Research Triangle Park

Comprehensive Transportation Plan

April 2026

Acknowledgments

Thank you to the Research Triangle Foundation and all its committee and board members for devoting their time, effort, and invaluable ideas to developing not only this Comprehensive Transportation Plan but also guiding the vision for Research Triangle Park 3.0. The dedication of the companies, owners, tenants, and leadership to this master planning effort speaks to RTF as the dedicated steward of RTP.

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Purpose + Vision

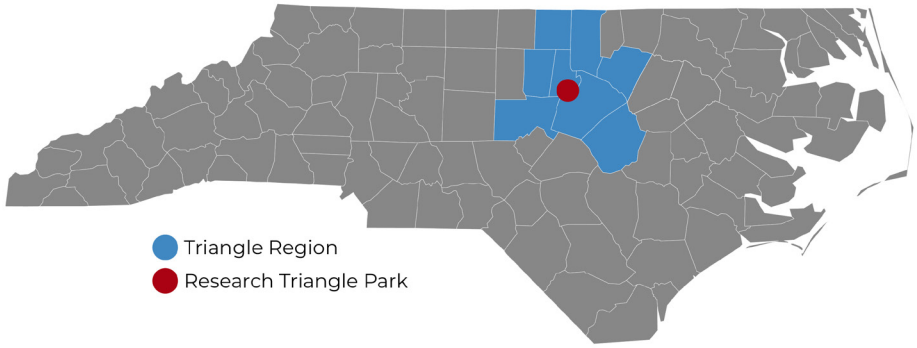
Introduction

Research Triangle Park

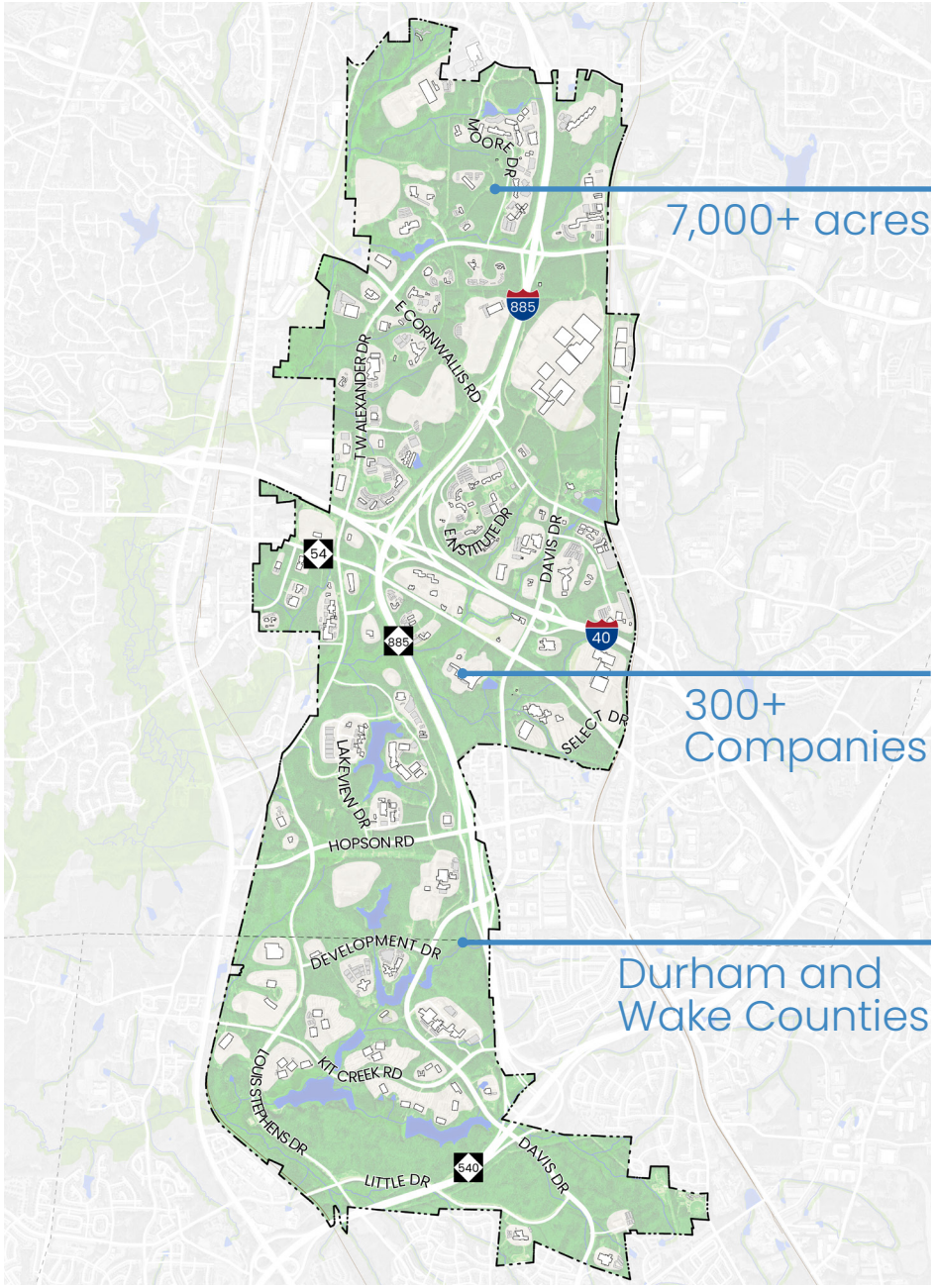
Research Triangle Park (RTP) is a world-renowned research community strategically located in the Triangle Region between the cities of Raleigh and Durham in North Carolina. Situated at the crossroads of two major highways, I-885 and I-40, and within a 10 minute drive from the Raleigh-Durham International Airport (RDU), RTP is easily accessible from major transportation infrastructure, making it a prime location for explosive growth.

Since its establishment in 1959, RTP has elevated North Carolina's economy and made the Triangle region a top-tier location for research and technology. As stewards of the Park, Research Triangle Foundation (RTF) has successfully attracted and created tens of thousands of jobs at hundreds of companies in RTP, driving the region's growth. With regional job and population growth projected to continue in the coming decades, RTP has the unique opportunity to evolve as a major center of not just employment, but housing, retail, and commercial development as well.

The Triangle and the Park



Study Area



RTP 3.0

RTP 3.0 is a visioning framework that will re-imagine what the Park can become over the next 60 years. RTP 3.0 is an opportunity to revisit the groundwork that has already been laid in RTP 2.0 and take a comprehensive look at what future growth and development can look like in the Park. Elements of RTP 3.0 include:

+ Fund Development – Actionable recommendations to guide the creation of the proposed RTP Regional Initiative Fund
+ Rezoning and Development Standards – A strategy that provides regulatory and zoning recommendations to achieve the desired land use and development goals
+ Infrastructure Framework – A vision for a north-south running greenway through RTP and a Comprehensive Transportation Plan that identifies a multimodal transportation strategy
+ Placemaking - A vision that establishes a mix of land use typologies that further the mission of RTP while providing for support uses and placemaking opportunites.

Comprehensive Transportation Plan

RTP's Comprehensive Transportation Plan (CTP) defines the strategy for creating a park-wide transportation system that accommodates the current mobility needs of its owners, partners, and visitors and looks to the future to anticipate where needs may arise. The CTP is a multimodal plan that will consider all forms of transportation, including biking, walking, transit, automobiles, and new emerging technologies and mobility options.

Vision

The vision and goals of RTP 3.0 serve to guide all elements of the framework that come out of this multidisciplinary planning effort. The transportation plan and recommendations that come out of the CTP will ultimately be informed by the vision and goals.

Maintain RTP as a global epicenter of 21st Century innovation and sustainability, strengthening its role as an economic driver in the region.

Goals

Diversify Uses

Introduce housing and mixed-use development to form live-work-play environments

Add Amenities

Introduce placemaking strategies, including open spaces, and public uses to activate and enhance RTP

Connect Assets

Improve accessibility and mobility through both the built and natural connections, prioritizing sustainable modes of transport

Create Inclusivity + Resiliency

Structure development to promote social, environmental, and economic sustainability

Support and Bolster Research + Development

Support and grow biotechnology, ag-tech, and life sciences, accommodating specific needs for research and development facilities, including security and privacy

Advance University Research

Partner with RTP's Founding Universities to advance cutting-edge research investments in the Triangle region.

02

Park Snapshot

The Park Today

This chapter examines current conditions related to travel and development trends in RTP and the greater Triangle Region through a look at **people, places,** and **mobility.**

People

Understanding how the population around RTP is changing will inform important considerations on how to best prepare RTP for future growth.

Places

Identifying places of interest in and around RTP provides insight into how RTP can increase its presence as both a local and regional destination.

Mobility

Analyzing the existing transportation network along with planned infrastructure through the lens of safety, accessibility, and connectivity forms the basis of understanding for mobility needs in RTP.

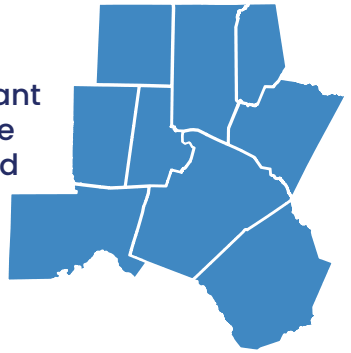
People

In the past decade, the Triangle Region has experienced rapid growth with a 21% increase in population. In contrast, RTP has experienced very little growth within its boundaries though the areas directly surrounding RTP have had population increases ranging from 35% to 215% since 2010. The areas experiencing the most growth are found along NC 540, NC 98, and I-40 where recent subdivisions with single and multifamily homes were developed.

The rapid growth in the Triangle is escalating the demand for more housing. With the extensive growth surrounding RTP, there's a clear desire to live near the area, making the Park a prime location to incorporate diverse housing options and mixed-use developments.

Since 2010:

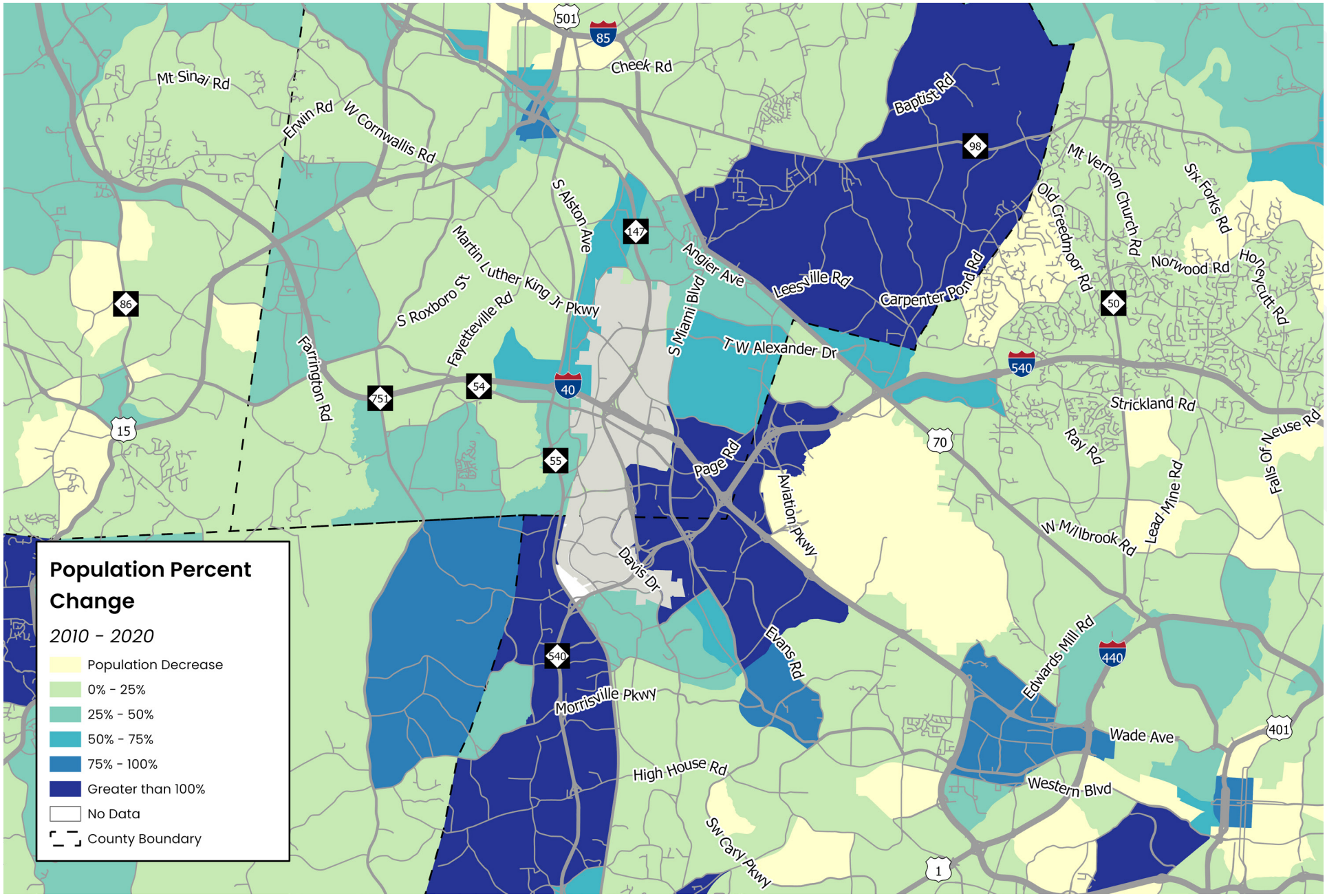
The population within RTP has remained constant but 40,215 people have been added to areas directly around the Park



366,458 people were added to the Triangle Region

Data sourced from 2020 & 2010 Decennial Census and UNC Population Center

Population Growth



Data sourced from 2010 & 2020 Decennial Census and UNC Population Center

Places

RTP Companies

RTP's 7,000 acres house hundreds of companies, including science and technology firms, government agencies, academic institutions, startups and nonprofits, making the Park a major employment hub for the entire Triangle Region. Attracting the local workforce to RTP's companies is a top priority for RTF.

Colleges & Universities

RTP is situated between various educational institutes including, Duke University, UNC Chapel Hill, North Carolina State University, North Carolina Central University, Campbell University, and Wake Technical College's RTP Campus. RTP's proximity to local universities is key to continuing the Park's efforts in advancing university research and attracting then next generations workforce.

Primary & Secondary Schools

A multitude of primary and secondary schools are situated within and around RTP. With the educational infrastructure in place, RTP could attract more families to live within the Park to foster a live-work-play environment.

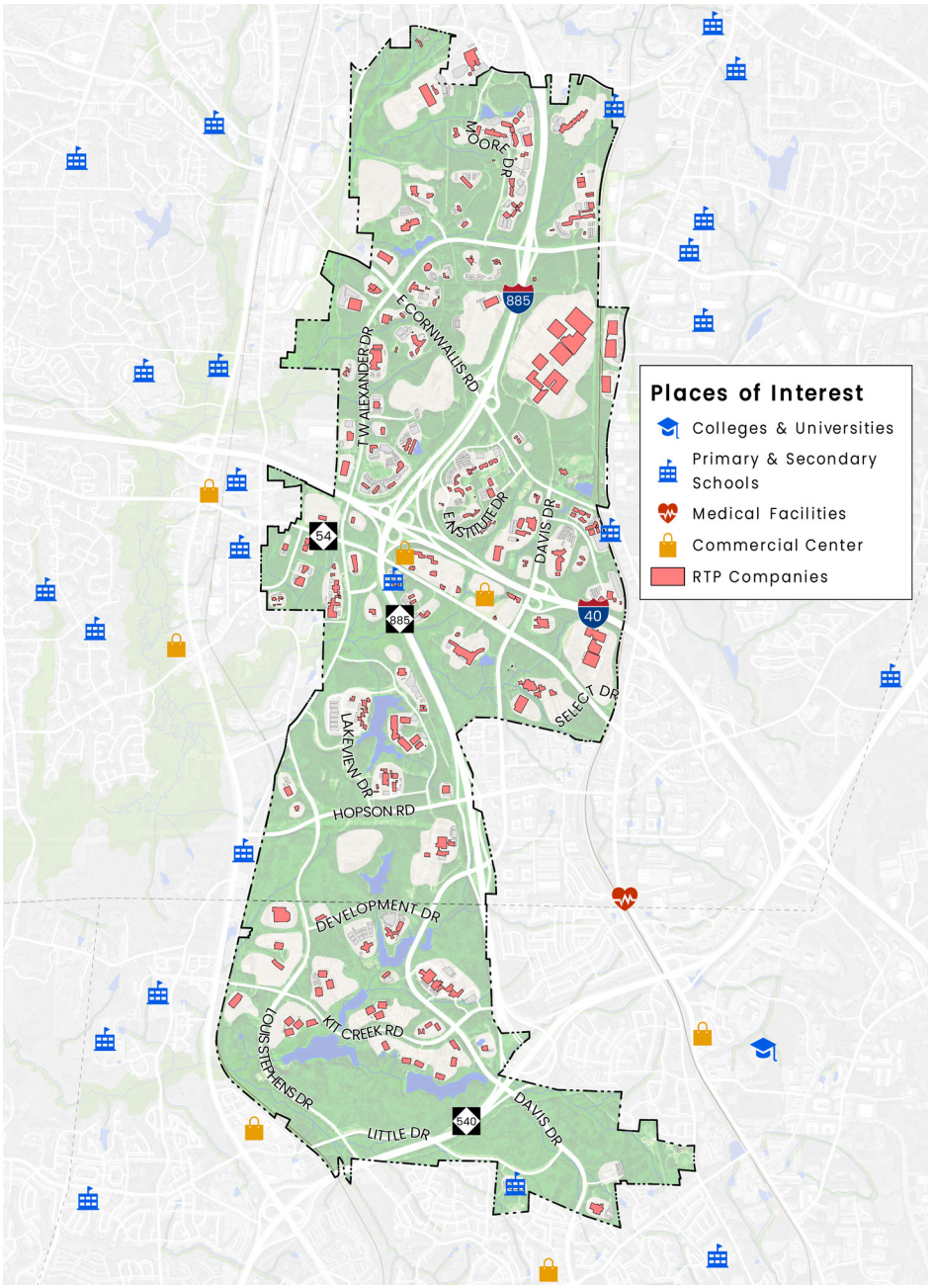
Retail + Commercial Centers

The area along NC 55 between I-40 and NC 540 contains the largest concentration of commercial activity centers, including Parkside Town Commons, Triangle Village, and Greenwood Commons. Within RTP, Boxyard and the Hub are the central commercial destinations. Improving the connections between local retail and commercial centers and RTP will aid in creating more mixed-use spaces.

Medical Facilities

The closest medical facility to RTP is the Shiloh Crossing Urgent Care Center. A 40-bed hospital by UNC Health is planned to be developed within RTP. These facilities are vital infrastructure to support an increasing population.

A Local and Regional Destination



Data sourced from Research Triangle Park, City and County of Durham, and Wake County

Mobility

Creating recommendations that support improved movement of people within and through RTP requires a thorough analysis of the state of mobility as it exists today. This section looks at RTP's transportation system through measures of quantity, connectivity, traffic, and safety in order to create a picture of current mobility in RTP.

Travel Patterns

RTP is a regional travel hot spot with over 40,000 trips ending or originating in RTP on a typical weekday. Approximately 34% of the trips (all modes) are from the immediately adjacent Census tracts which include RTP, Durham, Clegg, Bethesda, Brier Creek and Morrisville. Travel is dominated by automobiles; however, there are over 1,000 people who walk on the average weekday. RTP is burgeoning with activity, whether it be trips generated around RTP or the growing population living near RTP. To capitalize on local trends, RTP will need to rethink how housing and transportation coexist and interact throughout the Park.

Top Four Trip Types by Mode:

64.2% drive alone

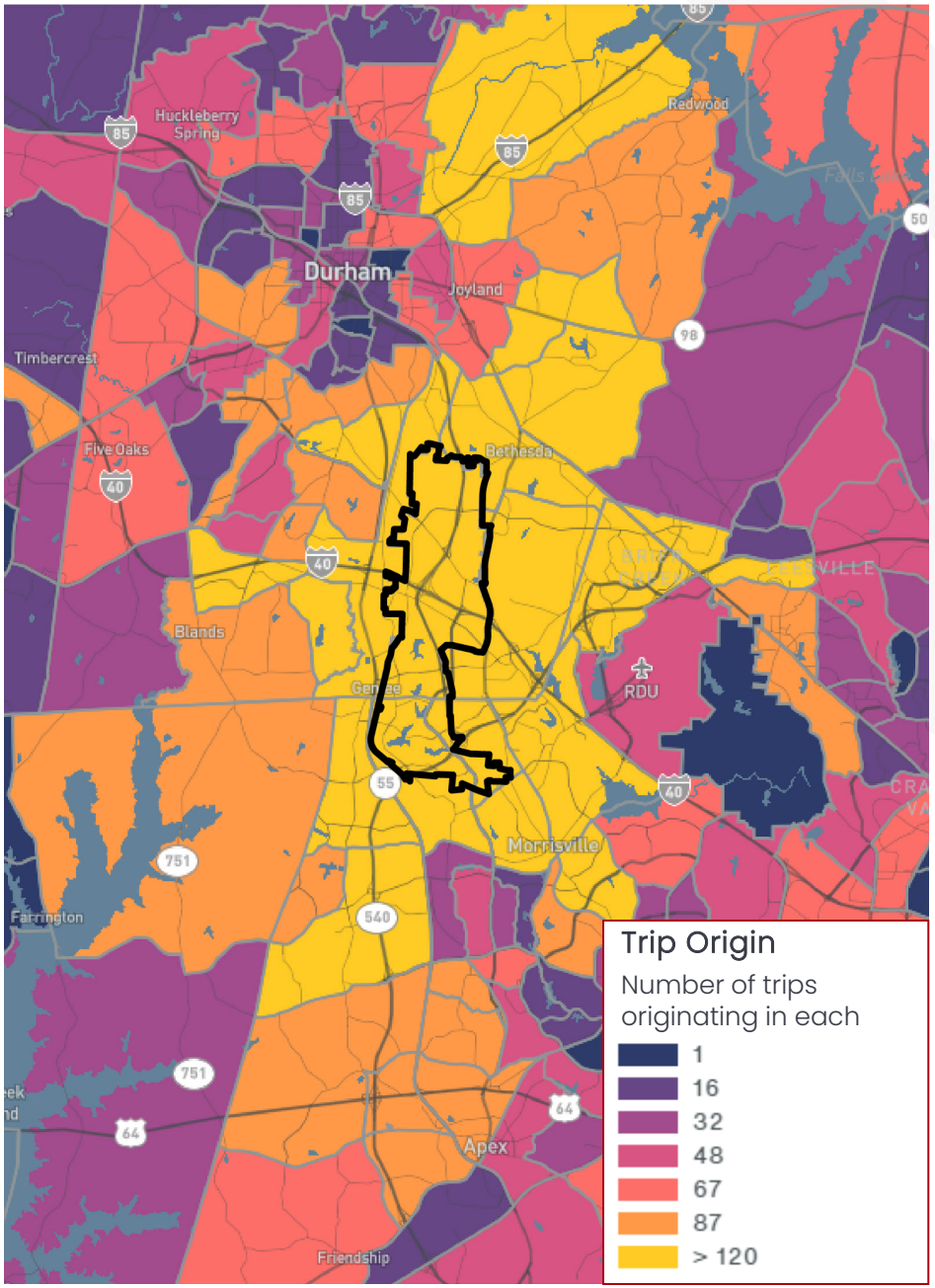
14.5% carpool

12.3% commercial vehicle

5.8% walk

Data sourced from Replica, Spring 2021 and the 2021 ACS 5-Year estimates

Travel Patterns



Roadway Characteristics

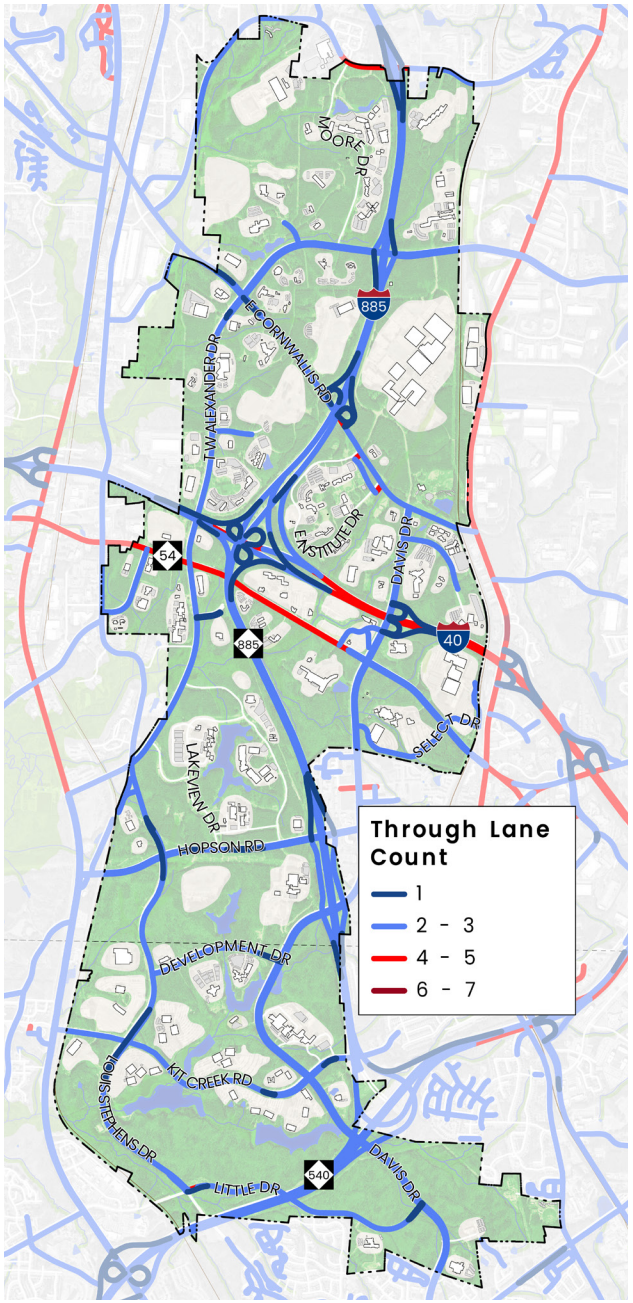
The number of thru-lanes generally determines the capacity of a given road, where more lanes allow for more cars. Most of the main streets in RTP are 2-4 lane roads with traffic volumes ranging from 1,000 - 15,000 vehicles per day.

Level of Service (LOS) is a measure of road performance where LOS A is a road that has free flowing traffic and LOS F is a road that is very congested. A few factors determine LOS, including laneage and surrounding land uses. The table below shows the number of vehicles per day that a given roadway can handle based on laneage and land use to operate at LOS D, the benchmark in transportation planning. The suburban commercial land use represents RTP today and the urban land use represents future development types, should the vision of RTP 3.0 come to fruition. Based on this table, the majority of RTP's roads have more capacity than is needed, which allows for more flexibility in future transportation solutions.

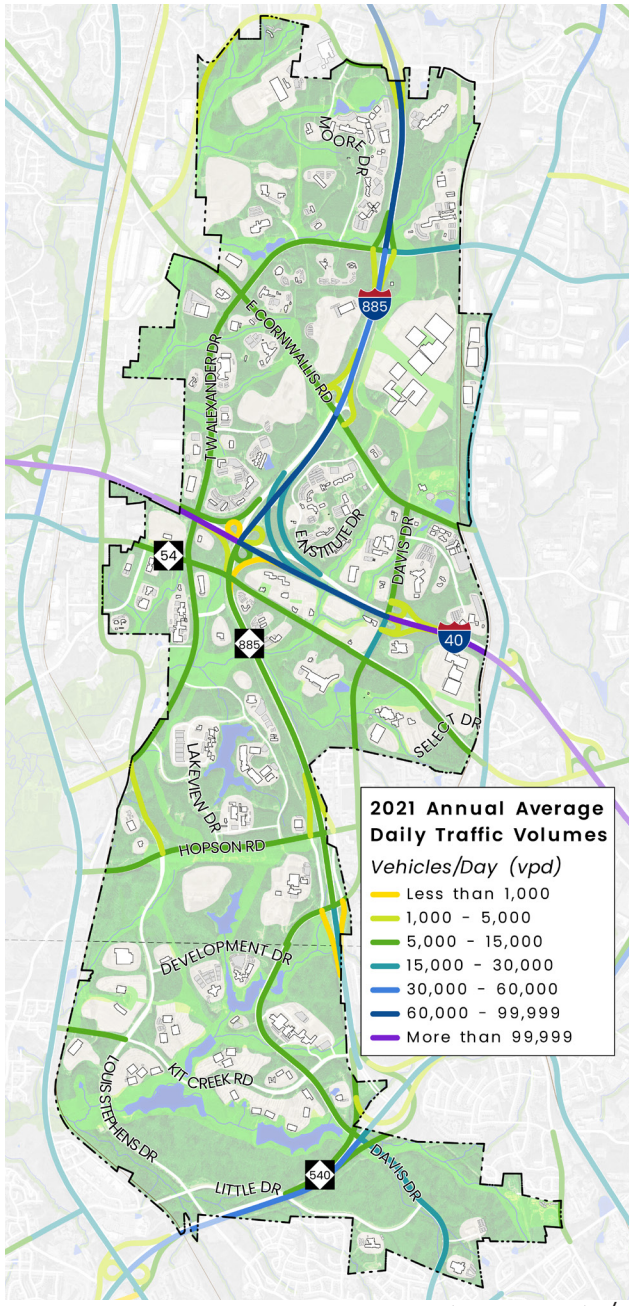
Level of Service D

Lanes	Suburban Commercial	Urban Core
2 Lanes	21,700	16,000
4 Lanes	36,600	30,100
6 Lanes	54,100	55,100
8 Lanes	64,200	65,700

Lanes



Annual Average Daily Traffic



Data sourced from NCDOT Roadway Characteristics, 2021 NCDOT AADT Segments, and FDOT 2023 Multimodal Quality/ Level of Service Handbook

Traffic and Congestion

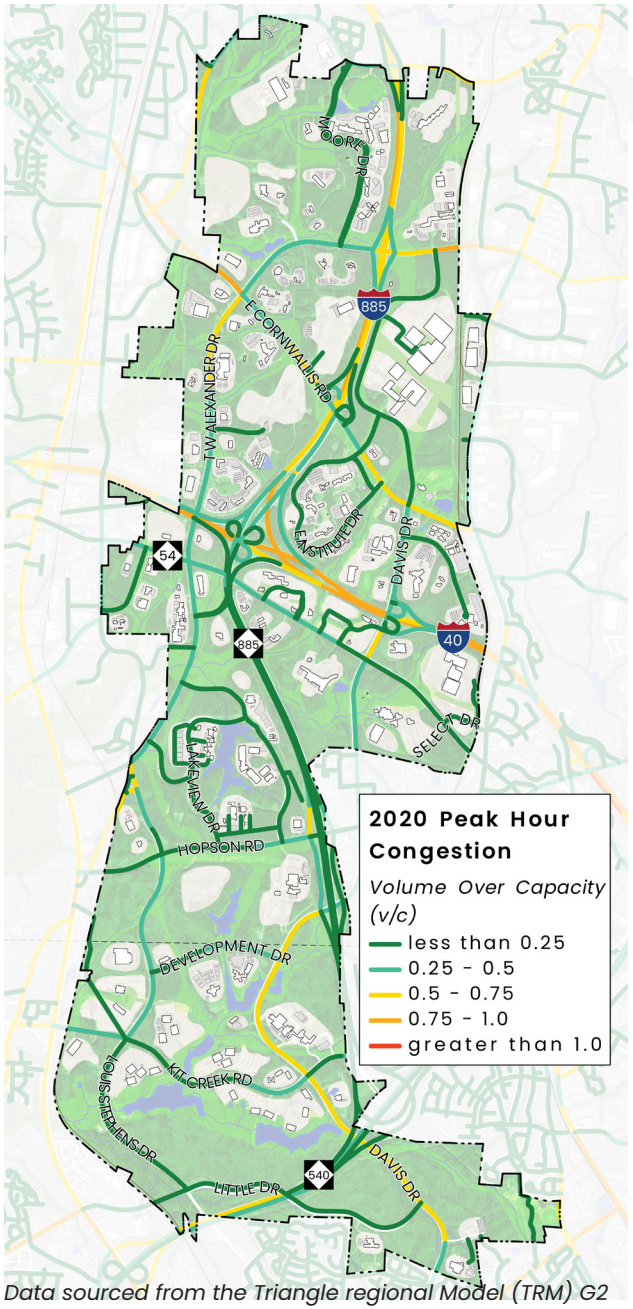
Another way to calculate roadway performance is using volume-to-capacity (V/C) ratios as a measure of congestion. Sophisticated models can simulate the interaction of estimated demand and available supply at a regional scale. Modeled traffic congestion provides system level insights into congestion issues and can indicate corridors that warrant higher levels of study and analysis or capacity improvements.

The maps to the right symbolize congestion based on V/C ratios during the afternoon rush hour in 2020 and 2050. Roads are typically approaching capacity at a V/C of 0.8 and above, considered at capacity at a V/C of 1.0, and considered over capacity above that threshold.

Based on these maps, traffic is expected to increase over the next 30 years with anticipated population and employment growth in the area. The major arteries through RTP, including I-40 and I-885, are projected to have some segments that are reaching capacity by 2050 but the majority of the roads internal to RTP remain under capacity.

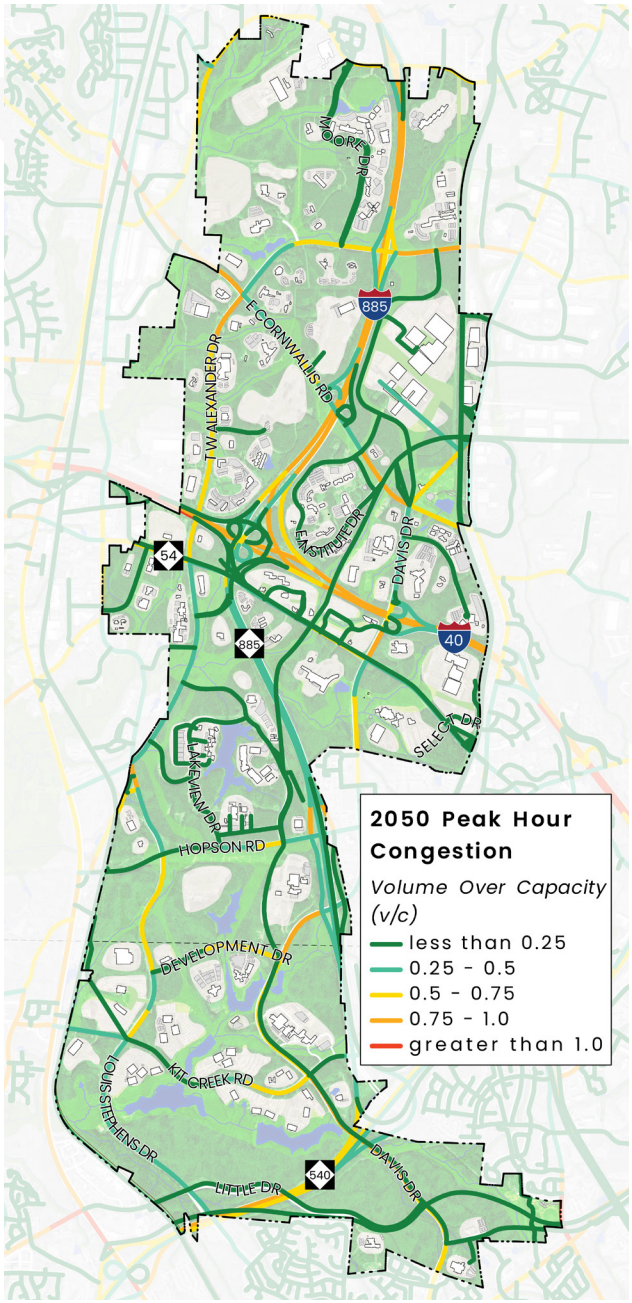
Analyzing roadway performance using both counts and projections provides a broader set of data points on which to determine ultimate transportation recommendations.

Existing Congestion



Data sourced from the Triangle regional Model (TRM) G2

Future Congestion



Safety

Safety is the top priority in transportation planning. This plan aligns its goals with NC Vision Zero, a state-wide program which aims to eliminate roadway deaths and injuries using data-driven prevention strategies. The North Carolina Department of Transportation (NCDOT) maintains historic crash data throughout the region. Within RTP, there were more than 500 reported crashes in the five years between January 1, 2018 and December 31, 2022. Automobile-related crashes were largely concentrated along:

- I-40
- I-885
- NC 54
- E Cornwallis Rd
- Davis Dr
- Louis Stephens Dr

I-40, NC-54, and NC-885 represent elevated danger zones due to the high occurrence of fatal and serious injury crashes. The only pedestrian crash in RTP occurred along TW Alexander Road where a multiuse sidepath is present. A singular bicycle crash occurred on Kitt Creek Road, which does not have any bicycle infrastructure.

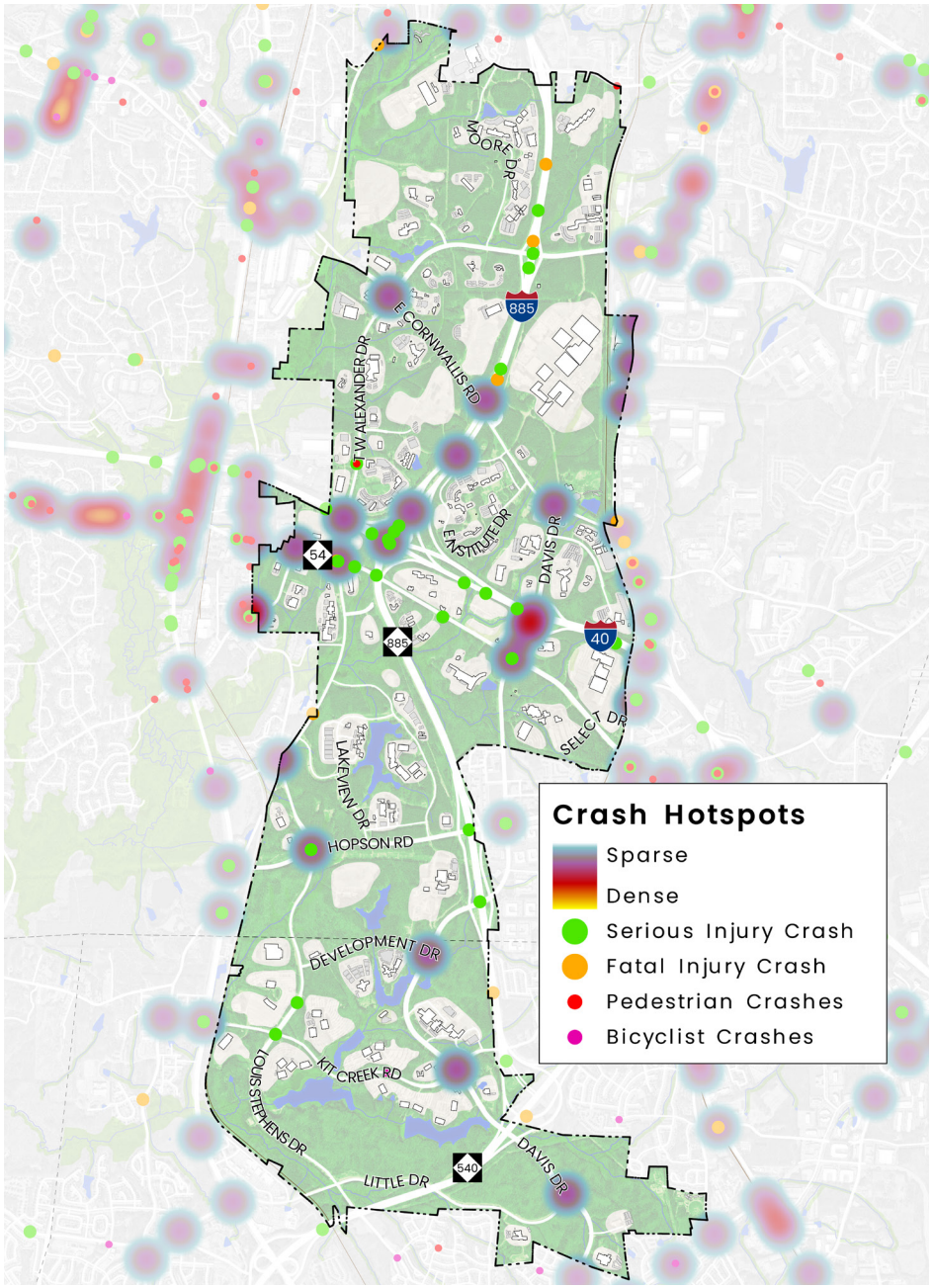
Top Three Crash Types Since 2018:

350+ property damage crashes

20+ serious injury crashes

5 fatal crashes

Crashes



Data sourced from NCDOT Crash Frequency By Intersection (2018-2022), NCDOT Fatal & Serious Injury Crash Locations (2017-2023), NCDOT Bicyclist & Pedestrian Crash Map (2007 - 2022)

Active Transportation

Expanding active transportation opportunities for walking, rolling, and biking is crucial to creating an environment where people can live, work, and recreate comfortably.

Bicycle + Pedestrian Facilities

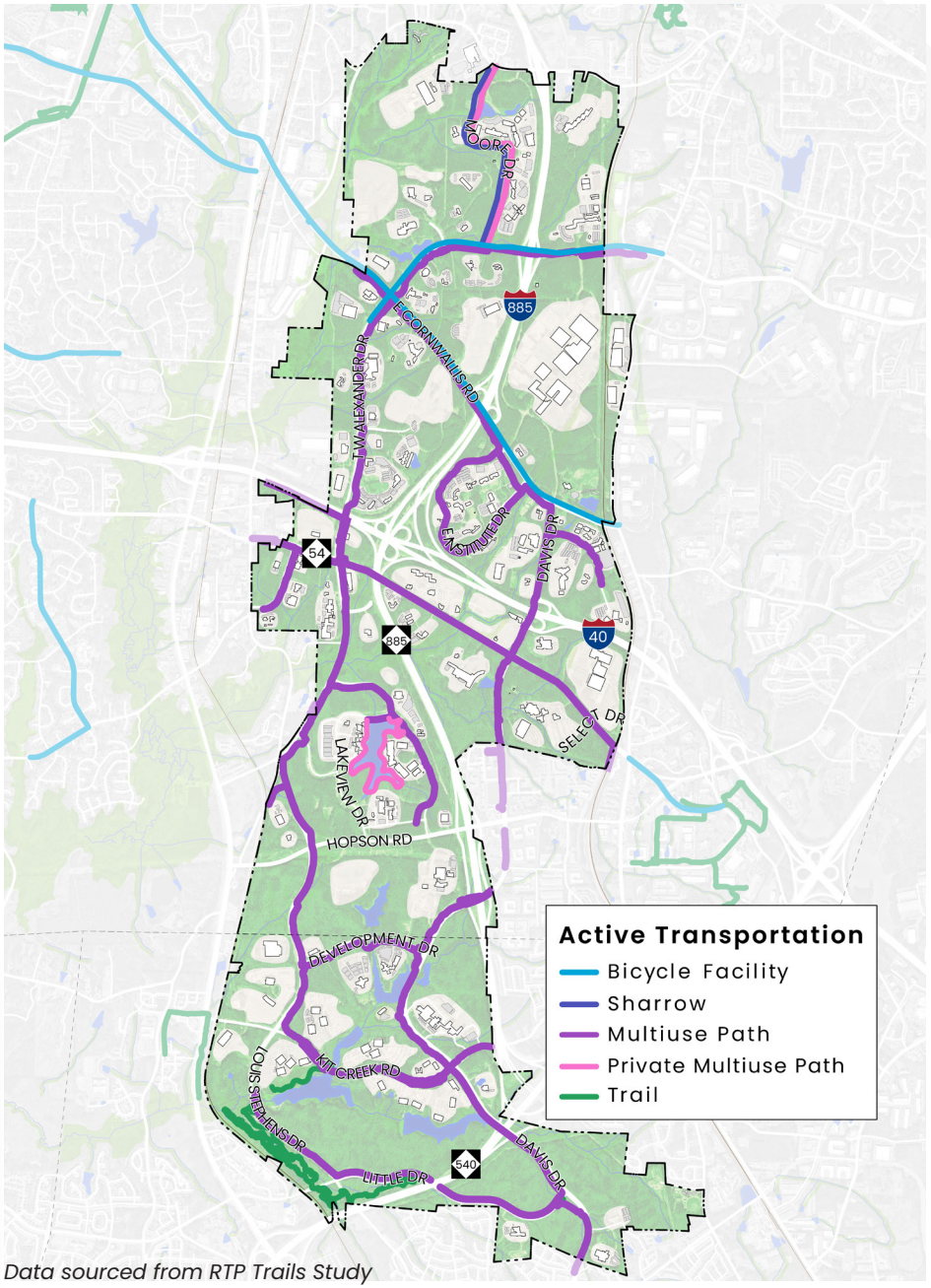
RTP contains over 25 miles of publicly-accessible multiuse paths that span the majority of park. There are also private paths along Moore Drive and on EPA's campus. While the network is fairly expansive, most of the multiuse paths do not directly connect pedestrians to RTP properties. Creating sidewalk networks that link the existing facilities to properties will bridge last mile gaps and improve connectivity. Moreover, the multiuse paths are often not ADA accessible, which limits who is able to safely use the facilities. Redesigning the portions of the side paths that are not ADA accessible will be necessary for improving equitable access.

Two conventional bike lanes run along East Cornwallis Road and TW Alexander Drive and Shared Lane Markings, or "sharrows," are painted on Moore Drive, indicating that cars need to share the road with bicycles. There are no on-road bicycle facilities south of I-40, which severely limits peoples' ability to access destinations in the southern portion of RTP via bike. Off-road mountain biking trails are available as recreational facilitates in the far south of the Park. Expanding both the network extents and the type of bicycle facilities throughout the Park is necessary for creating a comprehensive active transportation network.

Triangle Bikeway

The Triangle Bikeway is a planned 17-mile multiuse path that will link RTP to Raleigh, Cary, Morrisville, Durham, and Chapel Hill. Within RTP, the Bikeway is proposed to run along the NC 54 corridor, which will improve local access to Boxyard, the Frontier Campus, and the Hub. RTP is planning to leverage this resource to provide additional multimodal connections throughout the Park.

Bicycle + Pedestrian Facilities



Data sourced from RTP Trails Study

Transit

Multiple bus routes connect to RTP along I-40, I-885, and NC 54. Local buses include GoTriangle Routes 700, 800, and 805, and GoDurham Route 12B. GoTriangle's regional routes, DRX and CRX, are routed through RTP; however, there are no stops within RTP for either route. All of the local routes converge at the Regional Transit Center (RTC), which is less than two miles away from RTP.

GoDurham's 2024 Short Range Transit Plan programs expansions and improvements to transit service in RTP. By 2027, Route 12B will be combined with Route 12 to better serve RTP and connect with GoTriangle routes. Portions of Routes 12, 12B, and 805 will be removed from RTP and replaced by Route 800. By 2030, service times will range from 15 to 30 minutes for all routes in RTP. These changes will improve the reliability of transit for local communities and greatly increase access to transit along the NC 54 corridor.

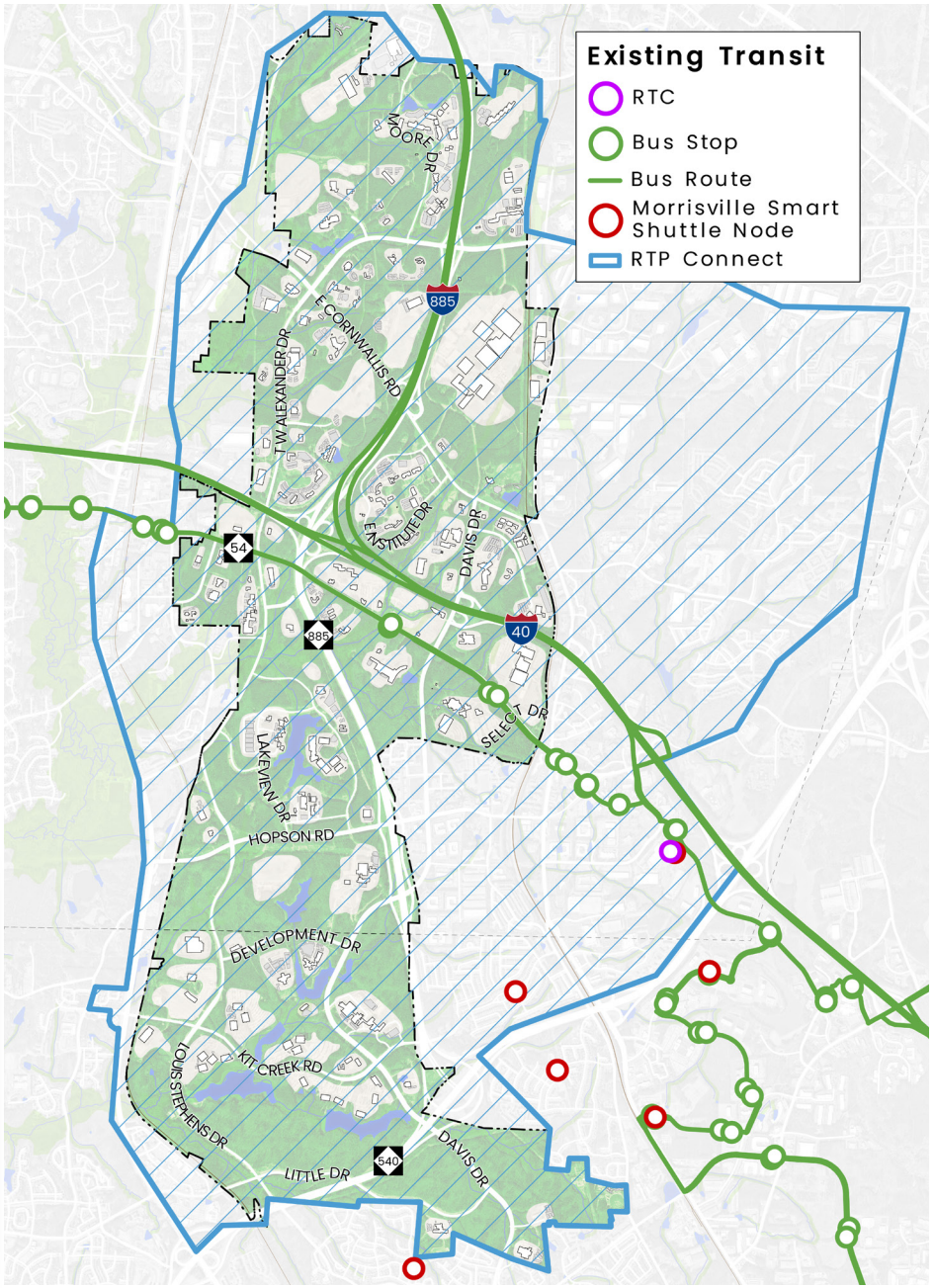
RTP Connect is a subsidy program that provides a $10 discount on Lyft trips for passengers traveling within the service area, which is shown on the map to the right. All trips must start or end at either the RTC or Boxyard and the service is available during the weekdays.

The Morrisville Smart Shuttle provides commuters with free on-demand transit throughout the Town of Morrisville. The service features multiple stops near RTP, including a stop at the RTC.

A Future Transit Hub

The RTC is proposed to be relocated within RTP borders, along NC 54. This relocation is planned in coordination with the western extension of the Wake Bus Rapid Transit (BRT) service and the potential passenger rail transit along the existing railroad that runs north-south within RTP. These planned expansions make the Park viable to attract transit-oriented development (TOD). Through RTP 3.0, TOD will be encouraged to achieve the vision of mixed-use and shared spaces in the Park.

Transit



Data sourced from GoTriangle, RTP, and the Town of Morrisville

Key Takeaway

RTP is a core employment destination for the Triangle Region and is well-suited to begin attracting growth as a mixed-use center. The population continues to rise in the communities directly adjacent to RTP, demonstrating a desire for people to not only work in RTP, but also live in the area. The Park's location, situated at the crossroads of two major highways, ensures easy access to the Park for businesses, commuters, and visitors alike, making it an ideal option for continued economic development.

03

Multimodal Vision

The Street and the Streetscape

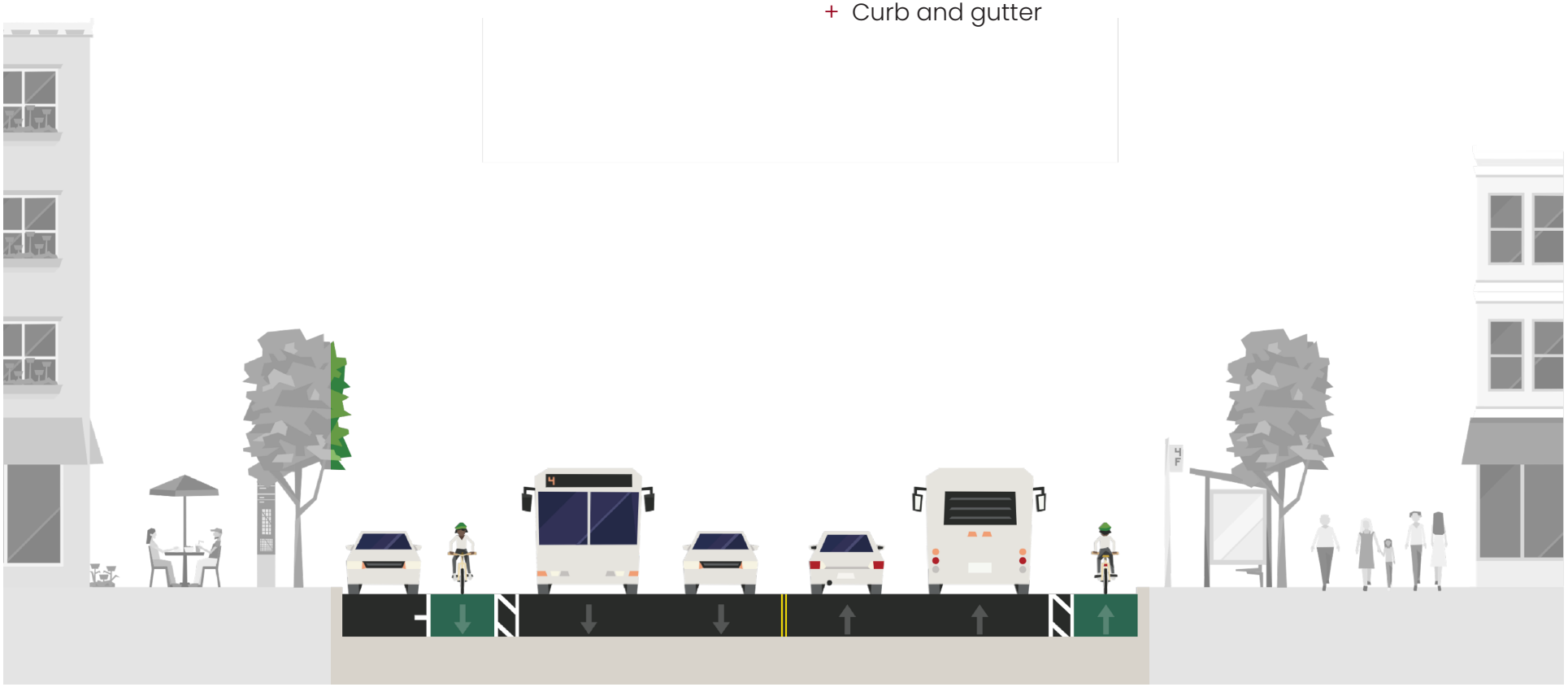
This CTP considers all components of the street holistically.

The Street

The street refers to the physical space or roadway that is designed and built for vehicular movement. It includes anything within the curbline such as the paved travel lanes for cars, bus lanes, on-street bike lanes, on-street parking, and medians. It also encompasses any necessary infrastructure like street lights, traffic signs, and drainage systems.

Street Elements

+ Vehicular travel and turn lanes
+ Transit lanes
+ Parking/flex zones
+ On-street bike lanes
+ Medians
+ Curb and gutter

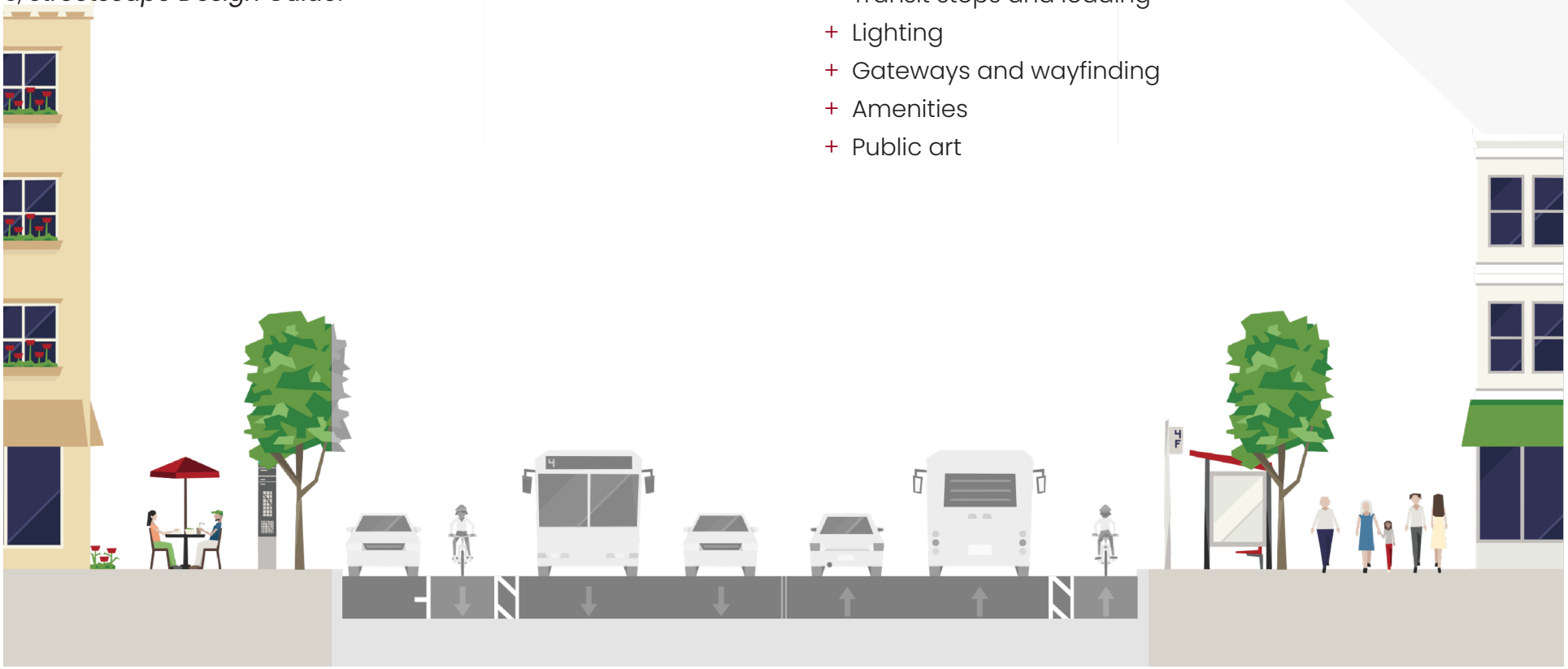


The Streetscape

The streetscape refers to the overall appearance, design, and character of the street and its surrounding environment. It encompasses not only the physical elements of the street itself but also the adjacent buildings, landscaping, street furniture, and other elements that contribute to the overall visual and functional experience of the street. These elements are detailed in Chapter 5, *Streetscape Design Guide*.

Streetscape Elements

+ Sidewalk/pedestrian zone
+ Curb cuts/driveways
+ Landscaping
+ Green infrastructure
+ Furnishings
+ Transit stops and loading
+ Lighting
+ Gateways and wayfinding
+ Amenities
+ Public art



Multimodal Transportation Vision

RTP 3.0 will ultimately transform the existing traditional suburban office park to a destination with a denser and greater mix of land uses. To achieve this vision, the transportation infrastructure needs to support multimodal travel by including facilities for people walking, biking, taking transit, and using other personal mobility devices. In pursuit of this goal , this plan is consistent with the NCDOT Complete Streets Guide and WalkBike NC.

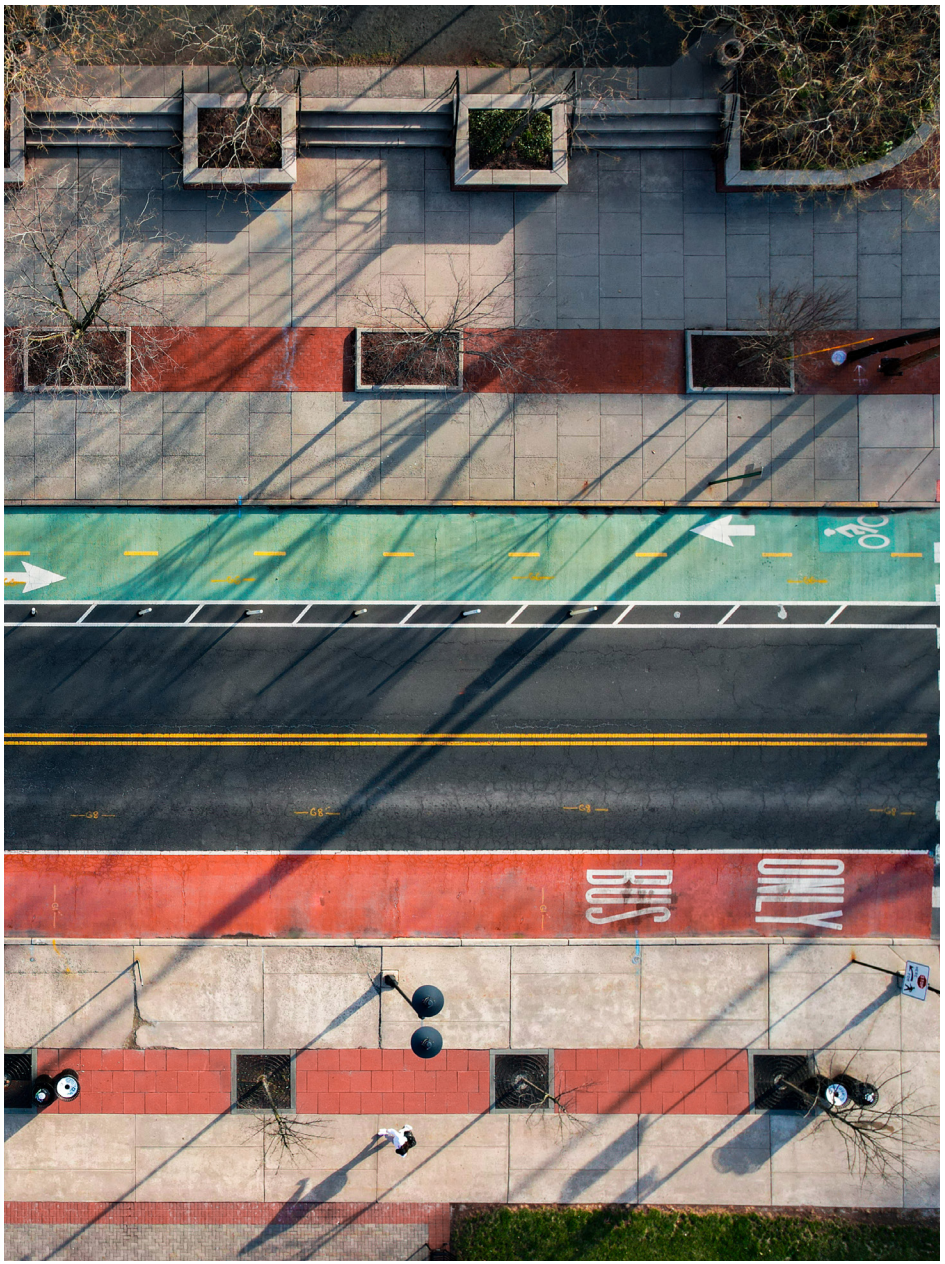
Complete Streets

Complete Streets is a nationwide policy approach that requires streets to be planned and designed to prioritize safety, comfort, and access to destinations for all people who use the street, regardless of their mode of transportation. Creating Complete Streets helps to ensure RTP is accessible and welcoming for the most vulnerable populations, including children, older adults, people living with disabilities, and people who do not have access to a car.

A Complete Street is not a single design, but rather a flexible approach to designing a street that best fits the surrounding community. Under the Complete Streets approach, community needs are key in determining the final street design.

NCDOT Complete Streets Guide

The NCDOT Complete Streets Implementation Guide is designed to assist department staff engineers, project managers, and designers in implementing the Complete Streets Policy as adopted by the NCDOT Board of Transportation. The document provides comprehensive guidance for incorporating a Complete Streets approach into NCDOT's planning, programming, design, and maintenance processes.



WalkBike NC

WalkBike NC, North Carolina's Bicycle and Pedestrian Plan, lays out a framework for improving bicycle and pedestrian transportation through the lens of five pillars.

- **Safety**
  Promote safety for all roadway and non-roadway users through strategic, consistent, and coordinated pedestrian and bicycle facility improvements, education, and enforcement strategies.

- **Health**
  Contribute to improved public health by providing active living environments with safe, connected, and accessible facilities along with programs that encourage walking and bicycling.

- **Economy**
  Maximize economic competitiveness, return on investment, and employment opportunities by creating more attractive walkable and bikeable communities through increased public and private funding.

- **Mobility**
  Improve mobility and accessibility and reduce traffic congestion through greater investment in walking and biking infrastructure, improved transportation equity and choice, connectivity among transportation modes, and reduced traffic congestion through coordinated land use and transportation planning.

- **Environment**
  Be good stewards of the environment by reducing automobile dependence, completing a Greenprint Plan for North Carolina, and linking together the state's natural and cultural resources through a statewide network of greenways.

The Six Es

The Six Es emphasize a multi-pronged approach to implementing bicycle and pedestrian facilities along with the policies and actions that can be taken to support community use for safe, comfortable, and connected active transportation networks.

- **Education**
  Development and information sharing activities related to safely navigating walking and biking trips.

- **Encouragement**
  Community-facilitated programs that introduce people to walking or biking through walking groups or organized bike rides.

- **Engineering**
  The design and installation of pedestrian and bicycle infrastructure.

- **Equity**
  Facilitating targeted outreach to underrepresented and vulnerable population groups in multimodal facility planning, design, education, and encouragement.

- **Enforcement**
  Application and enforcement of traffic safety laws and regulations.

- **Evaluation + Planning**
  Studying, planning, and measuring the walking and biking environment. Evaluation involves measuring the success of investments in achieving desired outcomes.

Sidewalk + Pedestrian Zone

Overview

Sidewalks are conduits for pedestrian movement and access by providing a dedicated walkway along a street. Sidewalks can serve multiple purposes, providing neighborhood and home access, a dedicated travelway, or even an activated space used for sitting, dining, or recreation within a more urban pedestrian zone.

Benefits

+ Creates a network for pedestrian travel
+ Improves safety along a street
+ Sidewalks support first-mile/last-mile connections to transit
+ Support commuter, utilitarian, or recreational travel and provide spaces for lingering, resting, shopping, dining, and other activities that contribute to a vibrant and lively street

Application

+ Sidewalks should be present along all streets and a wider pedestrian zone should be included in more urban and mixed-use areas
+ The widths of sidewalks vary can based on context but should be no less than 5 feet. See Chapter 4, Cross-Sections for specific dimension guidelines.
+ Sidewalks should only be used by pedestrians or wheelchair users. Motorized vehicles or personal mobility devices such as bicycles, scooters, roller skates, or skateboards should not utilize sidewalks
+ Sidewalks must be in compliance with the Americans with Disabilities Act (ADA)
+ Sidewalks must be free of obstructions including utilities, light poles, traffic signals, trees, and street furniture

Pedestrian Zone

Shaded Sidewalk

Supportive Facilities

The pedestrian experience is incomplete without the supportive facilities that are both necessities and amenities to users of sidewalks. The following infrastructure is needed to ensure the safe, comfortable, and connected transport of pedestrians:

Features

+ Lighting
+ Benches and seating
+ Pedestrian-scale wayfinding
+ Water fountains
+ Trash receptacles
+ Street trees and landscaping
+ Awnings and shade
+ Transit shelters
+ Public art
+ Public and accessible restrooms

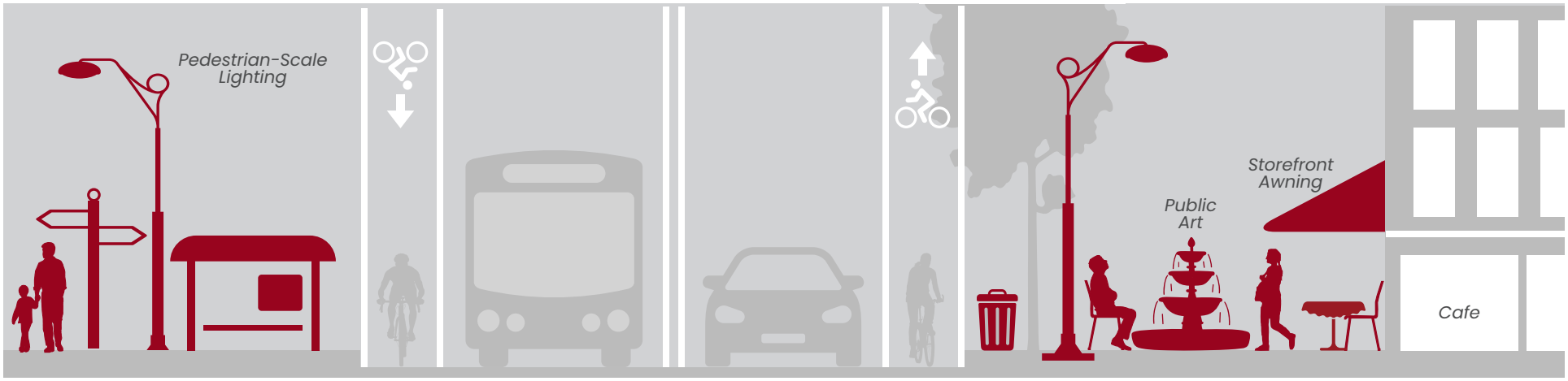
Benefits

+ Increased safety
+ Increased comfort
+ Improved access and connectivity
+ Increased convenience and incentivized use
+ Subsequent health benefits from recreation and exercise
+ Economic generator
+ Improved aesthetics

Placement

+ Pedestrian-scale lighting should be located between street lighting poles
+ Benches should be available without obstructing the walkway
+ Wayfinding signs should be at the pedestrian scale and provide clear direction at key intersections
+ Trash receptacles should be provided at every seating area

See Chapter 5, *Streetscape Design Guide* for additional placement details.



Bicycle Facilities

Overview

Bicyclists are often the most overlooked user in roadway planning and design even though it's a critical mode of transportation. Bikes fill in a critical gap between foot-travel and driving by allowing people to travel further distances by accessible and inexpensive means. The distance a person can ride a bike comfortably has even increased with the proliferation of the electric bicycles (e-bikes). Though the bike lane is specific in name by national roadway design standards, the facilities can still be utilized by other personal mobility devices such as scooters. Building the infrastructure for bike lanes now will also allow for flexibility of that pavement in the future should other micromobility devices be invented. For all these reasons and more, bicycle facilities are a highly prioritized mode of travel in this CTP.

Benefits

+ Improves safety and predictability (dedicated bike lanes not only provides the space needed to separate bikes from cars but also defines right-of-way and behavior)
+ Improves accessibility for bicyclists and other personal mobility devices
+ Supports first-mile/last-mile connections to transit
+ Increases roadway capacity

Applications

+ Adjacent to motor vehicle lanes and flows in the same direction as motor vehicle traffic (with the exception of a cycle track)
+ Streets with high transit volume
+ Streets with less than 3,000 vehicles per day and less than 20 mph can include a shared lane marking (sharrow) or bike boulevard
+ Streets with less than 6,000 vehicles per day and less than 30 mph should include a buffered bike lane

All Ages and Abilities

For bicycle facilities to be effective and accessible they need to follow design standards that would allow a user of any age and any experience level to be comfortable riding.

Supportive Facilities

Bike lanes should be supported by the following facilities to encourage a safe and successful bike network:

Features

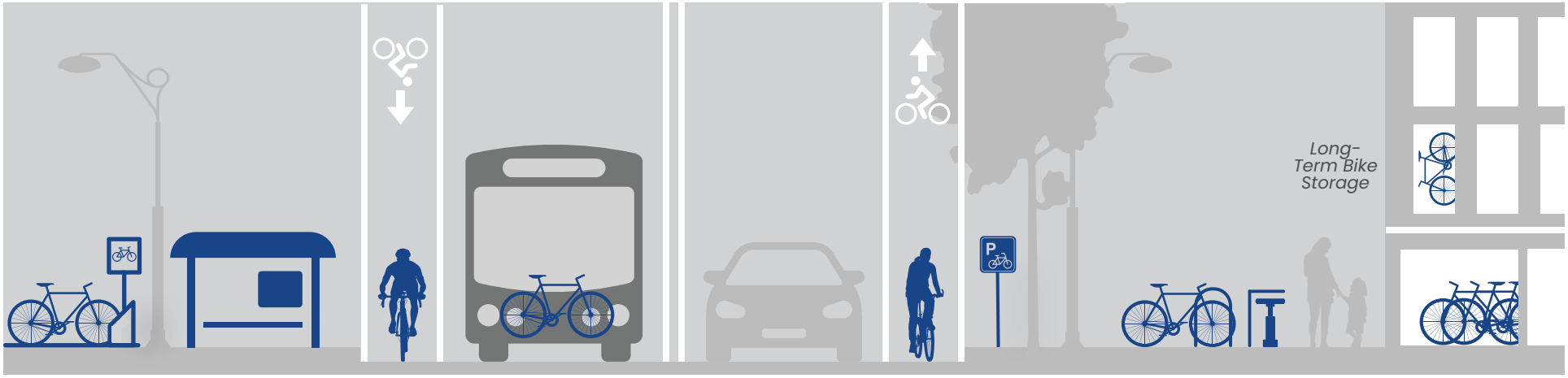
+ Bicycle wayfinding
+ Bike parking (racks, protected/covered, indoor, and long-term storage)
+ Bike shop
+ Bike repair station/air pump
+ Bike and scooter shares with e-bikes and e-scooters available
+ Bus bike racks
+ Street trees and landscaping
+ Transit shelters

Benefits

+ Increased safety
+ Increased comfort
+ Improved access and connectivity
+ Increased convenience and incentivized use
+ Subsequent health benefits from recreation and exercise
+ Economic generator

Placement

+ Bike wayfinding signs should be clearly marked and visible from the bike lane or facility
+ Bike racks, should be available less than 50 feet away from key destinations while protected, indoor bike parking, or long-term bike storage can be provided at strategic, higher-traffic destinations such as a transit hub or mixed-use developments
+ Rideshare stations should be strategically placed at key mixed-use destinations
+ Bike repair stations should be logically placed with rideshare stations or larger bike parking areas



Multiuse Paths

Overview

Multiuse paths provide a hybrid facility that both pedestrians and bicyclists can share. Multiuse paths are physically separated from vehicular travel lanes, typically located where a sidewalk would be. The separation provided by a landscaped barrier makes multiuse paths one of the safest and most comfortable facilities for bicyclists and pedestrians.

Benefits

+ Improves safety
+ Improves accessibility for bicyclists and pedestrians
+ Supports first-mile/last-mile connections to transit
+ Provides route for commuter, utilitarian, or recreational travel
+ Provides seamless connectivity between the street network and greenway trails

Applications

+ Separated from motor vehicle traffic
+ Designed for two-way travel
+ Streets with more than 6,000 vehicles per day and more than 30 mph
+ The widths of multiuse paths vary based on context but should be no less than 10 feet. See Chapter 4, Cross-Sections for dimensions

Multiuse Path

Multiuse Trail

Supportive Facilities

The infrastructure needed to support the safe and effective utilization of multiuse paths greatly overlaps with those for sidewalks and bike lanes but there are some unique needs:

Features

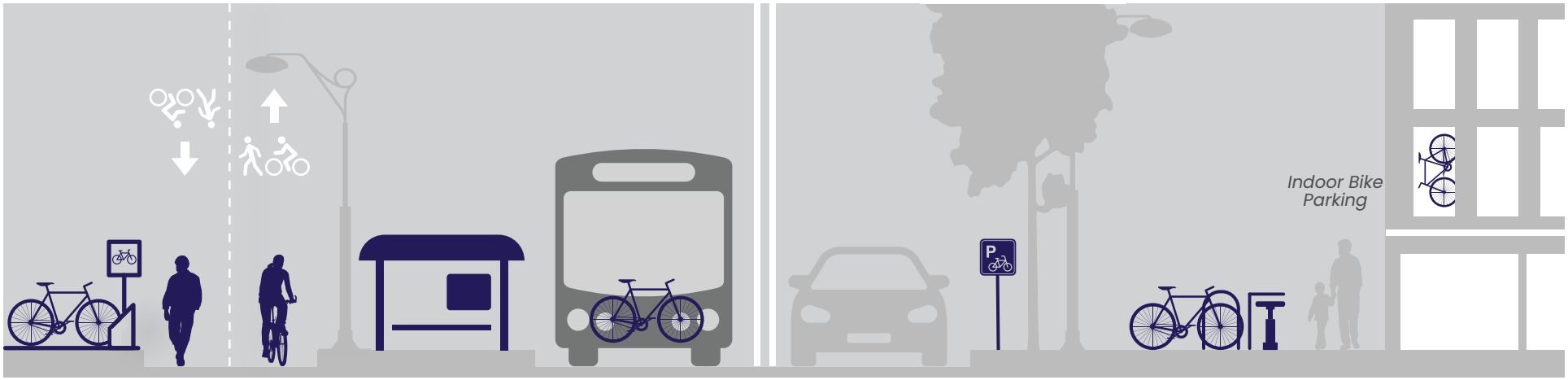
+ Lighting
+ Benches and seating
+ Pedestrian- and bicycle-scale wayfinding and striping
+ Bike racks
+ Bike repair station/air pump
+ Bike and scooter shares with e-bikes and e-scooters shares
+ Water fountains
+ Trash receptacles
+ Exercise equipment
+ Street trees and landscaping
+ Transit shelters
+ Public art

Benefits

+ Increased safety
+ Increased comfort
+ Improved access and connectivity
+ Increased convenience and incentivized use
+ Subsequent health benefits from recreation and exercise

Placement

+ Pedestrian-scale lighting should be placed along the multiuse path and at bridges and crossings
+ Benches should be available every mile and within 1/2 mile of path entrances
+ Wayfinding signs should be clearly marked and visible
+ The path should be striped to indicate directionality
+ Trash receptacles should be provided at the entrance of each path and at seating areas along the path (one per every two benches)



Greenway Highlight

Another element of RTP 3.0 includes the development of a greenway master plan. The greenway is envisioned to be a key north-south running connection over eight miles through the heart of RTP. While RTP has existing mountain biking trails and on-street multiuse paths, the greenway will be the spine of a greater recreational and greenspace experience through the Park. The greenway's alignment, as it's currently planned, will weave together key corporate campuses and future development and destinations within RTP to offer opportunities for multimodal commuting, recreation, and leisure.

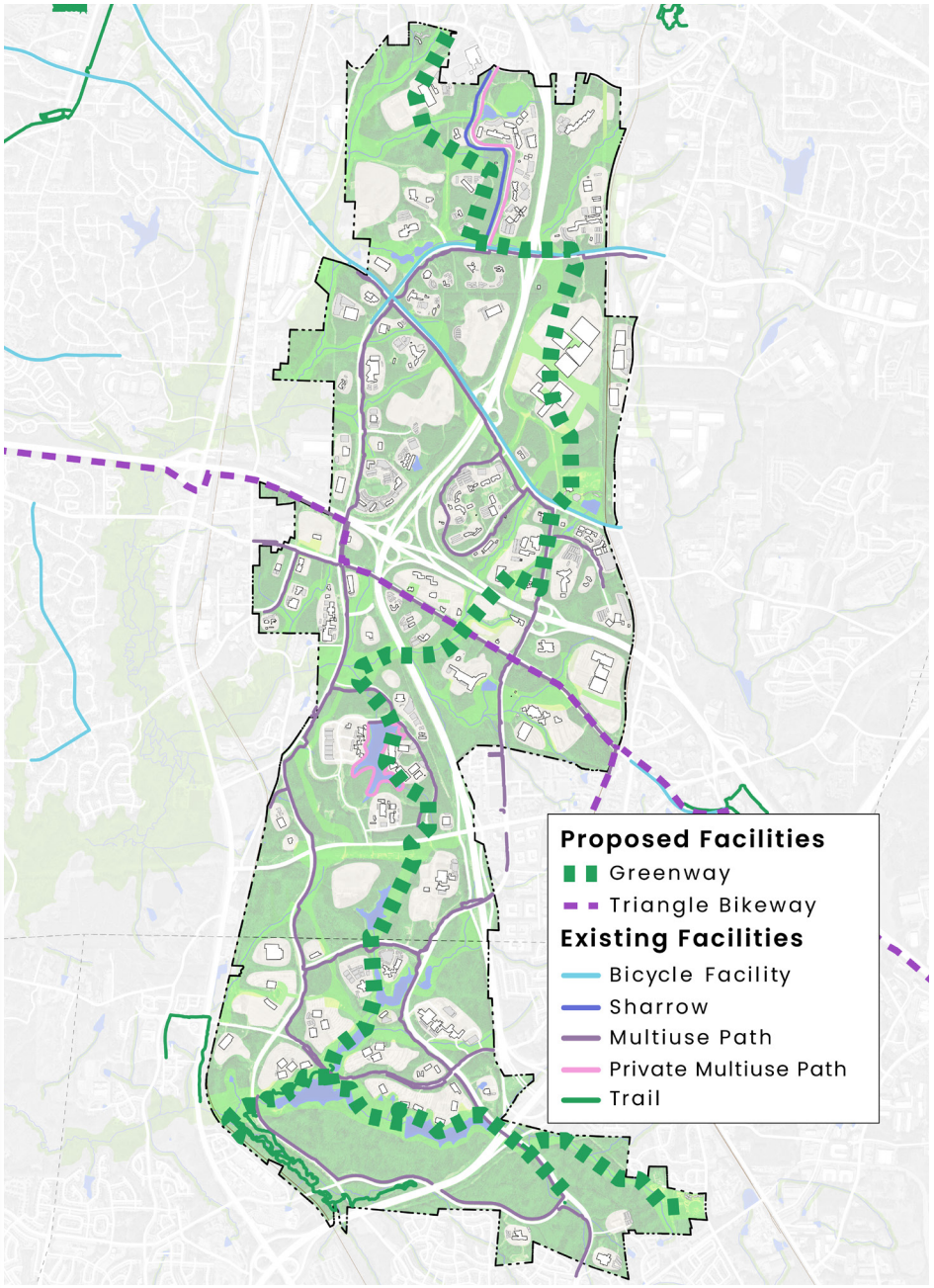
Key Connections

In addition to the local employment, retail, and recreation destinations that the greenway will connect, it will also be a key piece to a larger regional trail network. With the implementation of the Triangle Bikeway, the RTP greenway will connect to the American Tobacco Trail where it crosses I-40, west of Fayetteville Road. The American Tobacco Trail is a 10-foot wide, paved, off-road trail which follows the old CSX railroad for 11 miles. This connection, along with the realization of the Triangle Bikeway, will provide open up RTP to multimodal access from Raleigh, Cary, Morrisville, Durham, and Chapel Hill.

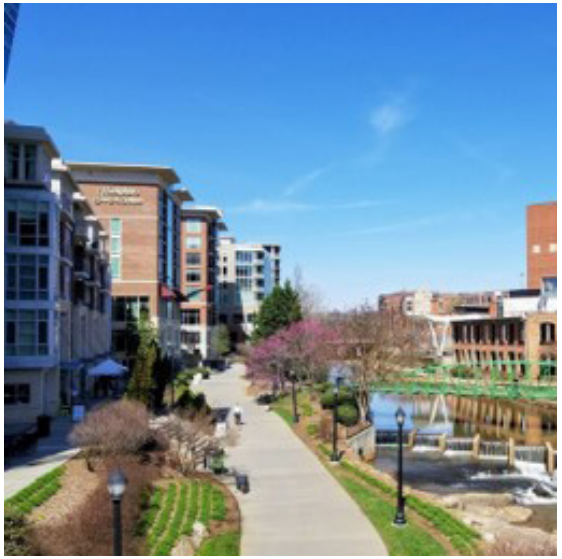
Greenway Goals

+ Build on and enhance existing RTP trail network
+ Align with natural systems
+ Connect existing and future assets and amenities
+ Spur economic development
+ Increase non-vehicular modes of circulation

Greenway Alignment



Greenway Visioning



Micromobility and Microtransit

As a long-range plan, there's variability and obscurity in the transportation technologies that will be available within the 60 year horizon. With this uncertainty, the CTP can offer strategies to best prepare RTP for implementing the existing and known technologies without precluding innovation in the future.

The Greenway as an Innovative Transportation Route

As a key connection through the entire Park, the greenway should incorporate the supportive facilities discussed earlier in this chapter, including bike- and scooter-shares. While the primary user of the greenway will be pedestrians and bicyclists, the greenway will also be a vital asset to future transit connectivity as a route that autonomous microtransit vehicles could utilize to transport people through RTP.

Bike-Share

Bike Shares

Bike shares serve shorter trips in urbanized areas with good connectivity and existing bicycle infrastructure. Programs already exist in the Triangle that promote bike share services.

+ Effectively bridges some of the gaps in transportation networks
+ Electric bicycles (e-bikes) and standard bicycles can be offered


E-Scooter-Share

Electric Scooter Sharing

Dockless electric scooter (e-scooter) share programs have accelerated in popularity in recent years. E-scooter rideshares are available in urbanized areas of Wake and Durham Counties.

+ Consumers rent on a per-ride basis using a smartphone
+ Typically operated by private companies

CAV Transit Vehicles

Microtransit enhances mobility where fixed-route transit is not productive due to low density, poor street connectivity, or other factors. Connected and autonomous microtransit vehicles could potentially utilize the greenway network for quick and reliable transportation throughout the RTP. CAVs that share facilities with bicyclists and pedestrians would operate at low speeds for safety.

Features

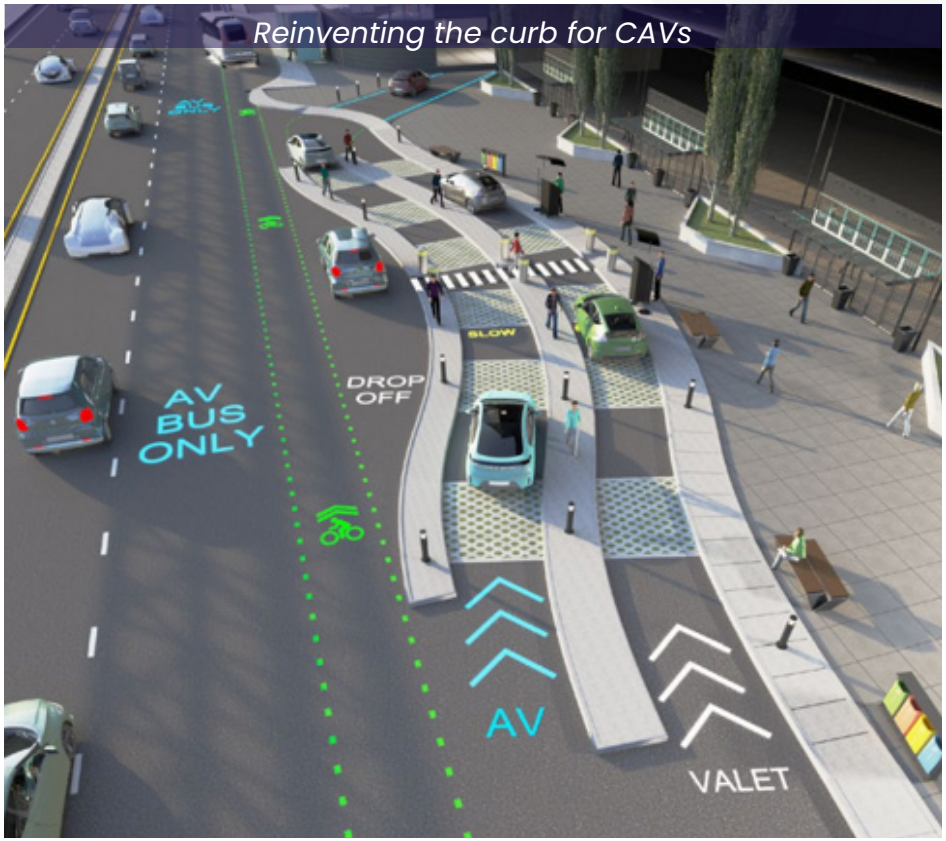
+ Flexibility in terms of operations and the type of vehicle used
+ Increases multimodal options and access with lower costs than fixed-route service
+ Services can be scheduled, partially on-demand, or fully on-demand
+ A contracted microtransit operator may provide any or all of the technology, vehicles, drivers, maintenance, and other operations

Low-speed automated shuttle (CASSI)

Future Parking Trends

+ App-based and contactless control
+ Flexible parking
+ Increase in CAVs
+ Mobility Hubs
+ Mixed-use service hubs

Reinventing the curb for CAVs



Flex Zones

Flex zones are temporary parking spaces that serve a number of uses, including rideshare pick-up and drop-off, freight loading, and valet services. Flex zones are adaptive facilities and can transform based on the tenant's and community's needs.

Reinvent the Curb

Modernized curbs enhance the parking experience for motorists while prioritizing the safety and comfort of other modes.

+ Expanded curbs and pull-off lanes for rideshare and bus pick-up/drop-off
+ Pedestrian-friendly drop-off and loading zones
+ Valet services for enhanced customer service and rapid/ attentive loading and unloading

Parklets

Parklets are public seating platforms that can replace underutilized parking stalls with vibrant community spaces.

+ Increases supply of public space in commercial and mixed-use areas
+ Foster foot traffic and revenue for adjacent businesses
+ Buffered using a wheel stop to ensure visibility to moving traffic and parking cars

Parklet


Parklet

Intersection Treatments

The safety and connectivity of multimodal users is often overlooked at intersections even though pedestrians and bicyclists are most vulnerable at cross-roads. This section identifies intersection facilities and treatments that should be implemented at intersections to ensure the safety and comfort of all users.

Curb Extensions

Overview

Curb extensions are created by extending the sidewalk at the corners of an intersection. Curb extensions both shorten the crossing distance for pedestrians and reduce travel lane widths, effectively slowing turns made by vehicles.

Benefits

+ Provide additional space for pedestrians to walk or gather
+ Create additional space for ADA compliant curb ramps, utilities, signs, and amenities
+ Calm and slow vehicular traffic and improve pedestrian visibility
+ Reduce crossing distances

Pedestrian Signal and Crosswalk Treatments

Overview

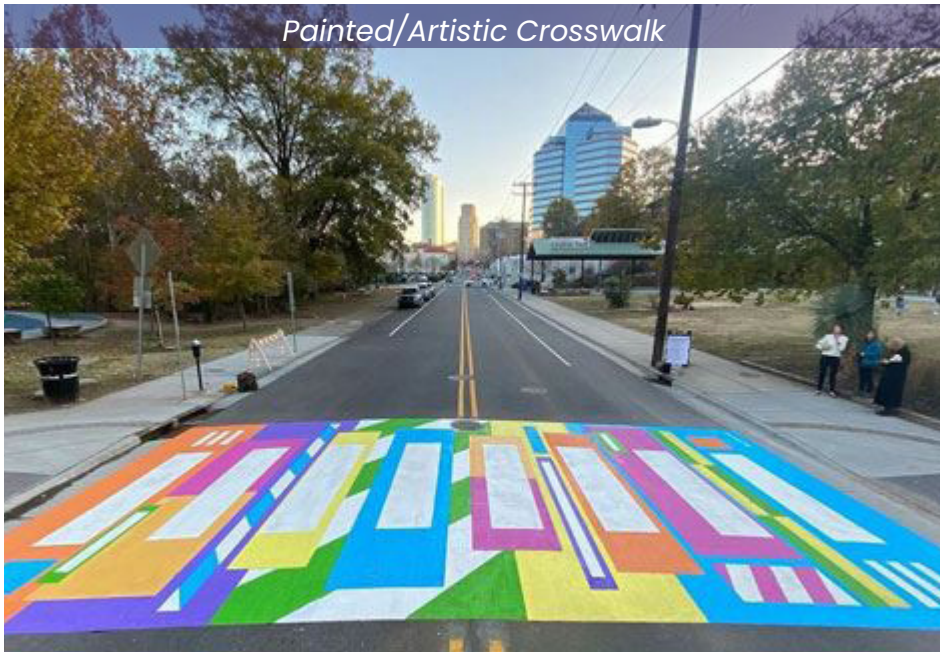
There are a variety of crosswalk and pedestrian signal treatments that enhance the safety of a traditional signalized, zebra-striped crossing.

+ Signal Options
  - Leading pedestrian interval
  - Accessible pedestrian signal heads
  - Restricting right turns on red
  - Pedestrian hybrid beacons at midblock crossings
+ Crosswalk Treatments
  - Painted/artistic crosswalk
  - Pedestrian refuge islands
  - Raised crosswalks and intersections

Benefits

+ Signal Options
  - Provide pedestrians more time
  - Improve visibility of pedestrians to cars
  - Accessibility for disabled users
  - Fewer crashes
+ Crosswalk Treatments
  - Color, texture, and grade changes provide visual cues to cars to slow down and be aware
  - Median refuge provides physical resting area for pedestrians

Raised Crosswalks and Intersections


Painted/Artistic Crosswalk

Bike Crossings

Overview

There are a variety of crosswalk and pedestrian signal treatments that enhance the safety of a traditional signalized, zebra-striped crossing.

+ Bike boxes
+ Intersection crossing markings
+ Two-stage turn queue boxes
+ Median refuge island
+ Combined bike and turn lane

Benefits

+ Increase visibility of bicyclists
+ Reduce right-hook conflicts with turning vehicles
+ Enable bicyclists to clear intersections quickly
+ Enhance safety and comfort of bicyclists at all skill levels
+ Reinforce bicyclist right-of-way and priority

Bike Box at Signalized Intersection

Bicycle Crossing

04

Cross-Sections

Cross-Sections

Roadway cross-sections are a vital component to a CTP because they determine the ultimate build-out of a project. This chapter culminates in defined cross-sections by first walking through land use integration and street hierarchy.

A cross-section outlines the design elements of a given roadway in the designated right-of-way. A road's cross-section will include the number of lanes, presence of a median, provisions for bicycles and pedestrians, and other elements that serve as a guideline during the project design phase.

The CTP was designed to be an adaptable planning document and for each cross-section, there may be more than one option. By building flexibility into the guiding planning document, the RTF can be better equipped to make decisions in the future based on changing circumstances. This flexibility is also represented in the cross-section dimensions which can vary. This gives RTF the ability to tailor roadway elements to the context that they are intended to serve while still holding developers to a set standard provided by the minimum and maximum dimensions allowable.

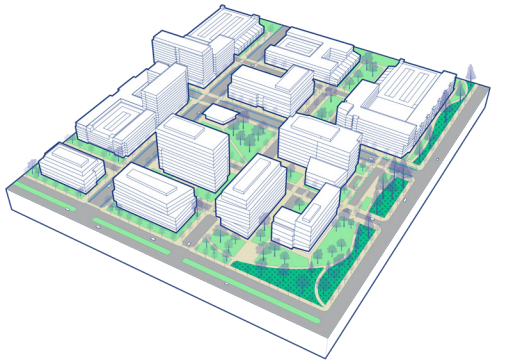
Transportation and Land Use

The connection between transportation and land use can highlight the synergies of long range planning. One goal of the CTP is to align the transportation recommendations with desired land use goals defined as part of RTP 3.0 process.

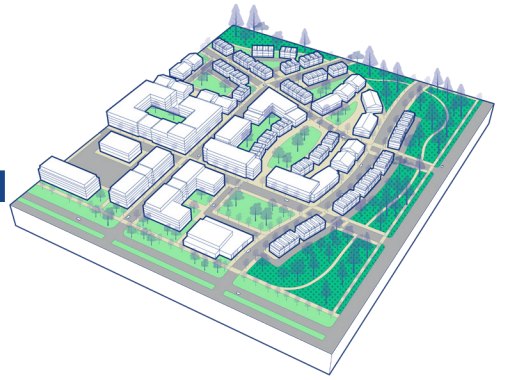
Place Types

Place Types are a classification system that provide guidance on the land uses, transportation amenities, and building form that is appropriate for an area. The rezoning and development standards proposed as part of RTP 3.0 include the three following place types.

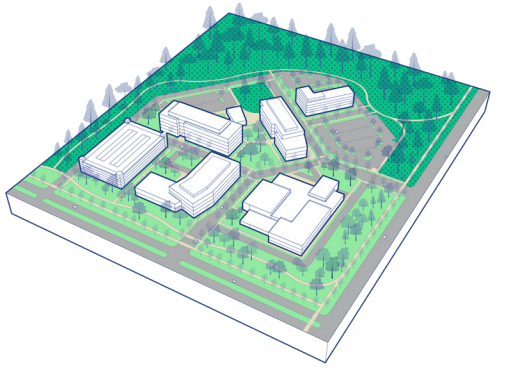
Mixed-Use Node



Residential Neighborhood Development



Enhanced Corporate Campus



Roadway Hierarchy

The two primary demands of any roadway network are to provide access while offering mobility options. These can be in competition with one another and therefore, provide challenges when attempting to balance the needs of an entire transportation network. By creating roadways that are responsive to the unique context and user needs, a given corridor is able to provide enhanced access and mobility.

Thoroughfare

The following features are characteristic of a thoroughfare:

+ Usually 4-lanes
+ Prioritizes movement through an area while still offering local access

Collector

The following features are characteristic of a collector street:

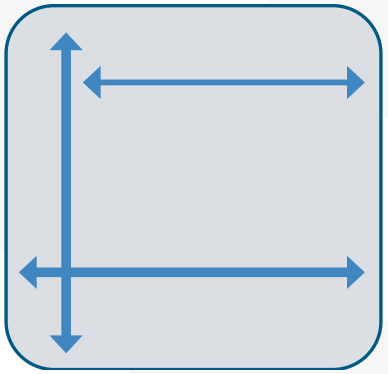
+ Usually 2-4 lanes
+ Balances mobility and access by supporting local development
+ Acts as a conduit for local traffic to connect to thoroughfares
+ Includes slower travel speeds

Local

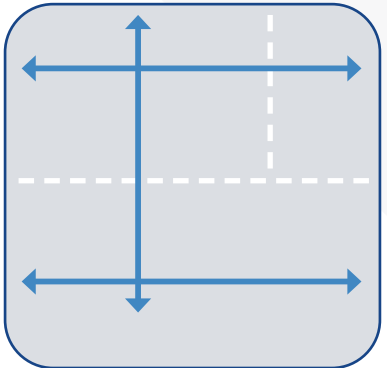
The following features are characteristic of a local street:

+ Usually 1-2 lanes
+ Provides slow-moving, local streets
+ Provide block-level access and safe connectivity to higher order streets

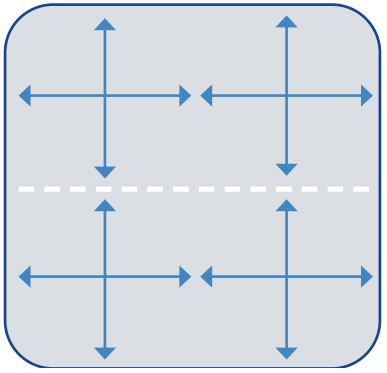
Thoroughfare



Collector



Local



CTP Road Description	Posted Speed	Width	Building Setback	Clear/Shy/Door Zone	Pedestrian Zone/ Sidewalk	Planting/Verge/ Furnishing	Multiuse/Bike Facility	Planting/Lighting/ Verge/Furnishing/ SCM	C&G	Bike Lane	Bike Buffer	Parking Lane/Flex Zone	Bike Lane	Bus Rapid Transit	Thru Lane	Thru Lane	C&G	Bus Rapid Transit
Thoroughfare Street with BRT - Center-Running																		
Central boulevard providing BRT	35-45mph	Included (filled in)					↓↑								↓	↓		↓
		Width Preferred	4'	2'	8'	4'	12'	8'	2'						10'	10'	1'	12'
		Width Options	0'-10'		8'-10'	0.5'-4'	10'-12'	4'-12'							10'-11'	10'-11'	1'-3'	
Thoroughfare Street with BRT - Side-running																		
Central boulevard providing BRT	35-45mph	Included (filled in)					↓↑	Station						↓	↓	↓		
		Width Preferred	4'	2'	8'	4'	12'	12'	2'					12'	10'	10'		
		Width Options	0'-10'		8'-10'	0.5'-4'	10'-12'	8'-12'							10'-11'	10'-11'		
Thoroughfare A																		
Central boulevard through and connecting corporate campuses	35mph	Included (filled in)					Opt. ↓↑			Opt. ↓	Opt				↓	↓		
		Width Preferred	2'	2'	8'	4'	10'	6'	2'	5'	3'				11'	10'		
		Width Options	0'-6'		6'-10'	0.5'-4'	8'-12'	4'-10'		5'-6'					10'-12'	10'-11'		
		Width Options	0'-6'		6'-10'	0.5'-4'	8'-12'	4'-10'				8'-8.5'	5'-6'			10'-11'		
Thoroughfare Street with Median																		
Central boulevard through and connecting TOD centers	35-45mph	Included (filled in)								Opt. ↓	Opt.				↓	↓		
		Width Preferred	4'	2'	8'			8'	2'	5'	3'				10'	10'	2'	
		Width Options	0'-10'		5'-10'			4'-12'		5'-6'					10'-11'	10'-11'		
Thoroughfare B																		
Central boulevard connecting neighborhoods	35mph	Included (filled in)					↓↑								↓	↓		
		Width Preferred	2'	2'			10'	8'	2'						11'	10'		
		Width Options	0'-6'				8'-12'	4'-10'							10'-12'	10'-11'		
Collector Street Four Lane																		
Urban street through mixed-use nodes	25-35mph	Included (filled in)				Opt.	Opt. ↓↑			Opt. ↓	Opt.	Opt.	Opt. ↓		↓	↓		
		Width Preferred	4'	2'	8'	0.5'	12'	6'	2'	5'	3'	8'	6'		10'	10'		
		Width Options	0'-10'		5'-10'	0.5'-4'	10'-12'	4'-10'		5'-6'		8'-8.5'	5'-6'		10'-11'	10'-11'		
Collector Street Three Lane																		
Urban street through mixed-use nodes	25-35mph	Included (filled in)				Opt.	Opt. ↓↑			Opt. ↓	Opt.	Opt.	Opt. ↓			↓		
		Width Preferred	4'	2'	8'	0.5'	12'	6'	2'	5'	3'	8'	6'			10'		
		Width Options	0'-10'		5'-10'	0.5'-4'	10'-12'	4'-10'		5'-6'		8'-8.5'	5'-6'			10'-11'		

The maximum building setback from curb is 30' when no multiuse path is present
[1]Must be greater than 20' (35-45 mph) for large street trees in median or 12' (35-45 mph) for small trees with C&G
Thoroughfare - assumed small tree only if verge is between 4-11'

Median/Turn Lane	Bus Rapid Transit	C&G	Thru Lane	Thru Lane	Bus Rapid Transit	Bike Lane	Parking Lane/Flex Zone	Bike Buffer	Bike Lane	C&G	Planting/Lighting/ Verge/Furnishing/ SCM	Multiuse/Bike Facility	Planting/Verge/ Furnishing	Pedestrian Zone/ Sidewalk	Clear/Shy/Door Zone	Building Setback	Back of Curb to Back of Curb (B/B)	Total ROW *(not inclusive of frontage)*
Station	↑		↑	↑														
14'	12'	1'	10'	10'						2'	8'			8'	2'	4'	84.0'	134.0'
		1'-3'	10'-11'	10'-11'							4'-12'			8'-10'		0'-10'		
			↑	↑	↑						Station							
			10'	10'	12'					2'	12'			8'	2'	4'	70.0'	128.0'
			10'-11'	10'-11'							8'-12'			8'-10'		0'-10'		
			↑	↑				Opt.	Opt. ↑									
			10'	11'				3'	5'	2'	6'			8'	2'	2'	62.0'	106.0'
			10'-11'	10'-12'					5'-6'		4'-10'			6'-10'		0'-6'		
			10'-11'			5'-6'	8'-8.5'				4'-10'			6'-10'		0'-6'		
			↑	↑				Opt.	Opt. ↑									
13.5'		2'	10'	10'				3'	5'	2'	12'			8'	2'	4'	77.5'	111.5'
13.5'-26'^			10'-11'	10'-11'					5'-6'		8'-12'			5'-10'		2'-10'		
			↑	↑								↓↑						
			10'	11'						2'	8'	10'			2'	2'	48.0'	86.0'
			10'-11'	10'-11'							4'-10'	8'-12'				0'-6'		
			↑	↑		Opt. ↑	Opt.	Opt.	Opt. ↑									
			10'	10'		6'	8'	3'	5'	2'	6'			8'	2'	4'	76.0'	122.0'
			10'-11'	10'-11'		5'-6'	8'-8.5'		5'-6'		4'-10'			5'-10'		0'-10'		
↖↘			↑			Opt. ↑	Opt.	Opt.	Opt. ↑									
11'			10'			6'	8'	3'	5'	2'	6'			8'	2'	4'	67.0'	113.0'
11'-13'			10'-11'			5'-6'	8'-8.5'		5'-6'		4'-10'			5'-10'		0'-10'		

Goals

Support transit-oriented, mixed-use development patterns

+ Create a street grid/blocks
+ Allow on-street parking to encourage retail access
+ Provide safe and accessible bicycle and pedestrian infrastructure
+ Facilitate transit connectivity
+ Include landscaping/ streetscaping to develop the pedestrian and public realm

Preferred Option

Collector - assumed small tree only if verge is between 4-7' with no on-street parking or bike facilities
Local - assumed small tree only if verge is between 4-7' with no on-street parking or bike facilities
SCM - Stormwater Control Measure; bioretention

CTP Road Description	Posted Speed	Width	Building Setback	Clear/Shy/Door Zone	Pedestrian Zone/ Sidewalk	Planting/Verge/ Furnishing	Multiuse/Bike Facility	Planting/Lighting/ Verge/Furnishing/ SCM	C&G	Bike Lane	Bike Buffer	Parking Lane/Flex Zone	Bike Lane	Thru Lane	Thru Lane	C&G
Collector Street with Multimodal Median																
Activated corporate campus street	15-25mph	Included (filled in)										Opt.			↓	
		Width Preferred	2'	2'	8'			6'	2'			8'			10'	
		Width Options	0'-10'		6'-10'			4'-10'				8'-8.5'			11'-14'	
Local Street Two Lane																
Urban street within mixed-use nodes	15-25mph	Included (filled in)											Opt. ↓		↓	
		Width Preferred	4'	2'	6'			6'	2'	5'	3'	8'	6'		10'	
		Width Options	0'-10'		5'-10'			4'-8'		5'-6'		8'-8.5'	5'-6'		10'-11'	
														Optional Sharrow		
Local Street Two-Way																
Internal residential street with wide lanes and unmarked parking	15-25mph	Included (filled in)														
		Width Preferred	0'	2'	6'			5'	2'			8'				
		Width Options	0'-6'		5'-7'			4'-8'				On-Street Parking Assumed				
Local Street Alley																
Shared street/ally with primary pedestrian use	5mph	Included (filled in)														
		Width Preferred	2'	2'												
		Width Options	0'-10'													
Local Street One-Way																
Shared street/ally with primary pedestrian use	5mph	Included (filled in)														
		Width Preferred	15'					5'								
		Width Options	15'-20'					4'-8'								

For RND-C2-3 the maximum building setback from curb is 25'
^ Must be greater than 16' (25-35 mph) or 20' (35-45 mph) for large street trees in median; or 6' (25-35 mph) or 12' (35-45 mph) for small trees with C&G
Thoroughfare - assumed small tree only if verge is between 4-11'
Collector - assumed small tree only if verge is between 4-7' with no on-street parking or bike facilities
Local - assumed small tree only if verge is between 4-7' with no on-street parking
SCM - Stormwater Control Measure; bioretention

Median/Alley	C&G	Thru Lane	Thru Lane	Bike Buffer	Bike Lane	Parking Lane/Flex Zone	Bike Buffer	Bike Lane	C&G	Planting/Lighting/ Verge/Furnishing/ SCM	Multiuse/Bike Facility	Planting/Verge/ Furnishing	Pedestrian Zone/ Sidewalk	Clear/Shy/Door Zone	Building Setback	Back of Curb to Back of Curb (B/B)	Total ROW *(not inclusive of frontage)*
Activated multimodal zone		↑				Opt.											
28'		10'				8'			2'	6'			8'	2'	2'	72.0'	100.0'
16'-28'^		11'-14'				8'-8.5'				4'-10'			6'-10'		0'-10		
		↑			Opt. ↑												
		10'			6'	8'	3'	5'	2'	6'			6'	2'	4'	40.0'	66.0'
		10'-11'			5'-6'	8'-8.5'		5'-6'		4'-8'			8'-10'		10-10'		
Opt. ↑↓																	
16'									2'	5'			6'	2'	2'	28.0'	54.0'
12'-24'										4'-8'			5'-7'		2'-6'		
Alley																	
20'														2'	4'	20.0'	24.0'
12'-24'															0'-10'		
One-Way																	
16'										5'					15'	16.0'	30'
14'-20'										4'-8'					15'-20'		

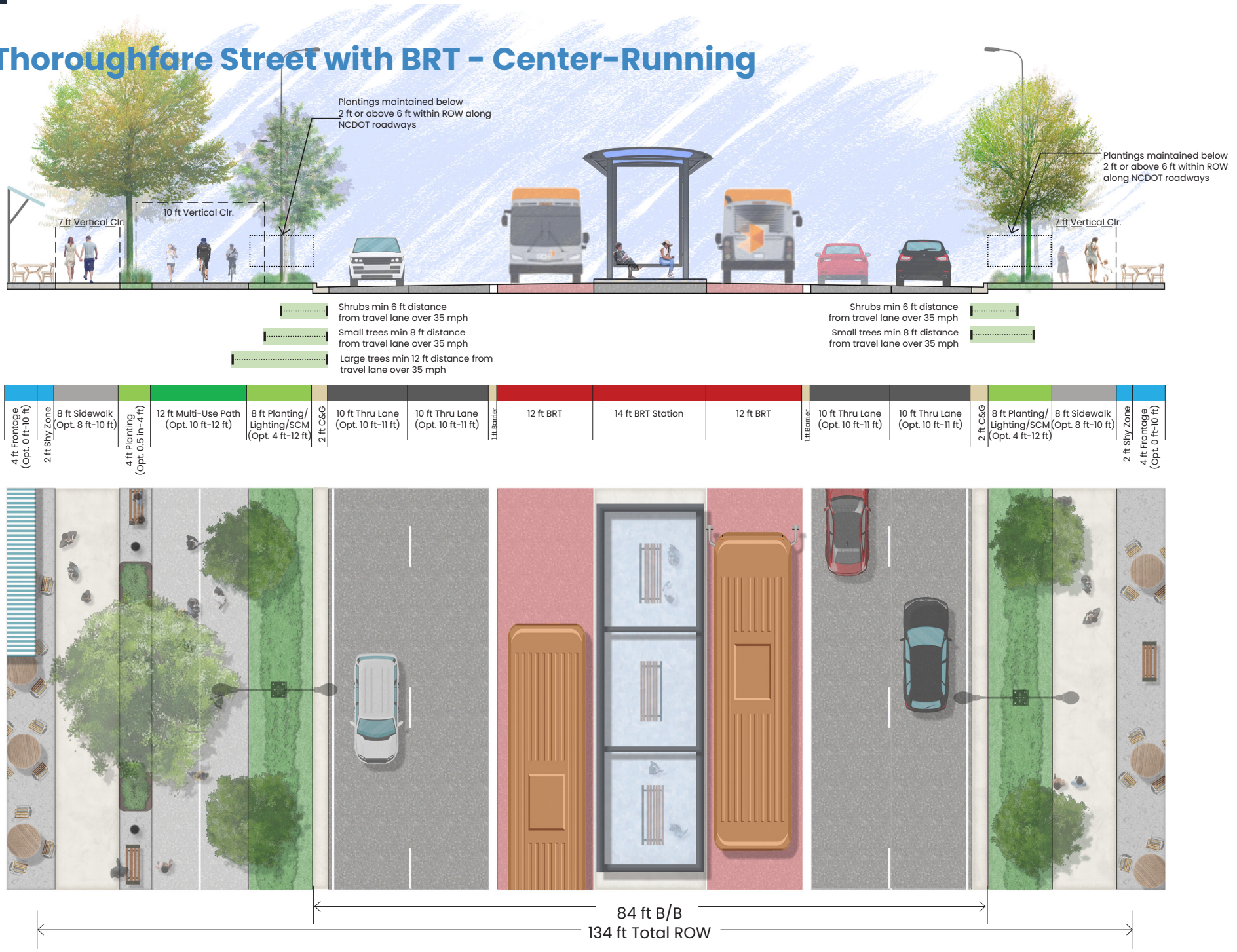
Goals

Encourage the urban neighborhood

+ Create multimodal connectivity through neighborhoods and into mixed-use nodes
+ Bring green space into the street through activated spaces
+ Establish neighborhood character

Preferred Option

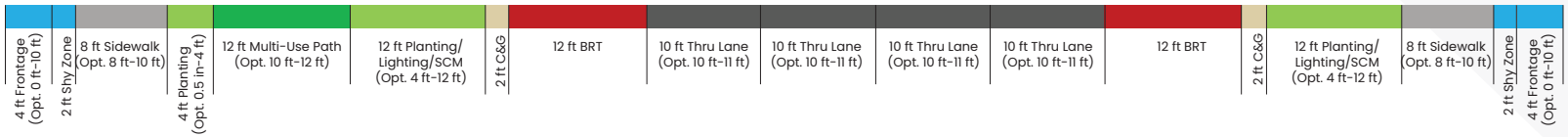
Thoroughfare Street with BRT - Center-Running

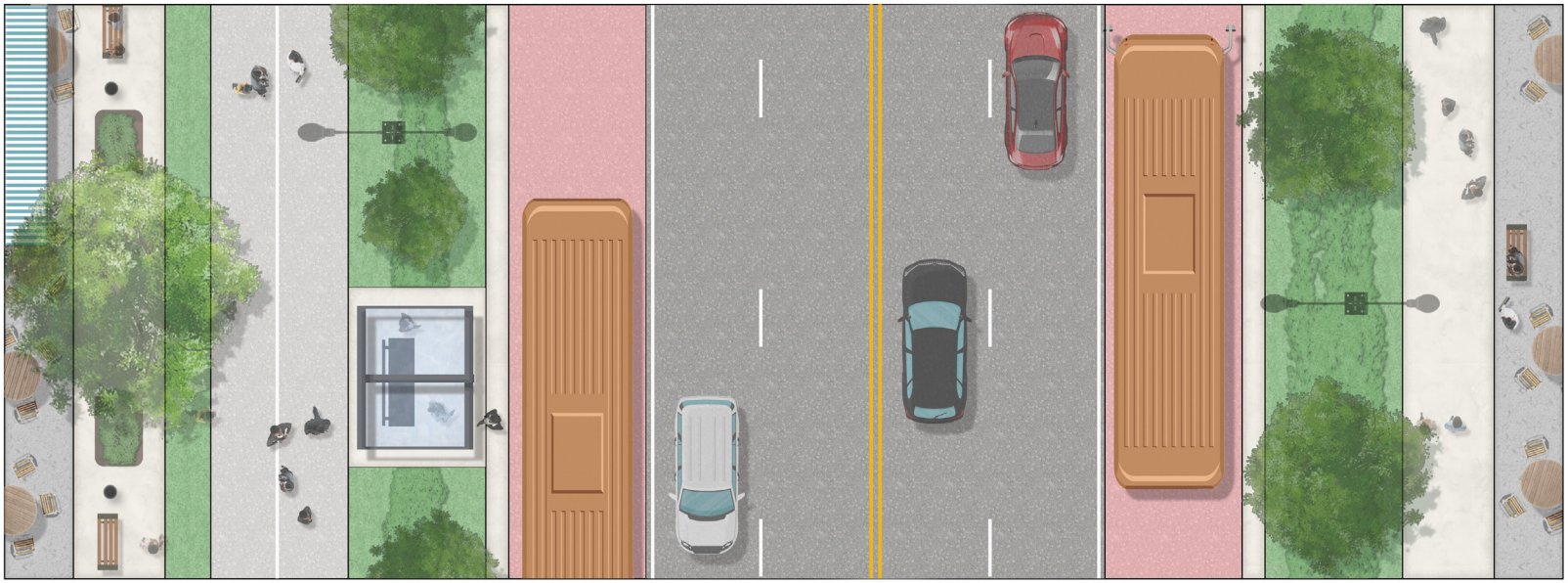


Thoroughfare Street with BRT - Side-Running

Shrubs min 6 ft distance from travel lane over 35 mph
Small trees min 8 ft distance from travel lane over 35 mph
Large trees min 12 ft distance from travel lane over 35 mph

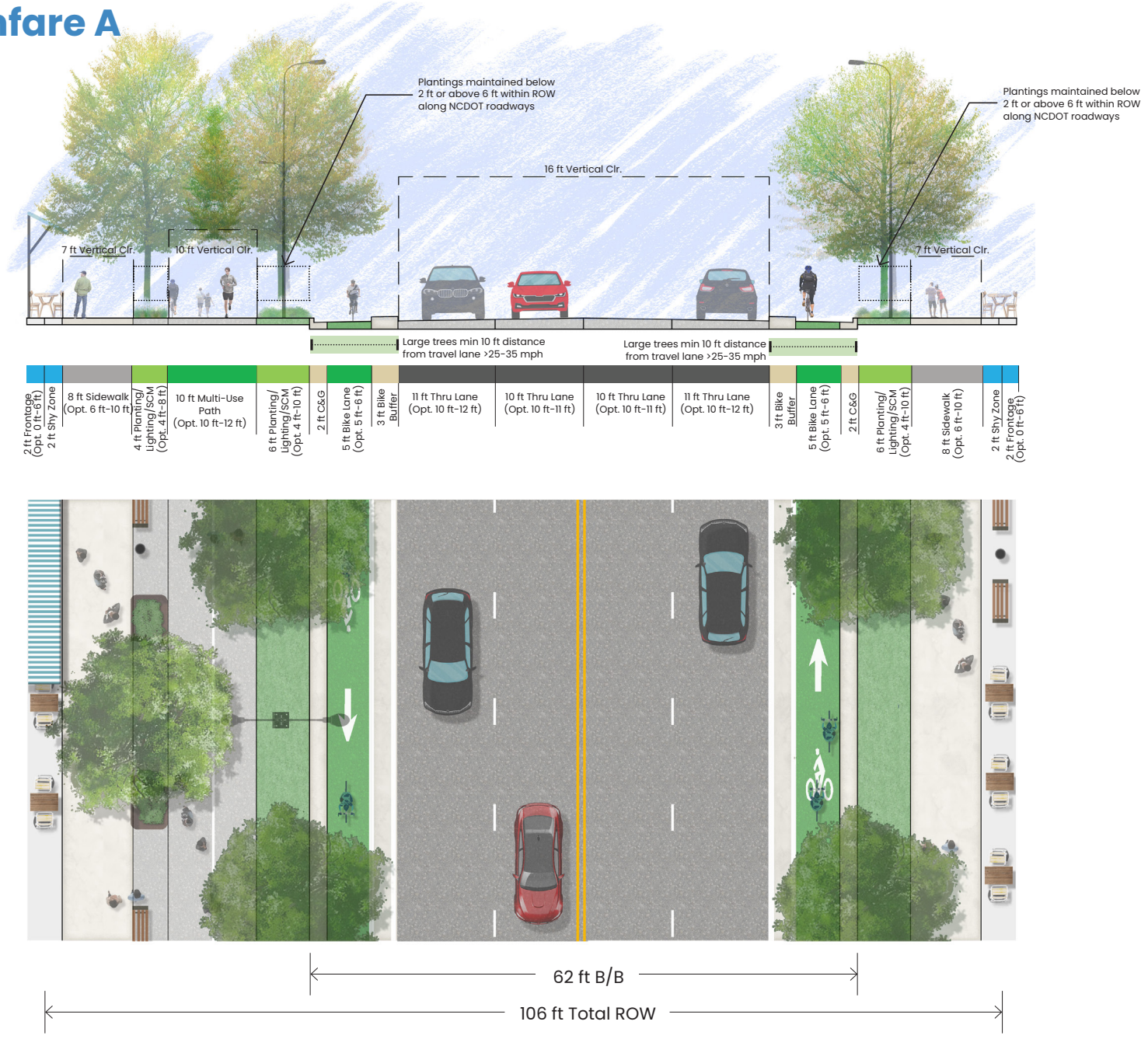
Shrubs min 6 ft distance from travel lane over 35 mph
Small trees min 8 ft distance from travel lane over 35 mph



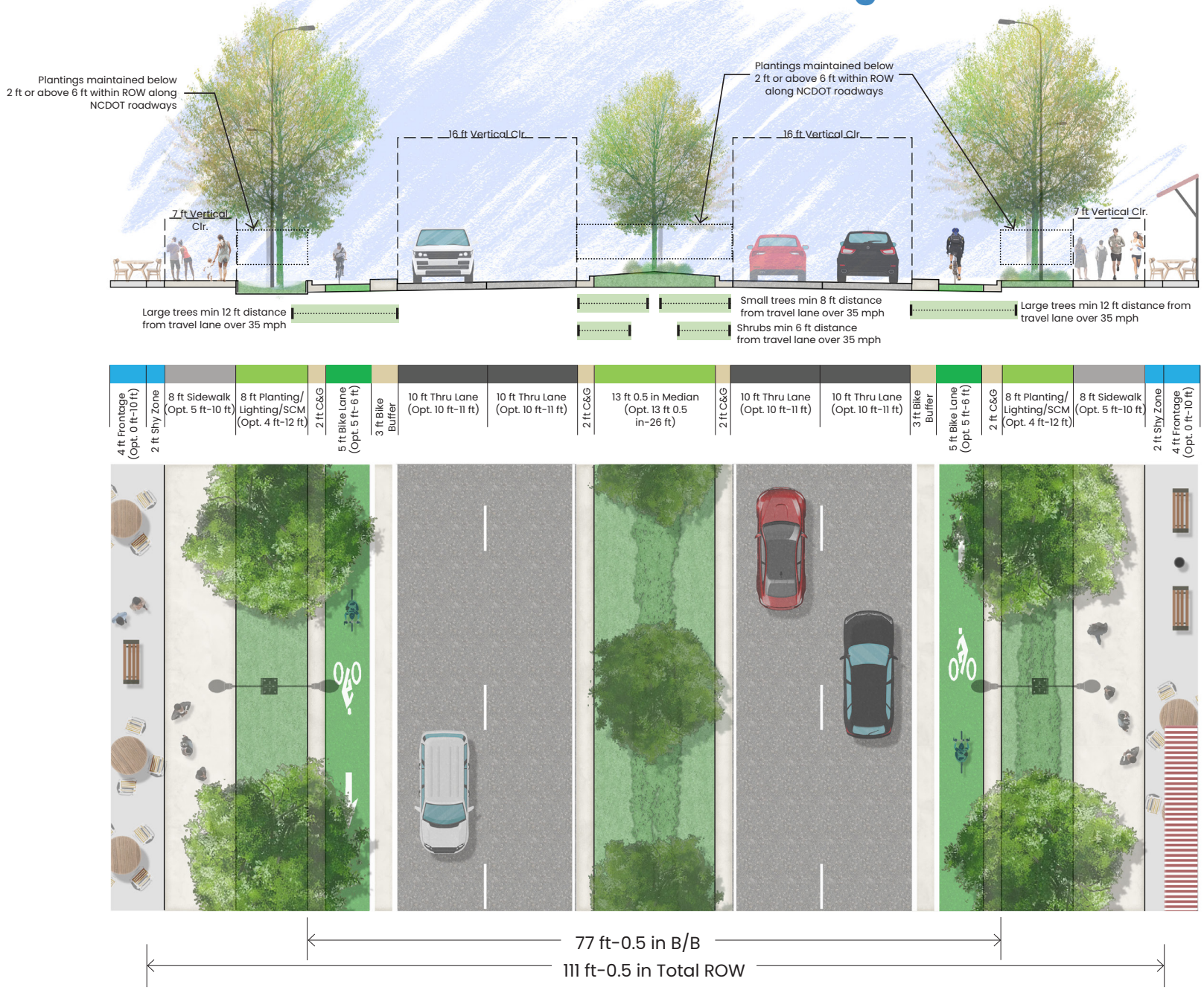


70 ft B/B
128 ft Total ROW

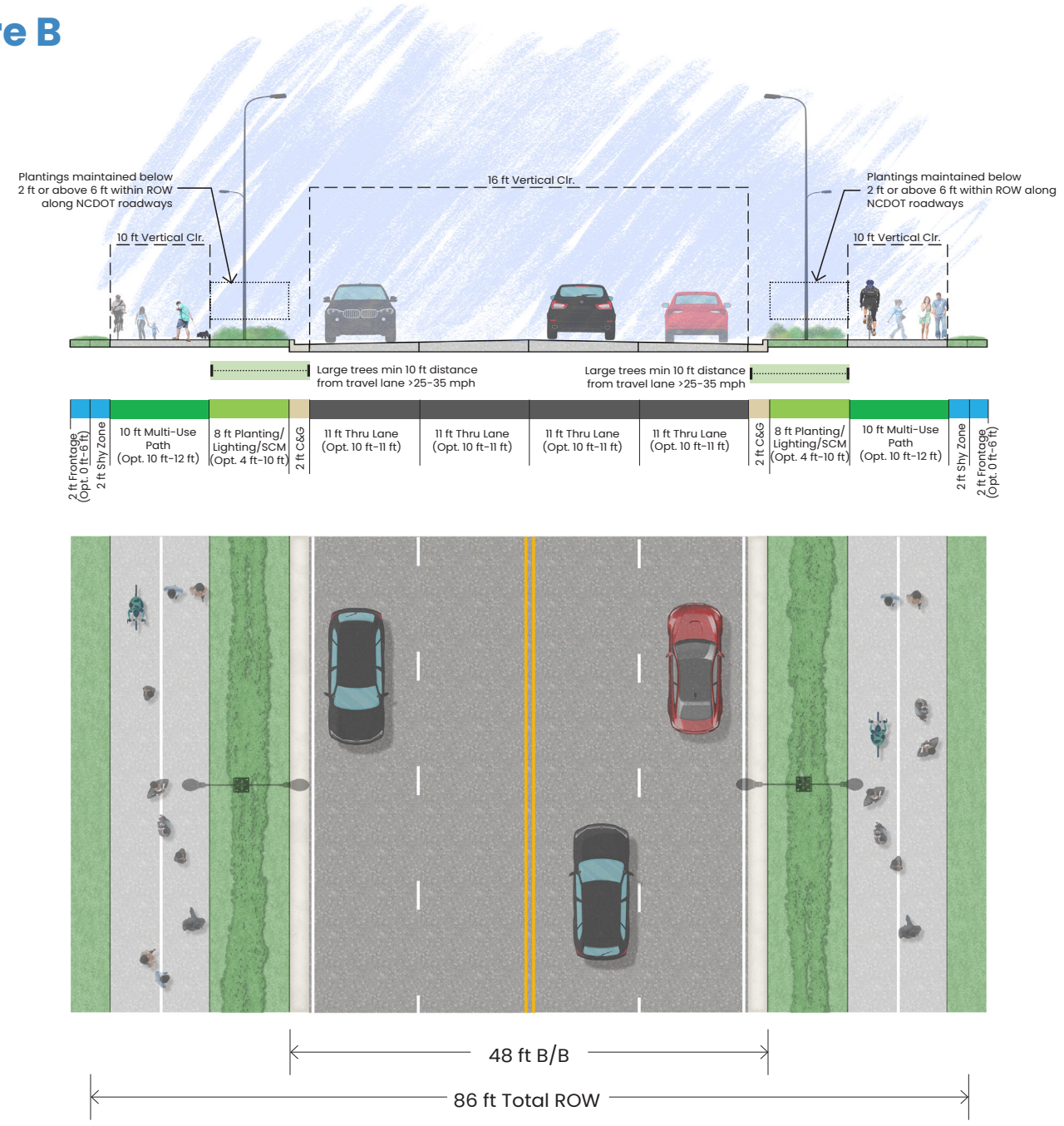
Thoroughfare A



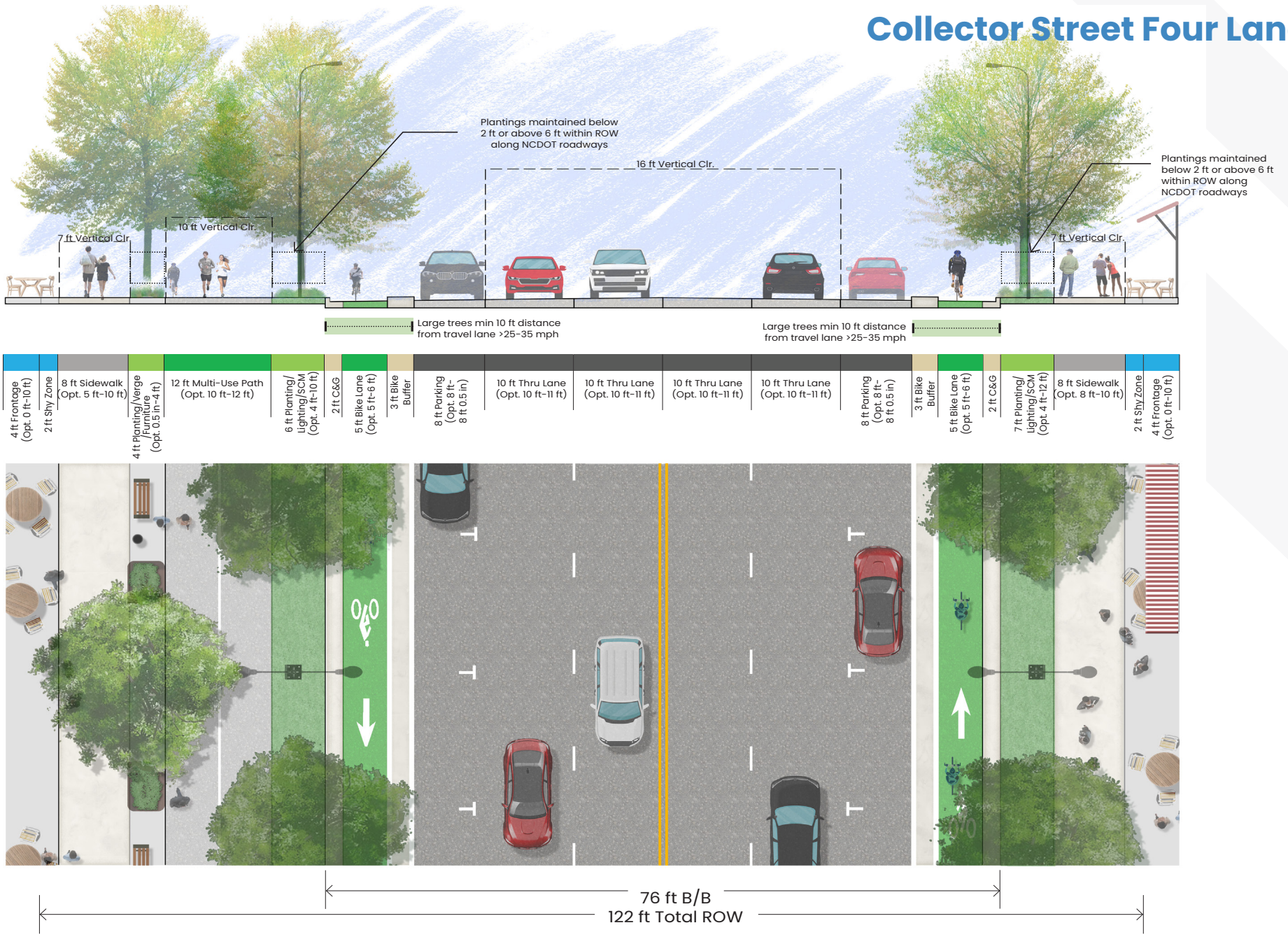
Thoroughfare Street with Median



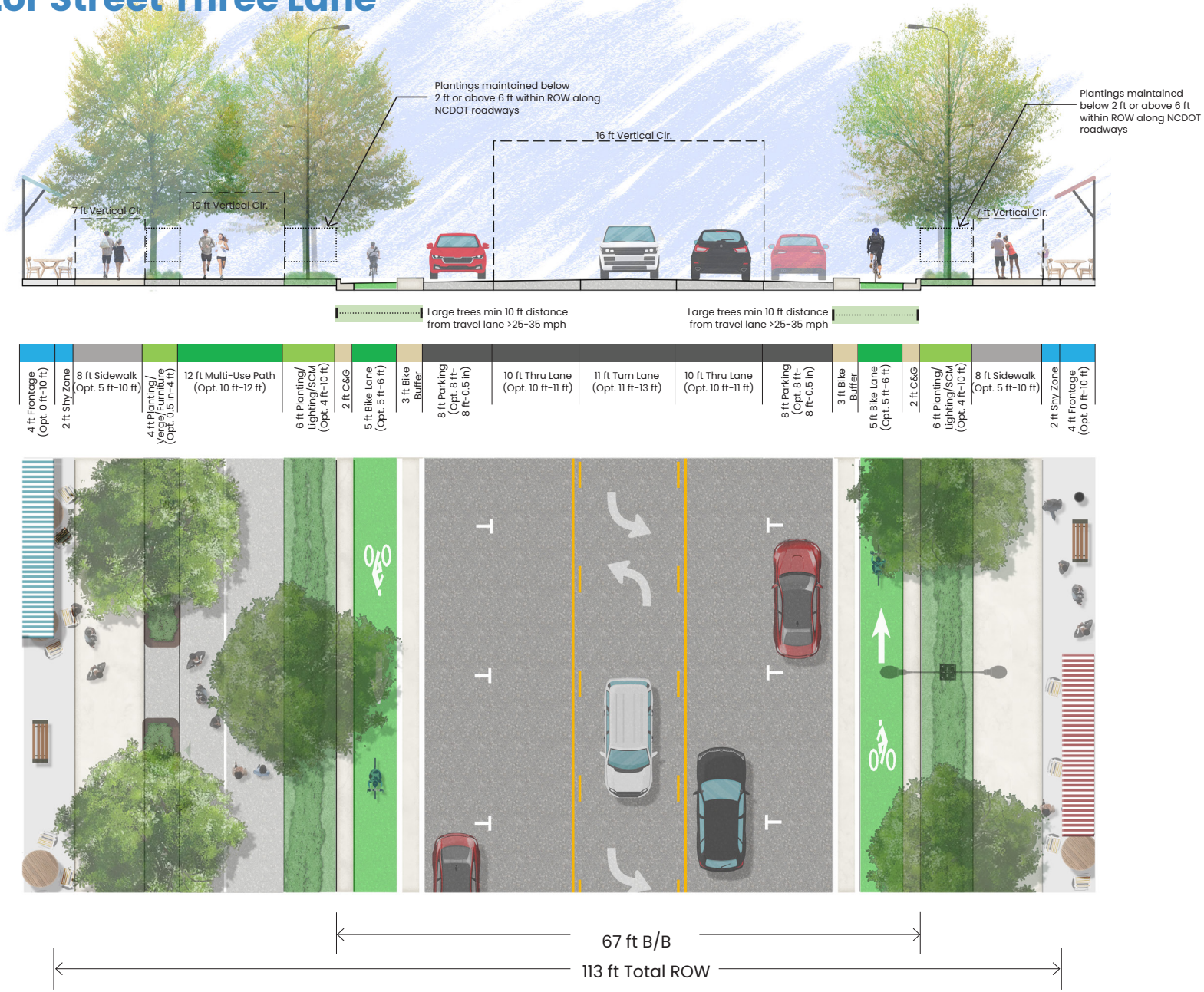
Thoroughfare B



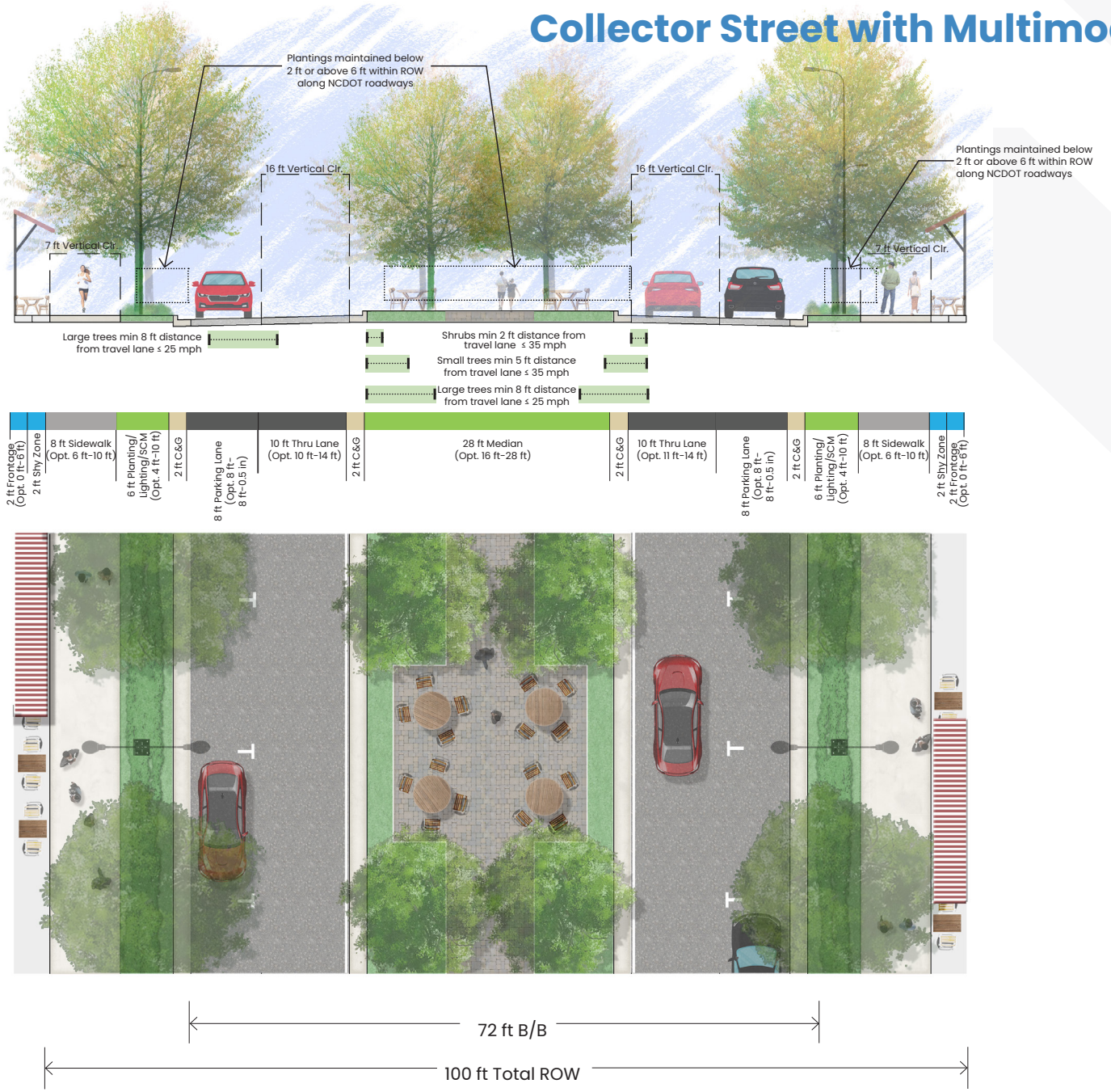
Collector Street Four Lane



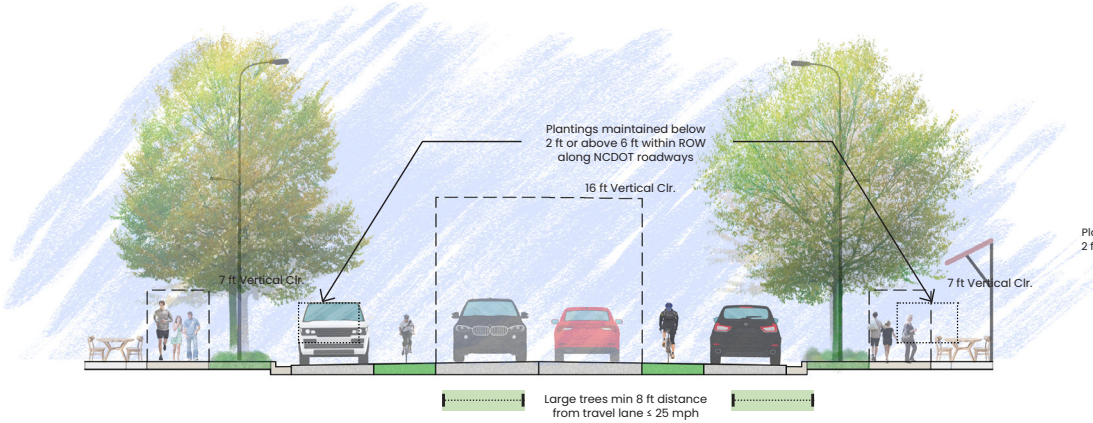
Collector Street Three Lane

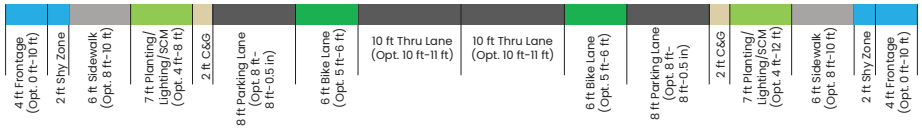


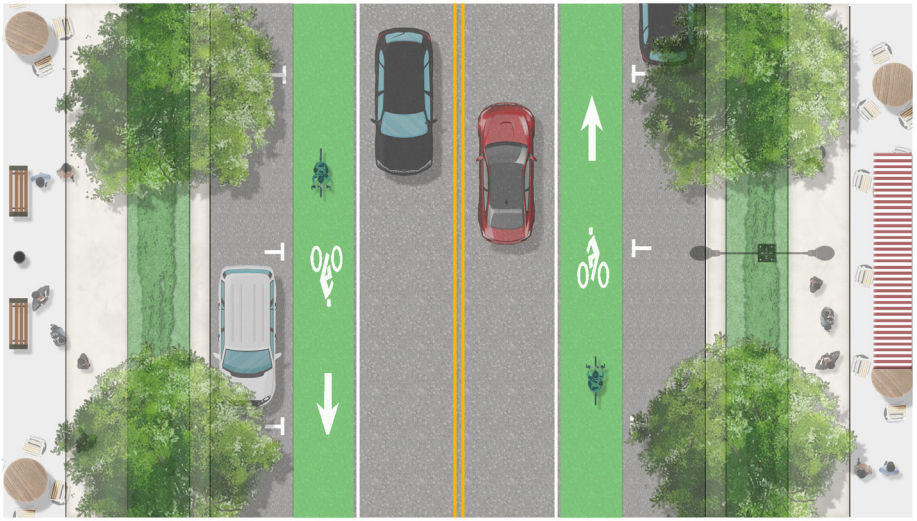
Collector Street with Multimodal Median

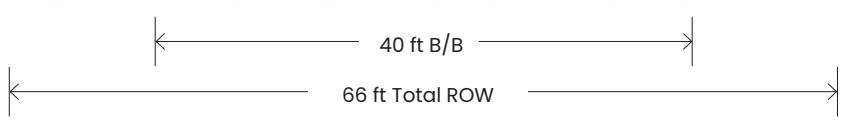


Local Street Two Lane

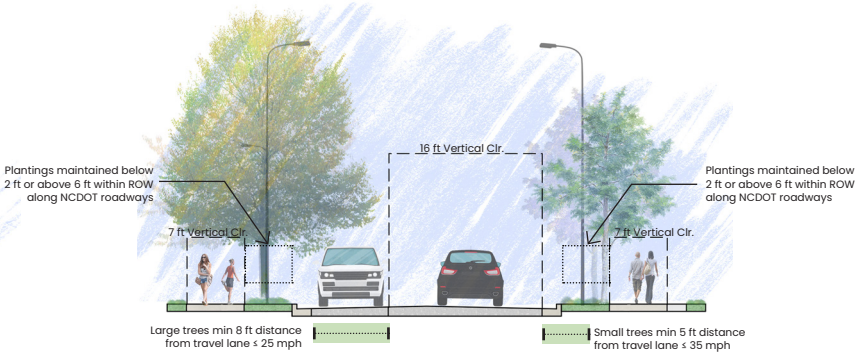


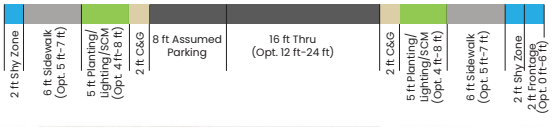


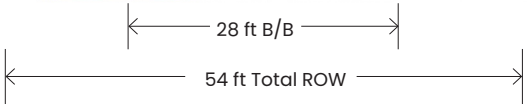




Local Street Two Way

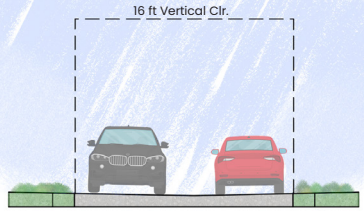


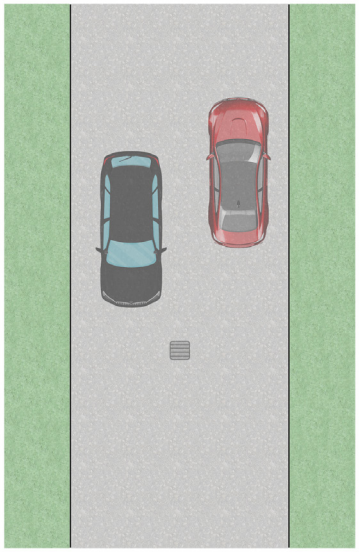


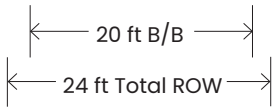


Note: Within Wake County, the back of curb to back of back dimension should be a minimum 40 ft for two-way travel or as shown in graphic above if one-way travel.

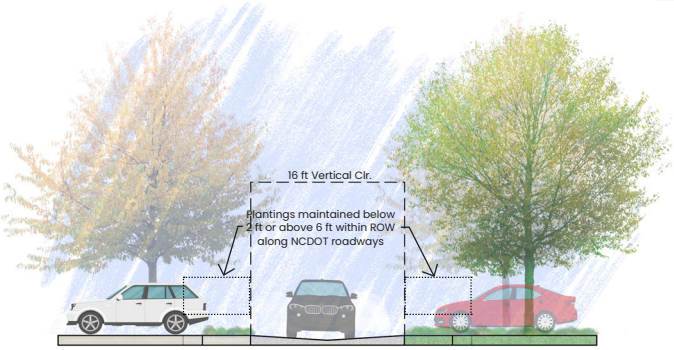
Local Street Alley

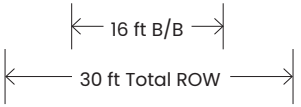






Local Street One Way





Typical Notes for all Sections:

1. *Setbacks shown assume curb and gutter for all street sections. If curb and gutters are not being provided, clear zone distances will be greater. NCDOT Guidelines for Planting Within Highway Right-of-Way should be referenced.*
2. *Horizontal spacing recommendations for street trees and plantings are noted within the 'Median, Verge and Island Planting' section.*
3. *Selection of plant species for any streetscape should consider the typical mature size of the plant to ensure vertical clearances, horizontal setbacks and root clearances are achievable at the plant's mature size.*
4. *Trees and shrubs that produce fruit or nuts should be considered for areas with little or no pedestrian access such as medians. Fruit and nuts, though positives for wildlife, can pose a hazard to pedestrian and stain sidewalks.*
5. *If overhead power lines are present; trees/shrubs are limited to 15 ft. max vertical height within ROW for distribution lines; or 7 ft max. vertical height within wire zone and 15 ft max. vertical height in border zones for transmission lines.*
6. *Buried power lines should be considered to promote an improved visual aesthetics for streetscapes and allow for additional use of large canopy trees, placement of signage/wayfinding, and promote a more resilient infrastructure.*
7. *Tree roots and underground power lines often co-exist without problems. However, trees planted near underground lines could have their roots damaged if the lines need to be dug up for repairs. The biggest danger to underground lines occurs during planting. Similar to overhead power lines, trees should be planted with a setback from the buried power line. The distance a tree should be planted from the buried power line varies however. A setback equal to the mature spread of the tree or shrub should serve as the distance it should be planted from the marked buried power line. An example is if an oak tree has a typical mature spread of 30 feet, than the tree should be planted 30 ft from the buried line to encourage minimum future root damage should the power line need to be serviced. This is a general guideline and not a standard minimum requirement.*
8. *If underground utilities, i.e. water, sewer, stormwater, etc. are present in the Right-of-Way and/or verge/tree lawn, consideration should be given to the impact tree roots may have on the utility. In many cases, a setback, similar to that used for underground power lines should be utilized. Trees should not be planted directly above an underground utility pipe or line. Trees should be generally planted outside any permanent utility easement and/or a distance equal to the root spread or canopy spread of the tree, which ever is greatest.*

Curb Cuts/Driveways

Curb cut (driveway access) standards vary across applicable local ordinances and state requirements.

While all non-NCDOT designated streets should be consistent with Durham's and Wake County access management and driveway spacing standards, local and collector street curb cut standards should shift away from access management (large spacing, wide driveways) toward pedestrian-oriented design. Objectives are to:

+ Minimize conflicts along primary pedestrian streets
+ Support tight block patterns and frequent intersections
+ Reduce driveway widths to shorten pedestrian crossing distances
+ Consolidate access where possible, but allow flexibility on low-speed internal streets

Recommended Curb Cut (Driveway Access) Standards by Street Typology

Street Type	Distance from Street Intersection (ft)	Distance from Other Curb Cut (ft)	Curb Cut Width (ft)	Curb Return Radii (ft)
Thoroughfare Street with BRT	200-400+	150-600+	16-30+	25-35
Thoroughfare Street with Median	150-400+	150-500+	16-30+	25-35
Thoroughfare Street A	150-400+	150-300+	16-30+	20-35
Thoroughfare Street B	150-400+	150-300+	16-30+	20-35
Collector Street Four Lane	100-200	150-300+	16-30+	20-30
Collector Street Three Lane	100-200	150-300+	16-30+	15-30
Collector Street with Multimodal Median	100-200	100-300+	12-24+	15-25
Local Street Two Lane	40-100	60-120+	10-24+	10-20
Local Street Two-Way	40-100	60-120+	10-24+	10-20
Local Street Alley	20-40	40-80+	10-20+	5-15
Local Street One-Way	40-100	40-120+	10-24+	10-15

In addition to the recommended standards, NCDOT regulates all curb cuts connecting to state-maintained roads through a permit-driven, engineering-based review process. Its standards are intended to ensure that each driveway operates safely within the roadway system, balancing access with traffic flow and minimizing conflict points. All driveway connections require an NCDOT permit along NCDOT roadways, and the agency retains final authority over location, design, and approval.

Typical NCDOT curb curt/driveway requirements include:

+ Spacing: 50–100 ft (local), 100–200 ft (collector), 200–400+ ft (arterial), increasing with speed and volume
+ Intersection setbacks: ~50 ft (local) up to 150–300+ ft (arterials/signalized intersections)
+ Width: ~16–20 ft (residential); ~24–36+ ft (commercial, wider for high-volume uses)
+ Radii: ~10–20 ft (passenger vehicles); ~30–50+ ft (truck access)
+ Throat length: ~30–50 ft minimum; 100+ ft for higher-intensity uses
+ Sight distance: ~250 ft (30 mph), ~425 ft (45 mph), ~550+ ft (55 mph)
+ Grade & drainage: ≤8–10% near roadway; culverts typically 15–24 inches required
+ Authority: NCDOT permit required; agency may restrict, modify, or deny access based on safety and operations

05

Streetscape Design Guide

Introduction

The importance of streetscape design guidelines can be outlined through the improved safety, visual quality, and community character they will bring to RTP. With a goal of creating a unifying vision for near and long-term streetscape improvements across the Park, a framework has been provided for pedestrians, transit, lighting, furnishings, and identifying elements.

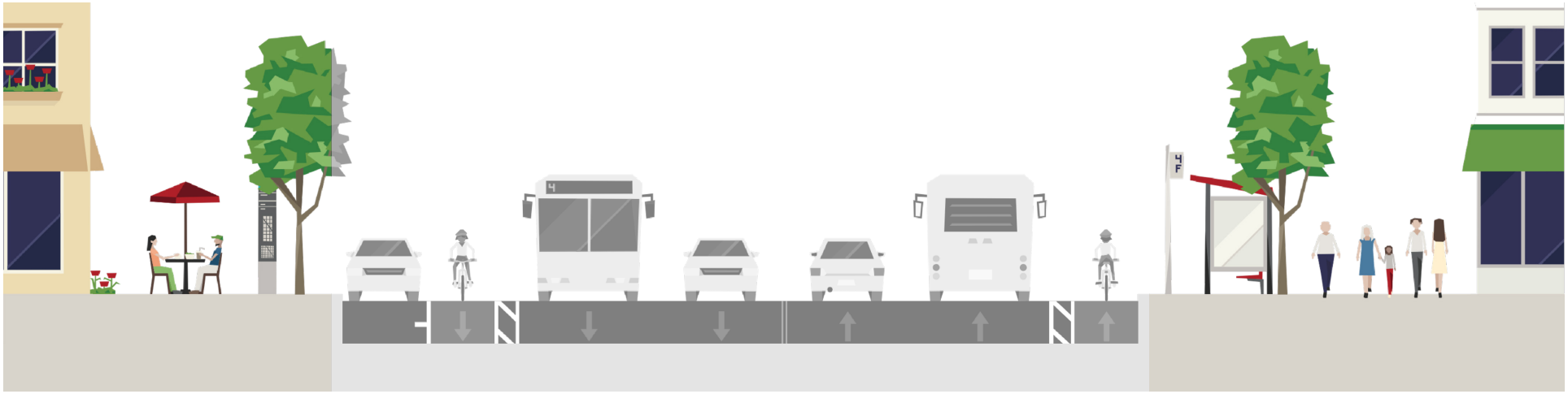
The need to create streetscape guidelines is rooted in the desire to improve the quality of the public realm with underlying goals of improving pedestrian experiences and developing a cohesive aesthetic.

Goals

The application of the design guidelines detailed in this chapter are intended to have a framing role in the design of streetscapes throughout RTP. There are numerous factors which may require deviation from these guidelines to a degree, including: impacts by horizontal metrics such as right-of-way or lane widths, utility conflicts, type of street, budget, and future actions by RTP which may build upon or modify these guidelines.

The following components of a typical streetscape are included in the guidelines:

+ Sidewalk character
+ Plantings
+ Hardscapes
+ Furnishings
+ Green infrastructure
+ Transit stops & loading
+ Lighting and Charging
+ Gateways
+ Public art

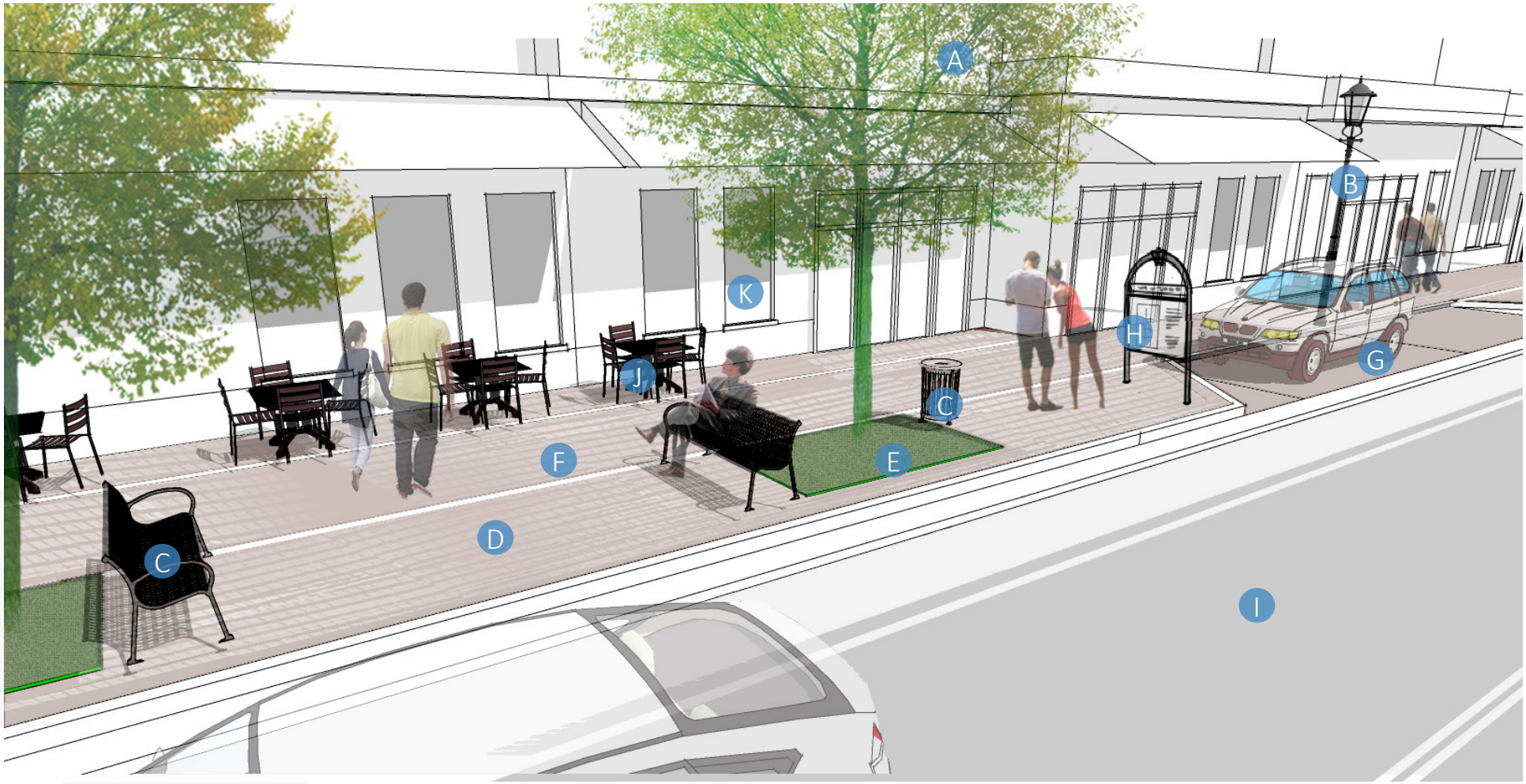


Streetscape Components

A streetscape consists of a variety of components, that when combined properly create a dynamic and engaging space. Understanding and providing space for various components is essential in creating a successful streetscape. These components consist of the pedestrian realm along the sidewalk, providing space for walking, talking and dining, as well as furnishings, lighting, landscape and street trees. On-street parking, bicycle lanes, travel lanes, bus loading and unloading zones, all make-up the vehicular realm of the street. These two areas consisting of the pedestrian realm and vehicular realm, and their associated materials and finishes, should seamlessly fuse to create a thriving public space through the following:

+ Providing orientation to its users
+ Providing a memorable character
+ Balancing the competing needs of the street
+ Supporting interesting activities and uses that create a varied streetscape
+ Relating well to its bordering uses, allowing continuous activity
+ Encouraging human contact and social activities
+ Employing consistency in hardscapes and landscapes
+ Promoting safety for all users
+ Promoting sustainability
+ Well maintained in a cost effective manner

Diagram: Typical Streetscape Components



- A Street Trees
- B Lighting
- C Furnishings
- D Materials and Finishes
- E Landscape Beds
- F Walkway
- G On-Street Parking/Loading Zone
- H Wayfinding
- I Travel Lanes
- J Dining Zone
- K Street Presence from Buildings

Street Typologies + Streetscape Elements

Streetscapes, much like the entirety of the street, must be responsive to the unique context and user needs. In the previous chapter, a proposed street typology hierarchy was created. These design guidelines are responsive to the three primary typologies identified in this CTP (but concepts could be applied to other typologies):

+ Thoroughfares
+ Collectors
+ Local streets

The following table lists the cross-sections for all three place types and identifies the appropriate multimodal facility or streetscape element that may be included for each. While not mandatory, the streetscape elements identified as appropriate for each cross-section serve as a marker for what elements are needed to achieve the desired use, impact, and character of a given street.

Streetscape Elements

CTP Road Description	Sidewalk/Ped Zone	Bike Lane/Facility	Multiuse Path	Flex Zone	Microtransit	Transit	Parking	Landscaping	Lighting	Street Furniture	Public Art	Wayfinding
Thoroughfare | MUN-BRT	✓	✓	✓		✓	✓		✓	✓	•	•	✓
Thoroughfare | MUN-T4	✓		•		•	•		✓	✓	•	•	•
Collector | MUN-C4	✓	✓	•	•	✓	•	•	✓	✓	•	•	•
Collector | MUN-C3	✓	✓	•	•	•	•	•	✓	✓	•	•	•
Local | MUN-L2	✓	✓		•	•	•	✓	✓	✓	✓	•	✓
Local | MUN-L1	✓		✓	✓	•			•	✓	•	•	•
Thoroughfare | RND-T4-1	✓		✓		•	•		✓	✓			•
Thoroughfare | RND-T4-2	✓	✓			•	•		✓	✓			•
Collector | RND-C2-1	✓		✓			•	•	•	✓			
Collector | RND-C2-2	✓	✓				•	•	•	✓			
Collector | RND-C2-3	✓	•				•	•	✓	✓	•		
Local | RND-L2	✓	•					✓	•	✓			
Local | RND-L1	✓		✓					•	✓			
Thoroughfare | ECC- T4	✓	✓			•	•		✓	✓	•	•	•
Collector | ECC- C3	✓	✓		•	•	•	•	✓	✓	•	•	•
Local | ECC-L2-1	✓	✓		•	•		✓	✓	✓	✓	•	✓
Local | ECC-L2-2	✓	✓		•	•		✓	✓	✓	✓	•	✓

Included	✓
Optional	•

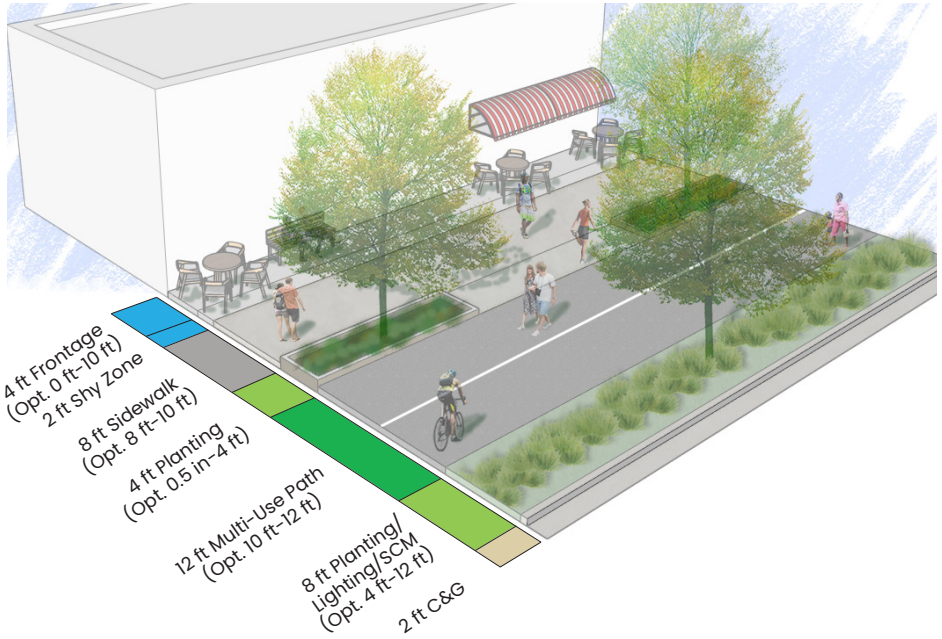
Sidewalk Character

Spatial configurations need to be considered to provide for a comfortable and accessible pedestrian realm. These configurations can vary from dining and walking areas, to the proper location of benches along a street. The diagrams to the right identify minimum space needed for various street furnishing scenarios, and should be used as a guideline for creation of these spaces.

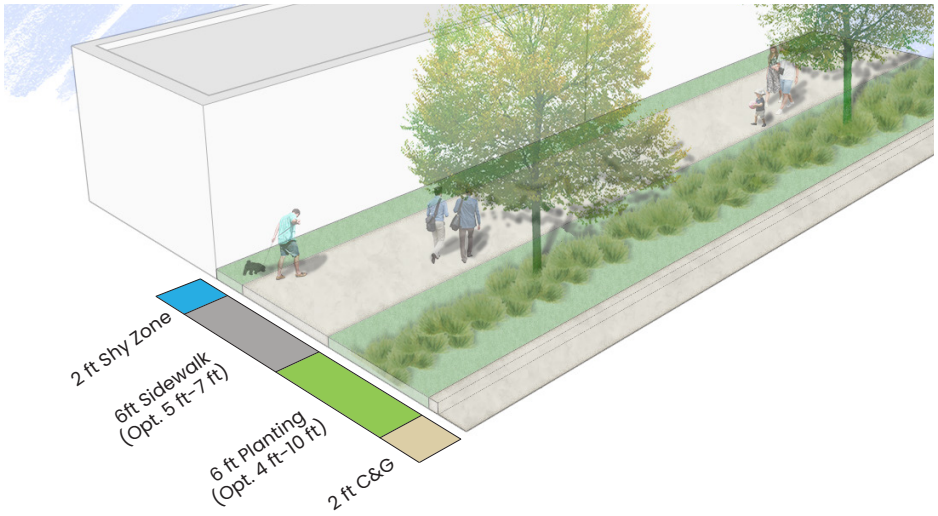
Where these dimensions are not attainable an additional sidewalk easement may be needed. Outdoor dining areas should have a minimum 5 ft clear zone for walking with a 6 ft clear zone preferred. Tree grates or pavers may be used in order to obtain the desired dimensions.

Note: All dimensions are minimum standards for treatment.
**Step Strip and Shy Zone areas may vary depending upon available right of way widths.*

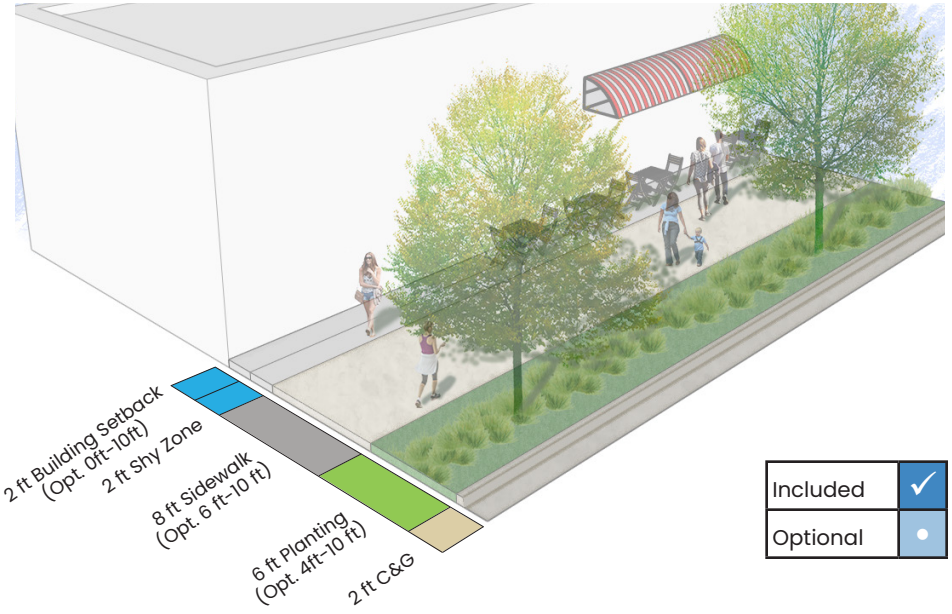
Mixed-Use Node Typical Sidewalk Character



Residential Neighborhood Development Typical Sidewalk Character

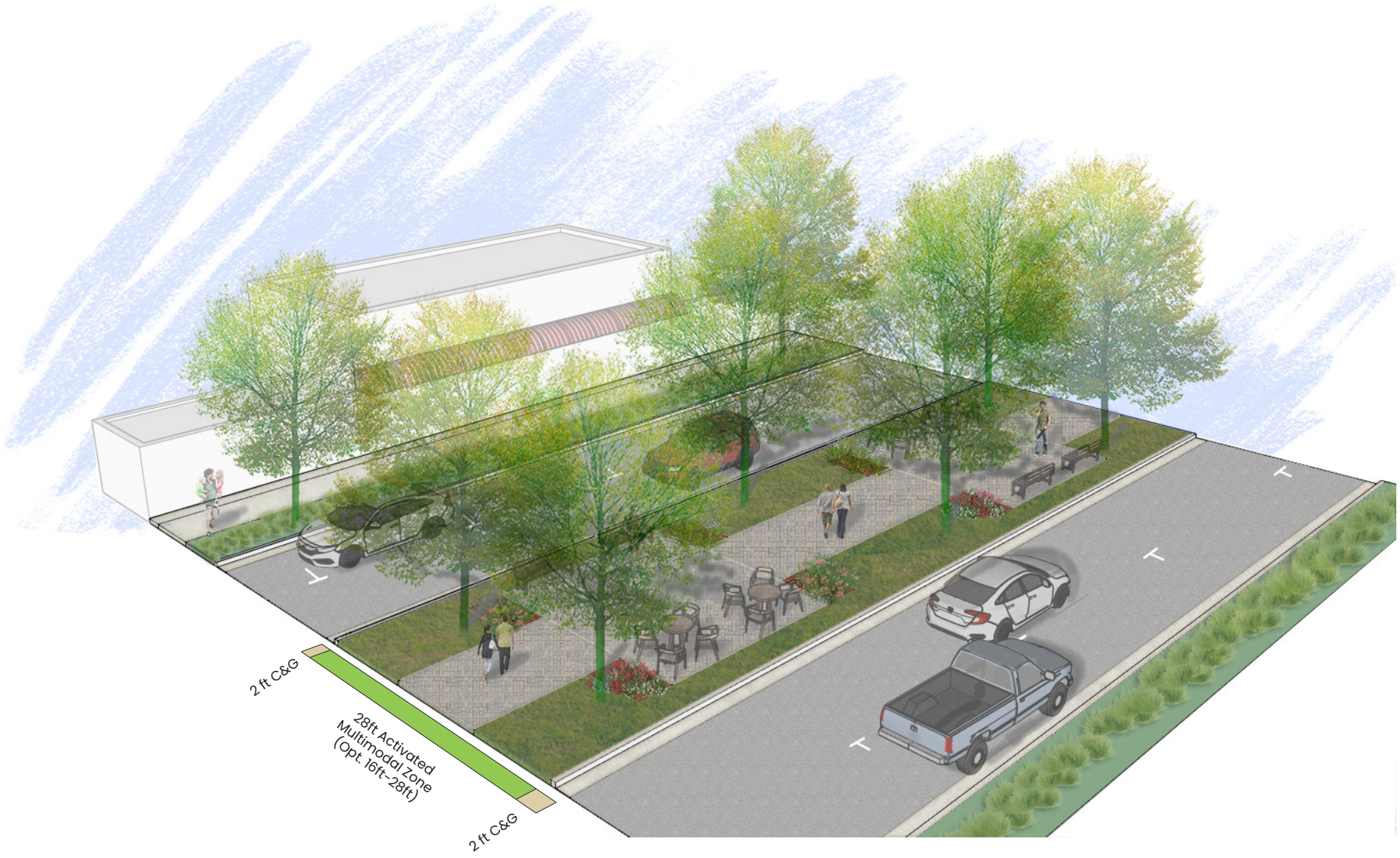


Enhanced Corporate Campus Typical Sidewalk Character



Included	✓
Optional	•

Median Parklet or Flex Zone Typical Character



Plantings

Plantings used throughout the public realm in RTP should seek to enhance the native landscape, minimize water consumption, and reduce maintenance needs by 'right sizing' the plant to needs based upon mature growth conditions.

In order to ensure appropriate plants are selected, the following table provides suggested species categorized by planting zone. This information is intended to serve as a guide. Suggested species emphasize drought-tolerant plants and do not typically include hybrids, varieties, or cultivars. Instead, use can be based upon when performance may be significantly better than the primary species.

It is expected that this table is reviewed and updated to remove any species that have come be known for problems or develop a history of not preforming well in RTP.

Use of mono-species planting schemes are not advised within the public realm. Use of street trees, planting beds, or massing of shrubs should be no more than 10% of any one species, 20% of any one genus, or 30% of any family.

Use of multiple species has several additional benefits to the Town on top of healthier plantings. Some species can be emphasized for providing food for wildlife, while others can be used for their radiant fall color. Other species can provide faster growth rates or have the ability to adapt to extreme soil or moisture conditions.

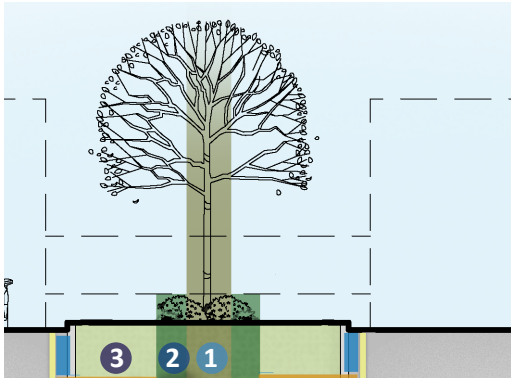
Use of trees, primarily as street trees, is to serve as a framing element. A 1:2 or 1:1 ratio is ideal where the mature height of the street tree equals or half the width of the street. This ratio is a pleasing experience for all modes of travel from vehicles to pedestrians.

Streets trees should be planted at a spacing and massings scale reflective of the design speed of the roadway. In the MUN and ECC Place Type, street tree spacing should generally be 30 ft. where posted speeds are 25 MPH of less. 50 ft spacing is appropriate in the RND and ECC Place Types for streets with posted speeds of 26-35 MPH, while spacing between 50-100 ft is appropriate for streets with speeds above 35 MPH. The spacing of trees creates a rhythmic ordering along the street and encloses the street space by defining edges. As

Species are categorized into three types in the table; trees, shrubs (and grasses), and groundcovers. The intent is to align plant type by reference number. Trees represent Zone 1, shrubs and grasses represent Zone 2, and groundcovers represent Zone 3 Zone 3 also includes sod. Within the tree and shrub categories, there are evergreen and deciduous subtypes. Trees are also divided into large and small or ornamental types.

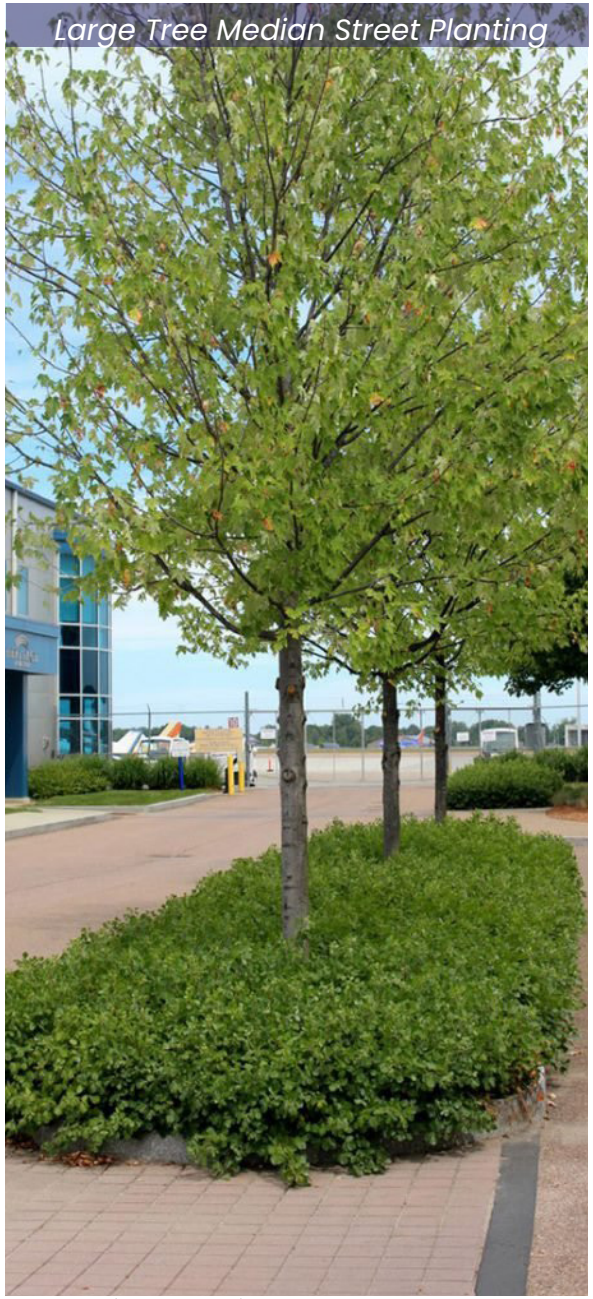
The following tables provides examples of the foliage and/or colors of interest for each plant species, as well as information regarding the specie's drought tolerance and whether the species are native to North Carolina. The color interest schedule is divided in the four primary seasons with the initial for each month identifying the overall schedule for the species' color.

Diagram: Typical Median Planting Scheme



Note: Refer to Street Typologies Sections for information regarding setbacks shown in this diagram.

1. Tree Zone; centerline of truck; 1.5 ft. width
2. Shrub Zone; 24" ht. max within site triangles
3. Groundcover/Sod Zone; 12" ht. max; min. width of 3 ft of sod from back of curb


Large Tree Median Street Planting

Source: Wild Seed Project

1 Large Tree Species (Deciduous)

Botanical Name	Common Name	Height	Color Interest Schedule (Winter: J F M; Spring: A M J; Summer: J A S; Fall: O N; D)	Drought Tol.	Native
Acer floridanum	Southern Sugar Maple	25-65ft ht		H	X
Acer rubrum	Red Maple	40-65ft ht		M	X
Betula nigra	River Birch	40-65ft ht		M	X
Carya ovata	Shagbark Hickory	40-65ft ht		H	X
Celtis laevigata	Sugar Hackberry	40- >65ft ht		H	X
Celtis occidentalis	Common Hackberry	40-65ft ht		H	X
Cladrastis lutea	American Yellowwood	40-65ft ht		M	X
Fagus grandifolia	American Beech	40- >65ft ht		M	X
Fraxinus americana	White Ash	40- >65ft ht		M	X
Fraxinus pennsylvanica	Green Ash	40-65ft ht		H	X
Gleditsia triacanthos inermis	Thornless Honey Locust	40-65ft ht		H	X
Magnolia acuminata	Cucumbertree Magnolia	40- >65ft ht	F F F	M	X
Nyssa sylvatica	Sour Gum	40-65ft ht		H	X
Platanus x acerifolia	London Plane Tree	40-65ft ht		M	X
Quercus acuminata	Chinkapin Oak	25-40ft ht		H	X
Quercus alba	White Oak	40- >65ft ht		H	X
Quercus bicolor	Swamp White Oak	40-65ft ht		H	X
Quercus falcata	Southern Red Oak	> 65ft ht		H	X
Quercus imbricaria	Shingle Oak	40-65ft ht		H	X
Quercus laurifolia	Laurel-leaved Oak	40- >65ft ht		H	X
Quercus lyrata	Overcup Oak	40- >65ft ht		H	X
Quercus nigra	Water Oak	40- >65ft ht		H	X
Quercus phellos	Willow Oak	40- >65ft ht		H	X
Quercus prinus	Chestnut Oak	25-40ft ht		H	X
Quercus rubra	Northern Red Oak	40-65ft ht		H	X
Quercus shumardii	Shumard Oak	40- >65ft ht		H	X
Quercus velutina	Black Oak	40-65ft ht		H	X
Taxodium distichum	Bald Cypress	40-65ft ht		H	X
Tilia tomentosa	Silver Linden	40- >65ft ht		H	
Ulmus parvifolia	Lacebark Elm	25-65ft ht		H	
Ulmus x 'Pioneer'	Pioneer Elm	40-65ft ht		H	

Large Tree Species (Evergreen)

Chamaecyparis thyoides	Atlantic White Cypress	40- >65ft ht		M	X
Ilex opaca	American Holly	15-40ft ht		M	X
Juniperus virginiana	Eastern Redcedar	25-40ft ht		H	X
Magnolia grandiflora	Southern Magnolia	> 65ft ht	F F F F F	M	X
Quercus hemisphaerica	Laurel Oak	40-65ft ht		H	X
Quercus virginiana	Southern Live Oak	25- > 65ft ht		H	X

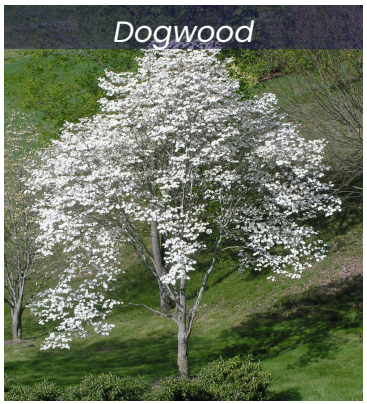
1

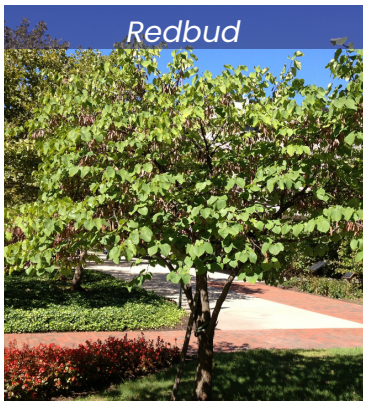
Small Tree Species (Deciduous)

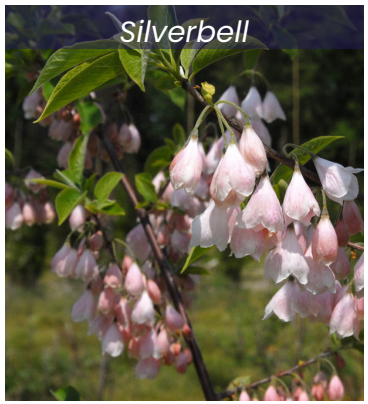
Botanical Name	Common Name	Height	Color Interest Schedule: Winter J	F	Spring M	A	M	J	Summer J	A	S	Fall O	N	D	Drought Tol.	Native
Acer leucoderme	Chalk Maple	25-40ft ht													H	X
Amelanchier arborea	Downy Serviceberry	15-25ft ht				F	F	F							M	X
Amelanchier canadensis	Canadian Serviceberry	15-25ft ht				F	F	F							H	X
Amelanchier laevis	Allegheny Serviceberry	25-40ft ht				F	F	F							M	X
Carpinus caroliniana	American Hornbeam	15-40ft ht													H	X
Cercis canadensis	Eastern Redbud	15-25ft ht				F	F								M	X
Chionanthus virginicus	White Fringetree	10-15ft ht				F	F								M	X
Cornus florida	Flowering Dogwood	15-25ft ht				F	F	F							M	X
Crataegus crus-galli	Cockspur Hawthorn	40-65ft ht					F	F							H	X
Crataegus phaenopyrum	Washington Hawthorn	15-25ft ht					F	F							H	X
Halesia carolina	Silverbell	25-65ft ht				F	F	F							H	X
Hamamelis virginiana	Common Witch Hazel	10-25ft ht				F	F								M	X
Ilex decidua	Possumhaw	25-40ft ht					F	F							H	X
Lagerstroemia indica	Crape Myrtle	10-15ft ht					F	F	F						M	
Magnolia virginiana	Sweetbay Magnolia	10-25ft ht				F	F	F	F	F					M	X
Ostrya virginiana	American Hophornbeam	25-40ft ht													H	X
Oxydendrum arboreum	Sourwood Tree	15-65ft ht													M	X

Small Tree Species (Evergreen)

Ilex cassine	Dahoon Holly	25-40ft ht				F									H	X
Ilex vomitoria	Yaupon Holly	15-40ft ht													H	X
Prunus caroliniana	Carolina Cherry Laurel	15-40ft ht				F	F	F							H	X

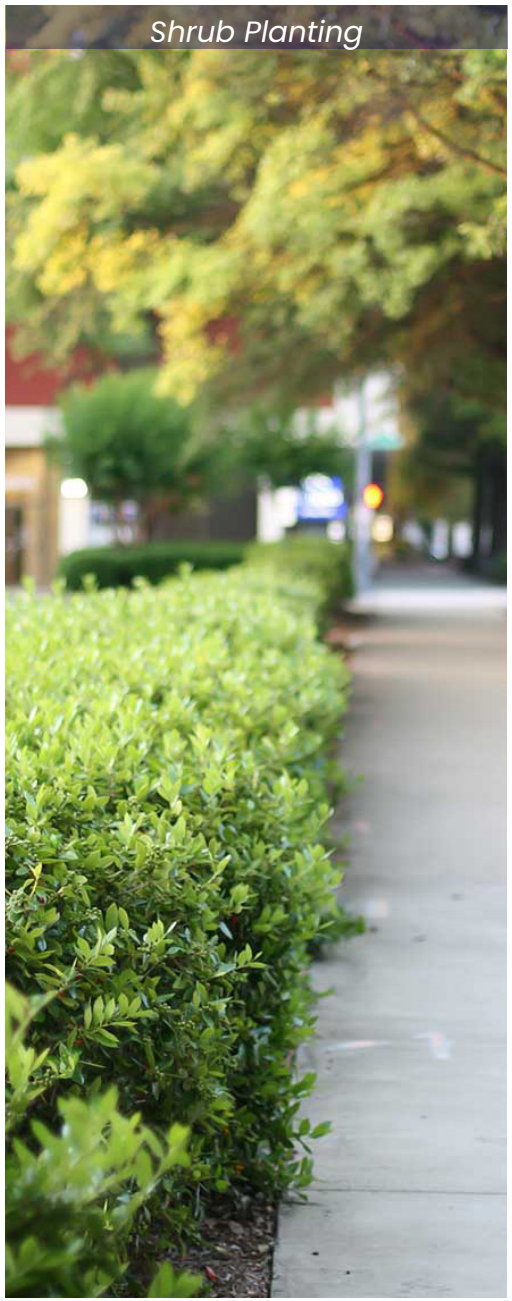






Source: NC State Plant Toolbox

Source: Capital Region Water: Green Stormwater Infrastructure



Source: Gardeners Path

2

Shrub Species (Deciduous)

Botanical Name	Common Name	Height	Color Interest Schedule: Winter J	F	Spring M	A	M	Summer J	J	A	Fall S	O	N	D	Drought	Native
Ceanothus americanus	New Jersey Tea	3-6ft ht				F	F	F							H	X
Deutzia gracilis	Slender Deutzia	18-36in ht			F	F									H	
Diervilla sessilifolia	Bush-honeysuckle	3-6ft ht						F	F	F					H	X
Hydrangea arborescens	Wild Hydrangea	3-6ft ht				F	F	F	F	F					M	X
Hypericum prolificum	Shrubby St. John's Wort	3-6ft ht			F	F	F	F	F	F	F				H	X
Hypericum x 'Hidcote'	Hidcote St. John's Wort	3-6ft ht				F	F	F	F	F					H	X
Itea virginica	Virginia Sweetspire	3-10ft ht					F	F	F						H	X
Rhus aromatica	Fragrant Sumac	18in-6ft ht			F	F									H	X
Rosa carolina	Carolina Rose	18-36in ht				F	F	F	F						H	X
Spiraea nipponica	Nippon Spirea	3-6ft ht			F	F	F								H	
Spiraea thunbergii	Thunberg Spirea	18-36in ht			F	F	F								H	
Spiraea x bumalda	Bumald Spirea	6-36in ht				F	F	F							H	
Viburnum acerifolium	Mapleleaf Viburnum	3-6ft ht			F	F	F								H	X
Viburnum carlesii	Koreanspice Viburnum	3-6ft ht			F	F									M	

Shrub Species (Evergreen)

Botanical Name	Common Name	Height	J	F	M	A	M	J	J	A	S	O	N	D	Drought	Native
Abelia x grandiflora	Glossy Abelia	18-36in ht				F	F	F	F	F	F	F	F	F	H	
Aucuba japonica	Japanese Laurel	6-10ft ht				F	F								H	
Berberis julianae	Wintergreen Barberry	18-36in ht				F	F	F							H	
Berberis thunbergii	Japanese Barberry	3-6ft ht						F							M	
Buxus microphylla japonica	Japanese Boxwood	6-10ft ht													H	
Buxus sempervirens	Common Boxwood	6-15ft ht													H	
Cryptomeria japonica 'Nana'	Dwarf Japanese Cedar	3-6ft ht													M	
Gardenia jasminoides 'Radicans'	Radicans Gardenia	6-18in ht						F	F	F					M	
Ilex cornuta 'Carissa'	Carissa Chinese Holly	18in-6ft ht													H	
Ilex cornuta 'Rotunda'	Rotunda Dwarf Chinese Holly	18in-6ft ht													H	
Ilex crenata 'Compacta'	Dwarf Japanese Holly	3-6ft ht													M	
Ilex crenata 'Green Lustre'	Green Luster Japanese Holly	6-15ft ht													H	
Ilex crenata 'Helleri'	Heler Japanese Holly	6-36in ht													M	
Ilex crenata 'Hetzi	Hetzii Japanese Holly	18in-15ft ht													M	
Ilex vomitoria 'Nana'	Dwarf Yaupon Holly	3-6ft ht													H	X
Jasminum floridum	Flowering Jasmine	3-6ft ht				F	F	F	F	F					H	
Jasminum nudiflorum	Winter Jasmine	18in-15ft ht	F	F		F	F								H	
Juniperus davurica 'Expansa'	Parson's Juniper	18-36in ht													H	
Kerria japonica	Japanese Kerria	6-10ft ht				F	F	F							H	
Pittosporum tobira 'Dwarf Variegata'	Dwarf Variegated Pittosporum	18-36in ht				F	F	F							M	
Pyracantha koidzumii 'Santa Cruz'	Santa Cruz Pyracantha	10-15ft ht				F	F	F							H	
Rhaphiolepis umbellata	Yedda Hawthorn	3-6ft ht					F	F							H	

3

Ornamental Grass Speices

Botanical Name	Common Name	Height	Color Interest Schedule (J F M A M J J A S O N D)	Drought	Native
Andropogon glomeratus	Bushy Bluestem	18-36in ht		H	X
Andropogon virginicus	Broomsedge Bluestem	18-36in ht		H	X
Carex morrowii	Japanese Sedge	6-18in ht		H	
Chasmanthium latifolium	Northern Sea Oats	18in-6ft ht		H	X
Elymus hystrix	Bottlebrush Grass	3-6ft ht		H	X
Muhlenbergia capillaris	Pink Muhly Grass	18-36in ht		H	X
Panicum virgatum	Switch Grass	3-6ft ht		H	X
Pennisetum alopecuroides	Fountain Grass	18-36in ht		H	
Pennisetum villosum	Feathertop	18-36in ht		H	
Schizachyrium scoparium	Little Bluestem	18-36in ht		H	X
Sorghastrum nutans	Indian Grass	3-6ft ht		H	X
Ground Cover Species					
Euonymus fortunei 'Coloratus'	Purple-leaf Wintercreeper	6-18in ht		H	
Gaylussacia brachycera	Box Huckleberry	18-36in ht	F F F F	H	X
Juniperus procumbens	Japanese Garden Juniper	6-18in ht		H	
Juniperus squamata	Juniper	18-36in ht		H	X
Liriope muscari	Lilyturf	6-18in ht	F F F F	H	
Liriope spicata	Creeping Lilyturf	6-18in ht	F F F F	H	
Phlox subulata	Creeping Phlox	< 6in ht	F F F F F F F	H	X
Vinca minor	Common Periwinkle	< 6in ht	F F F	M	

Pink Muhly Grass

Source: NC State Plant Toolbox

Creeping Phlox

Lilyturf

Source: Northern Virginia Bird Alliance

Hardscapes

The surface of pedestrian and multi-use paths are important, not just for aesthetics, but for safety. Consistency in surface materials, reduced number of transitions, and use of visually different materials to highlight important decision-making zones is critical. The hardscape used in RTP should have three distinct areas aligned with the three Place Types, which differ in scale, materials, and aesthetics, but materials used in both should be durable.

In general, concrete should be used for most sidewalks and side paths within the streetscape outside of the MUN and ECC Place Types. Concrete finish should be heavy broom finished in perpendicular pattern. For sidewalks, a tooled joint scoring perpendicular to the flow of traffic should be provided, while a saw cut joint should be used on paths where cyclists or other wheeled devices may be present.

The following images highlight additional hardscape details:

Typical permeable brick paver in herringbone pattern and single soldier edge course in furnishing zone of streetscape.

Crosswalks: Typical stamped and surface coat treatmented asphalt. Surface color applied with Endurablend or equal product.

Hardscape Medians

Medians typically provide opportunities to provide an attractive element such as landscaping or public art. In some cases, safety requirements, width, or surrounding conditions do not allow for optimal median aesthetics. In these cases, concrete medians are frequently installed. For RTP, these opportunities can be enhanced through creative applications of hardscapes for medians such as color and/or textured concrete, pavers, or natural materials such as pebbles or boulders.

Guidelines for hardscape include:

+ Where conditions or restrictions do not allow for optimal conditions for landscaping, low maintenance hardscapes should be utilized.
+ Hardscape medians should be visually distinct from surrounding roadway.
+ Paver hardscape medians should be utilized within the Mixed-Use Node, while stamped concrete utilized elsewhere throughout RTP.

Source: San Francisco Better Streets

Green Infrastructure

Green infrastructure uses natural processes to properly capture, store, and filter stormwater. Within the right-of-way, there are several opportunities to include green infrastructure as street projects are designed. Examples of green streetscape infrastructure include:

+ Stormwater Planters/Bioswales
+ Stormwater Bump-outs
+ Stormwater Trees
+ Green Gutters

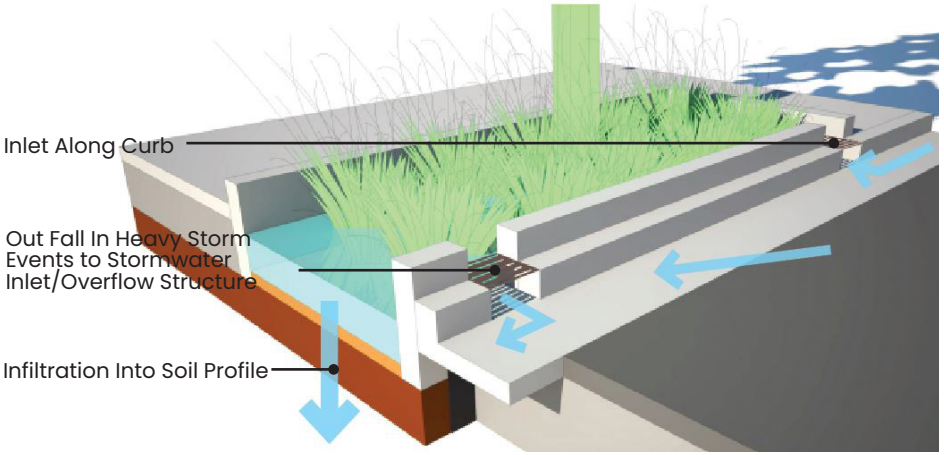
Stormwater Planters

This green infrastructure treatment is appropriate for less intense street types such as collectors or local/neighborhood connectors. Stormwater planters are landscaped reservoirs used to collect, filter, and infiltrate stormwater run-off from the street. This system allows pollutants to settle and filter out as the water percolates through the planter soil and infiltrates into the ground.

While stormwater planters help to achieve sustainability goals, they simultaneously serve as a visual amenity within the streetscape. Stormwater planters may be approximately 20 to 30 feet in length. Approximately 4 - 6 linear feet shall be provided between stormwater planters to allow for pedestrian passage between the sidewalk and the curb zone alongside on-street parking spaces. Drought-tolerant, native ground cover and shrubs should be provided within stormwater planters. Plant materials should be chosen for seasonal color variety as well as texture and visual interest.

Stormwater planters collect and treat stormwater using bio-retention. These systems collect and filter stormwater through layers of mulch, soil, aggregate, and plant root systems, where pollutants such as bacteria, nitrogen, phosphorous, heavy metals, oil and grease are retained, degraded and absorbed. Treated stormwater is then infiltrated into the ground as groundwater (infiltration planter) or, if infiltration is not appropriate, discharged into a traditional stormwater system (flow-through planter). Stormwater planters do not require a large amount of space and can add aesthetic appeal and wildlife habitat to streetscapes.

Diagram: Typical Stormwater Planter Detail



Stormwater Bump-outs

A stormwater bump-out is a landscaped curb extension that extends the existing curb line into the roadway. It is designed to manage stormwater runoff by setting the top of the planting media in the bump-out lower than the street's gutter elevation and connecting the bump-out to one or more inlets (types vary), which allows stormwater runoff from the street to flow into the bump-outs. Runoff from the adjacent sidewalk can flow directly into the stormwater bump-out from the surface.

Stormwater bump-outs are designed to capture, slow, and infiltrate stormwater within a planted area or subsurface stone bed. Landscape plantings within the curb extension effectively take up some of the stormwater through their root systems. The remaining stormwater is temporarily stored within the curb extension until it either infiltrates or drains back to the sewer. In mid-block bump-outs, overflow exits through an opening on the downstream side, and flows into a nearby storm drain inlet.

Example of stormwater bump-out. Source: Philadelphia Green Streets Design Manual

Mid-block Stormwater Bump-out

Stormwater Trees

A stormwater tree is a street tree planted in a specialized tree pit installed in the sidewalk area. It is designed to manage stormwater runoff by placing the top of the planting media in the tree pit lower than the street's gutter elevation and connecting the tree pit to an inlet (types vary), which allows stormwater runoff from the street into the tree pit.

Runoff from the adjacent sidewalk can flow directly into the tree pit from the sidewalk surface. Multiple tree pits can be designed in a series to maximize the potential for stormwater capture and treatment. Stormwater will either infiltrate or drain to a connection to the storm sewer network. If the stormwater tree is at capacity, runoff can bypass the stormwater tree inlet and enter other downstream storm drains.

Example of stormwater tree. Source: Philadelphia Green Streets Design Manual

Green Gutter

A green gutter is a narrow and shallow landscaped strip along a street's curb line. It is designed to manage stormwater runoff by placing the top of the planting media in the green gutter lower than the street's gutter elevation allowing stormwater runoff from both the street and sidewalk to flow directly into the green gutter. An elevated curb can be used along the street side of the green gutter with openings along its length to allow runoff to flow into the green gutter.

Green gutters can be designed to infiltrate and/or flow to the existing storm sewer. The system attenuates stormwater flows, provides storage and, in some cases, infiltration and evapotranspiration. In flow through green gutters, overflow runoff can be conveyed to the existing storm drain system, either through an underdrain tied to the existing storm drain system, or as shallow concentrated flow that is conveyed downstream to an existing inlet.

Green Gutter

Source: Philadelphia Green Streets Design Manual

Furnishings

Furnishings are an integral element of defining the identity and character of a streetscape. Benches, bike racks, trash/recycling receptacles, tree grates, pay stations, bollards, and pet waste stations, all have to work with the rhythm of street trees, lighting, signage and wayfinding, and the surrounding environment of building facades to create a holistic palette that is welcoming and comfortable.

The general intent of streetscape furnishings are:

+ To unify the public right-of-way with a unique character.
+ To provide necessary items for pedestrian comfort and convenience.
+ To ensure the public realm is clean, orderly, and presents an attractive appearance to visitors and users.
+ To encourage use of the public realm, therefore, contributing to the economic vitality of RTP.

Design guidelines for streetscape furnishings include:

+ Streetscape furnishings placement is encouraged in high-traffic corridors, mainly the MUN Place Type. Placement should be coordinated with businesses or other private property owners to ensure conflicts are avoided.

Example of a consistent furnishings palette at RTP HUB (Source: Kimley-Horn)

+ Placement, quantity, and style of furnishings should consider the overall street context, existing elements of nearby buildings, intended use, and consider consistency.
+ Consideration of functional needs for pedestrians, cyclists, and vehicles should be incorporated into the placement, dimensions, and quantity of furnishings.

Additional notes:

+ A durable substitution for tree grates is belgian block and reduces installation time, reduces material costs, is extremely durable, and can be easily removed to allow for healthy tree growth. Belgian blocks can also be used within the furnishing zone as a means to visually separate the space from the throughway/walking zone, for the step strip.
+ Bike repair stations should be considered in high traffic corridors along bike lanes or shared-use paths are located.
+ Bike corrals should be considered in high traffic areas or near primary destinations. Corrals are located within the street in place of on-street parking.
+ Consideration should be given for any streetscape within RTP for the placement of pay stations for on-street parking.
+ Placement of benches along sidewalks, outside of the MUN Place Type, should be set back from the sidewalk by at least two (2) feet to allow for users to comfortably be seated outside of the walkway.
+ Balance placement of furnishings with green infrastructure systems such as stormwater planters/bioswales.
+ Consideration should be given to use of DeepRoot Silva Cells (or equal) where soils may be compacted or additional paved spaces for furnishings is needed and promotes stormwater management and healthy trees.
+ Consider receptacles with tops/lids and universal symbols.

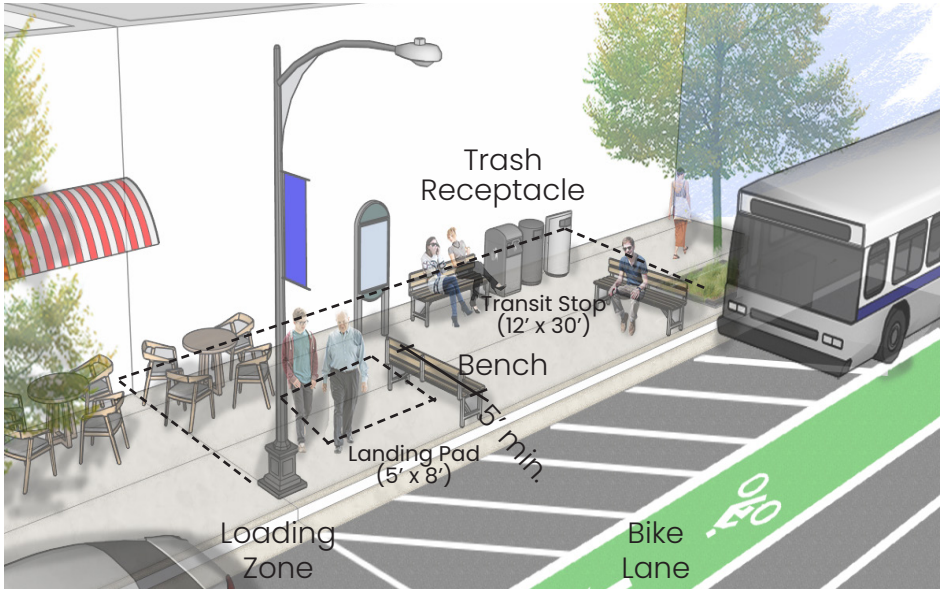
Transit Stops & Loading

All transit or shuttle stops should be laid out in accordance with required dimensions for clear-zones, landing pads, shelters, benches, bike racks, and trash receptacles.

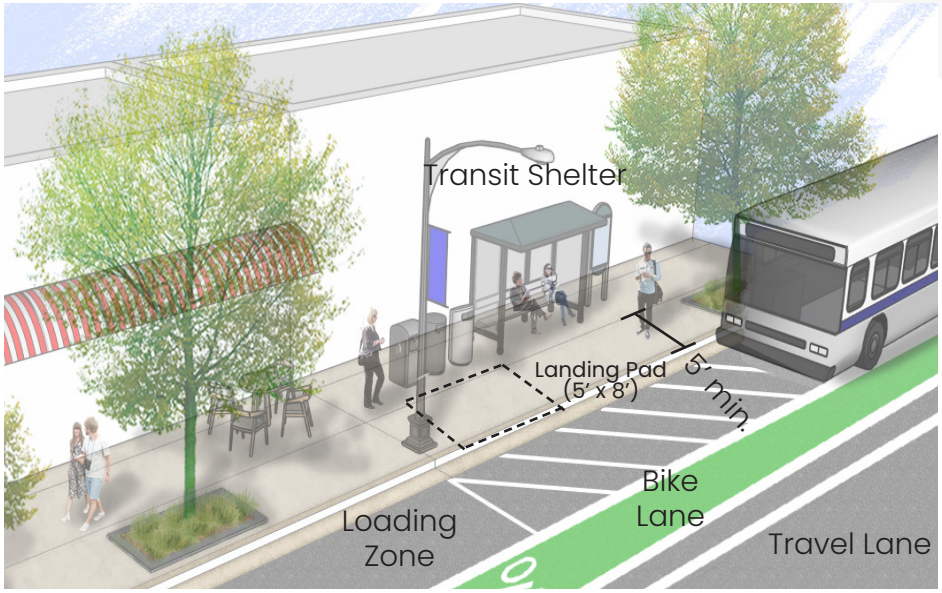
Transit shelters should match streetscape lighting and wayfinding style and incorporate RTP branding where possible.

Loading zones, passenage or food drop-off/pick-up zones should be prepared with transit stops where possible and/or consist of lane or space markings designating the area as such. Where possible, avoid signage on posts for areas, or consolidate signs with nearby light poles, wayfinding, or other signs to reduce sign clutter.

Curbside in-line transit/shuttle stop



Curbside in-line transit/shuttle stop with shelter



Lighting and Charging

Lighting has an important role in creating atmosphere, promoting safety, and branding for a community. Scale, style, lighting effect, and maintenance affect fixture requirements. Custom light poles, standard poles, specialty light fixtures, and pedestrian lighting all help to create a unified identity and consistent lighting level environment for the pubic right-of-way.

The intent of lighting should include the following:

+ To provide a safety environment for pedestrians and vehicles that is pleasing to the eye and encourages activity.
+ To provide aesthetic scale and framing of the streetscape during the day, creating a sense of place.

Guidelines for lighting include:

+ Pedestrian lighting should be included within the Mix-Use Node Place Type, consistent with prior adopted guidelines.
+ Roadway lighting should be coordinated with NCDOT where applicable and utilize a consistent style.
+ Spacing: Approximately 56' - 64' spacing in same alignment as street trees. Lights should be centered between trees. Conflicts with trees should be avoided.
+ Duplex outlets should be provided for tree pits within the MUN and ECC Place Types to allow for low-voltage seasonal lighting of trees. Outlets should be located on low profile posts with lockable covers.
+ Consider 30 amp or 50 amp needs based upon potential uses such as food trucks.
+ Pedestrian and street light poles within the MUN and ECC Place Types should include duplex outlets located near the fixtures adjacent to brackets or banner bars to allow for the mounting of seasonal lighting to the pole with power source located near the mounting.
+ Within the MUN and ECC Place Types, duplex outlets should be located within adjacent landscape beds or tree pits, or located within ground vaults adjacent to loading areas or parallel parking areas that will be permitted for food truck use to allow for electrical connection upon permitted authorization.

Guidelines for charging include:

+ Consider use of solar for phone, ebike, and person device charging.

Light Poles

Example of a consolidating lighting, camera, and Wi-Fi infrastructure to reduce poles, RTP HUB (Source: Kimley-Horn)

Example of a picnic table with solar panels powering 120 volt power sources. (Source: Kimley-Horn)

Example of a lockable power source and multiple power types, RTP HUB and Park Point (Source: Kimley-Horn)

Gateways and Wayfinding

Gateway elements enhance community branding and serve as welcome features for RTP.

The intent of gateways should include the following:

+ To provide a form of wayfinding that combines RTP branding and character.
+ To provide aesthetic scale and framing of major streetscapes and intersections.

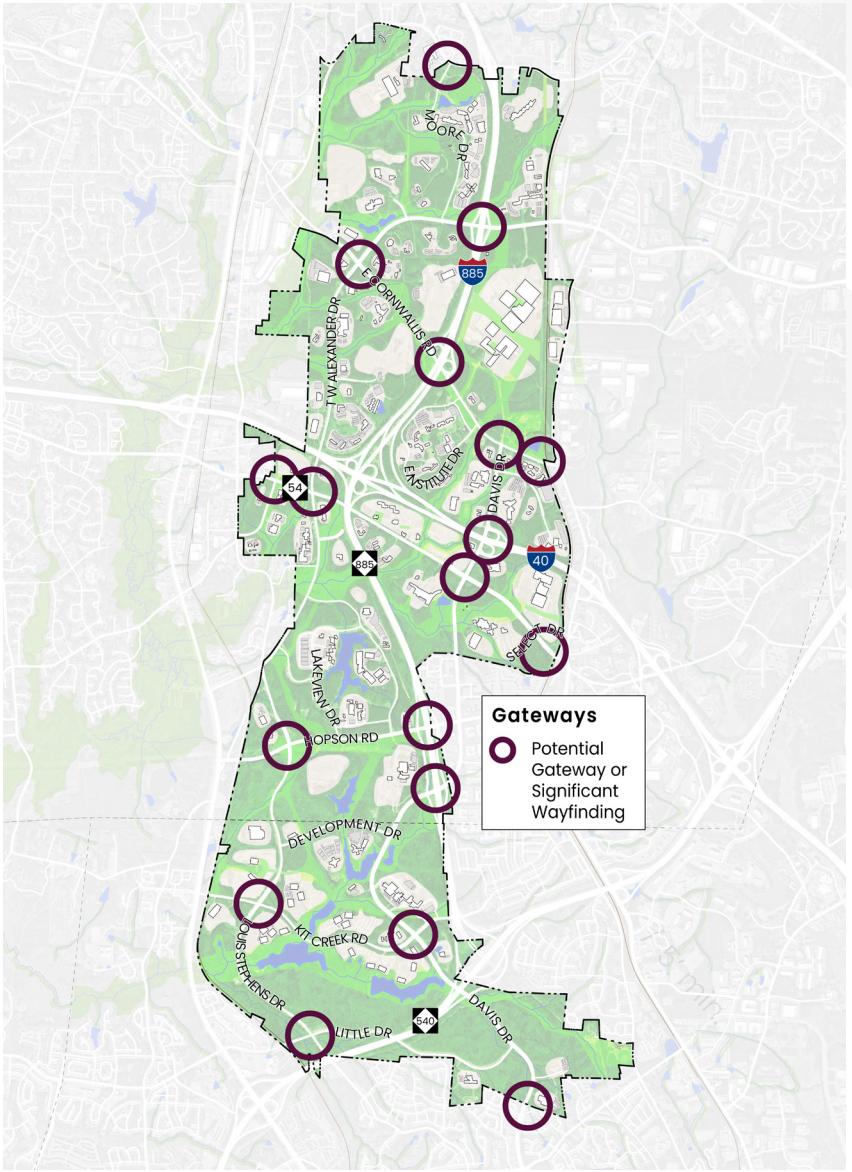
Guidelines for gateways include:

+ Gateways should be placed near the RTP boundary, at the exits of highways, and at the intersections of major cross-roads. The map to the right identifies potential future gateway locations or sites where major wayfinding signs may be appropriate.
+ Gateway elements should incorporate public art where possible.

Wayfinding signage along thoroughfares should include a decorative post, a colored framing for street sign banner, and a colored finish to the back of traffic signs. When possible signage should be grouped onto single poles to reduce signage clutter. Traffic signals poles and master arms should have a black finish with mounted street name banners and decorative poles.

All traffic signage should following Manual of Uniform Traffic Control Devices or (MUTCD) and NCDOT guidelines. Traffic signs do not need to have black finishes, nor decorative poles, however, consolidation of signage where possible should be considered. Traffic signal poles and master arms along corridors other than thoroughfares may be aluminum with mounted street name banners.

Recommended Gateways



Aesthetics of the Street

Art in the public realm is an important part of the culture of a diverse community, can create a sense of place, and provides character and branding. While not only aesthetically pleasing, public art provides opportunities for local artists to contribute to the image and economics of RTP, and exposes residents and visitors to the diversity and culture that makes RTP unique. The following are key goals for managing public art along streetscapes:

+ Provide diversity in public art. Different styles and mediums used to produce and display public art.
+ Integrate of Art into the community's public realm. Explore streetscapes, gateways, and intersections that would be ideal locations for public art installations, and other opportunities that may exist in conjunction with future projects.
+ Establish a funding source for a Public Art Program.
+ Commission distinctive works of art reflecting the character of RTP at priority locations.
+ Enhance community participation in the public art process through engagement of the public.
+ Create gateways to enhance community identity.
+ Celebrate the region's unique character, history and diversity through a broad range of public art projects.
+ Enhancing RTP's urban design objectives by using public art to animate and activate streetscapes and public spaces.
+ Promote the economic vitality of RTP by using public art to brand TRP as a vibrant arts and cultural destination.

Why Public Art?

Many may see the definition of public art as "permanent art installed in public spaces," but the definition and impact of public art on a community is much broader. Public art is a community investment in creativity that shapes, enhances, and activates public spaces. In its best realization, public art has the power to transform communities, invigorate and energize their populations, inspire passion and enthusiasm about the built environment, and engender ownership in artworks and the neighborhood at large. Public art has turned communities from anonymous series of spaces into rich landscapes reflecting history, embracing and honoring cultural differences, and teaching social values. Public art moves beyond improving aesthetic quality within neighborhoods and communities, by reinforcing social connections, and fostering improved health outcomes.

Diversity of Public Art

Public Art can take many forms and exists in a wide variety of public spaces. Common types of public art generally fall within one of the following categories:

+ Sculpture
+ Architecture
+ Murals / Paintings
+ Earthworks
+ Memorials
+ Signage
+ Installation Art
+ Interactive Art

Public art captures and reinforces the unique character of a place. The setting for public art should be considered as part of the experience of the art itself. The impact of the place, whether the comfort, noise, views, etc. all have a hand in the experience of art. Together the setting and the art create a memorable experience.

The intent of any public art should include the following:

+ To enrich the experience of RTP whether it is a moment of visual pleasure while stopped at a traffic signal or by creating a space along a streetscape for pedestrians to site, relax, and linger.

To contribute to RTP's sense of place by enhancing connections between people and the environment through art and distinctive landscape.

Guidelines for public art include:

+ Materials: Public art should consist of durable materials and where possible natural such as stone, wood, or metal should be used.
+ Siting: Public art should be sited to complement the surrounding environment. Art should not be a distraction to drivers or pedestrians or negatively impact the safety of the public. The scale of the art should be appropriate to the site. Consideration to art that serves as a terminus or focal point as space defining elements.
+ Landscape: Landscape should complement the art installation or serve as an extension or part of the art. Consideration to the mature size of landscape, maintenance requirements, and lifespan should be provided.
+ Playful: Public art should be approachable and challenging. It can incorporate seating, opportunities for children to play, water, or light.

RTP HUB (Source: Kimley-Horn)

Source: City of Durham

RTP HUB (Source: Kimley-Horn)

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Implementation + Action Plan

Action and Implementation

The Research Triangle Park Comprehensive Transportation Plan is ultimately a decision-making tool for RTF, developers, and Durham and Wake Counties to use in their pursuit of development and transportation improvements.

Project Development

This CTP is a design guide and toolkit to that will allow RTF to apply a cohesive and coordinated strategy when identifying, designing, and implementing transportation projects.

In the new governance structure proposed as part of RTP 3.0, the RTP Planning Board will be the deciding body to ensure that development plans comply with the vision and design guidelines detailed in the CTP.

Coordinated Effort

Establishing a coordinated effort between RTP and local partners is integral to the success of RTP 3.0. A project and plan of this scale involves many public and private stakeholders including, RTP property owners and tenants, developers, the City of Durham, Durham and Wake counties, NCDOT, local transit authorities, schools and colleges, and more. RTF will need to continuously collaborate with these partners in order to achieve the greater vision for RTP.

Transportation Investments

In order to best position themselves for success, RTF will need to capitalize off the already planned transportation improvements by expanding the existing infrastructure and supporting multiple modes of transport. Building upon the existing network of active transportation facilities will be essential in creating an environment where people can live, work, and play. Connecting local and regional transit opportunities to RTP will improve access to the Park, enabling greater growth as both a research center and mixed-use hub. Finally, ensuring that traffic flows efficiently and safely into and throughout RTP will keep the Park attractive as a destination.

Realistic Funding

Understanding funding options is a critical component of the CTP process.

State and Regional Partnership Opportunities

Many transportation improvements will involve NCDOT as the lead agency. It will be RTF's responsibility to work in close coordination with the Capital Area Metropolitan Planning Organization (CAMPO) to ensure that needs are reflected in the region's Metropolitan Transportation Plan (MTP), and as appropriate, submitted to the State for prioritization and inclusion in the Statewide Transportation Improvement Program (STIP).

Private Contributions

Private development will be the main driver for the funding, construction, and implementation of transportation infrastructure in RTP. By applying tools this CTP, RTP is able to clearly communicate with developers and identify improvements needed to accommodate new growth while promoting the mobility of current residents, employees, and visitors.

RTP Fund Development

As part of RTP 3.0, a fund for implementing the vision of the master plan. These funds will be critical to carrying out street network improvements needed that are RTP's responsibility.

Conclusion

RTP 3.0 is the guiding visionary document for the Research Triangle Park. The framework outlined in the RTP CTP defines the strategy for creating a park-wide transportation system that accommodates current needs while also anticipating future transportation considerations. Measurable success will require continued partnership, strategic investments, and alignment of local and regional priorities.

RESEARCH TRIANGLE PARK