

WATERVLIET BICYCLE MASTER PLAN

INTRACITY CONNECTIONS



December 2013

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The recommendations in this study are conceptual in nature and do not commit NYSDOT to the proposed projects. The concepts presented in this report (or in an illustration) may need to be investigated in more detail before any funding commitment is made. Undertaking additional engineering or other follow up work will be based upon funding availability.

Executive Summary

The City of Watervliet Bicycle Master Plan is intended to serve as the guiding document for the development of a network of bicycle routes linking activity centers within the City, as well as to the larger regional network. The City of Watervliet Bicycle Master Plan was developed in two parts: this report that focuses on an intracity bicycle network, and another report that focuses on the Mohawk Hudson Bike Hike Trail through the City of Watervliet.

A city-wide bicycling network will not only make cycling a more viable mode of transportation in Watervliet, but will contribute to an enhanced quality of life in the City and its resultant benefits to existing residents and economic development. This comprehensive intracity bicycle master plan identifies optimal biking routes and preferred treatments, and serves as an important reference document that can ensure that bicycle facilities are considered during road maintenance and reconstruction projects.

A system of north-south and east-west routes were identified to provide a series of bicycle routes that cover the entire city, providing access to each residential neighborhood and key destinations throughout the City of Watervliet. A bicycle route is recommended, on average, for every other roadway corridor in Watervliet. Each of these roadways and their proposed accommodations are summarized below:

East – West Routes

- 4th Street (between Broadway and 8th Avenue) – bicycle boulevard
- 6th Street (between Broadway and 8th Avenue) – bicycle boulevard
- 8th Street (between NYS Route 32 and 8th Avenue) – bicycle boulevard
- 10th Street (between Broadway and the City Line) – bike lanes and gateway treatment
- 14th Street (between Broadway and the railroad) – shared lane markings or bicycle boulevard
- 16th Street (between Broadway and Avenue A) – shared lane markings
- 19th Street/NYS Route 2 (between 2nd Avenue and the City Line) – shared lane markings
- Congress Street Bridge (City of Troy to 2nd Avenue) – cycle track
- 23rd Street and 24th Street (between Broadway and 12th Avenue) – shared lane markings or protected bike lane

North – South Routes

- 2nd Avenue (between 25th Street and 13th Street) – Bike Lanes
- 6th and 7th Avenues (between 25th Street and 14th Street) – Shared lane markings or protected bike lane
- Alley between 6th and 7th Avenue (between 25th Street and 14th Street) – resurface and traffic calming
- 6th Avenue (between 14th Street and 10th Street) – bicycle boulevard
- Alley between 5th and 6th Avenues (between 14th Street and 10th Street) – resurface and traffic calming
- 8th Street & Avenue A (between 19th Street and 10th Street) – shared lane markings
- 12th Street (between 25th Street and 19th Street) – widen sidewalk to shared use path
- 12th Street (between 19th Street and Hillside Drive) – bicycle boulevard
- 3rd Avenue/Route 32 (between Broadway and the City Line) – bicycle boulevard
- Alley between 3rd and 2nd Avenues (Schuyler Lane to 8th Street) – bicycle boulevard
- 8th Avenue (between 8th Street and 1st Street) – shared lane markings

In addition to the engineering improvements proposed, several program recommendations are included in the Bike Master Plan related to the other 4 E's – education, encouragement, enforcement, and evaluation. These include adoption of the Bike Master Plan, adoption of a complete street's policy, encouragement programs such as a Bike to Work Day and Safe Routes to School efforts. Education and enforcement programs go hand-in-hand and include programs for motorists, bicyclists, and local law enforcement. Evaluation, such as annual bicycle counts, is important to document the success of the system and identify needs for further improvements.

1 Introduction

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The proposed projects and program recommendations proposed in this plan will advance various local planning goals. It will become part of the City's comprehensive planning process and help achieve regional goals of promoting alternative transportation and smart growth.

1.1 Public Involvement

The 1st Public Meeting was held on May 6th 2013 at the Watervliet Senior Center. The community was presented with key project objectives, and discussed opportunities for creating a complete bicycle network in the City as well as an improved connection to the Mohawk Hudson Bike Hike Trail. Meeting attendees discussed opportunities and challenges in groups and presented their comments at the end of the meeting.

The 2nd public meeting was held on October 8th, 2013 at the Watervliet Senior Center to gather feedback on the proposed bicycle network and Mohawk Hudson Bike Hike Trail alternatives. The meeting began with a presentation describing the existing conditions analysis including the bicycle level of service analysis and crash analysis. The recommended City-wide bicycle network was described, along with a summary of the different types of bicycle accommodations proposed throughout the City, such as shared lanes, bike lanes, cycle tracks, and bicycle boulevards. Lastly, the four alternatives for the Mohawk Hudson Bike Hike Trail were described. For each alternative, the alignment, cross sections, and costs were presented. Following the presentation, the attendees at the public meeting discussed the alternatives that were presented.

In addition to these two public meetings, comments could be provided through the project website. Maps and deliverables were posted and an online survey was also included to gather information related to current bicycle use.

2 Existing Conditions

2.1.1 Comprehensive Plan

The City of Watervliet completed a Comprehensive Plan in 2010. The Plan documents existing conditions and goals for several aspects of the City including: demographics, housing, economy, land-use, infrastructure, environment, and community assets. The overarching vision for the City of Watervliet is to become a sustainable community with economic opportunities and a high quality of life.

Nine goals results from the Comprehensive Plan. Six of these goals can be supported directly and indirectly through increased bicycle accommodations and use within the City of Watervliet. These goals include:

Goal 1: Create an attractive and functional built environment that meets the needs of existing residents and businesses while creating opportunities to attract new residents and economic opportunities.

Goal 4: Offer high-quality recreation amenities.

Goal 5: Maintain and upgrade the City's infrastructure.

Goal 6: Preserve and promote Watervliet’s community character and the City’s rich cultural and historic resources.

Goal 7: Upgrade and maintain the City’s Transportation System.

Goal 9: Improve access to the waterfront by implementing the City’s Local Waterfront Revitalization Program (LWRP).

2.1.2 NYS Route 32 Linkage Study

The NYS Route 32 Linkage Study was completed in 2011 for the Village of Menands, Town of Colonie, and the City of Watervliet. The study summarizes existing land use and transportation conditions in three sections along Route 32. In Watervliet, the study considers Route 32 along 3rd Avenue, which is a two lane, 30 mph roadway with on-street parking and sidewalks on both sides. 2010 traffic volume estimates from NYSDOT show an average daily traffic volume of 10,160 vehicles per day.

Recommendations for this portion of the corridor involve significant improvements to the pedestrian environment, such as crosswalks at each intersection, pedestrian scale lighting, street trees, and ADA curb ramps. The consideration of sharrows (shared lane markings) is recommended in the long-term. “Share the Road” signage is located in the short term in strategic locations. Designation of local cross-streets as bike routes to facilitate east-west bicycle trips are recommended on 4th Street and 7th Street.

2.1.3 Local Waterfront Revitalization Program (LWRP)

The LWRP was approached in 2005. The LWRP describes 6 acres of freshwater wetlands located near the City’s southern border known as the Little River. Two Class D streams, one in the southern end and one in the northern end, were also identified. Both of these streams run into the Hudson River. The LWRP also identifies the 100-year flood zone that includes most of Broadway and 1st Street, and portions of 13th, 14th, 15th Streets and 1st, 2nd, 3rd Avenues. Key issues and opportunities that were identified in the LWRP include the Hudson Shores Park, access to the Hudson River waterfront, and a connection to the history of the City’s waterfront. Several projects were proposed as part of the process and include improvements to the Hudson Shores Park and the Mohawk Hudson Bike-Hike Trail. Projects to improve waterfront accessibility for both vehicles and pedestrians were included, along with preservation and economic development projects.

2.2 Existing Conditions

The City of Watervliet has 46.5 miles of roadway within the City limits, 2.6 miles of which is owned and operated by NYS Department of Transportation (NYSDOT). There are two major arterials that run through the City of Watervliet. NYS Route 2 is an east-west arterial, also known as 19th Street through the City, that runs from the Town of Colonie to the Congress Street Bridge across the Hudson River. There are four CDTA transit service routes that operate within the City, Routes 22, 35x, 84, and 90.

Residential use is approximately 52% of the 583 acres in the City of Watervliet. City services, such as City buildings and parks, account for approximately 18% of the land area within Watervliet. The Zoning Ordinance shows eleven districts, which include four residential districts, three business districts, three waterfront districts, and one manufacturing district. Existing land use shows several commercial areas within the City, primarily along 3rd Avenue, Broadway, and Route 2. Industrial land uses are located in the southern and northern areas of the City and also along the railroad corridor between 16th Street and 19th Street. The City is almost completely built out, with less than 20 acres of vacant land.

There are five designated historic landmarks located in the City of Watervliet. These include the Watervliet Arsenal National Historic Landmark, Watervliet Erie Canal Entrance, Ohio Street Methodist Episcopal Church Complex, St. Nicholas Ukrainian Church, and Jermain Memorial Presbyterian Church. As part of the LWRP process and Comprehensive Plan, several other sites were identified for their historic significance. Efforts are ongoing to receive official historic designation for a number of these sites.

The Watervliet Arsenal, owned and operated by the U.S. Army, is the oldest continuously active arsenal in the United States. It is known for the manufacturing of tank cannons, howitzers, and battleship guns. The Arsenal includes 143 acres and 72 buildings. Employment at the Arsenal has declined from 9,400 in 1941 to approximately 600 in 2010. Public-private partnerships and expansion of research and engineering suggest employment at the Arsenal may increase again over time. The Arsenal is located in the center of the city and spans from Broadway to the City line, cutting the City into north and south halves. The only roadways around the Arsenal are Broadway and I-787, both located between the Arsenal and the Hudson River.

There are two public school buildings located within the City and no private schools. The Elementary School is located on 25th Street near 11th Avenue. 703 students were enrolled during the 2007-2008 school year with an additional 54 students the pre-K program. The Jr/Sr High School is located on Hillside Drive near 12th Avenue and had 636 students enrolled during the 2007-2008 school year. Both Schools have undergone significant infrastructure improvement in the last few years. The public library is located on the other side of the City on Broadway.

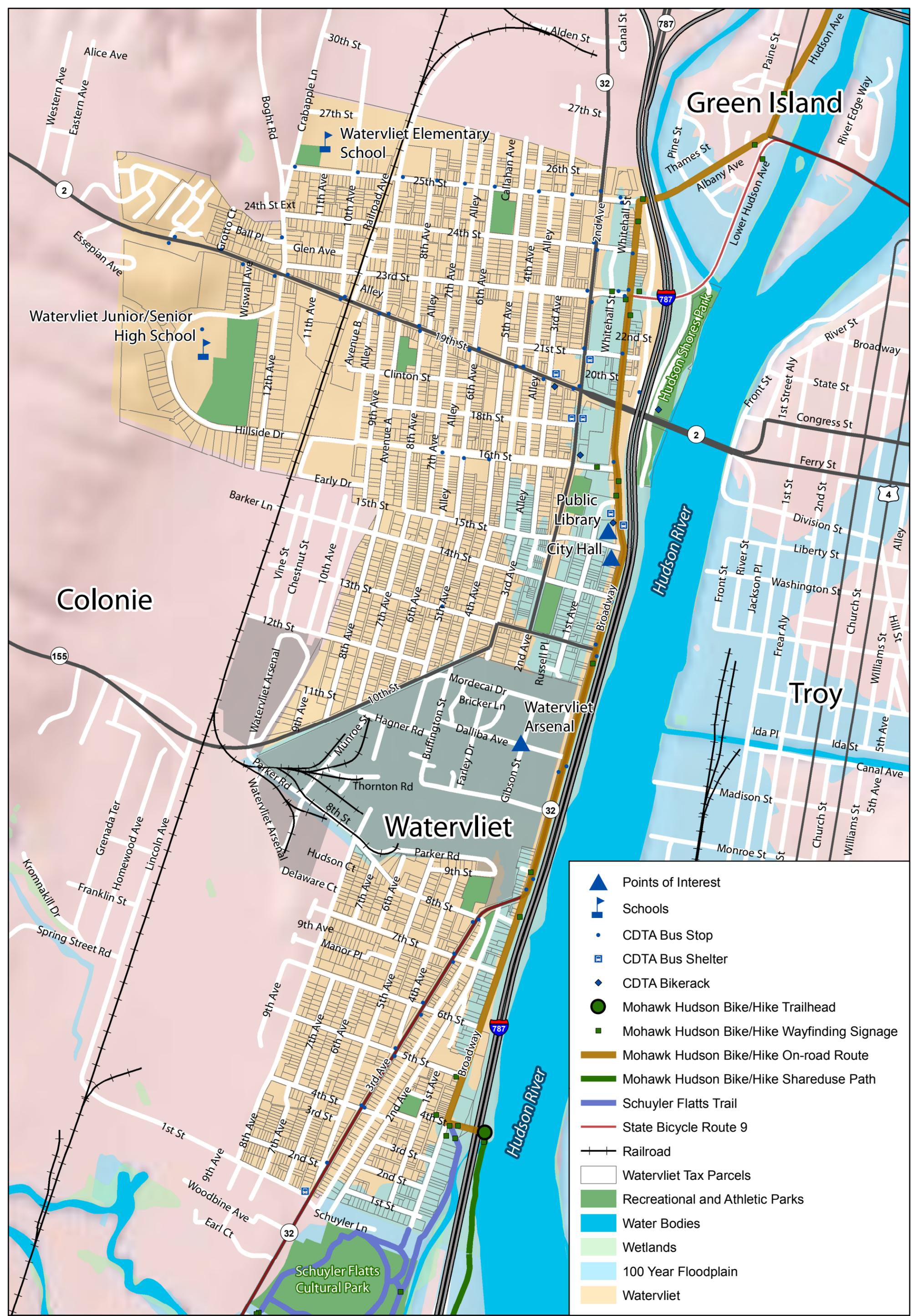
There are seven parks or playgrounds located within the City of Watervliet. These parks vary in size and amenities that are available. The largest park is the 9-acre Hudson Shores Park, located on 23rd Street and the Hudson River. Other recreational facilities include the Watervliet Civic Center, Schuyler Flatts (located primarily within the Town of Colonie), and the Dome/Watervliet Veterans Memorial Recreational Facility.

2.2.1 Existing Pedestrian and Bicycle Conditions

A majority of the City's roadways include adjacent sidewalks on one or both sides. These sidewalks vary in condition and width. Sidewalk widths in the residential areas are typically 4 to 5 feet wide. Sidewalks in more densely developed areas and commercial areas are in better condition and are 5 feet wide or greater.

Although the pedestrian network is robust, there are few bicycle accommodations available within the City of Watervliet. Bike racks are present in several locations, typically in conjunction with CDTA bus stops. A bike rack is also located at the Fourth Street trailhead for the Mohawk Hudson Bike-Hike Trail. There are no shared-use paths through the City. NYS Bike Route 9 is located along 3rd Avenue and 2nd Avenue, following NYS Route 32. The only on-road bicycle accommodations are the Mohawk Hudson Bike-Hike Trail wayfinding signs. Even though signage and striping for bicyclists is not present, the majority of the City's street network is low-volume residential streets, which lend themselves well to bicyclists. Section 2.2.2 describes the Mohawk Hudson Bike Hike Trail through the City of Watervliet in detail.

Demographics reported in the 2011 American Communities Survey (ACS) show that approximately 9% of households in Watervliet do not own a vehicle and 34% of households only own one vehicle. While a majority of people living in Watervliet travel more than 10 minutes or more, 10% have a travel time between 5 and 9 minutes and approximately 2.5 % have a travel time less than 5 minutes. Currently, only 0.2% of the population bike to work, while 5% walk. The current demographic data related to travel times and vehicle ownership show that there is room for improvement to the mode share for walking and bicycling.



Source: NY State GIS Clearinghouse, CDTC, NYSDOT
 Date: March 2013
 Authors: Sam Piper

Bicycle Master Plan Base Map - City of Watervliet, NY -

2.2.2 Bicycle Level of Service (BLOS)

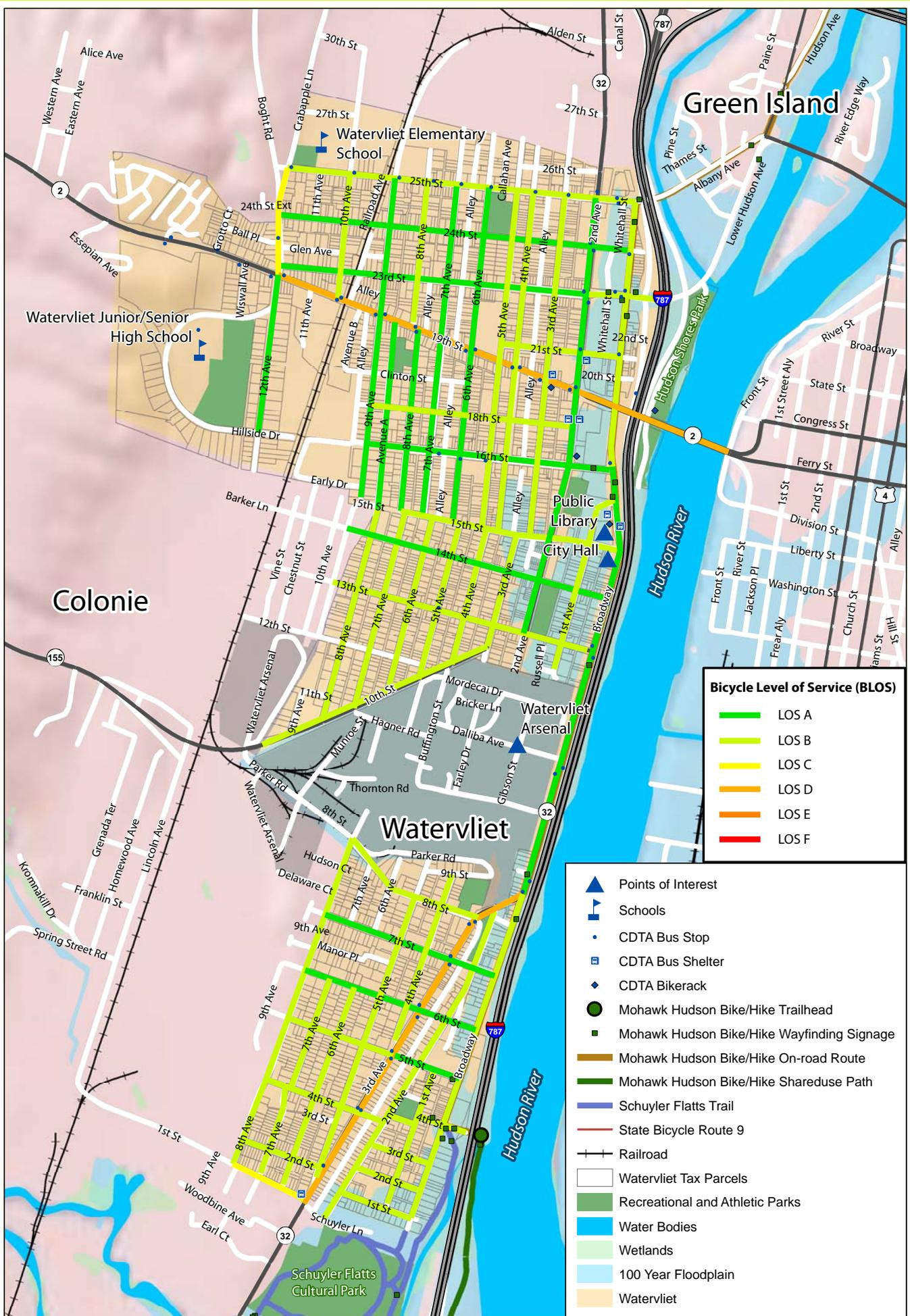
The BLOS Model was used to evaluate bicycle suitability on roadways in the Watervliet area. The BLOS is a scientifically-calibrated method of evaluating the comfort level of bicyclists on a roadway segment, given existing bicycling conditions in relation to motor vehicle traffic. It uses objective, quantitative data to produce a measure of the level of service perceived by a typical bicyclist. Model inputs include measurable traffic and standard roadway factors such as:

- Lateral separation between bicyclists and adjacent motor vehicle traffic
- Presence and width of a paved shoulder or bicycle lane
- Volume and speed of motor vehicle traffic
- Percentage of heavy trucks
- Number of travel lanes
- Presence of on-street parking
- Pavement condition

The BLOS model should be used with the following considerations in mind:

- BLOS grades represent the perceived level of comfort experienced by a typical bicyclist.
- BLOS grades are not associated with safety or reported crashes.
- The BLOS model is a roadway segment analysis; it does not apply to intersections.
- Errors are inherent with data inputs and changing roadway and traffic characteristics.

The BLOS model uses letter grades to describe existing conditions. Level “A” reflects the best conditions for bicyclists. Level “F” represents the worst conditions. The most common letter grade for Watervliet’s roadways was a “A” or “B.” Several roadways have a BLOS of “C”, and a BLOS of “D” was only present on 3rd Avenue.



Bicycle Level of Service (BLOS)

—	LOS A
—	LOS B
—	LOS C
—	LOS D
—	LOS E
—	LOS F

- ▲ Points of Interest
- ▤ Schools
- CDTA Bus Stop
- CDTA Bus Shelter
- ◆ CDTA Bikerack
- Mohawk Hudson Bike/Hike Trailhead
- Mohawk Hudson Bike/Hike Wayfinding Signage
- Mohawk Hudson Bike/Hike On-road Route
- Mohawk Hudson Bike/Hike Shareduse Path
- Schuyler Flatts Trail
- State Bicycle Route 9
- +— Railroad
- Watervliet Tax Parcels
- Recreational and Athletic Parks
- Water Bodies
- Wetlands
- 100 Year Floodplain
- Watervliet



Source: NY State GIS Clearinghouse, CDTC, NYSDOT
 Date: Sept 2013
 Authors: LZ

Bicycle Master Plan BLOS
- City of Watervliet, NY -



2.2.3 Crash Data Summary and Analysis

Crash Data for crashes involving pedestrian and bicycles within the City of Watervliet was extracted from the NYS ALIS LESQR/QRA database containing data from the NYS DMV and DOT for the 5 year time period from January 1st 2008 to December 31st, 2012. Data is complete for the 5 year time period. Data was also extracted for the incomplete period between December 31st, 2012 and August 19th 2013.

A total of 57 crashes involving pedestrians and bicycles occurred within the City in the 5 year period. 45 of the 57 crashes involved pedestrians and 12 involved bicyclists. Locations with multiple crashes only occurred on high volume roadways. There were no locations that were identified as high severity crash locations. By implementing the recommendations made in the Intracity Bike Master Plan, cyclists will be more visible to motorists and will lead to an overall reduction in crashes throughout the city. Analysis including many factors such as demographics, geography, and human behavior led to the following highlights:

Severity

51 of the 57 crashes (89%) involved injuries or property damage. There was one fatality. There were a total of 51 persons injured. Of those injuries 44% were classified as a possible injury, 26% non-incapacitating and 14% incapacitating.

Demographics

22 of the 57 crashes or 39% involved children under the age of 18 (7 of the 12 bicyclists (58%), 15 of the pedestrians (33%) and 2 of the drivers in pedestrian crashes (4%)). Seniors over 65 were drivers in 4 (33%) of the crashes involving bicyclists and 6 (13%) of the pedestrian crashes. Seniors also accounted for 6 (13%) of the pedestrians involved in crashes, including the one fatality.

Geography

In terms of frequency, there were only 4 locations within the City where multiple crashes involving bicyclists or pedestrians occurred:

- NY 2 @ NY 32 = 4 Crashes
- NY 32 @ 18th St = 4 Crashes
- Broadway @ 3rd St = 3 Crashes
- NY 32 @ 25th St = 2 Crashes

There are no obvious indicators within the crash data as to why these locations have experienced multiple bike/ped crashes within the 5 year period. It should be noted that the fatality also occurred on NY 32 @ 23rd St. Therefore it seems that perhaps the Route 32 Corridor from 18th St to 25th St as well as the intersection of Broadway at 3rd St could be areas worth considering bike/ped improvements and increased efforts to educate drivers and bicyclists/ pedestrians.

Human Behavior

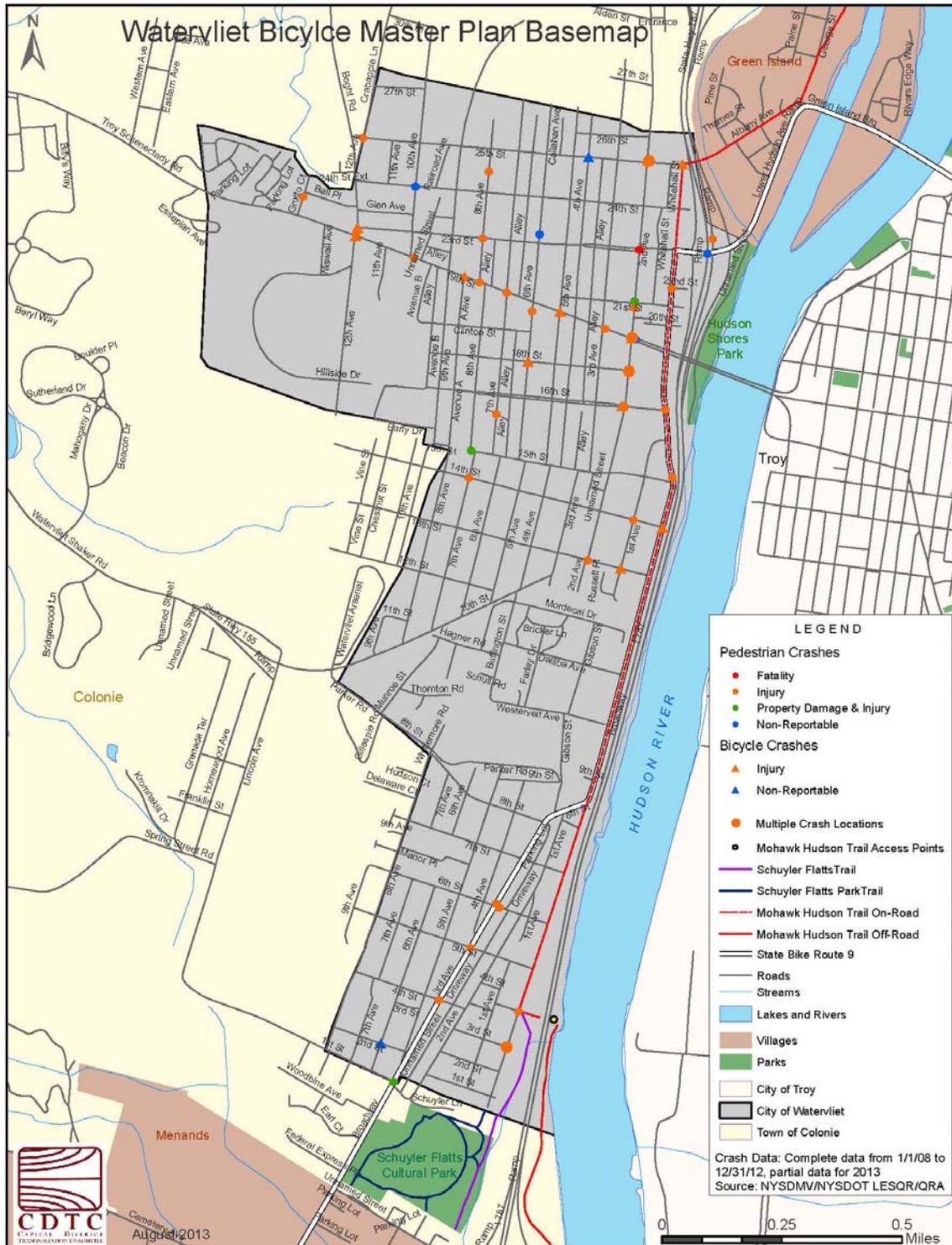
The contributing or associated factors assigned to drivers and pedestrians were similar in both bicycle and pedestrian crashes. For Drivers, Driver Inattention accounted for nearly half of all crashes and Failure to Yield the Right of Way for nearly 25%. In terms of fault from what can be gathered from the apparent or contributing factors, drivers were at fault alone in just over 50% of the crashes, with both drivers and bicyclists/pedestrians being responsible in nearly 20% of crashes. For bicyclists and pedestrians, nearly half of the crashes had no contributing factor assigned to the bike/ped and nearly 25% were attributed to Pedestrian Error/Confusion. In slightly more than half of all the crashes, the bicyclist or pedestrian was not at an intersection and crossing the road.

Enforcement

Citations were issued to drivers in 13 of the 57 crashes (23%). 12 of those crashes involved a pedestrian and one involved a bicyclist.

Environment

The majority of crashes occurred on dry roads in daylight. Over half of the crashes occurred in areas where there was no traffic control device. Of those occurring at locations with traffic control devices, 30% occurred at traffic signals and 16% occurred at stop signs. 70% of crashes occurred at intersections. One crash occurred in a high-way work zone and involved a construction worker and one crash involved a child getting off a school bus. Crashes were fairly evenly dispersed throughout the years and seasons, with most crashes occurring between March and November.



3 City of Watervliet Bike Master Plan

3.1 Bicycle Facility Network

The following guiding principles are consistent with the vision and goals of the City of Watervliet Bicycle Master Plan and have been used to develop the proposed bicycle network:

- The bicycling environment should be safe. All bicycling routes should be physically safe and perceived as safe by all users. Safe means minimal conflicts with external factors, such as noise, motor-vehicular traffic and protruding physical elements. Safe also means routes are clear and well-marked with appropriate pavement markings and directional signage.
- The bicycle network should be accessible. Shared-use paths, bike routes on-street bikeways, and crosswalks should permit the mobility of cyclists of all ages and abilities. The bicycle network should employ principles of universal design. Bicyclists have a range of skill levels, and facilities should be designed with a goal of providing for inexperienced/recreational bicyclists (especially children and seniors) to the greatest extent possible.
- Bicycle network improvements should be economical. Bicycle improvements should achieve the maximum benefit for their cost, including initial cost and maintenance cost, as well as a reduced reliance on more expensive modes of transportation. Where possible, improvements in the right-of-way should stimulate economic development, and reinforce and connect with adjacent private improvements.
- The bicycle network should connect to places people want to go. The bicycle network should provide continuous direct routes and convenient connections between destinations such as homes, schools, shopping areas, public services, recreational opportunities and transit. A complete network of on-street bicycling facilities should connect seamlessly to existing and proposed multi-use trails to complete recreational and commuting routes.
- The bicycling environment should be clear and easy to use. Shared-use paths, bikeways, and crossings should allow all people to easily find a relatively direct route to a destination with minimal delays. All public roads are legal for the use of pedestrians and bicyclists (except freeways, from which each is prohibited unless a separate facility on that right of way is provided). This means that most streets are bicycle facilities and should be designed, marked and maintained accordingly.
- The bicycling environment should be attractive and enhance community livability. Good design should integrate with and support the development of complementary uses and should encourage preservation and construction of art, landscaping and other items that add value to communities. These components might include open spaces such as plazas, courtyards and squares, and amenities like street furniture, banners, art, plantings and special paving. These along with historical elements and cultural references, should promote a sense of place.
- Design guidelines are flexible and should be applied using professional judgment. This document references specific local, state and national guidelines for bicycle facility design, as well as a number of design treatments not specifically covered under current guidelines. Statutory and regulatory guidance may change. For this reason, the guidance and recommendations in this document function to complement other resources considered during a design process, and in all cases sound engineering judgment should be used.

3.1.1 Benefits of a Bicycle-Friendly Community

A bicycle-friendly City of Watervliet will help to improve the health and fitness of residents, enhance environmental conditions, decrease traffic congestion, and contribute to a greater sense of community. Scores of studies from experts in the fields of public health, urban planning, urban ecology, real estate, transportation, and economics consistently back-up such claims and affirm the value of supporting bicycling as it relates to active living and alternative transportation. Communities across the United States and throughout the world are implementing strategies for serving the bicycle needs of their residents, and have been doing so for many years. They do this

because of their obligations to promote health, safety and welfare, and also because of the growing awareness of the many benefits of bicycling.

3.1.1.1 Increased Health and Physical Activity

A growing number of studies show that the design of our communities—including neighborhoods, towns, transportation systems, parks, trails and other public recreational facilities—affects people’s ability to reach the recommended daily 30 minutes of moderately intense physical activity (60 minutes for youth). According to the Centers for Disease Control and Prevention (CDC), “physical inactivity causes numerous physical and mental health problems, is responsible for an estimated 200,000 deaths per year, and contributes to the obesity epidemic.”¹ The increased rate of disease associated with inactivity reduces quality of life for individuals and increases medical costs for families, companies, and local governments.

The CDC determined that creating and improving places to be active could result in a 25% increase in the number of people who exercise at least three times a week.² This is a significant consideration for people who are inactive. Even small increases in physical activity can bring measurable health benefits. Establishing a safe and reliable bicycle network in City of Watervliet will positively impact the health of local residents. The Rails-to-Trails Conservancy puts it simply: “Individuals must choose to exercise, but communities can make that choice easier.”³

3.1.1.2 Economic Benefits

Bicycling is an affordable form of transportation. According to the Pedestrian and Bicycle Information Center (PBIC), of Chapel Hill, NC, the cost of operating a bicycle for a year is approximately \$120, compared to \$7,800 for operating a car over the same time period.⁴ Bicycling becomes even more attractive from an economic standpoint when the unstable price of oil is factored into the equation (e.g., in spring 2010, gasoline prices approached \$4 a gallon).⁵ The fluctuating cost of fuel reinforces the idea that local communities should be built to accommodate people-powered transportation, such as walking and biking. The City of Watervliet’s current mixed-use downtown area and surrounding residential neighborhoods, combined with new strategies for improving bicycle transportation, could facilitate a substantial local reduction in auto- and oil-dependency.

From a tourism perspective, cyclists can add real value to local economies. For example, in the Outer Banks, NC, bicycling is estimated to have an annual economic impact of \$60 million; 1,407 jobs are supported by the 40,800 visitors for whom bicycling was an important reason for choosing to vacation in the area. The annual return on bicycle facility development in the Outer Banks is approximately nine times higher than the initial investment.⁶ Similarly, Damascus, VA, the self-proclaimed ‘Friendliest Trail Town’, features 34-miles of trail where approximately \$2.5 million is spent annually related to recreation visits. Of this amount, non-local visitors spend about \$1.2 million directly into the economies of Washington and Grayson counties.⁷ While these examples feature beach and mountain destinations, the City of Watervliet also has key advantages, such as its parks system, the Hudson River, and proximity to Albany and Troy.

¹ U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (1996). Physical Activity and Health: A Report of the Surgeon General.

² U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (2002). Guide to Community Preventive Services.

³ Rails-to-Trails Conservancy. (2006) Health and Wellness Benefits.

⁴ Pedestrian and Bicycle Information Center. (2008). Economic Benefits: Money Facts. Retrieved 8/8/2008 from www.bicyclinginfo.org/why/benefits_economic.cfm

⁵ King, Neil. The Wall Street Journal: Another Peek at the Plateau. (2/27/08): In February 2008, the Wall Street Journal quoted industry experts, stating, “supply constraints could push the price of oil to \$150 a barrel by 2010”.

⁶ NCDOT and ITRE. (2006). Bikeways to Prosperity: Assessing the Economic Impact of Bicycle Facilities.

⁷ Virginia Department of Conservation. (2004). The Virginia Creeper Trail: An Assessment of User Demographics, Preferences, and Economics.

3.1.1.3 Environmental Improvements

As demonstrated by the Southern Resource Center of the Federal Highway Administration, when people get out of their cars and onto their bicycles, they reduce measurable volumes of pollutants.⁸ Other environmental impacts include a reduction in overall neighborhood noise levels and improvements in local water quality as fewer automobile-related discharges wind up in the local rivers, streams, and lakes.

3.1.1.4 Transportation Benefits

In 2001, the National Household Travel Survey found that roughly 40% of all trips taken by car are less than 2 miles. By taking these short trips on a bicycle, rather than in a car, citizens can substantially impact local traffic and congestion. Traffic congestion reduces mobility, increases auto-operating costs, adds to air pollution, and causes stress. Bicycle users can help alleviate overall congestion because each cyclist is one less car on the road. Incidentally, cyclists take up significantly less space on the road.

Additionally, many people do not have access to a vehicle or are not able to drive. According to the National Household Travel Survey (NHTS), one in 12 U.S. households do not own an automobile and approximately 12 percent of persons 15 or older do not drive.⁹ An improved bicycle network provides greater and safer mobility for these residents.

3.1.1.5 Quality of Life

Many factors go into determining quality of life for the citizens of a community: the local education system, prevalence of quality employment opportunities, and affordability of housing are all items that are commonly cited. Increasingly though, citizens claim that access to alternative means of transportation and access to quality recreational opportunities such as parks, trails, greenways, and bicycle routes, are important factors for them in determining their overall pleasure within their community. Communities with such amenities can attract new businesses, industries, and in turn, new residents. Furthermore, quality of life is positively impacted by bicycling through the increased social connections that take place by residents being active, talking to one another and spending more time outdoors and in their communities.

According to the Brookings Institution, the number of older Americans is expected to double over the next 25 years.¹⁰ All but the most fortunate seniors will confront an array of medical and other constraints on their mobility even as they continue to seek both an active community life, and the ability to age in place.

Children under 16 are another important subset of our society who deserve access to safe mobility and a higher quality of life. According to the U.S. Environmental Protection Agency, fewer children walk or bicycle to school than did so a generation ago. In 1969, 48% of students walked or bicycled to school, but by 2001, less than 16% of students between 5 and 15 walked or bicycled to or from school.¹¹

According to the National Center for Safe Routes to School, "Walking or biking to school gives children time for physical activity and a sense of responsibility and independence; allows them to enjoy being outside; and provides them with time to socialize with their parents and friends and to get to know their neighborhoods."¹² In a 2004 CDC survey, 1,588 adults answered questions about barriers to walking to school for their youngest child aged 5 to 18 years.¹³ The main reasons cited by parents included distance to school, at 62%, and traffic-related danger, at

⁸ Federal Highway Administration, Southern Resource Center. (1999). Off-Mode Air Quality Analysis: A Compendium of Practice. To calculate air quality benefits of bicycling, first calculate the Daily VMT reduction. $VMT\ Reduction = PD * Area * L * BMS$, where PD = Population density, persons/mile; Area = Project length * 1 mile radius, mile; L = Round trip length, one-half of the project length times 2 daily trips, miles; BMS = Bike mode share, %. Last, calculate the Daily Emission reductions for a pollutant. $Ed = EFX * VMT\ Reduction$, where Ed = Daily Emissions, grams/day; EFX = Emission factor for pollutant x, grams/mile; VMT = vehicle mile/day.

⁹ U.S. Department of Transportation (DOT), Bureau of Transportation Statistics (BTS) and the Federal Highway Administration (FHWA). (2002). National Household Travel Survey.

¹⁰ Brookings Institution. 2003. The Mobility Needs of Older Americans: Implications for Transportation Reauthorization.

¹¹ US EPA. (2003). Travel and Environmental Implications of School Siting.

¹² National Center for Safe Routes to School. (2006). National Center for Safe Routes to School Talking Points.

¹³ Centers for Disease Control and Prevention. The Importance of Regular Physical Activity for Children. Accessed 9/16/05 at http://www.cdc.gov/nccdphp/dnpa/kidswalk/health_benefits.htm.

30%. Strategic additions to City of Watervliet’s bicycle system could shorten the distance from homes to schools, and overall bicycle improvements can improve the safety of our roadways.

3.1.2 Types of Bicyclists

It is important to consider bicyclists of all skill levels when creating a bicycle plan or project. Bicyclist skill level greatly influences expected speeds and behavior, both in separated bikeways and on shared roadways. Bicycle infrastructure should accommodate as many user types as possible, with decisions for separate or parallel facilities based on providing a comfortable experience for the greatest number of people.

The bicycle planning and engineering professions currently use several systems to classify the population, which can assist in understanding the characteristics and infrastructure preferences of different bicyclists. The most conventional framework classifies the “design cyclist” as *Advanced*, *Basic*, or *Child*¹⁴. A more detailed understanding of the US population as a whole is illustrated in the figure below. Developed by planners in Portland, OR¹⁵ and supported by data collected nationally since 2005, this classification provides the following alternative categories to address varying attitudes towards bicycling in the US. Although a scientific poll has not been conducted to categorize comfort levels of in Watervliet, the demographic profile of the community and anecdotal evidence suggests that this categorization is also applicable to the City of Watervliet.

- **Strong and Fearless** (approximately 1% of population) – Characterized by bicyclists that will typically ride anywhere regardless of roadway conditions or weather. These bicyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections — even if shared with vehicles — over separate bicycle facilities such as shared use paths.
- **Enthusied and Confident** (5-10% of population) - This user group encompasses bicyclists who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared use paths when available. These bicyclists may deviate from a more direct route in favor of a preferred facility type. This group includes all kinds of bicyclists such as commuters, recreationalists, racers and utilitarian bicyclists.
- **Interested but Concerned** (approximately 60% of population) – This user type comprises the bulk of the cycling population and represents bicyclists who typically only ride a bicycle on low traffic streets or mul-



¹⁴ FHWA, *Selecting Roadway Design Treatments to Accommodate Bicycles*, Publication No. FHWA-RD-92-073. 1994

¹⁵ Roger Geller, City of Portland Bureau of Transportation, *Four Types of Cyclists*. 2009
<http://www.portlandonline.com/transportation/index.cfm?&a=237507>

ti-use trails under favorable weather conditions. These bicyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become “Enthusied & Confident” with encouragement, education and experience.

- **No Way, No How** (approximately 30% of population) – Persons in this category are not bicyclists, and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances.

3.1.3 Design Speed Expectations

The expected speed that different types of bicyclists can maintain under various conditions also influences the design of facilities such as shared use paths. The table to the right provides typical bicyclist speeds for a variety of conditions.

Bicycle as Design Vehicle - Design Speed Expectations

Bicycle Type	Feature	Typical Speed
Upright Adult Bicyclist	Paved level surfacing	15 mph
	Crossing Intersections	10 mph
	Downhill	30 mph
	Uphill	5 -12 mph
	Child/Senior	5-10 mph
Recumbent Bicyclist	Paved level surfacing	18 mph

3.2 Recommended Facility Types

3.2.1 Bicycle Facility Selection Guidelines

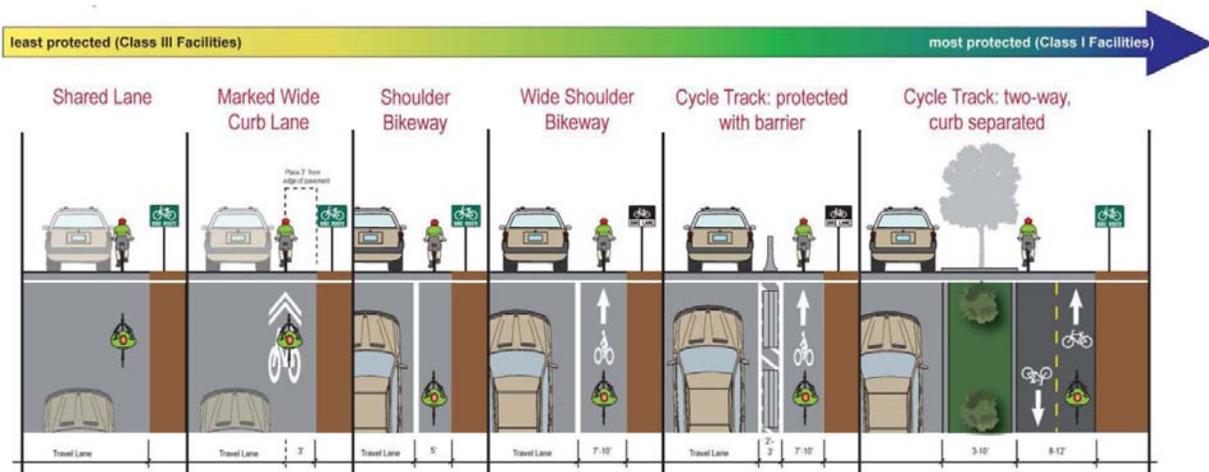
This section summarizes the bicycle facility selection typology developed for the City of Watervliet. The specific facility type that should be provided depends on the surrounding environment (e.g. auto speed and volume, and adjacent land use) and expected bicyclist needs (e.g. bicyclists commuting on a highway versus students riding to school on residential streets).

Facility Selection Guidelines

There are no 'hard and fast' rules for determining the most appropriate type of bicycle facility for a particular location — roadway speeds, volumes, right-of-way width, presence of parking, adjacent land uses, and expected bicycle user types are all critical elements of this decision. Additionally, most bicyclists prefer facilities separated from motor vehicle traffic or located on local roads with low motor vehicle traffic speeds and volumes. Because off-street pathways are physically separated from the roadway, they are perceived as safe and attractive routes for bicyclists who prefer to avoid motor vehicle traffic.

The following continua illustrate the range of bicycle facilities applicable to various roadway environments, based on the roadway type and desired degree of separation. **Engineering judgment, traffic studies, previous municipal planning efforts, community input and local context should be used to refine criteria when developing bicycle facility recommendations for a particular street.** In some corridors, it may be desirable to construct facilities to a higher level of treatment than those recommended in relevant planning documents in order to enhance user safety and comfort. In other cases, existing and/or future motor vehicle speeds and volumes may not justify the recommended level of separation, and a less intensive treatment may be acceptable.

Arterial/Highway Bikeway Continuum (without curb and gutter)



Arterial/Highway Bikeway Continuum (with curb and gutter)



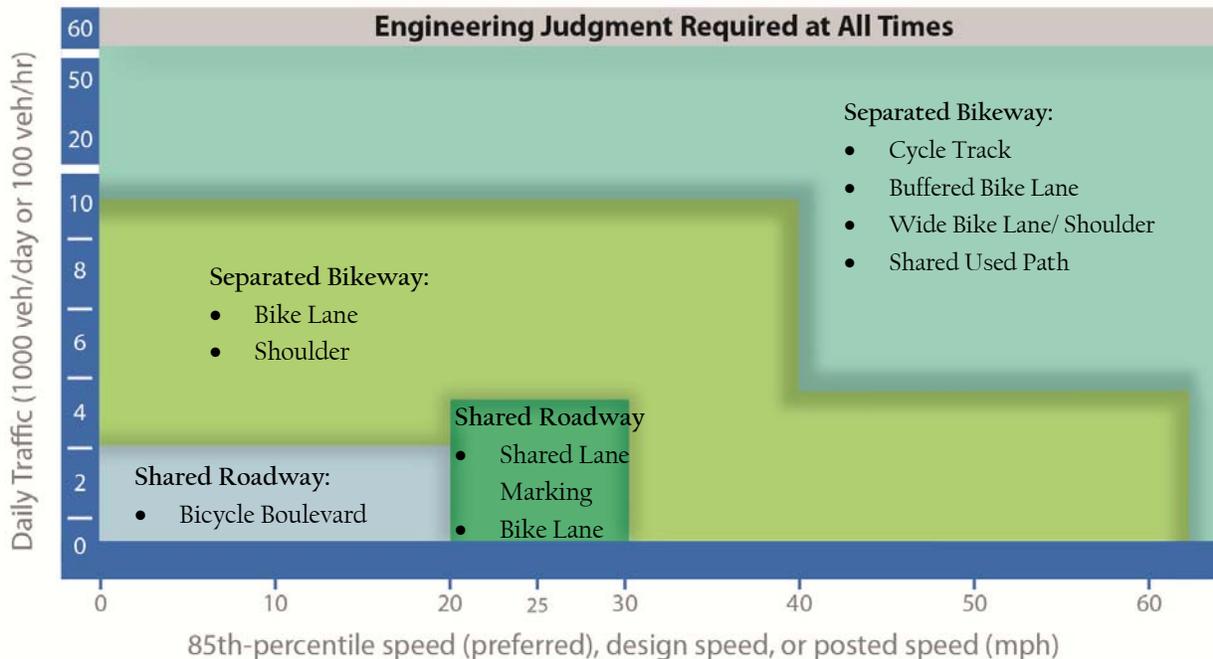
Collector Bikeway Continuum



Facility Selection Chart

Selecting the best bikeway facility type for a given roadway can be challenging, due to the range of factors that influence bicycle users' comfort and safety. There is a significant impact on cycling comfort when the speed differential between bicyclists and motor vehicle traffic is high and motor vehicle traffic volumes are high. As a starting point to identify a preferred facility, the chart below can be used to determine the recommended type of bikeway to be provided in particular roadway speed and volume situations. To use this chart, identify the daily traffic volume on the y-axis and travel speed on the x-axis for the existing or proposed roadway, and locate the facility types indicated by those key variables.

This chart by itself cannot fully represent the range of roadway complexities that can contribute to the optimal bikeway facility selection. Rather, this chart should be used as a starting point for the selection of bicycle facilities. Some of the other factors (beyond speed and volume) that could affect facility selection include the percentage of heavy vehicles, transit service and frequency, the presence of on-street parking, intersection density, surrounding land use, and roadway sight distance. The transportation planner or designer's judgment should be applied to select the facility that will provide the greatest amount of protection within the existing roadway context for the expected user group.



3.3 Recommended Bicycle Network

A system of shared use roadways and bicycle boulevards will provide a comprehensive bicycle network throughout the City of Watervliet. More protected bicycle accommodations, like bike lanes and cycle tracks, are proposed on the major arterials through the City, such as NYS Route 2 and NYS Route 32. Signage and traffic calming measures on the remaining residential streets will provide an even more cohesive bicycle network that will connect to every home and destination.

The following is a summary of the proposed priority bicycle routes through the City of Watervliet. A map showing the recommended bicycle network is shown following the summary. Recognizing that the bicycle network will be constructed in phases, a second map shows the short term, priority bicycle corridors.

3.3.1 East – West Routes

A bicycle route is recommended, on average, for every other east-west corridor in Watervliet. Each of these roadways and their proposed accommodations are summarized below:

4th Street (between Broadway and 8th Avenue)

This roadway is residential with low traffic volumes and already serves as a primary access route to the MHBHT trailhead. The road is approximately 34 feet wide with parking allowed on both sides and a speed limit of 30 mph.

- Bicycle boulevard treatments are recommended

6th Street (between Broadway and 8th Avenue)

This roadway is residential with low traffic volumes. 6th Street will serve as access to businesses along NYS Route 32, such as Stewarts, and the MHBHT. 6th Street is 32 to 34 feet wide with parking allowed on both sides of the roadway.

- Bicycle boulevard treatments are recommended

8th Street (between NYS Route 32 and 8th Avenue)

This roadway is residential, with low traffic volumes. The roadway width is less than 30 feet with parking allowed on both sides of the roadway.

- Bicycle boulevard treatments are recommended

10th Street (between Broadway and the City Line)

This roadway is a regional arterial with mixed uses. 10th Street extends west to the Town of Colonie. 10th Street is bordered by the Watervliet Arsenal to the south. The roadway width varies between 27 and 38 feet wide, including shoulders.

- Roadway widening as necessary for 5 foot bike lanes to be installed in the shoulders of the roadway, providing 10 foot travel lanes in either direction.
- Gateway treatment at the border of Watervliet and Colonie to encourage slower speeds when entering the City.

14th Street (between Broadway and the railroad)

This roadway is also residential with a 30 mph speed limit. 14th Street is 35 feet wide with parking on either side of the street.

- Shared lane markings or a bicycle boulevard treatment are proposed.

16th Street (between Broadway and Avenue A)

This street is 58 feet from curb to curb, with a 16 foot wide landscaped median. Parking is permitted on both sides.

- Shared lane markings are recommended

19th Street/NYS Route 2 (between 2nd Avenue and the City Line)

19th Street is the main east-west arterial through the City of Watervliet, serves as the connection to both the City of Troy and the Town of Colonie, and is a designated truck route. The roadway has recently been reconstructed with new sidewalks, curbs, and several curb bump-outs. The roadway is 40 feet wide with a travel lane in both directions and an adjacent parking lane. Land use along this street is primarily commercial.

- Shared lane markings are recommended

Congress Street Bridge (City of Troy to 2nd Avenue)

The bridge provides four travel lanes, two in each direction and is approximately 56 feet wide from curb to curb, including the center median. 5 foot sidewalks are provided on either side. Currently, there are no bicycle accommodations. This bridge provides a critical link between the City of Watervliet and the City of Troy and is used frequently by pedestrians and bicyclists. The bridge has been operating effectively with two lanes during the replacement of the bridge deck.

- Convert the eastbound outside travel to two-way cycle track or provide one-way cycle tracks in either direction.

23rd Street and 24th Street (between Broadway and 12th Avenue)

23rd and 24th Streets are east-west one-way pairs, just north of 19th Street. Each roadway is between 31 and 33 feet wide with on street parking provided on both sides.

- Shared lane markings or a protected bike lane (between the parking and the curb) are recommended for this one-way pair

3.3.2 North – South Routes

Broadway / Route 32 (between 25th Street and 4th Street)

Broadway is residential in the northern and southern most sections. To the north of the Watervliet Arsenal, Broadway is mostly commercial with several civic uses, such as City Hall and the public library. The roadway is a two lane roadway, approximately 38 feet wide, with parking permitted on the west side of the roadway. Parking is permitted on both sides of Broadway south of 3rd Avenue.

- See the Mohawk Hudson Bike Hike Trail Alternatives for recommendations

2nd Avenue (between 25th Street and 13th Street)

This arterial is a 30 mph roadway with several commercial, recreational, and residential land uses. The roadway is 42 to 46 feet wide with parking permitted on both sides in several blocks along the corridor.

- Bike lanes are recommended

6th Avenue and 7th Avenue (between 25th Street and 14th Street)

These roadways are one-way pairs that are approximately 31 feet wide with parking permitted on either side. Minor intersections are two-way stop controlled where 6th and 7th Avenues have free movement.

- Shared lane markings or a protected bike lane (between the parking and the curb) are recommended for this one-way pair

Alley between 6th and 7th Avenue (between 25th Street and 14th Street)

There is an alley located between 6th and 7th Avenues that is between 8 feet and 10 feet wide. The alley is mostly compacted stone or dirt, and only accesses a few driveways and garages. The alley is also used for maintenance and garbage pick-up. There is one gap in the corridor, on 19th Street due to an existing building. The 6th/7th Avenue pair would need to be used to bypass this section.

- Resurface the alley to provide a safe riding surface. Install speed tables at each roadway crossing with a high visibility crosswalk to calm traffic and provide a safe crossing. Continue the connection if the building on 19th Street becomes available.

6th Avenue (between 14th Street and 10th Street)

This roadway has a travel lane in both directions and on-street parking on both sides. It is approximately 35 feet wide.

- A bicycle boulevard treatment is recommended

Alley between 5th Avenue and 6th Avenue (between 14th Street and 10th Street)

There is an alley, located between 5th and 6th Avenues, which is between 8 feet and 10 feet wide. The alley is mostly compacted stone or dirt, and only accesses a few driveways and garages. The alley is also used for maintenance and garbage pick-up.

- Resurface the alley to provide a safe riding surface. Install speed tables at each roadway crossing with a high visibility crosswalk to calm traffic and provide a safe crossing.

8th Street & Avenue A (between 25th Street and 10th Street)

This roadway is residential, with low traffic volumes. The roadway width is approximately 36 feet wide with parking allowed on both sides of the roadway.

- Shared lane markings are proposed.

12th Street (between 25th Street and 19th Street)

The land use along this roadway is residential and offers a critical connection between the City of Watervliet Elementary School and Middle and High Schools. The roadway is 20 feet wide with no on-street parking allowed. Traffic volumes are low, at approximately 4500 vehicles per day. A sidewalk is provided and in the short term will provide safe passage for younger children riding to school.

- Widening the sidewalk to 8 feet on the east side of 12th Street is recommended in the long term.

12th Street (between 19th Street and Hillside Drive)

The land use along this roadway is residential and offers a critical connection to the City of Watervliet Middle and High School. The roadway is 44 feet wide with parking on either side. Traffic volumes are low.

- Although this roadway is wide enough to accommodate bike lanes, a bicycle boulevard technique to calm traffic is recommended. Creating a connection between the end of 12th Street and the end of Barker Ln (14th Street) will provide a connection across the railroad between the school and the densest part of the City.

3rd Avenue/Route 32 (between Broadway and the City Line)

3rd Avenue or NYS Route 32 has been previously studied as part of a joint linkage study with the City of Menands. Shared lane markings were recommended due to roadway constraints.

Alley between 3rd and 2nd Avenues (Schuyler Lane to 8th Street)

The alley provides secondary access to homes and businesses along 2nd and 3rd Avenues. This would provide an alternative route to 3rd Avenue.

- A bicycle boulevard treatment is recommended.

8th Avenue (between 8th Street and 1st Street)

This roadway is residential, with traffic volumes of approximately 1000 vehicles per day. The roadway width is approximately 33 feet wide with parking allowed on both sides of the roadway.

- Shared lane markings are proposed.



Green Island

Watervliet Junior/Senior High School

Watervliet Elementary School

Colonie

Watervliet

Bicycle Network

-  Bicycle Boulevard
-  Shared Lane
-  Bike Lane
-  MHBH Trail

-  Points of Interest
-  Schools
-  CDTA Bus Stop
-  CDTA Bus Shelter
-  CDTA Bikerack
-  Mohawk Hudson Bike/Hike Trailhead
-  Mohawk Hudson Bike/Hike Wayfinding Signage
-  Mohawk Hudson Bike/Hike On-road Route
-  Mohawk Hudson Bike/Hike Shareduse Path
-  Schuyler Flatts Trail
-  State Bicycle Route 9
-  Railroad
-  Watervliet Tax Parcels
-  Recreational and Athletic Parks
-  Water Bodies
-  Wetlands
-  100 Year Floodplain
-  Watervliet



Source: NY State GIS Clearinghouse, CDTC, NYSDOT
 Date: Sept 2013
 Authors: LZ

Bicycle Master Plan - Bicycle Network
- City of Watervliet, NY -

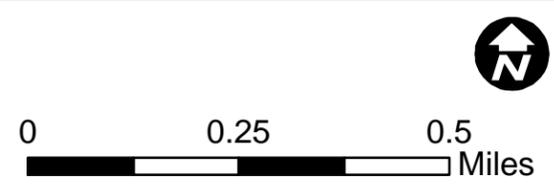
0 0.25 0.5 Miles





Source: NY State GIS Clearinghouse,
CDTC, NYSDOT
Date: Nov 2013
Authors: LZ

Bicycle Master Plan Short Term Bicycle Network - City of Watervliet, NY -



3.4 Facility Design Guidelines

3.4.1 Shared Roadways

On shared roadways, bicyclists and motor vehicles use the same roadway space. These facilities are typically used on roads with low speeds and traffic volumes; however, they can be used on higher volume roads with wide outside lanes or shoulders. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane or shoulder is provided.

Shared roadways employ a large variety of treatments from simple signage and shared lane markings to more complex treatments including directional signage, traffic diverters, chicanes, chokers, and/or other traffic calming devices to reduce vehicle speeds or volumes.

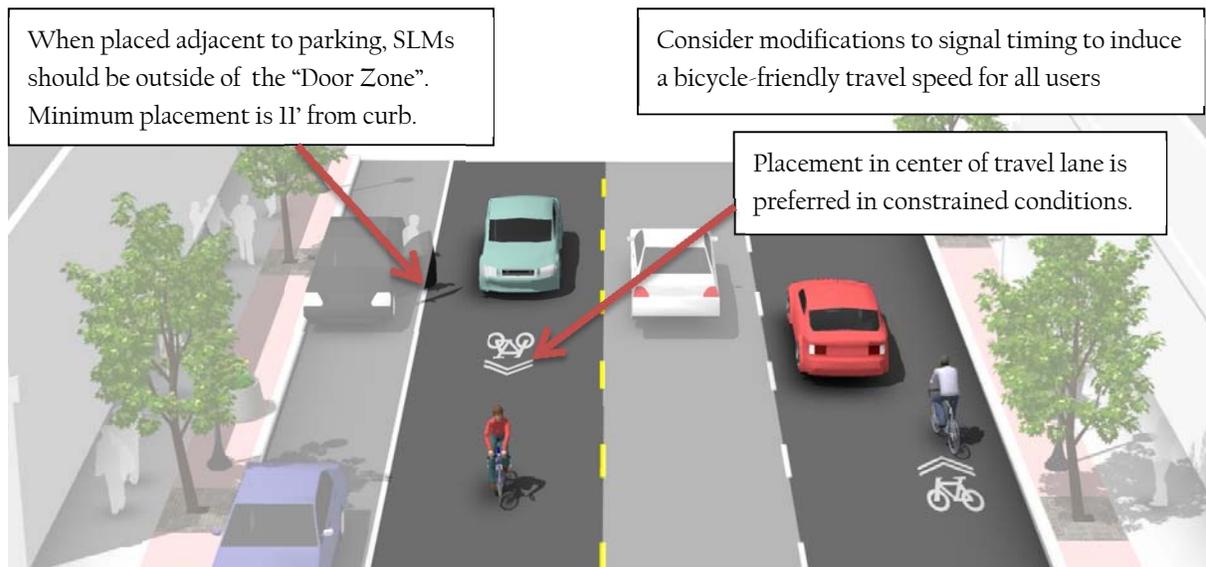
3.4.1.1 Marked Shared Roadway

Description

A marked shared roadway is a general purpose travel lane marked with shared lane markings (SLM) used to encourage bicycle travel and proper positioning within the lane. In constrained conditions, the SLMs are placed in the middle of the lane to discourage unsafe passing by motor vehicles. On a wide outside lane, the SLMs can be used to promote bicycle travel to the right of motor vehicles. In all conditions, SLMs should be placed outside of the door zone of parked cars.

Guidance

- In constrained conditions, preferred placement is in the center of the travel lane to minimize wear and promote single file travel.
- Minimum placement of SLM marking centerline is 11 feet from edge of curb where on-street parking is present, 4 feet from edge of curb with no parking. If parking lane is wider than 7.5 feet, the SLM should be moved further out accordingly.



Discussion

Bike Lanes should be considered on roadways with outside travel lanes wider than 15 feet, or where other lane narrowing or removal strategies may provide adequate road space. SLMs shall not be used on shoulders, in designated Bike Lanes, or to designate Bicycle Detection at signalized intersections. (MUTCD 9C.07)

This configuration differs from a Bicycle boulevard due to a lack of traffic calming, wayfinding, and other enhancements designed to provide a higher level of comfort for a broad spectrum of users.

Materials and Maintenance

Placing SLMs between vehicle tire tracks will increase the life of the markings and minimize the long-term cost of the treatment.

Additional References and Guidelines

AASHTO, *Guide for the Development of Bicycle Facilities*. 2012

FHWA, *Manual on Uniform Traffic Control Devices*. 2009

NACTO, *Urban Bikeway Design Guide*. 2012

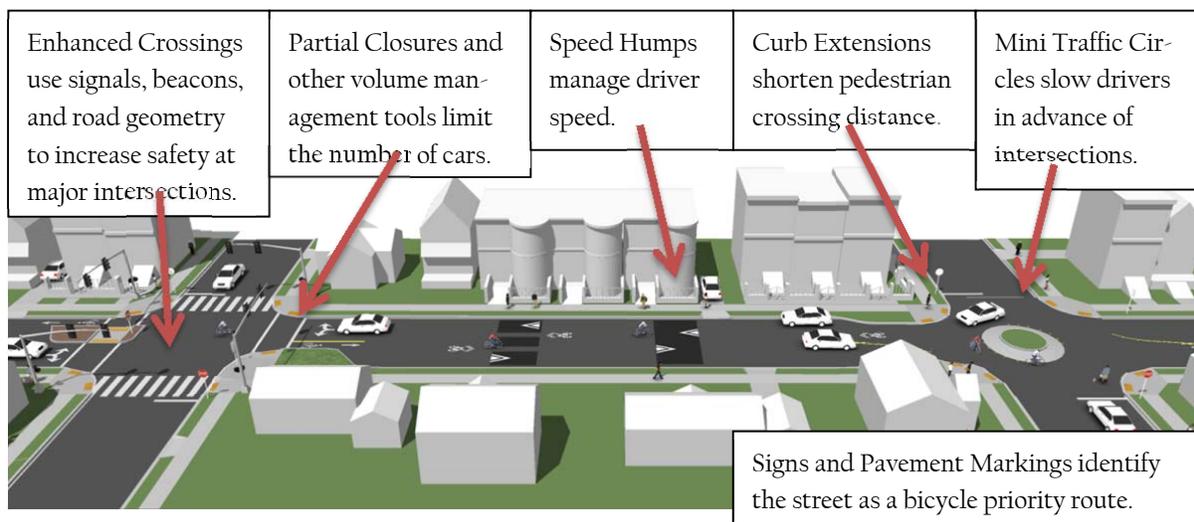
3.4.1.2 Bicycle Boulevards

Description

Bicycle Boulevards are low-volume, low-speed streets modified to enhance bicyclist comfort by using treatments such as signage, pavement markings, traffic calming and/or traffic reduction, and intersection modifications. These treatments allow through movements of bicyclists while discouraging similar through-trips by non-local motorized traffic.

Guidance

- Signs and pavement markings are the minimum treatments necessary to designate a street as a bicycle boulevard.
- Bicycle boulevards should have a maximum posted speed of 25 mph. Use traffic calming to maintain an 85th percentile speed below 22 mph.
- Implement volume control treatments based on the context of the bicycle boulevard, using engineering judgment. Target motor vehicle volumes range from 1,000 to 3,000 vehicles per day.
- Intersection crossings should be designed to enhance safety and minimize delay for bicyclists.



Discussion

Bicycle boulevard retrofits to local streets are typically located on streets without existing signalized accommodation at crossings of collector and arterial roadways. Without treatments for bicyclists, these intersections can become major barriers along the bicycle boulevard and compromise safety.

Traffic calming can deter motorists from driving on a street. Anticipate and monitor vehicle volumes on adjacent streets to determine whether traffic calming results in inappropriate volumes. Traffic calming can be implemented on a trial basis.

Materials and Maintenance

Vegetation should be regularly trimmed to maintain visibility and attractiveness.

Additional References and Guidelines

Alta Planning + Design and IBPI, Bicycle Boulevard Planning and Design Handbook. 2009

FHWA. BikeSafe, Bicycle Countermeasure Selection System. 2005

Ewing, Reid, Traffic Calming: State of the Practice. 1999

Ewing, Reid and Brown, Steven, U.S. Traffic Calming Manual. 2009

3.4.2 Separated Bikeways

Designated exclusively for bicycle travel, separated bikeways are segregated from vehicle travel lanes by striping, and can include pavement stencils and other treatments. Separated bikeways are most appropriate on arterial and collector streets where higher traffic volumes and speeds warrant greater separation.

- Separated bikeways can increase safety and promote proper riding by:
- Defining road space for bicyclists and motorists, reducing the possibility that motorists will stray into the bicyclists' path
- Discouraging bicyclists from riding on the sidewalk
- Reducing the incidence of wrong way riding
- Reminding motorists that bicyclists have a right to the road

3.4.2.1 Bike Lane

Description

Bike lanes designate an exclusive space for bicyclists through the use of pavement markings and signage. The bike lane is located adjacent to motor vehicle travel lanes and is used in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge or parking lane.

Many bicyclists, particularly less experienced riders, are more comfortable riding on a busy street if it has a striped and signed bikeway than if they are expected to share a lane with vehicles.

Guidance without on-street parking

- 4 foot minimum when no curb and gutter is present.
- 5 foot minimum when adjacent to curb and gutter or 3 feet more than the gutter pan width if the gutter pan is wider than 2 feet.
- 14.5 foot preferred from curb face to edge of bike lane. (12 foot minimum).
- 7 foot maximum width for use adjacent to arterials with high travel speeds. Greater widths may encourage motor vehicle use of bike lane.

Guidance with on-street parking

- 12 foot minimum from curb face to edge of bike lane.
- 14.5 foot preferred from curb face to edge of bike lane.
- 7 foot maximum for marked width of bike lane. Greater widths may encourage vehicle loading in bike lane. Use buffered bicycle lanes when a wider facility is desired.

should be 5-7 feet wide and marked with a solid double yellow line and appropriate signage. Bike lane markings should be clearly visible to ensure that the contra-flow lane is exclusively for bicycles. Coloration should be considered in the bike lane.

- Signage specifically allowing bicycles at the entrance of the contra flow lane is recommended.

Discussion

Because of the opposing direction of travel, contra-flow bike lanes increase the speed differential between bicyclists and motor vehicles in the adjacent travel lane. If space permits consider a buffered bike lane or cycle track configuration to provide additional separation. Special attention should be paid to intersections, where the contra-flow bike lane will create an additional conflicting movement. These intersections can be stop controlled or signalized.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining marking should be a high priority.

Additional References and Guidelines

AASHTO, Guide for the Development of Bicycle Facilities. 2012

FHWA, Manual on Uniform Traffic Control Devices. 2009

NACTO, Urban Bikeway Design Guide. 2012

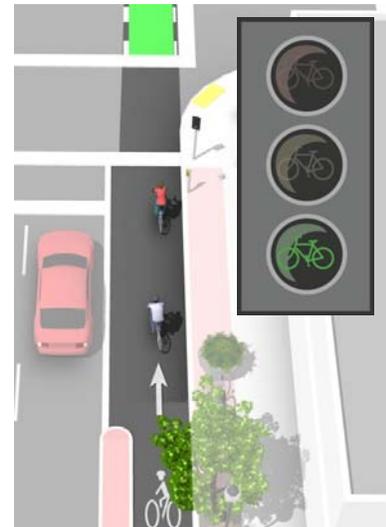
3.4.3 Intersection Crossing Markings

Description

Bicycle pavement markings through intersections indicate the intended path of bicyclists through an intersection or across a driveway or ramp. They guide bicyclists on a safe and direct path through the intersection and provide a clear boundary between the paths of through bicyclists and either through or crossing motor vehicles in the adjacent lane.

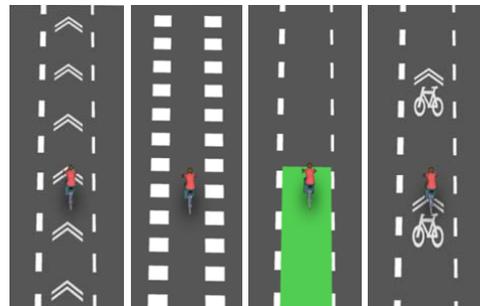
Guidance

- See MUTCD Section 3B.08: “dotted line extensions”
- Crossing striping shall be at least six inches wide when adjacent to motor vehicle travel lanes. Dotted lines should be two-foot lines spaced two to six feet apart.
- Chevrons, shared lane markings, or colored bike lanes in conflict areas may be used to increase visibility within conflict areas or across entire intersections. Elephant’s Feet markings are common in Canada, and in use in Chicago, IL.



Discussion

Additional markings such as chevrons, shared lane markings, or colored bike lanes in conflict areas are strategies currently in use in the United States and Canada. Cities considering the implementation of markings through intersections should standardize future designs to avoid confusion.



3.4.3.1 Bike Box

Description

A bike box is a designated area located at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible space to get in front of queuing motorized traffic during the red signal phase. Motor vehicles must queue behind the white stop line at the rear of the bike box.

Guidance

- 14' minimum depth
- A “No Turn on Red” (MUTCD R10-11) sign shall be installed overhead to prevent vehicles from entering the Bike Box.
- A “Stop Here on Red” sign should be post-mounted at the stop line to reinforce observance of the stop line.
- A “Yield to Bikes” sign should be post-mounted in advance of and in conjunction with an egress lane to reinforce that bicyclists have the right-of-way going through the intersection.
- An ingress lane should be used to provide access to the box.
- A supplemental “Wait Here” legend can be provided in advance of the stop bar to increase clarity to motorists.



Discussion

Bike boxes should be placed only at signalized intersections, and right turns on red shall be prohibited for motor vehicles when placed in front of a shared through-right lane. Prohibiting right turns on red improves safety for bicyclists, yet does not significantly impede motor vehicle travel. Bike boxes should be used in locations that have a large volume of bicyclists and are best utilized in central areas where traffic is usually moving more slowly. Installing bike boxes on downhill grades should be considered more carefully.

Materials and Maintenance

Because the effectiveness of markings depends entirely on their visibility, maintaining markings should be a high priority.

Additional References and Guidelines

- AASHTO. (2012). Guide for the Development of Bicycle Facilities.
- FHWA. (2009). Manual on Uniform Traffic Control Devices. (3A.06)
- NACTO. (2012). Urban Bikeway Design Guide.

3.4.5 Cycle Tracks and Shared Use Paths

A cycle track is an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane. A cycle track is physically separated from motor traffic and distinct from the sidewalk. Cycle tracks have different forms but all share common elements—they provide space that is intended to be exclusively or primarily used by bicycles, and are separated from motor vehicle travel lanes, parking lanes, and sidewalks. In situations where on-street parking is allowed, cycle tracks are located to the curb-side of the parking (in contrast to bike lanes).

Cycle tracks may be one-way or two-way, and may be at street level, sidewalk level or at an intermediate level. If at sidewalk level, a curb or median separates them from motor traffic, while different pavement color/texture separates the cycle track from the sidewalk. If at street level, they can be separated from motor traffic by raised medians, on-street parking or bollards.

A two-way cycle track is desirable when more destinations are on one side of a street (therefore preventing additional crossings), if the facility connects to a path or other bicycle facility on one side of the street, or if there is not enough room for a cycle track on both sides of the road.

By separating bicyclists from motor traffic, cycle tracks can offer a higher level of comfort than bike lanes and are attractive to a wider spectrum of the public. Shared Use Paths are facilities separated from roadways for use by bicyclists and pedestrians.

3.4.5.1 Cycle Track Separation and Placement

Description

Protection is provided through physical barriers and can include bollards, parking, a planter strip, an extruded curb, or on-street parking. Cycle tracks using these protection elements typically share the same elevation as adjacent travel lanes.

Raised cycle tracks may be at the level of the adjacent sidewalk or set at an intermediate level between the roadway and sidewalk to separate the cycle track from the pedestrian area.

Guidance

- Cycle tracks should ideally be placed along streets with long blocks and few driveways or mid-block access points for motor vehicles. Cycle tracks located on one-way streets have fewer potential conflict areas than those on two-way streets.
- In situations where on-street parking is allowed, cycle tracks shall be located between the parking lane and the sidewalk (in contrast to bike lanes).

Discussion

Sidewalks or other pedestrian facilities should not be narrowed to accommodate the cycle track as pedestrians will likely walk on the cycle track if sidewalk capacity is reduced. Visual and physical cues (e.g., pavement markings & signage) should be used to make it clear where bicyclists and pedestrians should be travelling. If possible, separate the cycle track and pedestrian zone with a furnishing zone.

One-Way Cycle Tracks

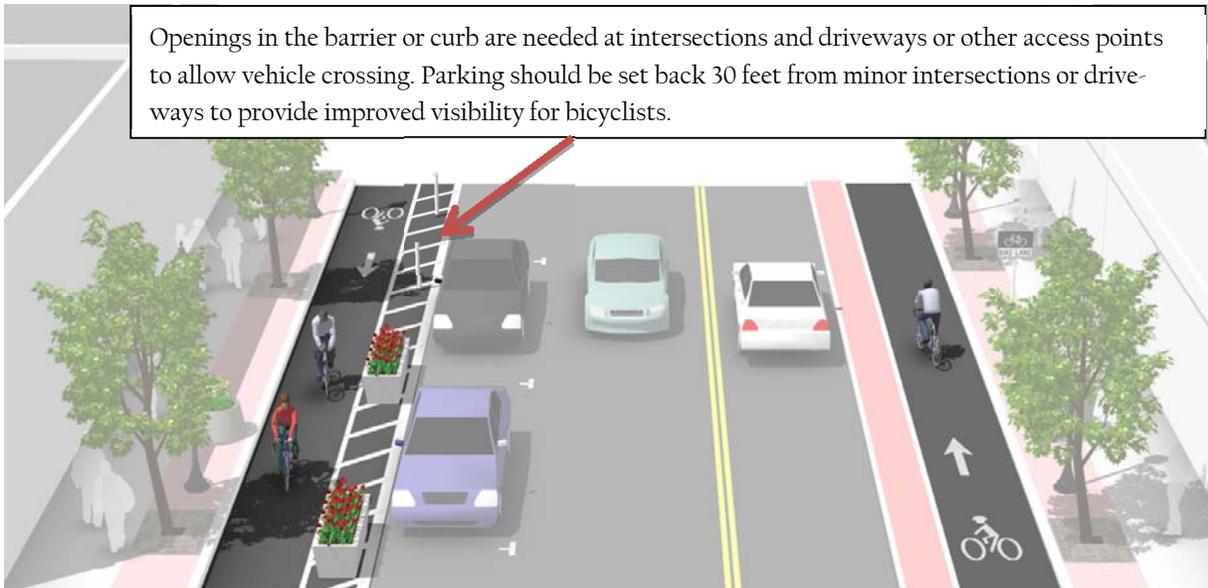
Description

One-way cycle tracks are physically separated from motor traffic and distinct from the sidewalk. Cycle tracks are either raised or at street level and use a variety of elements for physical protection from passing traffic.

Guidance

- 7 foot recommended minimum to allow passing.

- 5 foot minimum width in constrained locations.
- When placed adjacent to parking, the parking buffer should be three feet wide to allow for passenger loading and to prevent door collisions.
- When placed adjacent to a travel lane, one-way raised cycle tracks may be configured with a mountable curb to allow entry and exit from the bicycle lane for passing other bicyclists or to access vehicular turn lanes.



Discussion

Special consideration should be given at transit stops to manage bicycle and pedestrian interactions. Driveways and minor street crossings are unique challenges to cycle track design. Parking should be prohibited within 30 feet of the intersection to improve visibility. Color, yield markings and “Yield to Bikes” signage should be used to identify the conflict area and make it clear that the cycle track has priority over entering and exiting traffic. If configured as a raised cycle track, the crossing should be raised so that the sidewalk and cycle track maintain their elevation through the crossing.

Two-Way Cycle Tracks

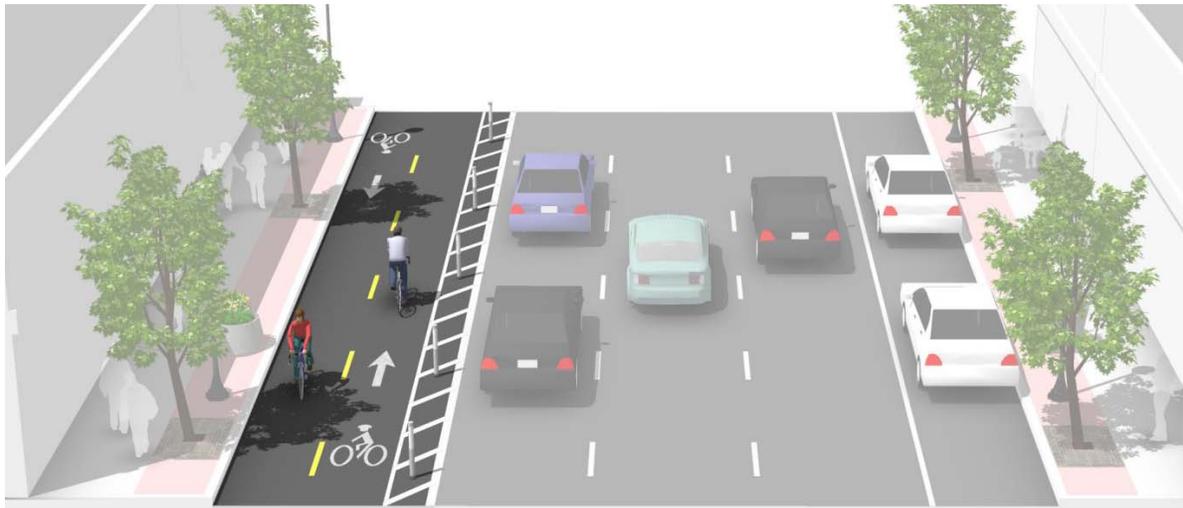
Description

Two-way cycle tracks are physically separated cycle tracks that allow bicycle movement in both directions on one side of the road. Two-way cycle tracks share some of the same design characteristics as one-way cycle tracks, but may require additional considerations at driveway and side-street crossings.

A two-way cycle track may be configured as a protected cycle track at street level with a parking lane or other barrier between the cycle track and the motor vehicle travel lane and/or as a raised cycle track to provide vertical separation from the adjacent motor vehicle lane.

Guidance

- 12 foot recommended minimum for two-way facility
- 8 foot minimum in constrained locations
- When placed adjacent to parking, the parking buffer should be three feet wide to allow for passenger loading and to prevent door collisions.



Discussion

Two-way cycle tracks require a higher level of control at intersections to allow for a variety of turning movements. These movements should be guided by separated signals for bicycles and motor vehicles. Transitions into and out of two-way cycle tracks should be simple and easy to use to deter bicyclists from continuing to ride against the flow of traffic.

At driveways and minor intersections, bicyclists riding against roadway traffic in two-way cycle tracks may surprise pedestrians and drivers not expecting bidirectional travel. Appropriate signage is recommended.

Materials and Maintenance

Barrier separated and raised cycle tracks may require special equipment for street cleaning operations.

Additional References and Guidelines

NACTO, Urban Bikeway Design Guide. 2012

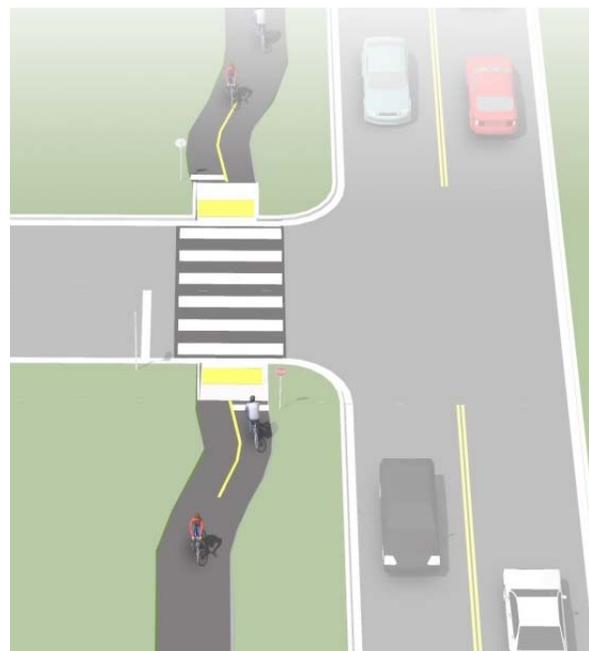
3.4.6 Shared Use Paths Along Roadways

Description

A shared use path allows for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, runners and other non-motorized users. These facilities are frequently found in parks, along rivers, beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles.

Along roadways, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding where bicyclists enter or leave the path.

The AASHTO *Guide for the Development of Bicycle Facilities* provides guidance on the development of shared-use paths directly adjacent to roadways.



Guidance

- 8 feet is the minimum allowed for a two-way path and is only recommended in low traffic situations.
- 10 feet is recommended in most situations and is adequate for moderate to heavy use.
- 12 feet is recommended for heavy use situations with high concentrations of multiple users such as runners, bicyclists, rollerbladers and pedestrians. A separate track (5' minimum) can be provided for pedestrian use.

Bicycle lanes should be provided as an alternate facility whenever possible.

Discussion

When designing a bikeway network, the presence of a nearby or parallel path should not be used as a reason to not provide adequate shoulder or bicycle lane width on the roadway, as the on-street bicycle facility is preferred over the “sidepath” by experienced bicyclists and those who are cycling for transportation purposes.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw-cut concrete joints (rather than troweled) improve the experience of path users.

Additional References and Guidelines

AASHTO, Guide for the Development of Bicycle Facilities. 2012

NACTO, Urban Bikeway Design Guide. 2012

3.4.7 Greenways

A greenway is a type of shared-use path that follows a linear corridor. Greenways allow for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. These facilities are frequently found in parks, along rivers, beaches, and in greenbelts or utility corridors where there are few conflicts with motorized vehicles. Path facilities can also include amenities such as lighting, signage, and fencing (where appropriate).

Key features of greenways include:

- Frequent access points from the local road network.
- Directional signs to direct users to and from the path.
- A limited number of at-grade crossings with streets or driveways.
- Terminating the path where it is easily accessible to and from the street system.
- Separate treads for pedestrians and bicyclists when heavy use is expected.

3.4.7.1 General Design Practices

Description

Shared use paths can provide a desirable facility, particularly for recreation, and users of all skill levels preferring separation from traffic. Bicycle paths should generally provide directional travel opportunities not provided by existing roadways.

Guidance

Terminate the path where it is easily accessible to and from the street system, preferably at a controlled intersection or at the beginning of a dead-end street.



Width

- 8 feet is the minimum allowed for a two-way bicycle path and is only recommended for low traffic situations.
- 10 feet is recommended in most situations and will be adequate for moderate to heavy use.
- 12 feet or more is recommended for heavy use situations with high concentrations of multiple users. A separate track (5' minimum) can be provided for pedestrian use.

Lateral Clearance

- A 2 foot or greater shoulder on both sides of the path should be provided. An additional foot of lateral clearance (total of 3') is required by the MUTCD for the installation of signage or other furnishings.
- If bollards are used at intersections and access points, they should be colored brightly and/or supplemented with reflective materials to be visible at night.

Overhead Clearance

- Clearance to overhead obstructions should be 8 feet minimum, with 10 feet recommended.

Striping

- When striping is required, use a 4 inch dashed yellow centerline stripe with 4 inch solid white edge lines.
- Solid centerlines can be provided on tight or blind corners, and on the approaches to roadway crossings.

Discussion

The AASHTO Guide for the Development of Bicycle Facilities generally recommends against the development of shared use paths along roadways. Also known as “sidepaths”, these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic and can result in wrong-way riding when either entering or exiting the path.

Materials and Maintenance

Asphalt is the most common surface for bicycle paths. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled improve the experience of path users.

Additional References and Guidelines

AASHTO, Guide for the Development of Bicycle Facilities. 2012

FHWA, Manual on Uniform Traffic Control Devices. 2009

Flink, Chuck, Greenways: A Guide To Planning Design And Development. 1993

Flink, Chuck, Trails for the Twenty-First Century. 2001

3.4.7.2 Greenways along Waterway Corridors

Description

Utility and waterway corridors often offer excellent opportunities for greenway development and bikeway gap closure. Utility corridors typically include powerline and sewer corridors, while waterway corridors may include canals, levees, drainage ditches, rivers, and beaches.

Waterway corridors are often ideally suited for greenways and bikeways. They are typically long and linear in nature and can generally offer a con-



tinuous bikeway with few conflicts with other transportation modes. Waterway corridors often have the benefit of great views and are suitable for users of all ages and skill levels.

The relatively clear, level surface of the top of a levee provides an ideal location for a greenway. Access to a trail on top of a levee would likely require ramps or boardwalk to provide Americans with Disabilities Act (ADA) compliance. Barriers such as water crossings, existing bridges and flood control infrastructure may require modifications or additional structures to provide continuous access for the greenway.

Discussion

Similar to railroads, public access to flood control channels or canals often necessitate additional features to make a greenway compatible with flood control or canal operations. Hazardous materials, deep water or swift current, steep, slippery slopes, and debris all constitute considerations that must be addressed for public access.

Wayfinding and Signage

Any access point to the path should be well-defined with appropriate wayfinding signage designating the pathway as a greenway or bicycle facility and prohibiting motor vehicles. Regulatory signage may also be needed along the path alignment. For instance, there are many existing conflicts with commercial driveways along the levee paths that present a safety issue. Regulatory signs should be placed at these conflict areas to alert greenway users to exercise caution when approaching the driveways. A sign displaying a commercial truck could serve as an appropriate sign treatment. Removable bollards, or gate features could also be installed, which would allow non-motorized access and would prevent motorized public use while preserving maintenance access.

Design Considerations

- Meet or exceed US Army Corps of Engineers standards
- Use permeable surfacing where possible; where impermeable surfaces are required, grade towards infiltration strips
- Meet ADA standards to the maximum extent feasible
- 12' minimum vertical clearance to permit passage of maintenance and emergency vehicles

Materials and Maintenance

Asphalt is the most common surface for greenways. The use of concrete for paths has proven to be more durable over the long term. Saw cut concrete joints rather than troweled joints improve the experience of wheeled greenways users.

Additional References and Guidelines

AASHTO, Guide for the Development of Bicycle Facilities. 2012

FHWA, Manual on Uniform Traffic Control Devices. 2009

Flink, Chuck, Greenways: A Guide To Planning Design And Development. 1993

3.5 Program Recommendations

3.5.1 Becoming a Bicycle Friendly Community

The League of American Bicyclists (LAB) promotes the national Bicycle Friendly Communities (BFC) Program. Awards are given twice a year to Bronze, Silver, Gold and Platinum level BFC's (with applications due every March and August). The program application includes a detailed review of all aspects of a comprehensive bicycling program: engineering, education, enforcement and encouragement. The application can be used as a set of benchmarks for measuring Watervliet's program against the most successful communities in the U.S. This has proven to be a powerful tool for communities such as Portland, OR – which formed a Mayor's "GO PLATINUM" committee after it was designated as a Gold BFC, with a goal of improving all required program areas in order to achieve Platinum status within two years. If Watervliet wants to become a great place for bicycling, it should strive to implement programs that other BFC communities have completed.

3.5.2 Bicycle and Pedestrian Advisory Committee (BPAC)

A permanent Bicycle and Pedestrian Advisory Commission (BPAC) should be formed on the citizen level. The BPAC would be a beneficial resource for promoting both bicycle and pedestrian safety, providing feedback on opportunities and obstacles within the City, educating bicyclists and motorists about sharing the road, mobilizing support for bicycle and pedestrian issues, and assisting in the coordination of events and outreach campaigns. BPAC subcommittees could take on specific tasks. The group should meet quarterly to encourage and evaluate the progress of overall plan implementation.

3.5.3 Bikes and Transit

Walking, bicycling and transit are all modes of transportation that reduce traffic congestion and have important health and environmental benefits for communities. Due to these benefits, increasing access to these modes of transportation, and creating improved connections between them, should be encouraged. Since the 1990s, cities and towns throughout the United States have actively sought to improve connections between bicycling and transit, and research over this period has indicated that installing bicycling amenities increase access to transit, which also has the effect of increasing transit ridership as well as bicycle ridership.^{16 17}

The transit catchment area is the area that a typical person will travel to reach a transit station, such as the CDTA bus stops that are located throughout the City of Watervliet. For pedestrians, this distance is estimated to be a ½ mile. For a bicyclist, this distance increases to 2 or more miles. By providing improved access to transit stops for bicyclists, the potential number of people who are serviced by transit is dramatically increased due to the expanded catchment area. Many of the network improvements highlighted in this report would make it safer and more comfortable for bicyclists to access the thirty-seven transit stops in the City of Watervliet. This could encourage more people to ride their bikes and take transit more frequently.

Additionally, improvements can be made at key bus stop locations to further increase the potential for residents to use bicycling combined with transit. One of these improvements, Bike-on-Bus Racks, has already been implemented by CDTA throughout the Capital Region. Bike-on-Bus racks provide the option for bicyclists to ride to a bus stop and load their bike onto the bus. This allows bicyclists to access transit by bicycle from trip origin and destination points that are not located within convenient walking distance to transit. Bike-on-Bus racks therefore increase the number of people who can viably use transit. The rack program continues to be popular program promoted by CDTA throughout the region and usage of these racks continues to increase each year.

Another bus stop improvement that can increase levels of bicycling and transit use includes bike parking. There are two designations of bike parking: short-term and long-term. Short-term parking facilities have a higher rate of

¹⁶ Pucher, J. Dill, J. and Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: An international review. *Preventative Medicine*, 50. S106-S125.

¹⁷ Federal Highway Administration (2006) Lesson 18: Bicycle and Pedestrian Connections to Transit *Federal Highway Administration University Course on Bicycle and Pedestrian Transportation*, 1-10

bicycle turnover, typically about two hours, while long-term parking facilities are intended to be used for eight or more hours a day, such as during the work day. For short term bicycle parking, inverted “U” racks are recommended because of their design and utility. Long term parking facilities should be covered and provide limited access to only those with a key or keycard. High demand bus stops within the City should be equipped with adequate bicycle parking facilities to provide cyclists with a safe and formalized location to park their bikes. Attractive bicycle parking can indicate to residents that a community supports bicycling, and this positive impression can increase respect for bicyclists and increase ridership levels.

The combination of an improved bicycling network and bus stop amenities can make riding a bicycle to transit more feasible by increasing the number of people who could potentially take transit, and by making riding to transit stops more appealing. Indeed, such improvements could potentially increase the number of transit riders and bicyclists in the City of Watervliet. Programs and marketing campaigns should coincide with the installation of new bicycling/transit amenities. Coordination with local bicycle and transit advocacy organizations is also important to ensure the success of infrastructure improvements and the continued use of the improved network and amenities.

3.5.4 Education

3.5.4.1 Public Education and Educational Devices

Watervliet should build on its and the region’s existing programs by continuing to develop a variety of safety materials and distribute them widely throughout the community. Educational materials focus on safe behaviors, rules, and responsibilities. Information may include important bicycle laws, bulleted keys for safe bicycle travel, helmet requirements, safe motor vehicle operation around bicycles, and general facility rules and regulations. This safety information is often available for download from national pedestrian advocacy organizations, such as the Pedestrian and Bicycle Information Center website, www.pedbikeinfo.org. The City of Watervliet should work with the CDTC to increase the awareness of the Capital Coexist campaign. Information can be distributed through brochures, newsletters, newspapers, bumper stickers, and other print media that can be inserted into routine mailings. It can also be posted on municipal websites and shown on local cable access television.

Local programs such as earn-a-bike programs, bicycle commuter mentoring, and summer camps can be organized by the City and the newly formed BPAC and can be utilized to distribute information using a booth to display related print media (these programs could be modeled after existing programs, such as Troy’s Bike Rescue). Brown-bag events and clinics are also excellent means to provide education, especially for adults. Local events, such as the farmers market, should be utilized to distribute information using a booth to display related print media. A representative from the newly formed BPAC could volunteer at the booth to answer questions related to bicycling in Watervliet.

3.5.4.2 Motorist Education

Equally important as bicyclist education is motorist education. Many motorists do not recognize the simple fact that a bicycle is a vehicle by New York state law. The CDTC Capital Coexist campaign and the New York State Bicycle Coalition provide brochures and other materials for driver education. The StreetSmart public awareness campaign in the Washington, DC region is another example of a Public Service Agency educating residents about pedestrian and bicycle safety.

3.5.4.3 Internal Training

‘Internal’ education refers to the training of all people who are involved in the actual implementation of the Bicycle Master Plan. Internal training will be essential to institutionalizing bicycle issues into the everyday operations of public works, planning, and parks and recreation departments. In addition to relevant City staff, members of the CDTC, NYDOT Region 1 staff, and Albany County staff should also be included in training sessions whenever possible. This training should cover all aspects of the transportation and development process, including planning, design, development review, construction, and maintenance. This type of ‘in-reach’ can be in the form of

brown bag lunches, professional certification programs and special sessions or conferences. Even simple meetings to go over the Bicycle Plan and communicate its strategies and objectives can prove useful for staff and newly elected officials that may not have otherwise learned about the plan. Bicycle planning and design issues are complex, and state-of-the-art research and guidelines continue to evolve. Therefore, training sessions need to be updated and repeated on a regular basis.

Local law enforcement should be trained in accurate reporting of bicycle crashes involving automobiles. In many communities, police do not always adequately understand the rights of bicyclists. Proper interpretation of individual circumstances and events is critical for proper enforcement and respect between motorists and bicyclists. Special training sessions should be instituted and occur annually for new employees within the Police Department that focus on laws relating to bicycle travel. Every effort should be made for representation from the Police Department on the BPAC.

3.5.5 Encouragement

3.5.5.1 Employer Programs

To encourage bicycling and walking to work, employers can provide programs and incentives. When bicycling is encouraged, the employer benefits from improved employee health and morale along with an enhanced community perception when protecting the environment and being active in the community. Promotions could include a Bike to Work Day or a morning Pit-Stop where employees can receive free refreshments. Employers can provide educational workshops, bicycle parking options, and employee incentives. Incentives may include prize drawings, t-shirts, free tune-ups at a local bicycle shop, and bicycle maps.

3.5.5.2 Watervliet Arsenal –“Mission Ready”

One of the three biggest problems facing the United States Military is lack of physical fitness. 27 percent of young Americans are too overweight to join the military. Many are turned away by recruiters and others never try to join. Of those who attempt to join, however, roughly 15,000 young potential recruits fail their entrance physicals every year because they are too heavy. This has also become an issue for those already in service. Increasing bicycling opportunities around the Watervliet Arsenal will allow for increased physical activity.

3.5.5.3 School Programs

Many programs exist to aid communities in developing safer pedestrian facilities around schools. Programs can be adopted by parents or the schools to provide initiatives for biking. Information is available to encourage group travel, prevent bicycle-related injuries, and sponsor commuter-related events. After-school programs, summer Bike Camps, bicycle rodeos, and Family Fun Rides can be created to provide a supportive environment for children to learn how to ride a bike comfortably and safely with friends, learn how to repair and maintain a bicycle, and tour their city and its destinations.

Safe Routes to School

The City of Watervliet should seek programming and facility funding from the Safe Routes to School program, administered by the NYSDOT Bicycle and Pedestrian Transportation Division. Funding is available for school workshops and action plans. The Safe Routes to School program also provides implementation and construction funding for facilities near schools. This includes bike rack accommodations on school grounds.

3.5.5.4 Awareness Days/Events

A specific day of the year can be devoted to a theme to raise awareness and celebrate issues relating to that theme. A greenway and its amenities can serve as a venue for events that will put the greenway on display for the community. Major holidays, such as July 4th, and popular local events serve as excellent opportunities to distribute bicycling information. The following are examples of other national events that the City of Watervliet can use to improve usage of bicycle facilities:

Bike-to-Work Day (Third Friday in May)

Bike-to-Work Day is an annual event held on the third Friday of May across the United States that promotes the bicycle as an option for commuting to work. Leading up to Bike-to-Work Day, national, regional, and local bicycle advocacy groups encourage people to try bicycle commuting as a healthy and safe alternative to driving by providing route information and tips for new bicycle commuters. On Bike-to-Work Day, these groups often organize bicycle-related events, and in some areas, pit stops along bicycle routes with snacks.

Car-Free Day (September 22)

Car Free Day is an international day to celebrate getting around without cars. This fall event coincides with the beginning of the school year and is the perfect way to kick-off programs that promote bicycling and raise awareness for environmental issues. Car-Free events can last for an entire week or month, featuring alternative transportation promotional activities, fitness expos, transit-use incentives, walking and jogging group activities, running and bicycling races and rides, etc.

National Trails Day

This event is held every year in June. Other events, competitions, races, and tours can be held simultaneously to promote trail use within Watervliet. Coordinate with surrounding municipalities for joint Mohawk Hudson Bike Hike Trail events.

3.5.6 Enforcement

3.5.6.1 Motorist Enforcement

Based on crash data analysis and observed patterns of behavior, law enforcement can use targeted enforcement to focus on key issues such as motorists speeding, passing too closely to cyclists, parking in bicycle lanes, etc. These issues should be targeted and enforced consistently. The goal is for bicyclists and motorists to recognize and respect each other's rights on the roadway.

3.5.6.2 Bicyclist Enforcement

Observations made by local trail and bicycle facility users can be utilized to identify any conflicts or issues that require attention. To maintain proper use of trail facilities, volunteers could be used to patrol the trails, particularly on the most popular trails and on days of heavy use. The volunteer patrol can report any suspicious or unlawful activity, as well as answer any questions a trail user may have.

When users of the bicycle network witness unlawful activities, they should have a simple way of reporting the issue to police. A hot line should be created, which would complement trail patrol programs. People could call in and talk to a live operator or to leave a voice mail message about the activity they witnessed. Accidents could also be reported to this hot line. Accident locations could then be mapped to prioritize and support necessary facility improvements.

Additionally, unsafe cycling (e.g. riding on the wrong side of the street, without lights at night, or children riding without helmets) should be addressed by local law enforcement through warnings, with an understanding that there may be a learning curve for new or inexperienced cyclists. Again, the goal is for bicyclists and motorists to recognize and respect each other's rights on the roadway.

3.5.7 Complete Streets Policy

Complete Streets policies direct transportation planners and engineers to consistently design roadways with all users in mind. Complete streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a complete street. There are many ways to implement Complete Streets policies. The Complete Streets Coalition provides a wealth of information regarding complete streets: <http://www.completestreets.org>. A Complete Streets Policy is

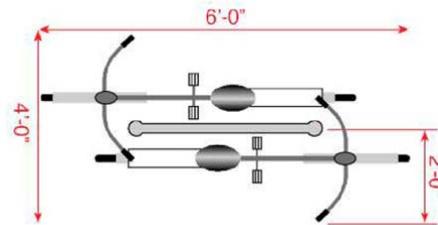
supported by the enactment of the NYS Complete Street's Law. Two components for creating more comfortable and safer streets include access management and streetscaping, as described below.

Access Management: Access driveways for developments create conflict points between vehicles entering and exiting the driveway and passing pedestrians and cyclists. Curb cuts should be limited to reduce the number of conflicts and reduced to a width of no more than 12 feet per lane to clearly define vehicle paths. Crosswalks should also be included across all driveways to more clearly define pedestrian right-of-way

Streetscaping: Streetscaping is a relatively inexpensive way to enhance corridors for all types of uses. Street trees, landscaping, and lighting not only provide a more comfortable pedestrian and cycling environment, but also help to reduce vehicles speeds. Streetscaping projects encourage more walking and biking, increase land values, and calm traffic.

3.5.8 Bicycle Parking

Bicycle parking facilities are intended to provide short-term bicycle parking, and include racks which permit the locking of the bicycle frame and at least one wheel to the rack and support the bicycle in a stable position without damage to wheels, frame or components. Such facilities encourage cycling and promote proper bicycle parking.



Where the placement of racks on sidewalks is not possible (e.g., due to narrow sidewalk width, sidewalk obstructions, or other issues), bicycle parking can be provided in the street where on-street vehicle parking is allowed. Two possible options for creating parking in the street include clustered racks in a vehicle parking space protected by bollards or curbs, and racks installed on sidewalk curb extensions where adequate sight distance exists. Installing bicycle parking directly in a car parking space incurs only the cost of the racks and bollards or other protective devices.



A curb extension is more expensive to install, and can be prohibitively expensive if substantial drainage and/or utility work is necessary. Costs may be less if the curb extension is installed as part of a larger street or pedestrian improvement project. While on-street bicycle parking may take space away from the automobile parking, there are ways to mitigate auto parking loss: Additional auto parking spaces can be created by consolidating driveways, moving fire hydrants, or otherwise finding places where it may be possible to permit auto parking where it is currently prohibited. Options for combining bicycle and motorcycle parking also exist.

On-street bicycle parking may be installed at intersection corners or at mid-block locations. Mid-block on-street parking may be closer to cyclists' destinations, although it could force cyclists to dismount and walk to the parking site if access from the street is difficult or dangerous. Combining a mid-block pedestrian crossing with mid-block on-street parking could mitigate this situation.

3.5.9 Wayfinding / Signage

Landmarks, natural features, civic destinations, neighborhood business districts and other visual cues help residents and visitors navigate through Watervliet. Placing signs throughout the city indicating to bicyclists their direction of travel, location of destinations, and the distance to those destinations will increase users' comfort and

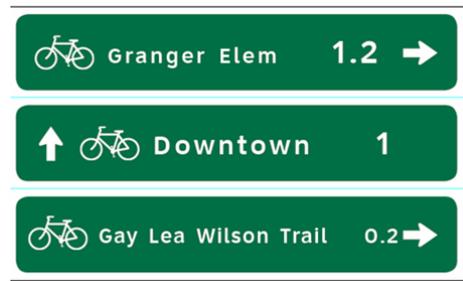
convenience of the bicycle system. Wayfinding signs also visually cue motorists that they are driving along a bicycle route and should use caution. Signage can serve both wayfinding and safety purposes including:

- Helping to familiarize users with the bikeway system
- Helping users identify the best routes to destinations
- Helping to address misperceptions about travel time and distance
- Helping overcome a “barrier to entry” for people who do not bicycle often and who fear becoming lost

Wayfinding signs are a relatively cost-effective means for improving the walking and bicycling environment. Signs are typically placed at key locations leading to and along bicycle routes, including the intersection of multiple routes. The City should create a community-wide Bicycle Wayfinding Signage Plan that identifies:

- Sign locations along existing and planned bicycle routes
- Sign type – what information should be included and what is the sign design
- Destinations to be highlighted on each sign – key destinations for bicyclists
- Approximate distance and riding time to each destination

The City of Watervliet should adopt a wayfinding signage system. It can be similar to the MUTCD-approved sign shown to the right for use along bicycle facilities, or the community specific wayfinding system shown below.



Model MUTCD-Approved Wayfinding Signage



4 Implementation

4.1 Plan Adoption

The Watervliet City Council should adopt a resolution in support of the bike master plan. This will allow for public support of the catalyst projects and help continue the momentum created by the development of the plan. It will also support future funding applications.

4.2 Bicycle Friendly Community Goals

The City of Watervliet can begin by comparing current programs to those of other similarly sized bicycle friendly communities. Watervliet should complete an application in the coming years and set a goal for achieving bronze, silver, gold or even platinum status within a set time frame. Even a bronze level designation would make Watervliet the first BFC in the Capital Region.

4.3 Performance Measures

Performance measures are a means of gauging the effectiveness of bicycle improvements. They can be used to evaluate progress towards adopted goals. The performance measures should be based on the following principles:

- A process that is policy-driven and can be supported by data.
- The measures reflect the users' experience on the system.
- The results are understandable to the general public.
- The application of the performance measures to programs and projects result in data that can be projected into the future.

The key to a successful benchmarking program is to have data that can be collected within the available resources, that is consistently available over time, and is reported in a format that allows year-to-year comparisons. With careful planning, the data system can serve as a core tool for system management in the long term, both to track performance and to ensure that resources are available and well managed. Performance measures can be collected through user counts, user surveys, land use, and land values. Vehicle miles traveled and vehicle counts on adjacent streets can also help to determine if vehicle trip are being replaced by trail use. The National Bicycle and Pedestrian Documentation Project (www.bikepeddocumentation.org) provides resources for bike/ped data collection.

4.4 Bicycle / Complete Streets Policies

The City of Watervliet can adopt a policy that includes appropriate infrastructure for bicycling, walking and trails into ongoing roadway projects. This policy will support the NY State Complete Streets legislation that passed in 2011. A similar policy is currently being proposed in the City of Troy.

4.5 Funding Opportunities

The following section outlines sources of funding for bicycle and pedestrian projects in New York State. Federal, state, local, and private sources of funding are identified. The following descriptions are intended to provide an overview of available options and do not represent a comprehensive list. Funding sources can be used for a variety of activities, including: planning, design, implementation and maintenance. Additionally, the City should take advantage of funding provided for other roadway projects, such as repaving and water/sewer main replacement to install bicycle and pedestrian accommodations. It should be noted that this section reflects the funding available at the time of writing. The funding amounts, fund cycles, and even the programs themselves are susceptible to change without notice.

Federal transportation funding is typically directed through state agencies to local governments either in the form of grants or direct appropriations, independent from state budgets. Federal funding typically requires a local match of 20%, although there are sometimes exceptions, such as the recent American Recovery and Reinvestment Act stimulus funds, which did not require a match.

The following is a list of possible Federal funding sources that could be used to support construction of many pedestrian and bicycle improvements. Most of these are competitive and involve the completion of extensive applications with clear documentation of the project need, costs, and benefits. However, it should be noted that the FHWA encourages the construction of pedestrian and bicycle facilities as an incidental element of larger ongoing projects. Examples include providing paved shoulders on new and reconstructed roads, or building sidewalks, on-street bikeways, trails and marked crosswalks as part of new highways.

4.5.1 Moving Ahead for Progress in the Twenty-First Century (MAP-21)

The largest source of federal funding for bicycle and pedestrian is the US DOT's Federal-Aid Highway Program, which Congress has reauthorized roughly every six years since the passage of the Federal-Aid Road Act of 1916. The latest act, Moving Ahead for Progress in the Twenty-First Century (MAP-21) was enacted in July 2012 as Public Law 112-141. The Act replaces the Safe, Accountable, Flexible, Efficient Transportation Equity Act – a Legacy for Users (SAFETEA-LU), which was valid from August 2005 - June 2012.

MAP-21 authorizes funding for federal surface transportation programs including highways and transit for the 27 month period between July 2012 and September 2014. It is not possible to guarantee the continued availability of any listed MAP-21 programs, or to predict their future funding levels or policy guidance. Nevertheless, many of these programs have been included in some form since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991, and thus may continue to provide capital for active transportation projects and programs.

In New York State, federal monies are administered through the New York State Department of Transportation (NYSDOT) and metropolitan planning organizations (MPOs). Most, but not all, of these programs are oriented toward transportation versus recreation, with an emphasis on reducing auto trips and providing inter-modal connections. Federal funding is intended for capital improvements and safety and education programs, and projects must relate to the surface transportation system.

There are a number of programs identified within MAP-21 that are applicable to bicycle and pedestrian projects. These programs are discussed below.

More information: <http://www.fhwa.dot.gov/map21/summaryinfo.cfm>

Transportation Alternatives

Transportation Alternatives (TA) is a new funding source under MAP-21 that consolidates three formerly separate programs under SAFETEA-LU: Transportation Enhancements (TE), Safe Routes to School (SR2S), and the Recreational Trails Program (RTP). These funds may be used for a variety of pedestrian, bicycle, and streetscape projects including sidewalks, bikeways, multi-use paths, and rail-trails. TA funds may also be used for selected education and encouragement programming such as Safe Routes to School, despite the fact that TA does not provide a guaranteed set-aside for this activity as SAFETEA-LU did. Unless the Governor of a given state chooses to opt out of Recreational Trails Program funds, dedicated funds for recreational trails continue to be provided as a subset of TA. MAP-21 provides \$85 million nationally for the RTP.

Complete eligibilities for TA include:

1. **Transportation Alternatives** as defined by Section 1103 (a)(29). This category includes the construction, planning, and design of a range of bicycle and pedestrian infrastructure including “on-road and off-road trail facilities for pedestrians, bicyclists, and other non-motorized forms of transportation, including sidewalks, bicycle infrastructure, pedestrian and bicycle signals, traffic calming techniques, lighting and other safety-related infrastructure, and transportation projects to achieve compliance with the Americans with Disabilities Act of 1990.” Infrastructure projects and systems that provide “Safe Routes for Non-Drivers” is a new eligible activity. For the complete list of eligible activities, visit: http://www.fhwa.dot.gov/environment/transportation_enhancements/legislation/map21.cfm

2. **Recreational Trails.** TA funds may be used to develop and maintain recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses. Examples of trail uses include hiking, bicycling, in-line skating, equestrian use, and other non-motorized and motorized uses. These funds are available for both paved and unpaved trails, but may not be used to improve roads for general passenger vehicle use or to provide shoulders or sidewalks along roads.

Recreational Trails Program (RTP) funds may be used for:

- Maintenance and restoration of existing trails
- Purchase and lease of trail construction and maintenance equipment
- Construction of new trails, including unpaved trails
- Acquisition or easements of property for trails
- State administrative costs related to this program (limited to seven percent of a state's funds)
- Operation of educational programs to promote safety and environmental protection related to trails (limited to five percent of a state's funds)

Under MAP-21, dedicated funding for the RTP continues at FY 2009 levels – roughly \$85 million annually. New York State will receive \$2.2 million in RTP funds per year through FY2014.

3. **Safe Routes to School.** The purpose of the Safe Routes to Schools eligibility is to promote safe, healthy alternatives to riding the bus or being driven to school. Education and enforcement projects must be within two miles of primary or middle schools (K-8). Eligible projects may include:

- *Education Efforts.* These programs are designed to teach children safe bicycling and walking skills while educating them about the health benefits, and environmental impacts. Projects and programs may include creation, distribution and implementation of educational materials; safety based field trips; interactive bicycle/pedestrian safety video games; and promotional events and activities (e.g., assemblies, bicycle rodeos, walking school buses).
- *Enforcement Efforts.* These programs aim to ensure that traffic laws near schools are obeyed. Law enforcement activities apply to cyclists, pedestrians and motor vehicles alike. Projects may include development of a crossing guard program, enforcement equipment, photo enforcement, and pedestrian sting operations.

4. Planning, designing, or constructing roadways within the right-of-way of former Interstate routes or divided highways. At the time of writing, detailed guidance from the Federal Highway Administration on this new eligible activity was not available.

Average annual funds available through TA over the life of MAP-21 equal \$814 million nationally, which is based on a 2% set-aside of total MAP-21 authorizations. Projected apportionments for New York State total \$32.4 million for FY 2013 and \$32.7 million for FY 2014. Note that state DOT's may elect to transfer up to 50% of TA funds to other highway programs, so the amount listed above represents the maximum potential funding. Remaining TA funds (those monies not re-directed to other highway programs) are disbursed through a separate competitive grant program administered by NYSDOT. Local governments, school districts, tribal governments, and public lands agencies are permitted to compete for these funds.

Surface Transportation Program

The Surface Transportation Program (STP) provides states with flexible funds which may be used for a variety of highway, road, bridge, and transit projects. A wide variety of bicycle and pedestrian improvements are eligible, including on-street bicycle facilities, off-street trails, sidewalks, crosswalks, bicycle and pedestrian signals, parking, and other ancillary facilities. Modification of sidewalks to comply with the requirements of the Americans with Disabilities Act (ADA) is also an eligible activity. Unlike most highway projects, STP-funded bicycle and pedestrian facilities may be located on local and collector roads which are not part of the Federal-aid Highway System. 50% of each state's STP funds are suballocated geographically by population; the remaining 50% may be spent in any area of the state.

Highway Safety Improvement Program

MAP-21 doubles the amount of funding available through the Highway Safety Improvement Program (HSIP) relative to SAFETEA-LU. HSIP provides \$2.4 billion nationally for projects and programs that help communities achieve significant reductions in traffic fatalities and serious injuries on all public roads, bikeways, and walkways. MAP-21 preserves the Railway-Highway Crossings Program within HSIP but discontinues the High-Risk Rural roads set-aside unless safety statistics demonstrate that fatalities are increasing on these roads. Bicycle and pedestrian safety improvements, enforcement activities, traffic calming projects, and crossing treatments for non-motorized users in school zones are eligible for these funds. NYSDOT estimates that they will receive an average of \$92.8 million annually for this program through the lifetime of MAP-21.

CDTC SPOT Program

The Capital District Transportation Committee (CDTC) Transportation Improvement Program (TIP) endorses a “Spot Improvements for Bicycle and Pedestrian Access” program. This ongoing program sets aside \$625,000 in federal funding to support bicycle and pedestrian projects that address problems at specific locations such as intersection, short lengths of roadway, or single destinations (e.g. an office building or shopping center). They can be distinguished from other bicycle and pedestrian-related projects such as development of new trails in that they bridge physical or functional gaps in the system rather than in and of themselves providing new routes. CDTC will be soliciting for new Spot Improvement projects in January 2014.

Enhance Mobility of Seniors and Individuals with Disabilities

MAP-21 continues a formula grant program that provides capital and operating costs to provide transportation services and facility improvements that exceed those required by the Americans with Disabilities Act. Examples of pedestrian/accessibility projects funded in other communities through “Enhance Mobility of Seniors and Individuals with Disabilities” include installing Accessible Pedestrian Signals (APS), and enhancing transit stops to improve accessibility.

More information: <http://www.fta.dot.gov>

Pilot Transit-Oriented Development Planning

MAP-21 establishes a new pilot program to promote planning for Transit-Oriented Development. At the time of writing the details of this program are not fully clear, although the bill text states that the Secretary of Transportation may make grants available for the planning of projects that seek to “facilitate multimodal connectivity and accessibility,” and “increase access to transit hubs for pedestrian and bicycle traffic.”

Partnership for Sustainable Communities

Founded in 2009, the Partnership for Sustainable Communities is a joint project of the Environmental Protection Agency (EPA), the U.S. Department of Housing and Urban Development (HUD), and the U.S. Department of Transportation (USDOT). The partnership aims to “improve access to affordable housing, more transportation options, and lower transportation costs while protecting the environment in communities nationwide.” The Partnership is based on five Livability Principles, one of which explicitly addresses the need for bicycle and pedestrian infrastructure (“Provide more transportation choices: Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation’s dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health”).

The Partnership is not a formal agency with a regular annual grant program. Nevertheless, it is an important effort that has already led to some new grant opportunities (including both TIGER I and TIGER II grants). The City of Watervliet should track Partnership communications and be prepared to respond proactively to announcements of new grant programs. Initiatives that speak to multiple livability goals (such as partnerships with CDTA, or with affordable housing groups) are more likely to score well than initiatives that are narrowly limited in scope to bicycle and pedestrian efforts.

More information: <http://www.sustainablecommunities.gov/grants.html>

Community Development Block Grants

The Community Development Block Grants (CDBG) program provides money for streetscape revitalization, which may be largely comprised of pedestrian improvements. Federal CDBG grantees may “use Community Development Block Grants funds for activities that include (but are not limited to): acquiring real property; reconstructing or rehabilitating housing and other property; building public facilities and improvements, such as streets, sidewalks, community and senior citizen centers and recreational facilities; paying for planning and administrative expenses, such as costs related to developing a consolidated plan and managing Community Development Block Grants funds; provide public services for youths, seniors, or the disabled; and initiatives such as neighborhood watch programs.” Pedestrian and Bicycle Master Plan projects that enhance accessibility are the best fit for this funding source. CDBG funds could also be used to write an ADA Transition Plan for the city.

More information: www.hud.gov/cdbg

Community Transformation Grants

Community Transformation Grants administered through the Center for Disease Control support community-level efforts to reduce chronic diseases such as heart disease, cancer, stroke, and diabetes. Active transportation infrastructure and programs that promote healthy lifestyles are a good fit for this program, particularly if the benefits of such improvements accrue to population groups experiencing the greatest burden of chronic disease.

More info: <http://www.cdc.gov/communitytransformation/>

Land and Water Conservation Fund

The Land and Water Conservation Fund (LWCF) provides grants for planning and acquiring outdoor recreation areas and facilities, including trails. Funds can be used for right-of-way acquisition and construction. The program is administered by the NYS Office of Parks, Recreation, and Historical Preservation as a grant program. Any Pedestrian and Bicycle Master Plan projects located in future parks could benefit from planning and land acquisition funding through the LWCF. Trail corridor acquisition can be funded with LWCF grants as well.

More info: <http://www.nps.gov/lwcf/>

Rivers, Trails, and Conservation Assistance Program

The Rivers, Trails, and Conservation Assistance Program (RTCA) is a National Parks Service (NPS) program providing technical assistance via direct NPS staff involvement to establish and restore greenways, rivers, trails, watersheds and open space. The RTCA program provides only for planning assistance—there are no implementation monies available. Projects are prioritized for assistance based on criteria including conserving significant community resources, fostering cooperation between agencies, serving a large number of users, encouraging public involvement in planning and implementation, and focusing on lasting accomplishments. This program may benefit trail development in the City of Watervliet indirectly through technical assistance, particularly for community organizations, but should not be considered a future capital funding source.

More info: <http://www.nps.gov/pwro/rtca/who-we-are.htm>

4.5.2 Additional Federal Funding

The landscape of federal funding opportunities for bicycle and pedestrian programs and projects is always changing. A number of Federal agencies, including the Bureau of Land Management, the Department of Health and Human Services, the Department of Energy, and the Environmental Protection Agency have offered grant programs amenable to bicycle and pedestrian planning and implementation, and may do so again in the future. For up-to-date information about grant programs through all federal agencies, see <http://www.grants.gov/>

4.5.3 New York State Funding

Several specific NYS funding sources are detailed below; however, the best source of state funding is the consolidated funding application (CFA). The CFA's are typically due in August of each year and the application applies for a variety of state programs and funding.

NYSDOS – Local Waterfront Revitalization Program (LWRP)

The Department of State works with communities in the Hudson Valley Region through the Local Waterfront Revitalization Program to promote community revitalization and resource protection through community-based plans and projects. The Department of State provides funding through the Environmental Protection Fund for projects that enhance public access to waterways and state lands, promote sustainable economic development, protect and improve water quality, and revitalize hamlets and downtowns. Eligible activities include planning, feasibility, design and construction of trails, and streetscape enhancements.

Consolidated Local Street and Highway Improvement Program (CHIPS)

A New York State-funded program administered through the NYSDOT to assist localities in financing the construction, reconstruction or improvement of local highways, bridges, highway-railroad crossings and other local facilities. Eligible CHIPS bicycle and pedestrian projects include: bike lanes and wide curb lanes, shoulder improvements, roundabouts, new signs, new or upgraded traffic signals and traffic calming installations (www.dot.ny.gov/programs/chips).

NYS Department of Health- Preventative Health and Health Services (PHHS) Block Grant

The Preventive Health and Health Services (PHHS) Block Grant provides funding for health problems in the state of New York that range from tuberculosis to adult physical activity. PHHS Block Grant dollars fund a total of 19 different New York State health programs, including the Healthy Heart Program. PHHS Block Grant funds are used to promote and evaluate increases in the number of adults participating in regular sustained physical activity. From 1995-2004, nearly 1.2 million New York State residents received help from local HHP contractors to increase their physical activity levels (www.health.ny.gov/funding/grants/block_grant.htm).

4.5.4 Private Foundations

Private foundations are an increasingly important source of funds for bicycle and pedestrian planning and implementation. More info: <http://www.foundationcenter.org/>