of a well-designed street network go beyond safety. They also support environmental, social, and economic benefits. Street networks shape land use markets and support compact development, in turn decreasing the costs of travel and providing utilities. Street networks like these are resilient over hundreds of years and accommodate changing technology, lifestyles, and travel patterns. Interconnected street networks can preserve habitat and important ecological areas by condensing development, reducing city edges, and reducing sprawl.

Interconnected street network with small blocks

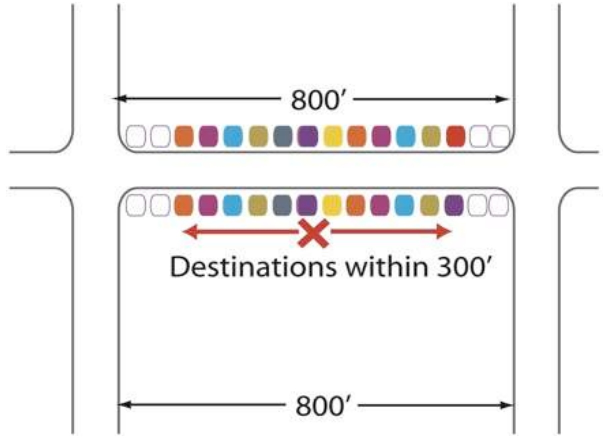
Cul-de-sac developments break up connectivity and create longer trips

(Credit: Michele Weisbart)

DESIGN PRINCIPLES

Interconnected streets come in many shapes and forms, but have the following overarching principles in common:

- The street network both shapes and responds to the natural and built environment.
- The street network encourages trips by foot, bicycle, and transit because these are the most sustainable types of trips.
- The street network is built to walking dimensions.
- The street network protects, respects, and enhances a city's natural features and ecological systems.
- The street network maximizes social and economic activity.
- The street network works in harmony with other transportation networks, such as pedestrian, bicycle, transit, and motor vehicle networks. Large parts of all of these networks are coincidental with the street network, but if any parts are separate from the street network, they must connect and interact with the network.



Many more destinations can be reached walking 300' within a network of short blocks than in one with long blocks

(Credit: Marty Bruinsma)

DESIGN STANDARDS

BLOCK DIMENSIONS	Establish a maximum block circumference of 2,500 linear feet (about 500 ft x 500 ft wide):
	Ensure greater accessibility within the block through shared-use paths, alleys and other minor accessways
	Where block size is exceeded, retrofit large blocks with new streets and pedestrian and bicycle connections
CLOSURE OF STREETS	For existing street networks, do not allow permanent street closures that result in larger blocks or superblocks
NETWORK CONNECTIVITY	Require multiple street connections between neighborhoods and districts across the whole region. This is achieved by having minor arterials and collectors that extend beyond the local area. Adjacent neighborhoods must also be connected by multiple local streets.
STREET SPEEDS	Establish speeds determined by the Design Speed or less than 25 MPH in certain areas pursuant to the O.C.G.A subsection 40-6-183 Alteration of Speed Limits by Local Authorities. Chapter 4, "Street and Roadway Design," contains guidance related to speed.

DESIGN GUIDANCE

CONNECTIONS ACROSS FREEWAYS	Connect streets across urban freeways so that pedestrians and bicyclists have links to neighborhoods without having to use streets with freeway on and off ramps.
PROVIDE PARKING	Provide on-street curbside parking on most streets. Exceptions can be made for very narrow streets, streets with bus lanes, (and at bus stops), or where there is a better use of the space, and City designated freight routes
AVOID NETWORK DISRUPTIONS	Maintain network function by discouraging: • One-way streets • Turn prohibitions • Permanent full or partial street closures (except on Community Streets, or areas taken over for other uses of public space) • Removal of on-street parking (except when replaced by wider sidewalks, an enhanced streetscape, bus lanes, bus stops, bicycle lanes, etc.) • Gated streets • Widening of individual streets unless justified to accommodate traffic demaned and identified in an adopted City of Atlanta Planning Document • Conversion of city streets to limited-access facilities
OTHER STREETS ATLANTA REFERENCES	For design purposes, also utilize the City of Atlanta Character Area Categories and Street Classifications (see following pages). Chapter 4, “Street and Roadway Design,” contains guidance related to cross sections of these street typologies

ADDITIONAL GUIDANCE: STREET CHARACTER AND CLASSIFICATION

The street network functions best when it provides a variety of street types and use characteristics. The variety is enforced by the pattern of the street network itself but also by the design of individual street segments. Natural and built features, including topography and important community destinations, should be considered as part of a site-sensitive design process. In this guide, the public right of way is categorized into functional classification and character area categories. Generally, functional classification often describes the transportation function of the street (distance, anticipated vehicle traffic). The functional classification system used in this guide is parallel to categories utilized by the Federal Highway Administration.

The Atlanta City Design identifies six different land use categories: City Core, Growth Corridors, Urban, Suburban, and Rural Neighborhoods; and Production Areas.

For the purposes of this guide, these designated land use categories have been consolidated into three character areas to form distinctive design guidelines and relationships for active, balanced and multi-modal streets.

CHARACTER AREA CATEGORIES

The three character area categories defined within this guide are: City Core/ Growth Corridor, Urban Neighborhood, and Suburban and Rural/ Production.

The City Core and Growth Corridor character area category is comprised of the densest portions of the City and those areas that will experience the most intense development in the future. This composite area provides the greatest potential mobility for pedestrians, bicyclists, and transit users.

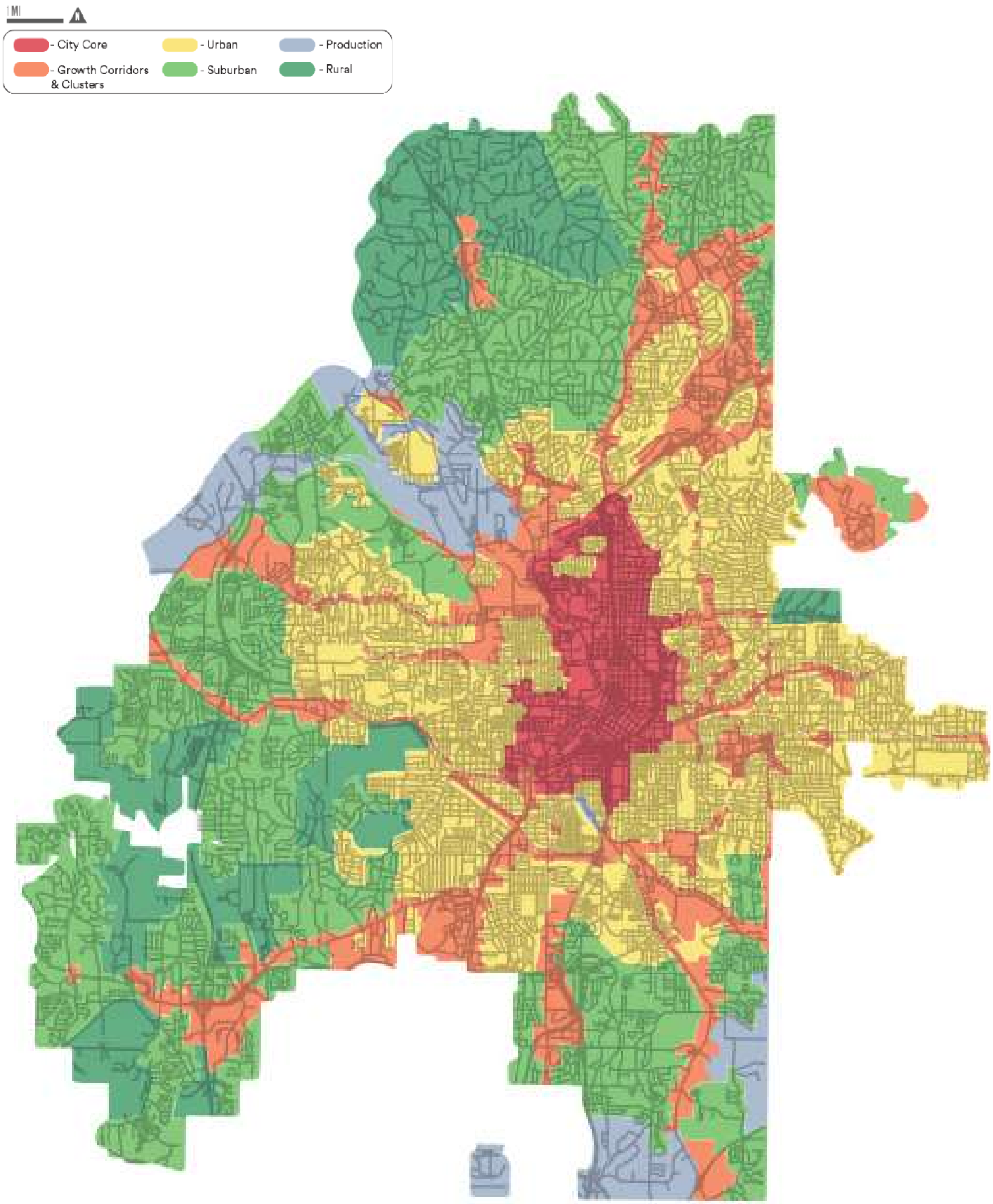
The Urban Neighborhood character area category is comprised of traditional neighborhood areas primarily developed before the 1950's. This character area category should be walkable and bikeable with complete sidewalk networks, streetscapes, and street connectivity.

The Suburban and Rural/ Production composite character area category includes post-war residential subdivisions primarily developed since the 1950's as well as industrial land used for manufacturing, wholesale, and distribution.

The residential lots are predominantly single family large lots located on local streets that are served by major arterials or collectors. There should be more connectivity through street grids and sidewalk construction upon redevelopment.

Production areas should be designed primarily for low-impact freight movement between those areas and nearby arterials and freeways, with a special focus on safe pedestrian and bicycle access to and from bus stops.

Figure 3-1: City Design Character Areas



CHARACTER AREA CATEGORIES DEFINED

CITY CORE AND GROWTH CORRIDORS/CLUSTERS

The City Core is the major economic, cultural and transportation hub of the region. It is intended to be the densest in terms of employment, residential, and cultural offerings, with the most developed transit service in the city and region. The City Core can handle the most intense development due to the amount of infrastructure already in place; though this infrastructure may need improvements due to its age.

The City Core is in competition with other central city areas in the southeastern US. The city and region must work together to keep these areas as competitive as possible in order to lure additional jobs and residents. With a growing regional population and growing congestion, the City Core needs to maintain easy accessibility by expanding multi-modal transportation and housing options.

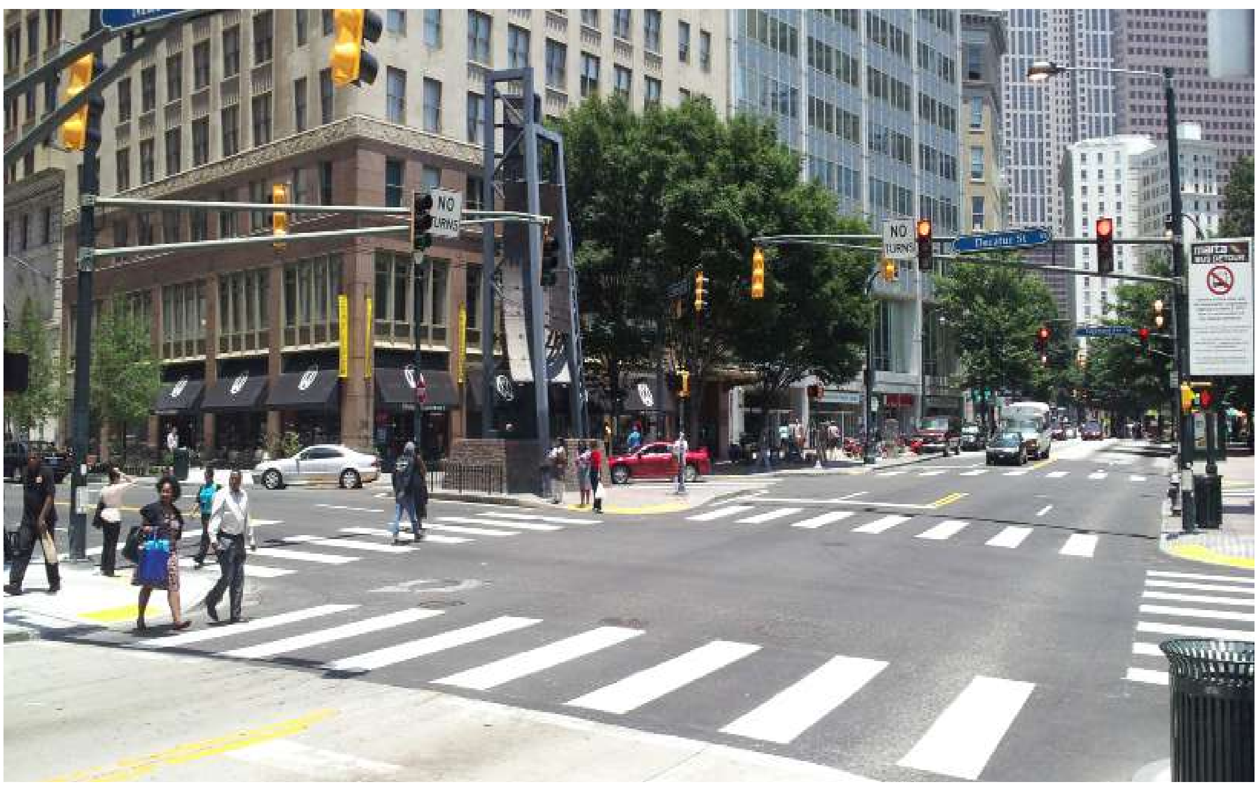
The City Core covers Downtown and Midtown as well as emerging districts like West Midtown, South Downtown, West End, and Castleberry.

Growth clusters are historically suburban commercial districts that are becoming increasingly urban. The largest and most established are Emory and Buckhead, but other clusters are poised for innovation and growth such as Greenbriar and outlying sites along Metropolitan and D L Hollowell Parkways.

Growth Corridors are the major streets that flow out of the City Core in all directions. Most are commercially developed with civic buildings and anchor institutions along their lengths. These corridors can accommodate a reasonable amount of growth that will spur commercial vitality and vibrant public life beyond the City Core.

Growth Corridors should be designed for multimodal access between commercial/ mixed-use centers and neighborhood residences, bus stops, schools, and parks. They should be especially focused on safe and convenient pedestrian access to and from rail transit stations, where present. Vehicle access will remain important while high capacity transit is being developed along these corridors.

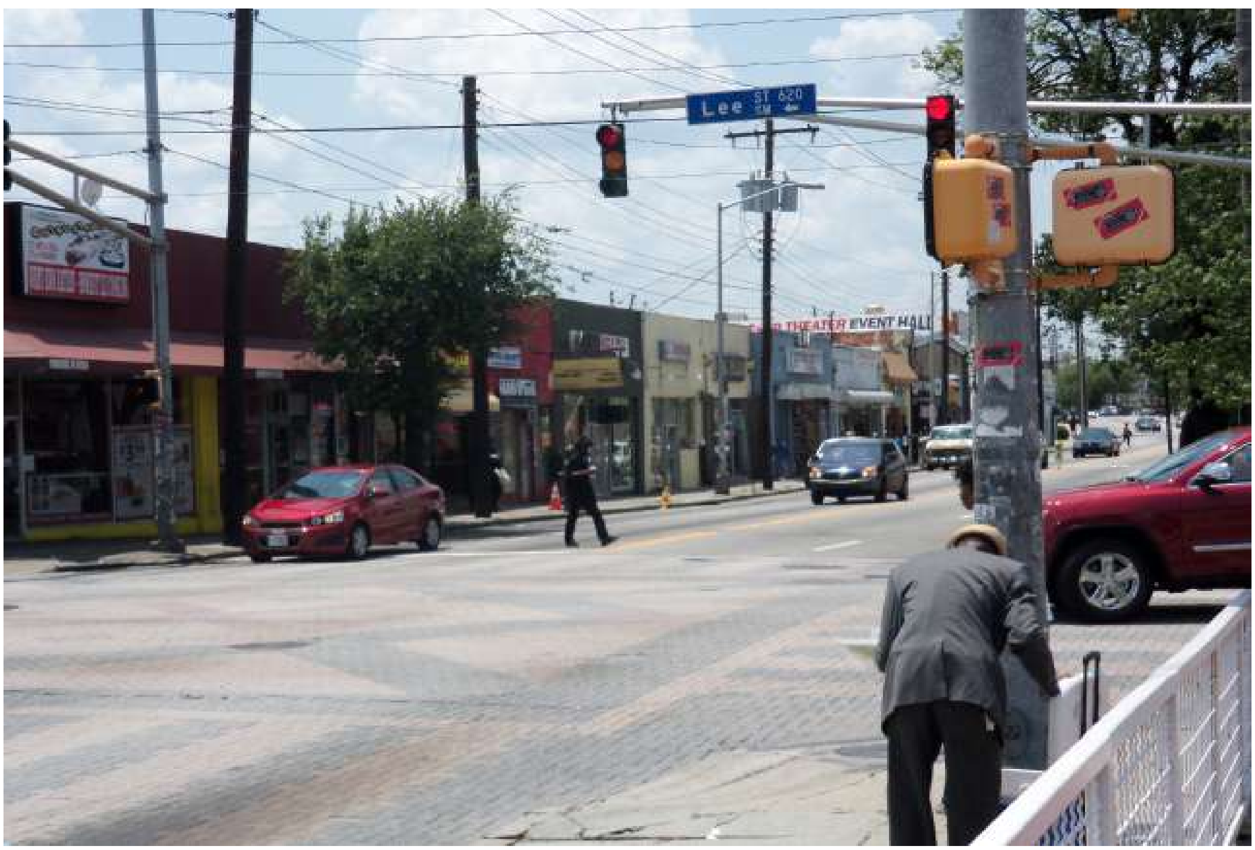
Street design should incorporate elements to improve bus operations and passenger convenience on key routes. Bicycle trips to and from the City Core are also a focus of these corridors. Regional trips into and through the character area should be made on transit, arterials, or freeways, rat6her than local and collector streets. Functional classification of surface streets is less important along the Growth



Five Points intersection in a City Core and Growth Corridors;

Corridors as all streets should be designed as multimodal corridors. The characteristics of adjacent freeway should not encroach into the design of the surface streets in the Growth Corridors.

Ralph David Abernathy Boulevard through the Westview neighborhood is in a City Core and Growth Corridors.



The intersection of Lee Street and Ralph David Abernathy is in a City Core and Growth Corridors

URBAN NEIGHBORHOODS

The Urban Neighborhood character area category is comprised of traditional, small-scale, historic, walkable neighborhoods where growth capacity is limited mostly by our desire to keep them the way they are. They are the traditional in-town communities that were built by the expansion of streetcars a century ago, such as Westview, Grant Park, and Brookwood Park. Most have some form of commercial district within walking distance from homes, and many include small apartment buildings, townhouses, or two and three-family homes. Their inherent walkability, historic charm, and proximity to Downtown make them highly desirable under today's market pressures, and therefore, threatened by even denser development. While there is still room for limited infill, these areas may begin to focus more on redevelopment over the next 30 years. Preservation of existing single-family neighborhoods is important, and, wholesale change will most likely not occur in the single-family areas that make up a majority of this character area. However, infill and redevelopment should occur in areas of retail/commercial concentrations, especially commercial corridors. Within this area, infrastructure is built out with limited ability to expand, which may constrain the amount of additional growth that is possible.

SUBURBAN AND RURAL/ PRODUCTION

Suburban Areas are areas that have primarily developed since the 1950s and whose was driven largely by the promised commuting potential of the automobile revolution. These areas are mostly residential and predominantly single family with lots larger than typical urban neighborhoods. They are frequently internally oriented. Some of these neighborhoods haven't developed their own identity and are not as well-know as many of the city neighborhoods. Non-residential uses are located along main roads and have developed in an auto-oriented pattern. Some areas are not well served by retail and services. Local streets are often curvilinear that and terminate in a cul-de-sac. They often lack adequate street lighting. Residential subdivisions have limited access/connectivity to the street network. Portions of Suburban Areas might be served by bus. Sidewalks might be present along some roads while others lack sidewalks. This forces people to walk on the street or adjacent to the street. In addition, many sidewalks are in poor condition.

Rural Neighborhoods, as defined by Atlanta City Design; are the least dense, least walkable

Top to bottom: Cherokee Avenue is in an Urban Neighborhood Character Area Category; Chattahoochee Avenue in a Suburban and Rural/Production Area Category neighborhoods in the City, with large lots and winding, often narrow, curbless streets.

Both suburban and rural neighborhoods should be walkable and bikeable. They should have complete sidewalk networks in good repair, well lit, safe and with well-marked pedestrian cross walks. There should be more sidewalk connectivity between subdivisions and to nearby retail and services, within retail areas, greenspace and to community facilities. New residential development should be integrated with the existing interconnected street network and not have cul-de-sacs or limited street connectivity.

The Production character area includes areas that are primarily used in manufacturing, wholesale trade, distribution, and construction. Production Areas play a significant role in the City's economy and are essential to sustain and support the needs of an urban environment. Due to the lower rent in most industrial areas, it is not uncommon to find start-up and entrepreneurial businesses in Production Areas. Jobs in production, distribution, and repair (PDR) businesses are often located in Production Areas because of the need to be near their clients. Lastly, Atlanta's city operating departments rely on Production Areas for staging and storage associated with providing City services.

The Production Areas should be designed primarily for low-impact freight movement between the areas and nearby arterials and freeways, with a special focus on safe pedestrian and bicycle access to and from bus stops. Regional trips into and through the Production Areas should be made on transit, arterials or freeways, not local and collector streets. At the same time, freight traffic should not adversely impact adjacent neighborhoods. Many of the streets in Production Areas are in poor condition due to the heavy wear and tear. On-street parking is very limited in Production Areas. As large parcels redevelop the new development should include new streets to increase redundancy in the street network. The new streets should provide connections to the existing street network.

CITY OF ATLANTA STREET CLASSIFICATION

TYPES AND ROLES OF STREETS

The Federal Highway Administration (FHWA) Functional Classification system is commonly accepted to define the function and operational requirements for streets. These classifications are also used as the primary basis for geometric design criteria.

The Streets Atlanta Design Guide includes five functional classifications of streets: Principal Arterial, Minor Arterial, Major and Minor Collector and Local Street. This classification system corresponds with the Federal Highway Administration and most current version of the Georgia DOT functional classification map to ease comparison to traditional street classifications within city ordinances and city departments. In order to better reflect the local context in the City of Atlanta, the Georgia DOT/FHWA functional classification map may be amended, through coordination with the metropolitan planning organization (Atlanta Regional Commission).

The terms for street classifications and typologies are described in the following sections.

FUNCTIONAL CLASSIFICATION

The functional classification system identifies the major transportation function of individual streets (i.e. connections between or within neighborhoods, long-distance travel, etc.) and may impact roadway design in certain character area categories. The different street types consider the balance between travel along the corridor (mobility) and access to and from the corridor (access). For example, Principal Arterials often have high level mobility but a low level of access, while local streets often have high level of access but lower mobility. These tradeoffs imply differences in which modes of transportation might be best accommodated by each functional classification. As the goals of active, balanced and multi-modal streets strive to accommodate the transportation needs of all users, it may be necessary to consider street design which balances mobility and access.

FREEWAYS, INTERSTATE HIGHWAYS AND NATIONAL HIGHWAY SYSTEM

Although most Freeways, Interstate Highways and National Highway System roadways are not within the City of Atlanta right-of-way, they serve important functions within the city's transportation system. In contrast with many streets in the City of Atlanta, freeways often serve automobile traffic exclusively, and their transportation function prioritizes traffic mobility and long-distance travel (including commuters). Many streets on the National Highway System serve as access to the interstate system (or serve a national military purpose).

PRINCIPAL ARTERIAL

A Principal Arterial is a street that carries high volumes at moderate speeds across the city. Principal Arterials often serve primary transit routes, and may be Core or Secondary Bicycle Connections. Principal Arterials often have multiple lanes and may be a designated freight route (refer to Cargo Atlanta for the City's official Freight Route Map). They should include wide sidewalks, furniture zones and safe and convenient pedestrian crossings at regular intervals. Principal Arterials should also have parallel Community Streets or shared-use paths. They may be equipped with bus-only lanes. Many Principal Arterials have landscaped medians and/or two-way left-turn lanes. Many Principal Arterials are state-owned and designated as Georgia or US highways.

MINOR ARTERIAL

A Minor Arterial is a street that carries moderate to high volumes at moderate speeds across a sector of the city. Minor Arterials often serve primary transit routes, and may be Core Bicycle Connections. They should include wide sidewalks, furniture zones and safe and convenient pedestrian crossings at regular intervals. Minor Arterials should also have buffered bicycle lanes, cycle tracks or other high-quality protected bicycle facilities. They may be equipped with bus-only lanes. Many Minor Arterials have landscaped medians and/or two-way left-turn lanes.

MAJOR AND MINOR COLLECTOR

A Collector is a street that carries moderate volumes at moderate to low speeds between neighborhoods and districts within the city. Collectors connect Minor Arterials and Principal Arterials with Local Streets. Collectors may serve transit routes. They should include sidewalks, furniture zones and safe and convenient pedestrian crossings at regular intervals.

LOCAL STREET

A Local Street is a street that carries low volumes at low speeds. Local Streets primarily provide direct access to adjacent properties. Local Streets do not often serve transit routes, but may be Core or Secondary Bicycle Connections.

Top to Bottom:

14th Street, Minor Arterial; Hosea L Williams Drive, Collector; Crumley Street, Local street

SPECIAL STREETS

STOREFRONT STREET

Storefront Streets are typically dominated by retail and other commercial uses and are designed for lower motor vehicle speeds, pedestrian movements and a large amount of streetscape features. Storefront Streets may be arterials, collectors or local streets, but they function differently than other streets in that they serve as destinations themselves. Driveway curb cuts should not be permitted on storefront streets except for hotels and hospitals.

TRANSIT BOULEVARD

A Transit Boulevard is a street identified for high-capacity, high-frequency transit in an adopted local or regional transportation plan. Transit Boulevards can have 11’ travel lanes with high volumes of bus transit and 12’ travel lanes to accommodate streetcar. Examples include Campbellton Road, Pryor Road, Edgewood Avenue, and North Avenue.

SHARED SPACE

Shared Space is a street with a slow, curbless street where pedestrians, motor vehicles, and bicyclists share space. Shared Space streets may support cafe seating, play areas, and other uses.

NEIGHBORHOOD GREENWAY

A Neighborhood Greenway is a street with low motorized traffic volumes and speeds, designated to give priority to bicycle travel. Neighborhood Greenways use signs, pavement markings, and speed volume management measures to discourage through trips by motor vehicles and create safe, convenient crossings of busy cross streets. These streets provide a low stress alternative. Chapter 7, “Bikeway Design”, describes Neighborhood Greenways as Bicycle Boulevards in more detail

TRANSIT MALL

The traveled way of a transit mall is for exclusive use by buses or trains, especially dominated by retail and other commercial uses. Excellent pedestrian access to and along the transit mall is critical. Bicycle access may be supported. An example is Alabama Street between Forsyth Street and Peachtree Street.

This page is intentionally blank

Chapter 4

STREET AND ROADWAY DESIGN

Roadway design in this chapter is defined as the part of the street right-of-way between the two faces of curbs and can include parking lanes, bicycle lanes, transit lanes, general purpose lanes, and medians. The design of the roadway is critical as it affects not just the users in the roadway, but those using the entire right-of-way, including the areas adjacent to the curb.

As with many American cities, the focus of the Atlanta's transportation infrastructure has changed over the years. Although it was developed first as a railroad and streetcar city, motor vehicle circulation was emphasized in the decades between 1960 and 2000. For example, many historically two-way streets in Atlanta were converted to one way to accommodate motorists and ease travel from downtown to the Interstate Highway System. In order to build active, living and multi-modal streets, the City of Atlanta must change the assumption that motor vehicle travel lanes should be considered first when making right-of-way design decisions.

To support Atlanta's Transportation Plan, the goals when designing roadways in the City of Atlanta are:

- Enhance the safety and security for all roadway users
- Consider needs of City of Atlanta residents and business owners first
- Always consider the needs of bicyclists, motorists, pedestrians, and transit users
- Provide multiple transportation options for people of all ages, physical abilities and/or income levels
- Serve the land uses that are adjacent to the roadway; mobility is a means, not an end
- Encourage people to bicycle, use transit and walk
- Support public health
- Support healthy livable neighborhoods and activity centersciy

DESIGN PRINCIPLES

The following key principles should be kept in mind for a well-designed roadway:

The safety of all street users, especially the most vulnerable users (children, the elderly, and disabled) and modes (pedestrians and bicyclists) should be paramount in any design of the roadway. The safety of streets can be dramatically improved through appropriate geometric design and operations.

- A well-designed roadway provides appropriate space for all street users to coexist. Design to accommodate all users. Roadway design should accommodate all users of the street, including bicyclists, motorists, pedestrians, and transit users.
- Roadways should be designed to self-enforce an appropriate motor vehicle operating speed for the character area category. Designers should not base the roadway design on existing operating speeds or speed limits. The speed of motor vehicles impacts all users of the street and the livability of the surrounding area. Lower speeds reduce crashes and injuries for all roadway users.
- Building on the momentum of multi-modal streets that have been successfully implemented in different parts of the nation and around the world, there is a strong need for the City of Atlanta to retrofit existing streets and create new types of street environments that reflect the values and desires of its citizens. This chapter discusses different factors affecting roadway design. Individual geometric design elements such as lane width and sight distance are examined in greater detail. The benefits and constraints of each element are examined and the appropriate location and correct use of each element is defined.

ROADWAY USERS

PEDESTRIANS

Walking is the most basic mode of transportation, yet pedestrians are often ignored in roadway design. Certain areas generate high pedestrian activity, such as downtowns, transit stations, residential, commercial, and entertainment areas, and schools. Yet even in areas of low pedestrian activity, such as along commercial strip-developed arterials, pedestrian needs and safety must be addressed, as drivers usually do not anticipate pedestrians, who are more vulnerable if a crash occurs. Much of this is due to speed. As speeds increase, drivers are less attentive to what is happening on the side of the road, reaction time is increased, and the pedestrian has a higher chance of dying or becoming severely injured in case of a crash. Additionally, drivers tend to be less attentive in areas with fewer pedestrians. Roadway design and adjacent development, such as flashing electronic signs, may also decrease driver attentiveness.

Most pedestrian crashes occur when a person crosses the roadway, and the most common crash type is a conflict between a crossing pedestrian and a turning vehicle at an intersection.

But designing for pedestrians should not focus primarily on avoiding crashes; the goal of roadway and intersection design should be to create an environment that is conducive to walking, where people can walk along and cross the road, where the roadside becomes a place where people want to be. The two most effective methods to achieve these goals are to minimize the footprint dedicated to motor vehicles and to reduce the operating speed of traffic. This approach allows the designer to use many features that enhance the walking environment, such as trees, curb extensions, and street furniture, which in turn slow traffic: a virtuous cycle. All streets should have sidewalks except for shared-space streets.

See Chapter 6, “Streetscape and the Walking Environment,” for the specifics of sidewalk and streetscape design and the specifics of pedestrian crossing design.

BICYCLISTS

All surface roadways should be designed with the expectation that bicyclists will use them. This does not mean every roadway needs a dedicated bicycle facility, nor will every road accommodate all types of bicyclists. Investment in bicycle facilities should be prioritized using the Atlanta Transportation Plan Bicycle Connection networks and the Cycle Atlanta 1.0 and 2.0 Studies. Minimizing the footprint dedicated to motor vehicle traffic and slowing down the speed of moving traffic benefits bicyclists. Chapter 7, “Bikeway Design,” describes in greater detail the various types of bikeways and their application. All collectors, minor arterials and principal arterials should have dedicated bicycle facilities within the right-of-way (bicycle lanes, buffered bicycle lanes, cycle tracks, etc.) or parallel to them (shared-use paths, neighborhood greenways, etc.). Local streets can often operate with a shared roadway, incorporating traffic calming elements to reduce motor vehicle operating speeds to <25MPH.

TRANSIT

Roadway design for transit vehicles must consider many factors. Buses have operational characteristics that resemble trucks, they usually operate in mixed traffic, they stop and start often for passengers, and they must be accessible to people from the sidewalk or shoulder. Transit accommodations should be prioritized on streets identified as Transit Boulevards (see Ch. 3, "Street Networks"). Important considerations for transit in roadway design include lane width (in most cases buses can operate safely in travel lanes designed for motorists), intersection design (turning radius or width of channelized turn lane), signal timing (often adjusted to give transit an advantage, i.e. queue jumping), pedestrian access (crossing the street at bus stops), sidewalk design (making room for bus shelters in the furniture zone), and bus stop placement and design (farside/nearside at intersections, bus pullouts, or bulb outs).

Chapter 8, "Transit Accommodations," describes in greater detail these and other design and operational considerations. Where express bus service or bus rapid transit is provided, full- or part-time exclusive bus lanes and traffic signal priority are desirable.

DESIGN VEHICLES

The design vehicle influences several geometric design features including lane width, corner radii, median nose design, and other intersection design details. Designing for a larger vehicle than necessary is undesirable, due to the potential negative impacts larger dimensions may have on pedestrian crossing distances and the speed of turning vehicles. On the other hand, designing for a vehicle that is too small can result in operational problems if larger vehicles frequently use the facility.

For design purposes, the WB-40 (wheel-base of 40 feet) is appropriate unless larger vehicles are more common. On bus routes and truck routes, designing for the bus (CITY-BUS or similar) or large truck (either the WB-50 or WB-62FL design vehicle) may be appropriate, but only at intersections where these vehicles make turns. For example, for intersection geometry design features such as corner radii, different design vehicles should be used for each intersection or even each corner, rather than a "one-size-fits-all" approach, which results in larger radii than needed at most corners. The design vehicle should be accommodated without encroachment into opposing travel lanes. However, it is acceptable to have encroachment into the far receiving lane (i.e. a truck may turn into the far lane when making a right turn onto a multilane roadway).

Furthermore, it may be inappropriate to design a facility by using a larger "control vehicle," which uses the street infrequently, or infrequently makes turns at a specific location. An example is a vehicle that makes no more than one delivery per day at a business. Depending on the frequency, the control vehicle can be allowed to encroach on opposing traffic lanes or make multiple-point turns.

Senior citizens need more time to cross the street.
(Credit: Ryan Snyder)

DESIGN SPEED

The application of design speed to create active, balanced and multi-modal streets is philosophically different than design for motor vehicle mobility. Traditionally, the approach for setting design speed is to use as high a design speed as practical. However, in accommodating an Atlanta designed for people, design speed should create a safer and more comfortable environment for bicyclists, motorists, and pedestrians.

For active, balanced and multi-modal streets, roadway design speeds of less than 30 MPH are desirable. The optimum speed for corridor efficiency is the posted speed. Studies have shown that above 30 MPH, the probability of pedestrian deaths increases substantially. From 2004-2008 in the City of Atlanta, 82 percent of pedestrian crashes occurred on streets with posted speeds greater than 25 MPH.

Most roadways in the City of Atlanta should be designed for 25 MPH or less. Narrow roadways intended to function as shared spaces may have design speeds as low as 15 MPH. Design speed should not include a +10 MPH tolerance, as is traditional in roadway design.

Design speed does not determine nor predict what speed motorists will travel on a roadway segment. Rather, design speed determines which features are permitted within the roadway. Features associated with high-speed designs, such as large curb radii, straight and wide travel lanes, ample clear zones (no on-street parking or street trees), guardrails, etc., degrade the walking experience and make it difficult to design active, balanced and multi-modal streets. In the end, the design of the roadway encourages high speeds and creates a vicious cycle. A slower design speed allows the use of features that enhance the walking environment, such as narrow curb radii and travel lanes, street trees, on-street parking, curb extensions, and street furniture, which in turn slow traffic: a virtuous cycle.

MOVEMENT TYPES

The following movement types are used to describe the expected driver experience on a given street and the design speed for pedestrian safety and mobility established for each of these movement types. They are also used to establish the components and criteria for design of active, balanced and multi-modal streets. Reference to the Design Speed Table below.

- Yield: Motorists must proceed slowly and with extreme care and must yield in order to pass a parked car or approaching vehicle. This is the functional equivalent of traffic calming. With a design speed of less than 25 MPH, this type should accommodate bicyclists with a shared roadway.
- Slow: Motorists can proceed carefully with an occasional stop to allow a pedestrian to cross or another car to park. Motorists should feel uncomfortable exceeding design speed due to the presence of parked cars, a feeling of enclosure, tight turn radii, and other design elements. With a design speed of 25 to 30 MPH, this type should accommodate bicyclists with a shared roadway, enhanced with signage and pavement markings.
- Low: Motorists can expect to travel without delay at the design speed. Street design supports safe pedestrian movement at the design speed. This movement type is appropriate for streets that traverse longer distances or that connect to higher intensity locations. With a design speed of 30 to 35 mph, this type should accommodate bicyclists with bicycle lanes, cycle tracks or other dedicated or separated facilities.

ACCESS MANAGEMENT

A major challenge in street design is balancing the number of access points to a street. As discussed in Chapter 3, “Street Networks,” there are many benefits of well-connected street networks. On the other hand, most conflicts between roadway users occur at intersections and driveways. The presence of many driveways, in addition to the necessary intersections, creates many conflicts between vehicles entering and leaving a roadway and bicyclists and pedestrians traveling along the roadway.

When possible, new driveways should be minimized and old driveways should be eliminated or consolidated, and raised medians should be placed to limit left turns into and out of driveways. Additionally, it is recommended to maintain existing bicycle and pedestrians crossings if a median is installed. For corner lots, driveways should be located on the lowest classified roadway or on the roadway with the lowest traffic volume.

TRAVEL LANES AND TURN LANES

Travel lane widths should be based on the context and design speed for the area that the street is located in. In low speed urban environments, lane widths are typically measured to the curb face instead of the edge of the gutter pan. Consequently, when curb sections with gutter pans are used, the vehicle and parking lane shall include the width of the gutter pan. Bicycle lanes are not to include the width of the gutter pan. Generally, 10-foot-wide travel lanes are preferred. On bus and truck routes, 11-foot-wide outside lanes should used.

In order for drivers to understand how fast they should drive, lane widths have to create some level of driver discomfort when driving too fast. The presence of on-street parking is important in achieving the speeds shown on page 4-7. When designated bicycle lanes or multi-lane configurations are used, there is more room for large vehicles, such as buses, to operate in, but car drivers will feel more comfortable driving faster than is desired.

The need for turn lanes for motor vehicle mobility should be balanced with the need to moderate operating speeds and the potential impact on the sidewalk width. Turn lanes tend to allow higher speeds at intersections, since turning vehicles can move over to the turn lane, allowing the through vehicles to maintain their speed.

ON-STREET PARKING

On-street parking is important to the success of local retail and services, pedestrian comfort and safety and to reduce motor vehicle operating speeds. On-street parking encourages patronage of local businesses and improves the pedestrian environment by creating a buffer from traffic. On-street parking occupies about half the surface area per car compared to off-street, which requires driveways and aisles for access and maneuvering. On-street parking may be limited to one side of the street, either continuously or on alternating sides. On-street parking is also determined by block length and should have special consideration to be permitted on City designated freight routes or streets with higher speed limits.

MEDIANS

Medians provide access management by limiting left-turn movements into and out of abutting properties to select locations where a separate left turn lane or pocket can be provided. The reduced number of conflict points decrease motorist crashes, provides pedestrians with a refuge as they cross the road, and provides space for landscaping, lighting, and utilities. Medians should be raised with curbing. Landscaped medians enhance the street and help create a gateway into a community.

DESIGN STANDARDS

DESIGN SPEED	Design speeds higher than 35MPH should not normally be used within the City of Atlanta, outside of freeways, interstates and the National Highway System. Design speeds greater than 35 MPH violate the principles of active, balanced and multi-modal streets. 35MPH is recognized as the optimum speed for the City of Atlanta in the Suburban and Rural/Production character area categories. The standard design and posted speed of 25MPH should be used in the City Core/ Growth Corridor Character Area Category and a 30MPH design speed and 25MPH posted speed on an Arterial roadway in the Urban Neighborhood Character Area Category.
ACCOMMODATING BICYCLISTS	Bicycle facilities within the roadway may include bicycle lanes, cycle tracks, bicycle boulevards, and other types of shared roadways (with or without shared lane markings and signs). See Chapter 7, "Bikeway Design," for design recommendations for these facilities.
ACCOMMODATING TRANSIT	Transit accommodations within the roadway may include dedicated transit lanes, streetcar rail, bus bulbs, bus pullouts, streetcar stop platforms and other features. See Chapter 8, "Transit Accommodations," for design recommendations for these features.
MEDIANS	Median Types and Widths (Page 4-9)
CURB CUTS	Curb cuts shall not be permitted on Arterial streets in the City Core/ Growth Corridor character area category since parking and loading can be provided off the lower classified streets—usually a locally classified street. The City Core/Growth Corridor Arterial will require design elements critical to achieve active, balanced, and multi-modal streets.
ACCOMMODATING PARKING	On new collector streets, on-street parking will be provided given the context and orientation in the neighborhood area.
SIDEWALKS REQUIRED	Sidewalks will be required on all new streets to provide safe mobility for pedestrians.
NEW LOCAL STREETS	New Local streets in the Suburban and Rural/Production character area category will provide access to the collector street network. This new street will serve predominately single family detached dwellings, no freight movement should take place on locally classified streets unless for deliveries. Therefore, this street will be designed and built to the same specifications as the Local streets in the Urban Neighborhood character are category. On-street parking should be accommodated on at least one side of the street.
PERMITS NEEDED FOR SPECIAL USE OF RIGHT-OF-WAY	A Valet Parking service is a business that provides the opportunity for patrons in a vehicle to load and unload at their immediate destination. The City's Department of Public Works oversees the permitting that regulates valet parking services within the City's Right-of-Way. Valet parking services that take place within the City's Right-of-Way must meet the specific criteria. Refer to the Department of Public Works for criteria.

DESIGN GUIDANCE: GENERAL

DESIGN SPEED

The table below outlines design/posted speed recommendations.

Character Area	Arterial	Collector	Local
City Core/Growth Corridor	25 mph	25 mph	25 mph
Urban Neighborhood	30 mph design/ 25 mph posted	25 mph	25 mph
Suburban and Rural/ Production	35 mph	30 mph	25 mph

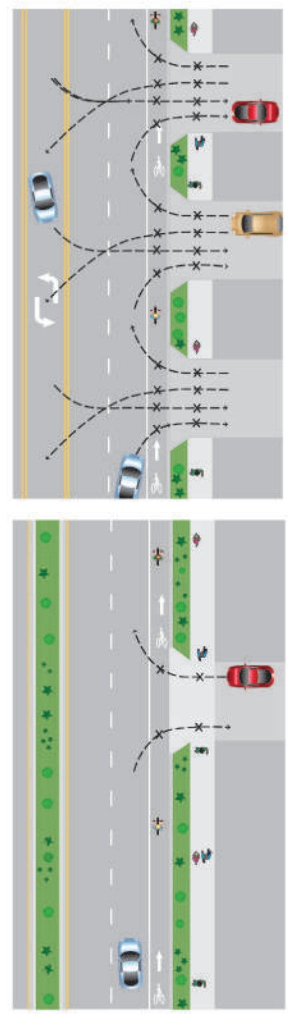
ACCESS MANAGEMENT

Access management through limiting driveways and providing raised medians has many benefits:

- The number of conflict points is reduced, especially by replacing center-turn lanes with raised medians since left turns by motorists account for a high number of crashes with bicyclists and pedestrians.
- Pedestrian crossing opportunities are enhanced with a raised median.
- Universal access for pedestrians is easier, since the sidewalk is less frequently interrupted by driveway slopes.
- Fewer driveways result in more space available for higher and better uses, but also require inter-parcel access in order to maintain access for all users.
- Improved traffic flow may reduce the need for road widening, allowing part of the roadway to be recaptured for other users.

Access management may increase motor vehicle speeds and volumes, which can be detrimental to other users. Reduced access to businesses may require out-of-direction travel for all users, including pedestrians and bicyclists.

Access to properties may be reduced if design does not account for site layout and heavy vehicle movements. This should be considered and addressed:



Adding medians and consolidating driveways to manage access

(Credit: Michele Weisbart)

VERTICAL ALIGNMENT

The American Association of State Highway and Transportation Officials (AASHTO) Geometric Design of Highways and Streets manual (AASHTO Green Book) provides acceptable values for designing vertical curves for active, balanced and multi-modal streets. The values used for the design of vertical curves should be selected based on the design speed appropriate for the context of the street. Using higher values can contribute to increased vehicle speeds and may require increased modification to the natural terrain, increasing negative impacts to the environment.

DESIGN GUIDANCE: GENERAL (CONT.)

HORIZONTAL ALIGNMENT	The AASHTO Green Book provides values for designing horizontal curves for active, balanced and multi-modal streets. The values used for the design of horizontal curves should be selected based on the design speed appropriate for the context of the street. Using higher values can contribute to increased vehicle speeds and also impacts the character of the street. Larger horizontal curves also create a more suburban or rural highway feel.
SIGHT DISTANCE/ STOPPING SIGHT DISTANCE	The AASHTO Green Book provides appropriate values for designing stopping sight distance for active, balanced and multi-modal streets. The 2004 AASHTO Guide for Achieving Flexibility in Highway Design is based on the latest research concerning the establishment of stopping sight distance. The document states that the established values for stopping sight distance are very conservative and provide adequate flexibility without creating increased crash risk. Consequently, appropriate design speed selection is critical to avoid overly negative impacts such as unnecessarily limiting on-street parking and tree planting.
INTERSECTION SIGHT DISTANCE	Intersection sight distance should be calculated in accordance with the AASHTO Green Book using the design speed appropriate for the context of the street. When executing a crossing or turning maneuver onto a street after stopping at a stop sign, stop bar, or crosswalk, drivers will move slowly forward to obtain sight distance (without intruding into the crosswalk or perpendicular travel lane). Therefore, when curb extensions are used or on-street parking is in place, the vehicle can be assumed to move forward on the second step movement, stopping just shy of the travel lane and without blocking the crosswalk, increasing the driver's potential to see further than when stopped at the stop bar. As a result, the increased sight distance provided by the two step movement allows parking to be located closer to the intersection.
HORIZONTAL CLEARANCE/MOTOR VEHICLE CLEAR ZONE	Horizontal clearance is the lateral distance from a specified point on the roadway, such as the edge of the travel lane or face of the curb, to a roadside feature or object. The motor vehicle clear zone is the relatively flat unobstructed area adjacent to the roadway that is provided for recovery of errant vehicles. In urban areas, horizontal clearance based on motor vehicle clear zone requirements for rural and suburban highways is not practical due to the presence of bicyclists and pedestrians, lower speeds, dense abutting development, closely-spaced intersections and driveways, higher traffic volumes, and constrained rights-of-way. Therefore, streets with curbs and gutters in urban areas do not have sufficient roadside areas to provide motor vehicle clear zones. Consequently, while there are specific horizontal clearance requirements for these streets, they are based on clearances for normal operation and not based on maintaining a recovery zone for errant motorists. The minimum horizontal clearance is 1.5' measured from the face of the curb where practicable shall not be located within the sight distance triangle located in the City Zoning Code of Ordinance Sec. 16-28.008.

DESIGN GUIDANCE: GENERAL (CONT.)

MEDIAN DESIGN

The table below outlines median design recommendations. In addition, the following should be kept in mind as general design guidance for any median sizes:

- Six feet measured curb-face to curb-face is generally considered the minimum width for proper growth of small caliper trees (less than four inches)
- Wider medians provide room for larger caliper trees and more extensive landscaping.
- A 10-foot-wide median provides for a turn lane without a concrete traffic separator.

Median Type	Minimum Width	Recommended Width
Median for access control	2.0’	4.0-6.0’
Median for pedestrian refuge	6.0’	8.0’
Median for trees and lighting	6.0’	10.0’
Median for single left-turn lane	10.0’	10.0’
Median for single left-turn lane and pedestrian refuge	16.0’	16.0’

Jersey barriers and heavily-landscaped medians inhibit informal pedestrian crossings. Medians should be designed with a normal curb height, vegetation that does not obscure pedestrians and regularly-spaced hard-surface landings to allow informal crossings by pedestrians at key locations (i.e. bus stops, cross streets with sidewalks, etc.), unless a pedestrian barrier/ fence is installed.

Well-designed street medians bring multiple benefits

(Credit: Dan Burden)

LANE WIDTHS

Generally, 10’ lanes are preferred. On bus and freight routes, 11’ travel curb-side lanes may be considered. Refer to the Guidance for Project Development in Chapter 2, “Plan Development” for additional information.

LEFT TURN LANES

Left-turn lanes are considered to be acceptable in an urban environment since there are negative impacts to roadway capacity when left turns block the through movement of vehicles. Sometimes just a left-turn pocket is sufficient, just long enough for one or two cars to wait out of traffic. Most multi-modal street retrofits include the installation of a continuous left-turn lane to preserve motor vehicle capacity. It may be preferable to provide intermittent left-turn lanes at intersections by ending on-street parking with a taper in advance of the intersection. Normally, no more than one left-turn lane should be provided, as dual turn lanes increasing the pedestrian crossing distance and severely degrade the pedestrian environment.

DESIGN GUIDANCE: GENERAL (CONT.)

ON-STREET PARKING DESIGN

Where angle parking is necessary, back-in parking should be used. Motorists pulling out of back-in angled parking can better see the street they are entering. This is especially important to bicyclists. Moreover, people exiting cars do so on the curb side and aren't likely to step into an active travel lane.

Back-in angled parking: Boise, ID

The table below details recommended parking lane widths.

Type of On-Street Parking	Parking Lane Width (distance from curb toward centerline)
Parallel	7.5'
Angle (45 degree)	18'
Angle (60 degree)	20'

PARKLETS

Parklets use platforms and benches to create public spaces (such as eating areas, miniparks, etc.; see photo at right) within the roadway. Parklets may be appropriate as an alternative to expanding the sidewalk area, depending on street classification and traffic volume.

Parklet, San Francisco
(Credit: Flickr)

DESIGN GUIDANCE: NEW STREETS

GENERAL DESIGN GUIDES FOR NEW ROADWAYS

As different areas of the City redevelop new streets will need to be designed and built. Roadways play an essential role in vehicle thoroughfares, bicycle routes, pedestrian mobility, parking amenities—such as on-street parking, and most importantly, public space. The needs of various new developments will led to the creation of streets that provide sidewalk space for short pedestrian trips, bicycle facilities, vehicular lanes, and other elements essential to connectivity. The new roadway construction guidelines outlined below describe detailed cross-sections for the nine possible new streets that may be built as new development occurs in the City of Atlanta. Refer to Chapters 5, 6, and 7 for more guidance.

As new roadways are constructed in the City Core/Growth Corridor and Urban Neighborhood character area categories, bicycle facilities along these new roadways should be protected if it is recognized in an adopted City of Atlanta Plan.

CITY CORE/GROWTH CORRIDOR CHARACTER AREA CATEGORY

As new development occurs in the City Core/ Growth Corridor areas of the City, many large blocks will be broken up by the construction of new street grids, providing much needed new connections and pedestrian access. It is also acknowledged that pedestrians and cyclists will use the streets and need both ample sidewalk space and dedicated bicycle facilities with a safe and comfortable separation from vehicle travel lanes.

As land uses and building configurations tend to have the same ground-floor retail and commercial on Collector streets in this character area category as they do on Arterial streets, space for on-street parking may be seen as important. Likewise, the viability of a collector street in a dense area serving pedestrians making short trips depends on longer stretches of protected zones for pedestrians, meaning curb cuts and driveways should be limited. Motor vehicle capacity will remain important to attract development and redevelopment along growth corridors in the near term, while the transit network is expanding.

URBAN NEIGHBORHOOD CHARACTER AREA CATEGORY

New Arterial streets constructed in the Urban Neighborhood character area category will serve as the 'bridge' between the mobility function of collectors and the access function of the local streets, arterials in the Urban Neighborhood context usually connect these corridors and nodes of concentration to the residential areas that surround them. New Arterials in this category will create multimodal access demand.

New Local streets in the Urban Neighborhood character area category will be the most access-oriented streets in the transportation network. The roadway will be designed and built for slow speeds to deter cut-through traffic. On-street parking will be required on at least one side of the street.

SUBURBAN AND RURAL/ PRODUCTION CHARACTER AREA CATEGORY

New Arterial streets in the Suburban and Rural/ Production character area category present a challenging situation: industrial land uses are zoned adjacent to streets that provide direct connection to other parts of the city and region to expedite the distribution function that industrial establishments rely on.

Newly constructed Collector streets in the Suburban and Rural/Production character area may provide access to newly developed sites or subdivisions. These streets will require a high demand for freight movement. This street will be designed with characteristics similar to an Arterial roadway in the same character area category.

NEW ROADWAY CONSTRUCTION CROSS-SECTIONS

The street sections in this section reflect the guidelines for new roadway construction for Arterials, Collectors, and Local streets in each of the character area categories. These figures display detailed recommended street design dimensions for meeting the needs of the context and provides a perspective illustration of how this suggested design would fit into its surroundings. On sections with complex treatments outside of the moving way of the street, particular attention is given to these design elements, including sidewalk/clear zones and street furniture/tree planting zones.

CITY CORE/GROWTH CORRIDOR ARTERIAL

Design Element	Typical
Travel Lane Dimensions[1]	10'-0"
Number of Travel Lanes (per direction)	Maximum 2
Bicycle Facilities[2]	6'-0"
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	10'-0"
Supplemental Zone	Minimum 5'-0"
Lighting	Pedestrian and vehicle/ street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	7'-6" on both sides of the street
Median	Yes, 11'-0" transitioning into left-turn lanes at intersections
Cross Section Total	108'-0"
Curb Type	Granite

1 Curb lanes should be 11'-0" if the new roadway is a City Designated Freight Route

2 Bicycle facilities on Arterials or Collectors should be protected if recognized in a City adopted plan

CITY CORE/GROWTH CORRIDOR COLLECTOR

Design Element	Typical
Travel Lane Dimensions[1]	10'-0"
Number of Travel Lanes (per direction)	1
Bicycle Facilities[2]	6'-0"
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	10'-0"
Supplemental Zone	Minimum 5'-0"
Lighting	Pedestrian and vehicle/ street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	7'-6" on both sides of the street
Median	Yes, 11'-0" transitioning into left-turn lanes at intersections
Cross Section Total	88'-0"
Curb Type	Granite

1 Curb lanes should be 11'-0" if the new roadway is a City Designated Freight Route

2 Bicycle facilities on Arterials or Collectors should be protected if recognized in a City adopted plan

CITY CORE/GROWTH CORRIDOR LOCAL

Design Element	Typical
Travel Lane Dimensions	10'-0"
Number of Travel Lanes (per direction)	1
Bicycle Facilities[1]	
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	8'-0"
Supplemental Zone	Minimum 5'-0"
Lighting	Pedestrian and vehicle/ street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	7'-6" on both sides of the street
Median	None
Cross Section Total	61'-0"
Curb Type	Granite

[1] Bicycle facilities on local streets should be designed as Neighborhood Greenways if recognized in a City adopted plan

URBAN NEIGHBORHOOD ARTERIAL

Design Element	Typical
Travel Lane Dimensions	10'-0"
Number of Travel Lanes (per direction)	1
Bicycle Facilities[1]	6'-0"
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	10'-0"
Supplemental Zone	Minimum 5'-0"
Lighting	Pedestrian and vehicle/ street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	7'-6" on both sides of the street
Median	Yes, 11'-0" transitioning into left-turn lanes at intersections
Cross Section Total	88'-0"
Curb Type	Granite

[1] Bicycle facilities on Arterials or Collectors should be protected if recognized in a City adopted plan

URBAN NEIGHBORHOOD COLLECTOR

Design Element	Typical
Travel Lane Dimensions	10'-0"
Number of Travel Lanes (per direction)	1
Bicycle Facilities[1]	6'-0"
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	8'-0"
Supplemental Zone	Minimum 5'-0"
Lighting	Pedestrian and vehicle/ street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	7'-6" on both sides of the street
Median	None
Cross Section Total	83'-0"
Curb Type	Granite

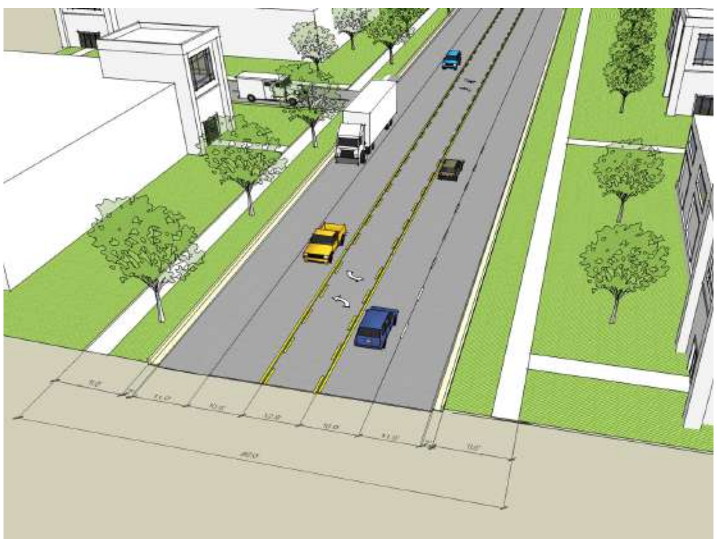
[1] Bicycle facilities on Arterials or Collectors should be protected if recognized in a City adopted plan

URBAN NEIGHBORHOOD LOCAL

Design Element	Typical
Travel Lane Dimensions	10'-0"
Number of Travel Lanes (per direction)	1
Bicycle Facilities[1]	
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	6'-0"
Supplemental Zone	None
Lighting	Vehicle/street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	7'-6" on one side of the street
Median	None
Cross Section Total	49'-6"
Curb Type	Granite

[1] Bicycle facilities on local streets should be designed as Neighborhood Greenways if recognized in a City adopted plan

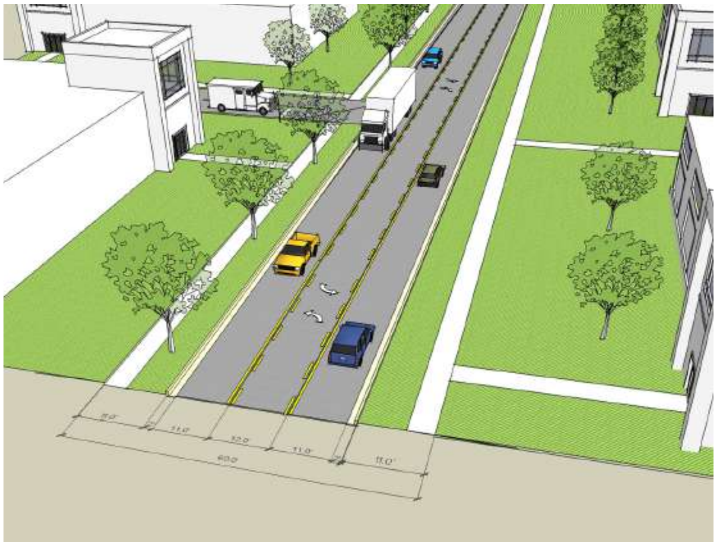
SUBURBAN AND RURAL/PRODUCTION ARTERIAL



Design Element	Typical
Travel Lane Dimensions	10'-0"
Number of Travel Lanes (per direction)	Maximum 2
Bicycle Facilities[1]	None
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	6'-0"
Supplemental Zone	None
Lighting	Vehicle/street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	None
Median	Shared left-turn lane, 12'-0"
Cross Section Total	80'-0"
Curb Type	Concrete with gutter, 2'-0"

[1] Bicycle facilities on local streets should be designed as Neighborhood Greenways if recognized in a City adopted plan

SUBURBAN AND RURAL/PRODUCTION COLLECTOR



Design Element	Typical
Travel Lane Dimensions	10'-0"
Number of Travel Lanes (per direction)	1
Bicycle Facilities[1]	None
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	6'-0"
Supplemental Zone	None
Lighting	Vehicle/street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	None
Median	Shared left-turn lane, 12'-0"
Cross Section Total	60'-0"
Curb Type	Concrete with gutter, 2'-0"

[1] Curb lanes should be 11'-0" if recognized in a City adopted plan as Freight Route

SUBURBAN AND RURAL/PRODUCTION LOCAL

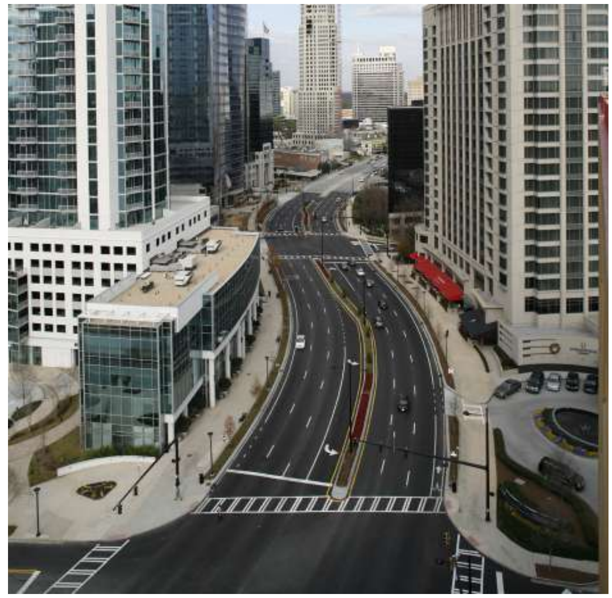
Design Element	Typical
Travel Lane Dimensions	10'-0"
Number of Travel Lanes (per direction)	1
Bicycle Facilities[1]	
Planting/Furniture Zone	5'-0"
Sidewalks/Clear Zone	6'-0"
Supplemental Zone	None
Lighting	Vehicle/street required. Minimum horizontal clearance from back of curb should be 1'-6"
On-Street Parking	7'-6" on one side of the street
Median	None
Cross Section Total	53'-6"
Curb Type	Concrete with gutter, 2'-0"

[1] Bicycle facilities on local streets should be designed as Neighborhood Greenways if recognized in a City adopted plan

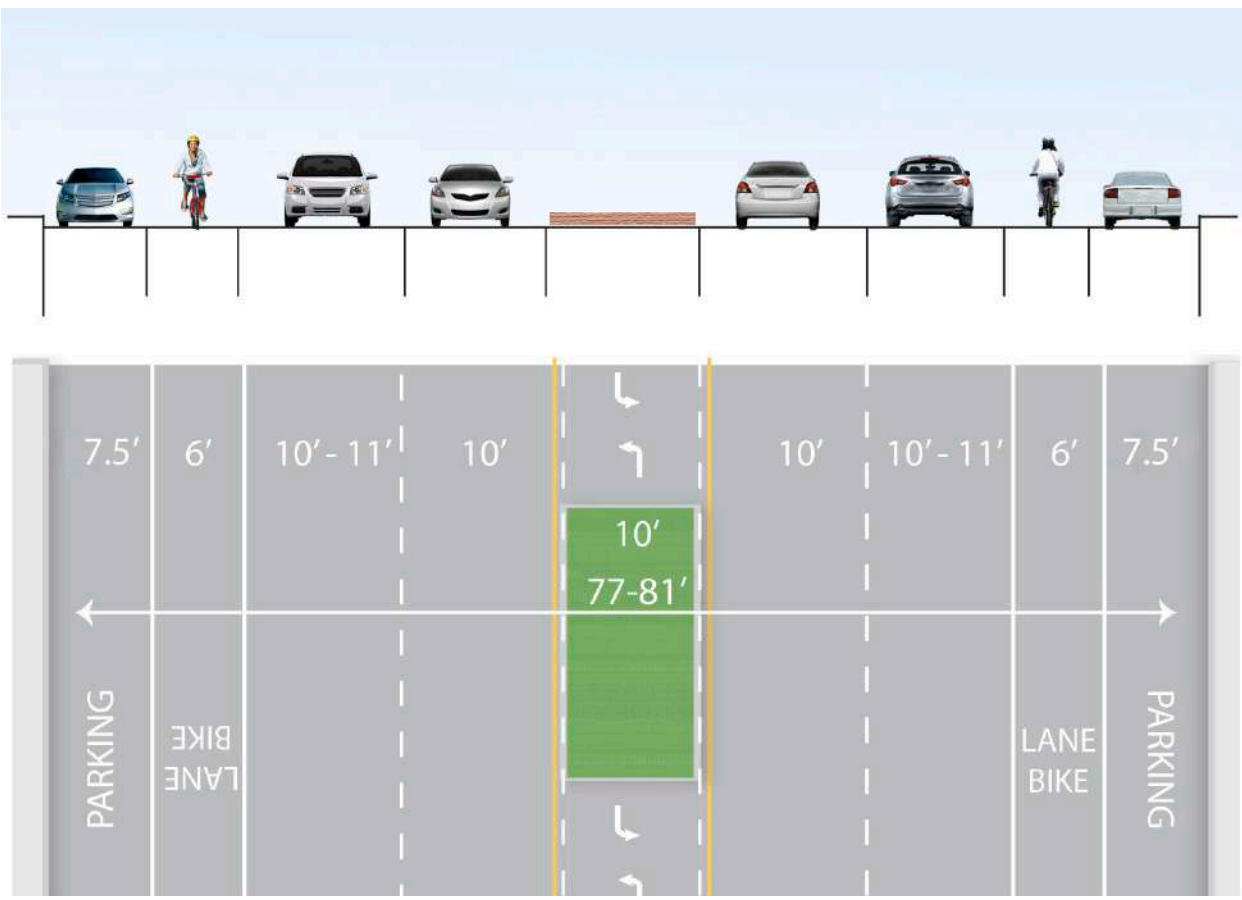
ADDITIONAL GUIDANCE: STREET RETROFITS

In built-out places such as the majority of City of Atlanta streets, rigid street standards are often difficult to implement due to existing right-of-way constraints. The City of Atlanta may want to reconfigure streets by reassigning space to make streets meet the principles of multi-modal streets more closely (See Chapter 2, "Project Development"). In these cases, the City of Atlanta can apply the principles along with the minimum and recommended widths shown in diagrams over the following pages.

ARTERIAL EXAMPLE: PEACHTREE ROAD

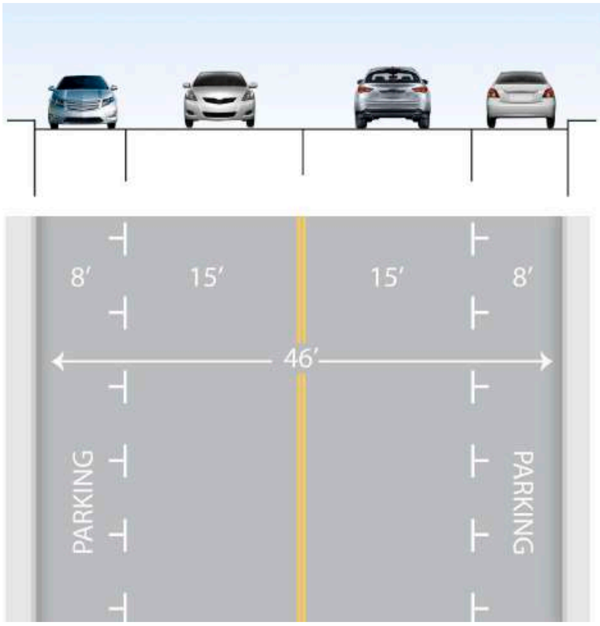


Credit: Buckhead Community Improvement District

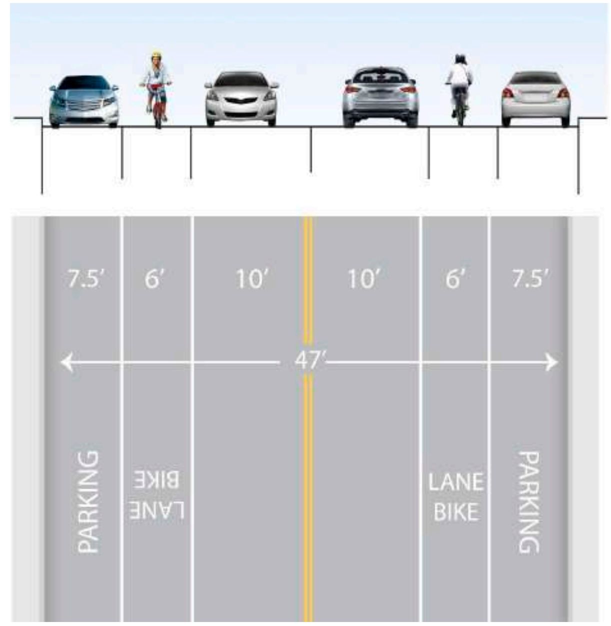


Arterial with medians interspersed with turn lanes

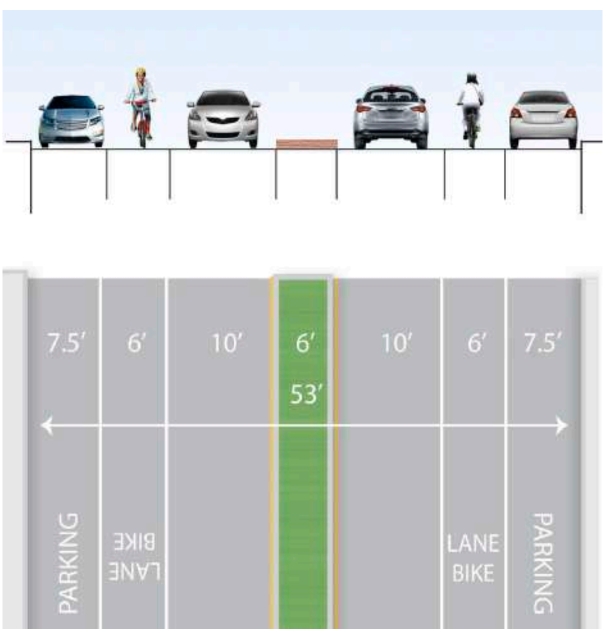
COLLECTOR EXAMPLE:



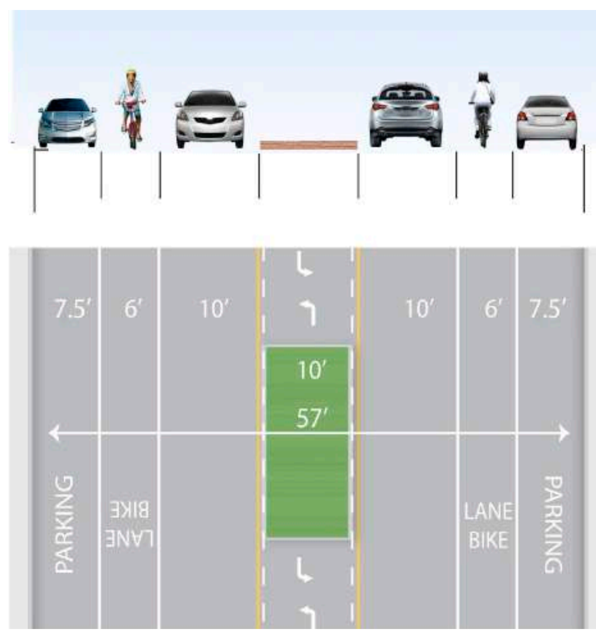
Existing 46'-wide collector



Restripe to add bicycle lanes*

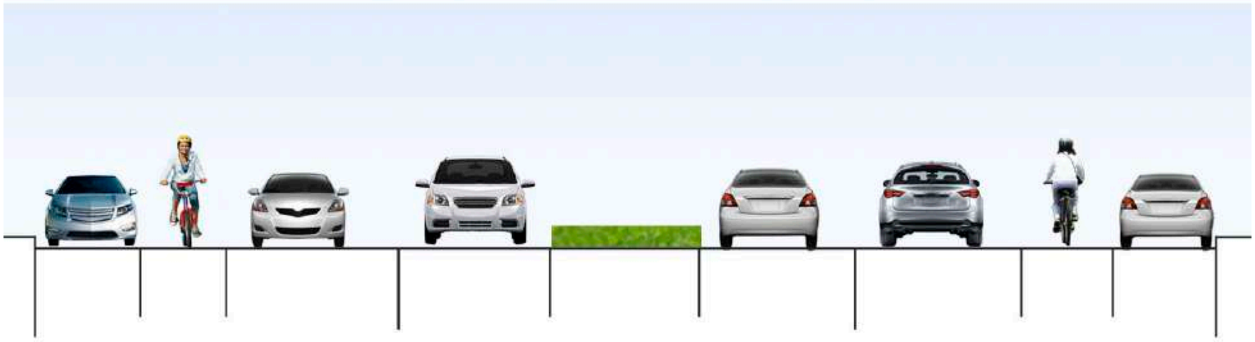


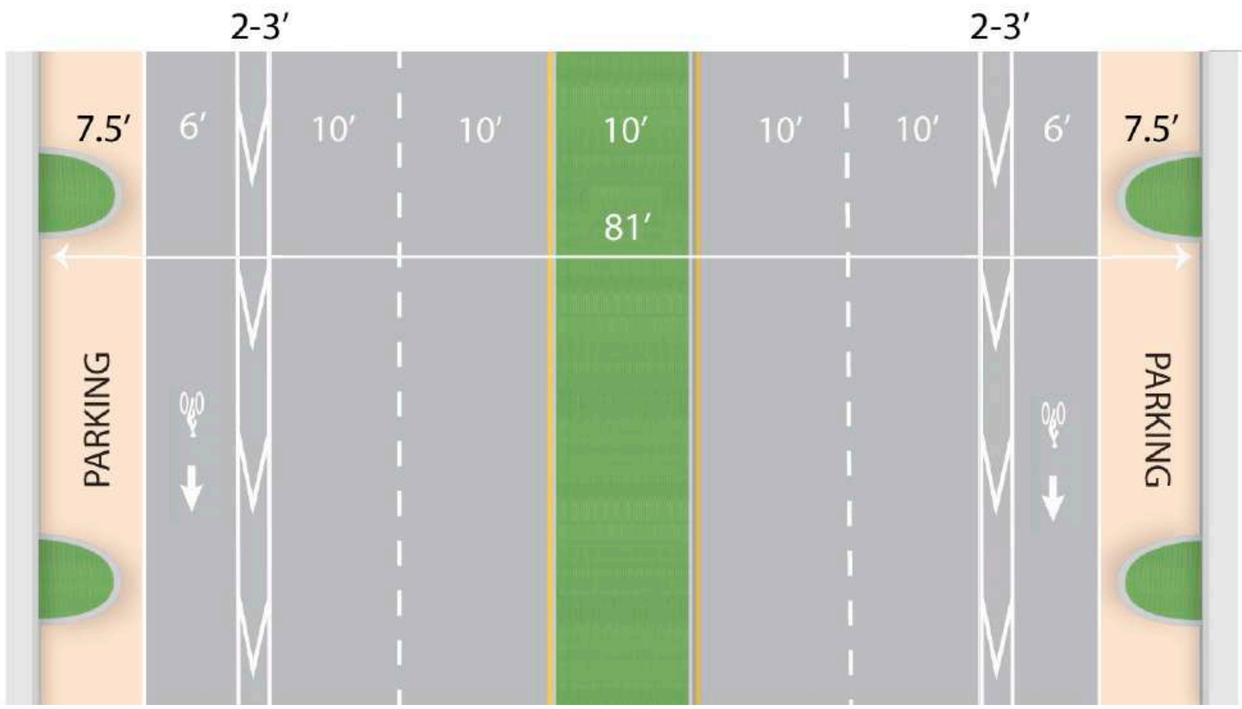
Collector with median



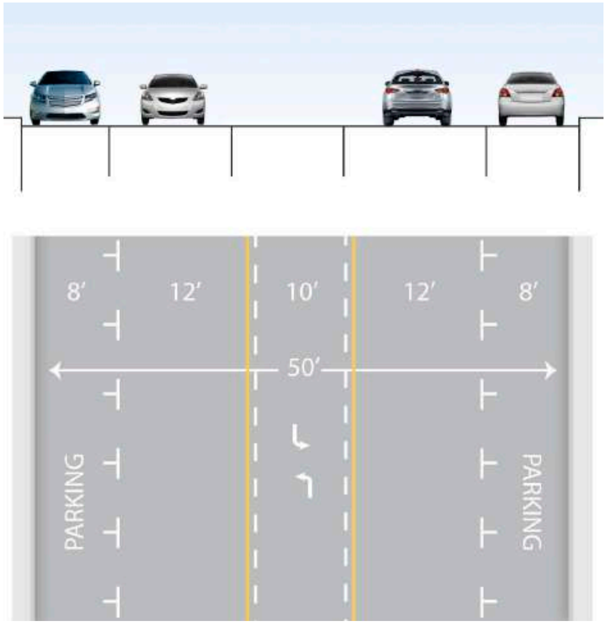
Collector with medians interspersed with turn lanes

*Parking lane may drop before intersections to accommodate left-turn pockets, if warranted.

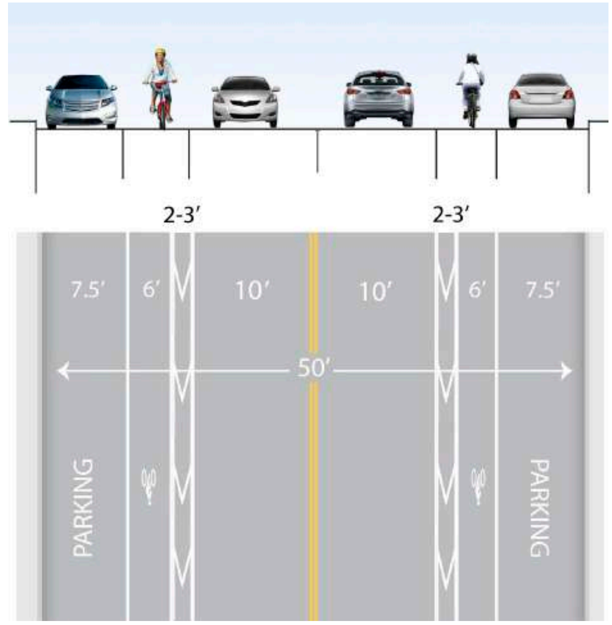




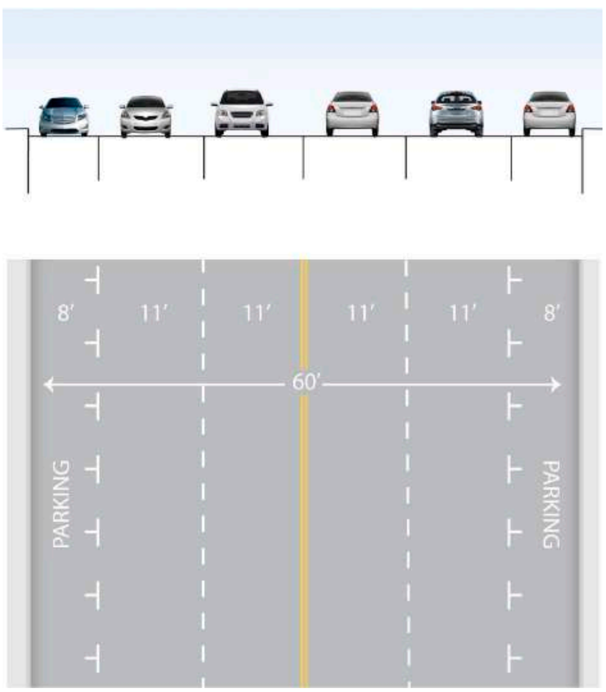
Principal/minor arterial with buffered bike lanes and inset parking



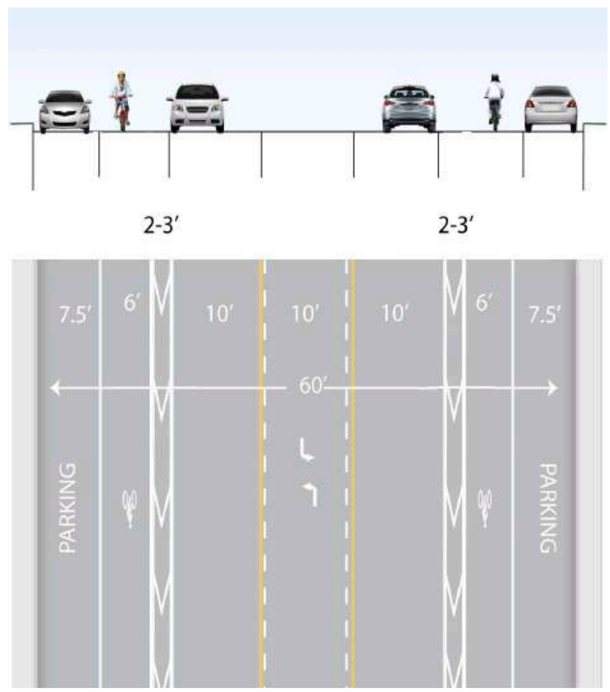
Existing 50’-wide collector



Restripe to add buffered bicycle lanes

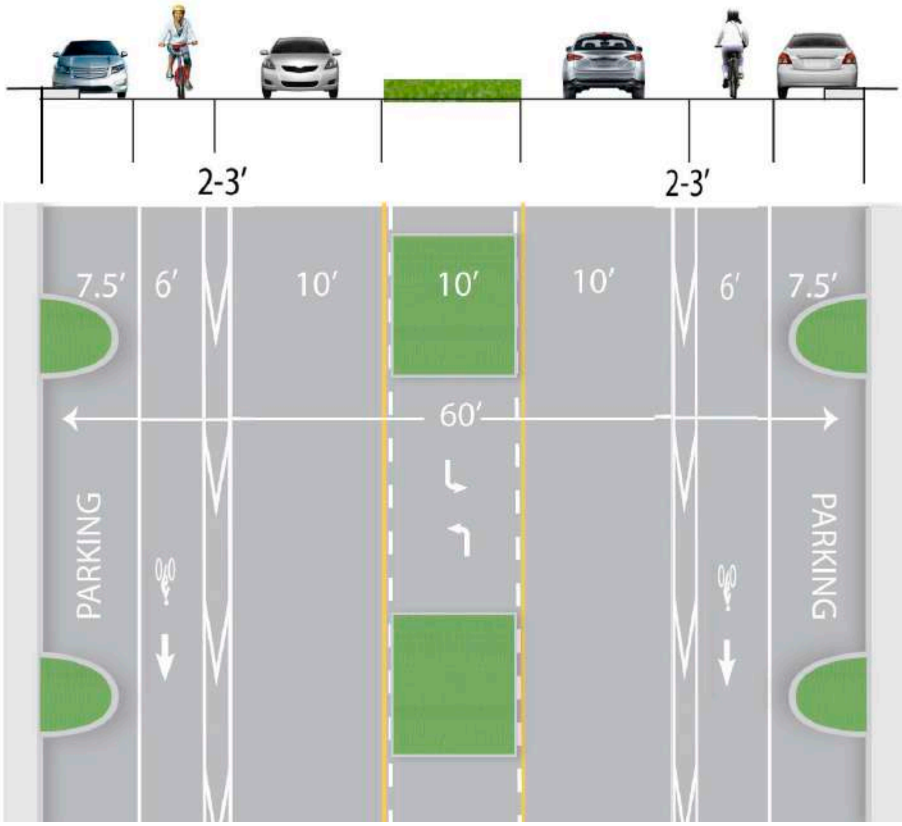


Existing 60’-wide collector or minor arterial

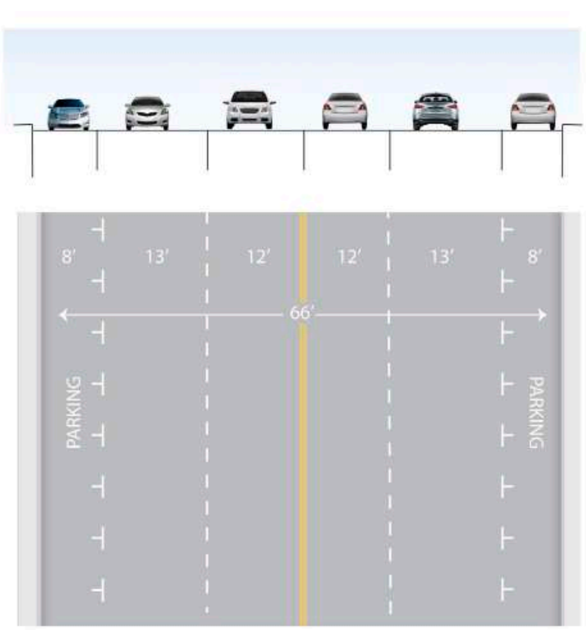


Option 1: Reduce travel lanes and add buffered bicycle lanes and a two-way left-turn lane

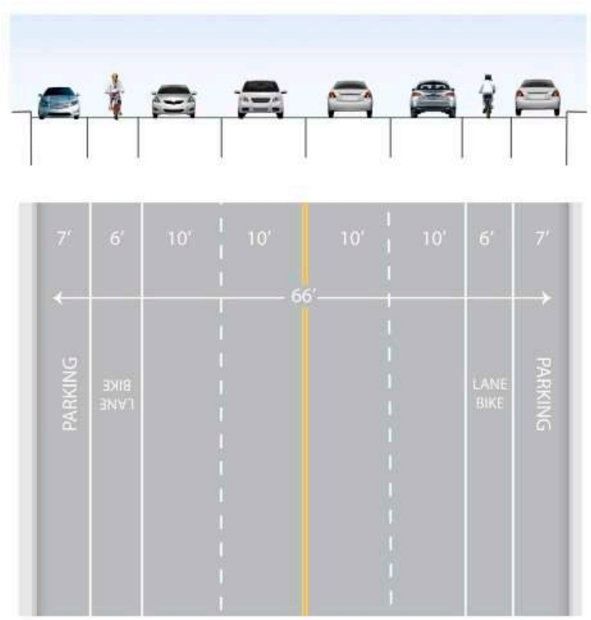
*Parking lane may drop before intersections to accommodate left-turn pockets, if warranted.



Option 2: Reduce travel lanes and add median islands interspersed with turn lanes; add interspersed landscaped curb extensions to inset parking



Existing 66'-wide principal/minor arterial



Narrow travel lanes to add bicycle lanes*

*Parking may end before intersections to accommodate left-turn pockets, if warranted.

Chapter 5

INTERSECTION DESIGN AND TRAFFIC CONTROL

Most conflicts between roadway users occur at intersections, where travelers cross each other's path. Good intersection design indicates to those approaching the intersection what they must do and who has to yield. Good design also encourages appropriate speed approaching the intersection.

This chapter describes design considerations in intersection geometry and intersection signalization, as well as roundabouts and other features to improve safety, accessibility, and mobility for all users. The benefits and constraints of each feature are examined and the appropriate use and design of each feature are described.

DESIGN PRINCIPLES

The following principles apply to all users of urban intersections:

- Continuous free-flowing movements should be avoided.
- Good intersection designs are compact.
- Unusual conflicts should be avoided.
- Simple right-angle intersections are best for all users since many intersection problems are worsened at skewed and multi-legged intersections.
- Signal timing should consider the safety and convenience of all users and should not hinder bicyclists or pedestrians with overly long waits or insufficient crossing times.

INTERSECTION GEOMETRY

Intersection geometry is a critical element of intersection design, regardless of the type of traffic control used. Geometry sets the basis for how all users traverse intersections and interact with each other. The principles of intersection geometry apply to surface street intersections with other surface streets as intersections with freeway ramps.

INTERSECTION SKEW

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

The travel distance across the intersection is greater, which increases exposure to conflicts and lengthens signal phases for bicyclists and pedestrians.

Skews require users to crane their necks to see other approaching users, making it less likely that some users will be seen.

Obtuse angles encourage high-speed turns.

MULTI-LEG INTERSECTIONS

Multi-leg intersections (more than two approaching roadways) are generally undesirable and introduce the following complications for all users:

- Multiple conflict points are added as users arrive from several directions.
- Users may have difficulty assessing all approaches to identify all possible conflicts.
- At least one leg will be skewed.
- Users must cross more lanes of traffic and the total travel distance across the intersection is increased.
- Total signal cycle length is likely increased.

CURB RADII

This intersection geometry feature has a significant impact on the comfort and safety of non-motorized users. Tight curb radii provide the following benefits:

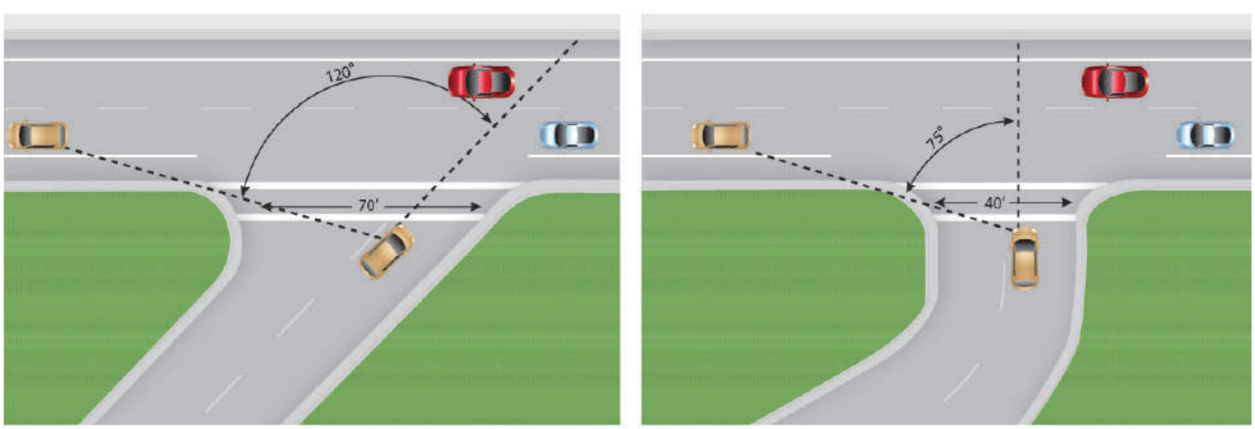
- Smaller, more pedestrian-scale intersections
- Slower turning speeds
- Reduced pedestrian crossing distance and required crossing time
- Simpler, more appropriate crosswalk and ramp placement, in line with the approaching sidewalks

CURB EXTENSIONS

Where on-street parking is allowed, curb extensions should be considered in the parking lane at intersection approaches. Curb extensions should be the same width as the parking lane. The appropriate curb radius should be applied based on the guidance in the section above. Due to reduced road width, the curb radius on a curb extension may need to be larger than if it were not installed.

Curb extensions offer many benefits related to the creation of active, balanced streets:

- Reduced pedestrian crossing distance, resulting in less exposure to motor vehicles and shorter pedestrian clearance intervals at signals
- Improved visibility between motorists and pedestrians and slower turning speeds
- A narrowed roadway, which has a potential traffic calming effect
- Additional room for street furniture, landscaping, and curb ramps



Realigning the skewed intersection in the graphic on the left to the right-angle connection in the graphic on the right results in less exposure distance and better visibility for all users.
(Credit: Michele Weisbart)

- Additional on-street parking potential due to improved sight lines at intersections. Since curb extensions allow pedestrians to walk out toward the edge of the parking lane without entering the roadway, pedestrians can better see vehicles and motorists can better see pedestrians.
- Management of stormwater runoff

RIGHT-TURN CHANNELIZATION ISLANDS

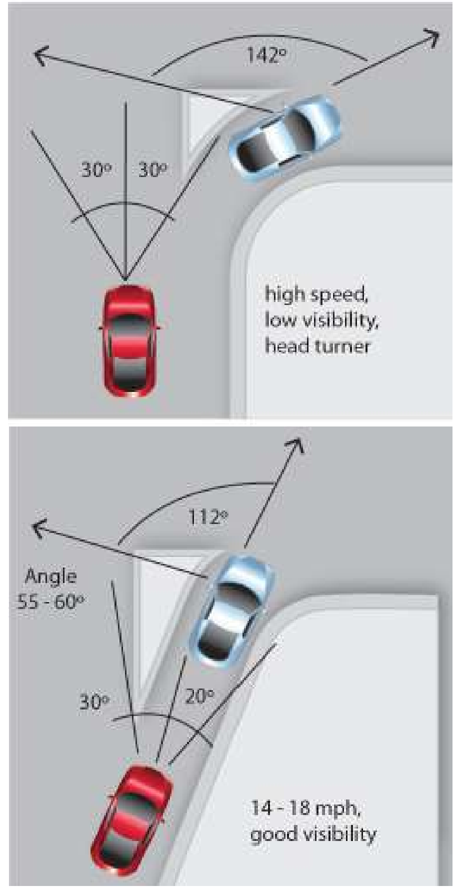
Right-turn lanes should generally be avoided as they increase the size of the intersection, the pedestrian crossing distance, and the likelihood of right-turns-on-red by inattentive bicyclists and motorists who do not notice pedestrians crossing from their right. However, where there are heavy volumes of right turns (approximately 200 vehicles per peak hour or more), a right-turn lane may be the best solution to provide additional capacity without adding additional lanes elsewhere.

At intersections with one receiving lane where buses and trucks make frequent right turns, a raised channelization island between the through lanes and the right-turn lane is a good alternative to an overly large corner radius. If designed correctly, a raised channelization island can achieve the following objectives:

- Allow pedestrians to cross fewer lanes at a time
- Allow motorists and pedestrians to judge the right turn/pedestrian conflict separately
- Reduce pedestrian crossing distance, which can improve signal timing for all users
- Balance vehicle capacity and truck turning needs with pedestrian safety
- Provide an opportunity for landscape and hardscape enhancement

The following design practices for right-turn lane channelization islands should be used to provide safety and convenience for pedestrians, bicyclists, and motorists:

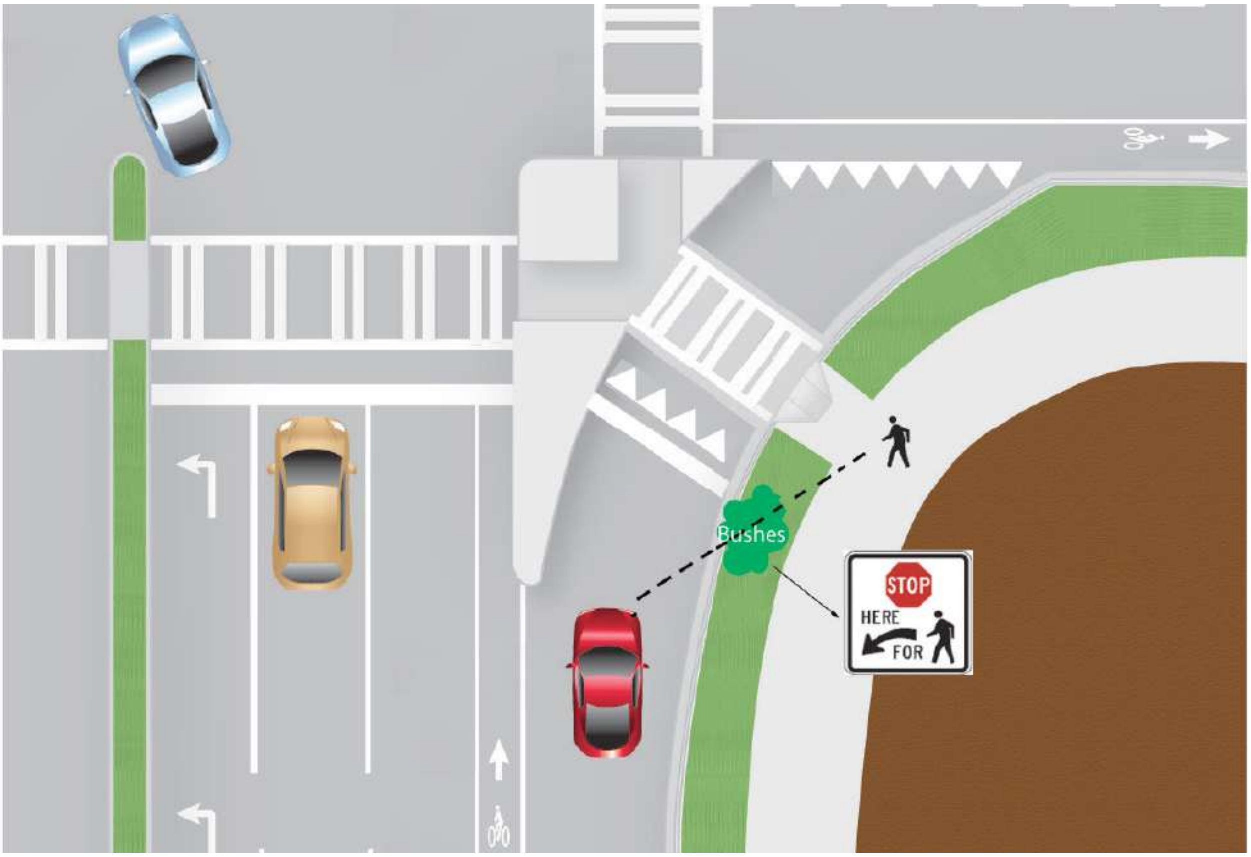
- Align slip lane at a 55-60 degree angle to reduce turning speeds and improve the yielding driver's ability to see bicyclists, motor vehicles and pedestrians
- Place the crosswalk across the right-turn lane about one car length back from where drivers yield to traffic in the receiving lane(s), allowing the yielding driver to respond to a potential pedestrian conflict first, independently of the vehicle conflict, and then move forward (within designated Senior Zones, the crosswalk shall be placed at the entry to the channelized right-turn lane)



Acute angles for channelized right-turn lanes are important to slow turning vehicles and increase sightlines
(Credit: Michele Weisbart)

- Install a stop bar and a STOP HERE FOR PEDESTRIANS sign (R1-5b) for the slip lane in advance of the crosswalk
- Consider a raised crosswalk to encourage slower speeds and yielding and to mitigate safety impacts of higher-speed turns (raised crosswalks should be prioritized in designated Senior Zones and adjacent to elementary schools)
- Install a yield bar and yield signs for the slip lane in advance of the merge with the receiving lanes

It is also important to consider pedestrian sight lines from the crosswalk termini. Pedestrian sight lines should not be blocked by vegetation or other obstructions next to the channelization island. According to the City of Atlanta's Senior Zone Policy, intersection sight distance (within Senior Zones) for right turns should be at least 2.5 seconds, at least 8 seconds for left turns, and an additional 0.5 second for each lane crossed (if more than one). Providing a dedicated lane feeding the channleized right-turn lane allows crossing pedestrians to clearly recognize gaps in approaching vehicles.



Channelized right-turn lanes should include advance stop bars and signage, raised crosswalks where appropriate, yield bars at merge with receiving lanes and arpropriate sightlines for crossing pedestrians.
(Credit: Michele Weisbart)

This reccommended channelized right-turn lane design is different from those that are intended to provide free-flow movements, where right-turning motorists turn into an exclusive receiving lane at high speed. In these cases, right turns should be STOP or signal-controlled to provide for a protected pedestrian crossing.

ROUNDABOUTS AND MINI-ROUNDABOUTS

Modern roundabouts are potentially the cheapest, safest and most context-sensitive form of traffic control for many intersections. Refer to the additional guidance at the end of this chapter for additional detail.

TRAFFIC CONTROL

YIELD AND STOP CONTROLLED INTERSECTIONS

Unsignalized intersection traffic control options include the following:

- Yield control, which is underutilized and should be considered more often to reduce unnecessary stops due to the overuse of STOP signs (especially on Neighborhood Greenways).
- Two-way stop control, which is the most common form of intersection control. This is also an overused control. At many intersections a neighborhood traffic circle is a preferable and more effective option.
- All-way stop control, which is often overused, incorrectly, to slow traffic.

SIGNALIZED INTERSECTIONS

Signalized intersections provide unique challenges and opportunities for livable communities and multi-modal streets. On one hand, signals provide control of bicyclists, pedestrians and motorists with numerous benefits. Where signalized intersections are closely spaced, signals can be used to control motorist speeds by providing appropriate signal progression on a corridor. Traffic signals allow bicyclists and pedestrians to cross major streets with only minimal conflicts with motorists. On the other hand, traffic signals can create challenges for non-motorized users. Signalized intersections often have significant motorist turning volumes, which conflict with concurrent pedestrian and bicycle movements. Even if an intersection meets signal warrants other measures, such as roundabouts should be considered In many cases, roundabouts offer safer, more convenient intersection treatment than signals.

SIGNAL DESIGN

Approximately two percent of roadway intersections are signalized, and approximately 20 percent of all intersection crashes occur at signalized intersections. Unfortunately, in many locations, signalization is the only option because of right-of-way limitations, high motorist volumes, and the need to create gaps to increase convenience for all users.

Over the years, the most common signal hardware has changed from pedestal-mounted signals to overhead mast arms. This change has lifted drivers' eyes upward and created a situation in many east/west streets where drivers must look toward a rising or setting sun that can block vision of a signal. In urban areas, the large mast arms can be intrusive and visually unappealing. As part of a conversion to activate and balance Atlanta's streets, changing to pedestal-mounted signals in the City Core and Growth Corridor character area category could lower the cost of installing and maintaining traffic signals, reduce the negative visual impacts, and help return drivers' vision back to street level, leading them to drive slower on the approach.

PEDESTRIAN ACTUATION AND ACCESSIBILITY

Automatic recall for all pedestrian phases should be used at all intersections located within the City Core and Growth Corridor character area category If pedestrian actuation is to be introduced, it should be limited only to the hours of the day when a pedestrian is not likely to be present at every signal cycle. The simple presence of pedestrian push-buttons does not require the use of pedestrian actuation during all times of day.

Wayfinding for pedestrians with visual impairments is significantly improved with the use of Accessible Pedestrian Signal (APS) at signalized intersections. In fact, APS are the most commonly requested accommodation under Section 504 of the Rehabilitation Act of 1973. They communicate information about pedestrian timing in non-visual formats such as audible tones, verbal messages, and/or vibrating surfaces. Verbal messages provide the most informative guidance.

SIGNAL CYCLES/PHASES/INTERVALS

A signal phase is the dedication of the right-of-way to a specific movement or combination of movements. Once programmed, the signal phases provide for all of the movements allowed at an intersection, sometimes protected and sometimes permissive.

The City of Atlanta will continue to base its signal design standards on the MUTCD and on accepted traffic engineering practice, though in implementing Atlanta's Transportation Plan, this guidance document encourages the use of shorter signal cycles and timing plans that promote convenient walking and crossing over moving high volumes of vehicle traffic, especially in Atlanta City Design-designated growth areas and the City Core and Growth Corridor character area category.

With regard to pedestrians, MUTCD requires that transportation agencies use an assumed walking speed of 3.5 feet/second for signal timing. In situations where a large number of senior and/or disabled pedestrians cross, this may be inadequate.

At intersections with excessive pedestrian delay, pedestrians will often avoid the intersection and cross midblock and/or cross against the light at the intersection. Both behaviors can endanger pedestrians and foster a sense of disregard for traffic control devices by bicyclists, pedestrians and motorists. According to the 2010 Highway Capacity Manual, there is a high likelihood that pedestrians will not comply with the signal when experiencing delays greater than 30 seconds per phase (Highway Capacity Manual 2010, citing Dunn & Pretty, 1984).

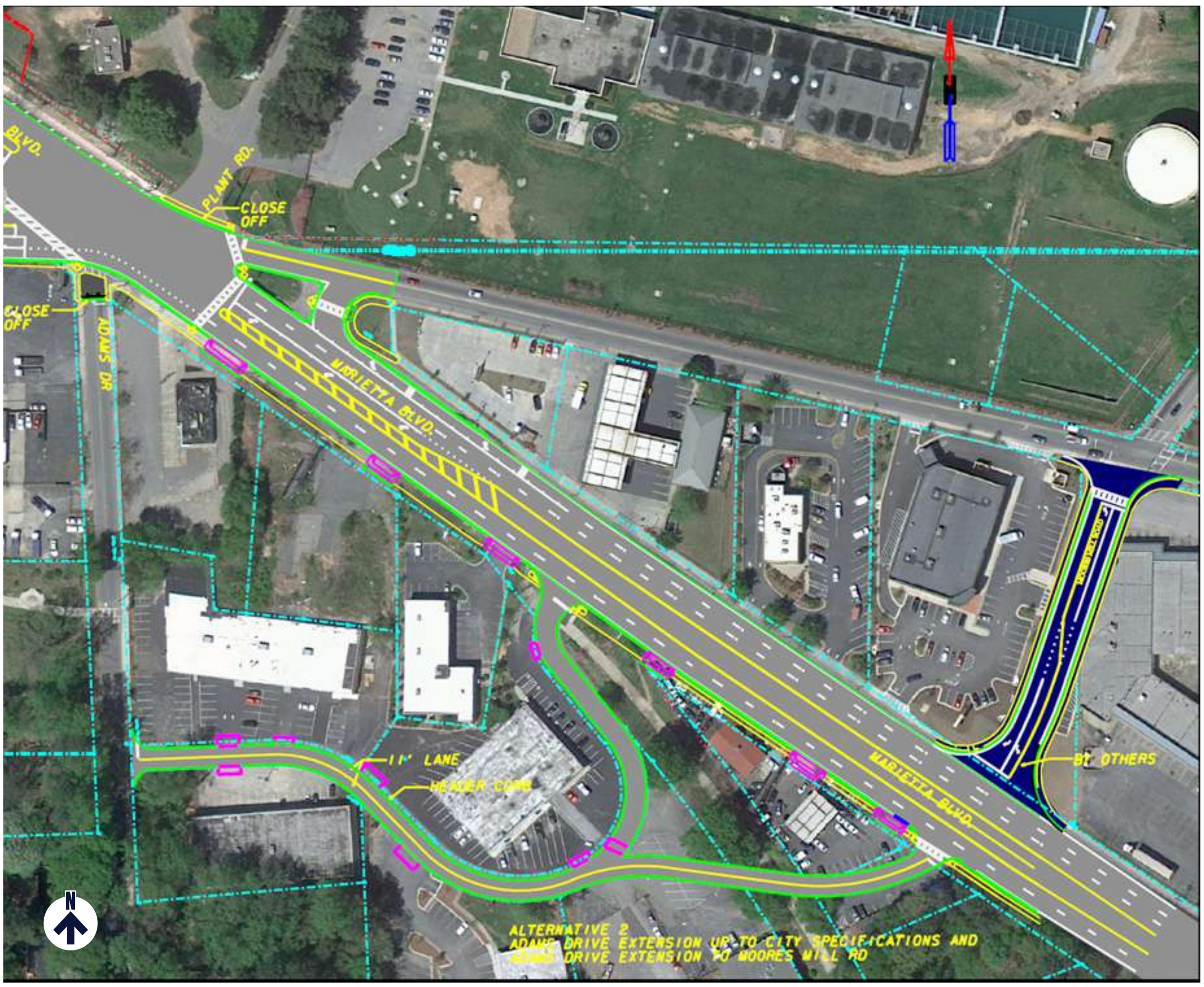
Bicycle signal phases facilitate bicyclist turning movements and roadway crossings. Bicycle phasing makes crossing intersections safer for bicyclists by clarifying when to enter an intersection and by restricting conflicting vehicle movements. Determining whether to include bicycle phasing at a signalized intersection depends on a variety of factors. These include designation as a Bicycle Connection in the Plan, roadway speed limits, average daily traffic, anticipated bicycle crossing and turning traffic, the configuration of planned or existing bicycle facilities, and all contra-flowing facilities, City wide. Bicycle phasing may be required as part of the construction of a protected bicycle facility such as a cycle track with potential turning conflicts, or to decrease vehicle or pedestrian conflicts at major crossings. An intersection with bicycle phasing may reduce stress and delays for a crossing bicyclist, and discourage illegal and unsafe maneuvers.

EXAMPLE PROJECT

BOLTON ROAD/MARIETTA BOULEVARD INTERSECTION PROJECT

Funded by a Livable Centers Initiative grant, the Bolton Road-Marietta Boulevard Intersection Project is a model for the realignment of a multi-leg intersection, also addressing some of the problems with intersection skew.

The Bolton Road-Marietta Boulevard Intersection Project has improved the intersection geometry and efficiency by closing Adams Drive (see graphic). The project includes upgrades to existing signals, installation of an additional turn lane on the eastbound leg of Bolton Road, improved pedestrian facilities, restriping of travel lanes, and drainage facilities.



Design schematic for the Bolton Road-Marietta Boulevard Intersection Project.
(Credit: Pond & Company)

DESIGN STANDARDS

<table>
<tr><td rowspan="2">SIGHT DISTANCE</td><td colspan="2">In the City of Atlanta, the required sight visibility triangle at intersections is 20’ by 20’. At intersection corners, no on-street parking or objects between 3’ and 10’ high are permitted in the sight visibility triangle. The required sight triangles at intersections depends on the type of intersection control, see the AASHTO Green Book for more details.</td></tr>
<tr><td colspan="2">According to the City of Atlanta’s Senior Zone Policy, intersection sight distance (within Senior Zones) for right turns should be at least 2.5 seconds, at least 8 seconds for left turns, and an additional 0.5 second for each lane crossed (if more than one). Providing a dedicated lane feeding the channelized right-turn lane allows crossing pedestrians to clearly recognize gaps in approaching vehicles.</td></tr>
<tr><td rowspan="2">PEDESTRIAN REFUGE</td><td>Crosswalks and ramps at intersections should be placed so they provide convenience and safety for all types of pedestrians.</td><td rowspan="2">

Lateral projection of sidewalk should align with crosswalk (Credit: Michele Weisbart)</td></tr>
<tr><td>At all intersections, regardless of the number of intersection legs, pedestrian refuges should be provided if the crossing distance exceeds 40 feet or four travel lanes.</td></tr>
<tr><td>GUIDING BICYCLES THROUGH INTERSECTIONS</td><td colspan="2">At skewed and multi-leg intersections, travel lanes and bicycle lanes should striped with mini-skips (“chicken tracks”) to guide bicyclists and motorists through a long undefined area, following MUTCD standards and guidance.</td></tr>
<tr><td>CORNER DESIGN AND CURB RADII</td><td colspan="2">When designing curb radii for active, balanced and multi-modal streets, the default design vehicle should be the passenger (P) vehicle. Therefore, the default curb radius is 15 feet. Refer to the Design Guidance for more detail on recommended curb radius dimensions.</td></tr>
<tr><td rowspan="2">CHANNELIZED RIGHT TURN LANES</td><td colspan="2">Install a stop bar and a STOP HERE FOR PEDESTRIANS sign (MUTCD sign R1-5b) for the slip lane in advance of the crosswalk.</td></tr>
<tr><td colspan="2">Install a yield bar and yield signs for the slip lane in advance of the merge with the receiving lanes.</td></tr>
</table>

DESIGN STANDARDS (CONT.)

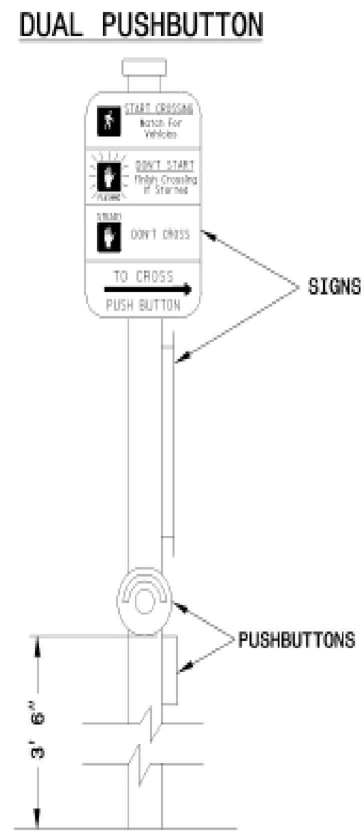
<table>
<tr><td rowspan="4">CROSSWALKS</td><td colspan="2">All crosswalks should be marked per City Standard, currently in the Piano-key Style in thermoplastic (per Detail Number TR-B_CW001).</td></tr>
<tr><td colspan="2">If decorative crosswalks are used, they shall include parallel >8”-wide white thermoplastic retroreflective bars on either side.</td></tr>
<tr><td colspan="2">Mark crosswalks on all legs of a signalized intersections, unless there are no sidewalks approaching on one or more of the corners. Not marking a crosswalk usually results in a pedestrian either walking around several legs of the intersection, exposing them to more conflicts, or crossing the unmarked leg, with no clear path or signal indication as to when to cross. Georgia state law designates crosswalks at all intersections.</td></tr>
<tr><td>Provide two ADA ramps per crosswalk. Ramps must be entirely contained within a crosswalk, however ramps do not have to be centered in the crosswalk. Align the ramp run with the crosswalk. ADA ramps and landings should should be constructed to current ADA standards.</td><td></td></tr>
<tr><td rowspan="3">TRAFFIC CONTROL</td><td colspan="2">The use of all-way stops should be consistent with the MUTCD or DPW adopted policy. At many intersections, a neighborhood traffic circle is a preferable and a more effective option.</td></tr>
<tr><td colspan="2">Roundabouts should always be considered before traffic signals during the project scoping and design phases.</td></tr>
<tr><td colspan="2">Where a gridded street network exists in the urban core, it is desirable to have most, if not all, intersections signalized. Not only do well-timed signalized intersections in this context regulate vehicle speeds and allow more efficient traffic flow, but they also create more convenient crossing opportunities for pedestrians.

Include automatic recall for pedestrian phase at intersections within the City Core and Growth Corridor character area category (this should be for signalized intersections with our with existing pedestrian push buttons.

At all intersections within City Core and Growth Corridor character area categories and at other intersections where there is a high probability of pedestrian demand at every cycle, WALK intervals should be set to an automatic pedestrian leading interval prior to concurrent parallel vehicle phase (with or without the presence a pedestrian push-button).

Use leading pedestrian intervals (LPI) at all intersections in the City Core and Growth Corridor Character Area category and other intersections with a high number of turning motorist-pedestrian conflicts.</td></tr>
<tr><td>PEDESTRIAN SIGNAL DEVICES</td><td>All new pedestrian signals heads within the City of Atlanta shall include a pedestrian countdown indication per current MUTCD manual.</td><td>
Pedestrian countdown signals
(Credit: Sky Yim)</td></tr>
</table>

DESIGN STANDARDS (CONT.)

<table>
<tr><td rowspan="2">PEDESTRIAN SIGNAL DEVICES</td><td>Pedestrian actuation should only be used at intersections located outside of the City Core and Growth Corridor character area category where pedestrians are not expected to be present at each signal cycle during most times of day.</td><td rowspan="2">
</td></tr>
<tr><td>These devices should be installed close to the departure location. Since they are typically only audible 6 to 12 feet from the push button, 10 feet should separate two APS devices on a corner. If two accessible pedestrian push buttons are placed less than 10 feet apart or on the same pole, each accessible pedestrian push button shall be provided with a push button locator tone, a tactile arrow, a speech walk message for the WALKING PERSON (symbolizing WALK) indication, and a speech push button information message. Volumes of the walk indication and push button locator tone shall automatically adjust in response to ambient sound.</td></tr>
<tr><td>BICYCLE SIGNALS</td><td colspan="2">Signals used for bicycle phasing within the City of Atlanta should consist of a standard 12” three-lens signal head with two regulatory signs (rectangular white signs with a black border and legend) reading “BICYCLE SIGNAL” mounted immediately above and below the signal head. Mounting the signal on the near side of the bicycle approach and/or using louvers or directional lenses may limit motorist confusion.</td></tr>
<tr><td>ADDITIONAL STANDARDS IN CHAPTER 6</td><td colspan="2">Refer to Chapter 6 “Streetscape and the Walking Environment,” for additional standards on crosswalks and pedestrian timing.</td></tr>
<tr><td>DETERMINING CROSSWALK LENGTH</td><td colspan="2">One of two methods should be used to determine the length of the crosswalk.
1. The crosswalk length should be measured from the center of one ADA ramp to the center of the opposing ADA ramp. This speed allows pedestrians, especially seniors, children, and disabled people, to clear the intersection.
2. The MUTCD includes another test that requires the total of the WALK interval plus the pedestrian clearance interval to be sufficient to allow a pedestrian traveling at a walking speed of 3 feet per second to travel the length of the crosswalk, measured from the top of one ADA ramp to the bottom of the opposing ADA ramp.</td></tr>
</table>

DESIGN GUIDANCE

SKEW-ANGLE INTERSECTIONS	Every reasonable effort should be made to design or redesign the intersection closer to a right angle. Some right-of-way may have to be purchased, but this can be offset by the larger area no longer needed for the intersection, which can be sold back to adjoining property owners or repurposed for a pocket park, rain garden, greenery, etc.
	Travel lanes and bicycle lanes may be striped with mini-skips (“chicken tracks”) to guide bicyclists and motorists through a long undefined area.
	At intersections where roads are skewed or where larger radii are necessary for trucks, it can be difficult to determine the best location for crosswalks and sidewalk ramps. In these situations, it is important to balance the recommended practices above. Tighter curb radii make implementing these recommendations easier.
MULTI-LEG INTERSECTIONS	To alleviate the problems with multi-leg intersections, several options are available: • Every reasonable effort should be made to design the intersection so there are no more than four legs. This is accomplished by removing one or more legs from the major intersection and creating a minor intersection further up or downstream. • As an alternative, one or more of the approach roads can be closed to motorists, while still allowing access for bicyclists and pedestrians. • Roundabouts should be considered.
CURB EXTENSIONS	To fully achieve the goal of active, balanced and multi-modal streets, the curb extension and parking area can be integrated into the furniture zone portion of the sidewalk. This technique involves using similar surface materials for the curb extension, parking area, and the sidewalk. Instead of the curb extensions appearing to jut out into the street, the parking appears as “parking pockets” in the furniture zone.
ON-STREET PARKING NEAR INTERSECTIONS	On-street parking should be positioned far enough away from intersections to allow for good visibility of traffic on the cross-street and pedestrians preparing to cross the street.
	To reinforce this design, where street grades permit, the gutter line and drainage grates should be placed between the travel lane and the parking lane/curb extensions. This is called a “valley gutter” and creates a stronger visual cue separating the parking lane from the bicycle lane or travel lane. It can sometimes allow existing drainage infrastructure to be left in place.
SELECTION OF DESIGN VEHICLES	Encroachment by large vehicles into the far receiving lanes on multi-lane roadways when turning is acceptable. When a design vehicle larger than the passenger (P) vehicle is used, the truck or bus should be allowed to turn into all available receiving lanes.
	Larger design vehicles should be used only where they are known to regularly make turns at the intersection, and curb radii should be designed based on the larger design vehicle traveling at crawl speed.
	If it is not feasible to tighten a curb radius at an overly wide intersection by moving the curb, a corner radius reduction may be implemented with paint, thermoplastic and/or traffic buttons (“turtles”).

DESIGN GUIDANCE (CONT.)

RIGHT-TURN LANES (GENERAL)	Right-turn lanes should generally be avoided as they increase the size of the intersection, the pedestrian crossing distance, and the likelihood of right-turns-on-red by inattentive bicyclists and motorists who do not notice pedestrians crossing from their right. However, where there are heavy volumes of right turns (approximately 200 vehicles per peak hour or more), a right-turn lane may be the best solution to provide additional capacity without adding additional lanes elsewhere.
RIGHT-TURN CHANNELIZATION ISLANDS	Align slip lane at a 55-60 degree angle to reduce turning speeds and improve the yielding driver's ability to see bicyclists, motor vehicles and pedestrians.
	Place the crosswalk across the right-turn lane about one car length back from where drivers yield to traffic in the receiving lane(s), allowing the yielding driver to respond to a potential pedestrian conflict first, independently of the vehicle conflict, and then move forward (within designated Senior Zones, the crosswalk shall be placed at the entry to the channelized right-turn lane).
	Consider a raised crosswalk to encourage slower speeds and yielding and to mitigate safety impacts of higher-speed turns (raised crosswalks should be prioritized in designated Senior Zones and adjacent to elementary schools).
	Pedestrian sight lines should not be blocked by vegetation or other obstructions next to the channelization island.
	Place crosswalks as close as possible to the desire line of pedestrians, which is generally in line with the approaching sidewalks. Crosswalks should be the same width as approaching sidewalks or shared-use paths and extend past edges of the ADA ramp flares.
	Provide as short as possible crossing distance to reduce the time that pedestrians are exposed to motor vehicles; this is usually as close as possible to right angles across the roadway, except for skewed intersections.
TRAFFIC CONTROL	To improve livability and pedestrian safety, signalized intersections should: • Provide signal progression at speeds that support the target operating speed for the street classification and character area category • Provide short signal cycle lengths, which allow frequent opportunities to cross roadways, improving the accessibility and livability of the surrounding area for all users • Include bicycle loop or video detection • Include clearly visible pedestrian signal heads • Include pedestrian push-buttons located immediately at the top of the corresponding ADA ramp on the side farthest from the intersection • Locate signal cabinet and signal mast arm in the furniture zone or at the far edge of the right-of-way, well outside of the pedestrian clear zone • Include pedestrian signal phasing that increases safety and convenience for pedestrians, as discussed in more detail below
	Include transit vehicle preemption and/or priority at intersections.
	In the City of Atlanta, all traffic signal mast arms, signal heads and pedestrian signal pedestals should be CODA green. As shown in the graphic on next page, no obstructions should be placed in the pedestrian clear zone. Signal equipment (signal cabinet and signal mast arms) should be placed in the furniture zone if possible. If the furniture zone is impractical, equipment should be placed at the far edge of the right-of-way, or outside of the right-of-way within an easement on private property.

DESIGN GUIDANCE (CONT.)

<table>
<tr><td rowspan="3">TRAFFIC CONTROL (CONT.)</td><td>When possible, total cycle lengths should be a maximum of 80 seconds in the City Core and Growth Corridor character area category. When cycle lengths greater than 80 seconds are necessary, special consideration shall be given to pedestrian and bicycle delay. Video Detection can be used in place of a Loop Detection to reduce pavement cuts.</td></tr>
<tr><td>Where appropriate, use signal timing and operations techniques that minimize conflicts between bicyclists, pedestrians and motor vehicles, including the following:

• Protected left-only turn phases to limit turning conflicts
• Turn on red prohibition at intersections where there are interrupted motorist sight lines, an unusual number of pedestrian conflicts with turns on red compared to right-turns-on-green, double right-turns, and contra-flowing bicycle facilities or where a leading pedestrian interval is present
• Signs that remind drivers to stop for pedestrians when turning (MUTCD R10-15) at all signalized intersections with skewed approaches that enable higher-speed turns by motorists, interrupted motorist sight-lines, and/or dual right- or left-turn lanes that operate concurrently with the parallel pedestrian phase
• Pedestrian-user-friendly-intelligent (PUFFIN) signals in designated Senior Zones (a PUFFIN detects slower pedestrians in crosswalk and adds time to the pedestrian phase)
• Exclusive pedestrian phase (scramble) at intersections where a large number of pedestrians seek to cross diagonally between two destinations (i.e. park and transit station), or if the intersection is skewed, (e.g. Edgewood Avenue and Park Place)</td></tr>
<tr><td>Bicycle phasing may be required as part of the construction of a protected bicycle facility such as a cycle track with potential turning conflicts, or to decrease vehicle or pedestrian conflicts at major crossings. An intersection with bicycle phasing may reduce stress and delays for a crossing bicyclist, and discourage illegal and unsafe maneuvers.</td></tr>
</table>

ADDITIONAL GUIDANCE: ROUNDABOUT DESIGN

A roundabout is an intersection design with the following characteristics and features:

Users approach the intersection, slow down, stop for pedestrians in a crosswalk, and then enter a circulating roadway, yielding to drivers already in the roundabout. The circulating roadway encircles a central island around which vehicles travel counterclockwise. Splitter islands force drivers to turn right, and provide a refuge for pedestrians. Deflection encourages slow traffic speeds, but allows movement by trucks. A landscaped visual obstruction in the central island obscures the driver's view of the road ahead, to discourage users from entering the roundabout at high speeds. Pedestrians are not allowed to access the central island, which should not contain attractions. The central island can vary in shape from a circle to a "square-a-bout" in historic areas, ellipses at odd shaped intersections, dumbbell, or even peanut shapes.

Each leg of a roundabout has a triangular splitter island that provides a refuge for pedestrians, prevents drivers from turning left (the "wrong-way"), guides drivers through the roundabout by directing them to the edge of the central island, and helps to slow drivers. Roundabouts can range from quite small to quite large, from a central island diameter of about 12 feet for a traffic calming device at a neighborhood intersection to 294 feet to the back of sidewalk on a large multi-lane roundabout.

This section of the chapter briefly describes roundabout application and design information. For more detailed information, refer to NCHRP Report 672, Roundabouts: An Informational Guide, Second Edition.

ADVANTAGES AND DISADVANTAGES

Roundabouts reduce vehicle-to-vehicle and vehicle-to-pedestrian conflicts, and, due to a substantial reduction in vehicle speeds, reduce all forms of crashes and crash severity. In particular, roundabout eliminate the most dangerous and common crashes at signalized intersections: left-turn and right-angle crashes.

- Other benefits of roundabouts include the following:
- Little to no delay for pedestrians, who have to cross only one direction of traffic at a time
- Improved accessibility for bicyclists through reduced conflicts and vehicle speeds
- A smaller environmental footprint (no electricity is required for operation and fuel consumption is reduced as motor vehicles spend less time idling and don't have to accelerate as often from a dead stop)
- The opportunity to reduce the number of vehicle lanes between intersections (e.g., to reduce a five-lane road to a two-lane road, due to increased vehicle capacity at intersections)
- Little to no stopping during off-peak hours
- Significantly reduced maintenance and operational costs because the only costs are related to the landscape and litter control
- Reduced delay, travel time, and vehicle queue lengths
- Lowered noise levels
- Simplified intersections
- Easier U-turns, which allows for installation of access-control medians
- The ability to create a gateway and/or a transition between distinct areas through landscaping

When constructed as a part of a new road or the reconstruction of an existing road, the cost of a roundabout is minimal and can be cheaper than the construction of an intersection and the associated installation of traffic signals and additional turn lanes.

Light rail vehicles and streetcars can pass through the center of a roundabout without delay because rail vehicles can be assigned the right of way.

The primary disadvantage is that sight-impaired pedestrians can have difficulty navigating around large roundabouts. But this can be mitigated with ground level wayfinding devices.

GENERAL DESIGN ELEMENTS OF ROUNDABOUTS

CENTRAL ISLAND

The design of the central island is an important element of a roundabout. In conjunction with well-designed approach and departure lanes, the central island controls vehicle speeds through deflection and controls the size of vehicles that can pass through and turn at a roundabout. It provides space for landscaping to beautify an intersection or create a focal point or community enhancement, but it also provides space for the inclusion of a vertical element such as a tree, which helps approaching bicyclists and motorists recognize the roundabout.

SPLITTER ISLANDS

Splitter islands and/or medians on each approach serve several functions. Most importantly, they provide a refuge for pedestrians crossing at the roundabout, breaking the crossing into two smaller crossings. This allows pedestrians to select smaller gaps and cross more quickly. Splitter islands and medians direct vehicles toward the edge of the central island and limit the ability of drivers to make left turns the wrong way into the circulating roadway. Splitter islands should have a minimum width of 6 feet, and preferably 8 feet, from the face-of-curb to the opposite face-of-curb.

BUS/TRUCK APRON

Because central islands must be made high enough to deflect and hence control the speed of passenger vehicles, they can limit the ability of buses and trucks to pass through or turn at a roundabout. To accommodate large vehicles, a bus/truck apron (a paved, load-bearing area) is included around the edge of the central island. The bus/truck apron is often paved with a fairly rough texture, and raised enough to discourage encroachment by passenger vehicles and single-unit trucks. The curb at the edge of bus/truck apron should be approximately 3 inches high.

PEDESTRIAN CROSSINGS

Pedestrian crossings are located one car length before the circulating roadway to shorten the crossing distance, separate vehicle-to-pedestrian conflicts from vehicle-to-vehicle conflicts, and allow pedestrians to cross between waiting vehicles.

SIGNING AND MARKING

Signing and marking should be in compliance with the current version of the MUTCD. For detailed design guidance on roundabouts, refer to the NCHRP Report 672, Roundabouts: An Informational Guide, Second Edition, 2010. However, care must be taken to not oversign roundabouts by including every sign allowed at roundabouts, except for needed directional signs; most roundabouts are designed so their function and use are self-explanatory.

ROUNDABOUT DESIGN CRITERIA

Before starting the design of a roundabout it is very important to determine the following:

- The goal/reason for the roundabout, such as crash reduction, capacity improvement, speed control, or creation of a neighborhood gateway or a focal point (all are valid reasons)
- The number and type of lane(s) on each approach and departure as determined by a capacity analysis
- The presence of and plans for sidewalks approaching the roundabout
- The presence of and plans for bicycle facilities approaching the roundabout
- The presence of and plans for transit facilities and routes approaching the roundabout
- The design vehicle for each movement
- Right-of-way and its availability for acquisition, if needed
- The grade of each approach

OPERATIONS AND ANALYSIS

Roundabouts operate on the principle that drivers approach a roundabout and look left for any approaching vehicles that could conflict with their travel path. If there is no possible conflict, the approaching driver can enter the roundabout without delay. If there is a vehicle, or many conflicting vehicles, the approaching drivers stop and yield to the conflicting vehicle(s) on their left and wait for a safe gap to enter the roundabout.

In simple terms, a roundabout capacity analysis determines the number of vehicles seeking to enter a roundabout from each approach and the availability of gaps. Based on this gap acceptance analysis, the number and type of approach and departure lanes can be determined to provide the desired level of operation. Since roundabouts keep traffic moving they have greater capacity than both signalized and stop-controlled intersections. Roundabout designer Michael Wallwork has observed about a 30 percent increase in intersection capacity with roundabouts over traffic signals.

Single-lane roundabouts can vary in size with central island diameters from 12 to 90 feet to fit a wide range of intersections and accommodate through movements and different turn movements by various design vehicles. As such, they can be used at a large number of intersections to achieve various objectives.

In some cases, roundabouts are constructed to accommodate through movements by large articulated trucks but do not permit them to make turn movements. However, they do accommodate turn movements by single-unit trucks such as ladder trucks and garbage trucks. In some cases, restricting or not accommodating turn movements by articulated trucks enables the construction of a smaller roundabout without acquisition of right-of-way and with all the benefits of roundabouts at the cost of forcing the occasional large truck to take an alternate route.

DESIGN

Following a careful assessment of the need to accommodate some or all design vehicle movements and the impact of that accommodation, the size of the roundabout is selected and a concept plan is prepared. The concept plan is then refined with the simultaneous application of design vehicle templates and design speed checks until a suitable design is prepared that meets design requirements. Bicycle and pedestrian facilities are incorporated and the signing and marking plans are drafted. In some cases, right-turn bypass lanes can be added to accommodate high turning volumes.

When single-lane roundabouts prove to be inadequate for the traffic volume, consideration should be given to using roundabouts that have two through lanes on the major street and a single lane on the minor street with or without additional bypass lanes before automatically designing a full multi-lane roundabout. Because these roundabouts are larger than single-lane roundabouts, they often accommodate all turn movements by most large vehicles. However, it is still necessary to confirm the size and movements by the design vehicle(s) because these roundabouts often have to accommodate larger trucks or special vehicles. It is necessary to consider the accomodation of buses and streetcar in the design of multi-lane roundabouts along existing or planned transit routes.

With many old style freeway interchanges failing, often because of a lack of storage for turning vehicles, retrofitting a roundabout on both sides of the freeway can reduce congestion and improve pedestrian mobility without widening the freeway bridge. Sometimes, the retrofit of a standard interchange with roundabouts can reduce the space allocated to the interchange, freeing the land for other community uses.

MULTI-LANE ROUNDABOUTS

Multi-lane roundabouts are more difficult for bicyclists and pedestrians to use because of the additional lanes, slightly higher speeds, and longer crossing distances. Crossing by some pedestrians with disabilities is a more complex task. As a consequence, the current draft PROWAG (Public Right-of-Way Accessibility Guidelines) includes a requirement to install accessible pedestrian signals at all crosswalks across any roundabout approach with two or more lanes in one direction. The PROWAG requirement does not specify the type of signal type except that it must be accessible, including a locator tone at the push button, with audible and vibrotactile indications of the pedestrian walk interval. Multi-lane roundabouts may need additional pedestrian safety countermeasures, such as a rectangular rapid flashing beacon (RRFB) (see Chapter 6, “Streetscape and the Walking Environment”).

METERING SIGNALS

Often a roundabout capacity is only exceeded during one peak period and often for only a short period. Rather than constructing a larger multi-lane roundabout, consideration should be given to constructing a smaller roundabout that is adequate for 23 hours a day and adding a metering signal for the short peak period when congestion can occur. A metering signal is similar to freeway ramp metering, where the approaching vehicle queue is metered and a part time signal is used to create gaps in the traffic flow. The result is a smaller, slower roundabout that is more appropriate for all users for most of the day.

DESIGN

Multi-lane roundabouts are more complex to design. However, the design process is the same as for single-lane roundabouts: confirm the design vehicle for each movement, prepare a concept plan, and refine it with the simultaneous use of design vehicle templates or software like AutoTURN and speed curves.

This page is intentionally blank

Chapter 6

STREETSCAPE AND THE WALKING ENVIRONMENT

The pedestrian environment, often equated with sidewalks, includes sidewalks, curb ramps, crosswalks, bus stops, signs, and street furniture. While perhaps not obvious at first glance, this is the realm of streets with the greatest amount of design detail considered and the variation in user capabilities, and thus the realm where attention to design detail is essential to effectively balance user needs. This is also where signs and street furniture are located, and where transitions are made between transportation modes (e.g., driver or passenger to pedestrian via parking, bus stop/ train station, or bike rack). For these reasons, the concept of universal access is especially important in the design of the pedestrian environment.

Without strict design guidelines, sidewalks are often too narrow, utility poles obstruct travel, steep driveway ramps are impassable to wheelchair users, and bus stops become blocked by the disorderly placement of shelters, poles, trash receptacles, and bike racks. When designed appropriately, new sidewalks will accommodate pedestrians of all ages and physical abilities and become inviting pedestrian environments.

This chapter details design guidelines for various streetscape elements. It also summarizes the legal framework for accessible design of streets and sidewalks, various users of streets and sidewalks and their needs, and important elements of pedestrian facility design.

DESIGN PRINCIPLES

The following design principles inform the recommendations made in this chapter and should be incorporated into every pedestrian improvement:

- The walking environment should be safe, inviting, and accessible to people of all ages and physical abilities.
- The walking environment should be easy to use and understand.
- The walking environment should seamlessly connect people to places. It should be continuous, with complete sidewalks, well-designed curb ramps, and well-designed street crossings
- Streetscape design, in addition to its aesthetic enrichment of the street right-of-way, should enhance the walking environment as much as possible.

WHY ARE THESE PRINCIPLES IMPORTANT?

Title II of the Americans with Disabilities Act (ADA) of 1990 requires state and local governments and public transit authorities to ensure that all of their programs, services, and activities are accessible to and usable by individuals with disabilities. They must ensure that new and modified facilities are designed and constructed to be accessible to persons with disabilities. State and local governments must also keep the accessible features of facilities in operable working condition through maintenance measures including sidewalk repair, landscape trimming, work zone accessibility, and snow removal.

An example of sidewalk zone widths in a City Core and Growth Corridor Peachtree Street.

SIDEWALKS

Sidewalks should provide a comfortable space for pedestrians between the roadway and adjacent land uses. Sidewalks along city streets are the most important component of pedestrian mobility. They provide access to destinations and critical connections between modes of transportation, including automobiles, transit, and bicycles. General provisions for sidewalks include pedestrian clear zone width, slope, space for street furniture, utilities, trees and landscaping, and building ingress/egress.

In addition to improving safety and accessibility, sidewalk design can also impact crime prevention efforts. According to Crime Prevention Through Environmental Design (CPTED) principles, pedestrian areas that are enclosed, poorly lighted or obscured by vegetation (or fencing) can create areas which make pedestrians more vulnerable to crime and encourage criminal activity. Designers should aim to avoid the creation of "mugger's walks" by preserving pedestrian sight lines and visibility. To improve safety, street trees and vegetation should not obscure pedestrian sight distance or driver sight lines, particularly at intersections.

The perception of safety can also be improved by designing buildings at a pedestrian scale, avoiding the installation of fencing and parking lots next to the sidewalk, and encouraging active uses fronting the street. Empty or vacant lots (and unnecessarily large setbacks) next to sidewalks can create the perception of being exposed and vulnerable to crime.

Sidewalks are defined as the area between the street's curb line and the adjacent property line that is intended for pedestrians (see Atlanta Code of Ordinances). Sidewalks include four distinct areas: the supplemental zone, the pedestrian clear zone, the furniture zone, and the curb. For the purpose of this design guide, terms are used which are most consistent with the Atlanta Code of Ordinances. The minimum recommended widths of each of these sidewalk zones vary based on street classifications as well as character area categories. Generally, the City of Atlanta requires that sidewalks be at least 60 inches wide (5'). Georgia state law stipulates that accessible, 40 inch or 48 inch wide curb ramps be on each side of the street, with one ramp per linear block.

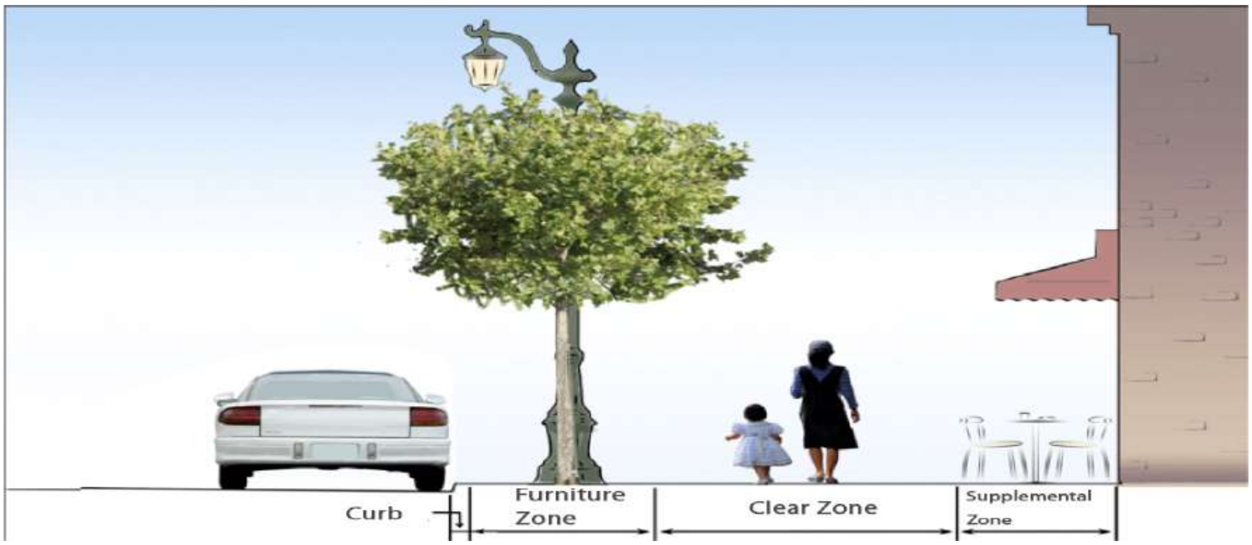
Preserving pedestrian sight lines is important for traffic safety and crime prevention, Ansley Park

SUPPLEMENTAL ZONE

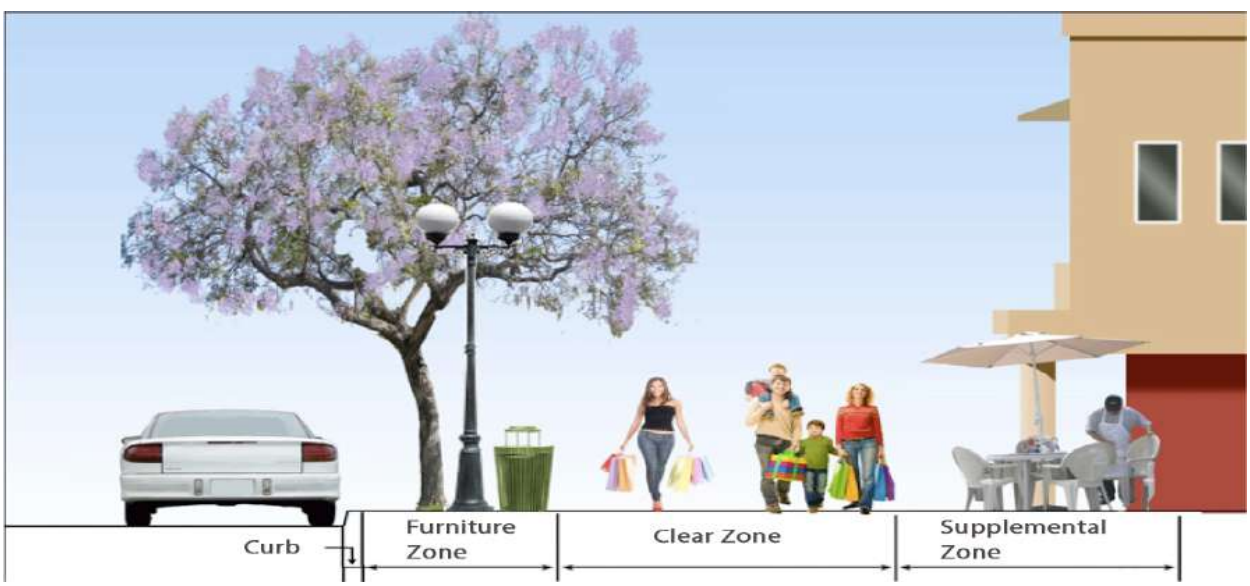
The supplemental zone is the portion of the sidewalk located immediately adjacent to buildings, and provides shy distance from buildings, walls, fences, or property lines. It includes space for building-related features such as entry ways and accessible ramps. It can include landscaping as well as awnings, signs, news racks, benches, and outdoor café seating. In single family residential neighborhoods, landscaping typically occupies the supplemental zone.

PEDESTRIAN CLEAR ZONE

The pedestrian clear zone, situated between the supplemental zone and the furniture zone, is the area dedicated to walking and should be kept clear of all fixtures and obstructions. Within the pedestrian clear zone, the Pedestrian Access Route (PAR) is the path that provides continuous connections from the public right-of-way to building and property entry points, parking areas, and public transportation. This pathway is required to comply with ADA guidelines and is intended to be a seamless pathway for wheelchair and cane users. As such, this route should be firm, stable, and slip-resistant, and should comply with maximum cross slope requirements (2 percent grade).



An example of the pedestrian zones in the Urban Neighborhood



An example of the pedestrian zones in the City Core and Growth Corridor

FURNITURE ZONE

The furniture zone is located between the curb line and the pedestrian zone. The furniture zone should contain all fixtures, such as street trees, bus stops and shelters, parking meters, utility poles and boxes, lamp posts, signs, bike racks, news racks, benches, waste receptacles, drinking fountains, and other street furniture to keep the pedestrian clear zone free of obstructions. Driveway aprons should also be entirely confined to the furniture zone. In residential neighborhoods, the furniture zone is often landscaped. Resting areas with benches and space for wheelchairs should be provided in high volume pedestrian districts and along blocks with a steep grade to provide a place to rest for older adults, wheelchair users, and others who need to catch their breath. When constructing or retrofitting sidewalks, it is important to consider the placement of utility poles within the public right-of-way. Utility poles shall be located within the furniture zone or the supplemental zone, and should not be within the pedestrian clear zone. At existing and future curbside transit stops, the furniture zone should consist of a smooth concrete surface between 60' and 80' long with very limited obstructions.

Furniture zone, pedestrian-scale lighting, Broad Street

CURB

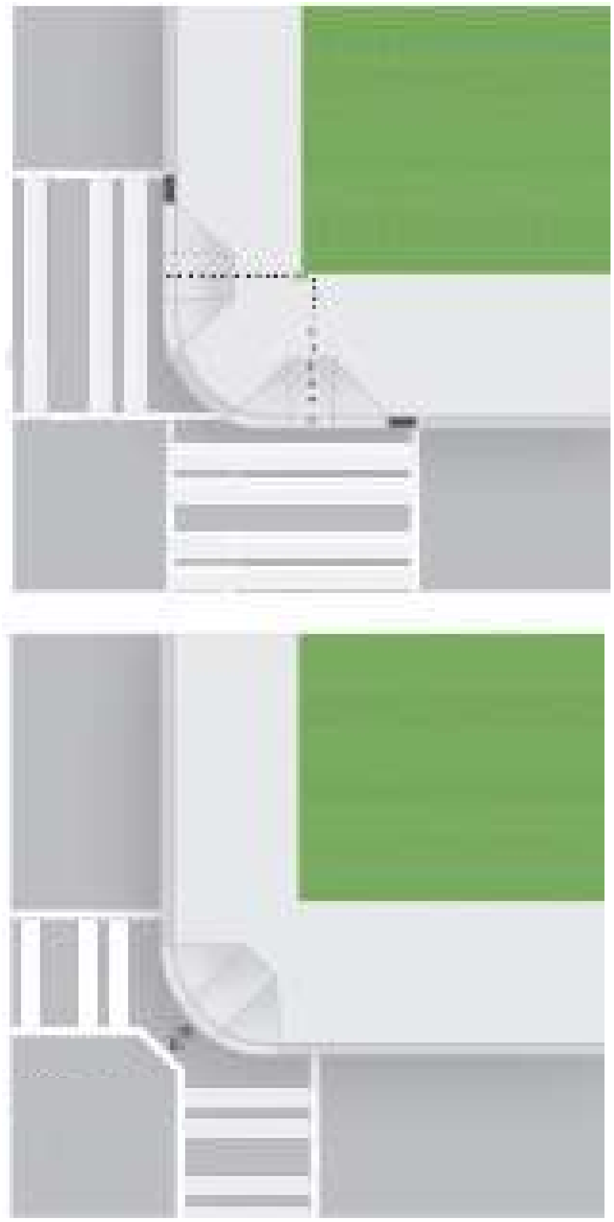
The curb serves primarily to prevent water, debris and vehicles from encroaching onto the sidewalk. It defines where the area for pedestrians begins, and the area for vehicles ends. It is the area people using assistive devices must traverse to get from the street to the sidewalk, so its design is critical to accessibility.

CURB RAMPS

Proper ADA ramp design is essential to enable pedestrians using assistive mobility devices (e.g., scooters, walkers, and crutches) to transition between the street and the sidewalk. These design guidelines provide a basic overview of curb ramp design. The ADA requires installation of curb ramps in new sidewalks and whenever an alteration is made to an existing sidewalk or street. Roadway resurfacing is considered an alteration and triggers the requirement for curb ramp installations or retrofits to current standards. ADA ramps are typically installed at intersections, mid-block crossings (including multi-use path connections), accessible on-street parking, and passenger loading zones and transit stops.

The following define the ADA ramp components along with minimum dimensions:

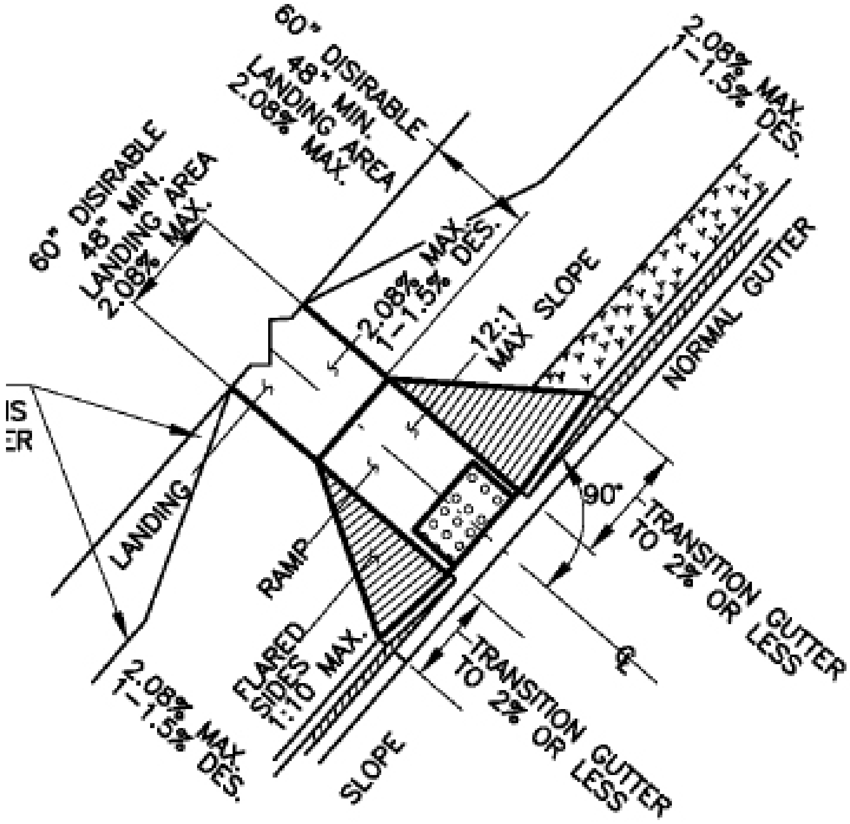
- Landing: the level area at the top of an ADA ramp facing the ramp path. Landings allow wheelchairs to enter and exit an ADA ramp, as well as travel along the sidewalk without tipping or tilting.
- Approach: the portion of the sidewalk on either side of the landing.
- Flare: the transition between the curb and sidewalk.
- Ramp: the sloped transition between the sidewalk and street where the grade is constant and cross slope at a minimum.
- Gutter: the trough that runs between the curb or ADA ramp and the street.
- Detectable Warning Strip: surface with distinct raised areas to alert pedestrians with visual impairments of the sidewalk-to-street transition.



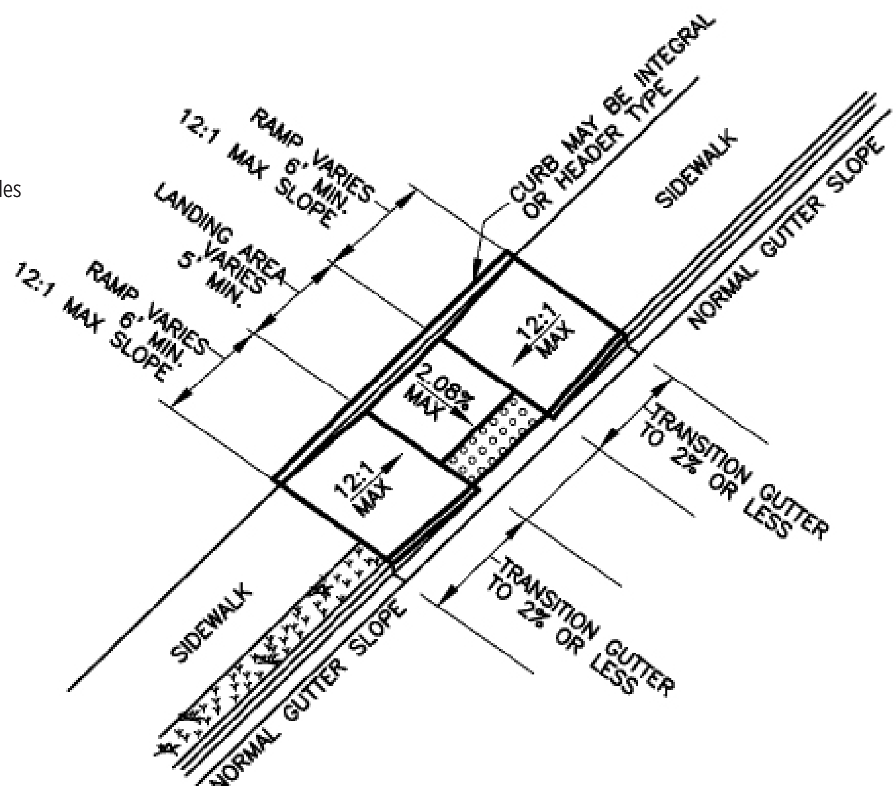
One ramp per crosswalk vs. single ramp at the apex
(Credit: Michele Weisbart)

ADA RAMP DESIGN

Type A ADA ramp; to be used in most circumstances where there is sufficient right-of-way and furniture zone width. This type of ramp is accommodated by a 4'x4' landing area

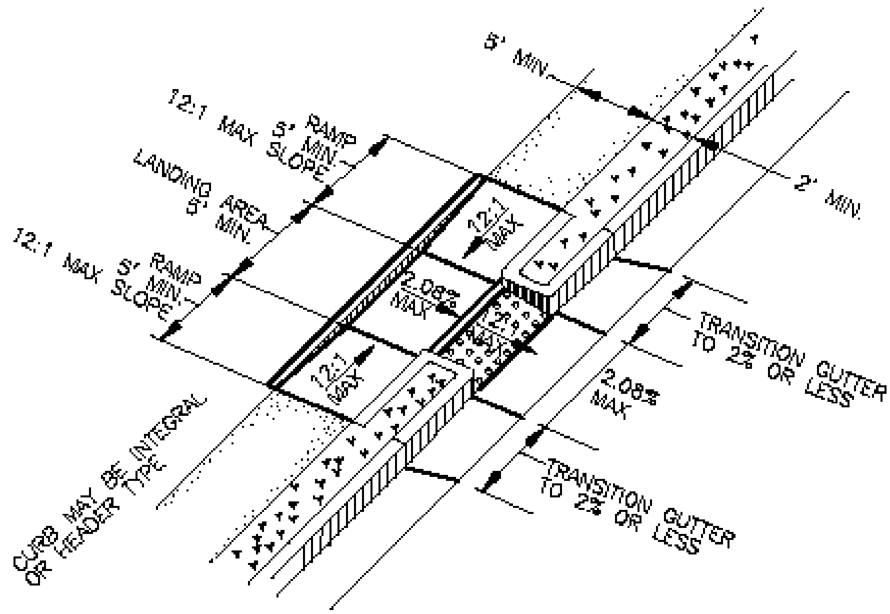


Type B ADA ramp; to be used where there is insufficient right-of-way and little to no furniture zone. This ramp des not contain a landing area.

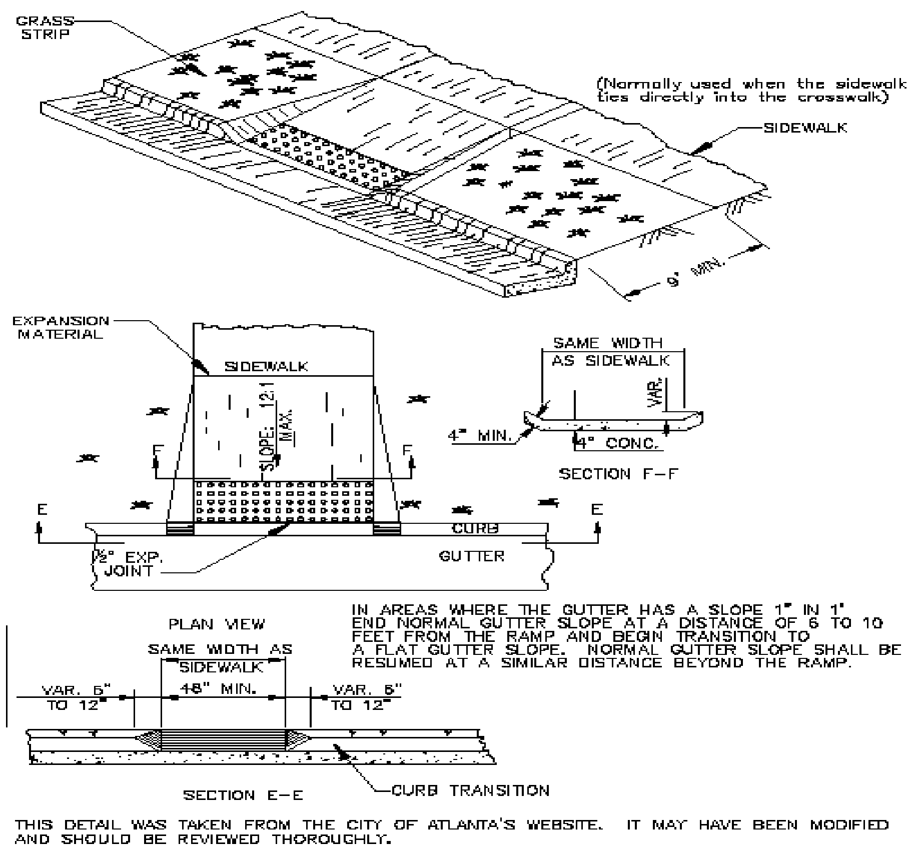


(NORMALLY USED WHEN SPACE
IS NOT AVAILABLE FOR A LANDING
AT THE TOP OF A TYPE A RAMP)

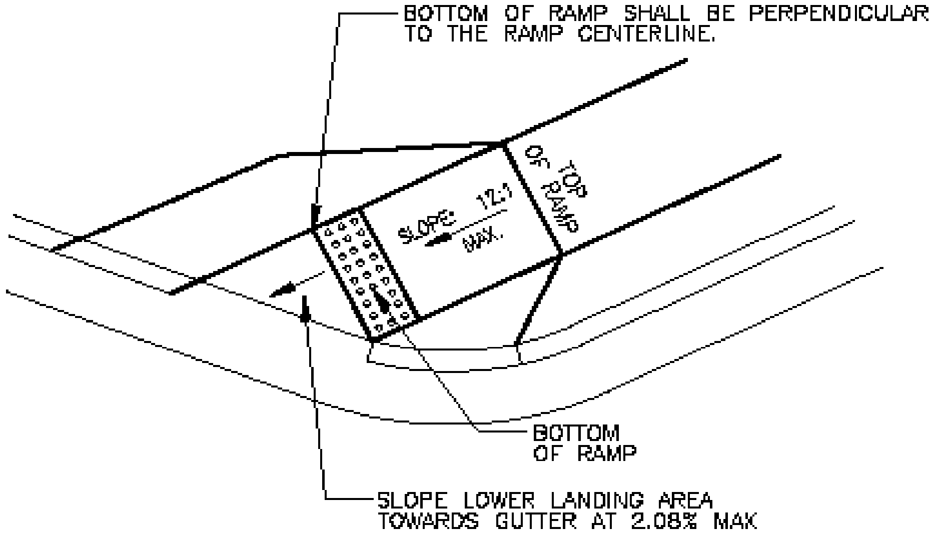
Type C Pedestrian Ramp



Type D Pedestrian Ramp



A Skewed ADA Ramp A and D only



DRIVEWAYS

Driveways connect residences, commercial development or industrial properties to the roadway. Driveways can present obstacles to pedestrian accessibility and bicycle safety, and should be designed to ensure a continuous and level pedestrian clear zone. Additionally, an excessive number of driveways can impede efficient traffic flow and pedestrian safety (mitigation is possible via access management strategies, see Chapter 4, "Street Design").

DRIVEWAY WIDTHS

Driveways widths should reflect their expected traffic volumes and vehicle type. Driveways serving multi-family residential uses should be the minimum width necessary to provide safe passage of two vehicles, but no wider. In circumstances where a drive serves only a small number of residential units and where a car is the expected vehicle type, two-way driveways may have a width of 18'. The width should be increased in situations with higher traffic volumes and larger vehicle types. However, in no circumstance shall the width exceed 12' for a one-way driveway or 24' for a two-way driveway.

DRIVEWAY APRONS

In the City of Atlanta it is customary for developers to place the top of a driveway apron at the right-of-way line. This has several negative impacts on the pedestrian and the motorist. For the pedestrian, it results in conditions where driveway aprons intrude into the required pedestrian clear zone and create cross slopes which are unsafe and fail to meet ADA requirements. In addition, this design creates the perception that vehicles have the right of way when crossing the sidewalk, and thus may create conflict points between motorists (or bicyclists) and pedestrians.

This practice also often creates wider aprons than are desired. The Atlanta Code of Ordinances limits driveway width with the intent of reducing apron widths and minimizing intrusions into the pedestrian clear zone. However, the practice of measuring driveway widths at the right-of-way line and then providing aprons from that point into the roadway results in actual apron widths that are wider than permitted. For new streets and areas where the existing furniture is wide enough, the standard going forward is that the driveway apron should be situated within the furniture zone and should not extend across the pedestrian clear zone.

Example of an accessible driveway approach to a sidewalk

Good integration of driveway apron and sidepath

STREET FURNISHINGS

The installation of street furniture confirms the importance of the pedestrian to the city, encourages use of the street by pedestrians and provides a more comfortable environment for non-motorized travel. Street furniture can include benches, bicycle racks, bicycle sharing stations, bollards, vending kiosks, news racks, public art, sidewalk restrooms, wayfinding signs, refuse receptacles, parking meters, and other elements.

Street furniture benefits the health and vitality of urban neighborhoods by:

- Making bicycling, transit use and walking more inviting,
- Improving the street economy and the city's prosperity, and
- Enhancing public space and creating a place for social interaction.

When feasible, recycled materials should be used for street furniture.

BENCHES AND SEATING

Public seating provides a comfortable, utilitarian, and active environment where people can rest, socialize, or read in a public space. A properly placed bench is a simple gesture that helps to create a sense of place.

BOLLARDS

Bollards are used to separate motorists from bicyclists and pedestrians. Thoughtful design and/or location of bollards can add interest, visually strengthen street character, and better define pedestrian spaces.

INFORMATIONAL KIOSKS

Kiosks in public areas provide valuable information, such as maps, bulletin boards, and community announcements. Kiosks can often be combined with gateway signs and are an attractive and useful street feature. In the City of Atlanta, information kiosks are often used within City Core and Growth Corridor character area category.

PARKING METERS

Parking meters can be either traditional single-space meters or consolidated multi-space meters (parking stations). Multi-space meters are preferred over single-space meters. Multi-space meters should be placed every 8 to 10 parking spaces or approximately 150' to 200' apart. Signs spaced at approximately 100' apart should clearly direct patrons to the multi-space meters.

SIGNS

Streetscape signs provide information specific to direction, destination, or location. They may include directional, gateway, parking and wayfinding signs. Comprehensive sign plans should be developed individually for each neighborhood or district and should not be installed in an ad-hoc manner. Streetscape signs are most appropriate in the CityCore and Growth Corridor character area category.

Bollards, Centennial Olympic Park

Benches, Peachtree Road

PUBLIC ART

On a large scale, public art can unify a district with a theme or identify a neighborhood gateway. At a pedestrian scale, public art adds visual interest to the urban environment.

Public art should be considered during the planning and design phase of development to more closely integrate art with other streetscape elements. From the street's perspective, public art is a pedestrian amenity and should be presented in an area suited for pedestrian viewing. The piece should be placed as a focal element in a park or plaza, or situated along a pedestrian path and discovered by the traveler.

Public art can be incorporated into standard street elements (lights, benches, trash receptacles, utility boxes, etc.), as well as information (maps, signs, etc.) or educational information (history, culture, etc.). All installations do not need to have an educational mission; art can be playful.

SIDEWALK DINING

Outdoor café and restaurant seating adjacent to the sidewalk activates the street environment and promotes economic activity. Tables and chairs shall be placed in the supplemental zone. Sidewalk dining furniture should not block the pedestrian clear zone.

UTILITIES

The location of underground and above-ground utilities must be considered when planning new landscaped areas in the right-of-way. Utility design should minimize the conflicts between landscaping and utilities based on input from all affected departments and agencies.

The majority of underground utilities, including sanitary sewers and storm drains, and water, gas, and electrical mains, are typically located under the roadway. Sanitary sewers are often in the center of the street directly under the potential location of a landscaped median. They are usually relatively deep. In general, if they have at least 4' to 5' of cover and they should not be affected by the introduction of a landscaped median. The other utilities within the roadway are typically located closer to the curbs.

Telecommunications, street lighting conduit, traffic signal conduit, and fiber optic conduit are often located under the sidewalk. Lateral lines extend from the utility mains in the public rights-of-way to serve adjacent properties.

Benefits of well-organized utility design/placement include

- Reduced clutter in the streetscape
- Increased opportunity for planting areas and for soil volume to support tree growth and stormwater infiltration
- Reduced maintenance conflicts
- Improved pedestrian safety and visual quality

RELATIONSHIP TO CHARACTER AREAS

The guidelines in this section integrate design and character area categories to provide safe and convenient passage for pedestrians. Sidewalks should have adequate walking areas and provide comfortable buffers between pedestrians and traffic. These guidelines will ensure sidewalks in all development and redevelopment provide access for people for all ages and physical abilities.

The design of the area outside the roadway will vary according to the type of street and character area category. A local street within a City Core and Growth Corridor will require different sidewalks dimensions than an arterial in the Urban Neighborhood character area category. The descriptions below indicate the type of pedestrian activity expected at each of the specified character area category. The graphics (credit: Marty Bruinsma) illustrate the minimum widths of zones outside the traveled-way for each of the categories. The matrix in the following section provides specific minimum requirements for the four sidewalk zones according to combinations of character area categories and street classifications

CITY CORE AND GROWTH CORRIDOR CHARACTER AREA CATEGORY

The sidewalks in City Core and Growth Corridor character area category should support very high all-day pedestrian volumes due to their role as regional employment, entertainment, recreation, restaurant and shopping destinations, and the high peak-hour pedestrian volumes to and from transit stations. Pedestrian safety is a high priority in City Core and Growth Corridor character area category, especially at street crossings that provide access to transit stops and stations. Transit service runs along most Major and Minor Collectors, and Major and Minor Arterials. Transit stop areas should be accommodated in street design.

On-street parking is encouraged as a pedestrian buffer along key pedestrian connections to Transit Stations. The City Core and Growth Corridor needs the widest sidewalks, widest crosswalks, brightest street lighting, comfortable, safe and supportive street-level commercial activity, and include most street furnishings and other features that will enhance the pedestrian environment. Within this character area category, the pedestrian clear zone is of paramount importance. In order to keep it completely clear of obstructions, supplemental zones and furniture zones should wide enough for sidewalk cafes, sign boards, street furniture, transit stops and shelters, and street trees. Special attention should be paid to the comfort and safety of key pedestrian and bicycle connections from the surrounding Urban Neighborhood character area category into the City Core and Growth Corridor character area category.

URBAN NEIGHBORHOOD CHARACTER AREA CATEGORY

The sidewalks in the Urban Neighborhoods should support access from residential areas to nearby transit stops, parks, schools and other neighborhood attractions. When constructing new sidewalks in Urban Neighborhoods, special attention should be given to connecting existing sidewalk segments to create a network. Construction of standalone sidewalk segments should be avoided. Major and Minor Collectors, and Major and Minor Arterials should be prioritized for new sidewalk construction. Generally, the pedestrian clear zone is the most important zone in Urban Neighborhoods. However, along busy Collectors, Minor Arterials and Principal Arterials, the furniture zone should be wide enough provide a substantial buffer from motor vehicle traffic.

SUBURBAN AND RURAL/PRODUCTION CHARACTER AREA CATEGORY

The sidewalks in Suburban and Rural/Production area should be functional and safe, as they will primarily be used by workers travelling between transit stops and stations and employers. Pedestrian volumes are likely to be low in Suburban and Rural/Production character area category, as this land use typically has a lower number of employees per square foot than commercial areas and density is more scarce. Many streets in Suburban and Rural/Production character area category do not have sidewalks due to their period of development and land use. Special attention should be paid to bicycle and pedestrian crossings of Major Arterials, railroads, and truck routes in Suburban and Rural/Production area.

PEDESTRIAN CROSSINGS

Crossing a street is just as critical for pedestrians as walking along it, and it should be easy, convenient, comfortable, and safe. While pedestrian behavior and design affect the street crossing experience, bicyclist and motorist behavior is the most significant factor in pedestrian safety.

A number of tools exist to improve pedestrian safety and to make crossing streets easier. Effective traffic management can address concerns about traffic speed and volume. A motorist driving slower has more time to see, react, and stop for a pedestrian. The number of pedestrians also influences bicyclist and motorist behavior. In general, bicyclists and motorists are more aware of pedestrians when more people are walking. Most tools to address crossing challenges are engineering treatments, but tools from the enforcement, education, and planning toolboxes are also important.

Providing marked crosswalks is only one of the many possible engineering measures for mid-block crossings. When considering how to provide safer crossings for pedestrians, the question should not be: "Should I provide a marked crosswalk?" Instead, the question should be: "What are the most effective measures that can be used to help pedestrians safely cross the street at this location?" Deciding whether to mark or not mark crosswalks is only one of the decisions needed to create easy, convenient, comfortable and safe pedestrian crossings.

This chapter describes a number of measures to improve mid-block pedestrian crossings, including marked and unmarked crosswalks, raised medians/refuge islands, signage, warning beacons, and lighting enhancements.

The following principles should be incorporated into every pedestrian crossing improvement:

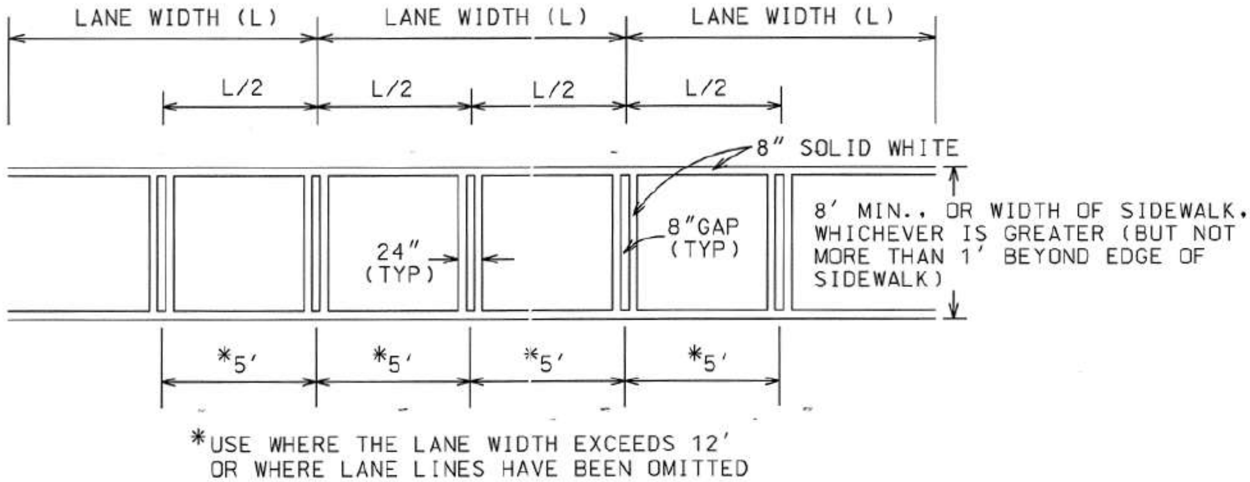
- Pedestrians must be able to cross all streets safely.
- The safety of all street users, particularly more vulnerable groups, such as children, the elderly, and those with disabilities, and more vulnerable modes, such as walking and bicycling, must be considered when designing streets.
- Pedestrian crossings must meet accessibility standards and guidelines.

Real and perceived safety must be considered when designing crossings. A crossing must be easy, convenient and comfortable. A safe crossing that no one uses serves no purpose.

- Countermeasures that have the highest crash reduction factors (CRFs) should be used.
- Pedestrian safety shall not be compromised to accommodate bicyclist and motorist traffic flow.
- Good crossings begin with appropriate vehicle speed. In general, urban arterials should be designed to a maximum of 35 mph outside the City Core and Growth Corridor and Urban Neighborhood character area categories.

Safe crossings are a necessary part of pedestrian mobility, 10th Street

Figure 6-1 City of Atlanta Standard Crosswalk Marking



- Every crossing is different and should be designed to fit its unique environment.

Many engineering treatments may be used at pedestrian crossings, depending on site conditions and potential users. Marked crosswalks are commonly used at intersections and sometimes at mid-block locations. Marked crosswalks are often the first measure in the toolbox followed by a series of other measures that are used to enhance and improve marked crosswalks. The decision to mark a crosswalk should not be considered in isolation, but rather in conjunction with other measures to increase awareness of pedestrians. Without additional measures, marked crosswalks alone may not increase pedestrian safety, particularly on multi-lane streets.

MARKED CROSSWALKS

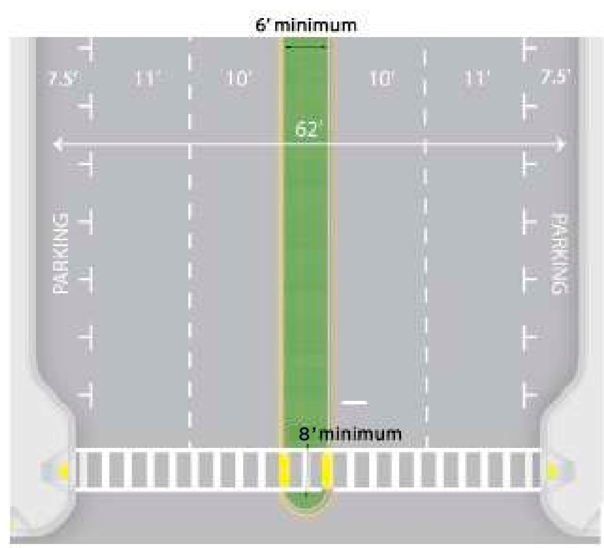
In Georgia, designated crosswalks are present by law at all intersections, whether marked or unmarked, unless the pedestrian crossing is specifically prohibited. One exception is the two major street crossings at a T-intersection.

At mid-block locations, crosswalks only exist where marked. At these locations, the crosswalk markings legally establish the crosswalk. Crosswalks should be considered at mid-block locations where there is strong evidence that pedestrians want to cross there, due to origins and destinations across from each other and an overly long walking distance to the nearest signal-controlled crossing. Marked crosswalks alert drivers to expect crossing pedestrians and direct pedestrians to desirable crossing locations.

Although many bicyclists and motorists are unaware of their legal obligations at crosswalks, Georgia state law requires both to stop and stay stopped for pedestrians in crosswalks, even if the crosswalk is unmarked. Bicyclists and motorists may not recognize unmarked crossings, especially at minor intersections. In addition, Georgia courts have not recognized the presence of designated crosswalks across the major street at T-intersections. By marking crosswalks, engineers can clarify where pedestrians have the right-of-way. Signs are often used to further alert drivers to the presence of a marked crosswalk.

CROSSWALK MARKINGS

In the City of Atlanta, all crosswalks shall be marked with retroreflective thermoplastic in the piano-key style, as shown in Figure 6-1. Bars and edge lines shall be solid white and 8" wide with an 8" gap between paired bars. The paired bars are aligned and spaced to avoid the wheelpath of motor vehicles driving across the crosswalk.



Mid-block crossings of multi-lane streets should include appropriate countermeasures like medians and curb extensions
(Credit: Michele Weisbart)

Total crosswalk width shall be between 8' and 15' wide, depending on the width of the approaching sidewalks and position of ADA ramps. Crosswalk widths greater than 15' must be approved as a special exception by the Commissioner of Public Works.

PLACEMENT

Candidates for the installation of marked crosswalks include:

- Signal and STOP controlled intersections
- Uncontrolled locations within City Core and Growth Corridor character area category shared-use path crossings
- High pedestrian traffic generators adjacent to transit stops/stations
- School walking routes
- When there is a preferred crossing location due to sight distance
- Where needed to enable easy, convenient, comfortable and safe crossings of multi-lane streets between signal controlled intersections

SIGNAL AND STOP CONTROLLED LOCATIONS

Intersections can be controlled by traffic signals or STOP signs. Marked crosswalks shall be provided on all intersection legs controlled by traffic signals, unless the pedestrian crossing is specifically prohibited. Marked crosswalks should be considered at STOP-controlled intersections. Factors to be considered include high pedestrian volumes, high vehicle volumes, school zone location, high volume of elderly or disabled users, and/or character area category.

MID-BLOCK LOCATIONS

Crosswalks without signal or STOP control of conflicting vehicles are considered mid-block locations. The decision to mark a crosswalk at a mid-block location shall be guided by an engineering study. Factors to be considered in the study include bicyclist and motorist volumes and speeds, roadway width and number of lanes, stopping sight distance and triangles, distance to the next controlled location, night time visibility, grade, origin-destination of pedestrian trips, left-turning conflicts, and pedestrian volumes. The engineering study shall be based on the FHWA study, Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations.

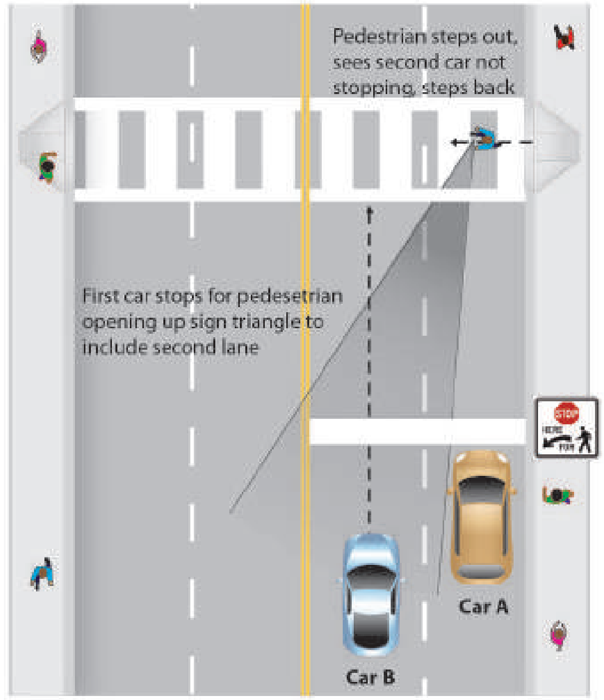
The following list provides some of the key recommendations from the study:

- It is permissible to mark crosswalks at mid-block locations on two-lane roadways.
- On multi-lane roadways, marked crosswalks alone are not recommended under the following conditions (the countermeasures listed in this section shall be considered to enhance the crosswalk):
- ADT > 12,000 without median
- ADT > 15,000 with median
- Operating speeds greater than 40 mph
- Raised medians can be used to reduce risk
- Rectangular rapid flashing beacons (RRFBs), hybrid pedestrian beacons (PHBs) or other countermeasures should be considered where there are many young and/or elderly pedestrians

Staggered crossing with refuge island, Buford Highway
(Credit: Marcel Schmaedick)

FREQUENCY OF MARKED CROSSWALKS AT MID-BLOCK LOCATIONS

Marked crosswalks should be spaced so people can cross conveniently. If people are routinely crossing streets at non-preferred locations, consideration should be given to installing a new mid-block crossing. Pedestrians need crossings of multi-lane streets with appropriate countermeasures (beacons, raised medians/ refuge islands, curb extensions, advanced stop bars, etc.) where there are strong desire lines. Along streets within the City Core and Growth Corridor character area category, a well-designed crossing should be provided every 300-600', with an average of 400', which is the length of typical city block. The Institute of Transportation Engineers' guidance Designing Walkable Urban Thoroughfares: A Context Sensitive Approach describes block lengths less than 400 feet as "desirable," with block lengths over 600 feet described as uncharacteristic of a walkable urban environment.



Advance stop bars should be used for all midblock crossings on multilane streets

(Credit: Michele Weisbart)

DECORATIVE CROSSWALKS

Decorative crosswalks consist of bricks, pavers, stamped asphalt, concrete and other materials. They shall only be installed at signal and STOP controlled locations and not at mid-block locations. Decorative crosswalks are strongly discouraged at all locations along arterial and collector streets. If used, decorative crosswalks must have two 12"-wide solid white reflective thermoplastic edgelines to improve safety and visibility, particularly at night.

Decorative crosswalk pavement materials should be chosen with care to ensure that smooth surface conditions and high contrast with surrounding pavement are provided. Textured materials within the crosswalk are not recommended. Decorative pavement materials often deteriorate over time and become a maintenance problem while creating uneven pavement.

CROSSWALKS AND ACCESSIBILITY

The ADA-defined Pedestrian Access Route (PAR) includes crosswalks and must conform to the surface condition, width, and slope requirements discussed earlier in this chapter the Standard Detail for Piano-Key Style Striped Crosswalk (Fig. 6-1) can be acquired from the Department of Public Works.

Longitudinal edgelines, which are included in the City of Atlanta standard crosswalk, provide the best guidance for pedestrians with limited vision.

Decorative crosswalk treatments made of distinctive materials can become uneven over time

(Credit: Ryan Snyder)

RAISED MEDIANS/REFUGE ISLANDS

In cases where the street cannot be altered to reduce vehicle operating speeds to a safe level or streets cannot be narrowed sufficiently to create a safe crossing, the addition of a refuge island can be an effective safety countermeasure. A raised median is a continuous raised area separating opposite flows of traffic. A refuge island is shorter and located just where a pedestrian crossing is needed. A refuge island may or may not include a marked crosswalk or other treatments. Raised medians and refuge islands are commonly used between intersections when blocks are long (500 feet or more in downtowns) and in the following situations:

- Vehicle speeds are high
- Streets are wide with multiple lanes
- Traffic volumes are high
- Sight distances are poor

Refuge islands can be placed in the City Core and Growth Corridor character area category, and in other similar places. They also encourage appropriate motorist speeds.

REASONS FOR EFFICACY

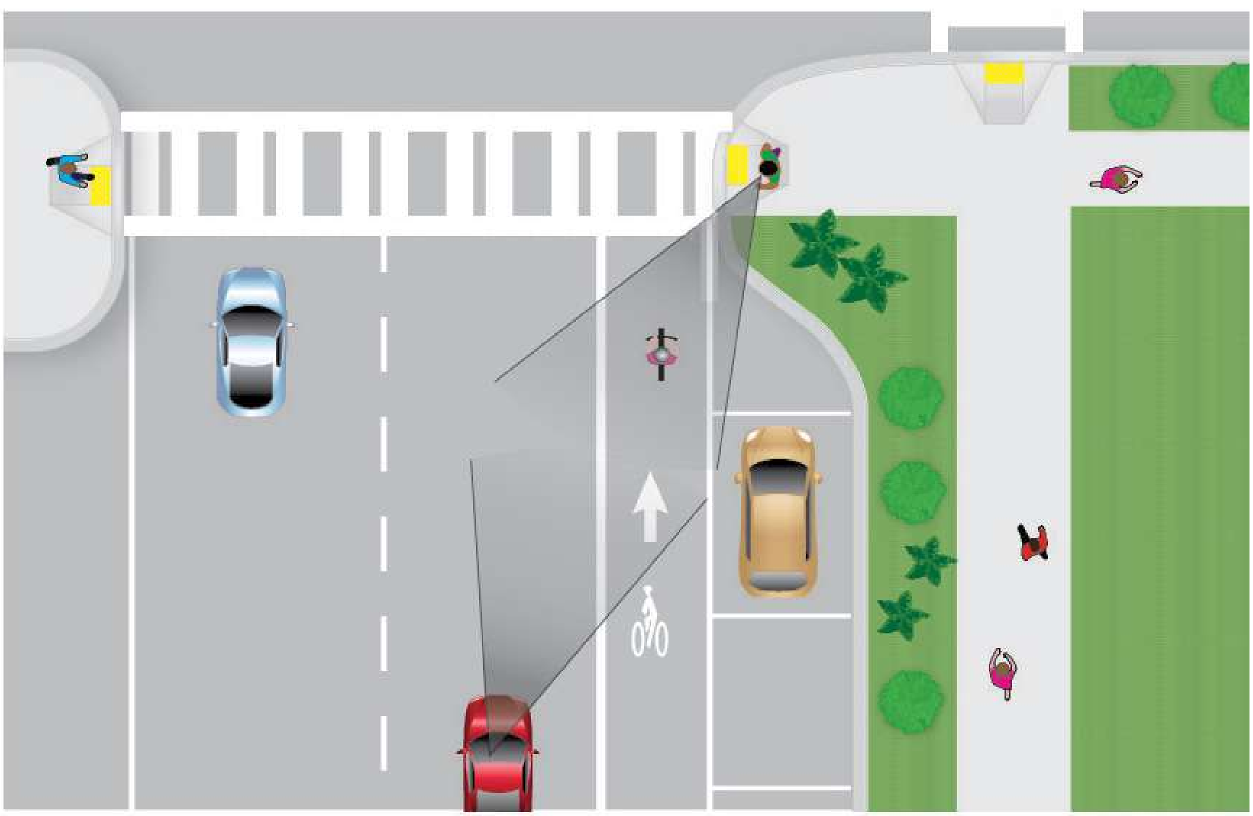
Raised medians and refuge islands shorten the distance of each crossing and require the pedestrian to deal with only one direction of traffic at a time. Conflicts occur in only one direction at a time and exposure time can be reduced from more than 20 seconds to just a few seconds.

On streets with traffic speeds higher than 30 mph, it may be unsafe to cross without a raised median/refuge island. At 30 mph, motorists travel 44' each second, placing them 880' out when a pedestrian starts crossing an 80'-wide multi-lane street. In this situation, the pedestrian may still be in the last travel lane when the motorist arrives. The vehicle may not have been within view at the time the pedestrian started crossing to street.

With a raised median/refuge island on multi-lane streets, people only need to cross two or three lanes at a time instead of four or six.

Raised medians/refuge islands can also be used at signal and STOP controlled locations.

Two-stage pedestrian crossings using zig-zag walkways within the raised median/refuge island encourage pedestrians to look for oncoming vehicles before using second leg of crossing.



Benefits of curb extensions
(Credit: Michele Weisbart)

WHERE TO PLACE REFUGE ISLANDS

Refuge islands are often used for shared-use path crossings, in high pedestrian traffic areas, at transit stops/stations, and near schools, employment centers, and shopping districts.

DESIGN DETAIL

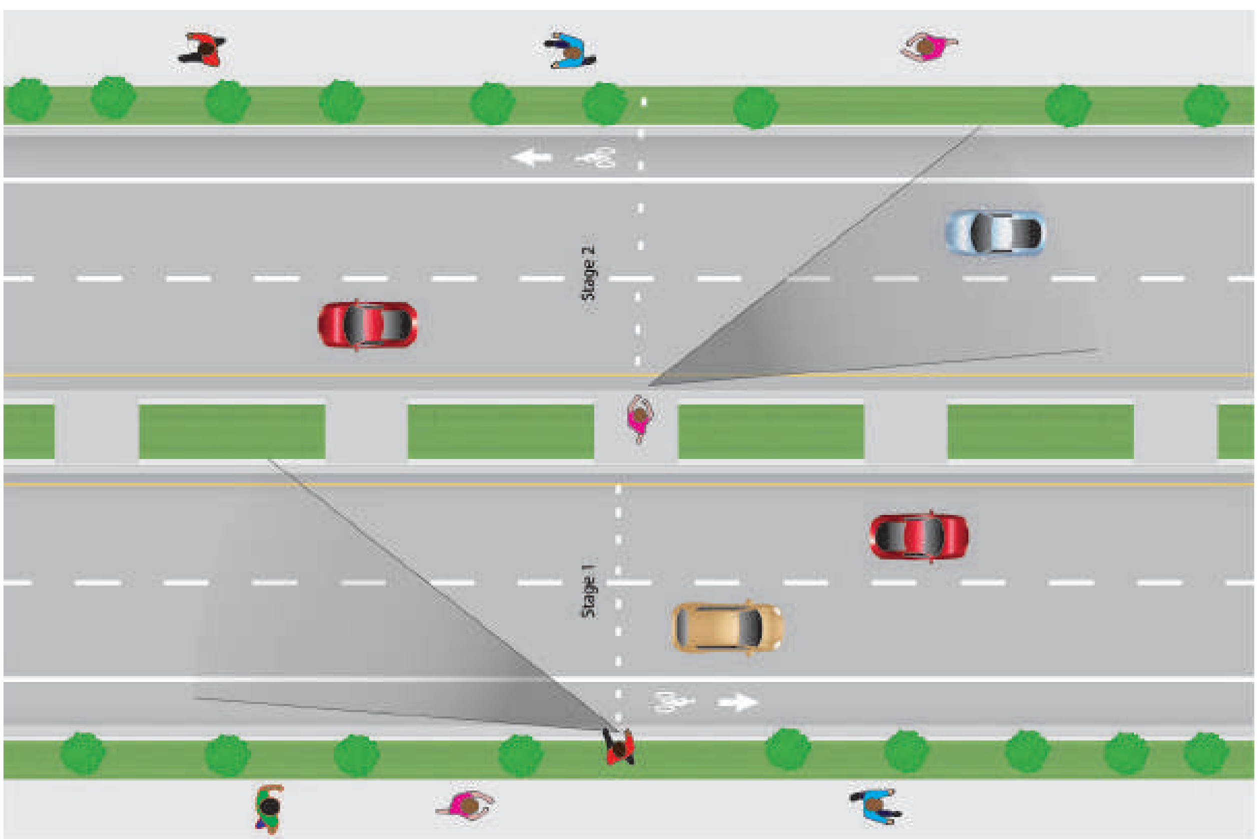
Refuge islands shall include a level landing area that is at least 6' deep (from travel lane to travel lane) and 10' long. They should generally include a 1' offset from adjacent lanes, assuming lanes are the standard width (10-11' for travel lanes and 4-6' for bicycle lanes). If the refuge island does not include a marked crosswalk, then this landing area may be level with the street or raised 6" above. If the refuge island does include a marked crosswalk, then this landing must be level with the street or accessed by ADA ramps on either side. Where curves and/or hills obscure crossing locations, refuge islands should be extended around the curve or over the crest of the hill to where bicyclists and motorists have a clear (six seconds or longer) sight line of the downstream change in conditions. Refuge islands shall be lighted. When used on higher speed streets, and where there is available space, a zig-zag channelized walkway should be considered to break the crossing into two stages.

RAISED CROSSWALKS

A raised crosswalk is an elevated pedestrian crossing used to reduce vehicle speeds, increase the rates of bicyclists and motorists stopping for pedestrians and emphasize the importance of the crossing.

WHERE TO PLACE RAISED CROSSWALKS

Per the City of Atlanta Code of Ordinances, raised crosswalks shall not be installed on arterial and collector streets. Raised crosswalks should be considered on local streets in areas with high pedestrian traffic and where vehicles move slowly, such as near schools, on college campuses and/or in the City Core and Growth Corridor zones. They are especially effective near elementary schools where they elevate small children by a few inches and make them more visible from a distance. As mentioned in Chapter 5, "Intersection Design," raised crosswalks should be used at channelized right-turn lanes, especially at locations with a large number of children and/or seniors. A study conducted by the City of Boulder found that



Raised medians and refuge islands allow pedestrians to complete the crossing in two stages
(Credit: Michele Weisbart)

Example of curb extensions

raised crosswalks increased motorist compliance from 69% to 91% at channelized right-turn locations.

DESIGN DETAIL

Raised crosswalks are trapezoidal in shape on both sides and have a flat top where pedestrians. The level crosswalk area must be paved with a smooth material, likely asphalt or concrete. Any special paving materials used for aesthetics should be placed on the beveled slopes, where they will be seen by approaching motorists. In order to mitigate impacts to existing drainage, raised crosswalks may include covered trench drains along the curb or they may begin several inches from the curbline to allow water to continue to flow along the gutter.

CURB EXTENSIONS/BULB-OUTS

Curb extensions extend the sidewalk or curb line out into the parking lane, which reduces the effective street width. Curb extensions significantly improve crossings by reducing the crossing distance and time that pedestrians are in the street, narrowing the street visually and physically, and improving bicyclist, pedestrian and motorist sight lines. At signal controlled locations, reducing the street width shortens the traffic signal cycle, as pedestrians need less time to cross.

Curb extensions and medians make crossing four-lane streets safer and more manageable to cross
(Credit: Dan Burden)

Bicyclists and motorists typically travel more slowly at intersections or mid-block locations with curb extensions, as the reduced street width sends a visual cue to slow down. Turning speeds are lower at intersections with curb extensions (curb radii should be as tight as is practicable). Curb extensions also prevent motorists from parking too close to the intersection.

Curb extensions provide additional space for two ADA ramps and for level sidewalks where existing space is limited, increase the pedestrian waiting space, and provide additional area for pedestrian push button and signal pedestals, street furnishings, plantings, bicycle parking and other amenities. Curb extensions allow for better placement of traffic control signs as well.

WHERE TO PLACE CURB EXTENSIONS

Curb extensions may be installed on all street classifications within the City of Atlanta, however they generally only work where there is an on-street parking lane.

Care should be taken when selecting locations, as curb extensions can impact street operations as follows:

- May create a chokepoint, exacerbating conflicts between bicyclists and motorists
- May impact street drainage and require catch basin relocation
- May impact underground utilities
- May necessitate loss of on-street parking, though careful planning can often mitigate (ex. relocate fire hydrant to curb extension)
- May complicate delivery truck access and trash removal
- May impact street sweepers and other maintenance equipment
- May impact the turning movements of larger vehicles such as school buses and large fire trucks

DESIGN DETAIL

Curb extensions may be constructed with curbing and include a hard surface or landscaping. This is often done as part of new street construction, as significant demolition and drainage adjustments are often required. If installed as part of a multi-modal streets retrofit, curb extensions may be constructed as monolithic concrete islands. In order to mitigate impacts to existing drainage, curb extensions may include covered trench drains along the curb or they may begin several inches from the curbline to allow water to continue to flow along the gutter. Curb extensions shall not extend into travel lanes or bicycle lanes, and should generally include a 1' offset from adjacent lanes, assuming lanes are the standard width (10-11' for travel lanes and 4-6' for bicycle lanes). Along Core and Secondary Bicycle Connections, mid-block curb extensions shall include bicycle bypasses.

SIGNS

CROSSING SIGNS & PAVEMENT MARKINGS

Signs and pavement markings can provide important information to street users, so they can react and behave appropriately. Their use and placement should be done judiciously, as overuse breeds noncompliance and disrespect. Too many signs create visual clutter. Regulatory signs, such as STOP, or turn restrictions, require driver actions and can be enforced. Warning signs provide information, especially to bicyclists, motorists and pedestrians unfamiliar with an area. All signs and pavement markings should comply with the MUTCD and be at least 80" above the ground.

R1-5b signs shall be used for crossings on multi-lane streets.
(Credit: MUTCD)

ADVANCE WARNING SIGNS

All mid-block crossings in the City of Atlanta shall be signed with the PEDESTRIAN CROSSING AHEAD assembly (W11-2 & W16-9P) or the SCHOOL CROSSING AHEAD assembly (S1-1 & W16-9P) in fluorescent yellow-green. Only the SCHOOL CROSSING AHEAD assembly is permitted in advance of signal and STOP controlled crossing locations. At shared-use path crossings, sign W11-15 shall be substituted for sign W11-2. On one-way streets, one assembly shall be installed on each side of the street. Engineering judgement shall be used to determine the appropriate distance from the crossing.

ADVANCE REGULATORY SIGNS & STOP BARS

On multi-lane streets, advance stop bars and R1-5b signs shall be installed 20-50' in advance of all mid-block crossings. On one-way streets, one R1-5b sign shall be installed on each side of the street. No on-street parking or other signs or pavement markings shall be located between the advance stop bar and the marked crosswalk. Advance stop bars reduce vehicle encroachment into the crosswalk, improve drivers' view of pedestrians and mitigate the multiple-threat issue. Research shows motorists begin slowing earlier at a crossing with advanced stop bars.

WARNING SIGNS AT CROSSINGS LOCATION

All mid-block crossings in the City of Atlanta shall be signed with the PEDESTRIAN CROSSING assembly (W11-2 & W16-7P) or the SCHOOL CROSSING assembly (S1-1 & W16-7P) in fluorescent yellow-green. At shared-use path crossings, sign W11-15 shall be substituted for sign W11-2. One assembly shall be installed on each side of the street. All effort should be made to mount the assembly downstream from the crossing to keep sight lines clear for motorists and pedestrians.

Advance stop bars, Peachtree Street
(Credit: PEDS)

Rectangular rapid-flash beacon, Peachtree Dunwoody Road

IN-STREET REGULATORY SIGNS AT CROSSING LOCATIONS

At mid-block crossings on two-lane streets where the rate of bicyclist and motorist compliance needs to be increased, the R1-6a in-street sign shall be installed at the centerline. On narrow, low-speed streets, in-street signs lead motorists to stop about 87% of the time (TCRP112 / NCHRP 562). Use of in-street signs on multi-lane one-way streets should be limited, as they are regularly hit by motorists and require frequent replacement. Alternatively, an overhead STOP FOR PEDESTRIANS (R1-9a) sign may be used.

LIGHTING

Lighting is important to include at all pedestrian crossing locations for the comfort and safety of the road users. Lighting should be present at all marked crossing locations. Lighting provides cues to drivers to expect pedestrians earlier. Overhead lighting at intersections reduces fatal vehicle-pedestrian crashes by 80%, and reduces other pedestrian-injuring crashes by 59% (CMF Clearinghouse). Raised medians/refuge islands can provide space for lighting, and they can be used in locations where other treatment options are limited.

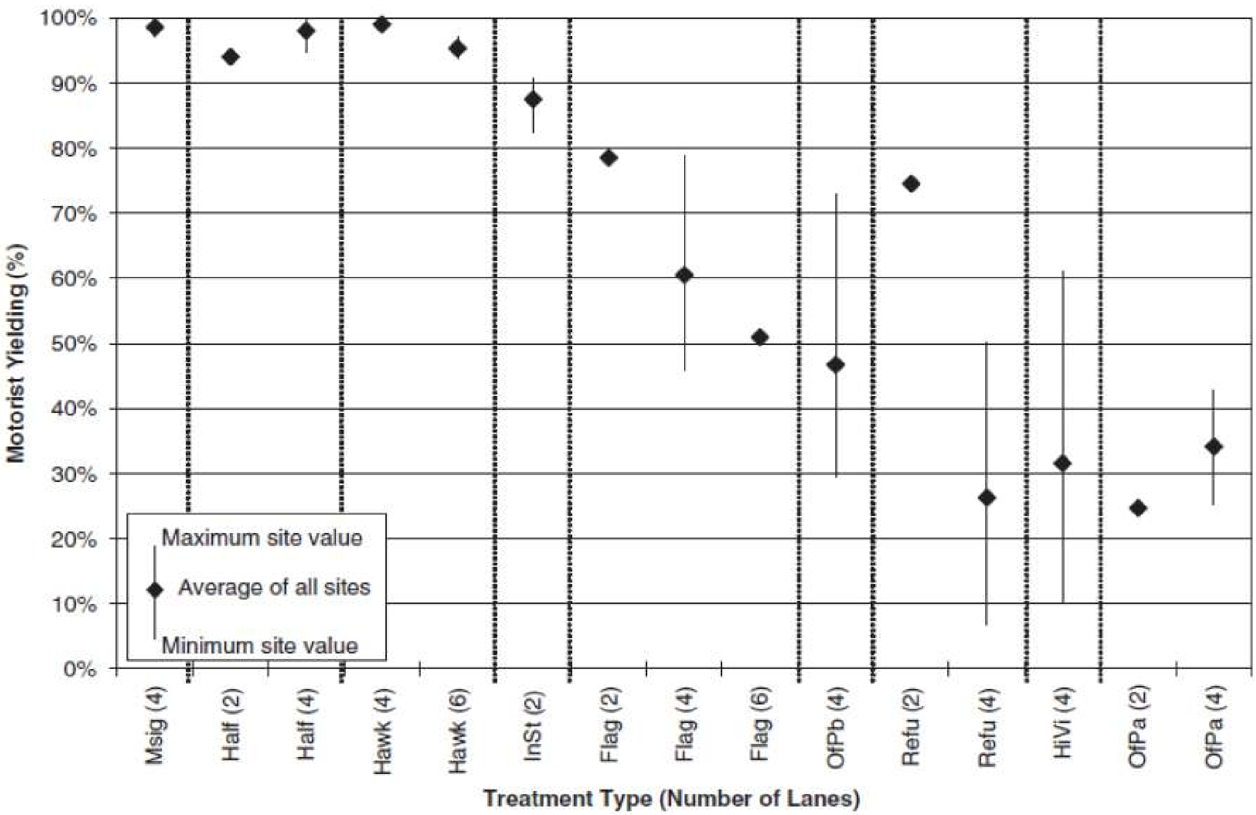
The FHWA HRT-08-053, 'Informational Report on Lighting Design for Mid-block Crosswalks', found that a vertical illumination of 20 lux in front of the crosswalk, measured at a height of 5' from the road surface, provided adequate detection distances in most circumstances. Although the research was constrained to mid-block placements of crosswalks, the report includes a brief discussion of considerations in lighting crosswalks co-located with intersections. The same principle applies at intersections. Illumination just to the front of crosswalks creates optimal visibility of pedestrians.

Other good guidance on crosswalk lighting levels comes from the Illuminating Engineering Society of North America (IESNA) intersection guidance to illuminate pedestrians in the crosswalk to vehicles. Crosswalk lighting should provide color contrast from standard roadway lighting. Appropriate pedestrian lighting should be provided on both sides of the street in designated Senior Zones.

RECTANGULAR RAPID FLASHING BEACON (RRFB)

A rectangular rapid flashing beacon (RRFB) unit consists of two rectangular high-intensity LED indicators mounted immediately between a fluorescent yellow-green W11-2 warning sign and a downward arrow supplemental plaque (W16-7p). The indicators flash rapidly in a wig-wag flickering pattern after being actuated by a pedestrian push-button or passive pedestrian detection, and they only flash long enough for a pedestrian to use the crossing. RRFB installations may consist of two to four units, depending on the width of the street and the presence and width of a raised median/refuge island. The units may be one- or two-sided. Two-sided units increase the visibility of the indicators on multi-lane roads and reduce the risk of multiple threat crashes by providing redundancy.

Figure 6-2 Pedestrian Crossing Countermeasures by Number of Lanes



From FHWA TRCP 112/NHCRP 562. Abbreviations: Msig (Midblock signal), Half (Half Signal), PHB (Pedestrian Hybrid Beacon), InSt (In-Roadway Warning Lights), Flag (Pedestrian Crossing Flags), OfPb (Overhead Flashing Beacon--Push button Activation), Refu (Refuge Island), HiVi (High-Visibility Signs and Markings), OfPa (Overhead Flashing Beacon, Passive Activation)

The FHWA Office of Transportation Operations has reviewed available data and considers the RRFB to be highly successful for the applications tested (uncontrolled crossing locations). The RRFB offers significant potential safety and cost benefits because it achieves very high rates of compliance at a very low cost compared to other more restrictive devices such as full traffic signalization. The components of the RRFB are not proprietary and can be assembled by any jurisdiction with off-the-shelf hardware. The FHWA believes that the RRFB has a low risk of safety or operational concerns. However, because proliferation of RRFBs in the roadway environment to the point that they become ubiquitous could decrease their effectiveness, use of RRFBs should be limited to locations with the most critical safety concerns, such as pedestrian and school crossings at uncontrolled locations, as tested in the experimentation.

While the RRFB is not in the 2009 MUTCD, the FHWA has issued an Interim Approval, which allows agencies to install this type of flashing beacon, pending official MUTCD rulemaking. RRFBs still hold experimental status, yet they have been approved for use on state highways, as well as on local streets within the City of Atlanta.

Data compiled for the first 30 days of operation for an RRFB installed on Scott Road in Roswell indicate that the device improved pedestrian safety, with a driver compliance rate of 97% on a four-lane road (with a center two-way left-turn lane). Additionally, the pilot project only cost $5,500.

RRFBs should be installed in conjunction with signs, crosswalks, and advanced stop bars to warn vehicle traffic at locations where pedestrians enter or cross a street. An RRFB should only be installed at a marked crosswalk.

PEDESTRIAN HYBRID BEACON (PHB)

A pedestrian hybrid beacon (PHB) installation consists of one or more three-lense signal heads facing each direction of vehicle traffic mounted above the mid-block crossing as well as two or more pedestrian signal heads facing the pedestrian crossing points. PHBs can be mounted on span-wire or on a mast-arm and may also include pedestal-mounted signal heads. Typically, the signal heads are supplemented with signs R1-9a and R10-23 mounted on the span-wire or mast-arm.

A pedestrian hybrid beacon utilizes a red-yellow-red traffic signal head. When the signal is not activated, no signal indication is shown. When activated by a pedestrian, the signal shows a flashing yellow first, then steady yellow indication, which is followed by a steady red indication, during which the WALK indication is provided for pedestrians. Following the steady red, the two red indicators flash in an alternating sequence, during which a flashing DON'T WALK is shown for pedestrians. During the flashing red, drivers may proceed after stopping and staying stopped for pedestrians within the crosswalk.

Federal guidance recommends that PHBs be used where gaps in vehicle traffic are too few to allow pedestrians to cross, where pedestrian delay is excessive (per MUTCD), or where streets make the crossing overly hazardous for pedestrians. The warrants for a pedestrian hybrid beacon are laid out in the 2009 MUTCD Chapter 4F. At least 20 pedestrians per hour are required to warrant a PHB. Installation of PHBs should be accompanied by a public education campaign (FHWA-SA-12-012).

PHBs should be installed in conjunction with signs, crosswalks, and advanced stop bars to warn vehicle traffic at locations where pedestrians enter or cross a street. A PHB should only be installed at a marked crosswalk.

Pedestrian hybrid beacon on North Avenue

PEDESTRIAN CROSSING TREATMENT RECOMMENDATIONS

The recommendations below consider various pedestrian crossing treatments that may be appropriate for a given functional classification. Each design context requires careful engineering study and expert judgment.

LOCAL STREET OR MINOR COLLECTOR

SOLUTION: ENHANCE VISIBILITY

On local streets or collectors, many simple, low cost treatments are appropriate. A double-sided PEDESTRIAN CROSSING assembly (W11-2 & W16-7P) or SCHOOL CROSSING assembly (S1-1 & W16-7P) in fluorescent yellow-green can be installed on both sides of the street. Additional reflective material can be attached to the sign posts to enhance visibility. In-street crosswalk signs (R1-6a) are effective at improving bicyclist and motorist stopping compliance on two-lane streets. Properly illuminating crossings will also enhance visibility (see Table 6-1).

MAJOR COLLECTOR OR MINOR ARTERIAL

SOLUTION: MEDIAN REFUGE ISLAND PLUS ENHANCEMENTS

Many city streets include two through lanes in each direction separated by a double solid yellow centerline. These roads sometimes have narrower lanes and a speed limit of 30 or 35 mph. Reconfiguring a street from four travel lanes to a three travel lanes has shown a 29% reduction in crashes (FHWA Proven Safety Countermeasures). For this reason, a lane reconfiguration should be considered before any substantial investments in crossing infrastructure. On street with average daily traffic over 23,000 cars, however, reducing the road to three lanes is likely to result in unacceptable vehicle delay during the peak hour (Road Diets: Fixing the Big Roads).

Reconfiguring the street to a three-lane cross-section allows room for median refuge islands within the two-way left-turn lane (TWLTL). If a lane reconfiguration is not feasible, engineers should still look for opportunities to install refuge islands. At locations where a safe refuge can be installed, an RRFB installation with three two-sided units may be the best treatment.

If no safe refuge can be provided, a PHB should be considered for all locations with at least 20 pedestrians per hour. At locations with fewer than 20 pedestrians per hour, engineers should consider installing an active treatment supplemented by another treatment. At locations with fewer than 20 pedestrians per hour, engineers should consider installing a combination of an RRFB and in-street (R1-6a) or overhead (R1-9a) signs. In addition, advance stop bars and R1-5b signs should be considered. On lower-speed streets, pedestrian crossing flags may suffice if no other treatments are available.

The locations of crossings and transit stop/station locations should be coordinated. Transit stops/stations should be placed on the far side of the crossing, with the head of the stop/station located about 60-80' downstream from the crossing. In addition, crossings should be placed as close as possible to pedestrian desire lines. Placing the crossing and transit stop/station in the optimal location may require closing driveways.

PRINCIPAL ARTERIAL

SOLUTION: RRFB OR PHB AND MEDIAN REFUGE ISLAND

The Georgia Department of Transportation (GDOT) requires a median on all roads with more than two through lanes in each direction (Design Policy Manual 6.12). Yet not all roads in metro Atlanta have been brought into compliance with this standard.

Even with a median, six-lane roads have been shown to be considerably more dangerous than four-lane roads for all users. For this reason, the feasibility of reducing the number of through lanes should be considered on all six-lane roads before investing in other expensive crossing treatments.

Placing a raised median/refuge island within the two-way left-turn lane further reduces the risk of crashes. A typical raised median/refuge island should include ADA-compliant ramps or a cut-through in an angled or zig-zag pattern. Staggered crosswalks encourage pedestrians to look towards oncoming traffic for the second portion of their crossing.

Using advanced stop bars and R1-5b signs reduces the likelihood of multiple-threat crashes, where a vehicle blocks the visibility between pedestrians and motorists in other lanes. With appropriate signage, advanced stop bars can get drivers to stop farther back from the crosswalk.

Rectangular rapid-flashing beacon installations help alert bicyclists and motorists to pedestrians crossing in marked crosswalks. RRFBs units should be placed on both curbs and both sides of the raised median/refuge island, so that a unit is adjacent to each through lane.

An overhead hybrid pedestrian beacon (PHB) should be used at crossing locations with at least 20 pedestrians per hour. To reduce the delay to bicyclists and motorists on wide streets, some PHBs have been timed for a multi-stage crossing, stopping cars traveling in each direction separately. In these cases, the PHB should utilize automated detection of pedestrians or synchronize timing of the second phase. This provides redundancy so that pedestrians do not need to push the button when standing on the median. Field observations show that many pedestrians neglect to push the button located on raised medians/refuge islands.

Crossings should be coordinated with transit stop/station locations, with each stop/station located at the far-side of the crossing. In addition, crossings should be placed as closely as possible to pedestrian desire lines. Placing the crossing and transit stops/stations in the optimal location might require closing driveways.

At transit stop/station locations where fewer than 20 pedestrians cross per hour, a raised median/refuge island should be provided. By enabling pedestrians to split their crossings into two stages, raised medians/refuge islands make it much easier for pedestrians to identify safe gaps in traffic.

Table 6-1: Recommended Illumination by Street Type

Intersection Functional Classifications	Average Maintained Illumination at Pavement by Pedestrian Area Classification [FC]*		
	High	Medium	Low
Arterial/Arterial	3.4 fc	2.6 fc	1.8 fc
Arterial/Collector	2.9 fc	2.2 fc	1.5 fc
Arterial/Local	2.6 fc	2.0 fc	1.3 fc
Collector/Collector	2.4 fc	1.8 fc	1.2 fc
Collector/Local	2.1 fc	1.6 fc	1.0 fc
Local/Local	1.8 fc	1.6 fc	0.8 fc

*FC stands for “foot candle” and is defined as the amount of illuminance on a 1 SF of surface of which there is uniformly distributed flux of one lumen. ANSI-IESNA RP-8-00, “Roadway Lighting,” P. 15

ADDITIONAL GUIDANCE: FACTORS FOR UNDERSTANDING ALL MOBILITY NEEDS

To fully accommodate everybody, designers must consider the widely varying needs and capabilities of the people in the community. People walk at different speeds. Some can endure long treks, while others can only go short distances. Some use wheelchairs and are particularly sensitive to uneven pavement and surface materials. Others have limited sight and rely on a cane. People's strengths, sizes, and judgmental capabilities differ significantly. The needs of one group of users may conflict with those of another group of users. For instance, gradual ramps and smooth transitions to the street help people in wheelchairs, yet present challenges for the sight-impaired, who can't easily find the edge of the sidewalk and the beginning of the street.

The text below identifies the unique constraints individuals with different types of disabilities and limitations face as pedestrians. Understanding their needs will help ensure more universal design of the sidewalk network.

PEOPLE WITH MOBILITY IMPAIRMENTS

People with mobility impairments range from those who use assistive devices, such as wheelchairs, crutches, canes, orthotics, and prosthetic devices, to those who use no such devices but face constraints walking long distances on non-level surfaces or on steep grades.

- Wheelchair and scooter users are most affected by the following:
- Uneven surfaces that hinder movement
- Rough surfaces that make rolling difficult and can cause pain, especially for people with back injuries
- Steep uphill slopes that slow the user
- Steep downhill slopes that cause a loss of control
- Cross slopes that make the assistive device unstable
- Narrow sidewalks that impede the ability of users to turn or to cross paths with others
- Devices that are hard to reach, such as push buttons for walk signals and doors
- Insufficient time to cross the street

Walking-aid (e.g. cane, or walker, etc.) users are most affected by the following:

- Steep uphill slopes that make movement slow or impossible
- Steep downhill slopes that are difficult to negotiate
- Cross slopes that cause the walker to lose stability
- Uneven surfaces that cause these users to trip or lose balance
- Long distances
- Situations that require fast reaction time
- Insufficient time to cross the street
- Prosthesis users often move slowly and have difficulty with steep grades or cross slopes.

PEOPLE WITH VISUAL IMPAIRMENTS

People with visual impairments include those who are partially or fully blind, as well as those who are colorblind. Visually impaired people face the following difficulties:

- Limited or no visual perception of the path ahead
- Limited or no visual information about their surroundings, especially in a new place
- Changing environments that conflict with what they memorize
- Lack of non-visual information
- Inability to react quickly
- Unpredictable situations, such as complex skewed intersections
- Inability to distinguish the edge of the sidewalk from the street
- Compromised ability to detect the proper time to cross a street
- Compromised ability to cross a street along the correct path
- Insufficient time to cross the street

PEOPLE WITH COGNITIVE IMPAIRMENTS

People with cognitive impairments encounter difficulties in thinking, learning, and responding, and in performing coordinated motor skills. Cognitive disabilities can cause some to become lost or have difficulty finding their way. They may also not understand standard street signs and traffic signals. Some may not be able to read and benefit from signs with symbols and colors.

CHILDREN AND OLDER ADULTS

Children and many older adults don't fall under specific categories for disabilities, but must be taken into account in planning and design. Children are less mentally and physically developed than adults and have the following characteristics:

- Less peripheral vision
- Limited ability to judge speed and distance
- Difficulty locating sounds
- Limited or no reading ability, so unable to understand text signs
- Occasional impulsive or unpredictable behavior
- Little familiarity with traffic
- Difficulty in carrying items
- Small children are also more difficult for bicyclists and motorists to see than adults.

The natural aging process generally results in at least some decline in sensory and physical capability. As a result, many older adults experience the following:

- Declining vision, especially at night
- Decreased ability to hear sounds and detect where they come from
- Less strength to walk up hills and less endurance overall
- Reduced balance, especially on uneven or sloped sidewalks
- Slowed reaction times to dangerous situations
- Slowed walking speed

Increased fragility and frailty. Seniors are more likely to be seriously injured in a fall or crash and their recovery becomes longer and more tenuous. This makes older pedestrians the most vulnerable pedestrians.

To provide a seamless travel path throughout the community that is accessible to all, designers should consider five important elements: sidewalks, curb ramps, crosswalks, signals, and transit stops.

ADDITIONAL GUIDANCE: CURB RAMP TYPES AND PLACEMENT

There are several different types of ADA ramps. Selection should be based on local conditions. The most common types are diagonal, perpendicular, parallel, skewed ADA ramps, and blended transition. PROWAG provides additional design guidance and ADA ramp examples appropriate for a variety of contextual constraints.

DIAGONAL ADA RAMPS

Diagonal ADA ramps are single ramps at the apex of the corner. These have been commonly installed by many jurisdictions to address the requirements of the ADA, but have since been identified as a non-preferred design type as they increase risk to wheelchair users. Diagonal curb ramps send wheelchair users and people with strollers or carts toward the middle of the intersection and make the trip across longer.

PERPENDICULAR ADA RAMPS (TYPE A & D)

Perpendicular ADA ramps are placed at a 90° angle to the curb. They must include a level landing at the top to allow wheelchair users to turn 90° to access the ramp, or to bypass the ramp if they are proceeding straight. Perpendicular ramps work best where there is a wide sidewalk, curb extension, furniture zone and/or tight corner radius. Perpendicular ADA ramps provide a direct, short trip across the intersection.

PARALLEL ADA RAMPS (TYPE B & C)

Parallel ADA ramps are oriented parallel to the street; the sidewalk itself ramps down to roadway level. They are used on narrow sidewalks where there isn't enough room to install perpendicular ramps. Parallel ADA ramps require pedestrians who are continuing along the sidewalk to ramp down and up. Where space exists in the furniture zone, parallel curb ramps can be designed in combination with perpendicular ramps to reduce the ramping for through pedestrians. Careful attention must be paid to the construction of the bottom landing to limit accumulation of water and debris.

SKEWED ADA RAMPS

Skewed ADA ramps are used when the ramp centerline is not perpendicular to the curb. Instead, the bottom of the ramp is perpendicular to the ramp centerline and usually has a maximum slope of 12:1 from the top of the ramp to the bottom of the ramp. The transition from the bottom of the ramp to the street has a maximum slope of 2.0%.

ADA RAMP PLACEMENT

For best practices in ramp placement, refer to Chapter 5, "Intersection Design." One ramp should be provided for each crosswalk, which usually translates to two per corner. This maximizes access by placing ramps in line with the sidewalk and crosswalk, and by reducing the distance required to cross the street, compared with a single ramp on the apex.

A single ramp at the apex requires users to take a longer, more circuitous travel path to the other side and causes users to travel towards the center of the intersection where they may be in danger of getting hit by turning cars; being in the intersection longer exposes the user to greater risk of being hit by vehicles. A single ramp at the apex should be avoided in new construction and may be used only for alterations where a design exception is granted because of existing utilities and other significant barriers. In all cases, reducing the curb radius makes ramp placement easier.

BLENDED TRANSITIONS

Blended transitions are situations where either the entire sidewalk has been brought down to the roadway level, or the roadway has been brought up to the sidewalk level. They work well on large radius corners where it is difficult to line up the crosswalks with the curb ramps, yet blended transitions have drawbacks. Children, persons with cognitive impairments, and guide dogs may not distinguish the street edge. Turning vehicles may also encroach onto the sidewalk. For these reasons, bollards, planting boxes, or other intermittent barriers should be installed to prevent cars from traveling on the sidewalk. Detectable warnings should also be placed at the edge of the sidewalk to alert pedestrians with visual impairments of the transition to the street.

DETECTABLE WARNING STRIPS/TRUNCATED DOMES

Because an ADA ramp removes the curb that visually-impaired persons use to identify the location of a street edge, a detectable warning strip must be placed at the edge of the roadway. This detectable strip should be as wide as the ramp and a minimum of 24” deep. These strips are most effective when adjacent to smooth pavement so the difference is easily detected. Color contrast is needed so partially sighted people can see them. Detectable warnings should not be used at unsignalized driveways or on driveway aprons or bike ramps.

The ADAAG standards for detectable warning strips are as follows.

- Detectable warning strips shall consist of a surface of truncated domes and shall meet standards for size, spacing, contrast and edges
- Base diameter: 0.9” minimum; 1.4” maximum
- Top diameter: 50% of base diameter minimum to 65% maximum
- Height: 0.2”
- Center-to-center spacing: 1.6” minimum to 2.4” maximum
- Base-to-base spacing: 0.65” minimum
- Visual contrast: light on dark, or dark on light with adjacent walking surface
- Platform edges: 24” wide and shall extend the full public use area of the platform

PROWAG best practices include the following.

- Width: as wide as the ramp and 24” deep
- Location: one corner at back of the curb, the other corner up to 5’ from back of curb
- Used at
  - The edge of depressed corners
  - The border of raised crosswalks and intersections
  - The base of ADA ramps
  - The border of medians
  - The edge of transit platforms and where railroad tracks cross the sidewalk

In the City of Atlanta, contrasting colors shall be black or red (brick color) on concrete and yellow on brick or other dark paving materials. All efforts should be made to match colors and materials across the street and on adjacent blocks. For more detail on signal design, intersection design and pedestrian accessibility, refer to Ch. 5, “Intersection Design.”

In addition to sidewalks, other elements such as street furniture, driveways, and utilities may be located outside of the roadway. Design guidelines and placement of these elements are described in this section.

ADDITIONAL GUIDANCE: DESIGNING FOR UTILITIES

Street design and new development should consider the overall pattern of plantings, lighting, and furnishings when placing new utilities in the street, and locate utility lines so as to minimize disruption to the prevailing streetscape pattern.

GENERAL GUIDANCE

- Utilities should be located underground wherever possible, as opposed to overhead or surface-mounted. Overhead utilities should be located in alleys or behind buildings where possible.
- New utilities should use durable pipe materials that are resistant to damage by tree roots and have minimal joints.
- Trenchless technologies, such as moling and tunneling, should be used wherever possible to avoid excavation and disruption of streetscape elements.
- New infrastructure projects should use resource-efficient utility materials. Re-used or recyclable materials should be incorporated wherever possible.
- Utility boxes and traffic signal cabinets may be painted as part of a public art program authorized by the Office of Cultural Affairs and the Department of Public Works.
- Tree removal should be avoided and minimized during the routing of large-scale utility burial projects.
- Any utility-related roadway or sidewalk work should replace paving material in kind (e.g., brick for brick) where removed during maintenance, or replace with new upgraded paving materials.

NEW DEVELOPMENT AND MAJOR REDEVELOPMENT

Privately-owned alleys for vehicle, utility, and service access should be incorporated to enable a more consistent streetscape and minimize above-ground utilities.

New utilities should be located to minimize disruption to streetscape elements per guidelines in this section.

ABANDONMENT

Currently abandoned dry conduits should be reused or consolidated if duplicate lines are discovered during street improvement projects. Utilities should be contacted for rerouting or consolidation. Where it is not possible to reuse abandoned mains, conduits, manholes, laterals, valves, etc., they should be removed per agency recommendations when possible to minimize future conflicts.

Abandoned water and sewer lines may be retrofitted as dry utility conduits where available or if possible to minimize the need for future conduit installations.

PROCESS

Utility installation and repair should be coordinated with planned street reconstruction or major streetscape improvements through the Department of Public Works Utility Coordination Committee, which meets regularly.

New development should submit utility plans with initial development applications, so that utilities may be sited to minimize interference with potential locations for streetscape elements.

Utility work also offers opportunities to make other changes to the street after the work is completed and should be coordinated with planned improvements to avoid duplication of efforts or making new cuts in new pavement. Examples of improvements to streets that can be done at low cost after utility work include restriping for bike lanes if utility work requires total street repaving, as well as building sidewalks in conjunction with utility work occurring outside the traveled way.

STREET LIGHTING

Lighting provides essential nighttime illumination to support bicyclist, motorist, and pedestrian travel and safety. Well-designed street lighting enhances the public realm while providing safety and security on streets and pedestrian routes including sidewalks, paths, alleys, and stairways. Historically significant street light poles and fixtures should be maintained and upgraded where appropriate. Pedestrian lighting should be coordinated with building and property owners to provide lighting attached to buildings for sidewalks, alleys, pedestrian paths, and stairways where separate lighting poles are not feasible or appropriate.

LIGHT COLOR

All light sources should provide a warm white (yellow, not blue) color light.

LIGHT POLES AND FIXTURES

Design should relate and be coordinated with the design of other streetscape elements (Pantone color 5467C)

DARK-SKY COMPLIANT LIGHTING

As appropriate, dark sky-compliant lighting should be selected to minimize light pollution cast into the sky while maximizing light cast onto the ground.

ENERGY EFFICIENCY

Solar light fixtures should be utilized where possible for new installations or for retrofit projects. Where solar light fixtures are not appropriate or possible, LED or a future more energy-efficient technology should be used.

PEDESTRIAN LIGHTING

Pedestrians are more likely to be hit when visibility is poor: at dusk, during the night, and at dawn. Many crosswalks are not well lit. Providing illumination or improving existing lighting increases nighttime safety at intersections and midblock crossings, as bicyclists and motorists can better see pedestrians. Pedestrian scale lighting along sidewalks provides greater security, especially for people walking alone at night.

FHWA-HRT-08-053, Informational Report on Lighting Design for Midblock Crosswalks, (April 2008) is a very good resource. It also contains very useful information about lighting design for pedestrians at intersections.

Transit stops require both kinds of lighting: strong illumination of the traveled way for a safer street crossing and pedestrian scale illumination at the stop or shelter for security. If a bus or streetcar stop is located between intersections, it is necessary to illuminate the roadway and the transit stop. The lighting at the bus or streetcar stop is essential to provide safety for transit users.

Pedestrian-oriented fixtures should be the Atlanta Light Type C Poles and Luminaires in CODA green (Pantone color 5467C).

Retrofits of existing street lights and new installations should provide lighting on pedestrian paths. Pedestrian lighting should be added to existing street light poles where feasible unless spacing between street light poles does not support adequate pedestrian lighting, in which case pedestrian lighting may need to be provided between existing street light poles.

Per the City of Atlanta Code of Ordinances, there should be appropriate pedestrian lighting on both sides of the street in designated Senior Zones.

DESIGN STANDARDS

<table>
<tr>
<td>ADA REQUIREMENTS AND TRANSITION PLANS</td>
<td colspan="2">The ADA charges the U.S. Access Board with developing the minimum accessibility guidelines needed to ensure compliance with ADA obligations. These guidelines for public rights-of-way are found in the Public Rights-of-Way Accessibility Guidelines (PROWAG). The U.S. Department of Transportation has recognized this document as current best practices in pedestrian design. In addition to the PROWAG guidelines, Title II of the ADA also requires states and localities to develop ADA Transition Plans that remove barriers to disabled travel.

These plans must:
Inventory physical obstacles and their location
Provide adequate opportunity for residents with disabilities to provide input into the plan
Describe in detail the methods the agency will use to make the facilities accessible
Provide a yearly schedule for making modifications
Name an official/position responsible for implementing the plan
Set aside a budget to implement the plan</td>
</tr>
<tr>
<td rowspan="3">PEDESTRIAN CLEAR ZONE DESIGN AND DIMENSIONS</td>
<td>All pedestrian clear zones outside of historic and landmark zoning districts shall be constructed with a broom-finished concrete surface (see Atlanta Code of Ordinances, Sec. 138-101). Specific zoning districts may have additional standards for pedestrian clear zone material and design. Zoning districts that often have specific sidewalk material and design requirements include the following: Historic Districts (HD), Landmark Districts (LD), Multi-Familt Residential (MR), Mixed Residential Commercial (MRC), Neighborhood Commercial (NC), and Special Public Interest Districts (SPI).</td>
<td>
</td>
</tr>
<tr>
<td colspan="2">The walkway grade shall not exceed the general grade of the adjacent street.</td>
</tr>
<tr>
<td colspan="2">The PAR should be a minimum of 4’, but preferably at least 5’ in width to provide adequate space for two pedestrians to comfortably pass or walk side by side. If the PAR is 4’ wide, it is required to have 5’-wide passing spaces at regular intervals. All transitions (e.g., from street to ramp or ramp to landing) must be flush and free of changes in level. The engineer should determine the pedestrian zone width to accommodate the projected volume of users. In no case will this zone be less than the width of the PAR.</td>
</tr>
</table>

DESIGN STANDARDS (CONT.)

PEDESTRIAN CLEAR ZONE DESIGN AND DIMENSIONS (CONT.)	Vertical surface discontinuities between hexagonal imprint units should not exceed the ADA standard of 0.5 inch maximum. Changes in level between 0.25 inch and 0.5 inch must be beveled according to federal accessibility standards. Horizontal gaps in joints may not permit a sphere of greater than 0.5 inch in diameter. These standards also apply to Urban Conservation districts existing prior to 1991. For additional information regarding designation of historic and landmark districts, consult the Atlanta Code of Ordinances. The Urban Conservation districts are described in Atlanta's Lasting Landmarks, on file at the Atlanta Urban Design Commission. In general, pedestrian clear zone material and design should reflect the specific context (i.e. continue the design and paving material used on the other side of the street or adjacent blocks).
DRIVEWAY APRONS	Driveway aprons that extend into the pedestrian zone can render a sidewalk impassable to users of wheelchairs and walking-aids. Non-compliant driveway aprons often present significant obstacles to wheelchair users. The cross slope on these driveways is often much steeper than the 2 percent maximum grade. To provide a continuous PAR across driveways, aprons shall be confined to the furniture zone and the curb area.
ADA RAMPS	The following define the ADA ramp components along with minimum dimensions: • Landing: the level area at the top of an ADA ramp facing the ramp path. Landings allow wheelchairs to enter and exit an ADA ramp, as well as travel along the sidewalk without tipping or tilting. This landing must be as wide as the ramp and measure at least 4' by 4'. There should also be a level (not exceeding a 2% grade) 4' by 4' bottom landing of clear space outside of vehicle travel lanes. • Approach: the portion of the sidewalk on either side of the landing. Approaches provide space for wheelchairs to prepare to enter landings. • Flare: the transition between the curb and sidewalk. Flares provide a sloped transition (10% maximum slope) between the sidewalk and curb ramp to help prevent pedestrians from tripping over an abrupt change in level. Flares can be replaced with return curb where the furniture zone is landscaped or fenced (must be a non-walkable surface). • Ramp: the sloped transition between the sidewalk and street where the grade is constant and cross slope at a minimum. ADA ramps are the main pathway between the sidewalk and street. • Gutter: the trough that runs between the curb or ADA ramp and the street. The slope parallel to the curb should not exceed 2% at the curb ramp. • Detectable Warning Strip: surface with distinct raised areas to alert pedestrians with visual impairments of the sidewalk-to-street transition. This strip must be as wide as the ramp and at least 24" deep.
CURB DESIGN AND MATERIAL	In the City of Atlanta, Granite header curb shall be used on all streets within the City Core and Growth Corridor and Urban Neighborhood character area categories. With written permission from the Department of Public Works Commissioner, standard concrete curb and gutter may be used outside of these areas.

DESIGN STANDARDS (CONT.)

<table>
<tr><td rowspan="7">FURNISHINGS</td><td>All street furnishing must be accessible per Public Rights-of-Way Accessibility Guidelines (PROWAG) and other City of Atlanta regulations and design standards.</td></tr>
<tr><td>In the City of Atlanta the standard bench shall be the Victor Stanley Model CR-96, or similar. All benches shall be CODA Green (Pantone color 5467C) and have a center armrest, to prevent lying and sleeping.</td></tr>
<tr><td>Per the Atlanta Code of Ordinances, news racks/publication vending devices shall not be located:
• Within 5’ of the nearest outer edge of any crosswalk,
• Within 20’ of any fire hydrant, fire call box, or police call box,
• Within 5’ of the nearest outer edge of any driveway,
• Within 2’ of signs, parking meters, streetlights, or utility poles,
• Within 15’ of any designated bus stop sign or post,
• In such a manner that hinders egress to parked vehicles in marked parking stalls,
• In such a manner that impairs bus, taxicab, truck or passenger loading zones, or
• In a manner that blocks historic markers, benches, or other public improvements.</td></tr>
<tr><td>News racks/publication vending devices shall be placed within the furniture zone no closer than 18” from the back of the nearest curb and shall be positioned to maintain at least 9’ of pedestrian clear zone. News racks/publication vending devices shall not be permitted on sidewalks with a width which is less than 12’.</td></tr>
<tr><td>The standard news rack shall be the Sho-Rack galvanized material model 100, or similar, as defined in the Atlanta Code of Ordinances section 138-156. All news racks should be CODA Green (Pantone color 5467C).</td></tr>
<tr><td>The standard trash/recycling receptacle should be the Victor Stanley Model S-42 or similar. In some high-use locations, Big Belly Solar Compactors or similar automated compacting units may be used. All trash receptacles shall be CODA Green (Pantone color 5467C) and all recycling receptacles shall be blue.</td></tr>
<tr><td>The standard bollard shall be a 32’’ classical design cast bollard with a 9’’ base. All bollards shall be CODA Green (Pantone color 5467C).</td></tr>
<tr><td rowspan="2">MAILBOXES</td><td>Mailboxes shall be located within the furniture zone and shall not be located within or encroach into the pedestrian clear zone.</td></tr>
<tr><td>The U.S. Postal Service requires that mailboxes adjacent to the curb/gutter line be perpendicular to the roadway. If a mailbox is relatively large, it may be necessary to orient parallel to the roadway in order to avoid obstructing the pedestrian clear zone. An application process is required by the postal service to turn mailboxes parallel to the roadway. Masonry mailboxes shall be installed only after obtaining an encroachment permit from the Department of Public Works.</td></tr>
<tr><td>PARKING METERS</td><td>Parking meters shall be placed in the furniture zone. Parking meters shall not face the pedestrian clear zone, as queueing customers tend to block pedestrian access. Single-space meters should be placed at the front end of the individual parking stalls within the furniture zone. If there is no furniture zone, single-space meters shall be placed within the supplemental zone or at the edge of the right-of-way.</td></tr>
</table>

DESIGN STANDARDS (CONT.)

DECORATIVE/ STREETSCAPE SIGNAGE	Streetscape signs should be kept to a minimum and placed strategically. They shall align with the existing street furniture and be placed within the furniture zone. They shall not be located within or encroach into the pedestrian clear zone. Headroom under all signs must be 7' or more.
PUBLIC ART	Public art should be accessible to persons with disabilities and placement must not compromise the pedestrian clear zone.
	Design of permanent public art commissioned by or for the City of Atlanta incorporates the following eligibility criteria: • Relevance of the work to the City of Atlanta, its values, culture and people; • Technical suitability of the work for outdoor display, including its maintenance and conservation requirements; • Relationship of the work to the site, especially how it serves to activate or enhance the public space; and • How closely the proposed artwork meets the specifications as outlined in the RFPs
LIGHTING	Spacing between lighting and street trees shall be at least 15'.

Table 6-2 Generalized Minimum and Standard Streetscapes by Character Area Category

Streetscape Requirements by Character Area and Functional Classification									
		Arterial			Collector			Local	
City Core and Growth Corridor		MIN	STD.	OTHER	MIN	STD.	OTHER	MIN	STD.
	Furniture	4'	5'	8'	4'	5'	8'	0'	5'
	Pedestrian/Clear[1]	8'	10'	10'	6'	10'	10'	6'	10'
	Supplemental	5'	5'	5'	18"	5'	5'	0'	5'
	Curb type	Granite *			Granite *			Granite	
Urban Neighborhood		MIN	STD.	OTHER	MIN	STD.	OTHER	MIN	STD.
	Furniture	5'	5'	8'	4'	5'	8'	2'	4'
	Pedestrian/Clear[1]	8'	10'	10'	6'	8'	10'	5'	6'
	Supplemental	18"	5'	5'	18"	5'	5'	0'	5'
	Curb type	Granite *			Granite *			Granite	
Suburban and Rural Production		MIN	STD.	OTHER	MIN	STD.	OTHER	MIN	STD.
	Furniture/Buffer	4'	5'	8'	4'	5'	8'	2'	4'
	Pedestrian/Clear	5'	6'	6'	5'	6'	6'	5'	6'
	Supplemental	0'	0'	0'	0'	0'	0'	0'	0'
	Curb type	Concrete *			Concrete *			Concrete	

* GDOT State Route or roadway has ≥ 5 lanes

[1] Refer to Department of City Planning for specific pavement material if designated historic district

DESIGN GUIDANCE: ALONG THE STREET

GENERAL DIMENSIONS	The recommended minimum supplemental zone width is 1'-6".
	The recommended minimum pedestrian/clear zone is 5'-0".
	4'-0" minimum with 6'-0" to 8'-0" furniture zone in transit stop areas, designated state route, or where the number of travel lanes is greater than or equal to 5.
	The recommended minimum furniture zone width is 2', with 4' to 8' preferred, dependent on character area category and State Route designation.
	The recommended minimum curb zone width is 6" or 1'-6"" where pedestrian or freight loading is expected and may conflict with obstacles in the furniture zone.
	The standard curb in the City of Atlanta is 6'' high granite header curb.
DRIVEWAY APRONS	Driveway aprons should also be entirely confined to the furniture zone. However, curb material should reflect the specific context (i.e. continue the design and material used on the other side of the street or adjacent blocks).
	Driveway aprons should end at the pedestrian clear zone and be confined to the furniture zone. Driveway aprons should have a slope of between 1:10 and 1:12 in order to slow vehicles entering the driveway and limit intrusion into the pedestrian clear zone. The pedestrian clear zone should be maintained at its adjacent cross slope and material within the driveway for a width of not less than 30". Where necessary to keep the driveway apron slope from exceeding 1:10, the sidewalk may be partially dropped to meet the grade at the top of the apron. Detectable warning strips should not be installed at unsignalized driveways.
ADA RAMPS	ADA Ramps shall be compliant with adopted City of Atlanta standards.
FURNITURE ZONE AND FURNISHINGS	Placement of street furniture should be provided: • At concentrations of pedestrian activity (nodes, gathering areas, etc.), and • On streets with pedestrian-oriented destinations (pedestrians may gather or linger and enjoy the public space).
	Street furniture placement should follow these criteria: • Street furniture is secondary to the pedestrian clear zone, street trees and lights. Street furniture should be placed in relation to these elements and be sensitive to pedestrian flow. Careful consideration to the placement provides ease of recognition and use. • In addition to the guidelines provided for each element, placement should adhere to the minimum spacing established in the Atlanta Code of Ordinances. Street furniture installed within the appropriate zone will be spaced not less than as shown in Table 6.2. • Seating arrangements should be located and configured according to the following guidelines: • Seating should be located in a shaded area under trees. • Seating should be oriented toward points of interest; this can be the adjacent building, an open space, or the street itself if it's lively. Where sidewalk width permits, seating can also be oriented perpendicular to the curb. • Informal seating opportunities, incorporated into the adjacent building architecture, may be used as an alternative to free-standing benches. Low planter walls can be used as informal seating areas.

DESIGN GUIDANCE: ALONG THE STREET (CONT.)

FURNITURE ZONE AND FURNISHINGS (CONT.)	Where no furniture zone exists, driveway ramps usually violate cross slope requirements. In these situations, sidewalks should be built back from the curb at the driveway as shown in the photos to the left.
	Benches and seating should be made of durable, high-quality materials. The seating design should complement and visually reinforce the design of the streetscape. All seating should be designed to discourage lying and sleeping. Seating opportunities should be integrated with other streetscape elements.
	Bollards are used to prevent motorists from encroaching onto sidewalks and other areas closed to motor vehicles. They should be placed at the edge of the roadway and be spaced 4’ to 6’ apart. Bollards range in size from 4” to 10” in diameter. Bollards should have articulated sides and tops to provide distinct design details. The details should be coordinated with other street elements of similar architectural character. At locations where intermittent or temporary motor vehicle access is required, fold-down bollards or automatic retractable bollards shall be used. Removable bollards should not be used, as they are often misplaced and/or damaged.
	Kiosks may be located in any of the following areas: • Furniture zone or supplemental zone, • Curb extensions, • Close to, but not within, transit loading areas. Kiosks should be designed to the following guidelines: • Kiosks should include bulletin boards or an enclosed case for display of information. • As a gateway element, the kiosk should include the neighborhood, commercial district, street, or park name; a map; and other information. • Kiosks should have details and features coordinated with other street elements and should have a similar architectural character. • Kiosks may include information regarding major office buildings, hotels, shopping centers, mixed-use developments, neighborhood and district names, MARTA rail stations, and colleges/universities.
	There should be a maximum of one trash/recycling receptacle every 200’ within City Core and Growth Corridor character area category and a maximum of four trash/ recycling receptacles at major intersections (one per corner).
PARKING METERS	Though not a decision that is in the purview of a street design effort, the City of Atlanta should encourage the conversion of single-space meters to multi-space units to reduce visual clutter. The multi-space units should be selected to minimize their impact on the pedestrian clear zone.
PARKING METERS	Though not a decision that is in the purview of a street design effort, the City of Atlanta should encourage the conversion of single-space meters to multi-space units to reduce visual clutter. The multi-space units should be selected to minimize their impact on the pedestrian clear zone.
DECORATIVE/ STREETSCAPE SIGNAGE	Streetscape signs should be clean and simple and complement the elements of other street furniture. All wayfinding signs should be the City of Atlanta standard design. However, color of signage will vary depending on the neighborhood/district. Signage for honorary street designation should be brown in color with white text, the same length as the street name sign and mounted below the street name sign. Private streets should be identified with standard markers and signs (see Chapter 5, “Intersection Design”).

DESIGN GUIDANCE: ALONG THE STREET (CONT.)

PUBLIC ART	Public art can be situated in a variety of areas and locations, including streets, public spaces with concentrations of pedestrians, or areas of little pedestrian traffic, to create a unique space for discovery. Siting of public art commissioned by or for the City of Atlanta should consider: • What is the relationship of the piece to the site? • Is the piece appropriately scaled? • Has a list of alternative sites been developed? • Will the site become a destination itself? • Will the piece help to anchor and activate the site and enhance the surrounding area? • Will there be convenient public access to the site? • Will additional parking be required? • What preparations need to be made to the site in anticipation of the installation of the piece? • Have arrangements been made to restore the site to its original condition for temporary pieces? • What are the utility requirements of the site? • Has the Office of Cultural Affairs, Atlanta Urban Design Commission and the Department of Public Works approved the site? • Has the neighborhood association and NPU reviewed and commented on the piece and site?
LANDSCAPING	Landscaped buffers or fences should separate sidewalks from off-street parking lots or off-street passenger loading areas.
	Pedestrian and driver sight distances should be maintained near driveways. Fencing and foliage near the intersection of sidewalks and driveways should ensure adequate sight distance as vehicles enter or exit.
LIGHTING	• Street and pedestrian lighting should be installed in the sidewalk furniture zone • Light fixtures should not be located next to tree canopies that may block the light • Where pedestrian lighting is not provided on the street light pole, special pedestrian lamps should be located between street light poles.
	Locate lights as part of an overall system that organizes other street elements such as trees, benches, pavers and street lights. 1. Place lights at least 2.5’ from the back of the curb to allow room for car bumpers and door swings. Align with street trees where possible. 2. Place lights at least 5’ from the edge of the curb transition point nearest the driveway, curb cut or alley and at least 20’ from the extended flow line of the nearest intersection 3. Space lights 60’ apart. This distance is preferred to provide room for street trees, other furnishings, and maximum light coverage.

DESIGN GUIDANCE: ALONG THE STREET (CONT.)

CROSSING LOCATIONS AND CONDITIONS	Ideally, uncontrolled crossing distances should be no more than 20 feet which allows for two 10-foot lanes. Ideally, crossings wider than 40 feet should be divided by installing a median or refuge island.
	The total number of travel lanes should be limited to a maximum of two travel lanes per direction on all streets (plus a median and/or left-turn lane).
	There should be a well-designed crossing at every transit stop/station. Transit stops/station may need to be relocated to appropriate crossing locations.
CROSSINGS AND TRAFFIC CONTROL	Dual right-and triple-left turn lanes should be prohibited.
	Pedestrians should not have to wait more than 40 seconds in City Core and Growth Corridor Character area category intersections.

Chapter 7

BIKEWAY DESIGN

Atlanta's Transportation Plan has emphasized the need to accommodate significant population and employment growth in the City of Atlanta without major expansion of the vehicle-carrying capacity of streets. While all non-drive alone modes of transportation play a part in achieving this, bicycle travel has a key role in fulfilling this vision in the near term: bicycle projects are relatively affordable to design and construct, and they are within the City's control on nearly all Atlanta streets.

This chapter defines key design considerations for how to expand the City's network and make cycling a desirable, safe, and convenient means of travel.

Plan bicycle facilities for various skill levels. Atlanta Streets Alive promotes new uses of streets and helps build demand for high quality bicycle infrastructure

DESIGN PRINCIPLES

The following principles inform the recommendations made in this chapter:

- Priority should be given to bicycle facilities called out in the Atlanta Transportation Plan and Cycle Atlanta Plans.
- People on bike should have safe, convenient, and comfortable access to all destinations.
- Every street is a bicycle street, regardless of bikeway designation.
- Street design should accommodate all types, levels, and ages of bicyclists.
- Bicyclists should be separated from pedestrians whenever possible.
- Bikeway facilities should take into account vehicle speeds and volumes, with;
  - Shared lanes on low volume, low-speed roads, and
  - Separation on higher volume, higher-speed roads.
- Bikeway treatments should provide clear guidance to enhance safety for all users.

Under Georgia state law, people riding bicycles are considered an operator of a vehicle and are legitimate road users. But they are slower, less visible and more vulnerable than motorists. Just as transportation design has incentived driving as a mode, transportation facilities need to accommodate people on bicycle differently on busy, higher-speed roads and at complex intersections. In congested urban areas, bicyclists provided with well-designed facilities can often travel faster than motorists.

Bicyclists use their own power, must constantly maintain their balance, and don’t like to interrupt their momentum. Typical bicyclist speeds range from 10 to 15 mph, enabling them to make trips of up to five miles in urban areas in about 25 minutes, the equivalent of a typical suburban commuter trip time. Bicyclists may wish to ride side-by-side so they can interact socially with a riding companion or shield a child from adjacent traffic.

PLANNING FOR A RANGE OF BIKEWAY USERS

A classification system developed by the City of Portland, Oregon, provides the following bicycle user types:

STRONG AND FEARLESS

Bicyclists who will ride anywhere regardless of roadway conditions. These bicyclists can ride faster than other user types, prefer direct routes, and will typically choose roadways, even if shared with vehicles, over separate bicycle facilities such as paths. Very low percentage of the population.

ENTHUSED AND CONFIDENT

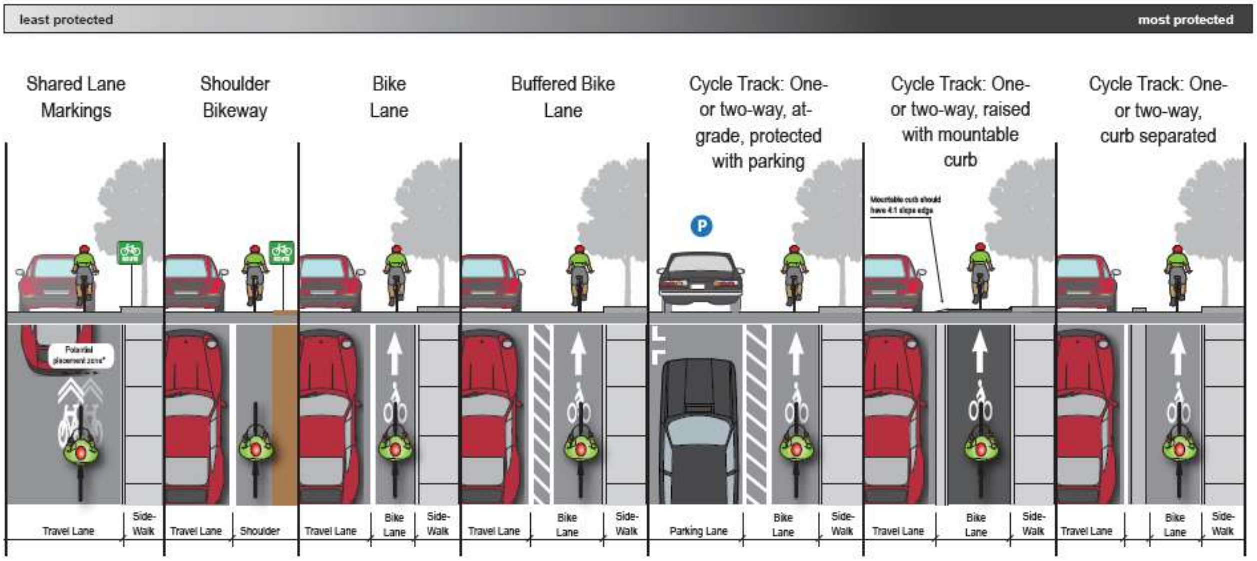
This group encompasses intermediate bicyclists who are mostly comfortable riding on all types of bicycle facilities but will usually prefer low traffic streets, bicycle lanes, or separate paths when available. They may deviate from a more direct route in favor of a preferred facility type. This group includes commuters, utilitarian cyclists, and recreational riders, and probably represents less than 10 percent of the population.

INTERESTED BUT CONCERNED

This user type makes up the bulk (likely between half and two-thirds) of the cycling or potential bicycling population. They are cyclists who typically ride only on bicycle boulevards, cycle tracks or shared-use paths under favorable conditions and weather. They perceive traffic and safety as significant barriers towards increased use of bicycling. These bicyclists may become “Enthused and Confident” with encouragement, education, and experience.

NO WAY, NO HOW

People in this category are not bicyclists; they perceive severe safety issues with riding in traffic and will not ride a bicycle under any circumstances. But some may eventually give bicycling a second look and may progress to the user types above, especially to ride recreational facilities (shared-use paths) or convenient, separated facilities. This group likely comprises something between a quarter and a third of the population.



Options for bicycle facilities in the public right-of-way, Washington County Bicycle Facility Design Toolkit
(Credit: Washington County, Oregon)

BIKEWAY TYPES

Bicycle facilities offer different degrees of physical separation from the roadway, convenience, directness and comfort (visualized as a continuum at left). Depending on the type of bicyclist expected on the roadway (or public right of way), it may be appropriate to provide greater or lesser levels of protection from traffic. A designated bikeway network provides a system of facilities that offers enhancement or priority to bicyclists over other roadways in the network. However, it is important to remember that all streets in a city should safely and comfortably accommodate bicyclists, regardless of whether the street is designated as a bikeway. Several general types of bikeways are listed below with no implied order of preference.

BICYCLE ROUTES

A term used for planning purposes or to designate recommended bicycle touring routes, a bicycle route can be designated along any bikeway type.

SHARED LANES

A shared lane is a facility in which bicyclists ride in the same travel lanes as other traffic. There are no specific dimensions for shared lanes. In narrow travel lanes, motorists have to cross over into the adjacent travel lane to pass a cyclist. Shared lanes work well on low-volume, low-speed local streets, but are not recommended on collectors, minor arterials or principal arterials.

NEIGHBORHOOD GREENWAYS

A neighborhood greenway (also known as a bicycle boulevard) is a type of shared lane street that has been modified to prioritize bicycle traffic and to discourage through motorist traffic. Traffic calming measures control traffic speeds and discourage through trips by motorists. Traffic controls limit conflicts between motorists and bicyclists and give priority to through bicyclist movements at intersections with collectors, minor arterials or principal arterials.

BICYCLE LANE

Portion of the roadway designated with striping, stencils, and signs for preferential use by bicyclists. Bicycle lanes are appropriate on collectors and minor arterials. They may be used on other streets where bicycle travel and demand is substantial. Where on-street parking is provided, bicycle lanes are striped on the left side of the parking lane.

ONE-WAY PROTECTED BIKE FACILITIES

A one-way protected bike facility (also known as a cycle track) is a bicycle path designated for travel in one direction along a roadway, physically separated from motorized traffic, and distinct from the sidewalk. Protected facilities can be separated from the parallel travel lane by a line of parked cars, landscaping, or a physical buffer that motorists cannot cross. Cycle tracks may also be raised. This type of facility are effective in attracting users who are concerned about safety and can be especially attractive to "interested but concerned" bicyclists. One-way protected facilities should be used on minor arterials and principal arterials.

Protected bike facilities have been endorsed by NACTO in its Urban Bikeway Design Guide.

Although the AASHTO Guide for the Development of Bicycle Facilities does not include separated cycle tracks, AASHTO does not preclude the use of cycle tracks. The AASHTO guide does not specifically discuss cycle tracks as distinct from shared-use paths.

TWO-WAY PROTECTED BIKE FACILITIES

A two-way protected bike facility can be defined as a bicycle path designated for travel in both directions along one side of a roadway, physically separated from other traffic, and distinct from the sidewalk. Two-way cycle tracks may also be raised above the curb. Design of two-way cycle tracks must consider potential conflicts with driveways and cross-streets, as well as conflict points with pedestrians at intersections. Two-way cycle tracks should be used on minor arterials and principal arterials, where very few driveway entrances exist.

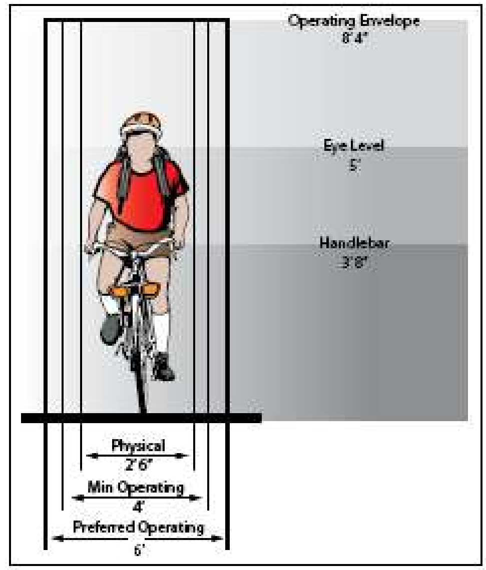
SHARED-USE PATHS/SIDEPATHS

Shared-use paths are shared facilities often located in parks, on public property or within an independent right-of-way. Sidepaths are shared facilities located within a roadway right-of-way and separated from other traffic with a planting

The Westview Drive two-way protected bike facility was installed to create a network with an existing multiuse path strip/furniture zone. and separated from other traffic with a planting strip/furniture zone.

Bicyclists, pedestrians, joggers, and skaters often use these paths. Shared-use paths are appropriate in areas not well served by the street system, such as in long, relatively uninterrupted corridors like waterways, utility corridors, and rail lines. Sidepaths are appropriate on principal arterials with a very limited number of driveways and cross-streets.

Shared-use paths and sidepaths are often elements of a community trail plan. Shared-use paths may also be integrated into the street network with new or existing subdivisions as described in Chapter 3, "Street Networks." In the City of Atlanta, most existing shared-use paths and sidepaths have been built by the PATH Foundation. These trails include the Stone Mountain Trail and the Chastain Park Trail.



Bicycle operating dimensions, 2010 Draft AASHTO Guide for the Development of Bicycle Facilities

(Credit: American Association of State Highway and Transportation Officials)

INTEGRATING WITH THE STREET SYSTEM

Most bikeways are part of the street; therefore, well-connected street systems are very conducive to bicycling, especially those with a fine-meshed network of low-volume, low-speed streets suitable for shared roadways. In less well-connected street systems, where wide streets carry the bulk of traffic, bicyclists need supplementary facilities, such as short sections of shared-use paths and bridges, to connect otherwise unconnected streets.

As traffic volumes and speeds increase, greater separation from motor vehicle traffic is desirable. Other factors to consider are users (more children or recreational cyclists may warrant greater separation), adjacent land uses (multiple driveways may cause conflicts with two-way cycle tracks and sidepaths), available right-of-way (separated facilities require greater width), and costs.

As a general rule, bikeways (e.g., bicycle lanes and cycle tracks) should be provided on all major streets (arterials and collectors), as these roads generally offer the greatest level of directness and connectivity in the network, and are typically where destinations are located. Priority should be given to streets that are identified in the Atlanta Transportation Plan's Bicycle Connections.

There are occasions when it is infeasible or impractical to provide bikeways on a busy street, or the street does not serve the mobility and access needs of bicyclists. The following guidelines should be used to determine if it is more appropriate to provide facilities on a parallel local street:

- Conditions exist such that it is not economically or environmentally feasible to provide adequate bicycle facilities on the street.
- The street does not provide adequate access to destination points within reasonable walking distances, or separated bikeways on the street would not be considered safe.
- The parallel route provides continuity and convenient access to destinations served by the street.
- Costs to improve the parallel route are no greater than costs to improve the street.
- If any of these factors are met, cyclists may actually prefer the parallel local street facility in that it may offer a higher level of comfort (bicycle boulevards are based on this approach).

Shared-use paths can also be used to provide transportation in corridors otherwise not served by the street system, such as along rivers and canals, through parks, along utility corridors, on abandoned railroad tracks, or along active railroad rights-of-way. While shared-use paths offer the safety and scenic advantages of separation from traffic, they must also offer frequent connections to the street system and to destinations such as residential areas, employment sites, shopping, and schools. Street crossings must be well designed with measures such as pedestrian hybrid beacons (PHBs), rectangular rapid flashing beacons (RRFBs) and/or raised medians or refuge islands.

DESIGN GUIDANCE FOR CHOOSING A FACILITY TYPE

Figure 7-1 National Association of City Transportation Official Facility Selection Guidance

<table>
<tr><th colspan="5">Contextual Guidance for Selecting All Ages & Abilities Bikeways</th></tr>
<tr><th colspan="4">Roadway Context</th><th rowspan="2">All Ages & Abilities Bicycle Facility</th></tr>
<tr><th>Target Motor Vehicle Speed*</th><th>Target Max. Motor Vehicle Volume (ADT)</th><th>Motor Vehicle Lanes</th><th>Key Operational Considerations</th></tr>
<tr><td colspan="2">Any</td><td>Any</td><td>Any of the following: high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts‡</td><td>Protected Bicycle Lane</td></tr>
<tr><td>< 10 mph</td><td>Less relevant</td><td rowspan="3">No centerline, or single lane one-way</td><td>Pedestrians share the roadway</td><td>Shared Street</td></tr>
<tr><td>≤ 20 mph</td><td>≤ 1,000 – 2,000</td><td rowspan="2">< 50 motor vehicles per hour in the peak direction at peak hour</td><td rowspan="2">Bicycle Boulevard</td></tr>
<tr><td rowspan="5">≤ 25 mph</td><td>≤ 500 – 1,500</td></tr>
<tr><td>≤ 1,500 – 3,000</td><td rowspan="3">Single lane each direction, or single lane one-way</td><td rowspan="4">Low curbside activity, or low congestion pressure</td><td>Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane</td></tr>
<tr><td>≤ 3,000 – 6,000</td><td>Buffered or Protected Bicycle Lane</td></tr>
<tr><td>Greater than 6,000</td><td rowspan="2">Protected Bicycle Lane</td></tr>
<tr><td>Any</td><td>Multiple lanes per direction</td></tr>
<tr><td rowspan="3">Greater than 26 mph†</td><td rowspan="2">≤ 6,000</td><td>Single lane each direction</td><td rowspan="2">Low curbside activity, or low congestion pressure</td><td>Protected Bicycle Lane, or Reduce Speed</td></tr>
<tr><td>Multiple lanes per direction</td><td>Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed</td></tr>
<tr><td>Greater than 6,000</td><td>Any</td><td>Any</td><td>Protected Bicycle Lane, or Bicycle Path</td></tr>
<tr><td colspan="2" rowspan="2">High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts</td><td rowspan="2">Any</td><td>High pedestrian volume</td><td>Bike Path with Separate Walkway or Protected Bicycle Lane</td></tr>
<tr><td>Low pedestrian volume</td><td>Shared-Use Path or Protected Bicycle Lane</td></tr>
</table>

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

† Setting 25 mph as a motor vehicle speed threshold for providing protected bikeways is consistent with many cities' traffic safety and Vision Zero policies. However, some cities use a 30 mph posted speed as a threshold for protected bikeways, consistent with providing Level of Traffic Stress level 2 (LTS 2) that can effectively reduce stress and accommodate more types of riders.[18]

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

(Credit: Designing for All Ages & Abilities, National Association of City Transportation Officials)

A two way protected cycle track at Tech Parkway .

BICYCLE FACILITY SELECTION

The National Association of Transportation Officials developed guidancefor selecting bicycle facilities based on an "All AGES and Abilities" criteria, a national and international design standard that meets the needs of a broad set of potential cyclist.

Figure 7-1 provides guidance in choosing a bikeway facility type that can create an All Ages & Abilities bicycling environment, based on a street's basic design and motor vehicle traffic conditions such as vehicle speed and volume.

After the facility type is selected, the next step is to identify a roadway modification strategy to accommodate the desired facility type. This chart should be applied as part of a flexible, results-oriented design process on each street, alongside robust analysis of local bicycling conditions. If the preferred facility does not fit within the available right-of-way or the potential modifications are unacceptable, the next most protective facility should be evaluated. In some cases, a bicycle facility may fall short of the All Ages & Abilities criteria but still substantively reduce traffic stress, and should not be used as a reason to avoid implementing a bikeway.

DESIGN GUIDANCE FOR FACILITIES

BICYCLE LANES

Bicycle lanes are a portion of the traveled way designated for preferential use by bicyclists; they are most suitable on collectors, minor arterials and prinicipal arterials. Bicycle lanes may also be provided on rural roads where there is high bicycle use. Bicycle lanes are generally not recommended on local streets with relatively low traffic volumes and speeds, where a shared roadway is the appropriate facility. There are no hard and fast mandates for providing bicycle lanes, but as a general rule, the City of Atlanta considers bicycle lanes on roads with traffic volumes in excess of 3,000-10,000 ADT or traffic speeds of 30 mph or greater.

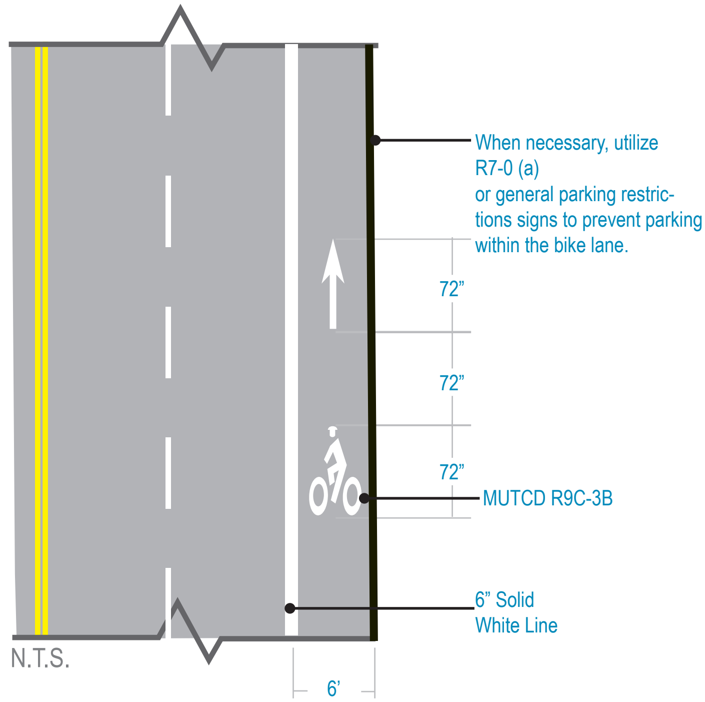
Bicycle lanes have the following advantages:

- They enable bicyclists to ride at a constant speed, especially when traffic in the adjacent travel lanes speeds up or slows down (stop-and-go).
- They enable bicyclists to position themselves where they will be visible to motorists.
- They encourage bicyclists to ride on the roadway rather than the sidewalk.

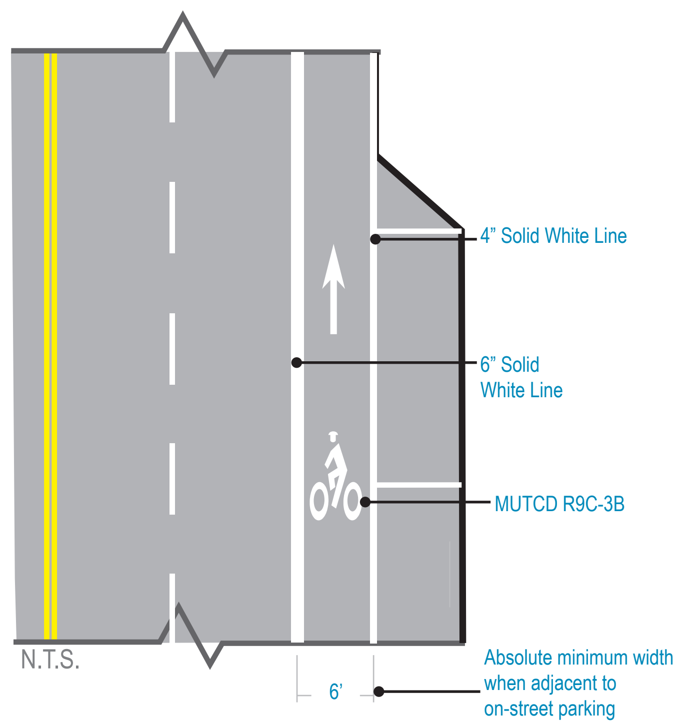
Bicycle lanes are created with solid white stenciled pavement markings and signage (R3-17). Motorists are prohibited from using bicycle lanes for driving and parking, but may use them for emergency avoidance maneuvers or breakdowns. Bicycle lanes are one-way facilities that carry bicycle traffic in the same direction as adjacent motor-vehicle traffic. Bicycle lanes should always be provided on both sides of a two-way street. One exception is on hills where topographical constraints limit the width to a bicycle lane on one side only. On hills, the bicycle lane should be provided in the uphill direction as bicyclists ride slower uphill, and they can ride in a shared lane in the downhill direction. Future bicycle facility planning should prioritize connections between the on-street and off-street bicycle network, such as connections between bicycle lanes and nearby shared-use paths.

The desired minimum bicycle lane width is 6' (minimum width of 5' or 4' if unavoidable) If on-street parking is permitted, the bicycle lane should be placed between the parking lane and the travel lane with a minimum width of 6', so bicyclists can ride outside the door zone. Buffered bicycle lanes should be considered on streets

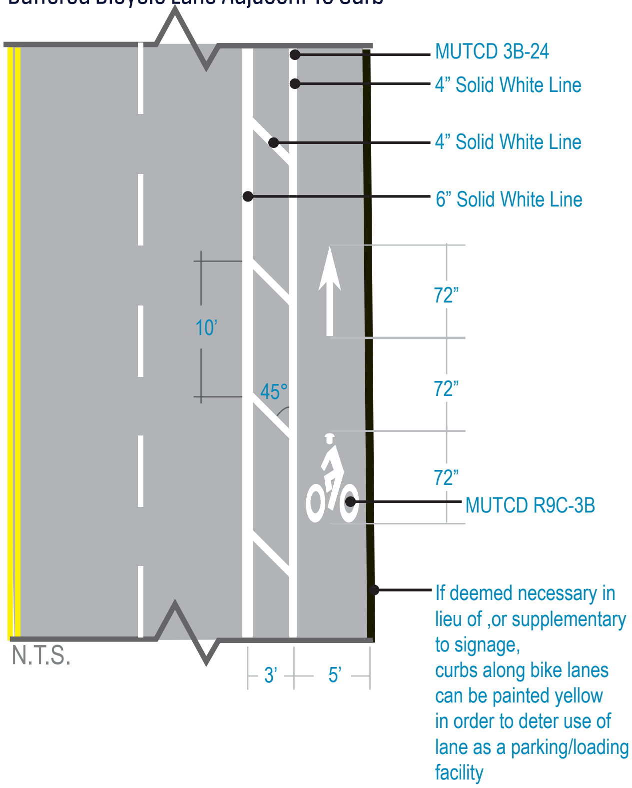
Bicycle Lane Adjacent To Curb



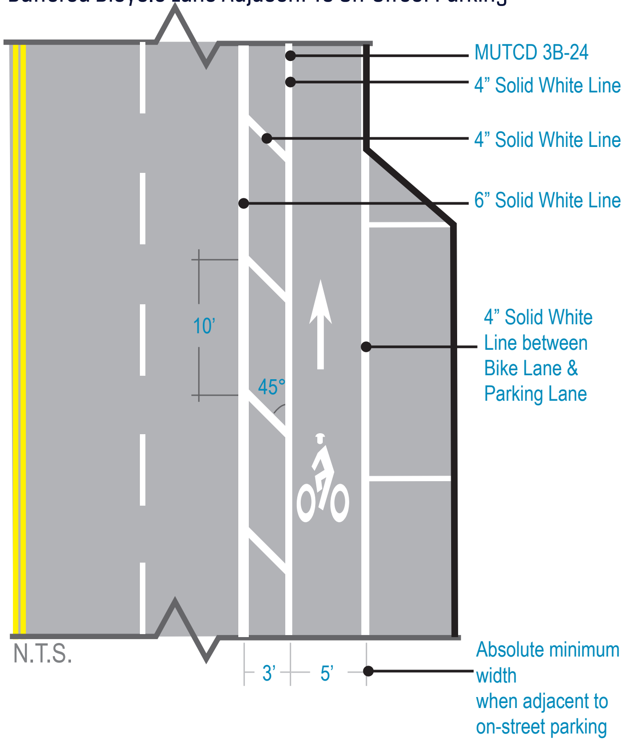
Bicycle Lane Adjacent To On-Street Parking



Buffered Bicycle Lane Adjacent To Curb



Buffered Bicycle Lane Adjacent To On-Street Parking



with high volumes of traffic and/or higher speeds. On curb and gutter sections, a 4'-wide smooth surface should be provided between the gutter pan and stripe. This minimum width enables bicyclists to ride far enough from the curb to avoid debris and drainage grates and far enough from other vehicles to avoid conflicts. By riding away from the curb, cyclists are more visible to motorists than when hugging the curb. Where on-street parking is permitted, delineating the bicycle lane with two white stripes, one on the travel lane side and one on the parking side, is preferable to a single white stripe.

BICYCLE LANES ON TWO-WAY STREETS

Basic bicycle lanes on two-way streets comprise the majority of bicycle lanes. They should follow the design guidelines for width with and without on-street parking.

BICYCLE LANES ON ONE-WAY STREETS

Bicycle lanes on one-way streets should generally be on the right side of the traveled way and should always be provided on both legs of a one-way couplet. The bicycle lane may be placed on the left of a one-way street if it decreases the number of conflicts (e.g., those caused by heavy bus traffic or parking) and if bicyclists can safely and conveniently transition in and out of the bicycle lane. If sufficient width exists, the bicycle lanes can be striped on both sides.

BUFFERED BICYCLE LANES

Buffered bicycle lanes provide a marked gore between the bicycle lane and the travel lanes. This additional space can improve the comfort of cyclists as they don't have to ride as close to motor vehicles. The width of the buffer should be between two to four feet. Buffered bicycle lanes can also be used to slow traffic as they narrow the travel lanes. An additional buffer may be used between parked cars and bicycle lanes to direct cyclists to ride outside of the door zone of the parked cars. Buffered bicycle lanes are most appropriate on minor and principal arterials. They can be used on streets where physically separating the bicycle lanes or cycle tracks is undesirable for cost, operational, or maintenance reasons.

CONTRA-FLOW BICYCLE LANES

Contra-flow bicycle lanes are provided to allow bicyclists to ride in the opposite direction of motor vehicle traffic. They convert a one-way street into a two-way street: one direction for motorists and bicyclists and the other for bicyclists only. Contra-flow bicycle lanes are separated with double solid yellow centerline striping. Combining both directions of bicycle travel on one side of the street to accommodate contra-flow movement results in a two-way protected bike lane.

Contra-flow bicycle lanes are useful where they provide a substantial savings in out-of-direction travel with direct access to high-use destinations, and safety is improved because of reduced conflicts compared to the longer route. The contra-flow design introduces new design challenges and may create additional conflict points as motorists may not expect on-coming bicyclists. Contra-flow bicycle lanes are not recommended adjacent to on-street parking.

A Contra-Flow Bicycle Lane in provided on Park Place in Downtown Atlanta

SHARED BICYCLE/ BUS LANES

In most instances, bicycles and buses can share the available roadway. On routes heavily traveled by both bicyclists and buses, separation can reduce conflicts (stopped buses hinder bicyclist movement and slower moving bicyclists hinder buses). Ideally, shared bicycle/bus lanes should be 13 feet to 15 feet wide to allow passing by both buses and bicyclists.

Separate bus lanes and bicycle lanes should be considered to reduce conflicts between passengers and bicyclists, with the bus lane at the curbside. Buses will be passing bicyclists on the right, but the fewer merging and turning movements reduce overall conflicts.

SHARED LANES (NO SPECIAL PROVISION)

Shared lanes should only be used on streets with speed limits <25 mph and less than 3,000 cars/ day. There are no specific width standards for shared lanes. Most are fairly narrow; they are simply the streets as constructed. Shared lanes are suitable on streets with low motor vehicle speeds or traffic volumes, and on low-volume streets and highways. The suitability of a shared roadway decreases as motor vehicle traffic speeds and volumes increase, especially on winding roads with poor sight distance.

If traffic speeds and volumes exceed those thresholds, separated facilities should be considered or traffic calming should be applied to reduce the vehicle speeds/volumes. Many traffic-calming techniques can make the streets more amenable to bicycling.


Bicycle Lane on Bill Kennedy

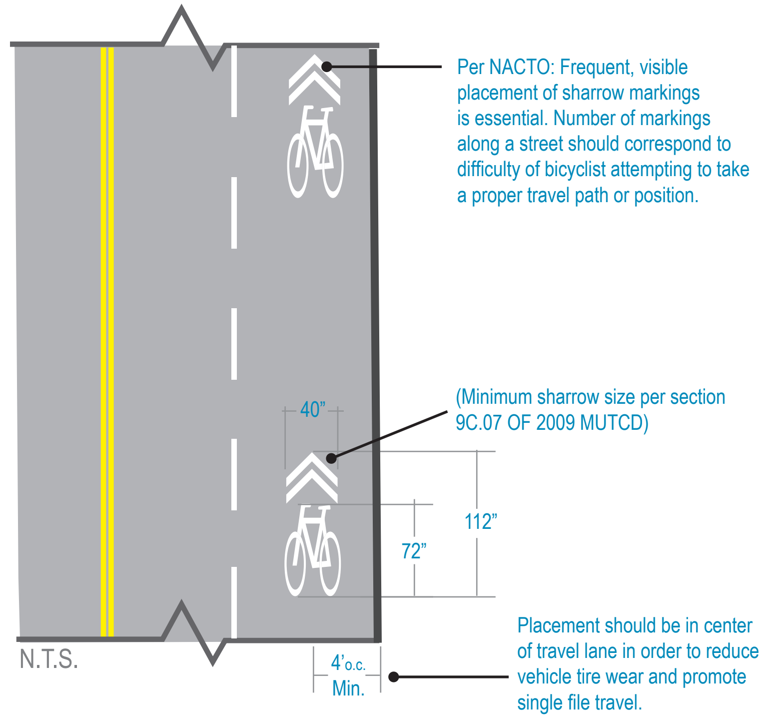
MARKED SHARED LANES

Shared-lane pavement markings (also commonly called "sharrows") may be used as additional signage for shared roadways. Sharrows are generally warning signs, and should not be considered as bicycle infrastructure (or a replacement for bicycle facilities when needed). The pavement markings can serve a number of purposes: they remind bicyclists to ride further from parked cars to prevent dooring crashes, they make motorists aware of bicycles potentially in the travel lane, and they show bicyclists the correct direction of travel. Sharrows next to parallel parking should be a minimum distance of 11 feet from the curb. Installing farther than 11 feet from the curb may be desired in areas with wider parking lanes or in situations where the sharrow is best situated in the center of the shared travel lane to promote cyclists taking the lane. Placing the sharrow between vehicle tire tracks increases the life of the markings and decreases long-term maintenance costs. In conjunction with sharrows, "BICYCLES MAY USE FULL LANE" sign (R4-11) should be used where no bicycle lanes or usable shoulders are present and the lane width is too narrow for both bicycles and motor vehicles to travel safely side-by-side. Sharrows are appropriate only on local streets and some low-speed low-volume collector streets.

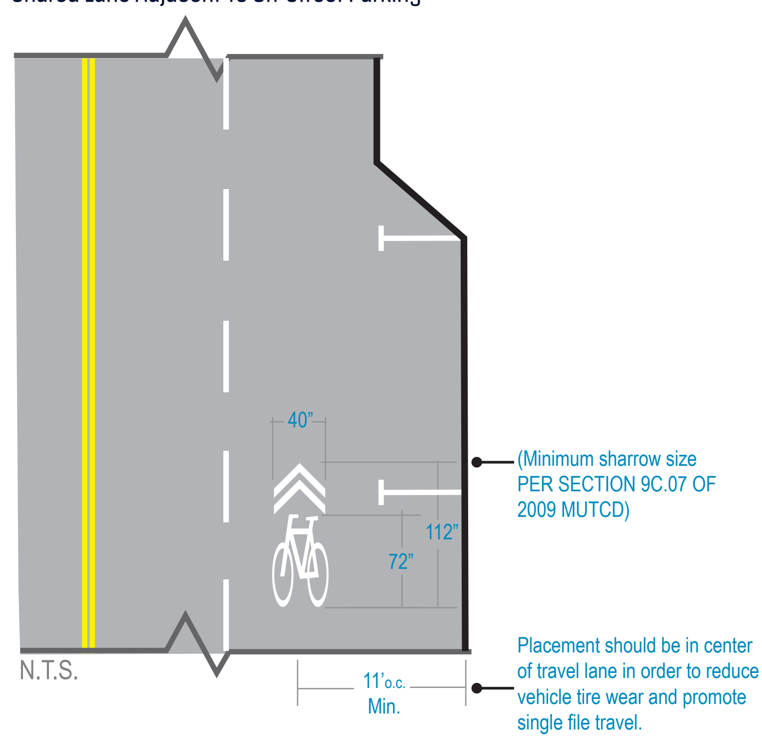
CENTERLINE REMOVAL/DASHED CENTERLINE

On streets with one travel lane in each direction, removal of the centerline is recommended to facilitate passing of bicyclists by motor vehicles instead of a solid double centerline. Using a dashed centerline will also facilitate passing by motorists. Motorists may be unwilling to cross over a double solid centerline to pass a cyclist, resulting in instances where motorists feel like that are stuck behind a slower moving cyclist and attempt to pass the cyclist too closely in an unsafe manner. Cyclists in these situations may feel pressured to ride to the extreme far right or in the gutter to allow motorists to pass. Removal of the centerline opens the entire traveled way for passing, and allows bicyclists to position themselves at a safe and comfortable distance from the curb. Lack of centerlines is also a traffic-calming technique, as drivers tend to drive slower without the visible separation from oncoming traffic. The MUTCD only mandates centerline stripes on urban streets with ADT of 6,000 or more; most neighborhood streets suitable for sharing are well below that threshold. Dashed centerlines are appropriate only on local streets and some collector streets.

Shared Lane Adjacent To Curb



Shared Lane Adjacent To On-Street Parking



NEIGHBORHOOD GREENWAY (BICYCLE BOULEVARD)

A neighborhood greenway is an enhanced shared roadway where interventions are taken to slow speeds and volumes of vehicular movements. Neighborhood greenways work best if planned and installed as a network. The streets are modified to function as a prioritized through street for bicyclists while maintaining local access for automobiles. This is done by adding traffic-calming devices to reduce motor vehicle speeds and through trips, and installing traffic controls that limit conflicts between motorists and bicyclists and give priority to through-bicyclist movement. One key advantage of neighborhood greenways is that they attract cyclists who do not feel comfortable on busy streets and prefer to ride on lower traffic streets. Bicycle travel on local streets is generally compatible with local land uses (e.g., residential and some retail). Residents who want slower traffic on neighborhood streets often like measures that support neighborhood greenways. By reducing traffic and improving crossings, bicycle boulevards also improve conditions for pedestrians. Successful neighborhood greenways implementation requires careful planning with residents and businesses to ensure acceptance. Neighborhood greenways are appropriate only on local streets.

ELEMENTS OF A NEIGHBORHOOD GREENWAY

Selecting a direct and continuous street, rather than a circuitous route that winds through neighborhoods. Bicycle boulevards work best on a street grid. If any motorist diversion will likely result from the bicycle boulevard, selecting streets that have parallel higher-classified streets can prevent unpopular motorist diversion to other residential streets.

- Placing motorist traffic diverters at key intersections to reduce through motorist traffic (diverters are designed to allow through bicyclist movement)
- Turning STOP signs towards intersecting streets, so bicyclists can ride with few interruptions (using YIELD signs is also an alternative).
- Replacing stop-controlled intersections with mini-circles and mini-roundabouts to reduce the number of stops cyclists have to make
- Placing traffic-calming devices to lower motor vehicle traffic speeds
- Placing wayfinding and other signs or markings to route cyclists to key destinations, to guide cyclists through difficult situations, and to alert motorists of the presence of bicyclists
- Where the bicycle boulevard crosses high-speed or high-volume streets, providing crossing improvements such as signals, where a traffic study has shown that a signal will be safe and effective. To ensure that bicyclists can activate the signal, loop detection should be installed in the pavement where bicyclists ride.
- Roundabouts where appropriate.
- Median refuges wide enough to accommodate a bicyclist (8’ minimum) and with an opening wide enough to allow bicyclists to pass through (6’). The design should allow bicyclists to easily see the travel lanes they must cross.
- Where bicycle boulevards cross collectors and arterials, and traffic signals are not warranted, install RRFBs, with additional buttons oriented towards bicyclists and trail crossing signage (W11-15 and W16-7P).

Median refuge island used in the streets of Portland, OR.
(Credit: National Association of City Transportation Officials)

The Westview Drive two way protected bicycle facility was installed during a typical resurfacing project.

RAISED CYCLE TRACKS

Bicycle lanes are typically an integral portion of the traveled way and are delineated from motor vehicle lanes with painted white stripes. Though some bicyclists ride on these facilities comfortably, others prefer more separation. Raised cycle tracks incorporate the convenience of riding on the street with some physical separation. This is done by elevating the bicycle lane surface two to four inches above street level, while providing a traversable curb to separate the bikeway from the motor vehicle travelway.

This treatment offers the following advantages:

- Motorists know they are straying from the travel lanes when they feel the slight bump created by the curb.
- The mountable curb allows motorists to make turns into and out of driveways across the raised cycle track.
- The mountable curb allows bicyclists to enter or leave the raised cycle track (e.g., for turning left or overtaking another cyclist).
- The raised cycle track drains towards the centerline, leaving it clear of debris and puddles.
- Novice bicyclists are more likely to ride in the raised cycle track, leaving the sidewalk for pedestrians.

Raised cycle tracks can be constructed at little additional expense for new roads. Retrofitting streets with raised cycle tracks is more costly; it is best to integrate raised cycle tracks into a larger project to remodel the street due to drainage replacement. Special maintenance procedures may be needed to keep raised bicycle lanes swept.

ONE-WAY AND TWO WAY PROTECTED BICYCLE FACILITIES (CYCLE TRACKS)

Protected bicycle facilities, also known as cycle tracks, are bikeways located on or adjacent to streets where bicyclists are separated from motorists by physical barriers, such as on-street parking, planters, posts/bollards, and landscaped islands. They are well suited to downtown areas where they minimize traffic conflicts with pedestrians. Streets selected for cycle tracks should have minimal pedestrian crossings and driveways. They should also have minimal loading/unloading activity and other street activity. The cycle tracks should be designed to minimize conflicts with these activities as well as with pedestrians and driveways.

Protected bike lanes can be provided on new facilities, but they require more width than other types of bikeways. They are best suited for existing streets; the combined width of the protected bike lane and the barrier is similar the width of a travel lane. Maintenance including street sweeping needs to be considered during design. Two way protected bike lanes work most effectively where there are few uncontrolled crossing points with unexpected traffic conflicts. Measures such as separate signal phases for right-turning motor vehicle and through bicyclists, and left-turning cyclists and through motor vehicles should be deployed to regulate crossing traffic.

Protected bike lanes may also be designed to accommodate transit stops, including bus stop platforms, pedestrian access routes to the landing pad, and on-street parking.

ONE-WAY AND TWO WAY PROTECTED BICYCLE FACILITIES (CYCLE TRACKS)

One way and two way protected facilities can be installed with various types of buffers depending on project budgets, context, roadway width, etc. The matrix below can be used to guide decisions about buffer type. It was created by People for Bikes and Nathan Wilkes, City of Austin. In Atlanta flex posts*, duracurb and granite curb have been utilized in the installation of bicycle facilities.

DELINEATOR POSTS

1.5 ft. additional width; $15k-$30k per lane-mile

PROTECTION LEVEL	+ + + +
INSTALLATION COST	$ $
DURABILTY	-o-
AESTHETICS	⊙

TURTLE BUMPS

1.5 ft. additional width; $15k-$30k per lane-mile

PROTECTION LEVEL	+ + + +
INSTALLATION COST	$ $
DURABILTY	-o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙

LARGE BUMPS

1.5 ft. additional width; $15k-$30k per lane-mile

PROTECTION LEVEL	+ + + + +
INSTALLATION COST	$ $
DURABILTY	-o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙ ⊙

OBLONG LOW BUMPS

1.5 ft. additional width; $10k-$20k per lane-mile

PROTECTION LEVEL	+ + +
INSTALLATION COST	$ $
DURABILTY	-o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙

PARKING STOPS

6 in. additional width; $20k-$40k per lane-mile

PROTECTION LEVEL	+ + + +
INSTALLATION COST	$ $
DURABILTY	-o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙

LINEAR BARRIERS

6 in. additional width; $25k-$75k per lane-mile

PROTECTION LEVEL	+ + + +
INSTALLATION COST	$ $
DURABILTY	-o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙

PARKED CARS

11 ft. for parking + buffer; $8k-$16k per lane-mile

PROTECTION LEVEL	+ + + + +
INSTALLATION COST	$
DURABILTY	-o- -o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙

JERSEY BARRIERS

2 ft. additional width; $80k-$160k per lane-mile

PROTECTION LEVEL	+ + + + +
INSTALLATION COST	$ $ $
DURABILTY	-o- -o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙

PLANTERS

3 ft. additional width; $80k-$400k per lane-mile

PROTECTION LEVEL	+ + + + +
INSTALLATION COST	$ $ $
DURABILTY	-o- -o-
AESTHETICS	⊙ ⊙ ⊙ ⊙ ⊙

RIGID BOLLARDS

2 ft. additional width; $100k-$200k per lane-mile

PROTECTION LEVEL	+ + + + +
INSTALLATION COST	$ $ $
DURABILTY	-o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙ ⊙ ⊙

CAST IN PLACE CURB

12 in. additional width; $25k-$80k per lane-mile

PROTECTION LEVEL	+ + +
INSTALLATION COST	$ $ $
DURABILTY	-o- -o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙ ⊙

12" PRECAST CURB

1.5 ft. additional width; $400k-$600k per lane-mile

PROTECTION LEVEL	+ + + + +
INSTALLATION COST	$ $ $ $
DURABILTY	-o- -o- -o- -o-
AESTHETICS	⊙ ⊙ ⊙ ⊙

*The City of Atlanta is working to standardize flex posts across bicycle facilities for ease of maintenance.

SHARED-USE PATHS/SIDEPATHS/MULTI-USE PATHS

Shared-use paths should be a minimum of 10 feet wide with 2 feet of graded shoulder on each side. Generally, 10-12 feet of paved path is recommended. Wider pavement may be needed in high-use areas, such as the Atlanta Beltline Trail, which is 14 feet wide. A winding shared-use path or sidepath is not a substitute for an on-road bicycle facility. Additionally, curfews on sidepaths and shared-use paths may prohibit the use of paths by commuter bicyclists.

Appropriate intersection design at cross-streets is important when designing shared use paths. Consideration should be given to bicyclists entering and exiting a shared-use path from cross-streets and adjace

BIKEWAY MARKINGS AT INTERSECTIONS

Chapter 5, "Intersection Design," provides general principles of geometric design; all these recommendations benefit bicyclists. The configuration of a safe intersection for bicyclists may include additional elements such as color, signs, medians, signal detection, and pavement markings. Intersection design should take into consideration existing and anticipated bicyclist, pedestrian, and motorist movements. In all cases, the degree of mixing or separation between bicyclists and other modes is intended to reduce the risk of crashes and increase bicyclist comfort. The level of treatment required for bicyclists at an intersection will depend on the bicycle facility type used, whether bicycle facilities are intersecting, the adjacent street function, and the adjacent land use.

Continuing marked bicycle facilities at intersections (up to the crosswalk) ensures that separation, guidance on proper positioning, and awareness by motorists are maintained through these potential conflict areas. The appropriate treatment for right-turn only lanes is to place a bicycle lane pocket between the right-turn lane and the rightmost through lane. If a full bicycle lane pocket cannot be accommodated, a shared bicycle/right turn lane can be installed that places a standard-width bicycle lane on the left side of a dedicated right-turn lane. A dashed strip delineates the space for bicyclists and motorists within the shared lane. This treatment includes signs advising motorists and bicyclists of proper positioning within the lane. Sharrows are another option for marking a bikeway through an intersection where a bicycle lane pocket cannot be accommodated.

BICYCLE BOXES

A bicycle box is a designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic the red signal phase in order to continue in the travel lane or make a left turn. Bicycle boxes work best with an approaching bicycle lane or cycle tracks and, generally, should not be used in a shared lane situation. Appropriate locations at signalized intersections include:

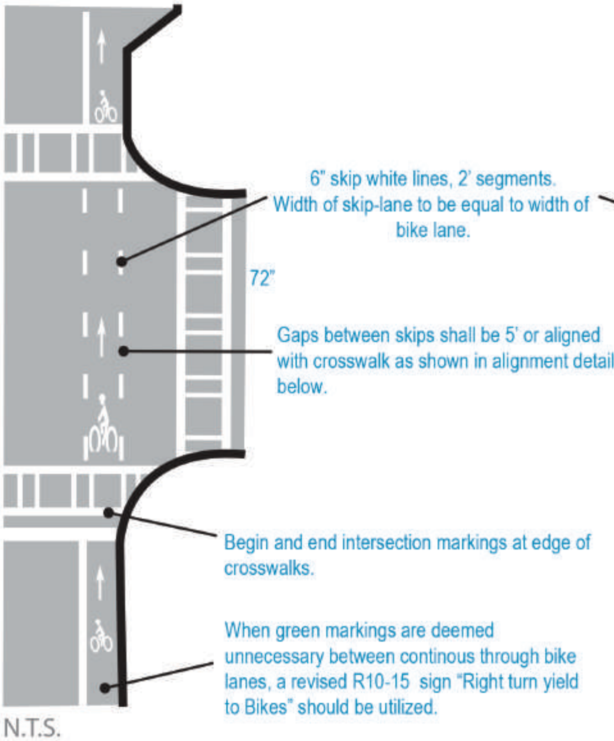
- Intersection of Atlanta Transportation Plan Bicycle Connections
- Intersection where the bicycle lane ends and bicyclists are required to ride in a shared lane on the receiving side of the intersection
- Intersection with frequent bicyclist left-turns and/or motorist right-turns
- Intersection with right or left-turning conflicts between bicyclists and motorists
- Intersection where a left turn is required to follow a designated bicycle route or access a shared-use path, or where the bicycle lane moves to the left side of the street
- Intersection where the dominant motor vehicle traffic flows right and bicycle traffic continues through (such as at a Y intersection or freeway access ramp)

TWO-STAGE LEFT-TURN QUEUE BOXES

On right-side protected bicycle lanes, bicyclists are often unable to merge into traffic to turn left due to the physical separation. This makes the provision of two-stage left turns critical in ensuring these facilities are functional. The same principles for two-stage turns apply to both bicycle lanes and cycle tracks. While two-stage turn queue boxes may increase bicyclist comfort in many locations, this configuration will typically result in a higher delay for bicyclists, due to the need to wait for two separate green signal indications (one for the through street, followed by one for the cross street) before proceeding. This treatment is recommended at complex intersections of Atlanta Transportation Plan Bicycle Connections.

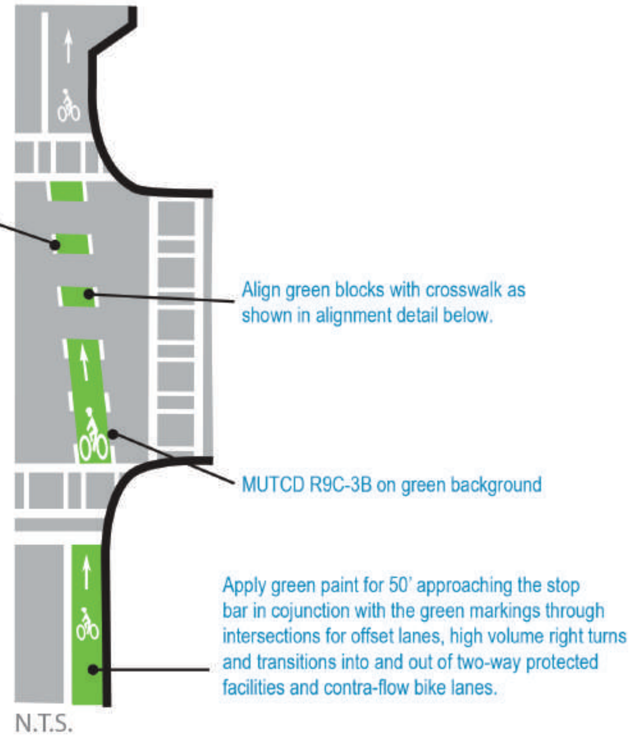
Typical Signalized Intersection

Use where bike lanes of any type cross a signalized intersection.



High Visibility Intersection

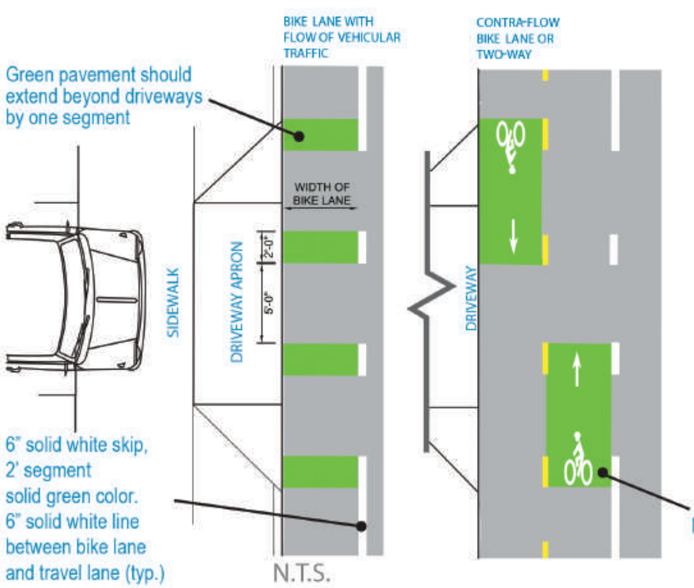
Use high visibility markings through intersections with 1) offset lanes, 2) high volume right turn movement, 3) transition between a two-way protected cycle track or contra-flow bike lane.



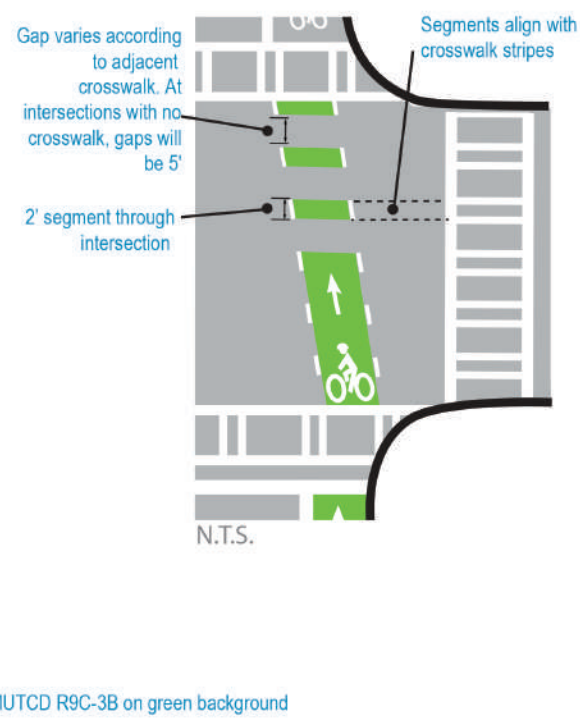
Driveway Crossings

"Dashed" green markings shall be installed in bike lanes and protected facilities across major driveways and/or where a driveway is used to access a parking deck or a significant number of surface parking spaces. In locations where bike travel is counter to the flow of vehicles (e.g. two way cycle tracks or contra-flow bike lanes), solid green fill with directional chevron markers should be used in lieu of dashed green fill.

TREATMENTS AT MAJOR DRIVEWAYS TO PARKING GARAGES AND LOTS:

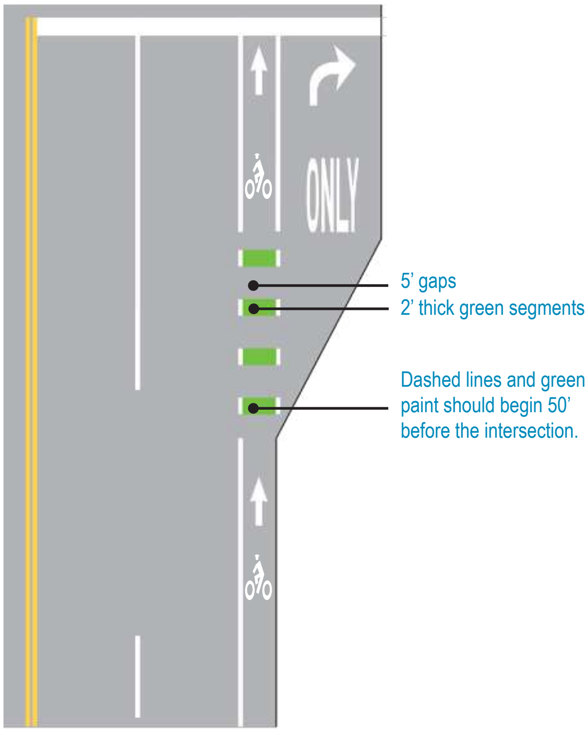


Bike Lane Crosswalk Alignment Detail



Bicycle Lane Adjacent To Turn Lane

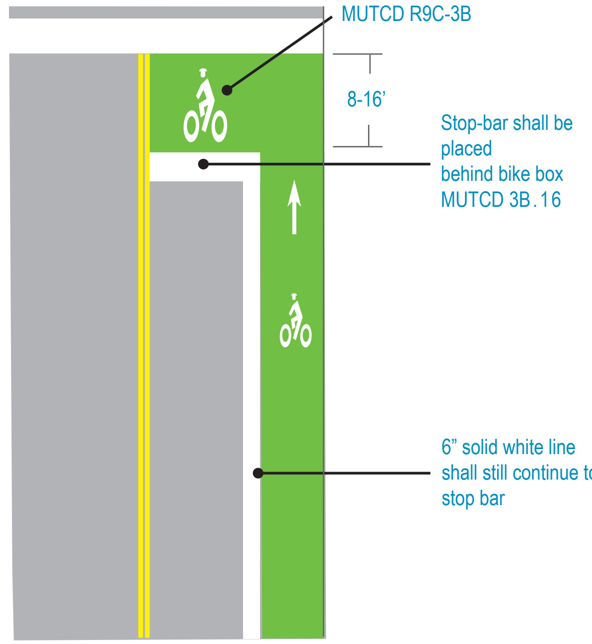
Preferred use where Right of Way width will allow seperate facilities.



N.T.S.

Bike Boxes

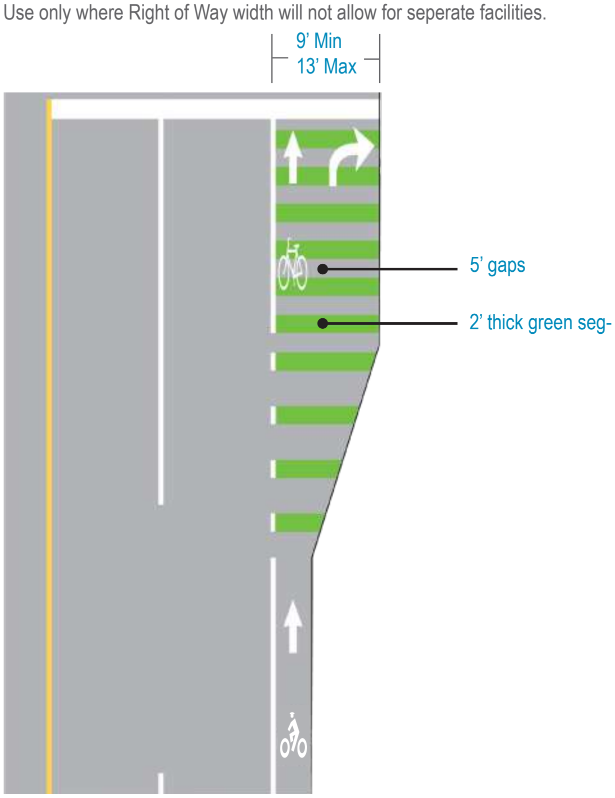
Green paint should be utilized to create bike boxes at signalized intersections where a cyclist can turn left onto other bicycle facilities.



N.T.S.

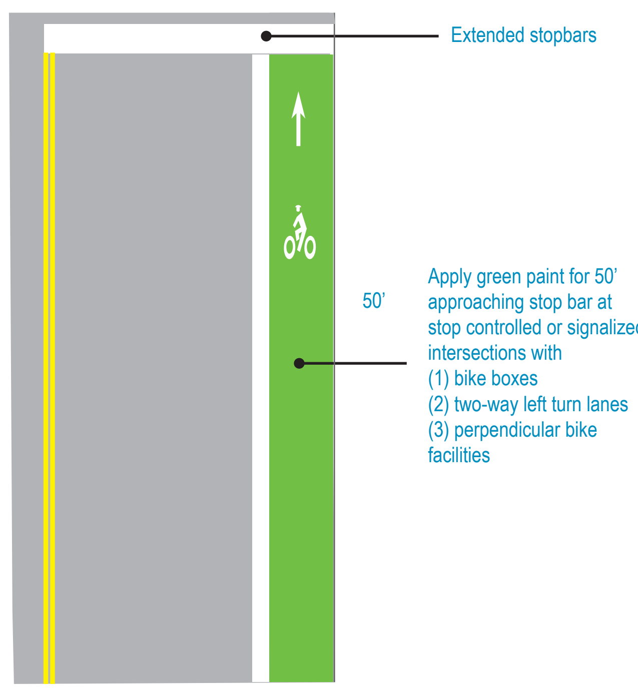
Shared Bike Lane/ Right Turn Lane

Use only where Right of Way width will not allow for seperate facilities.



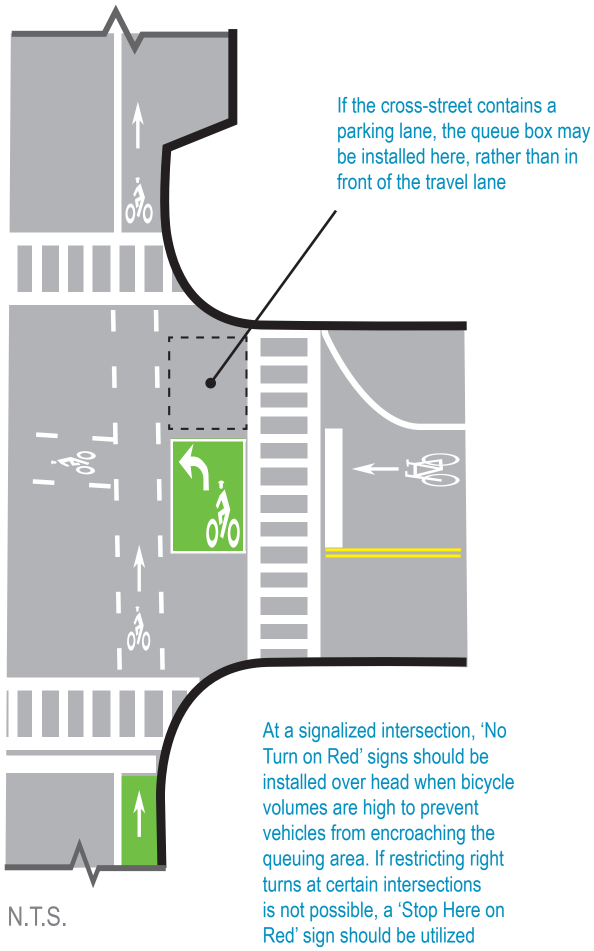
N.T.S.

Signalized Intersection Approaches



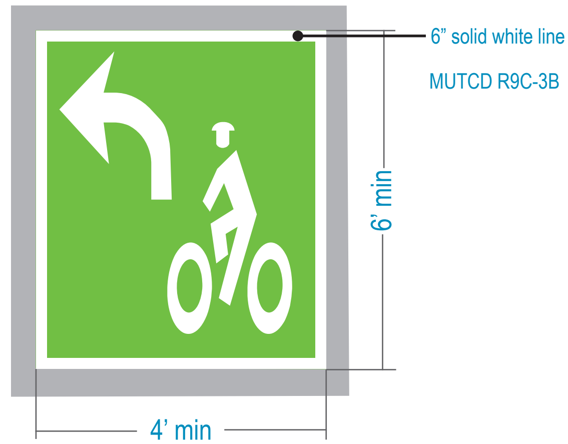
N.T.S.

Two-Stage Left Turn Queue Boxes

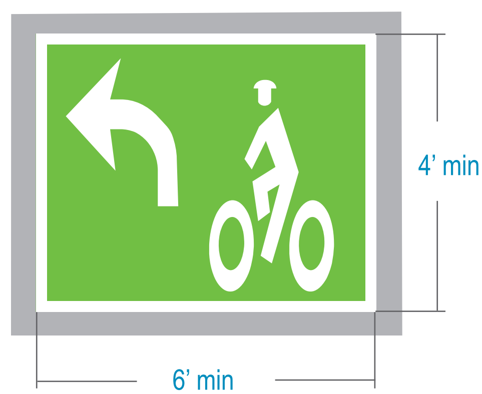


Typical Bike Queue Box Details

Turn arrow and bike stencil shall indicate proper bicycle direction and positioning



OR



When a thermoplastic marking is located within colored pavement, the contractor should affix the marking to pavement before applying MMA or other approved material specified in the design documents. Once markings are settled, it should be protected to prevent from potential paint stains.

NOTES FOR CONSTRUCTION DOCUMENTS:

General Notes:

• Contractor to install Color-Safe Color Pavement Marking and Anti-Skid Surfacing for bicycle facilities as noted in plans. Color to be approved by owner prior to construction activities and ordering of materials.

Plan Notes:

• Install [Left Turn Queue/Bike Box/Driveway Crossing, etc.] using green Color-Safe Color Pavement Marking and Anti-Skid Surfacing.

Color: c:71.4% m:15.41% y:100% k:1.83%

Or comparable color

BICYCLE SIGNAL FACES

Bicycle signal faces may be installed at signalized intersections to improve identified safety or operational problems for bicyclists; they provide guidance for bicyclists at intersections where bicyclists may have different needs from other road users (e.g., bicycle-only movements and leading bicycle intervals) or to indicate seperate bicycle signal phases and other bicycle-specific timing strategies.

In the City of Atlanta, bicycle signal facesshould be mounted on a standard 12" signal head and be installed at locations meeting the FHWA Interim Approval Guidelines

BICYCLE SIGNAL DETECTION

Bicycle signal detection is used at actuated traffic signals to alert the signal controller of bicyclist crossing demandon a particular approach. Bicycle detection occurs either through the use of push buttons or by automated means (e.g., in-pavement loops, video, and microwave). Inductive loop detection at many signalized intersections is calibrated to the size or metallic mass of a motor vehicle, meaning that bicycles may often go undetected. Loop sensitivity can be increased to detect bicyclists by using a whole bicycle or even a scrapped metallic bicycle frame.

Proper bicycle detection must accurately detect bicyclists (be sensitive to the mass and volume of a bicycle and bicyclist); and provide clear guidance to bicyclists on how to actuate detection. Bicycle detection should be prioritized on Atlanta Transportation Plan Bicycle Connections, at crossings of collectors and arterial streets Video detection is recommended for signal phasing in order to improve detection of bicycles at intersections.

A leading bicycle interval is used at the intersection of W Peachtree St and 5th St to give westbound bicyclists a head start before left-turning motorists.

Bicycle signal detection and signal design should follow the MUTCD guidelines, which state that signage may be installed at signalized intersections where markings are used to indicate the location where a bicyclist is to be positioned to actuate the signal. Signage should be placed at the roadside adjacent to the marking to emphasize the connection between the marking and the sign.

LEADING BICYCLE INTERVALS

Based on the Leading Pedestrian Interval, a Leading Bicycle Interval (LBI) can be implemented in conjunction with a bicycle signal face. With an LBI, bicyclists are given a green signal while motorists are held at an all red for several seconds, providing a head start for bicyclists to advance through the intersection. This treatment is particularly effective in locations where bicyclists are required to make a challenging merge or lane change shortly after the intersection.

BIKEWAY WAYFINDING

The ability to navigate through a region is informed by landmarks, natural features, signs, and other visual cues. Wayfinding is a cost-effective and highly visible way to improve the bicycling environment by familiarizing users with the bikeway network, helping users identify the best routes to destinations, addressing misconceptions about time and distance, and helping overcome a barrier to entry for infrequent cyclists (e.g., "interested but concerned" cyclists).

A bikeway wayfinding system is typically composed of signs indicating direction of travel, location of destinations, and travel time/ distance to those destinations; pavement markings indicating to bicyclists that they are on a designated route or bicycle boulevard and reminding motorists to drive courteously; and maps providing users with information regarding destinations, bicycle facilities, and route options.

In the City of Atlanta, bikeway wayfinding signs should be installed when bikeways are constructed. Bikeway wayfinding signs should be located at intersections, transitions and major destinations.

CRITERIA FOR BICYCLE WAYFINDING DESTINATIONS:

- Be a government entity or building;
- OR be a 'Super Destination', as defined as a high traffic generator with an annual attendance of 500,000 or more visitors;
- OR be a cultural venue or historical site including theaters and museums with an annual attendance of 50,000 or more visitors;
- OR be a college or university with an enrollment of 1,000 students or more;
- OR be a hospital that is a licensed facility providing continuous emergency medical care to the general public. The facility must have an emergency room open 24 hour/day, 365 day/year.
- AND be open to all persons regardless of race, color, religion, ancestry national origin, sex, age or disability;
- AND comply with all federal, state and local regulations for public accommodations concerning health, sanitation and safety;
- AND have sufficient and secure parking;
- AND maintain set days and hours of operation;
- AND be accessible by a road open to the general public.

The following types of destinations would not quality for directional signage:

- Seasonal attractions open less than six months per year
- Private, commercial venues including hotels and restaurants
- Any attraction located within an already signed attraction

Other destinations will need to be approved by the Department of Public Works

EXAMPLES OF CUSTOM SIGNAGE (N.T.S.)

*CUSTOM SIGNAGE TEXT TO UTILIZE MUTCD/FHWA-APPROVED "CLEARVIEW" FONT
(Green on signs shall be equal in color to green bike facilities)

WAYFINDING
SIZE 24"x24"
CAN BE UP TO 36"
IN HEIGHT

BIKE/PED DIRECTIONAL
SIZE 18"x18"

BIKE QUEUE BOX
SIZE 18"x24"

YIELD TO BIKES
SIZE 18"x24"

NO PARKING SIGN
SIZE 18"x24"

Standard City of Atlanta bicycle rack, Piedmont Park.

BICYCLE PARKING

Secure bicycle parking at destinations is an integral part of a bikeway network. Bicycle thefts are common and lack of secure parking is often cited as a reason people hesitate to ride a bicycle. The same consideration should be given to bicyclists as to motorists, who expect convenient and secure parking at all destinations. Bicycle parking should be located in well-lit, secure locations close to the main entrance of a building, no further from the entrance than the closest automobile parking space. In-street bicycle parking may be recommended in certain locations (See Chapter 4, "Street and Roadway Design"). Bicycle parking should not interfere with pedestrian circulation.

Bicycle racks along sidewalks should support the bicycle well, and make it easy to lock a U-shaped lock to the frame of the bicycle and the rack. The two examples at left show an "inverted –U" rack and an art design rack: both meet these criteria. Refer to the Association of Pedestrian and Bicycle Professionals Bicycle Parking Guidelines for additional information. City of Atlanta Zoning Code specifies bike parking requirements for various residential and commercial zoning catagories. Refer to zoning code for specifics.

DESIGN GUIDANCE FOR IMPLEMENTING THE NETWORK

Implementation of a bikeway network often requires an implementation plan. Some bikeways, such as paths, bicycle boulevards, and other innovative techniques described in this guide, will require a capital improvement project process, including identifying funding, a public and environmental review process, and plan preparation. Other bikeway improvements piggy-back onto planned construction, such as resurfacing, reconstruction, or utility work.

The majority of bikeway facilities are provided on streets in the form of shared roadways or bicycle lanes. Shared roadways usually require virtually no change to existing roadways, except for some directional signs, occasional markings, and minor changes in traffic control devices; removing unnecessary centerline stripes is a strategy that can be implemented after resurfacing projects. Striped bicycle lanes can be implemented on existing roads through use of the strategies below. As mentioned previously, Atlanta Transportation Plan Bicycle Connections should take precedence in allocation of bicycle facilities.

RESURFACING

The cost of striping bicycle lanes is negligible when incorporated with resurfacing, as this avoids the high cost of stripe removal; the fresh pavement provides a blank slate. City staff will need to anticipate opportunities and synchronize restriping plans with repaving and reconstruction plans. If new pavement is not anticipated in the near future, grinding out the old lane lines can still provide bicycle lanes.

There are three basic techniques for finding room for bicycle lanes:

1. Lane narrowing. Where all existing or planned travel lanes must be retained, travel lanes can be narrowed to provide space for bicycle lanes. Recent studies have indicated that the use of 10-foot travel lanes does not result in decreased safety in comparison with wider lanes for vehicle speeds up to 35 mph. Eleven-foot lanes can be used satisfactorily at higher speeds especially where trucks and buses frequently run on these streets. However, where a choice between a 6-foot bicycle lane and an 11-foot travel lane must be made, it is usually preferable to have the 6-foot bicycle lane, as larger vehicles can encroach slightly into bicycle lane. Parking lanes can also be narrowed to 7.5 feet to create space for bicycle lanes.

A four lane street in Boulder, CO was reduced to a single lane in each direction, a center turn lane, and a protected bike lane with bollards.
(Credit: PeopleForBikes)

2. Roadway Optimization. Reducing the number of travel lanes provides space for bicycle lanes. Many streets have more space for vehicular traffic than necessary (to determine how much capacity is necessary for a given traveled way, consult the Highway Capacity Manual). Some streets may require a traffic analysis to determine whether additional needs or impacts may be anticipated. The traditional roadway optimization changes a four-lane undivided street to two travel lanes, a continuous two-way left-turn lane (or median), and bicycle lanes. In other cases, a four-lane street can be reduced to a two-lane street without a center-turn lane if there are few left turns movements. One-way couplets are good lane-reduction candidates if they have more travel lanes in one direction than necessary for the traffic volumes. For example, a four-lane one-way street can be reduced to three lanes and a bicycle lane. Since only one bicycle lane is needed on a one-way street, removing a travel lane can free enough room for other features, such as on-street parking or wider sidewalks. Both legs of a couplet must be treated equally, so there is a bicycle lane in each direction.
3. Parking Modification. On-street parking is vital on certain streets (such as residential or traditional central business districts with little or no off-street parking), but other streets have on-street parking but no visible demand. In these cases, parking prohibition can be used to provide bicycle lanes with minimal public inconvenience (see Chapter 2 for more detail on procedure for parking modification).

If space is available, buffered bike lanes should be used on roadways with posted speeds of 30 MPH or higher, roadways with high traffic volumes (AADT greater than 5,000), and/or roadways with a high volume of cyclists, and the buffer shall be striped in thermoplastic. The total dimension of the buffered bicycle lane (travel lane + buffer) should be 8' wide (minimum width of 7'). The bicycle travel lane should be 5' wide (minimum width of 4'); the buffer should be 3' wide (minimum width of 1.5').

UTILITY WORK

Utility work often requires reconstructing the street surface to complete restoration work. This provides opportunities to implement bicycle lanes and more complex bikeways such as bicycle boulevards, cycle tracks, or paths. It is necessary to provide plans for proper implementation and design of bikeway facilities prior to the utility work. It is equally necessary to ensure that existing bikeways are replaced where they exist prior to utility construction.

REDEVELOPMENT

When streets are slated for reconstruction in conjunction with redevelopment, opportunities exist to integrate bicycle lanes or other facilities into the redevelopment plans. For example, the curb line can be moved during major reconstruction to accommodate bicycle facilities.

MAINTENANCE

Maintenance is a critical part of safe and comfortable bicycle access. Two areas that are of particular importance to bicyclists are pavement quality and drainage grates. Rough surfaces, potholes, and imperfections, such as joints, can cause a rider to lose control and crash. Care must be taken to ensure that drainage grates are bicycle-safe; otherwise a bicycle wheel may fall into the slots of the grate, causing the cyclist to crash. The grate and inlet box must be flush with the adjacent surface. Inlets should be raised after a pavement overlay to the new surface. If this is not possible or practical, the new pavement should taper into drainage inlets so the inlet edge is not abrupt.

The most effective way to avoid drainage-grate problems is to eliminate them entirely with the use of inlets in the curb face. This may require more grates to handle bypass flow, but is the most bicycle-friendly design.

Another way to avoid potential bicyclist drainage inlet conflicts is to rotate drainage grates 90 degrees so bicycle tires roll perpendicular over the grate. Additionally the City of Atlanta's Public Right of Way Standard Details provides a bicycle safe grate that should be used when a grate cannot be eliminated. City of Atlanta's Public Right of Way Standard Details can be found on the City's website.

Bike share is an important element to create a bicycle friendly city that is accessible to residents and visitors, a like. The City of Atlanta launched the first ten bike share stations in Downtown Atlanta in the summer of 2016. The following is the guidelines for siting and permitting new stations across the city.

- City of Atlanta Code of Ordinances
- Manual on Uniform Traffic Control Devices
- National Association of City Transportation Officials, Urban Bikeway Design Guide
- AASHTO Guide for the Development of Bicycle Facilities
- Washington County (OR) Bicycle Facility Design Toolkit

CONSTRUCTION STANDARDS

All projects should meet the design requirements in the latest editions of the AASHTO Guide for the Development of Bicycle Facilities, Manual of Uniform Traffic Control Devices, NACTO Urban Bikeway Design Guide, and the Public Right-of-way Accessibility Guidelines.

All projects should include MUTCD-compliant bicycle wayfinding signage at all intersections with existing bicycle facilities and at intersections and connections identified in the Atlanta Transportation Plan. Such signage shall conform to standards set forth by the City of Atlanta.

Existing pavement markings shall be removed using hydroblasting (or other method approved by the Department of Public Works) until no markings are visible during the day or night.

All new pavement markings shall be thermoplastic and affixed to pavement using industry best practices and any other marking material approved by the Department of Public Works.

All signs to be installed per MUTCD standards and affixed to Green U-Channel Pole or as otherwise directed by the Department of Public Works.

All projects that include asphalt/concrete point repair or milling and overlay shall adhere to the following practices:

- New surfaces: The new pavement surface of a bicycle lane or bicycle paths should be shaped to match existing features such as pit covers, edgings or driveways to within 1/5”. It is desirable that the finished surface of a new bicycle lane or path not have a rate of change in deviation in excess of 2/5” in 9 1/2”.
- Existing Surfaces: Parallel to the direction of travel, grooves must be no wider than 1/2” and steps no higher than 2/5”. Perpendicular to the direction of travel, steps should not be higher than 3/4” and preferably no higher than 2/5”.
- All Contractors will be required to secure a right-of-way permit from the Department of Public Works prior to starting construction.

COMMON MUTCD SIGNAGE (N.T.S.)

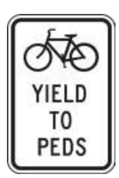
NO MOTOR VEHICLES
MUTCD R5-3
ADAPTED TO SIZE 18"x18"

BICYCLE LANE
MUTCD R3-17
SIZE 24"x 18"

ENDS
MUTCD R3-17bP
SIZE 24"x 8"

PUSH BUTTON
MUTCD R10-24
SIZE 9"x15"
(affix to push button)

BICYCLE FULL LANE USE
MUTCD R4-11
SIZE 30"x 30"



BIKES YIELD TO PEDS
MUTCD R9-6
SIZE 12"x18"

PUSH BUTTON
MUTCD R10-24
WITH MODIFIED TEXT
FOR RAPID FLASHING BEACON
SIZE 9"x15"
(affix to push button)

BIKE/PED GRAPHIC
MUTCD W11-15
SIZE 24"x 24"

BIKE/PED DIRECTIONAL
MUTCD R9-7

DETAIL 4.5 ARROW SUBPLAQUE
MUTCD W11-15
SIZE 12"x24"

Chapter 8

TRANSIT ACCOMMODATIONS

Transit serves a vital transportation function for many people; it is their access to jobs, school, shopping, recreation, visitation, worship, and other daily functions. Except for subways and rail lines on exclusive rights-of-way, most transit uses streets. For transit to provide optimal service, streets must accommodate transit vehicles as well as access to stops. Transit connects passengers to destinations and is an integral component of shaping future growth into a more sustainable form. Transit design should also support placemaking.

This chapter provides design guidance for both transit stops and transit operating in the roadway including transit stop layout and placement and the use of transit bulbs and transit lanes. The chapter ends with a discussion of ways to accommodate light rail, streetcars, and Bus Rapid Transit (BRT).

Public transit should be planned and designed as part of the street system. It should interface seamlessly with other modes, recognizing that successful transit depends on customers having adequate access to the service via walking, bicycling, car, taxi, or paratransit. Close coordination with operators of transit in the design of transit facilities in important to make sure that the design of the goal of improving access is maintained. Transit should be planned following these principles:

- Transit has a high priority on city streets. On some streets, transit vehicles should have higher priority than motorist.
- The busiest transit lines should have designated lanes.
- Where ridership justifies, some streets, called transit malls, may permit only buses or trains in the roadway. These often also allow bicyclists and pedestrians.
- Technology should be applied to increase average speeds of transit vehicles where appropriate.
- Transit stations and stops should be easily accessible, with safe and convenient pedestrian crossing opportunities.
- Transit stops should be active and attractive public spaces that   attract people on a regular basis, at various times of day, and all days of the week.
- Transit stops should include amenities for passengers waiting to board.
- Transit stops should provide space for a variety of amenities in commercial areas, to serve residents, shoppers, and commuters alike.
- Transit stops should be attractive and visible from a distance.
- Transit stop placement and design influences accessibility to transit and network operations, and influences travel behavior/ mode choice.
- Zoning codes, local land use ordinances, and design guidelines around transit stations should encourage walking and a mix of land uses.

- Streets that connect neighborhoods to transit facilities should be especially attractive, comfortable, and safe and inviting for pedestrians and bicyclists.

Transit depends primarily on walking to function well; most transit users walk to and from transit stops. Sidewalks on streets served by transit and on the streets that lead to transit corridors provide basic   access. Bicycle-friendly streets do the same for those who access transit by bicycle.

Every transit trip also requires a safe and convenient street crossing at the transit stop; a disproportionately high number of pedestrian crossing crashes occur at transit stops. Every transit stop should be evaluated for its crossing opportunities. If the crossing is deemed unsafe, mitigation can occur in two ways: a crossing should be provided at the existing stop, or the stop can be moved to a location with a safer crossing. For street crossing measures, see Chapter 6, "Streetscape and the Walking Environment." Simply stated, there should not be transit stops without means to safely and conveniently cross the street.

The following sections provide guidance for designing transit stops.

LAYOUT

A well placed and configured transit stop offers the following characteristics.

- Clearly defines the stop
- Provides a visual cue on where to wait for a transit vehicle
- Does not block the path of travel on the adjacent sidewalk
- Allows for ease of access between the sidewalk, the transit stop, and the transit vehicle.

Layout guidelines include the following:

- Consolidate streetscape elements to create a clear waiting space, minimize obstructions between the sidewalk, waiting area, loading area, and to allow egress from the rear bus door.
- Consider the use of special paving treatments or curb extensions (where there is on-street parking) to distinguish transit stops from the adjacent sidewalks.
- Integrate transit stops with adjacent activity centers whenever possible to create active and safe places
- Avoid locating transit stops adjacent to driveways, curb cuts, and land uses that generate a large number of automobile trips (gas stations, drive-through restaurants, e.g.)
- Remove/relocate objects, signs and vegetation that block sight lines between waiting transit users and approaching transit vehicles

Transit stops are required by the Americans with Disabilities Act (ADA) to be accessible. Specifically, ADA requires a clear loading area (minimum 5' by 8') perpendicular to the curb with a maximum 2% cross-slope to allow a transit vehicle to extend its lift to allow people with disabilities to board. The loading area should be located where the transit vehicle has its lift and be accessible directly from a transit shelter. The stop must also provide 30" by 40" of clear space within a shelter to accommodate wheelchairs.

TRANSIT-SPECIFIC STREETSCAPE ELEMENTS

The essential streetscape elements for transit include signs, shelters, and benches. All new signs for transit stops within the City of Atlanta should conform to the standards detailed in the Atlanta Regional Commission Unified Bus Stop Signage Plan.

Shelters keep waiting passengers out of the rain and sun and provide increased comfort and security. Shelters vary in size and design; standard shelters are 3' to 7' wide and 6' to 16' long. They include covered seating and sign panels that can be used for transit information.

Shelters should be installed based upon the following:

- Locations with demonstrated ridership (based upon agencies service standards)
- Adjacent land use supporting the location
- Activity centers that support concentrations of mixed-use, multi-family communities
- Be set back from the front of the transit stop to allow for the transit vehicle to merge into travel lanes when the stop is located at the far side of an intersection or at a mid-block location. This setback is not required when the stop is located at the near side of the intersection or at a transit bulb.
- Shelters should be located in the sidewalk furniture zone so they don't conflict with the pedestrian zone. Shelters may be placed in the sidewalk's supplemental zone provided that they do not block building entrances or the pedestrian zone.

Transit bulb-out in Huntington Park, CA
(Credit: Sky Yim)

- Transit stops should also provide other amenities to make waiting for the next vehicle comfortable, where possible:
- Trash/recycling cans
- Passenger information panels (i.e. maps, schedules, phone numbers)
- Real-time arrival information boards/screens

A transit stop's optimal placement depends on the operational characteristics of both the roadway and the transit system. The placement of transit stops at the far side of signalized intersections is generally considered to be preferable to near side or mid-block locations. However, each location has its advantages and disadvantages, as shown in Table 8-1.

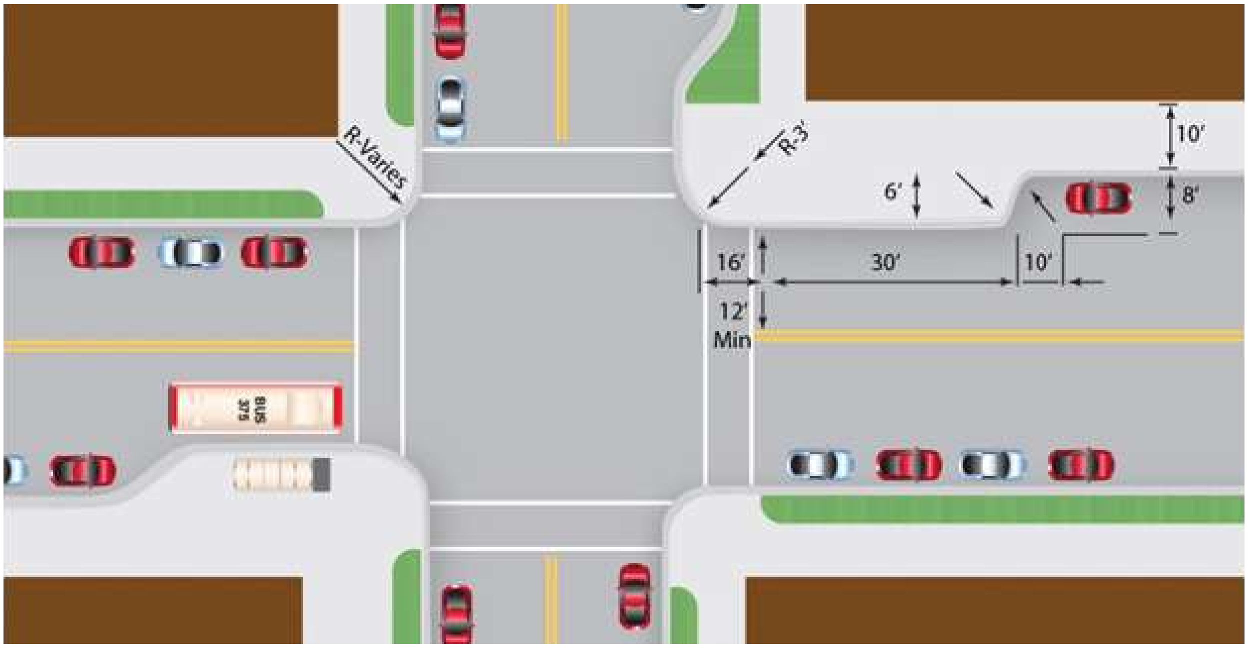
TRANSIT STOP ZONE DESIGN

This section provides guidance for designing the transit stop zone, the portion of the street where passengers load and unload from a transit vehicle. The guidelines provided allow for customization depending on the location. A significant number of these guidelines come from the Transit Cooperative Research Program Report 19, Guidelines for the Location and Design of Bus Stops, prepared by the Transportation Research Board and National Research Board and sponsored by the Federal Transit Administration. The length and configuration of a transit stop zone varies depending on the type of transit stop. Transit stop zones should be marked and clear of street furniture where bus doors open.

The following pages provide guidance for designing the transit stop zones for four typical kinds of transit stops: curbside transit stops, transit bulb-outs, queue jumper transit bays, and partial open transit bays.

Table 8-1 Bus Stop Placement Considerations

Location	Advantage	Disadvantage
Far Side (Preferable)	• Minimizes conflicts between right-turning vehicles and buses • Optimal location for traffic signal synchronized corridors • Provides additional right-turn capacity by allowing traffic to use the right lane • Improves sight distance for buses approaching intersections • Requires shorter deceleration distances for buses • Signalized intersections create traffic gaps for buses to reenter traffic lanes • Improves pedestrian safety as passengers cross in back of the bus at crosswalks	• Queuing buses may block the intersection during peak periods • Sight distance may be obstructed for vehicles approaching intersections • May increase the number of rear-end accidents if drivers do not expect a bus to stop after crossing an intersection • Stopping both at a signalized intersection and a far-side stop may interfere with bus operations
Near Side (Less Preferable)	• Minimizes interference when traffic is heavy on the far side of an intersection • Provides an area for a bus to pull away from the curb and merge with traffic • Minimizes the number of stops for buses • Allows passengers to board and alight while the bus is stopped at a red light • Allows passengers to board and alight without crossing the street if their destination is on the same side of the street. This is most important where one side of the street has an important destination, such as a school, shopping center, or employment center that generates more passenger demand than the far side.	• Increases conflicts with right-turning vehicles • Stopped buses may obscure curb-side traffic control devices and crossing pedestrians • Obscures sight distances for vehicles crossing the intersection that are stopped to the right of the buses • Decreases roadway capacity during peak periods due to buses queuing in through lanes near bus stops • Decreases sight distance of on-coming traffic for pedestrians crossing intersections • Can delay buses that arrive during the green signal phase and finish boarding during the red phase • Less safe for passengers crossing in front of the bus
Mid-Block	• Minimizes sight distance problems for pedestrians and vehicles • Boarding areas experience less congestion and conflicts with pedestrian travel paths • Can be located adjacent to or directly across from a major transit midblock use generator • Reduces the distance between stops at intersections	• Decreases on-street parking supply (unless mitigated with a curb extension) • Requires a mid-block pedestrian crossing or island • Increases walking distance to intersections



Typical dimensions for bus bulb bus stop zones
(Credit: Michele Weisbart)

CURBSIDE TRANSIT STOPS

Curbside transit stops have no curb extensions or pull-outs. They provide easy access for transit drivers, are simple and inexpensive, and are easy to relocate. However, where they block the travel lane, they can cause traffic to queue behind, and where they don't block the travel lane, transit drivers may have difficulty re-entering traffic.

TRANSIT BULB-OUTS

Transit bulb-outs are curb extensions that extend the length of the transit stop on streets with on-street parking. They improve transit performance by eliminating the need for transit vehicles to merge into mixed traffic after every stop. They also facilitate passenger boarding by allowing the vehicle to align directly with the curb; waiting passengers can enter the vehicle immediately after it has stopped. They improve pedestrian conditions by providing additional space for people to wait for transit and by allowing the placement of transit shelters where they do not conflict with a sidewalk's pedestrian zone. Table 8.2 displays the standard transit bulbout dimensions.

Transit bulb-outs also reduce the crossing distance of a street for pedestrians if they are located at a crossing. In most situations, transit vehicles picking up passengers at transit bulb-outs block the travel lane; but this is mitigated by the reduced dwell time, as it takes less time for the driver to position the transit vehicle correctly, and less time for passengers to board. One major advantage of transit bulb-outs over pulling to the curb is that they require less parking modification: typically two on-street parking

Table 8-2 Standard Transit Vehicle and Transit Bulb-Out Dimensions

Vehicle	Length (feet)	Number of Vehicles at Stop	Platform Length (feet)	
			Near Side	Far Side
Standard bus	40	1	35	45
		2	55	65
Articulated bus	60	1	80	90
		2	120	130
Streetcar	70-90	1	60-80	60-80

spots for a transit bulb-out instead of four for pulling over.

The following conditions should be given priority for the placement of transit bulb-outs:

- Streetcar stops along streets with on-street parking
- Areas with heavy transit and pedestrian activity and where narrow sidewalks do not allow for the placement of a transit shelter without conflicting with the pedestrian zone
- Where transit performance is significantly slowed by the transit vehicle's merging back into the travel lane
- Roadways served by express or bus rapid transit (BRT) lines
- Stops that serve as major transfer points
- Transit bulb-outs should not be considered for stops with any of the following:
- A queue-jumping lane provided for transit vehicles
- On-street parking prohibited during certain periods to allow for additional travel lanes

At a minimum, transit bulb-outs should be long enough to accommodate all doors of a transit vehicle to allow for the boarding and alighting of all passengers, or be long enough to accommodate two or more transit vehicles (with a 5' clearance between vehicles and a 10' clearance behind a transit vehicle) where there is frequent service such as with BRT or other express lines. Transit bulb-outs located on the far side of a signalized intersection should be long enough to accommodate the complete length of a transit vehicle so that the rear of the transit vehicle does not intrude into the intersection, which includes the crosswalk and sight triangle.

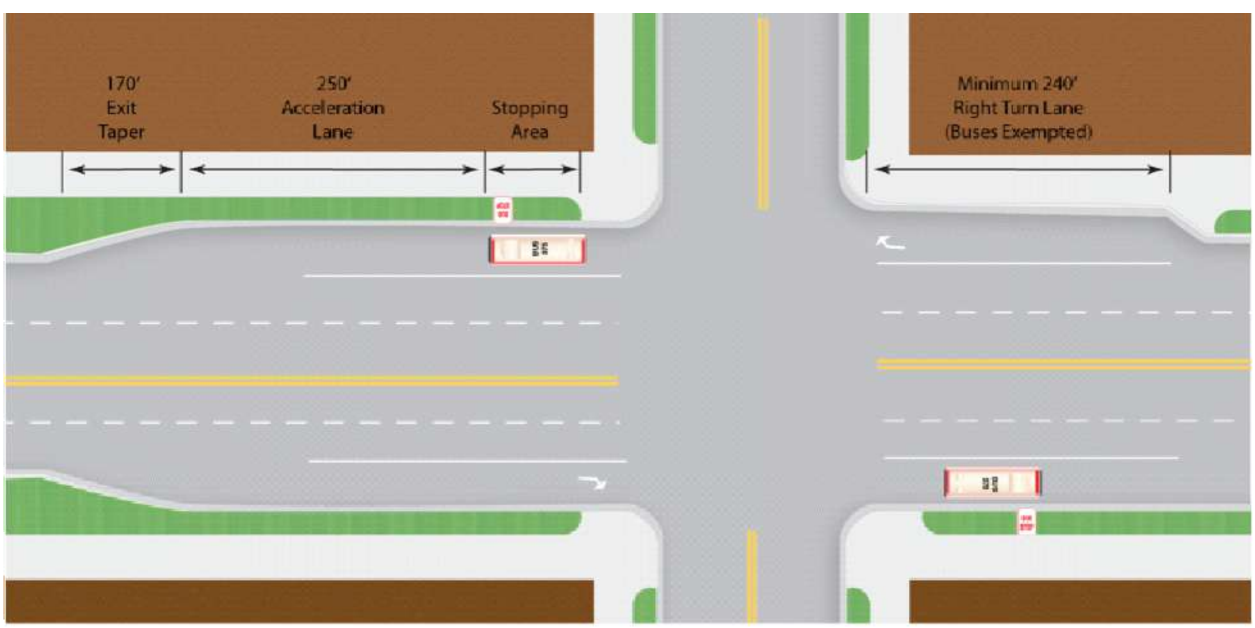
QUEUE-JUMPER TRANSIT BAY

Queue-jumper transit bays allow transit vehicles to bypass queued traffic and take advantage of signal priority and preemption, which give them a head start across the intersection. A queue-jumper transit bay is a dedicated lane extending for a short distance at both sides of the intersection. Queue- jumper transit bays are not needed with queue jumper signals where transit lanes exist.

Queue-jumper transit bays are most useful in the following situations:

- Along transit routes with short headways
- Where volumes exceed 250 vehicles per hour in the curb lane during the peak hour
- At congested intersections (where motor vehicle Level of Service is D or worse)
- Where the physical space for the lane exists and creating the bay isn't too costly

The stopping area length should be 50' for each standard 40'-foot-long bus, and 70' for each 60'-long articulated bus expected to be simultaneously stopped. The dimensions shown for the length of the exit taper, acceleration lane, and entrance taper are based on a through speed of 35 mph. These can be decreased with lower



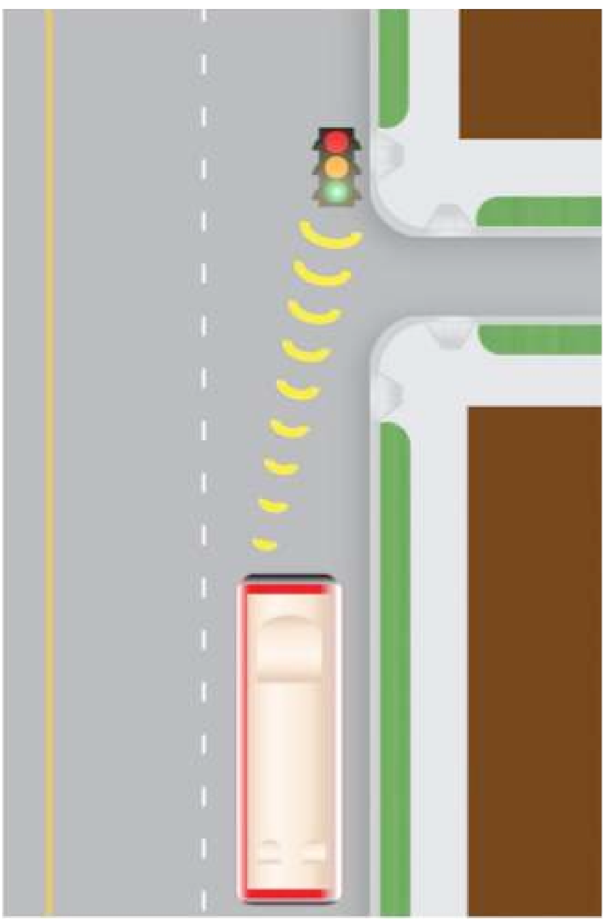
Typical dimensions for queue Jumper Bus Bay Zones
(Credit: Michele Weisbart)

speeds and should increase with higher speeds. The entrance taper should be at least 5:1 and the exit taper not sharper than 3:1.

TRANSIT PULL-OUTS

Transit pull-outs provide a designated loading area for transit vehicles outside of the travel lanes. The pull-outs have the disadvantage of requiring transit vehicles to merge into traffic when they re-enter the travel lane. Given the high priority that transit will play going forward, these are not the preferred design solution in the City of Atlanta

The stopping area length should be 50' for each standard 40'-long bus, and 70' for each 60'-long articulated bus expected to be simultaneously stopped. The dimensions shown for the length of the exit taper, acceleration lane, and entrance taper are based on a through speed of 35 mph. These can be decreased with lower speeds and should increase with higher speeds. The entrance taper should be at least 5:1 and the exit taper not sharper than 3:1.



Signal-priority technology can help reduce delay for buses
(Credit: Michele Weisbart)

Signal prioritization is a component of technology-based intelligent transportation systems (ITS). These systems are often used by transportation agencies in conjunction with transit agencies to help improve a roadway system's overall operations in the following ways:

- Reduce traffic signal delays for transit vehicles
- Improve an intersection's person throughput
- Reduce the need for transit vehicles to stop for traffic at intersections
- Help reduce transit vehicles' travel time
- Help improve transit system reliability and reduce waiting time for people at transit stops

TRANSIT SIGNAL PRIORITY

Signal prioritization is a component of technology-based "intelligent transportation systems" (ITS). These systems are often used by road authorities in conjunction with transit agencies to help improve a roadway system's overall operations in the following ways:

- Reduce traffic signal delays for transit vehicles
- Improve an intersection's person throughput
- Reduce the need for transit vehicles to stop for traffic at intersections
- Help reduce transit vehicles' travel time
- Help improve transit system reliability and reduce waiting times for people at transit stops

Signal prioritization projects include signal timing or phasing projects and transit signal priority projects. Signal timing projects optimize the traffic signals along a corridor to make better use of available green time capacity by favoring a peak directional traffic flow. These passive systems give priority to roadways with significant transit use within a district-wide traffic signal timing scheme. Transit signal prioritization can also be achieved by timing a corridor's traffic signals based on a transit vehicle's average operating speed instead of an automobile's average speed.

Transit signal-priority projects alter a traffic signal's phasing as a transit vehicle approaches an intersection. This active system requires the installation of specialized equipment at an intersection's traffic signal controller and on the transit vehicle. It can either give an early green signal or hold a green signal that is already being displayed in order to allow transit vehicles that are operating behind schedule to get back on schedule. Signal-priority projects also help improve a transit system's schedule adherence, operating time, and reliability.

Although they may use similar equipment, signal-priority and preemption are two different processes. Signal-priority modifies the normal signal operation process to better accommodate transit vehicles, while signal preemption interrupts the normal signal to favor transit or emergency vehicles.

The placement of a transit stop at the far side of a signalized intersection increases the effectiveness of transit signal-priority projects. Signal treatments should be used along streets with significant transit service, and prioritized on Transit Boulevards (see Chapter 3, "Street Networks").

QUEUE JUMPER SIGNALS

Queue jumpers give preference to transit vehicles at signalized intersections with a special phase in the traffic signal that allows transit vehicles a head start in crossing the intersection. They are used on dedicated transit lanes and where a special queue jumper lane provides an opportunity for transit vehicles to circumvent congestion at the intersection.

Where a transit route makes a right turn, it is important to ensure an adequate effective turning radius is available. The effective turning radius is greater than the curb radius if either intersecting street includes multiple travel lanes, on-street parking, bicycle lanes, or paved shoulders. In some locations near high volume tourist attractions, hotels, and convention centers, 45' charter buses will also need to be accommodated.

Transit stops and amenities vary in complexity and design from standardized off-the-shelf signs and furniture to carefully designed elements. The design of the transit stop elements, location of the transit stop in relation to adjacent land uses or activities, and the quality of the roadway's pedestrian environment contribute to a transit stop's placemaking. Transit operators like a branded look to their stops so they are easily identified, but often there is room for customized designs to fit in with the neighborhood, with at least some of the features and amenities.

Connecting bicycle facilities to transit stations helps extend the trip length for bicyclists and reduces automobile travel. Secure bicycle parking must be provided at or within close proximity to a transit stop, preferably sheltered. At a minimum, the accommodations can be bicycle racks or lockers. Bicycle stations and automated bicycle parking can be located at areas with high levels of transit and bicycle use.

Bus-only lane in Santa Monica, CA
(Credit: Sky Yim)

Table 8-3 Street Types and Transit Configurations

	Center Runnng		Two-way Split Side		Two-way Single Side		One-way Single Side	
Street Type	**Transit Reservation**	**In Street**	**In Street**		**In Street**		**In Street**	
Principal Arterial	Y	N	N	Y	Y	N	Y*	Y
Minor Arterial	Y	N*	Y	Y	N	N	Y*	Y
Major and Minor Collector	Y	Y	Y*	Y	Y*	N	Y	Y
Local	N	Y	Y	Y	N*	N	Y	Y

(Credit: Center for Transit-Oriented Development)

NOTES:
Y = Recommended street type/transit configuration combination
N = Not recommended/possible street type/transit configuration combination
* Denotes configurations that may be possible under certain circumstances, but are usually optimal

EXCLUSIVE TRANSIT LANES

Transit-only lanes provide exclusive or semi-exclusive use for transit vehicles to improve the transit system's travel time and operating efficiency by separating transit from congested travel lanes. They can be located in an exclusive right-of-way or share a roadway right-of-way. They can be physically separated from other travel lanes or differentiated by lane markings and signs.

Transit-only lanes can be located within a roadway median or along a curb-side lane, and are identified by lane markings and signs. They should generally be 12' wide. Streetcar lanes should not be shared with bicyclists. When designating transit-only lanes, cities should consider the following:

- Exclusive transit use may be limited to peak travel periods or shared with high-occupancy vehicles or with on-street parking in off-peak periods
- On-street parking may be allowed depending on roadway design, especially with transit lanes located in the center of the street
- A travel lane or on-street parking lane may be displaced; this is preferable to adding a lane to an already wide roadway, which increases the crossing distance for pedestrians and creates other problems discussed in other chapters
- High-occupancy vehicles and/or bicycles may be permitted to use transit-only lanes, but a separate bicycle lane is always preferable
- Pedestrian access to stations becomes an issue when transit-only lanes are located in roadway medians
- Table 8-3 outlines the compatibility of each configuration with the four street types.
- In the City of Atlanta, there are bus rapid transit, light rail and streetcar projects planned or under construction on city streets. These need to be carefully incorporated and accommodated into street design.
- The various options for accommodating BRT, light rail and streetcars include:
- Center-running
- Two-way split-side, with one direction of transit on both sides of the right-of-way
- Two-way single-side, with both directions of transit flow on one side of the street right-of-way
- One-way single-side, with transit running one direction (either with or against the flow of vehicular traffic) and usually operating in a one-way couplet on parallel streets.

For each configuration, transit can operate in a transit reservation or in travel lanes. When installing light rail or streetcars within streets, the safety of pedestrians and bicyclists needs to be prioritized. If poorly designed, these transit lines introduce hazards and serve to divide neighborhoods where crossings are highly limited and/or difficult or inconvenient (see Chapter 6, "Streetscape and the Walking Environment" for more guidance). In general, in areas of high pedestrian activity, the speed of the transit service should be compatible with the speed of pedestrians.

The potential for each configuration is influenced by the street type. Some transit configurations will not work effectively in combination with certain street types.

This page is intentionally blank

Chapter 9

TRAFFIC CALMING

DEFINING TRAFFIC CALMING

The definition of traffic calming is broad enough to apply to a myriad of contexts and situations but specific enough to have independent meaning so that it is not confused with other street design elements and design approaches.

Traffic calming is the combination of mainly physical measures that (i) reduce the negative effects of motor vehicle use, (ii) alter driver behavior, and (iii) improve conditions for non-motorized street users.

Through design, traffic calming aims to slow the speeds of motorists to the "desired speed" (usually 25 mph or less for Local streets and 25 to 35 mph for collectors and arterials) in a context-sensitive manner by working with the stakeholders (i.e., residents, business owners, and agencies). Traffic calming is acceptable on all street types where pedestrians are allowed. Traffic calming is applicable to all sizes of towns and cities as well as rural villages and hamlets.

Traffic calming typically connotes a street or group of streets that employ traffic calming measures with a "self-enforcing" quality that physically encourages motorists to drive at the desired speed. When a group of streets are involved, it is normally referred to as "area-wide calming."

GENERAL POLICY AND DESIGN GUIDANCE

Traffic calming measures can also be designed to treat and manage stormwater.

From a policy and design perspective, traffic calming measures fall into two broad categories: those that are appropriate for arterial and collector streets and those that are appropriate for arterial, collector and local streets. The sorts of traffic calming measures that are appropriate on arterial and collector streets include "cross-section measures" because emergency response times are generally unaffected by cross-section changes.

The majority of streets in the City of Atlanta are local streets. Local streets provide access to houses, businesses, offices, and parks, and are rarely used by emergency vehicles except for local calls. The sorts of traffic calming measures that are appropriate for local streets include cross-section measures and "periodic measures." Periodic measures are spaced intermittently, rather than continuously. They are very popular on non-framework streets because they are inexpensive when compared to cross-section measures, which typically require construction along the entire length of the street. Examples of both types of measures and guidance for their use are shown on the following page.

Traffic calmed street

PLANNING AND DESIGN PROCESSES

Traffic calming should be a normal part of any city's planning and design processes. The processes will vary dramatically depending on the context. For example, implementing a road diet in conjunction with a transit facility along a five-mile Collector would require a different process than reverting one-way streets back to two-way operation in a downtown. Similarly, a neighborhood traffic calming plan would require a different process than designing a City/Transit Center arterial. Also, identifying Collector streets that are barriers in a city during comprehensive planning would require a different process than altering streets on a college campus or hospital campus. The common threads that link all of the processes include the following:

- Gaining a good understanding of the context
- Involving the stakeholders in the definition of the problems to be solved and aspirations to be fulfilled
- Educating the stakeholders such that they can have meaningful involvement
- Aligning the project with a broader vision for the area
- Achieving an informed consent regarding the plan

Periodic traffic calming measurer, Colquitt Avenue

Partial closure: Riverside, CA
(Credit: Ryan Snyder)

Traffic calming is best done in conjunction with a development, revitalization, utility, or maintenance project; a downtown, corridor, or transit plan; a new street design; or other project. Then the traffic calming layer is simply incorporated into the larger project's processes. Traffic calming projects can be opportunitied to incorporate Green Infrastructure (Chapter 10).

The correct terminology for traffic calming measures is "measures" not "devices." "Devices" implies a degree of portability that does not apply to most traffic calming measures. The use of "devices" also causes confusion with the contents of the Manual of Uniform Traffic Control Devices. Adding street trees and changing the paving material to provide texture or contrast, for example, are measures to alter behavior and perceptions but they are clearly not "devices."

"Route modifications measures" are not traffic calming measures. Examples of route modifications measures include street closures, partial closures, turn prohibitions, diverters, and one-way streets. When "route modification" measures have been installed or are installed, bicyclists should be allowed absent safety concerns. Utilizing an EXCEPT BICYCLES horizontal plaque below regulatory signage advising the route modification. Route modifications effectively remove parts of the network. Route modifications result in circuitous and out-of-direction routing. The resulting trips are longer and burn more fuel; thus, circuitous routing can increase driver frustration and result in higher speeds. Route modification should be used sparingly and generally where traffic is diverted to boulevards to reduce cut-through traffic, or on bike boulevards to reduce their use by through motor vehicle traffic.

Lastly, signs and pavement markings are often used in conjunction with traffic calming measures, but they are traffic control devices, not traffic calming measures.

In 1999, the City of Atlanta prepared the Traffic Calming Device Implementation Guidebook. In this guidebook, the City outlines details to be used when implementing traffic calming measures. Subsequently, the Guidebook is located in the appendix of this document, in its entirety. Technical assistance, procedures, analysis and evaluation techniques, and physical techniques for implementing traffic calming measures are all detailed and outlined in the Guidebook.

This page is intentionally blank

Chapter 10

GREEN INFRASTRUCTURE

This chapter focuses on elements of green street design within the public right-of-way. The stormwater management section provides guidance on the green infrastructure (GI) practices suitable for streets. The second section addresses street trees and landscaping, providing guidance on how to design streets to include site-appropriate vegetation that maximizes environmental and social benefits.

PRINCIPLES OF GREEN INFRASTRUCTURE

The City of Atlanta, like many cities, struggles with managing stormwater runoff that causes flooding, degraded water quality, streambank erosion, and property damage. Green infrastructure (GI) is a cost-effective approach to managing stormwater runoff that emphasizes infiltration, evapotranspiration, and reuse and complements traditional engineered approaches in both combined and separated stormwater systems. GI uses natural systems and/or engineered systems designed to mimic natural processes to more effectively manage urban stormwater and reduce impacts on receiving waters. By maintaining and restoring the natural hydrologic function of urban areas, GI treats precipitation as a resource rather than waste, and can play a critical role in improving community development as well as achieving water quality goals.

GI works by reducing the volume of stormwater discharging through grey infrastructure (typically piped systems that discharge directly into bodies of water, or water treatment facilities) by managing rainwater where it naturally falls and removing many of the pollutants present in runoff. By reducing volume and pollutants, GI makes an effective strategy for addressing wet weather pollution and improving water quality.

GREEN INFRASTRUCTURE IN THE PUBLIC RIGHT-OF-WAY

Making our transportation system more sustainable involves many policies and practices that minimize environmental impact and create streets that are safe for everyone, regardless of age, ability, or mode of transportation. Many elements of street design, construction, and operation can work in favor of achieving streets that work for all travelers and 'green' streets that serve environmental sustainability. Of particular concern are drainage and stormwater runoff issues too common in traditional streets. Using GI for stormwater management looks beyond simply removing rainfall as quickly as possible, which risks negative environmental impacts associated with both stormwater quality and quantity, like polluted runoff, sedimentation, and bank erosion. Instead it focuses on efforts to retain and treat – or even eliminate – runoff at the source through cost-effective green infrastructure, improving water quality and complementing multi-modal streets efforts.

Bioretention is a planted landscape area designed to receive and infiltrate stormwater runoff. Bioretention encompasses a variety of vegetated stormwater infiltration practices that use an engineered soil media and specially chosen vegetation to infiltrate and clean stormwater that is directed to the practice. Bioretention areas typically consist of a flow inlet structure, a pretreatment element, a temporary ponding area with overflow, an engineered soil mix planting bed, vegetation, and an outflow regulating structure (for example, an upturned underdrain).

Bioretention is a very adaptable practice and can generally be implemented within, or even in lieu of, standard landscaped areas. Because its shape is flexible, bioretention can be adapted to a site by lowering conventional raised landscape areas to be able to receive runoff.

Bioretention refers to a range of functionally similar practices, with the primary differences being shape and location. For clarity, some variations have been given specific names. The bioretention types or configurations that will be most commonly used within the right-of-way are listed and described below.

STORMWATER PLANTER

Stormwater planters are contained landscape areas designed to receive stormwater runoff from paved surfaces. Stormwater planters consist of a planter box that is filled with an engineered soil mix and planted with trees, perennials, and shrubs. The top of the soil in the planter is lower in elevation than the surrounding pavement to allow runoff to flow into the planter. An underdrain is used when necessary to route excess runoff to the storm drain system. These are typically within the sidewalk, furniture zone, or on-street parking lanes and often replace typical tree wells or landscape strips in the sidewalk/ furniture zone, or bulb-outs (AKA curb-extensions) in on-street parking lanes.

BIOSWALE OR BIORETENTION SWALE

As the term is used by the Department of Watershed Management (DWM), this is specifically a bioretention area built on a slope that acts as a stormwater conveyance. This has the same soil media and plants as other bioretention practices, but is shaped like a swale or ditch. This is the one bioretention practice that can, if properly designed, replace the need for a standard storm sewer.

Bioswales require more space and maintenance that storm sewers, but can be significantly cheaper to install, provide water quality and runoff reduction benefits, and can be much more attractive if planted and maintained property.

Bioswales will typically be located alongside roadways or sidewalks, in much the same locations that roadside drainage ditches would have been used in the past. Culverts can be installed at driveways or other crossings, and check dams are typically used with the swale to reduce flow velocity and channel erosion, and to promote infiltration into the engineered soil media. Due to the slope, underdrains may not be needed in bioswales to prevent long-term ponding, or if used, may only be needed at the ends of the swales.

Bioswales are different from roadside ditches in one significant way. Bioswales use engineered soil media and check dams to slow the stormwater flows and promote infiltration, whereas roadside ditches do not.

Bioswales are identical to ‘enhanced swales’ as described in the Georgia Stormwater Management Manual (‘Blue Book’).

BIORETENTION

This more general term is used for most other bioretention practices that do not fall into the two categories above. While still using engineered soils, vegetation, and underdrains to capture and infiltrate stormwater, they may not have hard edges or act as conveyances. These would be used less frequently in the Right-of-Way, generally in larger areas where landscaping would typically be used such as centers of cul-de-sacs, large road or highway medians, or other large areas of vegetated right-of-way.

The primary purpose of green infrastructure practices like bioretention is to prevent polluted runoff from the smaller storms from reaching our streams. Bioretention, with the exception of bioswales, is generally not a substitute for a conventional storm sewer system.

Bioretention is typically sized in Atlanta to capture the runoff from storms that drop up to 1” of rain within 24 hours. The runoff from the 1” storm is known as the ‘first flush’ and carries the majority of the pollutants found in stormwater. By capturing and infiltrating this ‘first flush,’ bioretention prevents the majority of polluted runoff from reaching our streams.

The 1” storm accounts for approximately 80% of annual storm events in Atlanta, and represents about 70% of all rainfall volume, but is smaller than the storms that typically cause roadway flooding. While using bioretention to manage these smaller (1”) storms will capture the majority of the stormwater pollutants and rainfall volume that falls over the course of a year, it is not typically sized to manage the larger or very intense storms that cause roadway flooding. Standard storm sewers are often still needed as a backup system to manage the larger storms.

Larger roadside bioretention
(Credit: City of Portland, OR)

GENERAL GUIDELINES FOR ALL BIORETENTION PRACTICES

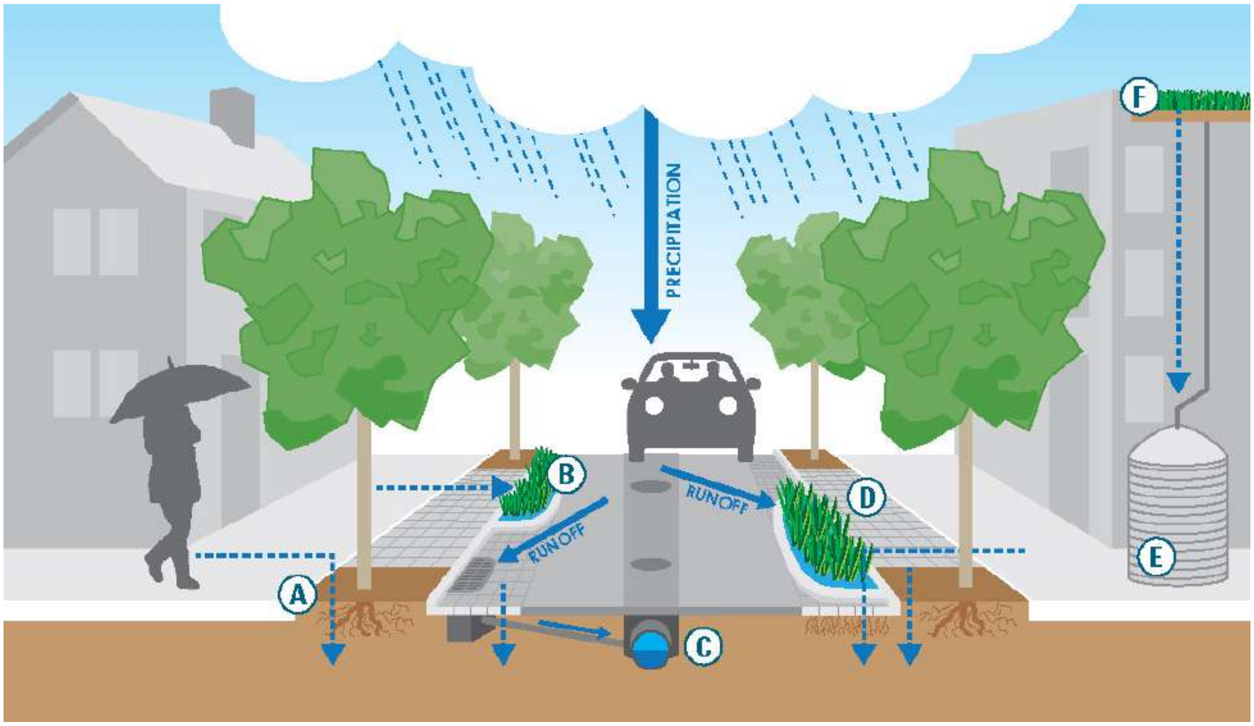
All practices must be designed to fit within the available area and manage the volume of runoff directed towards them. Bioretention is typically sized to accept the runoff from the 1”, 24 hour storm. Bioretention design is described in the Georgia Stormwater Management Manual, and the City of Atlanta Department of Watershed Management has typical details and construction specifications available for reference.

To function, stormwater must be directed to bioretention practices.

- Soil levels in bioretention practices must be lower than the surrounding area to allow room for water to pond within them. Ponding depths of 6-12” are typical.
- Flows from storms larger than the 1” storm should be diverted around the bioretention practice, or bioretention should be designed to safely pass through these larger flows without damaging the practice.
- Where space permits, provide stormwater pretreatment upstream of bioretention practices to remove some of the sediments that may cause clogging. Typical pretreatment practices are vegetated filter strips and fore-bays
- Bioretention, like all green infrastructure, should be protected from siltation during construction. Siltation during construction (or at any time) can cause clogging of the soil media and failure.

SOIL

- Bioretention uses a sand-based engineered soil media to ensure infiltration and treatment of the runoff from small storms. Refer to DWM specifications for more detail.
- Soil media depth is typically 36” to 48”, with a minimum depth of 18.” In order to thrive, trees and large shrubs require a minimum planting depth or 36”.



Water Collection Diagram

Ⓐ TREE WELL
Ⓑ STORMWATER PLANTER
Ⓒ STORM DRAIN
Ⓓ PERMEABLE PAVING
Ⓔ RAINWATER HARVESTING CISTERN
Ⓕ GREEN ROOF

VEGETATION

Vegetation is a very important component of the bioretention system, serving several functions: absorbs excess nutrients from runoff that would pollute surface waters, fosters soil microbes that break down pollutants such as nutrients and hydrocarbons, maintain the porosity of the soil to ensure long-term infiltration of stormwater.

- Bioretention should be planted with vegetation tolerant of the alternating wet/dry conditions experienced in these practices. Plant lists are available in the Georgia Stormwater Management Manual and from the Department of Watershed Management.
- Bioretention practices need to be mulched to suppress weeds, increase pollutant removal, enhance plant growth, and prevent erosion. Non-floating hardwood mulch is most frequently used, but gravel may be needed where strong flows occur.

STORMWATER PLANTERS

- Used where space is limited, often where tree wells, or bulb-outs, or traffic islands would ordinarily be used, or use as a buffer between the sidewalk and the street.
- When adjacent to sidewalks or other pedestrian areas, a curb or other low barrier may be needed around the perimeter.
- Planters do best in flat or gently sloped areas. When placed on steeper slopes, weirs, check dams, and terraces are required to allow for temporary ponding and infiltration.
- An impermeable membrane may be needed against the roadway side of a planter to prevent water infiltration into the roadbed.

Bioswale
(Credit: Kentucky Water Alliance)

UNDERDRAINS

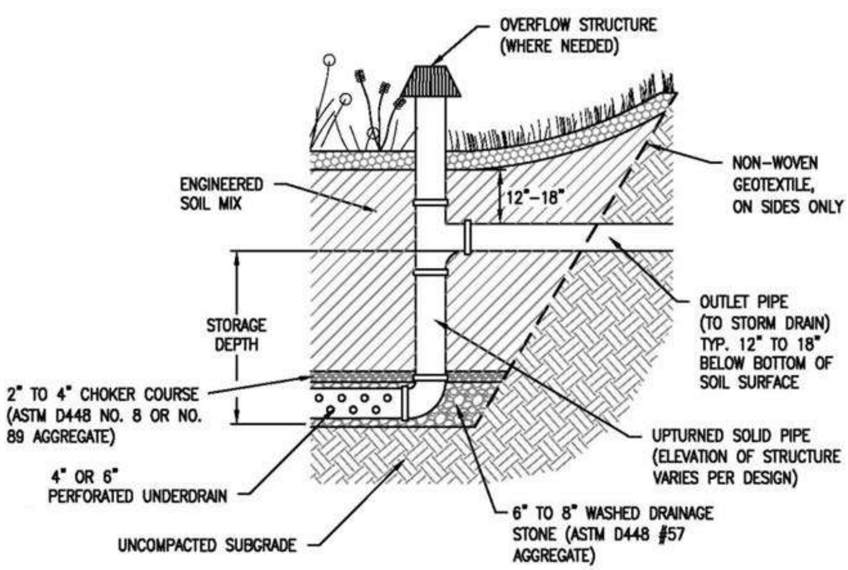
Underdrains are strongly recommended to insure that bioretention practices don't pond water for long periods of time. Ponding can happen if underlying soils are compacted or have a naturally low infiltration rate. Underdrains must be connected to an existing storm sewer or be able to 'daylight' to the surface at a low enough elevation to allow them to drain.

- Underdrains should utilize an 'upturned elbow' design to encourage a saturated zone within the practice, increasing nutrient removal from the stormwater and infiltration.
- Use and selection of bioretention depends largely on site conditions and available space.

BIOSWALES

Flexible in size and shape, can be used in a variety of applications, generally in larger areas where landscaping would typically be used such as centers of cul-de-sacs, large road or highway medians, or other large areas of vegetated right-of-way.

- Used where sufficient right-of-way beyond the roadway is available. These need more space than planters
- Used where a swale can convey stormwater and eliminate need for piped storm sewers
- If used as a replacement for a traditional storm sewer, swales must be designed to withstand flow velocity of at least the 10 year storm without eroding



Atlanta Department of Watershed Management - Standard Detail


Permeable pavers used for low-speed roadway


Permeable pavers used for parking lot

TYPES OF PERMEABLE PAVEMENT

General Description: Permeable pavement provides the structural support of conventional pavement, but allows stormwater to drain directly through the load-bearing surface into the underlying stone base and soils, intercepting and reducing stormwater runoff. During a rain event, stormwater flows through the porous surface, drains into the crushed stone sub-base beneath the pavement, and remains stored until stormwater can infiltrate into the soil or outlet through the underdrain.

PERMEABLE PAVERS

A pavement surface composed of interlocking structural units with void areas that are filled with gravel. Permeable paver systems are installed over a gravel base course that provides structural support and stores stormwater runoff that infiltrates through the system into underlying permeable soils.

- General Uses: parking lanes, low-speed roadways, sidewalks and plazas
- Advantages: Longer life than traditional pavement, aesthetically pleasing, decreases impermeable area, reusable product, high level of pollutant removal, reduces peak flows and volume of stormwater runoff, traffic calming benefits, most effective on gentle slopes, ability to restore permeability if heavy clogging occurs
- Limitations: Must be maintained to ensure long-term function, higher maintenance in areas with heavy tree canopy and high run-on ratio, requires specialized knowledge for installation and maintenance, not recommended on roadways with 35 MPH or higher speed limits or for roads with speed bumps/tables, structural loading analysis required during design, soils analysis required, avoid placing pavers adjacent to areas with high sediment loads (gravel parking lots, exposed soils from lawns, etc.)

PERVIOUS CONCRETE

Pervious concrete is a mixture of coarse aggregate, Portland cement and water that allows for rapid infiltration of water and overlays a stone aggregate reservoir. This reservoir provides temporary storage as runoff infiltrates into underlying permeable soils and/or out through an underdrain system.

- General Uses: parking lanes, bike lanes, sidewalks, multi-use trails, and plazas
- Advantages: Decreases impermeable area, high level of pollutant removal, reduces peak flows and volume of stormwater runoff
- Limitations: Must be maintained to ensure long-term function, higher maintenance in areas with heavy tree canopy and high run-on ratio, requires specialized knowledge for installation, structural loading analysis required during design, soils analysis required, avoid placing porous concrete adjacent to areas with high sediment loads (gravel parking lots, exposed soils from lawns, etc.), difficult to restore permeability once heavy clogging occurs.


Pervious concrete sidewalk in Chattanooga, TN

URBAN FOREST

The urban forest includes all trees, shrubs, and other understory plantings on both public and private lands. Urban forestry is the management of intentionally planted trees, naturally occurring trees, as well as all associated vegetation in cities. Management and protection of Atlanta's urban forest considers the environmental services our trees provide. As a natural resource, trees improve air quality, regulate the city's microclimate, play a vital role in stormwater management, and make the city more habitable for people.

A street lined with trees and other plantings looks and feels narrower and more enclosed, which can cause drivers to slow down and to pay more attention to their surroundings. Trees provide a physical and psychological barrier between pedestrians and motorized traffic, increasing safety as well as making walking more enjoyable. As Atlanta moves to treble its population in the next few decades, city planners seek to improve walkability in order to ameliorate automotive congestion. Street trees play a large role in shading pedestrians from the hot Georgia sun, making walking a more attractive option to get around town.

A healthy urban forest is also a powerful storm water management tool. Leaves and branches intercept, slow, and diffuse rainfall, thereby giving water an opportunity to soak into the ground. The plants themselves take up and store large quantities of water that would otherwise contribute to surface run-off. Part of this moisture is then returned to the air through evaporation to further cool the city.

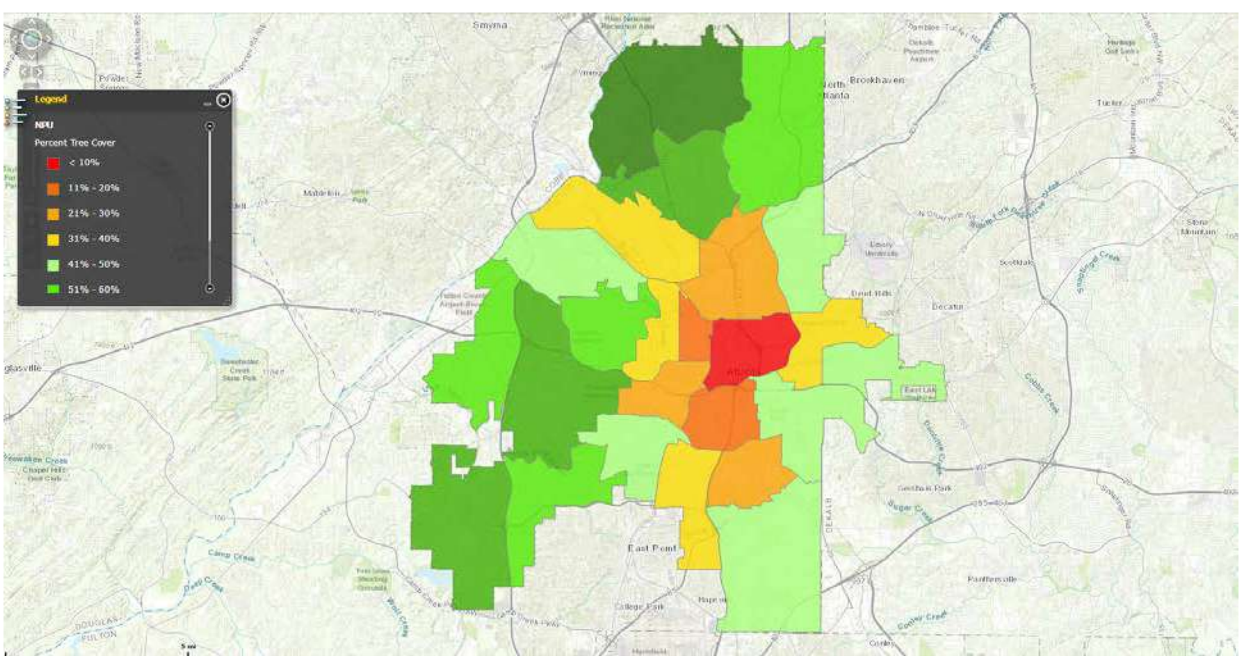
As an important element along sidewalks, street trees must be provided with conditions that allow them to thrive, including adequately uncompacted, aerated soil with sufficient water. This section provides guidance for appropriate conditions and selecting, planting, and caring for street trees, as well as for other landscaping along streets.

Before impacting street trees for construction, contact a City of Atlanta Office of Parks Arborist to better understand the City's Code requirements. Arborists can be reached through Parks Customer Service (ParksCustomerService@atlantaga.gov or 404.546.6813.)

CITY OF ATLANTA TREE ORDINANCE

The City's Tree Ordinance can be found in Section 158 of the Atlanta's Municipal Code. Section 158 contains permitting requirements for public property and private property tree impact.

Section 158-28 enumerates broad policy goals for urban forestry in the City of Atlanta, however more recent GIS-based tree canopy analysis of the city's urban forest gives us more specific goals. The goal is to maintain tree canopy coverage at 48%. The City's average tree canopy, that is the portion of the city shaded by trees, was found to be at 47.9% in 2008. Some parts of the City require more reforestation than others in order to capture the benefits of urban forestry. To get a better idea of areas of greatest need of reforestation, go to: http://carto.gis.gatech.edu/flexviewers/treemapatlanta/



Canopy coverage in the City of Atlanta

GOALS AND BENEFITS OF STREET TREES

The goal of adding street trees is to increase canopy cover of the street, the percentage of its surface either covered by or shaded by vegetation, not simply to increase the overall number of trees (discuss crown spread.) The selection, placement, and management of all elements in the street should enhance the longevity of the City of Atlanta's street trees and healthy, mature plantings should be retained and protected wherever possible.

ADDING OR RETAINING EXISTING TREES

- Creates shade to lower temperatures in a city, reduces energy use, and makes the street a more pleasant place in which to walk and spend time.
- Slows and captures rainwater, helping it soak into the ground to restore local hydrologic functions and aquifiers.
- Improves air quality by cooling air, producing oxygen, scrubbing particulates, and sequestering carbon dioxide in woody plant tissues.
- Increases property values and sales revenues for existing businesses
- Enhances local neighborhoods and cultural identity through specific plant forms and materials, the act of planting and sharing food crops, or by creating and sheltering spaces for social interaction
- Enhances safety and personal security on a street by calming traffic and by fostering denser and more consistent human presence, also referred to as eyes on the street
- Provides cover, food, and nesting sites for indigenous wildlife as well as facilitates habitat connectivity

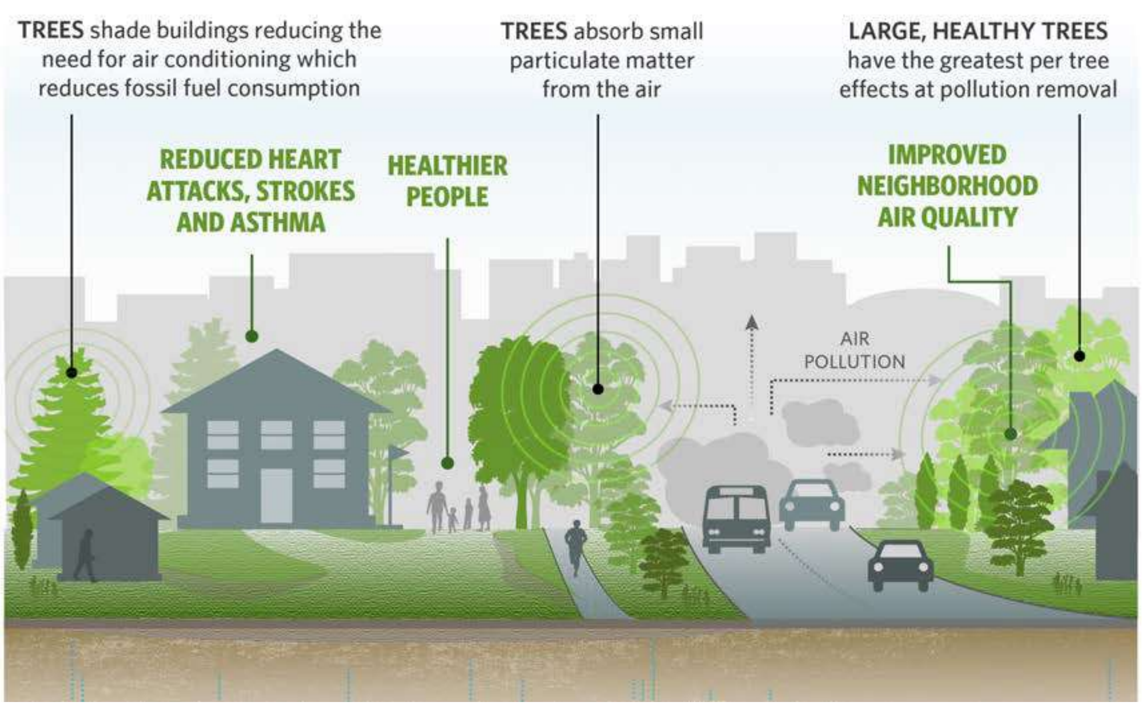
Additional Resources:

- ANSI A300 Guide
- International Society of Arboriculture Best Management Practices
- Reducing Infrastructure Damage by Tree Roots By Laurence R. Costello and Katherine S. Jones

More detailed guidelines for placement of street trees can be found in the City of Atlanta Zoning Code.

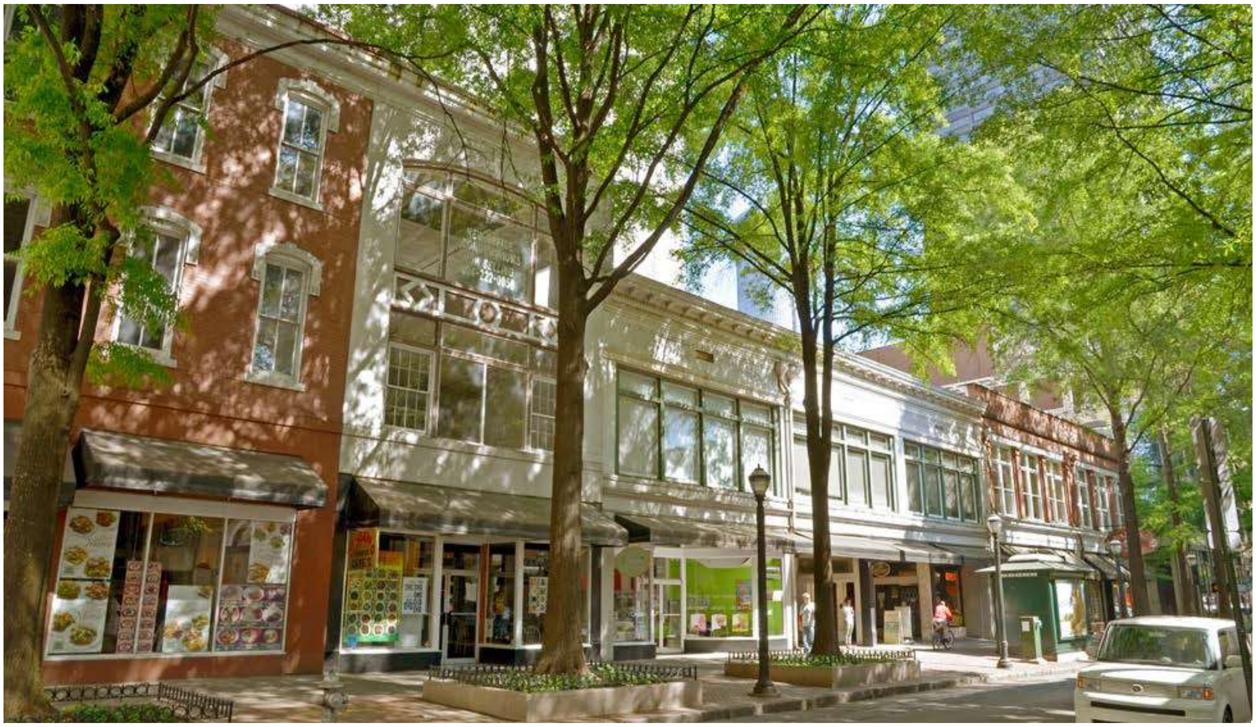
The following principles influence the selection of street trees and landscaping design:

- Seek out and reclaim space for trees. Streets have a surprising number of residual or left-over spaces between areas required for travel lanes and parking, once they are examined from this perspective. Traffic circles, medians, channelization islands, and curb extension can provide space for trees and landscaping.
- Create optimum conditions for growth. Space for roots and above ground growth is the main constraint to the urban forest



Urban trees can improve air quality by removing particulate matter pollution.

(Credit: The Nature Conservancy)



Street trees lining Broad Street in downtown Atlanta
(Credit: Ian Freimuth)

achieving its highest potential. Typically, a 6 to 8 foot wide, continuous sidewalk furniture zone must be provided, with uncompacted soil to a minimum of a three-foot depth. If space for trees is constrained, provisions should be made to connect these smaller areas below the surface to form larger effective areas for the movement of air, root systems, and water through the soil.

- Select the right tree for the right space. In choosing a street tree, consider its crown, form, and height will maximize benefits over the course of its life. Provide necessary clearances below electrical transmission lines and prevent limbs from overhanging potentially sensitive structures such as flat roofs. In commercial areas where the visibility of façade-mounted signs is a concern, choose species whose mature canopy allows for visibility, with the lowest branches at a height of 12 to 14 feet or more above the ground. Select trees with non-aggressive root systems to avoid damaging paving and sidewalks.
- Start with good nursery stock and train it well. When installing plant material, choose plants that have complete single leaders and good form.
- Check containerized trees are not root bound. Post-transplanting/installation, ensure the trees are watered adequately for two years. Three years after transplanting/installation, prune for form and to train the tree to fit the site best.
- Good maintenance practices post-installation ensures the best establishment and longevity of urban trees.

CLIMATE AND SOIL

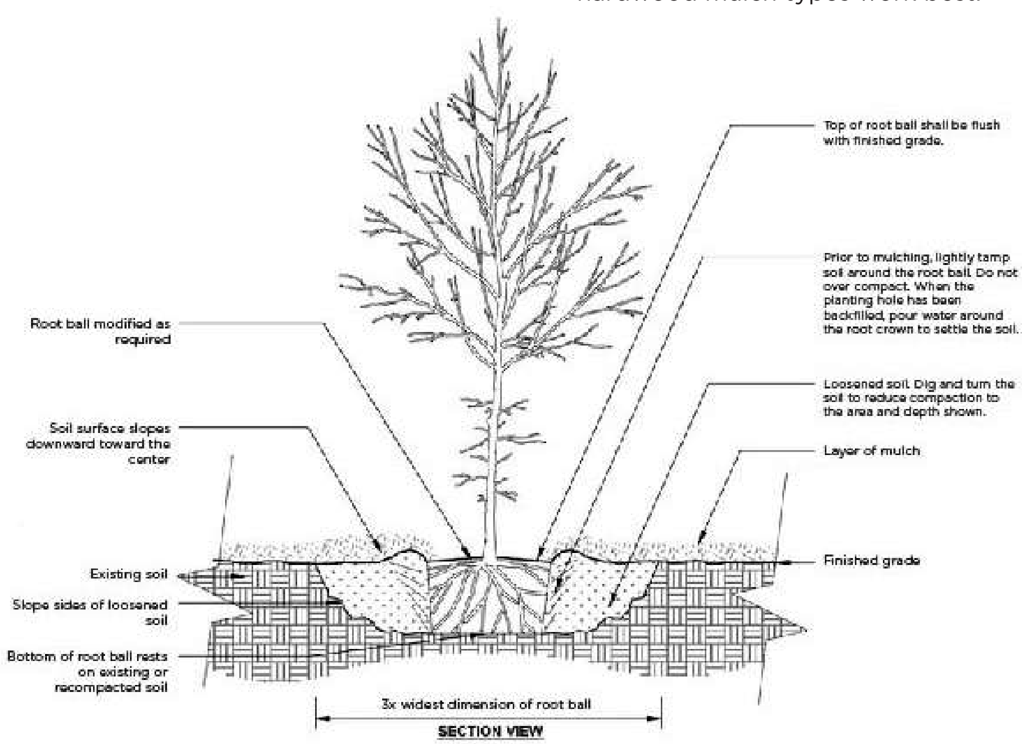
Selecting trees that are adapted to a site's climate and local rain cycles can create a more sustainable urban forest. The urban environment is harsh for many plants. Often plants native to an area are best adapted to that area's climate. Select plants that can tolerate the environmental elements, such as radiant heat from the sidewalk or street surface.

- Urban soils have become highly compacted through construction activities and the passage of vehicle and even foot traffic. Compaction reduces the soil's capacity to hold and absorb water. Plants need healthy soil, water, and air to thrive.
- To add biomass and canopy cover, both the volume and quality of soil at planting sites should be increased. Soil volume requirements depend on the expected size of the tree. A design protocol for street trees devised by James Urban recommends that designers consider soil quality, degree of urbanization and soil volume to determine the design detail for urban planting.

PLANTING SITES

Traditionally, trees have been squeezed into whatever limited space is easily found, but this does not work well for either the tree or the street. The following guidelines provide recommended planting areas:

- Establish and maintain 6 to 8-foot wide sidewalk furniture zones where possible (refer to City of Atlanta Zoning Code for specific width requirements within a given site). Many large trees need up to 12 feet in width, and are not suitable for placement in narrower furniture zones. In residential areas, sidewalk furniture zones within the root zone should be unpaved and planted/surfaced with low groundcover or mulch where these can be maintained. Where maintenance of such extensive sidewalk furniture zones is not feasible, provide 12-foot long tree wells with true permeable pavers (standard interlocking pavers are not permeable).
- If the above conditions are not feasible, provide for the tree's root system an adequate volume of uncompacted soil or structural or gap-graded soil (angular rock with soil-filled gaps) to a depth of 3 feet under the entire sidewalk (in the furniture, frontage, and pedestrian sidewalk zones).
- Spacing between trees will vary with species and site conditions. Target spacing should be less than ten percent less than the mature canopy spread. Closer spacing of large canopy trees is encouraged to create a lacing of canopy, as trees in groups or groves can create a more favorable microclimate for tree growth than is experienced by isolated trees exposed to heat and desiccation from all sides. On residential streets where lots are 40 or 50 feet wide, plant one tree minimum per lot between driveways. Where constraints prevent an even spacing of trees, it is preferable to place a tree slightly off the desired rhythm than to leave a gap in the pattern.
- Planting sites should be graded, but not overly compact, so that the soil surface slopes downward toward the center, forming a shallow swale to collect water (except in sites where stormwater infiltration is desired). The root crown of the tree should remain 2 inches above finished grade and not be in the center of a swale, but off to the side. The finished soil elevation after planting is held below that of the surrounding paving so 2 to 3 inches of mulch can be added. The mulch layer must be replenished as needed to maintain a nearly continuous level surface adjacent to paving. In Atlanta, doubleground and stranded hardwood mulch types work best.



Tree section diagram

(Credit: International Society of Arboriculture)

SPECIES SELECTION

Use of multiple varieties and selections is desired.

COMMON NAME	BOTANICAL NAME	MAX HEIGHT	MAX SPREAD	DROUGHT TOLERANT (DT)	ESTABLISHES WELL (EW)	COMPATIBLE WITH OVERHEAD POWER LINES (PL)	MINIMUM SOIL SPACE	URBAN GROWTH ENVIRONMENT
Florida Maple	Acer barbatum	20-25′	20-40′			X	3′ wide strip	Commercial Corridor
Chalkbark Maple	Acer leucoderme	25-30′	25-30′	X	X	X	3′ wide strip	Residential Corridor
Japanese Maple	Acer palmatum	15′-25′	10′-25′				Open lawn	Parkland
Red Buckeye	Aesculus pavia	20-25′	30-35′		X		Larger than 3′ strip	Commercial Corridor
Tag Alder	Alnus serrulataw	15-20′			X		3′ wide strip	Residential Corridor
Serviceberry	Amelanchier arborea	20-25′	15-20′		X	X	Larger than 3′ strip	Commercial Corridor
Monkey Puzzle	Araucaria araucana	50-80′	40-60′	X			Open lawn	Residential Corridor
Pawpaw	Asimina triloba	15-30′	15-20′			X	3′ wide strip	Residential Corridor
European Hornbeam	Carpinus betulus	30-50′	20-30′	X	X		3′ wide strip	Urban Core/Downtown
American Hornbeam	Carpinus caroliniana	20-30′	20-30′				3′ wide strip	Commercial Corridor
Water Hickory	Carya aquatica	80-100′	50′				5′ x 8′ well or larger	Residential Corridor
Pignut Hickory	Carya glabra	60-70′	25-35′				5′ x 8′ well or larger	Residential Corridor
Pecan	Carya illinoinensis	70-100′	40-75′				5′ x 8′ well or larger	Residential Corridor
Mockernut Hickory	Carya tomentosa	60-70′	50-60′				5′ x 8′ well or larger	Residential Corridor
Allegheny Chinkapin	Castanea pumila	25-50′	25-50′		X		Larger than 3′ strip	Residential Corridor
Deodora Cedar	Cedrus deodara	70-80′	40-50′	X			5′ x 8′ well or larger	Commercial Corridor
Eastern Redbud	Cercis canadensis	20-30′	30′		X	X	3′ wide strip	Commercial Corridor
Forest Pansy Redbud	Cercis canadensis	20-30′	25-30′		X		3′ wide strip	Residential Corridor
White Cedar	Chamaecyparis thyoides	40-50′	10-20′				Open lawn	Residential Corridor
Chinese Fringe tree	Chionanthus retusus	25-30′	25-30′		X	X	Larger than 3′ strip	Commercial Corridor
American Fringetree	Chionanthus virginicus	20′	20′		X	X	Larger than 3′ strip	Commercial Corridor
Yellowwood	Cladrastis kentukea	40′	30′	X	X		Larger than 3′ strip	Residential Corridor
Pagoda Dogwood	Cornus alternifolia	25′	40′			X	3′ wide strip	Residential Corridor
Flowering Dogwood	Cornus florida	20-30′	20′			X	Larger than 3′ strip	Understory
Kousa Dogwood	Cornus kousa	20-30′	20-30′			X	Larger than 3′ strip	Residential Corridor
Hazelnut	Corylus avellana	12-15′	10-12′	X		X	3′ wide strip	Residential Corridor
American Smoketree	Cotinus obovatus	20-30′	20-30′			X	Larger than 3′ strip	Residential Corridor
Washington Hawthorne	Crataegus phaenopyrum	25-30′	20-25′			X	3′ wide strip	Residential Corridor
Winter King Hawthorne	Crataegus viridis	25-30′	20-25′		X		3′ wide strip	Residential Corridor
Swamp Cyrilla	Cyrilla racemiflora	15-20′	15-20′		X		Open lawn	Residential Corridor

COLOR KEY

- Difficult to find in trade
- Species on Belt Line, Inc's original list
- Office of Parks Addendum

COMMON NAME	BOTANICAL NAME	MAX HEIGHT	MAX SPREAD	DT	EW	PL	MINIMUM SOIL SPACE	URBAN GROWTH ENVIRONMENT
Persimmon	Diospyros virginiana	35-60'	20-35'				Larger than 3' strip	Residential Corridor
American Beech	Fagus grandifolia	50-80'	40-60'				5' x 8' well or larger	Residential Corridor
China-fir	Cunninghamia lanceolata	40-70'	10-30'				Open lawn	Residential Corridor
Fig	Ficus carica	15-30'	15-30'			X	3' wide strip	Residential Corridor
Ginkgo	Ginkgo biloba (MALE)	100'	60'+		X		5' x 8' well or larger	Urban Core/Downtown
Ginkgo	Ginkgo biloba (MALE)	100'	60'+				5' x 8' well or larger	Urban Core/Downtown
Gordonia/Loblolly Bay	Gordonia lasianthus	30-40'	25'		X		Larger than 3' strip	Commercial Corridor
Kentucky Coffee Tree	Gymnocladus dioicus	60-70'	40-50'	X	X		5' x 8' well or larger	Commercial Corridor
Two-winged Silverbell	Halesia diptera	20-30'	20'				Larger than 3' strip	Residential Corridor
Carolina Silverbell	Halesia tetraptera	30-40'	20-35'				Larger than 3' strip	Residential Corridor
Virginia Witchhazel	Hamamelis virginiana	20-30'	20-25'		X		Open lawn	Commercial Corridor
Black Walnut	Juglans nigra	50-70'	50-70'	X			5' x 8' well or larger	Residential Corridor
Eastern Redcedar	Juniperus virginiana	30-40'	10-20'	X	X		3' wide strip	Commercial Corridor
Chinese Flame Tree	Koelreuteria bipinnata	20-40'	15-35'		X		3' wide strip	Commercial Corridor
Osage Orange	Maclura pomifera	20-40'	20-40'	X			Larger than 3' strip	Residential Corridor
Yellow Magnolia collection	Magnolia acuminata	30'	25'				Larger than 3' strip	Residential Corridor
Saucer Magnolia	Magnolia x soulangiana	25-35'	35-40'				Larger than 3' strip	Residential Corridor
Star Magnolia	Magnolia stellata	15-20'	10-20'			X	Larger than 3' strip	Residential Corridor
Sweetbay Magnolia	Magnolia virginiana	30-40'	20'				Larger than 3' strip	Commercial Corridor
Dawn Redwood	Metasequoia glyptostroboides	75-100'	15-25'	X	X		5' x 8' well or larger	Commercial Corridor
Water Tupelo	Nyssa aquatica	35-50'	20-30'				Larger than 3' strip	Commercial Corridor
Black Tupelo/Blackgum	Nyssa sylvatica	55'-75'	50'		X		Larger than 3' strip	Commercial Corridor
American Tea Olive	Osmanthus americanus	20'	25-30'			X	Open lawn	Residential Corridor
Fragrant Tea Olive	Osmanthus fragrans	20'-30'	20'		X	X		Residential Corridor
Hop Hornbeam	Ostrya virginiana	25-40'	25-40'	X			3' wide strip	Residential Corridor
Sourwood	Oxydendron arboreum	25-50'	20'	X			Open lawn	Residential Corridor
Persian Ironwood	Parrotia persica	20-40'	15-30'	X	X		Larger than 3' strip	Commercial Corridor
Swamp Redbay	Persea palustris	20-35'	10-25'				Larger than 3' strip	Residential Corridor
	Pinus taeda							
Chinese Pistache	Pistacia chinensis	25-40'	25-40'	X	X		3' wide strip	Urban Core/Downtown
Sycamore	Platanus occidentalis	70-100'	60-80'				5' x 8' well or larger	Commercial Corridor
Cottonwood	Populus deltoides	75-100'	50-75'	X	X		5' x 8' well or larger	Residential Corridor
Yoshino Cherry	Prunus × yedoensis	35'-45	40'-50'				Open lawn	Parkland
American Plum	Prunus americana							
Hop Tree	Ptelea trifoliata	15-20'	15-20'		X	X	Larger than 3' strip	Residential Corridor
White Oak	Quercus alba	80-100'	50-90'	X			5' x 8' well or larger	Residential Corridor
Swamp White Oak	Quercus bicolor	60-80'	60-70'	X	X		5' x 8' well or larger	Commercial Corridor

COLOR KEY

Difficult to find in trade

Species on Belt Line, Inc's original list

Office of Parks Addendum

COMMON NAME	BOTANICAL NAME	MAX HEIGHT	MAX SPREAD	DT	EW	PL	MINIMUM SOIL SPACE	URBAN GROWTH ENVIRONMENT
Southern Red Oak	Quercus falcata	70-90′	70-90′	X			5′ x 8′ well or larger	Residential Corridor
Georgia Oak	Quercus georgiana	15-30′	15-30′			X	Larger than 3′ strip	Commercial Corridor
Laurel Oak	Quercus hemisphaerica	40-60′	30-40′		X		5′ x 8′ well or larger	Commercial Corridor
Turkey Oak	Quercus laevis	30-40′	20-35′				5′ x 8′ well or larger	Residential Corridor
Overcup Oak	Quercus lyrata	60-80′	40-50′	X	X		5′ x 8′ well or larger	Urban Core/Downtown
Bur Oak	Quercus macrocarpa	80′	100′	X			5′ x 8′ well or larger	Residential Corridor
Blackjack Oak	Quercus marilandica	40-50′	30-40′	X			5′ x 8′ well or larger	Commercial Corridor
Swamp Chestnut Oak	Quercus michauxii	60-80′	50-70′		X		5′ x 8′ well or larger	Commercial Corridor
Chinkapin Oak	Quercus muhlenbergii	40-50′	40-60′	X			5′ x 8′ well or larger	Residential Corridor
Nuttall Oak	Quercus nuttallii	55′-80′	60′	X	X		5′ x 8′ well or larger	Urban Core/Downtown
Cherrybark Oak	Quercus pagoda	70-80′	70-80′				5′ x 8′ well or larger	Residential Corridor
Pin Oak	Quercus palustris	60-80′	40-50′	X	X		5′ x 8′ well or larger	Commercial Corridor
Chestnut Oak	Quercus prinus	60-70′	60-70′	X	X		5′ x 8′ well or larger	Residential Corridor
Northern Red Oak	Quercus rubra	60-80′	60-80′	X	X		5′ x 8′ well or larger	Commercial Corridor
Shumard Oak	Quercus shumardii	60-80′	40-50′	X	X		5′ x 8′ well or larger	Commercial Corridor
Post Oak	Quercus stellata	60-80′	40-50′	X	X		5′ x 8′ well or larger	Residential Corridor
Live Oak	Quercus virginiana	60-70′	60-80′	X	X		5′ x 8′ well or larger	Commercial Corridor
Black Locust	Robinia pseudoacacia	45-60′	25′	X	X		Larger than 3′ strip	Commercial Corridor
Elderberry	Sambucus canadensis	12-25′	12-25′	X	X	X	Open lawn	Residential Corridor
Sassafras	Sassafras albidium	30-60′	25-40′	X			Larger than 3′ strip	Residential Corridor
Japanese Pagoda Tree	Sophora japonica	40′	30-45′	X			Larger than 3′ strip	Commercial Corridor
American Bladdernut	Staphylea trifolia	15′	10-15′			X	3′ wide strip	Residential Corridor
Japanese Snowbell	Styrax japonicus	20-30′	25-35′			X		Commercial Corridor
Pond Cypress	Taxodium ascendens	70-80′	15-20′		X		5′ x 8′ well or larger	Commercial Corridor/ Urban Center
Bald Cypress	Taxodium distichum	50-80′	20-25′	X	X		5′ x 8′ well or larger	Urban Core/Downtown
Weeping Bald Cypress	Taxodium distichum	25′	15′	X			5′ x 8′ well or larger	Residential Corridor
Dwarf Bald Cypress	Taxodium distichum	15′	6′	X	X	X	5′ x 8′ well or larger	Commercial Corridor
Winged Elm	Ulmus alata	50-60′	30-40′		X		5′ x 8′ well or larger	Commercial Corridor
Sparkleberry	Vaccinium arboreum	15-25′	20-35′	X	X	X	3′ wide strip	Residential Corridor
American Linden	Tilia americana	60-100′	45-60′		X		5′ x 8′ well or larger	Commercial Corridor
Tulip Poplar	Liriodendron tulipifera							
American Elm	Ulmus americana	80-100′	40-80′	X			5′ x 8′ well or larger	Urban Core/Downtown
American Elm	Ulmus americana	80-100′	40-50′	X	X		5′ x 8′ well or larger	Urban Core/Downtown
Sparkleberry	Vaccinium arboreum	15-25′	20-35′	X	X	X	3′ wide strip	Residential Corridor
Zelkova	Zelkova serrata							Residential Corridor
Zelkova	Zelkova serrata							Urban Core/Downtown

COLOR KEY

- Difficult to find in trade
- Species on Belt Line, Inc's original list
- Office of Parks Addendum

Department of
CITY PLANNING