2 Needs & Opportunities

2.1 Introduction

Having documented existing conditions along the corridor, corridor needs and opportunities were identified and reviewed by the Technical Advisory Committee (TAC). These needs and opportunities were revised and expanded based on TAC input and then formulated into conceptual plans, which were presented to the public at two virtually identical public meetings at 3:00 p.m. and 6:00 p.m. on November 19, 2014. The meetings were held in the assembly room of Seven21 Media Center on Broadway. A brief summary of the information presented to the public is provided below and the actual PowerPoint can be found in this study's appendix.

This chapter presents a summary of the extensive input received at these meetings and refines the conceptual plans in response to the comments, concerns and suggestions offered. In conjunction with the further development of the plans, a series of decision-making matrices were developed for various elements of the plans to assist the TAC in deciding which alternative and which elements of that alternative should be selected for inclusion as the preferred plan to be considered for adoption by the City. For a fuller understanding of the scope of the conceptual plans, it is recommended that the substantial additional information relating to the various alternatives and the decision-making matrices, which are appended with this chapter, be carefully reviewed.

Following review and discussion of this chapter, the alternative plans and the decision-making matrices, the TAC will select a preferred alternative and component elements. Additional graphics and a conceptual rendering for the selected plan will then be developed and reviewed by the TAC before a final public meeting is scheduled to present the plan to the public for review and critique. Following that, any final changes to the plan will be incorporated and it will be presented to the City to be considered for adoption.

2.2 Needs & Opportunities Public Presentation

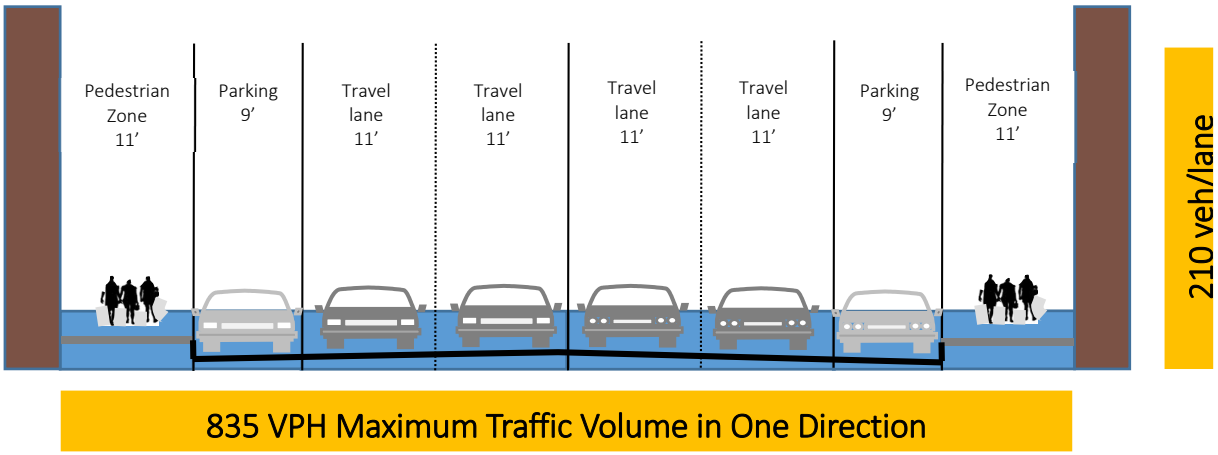
Following an opportunity for the public to view boards displayed throughout the room, Dennis Doyle, Director of the Ulster County Planning Department, welcomed everyone attending the meeting and discussed the planning process. He introduced Brian Slack and David Staas from UCTC. The members of the TAC and then turned the meeting to Robert Dennison, Principal in Charge, from VHB. Bob introduced John Canning from VHB who is the Project Manager for the project.

The presentation succinctly informed the public of the project's purpose.

- A Transportation Project to Renew, Restore and Revive Broadway
- To improve pedestrian and bicycle safety, aesthetics, transit and traffic flow.
- To re-connect the Broadway corridor with surrounding neighborhoods and amenities, such as the Kingston Point Rail Trail and other multi-use trails
- To revitalize this important regional corridor

To accomplish these goals, the City has recently been awarded almost $4 million in various state and federal grants to renovate the physical layout of Broadway and connect the surrounding streets.

The cross sections along the corridor within the study limits were presented, along with the peak-hour traffic volumes and traffic volume densities. This information indicated that the western end of the corridor, which is 4 lanes wide (plus parking) carries significantly fewer vehicles per lane during the peak hour than the remaining sections of the corridor.



Photographic data also indicated that traffic is generally concentrated in one lane per direction in this section of the corridor.

Potential opportunities for improvements along Broadway were presented which would include shorter crosswalks (resulting in reduced pedestrian exposure), bicycle lanes, bump outs, and opportunities for new public space.

Bicycle lane options and details of connections to the three contemplated Kingston bike trails were presented, accident history along the corridor and bus transit were reviewed, after which some place-making concepts and implementation techniques from Pittsfield, MA were presented.

Examples of streetscape furniture for receptacles, benches, planters, bike racks, landscape, and lighting were provided and the presentation also highlighted how the corridor and network will perform with these improvements.

After each presentation, the was a Question and Answer Session, which was followed by a Breakout Session where the public had an opportunity to review and discuss the presentation boards, provide comments at four stations through a post-it exercise, and interact with the

TAC and consultant team. A summary of the public feedback is provided below and provided in detail in the appendix.

2.3 Feedback from Public Meeting

Following the presentation there was a question and answer session to solicit input from those present and to provide more information on the project and the findings to that point. After the Q&A session, the public had an opportunity to review and discuss the presentation boards, provide comments at four stations through a post-it exercise, and interact with the TAC and consultant team. A summary of the feedback from the public information meeting is provided below and more detailed information is appended to this study.

2.3.1 Safety

Safety concerns were expressed generally relating to numerous issues, including burned out signals, difficulty making turns, and pedestrian crossings (including crossing distance). There were also many comments that parents with families who would like to ride in the downtown don't because of the lack of secure pedestrian facilities.

Intersections along Broadway about which the public have expressed concerns relative to safety include:

- Pine Grove Avenue
- Liberty Street
- Staples Street
- Cornell/Cedar Street
- East and West Chester Street
- O'Neill Street

2.3.2 Accommodating Bike Routes

While there were a couple of comments indicating opposition to bike lanes and questioning the need for them, the vast majority (by a 31 out of 33) were in favor of bike lanes. In fact, the most common comment related to bike lanes was the desire to see dedicated bike lanes, even at the expense of loss of parking. Many acknowledged that this would be a painful conversation but one they were willing to undertake.

Specifically, it was suggested frequently that the bike lanes should connect the 3 rail-trails entering Kingston's

downtown in the vicinity of Broadway. There were also many comments that more bike parking and bike racks were needed, perhaps some designed by local artists.

2.3.3 Transit / Bus Routes

There were a lot of comments in support of providing and improving bus service along the corridor. It appears that the general consensus is that the current service is ineffective and, therefore, much less utilized than it could be. Apart from improving transit facilities (including better service, schedule and route identification), suggestions to improve the current service included:

- Use of hydrogen fuel cell or electric shuttle buses (no fossil fuel buses).
- Provide frequent, dependable service that is visible and continuous between Broadway and the Plaza areas (perhaps a shuttle system).
- Merge City & County bus systems.

It was also mentioned that the bus service should be kept affordable for the less privileged in the community so that they could continue to participate in the Broadway community.

2.3.4 Transit and other Street Features

A lot of interest was expressed in making the sidewalk zones along the Broadway corridor places for people to meet and congregate, rather than just somewhere to walk or wait for the bus. To this end, it was suggested that tables and benches be added at intervals, have benches face each other to encourage community engagement, encourage outdoor dining, have a wider sidewalk zone instead of bike lanes, improve street lighting and extend a short distance into the side streets.

With regard to the type of street furniture there was considerable openness to pushing the envelope to create thought-provoking spaces as well as to deploying the most environmentally friendly lights and recycling receptacles. Tree planters which manage storm water runoff were generally viewed favorably. Public art was also mentioned as something which would enhance the public discourse.

One concern was expressed that bump outs can present safety issue with bus operations as buses merging with traffic disrupt the flow of traffic.

2.3.5 Sidewalk Treatments

When it came to sidewalk treatments, there was some ambivalence. While some favored blue stone, others favored brick, suggesting there might even be an opportunity to intersperse both judiciously. What was apparent was the desire to spend a little extra and use quality blue stone to avoid premature maintenance issues. There was also some interest in using permeable pavers. Bump outs were generally well received, with the one notable exception regarding bus pull stops.

2.3.6 Landscape Elements

Public comments expressed a strong desire for trees of character which dominate the landscape and provide shade from the sun and cover from the rain. Sycamores were a popular choice although there was some concern expressed about sidewalk root heaving. The public also inquired as to who would maintain new plantings and landscaping.

2.3.7 Placemaking

The possible creation of pocket parks in the vicinity of the intersections of Broadway with Henry Street and Pine Grove Avenue was generally commented on very favorably, as was the concept of narrowing Broadway at these intersections and at Cedar Street. The creation of a

multi-use space in front of UPAC with different pavement /parking (or not for big events) was also suggested.

2.3.8 Parking

Lack of parking was not expressed as a concern, rather, it was the need to better sign the parking lots just off Broadway to make the municipal parking lots more attractive with landscaping and to provide replacement municipal parking off Broadway where spaces on Broadway may be replaced by bicycle lanes (or perhaps angled-parking on the opposite side).

2.3.9 Miscellaneous

The public had a number of interesting miscellaneous suggestions including:

- Making Downs Street one-way away from Broadway or closing it
- Consider installing a roundabout at Henry Street
- Beginning Study at James Street and extending down beyond Delaware Avenue x2
- Add a westbound right-turn lane to Thomas Street

2.4 Development and Evaluation of Opportunities

The ideas and observations obtained from the Needs and Opportunities Public Meeting (as summarized above) were reviewed and, based on their relevance and the strength of support expressed for them, were further advanced, as detailed below:

2.4.1 Traffic Signal Timing Optimization

A review of the traffic signal timings at the current intersections revealed that the yellow and all red change intervals were longer than required to comply with current standards (see below). The same was generally true for pedestrian signal clearance intervals, although this was not true for all intersections. Finally, the amount of green time assigned to the major street and minor street approaches was not optimal for the prevailing traffic volumes at most locations. Changing these values is something that can be easily accomplished through regular routine maintenance.

Recommended Clearance Intervals

Intersection	Broadway				Side Street					
	Required Yellow (Seconds)	Required Red (Seconds)	Maximum Crosswalk Distance (Feet)	Crossing Countdown (Seconds)	Required Yellow (Seconds)	Required Red (Seconds)	Maximum Crosswalk Distance (Feet)	Crossing Countdown Existing X-Section	Maximum Crosswalk Distance (Feet)	Crossing Countdown with Curb Bump Outs
Liberty Street	3.5	2.0	52.5	15.0	3.5	2.5	66.4	19.0	56.0	16.0
Henry Street	3.5	3.5	52.5	15.0	3.5	2.5	66.4	19.0	49.0	14.0
Cedar Street	3.5	3.0	63.0	18.0	3.5	2.5	63.2	18.0	49.0	14.0
Grand Street	3.5	4.0	73.5	21.0	3.5	4.0	59.4	17.0	56.0	16.0
O'Reilly Street	3.5	2.0	35.0	10.0	3.5	2.5	45.5	13.0	35.0	10.0
Foxhall Avenue	3.5	2.5	35.0	10.0	3.5	2.5	45.5	13.0	38.5	11.0
Chester Street	3.5	2.0	35.0	10.0	3.5	2.5	45.4	13.0	45.5	13.0
Pedestrian Xing (at Delaware Av)	3.5	2.0	-	-	-	4.0	45.6	13.0	45.5	13.0

Analyses indicate that future delays (with a 25% growth in traffic to account for future development along the corridor) would be reduced by approximately 10%, from 17 seconds per vehicle to 15 seconds per vehicle if the optimal signal timings were implemented. There would be similar benefits to travel time, fuel consumption and emissions along the corridor, as shown in the summary tables below. It noted that similar benefits (a 10% +/- reduction in delay) could be achieved today, if these changes were implemented immediately.

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	15
Stops / Veh	0.32
Average Speed (mph)	9
Total Travel Time (hr)	251
Distance Traveled (mi)	2202
Fuel Consumed (gal)	282
Fuel Economy (mpg)	7.8
CO Emissions (kg)	19.72
NOx Emissions (kg)	3.84
VOC Emissions (kg)	4.57
Performance Index	208.3

Future Conditions – Optimized Clearances

At an estimated cost of $1,200 per signal (from design through construction) for all 8 signals along the corridor (including the pedestrian signal at Delaware Avenue), the total cost to reset the traffic signal controllers would be approximately $10,000.

2.4.2 Traffic Signal Timing Optimization with Traffic Calming Curb Bump Outs

In addition to simple traffic signal timing optimization, which can be implemented as part of routine signal maintenance, safety and operating conditions could be further improved by implementing traffic calming measures such as curb bumpouts at key locations. Constructed at the corners of intersections where there are crosswalks, they essentially extend the sidewalk into the parking lane on one side, the other or both, thereby shortening the distance for pedestrians to cross the street, reducing their exposure and allowing countdown pedestrian clearances to be reduced slightly. While bumpouts at either end of one block on one side of the street will typically require the elimination of three parallel parking spaces, it may be possible to reduce this number by moving fire hydrants to the corners of the block. Bumpouts also have the benefit of providing greater visibility of and for pedestrians waiting to cross the street.

Analyses indicate that future delays (with a 25% growth in traffic) would be reduced by approximately 25%, from 17 seconds per vehicle to 12 seconds per vehicle if the optimal signal timings were implemented along with curb bumpouts. There would be similar benefits to travel time, fuel consumption and emissions along the corridor, as shown in the summary tables below.

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	12
Stops / Veh	0.32
Average Speed (mph)	10
Total Travel Time (hr)	222
Distance Traveled (mi)	2202
Fuel Consumed (gal)	260
Fuel Economy (mpg)	8.5
CO Emissions (kg)	18.15
NOx Emissions (kg)	3.53
VOC Emissions (kg)	4.21
Performance Index	178.4

Future Conditions – Optimized Clearances With Bumpouts

At an estimated cost of $25,000 per intersection with a crosswalk (from design through construction) at 8 intersections with crosswalks, the total cost to construct bumpouts would be approximately $200,000.

2.4.3 Signal Coordination

An inspection of the existing signals on Broadway in the study area revealed that, in addition to having non-optimal clearance intervals and timings, and broken vehicle detection units, they are uncoordinated. This means that they do not functioning effectively as when one

group of cars are released from one intersection, they frequently arrive during the red indication at the next intersection. A number of options were developed which could be pursued to remedy this condition.

By replacing the existing signal control equipment with new, coordinated and optimized signals, the average delay per vehicle at the intersections along the corridor could be reduced considerably. Analyses indicate that future delays (with a 25% growth in traffic) would be reduced by approximately half, from 17 seconds per vehicle to 8 seconds per vehicle. There would be similar benefits to travel time, fuel consumption and emissions along the corridor, as shown in the summary tables below.

Detailed Measures of Effectiveness

Network Totals	
Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Measures of Effectiveness

Network Totals	
Number of Intersections	27
Total Delay / Veh (s/v)	8
Stops / Veh	0.28
Average Speed (mph)	13
Total Travel Time (hr)	171
Distance Traveled (mi)	2202
Fuel Consumed (gal)	215
Fuel Economy (mpg)	10.2
CO Emissions (kg)	15.04
NOx Emissions (kg)	2.93
VOC Emissions (kg)	3.49
Performance Index	123.6

Future Conditions – Optimized Signals

At an estimated cost of $200,000 per signal (from design through construction) for all 8 signals along the corridor (including the pedestrian signal at Delaware Avenue), the total cost to provide a state-of-the-art traffic signal system with Advanced Traffic Control Software would cost $1.6 million.

2.4.4 Signal Optimization with the Elimination of the signal at Elmendorf Street

A review of the projected peak-hour vehicular and pedestrian volumes on the Elmendorf Street approach to Broadway indicates that they will be considerably below the 100 vehicles or 107 pedestrians required to justify the installation of a signal. Therefore, after the completion of an appropriate engineering study, the traffic signal could conceivably be removed at this intersection. An analysis of peak-hour intersection operating conditions with the removal of this signal (and the optimization of the remaining signals) revealed that traffic operating conditions would be practically unchanged, except that average delays on the Elmendorf Street approach to Broadway would increase from 31 seconds to 247 seconds.

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	25
Total Delay / Veh (s/v)	9
Stops / Veh	0.26
Average Speed (mph)	12
Total Travel Time (hr)	184
Distance Traveled (mi)	2195
Fuel Consumed (gal)	214
Fuel Economy (mpg)	10.3
CO Emissions (kg)	14.94
NOx Emissions (kg)	2.91
VOC Emissions (kg)	3.46
Performance Index	129.3

Future Conditions – Signals Optimized, No Signal at Elmendorf Street

However, since the nearest signal-controlled crossings of Broadway on either side of Elmendorf Street would be more than 650 feet away (1,300 feet between controlled crossings), there would not be a convenient alternate location for pedestrians to cross Broadway. There is little engineering justification for pursuing this option.

It is estimated that it would cost $1.40 million (from design through construction) to replace all signals along the corridor (except the signal at Elmendorf Street) with a state-of-the-art traffic signal system and that it would cost an additional $30,000 to remove the existing traffic signal at Elmendorf Street.

2.4.5 Provide Safe Bicycle Routes

A key desire expressed by the public at the Existing Conditions, Needs and Opportunities public meeting, was to provide a safe bicycle route along the corridor which would connect the three contemplated multi-use trails which will converge in the vicinity of the study area. Specifically, to the extent that many parents are unwilling to allow their children to cycle on anything but separate bike paths, particularly in a busy, built-up area, it was expressed that the recreational use of these trails would be considerably compromised if they were not connected by bike lanes which are separated from traffic. Connection to the Stockade district was also expressed as a desire, although this connection would be less recreation-oriented and more oriented to providing mobility for workers who do not have cars. To the extent that there would be less demand for use by this connection by children, the need for separated bike paths were considered by some to be less important than for connecting the trails.

Based on these criteria, and considering the available cross sections, the following mutually exclusive alternatives could be considered (complete details for each option are appended with this chapter). Each would require optimization of the corridors signals, as described in Section 2.4.3.

2.4.5.1 Separated Bike Lanes Connecting Trails

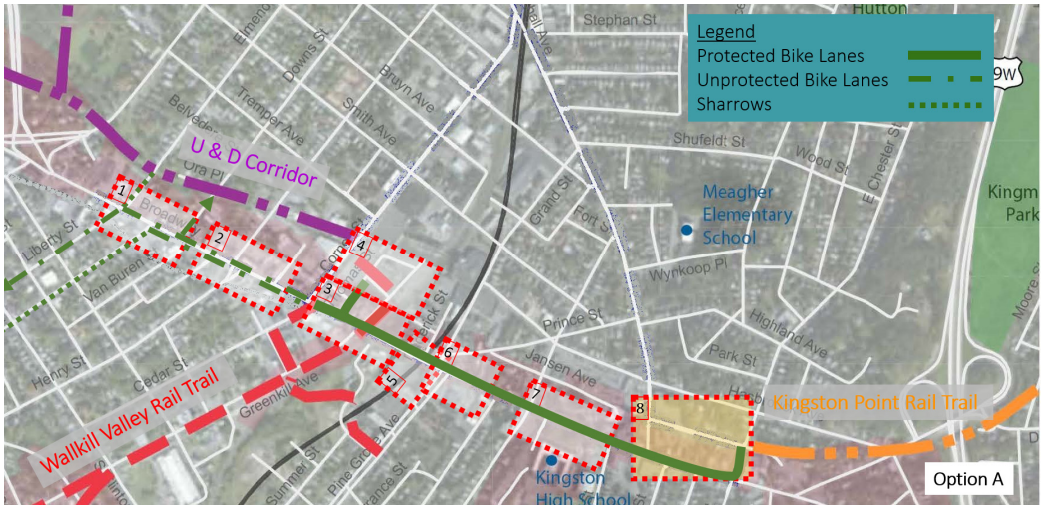
Option A- Via Broadway and East Chester Street

To provide a separated bike lane connection between the three trails entering the study area will require the following:

- Elimination of 5 parking spaces on the north side of Broadway from Cornell Street to Thomas Street, 4 parking spaces on the north side of Broadway, just east of Dederick Street, relocation of the bus stop from the south side of Broadway in front of Dunkin Donuts to immediately east of Cedar Street to create one additional parking space, providing two minimum 10-foot vehicle lanes, two separated 5-foot bike lanes and a 4-foot painted/median divider;
- Widening Broadway by up to 3 feet and the elimination of 45 parking spaces on the north side of Broadway from Pine Grove Avenue to Foxhall Avenue, providing two minimum 10.5-foot vehicle lanes, two separated 5-foot bike lanes and a 4-foot painted/median divider;
- Elimination of 15 parking spaces on the north side of Broadway from Foxhall Avenue to East Chester Street, providing two minimum 11-foot vehicle lanes, two separated 5-foot bike lanes and a 1-foot post-delineated divider;
- Widening Chester Avenue by up to 3 feet to provide two 11-foot wide vehicle lanes, a 10-foot wide, two-way separated bike lane and a 1-foot wide post-delineated divider;

Separated Bike Lanes between the 3 Rail Trails - Option A

Separated Bike Lanes between the 3 Rail Trails - Option A



- Elimination of parking on one side of Thomas Street between Broadway and Saccoman Lane to accommodate a 13-foot northbound vehicle lane, two separated 5-foot bike lanes, a 3-foot painted/median divider, and parking on one side of the street;
- Although it may be possible to widen the street by 3 feet, separated bike lanes could be provided by eliminating of parking and loading on both sides of Thomas Street between Saccoman Lane and Fashion Lane to accommodate two 10-foot vehicle lanes, two separated 5-foot bike lanes and a 1-foot post-delineated divider;
- Although it may be possible to widen the street by 3 feet, separated bike lanes could be provided by eliminating parking or loading on either side of Fashion Lane to accommodate two 10-foot vehicle lanes, two separated 5-foot bike lanes and a 1-foot post-delineated divider;
- Constructing a two-lane separated bike lane from the west end of Fashion Lane, through the municipal lot, to the terminus of the U&D Corridor on Cornell Street.

  (An alternative would be to narrow Saccoman Lane by 10 feet and making it one –way eastbound, to allow Fashion Lane – with 2 bike lanes – to be extended through the municipal and provide one lane westbound lot to Cornell Street, and then restriping Cornell Street from there to the Rail Trail to provide two 10-foot vehicle lanes, two separated 5-foot bike lanes and a 1-foot post-delineated divider. This option, along with making the Thomas Street one-way from Saccoman Lane to Fashion Lane, would restore parking/loading on that section of Thomas Street.)

The following measures would complete the connection for cyclists from Broadway and the vicinity to the Stockade district:

- Replacing one of the two through lanes in either direction along the west end of Broadway with a center turn lane and providing dedicated bike lanes on either side of the roadway from Cedar Street to Liberty Street/Franklin Street;
- Providing sharrows on southbound Elmendorf Street to connect the U&D Corridor to Broadway and beyond;
- Converting Downs Street one-way northbound to Ora Place and providing a dedicated bike lane for northbound cyclists from Broadway to the U&D Corridor;
- Restriping Liberty Street to provide a parking lane, a southbound vehicle lane and a dedicated bike lane to connect Broadway to the south and the Stockade District (via Clinton Avenue);
- Restriping Franklin Street to restrict parking to one side of the street, and sharrows in a slightly wider northbound lane to connect the south and the Stockade District (via Fair Street) to Broadway.

It is also noted that to complete the desired connection to the Wallkill Valley Rail Trail and to maintain 2-way traffic on Greenkill Avenue will require either the reconstruction of a wider Greenkill Avenue Bridge over Broadway or the construction of a ped/bike path bridge across Broadway next to the reconstructed Greenkill Avenue Bridge.

The potential elimination of parking on the north side of Broadway between the Greenkill Avenue bridge and Cedar street would eliminate a net of 4 parking spaces, where 1 vehicle was observed to be parked. This vehicle could be accommodated in the three parking spaces on the south side of the street. The potential elimination of parking on the north side of Broadway just west of Dederick Street would eliminate 4 parking spaces where 4 vehicles were observed to be parked. These vehicles could be accommodated in the 18 spaces on Dederick Street, where only 5 vehicles were observed to park. The maximum distance someone would have to walk because of the elimination of these parking spaces would be no more than 400 feet, indicating that, while it might be somewhat inconvenient, separated bike lanes could be provided through this area while at the same time accommodating observed peak parking demand.

The potential elimination of parking on the north side of Broadway from Pine Grove Avenue to Hoffman Street would eliminate 11 parking spaces where 5 vehicles were observed to be parked. These vehicles could be accommodated in the 4 spaces at the western end of Prince Street, the 16 parking spaces at the south end of Grand Street or the 4 spaces just east of Grand Street on Prince Street, where just 6 vehicles were observed to park in the 23 spaces provided. The potential elimination of parking on the north side of Broadway from Hoffman Street to O'Reilly Street would eliminate 6 parking spaces where 5 vehicles were observed to be parked. These vehicles could be accommodated on East O'Reilly Street, where just 2 vehicles were observed to park in the 9 spaces provided. The maximum distance someone would have to walk because of the elimination of these parking spaces would be no more than 500 feet, indicating that, while it might be somewhat inconvenient, separated bike lanes

could be provided through this area while at the same time accommodating observed peak parking demand.

The potential elimination of parking on the north side of Broadway from O'Reilly Street to Andrew Street would eliminate 20 parking spaces where 11 vehicles were observed to be parked. These vehicles could be accommodated on West O'Reilly Street, where just 7 vehicles were observed to park in the 18 spaces provided, or on the opposite side of Broadway, where 3 vehicles were observed to park in the 18 spaces provided. The potential elimination of parking on the north side of Broadway from Andrew Street to Foxhall Avenue would eliminate 8 parking spaces where 5 vehicles were observed to be parked. These vehicles could be accommodated on Andrew Street, where 7 vehicles were observed to park in the 10 spaces provided or on the opposite side of Broadway, where no vehicles were observed parked in the 2 spaces provided. The maximum distance someone would have to walk because of the elimination of these parking spaces would be no more than 600 feet, indicating that, while it might be somewhat inconvenient, separated bike lanes could be provided through this area while at the same time accommodating observed peak parking demand.

The potential elimination of parking on the north side of Broadway from Foxhall Avenue to Brewster Street would eliminate 4 parking spaces where 1 vehicles was observed to be parked. This vehicle could be accommodated on Brewster Street, where just 9 vehicles were observed to park in the 28 spaces provided. The potential elimination of parking on the north side of Broadway from Brewster Street to Staples Street would eliminate 11 parking spaces where 5 vehicles were observed to be parked. These vehicles could be accommodated on Staples Street, where 6 vehicles were observed to park in the 15 spaces provided or in the municipal lot on the opposite side of Broadway, where 12 vehicles were observed to park in the 22 spaces provided. The maximum distance someone would have to walk because of the elimination of these parking spaces would be no more than 300 feet, indicating that, while it might be somewhat inconvenient, separated bike lanes could be provided through this area while at the same time accommodating observed peak parking demand.

The potential elimination of parking on Railroad Avenue, Fashion lane, Thomas Street, Saccoman Lane and Cornell Street would eliminate 20 parking spaces, where 7 vehicles were observed to be parked. Connecting to the U&D Corridor would result in the elimination of between 10 and 15 parking spaces in the 128-space municipal lot on Cornell Street, where 47

vehicles were observed to be parked. Thus, providing separated bike lanes would reduce the total number of parking spaces in this area from 148 to as few as 113 (all in the municipal lot) while parking in the municipal lot would be increased to 54 vehicles. The maximum distance someone would have to walk because of the elimination of these parking spaces would be no more than 450 feet, indicating that, while it might be somewhat inconvenient, separated bike lanes could be provided through this area while at the same time accommodating observed peak parking demand.

The potential elimination of parking on one side of Franklin Street would eliminate slightly less than half of the parking spaces provided. Surveys indicate that daytime parking demand on Franklin Street is considerably less than this. To accommodate overnight parking, if needed, it would be necessary to convert Franklin Street to one-way northbound.

Making Downs Street one-way northbound from Broadway to Ora Place would divert less than 100 vehicles in the peak hour (this is assuming a 25% increase in existing traffic volumes in the future). Approximately 45 of these trips would be diverted to Elmendorf Street while the remainder (less than 40) would be diverted to O'Neill Street. Intersection capacity analyses revealed that the signalized intersections of O'Neill Street and Elmendorf Street with Broadway have more than adequate capacity to accommodate these additional trips without any noticeable increase in delays to motorists.

By replacing the existing signal equipment with new, coordinated and optimized signals in conjunction with implementing the necessary measures to provide separated bike lanes, the average delay per vehicle at the intersections along the corridor could still be reduced considerably. Analyses indicate that future delays (with a 25% growth in traffic to account for future development along the corridor) would be reduced by approximately half, from 17 seconds per vehicle to 9 seconds per vehicle. There would be similar benefits to travel time, fuel consumption and emissions along the corridor, as shown in the summary tables below.

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	25
Total Delay / Veh (s/v)	9
Stops / Veh	0.28
Average Speed (mph)	12
Total Travel Time (hr)	182
Distance Traveled (mi)	2195
Fuel Consumed (gal)	213
Fuel Economy (mpg)	10.3
CO Emissions (kg)	14.89
NOx Emissions (kg)	2.90
VOC Emissions (kg)	3.45
Performance Index	128.4

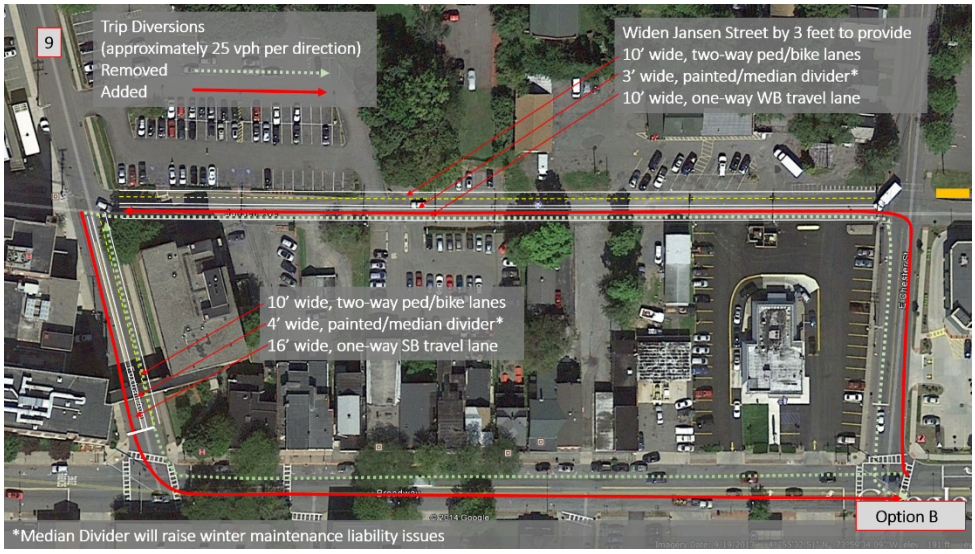
Future Conditions – Separated Lanes Option A

It is estimated that it would cost $430,000 to construct the separated bike-lane network described above and that, when added to the cost of coordinating the signal system, the total cost would be approximately $1.67 million (from design through construction).

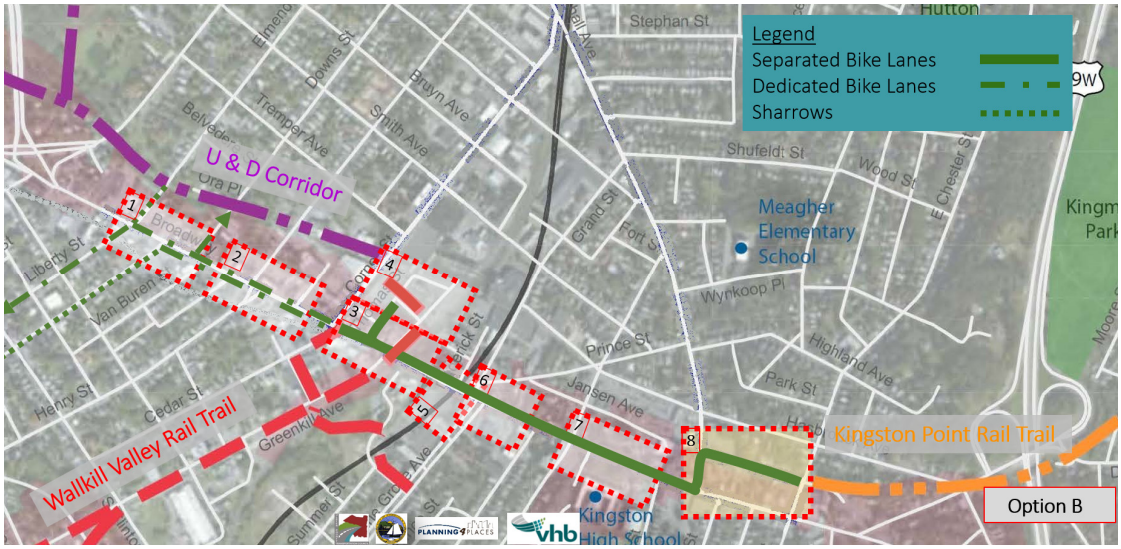
Graphics depicting this alternative in detail are provided in the appendix.

Option B- Via Jansen Avenue and Foxhall Avenue

As previously described in Option A, since the east end of Broadway is just 41 feet wide (60 feet building to building) and East Chester Avenue is just 30 feet wide, in order to provide separated bike lanes along the east end of Broadway to the Kingston Point Rail Trail at East Chester Street, it will be necessary to eliminate parking on one side of Broadway and to provide a 1'wide post-delineated divider between the vehicular lanes and the bicycle lanes. On East Chester Street, it will be necessary to install a similar post-delineated divider and to widen the street up to 3 feet. An alternative means to achieving the project goal of providing separated bike lanes between the trails, would be to make Jansen Street one-way (westbound), widen it by 3 feet and make Foxhall Avenue one way (southbound). With these measures, Foxhall Avenue would provide a 10-foot wide 2-way bike lane, a 16-foot wide southbound travel lane and a 4-foot wide painted/median divider. Jansen Avenue would provide a 10-foot wide 2-way bike lane, a 10-foot wide southbound travel lane and a 3-foot wide painted/median divider.



Option B



Separated Bike Lanes between the 3 Rail Trails - Option B

A review of the PM Peak Hour projected future traffic volumes (increased by 25%) indicated that approximately 95 vehicles would be diverted from northbound Foxhall Avenue, with approximately 65 vehicles diverted to East O'Reilly Avenue and approximately 30 vehicles diverted to East Chester Avenue. Similarly, it is estimated that approximately 60 vehicles would be diverted from eastbound Jansen Avenue, with approximately 40 vehicles diverted to Broadway and 20 vehicles diverted to Hasbrouck Avenue.

Intersection analyses were undertaken to confirm that the effected intersections would have adequate capacity to accommodate the increased vehicular demand and this was found to be the case. Although overall network performance and the operation of the effected intersections of Foxhall Avenue and O'Reilly Street was slightly degraded by the diversions, conditions were found to still be acceptable and the difference from Option A conditions to be practically imperceptible.

By replacing the existing signal equipment with new, coordinated and optimized signals in conjunction with implementing the necessary measures to provide separated bike lanes under this option, the average delay per vehicle at the intersections along the corridor would also be reduced by approximately half, from 17 seconds per vehicle to 9 seconds per vehicle. There would be similar benefits to travel time, fuel consumption and emissions along the corridor, as shown in the summary tables below.

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	25
Total Delay / Veh (s/v)	9
Stops / Veh	0.28
Average Speed (mph)	12
Total Travel Time (hr)	184
Distance Traveled (mi)	2195
Fuel Consumed (gal)	215
Fuel Economy (mpg)	10.2
CO Emissions (kg)	15.01
NOx Emissions (kg)	2.92
VOC Emissions (kg)	3.48
Performance Index	130.6

Future Conditions – Separated Bike Lanes Option B

It is estimated that it would cost $450,000 to construct this option and that, when added to the cost of coordinating the signal system, the total cost would be approximately $1.69 million (from design through construction).

2.4.5.2 Bike Lanes on the West End of the Corridor, Sharrows Elsewhere

An alternative to providing separated bike lane connections between the three rail trails in the vicinity of the Broadway Corridor would be to provide dedicated bike lanes on the Higher Volume Streets and sharrows on the lower volumes streets. This would practically eliminate the need to remove parking spaces from the Broadway corridor and would significantly reduce the cost of providing the desired bicycle infrastructure connecting the rail trails. However, as has been pointed out by many at the public meetings, it may dramatically reduce, if not eliminate, the willingness of parents to allow their children to cycle on these facilities between the rail trails.

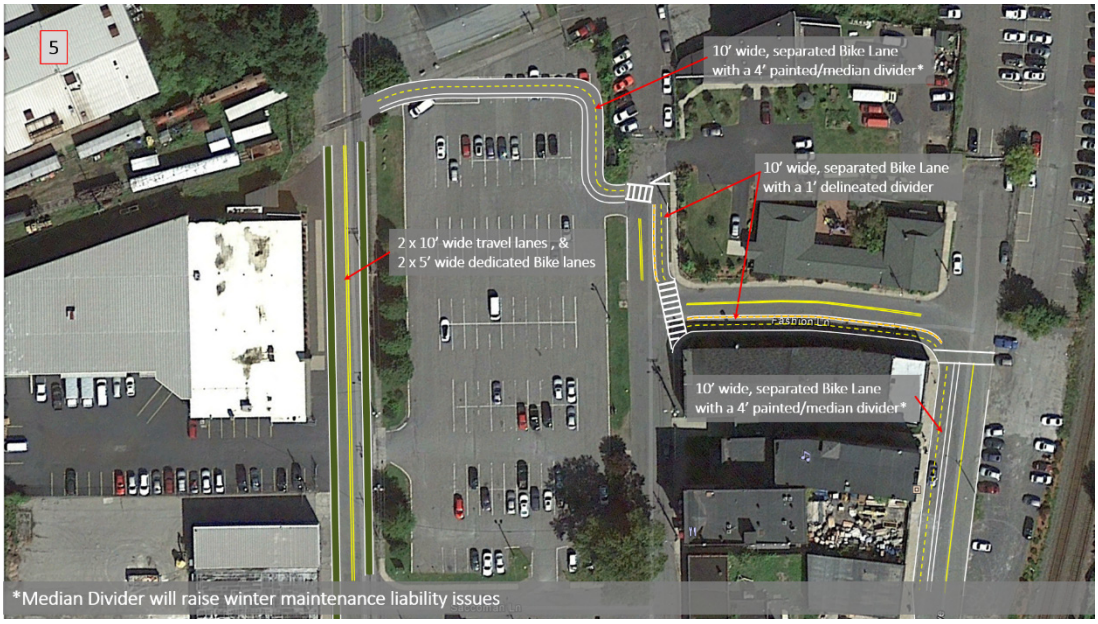
Option A- Dedicated Bike Lanes from Liberty Street East

To provide a dedicated bike lane connection between the three trails entering the study area will require the following:

- Replacing one of the two through lanes in either direction along the west end of Broadway with a center turn lane and providing dedicated bike lanes on either side of the roadway from Grand Street to Liberty Street/Franklin Street;
- Providing sharrows on southbound Elmendorf Street to connect the U&D Corridor to Broadway and beyond;
- Converting Downs Street one-way northbound to Ora Place and providing a dedicated bike lane for northbound cyclists from Broadway to the U&D Corridor;

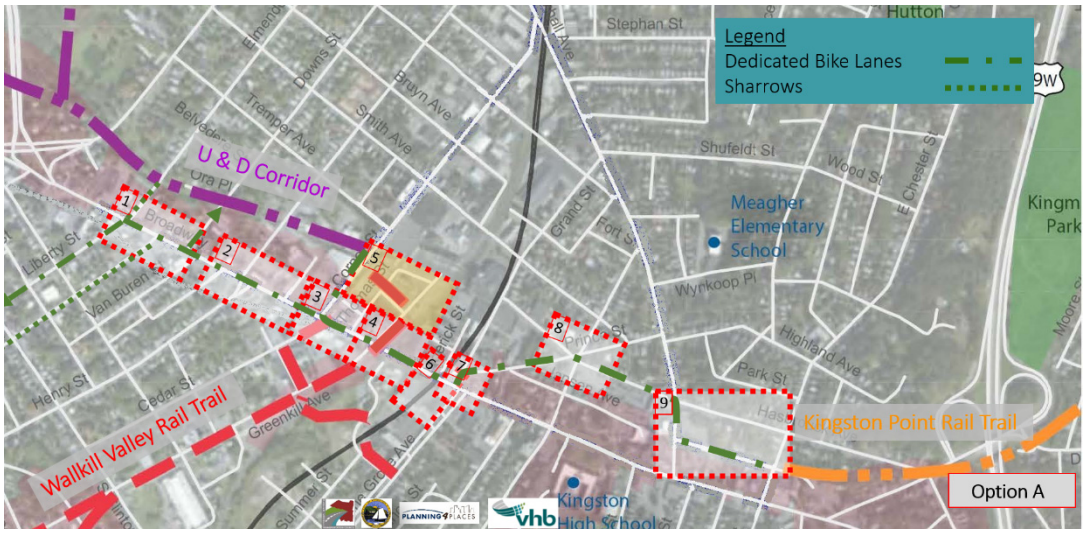
- Restriping Liberty Street to provide a parking lane, a southbound vehicle lane and a dedicated bike lane to connect Broadway to the south and the Stockade District (via Clinton Avenue);
- Restriping Franklin Street to restrict parking to one side of the street, and sharrows in a slightly wider northbound lane to connect the south and the Stockade District (via Fair Street) to Broadway;
- Prohibiting parking on Cornell Street from Broadway to the U&D Corridor to provide one 10' travel lane and one 5' dedicated bike lane in each direction;
- Eliminating parking on both sides of Thomas Street north of Fashion Lane to accommodate two 10-foot vehicle lanes, two separated 5-foot bike lanes and a 1-foot post-delineated divider (or a 4' painted/median divider if the road can be widened by 3 feet);
- Eliminating parking or loading on both sides of Fashion Lane to accommodate two 10-foot vehicle lanes, two separated 5-foot bike lanes and a 1-foot post-delineated divider (or a 4' painted/median divider if the road can be widened by 3 feet);
- Constructing a two-lane separated bike lane through the municipal lot, from Thomas Street to the terminus of the U&D Corridor on Cornell Street.

  (An alternative would be to narrow Saccoman Lane by 10 feet and making it one –way eastbound, to allow Fashion Lane – with 2 bike lanes – to be extended through the municipal and provide one lane westbound lot to Cornell Street)

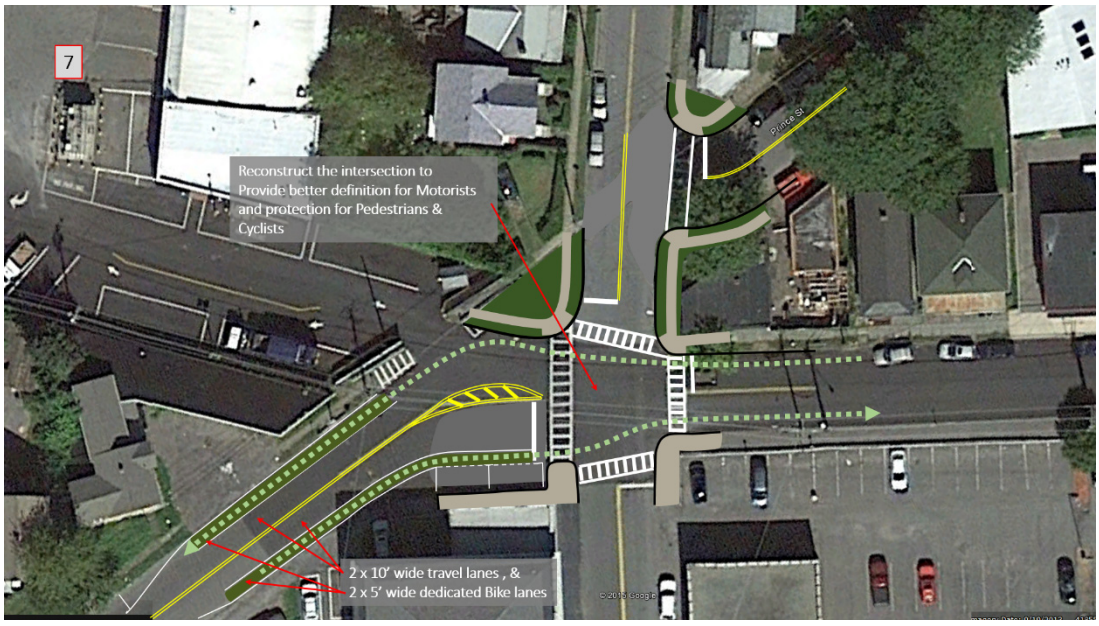


Dedicated Bike Lanes Between the 3 Rail Trails – Cornell Street Municipal parking lot

Dedicated Bike Lanes between the 3 Rail Trails - Option A



- Restripe the very southern end of Grand Street and Prince Street from Grand Street to Hasbrouck Avenue to provide Sharrows in either direction (and eliminate on street parking along this portion of Prince Street)
- Reconstruct the intersection of Prince Street with Hasbrouck Avenue/ E O'Reilly Street to better accommodate pedestrians and cyclists and provide Sharrows along Hasbrouck Avenue between East O'Reilly Street and Foxhall Avenue;



Reconstruction of the intersection of Prince Street with Hasbrouck Avenue

- Restripe Foxhall Avenue between Hasbrouck Avenue and Jansen Avenue to provide one 10' vehicle lane and one 5' bike lane in either direction.
- Convert Jansen Street to one-way flow (eastbound or westbound, depending on which direction has the higher volumes) and restripe the street to provide an 11'foot travel lane and a 5' wide bike lane in either direction.

Again, it is also noted that to properly complete the Wallkill Valley Rail Trail will require either the reconstruction of a wider Greenkill Avenue Bridge over Broadway or the construction of a ped/bike path bridge across Broadway next to the reconstructed Greenkill Avenue Bridge. With its current 24-foot roadbed (and 5-foot sidewalk) the best that can be accomplished would be Sharrows in either direction.

The potential elimination of parking on Prince Street from Grand Street to East O'Reilly Street would eliminate 16 parking spaces where 12 vehicles were observed to be parked. These vehicles could be accommodated on the surrounding streets of Jansen Avenue, Hasbrouck Avenue, East O'Reilly Street and Garden Street, where just 45 vehicles were observed to park in the 72 spaces provided. Significant capacity was also noted in the westernmost portion of the Kingston Hospital parking lot on Hasbrouck Avenue, where fewer than 40 of the 140 parking spaces were observed to be occupied. The maximum distance someone would have to walk because of the elimination of these parking spaces would be no more than 600 feet, indicating that, while it might be somewhat inconvenient, dedicated bike lanes could be provided through this area while at the same time accommodating observed peak parking demand.

The potential elimination of parking on Railroad Avenue, Fashion lane, Thomas Street, and Cornell Street would eliminate 18 parking spaces, where 6 vehicles were observed to be parked. Connecting to the U&D Corridor would result in the elimination of between 10 and 15 parking spaces in the 128-space municipal lot on Cornell Street, where 47 vehicles were observed to be parked. Thus, providing separated bike lanes would reduce the total number of parking spaces in this area from 148 to as few as 115 (all in the municipal lot) while parking in the municipal lot would be increased to 53 vehicles. The maximum distance someone would have to walk because of the elimination of these parking spaces would be no more than 400 feet, indicating that, while it might be somewhat inconvenient, separated bike lanes could be provided through this area while at the same time accommodating observed peak parking demand.

The potential elimination of parking on one side of Franklin Street would eliminate slightly less than half of the parking spaces provided. Surveys indicate that daytime parking demand on Franklin Street is considerably less than this. To accommodate overnight parking, if needed, it would be necessary to convert Franklin Street to one-way northbound.

Making Downs Street one-way northbound from Broadway to Ora Place would divert less than 100 vehicles in the peak hour (this is assuming a 25% increase in existing traffic volumes

in the future). Approximately 45 of these trips would be diverted to Elmendorf Street while the remainder (less than 40) would be diverted to O'Neill Street. Intersection capacity analyses revealed that the signalized intersections of O'Neill Street and Elmendorf Street with Broadway have more than adequate capacity to accommodate these additional trips without any noticeable increase in delays to motorists.

By replacing the existing signal equipment with new, coordinated and optimized signals in conjunction with implementing the necessary measures to provide separated bike lanes, the average delay per vehicle at the intersections along the corridor could still be reduced considerably. Analyses indicate that future delays (with a 25% growth in traffic to account for future development along the corridor) would be reduced by approximately half, from 17 seconds per vehicle to 9 seconds per vehicle. There would be similar benefits to travel time, fuel consumption and emissions along the corridor, as shown in the summary tables below.

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	25
Total Delay / Veh (s/v)	9
Stops / Veh	0.28
Average Speed (mph)	12
Total Travel Time (hr)	184
Distance Traveled (mi)	2199
Fuel Consumed (gal)	215
Fuel Economy (mpg)	10.2
CO Emissions (kg)	15.02
NOx Emissions (kg)	2.92
VOC Emissions (kg)	3.48
Performance Index	130.5

Future Conditions – Dedicated Bike Lanes Option A

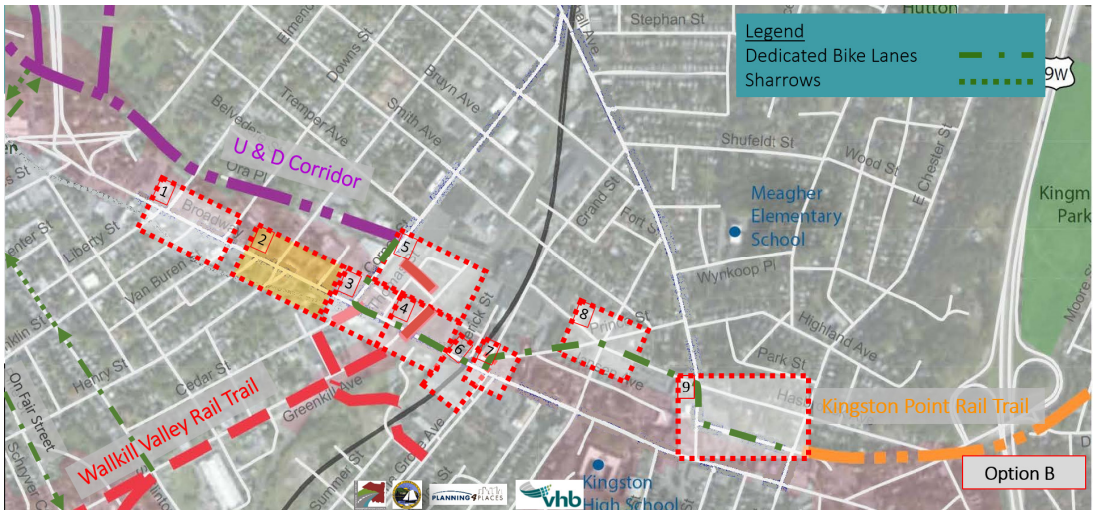
It is estimated that it would cost $400,000 to construct the dedicated bike-lane network described above and that, when added to the cost of coordinating the signal system, the total cost would be approximately $1.64 million (from design through construction).

Graphics depicting this alternative in detail are provided in the appendix.

Option B- Dedicated Bike Lanes from Cornell Street East

This alternative would be similar to Option A, except that the dedicated bike lanes on Broadway connecting the three rail trails entering the downtown would end at Cornell Street, instead of extending to Liberty Street, and connections to the Stockade District from the rail trails would be made directly from the Walkill Valley Rail Trail (via Clinton Avenue and Fair Street) and from the U&D Corridor (in the vicinity of Westbrook Lane).

Instead of providing bike lanes at the west end of the Broadway corridor, the sidewalks on either side of the street would be widened by three feet, providing approximately 25 percent more sidewalk area in that section for the corridor for pedestrian activities and placemaking.



Option B – Dedicated Bike Lanes with Wider Sidewalks at the west end Broadway

With this option, the west end of Broadway would still be converted from a 4-lane cross section to a 3-lane cross section and traffic operating conditions would be virtually identical to Option A.

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	25
Total Delay / Veh (s/v)	9
Stops / Veh	0.28
Average Speed (mph)	12
Total Travel Time (hr)	184
Distance Traveled (mi)	2199
Fuel Consumed (gal)	215
Fuel Economy (mpg)	10.2
CO Emissions (kg)	15.02
NOx Emissions (kg)	2.92
VOC Emissions (kg)	3.48
Performance Index	130.5

Future Conditions – Dedicated Bike Lanes Option B

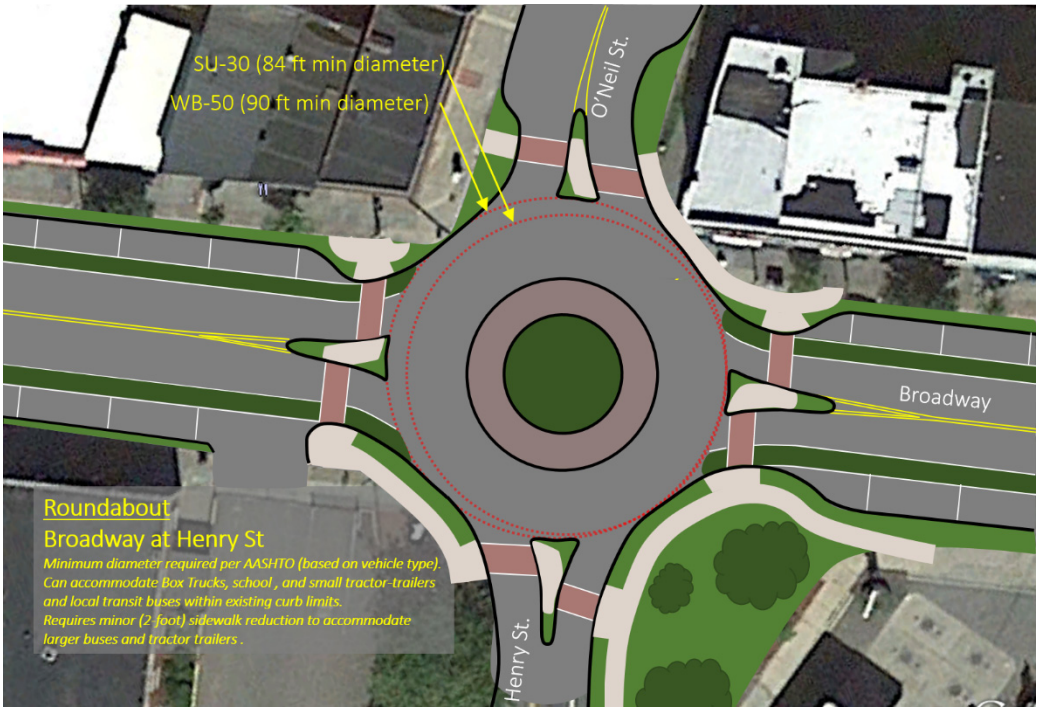
It is estimated that it would cost $410,000 to construct this option and that, when added to the cost of coordinating the signal system, the total cost would be approximately $1.65 million (from design through construction).

Graphics depicting this alternative in detail are provided in the appendix.

2.4.6 Replacing Traffic Signals with Roundabouts.

An analysis was conducted to determine whether it would be possible and desirable to replace some of the traffic signal on Broadway with roundabouts. Although the NYSDOT standard diameter for a roundabout is in excess of 100 feet and would not fit anywhere along the corridor, roundabouts of smaller diameter can be constructed and do function adequately, provided that they take into consideration the projected volumes and size of vehicles which will traverse them.

The smallest practical roundabout diameter is 84 feet, which would accommodate cars, most box trucks, city transit buses, school buses and small tractor trailers. These roundabouts, frequently referred to as mini-roundabouts, are not suitable to accommodate larger tractor trailers or intercity coaches. A roundabout of this size could be located at the intersections of Broadway with Henry Street/O'Neill Street and Cedar Street/Cornell Street. A slightly larger



roundabout, with a diameter of 90 feet could, in addition to the previously listed vehicles, accommodate larger (but not the largest) tractor-trailers (WB-50) and most intercity coaches. A roundabout of this size could be located at the intersections of Broadway with Henry Street/O'Neill Street and Cedar Street/Cornell Street, although it would be necessary to cut

back the sidewalk on opposite corners at Henry Street by a total of 2 feet and on opposite corners at Cornell Street by a total of 5 feet in order to construct the roundabouts.

It is noted that roundabouts are typically constructed in areas of low to moderate pedestrian and bicycle volumes and that they are not as well suited to accommodating pedestrians and cyclists as they are vehicles. The location of unsignalized roundabouts at Henry Street or Cornell Street would be somewhat unusual from this perspective, as both locations experience a considerable volume of pedestrian activity (as many as 112 per hour at Henry Street) and a modest volume of bicycle traffic (14 per hour at henry Street).

An evaluation of operating conditions at the intersections of Broadway with Henry Street/O'Neill Street and Cedar Street/Cornell Street revealed that acceptable peak-hour levels of service would prevail at the Henry Street intersection (average of 36 seconds per vehicle, although this is almost twice the delay that would be experienced if the signal remained at this location). At the Cedar Street intersection, the analyses revealed that unacceptable (81 seconds per vehicle) peak-hour levels of service would prevail.

By constructing a roundabout at the Henry Street intersection and replacing the existing signal equipment at the remaining intersections with new, coordinated and optimized signals, in conjunction with reducing the cross-section on the west end of Broadway from 4 lanes to three, the average delay per vehicle at the intersections along the corridor could still be reduced considerably when compared to the no-action conditions. Analyses indicate that future delays (with a 25% growth in traffic to account for future development along the corridor) would be reduced by slightly less than half, from 17 seconds per vehicle to 10 seconds per vehicle. There would be similar benefits to travel time, fuel consumption and emissions along the corridor, as shown in the summary tables below. These values as slightly worse (approximately 8%) than the alternative which retains a traffic street at the intersection of Broadway with Henry Street/O'Neill Street.

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	27
Total Delay / Veh (s/v)	17
Stops / Veh	0.33
Average Speed (mph)	8
Total Travel Time (hr)	278
Distance Traveled (mi)	2202
Fuel Consumed (gal)	303
Fuel Economy (mpg)	7.3
CO Emissions (kg)	21.17
NOx Emissions (kg)	4.12
VOC Emissions (kg)	4.91
Performance Index	235.8

Future Conditions – No Action

Detailed Measures of Effectiveness

Network Totals

Number of Intersections	25
Total Delay / Veh (s/v)	10
Stops / Veh	0.31
Average Speed (mph)	11
Total Travel Time (hr)	192
Distance Traveled (mi)	2175
Fuel Consumed (gal)	228
Fuel Economy (mpg)	9.5
CO Emissions (kg)	15.94
NOx Emissions (kg)	3.10
VOC Emissions (kg)	3.69
Performance Index	143.4

Future Conditions – Henry Street Roundabout

It is estimated that the premium to construct a roundabout at Henry Street (instead of replacing the existing traffic signal as part of a new, coordinated signal system) would be $50,000 and that, when added to the cost of coordinating the signal system and installing a separated/dedicated bike lane, the total cost would be approximately $1.72 million (from design through construction).

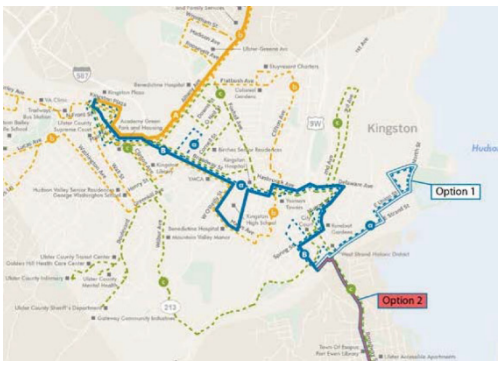
Graphics depicting this alternative in detail are provided in the appendix.

2.4.7 Bus Route and Service Enhancements

To provide a successful transit service through the study area, which is an essential lifeline for many area residents and employees and which could support the City's BEAT (Business, Education, Arts, and Technology) initiative, significant infrastructure, service and organizational changes are required and recommended. These include:

- Upgrading the Fleet and the technology which supports it – Providing new, comfortable, low-emissions buses equipped with GPS and wi-fi which will prove attractive not only to current local riders but also to visitors to the Broadway corridor who come in response to development associated with the City's BEAT initiative. GPS tracking and the supplemental apps will let current and future users know precisely when the next bus will be at their stop. This will allow users to stay out of the wet, the cold and the heat until just before the bus arrives. It will allow visitors to linger longer in stores and restaurants and, on those days when there may be weather-related or other delays, it will let travelers alert those waiting at their destinations when they are expected to arrive. All of these measures will help make buses a desirable and competitive mode of travel;

- Provide service which is logical, reliable, predictable (extend service hours and frequency) – A less circuitous fixed route service which connects points which generate a significant numbers of riders with service which is prompt, frequent, reliable and easy to figure out will make taking the bus convenient and dependable, which is key to building a growing, repeat-customer base. A suggested route is from the Rondout to the Stockade and the Hannaford/Kingston Plaza along the Broadway corridor, with stops at key locations. Schedules and maps should be user friendly and smart-device accessible;



- Installing new, consistent and attractive bus infrastructure (shelters, benches and trash receptacles) which will not only serve customers while waiting for a bus (or waiting for a shower to pass after they alight), but will also serve as a positive advertisement for a successful, attractive transit system;

- Consolidation/coordination of UCAT and Citibus service into a seamlessly integrated system which service the City and the corridor – At the very least, passenger schedules for both UCAT and Citibus should be standardized, coordinated and reported on the others service. Service restrictions between UCAT and Citibus should be eliminated and, in a best case scenario, the services should be merged to allow city residents to travel with ease to desired destinations other than those within the City limits.

Relative to the accommodation of buses along the corridor, to enable buses to pull to the curb without the back of the bus hanging out in the street and blocking traffic, it is recommended that bus stops be located at the far side of signalized intersections and that curb bump outs not be located at the corner next to the bus stop. At intersections where traffic volumes are lighter, bus bumpouts (where the curb is extended for a sufficient length to allow the bus to pull alongside in the lane to allow passengers to get on or off) may be considered. The estimated costs to implement all of these identified bus route and service enhancements is $0.8 million, including $0.3 million for bus shelters.

2.4.8 Parking Strategies

According to the existing conditions technical memorandum, parking is near capacity or heavily utilized along certain portions of Liberty Street, Cedar Street, Prince Street, Hasbrouck Avenue, and most private parking lots along Broadway, but not Broadway itself. A short-term strategy to alleviate parking issues would be to provide better directional signing to the existing municipal lots. The parking duration on Broadway may be a deterrent, so another short term strategy would be to reevaluate parking meter time regulations on Broadway so that they would best serve the needs of the corridor.

The need for more parking was not strongly expressed at the public meeting and previously by stakeholders, although there was an expressed need for better municipal parking wayfinding signs. As business and activity picks up on Broadway (per the desired vision of the Comprehensive Plan), there will need to be a more responsive parking strategy. Under future conditions, there will most likely be less parking as a result of infill development on lots currently used for parking, and reductions in on-street parking resulting from the side effect of improvements. This can be mitigated by the reasonable application of zoning requirements for replacements parking as redevelopment occurs.

Pedestrian safety improvements such as corner bump outs can remove one or two spaces per location. Bike enhancements such as dedicated bike lanes on streets can necessitate the removal of parking, which has been quantified above. And vehicle safety improvements such as daylighting parking to improve sight distance can remove one or two spaces per location. The cost of reducing on-street parking is equal to the loss in revenues to the City, but there is a hidden cost of reduced convenience to users and attractiveness to businesses along the street. There are similar costs to reducing off-street parking whether the lots are managed by the City or private businesses, and whether they are shared by multiple businesses or not.

Apart from the potential net loss in parking under future conditions, there is an opportunity to manage on-street parking regulations. A management strategy for curbside regulations adjacent to mixed-use development consisting of street-level commercial with residential on upper floors is as follows:

- Allow free overnight parking to encourage residential developments to build fewer off-street parking spaces (must be done in concert with zoning)
- Provide designated commercial loading/unloading areas that are either all-day or confined to early morning hours when most food deliveries take place (paid or free depends on supply and demand)
- From late morning through evening, provide paid short-term parking with turnovers matched to the adjacent commercial land use. Shorter turnovers are appropriate for shops where customers stop-in and leave, e.g., 30 minutes. Medium turnovers of 1 to 2 hours are appropriate for areas where multiple destinations can be served. Long turnovers of 3 to 4 hours may be considered during evening hours near bars and restaurants, UPAC and where evening events take place.

To conduct the parking management strategies and optimize parking resources, detailed projections of alternative development parking needs, determined in conjunction with the Kingston Comprehensive Plan, combined with potential parking fare structures and turnovers for on-street parking will need to be analyzed. It is recommended that this be undertaken in a separate analysis, which is estimated to cost approximately $50,000.

2.4.9 Safety

According to the existing conditions technical memorandum, the Broadway corridor has a relatively high crash rate. There were also 15 pedestrian crashes and 12 bicycle crashes within the study area. Of the pedestrian and bicycle crashes, 25 percent occurred at intersections and 75 percent occurred midblock. The high crash intersections for overall crashes are Broadway at Liberty Street/Elmendorf Street, O'Neil Street/Henry Street, Cedar Street/Cornell Street, Pine Grove Avenue/Grand Street, O'Reilly Street, and Chester Street. The traffic signal timing, traffic calming, bike facility improvements and roundabout opportunities discussed above will increase vehicular, pedestrian and bicycle safety and should reduce the relatively high overall crash rate on Broadway. The safety opportunities below are focused on pedestrian safety and will complement the opportunities discussed above.

There are currently uncontrolled crosswalks across Broadway at:

- Downs Street/Van Buren Street
- Field Court at UPAC
- Andrew Street
- Brewster Street

There are currently controlled crosswalks across Broadway at these signalized intersections:

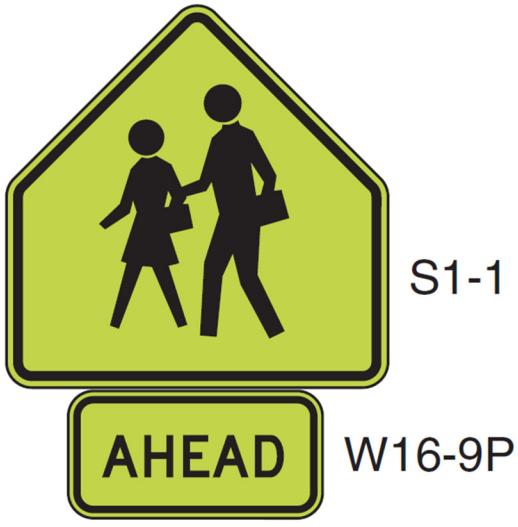
- Liberty Street/Elmendorf Street
- O'Neil Street/Henry Street
- Cedar Street/Cornell Street
- Pine Grove Avenue/Grand Street
- O'Reilly Street
- Foxhall Avenue
- Chester Street

Between these intersections, there are no marked pedestrian crossings:

- Cedar Street/Cornell Street and Pine Grove Avenue/Grand Street
- Pine Grove Avenue/Grand Street and O'Reilly Street
- O'Reilly Street and Andrew Street
- Brewster Street and Chester Street

2.4.9.1 Pedestrian Warning Signage

There is a need to provide warning signage to increase the awareness of pedestrians crossing Broadway and its side streets. A combination of advanced pedestrian warning signage, pedestrian crosswalk warning signage, advanced school crosswalk warning signage, school crosswalk warning signage, yield to pedestrian, and turning vehicles yield to pedestrian signage would increase pedestrian safety on the corridor.



W11-2 Pedestrian Warning Sign

S1-1 School Crossing Warning Signage

R1-6 Median Pedestrian Warning Signage

R10-15 Turning Vehicles Yield to Pedestrians

These pedestrian warning and advanced pedestrian warning signs should be placed on either side of the street in both directions on Broadway, and median pedestrian warning signage should be placed at the crosswalk in the middle of Broadway at the uncontrolled crosswalks listed above and potential new uncontrolled crosswalks where there are no marked crosswalks between intersections listed above. The school crosswalk warning signage and advanced signage should be placed on either side of the street in both directions on Broadway at Foxhall Avenue, Andrew Street, and O'Reilly Street to designate school crosswalks on both sides of Kingston High School. In addition, turning vehicles yield to pedestrian signage should be placed where there are turning lanes on Broadway at signalized intersections, which indicate heavy turn volumes. These signs should also be placed on side streets at signalized intersections, since the Broadway crosswalks are wider crossings. Estimated Cost (school and general pedestrian signage): $25,000.

2.4.9.2 Advanced Stop Bars at traffic Signals

Advanced stop bars are the systematic placement of stop bars 8' to 10' back from marked crosswalks at signalized intersections. This provides a buffer between stopped vehicles and

pedestrians in the crosswalk that facilitates better sight distance and increases pedestrian safety without noticeably affecting traffic operations. No Cost – implement when road is next restriped.

2.4.9.3 Neckdowns at Uncontrolled Crossings

Because crossings along Broadway are wide, neckdowns (where the sidewalk and curb are extended into the roadway narrowing its width) could be installed at uncontrolled crossings. If feasible in terms of turning vehicle geometries, on-street parking loss and utility and infrastructure locations such as stormwater drains, they could be installed at four uncontrolled crossings listed above, plus potential new crossings between intersections listed below:

Uncontrolled crosswalks across Broadway at:

- Downs Street/Van Buren Street
- Field Court at UPAC
- Andrew Street
- Brewster Street

Locations with no marked pedestrian crossings on Broadway at:

- Cedar Street/Cornell Street and Pine Grove Avenue/Grand Street
- Pine Grove Avenue/Grand Street and O'Reilly Street
- O'Reilly Street and Andrew Street
- Brewster Street and Chester Street

In addition to neckdowns at uncontrolled crossings, other horizontal deflection traffic calming could be applied along the corridor. The intersection "normalization" techniques shown in the previous sections illustrating the implementation of bike lanes on the corridor would create several curb extensions that would better channelize and slow traffic and reduce pedestrian crossing distances and exposure to vehicular traffic. Pedestrian islands should also be considered where pedestrian refuge is needed. Estimated Cost: $200,000.

2.4.9.5 More Visible Street Signage

Broadway is a wide street and it is difficult for users to see the street signs across the street or from down the block. Larger streets signs should be considered. The street signs along Broadway are not currently illuminated or large enough for older users to easily see them. It is recommended that larger lettering, changing the font to the FHWA-approved "Clearview Hwy" font, and either self-illuminated or externally illuminated signs be used along the corridor. Exceptions will need to be made where historic signage must be maintained. Estimated Cost: $26,000.

2.4.9.6 Upgrade Traffic Signals from 8" Lenses to 12" Lenses

Broadway currently has outdated 8" lenses on all of its signal faces. 12" lenses are the current standard because they are more visible to older drivers. It is recommended that the traffic

signal faces be upgraded to modern 12" lenses. Estimated Cost: $84,000 but exclude this this cost if signals are replaced as part of overall signal upgrade).

2.4.9.7 Consider Turn Prohibitions to Increase Pedestrian Safety

Broadway is a wide street and it is difficult for vehicles that are turning left onto or off of Broadway under permissive signalized left turns or uncontrolled left turns to find a gap in traffic while simultaneously scanning the opposing crosswalk for pedestrians legally crossing the intersection. At signalized intersections, there are two options to avoid the potential conflict between left-turning vehicles and pedestrians. The first option is to protect the left turn and not allow pedestrians to walk concurrently with that traffic signal phase. This does not ensure that pedestrians will not walk against the signal, but it can reduce the occurrence of the conflict. The other option is to prohibit the left turn. This does not ensure that vehicles will not turn left against the prohibition, but it can reduce the occurrence of the conflict. The traffic effects of either option must be analyzed, because both can potentially increase vehicle delays. Minimal or No Cost (just signs).

2.4.9.8 Installing Pedestrian Beacons at Uncontrolled Crossings

Pedestrians cross Broadway at four uncontrolled, striped crosswalks described above. At these locations, signage has been recommended. But, to further improve safety, awareness of pedestrians in the crosswalks, and compliance with vehicles yielding to pedestrians, it is recommended that flashing beacons be considered. There are two types of flashing beacons that could be used: a Pedestrian Hybrid Beacon (PHB) or Rectangular Rapid Flashing Beacon (RRFB). The PHB has a higher rate of compliance than an RRFB. But, the RRFB has a high rate of compliance compared to older flashing beacons using yellow lights.
Estimated Cost: $231,000.

Pedestrian Hybrid Beacon (PHB), aka "HAWK" Rectangular Rapid Flashing Beacon (RRFB)

2.4.9.9 Move Bus Stops to the Far Side of Intersections

Bus stops should be located on the far side of intersections to improve pedestrian safety and traffic flow. If a bus stop is located on the near side of an intersection, pedestrians exiting the bus sometimes walk in front of buses to cross the street. When they are in front of the bus, passing vehicles cannot see the pedestrians. If the bus stop is on the far side of the intersection, pedestrians cross behind the bus where they are visible to passing vehicles. Having bus stops on the far side of intersections aids in traffic flow, too. All vehicles are held at a green light by a bus dropping off or picking up passengers at a near side bus stop. However, if the bus stop is on the far side of the intersection, turning vehicles can proceed through the intersection; and, through vehicles have a better view of the intersection and may be able to pass the bus on the far side if there is no oncoming traffic.
Estimated Cost: $5,000.

2.4.9.10 Upgrade Pedestrian Ramps and Driveways to ADA Compliance

According to the existing conditions memorandum, the majority of pedestrian crossings have pedestrian ramps. However, the condition of the ramps was sometimes poor, and the slope and presence of truncated domes/tactile warning strips was not observed to be compliant with ADA standards. Therefore, it is recommended that pedestrian ramps be upgraded to ADA compliant condition by installing truncated domes/tactile warning strips, checking that the slope and landing areas on sidewalks conforms to ADA code, and that they are the proper width. Estimated Cost: $52,000.

Truncated dome/tactile warning strip

Also, driveways along Broadway should be designed so that sidewalks cross continuously and at the same grade as the adjacent sidewalk and with minimal cross slopes. In an urban environment such as Midtown, there are not high-volume driveways (such as to shopping centers) where they are designed to operate like an intersection. Therefore, driveways along Broadway should conform to a typical standard where crosswalks continue across driveways at grade and with minimal cross slopes. Estimated Cost: $5,000.

2.4.9.11 Perform Access Management Study

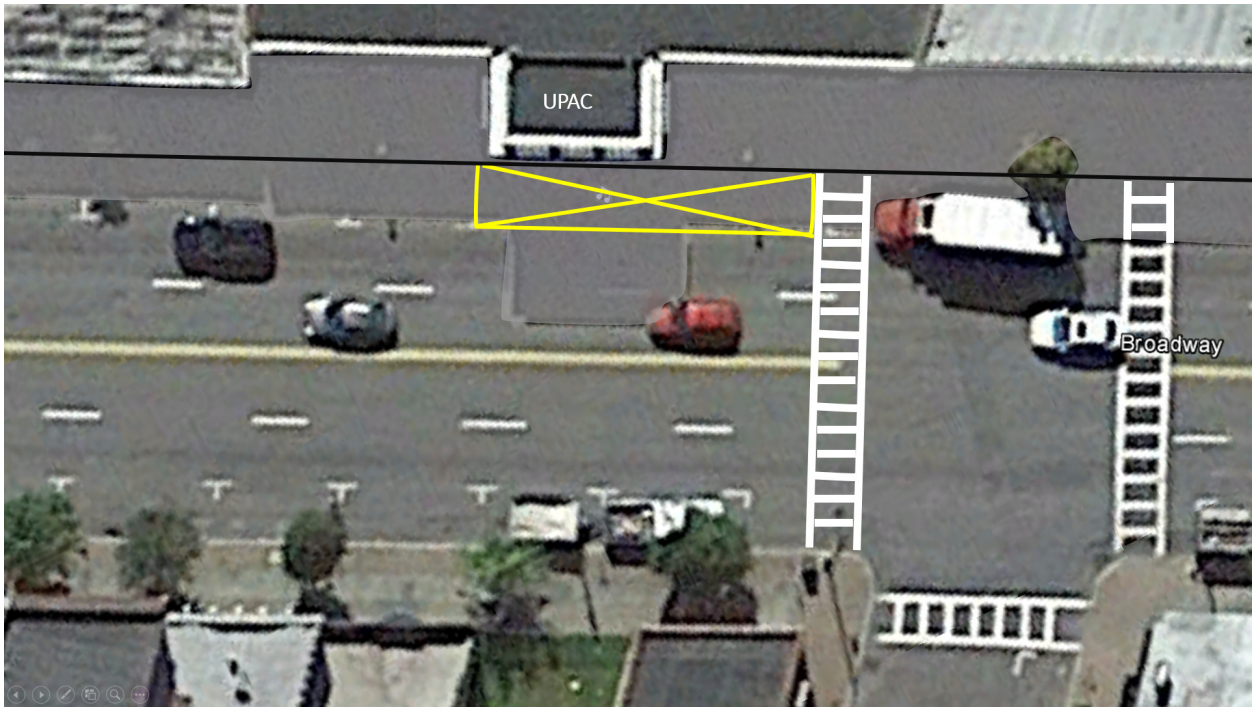
In a few places on Broadway – such as between Chester Street and Staples Street, there are several curb cuts between closely-spaced intersections. The number of curb cuts per block is directly proportional to the number of pedestrian-vehicle and vehicle-vehicle conflicts. The more curb cuts there are, the more conflicts there are, which affects safety. The practice of access management applies these principles to encourage land use/zoning practices and property access planning that minimizes the number of curb cuts and consolidates curb cuts so they can be shared between adjacent properties. It is recommended that an access management study be performed on the corridor, and that the Kingston Comprehensive Plan incorporates access management best practices. Estimated Cost: $50,000.

2.4.10 Freight

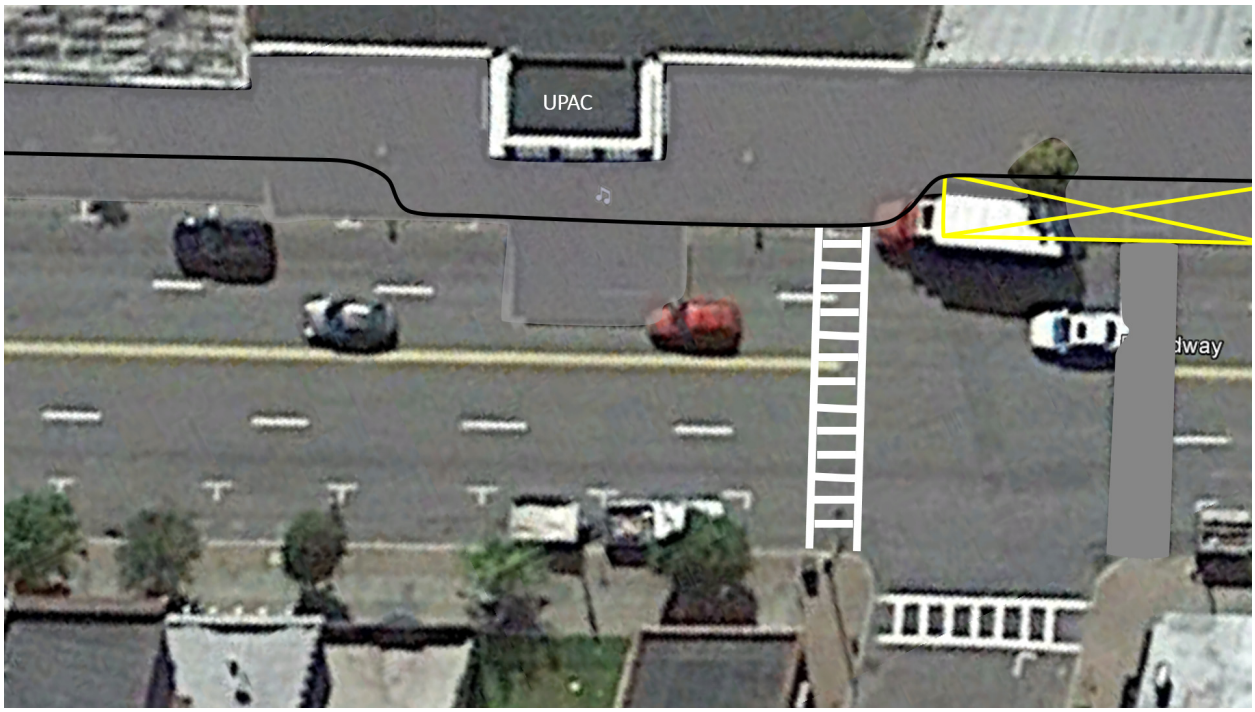
Redesign of all intersections should respect the need for trucks to make deliveries to businesses throughout the City. To this end, all changes in turning radii should preserve the existing turning paths, unless it is determined that they are currently more than what is needed for the design vehicles appropriate to the movement. Establishing 60-foot long loading zones on the far side of unsignalized intersections along the corridor and prohibiting parking between 7:00 a.m. and 11:00 a.m. at those locations would better accommodate commercial deliveries. To the extent that curb bumpouts are adopted in the plan, it would be preferable that they not be located on the corners closest to designated loading zones.

2.4.11 Ulster Performing Arts Center (UPAC)

There is currently a 55-foot long no parking zone on the south curb of Broadway directly in front of UPAC which functions as a drop-off zone and gathering area for events. If the preceding parking space were eliminated, a second crosswalk across Broadway could be provided at its intersection with Field Court, thereby improving the connection across Broadway at that location, and the drop-off area could be used for loading in the mornings from 7:00 t0 11:00. An alternative would be to bump out the pavement area in front of UPAC to better accommodate on-street gathering before and after events, with the drop-off area shifted to the north opposite Field Court. This would result in a shorter crosswalk across Broadway on the east side of the intersection but the elimination of the crosswalk on the west side of the intersection.



UPAC with Loading Zone and Second Crosswalk



UPAC with Gathering Area and Relocated Crosswalk

2.4.12 Streetscape

According to the existing conditions technical memorandum, the Broadway corridor has areas of streetscape that vary significantly in condition and character, with room for improvement in terms of sidewalk surface materials, street trees and plantings, street lighting, bus shelters, street furniture (benches, trash receptacles, bike racks, bollards, etc.), and wayfinding signage.

In addition, comments from the public at the Needs and Opportunities sessions identified some additional areas for improvements including the desire for the sidewalk zones to be not only safe, attractive pedestrian corridors, but also places for people to meet and congregate; potentially including pocket parks, tables for outdoor dining, improved lighting, and the option of wider sidewalks in lieu of dedicated bike lanes (see also Sections 2.3.4 through 2.3.7).

To provide attractive, consistent streetscape throughout the study area, the elements described in the Streetscaping Matrix are recommended and prioritized. These include (in order of priority from the Steetscaping Matrix and input from public meeting):

- Sidewalk Improvements: This appears to be the highest priority for the corridor in terms of streetscape. The improved sidewalks should have the goal of maintaining a consistent and attractive design concept, safe surfaces, unified materials, which are also relatively low maintenance. Initial costs for sidewalk surface materials can vary significantly based on materials, and replacement/maintenance costs should also be considered. Estimated Cost: $1.5 million.

- Street Trees: Street trees can make a significant impact on the visual character of a pedestrian and vehicular corridor. After an inventory of existing trees is conducted, a plan for new trees and tree replacement can be formulated based on space available for locating trees, and existing conditions. It is important to identify where trees can be successful in terms of soils, sunlight, hardiness of species, etc. and provide conditions that encourage their survival and success. This also would include appropriate tree grates, soils and installation. Estimated Cost: $90,000.

- Street Furniture: Street furniture with relatively consistent design, style and materials is generally encouraged to unify a corridor, along with sidewalk materials, lighting, street trees and other plantings. Benches, bike racks, waste/recycling containers with a consistent style or theme that are also well-maintained will improve the aesthetics of the pedestrian zone as well as encouraging their use as gathering areas. At the public meetings the option of having tables and benches that face each other is another way to encourage people to use the pedestrian zone. Bollards, planters and pavement patterns also help to define spaces, pedestrian zones as well as activity zones if any public activity programming or pocket parks are proposed. Estimated Cost: $290,000.

- Street Lighting: As with other street furniture and trees, street lighting serves to unify the corridor and provide a consistent design aesthetic. Consistent, well-maintained street lighting makes streets safer and should be integrated into the overall design. Estimated Cost: $770,000.

- Bus Shelters: Although this was a lower priority in the corridor, and is only one of many potential upgrades to encourage more bus ridership. Providing clean, attractive shelters for the most highly utilized bus stops should encourage their use. Providing shelter from the elements is important and new bus shelters with design character consistent with the other streetscape elements would also help to unify the entire corridor as a pedestrian friendly place. Estimated Cost: $300,000.

- Wayfinding Signage: Although this also was not a high priority, this is truly an item that could unify a corridor by way of a common design theme, as well as encouraging pedestrian and bicycle activity and orientation to the corridor and making connections to surrounding streets, trails, districts and landmarks. Estimated Cost: $10,000.

2.4.13 Kingston Comprehensive Plan

In January 2015, the City of Kingston issued a draft of its proposed *Comprehensive Plan*, prepared with technical assistance from Shuster-Turner Planning Consultants. As with the previously completed report, *Kingston 2025: Vision for the Future and Planning Needs*, the *Comprehensive Plan* includes a number of recommendations that relate to the future of the Midtown area in general and the Broadway Corridor specifically. These include the following:

- The Plan for Economic Development includes the Mayor's BEAT initiative to transform Midtown to a center for Business, Education, Arts and Technology
- One economic development objective is to attract green-technology users to existing commercial corridors, including Broadway.
- The Plan for Transportation and Mobility highlights the need to provide for Complete Streets for all users; Broadway is identified as a high priority for such treatment.
- One transportation strategy calls for leveraging the new I-587, Broadway and Albany Avenue Roundabout as a model gateway to the City.
- The Plan identifies Broadway as one of the arterials which functions poorly and which should be a candidate for conversion to a partial boulevard or to undergo a "road-diet."
- Kingston should employ traffic-calming techniques in Midtown and elsewhere to, among other things, enhance pedestrian and bicycle safety.
- The Plan for the Midtown Core Area notes that Broadway evolved as "a corridor rather than a place" and that it currently includes significant vacancies, deteriorated buildings and an unpleasing visual environment.

Goal 5: Promote an effective and comprehensive transportation system that enhances safety, encourages and enables active mobility for all users of the streets including children, families, older adults, and people with disabilities, ensures accessibility, minimizes environmental impacts and encourages community connectivity;

To the extent that the Comprehensive Plan envisions the transformation of Midtown to a center for Business, Education, Arts and Technology with a road diet, traffic calming and complete streets to enhance pedestrian and bicycle safety and mobility, the measures outlined in the previous sections are consistent with the Comprehensive Plan and will help contribute to the achievement of its vision. Specifically:

- A Road Diet along the western section of the corridor will eliminate the ability to pass slower vehicles, thereby reducing traffic speeds;
- Similarly, a road diet with curb bumpouts and new, ADA-compliant curb ramps will also enhance pedestrian safety and the contemplated bike lane trail connections will enhance bicycle safety;
- Upgrades to transit fleets which incorporate green- and e-technology are also consistent with the Comprehensive Plan's recommendations.

2.4.14 Project Cost

While there is some overlap between the various elements of each of the three major project components (Traffic Operations & Parking, Complete Streets & Pedestrian Safety, and Streetscaping), the total cost of designing and installing the most comprehensive set of corridor

improvements is estimated to be $5.87 million, broken down as follows (details provided in the decision-making matrices:

- Traffic Operations & Parking $2.32 million
- Complete Streets & Pedestrian Safety $1.43 million, less $0.84 for lens replacement)*
- Streetscaping $2.96 million

* Lens replacement is included in the cost of signal upgrades associated with signal coordination, if that option is selected.