Troy Bicycle Connections Plan

A guide for making safe, enjoyable, and efficient bicycling a reality for Troy

Troy Bicycle Connections Plan

January 2018

Prepared by Parks & Trails New York for the City of Troy and the Capital District Transportation Committee

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Parks & Trails New York
PTNY is a non-profit organization working since 1985 to expand, protect, and promote a network of parks, trails, and open spaces throughout New York State for the use and enjoyment by all.

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About the Troy Bicycle Connections Plan
This plan was funded in part through a grant from the Federal Highway Administration, U.S. Department of Transportation. The views and opinions of the authors [or agency] expressed herein do not necessarily state or reflect those of the U.S. Department of Transportation. This report was prepared in cooperation with the City of Troy, the Capital District Transportation Committee, the Capital District Regional Planning Commission, the Capital District Transportation Authority, Rensselaer County, and the New York State Department of Transportation. The contents do not necessarily reflect the official views or policies of these government agencies. The recommendations are conceptual in nature and are presented to characterize the types of improvements that are desirable, and that may be implemented as part of future land use and transportation improvement projects. All transportation concepts will require further engineering evaluation and review. Undertaking additional engineering or other follow up work will be based upon funding availability. The *Troy Bicycle Connections Plan* will have a positive impact on the affected Environmental Justice populations, as documented in the Appendix.

CDTC Capital District Transportation Committee

Parks & Trails New York

City of Troy, N.Y.

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Executive Summary

The *Troy Bicycle Connections Plan* is a guide for making safe, enjoyable, and efficient bicycling a reality for Troy. It is a guide for city officials, advocates, and interested residents and business owners. As the name implies, a major focus of the plan is to connect existing bicycle facilities, such as bike lanes and the Uncle Sam Bikeway, to create a viable transportation network for bicyclists.

The *Troy Bicycle Connections Plan* uses best practices from across the United States to assemble a bikeway network that accommodates the comfort level and abilities of all current and future bicyclists. The network outlined in the following pages consists of three bikeway types - primary, secondary, and neighborhood bikeways. Each bikeway type responds to roadway characteristics, such as traffic volumes, speeds, and connectivity to parks, trails, schools, workplaces, and business districts, that help appropriately categorize it. Primary Bikeways have the highest levels of traffic, oftentimes because they are the most direct routes to important destinations. Secondary Bikeways, too, can have high traffic volumes and high connectivity, though they usually serve important destinations less directly. Neighborhood Bikeways, which are usually residential streets, are the least connected and therefore have the lowest traffic volumes.

The recommended bicycle facility for each bikeway type takes into account the level of comfort and safety of bicyclists; so Primary Bikeways will have more protection recommended than Secondary and Neighborhood Bikeways. To accommodate flexibility and encourage innovative solutions, there is no single recommendation for each bikeway type. The plan also includes a matrix the City of Troy should use to determine the appropriate treatment for each street. In addition to bikeway treatments, the *Troy Bicycle Connections Plan* makes recommendations for bicycle parking, which is a necessary component of any well-developed cycling network.

The final section of the *Troy Bicycle Connections Plan* prioritizes ten projects that the City of Troy should undertake within the next 3-5 years to jumpstart the network. Facility recommendations and corresponding cost estimates are available for each priority project.

The *Troy Bicycle Connections Plan* recognizes that creating a world-class cycling city is a challenging undertaking, requiring continued community involvement and political will. By creating a shared community vision and identifying short- and long-term priorities for improving bicycle connectivity, this guide gives Troy the necessary framework and tools to become a place where bicycling is safe, enjoyable, and efficient for all ages and abilities.

STOP

Introduction

Cities and towns across the United States are embracing bicycling as a viable form of transportation. Some cities started this process decades ago, while many, including the City of Troy, are only just beginning. In addition to providing residents with low-cost transportation options, planning for bicycling leads to reduced costs related to roadway wear and tear, congestion pollution, and health issues caused by sedentary lifestyles. In addition to lowering these costs to residents and society, bicycling is a proven engine of economic development. Studies from cities large and small show that the installation of bicycling infrastructure leads to increased revenue for shops and restaurants and higher property values for adjacent landowners. Bicycling can have positive effects on mental health, leading to happier and more productive residents.

The Troy Bicycle Connections Plan will help the City of Troy achieve a network of bikeways that fit the city's budget and a comfort level that accommodates people of all ages and abilities. The plan is pragmatic, with multiple alternatives offered for each bikeway. Thanks to multiple opportunities for feedback along the way, it has been informed by residents and visitors.

The treatments outlined in the Troy Bicycle Connections Plan are largely influenced by the National Association of City Transportation Official's (NACTO) Urban Bikeway Design Guide. NACTO's treatments are based on the experience of the best cycling cities in the world and almost all are permitted under the Manual on Uniform Traffic Control Devices (MUTCD). Treatment examples can be found in cities across the United States, and increasingly, elsewhere in the Capital District.

About Troy

The City of Troy is one of the principle cities of the Albany-Schenectady-Troy metropolitan area, a region that is home to almost 1 million people and is more commonly referred to as the Capital District. Troy is also the county seat for Rensselaer County.

Despite its separation from much of the region by the Hudson River, Troy is well-integrated into the Capital District, with many residents and visitors traveling between the city and neighboring municipalities for work, recreation, and shopping.

Troy is known as the home of "Uncle Sam" Wilson, a local butcher whose likeness came to personify the U.S. government. Troy is also referred to as the "Collar City", after resident Hannah Lord Montague's innovation of the removable shirt collar.

A long period of disinvestment followed the deindustrialization of the Northeast in the middle of the 20th century, resulting in a higher than average percentage of the city's population living in poverty. While the city continues to rebound from this period of economic decline and stagnation, Troy's thriving downtown, waterfront access to the Hudson River, and the presence of world-class educational institutions point to a bright future.

Much of Troy was developed before the arrival of the automobile, leaving a legacy of dense, walkable neighborhoods. Many residents rely on public transit, walking, and biking to travel throughout the city and region. A growing demand for accommodating more sustainable transportation modes, such as bicycling, among city residents, elected officials, and the Capital District Transportation Committee means that retrofitting the existing, well-developed on- and off-road transportation network and identifying new opportunities in Troy has become a priority, leading to the

development of the *Troy Bicycle Connections Plan*.

Capital District Transportation Committee's Linkage Program

CDTC's Community and Transportation Linkage Planning Program (the Linkage Program) is an integrated land use and transportation planning program created to implement the regional transportation plan known as New Visions 2040. The program has been recognized as a national best practice in livability planning and is the cornerstone of CDTC's public outreach efforts. The program provides financial and technical assistance to local communities for planning, with particular emphasis on projects that support implementation of innovative transportation and land use concepts. Examples include strategic zoning code changes/zoning code overlays, the development of complete streets design guidelines, strategic master plans, etc.

The Linkage Program is one of the most significant cooperative regional efforts in the nation to reflect, in practice, what representatives of the region's counties, cities, towns and villages as well as state and local transportation providers have adopted as policy. In recognition of this regional achievement, the Linkage Program received a 2010 National Planning Excellence Award from the Federal Highway Administration, the Federal Transit Administration and the American Planning Association.

As of March 2017, CDTC has funded a total of 86 collaborative, jointly-funded studies over the past sixteen years. Study sponsors have included 40 separate urban, suburban and rural municipalities and counties as well as not-for-profits and other public entities. Roughly $6.0 million in federal, state and local funds have been committed to the Linkage Program since its inception in 2000.

The Study Advisory Committee

Throughout the development of the *Troy Bicycle Connections Plan*, PTNY regularly informed and sought feedback from a diverse stakeholder group of planning professionals, community leaders and activists, and city residents who served as a Study Advisory Committee (SAC). The group was convened by the Capital District Transportation Committee and the City of Troy, the project leaders. Many members of the SAC performed community outreach to their constituencies on behalf of the plan.

1 Existing Conditions

Troy Bicycle Connections

Existing Conditions

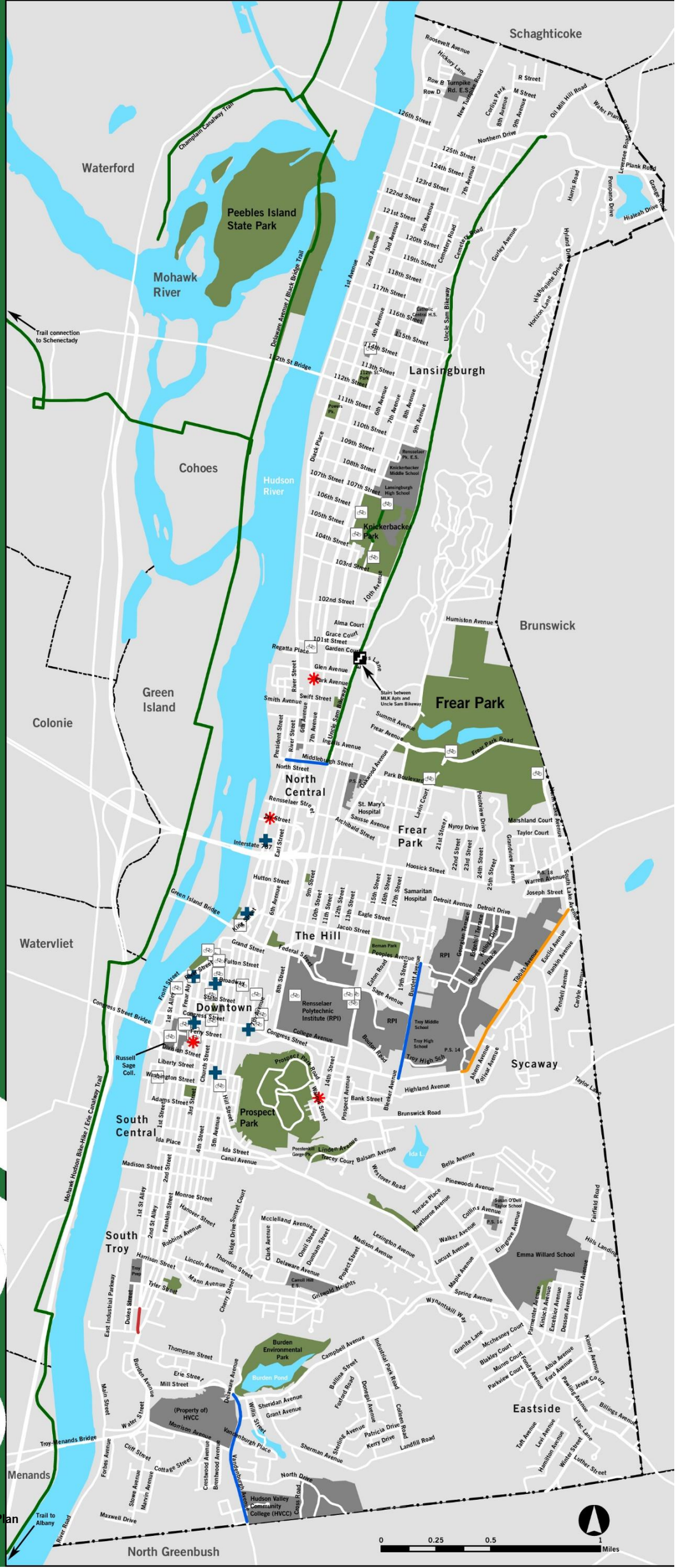
January 2018

Bike Infrastructure

- Striped bike lane
- Climbing lane
- Shared lane markings, "sharrows"
- Multi-use trail

Bicycle Amenities

- Fix-it Bicycle Repair Station
- Bike Rack
- CDPHP Cycle! Bike Share Hub



Land Use

As a relatively old and prosperous city, Troy has a diverse land-use development pattern. While the city previously hosted large manufacturing areas, today, the land-use pattern is dominated by institutional uses such as hospitals and colleges and universities. Many of the city's neighborhoods are mixed-use, with varying levels of density and uses. These characteristics of Troy's land-use development pattern mean that most residents are located close to services, schools, parks and recreation, and business and employment centers.

Demographics

According to the 2010 Census, the City of Troy has 50,129 residents. Compared to the wider Capital District, which encompasses the Albany-Schenectady-Troy Metropolitan Area, Troy is more racially and ethnically diverse. A higher percentage of the city's residents live below the poverty line compared to the rest of the Capital District.

Troy is included within the boundaries of the Capital District Transportation Committee's Environmental Justice impact area. An analysis of how this study relates to this designation is included in Appendix C.

See Appendix A for information and analysis of Troy's land use, demographics including population, race, poverty and educational attainment. Appendix A also presents background information on Troy's existing transportation network, including public transportation, walkability, mode share, safety, and housing and transportation affordability.

Transportation

The City of Troy is already a multi-modal city, with a well-developed transit system, network of streets with sidewalks, and bicycle infrastructure that includes some painted lanes and a growing bike share system.

The Census Bureau estimates that 22% of residents had access to no vehicle, a figure that is more than double that of the rest of the Capital District Metropolitan Area. According to the Capital District Regional Planning Commission (CDRPC), 0.2% of employed residents of Troy commuted by bicycle. Since this figure is only measuring work trips, it's likely that it misses many other trips that occur by bicycle, such as errands, trips to school, and recreational rides.

Public Transportation

The primary public transportation service in Troy and the surrounding areas is Capital District Transportation Authority (CDTA) bus service. CDTA serves Troy with 10 routes, half of which connect Troy to the greater Capital District. All CDTA buses are equipped with front bike racks. CDTA plans to introduce bus rapid transit (BRT) service in Troy and upgrade the existing Uncle Sam Garage into a major transit hub, complete with bicycle friendly amenities that include long- and short-term parking options.

Bike Share

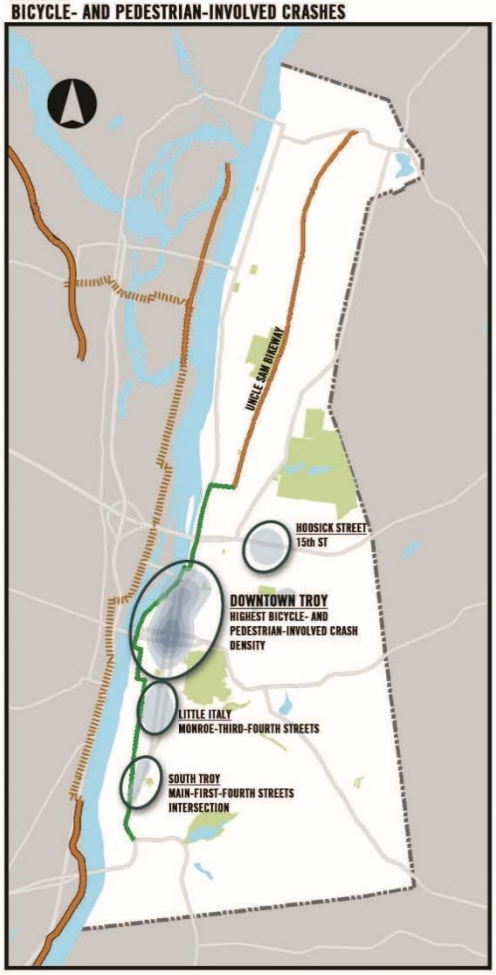
CDTA launched the bike share service, CDPHP Cycle!, in 2017. In the system's first year Troy hosted seven docking stations. These stations were concentrated primarily Downtown, though there were two stations outside of Downtown at Sage College and at the intersection of Liberty and Hill Streets; CDTA reported that the latter location was the busiest in Troy. Unlike many bike share systems, the CDTA system allows users to lock bikes to any bike rack, extending the usable range of the system outside of the areas immediately adjacent to the docking stations.

CDTA anticipates approximately doubling the number of CDPHP Cycle! station locations in Troy for the 2018 riding season, with expansion to North Central, Lansingburgh, South Troy, and the Hill neighborhoods. As of the writing of this plan, these specific locations of these new docking stations were unavailable.

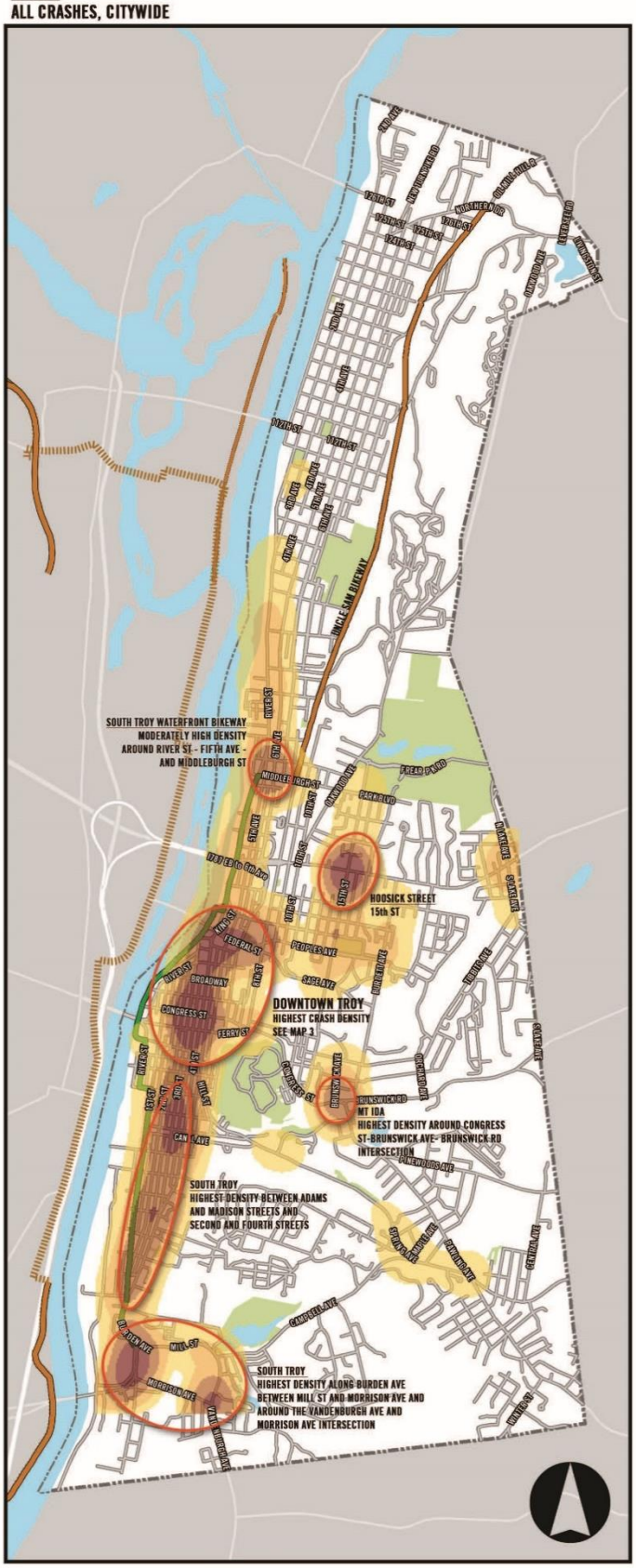
Crash Density Analysis, 2012-2017

Maps display relative crash density, not specific crash locations

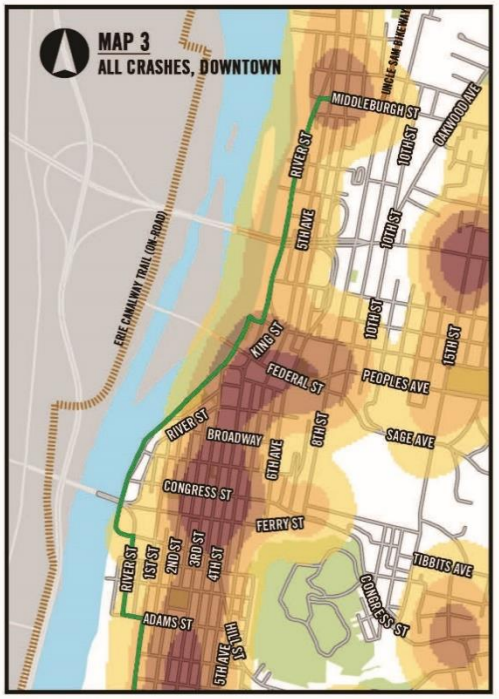
MAP 1
BICYCLE- AND PEDESTRIAN-INVOLVED CRASHES



MAP 2
ALL CRASHES, CITYWIDE



MAP 3
ALL CRASHES, DOWNTOWN



Map produced by Parks & Trails New York, June 23, 2017
Data Sources: Capital District Transportation Committee and New York State Department of Transportation

Existing Street Network
Thanks to a well-developed and connected street grid, the City of Troy offers significant potential to develop a robust cycling network that will help make cycling across the city more efficient, enjoyable, and safer.

Downtown Troy
Downtown streets that run north-south are primarily numbered streets, with even-numbered streets generally moving traffic northbound and odd-numbered streets generally moving traffic southbound. This pattern is broken by Sixth Avenue, which is bi-directional for its entire length, and River Street, which is bi-directional for two blocks between Fulton Street and Broadway. Cross streets, which run east-west, alternate in direction for eight blocks between Federal and Liberty Streets. Narrow bi-directional alleys run north to south throughout Downtown Troy. Primary Downtown north-south streets include River Street, Third Street, Fourth Street, Fifth Avenue, and Sixth Avenue. Federal Street, Fulton Street, Broadway, State Street, and Congress Street, and Ferry Street are the primary east-west streets.

South Troy and North Central Neighborhoods
The completeness of the City's street grid from North Central to South Troy yields a dense pattern of one-ways that run primarily north-south and two-ways that run east-west. The general rule in South Troy is that odd-numbered streets run south, while even-numbered streets run north. Most cross-streets in this neighborhood run both ways (east and west). South of Downtown, Third and Fourth Streets complement each other as a primary north-south one-ways.

North Central Troy's streets are more complicated, though the north-south streets generally alternate in direction. North of Downtown Troy, River Street and Sixth Avenue are the primary north-south streets. A network of narrow bi-directional alleys run through both of these neighborhoods.

Lansingburgh
In Lansingburgh, city streets conform to a grid that includes a mixture of one-ways and two-ways that as a whole, mesh together for efficient wayfinding for pedestrians and drivers. River Street / Second Avenue and Sixth Avenue / Fifth Avenue serve as the primary two-way north-south routes through this section of Troy. The eastern boundary of this neighborhood also includes the Uncle Sam Bikeway, which serves as a completely vehicle-free route for just over three miles between Middleburgh Street and Northern Drive.

The Hill
In the neighborhood on the hill between Hoosick Street and the Rensselaer Polytechnic Institute Campus, the streets largely follow a grid that while disconnected from the downtown grid, follows a similar pattern of one-ways and two-ways intersecting each other to form an easily understandable wayfinding network. In this neighborhood, numbered two-way north-south streets run for ten blocks from Eighth Street through 17th Street and two blocks of complementing one-way east-west streets (Jacob and Eagle Streets) are supplemented by two-way east west streets near the neighborhood boundaries (Peoples Avenue and Hutton Street). In this neighborhood, 15th Street is the primary north-south route and connects the RPI campus with Hoosick Street.

Other Areas
The remainder of the City of Troy consists primarily of two-way streets. Major streets south of Downtown include High Street, Mill Street, Morrison Avenue, Vandenburgh Avenue, and Pawling Avenue. East of Downtown, major streets include Spring Avenue, Congress Street, Brunswick Road, and Pawling Avenue. East of Lansingburgh, major streets include Oakwood Avenue and Northern Drive.

Hoosick Street
Hoosick Street, is a major east-west street, with almost 50,000 vehicles per day using the street along the stretch between the Collar City Bridge and the Town of Brunswick. While this street is an important corridor home to shops, restaurants, grocery stores, and employment centers, it has long served as a barrier between adjacent neighborhoods and the rest of the city. Moreover, the street sees major vehicle congestion during rush hour periods. Due to the scale of interventions needed on Hoosick Street, and fact that it is outside of City jurisdiction, bikeway treatments were not considered for this stretch of roadway. Future planning regarding Hoosick St. should include consideration for cyclists and maintaining the continuity of bikeways crossing the busy roadway.

Schools

Grade Schools

Two public school districts, Lansingburgh and Troy City, educate thousands of children at seven elementary schools, two middle schools, two high schools, one charter school, and an alternative learning program. These schools are dispersed throughout the city, oftentimes serving as an important neighborhood gathering area. Troy is also home to several private schools that draw students from surrounding neighborhoods and in many cases, from other states and countries.

For public elementary school students who live less than 0.6 miles and for public middle and high school students who live less than one mile from the school, school bus service is not provided. This transportation policy, combined with the important resources these schools offer neighborhood residents, demonstrates the importance of providing safe bicycling facilities in areas around schools.

Colleges and Universities

In addition to a diverse mix of private and public schools, Troy is home to three colleges and universities that vary in student composition and size. The largest of these colleges is Hudson Valley Community College. While this school primarily serves a commuter population from around the region, many students and faculty live close enough to the campus to arrive by bicycle. The remaining two colleges, Russell Sage College and Rensselaer Polytechnic Institute (RPI) are primarily residential schools, with many students living either on campus or in nearby apartments. Therefore, students of these schools, and many faculty and staff, are more likely to arrive to campus by active transportation and public transportation. This plan will focus on prioritizing improvements to bicycling connections between universities and colleges and surrounding neighborhoods and commercial areas.

Parks and Recreation

The City of Troy is home to three major parks, two memorial parks, and 18 neighborhood parks. The three major parks - Frear, Knickerbacker, and Prospect – are important community recreational assets due to the fact that they offer residents nature trails, pools, skating and hockey rinks, tennis and basketball courts, playgrounds, picnic areas, baseball and soccer fields, an outdoor track, and a golf course. The neighborhood parks are much smaller and are more limited in the facilities they offer residents; however, they are still important community gathering places and host basketball and tennis courts and playgrounds.

These 23 parks are spread throughout the City of Troy, and since most offer no dedicated parking areas, connecting them is a high priority of the Troy Bicycle Connections Plan.

Bicycle Infrastructure

While Troy currently lacks a developed network of bicycling facilities, amenities traditionally found in cities with a more substantial bicycle

network provide a good foundation for future bicycle infrastructure investments.

Striped Bike Lanes
The City of Troy began expanding striped bicycle lanes after the passing a complete streets ordinance in 2014. As of the writing of this plan, the following streets have striped bicycle lanes:

Middleburgh Street, between River Street and the Uncle Sam Bikeway: eastbound bicycle lane and westbound shared lane markings;

Burdett Avenue, between Tibbits Avenue and Peoples Avenue: bicycle lanes on both sides of the street;

Tibbits Avenue, between Orchard Avenue and S. Lake Avenue: alternating bicycle lanes on the uphill and shared lane markings on the downhill;

Vandenburgh Avenue, between North Greenbush and Mill Street / Campbell Avenue: bicycle lanes on both sides of the street.

Shared Lane Markings
Northbound shared lane markings are located on **1st Street** between Main Street and Polk Street. Their primary purpose is to direct bicyclists into Downtown Troy. Most of these markings have faded beyond recognition, however. Wayfinding signage supplements these faded pavement markings.

Wayfinding Signage
In addition to striped bike lanes and shared lane markings, several streets in Troy have wayfinding signage. The current wayfinding signage guides bicyclists between the Troy-Menands Bridge and Downtown Troy and along River and Middleburgh Streets to the Uncle Sam Bikeway. In Lansingburgh and South Troy, old route signage directs travelers to the Mohawk Hudson Heritage Trail.

Bicycle Parking
The existing conditions map displays known bike parking locations. In general, bike parking is more readily available in the downtown area than in other neighborhoods. However, municipal facilities such as schools, libraries and parks throughout Troy were observed to have reasonable amounts of bicycle parking.

Bicycle Fix-it Stations
Bicycle fix-it stations, which provide bicyclists with a public stand and attached tools to make bicycle repairs, are currently located at the following four locations:

- Capital Roots, 594 River Street
- Troy Public Library, 100 2nd Street
- Troy Bike Rescue, 3280 6th Avenue
- 338 Congress Street

These fix-it stations are a particularly important amenity for bicyclists in Troy since the city lacks a retail bicycle repair shop.

Troy Bicycle Rescue
A non-profit, community-run organization that offers bicycle repair workshops twice a week, adopt-a-bike, and donate-a-bike programs. Troy Bicycle Rescue is currently the only bicycle shop operational in Troy. The workshop is located on 6th Avenue in the Lansingburgh neighborhood.

Uncle Sam Bikeway
The 3.1-mile Uncle Sam Bikeway is the only multi-use trail that exists within the City of Troy. This paved rail trail primarily serves Lansingburgh and connects Northern Drive and Middleburgh Street. Trailheads for the Uncle Sam Bikeway are located (south-north) at Middleburgh Street, Ingalls Avenue, Garden Court, 114th Street / Gurley Avenue, Cemetery Road, and Northern Drive.

In 2016, Parks & Trails New York and the Capital District Transportation Committee conducted trail user counts at 114th Street and Garden Court as part of CDTC's Trail Perspectives Update. Data from counts conducted at Garden Court estimate that 33,150 uses occur annually, while annual estimates for 114th Street are 20,358 uses. These usage estimates are among the lowest compared to other trails across the Capital District. In the same study, CDTC surveyed adjacent land owners. Among those surveyed, the majority did not feel very enthusiastic about living adjacent to the Uncle Sam Bikeway, with almost one third (31.8%) saying they never use the trail.

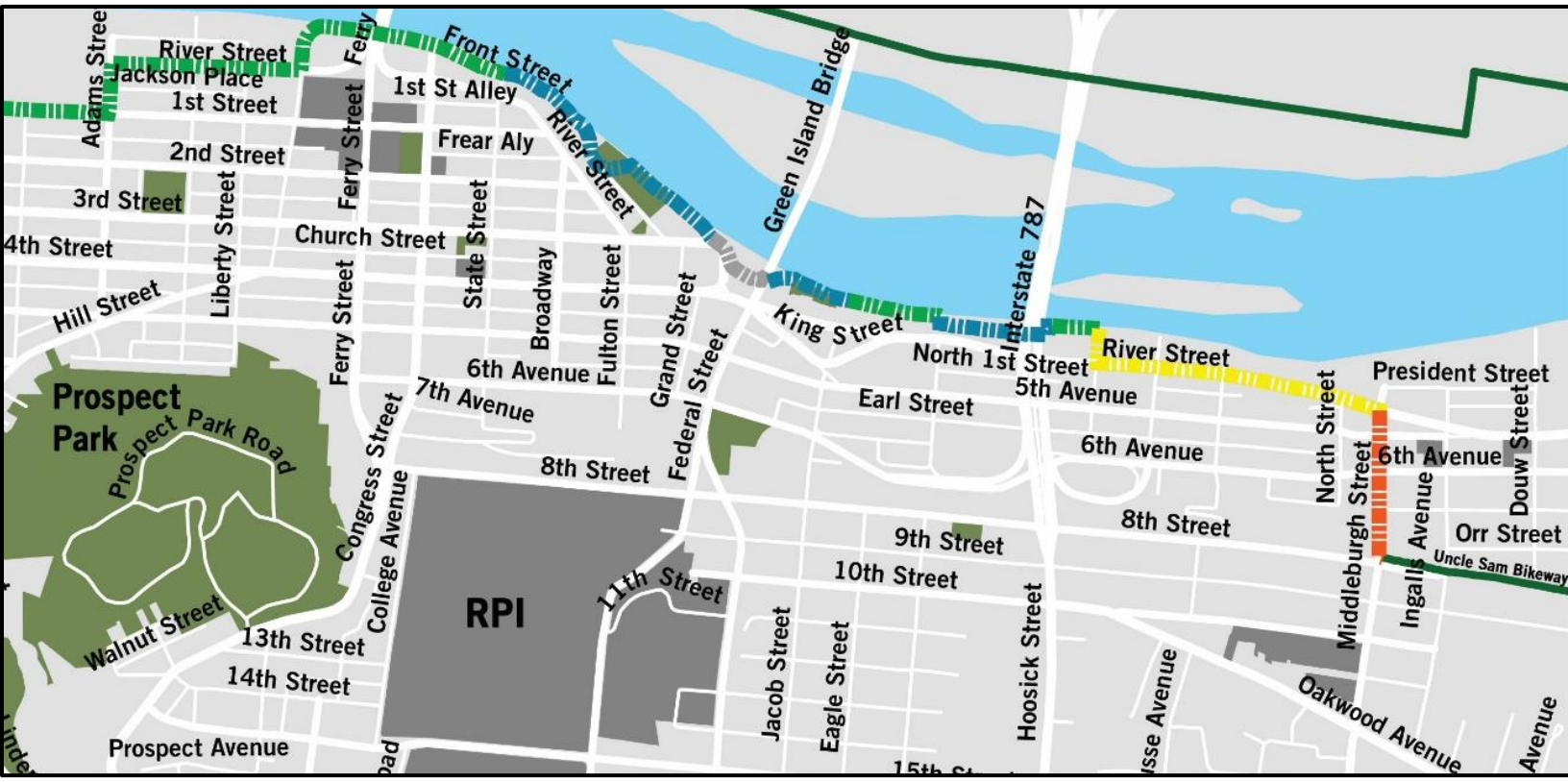
The underlying causes of lower than expected levels of usage along the Uncle Sam Bikeway may be numerous, though recent planning, such as the *Uncle Sam Bikeway Improvement Action Plan*, *Transport Troy's Sustainable Transportation Plan*, and this bicycle master plan, recommend ways to raise the profile and usage of this trail by providing amenities and enhancements to the trail and strengthening connections between the trail and adjacent city streets.

The creation of the South Troy Riverfront Bikeway in 2018 will extend the Uncle Sam Bikeway four miles south to Burden Avenue through a mix of on- and off-road bicycle infrastructure.

Regional Trail Connections

Troy is located adjacent to the growing network of multi-use trails located across the Capital District. These trails not only serve the recreational needs of residents, but they are also important transportation corridors for bicycle commuters. Improving the connections to these trails requires the participation of multiple local governments and state agencies due to the fact that accessing these trails is currently only possible by crossing one of the five Hudson River bridges that allow bicyclists: Troy-Menands / High Street, Congress Street, Green Island, 112th Street, and 126th Street Bridges.

	DELAWARE AVENUE / BLACK BRIDGE TRAIL	MOHAWK HUDSON BIKE-HIKE / ERIE CANALWAY TRAIL	CHAMPLAIN CANALWAY TRAIL
LOCATION	Cohoes, Waterford	Cohoes, Green Island, Watervliet	Waterford
LENGTH	2.1 miles	35 miles (part of the 360-mile Erie Canalway Trail and future 750-mile Empire State Trail)	5.9 miles (62 miles planned between Waterford and Whitehall and part of the future 750-mile Empire State Trail)
SURFACE	Paved	Paved	Stonedust
CONNECTIONS	Mohawk Hudson Bike-Hike / Erie Canalway Trail (and future Empire State Trail) and Peebles Island State Park	Numerous employment centers, including Downtown Albany and Schenectady	Peebles Island State Park and Mohawk Hudson Bike-Hike Trail
BRIDGE CROSSING	112th Street and 126th Street Bridges	Troy-Menands, Congress Street, and Green Island Bridges	126th Street



2 Previous Planning

Troy's Complete Streets Ordinance

Troy's Complete Streets Ordinance (Ord. No. 35) was adopted by the City Council in June, 2014. The Ordinance defines Complete Streets as those "designed and operated to enable safe access for all users, in that pedestrians, bicyclists, motorists and public transportation users of all ages and abilities are able to safely move through the transportation network." The Ordinance explicitly mentions improved health, economic growth, public safety, recreational opportunity and social equality as benefits of improved roadway and transportation network design. Troy's policy applies to both City-owned and privately-constructed streets within Troy's boundaries, and establishes a Complete Streets Advisory Board, composed of both City employees and citizen appointees, to regularly review progress toward the stated goals and review any proposed exceptions to full Complete Streets consideration.

Immediately after its passage, Troy's policy achieved acclaim, being ranked the nation's second best Complete Streets policy by The National Complete Streets Coalition, a program of Smart Growth America.

Transport Troy's Sustainable Transportation Plan

In 2013 then-Mayor Lou Rosamilia appointed a volunteer citizen work group to study the conditions of Troy's transportation network and to suggest improvements. The assembled group released the Sustainable Transportation Plan, and has continued to meet with a goal of pursuing recommendations found in the Plan and general improvements in walkability and bikeability. The Plan summarizes existing conditions of the bicycle and pedestrian network, and also list the projects undertaken as of 2013 to address the network. The Plan juxtaposes the current challenges and needs in the non-motorized transportation network with the great opportunity for walkability presented by Troy's dense neighborhoods and downtown, as well as the existence of the multi-use Uncle Sam Bikeway in Lansingburgh. The Plan maps pedestrian conflict areas, as well as opportunity locations for improving the biking network.

Important recommendations from the Plan include the following:

- Adopt a municipal Complete Streets Policy, and establish a citizen-run Complete Streets Advisory Board to monitor progress and report to City leaders (implemented in 2014);
- Create a Troy Bike Master Plan that outlines a network of suggested routes and safe biking infrastructure and enhancements such as bike racks (implemented in 2018);
- Enhanced connection to the Hudson River (ongoing, although the South Troy Riverfront Bikeway will partly achieve this in 2018);
- Safe Routes to School programming and street enhancements to complement school bussing efforts (ongoing).

Uncle Sam Bikeway Improvement Action Plan

In 2016, the City of Troy received funding to undertake the *Uncle Sam Bikeway Improvement Action Plan*, an assessment of the needs and opportunities for the multi-use trail, and recommendations for improving the trail and promoting its use to local and regional audiences. Alta Planning + Design served as the consultant on the Plan, with funding from the Hudson River Valley Greenway Grant Program, and the New York State Department of Health's Creating Healthy Schools & Communities program by way of Capital Roots, a local non-profit organization. Important recommendations from the Plan include the following:

- Specific design recommendations for each of three trailheads and street approaches, including the use of shared lane markings,

buffered bike lanes, and construction of separated multi-use trail at various points
- Enhancements to improve connections to nearby community destinations such as schools and parks at each trail access point
- Lighting and other "comfort and safety" recommendations that respond to documented trail user concerns
- Wayfinding throughout the trail corridor and on streets that provide access to the trail
- Techniques to limit vehicular access to the trail, addressing another issue often cited by trail users
- Creation of a trail maintenance organization and regular trail patrols by Troy Police
- Continued programming to highlight the trail and other Complete Streets initiatives in Troy

Realize Troy

Realize Troy is the City of Troy's first comprehensive plan update in over 50 years. This ongoing planning project will introduce new zoning policies, a Downtown Economic Development Strategy, and a Local Waterfront Revitalization Plan. City Council has developed eight principles to guide the formulation of the Comprehensive Plan, DEDS and LWRP. In general, these principles will focus on:

- The importance of maintaining the stability and attractiveness of all neighborhoods;
- expanding downtown reinvestment to include the entire central business district;
- the need for a fully transparent and inclusive consultation and planning process that creates multiple opportunities to participate in the process including through the use of social media;
- large scale revitalization of the riverfront transforming underutilized brownfields into publically accessible waterfront amenities and redevelopment projects;
- the importance of considering tax implications associated with plan development;
- the desire for ecological benefits and reduced burdens on municipal infrastructure and the natural environment;
- plan adoption and implementation, and;
- Consideration of form based code as an alternative to traditional Euclidean zoning.

At the time of writing the *Troy Bicycle Connections Plan*, Realize Troy was in the late stages of the planning process.

Watervliet Bicycle Master Plan

Watervliet is located directly across the Hudson River from Troy, providing an important link between Downtown Troy and the Mohawk Hudson Bike-Hike / Erie Canalway Trail and future Empire State Trail via the Congress Street Bridge. Additionally, for many residents of Troy, the closest grocery store is located in Downtown Watervliet.

Developed by Alta Planning + Design, the City of Watervliet Bicycle Master Plan guides development of a network of bicycle routes linking activity centers within the City, as well as to the larger regional network. The Plan was developed in two parts: an initial report that focuses on an intra-city bicycle network, and another report that focuses on completing the Mohawk Hudson Bike Hike Trail through the City of Watervliet (final report yet to be published).

On the Congress Street Bridge, the Watervliet Bicycle Master Plan recommends converting the eastbound outside travel lane to a two-way cycle track or provide one-way cycle tracks in either direction. The cities of Troy and Watervliet should coordinate any striping on the bridge to ensure there is continuity along the bike network between the two downtowns.

The Plan proposes a system of north-south and east-west routes that cover the entire city,

providing access to each residential neighborhood and key destinations. In addition to the infrastructure/engineering improvements proposed, several program recommendations are included in the Plan related to the other 4 E's – education, encouragement, enforcement, and evaluation. These include adoption of the Bike Master Plan, adoption of a local Complete Streets policy, and encouragement of programs such as a Bike to Work Day and Safe Routes to School.

Empire State Trail

In 2017, Governor Andrew M. Cuomo announced the creation of the $200-million, 750-mile Empire State Trail. This mega trail will complete and connect the existing Erie Canalway Trail, Champlain Canalway, Hudson River Greenway, and add enhancements to NY Bike Route 9 by 2020. The impact on communities adjacent to the Empire State Trail, such as Troy, will be enormous. According to a 2014 study by Parks & Trails New York, the 1.6 million annual visits to the 360-mile Erie Canalway Trail, which serves as the east-west spine, have an estimated economic impact of more than $250 million on adjacent communities. Providing a safe reliable connection to this trail will not only improve recreational opportunities for residents of Troy, but it will also encourage economic development through increased tourism.

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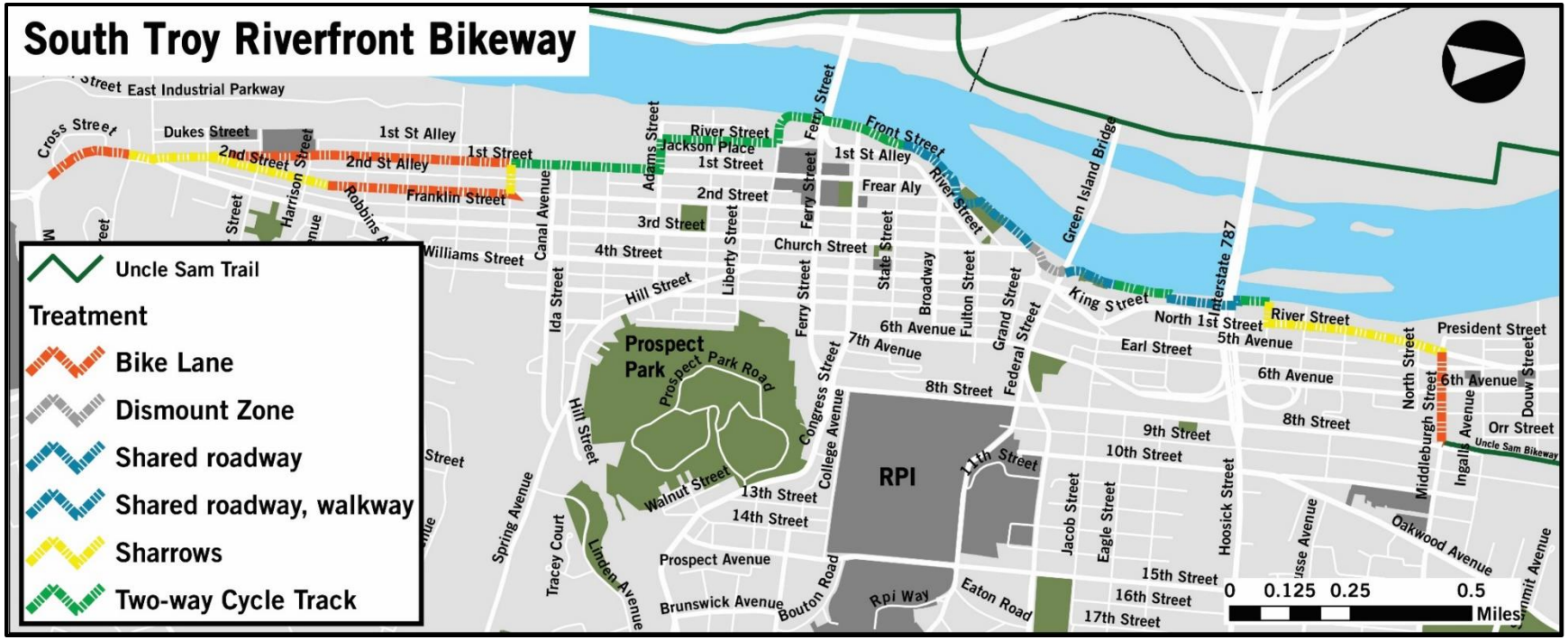
Rensselaer County Trail

Plans for the Rensselaer County Trail were prepared in 2004.When completed, the 4.5-mile trail will connect Troy and the City of Rensselaer (and eventually Albany via the Livingston Avenue Bridge), passing through the Town of North Greenbush along the Hudson River. The trail will enter Troy just south of the High Street / Troy-Menands Bridge at River Road. A combination of factors, including unsuccessful funding solicitations and landowner access issues, have prevented the trail from moving beyond the planning phase, however CDTC's New Visions 2040 long-range transportation plan does list completing the trail as a key recommendation.

Capital District Trails Plan

In 2016 CDTC began updating its regional trails plan. The Capital District Trails Plan consists of two components: a trail user count and survey conducted in 2016 with Parks & Trails New York and a regional trails plan that CDTC began in 2018. The trail user count and survey measured usage and the public's perceptions of the Capital District's nine best-known multi-use trails, including Troy's Uncle Sam Bikeway. The Capital District Trails Plan will identify opportunities for expanding and connecting the Capital District's multi-use trail network.



South Troy Riverfront Bikeway

Greenman-Pedersen, Inc. and the City of Troy have prepared designs to connect the Uncle Sam Bikeway to the approach of the Troy-Menands Bridge on Burden Avenue, offering improved access to the Hudson Riverfront and the Mohawk Hudson Bike-Hike/Erie Canalway Trail for bicyclists and pedestrians. In addition to improving bicycling and walking connections to the regional trail network along the South Troy Riverfront, this project will lead to quality of life improvements for South Troy residents as a result of traffic calming and enhanced transportation alternatives along the streets that are part of the route.

The resulting South Troy Riverfront Bikeway will be approximately four miles long and introduce varying levels of protected facilities along the proposed route. The plan calls for bike lanes along Burden Avenue, 1st and 2nd Streets between Mill and Madison Streets, a two-way cycle track along 1st, Adams, River, and Front Streets, shared lane markings along River Street between Vanderheyden and Middleburgh Streets, and a new multi-use trail under the Collar City Bridge. The South Troy Riverfront Bikeway is expected to be complete in 2018. Providing bicycling connections between the South Troy Riverfront Bikeway and schools, parks, and employment areas is a major priority for the *Troy Bicycle Connections Plan*.

3 Public Engagement and Participation

PTNY, the City of Troy, and CDTC, along with members of the Study Advisory Committee, conducted a full-featured public engagement campaign in order to inform all phases of the Troy Trail Connections Plan.

Outreach was performed across a broad spectrum of stakeholders and community members, with a goal of offering a variety of engagement opportunities requiring various levels of time and effort to facilitate broad participation. Efforts were made to ensure that Troy's low-income and historically-disadvantaged residents were able to provide input, supporting CDTC's equity and environmental justice directives

Outreach Components

- TroyTrailConnections.weebly.com – project website
- Community Survey – distributed in hard copy, and linked on TTC website (see results below)
- One-pager with background information on the project, and directions for those wanting to provide feedback
- Tabling materials including large-format maps
- Social media posts – using hashtag #TroyTrailConnections #518Trails #CompleteStreets #CollarCityRamble and tags @MPOCDTC @PTNY @TroyCityHall @CapitalRootsNY @CDPHPCycle @CDTA @TroyBikeRescue @AARPNY @TroyMarket

Events

Project partners provided information about the project and collected feedback at various events in Troy:

- Tabling at Troy Farmer's Market, July 29
- Troy Bike Breakfast, August 9
- Transport Troy monthly meetings
- Capital Roots' Veggie Mobile Outreach
- Public Meeting to discuss draft plan, November 8

All events were promoted by the social media pages of PTNY, CDTC, the City of Troy and/or Study Advisory Committee members. These posts generally included a link to the website, along with a quick poll or participation ask.

Survey Results

The primary means of engaging the public regarding Troy's bike network was the Community Survey (See Appendix B). Although respondents were asked basic demographic information (ZIP code, age, gender, race/ethnicity), entering name and contact information was optional. Beyond this basic data, questions related to their biking and walking experience in Troy, the type of improvements that they feel would most benefit the bicycle and pedestrian network, and familiarity with local biking initiatives and events.

All told, nearly 130 people completed the Community Survey.

Location

A majority of respondents identified their ZIP code as 12180, which corresponds to the City of Troy, but also extends into other parts of Rensselaer County.

Walking

Nearly 85% of respondents said that they regularly walked to work or school, walk to run errands, or walk for physical activity. Of those who responded that they didn't walk, safety and convenience were the two most often cited reasons. When asked to prioritize suggested improvements, opinion was divided. However, crossing busy thoroughfares such as Hoosick Street, lighting, and blocked or poorly-maintained sidewalks, including snow clearing, were often mentioned by respondents who chose "Other."

Biking

Predictably, a large share of respondents (64%) said they ride a bike in Troy, with the large numbers of these cyclists describing themselves as either intermediate level, "enthused and confident" or novice, "interested but concerned". A smaller number of respondents described themselves as very experienced, "strong and fearless." Still, this breakdown skews heavily toward the experienced cyclist, **Generally, a majority of cyclists identify as "interested but concerned**."

Support for bicycle and pedestrian spending

Survey respondents overwhelmingly supported spending public funds on bike and pedestrian safety improvements, 93%.

Poll Results

Beyond the survey, feedback was provided on several key questions via a quick poll function on the Troy Trail Connections website, and through Twitter polls.

Quick Poll 1: "What improvements would most likely influence you to walk or bike more in Troy?

Respondents to the first Quick Poll posted to the website were most likely to choose "More bike lanes and multi-use trails" (47%) or

"Maintenance of sidewalks and other surfaces" (29%). There were 34 total responses.

Quick Poll 2: "Where would you most like to see bicycle improvements in troy?"
The second Quick Poll received fewer responses, 16. Of four locations offered, the Green Island Bridge was the location considered most in need of improvements, with four responses.

Twitter Polls
"More protected bike lanes" was selected by the most respondents as a priority in a bicycling-specific Twitter poll. When asked about biking and walking in Troy, Twitter respondents indicated that "enforcement of traffic laws," "streetscaping," and "more shade trees/benches" were prioritized.

When asked "Where would you most like to see bicycle improvements in Troy?" 10 of 13 Twitter respondents chose the Troy Menands Bridge.

Urban Bikeway Demonstration Project

Participants of the annual Collar City Ramble bicycle ride and bicyclists from the City of Troy and Capital Region had the chance to experience bicycle-friendly enhancements on three city streets during a pop-up bikeway demonstration. During the demonstration three streets had a specific treatment type proposed by PTNY as part of the Troy Trail Connections Plan. The enhancements included a bike lane, neighborhood bikeway, and two-way cycle track on the following streets.

CONVENTIONAL BICYCLE LANE

4th Street between Adams Street and Washington Street: striped bike lane and bicycle wayfinding signage.

NEIGHBORHOOD BIKEWAY ENHANCEMENTS

Washington Street between 4th Street and Hill Street: neighborhood bikeway enhancements that included shared lane and route markings and bicycle wayfinding signage.

TWO-WAY CYCLE TRACK

Hill Street between Washington Street and Liberty Street: two-way cycle track that acts like an on-road trail but is protected from traffic by a physical barrier and wayfinding signage.

These enhancements were part of a larger effort by community partners to improve bicycle connectivity throughout the city. The temporary nature of the pop-up demonstration meant residents and visitors were able to experience innovative bicycle treatments without requiring a large investment of time and money from the City of Troy. On the other hand, PTNY, the City of Troy, and CDTC had the opportunity to use the overwhelming positive feedback in order to propose changes for more permanent bicycle infrastructure. See Appendix B for a full summary of community feedback.

4 Recommended Bikeway Network

Troy's Bicycle Network

Bikeway Types

Primary Bikeways

Secondary Bikeways

Neighborhood Bikeways

South Troy Riverfront Bikeway

Uncle Sam Bikeway

Other Facilities

Climbing Lane

One-way Neighorhood Bikeway Pair

The Troy Trail Connections Plan is intended to serve as the guiding document for implementing bicycle route connections that link activity centers within the City of Troy to the Uncle Sam Bikeway and planned South Troy Riverfront Bikeway.

The Troy Trail Connections Plan largely uses treatments described in detail in the National Association of City Transportation Officials' *Urban Bikeway Design Guide*. These treatments are considered to be state-of-the-art and the varying treatment types laid out in the guide allow for an enormous amount of flexibility for the City of Troy as it considers where available funding levels allow for the best and most visible improvements to bicycling across the City. NACTO's treatments are also highly compatible with the Federal Government's Manual on Uniform Traffic Control Devices (MUTCD). Dozens of cities in the United States, including regional neighbor Albany, have already implemented many of these treatments.

Bikeway Criteria

The Troy Trail Connections Plan recommends on-road treatments based on multiple different street characteristics. The following street characteristics were considered:

- Daily traffic volume
- Traffic speed
- Street width and number of travel lanes in each direction
- Surrounding land use
- Connectivity to existing bikeways and proposed infrastructure

The varying characteristics of streets and surrounding land uses across the City resulted in a wide range of proposed bikeways. To make the Troy Trail Connections Plan a more helpful document for city transportation officials, these characteristics were grouped into three major bikeway classifications: Primary Bikeways, Secondary Bikeways, and Neighborhood Bikeways. A range of treatment options accompanies each bikeway classification. However, even within a bikeway classification there will inevitably be variability. Choosing the best option for a specific street should take into account on-the-ground characteristics such as on-street parking, lane width, and the density and uses of surrounding development. Inevitably, funding, political will, and community support may also influence implementation.

Section 5 (Implementation) includes a guide that city officials should use when considering the implementation of these treatments

COMMON CHARACTERISTICS OF TROY'S BIKEWAYS

	PRIMARY BIKEWAYS	SECONDARY BIKEWAYS	NEIGHBORHOOD BIKEWAYS
DAILY TRAFFIC VOLUME (VEHICLES PER DAY)	5,000 – 50,000+ VPD	3,000 – 5,000 VPD	<3,000 VPD
TRAFFIC SPEED	>30 MPH	30 MPH	30 MPH or less
APPROXIMATE STREET WIDTH AND NUMBER OF TRAVEL LANES	17 feet or more, 2 or more lanes	16 feet or less, 2 or fewer	16 feet or less, 2 lanes or fewer
SURROUNDING LAND USE	Mixed use, though some areas have high densities of single uses	Medium density mixed use	Low to medium density residential, some mixed use

Primary Bikeways

Primary Bikeways

Roadway characteristics: highest level of connectivity between schools, parks, and business districts and have relatively high traffic volumes (usually exceeding 5,000 vehicles per day) and vehicle speeds. Some primary bikeways are on streets with multiple lanes in each direction.

Recommended treatments: require the highest level of vehicle-bicycle traffic separation. Where space permits, protected cycle tracks or bike lanes. Intersections will also require pavement markings and other treatments described below.

Candidate streets: Congress Street, 6th Avenue (between Vanderheyden Street and Congress Street), Hudson River Bridge Crossings, and Burdett Avenue.

Primary Bikeways, as their name implies, serve as the most direct connections between Troy's activity centers, the Uncle Sam Bikeway, and the South Troy Riverfront Bikeway. A common characteristic of most Primary Bikeways is that their traffic volumes exceed more than 5,000 vehicles per day. Many of these streets are bi-directional and some even include multiple lanes in each direction; however, some are one-way streets with multiple lanes. Therefore, multiple different treatment types are appropriate for Primary Bikeways.

Cycle Tracks

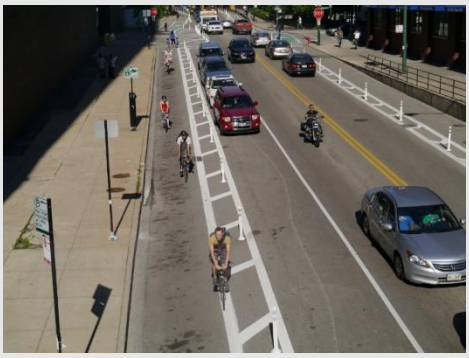
Protected cycle tracks offer the greatest level of perceived comfort and safety among on-road bicycle infrastructure. Cycle tracks can be both two-way and one-way and usually consist of a conventional bike lane separated from moving traffic by a curb, bollard, painted buffer, or on-street parking. The benefits of cycle tracks are numerous. In addition to physical separation from moving vehicles, cycle tracks increase safety by lowering the risk of injuries associated with "dooring," which is caused by an unsuspecting motorist opening their vehicle door into the path of an oncoming cyclist; depending on the method of physical separation, cycle tracks also remove the ability for vehicles to double park in the bike lane. Cycle tracks are also one of the most visible infrastructure investments the City of Troy can make to demonstrate its commitment to the complete streets ordinance it passed in 2014.

Some cycle tracks are also raised above the street level and are usually at the same level as the sidewalk. Raising the cycle track offers a secondary level of safety since bicyclists are more visible.

Cycle tracks are best suited for streets in the City of Troy where traffic volumes exceed 10,000 vehicles per day. These streets include all of the Hudson River crossings, Burden Avenue, Mill Street, Campbell Avenue, Pawling Avenue, Congress Street, Ferry Street, King Street, Fourth Street (between Federal and Ferry Streets), River Street, Second Avenue, and Hoosick Street.

Minimum road width requirements

Road width is an important characteristic to consider when deciding between the two types of protected cycle tracks.

ONE-WAY PROTECTED CYCLE TRACKS		Ideal for streets where traffic flows in one-direction or on both sides of a two-way street. They require a minimum of eight feet of roadway width, which includes a three-foot-wide buffer. On streets where bicycle traffic is high, a minimum width of 10 feet is recommended to give cyclists enough room to safely pass each other.
TWO-WAY PROTECTED CYCLE TRACKS		Ideal for primary one-way streets on which bicyclists commonly ride against traffic and for two-way streets where one side of the street has fewer driveways, bus stops, and high parking turnover. They require 8-12 feet of roadway space and an additional three feet for a painted buffer.

Buffered Bike Lanes

Buffered bike lanes can offer a compromise between protected cycle tracks and striped bike lane on streets where roadway widths are wide enough to accommodate a 7-foot-wide bicycle lane or when snow-removal procedures would not allow for plows to maneuver around bollards or curbs required for protected cycle tracks.

There are many safety benefits to using buffered bike lanes. The relatively wide zone of separation between moving vehicle traffic and bicyclists ensures a high level of comfort among bicyclists and reduced stress levels among bicyclists and motorists. Moreover, the additional roadway space gives bicyclists enough room to safely overtake slower riders without riding in the travel lane, improving the flow of bicycle and vehicle traffic along a city street

BUFFERED BIKE LANES

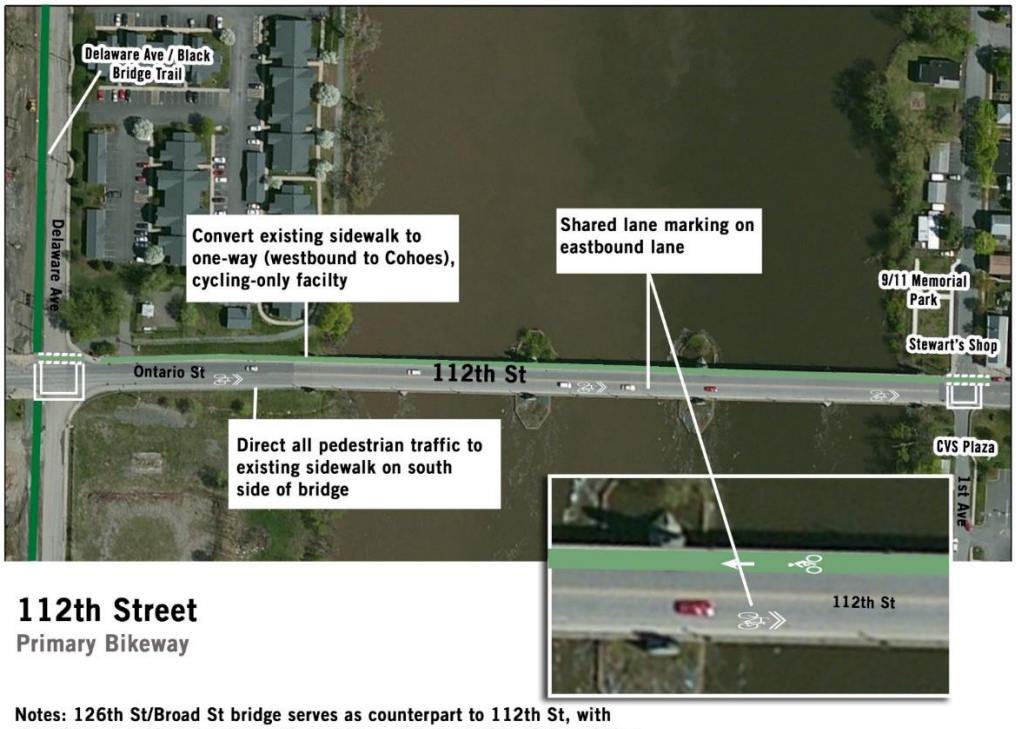
In the simplest terms, a buffered bike lane, as its name implies, is a conventional bike lane that is separated from roadway traffic by a separation zone that is significantly wider than a bike lane's line of demarcation. The separation zone can be painted line pattern or a line of parked cars. **Each separation zone type requires at least 18 inches of roadway space in addition to 3 to 4 feet of roadway space for the bike lane.** If the buffered bike lane is located next to the parking lane, it should be at least 5 feet wide to provide enough space for bicycles to avoid the door zone.

Hudson River Bridge Crossings

Due to their high level of connectivity to regional trails, employment centers, and shops and services, the five Hudson River bridges that allow bicyclists are an important component of the bikeway network.

Where possible, protected facilities, such as multi-use paths or cycle tracks, should be considered. When a bridge's roadway space isn't wide enough to accommodate protected facilities, the City of Troy should decide whether alternatives, such as allowing bicycles to use sidewalks or proposing complementary treatments along a nearby bridge, exist. The rendering below demonstrates this, treating the 112th and 126th Street Bridges as a pair.

Cooperation among Troy and neighboring municipalities and New York State DOT is necessary to coordinate any bridge enhancements, ensuring continuity along the bike network between the two cities. For example, any enhancements to the Congress Street Bridge should be coordinated with the Watervliet Bicycle Master Plan's recommendation for reconfiguring the bridge lanes to accommodate a cycle track.



112th Street
Primary Bikeway

Notes: 126th St/Broad St bridge serves as counterpart to 112th St, with shared lane markings on the westbound lane, and conversion of the existing sidewalk on the south side of the bridge to a cycling-only facility

Primary Bikeways

Recommended Treatments

High-visibility intersections

Highlight potential conflict zones between motorists and bicyclists

Protected or buffered bike lane

Offer higher level of protection from vehicle traffic

Signage

Wayfinding and route marking

Rendering location: 2nd Avenue at 117th Street

Secondary Bikeways

Secondary Bikeways

Roadway characteristics: provide direct access to parks, schools, and business districts and see daily traffic volumes between 3,000 and 5,000 vehicles per day, though some streets are busier with volumes exceeding 5,000 vehicles per day. Many of these streets are one ways, so their treatments should focus on finding complementing streets to create a neighborhood and city-wide bicycle network.

Recommended treatments: striped bike lanes and intersection pavement markings.

Candidate streets: 4th Street, 6th Avenue (between 101st Street and Hoosick Street), 8th Street, 15th Street, Broadway, Brunswick Road, Fulton Street, Oakwood Avenue, and Spring Avenue.

Secondary bikeways, similar to primary bikeways, provide direct connections between neighborhoods and schools, parks and recreational areas, business districts, and the Uncle Sam and South Troy Riverfront Bikeways. The biggest difference between secondary bikeways and primary bikeways, however, is the volume of vehicle traffic on a majority of their respective streets: while most primary bikeways see more than 5,000 vehicles per day, many secondary bikeways see between 3,000 and 5,000 vehicles per day.

STRIPED BIKE LANES

STRIPED BIKE LANES

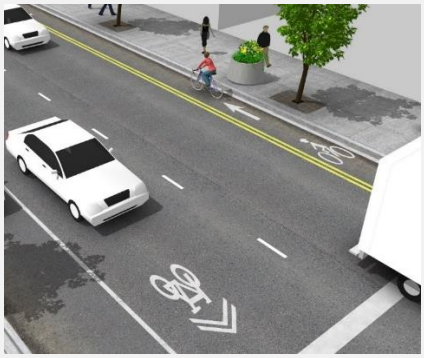
Striped bike lanes provide a basic level of protection that is appropriate for streets with more than 3,000 vehicles per day and have a posted speed of greater than 25 mph. Bike lanes require at least 6 feet of road width, however, for narrower streets, a 3-4-foot-wide lane may suffice if there is a line of demarcation between traffic that is at least 6 inches wide and vehicle traffic does not exceed 35 mph.

Since many city streets have on-street parking, it's important to consider that in order for a bike lane to feel comfortable enough for riders, the total amount of space between the outer edge of the bike lane and the curb should be at least 12 feet wide, with 14.5 feet considered ideal. This will provide enough space to accommodate a bike lane, parking lane, and a buffer between them to protect cyclists against dooring. If roadways are too narrow to accommodate this width, narrowing the parking lane is the best solution to provide greater protection for cyclists from moving vehicle traffic.

BIKE LANE VARIATIONS

The nature of Troy's street network, with a high level of connectivity and a concentration of one-way streets in the neighborhoods along the Hudson River, provides an opportunity for using variations of the conventional bike lane that can improve safety for bicyclists and improve the overall flow of traffic for all roadway users.

CONTRA-FLOW BIKE LANES



Allow bicyclists to move in the opposite direction of vehicle traffic. This variation is best used on streets where there are large numbers of bicycles riding against traffic and using another street is either too unsafe or not practical for some reason. Oftentimes, the contra-flow lane will be separated from traffic by a double yellow line and the bicycle traffic flowing in the direction of vehicle traffic is given full reign of the vehicle lane with shared lane markings.

See applicability note below.

LEFT-SIDE BIKE LANES

Should be used on one-way streets to reduce the likelihood of driver-side dooring and other conflicts common on the right side of the street. They are also ideal on one-way streets that are along bus routes since buses will typically pull into stops on the right side of the street. Lastly, left side bike lanes provide a significant boost in visibility of cyclists to drivers by placing them on the driver's side of the lane.

CLIMBING LANES

Troy's unique topography offers an opportunity to provide cyclists riding on narrow streets up steep hills with a striped bicycle lane on the climb. An advisory bicycle lane or shared lane marking complements the uphill bike lane on the descent. Bicyclists riding down the hill likely do not need the level of protection a dedicated lane offers since they will be able to get up to the speed of vehicle traffic.

Climbing lanes may be appropriate for the uphill climbs on following streets: Northern Drive, Cemetery Road, Gurley Avenue, Middleburgh Street, Federal Street, Peoples Avenue, Tibbits Avenue (see rendering above), Ferry Street / Congress Street, Linden Avenue, Spring Avenue, Project Road, Mill Street, Mann Avenue / Lincoln Avenue

To determine the suitability of a contra-flow lane, the City of Troy should conduct observational counts along a one-way corridor to determine whether or not there are high numbers of cyclists riding against

the flow of traffic. In some cases, signage directing cyclists one block over to a more conventional facility can achieve the same result.

While cities across New York State, such as New York City, Rochester, Syracuse, have implemented contra-flow bicycle lanes, an additional step may be necessary to ensure that no vehicle traffic codes are violated. The City of Rochester, for example, required approval from the City's Traffic Control Board to install four contra-flow lanes. In addition to following MUTCD standards, passing an ordinance that explicitly allows contra-flow lanes on streets with known instances of bicyclists riding against the flow of vehicle traffic would be a proactive approach the city may consider before implementing contra-flow lanes.

Neighborhood Bikeways

Neighborhood Bikeways

Roadway characteristics: low vehicle traffic (fewer than 3,000 vehicles per day) and high connectivity between neighborhood streets and schools and parks.

Recommended treatments: traffic and volume management techniques to "calm" streets and prioritize bicycle traffic. There is a high potential to incorporate green stormwater management techniques and public art projects into these treatments.

Candidate streets: 6th Avenue (119th Street – Northern Drive) 7th Avenue, 8th Street, 9th Street, Adams Street, Hutton Street, and Uncle Sam Bikeway crossings.

Neighborhood bikeways, also known as bicycle boulevards, rely less on physical infrastructure and more on a connected city grid that includes network of low-traffic, low-stress secondary streets. Neighborhood bikeways prioritize bicycle and pedestrian movements over vehicle movements, though they do not restrict local vehicle access.

Neighborhood bikeways will have traffic volumes of less than 3,000 vehicles per day, with an ideal volume of less than 1,500 vehicles per day, and the 85th percentile of traffic traveling between 20-25 mph.

Neighborhood bikeways do not replace more protected infrastructure such as multi-use trails and protected bike lanes; in fact, neighborhood bikeways should only be used to supplement infrastructure such as protected bike lanes along more direct routes.

Bicycle-friendly Speed Management Techniques

To ensure that reduced speed conditions exist, bicycle boulevards commonly utilize "horizontal and vertical deflection" techniques. These techniques can complement or eliminate the need for reducing posted speed limits to 20 mph, which may require passing local legislation.

Vertical deflection techniques require drivers to slow down to negotiate wide and slight pavement elevations.

Horizontal deflection involves visually narrowing the roadway or adding an obstacle to the path of direct travel that requires drivers to slow down to navigate intersection or roadway. Horizontal deflection techniques should not be used if the travel lane is narrowed to less than 12 feet. In addition to calming traffic, horizontal deflection techniques can improve safety for neighborhood residents, increase the aesthetic appeal of a particular block, and incorporate green storm water technology.

Bicycle-friendly Vertical Deflection Techniques

SPEED HUMPS		Pavement raised 3-4 inches for 12-14 feet. Speed humps are often referred to as speed bumps, but should not be confused with abrupt speed management techniques often found in parking lots or driveways, which are dangerous to bicyclists.
SPEED CUSHIONS		Speed humps that have cutouts for emergency vehicles' wheels, making them ideal for key emergency response routes.
SPEED TABLES		Plateaued pavement raised 3-3.5 inches for 22 feet. They typically reduce speeds to within the 25-35 mph range and are best suited for streets that already accommodate buses and emergency response routes. May also incorporate **raised crosswalks**: speed tables that feature crosswalk markings.

Bicycle-friendly Horizontal Deflection Techniques

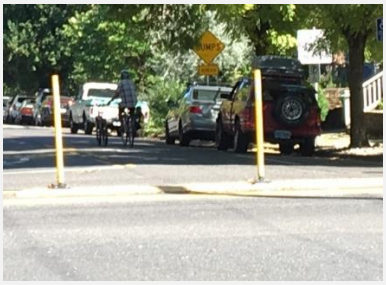
CURB EXTENSIONS		Also called "bulb-outs." As their name suggests, curb extensions extend the sidewalk into an intersection's parking lane, narrowing the lane width at an intersection. Curb extensions also benefit pedestrians because they decrease crossing distances and increase pedestrian visibility due the lack of parked cars at the intersection. Curb extensions also provide space for benches, kiosks, public art, and rain gardens.
NEIGHBORHOOD TRAFFIC CIRCLES		Small roundabouts located at intersections that reduce speeds by narrowing turning radii and the travel lane. Neighborhood traffic circles with plants and trees can further reduce traffic speeds by reducing sight lines.

On-street parking can also serve as a horizontal deflection technique by reducing travel lane widths and requiring vehicles to queue slowly behind bicycles until there is enough room for them to overtake the cyclist. Most streets in Troy already permit on-street parking, so combining this technique with other horizontal and vertical deflection techniques will achieve major safety and efficiency improvements.

Bicycle-friendly Volume Management Techniques

Some stretches of neighborhood bikeways may exceed the required 3,000 vehicles per day to make them low-stress enough for most users to enjoy. There are several volume management techniques that can maintain or reduce vehicle volume to the 1,500 to 3,000 vehicles per day. These techniques may involve physically cutting off vehicle flow at an intersection or a sign that simply restricts vehicle flow through an intersection.

It's important to consider the effect these techniques may have on accessibility for neighborhood residents and the ability of the city to carry out snow removal. Signage warning drivers of limited access at the choke points are also important to include throughout the block. Moreover, these treatments should only be installed where a clear understanding of what, if any, impacts they may have on adjacent streets.

MEDIAN ISLANDS/ DIVERTERS		Vehicle through movement is prohibited by a concrete median also known as a "snake diverter." Bicycles can move through the intersection by two separate openings in the snake diverter corresponding to each direction. Each opening must be at least 5 feet wide. This technique can also reasonably accommodate snow removal, especially if removable bollards are used instead of a concrete median. Another alternative, which can also benefit emergency vehicle through movement and snow removal, is to lower curb heights to less than 6 inches.
PARTIAL CLOSURES		A contra-flow bike lane, at least 4 feet wide, allows bicycle traffic to cross through the intersection but signage and pavement markings require vehicles to turn right or left. Cross-street vehicle traffic must continue straight. This technique best accommodates snow removal.

Signage and Pavement Markings

Signage and pavement markings are an important component that should be included along with any speed or volume management. They not only help guide cyclists through the route, but they also notify vehicles of the presence of bicycles in the roadway. Recommended signage consists of wayfinding and branding signage to help direct cyclists to important destinations and raise the profile of the neighborhood connectors. Other signage, such as reduced speed limit signs and "bicycles in lane" signs, should address drivers. Signage is discussed in more detail in the "Bicycle Route Signage" section of the Troy Bicycle Connections Plan.

PAVEMENT MARKINGS		Pavement markings are similarly targeted towards bicyclists and drivers. **Shared lane markings** and **advisory bike lanes** should not only indicate to drivers the presence of cyclists, but where possible, the chevrons should also guide cyclists along the route.
BICYCLE BOULEVARD STREET SIGNS		Help bicyclists identify streets that are part of the bicycle boulevard network. They also give the City the chance to "brand" and promote the infrastructure investment.

Neighborhood Bikeways at Intersections

Special accommodations should be made for bicyclists at intersections between neighborhood bikeways and other streets. Since it's critical that neighborhood bikeways prioritize bicycle through traffic, several treatment types should be considered depending on the type of intersection. Determining factors include daily traffic volume, intersection geometry, and the presence of a signalized crossing.

Neighborhood Bikeways

Recommended Treatments

Bulb-outs at intersections

Increase visibility and slow traffic

Pavement Markings

Wayfinding and route identification

Neighborhood Traffic Circle

Slows traffic; may also include green stormwater management techniques

Signage

Wayfinding and route identification

Rendering location: 6th Avenue at 124th Street

Intersection Treatments

Intersection Treatments

Minor street crossings
Minor street crossings typically exist where two residential streets intersect, usually warranting either a four-way or two-way stop. In order to accommodate a neighborhood bikeway, these intersections should prioritize bicycle movement and require stops for vehicle traffic at the intersecting cross streets. This allows cyclists using the neighborhood connector route to stop only where necessary. The easiest way to do this is to remove the stop signs at any four-way stops on the section of roadway that is part of the neighborhood bikeway.

Installing a partial closure or median diverter at some point along the route would help reduce the likelihood of vehicles using the neighborhood bikeway as a short cut. The City of Troy should consider the impact on neighboring streets before making a decision to install a partial closure or median diverter.

Major street crossings
Major street crossings typically prioritize vehicle traffic, which is usually travelling at higher speeds than it would be on neighborhood bikeways. In many cases, they also require bicyclists to cross multiple lanes of traffic. Ensuring bicyclists can safely cross through these intersections is possible through the following treatments.

Signalized Intersection Treatments

BIKE BOXES

Reserve space for cyclists at the front of an intersection. Bike boxes are most effective when they are used at intersections where bicyclists and motorists are likely to turn out of the intersection or if vehicles are turning and bicyclists are continuing straight.

The benefits of bike boxes include improvements to intersection safety and efficiency. They increase safety by improving cyclists' visibility to motorists, give space for left-turning cyclists, and reduce the likelihood of a "right-hook" collision caused by a turning vehicle. Bike boxes can also improve safety and efficiency for other road users because they open up intersections and improve visibility for crossing pedestrians and reduce bus delays caused by queuing cyclists.

BICYCLE SIGNALS		Similar to pedestrian crossing signals, bicycle signals give bicyclists priority as part of the traffic signal cycle. A major benefit of bicycle signals is removing the barrier of crossing a major intersection due to either real or perceived safety and comfort concerns, which when overcome, can significantly open up Troy's bicycle network at critical locations. An ideal location for installing bicycle signals would be at intersections that provide access to the Capital District's regional bicycle network such as at the Water Street – Burden Avenue – Mill Street Intersection in South Troy and the King Street – Federal Street – 5th Avenue Intersection located at the entrance to the Green Island Bridge.

Unsignalized Intersection Treatments

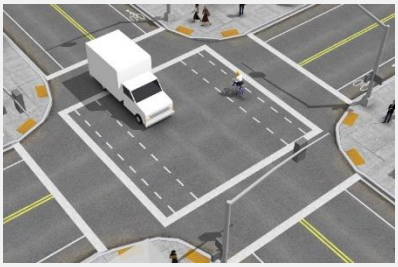
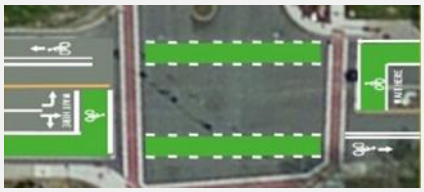
A major goal of treatments installed at unsignalized crossings should be to reduce the physical and mental "gap" between the comfortable riding conditions along the bicycle boulevard caused by the conditions of the major street such as multiple lanes or high vehicle speeds and volumes.

CURB EXTENSIONS		Reduce the gap distance by decreasing the crossing length at an intersection. Curb extensions require extending the curb at the intersection into the space typically reserved for parking. They also improve safety for pedestrians.
BICYCLE FORWARD STOP BARS		When used with the curb extension treatment, advances the stopping line for bicyclists to the edge of the intersection, reducing crossing distance and increasing the sight lines of oncoming cross-traffic. The vehicle stop line remains at the same location (typically before the crosswalk), increasing bicyclists' visibility to waiting motorists.

HYBRID BEACONS		Require motorists to come to a full stop when activated by a cyclist. The hybrid beacons, which are usually a signal head that sits above the traffic lanes, run through a signal phasing similar to a typical traffic signal that first gives motorists warning that they should slow down and prepare to stop. They are ideal for neighborhood bikeways and multi-use trails that cross intersections with traffic volumes too low to justify a traffic signal. Hybrid beacons are sometimes referred to as **High-intensity Activated CrossWalks (HAWKs)**. The intersections of the Uncle Sam Trail at Northern Drive and Middleburgh Street are two ideal locations for hybrid beacons.
ACTIVE WARNING BEACONS		Alert motorists to the presence of cyclists (or pedestrians) at an intersection through a **Rectangular Rapid Flash Beacon (RRFB)** that can detect oncoming cyclists or be manually activated by a push button. Active warning beacons, specifically RRFBs, are already used throughout New York State at crosswalks or road-trail intersection crossings. Future enhancements made as part of the South Troy Riverfront Bikeway will include RRFBs along Middleburgh Street.
MEDIAN REFUGE ISLANDS		Give cyclists the opportunity to cross a busy street when breaks in traffic moving in one direction allow. Median refuge islands can also be a neighborhood bikeway volume management technique. An ideal use for these would be on busy streets such as Hoosick Street, where high vehicle volumes and multiple lanes for each direction make it difficult for cyclists to cross at unsignalized intersections. Moreover, since they reduce the width of travel lanes, they can also calm traffic, providing safety benefits to all road users.

Pavement Markings

Pavement markings should be used at all major street crossings to mark roadway space for bicyclists and give notice to motorists that bicycles are likely to be crossing. Pavement markings typically come in four types, though a combination of all or some can be used depending on intersection conditions.

DOTTED LINE EXTENSIONS		Demarcate space for bicyclists through the intersection.
SHARED LANE MARKINGS		Help guide bicyclists through the intersection.
ELEPHANT'S FEET		Increase bicyclist safety with wider, more visible dotted lines
COLORED CONFLICT AREAS		Increase bicyclist safety by highlighting motorist and bicycle "mixing areas." Typical applications include areas where vehicles are likely to be making turns such as intersections and highway and bridge ramp entrances and exits.

At busier intersections or to link two highly protected facilities, extra ease of use and safety considerations may include the addition of pavement markings that direct cyclists to make two-stage left turns

TWO-STAGE TURN QUEUE BOXES

Pavement markings that give cyclists space to make a left turn in two-stages – first, a right turn into a green bicycle box at the front of vehicles queuing at the cross street and then at the next green signal, or safe crossing opportunity at unsignalized crossings, continuing straight through the intersection.

They should be used at intersections where bicycle traffic is turning from a protected cycle track or bike lane either onto a neighborhood greenway or onto an untreated city street. They can also be used at streets that intersect the Uncle Sam Bikeway or other multi-use trail.

In addition to making it more comfortable for cyclists to make left turns at busy intersections, two-stage turn queue boxes reduce the likelihood of conflicts between turning bicyclists and vehicles passing through the intersection and improve traffic flow for bicyclists and vehicles continuing straight.

Bicycle Route Signage

Bicycle route signage is an important component of Troy's bicycle network since it not only serves as a wayfinding tool but it can also promote the infrastructure investments Troy makes, encouraging bicycle facility usage and improving bicyclist safety.

There are three main signage types the City of Troy should consider: confirmation signage, turn signs, and decision signs. Using a combination of the three will ensure that bicyclists can safely and conveniently navigate the City's bicycle network.

Confirmation Signs

Confirmation signs indicate to cyclists the route on which they are riding and give notice to drivers that they will likely encounter bicyclists on the street. They do not include arrows or directional instructions, but they may include distances to upcoming route destinations.

On multi-use trails such as the Uncle Sam Bikeway, confirmation signs should be installed every 0.25-0.5 miles. On on-street facilities such as neighborhood bikeways, they should be installed more frequently, such as every 2-3 blocks, and soon after every decision sign to indicate to bicyclists which route they are using.

Turn Signs

Turn signs notify cyclists that the bikeway is moving onto a different street or multi-use

trail. Where possible, such as on neighborhood bikeways, turn signs should be used in conjunction with pavement route markings. Turn signs should display important destinations and their distance from the sign location. It's important to place them far enough in advance before the intersection to ensure that cyclists do not pedal past the turn.

Decision Signs

Decision signs are located near the point of intersection between bikeways and also indicate what important destinations are accessible from the bikeways. Decision signs should display not only the specific names of destinations, but also their distance – in both miles and minutes – from the route. Arrows should accompany the destination to indicate which direction the bicyclist must turn. It's important to place the signs before the intersection, or if the destination is along the route, before the turn-off.

Decision signs should prioritize important community destinations, such as schools, parks, hospitals, colleges and universities, and business districts. They can also display important transportation centers, such as the future CDTA Uncle Sam Transit Center, bridge crossings, and multi-use trails, such as the Uncle Sam Bikeway. Decision signs should not include destinations that are more than 5 miles away and the cycling time should assume a cyclist is riding at 10 mph.

Decision signs can also benefit motorists and pedestrians, though their focus should be on bicycle route wayfinding.

CONFIRMATION SIGNS

Placement guidelines:
For multi-use trails: Every 0.25-0.5 miles

For on-street facilities: Every 2-3 blocks and after turns

TURN SIGNS

Placement guidelines:
In advance of important destination

DECISION SIGNS

Placement guidelines:
At intersection of two bikeways or other important intersection

Bicycle Parking

Bicycle parking is an important amenity to consider when making investments in Troy's city-wide bicycle network. People are more likely to commute to work or run errands if they know there are places to lock their bikes at the end of their trip. Troy should consider both short-term and long-term parking options when planning new bike racks or replacing old ones.

The City of Troy and Transport Troy have created a set of guidelines that should inform future bicycle rack installations. These guidelines require at least 9 feet of sidewalk width, so they may not be suitable for all locations across the City.[1]

Additionally, the Association of Pedestrian and Bicycle Professionals (APBP) has created a guide, *Essentials of Bike Parking: Selecting and installing bicycle parking that work*, to help instruct city officials' decisions regarding the appropriate bicycle parking needs at each site.

Short-term and long-term bicycle parking needs

The APBP's guidelines helpfully explain the considerations Troy should make when deciding between short- and long-term parking needs. According to APBP, short-term bicycle parking accommodates the needs of cyclists visiting an area for a maximum of two hours at a time. Therefore, decisions made for short-term parking should depend more on visibility, convenience to destinations, and ease of use. Long-term bicycle parking prioritizes protection from weather and theft over visibility and convenience. Oftentimes, long-term bicycle parking is located inside of a building or parking garage, providing an extra level of security. In order to encourage use, however, it shouldn't be totally hidden or difficult to find, especially if there is a code or card required for access. Long-term parking facilities should also be able to handle a variety of bikes, that wouldn't traditionally park at a short-term rack such as large cargo bikes and recumbent bicycles. Encouraging work places and apartment complexes to allow bicyclists to store their bikes inside is another way to accommodate long-term bicycle parking in Troy.

Moreover, APBP offers guidance on bike racks Troy should choose from or avoid. Taking this guidance into consideration will ensure that residents and visitors have a convenient and secure place to store their bikes when they reach their destination. A summary of APBP's guidelines is located in the table below.

Existing Bicycle Parking Guidelines

	SHORT-TERM AND LONG-TERM PARKING GUIDANCE	RACK PREFERENCE	PLACEMENT GUIDANCE
CITY OF TROY	No	Inverted U	Yes
APBP	Yes	**Universally applicable**: inverted U, post & ring, wheelwell-secure **High-density parking areas**: staggered wheelwell-secure, vertical, two-tier racks	Yes

[1] http://www.transporttroy.com/resources

It would be helpful for Troy to consider amending their guidelines to include some of the APBP recommendations, especially when space constraints prevent properly adhering to existing requirements.

The City of Troy is home to a vibrant Downtown and several neighborhood business districts. Throughout the Spring, Summer, and Fall, the City hosts one of the Capital District's largest Farmers' Markets and several festivals. It's important that the needs of bicycle parking for these attractions do not get overlooked.

Business district bicycle parking

Much of the business district bicycle parking will fall under the category of short-term bicycle parking. Therefore, a visible location that is less than 50 feet from the entrance to a business or other destination, and a rack that is installed securely, such as mounted into the concrete sidewalk are important considerations. It may be difficult initially to gauge the number of racks the City of Troy or business owners should install, so it's important to revisit bicycle parking demands periodically either by doing a quick census or observation during peak usage periods or survey residents and business owners regarding their perceptions and realities of bike parking. Another solution is to dedicate an area alongside the road, either a vehicle parking space or area not quite large enough to accommodate parking, to bicycle parking by installing a bicycle corral. One parking space-sized corral can park between 8 and 12 bicycles.

Parking garages, such as the Uncle Sam Garage, may also accommodate bicycle parking needs, especially for long-term parking. Future development of CDTA's Uncle Sam Transit Center should include some kind of enclosed long-term bicycle parking space, such as a bike locker or card/code accessible bicycle shelter.

Addressing future bicycle parking needs

The Implementation section of the Troy Bicycle Connections Plan includes zoning ordinance language from other cities, including the City of Albany.

The City of Troy should periodically conduct an inventory of bicycle parking availability, especially in business districts or other areas that serve as short-term destinations such as schools, parks, and libraries. The City's Business-sponsored bicycle rack program, initiated and managed by Capital Roots and Transport Troy should continue to ensure that bicycle parking needs can be met with using public-private partnerships.

Another way to address future bicycle parking needs is to require by city code that developers accommodate bicycle parking into new multi-unit housing or mixed-use developments. Alternatively, Troy could achieve a similar goal by providing incentives such as reduced parking minimums or additional units if a certain minimum bicycle parking standard is met.

Temporary bicycle parking

The City of Troy hosts many events throughout the Spring, Summer, and Fall that draw hundreds of people to Downtown Troy and along the Hudson River Waterfront. Inevitably, these events strain local parking facilities and vehicles circling the block looking for on-street parking add to congestion problems on narrow Downtown streets. It would be impractical to suggest installing enough bike racks to meet enough of the demand for bicycle parking caused by a likely increase in bicycling to these events attributed to a significant bicycle infrastructure investment.

Similarly situated cities such as Burlington, Vermont install temporary racks at these events and allow people to park their bikes for free or a small donation to a local non-profit organization. These bicycle valets, as they are

sometimes called, require an insignificant investment but the added visibility they bring can have a big effect on bicycle friendliness. The presence of a few volunteers checking bikes also ensures that there is a relatively high level of security. Implementing this idea in Troy at the weekly Farmers' Market, even on a small scale by providing bike parking for just 50 bicycles, could be an opportunity for a local non-profit, such as bicycle advocacy organization Transport Troy, to benefit financially and the whole city to benefit by reducing road congestion.

Additionally, providing incentives to people who arrive to the Famers' Market by bicycle could have a similar effect. The City of Rochester's Best Parking at the Market program offers bicyclists credits for purchases made at the Public Market if they arrive by bicycle. More information about Rochester's program is available here, http://www.cityofrochester.gov/biketomarket/.

5 Implementation

The *Troy Bicycle Connections Plan* is meant to provide the City with a roadmap that guides development of the cycling network over the next decade, and beyond. However, there are intermediate goals and actions necessary to create a workable network more rapidly.

The first goal is to create safe and accessible connections from north to south through the City of Troy, and to provide multiple east west routes to serve the various sectors of the City. Designation of a set of priority routes that should be undertaken within 3-5 years addresses this goal. This priority network also relies heavily on existing and in-progress facilities, including the Uncle Sam Bikeway and the South Troy Riverfront Bikeway; improving access to these facilities and building complementary routes is the most efficient way to build out the system. The priority projects table lists these projects and provides timeframes and estimated costs for each. Full and lean implementation costs are provided for several larger projects. The full estimates should not be viewed as "luxury" implementations. Instead, the City of Troy should view the lean implementation estimate as the cost of a good start for a given route that can be enhanced with features included in the full-cost estimate. Routes where only one estimate is provided can similarly be enhanced after the base-level facility is developed.

The priority table is a recommendation that serves the goal of creating a connected system throughout Troy efficiently and quickly. However, it wasn't created with full knowledge of paving schedules, future funding availability, or future planning or engineering processes. Therefore, the City should remain flexible, promoting projects as opportunities arise. Paving schedules, in particular, may also help the City to prioritize projects or parts of projects within a given timeframe.

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Further embracing flexibility, the City of Troy should continue to promote demonstration projects similar to the pop-up bikeway created as part of the outreach component for preparing the *Troy Bicycle Connections Plan*. This not only gives residents the opportunity to participate in the implementation of the bikeway network, but it also allows the City to quickly and cost-effectively change a particular configuration if necessary. Oftentimes a major barrier to increasing the numbers of cyclists is that the infrastructure that would most likely encourage more people to ride safely, such as a cycle track, is seen as a luxurious investment at the time. Temporary demonstrations, whether they last a few months or a year, can help show whether or not the benefits associated with increases in cycling can justify these investments.

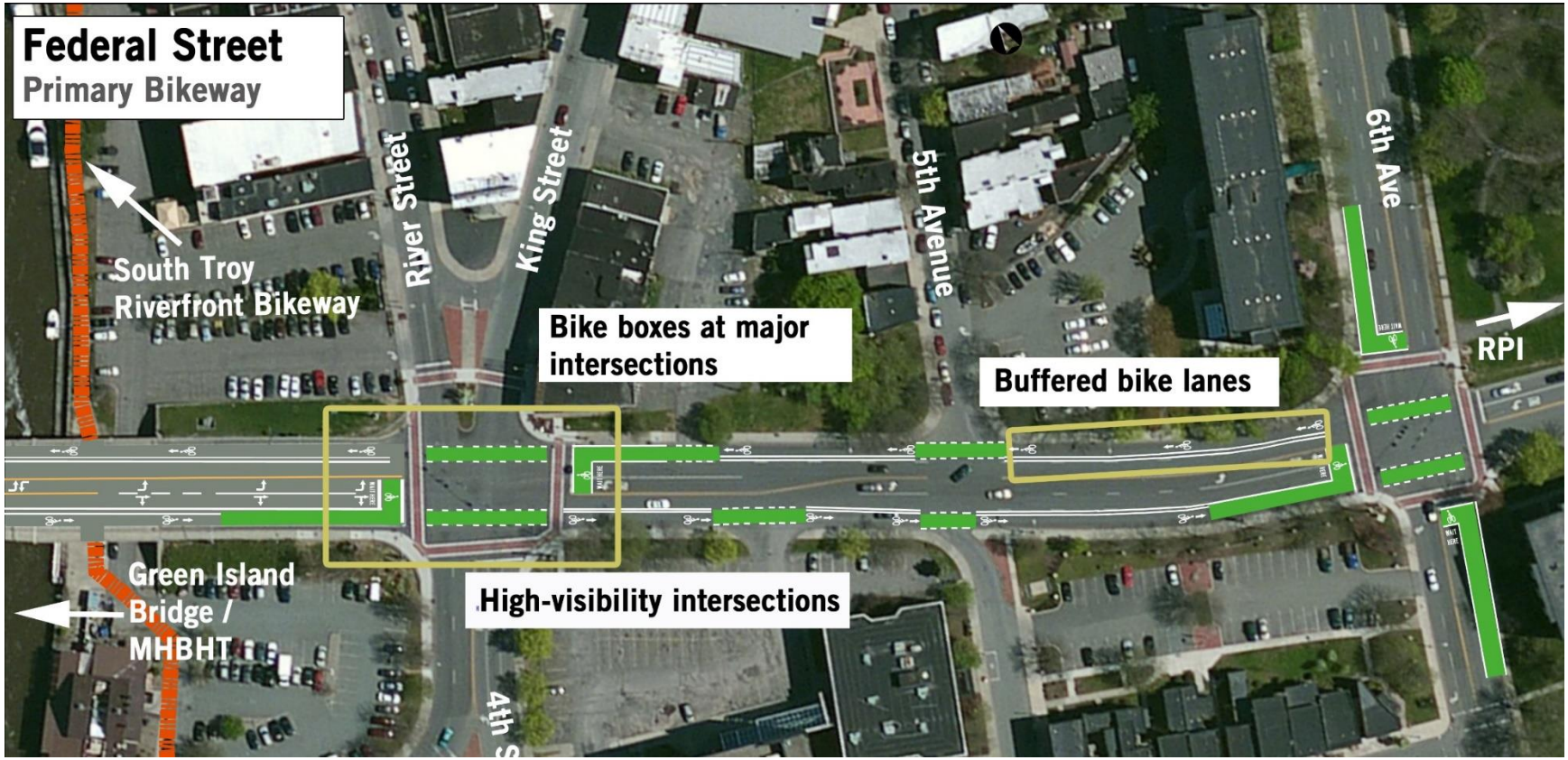
Beyond development of this priority network, the long-term goal of the *Troy Bicycle Connections Plan* is to build a comprehensive, citywide cycling network, and to give the City a framework for evaluating decisions regarding locations and facility types in order to achieve this. Project lists for each of Troy's neighborhoods provide recommendations for facilities beyond the 3-5-year timeframe, as well as proposed treatments and the benefits they could provide to the network. Some priority projects, such as the Hudson River Bridge Crossings, may require cooperation from other agencies and municipalities.

The Recommended Bikeway Treatment Matrix should bring an extra layer to the process the City of Troy uses to determine what upgrades to make to a street as part of a particular project. An a la carte listing of facility cost estimates can also help with budgeting for future bikeway enhancements.

Priority Projects

	STREETS (MILEAGE)	TREATMENTS	NETWORK IMPACT	COST ESTIMATE	PRIORITY
UNCLE SAM BIKEWAY	Connection to Knickerbacker Park; access and intersection improvements	See Uncle Sam Bikeway Improvement Plan for details		$1,057,000	Ongoing
LANSINGBURGH NEIGHBORHOOD BIKEWAY	6th/7th Avenues between Northern Drive and Middleburgh (3 miles)	• Directional pavement markings • Route and decision signage • Curb bulb-outs • Speed tables • Speed and volume management techniques, where necessary	North-South Neighborhood Bikeway connection to South Troy Riverfront Bikeway (STRB)	$950,000	3 YEAR
2ND AVENUE BIKEWAY	Between 126TH St Bridge and Middleburgh; River St from Middleburgh to Vanderhyden (3.4 miles)	• Two-way cycle track with protection • Route and decision signage • Intersection treatments, bike boxes, and/or left hand turn boxes Signal and detectors at major intersections	North-South Primary Bikeway route	$1.2 M	3 YEAR
4TH ST BIKEWAY	Between South Troy Riverfront Bikeway and Green Island Bridge/Federal St (2 miles)	• One way striped lane (left-side) • Route and decision signage • Intersection treatments, bike boxes, and/or left hand turn boxes	North-South route paralleling STRB	$70,000	3 YEAR
CENTRAL TROY EAST – WEST BIKEWAY (SEE RENDERING BELOW)	Green Island Bridge; Federal St; Sage Ave to Burdett Ave (1 mile)	• Striped bike lanes • Route and decision signage • Intersection treatments, bike boxes, and/or left hand turn boxes	Primary bikeway / E-W route – connections to regional trail, downtown Troy, RPI, Hill Neighborhood, Troy High and Middle Schools	$45,000	3 YEAR

PAWLING AVE BIKEWAY	Pawling Ave (Brunswick line to Congress Street) (3 miles)	• Striped bike lanes • Route and decision signage • Intersection treatments, bike boxes, and/or left hand turn boxes	Primary Bikeway connection to Albia neighborhood, Downtown Troy, Prospect Park	$110,000	3 YEAR
NORTHERN DRIVE BIKEWAY	Northern Dr between 2ND Ave and Oakwood Ave (1 mile)	• Striped bike lanes • Route and decision signage • Intersection treatments, bike boxes, and/or left hand turn boxes	Connections to Uncle Sam Bikeway – E-W connection to 126TH St Bridge; northernmost E-W route	$45,000	3 YEAR
BURDETT AVE BIKEWAY	Burdett Ave between Peoples Ave and Hoosick St; Hoosick St; 21ST St to Troy YMCA	• Sidewalk and crossing improvements at Hoosick and 21st • Extend existing bike lane • Intersection treatments, bike boxes, and/or left hand turn boxes Route and decision signage	Primary Bikeway; extends bike lanes on Burdett; access to recreation, education, employment centers	$35,000	3 YEAR
HIGH STREET / TROY-MENANDS BRIDGE	South Troy Riverfront Bikeway/Water St to MHBHT/EST/ECT	• Convert sidewalk to green multi-use path; remove dismount zone • Signal and detector at intersection • Route and decision signage • Clear overgrown brush along sidewalk on Burden Ave/High St • Install bollards in greenway along High Street • Intersection treatments, bike boxes, and/or left hand turn boxes • Advance stop line on Water Street	Regional trail connection	$125,000	5 YEAR
LANSINGBURGH BRIDGES	126TH St Bridge 112TH St Bridge	• Two-way cycle track • Shared lane markings • Route and decision signage	Regional trail connections; connections to Cohoes	$25,000	5 YEAR
TOTAL				**$3.7 M**	


Federal Street
Primary Bikeway
South Troy
Riverfront Bikeway
River Street
King Street
5th Avenue
6th Ave
RPI
Bike boxes at major
intersections
Buffered bike lanes
Green Island
Bridge /
MHBHT
High-visibility intersections
4th

Policy Recommendations & Other Next Steps

To expedite the implementation of the *Troy Bicycle Connections Plan* **the Troy City Council should pass a resolution in support of the Plan's recommendations**.

After 5 years, the recommendations in the *Troy Bicycle Connection Plan* should be revisited. The introduction of innovative new bicycle facilities and updates to existing treatments should be considered as supplementary to this Plan. Moreover, roadway characteristics may change, necessitating a reevaluation of the treatment recommendations laid out in the Plan. To accommodate this level of flexibility, the City of Troy and its Complete Streets Advisory Group should use the Bikeway and Intersection Decision Matrix included below.

Bike parking is an issue that will require monitoring and continued investment as the network grows. As described in the Plan text, the City of Troy should periodically conduct an inventory of bicycle parking availability, and continue to operate the business-sponsored bicycle rack program. The City should also consider other ways to regularize the inclusion of bike parking in new development, using the city code to require developers to include bicycle parking into new multi-unit housing or mixed use developments and/or providing incentives such as reduced parking minimums or additional units if a certain minimum bicycle parking standard is met.

Bike counts should be conducted annually, at a minimum, and, ideally, bi-annually. Annual counts should occur in September, with an additional spring count added if possible. Counts involve volunteers and/or City personnel counting cyclist use of important intersections on the bikeway network and several locations on the Uncle Sam and South Troy Riverfront Bikeways. The City may also want to consider utilizing automated counters to monitor trail sections for longer periods of time, as was done on the Uncle Sam Bikeway for the 2016 Capital District Trail User Counts. More information and resources for conducting counts is available from the National Bike and Pedestrian Documentation Project, http://bikepeddocumentation.org/, and from Parks & Trails New York, ptny.org.

Contra-flow bike lanes are a facility type included as an option in the Plan, and could be a useful tool for the City considering Troy's street network includes many one-way streets. In order to move forward with contra-flow lanes, the Plan recommends observational bike counts along a one-way street to determine the amount of cyclists riding against traffic. These counts can be conducted as part of annual or bi-annual counts, or as a standalone exercise. While not something that has been done in all locations using contra-flow lanes, **the Plan also recommends passing an ordinance explicitly endorsing contra-flow lanes as a proactive step**.

Recommended Bikeway Decision Matrix

To use the matrix, planners should gather data on a given street or intersection that correspond to the numbered columns on the left of the chart. Traffic speed and traffic volume are important characteristics for both roadways and intersections, and should be considered first. As you move from left to right on the chart, other characteristics and data are considered. The last column contains the facility recommendation based on the input characteristics. A recommended categorization that corresponds to the recommended facility is also displayed.

Recommended Bikeway Treatment Matrix

Street Characteristics					Bikeway Network type	Recommended bikeway treatment elements
1 Posted Traffic Speed	2 Traffic Volume	3 Street width and number of travel lanes in each direction	4 Connectivity to parks, schools, and businesses	5 Other possible characteristics		
>30 MPH	>5,000 VPD	17+ feet 2 lanes	High	CDTA route Both-side on-street parking	Primary	Buffered or protected bicycle lane (cycle track) [Increased bike lane width should be considered for one-way streets]
			High	CDTA route	Primary	Two-way buffered or protected bicycle lane
		17+ feet 1 lane	High	CDTA route Both-side on-street parking	Primary	Left-side protected or buffered bicycle lane [Increased bike lane width should be considerd for one-way streets]
30 MPH	>3,000 VPD	<17 feet 1 lane	High	Both-side on-street parking	Primary / Secondary	Striped bicycle lane [Increased bike lane width should be considered for one-way streets]
	>5,000 VPD	<17 feet 1 lane	High	One-way CDTA route Both-side on-street parking	Primary	Left-side striped bicycle lane
	3,000-5,000 VPD	<17 feet 1 lane	Medium	One-way Both-side on-street parking High volume of wrong-way cycling	Secondary	Contra-flow bicycle lane
	3,000-5,000 VPD	<17 feet 1 lane	Medium	One-side on-street parking	Secondary	Protected bicycle lane buffered by on-street parking
	3,000-5,000 VPD	<17 feet 1 lane	Medium	Approaching school zone or neighborhood park	Secondary	Striped bicycle lane Where applicable: speed humps/ cushions/ tables
	3,000-5,000 VPD	<17 feet 1 Lane	Medium	Hill routes	Primary / Secondary	Striped bicycle lane in uphill direction Shared lane marking / advisory bicycle lane in downhill
30 MPH or less	3,000-5,000 VPD	17+ feet 1 Lane	Medium	One-way On-street parking	Neighborhood	Advisory bicycle lane
	<3,000 VPD	<17 feet 1 Lane	Medium	On-street parking	Neighborhood	Advisory bicycle lane

>30 MPH	<3,000 VPD	<17 feet 1 Lane	Medium	High incidence of speeding	Neighborhood	Where applicable: Neighborhood traffic circle Speed humps/cushions/ tables
30 MPH or less	<3,000 VPD	<17 feet 1 Lane	Medium	Higher than desirable traffic volumes	Neighborhood	Where applicable: Partial closures Median diverters

Recommended Intersection Treatments Matrix

Intersection characteristics				Recommended intersection treatments
1 **Traffic volume of intersecting streets**	**2** **Intersection signalization**	**3** **Intersecting bikeway types**	**4** **Reported level of traffic incidents**	
>5,000 VPD	Traffic light	Primary Secondary	High	Bicycle-priority signalization High-visibility intersection markings Left-turn accommodations Protected intersection
	Traffic light Stop sign	Primary Neighborhood	High	Bicycle-priority signalization High-visibility intersection markings Left-turn accommodations Protected intersection
3,000-5,000 VPD	Traffic light	Secondary	High	Bicycle-priority signalization High visibility intersection markings
<3,000 VPD	All-way stop	Secondary Neighborhood	Medium	High-visibility intersection markings
	Two-way stop	Secondary Neighborhood	Medium	High-visibility intersection markings
	All-way / two-way stop	Neighborhood	Medium Low	Neighborhood traffic circle
Intersecting streets differ significantly in traffic volume	Traffic light Stop sign	All	--	Intersection treatments should conform to higher order cycling facility (i.e. primary or secondary bikeway treatments should be maintained through intersections with neighborhood bikeways and/or other lower volume streets)

A La Carte Facility Costs

Costs for individual bikeway elements are displayed in order to assist the City in decision-making and prioritizing future routes and facilities.

FEATURE	UNIT COST/SET COST[2] (MEDIAN COST USED IF AVAILABLE, INCLUDES INSTALLATION)
ADVANCE STOP/YIELD LINE	$380
BIKE BOX/LEFT TURN BOX	$350
BIKE LANE (STRIPED LANE + MARKINGS, TWO-WAY)	$23,000 per mile
BIKE LOCKER	$2,140
BIKE ROUTE SIGNAGE	$300 w/ post
BIKE PARKING	$540
CURB EXTENSION	$10,150/$100,000 for 4-way intersection
CYCLE TRACK	$105,600 per mile
DECISION/WAYFINDING SIGNAGE	$530 w/ post
FIXIT STATION	$1100 w/ air pump
FLEXIBLE DELINEATORS (RECOMMENDED SPACING IS 20 FT)	$50
HIGH INTENSITY ACTIVATED CROSSWALK (HAWK)	$50,000
INTERSECTION TREATMENT (EXTENDS BIKEWAY THROUGH INTERSECTION)	$350
LEFT HAND TURN LANE	$350
PEDESTRIAN/BIKE SIGNAL + DETECTOR	$2,000
NEIGHBORHOOD TRAFFIC CIRCLE	$35,000
SHARED LANE (PAVEMENT MARKINGS)	$13,000 per mile
SPEED TABLE (RECOMMENDED IN SETS OF 3)	$2,000/$6,000

[2] Costs derived from Alta Planning + Design analysis of New York State Department of Transportation's Pay Item Catalog, https://www.dot.ny.gov/pic, as well *Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public*. Bushnell, Poole, Zegeer, Rodriguez. October 2013. http://www.pedbikeinfo.org/cms/downloads/Countermeasure%20Costs_Report_Nov2013.pdf

Potential Funding Sources

Transportation Alternatives Program / Congestion Mitigation and Air Quality Improvement Program	Reduce traffic congestion on local streets and improve air quality in places that do not meet air quality standards. Transportation Alternatives Program rolled into CMAQ in 2016.	Contact CDTC 518-458-2161 to determine appropriate CMAQ staff representative. For TAP eligibility, visit https://www.dot.ny.gov/tap-cmaq
Transportation Improvement Program (TIP)	Funds infrastructure improvements related to the goals of the New Visions long-range transportation plan. The City of Troy could use this funding source for resurfacing projects that would help achieve the result of the Bikeway Network.	Contact CDTC at 518-458-2161 or visit http://www.cdtcmpo.org/documents-reports/transportation-improvement-program for more information.
People for Bikes Community Grant Program	Supports bicycle infrastructure projects and targeted advocacy initiatives that make it easier and safer for people of all ages and abilities to ride.	http://peopleforbikes.org/grant-guidelines/
Recreational Trails Grant	Provides funds to states to develop and maintain recreational trails for both motorized and non-motorized recreational trail use. Funding is available for the maintenance and restoration of existing recreational trails, development and rehabilitation of trailside and trailhead facilities and trail linkages for recreational trails, purchase and lease of recreational trail construction, maintenance equipment, and construction of new recreational trails.	https://parks.ny.gov/grants/recreational-trails/default.aspx
Local Waterfront Revitalization Program (LWRP)	Communities that have prepared LWRP plans (Troy will have one at the conclusion of Realize Troy) are eligible for funding to implement the components of that plan. Funding through the LWRP may be used to construct multi-use trails and other bicycle and pedestrian infrastructure.	https://www.dos.ny.gov/grants.html
Brownfield Opportunity Area Program	For areas that are perceived as environmentally-harmful, such as former industrial areas along the South Troy Riverfront, funding through this program can be used for up to 90% of project costs for multi-use trails and other bicycle-related infrastructure.	https://www.dos.ny.gov/funding/rfa-16-boa-25/index.html

US Department of Transportation - TIGER	A competitive grant program with funds allocated directly by the U.S. DOT for innovative projects that deliver on five long-term outcomes: safety, economic competitiveness, state of good repair, livability, and environmental sustainability	https://www.transportation.gov/tiger/2017-tiger-application-faqs
Hudson River Valley Greenway Grant Program	Funds planning for trails and other projects that align with the goals of the Hudson River Valley Greenway. Grants are available for $5,000-$10,000 but require 50% community match.	http://www.hudsongreenway.ny.gov/GrantFunding/HudsonRiverValleyGreenwayGrantsProgram.aspx
AARP Community Challenge Grant	Grants to encourage "quick action" projects that help facilitate the development of livable communities.	https://www.aarp.org/livable-communities/about/info-2017/aarp-community-challenge.html

Bicycle Parking Ordinances

The following examples provide serve to provide inspiration to the City of Troy's efforts to encourage an expansion of the availability of long- and short-term bicycle parking facilities. It is entirely possible to achieve this result without passing an ordinance, however, with increasing development happening in Downtown Troy and adjacent neighborhoods, it may allow the city to achieve its goal in a more predictable way.

City of Albany Bicycle Parking Ordinance

Albany requires provision of off-street bicycle parking in multi-unit residences, and many institutional and commercial uses. The ordinance applies to new construction, significant enlargement, and change of use that would increase demand. Albany's ordinance does not seem to differentiate between short- and long-term parking.

Albany's Bicycle Parking Ordinance: http://rezonealbany.com/sites/rezonealbany.com/files/media/Albany%20USDO%206-month%20review%20edits_w-memo.pdf

City of Cambridge (MA) Bicycle Parking Zoning Ordinance

Since 1981 Cambridge, Massachusetts' Zoning Ordinance has required new residential and commercial developments, and significant enlargements of existing buildings to include bike parking, both short-term and long-term. The City publishes a guide that explains the ordinance and provides specific guidance as to the number of short- and long-term spaces required for different uses. If a property owner cannot provide the specified amount of bicycle parking, the owner is required to contribute to a Public Bicycle Parking Fund. The City credits its bike parking policies in supporting cycling as a preferred transportation option.

More information at http://www.cambridgema.gov/cdd/projects/planning/bicycleparkingzoning

San Francisco Bike Parking Ordinance

Bicycle parking requirements were first adopted into San Francisco's Planning Code in 1996, although at that time, the requirement only applied to City-owned and leased buildings. Over the years, growing rates of cycling have led the City to progressively expand these policies. The latest iteration of

the bicycle parking requirement in the Planning Code requires bike parking to be included in both residential and commercial uses, with the number of parking spaces specified based upon the anticipated need for different uses. A residential or office building requires more long-term capacity, for residents and commuters, while a retail store needs more short-term spaces to accommodate shoppers. The law applies to new construction as well as certain renovations, enlargement, or a change of use that would add demand.

More on San Francisco's policy at http://sf-planning.org/bicycle-parking-requirements

Madison (WI) Bike Parking Ordinance
In 1988, the Madison Common Council passed an ordinance requiring the inclusion of off-street bicycle parking for new developments, expansion of existing developments, and changes in use that would increase bike parking demand. For expansions or changes in use, bicycle parking must be increased in proportion to the extra amount needed by the addition or change in use. The number of bicycle parking spaces allotted for a development is determined based on guidelines included in the ordinance. Bicycle parking facilities are required in all areas of the city.

More at https://www.groundcontrolsystems.com/resources/tools-assets/city-madison-bicycle-parking-ordinance/

SUNY Albany Institute for Healthy Infrastructure's Planning and Policy Models for Pedestrian and Bicycle Friendly Communities in New York State
The model ordinance provides language to differentiate the difference between short- and long-term parking. It also uses the APBP standards addressed previously in this plan. For every 10 bicycle parking spots a developer provides, they are able to deduct 1 automobile parking space from their proposal.

The model ordinance begins on page 17 here: https://www.albany.edu/ihi/files/NY_Planning_And_Policy_Models_iHi.pdf

Fix-It Bicycle Repair Stations

The City of Troy, as previously mentioned, has Fix-It Bicycle Repair Stations at four prominent locations. In addition to these repair stations, the non-profit organization, Troy Bike Rescue, operates a community bicycle repair workshop. As of the writing of this plan, there is no retail bike shop in within the City. To expand the bicycle-friendliness of the City, it's important to continue to offer more amenities like bicycle racks and Fix-It stations.

High profile locations, such as schools, parks, and business districts are the best places for future installation, since they are likely to be destinations for bicyclists. Examples include Monument Square, RPI's campus, major trailheads for the Uncle Sam Bikeway, the Lansingburgh Branch of the Troy Public Library, Knickerbacker Park, Frear Park, Prospect Park, in neighborhood business districts such as 15th

Street and Pawling Avenue. Capital Roots installed three of the four Fix-It stations that currently exist. Any future installation should be coordinated with their efforts.

Maintenance and Snow Removal

Maintenance

The City of Troy should consider adopting a policy that encourages regular maintenance of the bikeway network or roll it into their regular maintenance protocol. The relevant city department should ensure that regular street sweeping removes debris from bicycle lanes, pavement markings are not faded or missing, and that signage is clearly visible and unobstructed by vandalism or overgrown vegetation.

The following table displays the average bikeway maintenance unit costs for the City of Minneapolis' urban bikeway network. These costs are meant to provide a ballpark estimate; actual costs for Troy's network may vary significantly.

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	MAINTENANCE TYPE	ANNUAL COST PER LINEAR FOOT
MULTI-USE TRAIL	Clear snow and sweep weekly	$2.00
BIKE LANE WITH ENHANCED SWEEPING (per direction)	Clear snow and sweep weekly	$1.00
BIKE LANE WITH YEAR-ROUND MAINTENANCE (per direction)	Remove snow & sweep weekly	$3.75
ONE-WAY PROTECTED BIKE LANE (per direction)	Remove snow & sweep weekly	$6.50
TWO-WAY PROTECTED BIKE LANE ON ONE SIDE	Remove snow & sweep weekly	$10.00

Snow Removal

Snow and ice should not limit the effectiveness of the treatments the *Troy Bicycle Connections Plan* recommends. Many cities with extensive bikeway networks such as Chicago, Minneapolis, and Montreal experience harsher winter conditions than Troy. These cities continue to maintain their bicycle network throughout the year, ensuring that bicycling remains a viable form of transportation during all four seasons.

Identify a priority network: The City should choose which streets it will maintain first during snow and ice storms. It would make sense to start with Primary Bikeways, since these facilities will likely be on the same streets the city already prioritizes. Moreover, winter cyclists tend to be more confident riders in general, so they are more likely to use the most direct routes during their trip.

Determine a threshold at which conditions require action: The City of Troy should define under what conditions bikeway-specific winter maintenance is necessary. Many cities use an inch of snow as a threshold.

Ensure that snow and ice build-ups do not obstruct the lane: snow removal vehicles should pay close attention to the shoulders on roads and other areas along the side of the road where bicyclists typically ride. Additional de-icing may be necessary in bike lanes due to the fact that they are less likely to break up ice and snow compared to vehicles.

Other considerations

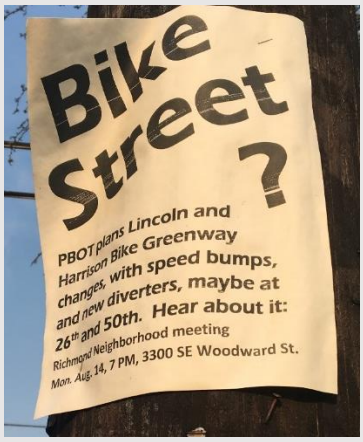
The Recommendations section of this plan gives many options to achieve the desired bikeway network. To help facilitate snow removal along the bikeway, the City of Troy should avoid using materials and treatments that are not durable enough to withstand the wear and tear winter weather puts on the city's roadways. For example, for cycle tracks, the city should use flexible delineators with reflectors; for speed and volume management, the city should use curbs or speed humps with gradual slopes to ensure that the plow can thoroughly remove snow and ice.

Post-installation Education

Since the current bicycle network is underdeveloped, once novel infrastructure such as cycle tracks or new pavement markings, is installed, it is important for community groups, such as neighborhood associations, Capital Roots, and Transport Troy, and the City of Troy to conduct an additional level of community education. The three examples below feature educational signage from Portland, Oregon and Burlington, Vermont that was installed to help drivers and bicyclists navigate unfamiliar infrastructure.

INTERSECTION PAVEMENT MARKINGS, Portland

NEIGHBORHOOD BIKEWAY TREATMENTS, Portland



CYCLE TRACK, Burlington

Glossary of Terms

Active Warning Beacons – User-actuated flashing light that supplements warning signs at un-signalized intersections or mid-block crosswalks. Beacons can be actuated manually by a push-button or passively through detection. Active warning beacons are used to alert drivers to yield where bicyclists have the right-of-way crossing a road.

Bike Boxes – a designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible space to wait for the light. This allows cyclists to get ahead of queuing traffic during the red signal phase.

Bike Lane – a bike lane is defined as a portion of the roadway that has been designated by striping, signage, and/or pavement markings for the preferential or exclusive use of bicyclists (*see also buffered, contra-flow, and conventional bike lanes*).

Buffered Bike Lanes – a conventional bike lane paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and or parking lane. Buffered bike lanes provide space for bicyclists to pass another bicyclist without encroaching into the adjacent motor vehicle travel lane.

Capital District Transportation Authority (CDTA) – a public benefit corporation created by New York State that operates public transportation in the Capital District of New York, serving Albany, Schenectady, Rensselaer and Saratoga counties. CDTA runs local and express buses, as well as a bike share program called CDPHP Cycle!

Capital District Regional Planning Commission (CDRPC) – CDRPC is a regional planning and resource center serving the upstate New York counties of Albany, Rensselaer, Saratoga and Schenectady. CDRPC provides objective analysis of data, trends, opportunities and challenges relating to the region's economic development and planning.

Confirmation Signs – wayfinding signage that indicates to bicyclists that they are on a designated bikeway. Confirmation signs also make motorists aware of the presence of a bicycle route.

Contra-flow Bicycle Lanes – bicycle lanes designed to allow bicyclists to travel in the opposite direction of motor vehicle traffic. Combining two ways of bicycle traffic on one side of the street to accommodate contra-flow movement results in a two-way cycle track.

Conventional Bike Lanes – bikes lanes that run curbside when no parking is present, or adjacent to parked cars on the right-hand side of the street when parking is present. Alternately, bike lanes may be placed on the left-hand side of the street on one-way streets.

Curb Extensions – Commonly called bulb-outs, curb extensions extend the sidewalk or curb face into the parking lane at an intersection. When used at a crosswalk, curb extensions shorten the crossing distance for pedestrians. They also assist in bringing vehicle speeds down, so are often included as part of a bikeway.

Cycle Tracks – an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane.

Decision Signs – wayfinding signage that marks the junction of two or more bikes ways. The purpose of decision signs is to direct bicyclists on the designated bike route to key destinations.

High-intensity Activated Crosswalk (HAWK) - also called a hybrid beacon; consists of a flashing, lighted signal visible on the major street, and pedestrian and/or bicycle signals for the minor street. Hybrid beacons enhance pedestrian comfort while crossing major streets. Hybrid beacons are used in locations where side-street volumes do not support installation of a conventional traffic signal.

Horizontal Deflection – speed control measures that cause motorists to slow down in response to either a visually narrower roadway or a need to navigate a curving travel lane. Examples of horizontal deflections include curb extensions and neighborhood traffic circles.

Left-side Bike Lanes – conventional bike lanes placed on the left side of one-way streets or two-way median divided streets. Left-side bike lanes offer advantages along streets with heavy delivery or transit use, frequent parking turnover on the right side, or other potential conflicts that could be associated right-side bicycle lanes.

Major Street Crossings – a location where a bicycle boulevard crosses a major street with right-of-way priority. In this case, a variety of measures will improve visibility and reduce delay for bicyclists. These include signs, markings, and signals that enhance crossings, advance stop bars and advance signing, median refuge islands and curb extensions.

Minor Street Crossings – The intersection of two residential or local streets, both having low motor vehicle volumes and speeds. At intersections with local streets and minor collectors, bicycle boulevards have right-of-way priority. As a method of reducing delay for cyclists, these intersections may be candidates limiting the number of stop signs along the route.

National Association of City Transportation Officials (NACTO) – an organization comprised of transportation officials from North American cities. NACTO's mission is to elevate the state of the practice for street design and transportation by building a common vision, sharing data, peer-to-peer exchange in workshops and conferences, and regular communication among member cities. NACTO Urban Street Design Guide sets the standard for urban bikeway design, and was utilized extensively in preparing this Plan.

Neighborhood Traffic Circles – minor street crossing treatments that provide speed management. They are raised or delineated islands places at intersections that reduce vehicle speeds by narrowing turning radii and the travel lane.

One-way Protected Cycle Track – a bikeway that are at street level and use a variety of methods for physical protection from passing traffic. It may be combined with a parking lane or other barriers between the cycle track and the motor vehicle travel lane.

Sharrows – a combination of the words "share" and "arrow," sharrows are intended to serve as a visual reminder that space on the road is meant to be shared by cyclists and motorists. Sharrows don't provide dedicated space on the street for people biking, meaning motorists can still use a lane with

sharrows in it. The main function of a sharrow is to indicate a general area on the road in which it should be safe for people to bike.

Speed Management Techniques – or traffic calming; measures used on bicycle boulevards or other bikeways to bring motor vehicle speeds closer to those of bicyclists. Reducing speeds along the bicycle boulevards improves the bicycling environment by reducing overtaking events, enhancing drivers' ability to see and react, and diminishing the severity of crashes if they occur. Speed management measures can be divided into vertical or horizontal features.

Striped Bike Lanes - bike lanes that aim to provide a clearer sense of where cyclists should be on the road by creating a lane for bikes. Typically, these lanes are striped with white paint and are often located on far right side of the road. They also may be painted a separate color to draw more attention.

Transport Troy – Transport Troy is an active citizens group representing all citizens of Troy who desire more complete access to the City's streets. Their belief is that in order for Troy to be competitive, to retain current residents and attract newcomers, Troy will need to make a meaningful commitment to walkability.

Two-way Cycle Track – also known as protected bike lanes, separated bikeways, and on-street bike paths; physically separated cycle tracks that allow bicycle movement in both directions on one side of the road. Two-way cycle tracks are similar in design characteristics to one-way cycle tracks, but may require additional considerations at driveways and side-street crossings.

Two-stage Turn Queue Boxes – a bike facility which offers bicyclists a safe way to make left turns at a multi-lane signalized intersections, from a right-side cycle track or bike lane. Two-stage turn queue boxes may also be used at un-signalized intersections to simplify turns from a bicycle lane or cycle track.

Turn signs – indicate where a bikeway turns from one street onto another street. Turn signs generally are used with pavement markings and include destinations and arrows.

Vertical Deflection – Speed control measures that are composed of wide, slight pavement elevations that self-enforce a slower speed for motorists. Recommended techniques include speed humps, speed cushions, and speed tables.

Volume Management – measures taken to reduce or discourage thru traffic on designated bicycle boulevard corridors by physically or operationally reconfiguring select corridors and intersections alone the route. These measures may include a forced turn at an intersection, partial closures, and median islands.

VPD – Commonly referred to as Vehicles per day, a measure of the number of vehicles that pass a particular point on the road during a 24-hour period.

Photo Acknowledgements

Unless stated below, all photos in this plan are credited to Parks & Trails New York

National Association of City Transportation Officials (NACTO): One-way protected cycle track (Chicago); Contra-flow bike lane; Left-side bike lane; Speed humps; Speed cushions; Speed tables; Curb extensions (Santa Fe, NM); Bicycle traffic light (San Luis Obispo, CA); Bicycle forward stop bars (Seattle); Hybrid beacons; Active warning beacons; Median refuge islands; Dotted line extensions; Shared lane markings; Elephant's feet; Two-stage turn queue boxes; Turn signs (Chicago)

Corey Aldrich / Collar City Ramble: Urban Bikeway Demonstration Project (top L and R)

Appendix A: Existing Conditions

Land Use & Development

The largest land uses by acreage in Troy are Community Services, Residential, and Vacant Land. Within the second largest land use, "Residential", the look and feel of Troy's residential blocks differ significantly by neighborhood, but overall the City exhibits high population density. Troy scores a 7.6 in the "Compact Design" metric from the Center for Neighborhood Technology, compared with a regional score of just 1.5.

The "compactness" of Troy's development pattern lends itself to mixed use residential and commercial building, which proliferate along many of Troy's streets. Constraints imposed on development by geography, including numerous steep hills, gorges, ravines and rock outcroppings also contribute to commercial and residential density in Troy's downtown and several of its neighborhoods.

Table A.1 Land Use by Acreage

Land Use	Acreage	Percentage of Total
Total	*7496.82*	*100%*
Agricultural (Property used for the production of crops or livestock)	0	0.0%
Residential (Property used for human habitation; Living accommodations such as hotels, motels, and apartments are in the Commercial category)	1859	24.8%
Vacant Land (Property that is not in use, is in temporary use, or lacks permanent improvement)	1655	22.1%
Commercial (Property used for the sale of goods and/or services)	943	12.6%
Recreation & Entertainment (Property used by groups for recreation, amusement, or entertainment)	658	8.8%
Community Services (Property used for the well being of the community)	1940	25.9%
Industrial (Property used for the production and fabrication of durable and nondurable man-made goods)	64	0.9%
Public Services (Property used to provide services to the general public)	346	4.6%
Wild, Forested, Conservation Lands & Public Parks (Reforested lands, preserves, and private hunting and fishing clubs)	32	0.4%

Source: PTNY analysis of City of Troy tax parcel data

Population & Income

With a population of just over 50,000 as of 2010, Troy is the largest city in Rensselaer County. Conversely, it is the smallest of the Capital District's three principal cities.

Troy's household sizes are comparable to Rensselaer County's and to the wider region, but the City's age cohorts skew younger, with over 40% of City residents under the age of 25.

Troy has significantly higher Black and Hispanic populations, at 16.38% and 7.95% of total population, than its county or region.

Troy's median household income is $38,954, significantly lower than Rensselaer County or the wider Capital District, and a relatively larger share of Troy's residents live below the poverty line (22.70%). While there is a wealth disparity between Troy and Rensselaer County and the wider region, the city closely resembles Albany and Schenectady in median income and poverty level.

Troy's residents have education attainment levels that are lower than Rensselaer County and the Capital District, and fall between Schenectady and Albany's educational attainment levels, with 21.1% of Schenectady's and 36.4% of Albany's residents having at least a Bachelor's degree.

Transportation, employment, and affordability

The following tables summarize how the Troy compares with Rensselaer County, and the wider Albany- Troy-Schenectady region on a number of important transportation metrics. These metrics give insight into how residents are moving around, how much they are spending on transportation, and how accessibility to infrastructure for biking, driving, and walking may be influencing their transportation choices.

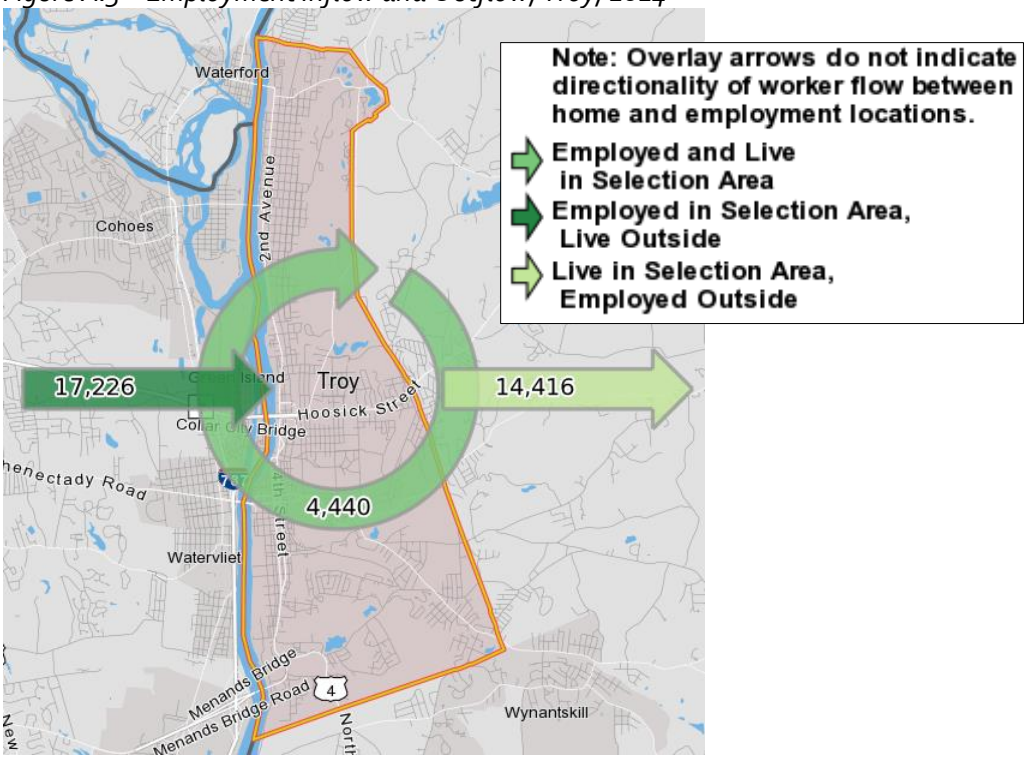
Traveling to and from work is often the largest component of a resident's travel behavior. Table 1.8 and Figure 1.9 show that Troy residents work in an array of communities throughout the region, with 23.5% staying in Troy for employment, and another 18.5% commuting to Albany. Troy also serves as a regional employment center, with over 17,000 workers travelling from elsewhere in the region to work in Troy.

Table A.2 – Employment locations of Troy residents, 2014

	2014	
	Count	Percent
Total Employed Population*	18,856	100.0%
Troy	4,440	23.5%
Albany	3,491	18.5%
New York City	836	4.4%
Schenectady	462	2.5%
City of Cohoes, NY	277	1.5%
Village of Colonie, NY	243	1.3%
Village of Menands, NY	212	1.1%
Village of Green Island, NY	190	1.0%
City of Saratoga Springs NY	165	0.9%
City of Watervliet, NY	138	0.7%
All Other Locations	8,402	44.6%

**Primary jobs include public and private-sector jobs. Primary Jobs represent the highest paying job for an individual worker.*
Source: Longitudinal Employer-Household Dynamics.

Figure A.3 – Employment Inflow and Outflow, Troy, 2014



Source: Longitudinal Employer-Household Dynamics, www.lehd.com

Commuting Mode Share

Mode share indicates what percentage of trips taken are using a specific type of transportation, such as driving alone or transit. While the majority of Troy residents drive alone to work, a significant portion carpool, and another large segment of workers walk to their employment. The number of Troy residents biking to work is currently quite low, at 0.2%.

Table A.4 – Mode share, as percentage of work trips

	Troy	Rensselaer County	Capital District
Total workers	21,942	78,398	416,691
Worked at home	580	2,525	15,629
Total commuting population*	21,362	75,873	401,062
Drive alone	68.6%	83.4%	83.3%
Carpool	11.9%	9.0%	8.2%
Public Transportation	6.0%	2.3%	3.6%
Walked	12.2%	4.3%	3.7%
Bicycle	0.2%	0.1%	0.0%
Taxicab, motorcycle, or other means	1.1%	0.8%	1.0%

**Mode shares are expressed as percentages of the working population that did not work from home.*
Source: Capital District Regional Planning Commission, based on 2011-2015 American Community Survey figures

Car Availability and Use

Troy's residents have relatively limited access to automobiles compared with their counterparts in Rensselaer County and the wider region. Therefore it is not surprising that average number of miles driven annually by Troy households is less than those in Rensselaer County, and the wider region.

Table A.5 – Access to one or more vehicles, as percentage of occupied housing units

	Troy	Rensselaer County	Albany Troy Schenectady Metro Area
Occupied housing units	19,808	63,447	347,401
No vehicle available	22.0%	9.7%	9.8%
1 vehicle available	44.2%	35.2%	36.0%
2 vehicle available	25.6%	37.5%	38.3%
3 or more vehicles available	8.1%	17.6%	15.9%

Source: U.S. Census Bureau, 2011 - 2015 American Community Survey 5-Year Estimates (DP04)

Table A.6 – Average annual vehicles miles traveled (VMT) per household

Troy	Rensselaer County	Albany Troy Schenectady Region (CBSA)
17,995 annual miles	22,941 annual miles	22,520 annual miles

Source: Center for Neighborhood Technology, calculated for Municipal Energy Profiles, available at "H+T Affordability Index" website: http://htaindex.cnt.org/

Housing & Transportation Costs

The Center for Neighborhood Technology (CNT) has developed the Housing and Transportation (H+T) Affordability Index which examines the cost of housing as well as the cost of transportation associated with the location of the home. An affordable area, according to CNT, is one that has combined housing and transportation costs that consume no more than 45 percent of the average household income. Troy scores well in both facets, with combined housing and transportation costs of 39%, compared with 49% for Rensselaer County and 50% for the region as a whole. Troy's transportation costs averaged 18% of household income, also lower than the county or regional figures.

Walkability

Troy neighborhoods have an average Walk Score of 55, which is described as a "somewhat walkable" area. For comparison purposes, Albany's neighborhoods average a Walk Score of 65, and Schenectady's 64. Walk Scores are not available for larger areas such as counties or regions.

Appendix B: Community Feedback Summary

Respondents

The Community Survey generated 129 responses, with respondents coming from a variety of zip codes in and around Troy, and representing a range of ages. 62% of participants (78 responses) indicated a home zip code of 12180, the zip code for the City of Troy. Most participants indicated that they are between of 30 and 42 years of age (34.65%), followed closely by age 50-64 (31.5%). 51% of respondents were female, and 49% of respondents were male.

Walking Experience

In order to assess Troy as a walking environment, the survey asked respondents to indicate where they walk to work or school, walk to run errands, or walk for physical activity. 85% of participants (104 responses) answered yes. Respondents who answered no were asked to identify the biggest obstacles to walking as a follow-up question. The following answers were given:

- Distance
- Doesn't feel safe
- Health reasons
- Weather
- Bad street conditions
- Walking is not convenient

Question 4 asked respondents to indicate the impact that six suggested improvements would have on their walking behavior, from most important to not important at all.

Table B.1 Response to Question 4: "What type of improvements would make you feel more comfortable walking?"

What type of improvements would make you feel more comfortable walking?					
	Most important	Somewhat important	No opinion	Not very important	Not important at all
More sidewalks	**16	*34	17	8	2
Better side walk surfaces/ More sidewalk maintenance	65	28	9	4	9
Better signage and wayfinding	14	42	27	7	9
Improved crosswalks and other intersection treatments	36	46	19	7	6
Shade trees, benches or other amenities	34	35	21	16	6
Better access to multi-use trails	48	44	9	4	8

*** Green highlighting indicates that more than 40% of respondents chose the specified level of importance (i.e. "Somewhat important") for suggested improvements, representing statistically significant data. This was determined using a threshold of any percentage greater than 40%.*
***Yellow highlighting indicates that between 20% and 39% of respondents chose the specified level of importance for a suggested improvement.*

Question 4 points to the following common concerns amongst pedestrians and other trail users:
Safety was the number one concern for walkers in Troy. With improved crossings and intersection. 38% (42 responses) of participants agreed that better signage and directional wayfinding would make them feel more comfortable walking.

Accessibility of trails is a growing concern for trail users. 42% (48 responses) agreed that better access to multi-use trails would be somewhat important, while 38% (44 responses) agreed that it was most important.

Connectivity is also a cause for concern because it relates to safety issues. Participants commented that a connection throughout the city and to regional parks and trails would increase the amount of walkers.

Among respondents ranking "Other" improvements as important, lighting was raised by a large share as a needed improvement in Troy.

Biking Experience
In order to gain a better understanding of cycling in Troy, Question 5 asked respondents if they ride a bike in Troy. 67% of respondents (56 responses) answered yes, they do bike in Troy, while 33% of respondents (27 responses) answered no they do not bike in Troy.

Those answering yes were asked to describe themselves as cyclists. 64% (72 responses) indicated that they bike in Troy, and of those 45% (34 responses) said they were "enthused and confident," 39% (31 responses) described themselves as "interested but concerned," and 16% described themselves as the "strong and fearless" rider type.

Question 6 asked respondents to indicate the impact that six suggested improvements would have on their biking behavior, from most important to not important at all.

Table B.2 Responses to Question 6: "What type of improvements would make you feel more comfortable biking in Troy?"

What type of improvements would make you feel more comfortable biking in Troy?					
	Most important	Somewhat important	No opinion	Not very important	Not important at all
Better signage/wayfinding	14	41**	18	20*	7
On road cycling infrastructure	59	30	13	5	7
More protected cycling infrastructure	70	27	7	3	9
Increase maintenance on roads	57	29	13	7	5
Improved street crossings, intersection treatments and	28	42	22	13	6

other transition points					
I need a Bike!	14	5	21	5	38
Other					

*** Green highlighting indicates that more than 40% of respondents chose the specified level of importance (i.e. "Somewhat important") for suggested improvements, representing statistically significant data. This was determined using a threshold of any percentage greater than 40%.*
**Yellow highlighting indicates that between 20% and 39% of respondents chose the specified level of importance for a suggested improvement*.

Most of the participants in the survey revealed that it was somewhat important to them to have; more on road cycling infrastructure, such as bike lanes or shared road markings, increased protection for cycling infrastructure, such as separate bike lanes and multi-use trails, improved signage, and improved transition points and other intersection treatments. Other concerns involved connectivity and infrastructure.

Connectivity matters for participants in order for them to connect to other existing bike paths for flow, but this also means within the city. For many participants, when asked what type of improvements would make them feel more comfortable cycling, 37% (42 responses) responded they felt improved street crossings, intersection treatments and other transition points would help.

Infrastructure is also a growing concern for participants, both on road and off road. 51% (59 responses) of participants indicated that an increase of on road cycling infrastructure such as bike lanes or shared road marking would make them feel more comfortable cycling in Troy. Likewise 60% (70 responses) indicated that better protection of cycling infrastructure, such as bike lanes and multi-use trails would make them feel more comfortable cycling in Troy.

Respondents ranking "Other" improvements as important suggested the following:

- Enforcement of traffic laws, including sharing the road
- Bike signals and bike boxes
- Bike racks at commercial establishments
- More connectivity within the City of Troy and with the regional parks and trails
- More multi-use trails, and trailhead and surface improvements for Uncle Sam Trail
- Lighting and cameras
- Signage to educate drivers about bicyclists rights to the road - "Bicycle May Use Full Lane" and "Bike in Lane" signs are preferred as opposed to "Share the Road"
- Wayfinding and connectivity with existing and proposed infrastructure

Additional Biking & Walking Improvements

Respondents were also surveyed on their opinion concerning which amenities and improvements would influence them to walk and or bike more in Troy.

Of the additional amenities and improvements that would influence people to walk or bike more in Troy, 35% (40 responses) noted that better enforcement of traffic laws that affect biking and walking was the most important influence, followed by an increase in convenient bike parking.

Table B.3 Responses to Question 7: "Which additional amenities/ improvements would influence you to walk/bike more in Troy?"

Which additional amenities/improvements would influence you to walk and/or bike more in Troy?					
	Most important	Somewhat important	No opinion	Not very important	Not important at all

Convenient bike parking	29*	39	20	9	9
Enforcement of traffic laws that affect biking and walking	40	37	23	8	6
Improvement of Streetscapes	27	41	20	19	7
Moving parking away from pedestrian and bike areas	18	26	40	24	8
Increase educations programming that offers encouragement and instruction for biking and walking	23	33	30	18	5
Other					

** Green highlighting indicates that more than 40% of respondents chose the specified level of importance (i.e. "Somewhat important") for suggested improvements, representing statistically significant data. This was determined using a threshold of any percentage greater than 40%.
*Yellow highlighting indicates that between 20% and 39% of respondents chose the specified level of importance for a suggested improvement.

Respondents who choose "Other" were mainly concerned about connectivity and funding. While others emphasized education as a continuous concern.

Connectivity and **Funding** were also problem areas for respondents. Some felt that a Troy Trail Guide with a map, descriptions, whether the trail is dog friendly and difficulty of terrain would help cure some of the confusion associated with trails. Moreover, neighborhood revitalization and beautification would help with the growing population and a growing economy that is more supportive of walking/biking connectivity

Education about cycling would eliminate popular misconceptions that surround cycling among pedestrians and motorists. Some responders told experiences about the dangerous possibilities that can happen when people are not paying attention. 30% of responders noted that if there were more educational programing about cycling and pedestrian safety, it would influence them to walk or bike more,

Public Transportation
Public transportation in Troy is a valuable resource for the city and its residents. When asked whether they use public transportation, 42% of respondents answered yes.

Public Funding for Bike & Pedestrian Safety
When asked if they supported using public funding for bike and pedestrian safety improvements, an overwhelming amount of participants, 93%, answered yes in support.

Locations of Concern
Question 10 of the survey was an open ended question asking respondents what they thought is the worst location and/or intersection in the City of Troy for biking or walking. It then asked for a description of the location and what they think needs to be done in order to fix this location. Locations respondents disliked included:

    - Hoosick Street and its intersections
    - Green Island Bridge
    - Jay Street
    - Pinewoods Ave., Spring Ave.
    - High Street/Sidewalk & Troy-Menands Bridge
    - Streets intersecting and around Ferry/Congress can be perilous
    - Green Island Bridge and Federal St/Hoosick St approach to Troy-Menands Bridge
    - Federal/King/River St. corridor
    - 4th and 3rd Sts – stressful biking environments

- Locations cyclists want improved:
    - Northbound portion of 4th St / River St / King St that crosses Federal St.
    - I would love to see "biking only" lights that allow bikers for say, 30 seconds, to cross while all other traffic is standstill
    - Getting from downtown to the Albany bike path, especially the last bit from just north of Mill St. to the other side of the river; crumbling concrete barriers which are part of the sidewalk on the southbound side of the street could be replaced with a wider surface consisting of sidewalk and bike lane

- Locations pedestrians want improved:
    - The intersection of 2nd Street and River
    - Hoosick St. from 8th to Burdett: enforce snow removal, speed and noise laws; install bollards and street trees; longer-term changes to road design
    - Hoosick Street and 6th: no walking lights at the intersection or bike lanes

Familiarity with Biking-related Programming
The final question in the survey asked participants are they are familiar with any of the existing programs, initiatives, or events that promote biking and walking in Troy. The most popular program that people were familiar with was Troy Bike Rescue.

Weebly Quick Poll Results
A Quick Poll was completed in order to find what improvements would most likely influence someone to walk or bike more in the City of Troy.

Of the options presented, the improvement thought to be most influential in increasing the number of pedestrians and cyclists was more bike lanes and multi-use trails. Additional comments were made, including:

- More bike parking/racks
- Sidewalk maintenance, bike lanes/trails, and enforcement are all needed
- Complete connection through Troy, not on busy roads, and safer crossing of Hoosick St.
- I commute by bike from the Emma Willard neighborhood to Peebles Island in Waterford. Second Ave in North Troy scares me to death, but I got a big mirror, which helps. It is so tight and cars go fast. I could go on the Green Island Bike Path but it takes longer and makes me nervous because there are no people to see me if there is a crime. I often see a pickup truck parked along the side of the scheduled road with someone in it. I am sure they are perfectly nice but I don't like the seclusion of the trail
- More bike lanes and multi-use trails, Maintenance of sidewalks and other surfaces, Better signage/wayfinding, enforcement of traffic laws, Better crosswalks and other intersection treatments.

Another Quick Poll was conducted in order to find out where respondents would most like to see bicycle improvements in Troy. The most common answer was the Green Island Bridge, followed by Mill Street between Campbell Avenue and Burden Avenue, and Spring Avenue between Campbell Avenue and Adams Avenue. Respondents choosing "Other" listed the following additional locations:

- Second Avenue
- Downtown to Hoosick St., traffic to Green Island and Watervliet

Social Media Polls
In an effort to gain additional feedback and to reach diverse audiences, social media polls were conducted regarding Troy's biking and walking network. The first polled asked participants what improvements would influence you to walk/bike more in Troy. The majority of responses (38%) answered the enhancement of streetscapes to improve the look and feel of local streets and sidewalks.

Another poll with the same questions was posted, but offered different poll resulted in 50% of respondents choosing stricter enforcement of traffic laws including speed limits, right of way at intersections, and other traffic laws that affect biking and walking.

PTNY conducted a biking-specific poll, asking which improvement would make respondents feel more comfortable biking in Troy. This yielded 100% of participants answering that protected bike lanes would make them feel more comfortable biking in Troy.

PTNY conducted an additional poll that asked participants what improvements would make them feel more comfortable walking in Troy. An overwhelming majority chose (75%) an improvement of shade trees, benches and other amenities.

A final social media poll asked where respondents would most like to see bicycle improvements in Troy. 77% of responses answered the Troy-Menands Bridge, while 15% answered the Green Island Bridge.

Popup Demonstrations Feedback
In late September, PTNY and partners from the Steering Advisory Committee created a "Pop-up Bikeway" demonstration in an effort to illustrate to cyclists how several of the proposed bike facilities would look. As part of the demonstration a bike lane was created on 4th Street, a neighborhood bikeway was created on Washington Street, and a protected cycle track was created on Hill Street. The demonstration was timed to coincide with the Collar City Ramble, a large event in Troy which includes a guided bike ride through the City. The route for the Ramble was adjusted to include the Pop-up, with nearly 50 riders using the facilities. In addition to Ramble participants, members of the public were able to use the facility throughout the day on Saturday (9.23.17). PTNY staffed a table at the end of the Hill St. cycle track, and asked participants for feedback on a half-sheet survey. They also posted the same feedback questions on the Weebly site.

Users were asked their thoughts on the 4th Street bike lane, with possible answers: "Awesome no problems", "I don't like cycling next to parked cars", "Striping puts Picasso to shame", and "Other", with the ability to further explain. In all, 6 people provided feedback. The most frequent feedback was "Awesome, no problems." There were two additional comments from participants that emphasized the danger for cyclists on 4th street and infrastructure of the road and prioritizing sidewalks for pedestrian use.

For the Washington Street facility, users were asked their thoughts on Washington Street where the neighborhood bikeway was located. The possible answers were: "Awesome, no problems", "Jeesh, I need some kind of protection", "That stenciling WOW!", and "Other". In all, 5 people provided feedback. Washington Street's facilities elicited similar sentiments as 4th St., with the majority of respondents stating "Awesome, no problems." However additional comments from participants indicated that they would need some additional level of protection, and better traffic flow.

For Hill Street facility, users were asked what their thoughts on the Hill Street Cycle Track. The possible answers were "We need these everywhere!", "Cycling against traffic was weird", "Eh, kind of overkill", and "Other", with the ability to add a comment. In all 4 people provided feedback. The majority of the Hill St. responses were "We need these everywhere!" Additional comments asserted that protected bike lanes would make biking around Troy a better experience.

Appendix C: Environmental Justice

Introduction

Per federal requirements, the Capital District Transportation Committee (CDTC) undertakes an analysis of Environmental Justice in all Community and Transportation Linkage Planning Program (Linkage Program) initiatives to evaluate if transportation concepts and recommendations impact Environmental Justice populations. Impacts may be defined as those that are positive, negative and neutral as described in CDTC's Environmental Justice Analysis document, published March 2014 (available at http://www.cdtcmpo.org/ej/ej.htm). The goal of this analysis is to ensure that both the positive and negative impacts of transportation planning conducted by CDTC and its member agencies are fairly distributed and that defined Environmental Justice populations do not bear disproportionately high and adverse effects.

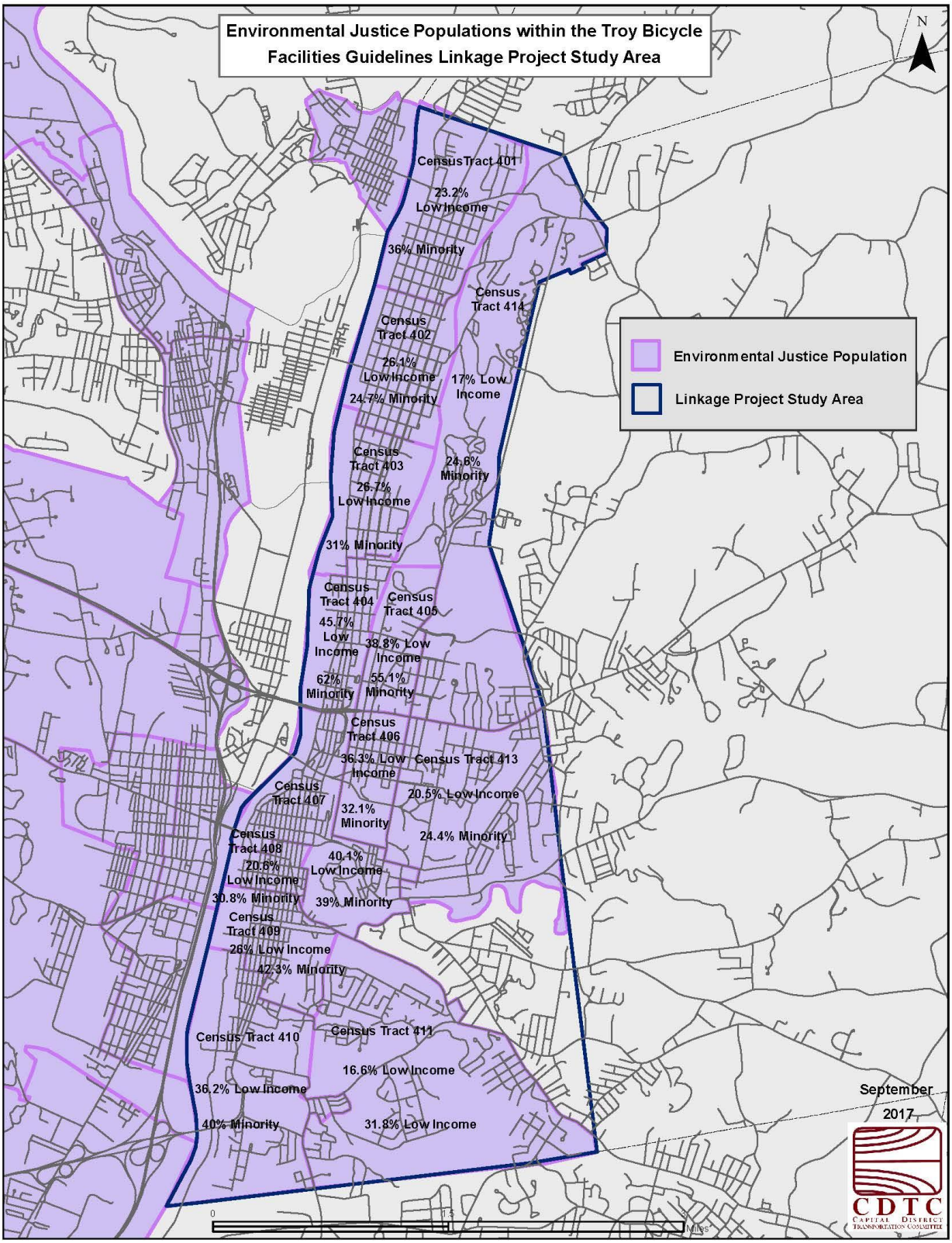
This goal has been set to:

- Ensure CDTC's compliance with Title VI of the Civil Rights Act of 1964, which states that "no person in the United States shall, on the basis of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance,"
- Assist the United State Department of Transportation's agencies in complying with Executive Order 12898 stating, "Each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."
- Address FTA C 4702.1B TITLE VI REQUIREMENTS AND GUIDELINES FOR FEDERAL TRANSIT ADMINISTRATION RECIPIENTS, which includes requirements for MPOs that are some form of a recipient of FTA, which CDTC is not.

Data and Analysis

In developing a methodology for analysis, CDTC staff created demographic parameters using Summary File 1 data from the 2010 United States Census as well as data from the 2007-2011 American Community Survey (ACS). Threshold values were assigned at the census tract level to identify geographic areas with significant populations of minority or low-income persons. Tracts with higher than the regional average percentage of low-income or minority residents are included on Map 1 as Environmental Justice populations. Minority residents are defined as those who identify themselves as anything but white only, not Hispanic or Latino. Low-income residents are defined as those whose household income falls below the poverty line.

Map 1



The transportation patterns of low-income and minority populations in CDTC's planning area are depicted in Table 1, using the commute to work as a proxy for all travel. The greatest absolute difference between the defined minority and non-minority population is in the Drive Alone and Transit categories: The non-minority population is 17.5% more likely to drive alone, slightly more likely to work at home, 10.1% less likely to take transit, and is also less likely to carpool, walk, or use some other method to commute. The greatest absolute difference between the defined low-income

population and the non-low-income population follows the same trend, with the non-low-income population 20.9% more likely to drive alone and 11.7% less likely to commute via transit.

Table 1 -Commute Mode 4-County NY Capital Region						
By Race	Drive Alone	Carpool	Transit	Other	Walk	Work at Home
All Workers (16+)	80.0%	8.3%	3.2%	1.2%	3.6%	3.7%
White Alone Not Hispanic or Latino	82.5%	7.8%	1.8%	1.0%	2.9%	3.9%
Minority	**65.0%**	**11.0%**	**11.9%**	**2.1%**	**7.4%**	**2.6%**
By Income	Drive Alone	Carpool	Transit	Other	Walk	Work at Home
All Workers (16+) for whom poverty status is determined	80.7%	8.3%	3.2%	1.2%	3.0%	3.6%
At/Above 100% Poverty Level	81.7%	8.2%	2.6%	1.1%	2.8%	3.6%
Below 100% Poverty Level	**60.8%**	**10.2%**	**14.3%**	**3.1%**	**7.7%**	**3.9%**

Data: American Community Survey 2011 5-year estimates, tables B08105H + B08122. Other incl. taxi, motorcycle, bicycle.

The *Troy Bicycle Connections Plan* area is included in the Environmental Justice area based on the study area Census Tracts having a higher than regional average percentage of minority residents. Consideration for including these populations in the planning process was given in the following ways:

- The Internet was used to display and advertise information about the study.
- Social media was used to provide information and input opportunities.
- Various public participation opportunities were provided, including at city and neighborhood events and in conjunction with the Capital Roots Veggie Mobile. All opportunities were in transit-accessible locations.
- Public comment was accepted throughout the study process.
- Final products will be posted to CDTC's website, the City of Troy's website, PTNY's website, and on social media.

Conclusion

CDTC defines plans and projects with a primary or significant focus on transit, bicycling, walking, or carpool as being "positive". As the primary purpose of the Troy Bicycle Connections Plan is to develop a citywide bike network, connecting city parks, schools and major institutions, which includes neighborhoods with Environmental Justice populations, it has been determined that the Troy Bicycle Connections Plan will have a positive impact on the affected populations. The Study makes recommendations for new bicycle facilities on roadways and at intersections. These improvements which, if implemented, will provide positive benefits for Environmental Justice populations in the study area.

Environmental Features Scan

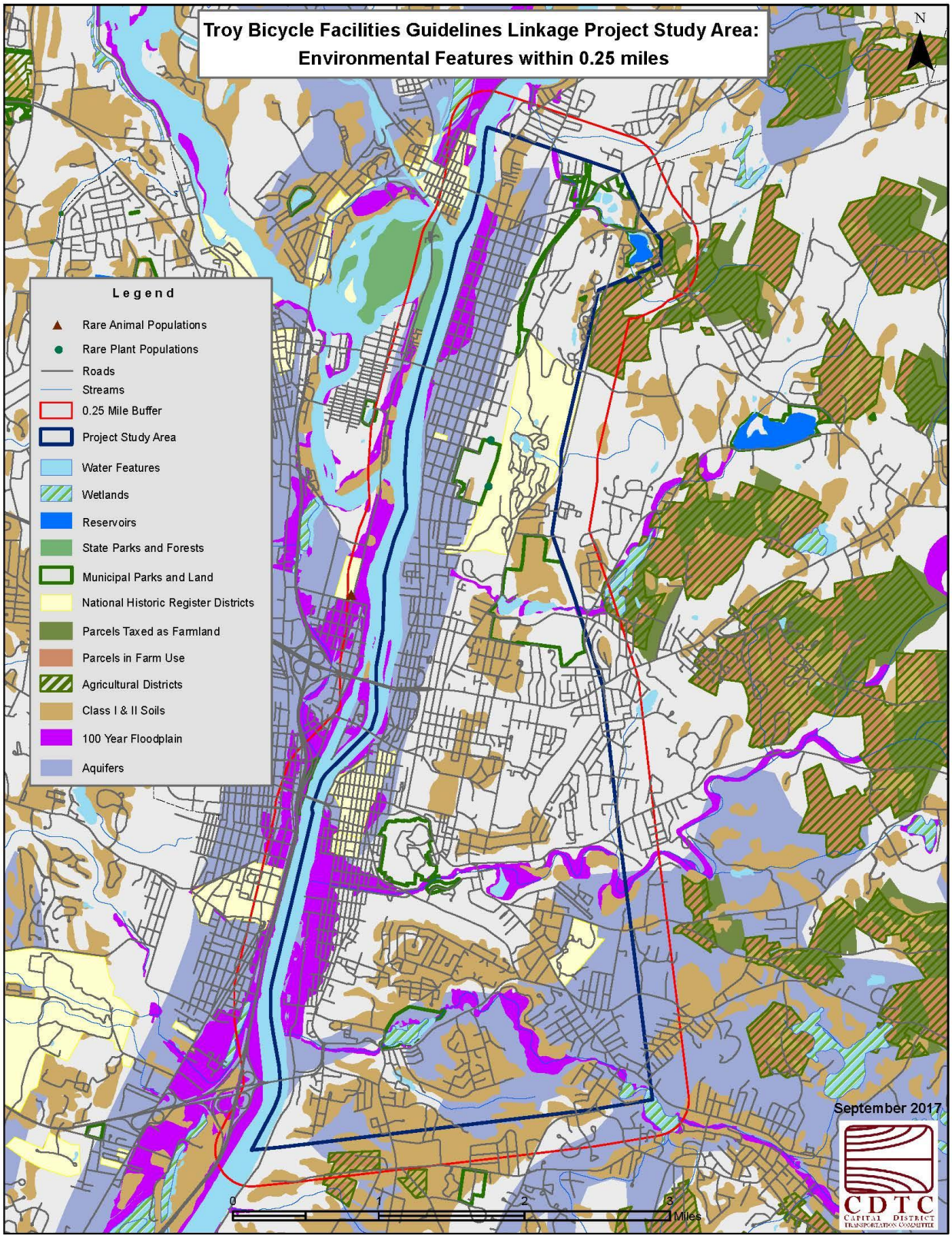
CDTC's New Visions 2040 regional transportation plan encourages smart growth as well as investment and development in urban areas as a method to protect natural resources. Smart growth policies also help to protect rural character and open space, and protect quality of life in the Capital Region. CDTC has undertaken review of natural and cultural resource mapping, and for the development of the Regional Transportation Plan consulted with federal, state and local agencies on environmental issues as an important part of the environmental mitigation process. Along with evaluating the impacts to environmental systems of candidate transportation projects for federal funds, CDTC documents the environmental systems present in the study areas for Linkage Program planning initiatives.
Map 2 provides an overview of the environmental systems present in the Troy Bike Connections Plan area. CDTC uses GIS mapping of the below environmental systems to screen for potential project impacts. Features within 0.25 miles of

the study area are included in Map 2. The Troy Bicycle Connections Plan recommendations are not expected to impact any identified features since the study area is already developed.

Environment features include:

- sole source aquifers
- aquifers
- reservoirs
- water features (streams, lakes, rivers and ponds)
- wetlands
- watersheds
- 100 year flood plains
- rare animal populations
- rare plant populations
- significant ecological sites
- significant ecological communities
- state historic sites
- national historic sites
- national historic register districts
- national historic register properties
- federal parks and lands
- state parks and forests
- state unique areas
- state wildlife management areas
- county forests and preserves
- municipal parks and lands
- land trust sites
- NYS DEC lands
- Adirondack Park
- agricultural districts
- NY Protected Lands
- natural community habitats
- rare plant habitats
- Class I & II soils

MAP 2


Troy Bicycle Facilities Guidelines Linkage Project Study Area:
Environmental Features within 0.25 miles
N
Legend
Rare Animal Populations
Rare Plant Populations
Roads
Streams
0.25 Mile Buffer
Project Study Area
Water Features
Wetlands
Reservoirs
State Parks and Forests
Municipal Parks and Land
National Historic Register Districts
Parcels Taxed as Farmland
Parcels in Farm Use
Agricultural Districts
Class I & II Soils
100 Year Floodplain
Aquifers
0
1
2
3
Miles
September 2017
CDTC
Capital District Transportation Committee