RESOLUTION 2019-168
SUPPORT FOR THE ROUTE 9 ACTIVE TRANSPORTATION CORRIDOR STUDY

Mayor Smith offered the following resolution, which was seconded by Trustee Gilliland and adopted:

WHEREAS, interested residents and officials from the Villages of Hastings-on-Hudson, Dobbs Ferry, Irvington, Tarrytown and Sleepy Hollow (the "Rivertowns") have been working together since 2016 as a Steering Committee jointly studying traffic, safety, pedestrian and bicycle access conditions in connection with their shared "Route 9 Corridor;" and

WHEREAS, the new Governor Mario M. Cuomo Bridge includes a dedicated bicycle/pedestrian lane scheduled to open in 2019, bringing with it new transportation and recreational opportunities to Rivertowns residents and a significant increase in bicycle traffic on Route 9 from neighboring areas of Westchester, areas west of the Hudson River and New York City; and

WHEREAS, by Resolution, dated July 20, 2016, the Irvington Board of Trustees approved the submission of an application by Sustainable Westchester on behalf of the Steering Committee and the five participating villages for a $150,000 grant from the New NY Bridge Community Benefits Program to fund a proposed Active Transportation Corridor Study and Plan along U.S. Route 9 in the Rivertowns and interconnecting with the planned bicycle-pedestrian lane on the New NY Bridge (the "Project"); and

WHEREAS, after the application was favorably received and the grant was awarded, the Steering Committee, through the administrative support of the Village of Irvington, procured the services of transportation consultant Nelson\Nygaard to perform a conceptual study evaluating the potential for implementing a shared roadway strategy along Route 9 (the "Study"); and

WHEREAS, the Study included extensive public outreach, including five open-house sessions, a public survey and the maintenance of a website to share information with and receive comments from the general public; and

WHEREAS, the Study demonstrated the potential to build a bike-pedestrian connection between the five Villages and the new Mario M. Cuomo Bridge, and examined related issues concerning safety, transit access, traffic calming, walkability, sidewalks, crosswalk configurations, parking availability and motor vehicle level of service; and

WHEREAS, the implementation of the Project over the full Project area is expected to result in significant health and lifestyle enhancements for Rivertowns residents and increased tourism and economic benefit for the area merchants; and

WHEREAS, the Steering Committee and Nelson\Nygaard convened a public meeting to present the completed Study to the public at Mercy College on November 17, 2018 and the completed study and other plan documents continue to be available to the public on route9active.org; and

WHEREAS, the Board of Trustees has reviewed the Study and agrees in principle with that the goals contained therein are worthy of further consideration and pursuit; now therefore be it

RESOLVED, that the Board of Trustees supports the concept of dedicated bike lanes, but has significant concerns about their viability and potential impact on traffic and pedestrian safety throughout the Route 9 corridor in the Village of Irvington, including but not necessarily limited to:

- The traffic impact, particularly on the full length of North Broadway and on South Broadway from Main Street to Harriman Road
- Loss of parking near the business district
- Impact on and interaction with driveways from adjacent bike lanes; and

FURTHER RESOLVED, that the Board of Trustees encourages future development of the Route 9 Active Corridor plan, with a keen focus on vehicle and pedestrian safety.

STATE OF NEW YORK }
}
COUNTY OF WESTCHESTER } **ss:**
}

I, Brenda Jeselnik, Clerk-Treasurer of the Village of Irvington, County of Westchester, State of New York do hereby certify that I have compared the foregoing copy of this Resolution with the original on file in my office, and that the same is a true and correct transcript of said original Resolution and of the whole thereof, as duly adopted by said Village Board of Trustees at a meeting duly called and held at the Village of Irvington on December 18, 2019 by the required and necessary vote of the members to approve Resolution.

WITNESS my hand and the official seal of the Village of Irvington, NY, this 2nd day of March 2020.

Brenda Jeselnik, Clerk-Treasurer

Route 9 Active Transportation Conceptual Design Plan

Final Report

November 2018

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Contents

1 **Introduction** **1-1**
- Background 1-1
- Why an Active Transportation Plan? 1-3
- How Is This Plan Structured? 1-8

2 **Moving Along Route 9 Today** **2-9**
- Travel Behavior 2-12
- Existing Plans, Programs, and Policies 2-34
- Community Input 2-36

3 **Network Development** **3-39**
- Goals 3-39
- Principles 3-39
- Design Guidelines 3-40
- Opportunities and Constraints 3-50
- Potential Bike Facilities Suitable for Route 9 3-52

4 **Design Alternatives** **4-53**
- Development of the Alternatives 4-53

5 **Conceptual Design** **5-1**

6 **Action Plan** **6-4**
- Project List and Key Actions 6-4
- Potential Funding Sources 6-1

7 **Supportive Programs, Policies, & Procedures** **7-5**
- Programs 7-5
- Policies 7-8
- Procedures 7-9

Appendices

Appendix A: Traffic Analysis

Appendix B: Transit Analysis – Existing Conditions

Appendix C: Public Outreach

Appendix D: Cost Estimates

Appendix E: Projected Traffic Analysis Under Conceptual Design Conditions

1 INTRODUCTION

The Route 9 Active Transportation Conceptual Plan is a collaborative effort of a five village consortium of Dobbs Ferry, Hastings-on-Hudson, Irvington, Sleepy Hollow, and Tarrytown (collectively, the "Village Consortium")who have worked together as part of the Inter-Municipal Historic Hudson River Towns agreement. Even though these villages are connected by Route 9, the Hudson, Metro-North Railroad, and the Bee-Line, Route 9 also serves to divide many community residents from each other and from valued community assets. This project is intended to promote the historic, cultural and natural resources of the area while enhancing access to the Governor Mario M. Cuomo Bridge, accommodating a variety of transportation options, and improving traffic safety for all modes. It creates solutions that support local economies and tourism, and complements improved waterfront access and riverfront redevelopment.

BACKGROUND

As Route 9 winds its way north from Hastings through the five Historic Hudson River towns collaborating on this project, it is easy to miss the monuments erected to celebrate some of the characters that traveled this path over the centuries – Major John Andre, Washington Irving, and the Headless Horseman among them. It's also easy to miss the fact that a half dozen Historic Places like Irvington's Main Street or Lyndhurst have Broadway addresses, and even more are within walking distance. Today's theatres, business and social destinations, and schools are overshadowed by trucks and passenger cars traveling along the iconic extension of New York City's most famous main street.

Residents and visitors alike are challenged to navigate along or across most of the Route 9 corridor by bus, bike and walking due to a steady stream of 4,000 to 75,000 vehicles per day, long distances between protected crossings, poor wayfinding, and missing sidewalks. For long stretches, narrow and obstructed sidewalk immediately adjacent to moving traffic is limited to the river side of the road, making access to transit and commercial districts on foot an unpleasant challenge for people across the street. Riverfront parks and Metro-North train stations are within bicycling distance to most residents of the villages, but topography and lack of infrastructure make them inaccessible to all but the hardiest of people on bikes.

The corridor is served by Westchester Bee Line's bus routes, and while this leads to a reasonable quantity of service at some points, bus schedules are not coordinated to ease transfers and service is relatively infrequent during off-peak hours. Bus stops vary as to amenity and connectivity: most have no shelter, some have no curb, no sidewalk connections, or are too short, and the stops would benefit from a re-spacing. Due to the topography, bus routes generally do not serve the rail stations in each village, and sometimes fail to serve the main business street.

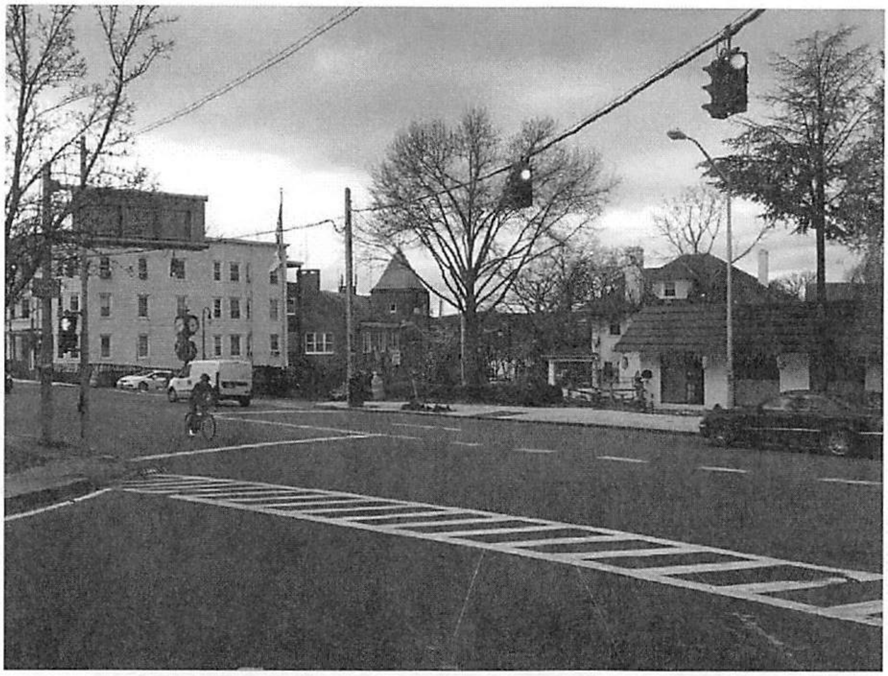
Many parts of Route 9, including segments in Sleepy Hollow, have been road dieted over the last ten years, which has relieved some of the pressure still felt in other places along the corridor, where left turning motorists have to navigate the pressures of both finding a gap in oncoming traffic and avoiding a rear-end collision with upcoming vehicles. Many intersections suffer from roadway geometry that favored the long trucks that served industrial and manufacturing sites along the Hudson. This project provided the opportunity to consider how some of the pressures of Route 9 between Hastings and Sleepy Hollow can be relieved by providing safe, connected, and attractive active transportation infrastructure that best supports the transportation challenges of the future.

The corridor includes numerous intersections with the Old Croton Aqueduct, and Main Street elements of River Walk. This study pays attention to street crossings and transit improvements at these crossings.

The consulting team has drawn from existing studies and plans, data collection, public meetings, and technical expertise to pilot and document a practical plan that can be submitted for final engineering before the end of 2018. This project will result in design that supports high quality vehicle access to the Governor Mario M. Cuomo Bridge, I-287, the Saw Mill Parkway and other high volume intersections, while providing continuous active transportation connectivity, and better safety and local business and residential access for all modes.

Figure 1 Students from local school adjacent to Route 9

Figure 2 Example of a multi-leg intersection in Sleepy Hollow that exposes people to turning vehicles



WHY AN ACTIVE TRANSPORTATION PLAN?

Improving walking and bicycling along and across Route 9 supports village goals related to community livability, safety, economic development, and the environment:

- More people bike when there is a safe and comfortable bicycle network.[1]
- Walking and bicycling are some of the most affordable ways for people to get around
- People riding bikes and walking spend more at local businesses than people driving.[2,3]
- Good bike infrastructure helps attract a talented, 21st-century workforce that fuels economy, producing jobs and economic growth.
- When more people walk and bike instead of drive, there is less motor vehicle traffic, which means a reduction in congestion and auto-related pollution.[4]

The primary purpose of the Route 9 Active Transportation Plan is to **create a safe, low-stress walking and bicycle network that is accessible and welcoming for people of all ages and abilities.**

Figure 3summarizes the community benefits of walking and biking.

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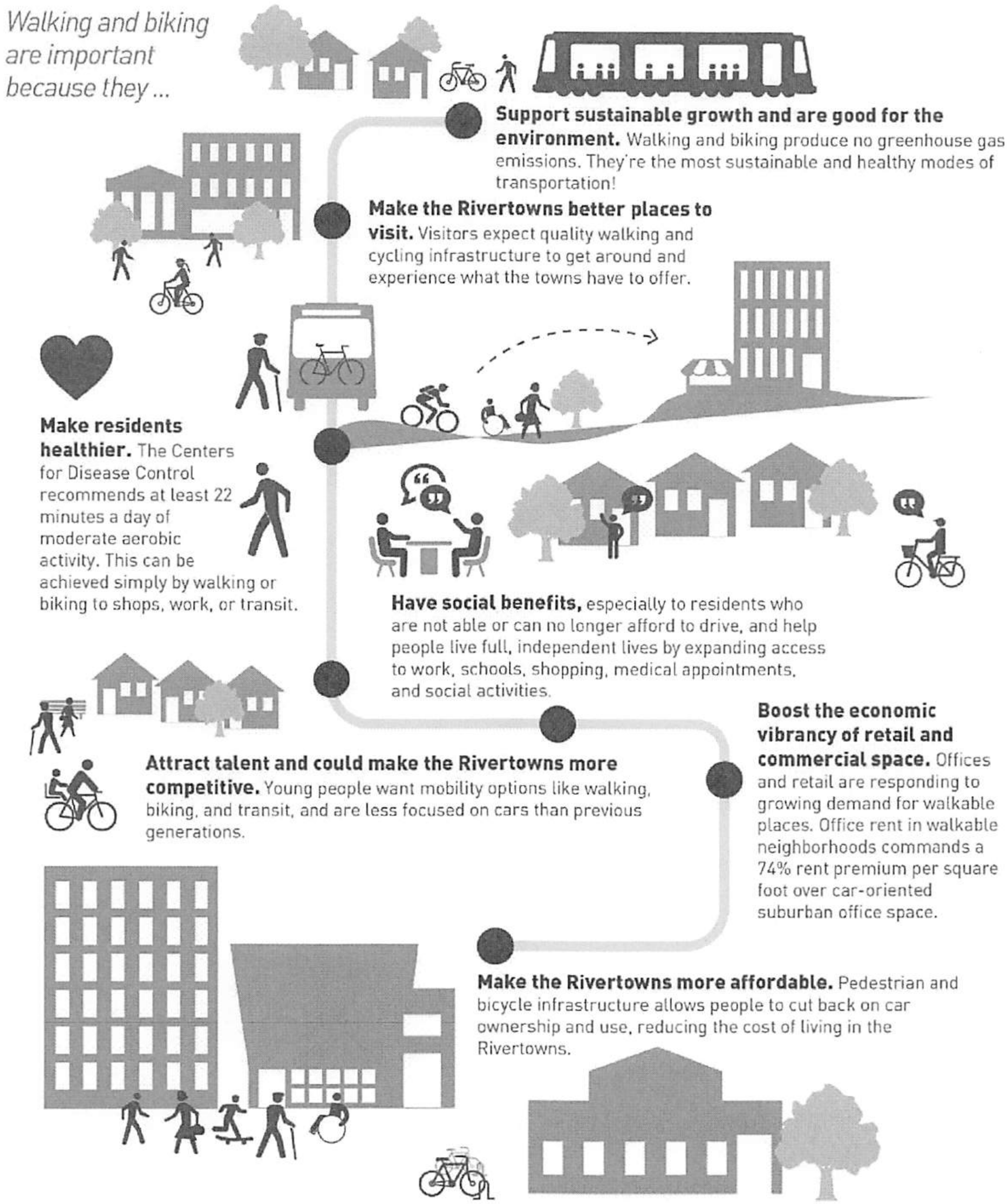
[1] 2014. Monsere, C., "Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S." https://trec.pdx.edu/research/project/583/Lessons_from_the_Green_Lanes:_Evaluating_Protected_Bike_Lanes_in_the_U.S._

[2] 2012. Transportation Alternatives. "East Village Shoppers Study: A Snapshot of Travel and Spending Patterns of Residents and Visitors in the East Village." https://www.transalt.org/sites/default/files/news/reports/2012/EV_Shopper_Study.pdf.

[3] 2012. Clifton et al. "Consumer Behavior and Travel Choices: A Focus on Cyclists and Pedestrians." https://nacto.org/wp-content/uploads/2015/04/consumer_behavior_and_travel_choices_clifton.pdf.

[4] 2010. Gardner, G. "Power to the Pedal". World Watch Magazine. http://www.worldwatch.org/node/6456.

Figure 3 Benefits of walking and biking



Street Designs That Support People Who Walk

A people-oriented street is welcoming, safe and accessible for people in all forms of transportation but especially on foot. The buildings, sidewalks and other features are all scaled to people, not cars.

Streets need to be designed so that walking trips are convenient, pleasant and safe. In order to make walking a favored mode for many there needs to be:

- High quality pedestrian infrastructure, especially near key destinations such as workplaces, transit, schools and shops
- Mixed land uses and densities to support active transport, and
- Choices of destinations

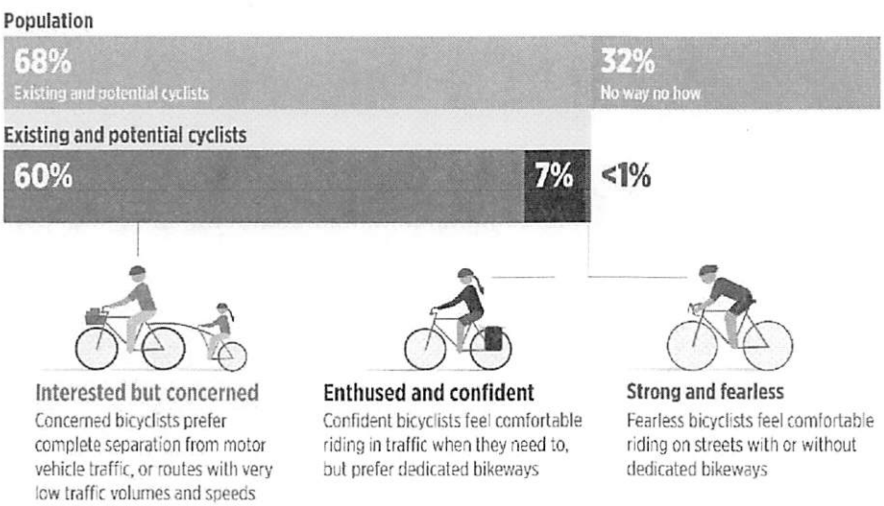
The location of key facilities such as shops and schools, close to homes and on the most convenient path between two major activity centers is key to ensuring a high level of active transport, and will also help ensure the sustainability of commercial activities.

Understanding People Who Bicycle

Most people fall into one of four bicycling categories: (1) strong and fearless, (2) enthused and confident, (3) interested but concerned, or (4) no way no how.

Approximately two-thirds of people say they would use a bicycle if they felt it was a safe and easy way to get around, while one-third are uninterested in cycling.[5] Of those that would consider bicycling, the vast majority of people (60%) are "interested but concerned"—people who would ride if they felt safe and comfortable. A much smaller proportion (7%) fall into the "enthused and confident" category: those who feel comfortable riding in traffic when necessary but prefer dedicated bikeways. Less than 1% of people are of the "strong and fearless" type that feel comfortable riding on any street, including in auto traffic. See Figure 4. Today Route 9 provides biking facilities that are comfortable only for the Strong and Fearless.

Figure 4 Four Types of Cyclists



Source: 'Four Types of Cyclists' by Roger Geller, Bicycle Coordinator for Portland, OR. 2009.

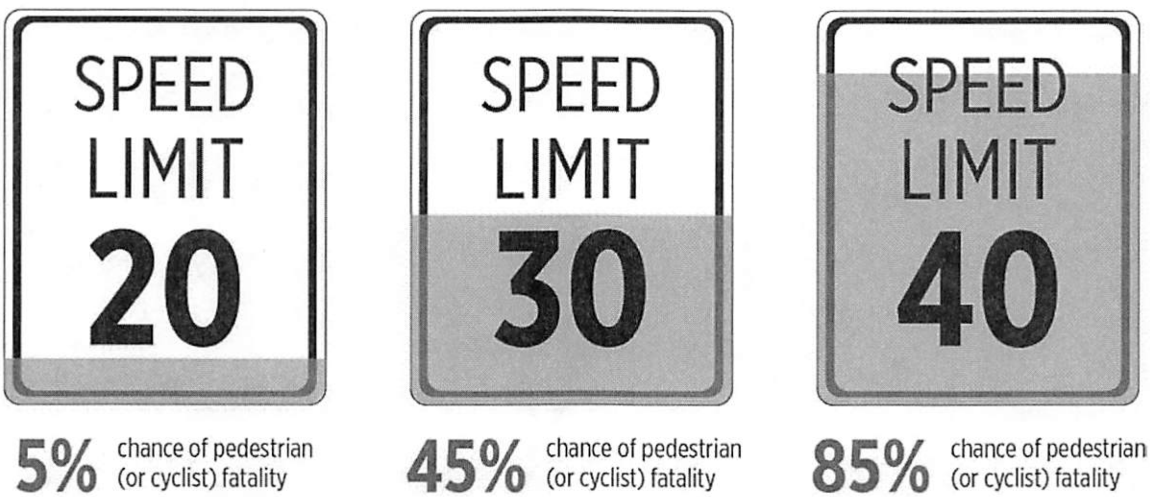
[5] Four Types of Cyclists by Roger Geller, Bicycle Coordinator for Portland, OR. 2009.

A robust network should not be just for people who are "strong and fearless"—it should be for everyone from ages eight to 80 (and beyond!). To achieve this, this Plan will focus on safety and stress reduction. Together, these have the power to encourage the Route 9 residents who are "interested but concerned" to get from point A to point B on a bike.

What Makes Walking and Biking Safer and More Comfortable?

This plan prioritizes street designs that minimize the potential for crashes. Because higher vehicle speeds are responsible for severe collisions, it is particularly important to physically separate people driving from people walking and biking on higher-speed, higher-traffic streets. This approach reduces the safety-related apprehension that keeps so many "interested but concerned" people from walking and biking along Route 9.

Figure 5 Effects of Speed on Pedestrians and Cyclists in Crashes



Source: Killing Speed and Saving Lives, UK Dept. of Transportation, London, England. See also Limpert, Rudolph. Motor Vehicle Accident Reconstruction and Cause Analysis. Fourth Edition. Charlottesville, VA. The Michie Company, 1994, p. 663.

People feel more comfortable biking where there are fewer vehicles, slower vehicle speeds, or a physical barrier (such as a curb, bollards, or planters) that protects people biking from adjacent traffic. The more interaction a person riding their bike has with cars, the more stressful the route. Streets with higher vehicle speeds and more cars feel dangerous for people bicycling. This perception of safety risk is an important deterrent to more bike riding.[6] Figure 6 shows what contributes to this stress: motor vehicle speeds and traffic volumes, two-way traffic, auto travel and parking lanes, street centerlines, and bike lane width. Similarly, people feel more comfortable walking where sidewalks have sufficient clearance space and are separated from moving traffic by parking. Narrower streets, two stage crossings, enhanced visibility, and lower traffic speeds also make walking more comfortable by making it easier to cross streets and minimizing the threat of dangerous driving behavior. See Figure 7.

[6] 2012. Mekuria, Furth, and Nixon. "Low-Stress Bicycling and Network Connectivity." <http://transweb.sjsu.edu/PDFs/research/1005-low-stress-bicycling-network-connectivity.pdf>

Figure 6 Contributors to Traffic Stress

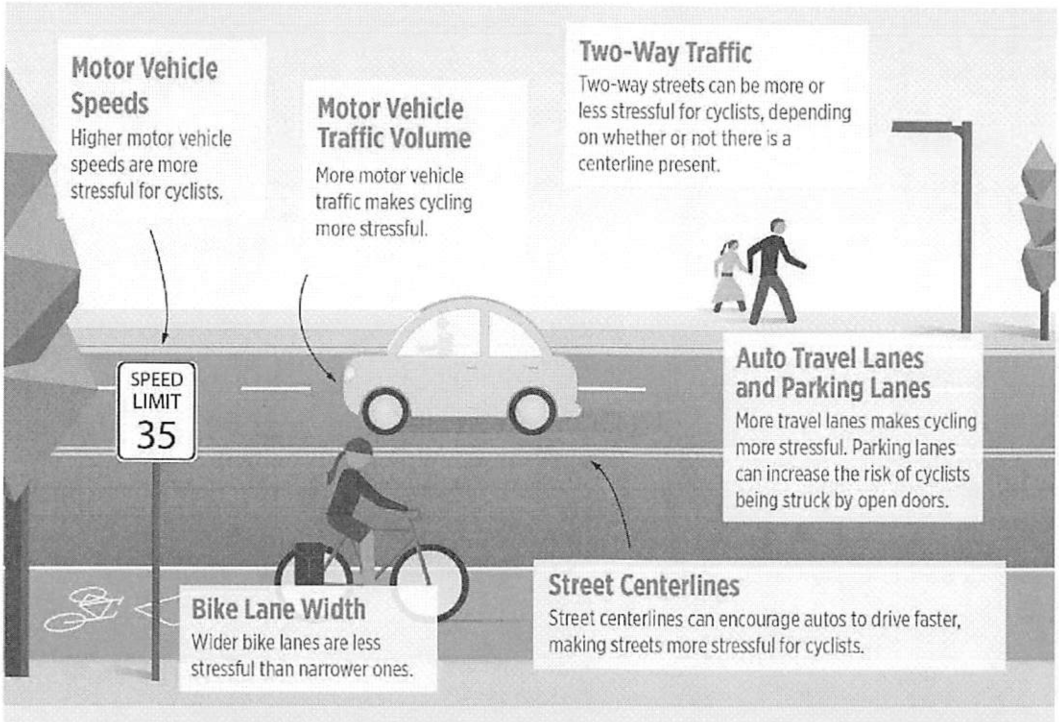
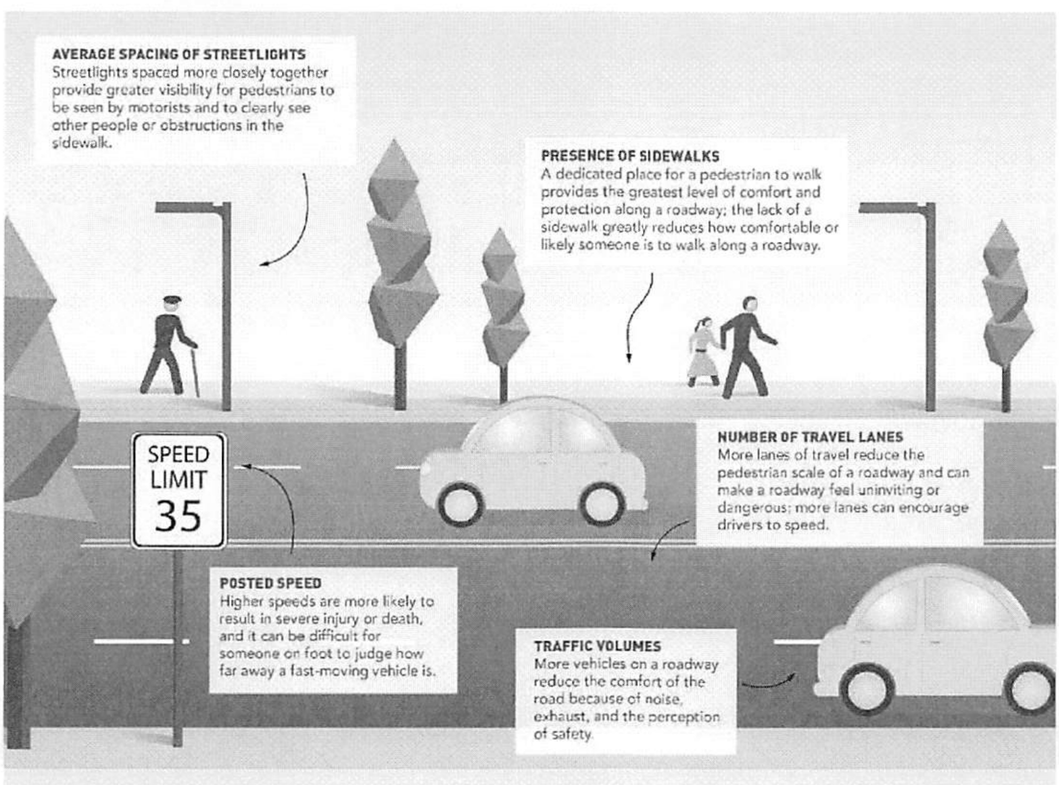


Figure 7 Contributors to Walking Comfort



HOW IS THIS PLAN STRUCTURED?

Following this introduction (Chapter 1), Route 9 Active Transportation Plan is made up of six chapters:

- **Chapter 2: How do people move along Route 9 today?** This chapter describes the existing mobility patterns and transportation network in the study area, its policy framework, and community feedback on moving along Route 9.
- **Chapter 3: Goals.** The Route 9 Active Transportation Plan goals help to guide the plan's recommendations, and provide a basis for monitoring performance over time.
- **Chapter 4: Active Transportation Network Development.** This chapter reveals a proposed pedestrian and bicycle network for Route 9. It also explains the principles that guided its creation, as well as the underlying set of analyses.
- **Chapter 5: Designing the Bicycle and Pedestrian Network.** Without design, an Active Transportation network is only a set of lines on a map. This chapter explains different design alternatives by segment.
- **Chapter 6: Conceptual Design.** This chapter provides the proposed design along the corridor.
- **Chapter 7: Implementation Plan.** The implementation plan outlines the list of projects, key action items, and potential funding sources. In other words, this chapter is a roadmap for implementation.
- **Chapter 8: Programs, policies, and procedures** to further support walking and bicycling within the study area.

2 MOVING ALONG ROUTE 9 TODAY

DEMOGRAPHICS

Like other suburban areas, the villages' booming growth between 1940 and 1970 settled into a relatively steady state with modest changes between 2000 and today. Overall, the current population stands at about 47,000 people across the study area. [7] (Figure 8)

Figure 8 Population Shifts of Study-Area Villages

Village	Population (2015)	Change since 2009
Hastings-on-Hudson	7,951	0.74%
Dobbs Ferry	11,055	-0.86%
Irvington	6,540	-1.65%
Tarrytown	11,452	2.47%
Sleepy Hollow	10,074	-0.2%
Total	**47,072**	**0.25%**

It's been a popular area to raise families, as suggested by the large number of people in the age ranges of 35-59 and under 20 years old. Residents in the 20-34 age group are a notably smaller share of the population in Hastings-on-Hudson and Irvington than in the other villages and the state. (Figure 9)

Figure 9 Population by Age Group, 2015

Village	19 & Under	20 to 34	35 to 59	60+
Hastings-on-Hudson	27.0%	9.9%	35.7%	27.6%
Dobbs Ferry	25.2%	17.5%	33.8%	23.4%
Irvington	28.5%	9.1%	42.5%	19.9%
Tarrytown	24.2%	20%	36%	19.7%
Sleepy Hollow	26.7%	15.5%	37.4%	20.5%
Average	26.2	14%	37.08	22.2
Westchester*	25.6	17.5	35.4	21.5
New York City	23.6	25	33.1	18.4
Total Population	**12,258**	**7,169**	**17,245**	**10,404**

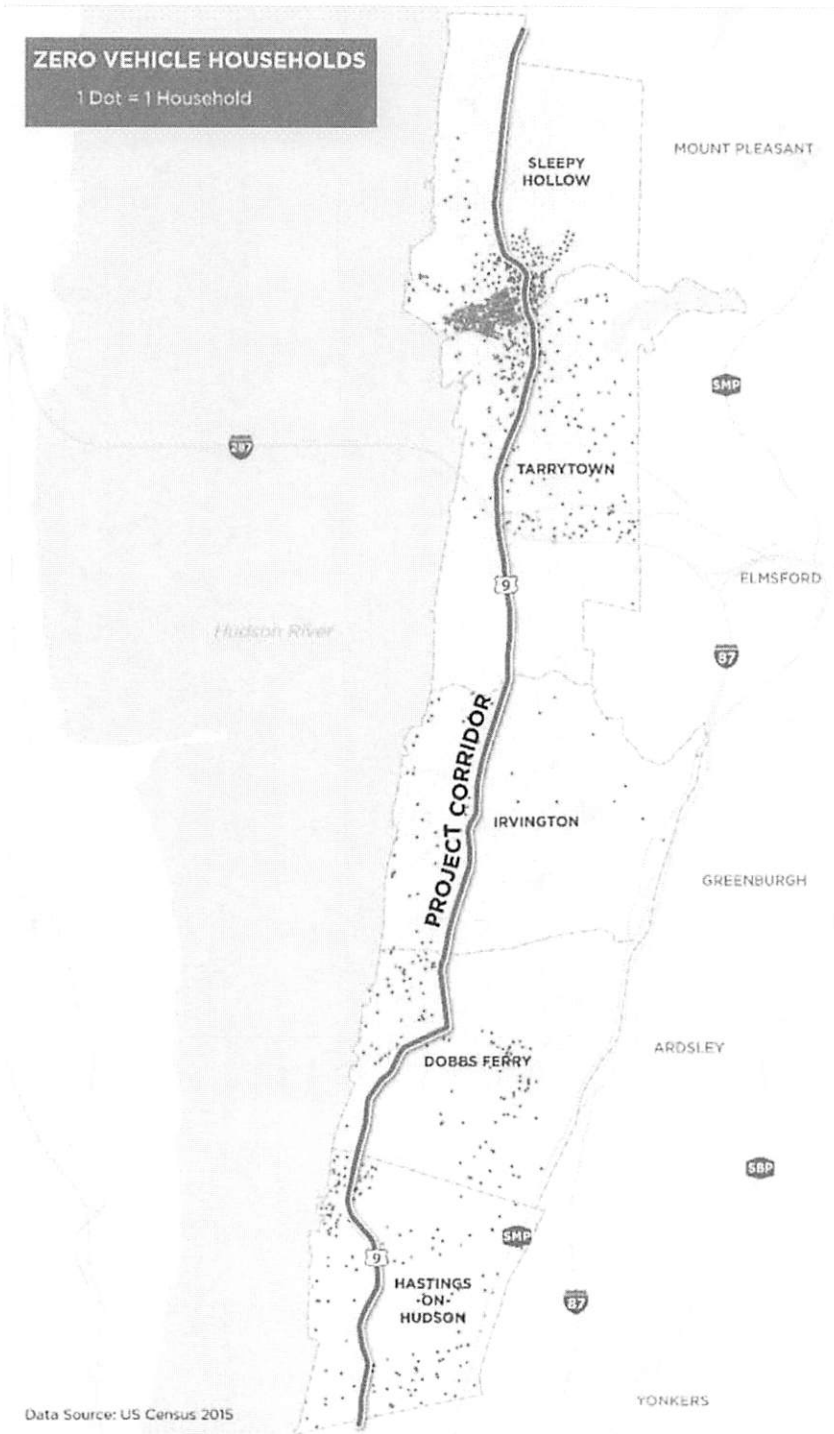
Because the study area is made up of mostly single-family housing units the population density is relatively low throughout much of the study area, with Hastings-on-Hudson, Dobbs Ferry, and Tarrytown north of I-287 having the highest density.

The majority of zero-vehicle households lie in the northern section of the corridor, encompassing neighborhoods in Sleepy Hollow. Additionally, there is a significant change in density when

[7] 2015 American Community Survey; * U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

comparing the neighborhoods west of Route 9 to the neighborhoods east of Route 9, especially in Irvington. The Metro North Train Stations are all located to the west of the corridor, supporting the higher density of zero-vehicle households. Figure 10 shows where households with zero vehicles are located, by census block group along the corridor.

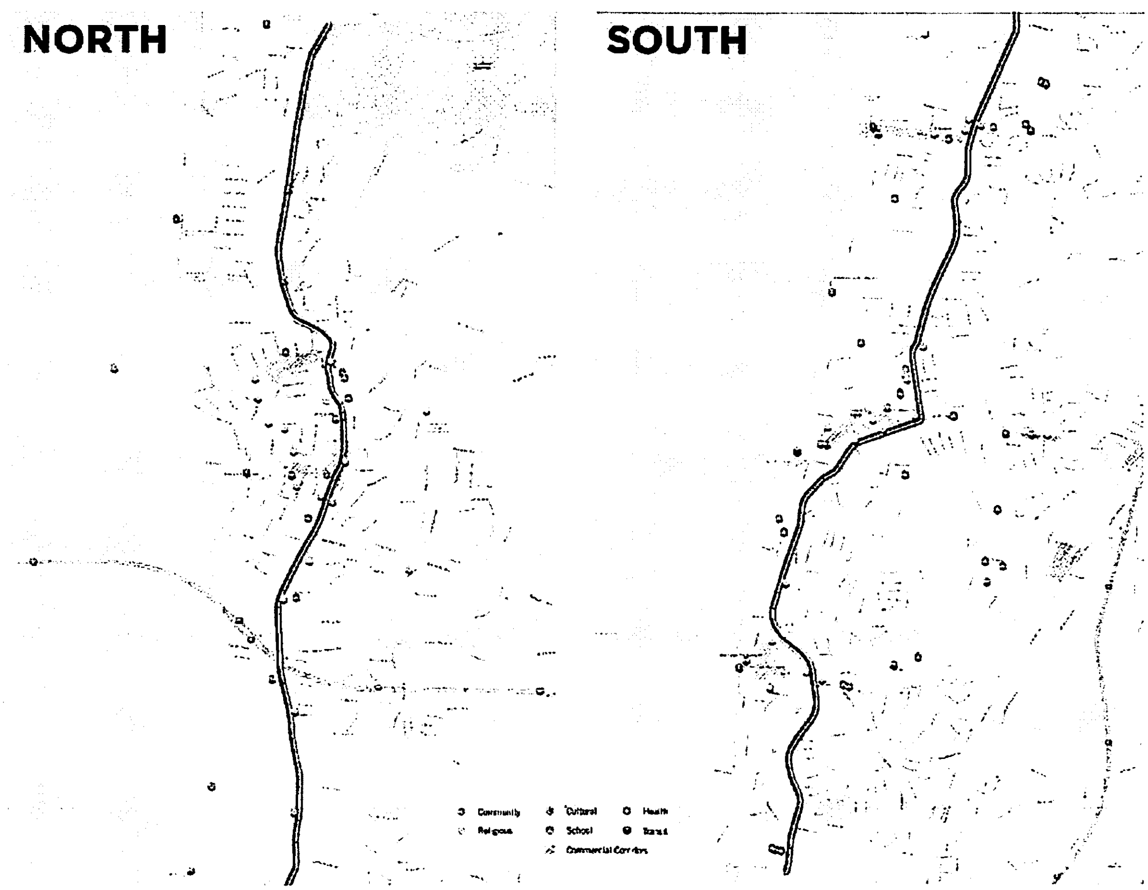
Figure 10 Zero Vehicle Households



KEY DESTINATIONS

Many of the commercial corridors or key destinations in the study area can be found immediately along, or within a few blocks of, Route 9. Most notably, most of the schools and churches (destinations that are typically frequented by families and children within a walkable or bikeable proximity) in the study area can be found along or within five blocks of Route 9. Many of the area's cultural and historic sites, which draw in visitors both locally and from further afield, are also immediately accessible from Route 9 or can be found within a short walking distance. All told, there is great potential for key local destinations, as well as the commercial, cultural, and historic richness of the area, to be served by a complete Route 9 that maximizes opportunities for users to walk, bike, or ride transit. Figure 11.

Figure 11 Key Destinations within the Study Area



LAND-USE

As Route 9 winds its way north from Hastings-on-Hudson north to Sleepy Hollow, it passes through areas of varying land use. The majority of the adjacent land areas are large parcels with single-family residential development. There are pockets of greater density comprised of multi-family residential buildings, as well as areas used for commercial, retail, institutional and public assembly purposes. There is a greater concentration of mixed land uses and higher levels of density close to I-287.

Waterfront redevelopment projects are occurring throughout the five villages. Many of these projects will support higher residential densities, especially those in close proximity to Metro North Railroad stations. Although concerns related to increased traffic are well founded, mixed land uses, with a viable transit experience supported by safe active transportation facilities, will create an environment where people can get to work, social, and other destinations without generating passenger vehicle trips on Route 9.

TRAVEL BEHAVIOR

Commute Flows

The villages are home to businesses employing more than 20,000 people, the majority of whom (nearly 18,500) commute in from other places (See Figure 13). Approximately 3,000 residents live and work in the 5-village study area. The majority of commute trips that begin and end within the corridor are less than one mile long, and thus shorter than the typical bike commute distance of 3 miles (15-minute bike ride)(See Figure 14).

Of commutes beginning and ending within the corridor, the greatest number of people commute from Sleepy Hollow to Tarrytown, and Tarrytown to Sleepy Hollow.

Figure 12 Commute Flows

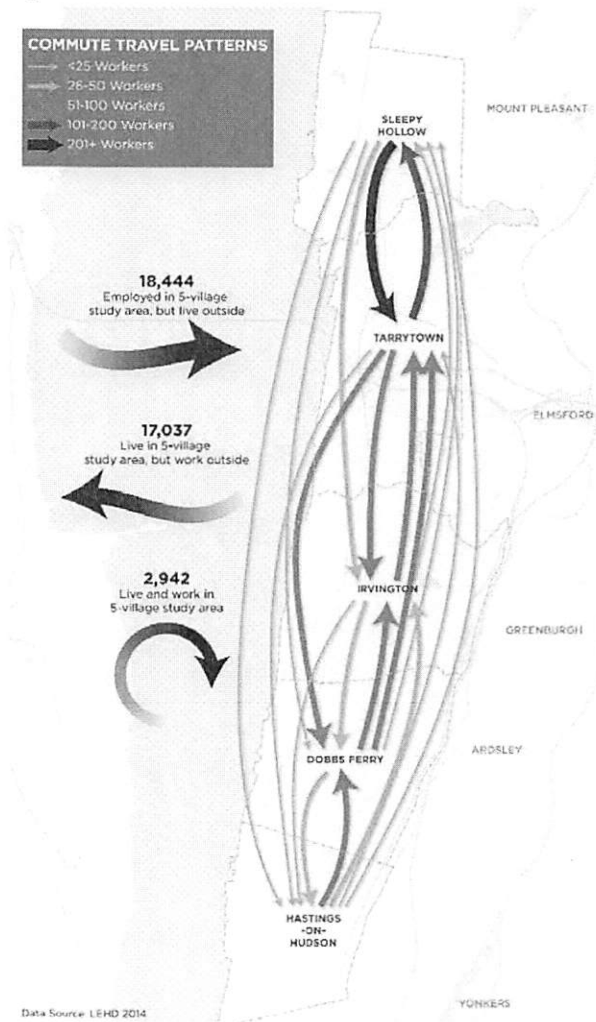
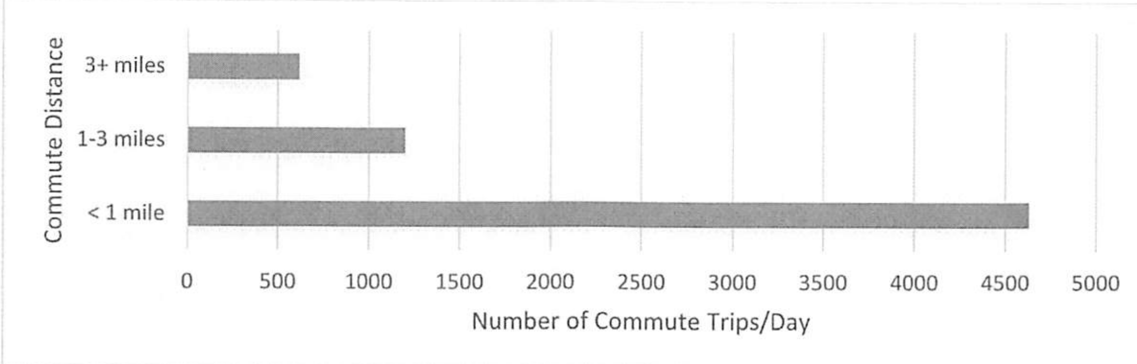


Figure 13 Distance of Commute Trips within the Corridor



Mode Share

Data provided by the American Community Surveys of 2010, 2014, and 2015 were analyzed to determine the characteristics and recent trends of commute-travel mode behaviors of residents of the five villages that make up the study area. The commute mode shares and trends of the five villages that make up the study area are relatively similar, with a few notable exceptions. Key corridor-wide findings include the following:

- Over the past five years, there have been few significant mode shifts
- Driving is the most popular, and four of the five villages have consistently seen driving mode shares between about 55%-60%
- Bicycle use for commuting purposes is virtually nonexistent
- About 20%-30% of commuters are using public transportation as their primary commute mode
- In several of the villages telecommuting appears to be on a slight downward trend
- The rates of walking for commute purposes varies notably throughout the corridor

Key findings for each of the individual villages are as follows:

- Sleepy Hollow (Figure 14)
  - Sleepy Hollow has by far the lowest drive-alone rates of all of the study-area villages, and indeed, is the only village with a drive alone rate below 50%
  - The walking rates in Sleepy Hollow are notably higher than all other villages, and have been steadily increasing
  - Sleepy Hollow has also had the highest rates of carpooling, though its use appears to have decreased considerably
- Tarrytown (Figure 15)
  - Tarrytown has one of the higher drive-alone rates of the study villages, but has seen a notable increase in public transportation use
  - Working from home in Tarrytown appears to have decreased by about half since 2010
- Irvington (Figure 16)
  - Irvington currently has the highest drive-alone rates, and is the only of the study villages that has seen a notable increase in drive-alone rates since 2010

- Irvington has also seen a corresponding notable decrease in the use of public transit as well as working from home
- Carpooling among Irvington commuters, on the other hand, has increased slightly since 2010

▪ Hastings-on-Hudson (Figure 17)
  - Hastings-on-Hudson has the most consistent mode shares of all of the villages, with only very marginal changes, if any, to each commute mode over time, though there are signs that drive-alone rates may be falling
  - Hastings-on-Hudson has consistently seen the highest rates of public transportation use among the five study villages

▪ Dobbs Ferry (Figure 18)
  - Carpooling in Dobbs Ferry has doubled from since 2010, and the village now has the highest rates of carpooling in the study area
  - The increased rates of carpooling in Dobbs Ferry does not, however, correspond with a decrease in driving alone, but instead corresponds with decreases in walking and working from home

Figure 14 Mode Share of Sleepy Hollow Resident-Commuters

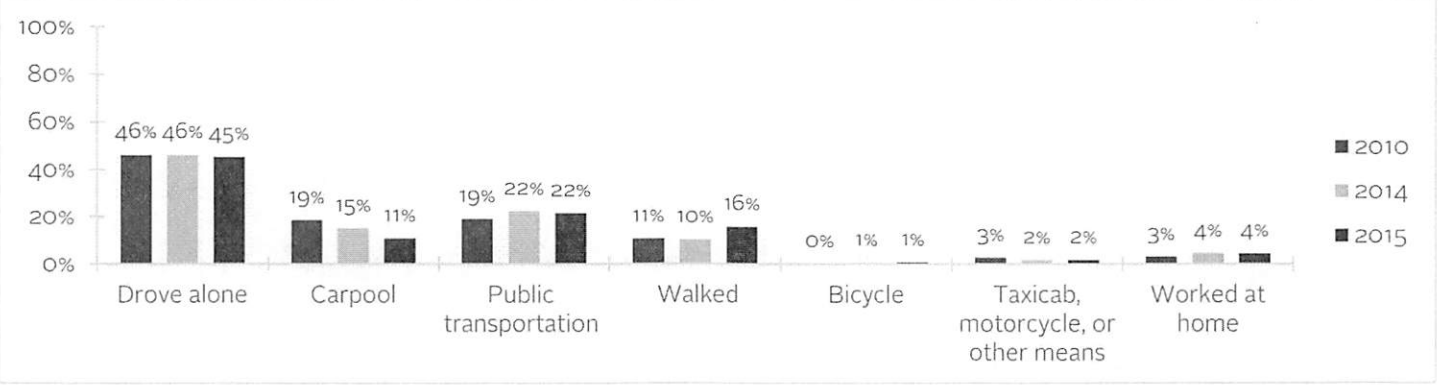


Figure 15 Mode Share of Tarrytown Resident-Commuters

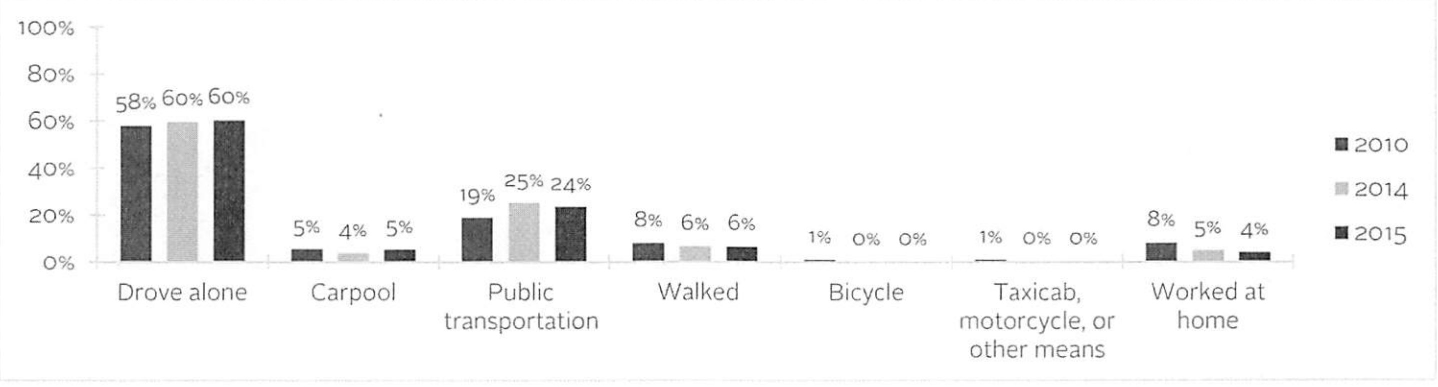


Figure 16 Mode Share of Irvington Resident-Commuters

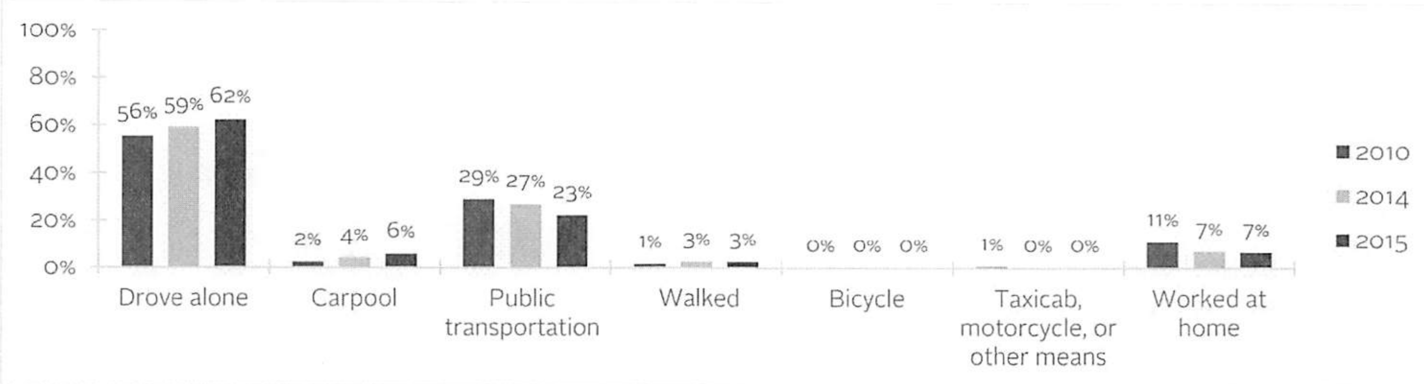


Figure 17 Mode Share of Hastings-on-Hudson Resident-Commuters

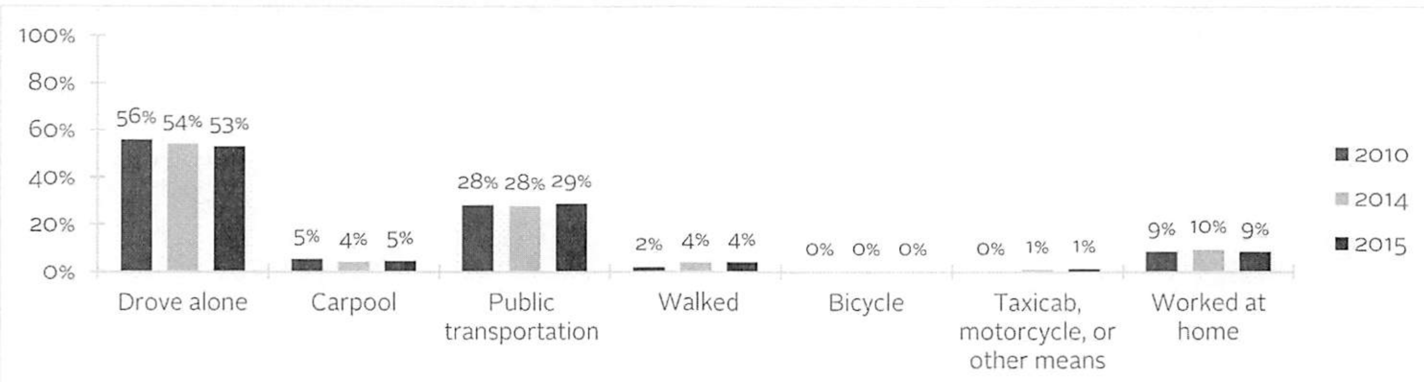
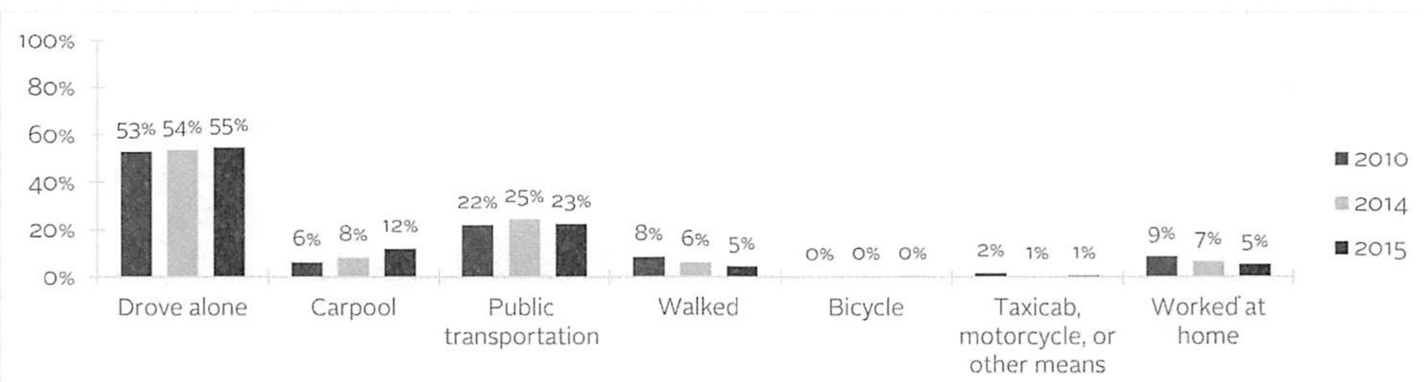


Figure 18 Mode Share of Dobbs Ferry Resident-Commuters

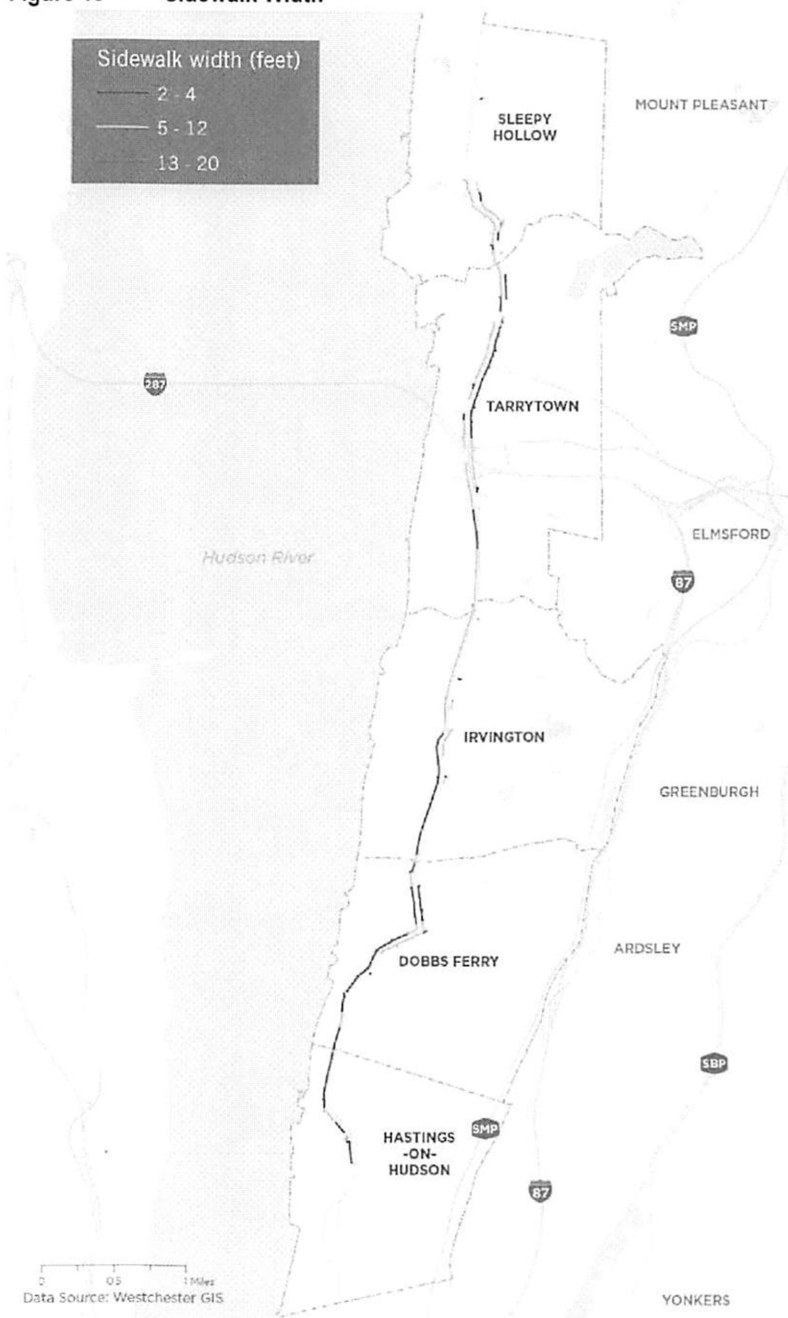


Sidewalks

With the exception of the south segment of Route 9 in Hastings-on-Hudson, sidewalks are present on at least one side of the Route throughout the corridor. However, 31% of sidewalks have widths narrower than 5 feet, which is the minimum passing-space width for an ADA compliant sidewalk.[8] Many of Tarrytown's sidewalks are less than 5 feet in width, as are those in Southern Irvington, Dobbs Ferry, and southern Hastings-on-Hudson. Additionally, a majority of the corridor's sidewalks are adjacent to moving traffic, which is not comfortable for people walking. See Figure 19.

There are many areas where the only sidewalk is on the west side of the road, such as at segments in the south parts of Irvington. Nearly one-quarter of the length of the corridor does not have a sidewalk on either side of the street, though most of this space is found in northern Sleepy Hollow.

Figure 19 Sidewalk Width



[8] The absolute minimum width for an ADA-compliant sidewalk is 36 inches (3 feet)

Figure 20 **Example of a row of utility poles that Violates the ADA Minimum Sidewalk Width Requirement**

Crossings

There are more than 50 marked crosswalks along the corridor, with a variety of enhancements, including warning signs, delineators on the centerline and traffic signals. With long distances between traffic signals there are many locations where pedestrians have to wait for long periods to get a gap in traffic suitable for crossing or to gain driver compliance to yield. For instance, the coordinated traffic signals at Cedar Street and Ashford Avenue only allow pedestrians to cross during a single pedestrian phase that is only activated via a pedestrian push button, giving pedestrians 25 seconds to cross after waiting through 90 seconds of time allotted for vehicular traffic at these coordinated intersections.

Similarly, there are many large intersections with traffic signals, but noncompliant pedestrian amenities, leaving pedestrians to walk busy intersections with no walk signal or crosswalk. Figure 21 shows the intersection of Route 9 and Pocantico Street by the entrance to Philipsburg Manor, which leaves pedestrians a single marked crosswalk, without a pedestrian signal in the widest cross section. Figure 22 shows the intersection's aerial view. Similarly, to the north, the signal phasing at the Old Dutch Church leaves people with no cues about when it will be safe to cross, causing frequent crossings against the signal (See Figure 24).

Figure 21 **Broadway at Pocantico Street**

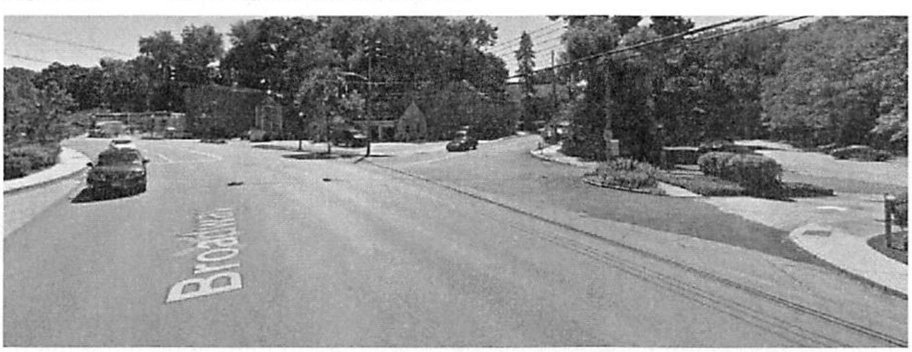


Figure 22 Broadway at Pocantico Street, Aerial View

Figure 23 Broadway at Ashford Ave

Figure 24 Old Dutch Church Crossing

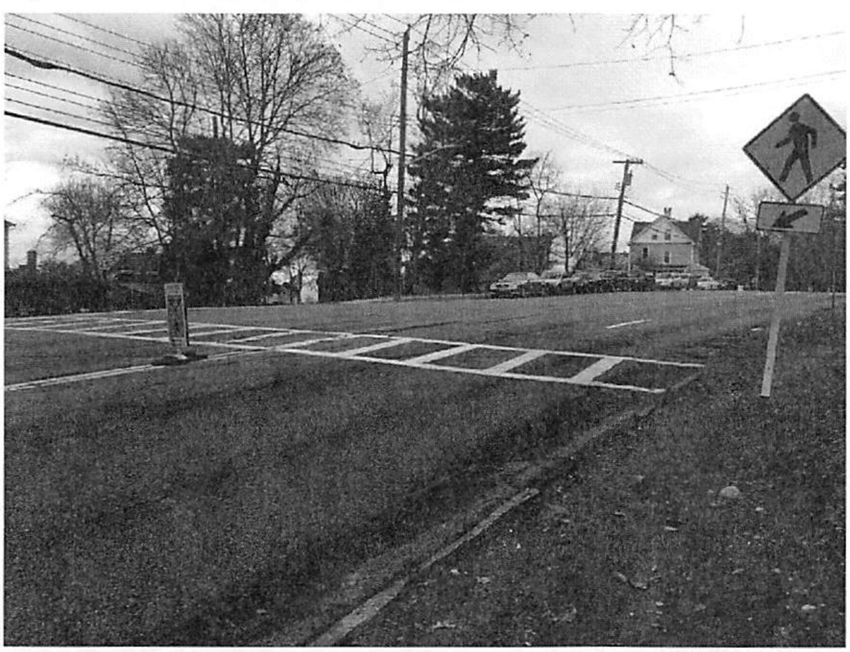
There are many Croton Aqueduct crossings midblock that get heavy use and have minimal improvements, and residence on the east side of the corridor complain about having to walk long distances out of direction to get from home to important community destinations. Below is a summary of findings of the *Pedestrian Safety Study: Broadway (US Route 9), Ashford Avenue & Walgrove Avenue* (Village of Dobbs Ferry, 2016), where the improvement of pedestrian crossings, and in particulars the OCA crossings, were identified as safety projects to implement in the short and medium term.

Figure 25 Route 9-Related Pedestrian Safety Projects

Goal/Objective	Associated Projects	Implementation Term[9]
Provide safe, logical ADA/PROWAG compliant crossing locations for pedestrians.	Improve the crossing of Broadway at Clinton Street	Short
	Improve the crossings of Broadway in the vicinity of the Middle/High School	Short
	Improve the OCA crossing at Broadway	Short
Provide a network of continuous, accessible and well-delineated sidewalks and ramps.	Construct new sidewalks to fill missing links along Broadway	Short/Medium
	Reconstruct existing sidewalk and curb ramps throughout the entire Village	Medium/Long
	Improve pedestrian crossings throughout the Broadway corridor	Short/Medium
Reconstruct roadway to accommodate modes of non-motorized transportation, reduce the accident rate, and reduce vehicle speeds.	Construct curb extensions at pedestrian crosswalks	Short/Medium
	Construct raised medians/traffic control islands/pedestrian refuge islands	Short/Medium
	Reduce travel lanes/minimize lane width	Medium/Long
	Install modern roundabouts	Medium/Long
Reconstruct roadway to include dedicated bicycle accommodations.	Reconfigure Broadway to include either dedicated bicycle lanes, a two-way cycle track or raised cycle track	Medium/Long

Source: Pedestrian Safety Study: Broadway (US Route 9), Ashford Avenue & Walgrove Avenue, Village of Dobbs Ferry, 2016

Figure 26 OCA crossing at Dobbs Ferry

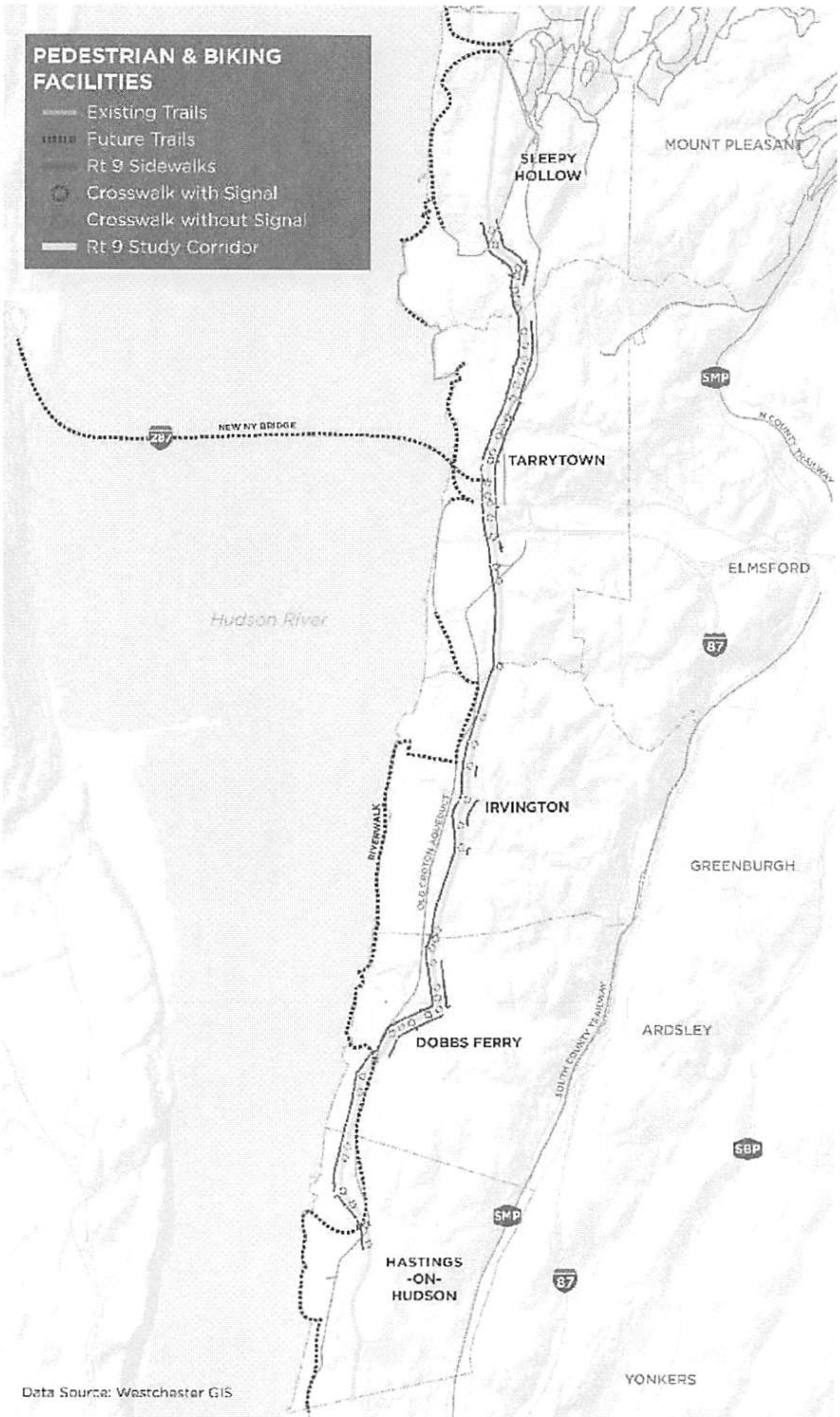


[9] Short = 1-2 years
Medium = 3-9 years
Long = 10+ years

Bikeways

Though Route 9 is classified as a bike route by the state, there are no designated lanes for cycling on the corridor. Best practice for roads prioritizing moving people by bike, in places with speed limits in excess of 25 miles per hour with high traffic volumes support separated bike lanes.

Figure 27 Pedestrian/Bike Facilities



Trails

Figure 27 shows existing and planned trails in the area. Bicycling is not permitted on many of the trails within the parklands of Sleepy Hollow.

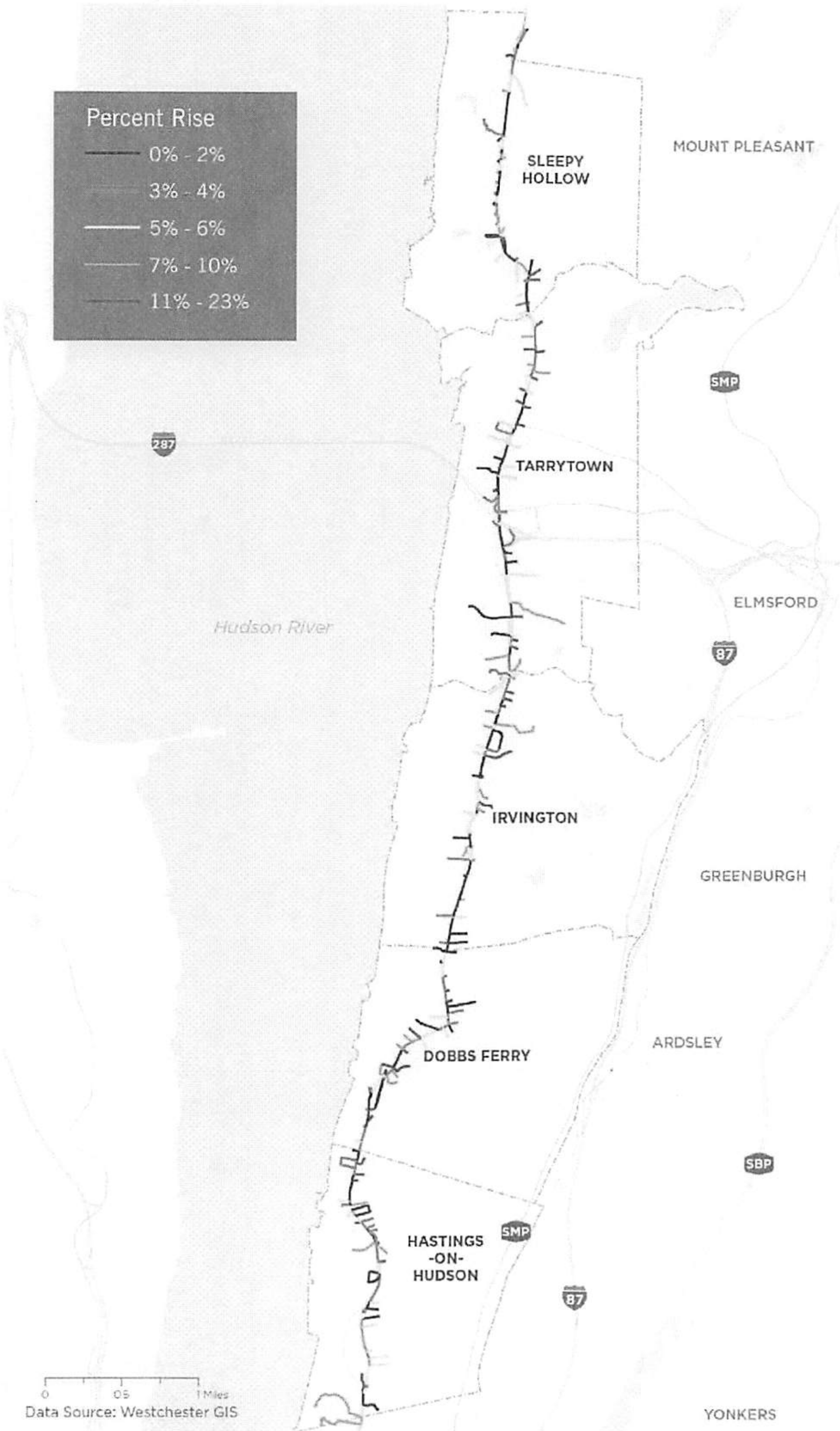
The **Old Croton Aqueduct** is a valued asset that runs from the northern most border of Van Cortland Park in The Bronx, north through the five villages and beyond. Multiple separate planning studies have confirmed that better supported Route 9 crossings are desired, but the general nature of the dirt path with a slower pace and surface that does not support high speed bicycling should be preserved. In general, the Old Croton Aqueduct parallels Route 9. Figure 28 shows an OCA sign and entrance off of East Franklin Street. The entrance is less than a block off of Broadway, but as the photos show, the trail is not level.

Figure 28 Old Croton Aqueduct Entrance, East Franklin Street

Although locations in Sleepy Hollow, Dobbs Ferry and Hastings-on-Hudson have slopes in excess of 5%, the gentle rolling hills and generally flat topography of Route 9 make it an ideal street to consider how to better support bicycle access to the many local shopping and social destinations. The following segments are locations where the slope is higher than 5%:

- Sleepy Hollow: Saint Paul's Hill in Sleepy Hollow has a slope over 5% (Route 9 between Gordon Ave and Beekman Ave, 700 ft)
- Sleepy Hollow: Segment between Palmer Ave and Pierson Ave intersections, in Sleepy Hollow (1,130 ft).
- Dobbs Ferry: from Oak St to Elm St (315 ft)
- Hastings-on-Hudson: from High St to Hudson St (1,120 ft)

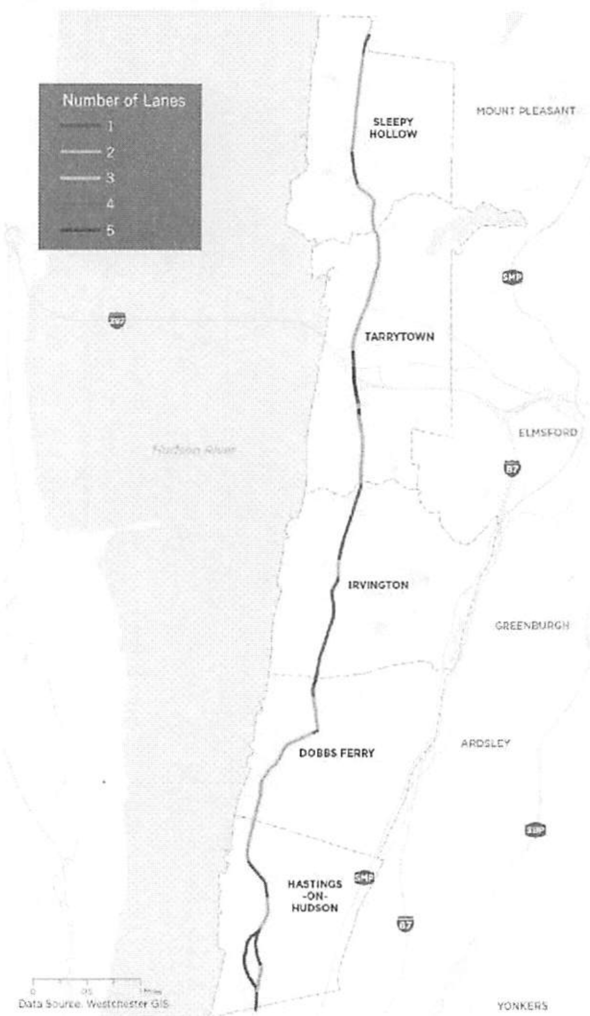
Figure 29 Slope Characteristics of Route 9 and Connecting Streets



Roadway Characteristics and Traffic

The nature of transportation and land development has been changing over the last decade, and the only certainty with respect to the future, is uncertainty. Studies show that mixed use development and a millennial preference for shared mobility may be reducing vehicle miles traveled. With bus rapid transit and shared autonomous vehicles on the horizon in this corridor, it is worth considering whether more auto trips are a necessary consequence of growth and development. One source of data to explore this question is historical traffic volume counts from New York State. Unfortunately, there are only two continuous counts along Route 9 near the study area, one in the Bronx[10] which shows a decline in automobile daily trips since 2006, and another in Croton which shows no growth[11], while population in both Bronx and Westchester counties increased during the same time period[12].

Figure 30 Number of Lanes



The number of travel lanes on Route 9 ranges from 2 to 6, with the majority of the length having between 2 and 4 lanes and curb-to-curb widths varying from 20 to 60 feet.

NYSDOT traffic data for 2015 indicates that the Average Annual Daily Traffic (AADT) along the corridor were lower than 25,000 vehicles with the exception of the segment north of I-287 in Tarrytown, where volumes reached 27,000.

Data collected for this Plan confirmed these figures. Twenty-four hour screen line traffic volume counts were supplemented by morning and afternoon weekend and weekday peak hour turning movement counts and signal timing data to understand conditions in the fall of 2017 at 16 signalized study intersections.

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[10] http://ftp.dot.ny.gov/tdv/YR2015/R11/01_Bronx/01_0012_VOL_00-2015.pdf

[11] http://ftp.dot.ny.gov/tdv/YR2015/R08/87_Westchester/87_0021_VOL_00-2015.pdf

[12] https://www.opendatanetwork.com

Figure 31 AADT 2017

	Total lanes	AADT
Dobbs Ferry: Between Cedar Street and Ashford Avenue	4 lanes (44' curb to curb)	20,079
Tarrytown: Between Benedict Avenue and Franklin Street	2 through lanes and 1 turning lane (39' curb to curb)	25,079

Source: Nelson\Nygaard, 2017

A detailed traffic analysis was undertaken to evaluate how these intersections operate during peak periods, which are typically defined as the one continuous hour of peak traffic flow counted within a two-hour period in the morning and afternoon.

Results showed that during the weekday AM Peak three of the intersections showed some delay beyond the NYSDOT threshold (Level of Service D) in one leg of the intersection, including I-87 WB (Tarrytown), EB left turn movements at Ashford Ave (Dobbs Ferry), and WB through movements at Farragut Avenue (Hastings-on-Hudson). During the weekday PM Peak, the intersections that experienced high delay were Beekman Avenue (Sleepy Hollow), I-87 NB through movement of Route 9 (Tarrytown), and Farragut Avenue (Hastings-on-Hudson). In addition, Farragut Avenue (Hastings-on-Hudson) experienced high delay during the midday Saturday period. When a leg or intersection falls below this threshold, vehicles typically wait a tolerable delay, occasionally through more than one signal cycle before proceeding.

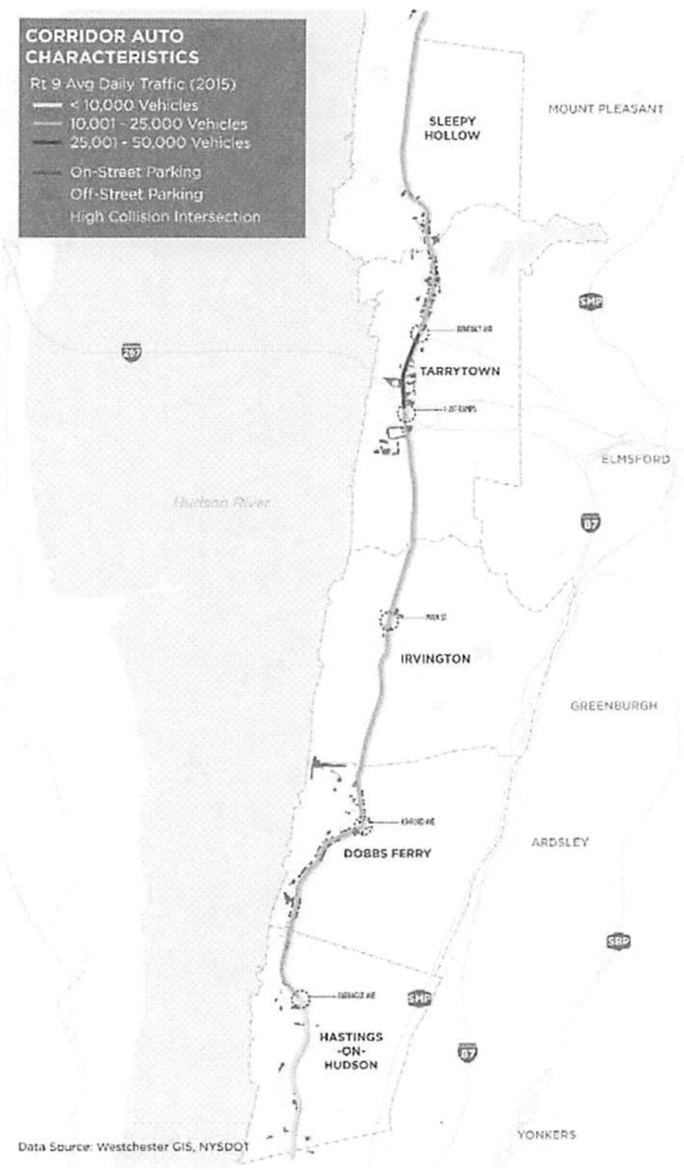
The State of New York utilizes adopted Complete Streets and traffic calming policies to help make design decisions that reflect local values. According to the Complete Streets policy, all project applicants are required to evaluate the project limits for needed bicycle and pedestrian accommodations as part of initial scoping. The state recognizes that some locations may provide LOS below D and that making Complete Streets improvements may be difficult, so that where existing operations are at LOS is E or F, mitigations may be limited to changes such as signal timing or hardware improvements.

In the case of the Route 9 corridor within these project limits, the Route 9 Active Transportation Corridor project has demonstrated a need for complete streets accommodation, which may warrant bicycle and pedestrian accommodations along and across the corridor with a tradeoff of vehicle quality of service.

A detailed description of the methodology and results can be found at Appendix A.

Collision Analysis

Figure 32 Road Characteristics and High Collision Locations



The Dobbs Ferry 2013-2015 Pedestrian Safety Study along Broadway, Ashford Avenue, and Walgrove Avenue reported a total of 264 crashes, with 3% involving pedestrians and/or cyclists. It was noted that pedestrians did not use crosswalks, crossed midblock or in between parked vehicles, and/or left-turning drivers did not yield to pedestrians in crosswalks. The average crash rate during the time period "greatly exceeded" the statewide average of comparable facilities, which is 3.44 crashes per million vehicle miles, with Broadway reporting an average rate of 8.52.[13]

Furthermore, five intersections along Broadway have seen a notable number of crashes in the past five years. These intersections include:

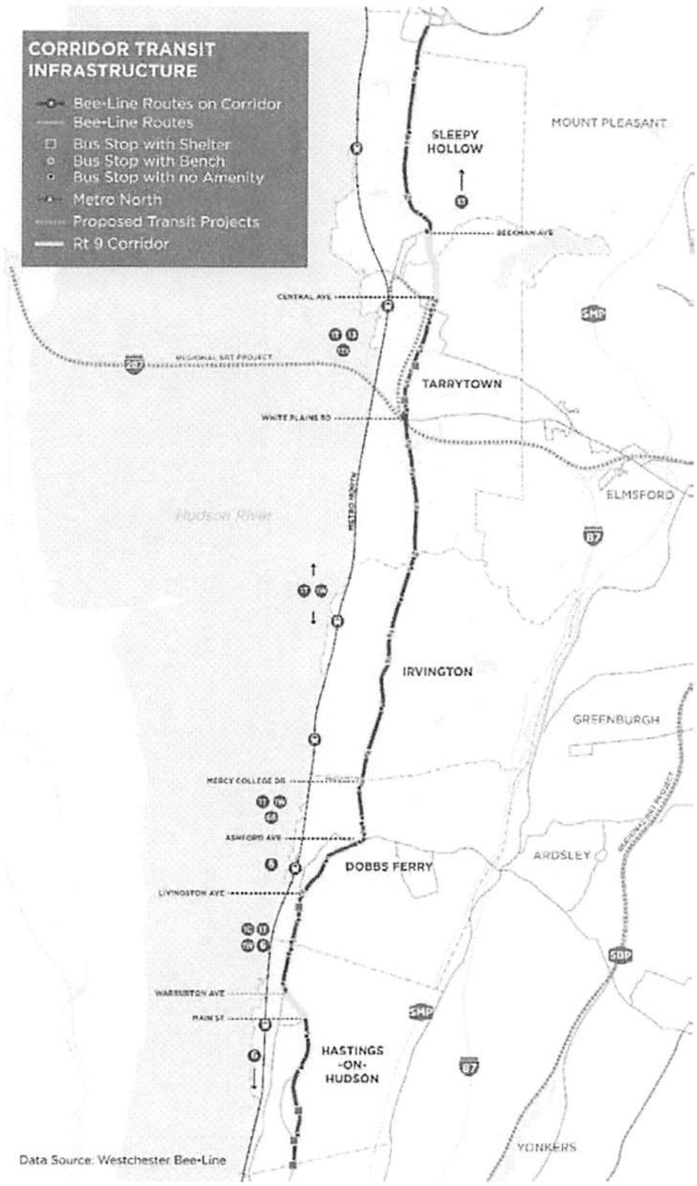
- Benedict Avenue
- 1-278 Ramps
- Main Street in Irvington
- Ashford Avenue
- Farragut Avenue

Some of these intersections saw crashes between vehicles and pedestrians. For example, one crash of the many at Main Street was a collision between vehicles and pedestrians that resulted in injury. By Farragut Avenue, there were two crashes between a vehicle and pedestrian, both causing injuries.

[13] Pedestrian Safety Study: Broadway (US Route 9), Ashford Avenue & Walgrove Avenue, Village of Dobbs Ferry, 2016

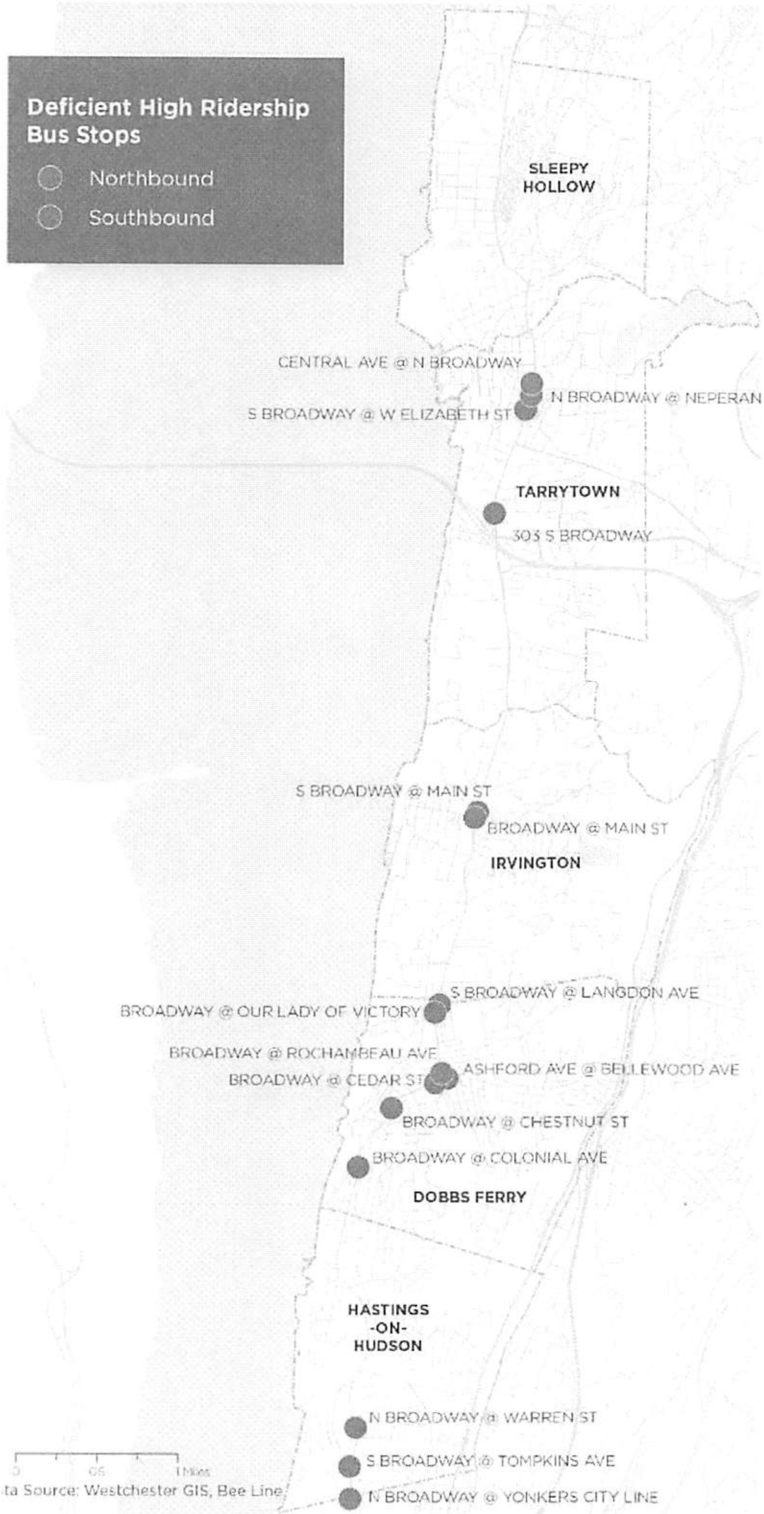
Transit Facilities

Figure 33 Transit Facilities Within the Study Area



The Westchester Bee-Line bus system serves Westchester County with over 60 routes and a fleet of 330 vehicles. The five villages are served by 8 routes: the 13, 1, 1T, 1W, 1C, 6, and 66, as well as Rockland's Tappan Zee Express. The 1, 1T, 1W, and 1C connect to Van Cortlandt Park – 242 Street 1 Train in The Bronx, allowing convenient connection into New York City and the subway system. These routes fully or partially connect the villages of the study area among them, as well as with other villages and cities in Westchester County, such as White Plains, Port Chester and Rye, and west of the Hudson River. See Appendix B for a detail of the itineraries of each routes.

Figure 34 Deficient High Ridership Bus Stops



Many bus stops do not have a bench or shelter: only 33% of bus stops along the corridor have at least a bench, and only 9% have a shelter and a bench, and some of them are not on the walking network.

In July 2017, the Liberty Lines Transit staff (Contract Operator for the Bee Line system) conducted a survey along Route 9 from the southernmost part of Hastings-on-Hudson to Sleepy Hollow's Phelps Hospital. The survey found that buses stopping along Route 9 block traffic lanes (tail end or traffic behind), spaces dedicates for buses to stop are not long enough for the bus sizes, and often block the vision of drivers. Some areas with bus stops on corners have no traffic control device and thus create hazards for drivers exiting driveways who cannot see past the bus. Some bus stops are located in busy right-turn only lanes and cause congestion. Furthermore, vehicles were observed parking in bus stops along Broadway on both sides of the street.

Appendix B includes a detailed assessment of the bus stops with high ridership along the corridor as well as some initial improvements that were considered in this plan.

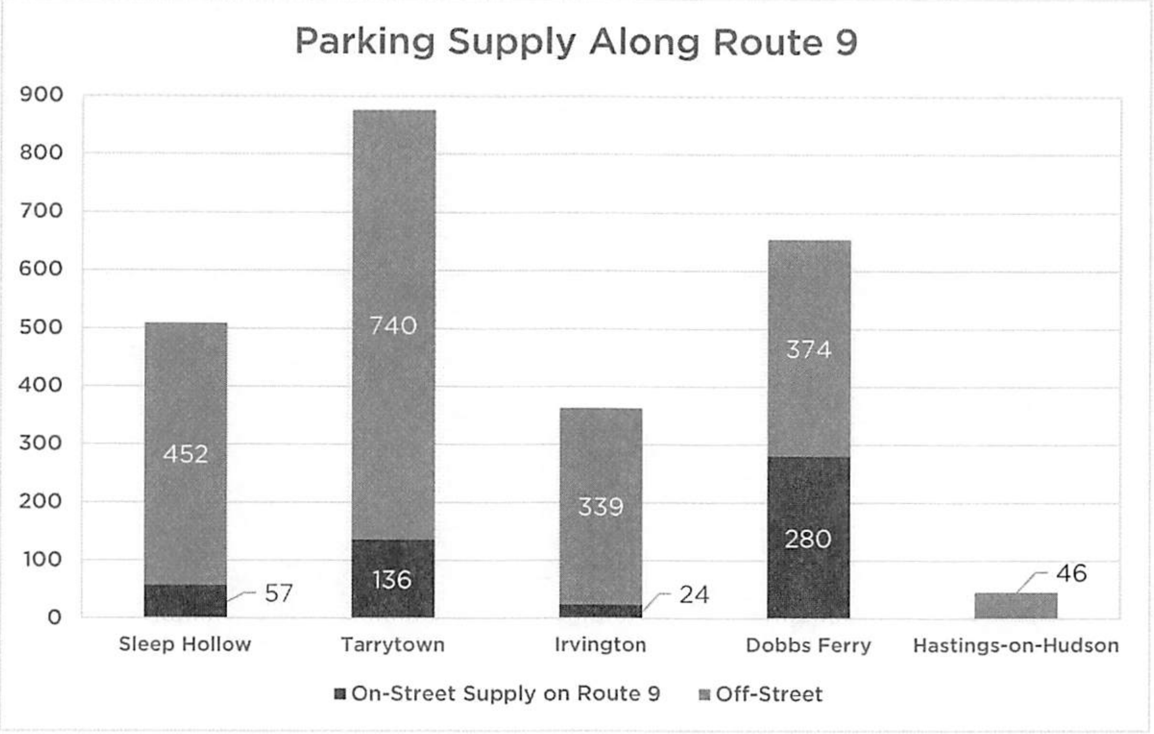
Figure 35 Example of a Transit Stop Located on the Curb with No Walking Facility Infrastructure

Parking Supply and Utilization

Parking Supply

Parking supply along Route 9 consists of 2,525 car spaces, 80% of which are in off-street parking lots. See Figure 36.On-street parking is free in some of the segments and metered in the center of Tarrytown, Sleepy Hollow, and Irvington. Some parking spaces, particularly in Sleepy Hollow, have painted lines denoting where each space is. The majority, however, are denoted only by parking regulation signage. Off-street parking lots immediately off the corridor are both municipal and private with a variety of parking management and pricing strategies in effect.

Figure 36 Parking Supply along Route 9



Parking Utilization

Based upon the guidance of the project steering committee, parking utilization counts were done during a weekday evening and lunch time on a Saturday in July 2017. Overall parking utilization along the corridor was less than 55% in both peak weekday and weekend periods, but it was higher during weekend peaks, reaching 60% in on-street parking in Tarrytown and in off-street parking in Dobbs Ferry. Where on-street parking utilization was over 85%, there is on-street and off-street parking supply nearby which is less than 75% occupied. See Figure 37 to Figure 39.

The optimal utilization rate for an on-street segment of parking is 85%. For example, if a driver were to see a typical road segment of eight spaces on one side of the street, one of those spaces would be vacant, allowing them to promptly occupy that space without resorting to circling the block. In regards to off street parking facilities, the optimal utilization rate is 90%. Even though a facility is not 100% full at optimal utilization, it is still functioning at capacity (accounting for the constant movement of people entering and leaving their parking space) and drivers may perceive the facility as full.

Figure 37 Parking Utilization – Sleepy Hollow and Tarrytown

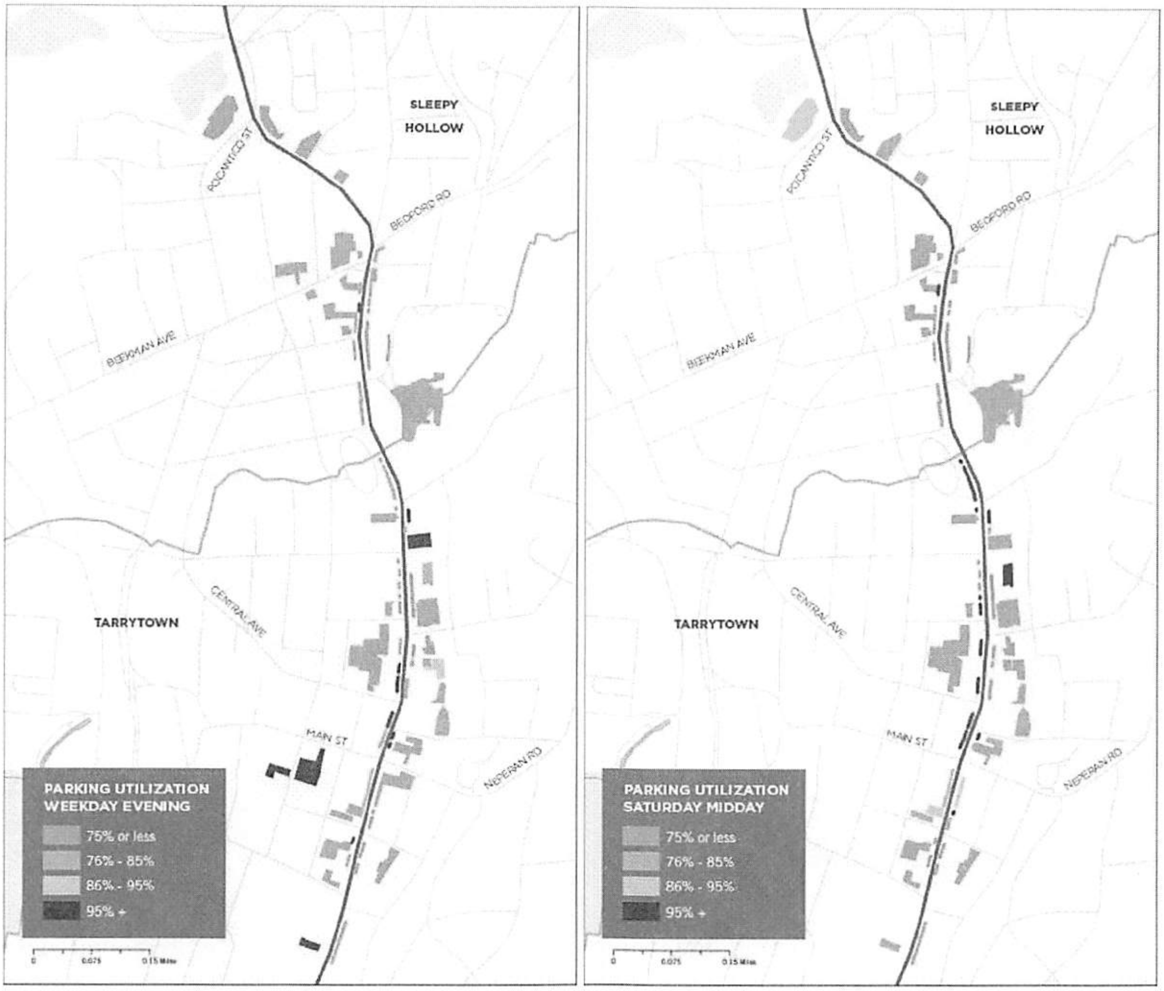
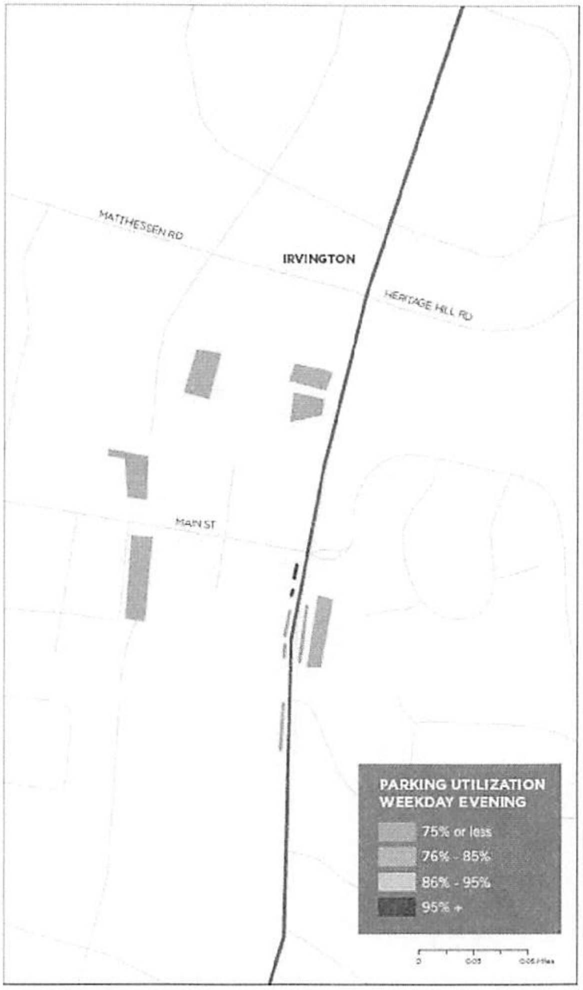


Figure 38 Parking Utilization – Irvington



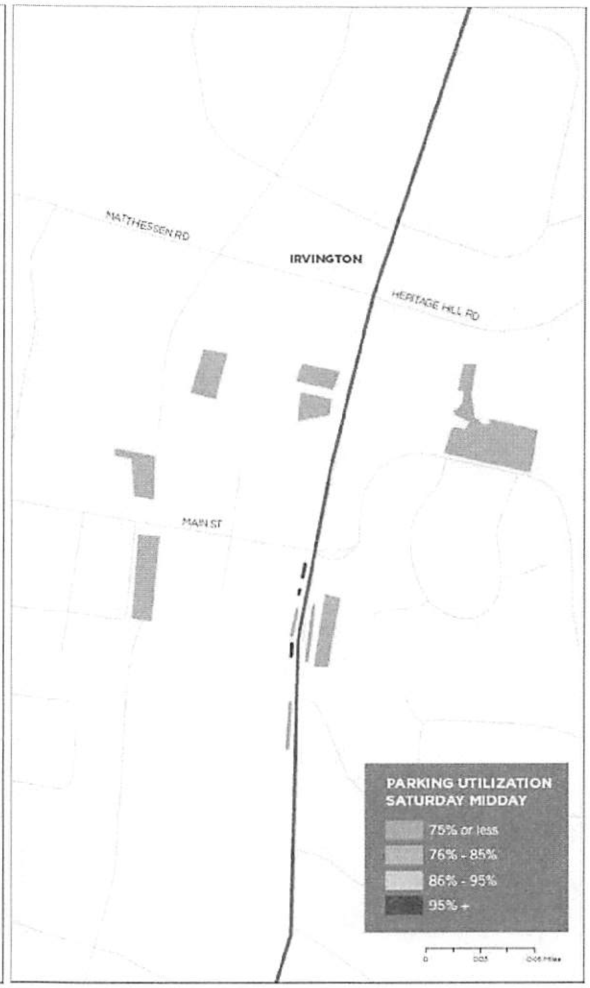


Figure 39 Parking Utilization – Dobbs Ferry and Hastings-on-Hudson

EXISTING PLANS, PROGRAMS, AND POLICIES

Because the study are is multi-jurisdictional, there is no single primary policy document that can provide baseline guidance for active transportation improvements along the corridor. As a highway managed by the State, Route 9 is ultimately governed by state policy, and any improvements made to and along the corridor are subject to approval by the New York State Department of Transportation (NYSDOT). However, there are a number of policies, plans, and study documents (state, county, and local) from which a policy context supporting the Route 9 Active Transportation study can be derived.

Complete Streets Policies

In 2013, Westchester County passed a complete streets policy that commits the county to implement infrastructure that better supports transit and active transportation initiatives along county roads. New York State implemented a complete streets policy in February 2012.

With the exception of Irvington, all villages have local Complete Streets resolutions that support the consideration of pedestrian, transit and bicycle improvements to reduce reliance on automobile travel, when planning roadway projects.

Adopted Plans and Studies

Adopted plans and completed studies that are supportive of the goals of the Route 9 Active Transportation Corridor project are summarized in Figure 40 below.

Figure 40 **Project supportive local plans and transportation studies**

Village	Previous Plans and Studies	Brief Description
Sleepy Hollow	Sleepy Hollow Pedestrian and Vehicular Traffic Summary Report, Provident Design Engineering, 2016	This report included improvements for bikers and pedestrians at Broadway (Us Route 9) @ Pocantico Street/Old Broadway, @ Pierson Avenue/Old Broadway.
Tarrytown	Tarrytown Comprehensive Plan, 2007	The plan identifies Routes 9 and 119 as priority active transportation corridors and recommends removing barriers to public accessibility, installing new crosswalks and traffic calming features, allocating space for bicycles, and prioritizing sidewalks over driveways.
Irvington	Village of Irvington Comprehensive Plan, 2003	Among the implementation recommendations included in the plan to improve traffic operating conditions as well as safety conditions for all users is a recommendation to continue working with state officials to reduce the speed limits on portions of Broadway.
Dobbs Ferry	Dobbs Ferry Vision Plan, 2010	General citywide recommendations included in the Vision Plan that are related to the Route 9 Active Transportation Corridor Study include supporting shared parking agreements, emphasizes pedestrian facilities through enhanced design, enhanced pedestrian and cycling use, and emphasizes on-street parking.
	Pedestrian Safety Study: Broadway (US Route 9), Ashford Avenue & Walgrove Avenue, Village of Dobbs Ferry, 2016	The Dobbs Ferry Pedestrian Safety Study identifies a number of goals and objectives for improving pedestrian safety along several major corridors, including Route 9, in Dobbs Ferry.
	Parking & Traffic Report, Dobbs Ferry Chamber of Commerce, 2016	Recommendations include roadway reconfigurations, roadway design (curb-cut eliminations), increasing pedestrian safety and environment in the business district, and increasing the navigational ease for drivers. Pedestrian recommendations include new pedestrian islands and the addition of crosswalks. The report ultimately recommends the implementation of complete streets design.
Hastings-on-Hudson	Village of Hastings-On-Hudson Complete Comprehensive Plan - Chapter 5: Circulation, 2011	Recommendations include adding or improving sidewalks to downtown, enhancing "Safe Routes to School", improving pedestrian connections between neighborhoods and circulation in the downtown. The Plan also recommends a study for improving intersections, which is emphasized by the strategy recommendation of implementing traffic calming measures.
	Hastings-On-Hudson Transportation Plan: Draft Final Report, 2007	Key recommendations include streetscape design improvements, including raised medians, sidewalks, roundabouts – all of which are focused on the Broadway, Devon Way and Farragut Parkway sections of the study area.

COMMUNITY INPUT

The Route 9 Active Transportation Corridor Study is informed by a public outreach process that included several rounds of outreach, each with its own distinct purpose and goals. Each round of outreach featured online engagement activities and public workshops held in various locations throughout the study area. These activities were designed to engage stakeholders and the public in identifying local issues, concerns and experiences.

Throughout the life of the project, the project team has kept the public informed of project related events and updates through a communication process that included, but was not limited to, the following elements:

- **Website**: The Route 9 Active website (http://www.route9active.org) allows interested parties to find background information about the project, information relating to the project's planning process, project updates and status reports, and ways that community members could get involved. The website also provides links to online surveys, and other engagement activities.
- **Email updates**: Email addresses were collected from interested parties at outreach events and online, and project updates and event notifications were distributed periodically.
- **Social media**: Social media activity coincided with public notifications related to outreach activities and survey collection, as well as general project updates.

Spring 2017 Outreach: Project Priorities and Major Concerns

In many locations along the corridor, the addition of a protected bikeway would require a tradeoff of lane widths, number of travel lanes or on-street parking supply. The Route 9 Active Transportation Tradeoffs Survey asked the public to consider possible tradeoffs and prioritize different purposes the road serves. This exercise showed that respondents value a walkable environment with a sense of place, including parking, more than high traffic speeds and congestion. The complete results of the tradeoffs exercise are as follows:

- 70% would prioritize a stronger sense of place over reduced traffic congestion
- 75% would prioritize maintaining on-street parking over maintaining multiple traffic lanes
- 90% would prioritize a more comfortable walking environment to faster traffic speeds
- 54% prioritize reliable public transportation over personal vehicle access
- 54% would prioritize biking on trails over biking on-street
- 52% would prioritize on-street parking over continuous bike lanes
- 69% would prioritize safe pedestrian crossings over maintaining left and right turn pockets.

Participants were additionally invited to comment on specific areas and concerns along the corridor. Of all responses, crosswalks, safety, sidewalks, and pedestrians were the most prominent themes.

A WikiMapping project allowed community members to identify problem areas related to each mode of transportation directly on a map.

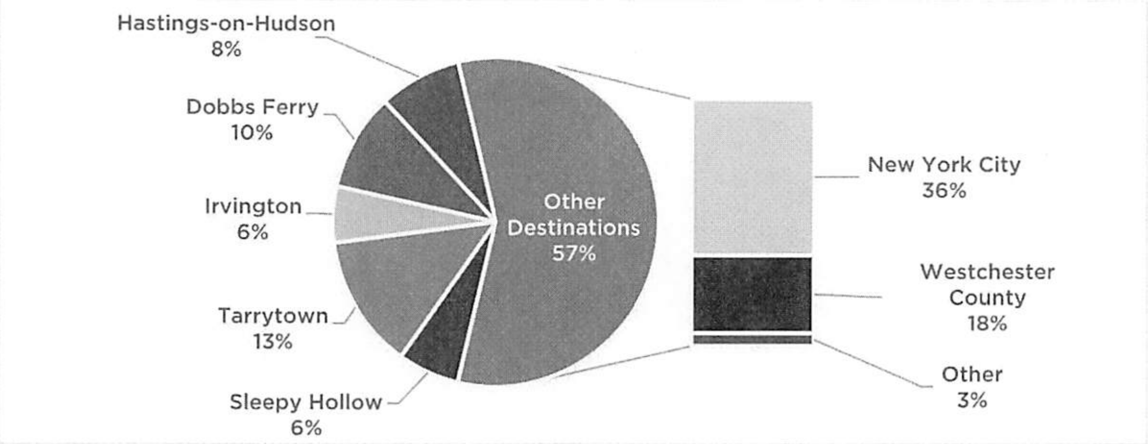
See Appendix C for a detailed explanation of the findings of the Community Outreach process.

Fall 2017 Outreach: Design Alternatives

The second outreach/public engagement session presented design alternatives to the public. They were able to select and identify their level of comfort walking and cycling along and across Route 9. More than 1,000 people from within and outside the study area responded.

About 85% of respondents regularly travel Route 9 for commuting purposes (i.e. to work or school). Of those who regularly travel for commuting purposes nearly 60% commute to locations outside of the study area, particularly to New York City. About 16% of respondents are retired or do not regularly commute.

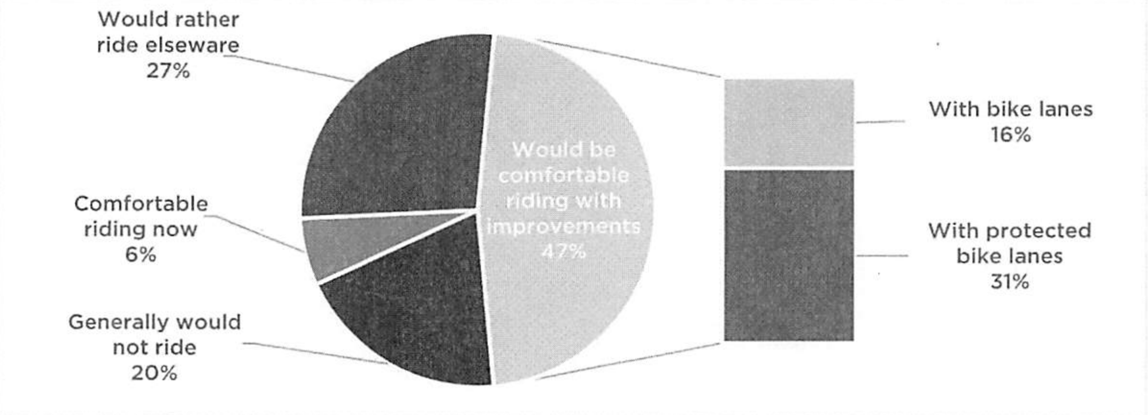
Figure 41 Commute Destinations of Respondent Commuters



Level of Comfort

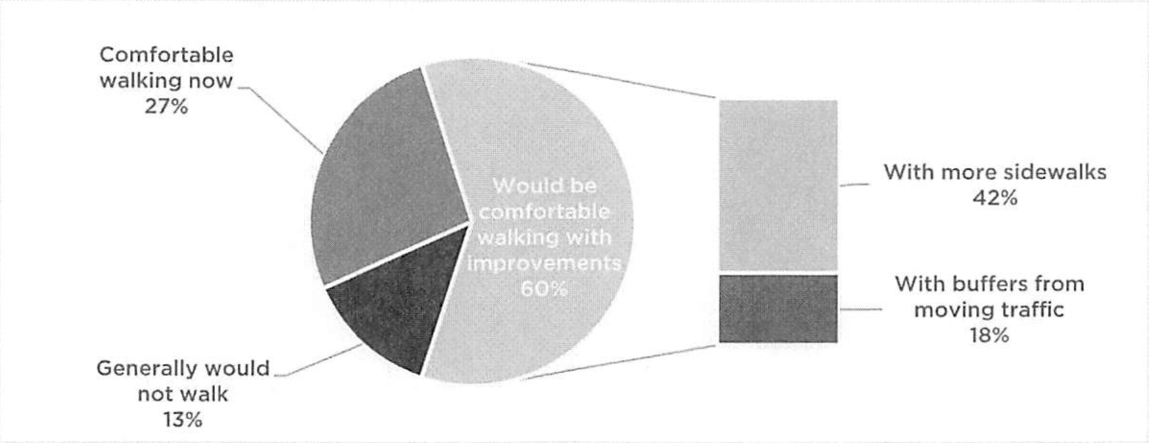
Very few survey respondents, about 6%, are currently comfortable with bicycling along Route 9. Just under half of respondents, however, indicated that they would be comfortable riding a bicycle along Route 9 with some form of improvement to bicycle facilities, particularly protected bike lanes. Over one-quarter of respondents would rather ride on other pathways, while nearly 20% of respondents indicated that they would not ride a bicycle along the corridor under any circumstances.

Figure 42 Comfort Riding a Bicycle Along Route 9 – All Respondents



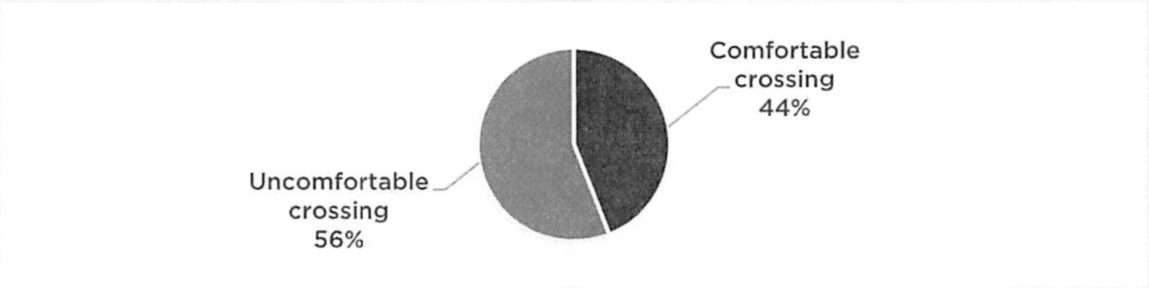
Alternatively, only about one-quarter of respondents are currently comfortable walking along Route 9 as it is, and less than half are comfortable crossing the road as it is. However, about 60% would be comfortable walking along Route 9 with some form of improvement to pedestrian facilities, particularly adding sidewalks. Just over 10% of respondents indicated that they would not walk along the corridor under any circumstances.

Figure 43 Comfort Walking Along Route 9 – All Respondents



In terms of crossing, over half of all respondents indicated that they are generally uncomfortable crossing Route 9 on foot. (Figure 44)

Figure 44 Comfort Crossing Route 9 – All Respondents



The remainder of the survey asked residents to select from among potential walking and bicycling concepts in space constrained locations, where an active transportation facility could not be provided without a trade-off in travel or parking lanes. Prior to presenting the alternatives, the design team eliminated any alternatives that did not fit within the apparent right of way or did not offer an improvement in perceived or actual safety for inexperienced or young riders.

For all locations, respondents were offered a space to prefer an alternative not considered by the design team. The range of respondents who opposed the project in general was 5% to 10%. These respondents expressed opposition to bicycle traffic on Route 9, concerns about parking, or a general desire to keep the corridor the same. The highest level of opposition to the project is in Sleepy Hollow.

3 NETWORK DEVELOPMENT

GOALS

Every successful plan needs clear goals. They are critical for two reasons: (1) they help to guide strategies and (2) they provide a basis for monitoring progress over time. The goals of this plan are:

- Improve safety by reducing vehicle speeds and managing traffic
- Attract people using New NY Bridge path to shops and restaurants
- Create safe and connected places to walk along and across corridor
- Create Safe and connected bicycle infrastructure within, and between, villages
- Support planned transit to reduce automobile trips

A safe and accessible pedestrian and bicycle network along and across Route 9 from Hastings-on-Hudson through Sleepy Hollow will make progress towards this plan's goals. This chapter details the principles and analysis used to develop this network.

PRINCIPLES

Pedestrians, people with reduced mobility and bicyclists are an integral part of every community's transportation system. The importance of good facility design not only applies to development of new facilities, but also to the improvement and retrofitting of existing facilities for these users use. Well-designed and maintained active transportation facilities promote walking and biking and promotes higher levels of pedestrian and bicyclists travel. Pedestrians and bicyclists want facilities that are safe, attractive, continuous, convenient, and easy to use. Build a continuous active transportation network to access major community destinations for all residents.

The following principles were utilized to guide decisions about facility design, prioritization of projects, and network development.

- The active transportation network should be safe. Sidewalks, walkways, bike facilities and crossings should be designed and built to be free of hazards and to minimize conflicts with vehicular traffic and street design elements. .
- The network should be accessible to all. Sidewalks, walkways, and crosswalks should ensure the mobility of all users by accommodating the needs of people regardless of age or ability.
- The network should connect to places people want to go, and should provide continuous direct routes and convenient connections between destinations, including homes, schools, shopping areas, public services, recreational opportunities, and transit.

DESIGN GUIDELINES

The Active Transportation network must incorporate safe and accessible pedestrian infrastructure, as every person who bikes begins and ends their trip on foot. This includes safe crossings and sidewalks, with adequate space for people walking and bicycling. Guidance for successful integration of bicycle and pedestrian facilities comes from Complete Streets principles, which dictate that all streets should have adequate infrastructure for every mode of transportation.

This network must also have good connections with existing and future transit. For example, transit stops without sidewalks adjacent or nearby crossing improvements prove to be a barrier to access.

Intersections are among the most dangerous places for people on bikes—they are mixing zones where drivers, pedestrians, and cyclists interact. Best practice multimodal intersection design is based on the principles of a complete and protected intersection, which allows people on bikes to safely cross multiple lanes of traffic without being exposed to a turning vehicle.

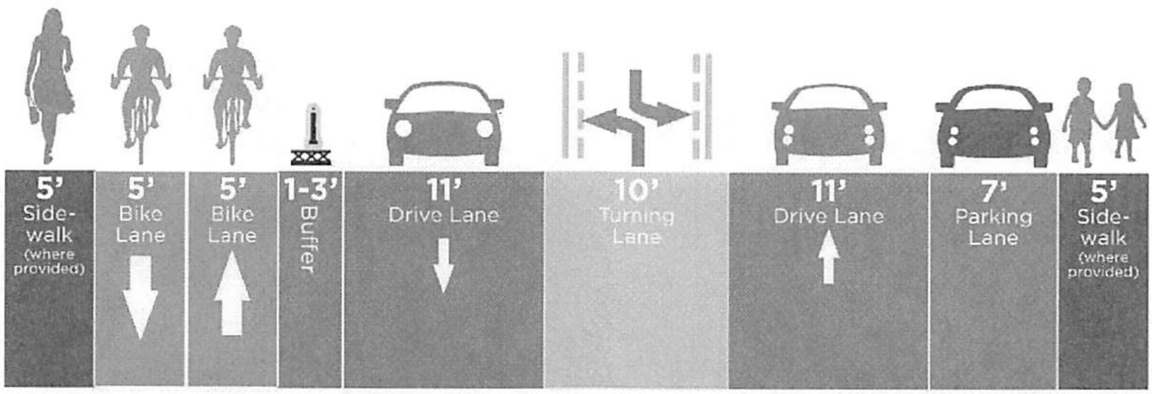
Street Design

The design guidelines outlined in Figure 45 were established to guide decision making around right-of-way reallocation throughout the study area. The typical dimensions include:

- Minimum sidewalk width of 5' of clearance space for through pedestrian traffic in industrial and low-density areas, and 6' elsewhere
- 11' vehicle travel lanes with consideration for 10' lanes where no significant traffic of heavy vehicles or transit occurs, to discourage high speeds.
- Turning lanes should be 10' wide, and physical medians may be as little as 5' wide.
- Curbside lanes can accommodate several uses: parking lanes should be 7' wide, while bike lanes should have a minimum width of 5' per direction and a buffer of at least 1' to 3', depending on the adjacent traffic volumes, with physical protection if possible.

As indicated in Figure 46, bike infrastructure design should be based on the street's basic design and motor vehicle traffic conditions such as vehicle speed and volume. Protected bike lanes are encouraged in streets with targeted motor vehicle speeds >20 mph and daily traffic volumes higher than 3,000 vpd (vehicles per day). Below this threshold, a shared space with motor vehicles (sharrows) or with pedestrians might be considered in bidirectional streets with no centerline and single lane on-way streets.

Figure 45 Street Design Guidelines



Number of Travel Lanes

Streets can function with one travel lane per direction and a center turning lane to accommodate left turns when their averagely daily volumes is 25,000 or lower.[14] If the number of traffic lanes is higher, the extra capacity encourage higher traffic speeds and weaving movements. A similar effect occurs when travel lanes are too wide and the density of crossing is too low, as vehicles tend to increase their speeds due to the lack of obstacles, even in residential areas. Changes on the roadway and intersection design will maintain traffic operations at an acceptable level.

Parking

Parking removal to accommodate bike infrastructure will not be recommended where current on-street and nearby off-street utilization is high.

[14] Nikiforos Stamatiadis and Adam Kirk, "*Guidelines for Road Diet Conversions*," (University of Kentucky, 2012)

Figure 46 **Contextual Guidance for Selecting All Ages and Abilities Bikeways**

Contextual Guidance for Selecting All Ages & Abilities Bikeways

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

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

† Setting 25 mph as a motor vehicle speed threshold for providing protected bikeways is consistent with many cities' traffic safety and Vision Zero policies. However, some cities use a 30 mph posted speed as a threshold for protected bikeways, consistent with providing Level of Traffic Stress level 2 (LTS 2) that can effectively reduce stress and accommodate more types of riders.[15]

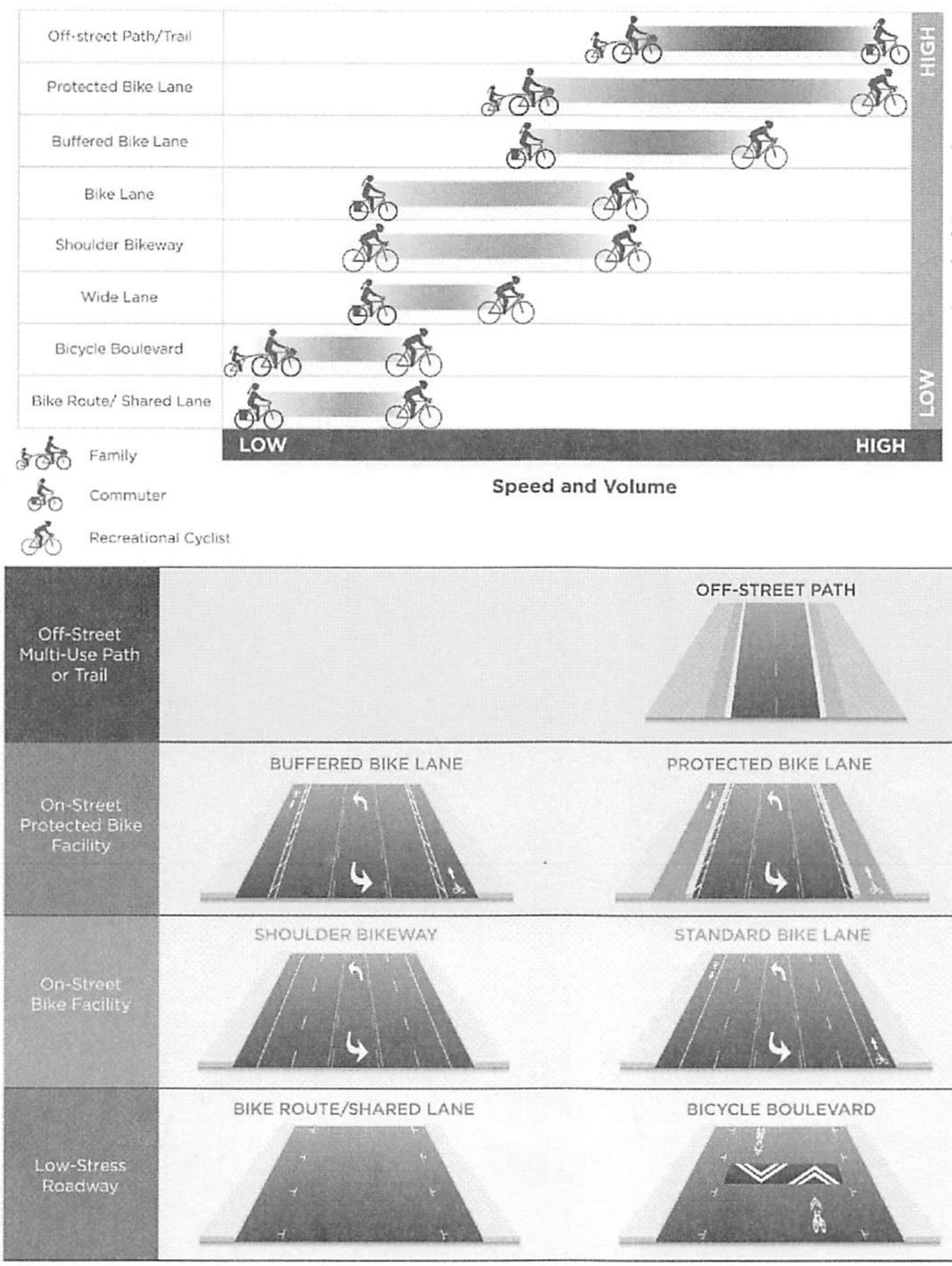
‡ Operational factors that lead to bikeway conflicts are reasons to provide protected bike lanes regardless of motor vehicle speed and volume.

Source: NACTO

Types of Bike Facilities

Tailoring the design of bicycle facilities to fit local context is key to developing a bike network that is comfortable for riders of all ages and abilities. As mentioned in the introduction, people riding bicycles and walking generally feel more comfortable with a larger separation from moving vehicle traffic, crossing streets when vehicles are traveling at slower speeds. The types of facilities that are comfortable to recreational cyclists are unlikely to be comfortable for children and novice riders. See Figure 47.

Figure 47 Types of Bike Facilities



Intersection Design Guidance

Pedestrians

Crosswalks vary in their design; some are unmarked, while others have stop lines, median islands, rapid flashing beacons or other elements that can improve safety. Appropriate crosswalk design and treatments depend on adjacent speeds and volumes. As traffic speeds and volumes increase, so too does the level of protection desired by pedestrians. Where vehicle speeds and volumes are high and pedestrian access is expected at regular intervals, signalized crossings preserve a safe walking environment. Where anticipated pedestrian traffic is low or intermittent, or where vehicle volumes are lower and pedestrian crossings shorter, the use of unsignalized crossing treatments such as medians, hybrid or rapid flash beacons, or raised crossings should be considered.

The National Association of City Transportation Officials (NACTO) Urban Street Design Guide indicates that on streets with low volume (<3000 ADT), low speeds (<20 mph), and few lanes (1–2), marked crosswalks are not always necessary at the intersections. However, at key destinations such as schools, parks, plazas, senior centers, transit stops, hospitals, campuses, and major public buildings, marked crosswalks may be beneficial regardless of traffic conditions.

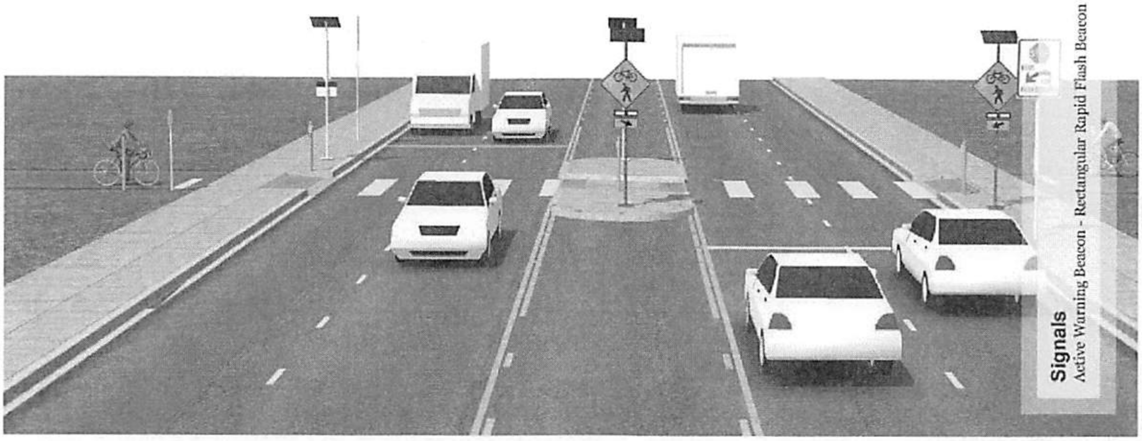
The same source highlights that all legs of signalized intersections must have marked crosswalks unless pedestrians are prohibited from the roadway or section thereof, or if there is physically no pedestrian access on both corner and no likelihood that access can be provided.

In addition to the traditional warrants for traffic signals, the following treatments should supplement marked crosswalks midblock where there is a pedestrian desire line:

1. **Median/Refugee Islands**: A median or refuge island is a raised longitudinal space separating the two main directions of traffic. Mid-block crossings can be kept simple and are easily located on low-volume, low-speed roadways, such as short 40- to 48-km/h (25- to 30-mph) streets[15].
2. **Active Warning signals**: Active warning beacons are user-actuated amber flashing lights that supplement warning signs at unsignalized intersections or mid-block crosswalks. Beacons can be actuated either manually by a push-button or passively through detection. Rectangular Rapid Flash Beacons (RRFBs), a type of active warning beacon, use an irregular flash pattern similar to emergency flashers on police vehicles and can be installed on either two-lane or multi-lane roadways. Active warning beacons should be used to alert drivers to yield where bicyclists have the right-of-way crossing a road. See Figure 48.
3. **Curb extensions**: visually and physically narrow the roadway, creating safer and shorter crossings for pedestrians while increasing the available space for street furniture, benches, plantings, and street trees.
4. **High-intensity Activated CrosswalK (HAWK)**, consists of a signal-head with two red lenses over a single yellow lens on the major street, and pedestrian and/or bicycle signal heads for the minor street. There are no signal indications for motor vehicles on the minor street approaches.

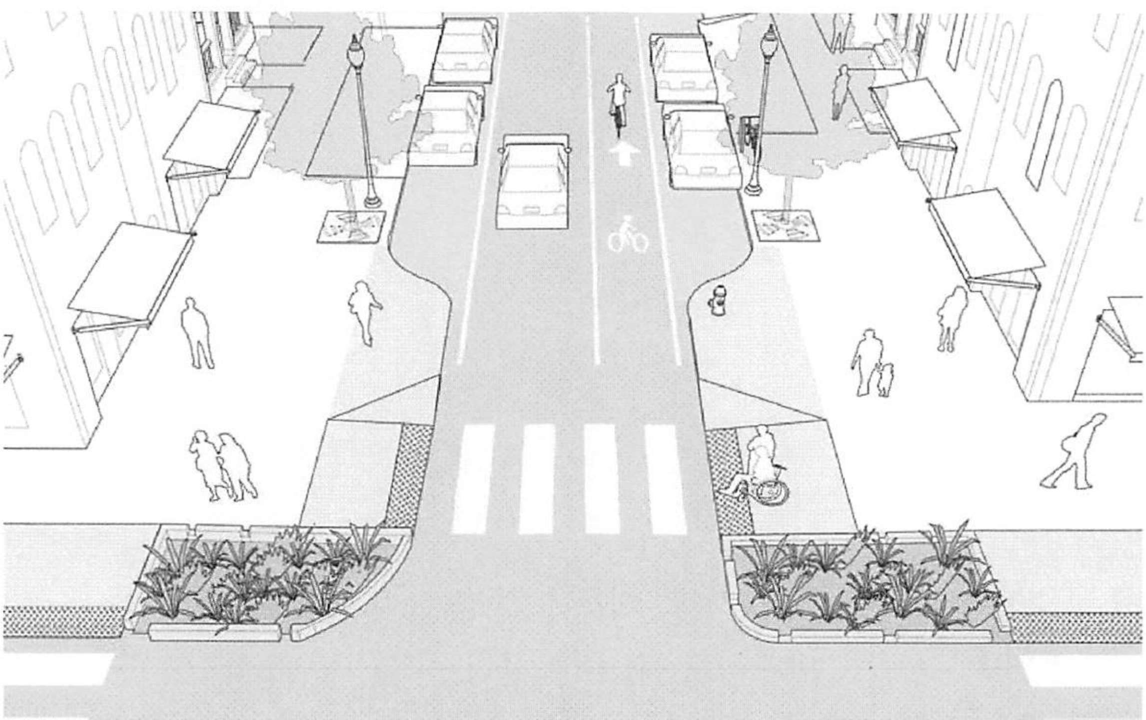
[15] https://safety.fhwa.dot.gov/PED_BIKE/univcourse/pdf/swless16.pdf

Figure 48 Example of a Median Refugee Island for Pedestrians and Bicyclists and a Flashing Beacon



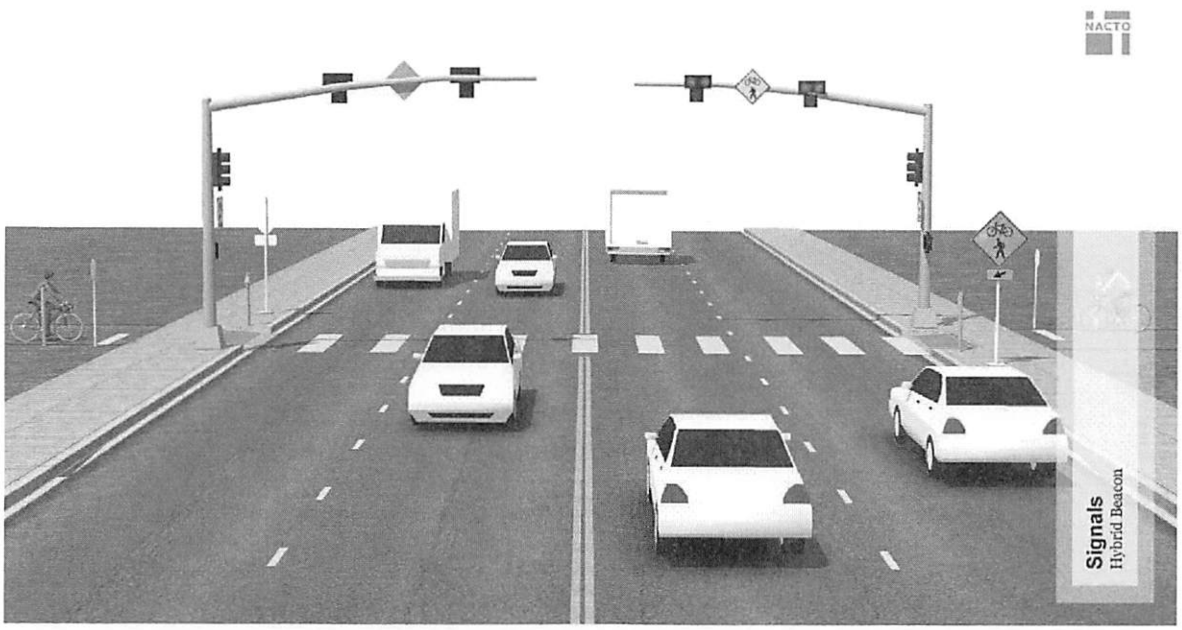
Source: NACTO

Figure 49 Example of a Curb Extension



Source: NACTO

Figure 50 Example of a Hybrid Beacon



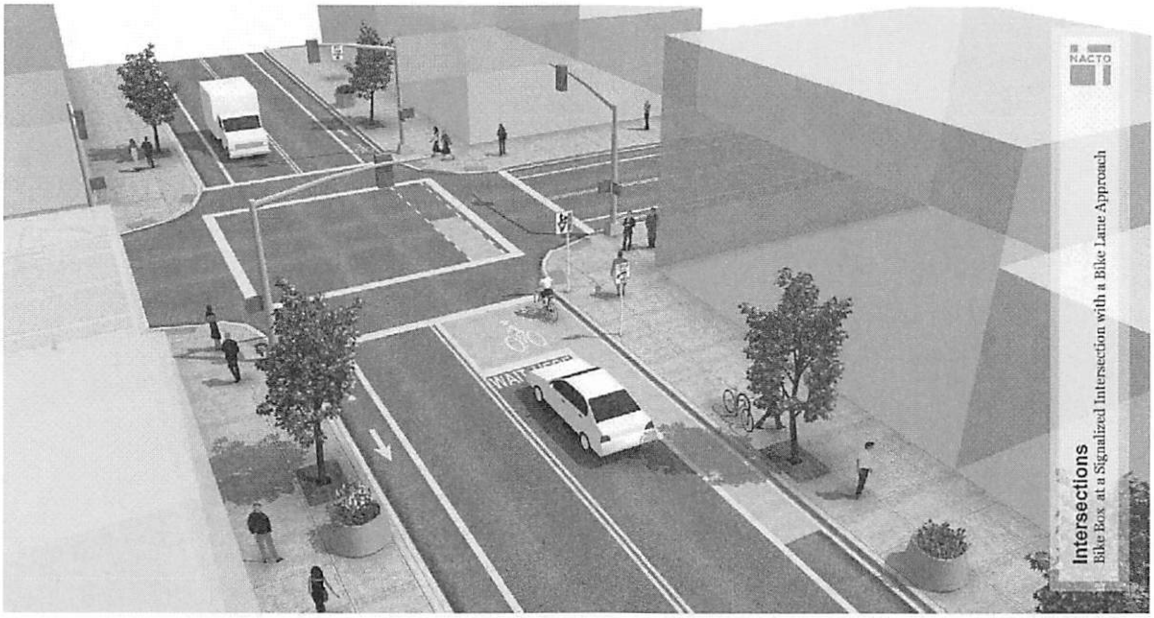
Source: NACTO

Bicycles

Intersections are crucial to the success of all types of bicycle facilities. A low-stress segment of a bike network will be used only if it includes safe, low-stress intersections that connect people to and through the network. There are a number of strategies for making intersections safer for everyone using the road, including all types of cyclists:

1. **Physical protection:** The safest intersection design is a "protected intersection," which uses concrete islands and pavement markings to keep different modes separated to eliminate conflicts.
2. **Paint:** Painted intersection treatments, such as green bike boxes, turn lanes, and driveway crossings, help alert drivers to the presence of people on bikes and direct cyclists through an intersection.
3. **Bike signals:** On high-volume bikeways, bicycle-specific traffic signals clearly define time and space for bike movements, and make drivers more aware of people on bikes. Bike signals are particularly important on as part of a protected bike lane installation, as they help to separate bike movements from vehicles turning across a bike lane.
4. **Raised crossings:** Raised crossings for people walking and biking slow traffic and improve safety. They also make the crossing smoother by keeping people walking or biking at the same grade as an adjacent sidewalk or bikeway.
5. **Pavers:** Using pavers, such as bricks, at intersections can help designate an intersection as a mixing zone, slowing auto traffic and making drivers more aware of people crossing an intersection on foot or on bike.

Figure 51 Example of a Bike Box at a Signalized Intersection with a Bike Lane Approach



Source: NACTO

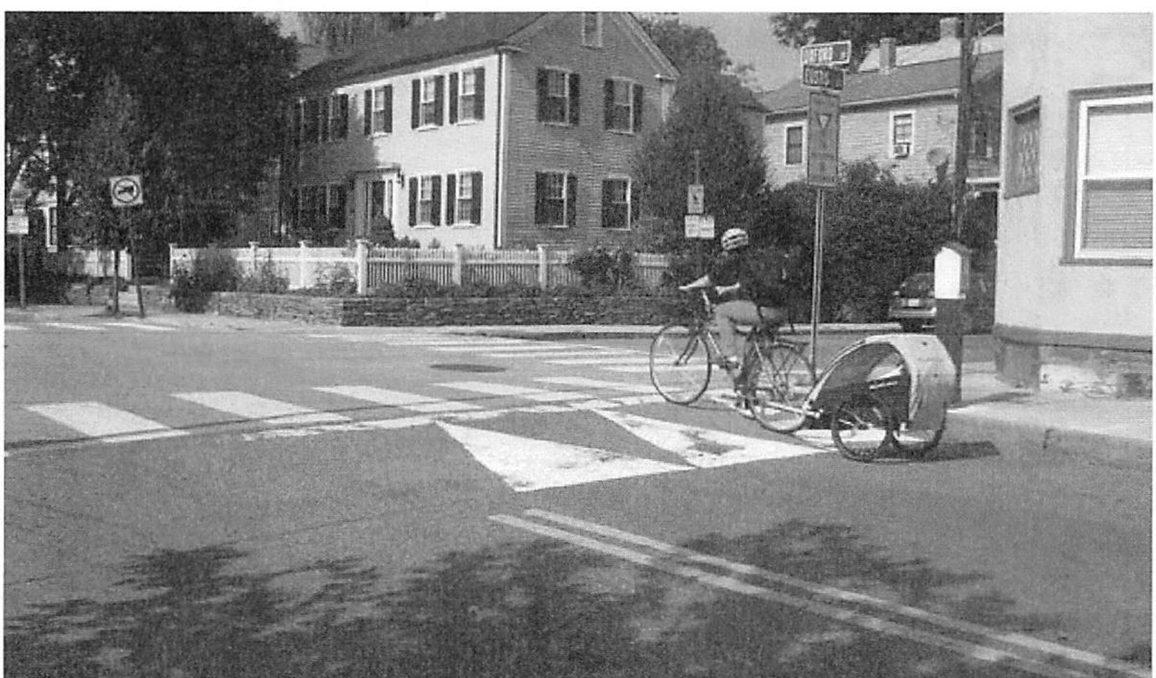
Figure 52 Example of a Painted Merging Area Between a Bike Lane and Right Turns for Vehicles

Source: NACTO

Figure 53 Example of Bike Signals at an Intersection

Source: rEvolving Transportation. New York, NY

Figure 54 Raise Intersection and Bike Crossing



Source: NACTO. Cambridge, MA

Figure 55 Example of a Curb Extension as a Speed Management Measure

Source: NACTO

Figure 56 Intersection with Pavers to Help Designate An Intersection as a Mixing Zone

Source: Cultural Trail, Indianapolis

OPPORTUNITIES AND CONSTRAINTS

Below are the opportunities and constraints linked to the existing conditions of Route 9 and the design guidelines presented above. Most of the Route 9 segments have the sufficient width to meet these guidelines, but some others don't meet the minimum width required to improve the active transportation network due to the presence of on-street parking, narrow roadway and/or high traffic volumes (indicated as Pinch Points in Figure 57).

Opportunities

- Most Route 9 segments have the sufficient roadway width to meet design guidelines
- Better connections to transit
- Improving Old Croton Aqueduct connectivity at street crossings
- Some suitable parallel alternatives close to village destinations
- Improve student safety for school journey and reduce school drop off traffic

Constraints

- Street segments with insufficient roadway width due to:
  - On- street parking demand
  - Narrow roadway width
  - Higher traffic volumes
- Locations without nearby parallel routes
- Locations where parallel routes are unsuitable due to slope, lighting or surface type

Figure 57 Location with Insufficient Width