Route 9 Active Transportation Conceptual Design Plan

Final Report

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Appendices

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 3 summarizes the community benefits of walking and biking.

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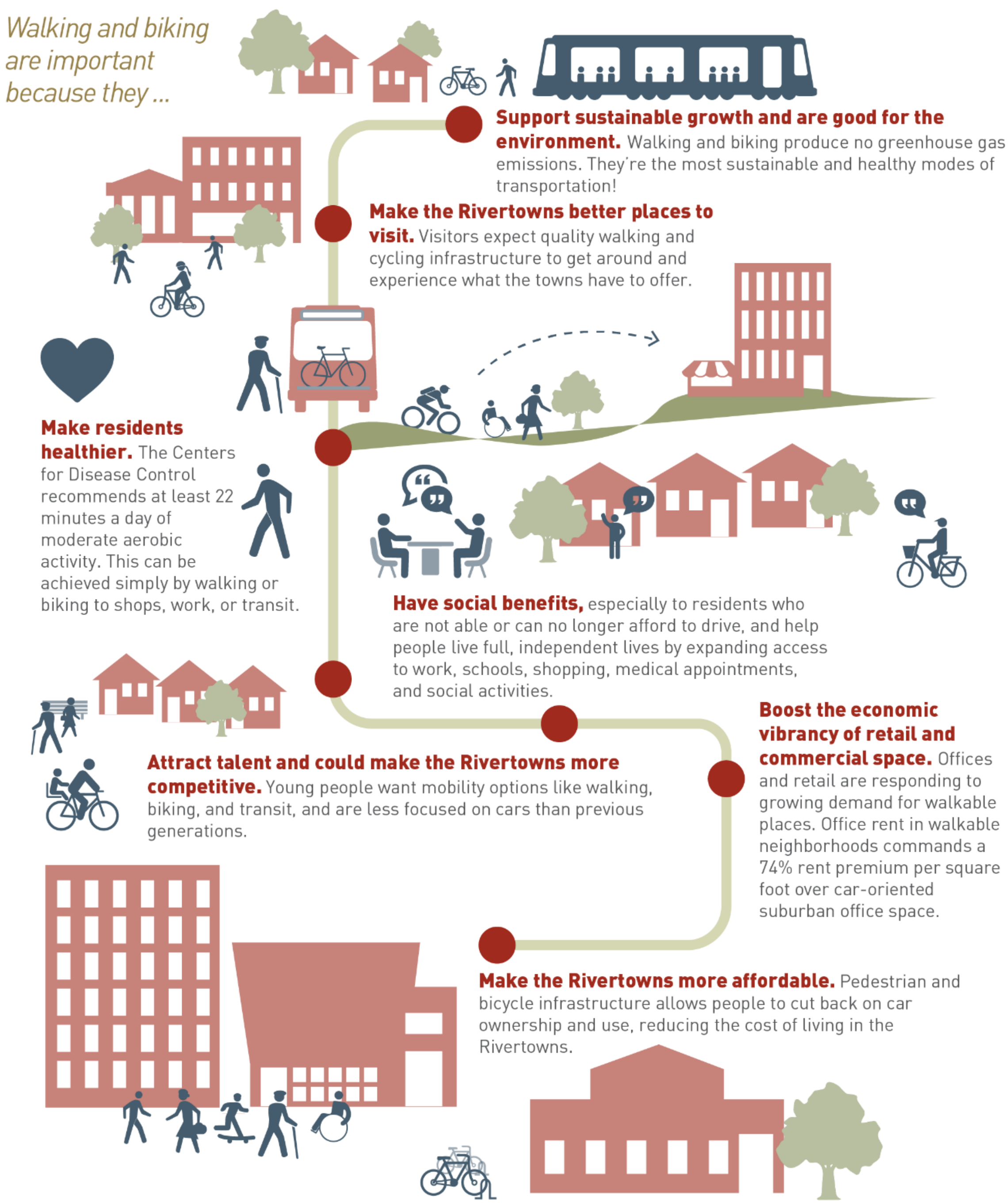
[1] 2014. Monsere, C., "Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S." https://trec.pdx.edu/research/project/583/Lessons_from_the_Green_Lanes:_Evaluating_Protected_Bike_Lanes_in_the_U.S._

[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

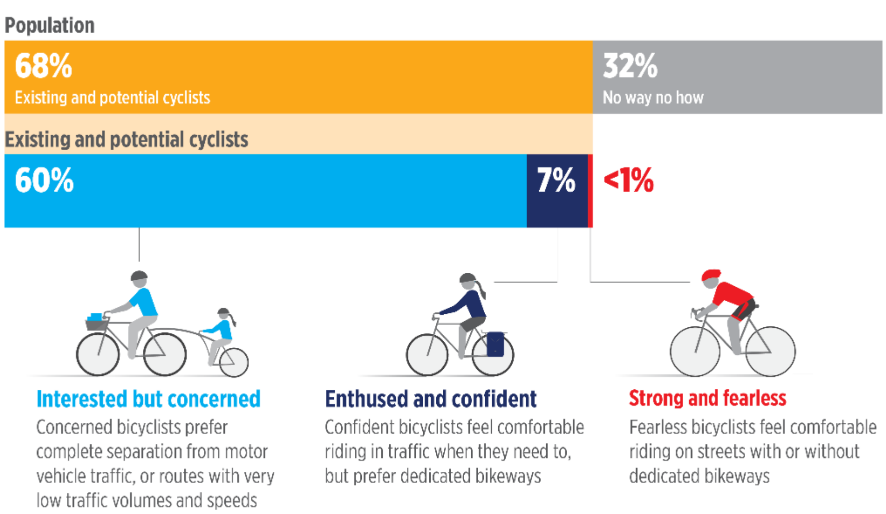
The location of key facilities such as shops and schools, close to homes and on the most convenient path between two major activity centers is key to ensuring a high level of active transport, and will also help ensure the sustainability of commercial activities.

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.

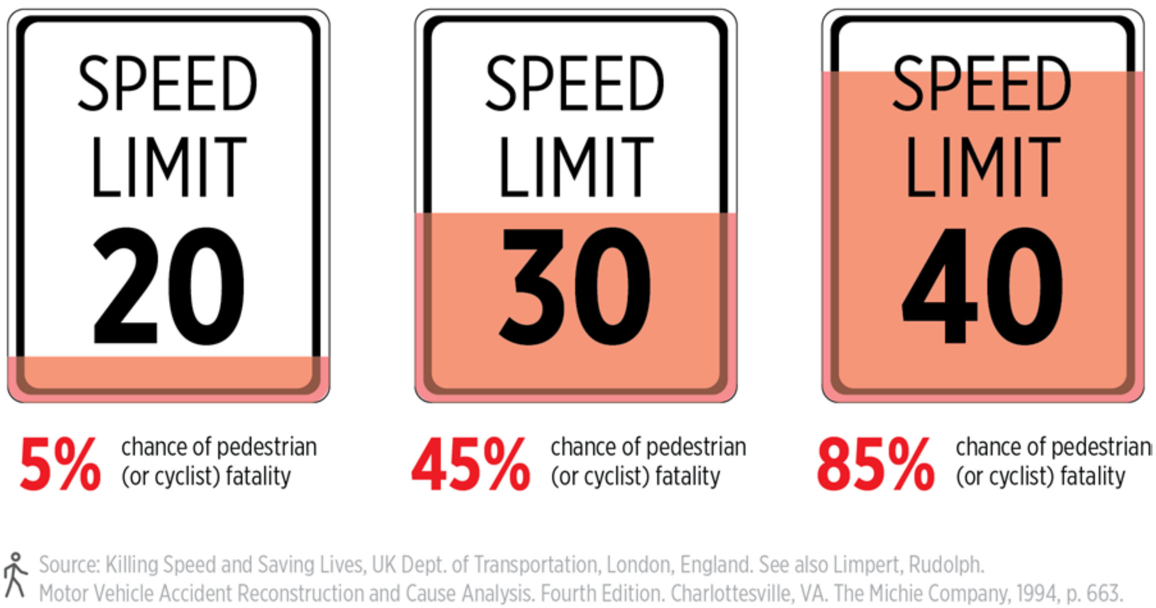
[5] Four Types of Cyclists by Roger Geller, Bicycle Coordinator for Portland, OR. 2009.

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



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

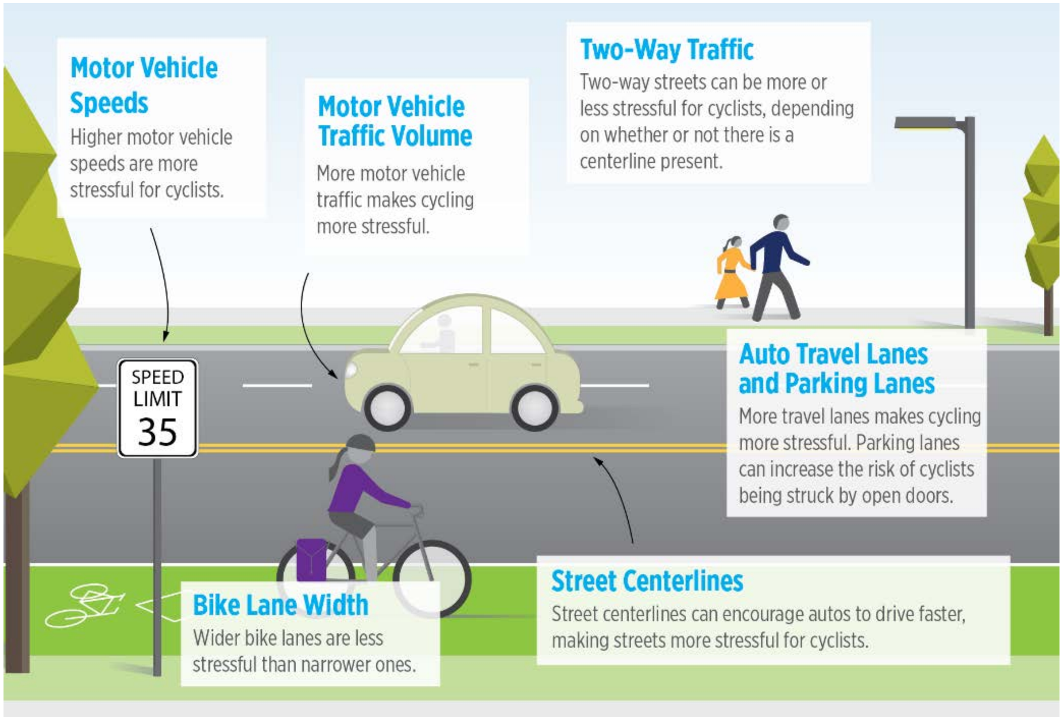
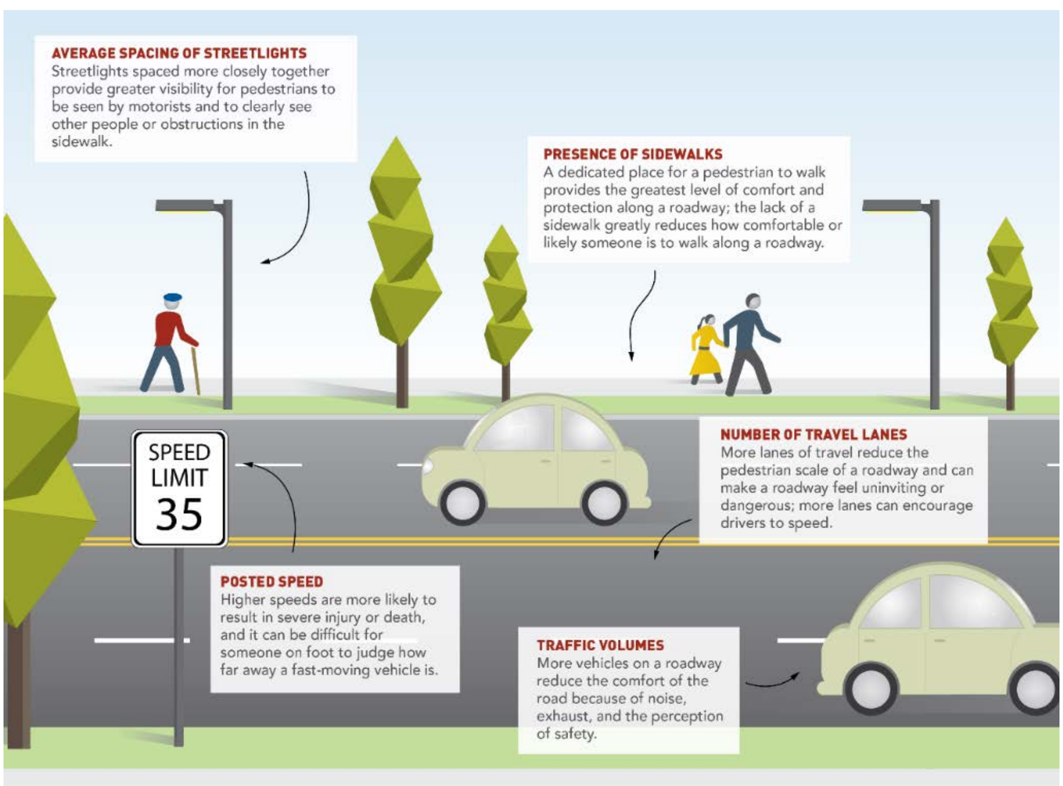


Figure 7 Contributors to Walking Comfort



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

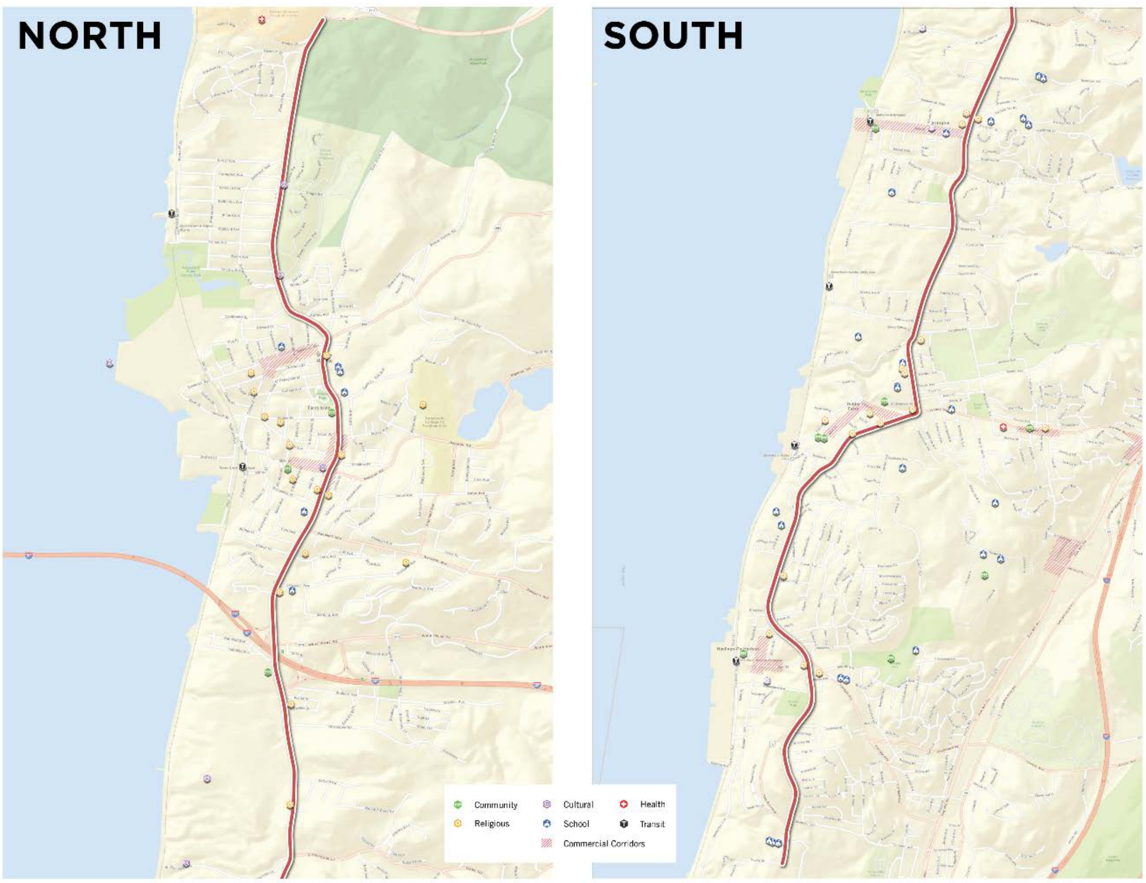
comparing the neighborhoods west of Route 9 to the neighborhoods east of Route 9, especially in Irvington. The Metro North Train Stations are all located to the west of the corridor, supporting the higher density of zero-vehicle households. Figure 10 shows where households with zero vehicles are located,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

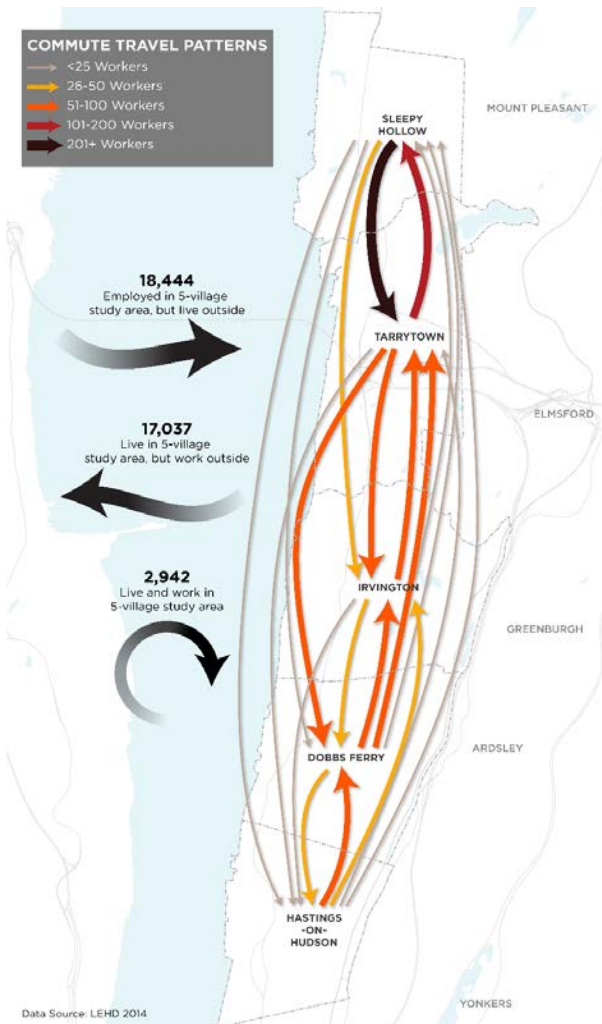
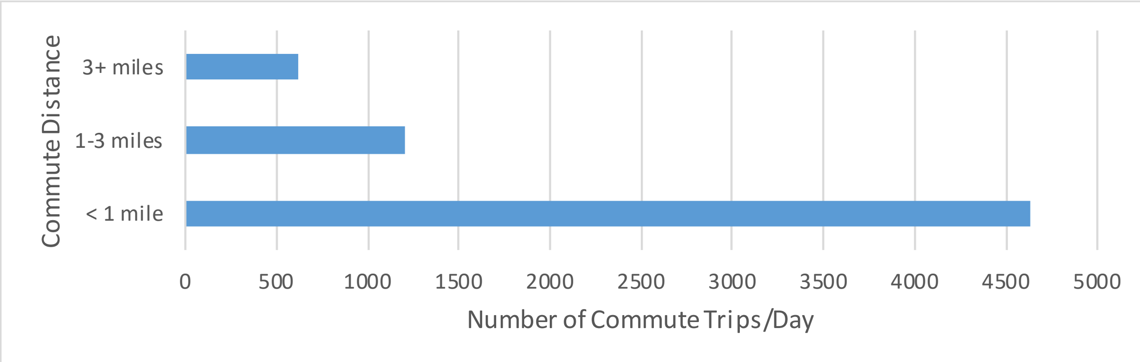


Figure 13 Distance of Commute Trips within the Corridor



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

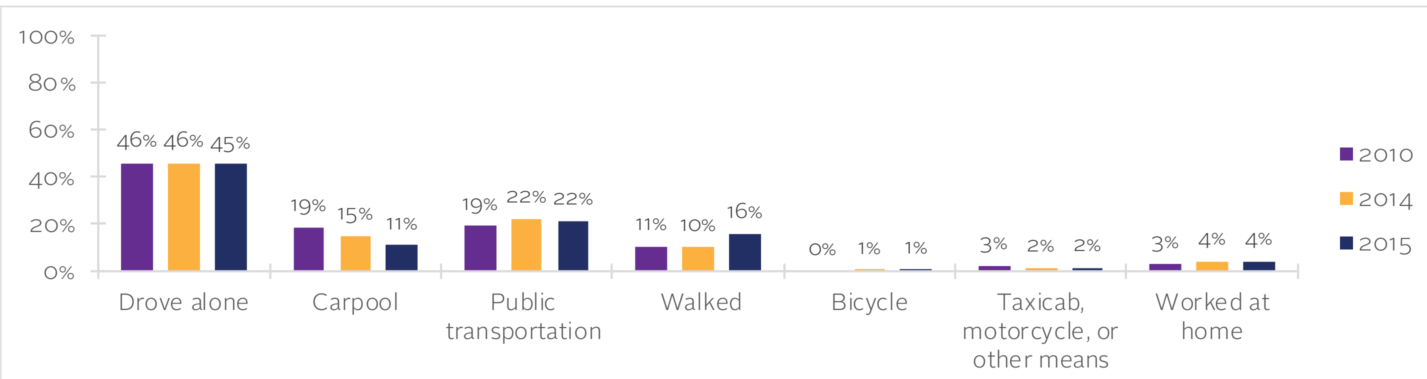


Figure 15 Mode Share of Tarrytown Resident-Commuters

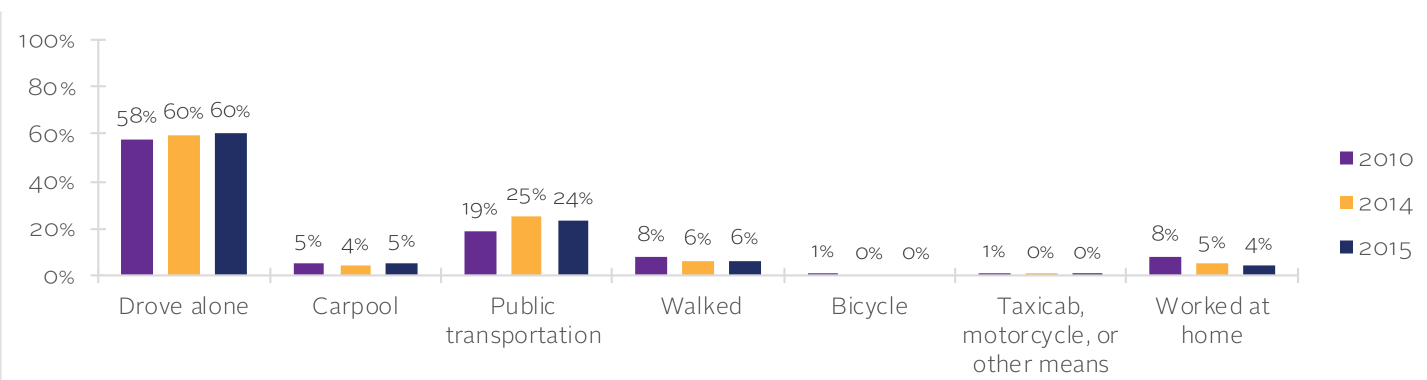


Figure 16 Mode Share of Irvington Resident-Commuters

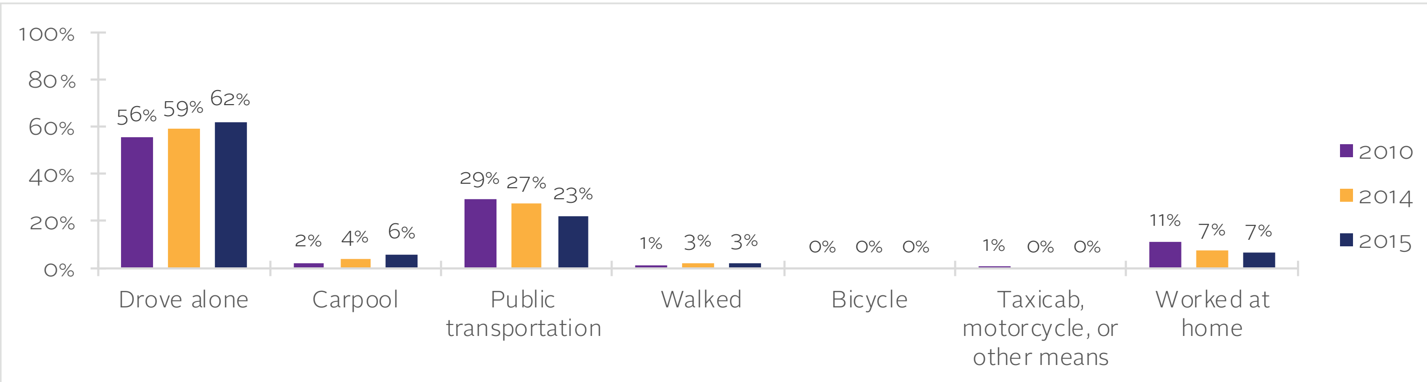


Figure 17 Mode Share of Hastings-on-Hudson Resident-Commuters

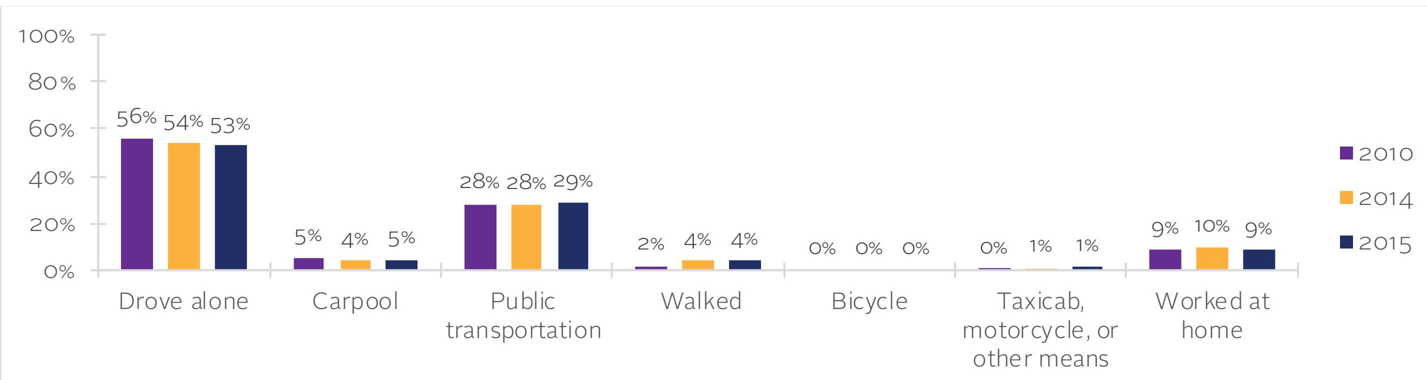
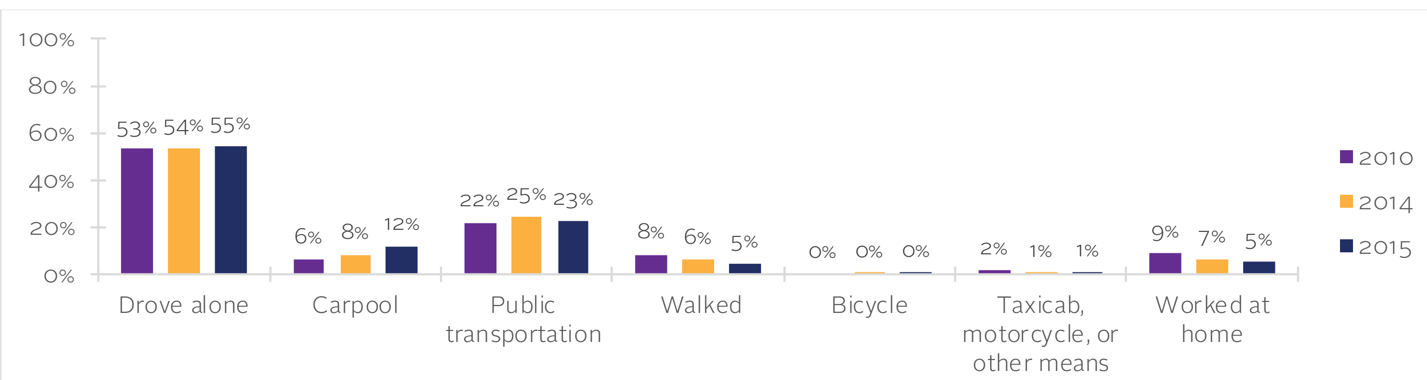


Figure 18 Mode Share of Dobbs Ferry Resident-Commuters

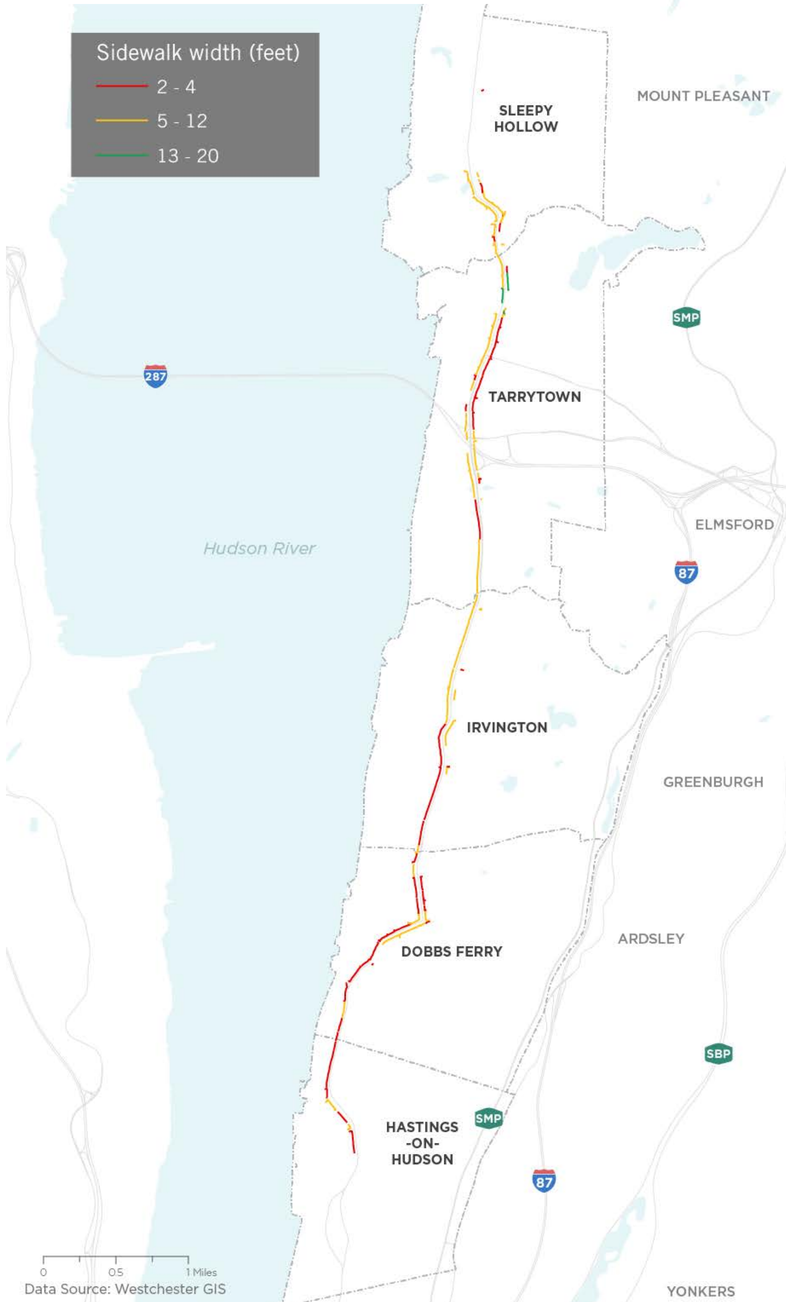


Sidewalks

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

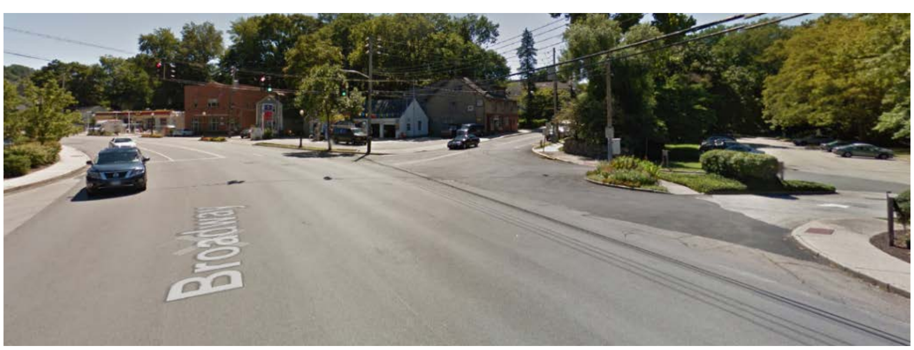


Figure 22 Broadway at Pocantico Street, Aerial View

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

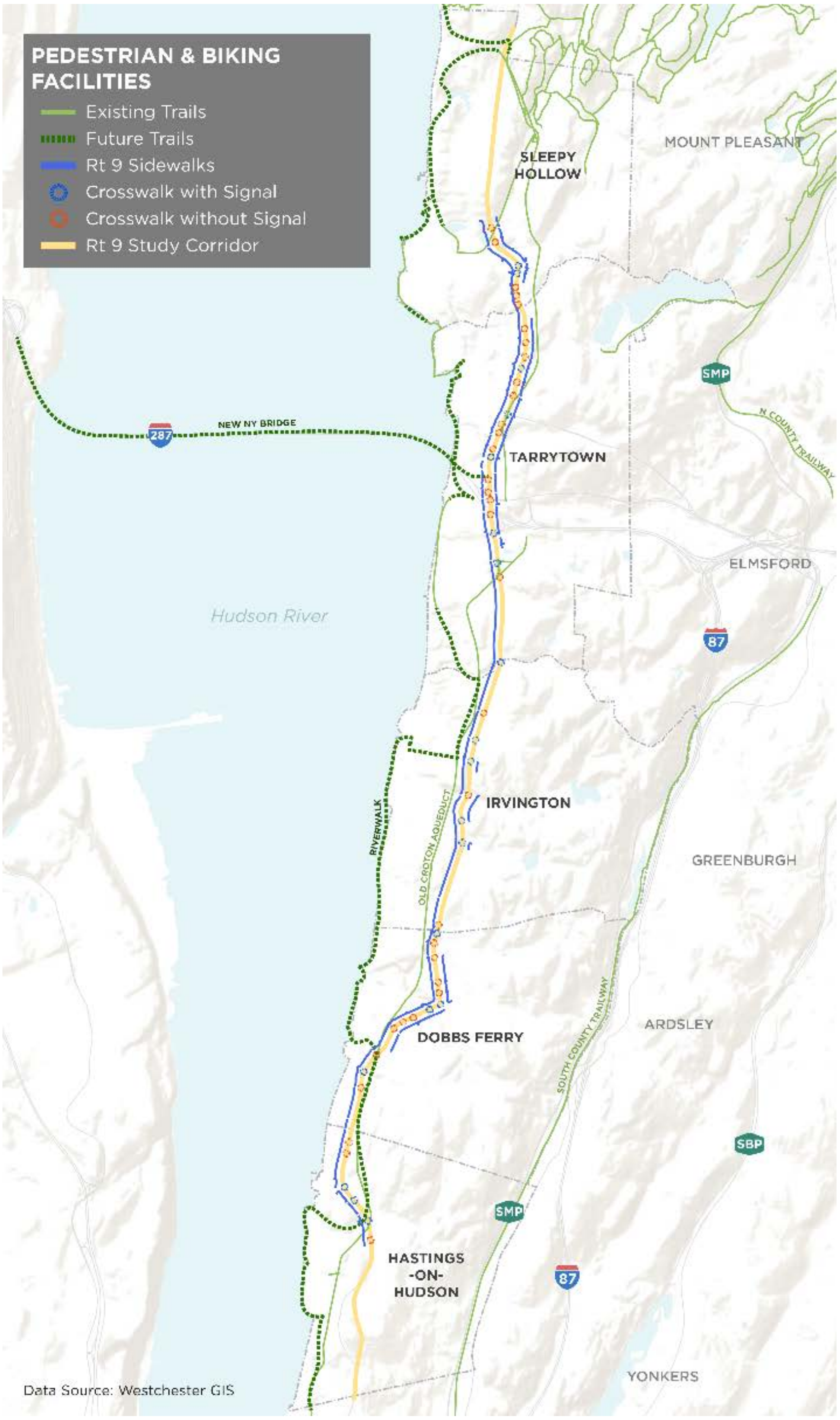
Figure 26 OCA crossing at Dobbs Ferry

[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%:

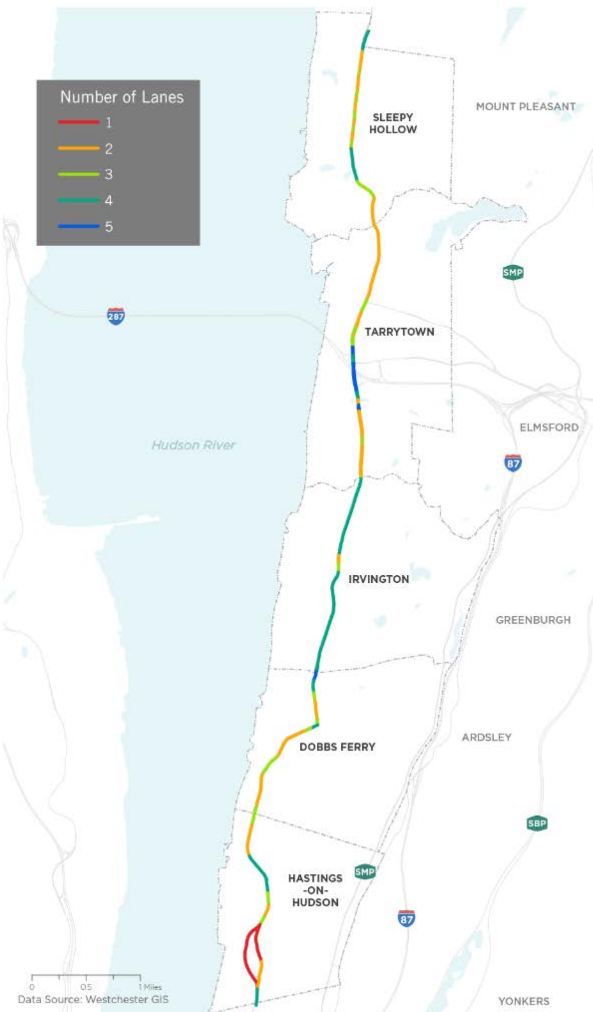
- Sleepy Hollow: Saint Paul's Hill in Sleepy Hollow has a slope over 5% (Route 9 between Gordon Ave and Beekman Ave, 700 ft)
- Sleepy Hollow: Segment between Palmer Ave and Pierson Ave intersections, in Sleepy Hollow (1,130 ft).
- Dobbs Ferry: from Oak St to Elm St (315 ft)
- Hastings-on-Hudson: from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

NY SDOT 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.

[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:

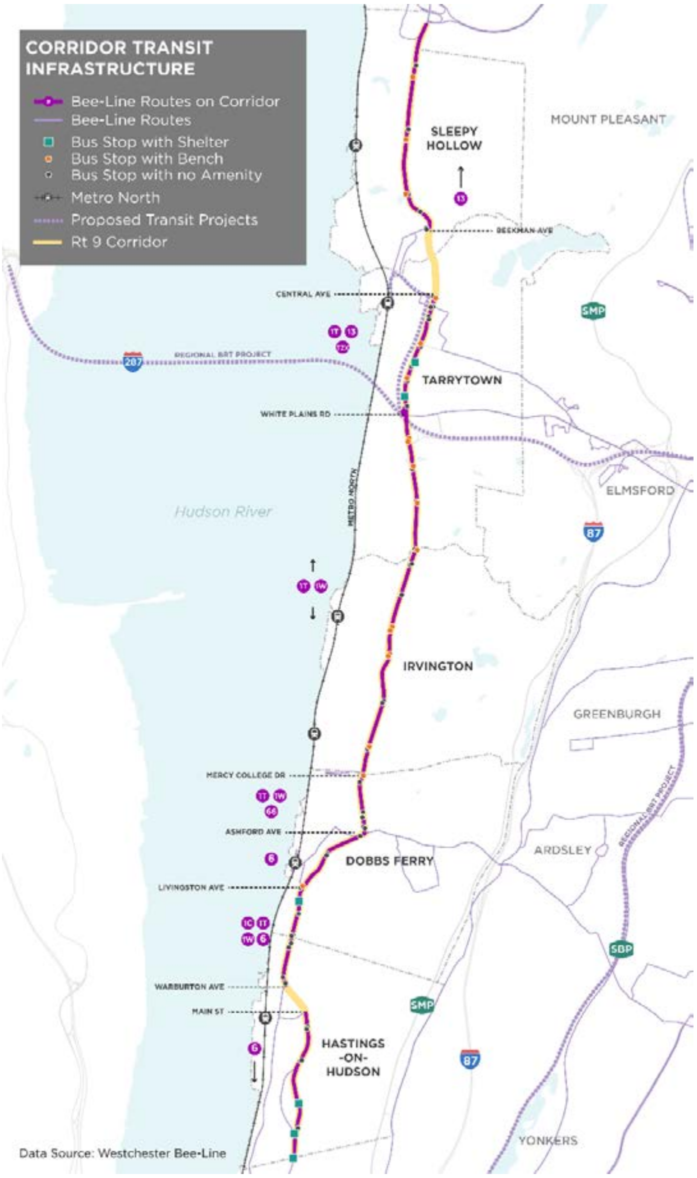
- Benedict Avenue
- 1-278 Ramps
- Main Street in Irvington
- Ashford Avenue
- Farragut Avenue

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.

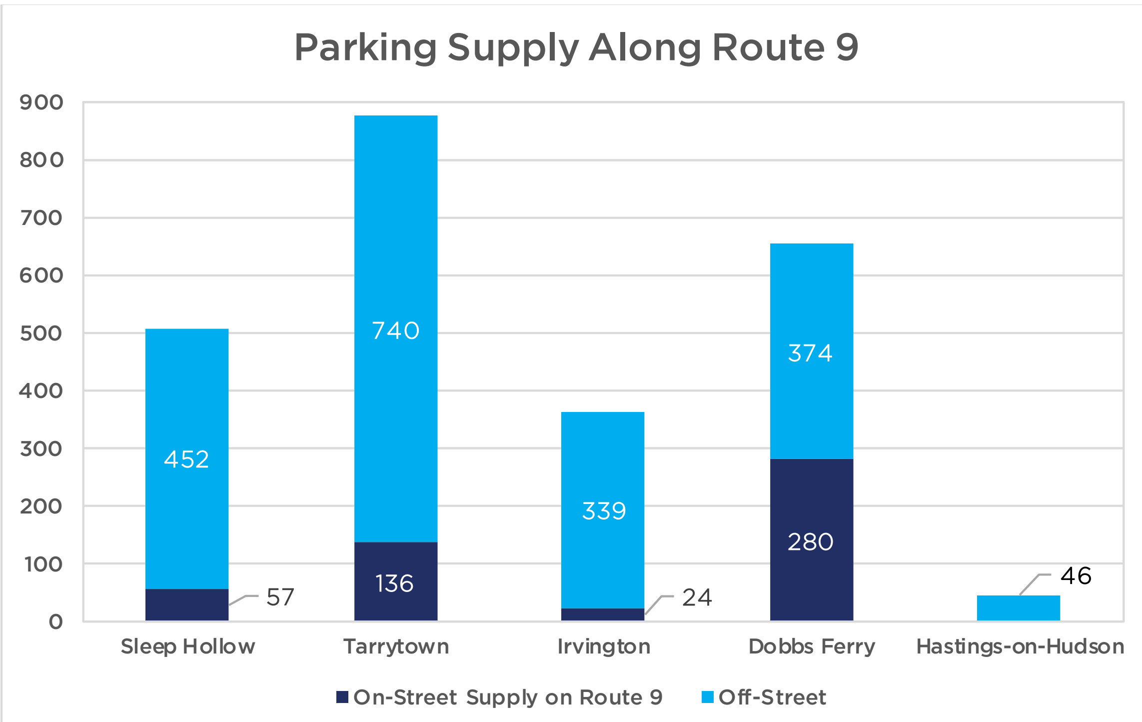
Figure 35 Example of a Transit Stop Located on the Curb with No Walking Facility Infrastructure

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

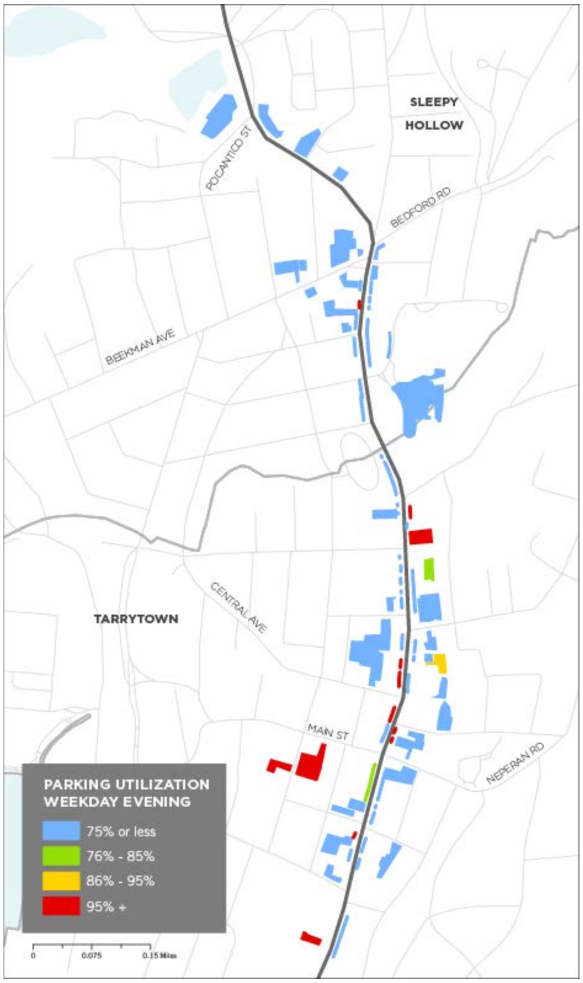


Parking Utilization

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



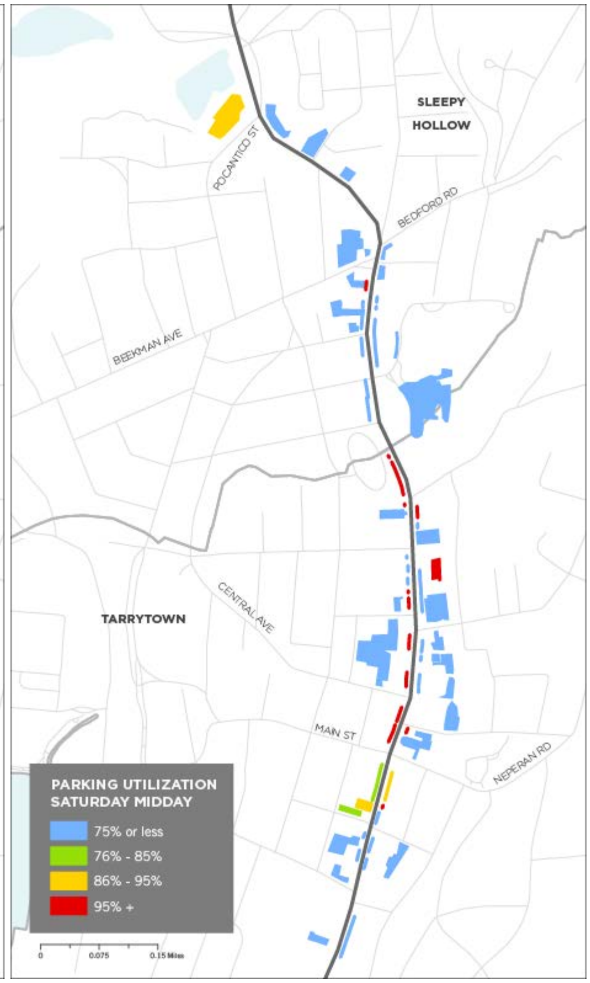
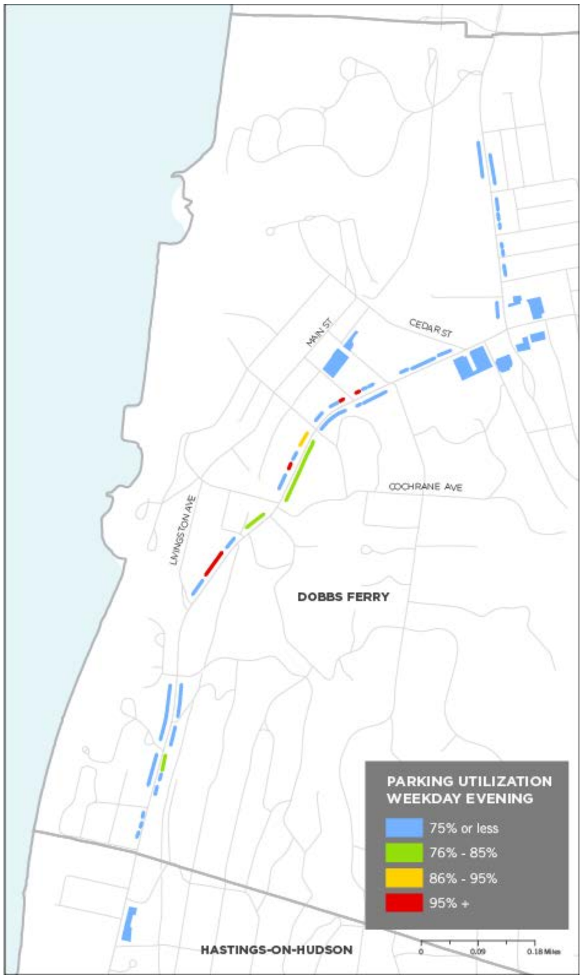
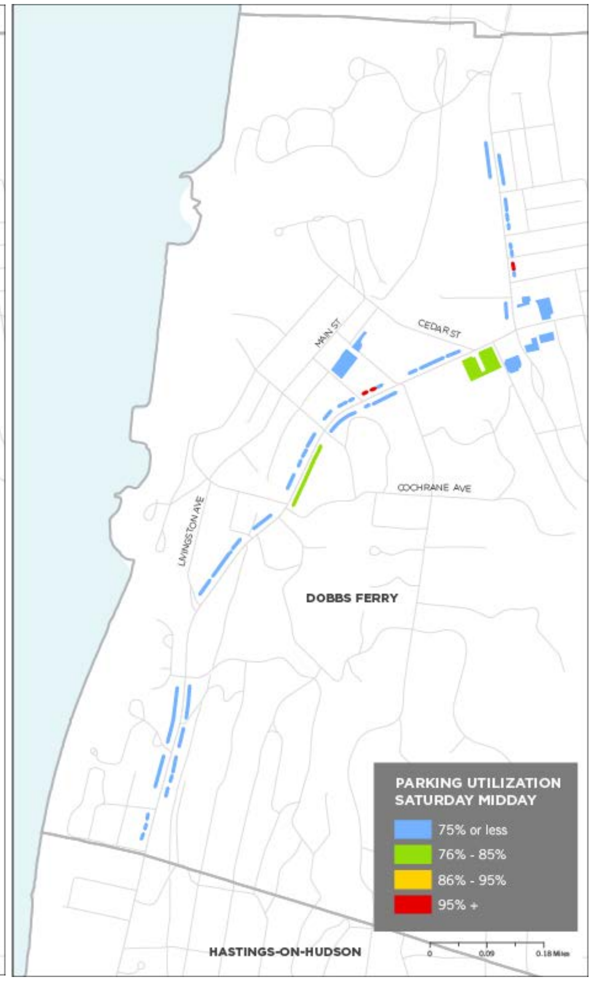


Figure 38 Parking Utilization – Irvington

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.

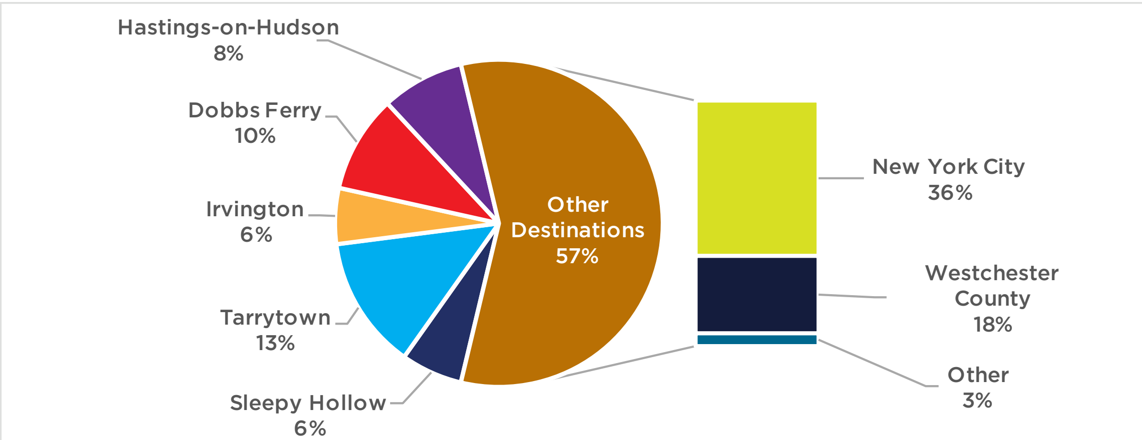
See Appendix C for a detailed explanation of the findings of the Community Outreach process.

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.

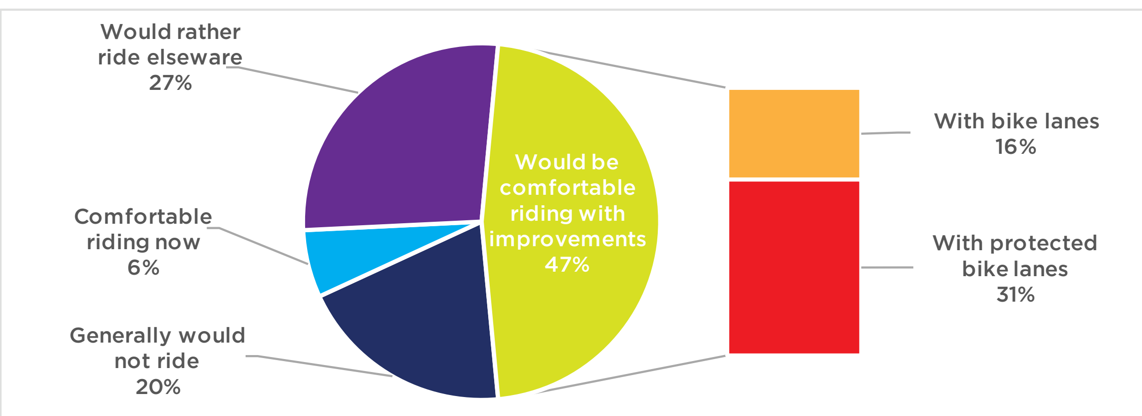
Figure 41 Commute Destinations of Respondent Commuters



Level of Comfort

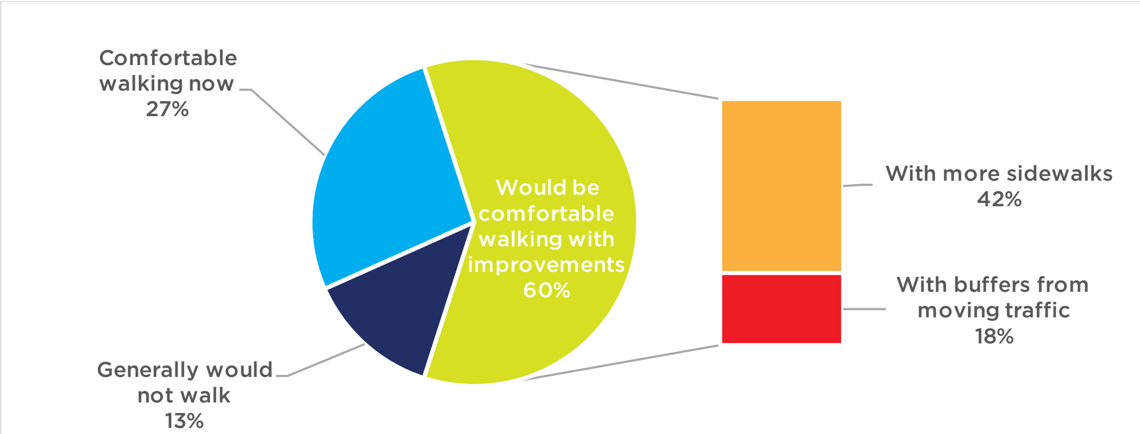
Very few survey respondents, about 6%, are currently comfortable with bicycling along Route 9. Just under half of respondents, however, indicated that they would be comfortable riding a bicycle along Route 9 with some form of improvement to bicycle facilities, particularly protected bike lanes. Over 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



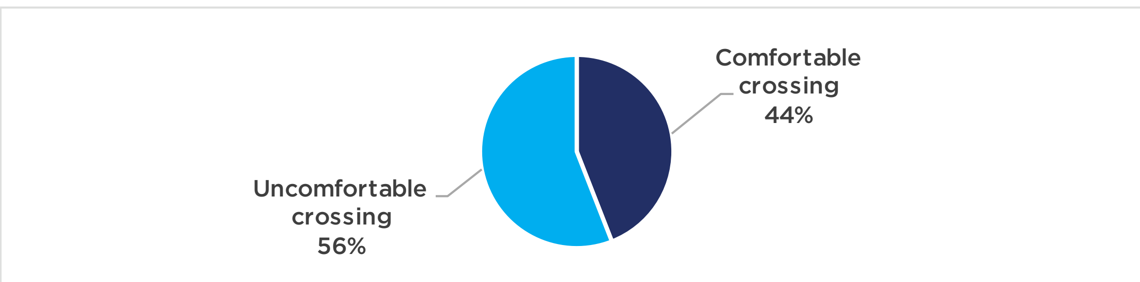
Alternatively, only about one-quarter of respondents are currently comfortable walking along Route 9 as it is, and less than half are comfortable crossing the road as it is. However, about 60% would be comfortable walking along Route 9 with some form of improvement to pedestrian facilities, particularly 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.

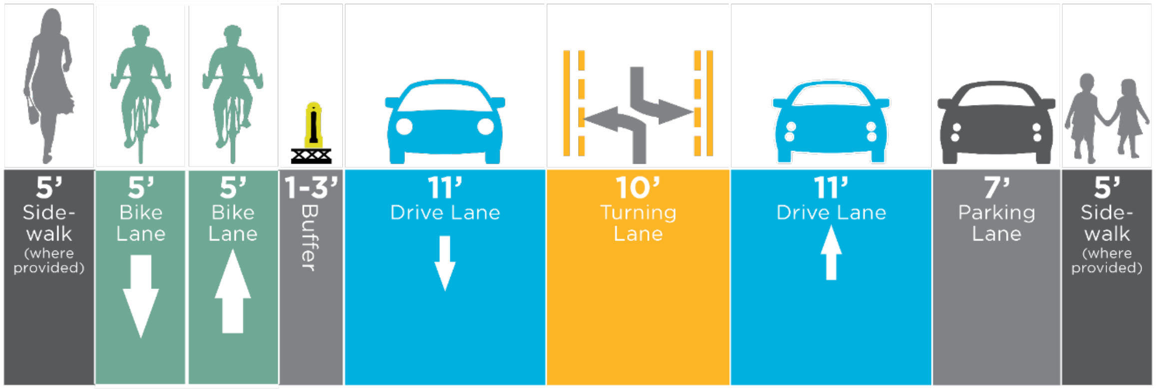
Street Design

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.[18]

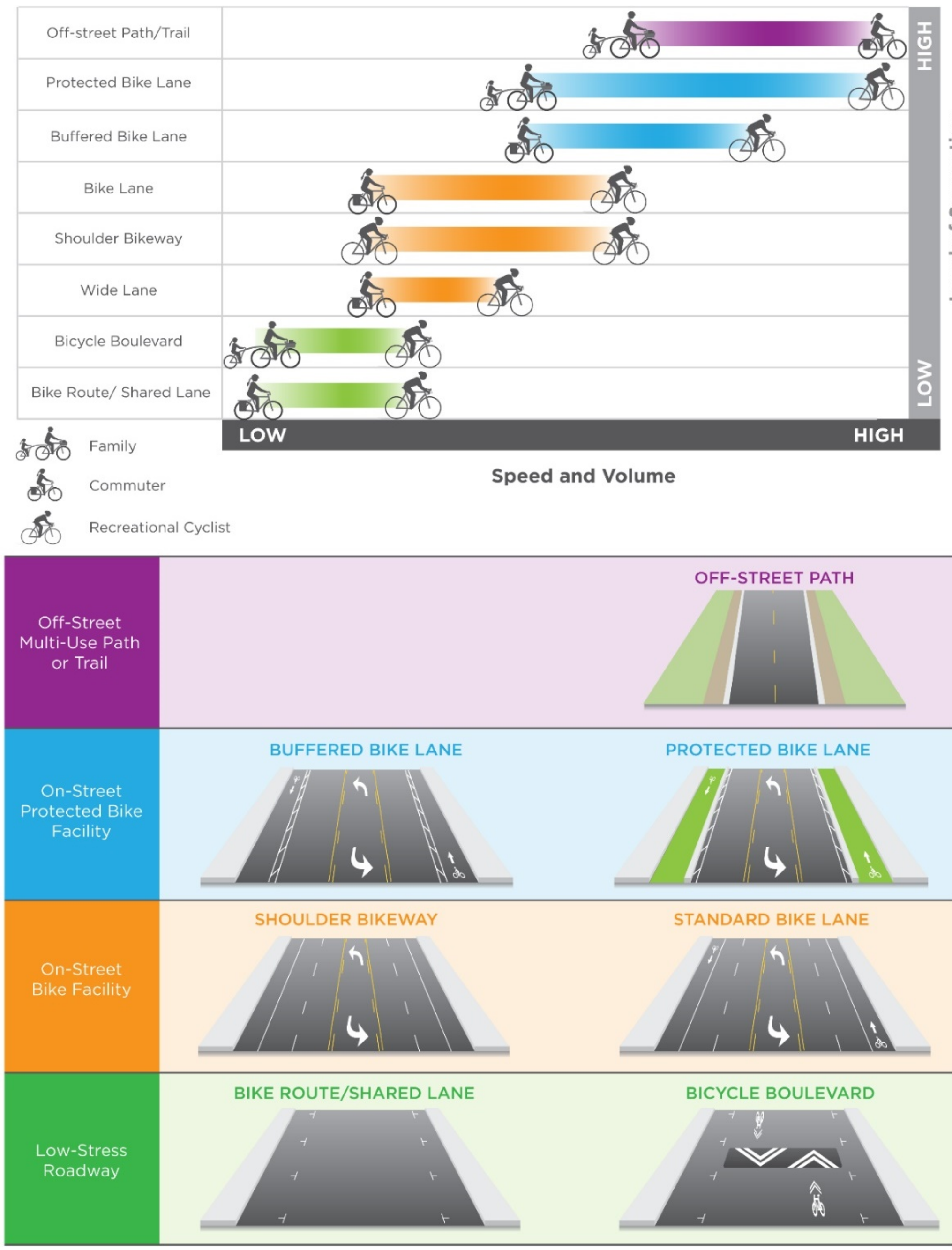
‡Operational factors that lead to bikeway conflicts are reasons to provide protected bike lanes regardless of motor vehicle speed and volume.

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:

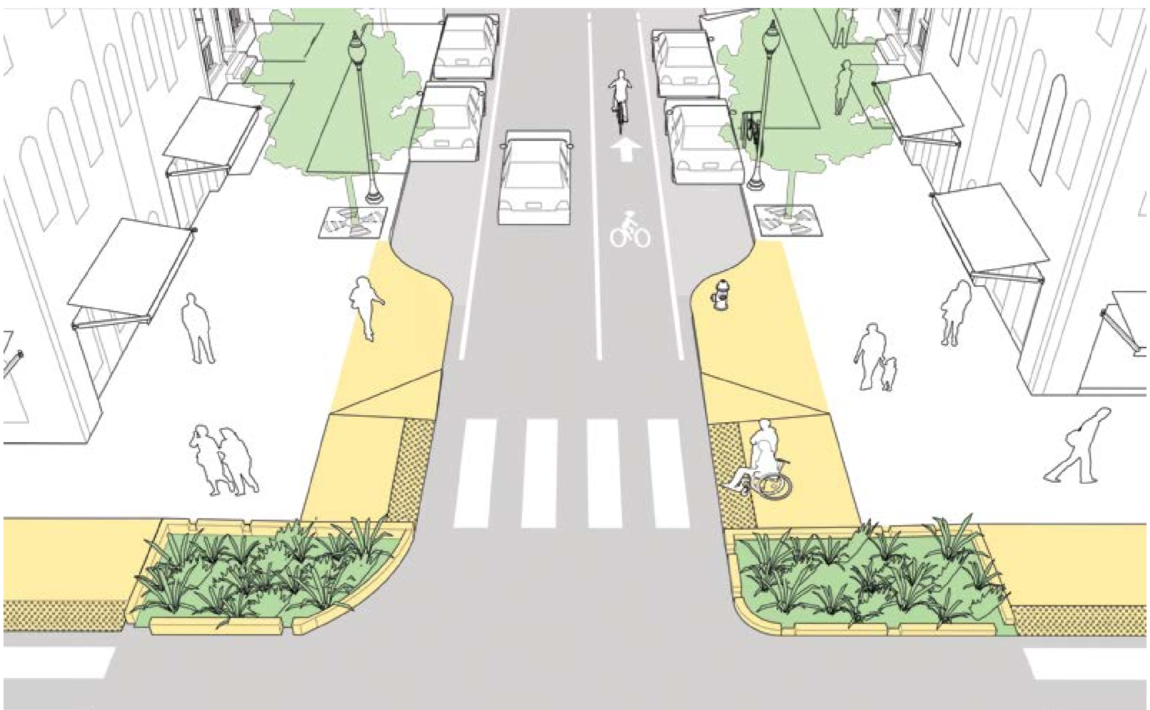
1. **Median/Refugee Islands**: A median or refuge island is a raised longitudinal space separating the two main directions of traffic. Mid-block crossings can be kept simple and are easily located on low-volume, low-speed roadways, such as short 40- to 48-km/h (25- to 30-mph) streets[15].
2. **Active 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

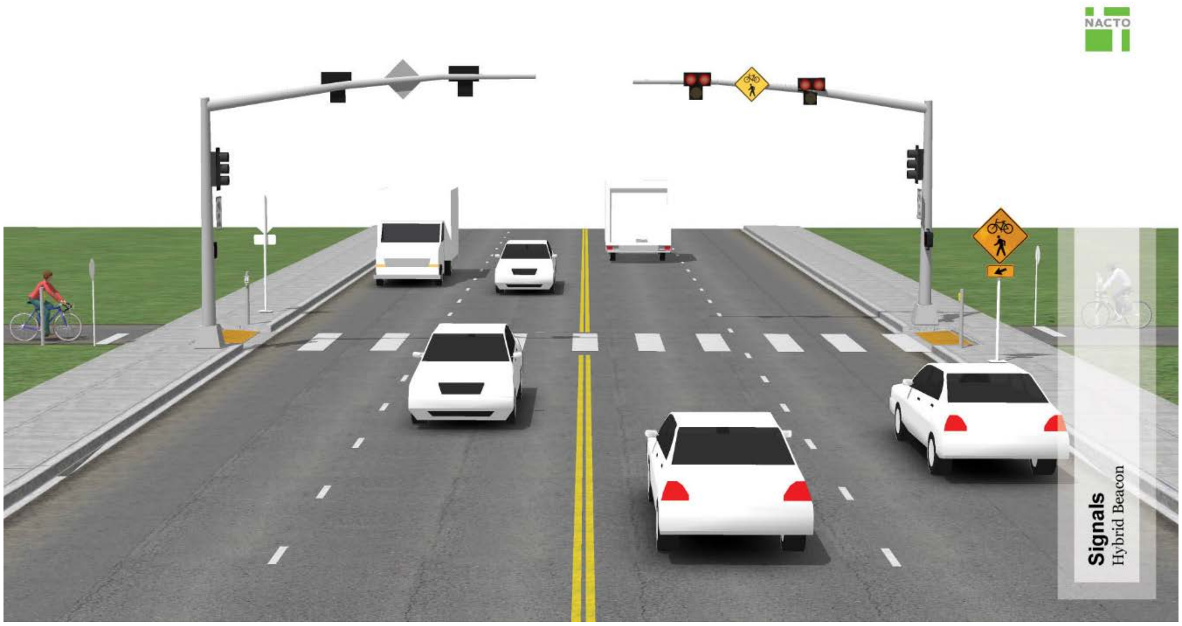
Source: NACTO

Figure 49 Example of a Curb Extension



Source: NACTO

Figure 50 Example of a Hybrid Beacon



Source: NACTO

Bicycles

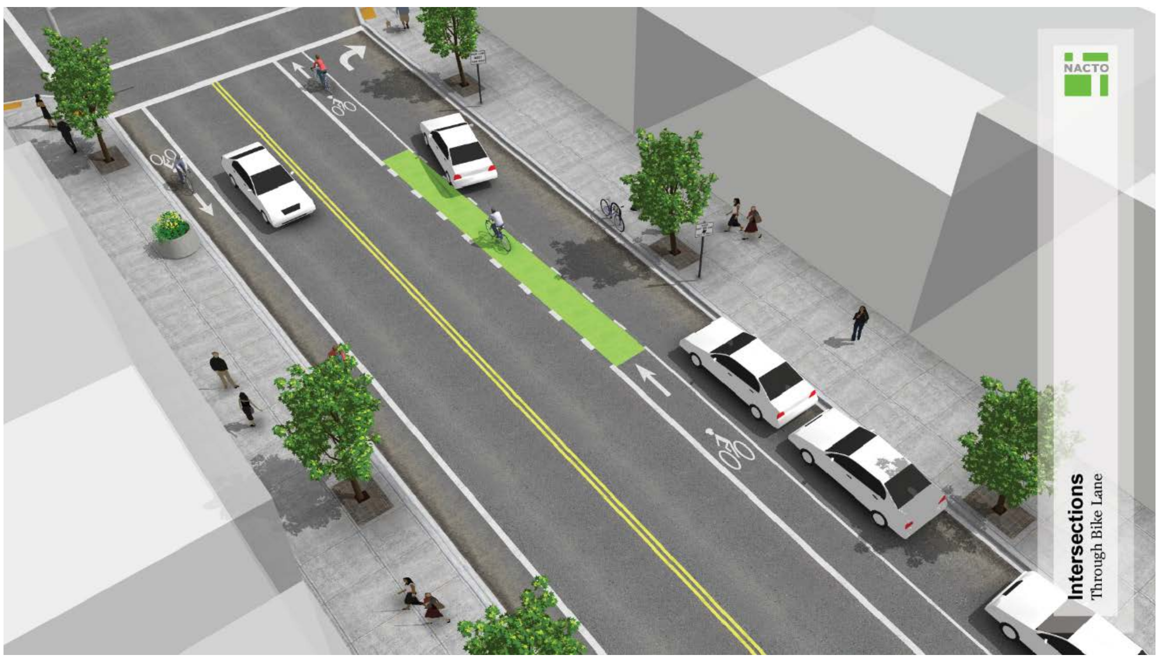
Intersections are crucial to the success of all types of bicycle facilities. A low-stress segment of a bike network will be used only if it includes safe, low-stress intersections that connect people to and through the network. There are a number of strategies for making intersections safer for everyone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

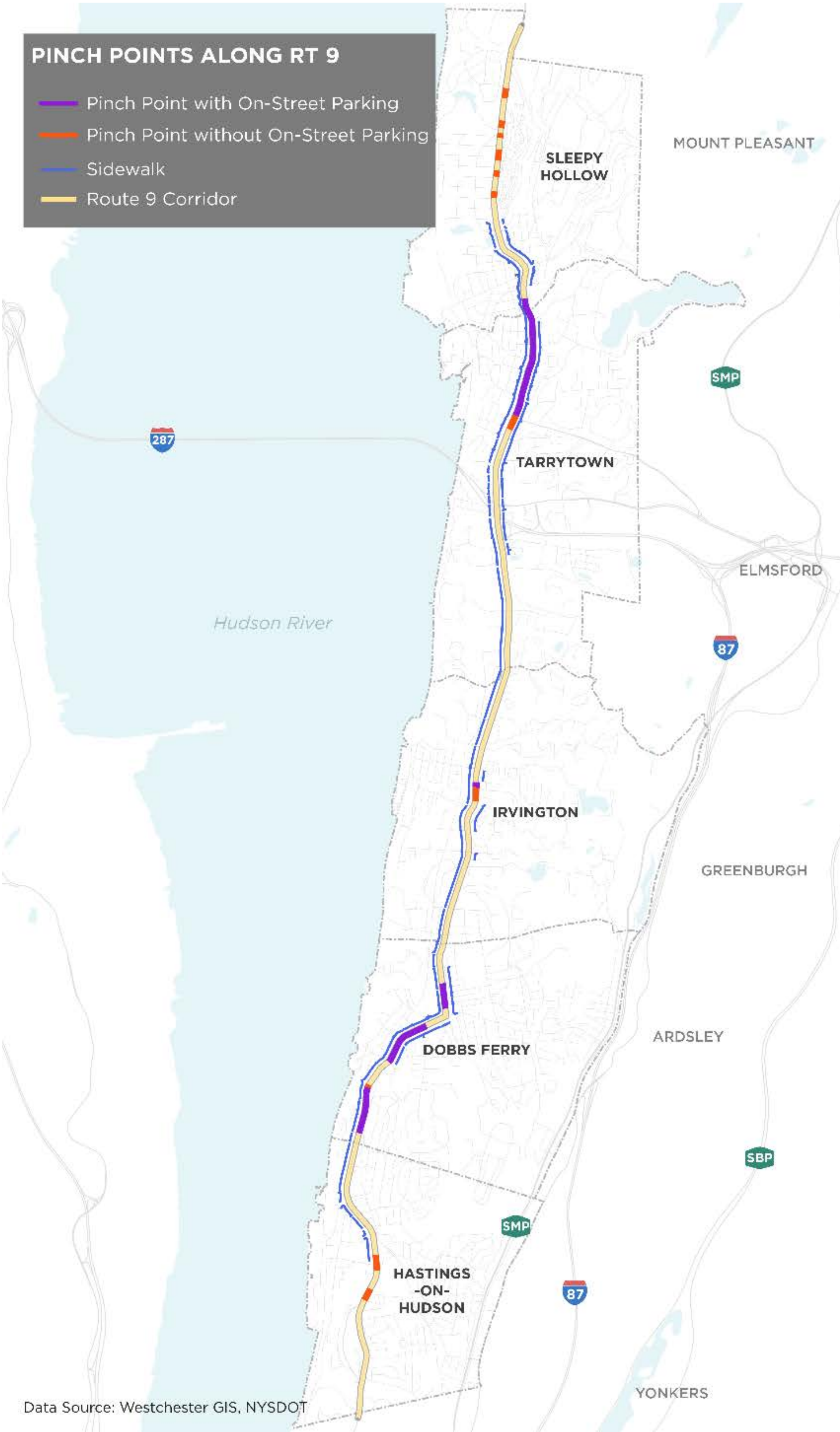
Opportunities

- 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



POTENTIAL BIKE FACILITIES SUITABLE FOR ROUTE 9

Figure 58 Suitability of the Types of Bike Facilities

Facility Type	Definition	User type	Design Considerations	Impact on villages
Shared Lane (no change)	People biking share lane with motor vehicle traffic, no change in lanes	Recreational	Existing conditions	With the opening of the New NY Bridge's shared use path, the villages along Route 9 will see an increase in the number of people cycling. Encouraging people to cycle in existing vehicle lanes may exacerbate congestion and create hostility.
Side path on one side of the street	People walking and bicycling share a path in the approximate location of the sidewalk	Family	Extra attention to design details at driveways and intersections is needed to increase visibility or separation of people biking against the flow of adjacent or turning traffic	This facility type will require the acquisition of right of way outside of the paved/curbed roadway, and requires sweeping by sidewalk equipment, unless ordinance closes facilities during snow events.
Bike Boulevard	People walking and biking share lane with motor vehicle traffic, traffic volumes and speeds very low	Family	Not suitable for Route 9 because of vehicle volumes	N/A
Bike Lane on each side of the street	Striped lane for one way bike travel, with curb or parking lane on right side and moving traffic on left side	Commuter	Parking adjacent bike lanes place riders in the door zone so are not suitable for location with lots of parking turnover	May be accomplished on sections of Route 9 without parking or lane modifications where 10' of excess roadway exists
Buffered bike lane on each side of the street	Striped lane for one way bike travel, with curb or parking lane on right side and a 2-3 foot buffer from moving traffic on left side	Commuter	Parking adjacent bike lanes place riders in the door zone so are not suitable for location with lots of parking turnover	▪ May be accomplished on sections of Route 9 without parking or lane modifications where 16' of excess roadway exists ▪ Requires sweeping by sidewalk equipment, unless ordinance closes facilities during snow events
1-way Protected Bike Lane on each side of the street	Exclusive use by bicycles, including vertical separation between the bikeway and through motor vehicle traffic, one way travel for people on bikes in same direction of motor	Family	▪ Separation may be accomplished by on-street parking, flexible posts, planters, or grade separation. ▪ 1 way protected bike lanes pose fewer challenges at intersections because people on bikes and motorists are traveling in the same direction	▪ May be accomplished on sections of Route 9 without parking or lane modifications where 12' of excess roadway exists ▪ Requires sweeping of debris and snow as needed, unless ordinance closes facilities during snow events
2-way Protected Bike Lane on one side of the street	Exclusive use by bicycles, including vertical separation between the bikeway and through motor vehicle traffic; two way travel for people on bikes	Family	▪ Separation may be accomplished by on-street parking, flexible posts, planters, or grade separation. ▪ Extra attention to design details at driveways and intersections is needed to increase visibility and separation of people biking against the flow of adjacent or turning traffic	▪ Consistent with side path design for NNYB ▪ May be accomplished on sections of Route 9 without parking or lane modifications where 11' of excess roadway exists ▪ Requires sweeping of debris and snow as needed, unless ordinance closes facilities during snow events

4 DESIGN ALTERNATIVES

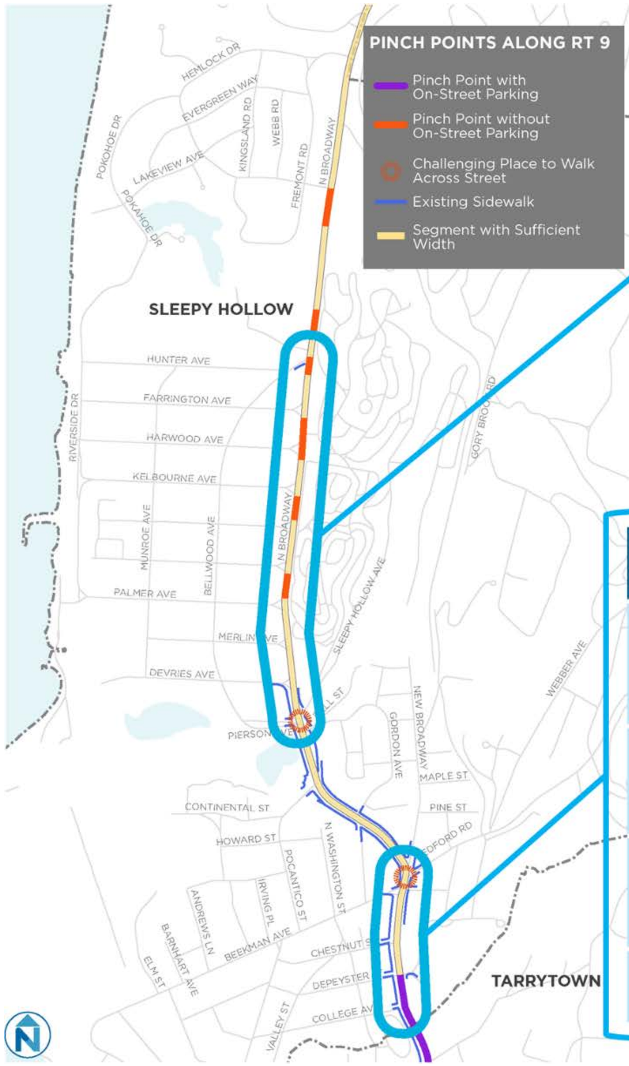
DEVELOPMENT OF THE ALTERNATIVES

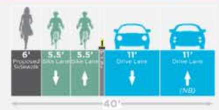
In order to make Route 9 safer, better connected, and more accessible for all its users, the physical layout and design of the Route itself must be reconsidered. Prior to the engineering of any redesign of the Route, it is imperative that a variety of potential Route 9 redesigns are put forward and evaluated by project stakeholders. Accordingly, the following cross-section alternatives were developed to provide project stakeholders with an understanding of potential design modifications to Route 9 that would enhance safety and accessibility. These cross sections were developed and evaluated as follows:

- Two or more alternative cross sections were developed at two typical locations in each village.
- All cross section alternatives were presented to the public for review at public meetings along the Route 9 corridor, and via an online survey.
- In both settings, members of the public were able to vote on their preferred cross-section alternative for each section of the example locations. The results of public voting were tallied to determine the preferred cross-section alternatives for the Route 9 corridor.
- The Steering Committee was presented with a summary of the cross-section alternatives, and public preferences towards them, and selected a preferred option that was extended throughout the corridor.

Figures 59 to 77 display the initial and preferred cross section alternatives for each example location along the corridor, and outline some of the important considerations affecting their design and possible implementation.

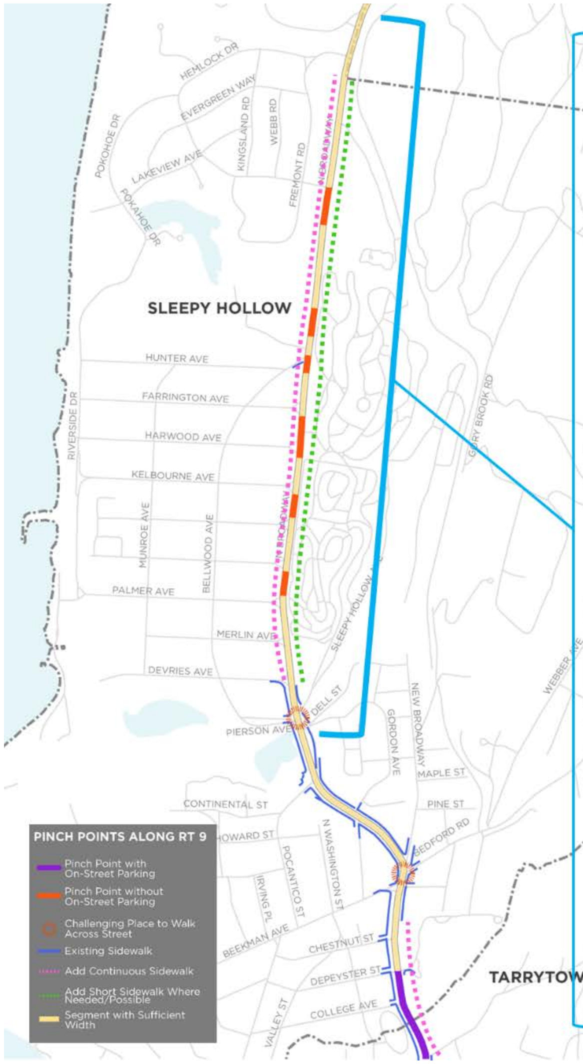
Figure 59 Initial Cross-Section Alternative Options – Sleepy Hollow



Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
1A		**One traffic lane in each direction with a two-way protected bike lane and a sidewalk on one side of Route 9**	**▪ No turning lanes** **▪ Does not take grassy areas outside of road bed**	**60%**	**Yes**
1B		Detour to Pierson/Bellwood with a two-way protected bike lane and a sidewalk on one side; or directional bike lanes on each side	▪ Not on Route 9	40%	

Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
2A		**One traffic lane in each direction with a two-way protected bike lane on one side, on-street parking on one side, and a sidewalk on both sides**	**▪ Parking on one side**	**40%**	**Yes**
2B		One traffic lane in each direction with a two-way protected bike lane on one side, a sidewalk on both sides, and no on-street parking	▪ Wider bike lanes ▪ No parking	29%	
2C		One shared traffic lane in each direction with a sidewalk on both sides and on-street parking on both sides	▪ Parking on both sides ▪ No separated bike path	19%	
2D		Use a parallel on-street route from Pocantico Street to Howard Street to Washington Street to Franklin Street	▪ Not on Route 9	12%	

Figure 60 Community Preferred Cross-Section for Sleepy Hollow from Phelps Lane to Pierson Ave



Sleepy Hollow

From Phelps Lane to Pierson Ave

Existing Conditions

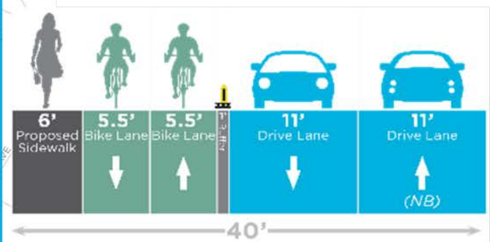
- Total with Sufficient Width: 76%
- Total with Space Constraints: 24%

Ideal Design Characteristics for Areas with Sufficient Width

NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	2	11'	Only where needed	9'	West side	2-way buffered lanes	5'-8' per lane	1'-3'	West side min (both sides if space is available)	4'-10'

Preferred Design Option for Areas with Space Constraints

Option 1A (concept)



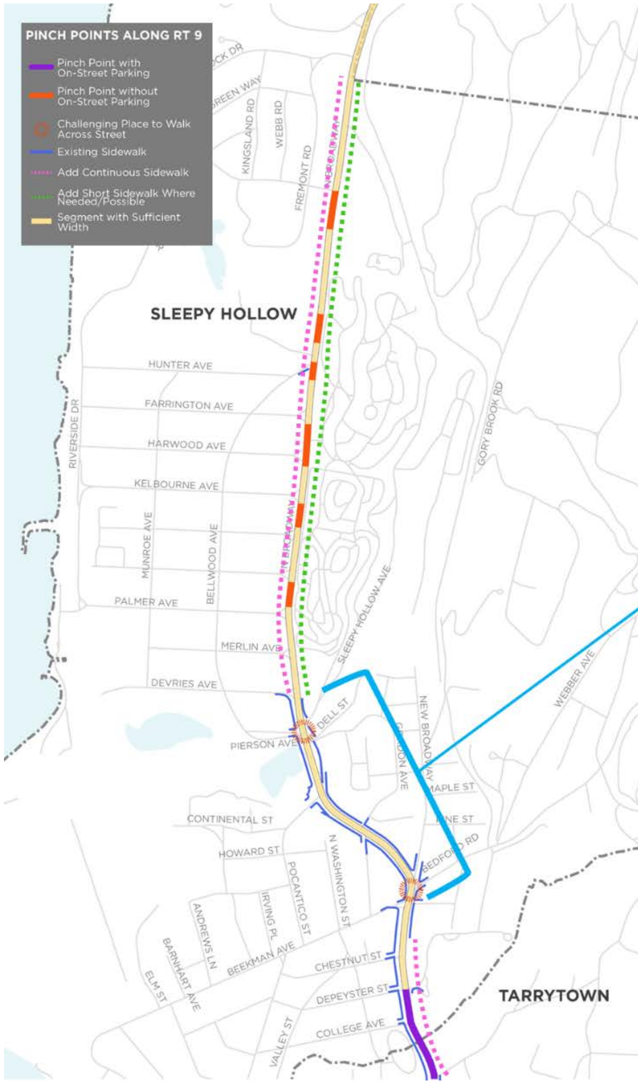
Tradeoff: Turning Lanes

- Option 1 – Limit left turns into Philipse Manor to Pierson Ave and north end of Bellwood Ave, retaining right in/right out only at all other locations; limit left turn access to and from Sleepy Hollow cemetery to Pierson Avenue; Keep LT at Hemlock Dr North, and remove it at Hemlock Dr South
- Option 2 – acquire private ROW to accommodate new bike/ped facilities and turn lanes at above locations

Other Consideration: One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition
- Proposed locations for short sidewalk connections to trip generators, enhanced crossings, etc. may require right of way acquisition

Figure 61 Community Preferred Cross-Section for Sleepy Hollow from Pierson Ave to Beekman Ave



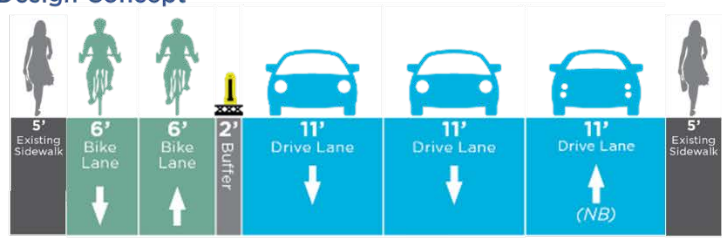
Sleepy Hollow

From Pierson Ave to Beekman Avenue

Ideal Cross Section Characteristics (west to east)

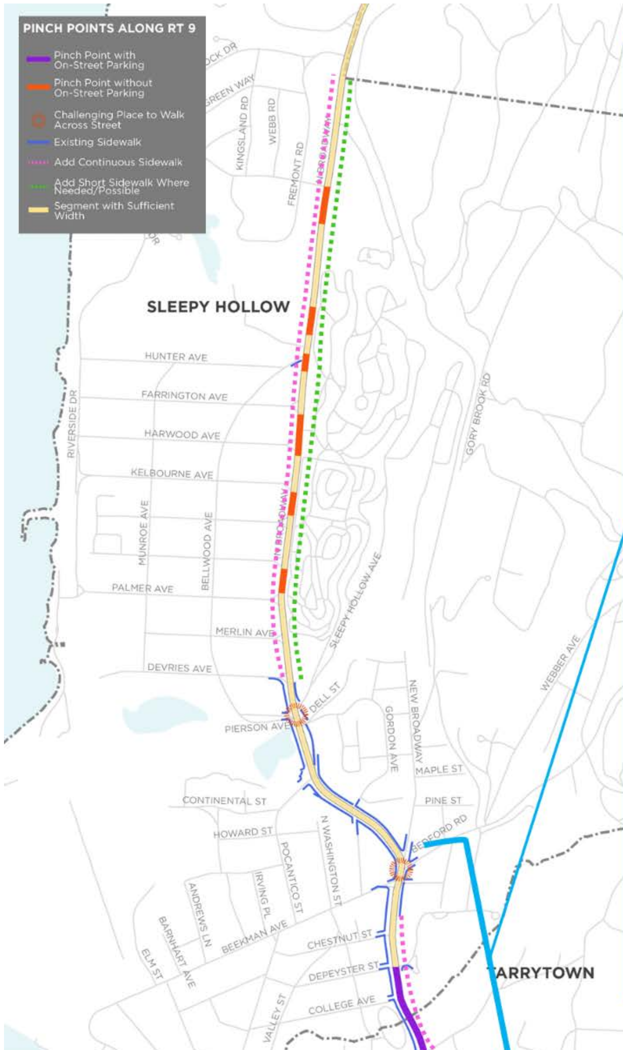
West Side Sidewalk	Bicycle Facility (width)	Buffer Width	NB Travel Lanes	SB Travel Lanes	East Side Sidewalk
4'-10'	2-way buffered lanes (5'-8' per lane)	1'-3'	One (1) 11' lane	Two (2) 11' lanes	4'-10'

Design Concept



Concern: Trucks, speed, & slopes

Figure 62 Community Preferred Cross-Section for Sleepy Hollow from Beekman Ave to Wildey Street (Tarrytown border)



Sleepy Hollow

From Beekman Avenue to Wildey Street (Tarrytown)

Existing Conditions

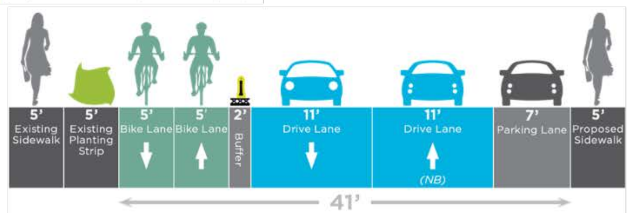
- Total with Sufficient Width: 41%
- Total with Space Constraints: 59%

Ideal Design Characteristics for Areas with Sufficient Width

NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	1	11'	NA	NA	West side	2-way buffered lanes	5'-8' per lane	1'-3'	Both sides	4'-10'

Preferred Design Option for Areas with Space Constraints

Option 2A (concept)



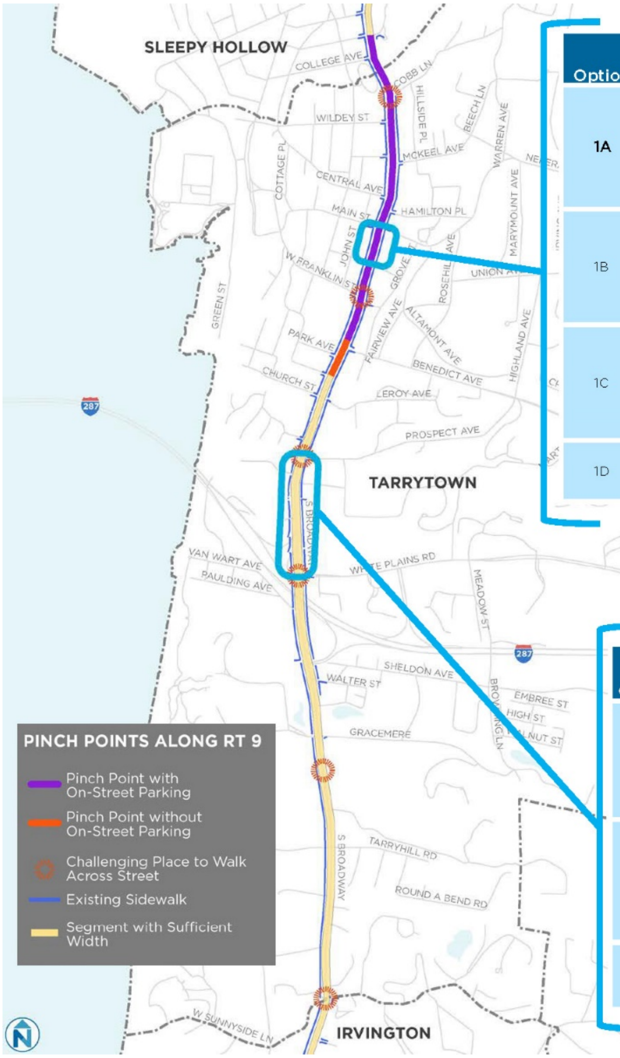
Tradeoff: Parking

- Remove lane of parking between Beekman Avenue and College Avenue
  - 28 spaces on the west side
- Over 100 off-street spaces nearby

Other Considerations: One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers. With parking, one way bike lanes result in door zone bike lanes
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition

Figure 63 Initial Cross-Section Alternative Options – Tarrytown



Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
1A		**One traffic lane in each direction with a two-way protected bike lane on one side, a sidewalk on both sides, and on-street parking one one side**	**▪ Bike lanes are too narrow to be used safely** **▪ Parking on one side**	**32%**	**No**
1B		One traffic lane in each direction with a two-way protected bike lane on one side, a sidewalk on both sides, and no on-street parking	▪ No parking	27%	LONG TERM SOLUTION
1C		One shared traffic lane in each direction with a sidewalk on both sides and on-street parking on both sides	▪ Parking on both sides ▪ No separated bike path	24%	INTERIM SOLUTION
1D		Use the OCA trail from Cobb Lane to Franklin Street	▪ Not on Route 9 ▪ May require paving the OCA Trail	17%	

Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
2A		Two traffic lanes in each direction with a two-way protected bike lane on one side, a sidewalk on both sides, and no on-street parking	▪ No turning lane ▪ 2 lanes in both directions	30%	
2B		**One northbound traffic lane, two southbound traffic lanes, and a turning lane, with a two-way protected bike lane on one side, a sidewalk on both sides, and no on-street parking**	**▪ Turning lane** **▪ Two lanes SB, one lane NB**	**50%**	**Yes**
2C	OCA Trail	Use the OCA Trail from Leroy Avenue to Route 119	▪ Not on Route 9 ▪ May require paving the OCA Trail	20%	

Figure 64 Community Preferred Cross-Section for Tarrytown from Wildey Street to Elizabeth Street

Tarrytown

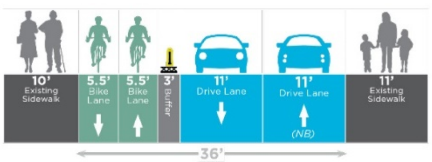
From Wildey Street to Elizabeth Street

Existing Conditions

- Total with Space Constraints: 100%

Preferred Design Options

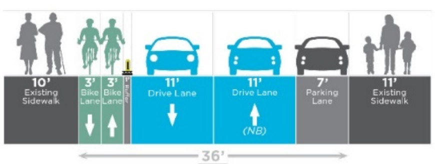
NN Preferred Option: 1B (concept)



Tradeoff: Parking

- Remove both lanes of parking between Wildey Street and Elizabeth Street
  - ❖ 66 spaces on west side, 51 spaces on east side
- Over 300 off-street spaces nearby

Public Preferred Option: 1A (concept)



Tradeoff: Parking

- Remove lane of parking between Wildey Street and Elizabeth Street
  - ❖ 66 spaces on west side
- Over 300 off-street spaces nearby
- Substandard bikeway width

Other Considerations – One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers

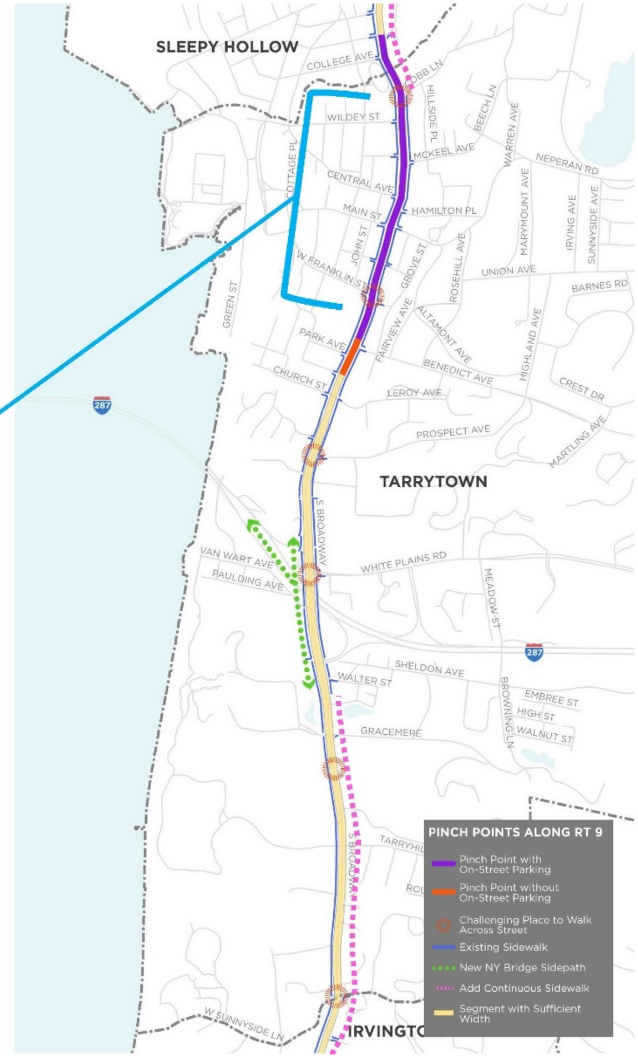


Figure 65 Community Preferred Cross-Section for Tarrytown from Elizabeth Street to Prospect Ave

Tarrytown

From Elizabeth Street to Prospect Avenue

Existing Conditions

- Total with Sufficient Width: 43%
- Total with Space Constraints: 57%

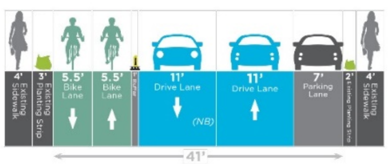
Ideal Design Characteristics for Areas with Sufficient Width

NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	1	11'	NA	NA	West side	2-way buffered lanes	5'-8' per lane	1'-3'	Both sides	4'-10'

Preferred Design Option for Areas with Space Constraints

NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	1	11'	NA	NA	West side	2-way buffered lanes	5'-8' per lane	1'-3'	Both sides	4'-10'

Design Concept



Tradeoff: Parking

- Remove lane of parking between Elizabeth Street and Park Avenue
  - 6 spaces on west side
- Acquire additional ROW to keep the RT dedicated lane to access Benedict Ave and have a 5'+5'+1' bike lane on the West side (there are only 7' to do it with the current section)

Other Considerations: One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers. With parking leads to door zone bike lanes.

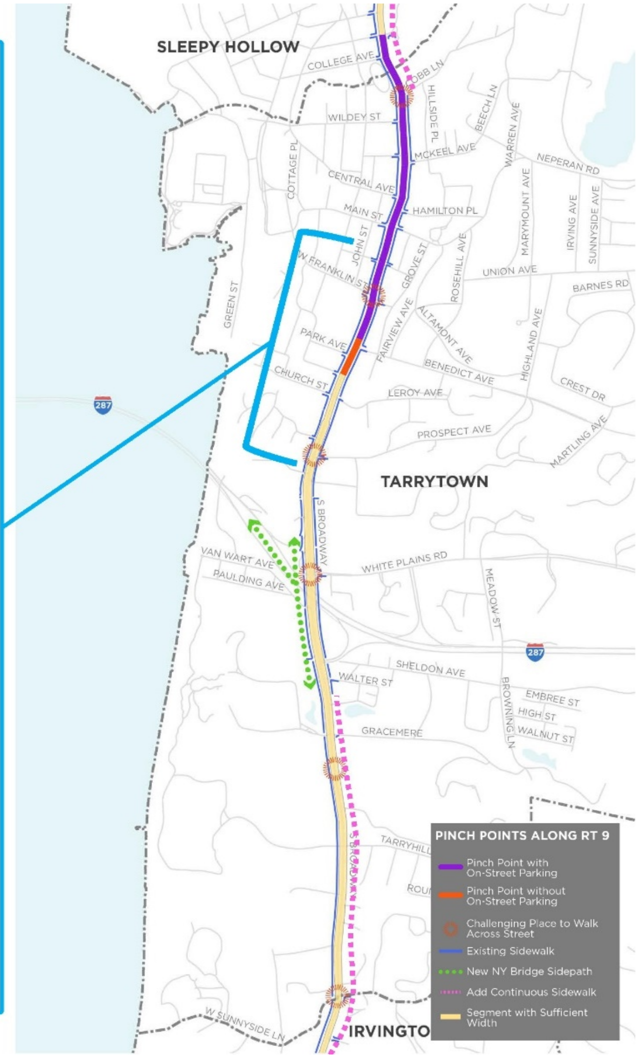
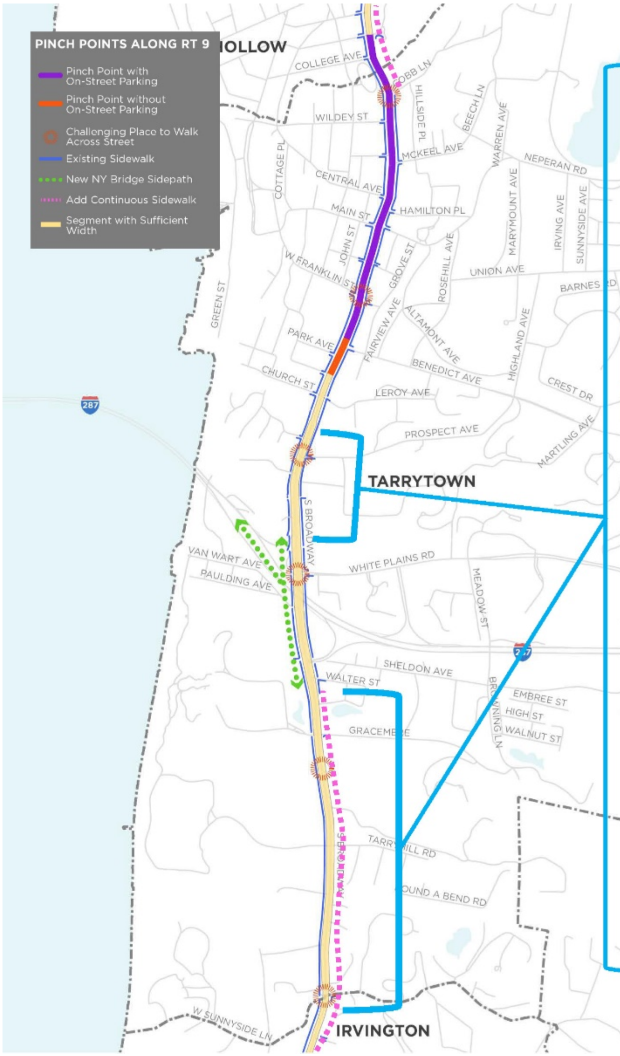


Figure 66 Community Preferred Cross-Section for Tarrytown from Prospect Ave to Sunnyside Lane



Tarrytown

From Prospect Avenue to Sunnyside Lane (incl. NNYB Sidepath)

Existing Conditions

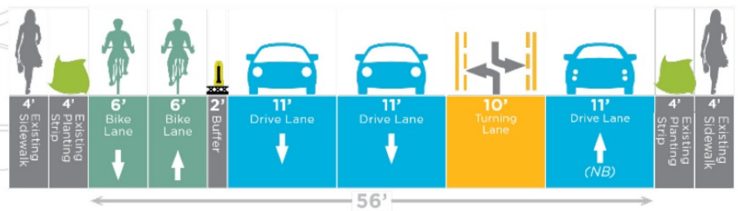
- Total with Sufficient Width: 100%

Ideal Design Characteristics

NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	2	11'	Where needed	9' 10'	West side	2-way buffered lanes	5' 8' per lane	1' 3'	Both sides	4' 10'

Preferred Design Option

Option 2B (concept)



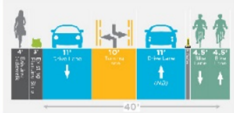
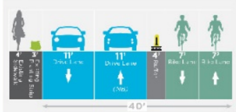
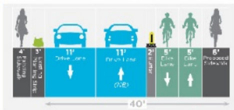
Tradeoff: Travel Lanes

- Only one northbound lane

Other Considerations

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers.
- Two-Way NNYB Sidepath will be on west side of Route 9
- Design of Route 9 at Exit 9 currently underway. Active Transportation Corridor project will have to coordinate recommended design with final consideration
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition

Figure 67 Initial Cross-Section Alternative Options – Irvington

Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
1A		**One traffic lane in each direction and a turning lane, with a two-way protected bike lane on one side, a sidewalk on one side, and no on-street parking**	**▪ Turning lane ▪ Narrow Bike lanes ▪ Sidewalk on one side**	**46%**	**Yes, with alterations. Bike lanes should be moved to the west side of the roadway.**
1B		One traffic lane in each direction with a two-way protected bike lane on one side, a sidewalk on one side, and no on-street parking	▪ No turning lane ▪ Wider bike lanes ▪ Sidewalk on one side	24%	
1C		One traffic lane in each direction with a two-way protected bike lane on one side, a sidewalk on both sides, and no on-street parking	▪ No turning lane ▪ Sidewalk on both sides	19%	
1D		Use OCA Trail from Sunnyside Lane to Main Street	▪ Not on Route 9 ▪ May require paving the OCA Trail	11%	

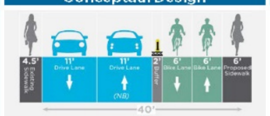
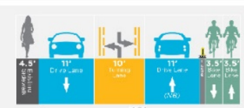
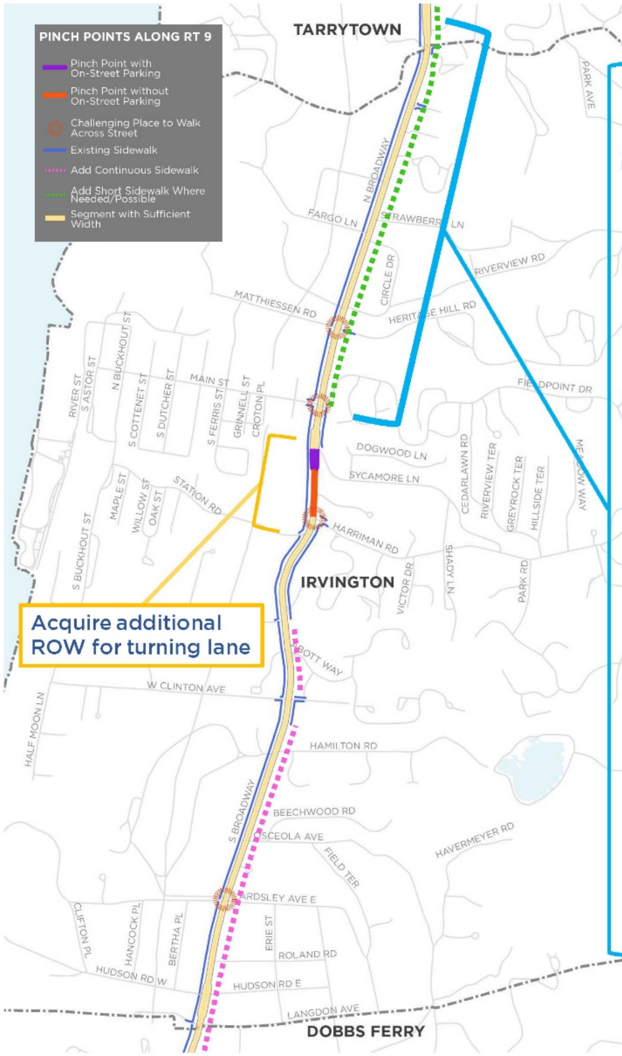
Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
2A		**One traffic lane in each direction with a two-way protected bike lane on one side, a sidewalk on both sides, and no on-street parking**	**▪ No parking ▪ Sidewalk on both sides ▪ Wider bike path**	**46%**	**Yes, with alterations. Bike lanes should be moved to the west side of the roadway.**
2B		One traffic lane in each direction and a turning lane, with a two-way protected bike lane on one side, a sidewalk on one side, and no on-street parking	▪ Turning lane ▪ Sidewalk on one side only ▪ Very narrow bike path	35%	
2C		Use OCA Trail from Clinton Avenue to Ardsley Avenue	▪ Not on Route 9 ▪ May require paving the OCA Trail	21%	

Figure 68 Community Preferred Cross-Section for Irvington from Sunnyside Lane to Main Street



Irvington

From Sunnyside Lane to Main Street

Existing Conditions

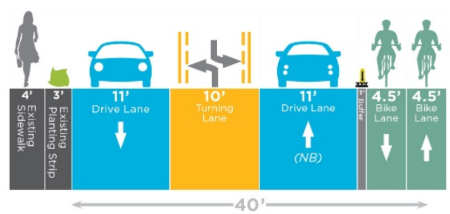
- Total with Sufficient Width: 100%

Ideal Design Characteristics

NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	1	11'	Where needed	9'-10'	West side	2-way buffered lanes	5'-8' per lane	1'-3'	Both sides	4'-10'

Preferred Design Option

Option 1A (concept)



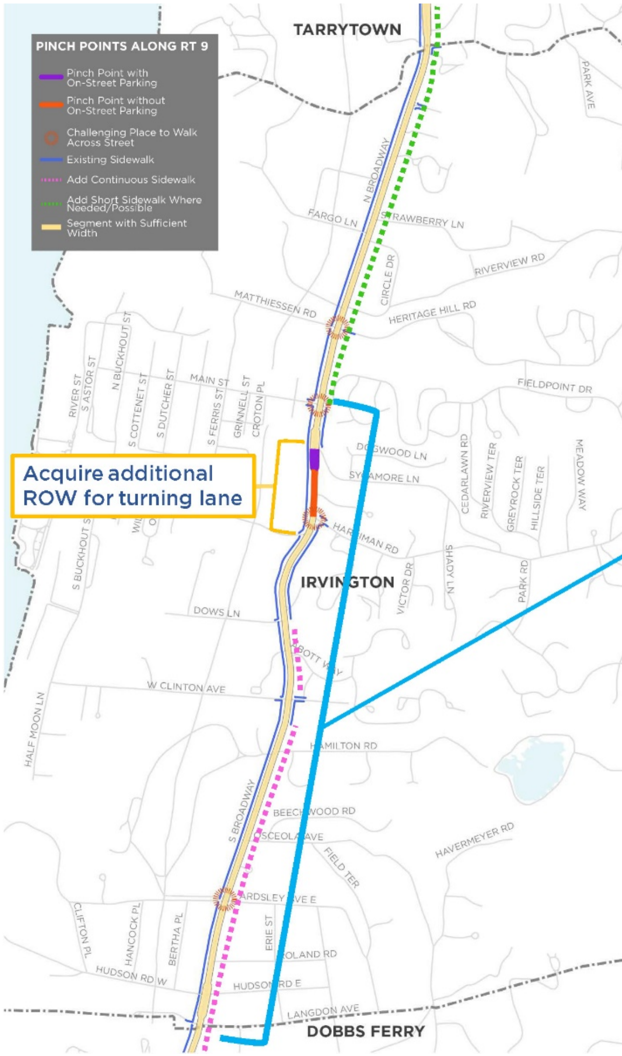
Design Consideration

- Bicycle facilities in Option 1A will be moved to the western side of the corridor
- Add sidewalks to east side where there is no need for a turning lane

Other Considerations: One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers
- Proposed locations for short sidewalk connections to trip generators, enhanced crossings, etc. may require right of way acquisition

Figure 69 Community Preferred Cross-Section for Irvington from Main Street to Langdon Ave



Irvington

From Main Street to Langdon Avenue

Existing Conditions

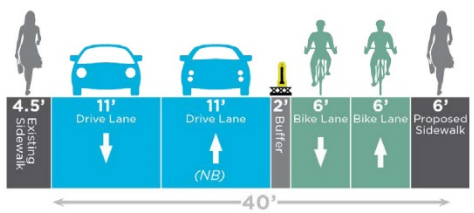
- Total with Sufficient Width: 89%
- Total with Space Constraints: 11%

Ideal Design Characteristics for Areas with Sufficient Width

NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	1	11'	NA	NA	West side	2-way buffered lanes	5' 8' per lane	1'-3'	Both sides	4'-10'

Preferred Design Option for Areas with Space Constraints

Option 2A (concept)



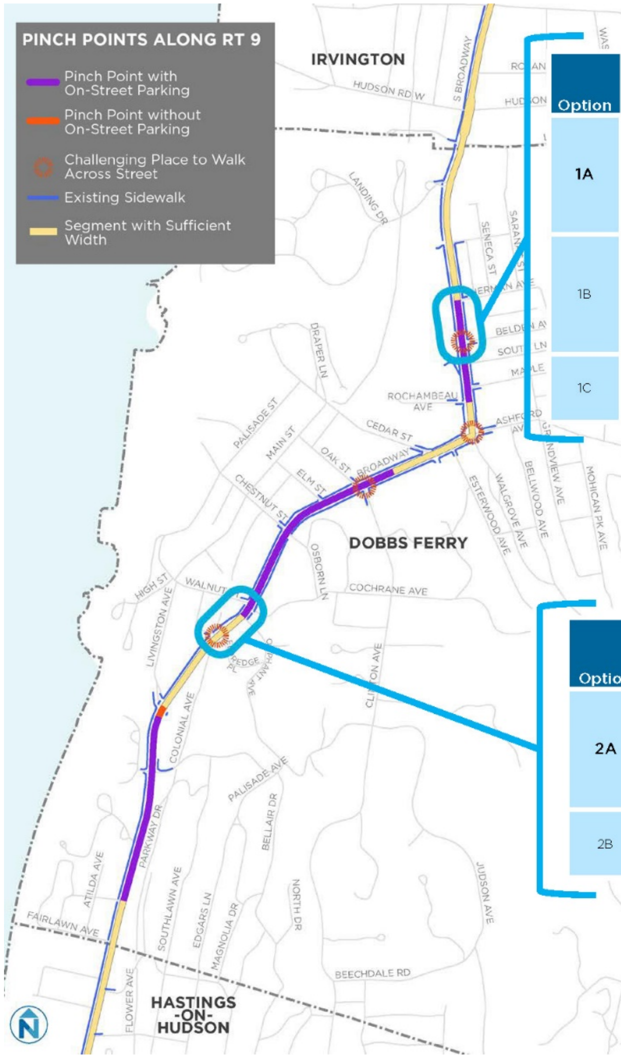
Tradeoff: Parking

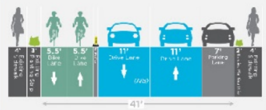
- Remove lane of parking between Main Street and Harriman Road
  - 16 spaces on the west side

Tradeoff: Turning Lane

- Keeping turning lane at Main Street would require acquisition of additional Right-of-Way
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition

Figure 70 Initial Cross-Section Alternative Options – Dobbs Ferry



Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
1A		**One traffic lane in each direction and a turning lane, with a two-way protected bike lane on one side, a sidewalk on both sides, and no on-street parking**	**▪ Turning lane** **▪ No parking**	**50%**	**Yes, with alterations. Bike lanes should be moved to the west side of the roadway.**
1B		One traffic lane in each direction with a two-way protected bike lane on one side and a sidewalk on both sides, and on-street parking on one side	▪ No turning lane ▪ Parking on one side only	31%	
1C		Use OCA Trail from Landing Drive to Cedar Street	▪ Not on Route 9 ▪ May require paving the OCA Trail	19%	

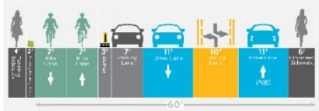
Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
2A		**One traffic lane in each direction and a turning lane, with a two-way protected bike lane on one side, a sidewalk on both sides, and on-street parking on one side**	**▪ Turning lane** **▪ Parking on one side** **▪ Wider bike lanes**	**75%**	**Yes**
2B		Use the OCA Trail from the Route 9 Crossing To Colonial Avenue	▪ Not on Route 9 ▪ May require paving the OCA Trail	25%	

Figure 71 Community Preferred Cross-Section for Dobbs Ferry from Langdon Ave to Oliphant Ave

Dobbs Ferry

From Langdon Avenue to Oliphant Avenue

Existing Conditions

- Total with Sufficient Width: 53%
- Total with Space Constraints: 47%

Ideal Design Characteristics for Areas with Sufficient Width

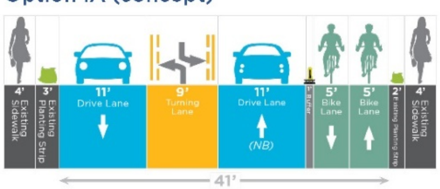
NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	1	11'	Where needed	9'-10'	West side	2-way buffered lanes	5'-8' per lane	1'-3'	Both sides	4'-10'

Preferred Design Option for Areas with Space Constraints

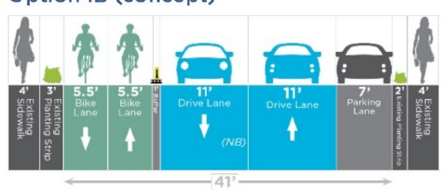
Mixed Design Area

- Option 1A where a turning lane is needed (no parking)
- Option 1B where no turn lane is needed (keep parking on east/south side)

Option 1A (concept)



Option 1B (concept)



Design Consideration

- Bicycle facilities in Option 1A should be moved to the western side of the street

Other Considerations: One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers without eliminating parking or turn lanes
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition

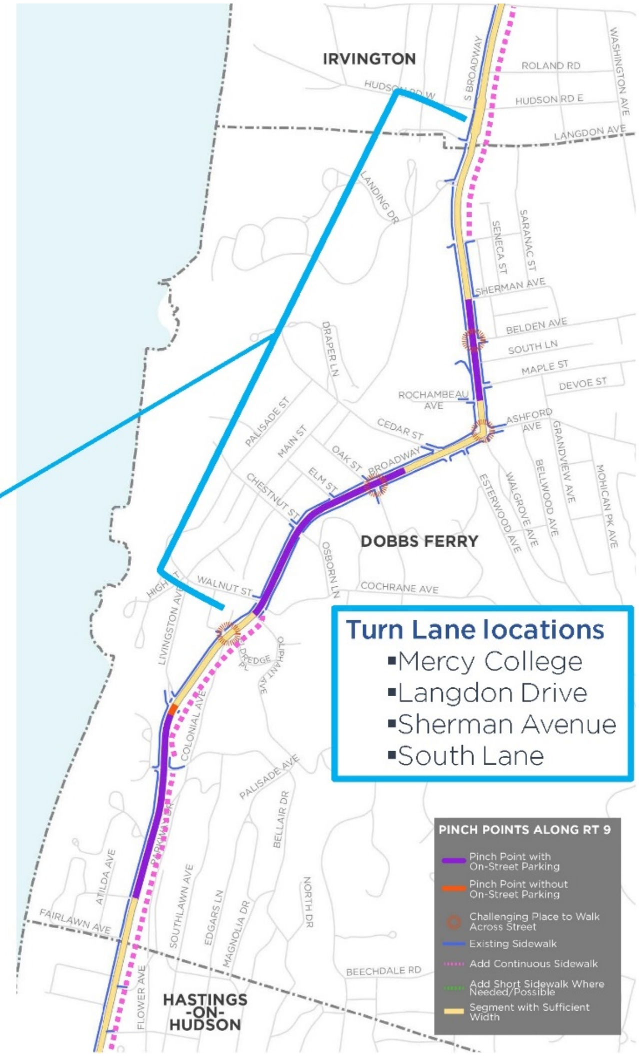


Figure 72 Community Preferred Cross-Section for Dobbs Ferry from Oliphant Ave to Eldridge Place

Dobbs Ferry

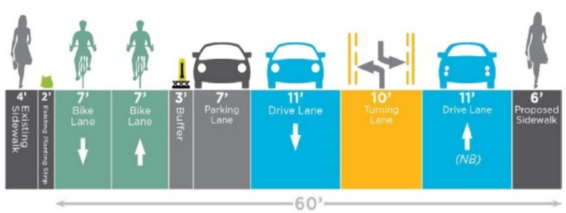
From Oliphant Avenue to Eldridge Place

Existing Conditions

- Total with Sufficient Width: 100%

Preferred Design

Option 2A (concept)



Other Considerations: One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Two buffers can fit in this section

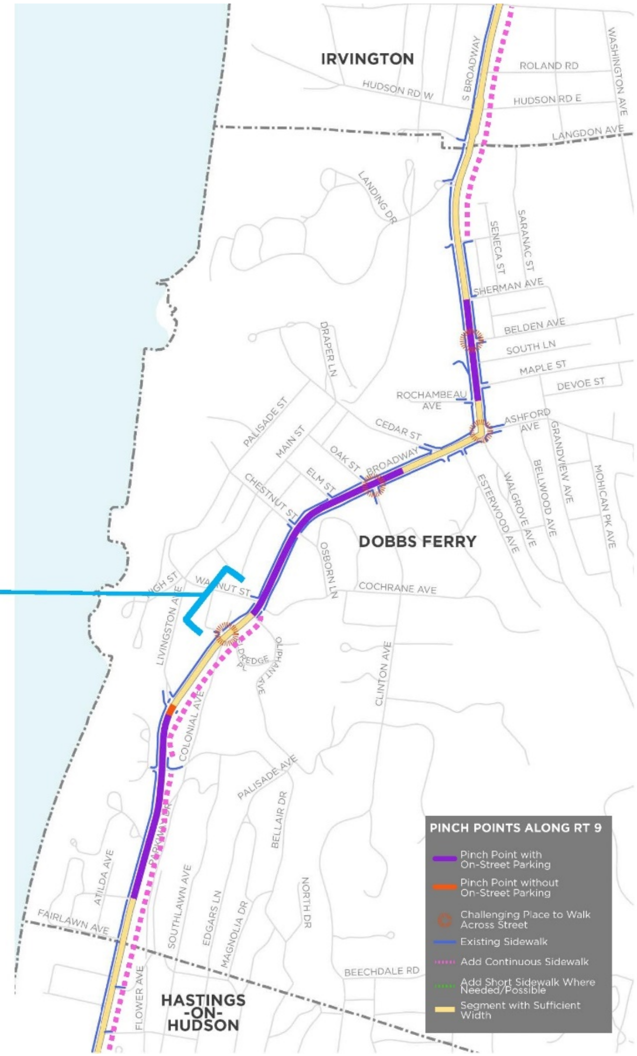


Figure 73 Community Preferred Cross-Section for Dobbs Ferry from Eldridge Place to Main Street (Hastings-on-Hudson)

Dobbs Ferry

From Eldridge Place to Main Street (Hastings-On-Hudson)

Existing Conditions

- Total with Sufficient Width: 73%
- Total with Space Constraints: 27%

Ideal Design Characteristics for Areas with Sufficient Width

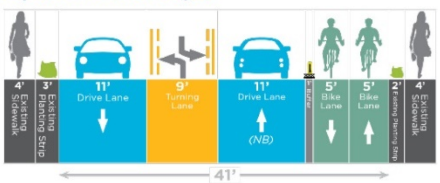
NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	1	11'	Where needed	9'-10'	West side	2-way buffered lanes	5'-8' per lane	1'-3'	Both sides	4'-10'

Preferred Design Option for Areas with Space Constraints

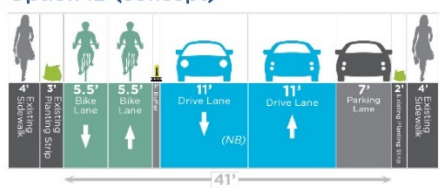
Mixed Design Area

- Option 1A where a turning lane is needed (no parking)
- Option 1B where no turn lane is needed (keep parking on east/south side)

Option 1A (concept)



Option 1B (concept)



Design Consideration

- Bicycle facilities in Option 1A will be moved to the western side of the street

Other Considerations: One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers without removing turn or parking lane
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition

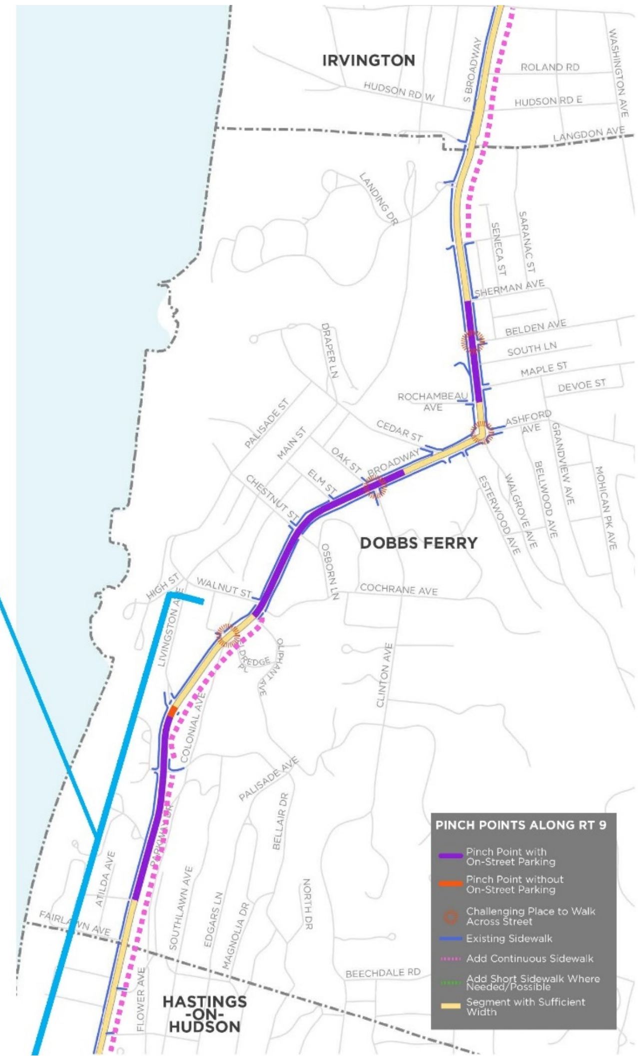
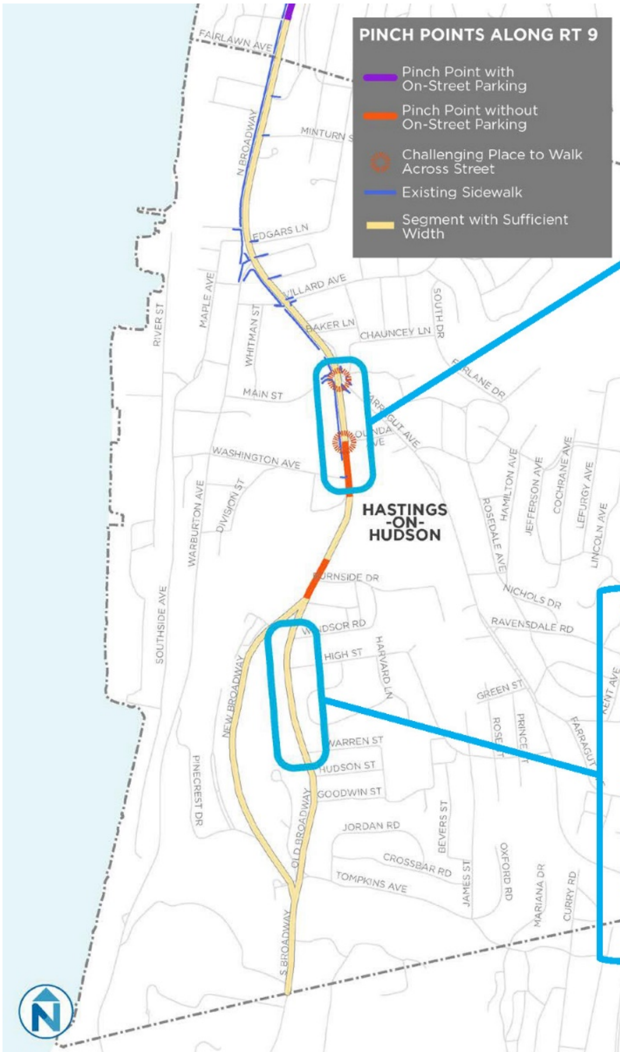


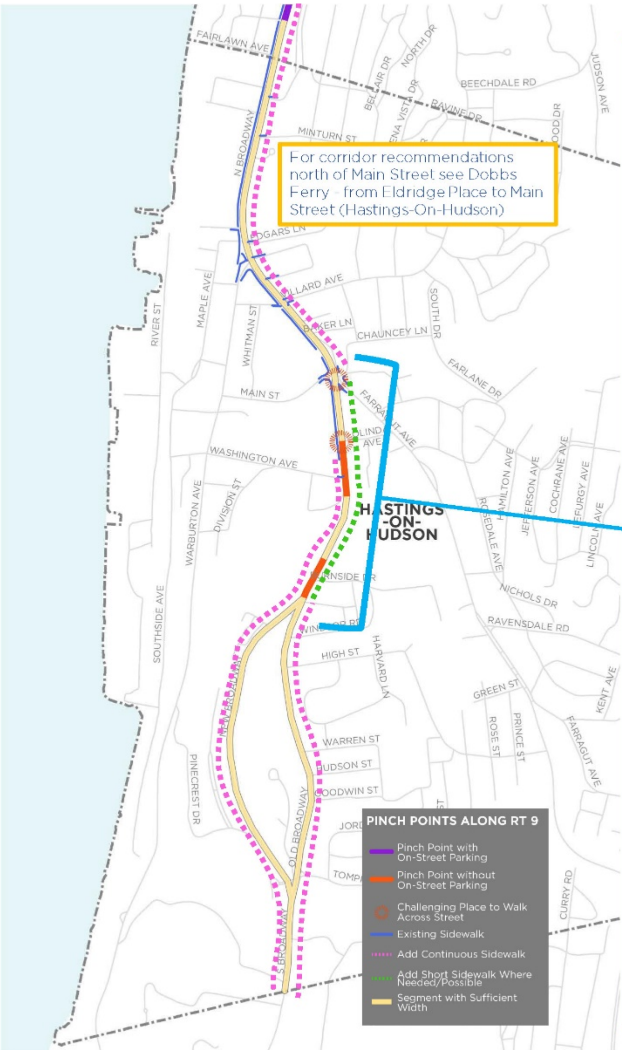
Figure 74 Initial Cross-Section Alternative Options – Hastings-on-Hudson



Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
1A		**One traffic lane in each direction and a turning lane, with a two-way protected bike lane on one side, a sidewalk on one side, and no on-street parking**	▪ **Turning lane** ▪ **Narrow bike lanes**	**76%**	**Yes**
1B		Use the OCA Trail from Chauncey Lane to Washington Avenue	▪ Not on Route 9 ▪ May require paving the OCA Trail	24%	

Option	Conceptual Design	Description	Tradeoffs	Vote Results	NN Preferred
2A		One traffic lane with a two-way protected bike lane on one side, no sidewalks, and no on-street parking	▪ Sidewalk on eastern branch ▪ No sidewalk on western branch ▪ Bike lanes on western branch ▪ No bike lanes on eastern branch	15%	
2B		**One traffic lane with a one-way protected bike lane on one side, a sidewalk on one side, and no on-street parking**	▪ **Sidewalk on both branches** ▪ **SB bike lane on western branch** ▪ **NB bike lanes on eastern branch**	**65%**	**Yes**
2C		Use the OCA Trail from Washington Avenue to Pinecrest Drive	▪ Not on Route 9 ▪ May require paving the OCA Trail	20%	

Figure 75 Community Preferred Cross-Section for Hastings-On-Hudson from Main Street to Devon Way



Hastings-On-Hudson

From Main Street to Devon Way

Existing Conditions

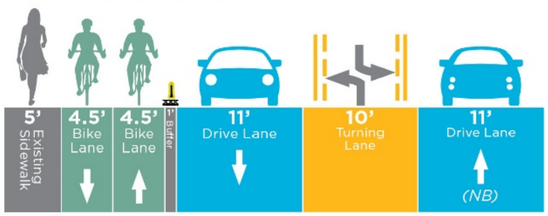
- Total with Sufficient Width: 59%
- Total with Space Constraints: 41%

Ideal Design Characteristics for Areas with Sufficient Width

NB Travel Lanes	SB Travel Lanes	Travel Lane Width	L/R Turn Lane	Turn Lane Width	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Buffer Width	Sidewalks	Sidewalk Width
1	1	11'	Where needed	9'-10'	West side	2-way buffered lanes	5'-8' per lane	1'-3'	Both Sides	4'-10'

Preferred Design Option for Areas with Space Constraints

Option 1A (concept)



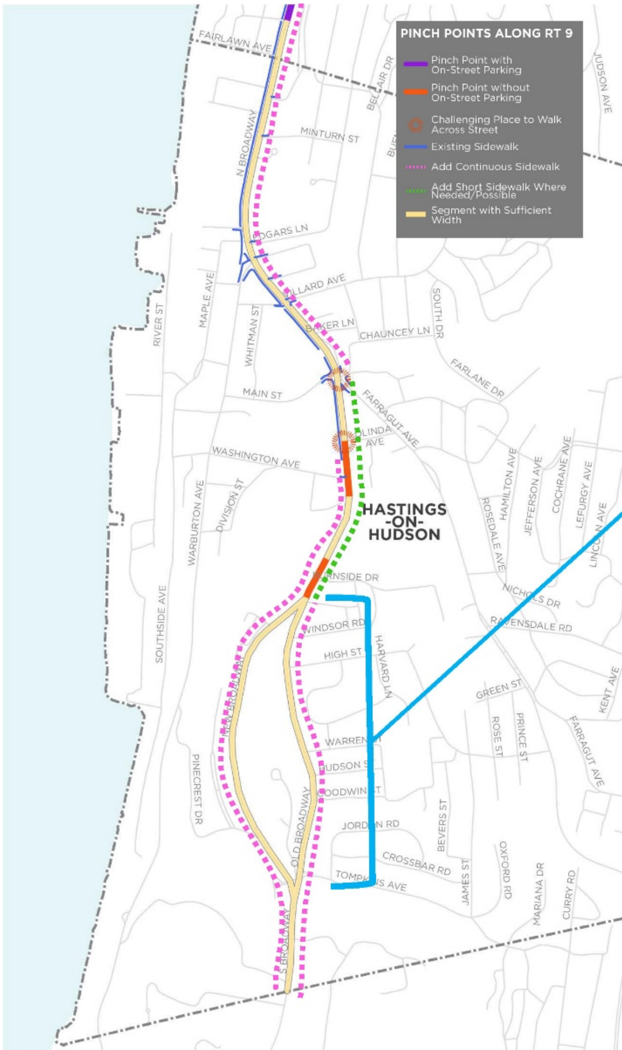
Design Consideration

- Add sidewalks to east side where there is no need for a turning lane
- Where there is a need for a turning lane acquire additional ROW, or remove LT in Washington Ave, and force all vehicles to use Main St intersection to access Washington Ave

Other Considerations: One Way Bike Lanes

- Traffic volumes inappropriate for one way bike lanes without buffer. Insufficient right of way for two buffers without removing turn or parking lane
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition
- Proposed locations for short sidewalk connections to trip generators, enhanced crossings, etc. may require right of way acquisition

Figure 76 Community Preferred Cross-Section for Hastings-On-Hudson from Devon Way to Tompkins Ave



Hastings-On-Hudson

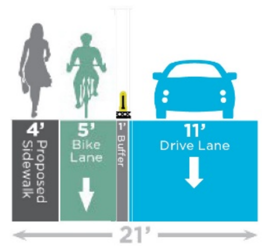
From Devon Way to Tompkins Avenue

Ideal Design Characteristics for Each Branch

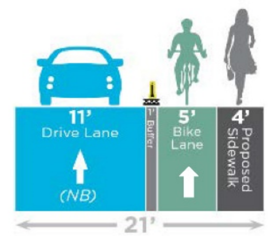
Travel Lanes	Travel Lane Width	Travel Lane Direction	Bicycle Facilities	Bicycle Facility Type	Bicycle Lane Width	Bicycle Lane Direction	Buffer Width	Sidewalks	Sidewalk Width
1	11'	North on eastern branch, South on western Branch	Outside shoulder of travel lane	1-way buffered lane	5'-8'	North on eastern branch, South on western Branch	1'-3'	Outside shoulder of bicycle lane	4'-10'

Preferred Design Option

Option 2A – Western Branch (concept)



Option 2A – Eastern Branch (concept)



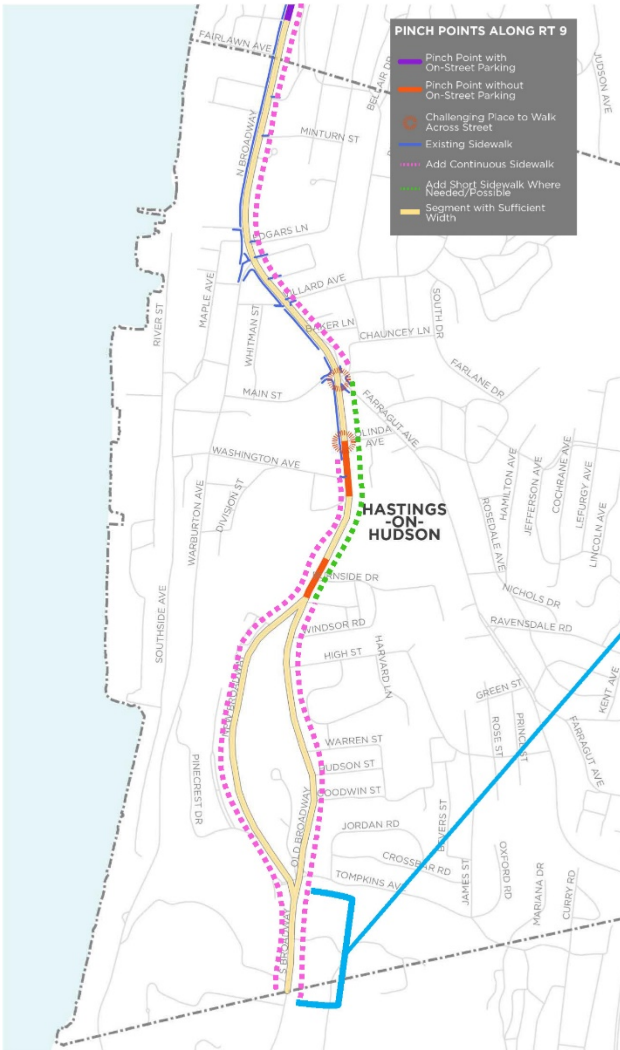
Design Consideration

- Dudley Street intersection will require further design to allow northbound bicycle riders to safely transfer from bicycle facilities on the eastern branch to bicycle facilities on the western side of the corridor

Other Considerations: One Way Bike Lanes

- This is a suitable location for one way bike lanes
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition

Figure 77 Community Preferred Cross-Section for Hastings-On-Hudson from Tompkins Ave to Dudley Street



Hastings-On-Hudson

From Tompkins Avenue to Dudley Street

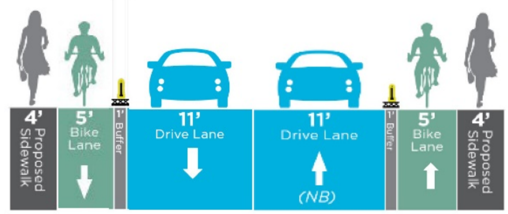
Existing Conditions

- Total with Sufficient Width: 100%

Ideal Cross Section Characteristics (west to east)

West Side Sidewalk	West Side Bicycle Facility (width)	Buffer Width	NB Travel Lanes	SB Travel Lanes	Buffer Width	East Side Bicycle Facility (width)	East Side Sidewalk
4'-10'	1-way buffered lane (5'-8')	1'-3'	One (1) 11' lane	One (1) 11' lane	1'-3'	1-way buffered lane (5'-8')	4'-10'

Design Concept



Other Considerations: One Way Bike Lanes

- This is a suitable location for one way bike lanes
- Proposed continuous sidewalk installations/enhancements may require right of way acquisition

5 CONCEPTUAL DESIGN

The recommended Conceptual Design is the result of technical analyses, public engagement, Steering Committee meetings, and consultation with elected and appointed officials. While the corridor is continuous throughout the study area, and within some segments due to the different conditions of the roadway and villages priorities.

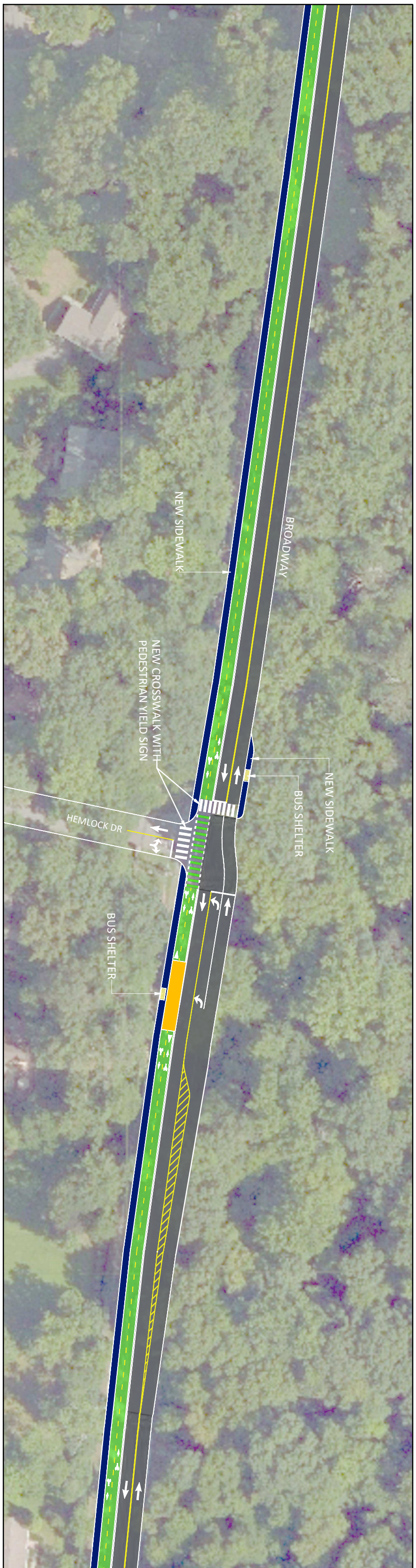
LEGEND:

TRAVEL LANE
BIKE LANE
CURB EXTENSION
NEW SIDEWALK
EXISTING SIDEWALK
SIDEWALK EXPANSION
PLANTED MEDIAN
BUS STOP PLATFORM
BUS STOP SHELTER

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

0' 100' 200'

MATCH - SEE ABOVE RIGHT



MATCH - SEE SHEET 02 TOP LEFT

MATCH - SEE BELOW LEFT

ROUTE 9

SLEEPY HOLLOW

NEW YORK
Conceptual Design Plans

sheet 01 of 28

NELSON NYGAARD

DRAWN:	-
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REVIEWED:	
DATE	2 July 2019
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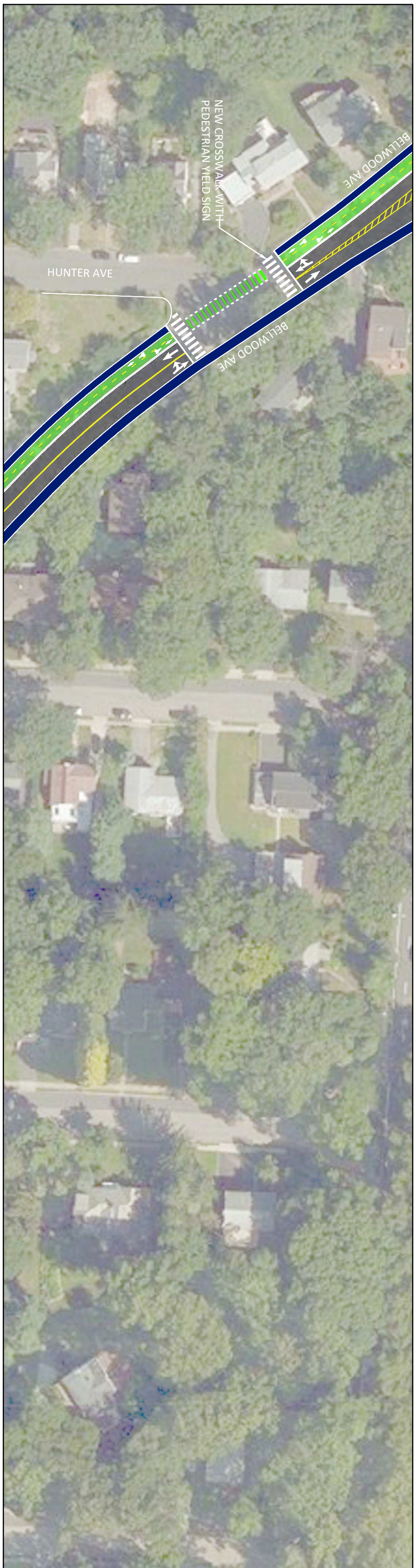
LEGEND:
TRAVEL LANE
BIKE LANE
CURB EXTENSION
NEW SIDEWALK
EXISTING SIDEWALK
SIDEWALK EXPANSION
PLANTED MEDIAN
BUS STOP PLATFORM
BUS STOP SHELTER

MATCH - SEE ABOVE RIGHT



MATCH - SEE SHEET 03 TOP LEFT

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DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

0' 100' 200'

ROUTE 9

SLEEPY HOLLOW

NEW YORK

Conceptual Design Plans

sheet 02 of 28

NELSON NYGAARD

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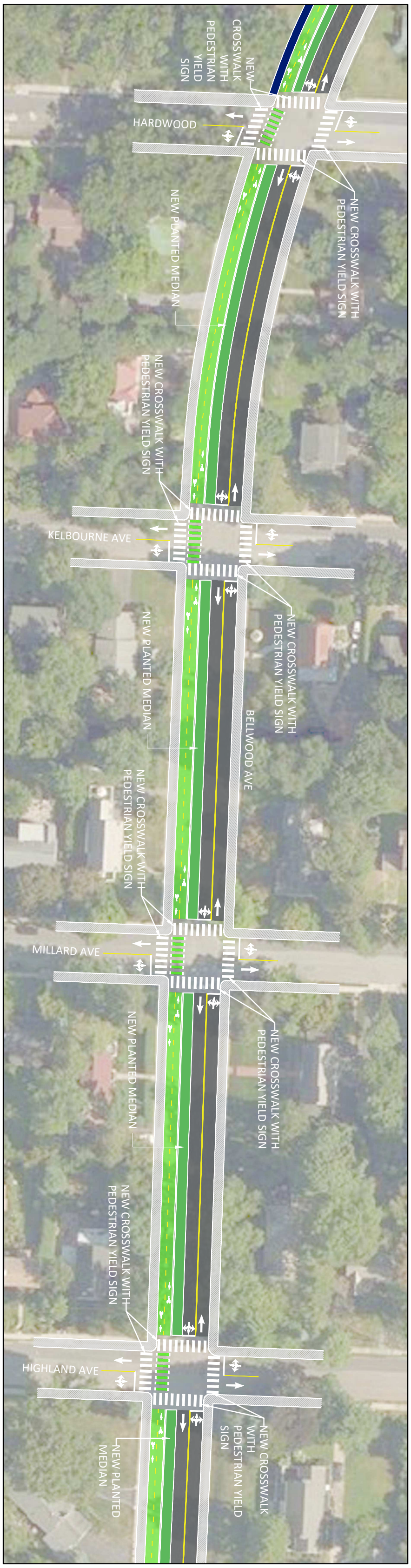
LEGEND:

- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

0' 100' 200'

MATCH - SEE ABOVE RIGHT



MATCH - SEE SHEET 04 TOP LEFT

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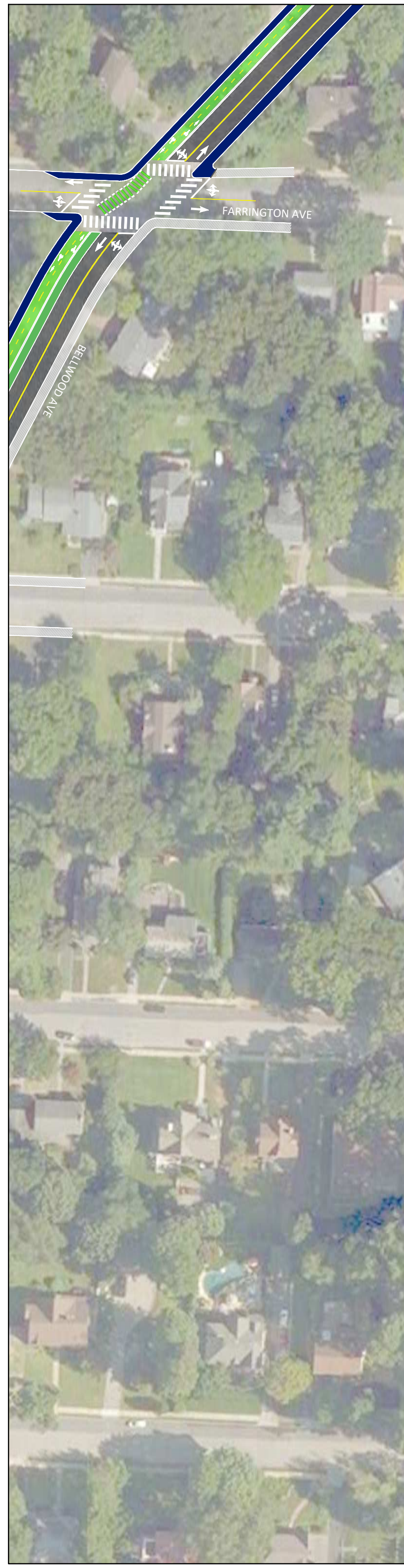

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ROUTE 9

SLEEPY HOLLOW

NEW YORK

Conceptual Design Plans

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DATE	2 July 2019
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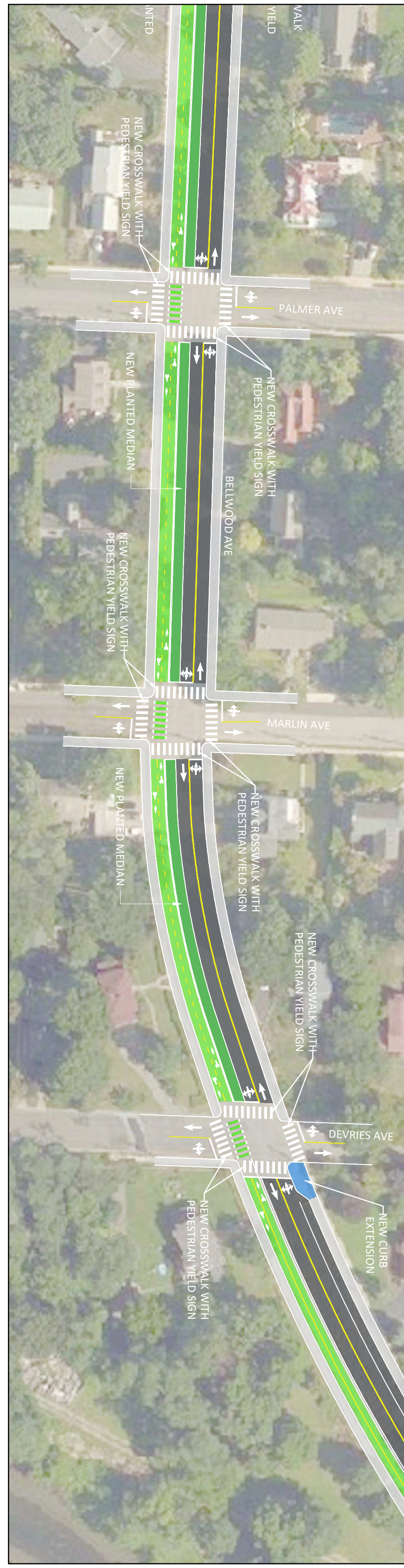
LEGEND:
- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

MATCH - SEE ABOVE RIGHT

MATCH - SEE SHEET 05 TOP LEFT

MATCH - SEE SHEET 03 BOTTOM RIGHT



MATCH - SEE BELOW LEFT

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

0' 100' 200'

ROUTE 9

SLEEPY HOLLOW

NEW YORK

Conceptual Design Plans

NELSON NYGAARD

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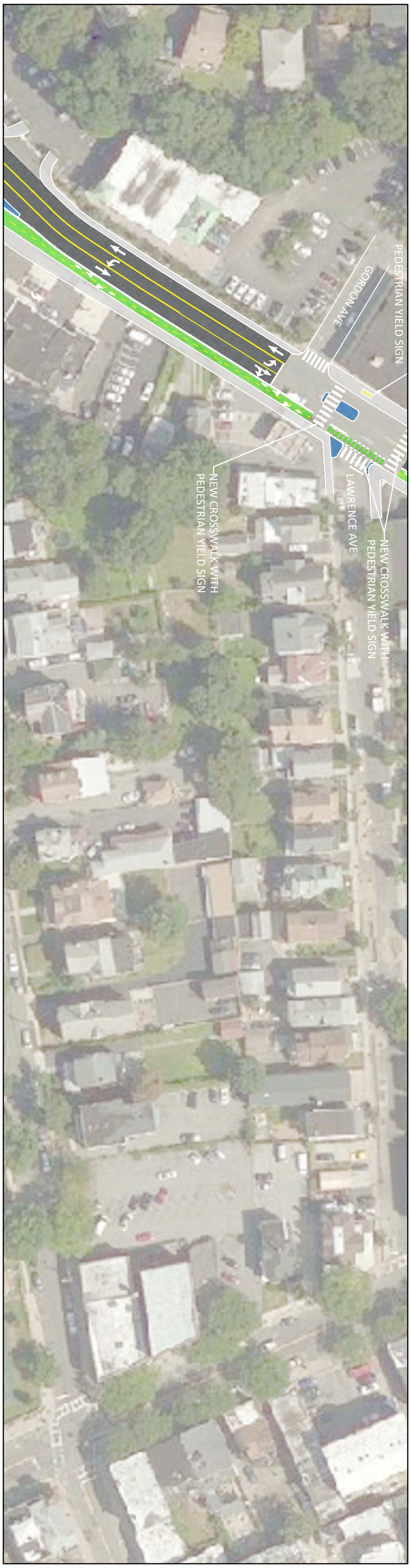
LEGEND:
- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

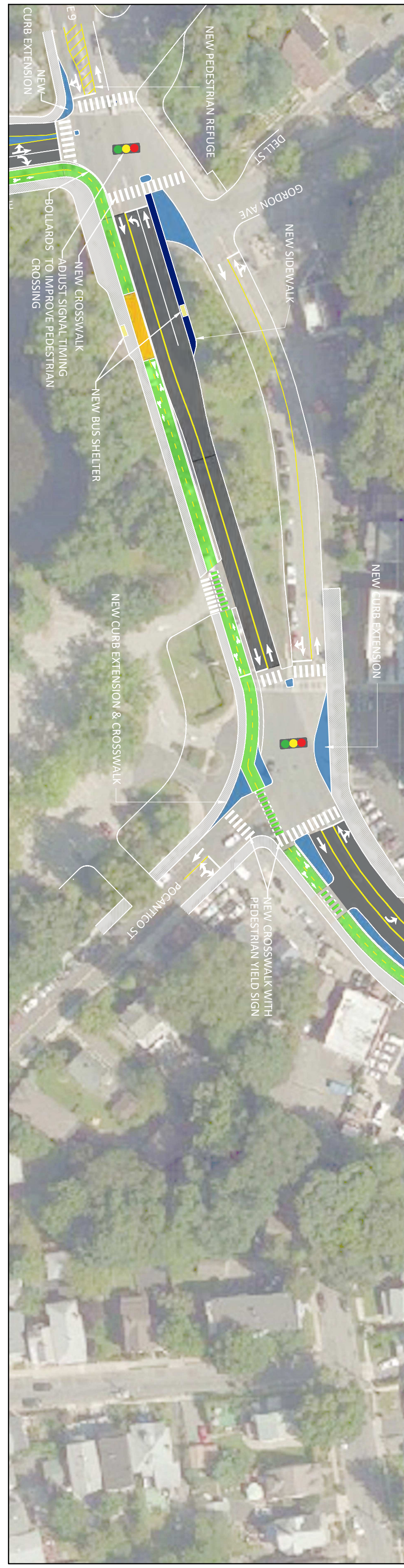
DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

MATCH - SEE ABOVE RIGHT



MATCH - SEE SHEET 06 TOP LEFT

MATCH - SEE SHEET 04 BOTTOM RIGHT



MATCH - SEE BELOW LEFT

0' 100' 200'

ROUTE 9

SLEEPY HOLLOW

NEW YORK

Conceptual Design Plans

NELSON NYGAARD

DRAWN:	-
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REVIEWED:	
DATE	2 July 2019
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LEGEND:

TRAVEL LANE
BIKE LANE
CURB EXTENSION
NEW SIDEWALK
EXISTING SIDEWALK
SIDEWALK EXPANSION
PLANTED MEDIAN
BUS STOP PLATFORM
BUS STOP SHELTER

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

MATCH - SEE ABOVE RIGHT

MATCH - SEE SHEET 07 TOP LEFT

MATCH - SEE SHEET 05 BOTTOM RIGHT

MATCH - SEE BELOW LEFT

0' 100' 200'

ROUTE 9

SLEEPY HOLLOW

NEW YORK

Conceptual Design Plans

sheet 06 of 28

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DRAWN:	-
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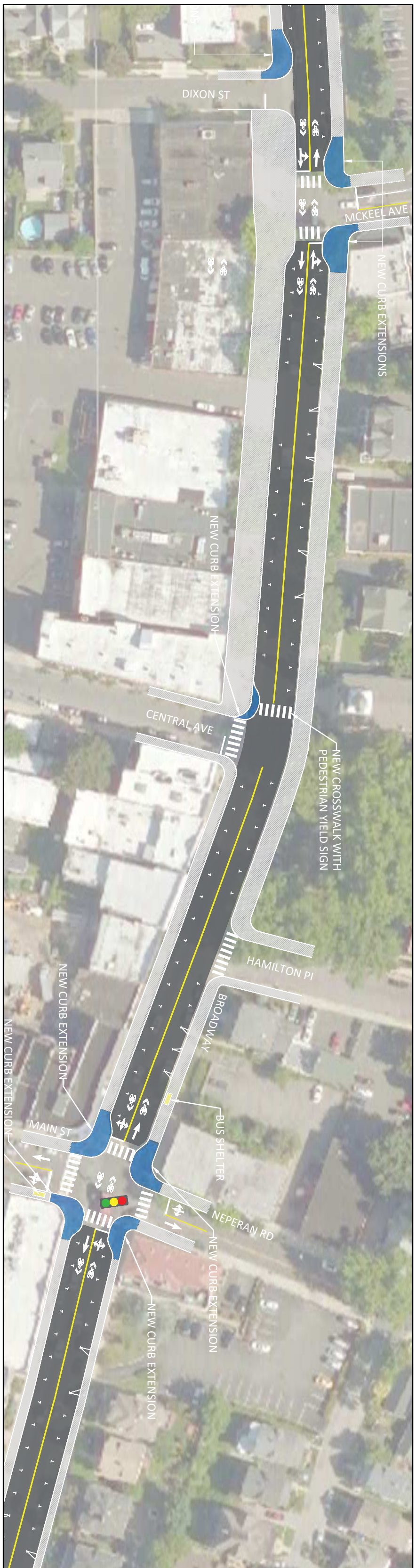
LEGEND:

- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

MATCH - SEE ABOVE RIGHT



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0' 100' 200'

ROUTE 9

TARRYTOWN

NEW YORK
Conceptual Design Plans

sheet 07 of 28

DRAWN:	-
DESIGN:	-
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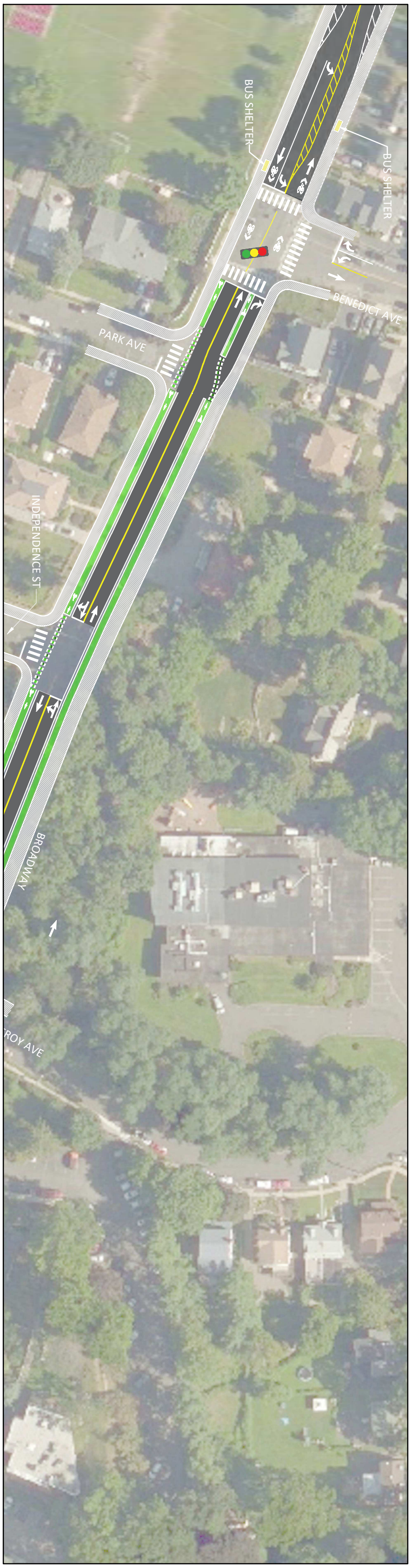
DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

LEGEND:

- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

MATCH - SEE ABOVE RIGHT



MATCH - SEE SHEET 09 TOP LEFT

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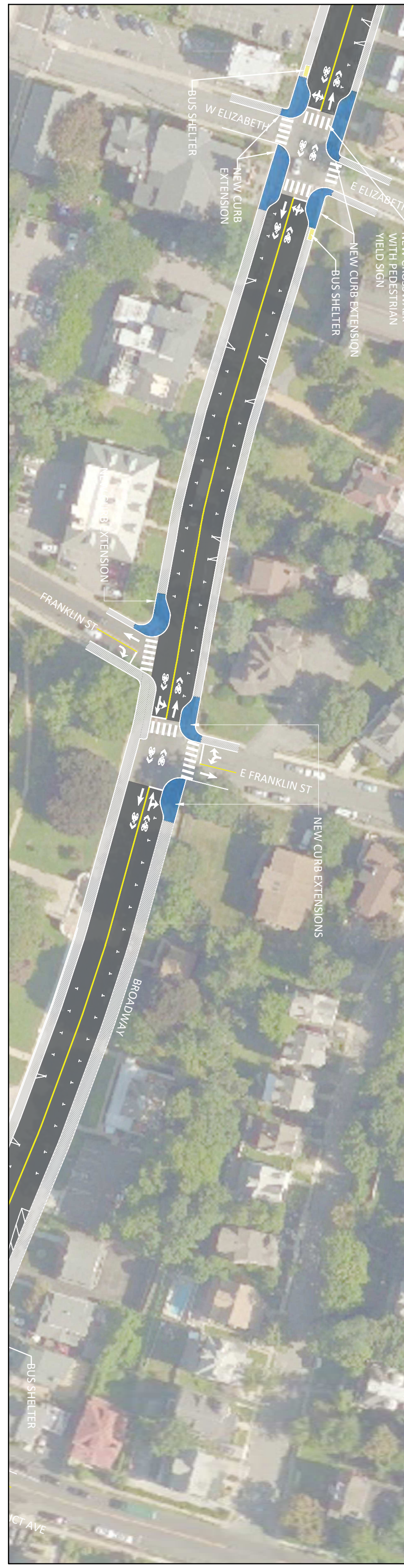

MATCH - SEE BELOW LEFT

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

0' 100' 200'

ROUTE 9

TARRYTOWN

NEW YORK

Conceptual Design Plans

NELSON NYGAARD

DRAWN:	-
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DATE	2 July 2019
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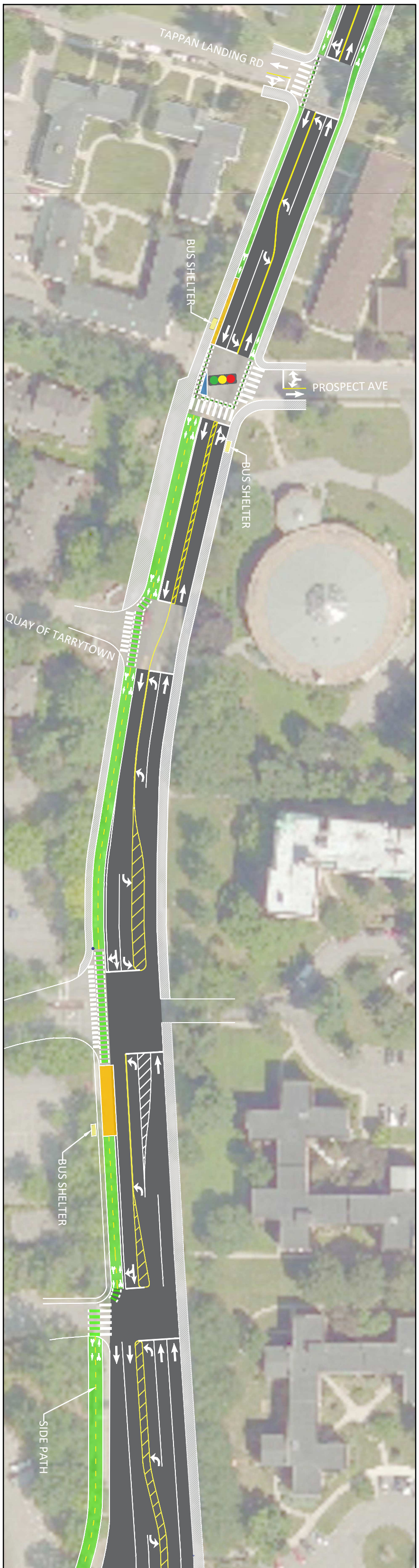
LEGEND:
- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

MATCH - SEE ABOVE RIGHT



MATCH - SEE SHEET 10 TOP LEFT

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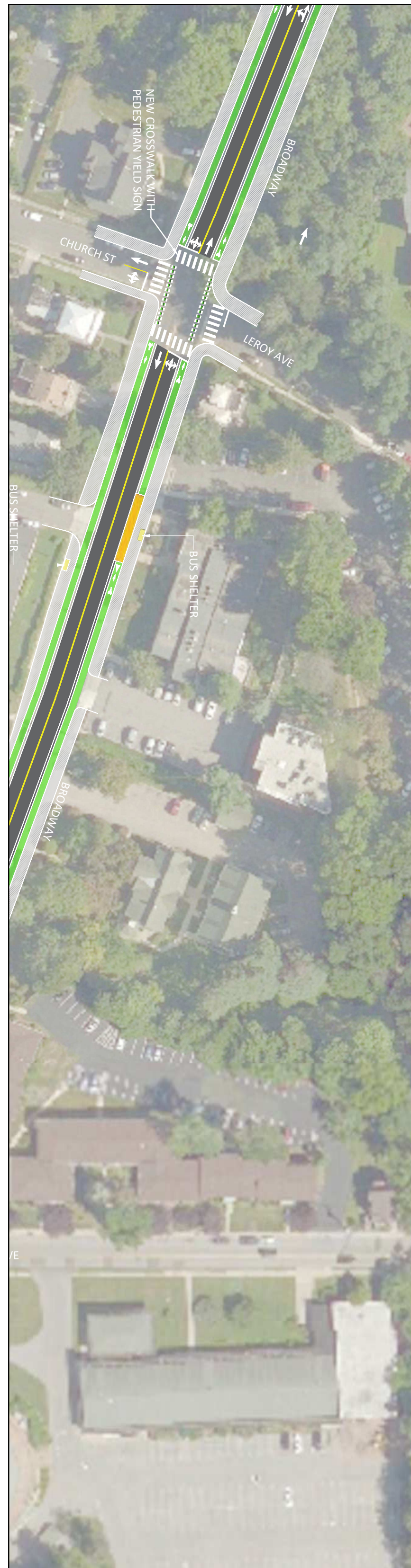


MATCH - SEE BELOW LEFT

0'
100'
200'

ROUTE 9
TARRYTOWN

NEW YORK
Conceptual Design Plans

NELSON NYGAARD

DRAWN:	-
DESIGN:	-
REVIEWED:	
DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

LEGEND:

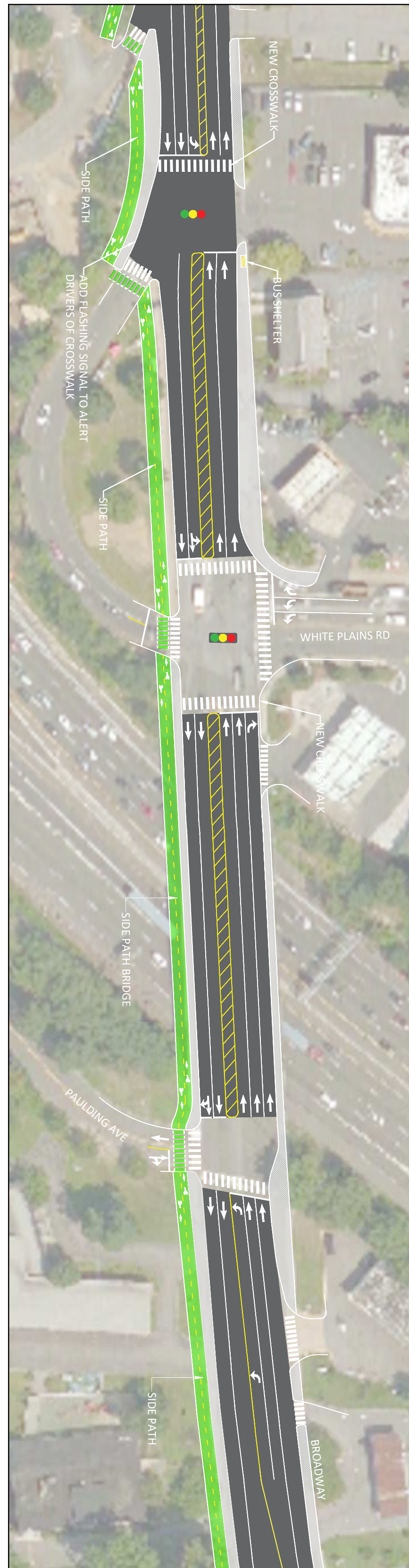
- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

MATCH - SEE ABOVE RIGHT

MATCH - SEE SHEET 11

MATCH - SEE SHEET 09 BOTTOM RIGHT



MATCH - SEE BELOW LEFT

0' 100' 200'

ROUTE 9

TARRYTOWN

NEW YORK

Conceptual Design Plans

sheet 10 of 28

NELSON NYGAARD

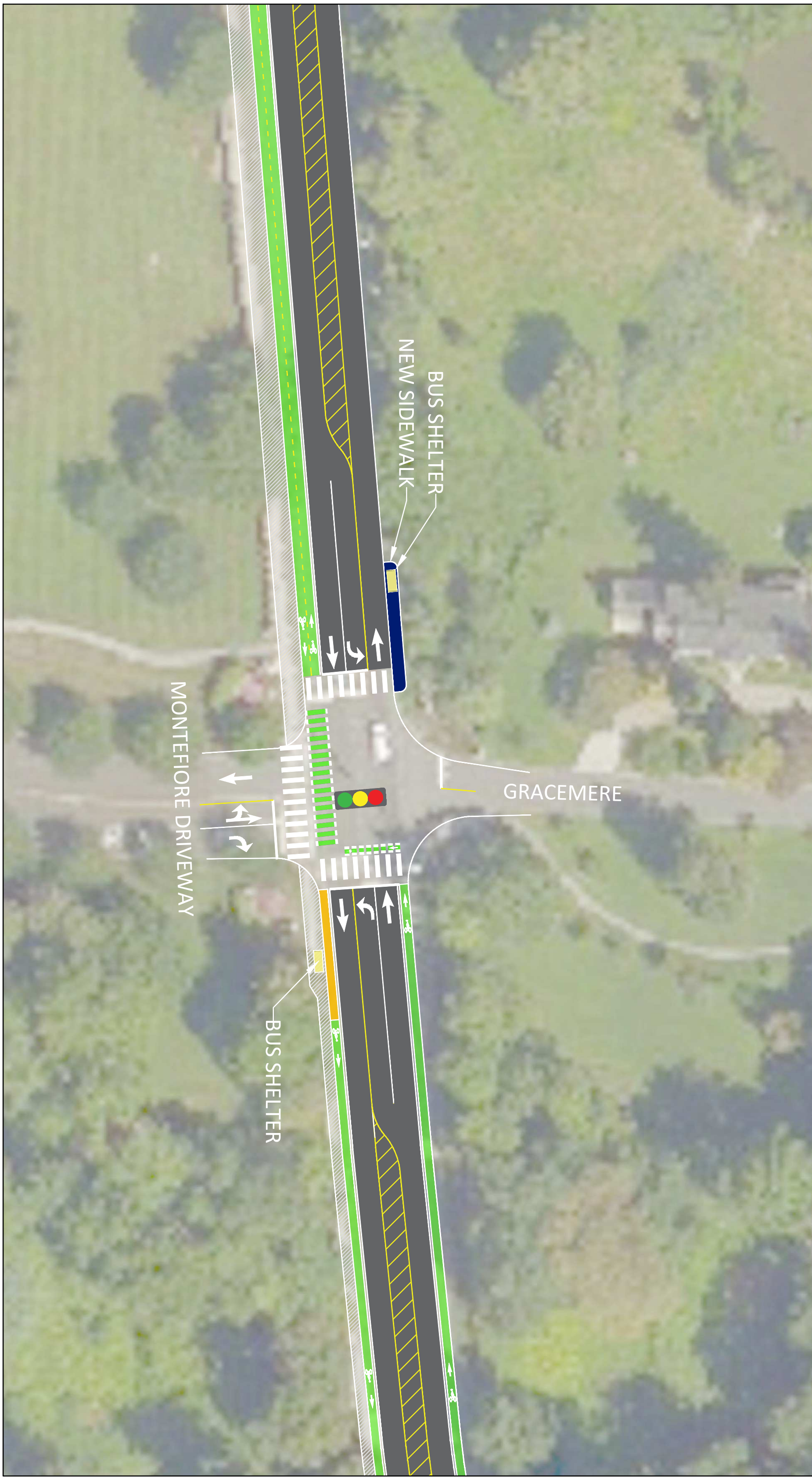
DRAWN:	-
DESIGN:	-
REVIEWED:	
DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

MATCH - SEE SHEET 10 BOTTOM RIGHT

LEGEND:

- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION



0'
100'
200'

MATCH - SEE SHEET 12 TOP LEFT

ROUTE 9

TARRYTOWN

NEW YORK
Conceptual Design Plans

sheet 11 of 28

NELSON NYGAARD

DRAWN:	-
DESIGN:	-
REVIEWED:	
DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

LEGEND:
- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

DRAFT CONCEPTUAL
NOT FOR CONSTRUCTION

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ROUTE 9
TARRYTOWN

NEW YORK
Conceptual Design Plans

sheet 12 of 28

NELSON NYGAARD

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DESIGN:	-
REVIEWED:	
DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

LEGEND:
- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

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sheet **13** of 28	
ROUTE 9	
IRVINGTON	
NEW YORK	
Conceptual Design Plans	
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DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

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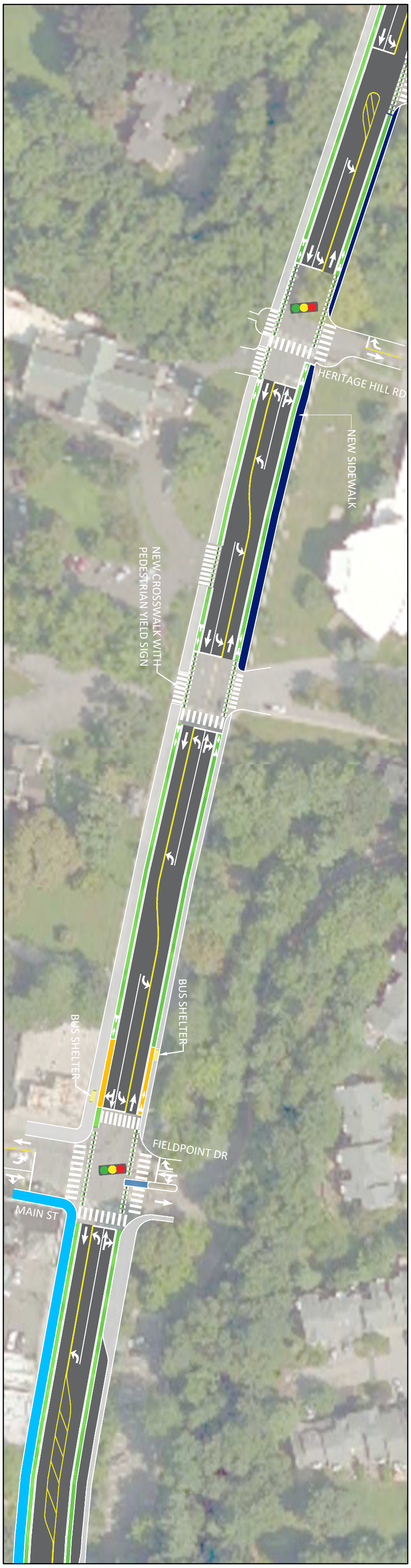

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ROUTE 9

IRVINGTON

NEW YORK
Conceptual Design Plans

sheet 14 of 28

NELSON NYGAARD

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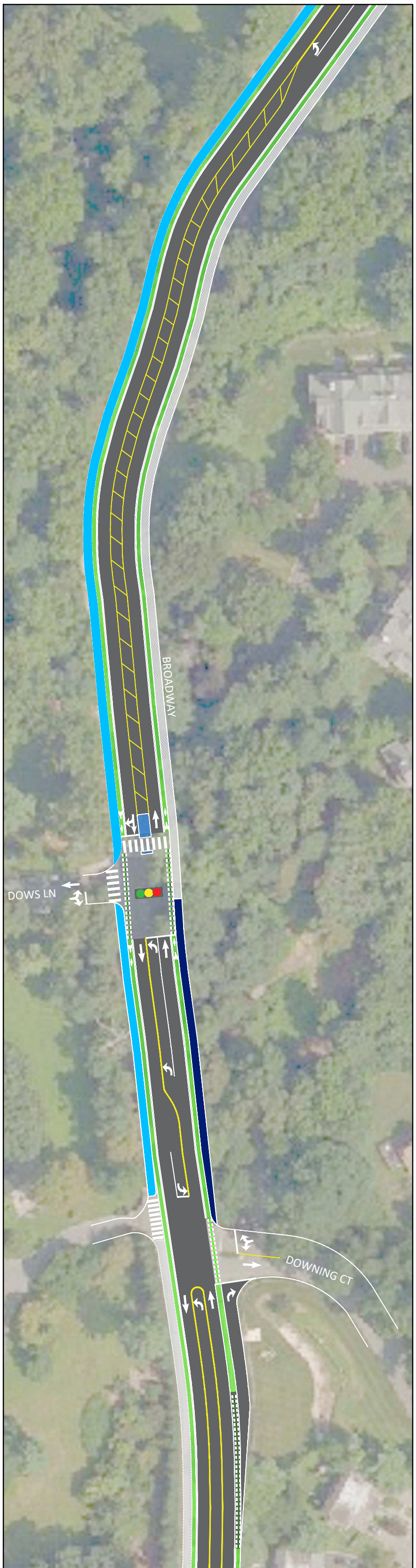

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ROUTE 9

IRVINGTON

NEW YORK

Conceptual Design Plans

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- BUS STOP PLATFORM
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ROUTE 9

IRVINGTON

NEW YORK

Conceptual Design Plans

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NEW SIDEWALK
EXISTING SIDEWALK
SIDEWALK EXPANSION
PLANTED MEDIAN
BUS STOP PLATFORM
BUS STOP SHELTER

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ROUTE 9
IRVINGTON

NEW YORK
Conceptual Design Plans

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- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

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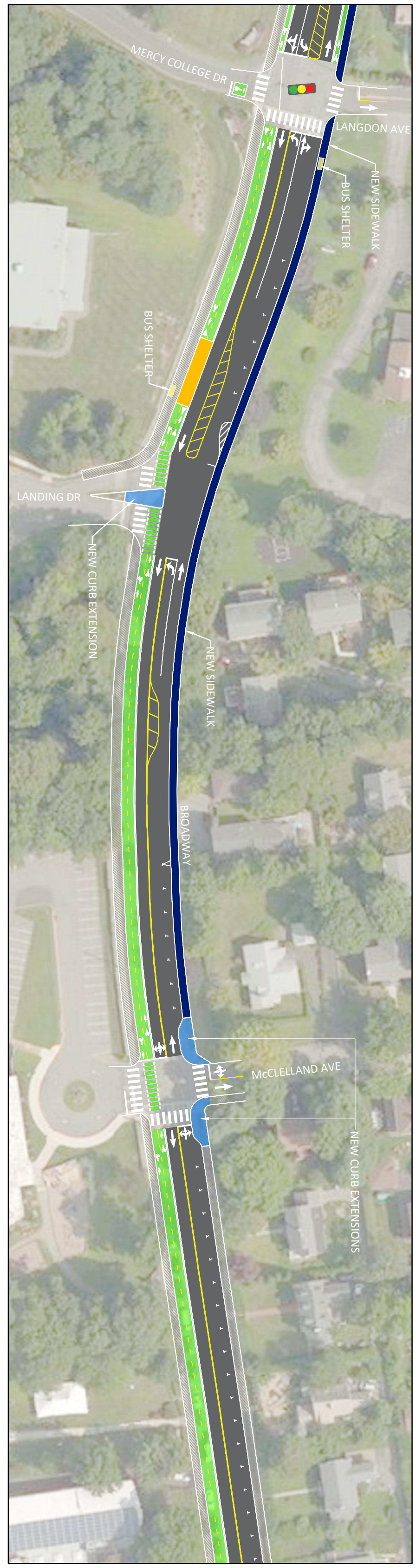

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ROUTE 9

DOBBS FERRY

NEW YORK

Conceptual Design Plans

NELSON NYGAARD

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DATE	8 October 2019
PROJECT:	Route 9_CAD Design.dwg

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ROUTE 9

DOBBS FERRY

NEW YORK
Conceptual Design Plans

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- EXISTING SIDEWALK
- PLANTED MEDIAN
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- BUS STOP SHELTER

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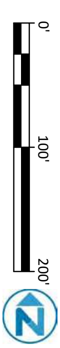

ROUTE 9

DOBBS FERRY

NEW YORK

Conceptual Design Plans

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DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

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- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

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sheet 21 of 28

ROUTE 9

DOBBS FERRY

NEW YORK

Conceptual Design Plans

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- BIKE LANE
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- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

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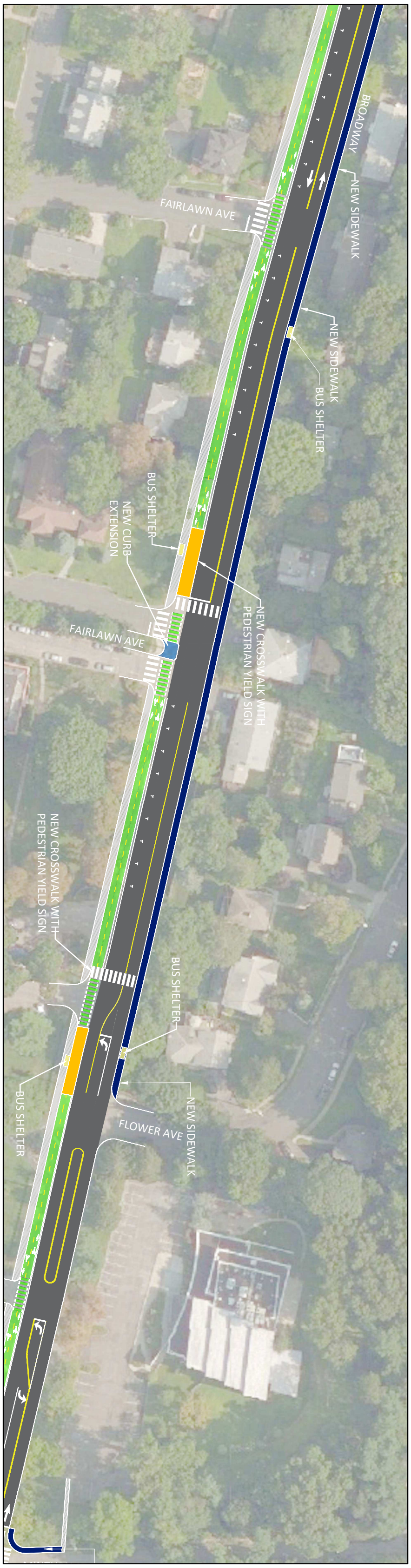

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ROUTE 9

DOBBS FERRY

NEW YORK
Conceptual Design Plans

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DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

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- TRAVEL LANE
- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
- EXISTING SIDEWALK
- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

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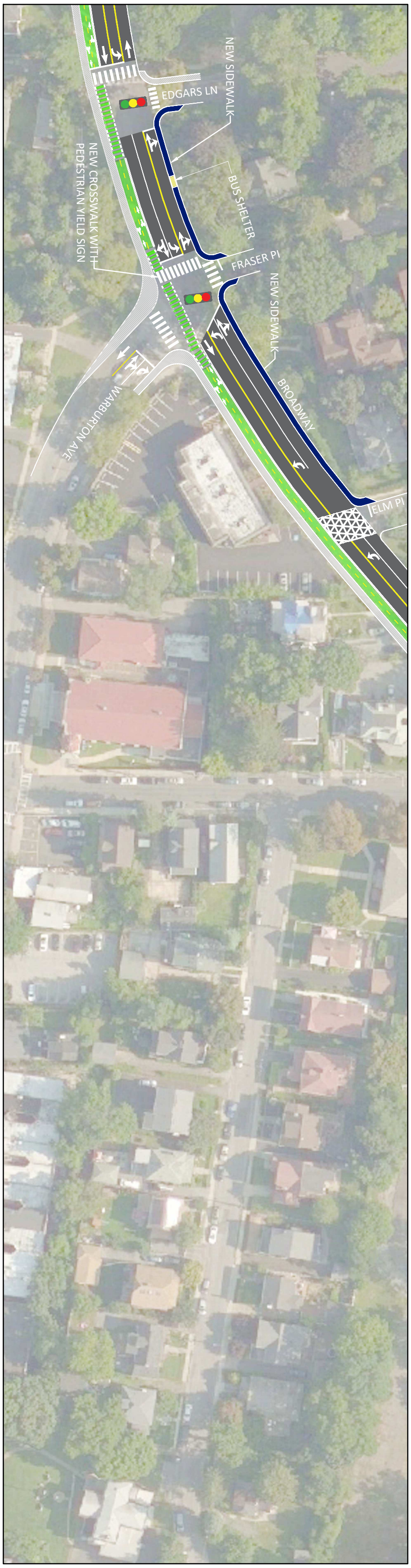

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ROUTE 9

HASTINGS-ON-HUDSON

NEW YORK

Conceptual Design Plans

sheet 23 of 28

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DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

LEGEND:
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BIKE LANE
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NEW SIDEWALK
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SIDEWALK EXPANSION
PLANTED MEDIAN
BUS STOP PLATFORM
BUS STOP SHELTER

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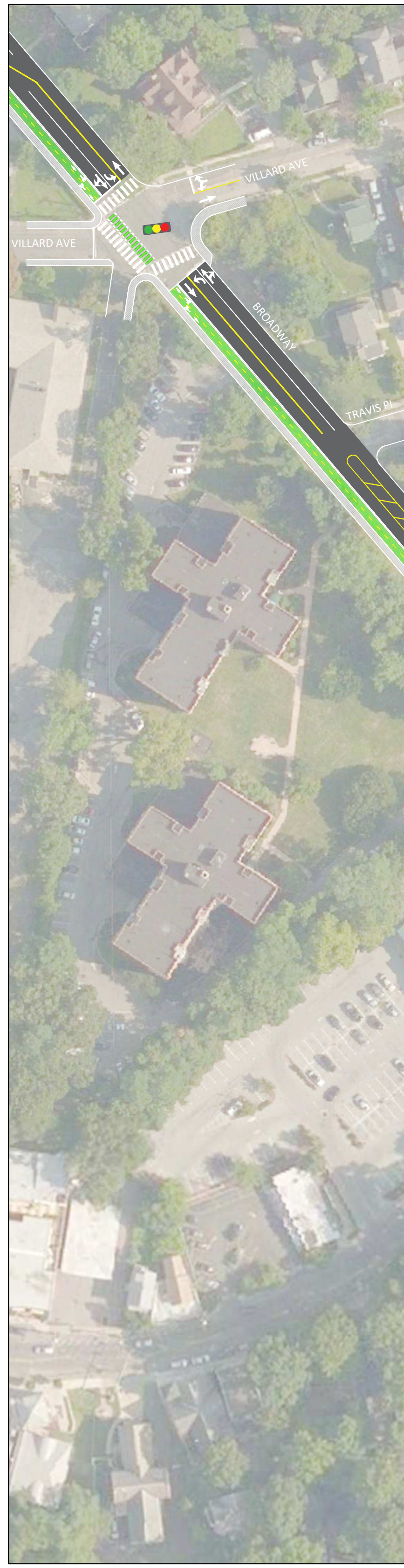

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ROUTE 9

HASTINGS-ON-HUDSON

NEW YORK
Conceptual Design Plans

NELSON NYGAARD

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DATE	2 July 2019
PROJECT:	Route 9_CAD Design.dwg

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BIKE LANE
CURB EXTENSION
NEW SIDEWALK
EXISTING SIDEWALK
SIDEWALK EXPANSION
PLANTED MEDIAN
BUS STOP PLATFORM
BUS STOP SHELTER

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ROUTE 9

HASTINGS-ON-HUDSON

NEW YORK
Conceptual Design Plans

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- BIKE LANE
- CURB EXTENSION
- NEW SIDEWALK
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- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
- BUS STOP SHELTER

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ROUTE 9

HASTINGS-ON-HUDSON

NEW YORK
Conceptual Design Plans

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LEGEND:
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BIKE LANE
CURB EXTENSION
NEW SIDEWALK
EXISTING SIDEWALK
SIDEWALK EXPANSION
PLANTED MEDIAN
BUS STOP PLATFORM
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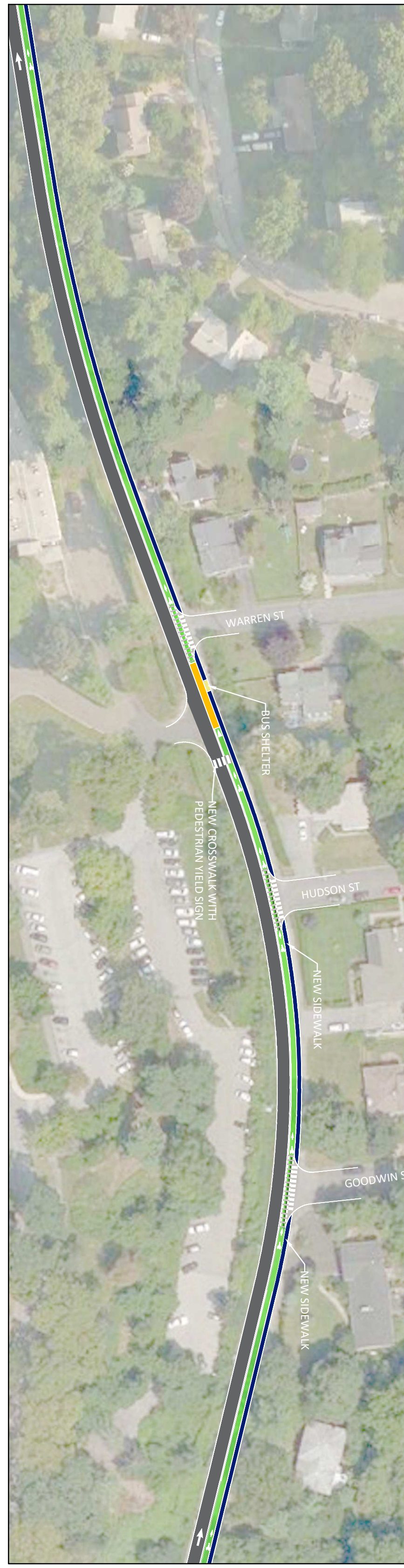

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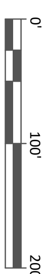

ROUTE 9

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Conceptual Design Plans

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- CURB EXTENSION
- NEW SIDEWALK
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- SIDEWALK EXPANSION
- PLANTED MEDIAN
- BUS STOP PLATFORM
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ROUTE 9

HASTINGS-ON-HUDSON

NEW YORK
Conceptual Design Plans

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PROJECT:	Route 9_CAD Design.dwg

Preliminary Cost Estimates

The preliminary cost estimates provided as part of the Implementation Plan were broken down into the categories and Village of Walk Infrastructure, Bike Infrastructure, Traffic Operations and Transit, and include the following elements and units:

Figure 106 Description of Elements and Units Incorporated in the Preliminary Cost Estimate

Category	Description	Unit
Walking facilities	New Concrete Sidewalk	Linear ft
	High Visibility Crosswalk	Square ft
	Curb Extensions/Median Islands	Square ft
	HAWK Signal	Ea
Traffic operations	Traffic Lane Restriping	Linear ft
Bike Facilities	Bike Lane	Linear ft
	Bike Lane Separation	Ea
	Sharrows	Ea
	Pre-Fabricated Boarding Platform with Integrated Bike Lane	Ea
Transit facilities	Bus Shelter	Ea

A current unit cost was assigned to components of the network. Unit costs are based on experience implementing these facility types nationwide. When implementing an on-street facility, the street resurfacing required to remove previously existing striping is a significant cost associated with implementation. The cost estimates as part of the Implementation Plan and do not include the cost of resurfacing. However, coordination and prioritization of the street resurfacing program represents a significant opportunity to reduce the overall cost of this network investment.

The construction is estimated to cost between $ 6M to $36M. Appendix D contains a detail cost estimate broken by Village. See below for the total costs by Village.

Figure 107 Total cost estimates per Village (2018)

Village	Low cost estimate	High cost estimate
Sleepy Hollow	$945,387	$4,966,069
Tarrytown	$1,440,800	$9,221,151
Irvington	$1,263,079	$6,847,179
Dobbs Ferry	$1,270,238	$5,790,165
Hastings-on-Hudson	$1,589,881	$9,413,282
Total	$6,509,385	$36,237,846

Impact on Parking Supply

The implementation of the proposed active transportation corridor will require removing some on-street parking spaces in some segments along Route 9. With the exception of Irvington, the parking utilization analysis performed for this project show that maximum utilization during peak periods is lower that the on-street parking supply of the proposed design. In Irvington, although all on-street parking spaces would be removed, there is sufficient adjacent underutilized off-street parking supply that can supplement that (See Figure 109).

Figure 108 Balance of On-Street Parking Supply in the Proposed Design and Current Parking Utilization

Village	On-Street Supply	On-Street Weekend Peak Utilization	On-Street Weekday Peak Utilization	Off-Street Supply	Off-Street Weekend Utilization	Off-Street Weekday Utilization	Repurposed On-Street Spaces	On-Street Supply After Implementation
Sleepy Hollow	57	20	7	726	275	350	29	28
Tarrytown	136	83	67	667	237	319	2	134
Irvington	24	15	12	452	117	92	24	0
Dobbs Ferry	280	124	120	339	32	25	40	240
Hastings-On-Hudson	0	0	0	374	227	191	0	0

Impact on Traffic Operations

As indicated in the Existing Conditions analysis, some intersections in the study area operate outside of this minimum standard during the peak hour. With the addition of the Active Transportation corridor as indicated in the Conceptual Design, those intersections operating below the NYSDOT threshold will continue operating similarly, while some others will increase the vehicle delay due to the changes in the road and intersection configurations.

During the weekday PM Peak, the intersections that experienced a Level of Service below the NYSDOT threshold as explained in the Existing Conditions chapter with the addition of the active transportation facilities include Pierson Avenue/Gordon Avenue (Sleepy Hollow), Beekman Avenue (Sleepy Hollow), I-87 WB (Tarrytown), Livingston Avenue (Dobbs Ferry), Ashford Avenue (Dobbs Ferry), and Farragut Avenue (Hastings-on-Hudson). As with the AM Peak, most of these intersections operate beyond acceptable levels during existing conditions as well as with the active transportation facilities, with the exception of Ashford Avenue which shifted from an LOS D in existing conditions to an LOS E with the addition of the active transportation facilities.

Finally, Livingston Avenue (Dobbs Ferry) and Farragut Avenue (Hastings-on-Hudson) experienced LOS F during the midday Saturday period. As with the AM and PM conditions, both of these intersections operate beyond acceptable levels during existing conditions as well as with the active transportation facilities.

Appendix E contains details on the methodology used and the results by intersection.

Additional Improvements to the Transit Network

Below is a list of improvements to the transit network, additional to those indicated in the Conceptual Design Plan and listed below in the Action Plan:

- In Tarrytown:
  - On Central Ave, remove two on-street car spaces eastbound to provide more space for the bus to stop (Routes 1 and 13)
  - Tappan Zee Express (TZx) to stop at the bus stop of Routes 1 and 13 adjacent to the SUP landing southbound and south of Prospect Ave northbound to improve transfer between the bicycle and transit network. Add bike racks in both stations
  - Lengthen the bus stop on Route 9 north of Neperan Road from 40' to 60' by removing one metered space
- In all villages:
  - add new shelters with benches to the any bus stops marked with a pole

6 ACTION PLAN

The primary goal of the Village Consortium is to create a continuous Active Transportation corridor that makes Route 9 safer and is accessible and welcoming for people of all ages and bicycling abilities. Building the entire corridor will require a sustained commitment over the coming years. This section includes specific recommendations categorized as follows:

- Making new connections for biking
- Making it easier to walk along Route 9
- Making Route 9 easier to cross
- Supporting Transit
- Road configuration improvement and parking supply changes

These design concepts, and their corresponding projects, are suitable for securing future funding for engineering design and construction.

PROJECT LIST AND KEY ACTIONS

The following tables describes the facilities improvement by category, road segment and Village, and specifies the Implementation Term (IT) as:

- Short = 1-2 years
- Medium = 3-9 years

Note that some of the improvements are interrelated, in particular in road segments where a protected bike lane has been proposed, which requires restriping and specific intersection design where the bike lane crosses the pedestrian crossings. As a result, the IT considered for both improvements is the same.

Figure 109 Active Transportation Facilities Improvements – Sleepy Hollow

Segment	Making new connections for biking	Make it easier to walk along Route 9	Make it easier to cross Route 9	Supporting Transit	Improvements in the roadway configuration and changes in the parking supply
North of Bellwood Ave north entrance	2-way protected bike lane on the west side of the street on Route 9	▪ New sidewalks on the west side of Route 9 from Phelps Ln to Bellwood Ave north entrance ▪ New sidewalks at Helmock Dr bus stop NB	▪ New crosswalks along Route 9 at the intersections of intersecting streets ▪ New curb extension on the north corner of Bellwood Ave crossing	Hemlock Dr bus stop NB: new sidewalk and new crosswalk across Route 9	▪ Restriped to two lanes with painted center line: 11' wide travel lanes ▪ Left turn lanes at Phelps Ln, Hemlock Dr: 10' wide turning lanes
Implementation Term	Medium	Medium	Short	Short	Medium
Bellwood Avenue to Pierson Ave	2-way protected bike lane on the west side on Bellwood Ave	▪ New sidewalks on both sides on Bellwood Ave from Route 9 to Farrington Ave ▪ New sidewalk on the west side on Bellwood Ave from Farragut Ave to Hardwood Ave	▪ New Crosswalks in all four legs of each intersection ▪ New Curb extension on the south-east corner of Devris Ave intersection ▪ Pierson Ave intersection is improved with new crossings and curb-extensions	-	Restriped to two lanes with painted center line: 11' wide travel lanes
Implementation Term	Medium	Short	Medium	-	Medium
Pierson Ave to New Broadway	2-way protected bike lane on the west side of the street	New sidewalk to access the bus stop NB south of Pierson Ave intersection	▪ New crosswalk to access the bus stop NB south of Pierson Ave intersection ▪ New crosswalks at Pocantico St and Lawrence Ave ▪ Intersection improvements with curb extensions and new crosswalks (Pocantico St, Lawrence Ave)	New sidewalk and crosswalk to access the bus stop NB south of Pierson Ave intersection	Restripe to the east: 11' wide lanes, one NB and two SB
Implementation Term	Medium	Short	Short	Short	Medium
South of New Broadway	▪ 2-way protected bike lane on the east side of the street ▪ Transition point in a new crosswalk south of New Broadway	New sidewalk on the east side of Route 9 from the Korean Church to the Village south border	▪ New crosswalks in all legs of the intersections and curb extensions on Route 9 to narrow the crossings ▪ Intersection improvements with curb extensions and pedestrian islands in Beekman Ave	-	▪ Remove 5 on-street parking spaces on the west side from Beekman Ave to the Korean Church new crossing ▪ Remove 23 on-street parking spaces on the east side from Hudson Terrace to the High School entrance on the east side ▪ Restripe to two 11' lanes NB and one 11' lane SB from Beekman Ave to the new crossing at the Korean Church
Implementation Term	Medium	Short	Short	-	Short-Medium

Figure 110 Active Transportation Facilities Improvements – Tarrytown

Segment	Making new connections for biking	Make it easier to walk along Route 9	Make it easier to cross Route 9	Supporting Transit	Improvements in the roadway configuration and changes in the parking supply
North border to Benedict Ave	Sharrows	-	▪ New crosswalks at Central Ave and Elizabeth St ▪ Intersection improvements with curb extensions and additional crosswalks	Extend the bus bay for NB routes at the stop north of Neperan St intersection	Remove 3 on-street car spaces on the east side south of the Neperan St crossing
Implementation Term	Short	-	Short	Short	Short
Benedict Ave to Prospect Ave	▪ Separated protected bike lane on each side of Route 9 ▪ Transition point at Prospect Ave intersection	-	New crosswalk at Leroy Ave	-	▪ Restripe to 11' lane, one in each direction, with 10' right turn lane on Benedict Ave, from Benedict Ave to Tappan Landing Rd ▪ Restripe to 11' lane, one in each direction, with 10' center turn lane, from Tappan Landing Rd to Prospect Ave
Implementation Term	Short-Medium	-	Short	-	Short-Medium
Prospect Ave to SUP landing (Governor Mario M. Cuomo Bridge Planned Shared-Use Path)	2-way protected bike lane on the west side of the street	Crosswalks connecting sidewalks in adjacent access points	▪ New sidewalk to access the bus stop NB south of Pierson Ave intersection ▪ Intersection improvements with curb extensions and new crosswalks	New sidewalk and crosswalk to access the bus stop NB south of Pierson Ave intersection	Restripe to 11' lane, one in each direction, and 10' turning lane NB left on Quay of Tarrytown and both ways on 303 entrance
Implementation Term	Medium	Short	Short	Short-Medium	Short-Medium
SUP landing to I-287 intersection	2-way side path west of the sidewalk	Crosswalks connecting sidewalks in adjacent access points	New crosswalk at the shopping plaza traffic light, between the SUP landing and White Plain Rd EB entrance	Move NB bus stop at the shopping plaza south of the entrance	NYSDOT design
Implementation Term	Short-Medium	Short-Medium	Short-Medium	Short	Short-Medium
I-287 intersection to Lyndhurst Museum Ln	▪ 2-way protected bike lane on the west side on Route 9 ▪ Transition point at Lyndhurst Museum Ln	New sidewalk at the NB bus stop at Lyndhurst Museum	▪ New crosswalk on Route 9 to access the NB bus stop at Lyndhurst Museum ▪ New crosswalks, islands and HAWK signal at the OCA crossing ▪ Crosswalks at all legs of the intersections	Accessibility improvements to the NB bus stop at Lyndhurst Museum	Restripe to 11' lane, one in each direction, and 10' painted median/turning lane
Implementation Term	Short-Medium	Short	Short	Short	Short-Medium
Lyndhurst Museum Ln to Sunnyside Ln	Separated protected bike laneon each side of Route 9	-	Pedestrian Island and new crossing at East Belvedere	-	Restripe to 11' lane, one in each direction, and 10' painted median/turning lane
Implementation Term	Short-Medium	-	Short	-	Short-Medium

Figure 111 Active Transportation Facilities Improvements – Irvington

Segment	Making new connections for biking	Make it easier to walk along Route 9	Make it easier to cross Route 9	Supporting Transit	Improvements in the roadway configuration and changes in the parking supply
Sunnyside Ln to Langdon Ave	Separated protected bike lane on each side of Route 9	New sidewalk on the east side from Sunnyside Ln to the Immaculate Conception Church, from Sycamore Ln to Harriman Rd, and from Clinton Ave to Langdon Ave	▪ New crosswalks along Route 9 at all the intersections ▪ Intersection improvements with curb extensions	▪ Remove bus stops at Irvington Gardens due to its proximity to Sunnyside Ln bus stops ▪ New bus stop north of the crossing at Circle Dr	▪ Road diet to 11' lane, one in each direction, and 10' painted median/turning lane ▪ Remove on-street parking on Route 9 (25 spaces)
Implementation Term	Short-Medium	Short	Short	Short-Medium	Short-Medium

Figure 112 Active Transportation Facilities Improvements – Dobbs Ferry

Segment	Making new connections for biking	Make it easier to walk along Route 9	Make it easier to cross Route 9	Supporting Transit	Improvements in the roadway configuration and changes in the parking supply
Langdon Ave to the High School entrance	▪ 2-way protected bike lane on the west side on Route 9 ▪ Transition point at Langdon Ave	New sidewalk on the east side from Langdon Ave to McCelland Ave	▪ Crosswalks paired with pedestrian islands/curb extensions to always be on the other side of the intersection from the stop bar for the left turn lane, which will reduce the number of crosswalks ▪ Intersection improvements with curb extensions and pedestrian islands: McCelland Ave, Sherman Ave	Improvements to access the NB stop at Ardsley Ave	Road diet to 11' lane, one in each direction, and 10' painted median/turning lane
Implementation Term	Short-Medium	Short	Short	Short	Short-Medium
High School entrance to OCA crossing	▪ Sharrows on Route 9 ▪ OCA trail as an alternative (intensify Wayfinding to indicate the continuity of the protected bike lane)	New sidewalk on the east side from Oliphant Ave to the OCA trail	▪ New HAWK signal at the OCA crossing ▪ Improvements with curb extensions and pedestrian islands: Belden Ave, Maple Ave, Clinton Ave, OCA crossing	▪ New proposed NB bus stop south of the intersection with Estherwood Ave ▪ New proposed bus stops, one in each direction, at Clinton Avenue/Oak Street	
Implementation Term	Short	Short	Short	Short-Medium	
OCA crossing to Livingstone Ave	▪ 2-way parking protected bike lane on the east side on Route 9 ▪ Transition point in Livingston Ave		Improvements with curb extensions and pedestrian islands: Livingstone Ave		▪ Restripe to 11' lanes, one per direction. ▪ Remove on-street parking on the west side
Implementation Term	Short-Medium				Short-Medium
Livingstone Ave to Fairlawn Ave	2-way parking protected bike lane on the west side on Route 9	New sidewalks from north Colonial Avenue to southern border	▪ New crossings with pedestrian yield signs north of the southbound bus stop at Fairlawn Ave and Flower Ave ▪ Improvements with curb extensions and pedestrian islands: Colonial Ave	New sidewalk to access the northbound bus stop north of Colonial Avenue	▪ Restripe to 11' lanes, one per direction. ▪ Remove 29 on-street parking spaces on the east side south of Colonial Ave
Implementation Term	Short-Medium	Short	Short	Short-Medium	Short-Medium

Figure 113 Active Transportation Facilities Improvements – Hastings-on-Hudson

Segment	Making new connections for biking	Make it easier to walk along Route 9	Make it easier to cross Route 9	Supporting Transit	Improvements in the roadway configuration and changes in the parking supply
Fairlawn Ave to Devon Way (Route 9 split)	▪ 2-way protected bike lane on the west side on Route 9 ▪ Transition point at Devon Way	▪ New sidewalk on the east side from northern border to Flower Ave, from Minturn St to Wagner Pl, from Edgars Ln to Elm Pl, from the 5 corners to Washington Ave ▪ New sidewalks on the west side from the existing sidewalk north of Washington Ave to Devon Way	▪ Crosswalks paired with pedestrian islands/curb extensions at 5 Corners and Devon Way ▪ New crosswalks with pedestrian yield signs north of Flower Ave, at Fraser Pl, and at Devon Way	Improve access to all bus stops	▪ Road diet/Restripe to 11' lane, one in each direction, and 10' painted median/turning lane ▪ Roundabout at 5 Corners
Implementation Term	Short-Medium	Short	Short	Short	Short-Medium
From Devon Way to south of Tompkins Ave (Route 9 reunites)	Protected bike lane in each direction	New sidewalks in east and west of the proposed bike lanes	▪ Crosswalks paired with pedestrian islands/curb extensions at Tompkins Ave ▪ Improvements with curb extensions and pedestrian islands: Devon Way and Tompkins Ave	Improve access to all bus stops	
Implementation Term	Short-Medium	Short	Short	Short	Short-Medium
Tompkins Ave (Route 9 reunites) to south border	Protected bike lane in each direction	New sidewalks in east and west of the proposed bike lanes		Improve access to all bus stops	Road diet/Restripe to 11' lane, one in each direction, and 10' painted median/turning lane
Implementation Term	Short-Medium	Short		Short	Short-Medium

Further Actions

In addition to these infrastructure projects, the Villages should also address the following needed improvements and actions in the city.

- **Ongoing Maintenance:** Regular maintenance of the bicycle and pedestrian network should be planned and budgeted. Well-maintained facilities are crucial to ensuring these important investments remain accessible to riders of all experience levels, and that people feel confident they can rely on the network for their regularly-scheduled trips. Proper maintenance also extends the life of infrastructure, limiting the need for expensive repairs.
- **Coordinated Implementation:** Coordinating implementation across Villages departments will help to improve efficiency in project delivery and speed the delivery of complete streets and other complementary infrastructure. It is recommended to coordinate plans and project prioritization to support multi-plan implementation.
- **Crash Data:** Better bicycle and pedestrian-involved crash data would provide the Villages with a more complete picture of the causes of crashes and help to inform the solutions needed to make Route 9 safer for bikers and pedestrians.
- **Bicycle and Pedestrian Counts:** counts can be collected effectively with machines that automatically record the number of people on bikes and walk that pass by a specific location. While effective, these machines are expensive and cover only a limited area of the city. By partnering with community groups or Advisory Councils, the Villages could recruit volunteers for manual counts over a larger geographic area. This would provide a better estimate of bicyclists and pedestrians and would be useful in validating assumptions and analyses used in developing the network.

POTENTIAL FUNDING SOURCES

There are many funding sources that can be used to support the Route 9 Active Transportation Plan's implementation, including leveraging existing resources; local, regional, state, and federal grant funding opportunities; private funding; and partnership opportunities. While many of these funding sources are competitive—particularly the public grant sources—the villages have been very successful at competing for grant funds. By matching projects to the funding sources for which they are best suited (and for which they can be most competitive), the area can continue to use a variety of funding mechanisms to build projects and implement new programs.

This section is organized into public funding sources and private funding sources. The public sources are further categorized into local, regional, state, and federal programs.

Public Funding Sources

Public funding sources include local, regional, state, and federal funds and grant opportunities. The regional, state, and federal sources are distributed through regular funding competitions, and the amount available in a given year depends on a wide range of factors. The majority of the projects identified below will be competitive for public funding given the benefits they provide to specific communities and their focus on improving comfort and safety.

Figure 114 Public Funding Sources

Source	Description	Eligible Agencies
Local		
Advertising	Paid advertisements on agency properties	Subject to local regulations
Naming Rights / Sponsorships	Selling naming rights has become more common among organizations and some transit agencies	Subject to local regulations
Public-Private Partnerships and Joint Development	A mutually beneficial agreement between public and private entities that seek to improve the value of an asset or property	Subject to local regulations
Property Assessments	Voluntary or codified property assessments can be attributed to programs and services that directly benefit the assessed property or business	Subject to local regulations
General Municipal and Capital Improvement Funds	Where possible, project elements can be implemented into existing funding mechanisms, particularly in cases of ROW maintenance	
Parking Meter Revenues	Increasingly, surplus parking revenues are used by municipalities to fund non-motorized transportations investments and streetscape improvements	
State/Regional		
Community Development Block Grant Funds	Funds are available for technical assistance and implementation grants for neighborhood revitalization and community development projects	Local government
Hudson River Valley Greenway Grants	Greenway Communities are eligible to receive up to $10,000 to develop plans or projects consistent with the five Greenway criteria Greenway Compact communities are eligible to receive more than $10,000 for projects that develop, approve, and implement a compact strategy consistent with the Greenway criteria and the Greenway Act.	Greenway or Compact communities
Westchester Community Foundation	Where appropriate, will provide funding for tax-exempt 501(c)(3) organizations operating or proposing to operate programs for the benefit of Westchester residents and communities, including school districts.	Any tax-exempt entity
NYSDOT State Dedicated Fund (SDF)	Provide funds for transit system improvements and innovative capital transit projects	Counties, cities, and non-MTA transit authorities
Transportation Alternatives Program Set-Aside	Provides up to 80 percent of project-related cost funding for programs and projects defined as transportation alternatives	▪ Any local or regional governmental entity ▪ MPO's and State agencies are not eligible
NYSOCR New York Main Street Program	Provides financial resources and technical assistance to communities to strengthen the economic vitality of the State's traditional Main Streets and neighborhoods	Local government
NYSOPRHP Recreational Trails Program	Provides funds to states to develop and maintain recreational trails for both motorized and non-motorized recreational trail use. Grants can fund up to 80% of the total project cost.	Any public entity in NYS
NYSDEC Climate Change Grants	Funding for projects that help communities reduce greenhouse gas emissions and prepare for a changing climate	Any public or private entity registered in the NYS Grants Gateway
Federal		
TIGER/Build Grant	Provides investments in road, rail, transit and port projects that promise to achieve national objectives; including safety, economic competitiveness, quality of life, environmental protection, state of good repair, innovation, partnership, and additional non-Federal revenue for future transportation investments	Any public entity
FTA Capital Investment Grants	Bicycle and pedestrian improvements that are components of transit investments are eligible for funding through this program.	State or local governments
Transportation Infrastructure Finance and Innovation Act	Provides credit assistance for qualified projects of regional and national significance	Any public or private entity

Private Funding Sources

Private funding sources are increasingly used to supplement public funds, particularly in areas that are experiencing a great deal of growth and development. While private funding is most often the “last dollar in” for a project—rather than the seed money for an improved bike crossing, for example—leveraging private investment is a powerful way for cities to implement more projects and build stronger partnerships with community members.

Partnerships with local businesses can generate support and funding for bike network projects in specific places or as a part of larger neighborhood initiatives. Projects funded through public-private partnerships may include green streets and pedestrian plazas, pedestrian tunnels, bike share programs, and multi-use trails. Working proactively with corporate stakeholders—which often occurs as a part of large redevelopment projects or within the scope of a specific community benefits agreement—can also lead to a partnership for funding bike projects.

Non-profit organizations, community groups, and advocacy organizations also offer funding for bike infrastructure projects in the form of grants. For example, PeopleForBikes is an advocacy group that administers a Community Grant Program, funding for a variety of bike network projects, including shared-use paths, trails, and protected bike lanes.

Finally, a number of national foundations have begun to play important roles in supporting pedestrian infrastructure improvements and programming. National foundations that have funded urban health and active transportation investments in the recent past include the following:

- Bloomberg Philanthropies' Sustainable Cities and Initiative for Global Road Safety, respectively, grants aim to tackle climate change at the city and local level and reduce traffic deaths and injuries.
- The Kresge Foundation has supported planning (not construction) for bicycle and pedestrian facilities.
- Outside the Box is a grant program funded by Redbox and managed by the Online Computer Library Center (OCLC) in partnership with the Project for Public Spaces to support libraries and their communities in carrying out free, fun events in the public right-of-way to activate spaces.
- The Robert Wood Johnson Foundation funds projects and research related to the health impacts of active transportation and the built environment.
- Southwest Airlines' Heart of the Community Program grants provide financial and technical assistance to local community partners who seek to bring new life to public spaces and transform them into vibrant places that connect people and strengthen communities.
- The Surdna Foundation's Sustainable Transportation Networks and Equitable Development Patterns Grant supports efforts to boost sustainable transportation networks.

Development Fees

Some jurisdictions have implemented impact fees that can be used to fund various types of infrastructure. For example, a fee may be adopted for each peak hour vehicle trip that is generated by a new residential project. In most cases, this funding is combined with funds from other projects to establish a pool of money to construct the improvements that are on an adopted project list which can include projects that serve many travel modes.

As part of approval for new projects, the Villages could require developers to fund or build bicycle infrastructure in right-of-way adjacent to their project. Codifying bike parking requirements in zoning rules is another way that local governments can incorporate bicycle facilities in new development.

Business Improvement Districts and Community Benefit Districts

Bicycle infrastructure can be funded as part of a local benefit assessment district, which is based on the concept that those who benefit from a service should help to fund it. One common example is the Business Improvement District (BID), where business owners pay directly into a common fund to provide improved infrastructure, support operations to maintain clean and safe streets, and enhance wayfinding and placemaking elements in the district. These districts may fund bike improvements along with ongoing maintenance, placemaking, and landscaping projects.

7 SUPPORTIVE PROGRAMS, POLICIES, & PROCEDURES

Walking and cycling-supportive programs, policies, and procedures complement the low-stress walking and bicycle network. Developing a culture of active transportation that makes biking a fun, efficient and attractive travel option for people of all ages and abilities takes years of commitment and engagement by stakeholders at all levels. Programs like Safe Routes to School, policies such as Vision Zero, and regular maintenance of bike infrastructure are essential components of a sustainable, high-ridership network.

The sections below introduce select programs to support people riding bikes, policies to help make Route 9 a bike-friendly corridor, and procedures that the Villages should implement to support development of the Active Transportation network.

PROGRAMS

Programs are targeted, actively managed, village-led initiatives that include collaboration with partners and the involvement of community members to elevate biking as a primary mode of transportation and to improve safety and comfort for people.

Encouragement

- **Community rides** such as monthly bike parties or bike-based tours help expose new riders to a bike network. Low-speed, relaxed group rides are particularly effective at building family ridership, and these group rides can be used as an economic development tool when trips are routed through shopping areas.
- **Bike races** and other competitions build community and draw committed cyclists from across the region. Bike-based competitions are excellent for involving youth, and both spectators and participants bring tourist dollars to competition sites.
- **Open streets events,** also known as ciclovías, close down major community thoroughfares for a day, opening the street for people to walk, bike, roller blade, and use other non-motorized transportation. These events help build a sense of community and neighborhood pride and can be targeted economic development tools that coincide with holidays, festivals, or other special events.

Figure 115 Bicycle Race in Crystal City, VA

Education

- Building a world-class bike network means familiarizing drivers with the growing number of bikes in the area. Adding **bike awareness training** to driver's education programs helps normalize auto interactions with bikes and teach people driving about bicycle infrastructure. Adding bike awareness training to commercial licensing and other large vehicle operator training is particularly important, as these vehicles pose the greatest danger to people on bikes.
- **Safe Routes to School** is a nationwide program that creates safe, simple, and fun opportunities for children to walk or bike to school. This program encourages important physical activity before and after school and can reduce traffic caused by vehicles dropping off and picking up students. A bike rodeo, an on-bike clinic with stations focusing on bike skills, bike maintenance, rules of the road, and helmet fit. Bike Rodeos are a fun, active and hands on activity for elementary students to learn biking and safety skills in a safe and comfortable environment. See below an advertisement of Walk Safe in Irvington NY, who offer programs to teach students to walk to school, such as the Walking School Bus.

Figure 116 Awareness Training for Compactor Truck Operators and Cyclists in Cambridge, MA

Source: Nelson\Nygaard

Figure 117 Walk Safe in Irvington NY Offers Walk to School Education Programs

Advocacy/Support Groups

- Building a positive, collaborative relationship with **local advocacy groups** such as Bike Tarrytown helps bring more community members into the bike planning processes and can streamline project delivery by drawing stakeholder engagement into earlier phases of project and plan review.
- **Community groups** that support bike network implementation can help produce the special events and community rides that build familiarity with a bike network. They can also serve as an intermediary between local businesses and bike-based events, thereby channeling economic development to bike-friendly shopping events and corridors.

Bicycle Parking

- **Safe, secure, bike parking** ensures that the beginning and end of every cycling trip is comfortable and stress-free. Incentivizing easily-accessible, well-lit, and sheltered bicycle parking at major destinations and trip generators can increase ridership, and prominently-located bike parking facilities can encourage people who drive to try biking to regular destinations.
- Mandating high-quality **bicycle parking sites in large residential and commercial developments** ensures that future residents have access to safe, clean, and sheltered parking for their bikes.
- **Valet bike parking at special events** is a fun and novel way to encourage cycling to large events.

Figure 118 Bike Locker at BART Station in the Bay Area, CA

Source: Nelson\Nygaard

Wayfinding

- **Good wayfinding** is crucial to successful bike network implementation. Signs that provide the distance and direction to major destinations, transit connections, and places of interest help new riders build familiarity with bike routes and the larger network.
- Wayfinding can be used as an **economic development tool,** directing people on bikes towards shopping sites such as retail corridors, farmers markets, and special events.

POLICIES

Policies translate plan goals into operational standards, guidelines, and practices, and establish street design, operational, and maintenance standards to increase safety and reduce collisions.

Eliminating Traffic Deaths

- Establishing a **Towards Zero Death** or **Vision Zero policy** formalizes a city's commitment to eliminating traffic deaths. By operating under the belief that every death in a traffic crash is preventable, the Villages along Route 9 can work to produce the safest possible outcomes with every infrastructure project. A key component of the Vision Zero mission is the reduction of auto speed in places where people walk and bike.

Design Criteria

- Building an accessible low-stress bike network is a **context-sensitive undertaking** that is carried out differently along the corridor. Appropriate design guidelines can be developed from general principles but must take into account the unique needs of the community for which they are produced and the neighborhoods in which they are applied.
- **Infrastructure design guidelines** that separate people biking from moving vehicles are the cornerstone of a bike network with low levels of traffic stress. Successful guidelines are produced for network segments and nodes, thereby protecting people on bikes at both intersections and along rights-of-way.
- In many places, rights-of-way are generous enough to support auto lanes, sidewalks, and protected bike infrastructure. In instances where protected bike infrastructure is missing, road diets may be necessary to reduce the width or number of auto lanes. This type of **"roadway recanalization"** reduces speeds to improve safety and reflects the transportation goals and priorities of a multimodal city.

Dedicated Funding

- A commitment of **dedicated and sustained infrastructure funds** is essential to the successful implementation of the Active Transportation network. A baseline financial commitment provides assurance to public, private, and non-profit partners that their investments will be matched and their partnership is valued. Funding commitments can come in the form of grant programs, capital investment programs, or budget allocations to relevant departments.

PROCEDURES

Procedures are the day-to-day practices that can make Route 9 streets safe and comfortable for walking and biking. Procedures can be staffing changes to street management to project delivery that have a profound impact on the quality of the bicycle network along Route 9.

Pedestrian Facilities Maintenance Standards

- Defining **maintenance** and developing **standards for pedestrian facilities maintenance** that are integrated into regular maintenance cycles helps establish the point in which maintenance ends and higher forms of project development takes form and removes ambiguity about when or how this type of infrastructure is to be maintained. Good maintenance practices also reduce long-term capital costs by extending the lifespan of expensive infrastructure.
- Establish a **model maintenance program** for pedestrian facilities to be able to respond quickly to a hazard or frequent complaints, and to address sidewalk issues in a manageable and predictable fashion. Maintenance can be a partnership between public, private, and advocacy organizations and can be facilitated by issue-reporting apps such as SeeClickFix.

Bikeway Maintenance Standards

- Developing **standards for bikeway maintenance** that are integrated into regular maintenance cycles removes ambiguity about when or how a bikeway is to be maintained. Good maintenance practices also reduce long-term capital costs by extending the lifespan of expensive infrastructure.
- Encouraging regular ridership on a bike network means the **network must be well maintained,** with regular sweeping and short response times for repairs. Commuter ridership, in particular, requires that routes to major workplaces are consistently clear of snow and debris, and pavement is free from cracks, potholes, and other defects. Maintenance can be a partnership between public, private, and advocacy organizations and can be facilitated by issue-reporting apps such as SeeClickFix.

Tracking Progress

- Developing and using **performance measures** is an important step in monitoring progress toward meeting the goals of this corridor. Performance measures should be clear and easily understandable, related to community values and goals, and reported on an annual basis. Metrics are valuable for tracking progress, such as the number of miles of biking lanes added each year, and for establishing targets for the future, such as increasing bicycle commute mode share.