3 Light Rail Transit in the Corridor

PCC Car

Light Rail Transit (LRT) is the current version of the original streetcar technology, which actually began with horse-pulled carriages. The President's Conference Committee (PCC) car was the dominant transit mode in the early 1930s.

In the 1970s, European versions of the trolley, updated to current technologies and operating requirements, led to the modern LRT vehicle. "Light" in LRT refers to light capacity and light cost, as it was intended to be a lower-cost option to modern rail rapid transit (RRT) systems.

3.1 Description of LRT Systems

LRT systems are primarily designed for moderate- or short-distance trips in urban areas, and therefore feature more stations per mile than RRT or CRT. They are also designed to operate as single-car trains, but can be joined in trains of up to four cars. Because they start and stop often and may operate in mixed traffic, they have a lower top speed than CRT or RRT systems – usually around 55 mph. Key aspects of typical LRT systems are:

- Close station spacing.
- Broad choice of guideway types.
- Short trains (one to four cars in length).
- Typically low top speeds (55 mph).
- Coordination with local bus services.
- On-board fare collection.
- Moderate passenger capacity.

Because LRT technology has been adapted to a wide range of applications, it includes examples that range from simple streetcar systems to full metros. Figure 3-1 graphically portrays the range of systems available. While it is possible to mix and match between categories, the characteristics of most systems tend to all fall into the same column. For instance, having stations that include fare-collection provisions does not necessarily limit guideway options, but for automated operation to be possible, the guideway must have an exclusive ROW.

A top-end LRT system can consist of light-rail vehicles operating on exclusive ROWs at grade in freeway medians, on tracks adjacent to the freeway, or on elevated ROWs along other streets. The key point is that the guideway is exclusive – roadways do not cross its tracks, nor does it interact with either vehicles or pedestrians. As a result, it could be automated to operate without on-board personnel, as in Vancouver or the Docklands in London. Such a high-end LRT system can operate at speeds of up to 70 miles per hour (mph), in trains of up to four cars. Stations in such systems have platforms for direct access, which, for optimum operational efficiency, would need to be at least one mile apart.

Top-End LRT System

Element	Simple	⟷	Complex
Running Ways	Mixed Traffic	Grade Crossing	Exclusive Right-of-Way
Stations	Shelters	Stations	Stations with Fare Collection
Service Plan	Run with Traffic	Signal Preemption	Automated Operation
Vehicles	Trolley	Articulated Vehicles	Automated Articulated Vehicles
Systems	Line of Sight Operation	Central Train Control	Automated Train Control

Figure 3-1 Range of Options Available for LRT

In the low-end LRT concept, streetcars operate in mixed traffic, with no preferential treatment given to their operations over buses or automobiles. LRT operating in mixed traffic (as streetcars do) is subject to all of the vagaries of traffic congestion, and operates at traffic speeds, with the risk of delays due to congestion. In this study, the only in-street operations that were considered used reserved at-grade ROWs, so that vehicular traffic and pedestrians could cross the tracks, but only emergency vehicles could operate on the tracks. With allowances for catenary poles and platforms, the required ROW per set of tracks is in excess of a single lane for each direction.

Stations in such a system could be as simple as bus stops are, at street grade and with low-floor LRT vehicles. This type of LRT is designed to provide circulator-type service, with frequent stops and relatively low average speeds. A streetcar system might address short-distance circulation needs, but could not provide travel-time advantages over the length of the full corridor, or even over a significant portion of the corridor.

LRT systems operate as integrated services, with central controls that monitor system operations in a manner similar to the operations of CRT and RRT systems. Because most LRT systems operate with grade crossings where cars and pedestrians can cross the guideway, they are usually not operated in automated mode, but rather have drivers in control of the trains. The exception to this is the Vancouver Skytrain system, which operates on an exclusive guideway and does not have drivers in the vehicles, which operate as automated vehicles similar to the automated guideway transit systems most commonly encountered in airports or amusement parks.

In-Street LRT on Exclusive Guideway

Because LRT systems commonly operate in streets, their operations must be coordinated with the street signal system to provide a high level of service. This often takes the form of preferential treatment, by which the LRT trains are allowed to extend or shorten crossing signals by a modest amount to facilitate their crossing of intersecting streets. While pre-emption of traffic signals – by which the trains completely override street traffic-signal timing – is technically possible, it is not done in practice because it would have severe impacts on street traffic. Where the existing traffic-signal system is not fully automated, construction of an LRT system typically results in upgrading the traffic-signal system to allow the closer coordination of traffic and rail operations.

Like other guideway transit systems, LRT systems depend on coordinated bus services to provide the largest number of passengers access to the system. This includes provision of locations for passengers to transfer between the rail and bus systems; addition or modification of bus service to allow passengers to make transfers; and can include close coordination of bus and rail operations.

In general, the cost of systems with characteristics listed in the leftmost column in Figure 3-1 will be substantially lower than those with characteristics listed in the middle column, which in turn will be lower than those with characteristics listed in the column on the right. This is so because as the system becomes more complex it requires more structure, more equipment, and more-expensive equipment. The benefit of moving from the simpler to the more complex systems is in their capacity, with systems on the right side of the matrix having far greater passenger-carrying capacity, running at higher average speeds, and providing more reliable service. The objective in planning such systems is to strike a balance between capacity and need, as well as between cost and capacity.

3.1.1 Types of Guideway

As they are designed for street operations, LRT systems can work in a wide array of guideways. LRT can also operate on exclusive guideways similar to those of CRT systems. They even have the capability of operating in conjunction with other vehicles traveling down the guideway, although this arrangement is not common, as it severely compromises reliability. Therefore, LRT systems have the fewest guideway constraints of any rail-transit mode. They can operate with the following guideway types:

- Exclusive Guideway:
  - In-Street exclusive ROW.
  - Off-Street exclusive ROW.
- Non-Exclusive Guideway:
  - In-Street, with limited at-grade crossings.
  - In-Street, with other vehicles allowed along the guideway.

LRT guideways typically (although not always) include an overhead wire – the catenary – for power distribution. This allows people and vehicles to cross the tracks without danger of electrocution from the power system. Figure 3-2 shows two fairly typical LRT in-street configurations. In each case the guideway requires one lane-width to operate. In both cases the view is at a station location.

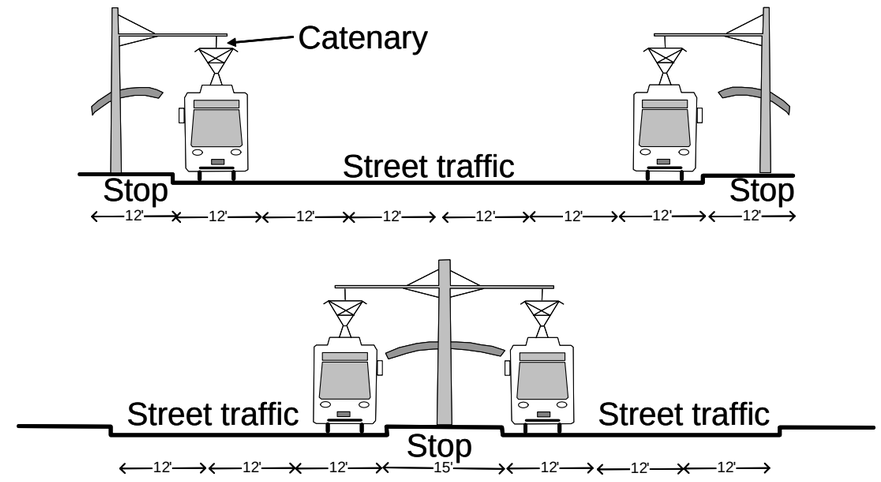


Figure 3-2 Typical LRT In-Street Configurations

Among the more notable capabilities of LRT is its ability to negotiate steeper gradients and tighter curves than other rail-transit technologies. Maximum gradients over short distances of up to 10 percent have been occasionally achieved with LRT technology, although four- to six-percent gradients are more common. Of course, steep grades and tight turns affect system speeds for LRT systems as they would any other rail technology. Because the LRT vehicles can climb grades up to about six percent and make tighter turns than RRT or CRT vehicles, when they must go over an obstacle they can do so in a shorter distance, reducing the amount of elevated guideway and thereby saving money.

The photo shows a Pittsburgh Light Rail Vehicle negotiating one of the steeper grades of that system.

LRT Vehicle Negotiating Steep Grade

Typical At-Grade Crossing of LRT

Traffic coordination is an essential component of any LRT system that uses or crosses public streets. Most systems do not allow other vehicles to drive down the tracks, but do allow them to cross the tracks. The accompanying photo of the Dallas system's downtown transit mall shows people crossing behind the vehicle at an intersection, much as they would were it a bus.

LRT Aerial Guideway at an Interchange

The ability of LRT systems to make tighter turns than other rail transit technologies allows them to operate in streets and negotiate turns. The aerial photo shows a 90-degree turn that is part of the light rail system in Dallas.

One of the consequences of being able to handle steeper grades and tighter turns is that where the guideway must go over or under an obstacle, it can do so in a shorter distance than is required with other rail technologies. Therefore, any necessary bridges and underpasses can be shorter, which reduces construction costs. The photo shows an LRT guideway threading through an interchange as well as a rail crossing.

LRT Vehicles Negotiating Curve

3.1.2 Key Vehicle Concepts

LRT vehicles have a number of notable features:

- Overhead Power (typically).
- Articulated Vehicle Body.
- Double-Endedness (driver cab on both ends).
- Low Floor, High Floor or Partial Low Floor.

A wide array of LRT vehicles is currently available on the market. There is significant competition between vehicle manufacturers, and each system tends to be somewhat customized to fit the needs of the operating environment.

The Hudson River Waterfront LRT system vehicle, like almost all LRT vehicles, has an operator's cab at each end so that trains can reverse direction without being turned around. These vehicles can have low floors for level boarding from curb-height platforms, but there are also alternatives with high-level floors, as well as alternatives with a mix of floor types.

Typical LRT Vehicle

Diesel Powered LRT Vehicle

Although almost all LRT systems use overhead wires (catenary) to distribute power to the vehicles, a diesel-powered LRT vehicle is used in the South Jersey system. The choices for traction power can be expected to keep getting broader (hybrid systems are now coming on line for buses) so that a hybrid-powered LRT vehicle is possible in the future.

One of the more notable traits of LRT vehicles is their ability to bend in the middle, enabling them to navigate tighter turns than other rail-transit vehicles. This bending is accomplished with a hinge called an articulation unit. The accompanying two photos show how an articulation unit looks from inside the vehicle and an LRT vehicle bending as it navigates a tight turn.

LRT Articulation Unit

LRT Articulation Unit Bending

The interior design of LRT vehicles can be customized to suit the type of travel market being served. Where average trips are very short and there will be frequent boarding and alighting, the interior may feature few seats and a higher carrying capacity due to the predominance of standees. The photo shows an LRT interior optimized for this type of service.

Poles (stanchions) and grab bars are provided for standing riders. Most LRT vehicles are narrower than typical CRT or RRT vehicles, with many having an outside width of 8.5 feet, dictating a narrower interior. However, wider vehicles are available, and they have more space for seating as well as standees.

LRT Interior with Seating

LRT Interior Designed for Standees

Because LRT vehicles have an operator's cab at each end of the vehicle, most if not all LRT vehicles lack end doors to permit movement between the vehicles in a train.

The typical LRT vehicle can carry between 100 and 125 passengers per car (including standees), which translates to 400 to 500 passengers for a four-car train, which is the usual maximum length of train allowed. LRT train lengths are

limited because where LRT systems run at grade, if the train is over a block in length, when stopped it would block cross streets. The shortest block-length of a route is thus the effective limit of train length. For this reason, most LRT systems run trains no more than four cars in length, and in some cases no more than three cars.

3.1.3 Key Station Concepts

LRT stations have the same elements as other guided transit technologies:

- Platforms.
- Platform Enclosures.
- Canopies.
- Waiting and Ticketing Areas.
- Parking Options.
- Bus Transfer Areas.
- Pedestrian Connections.

San Diego LRT Station on Exclusive ROW

Because LRT systems can operate in street ROWs, they can include stations in street medians or along the sides of streets, as well as stations off of street ROWs.

Street-median stations must be designed to fit in tighter locations than other stations. This can include the provision of end-loaded platforms fed from pedestrian crosswalks.

San Diego LRT In-Street Station

The photo of the Denver LRT station shows the platform, canopy, and amenities typical of rail stations. The size of the platform is a function of the length of the trains and the space needed for passengers to board and alight. The photo of the San Diego station shows a typical bus-stop style station located in a roadway.

Denver LRT Station

Stations can be as minimalist as a bus stop or as elaborate as any rail station. Typically they tend toward the minimalist, while offering weather protection and such amenities as wind screens and benches. They increasingly include interactive signage to inform customers of expected arrival times for the next train and the status of service.

As with BRT alternatives/options, LRT transit stations may offer an excellent opportunity to create multimodal transportation centers where pedestrians, bicycles, cars, and transit vehicles converge. They may also foster TOD.

3.1.4 ITS Components

The signal system of a modern LRT system includes the usual elements of any rail train control system, with provisions to allow the safe operation of trains by providing buffer spaces between the trains, scheduling service to meet the ridership levels of the system, and communications to inform the operators in the trains of any conditions they may need to be aware of and to report incidents. Unlike CRT and RRT systems, it is not uncommon for LRT systems to be closely coordinated with the street-signal system for at least those portions of the LRT system that operate in public-street ROWs. In addition, coordination with feeder-bus services is increasingly common. Passenger-information systems designed to provide projected arrival times, incident reporting, and rider alerts in stations and aboard vehicles are available as well.

Fare collection in LRT systems is often managed on board the vehicles, but proof-of-payment systems have become more common. In such systems, riders are required to show a valid ticket to inspectors, but inspectors only make spot checks, rather than attempting to inspect all tickets; results for such systems have been mixed, but there are successes. Barriered systems, typical of RRT systems, are not common, as the systems are designed for ease of access and egress, with generally shorter rides.

3.2 Application of LRT Technology to the Tappan Zee Bridge/I-287 Corridor

Introduction of LRT technology in the Tappan Zee Bridge/I-287 Corridor is an opportunity to begin with a clean slate and develop an entire system that will be independent of the existing bus and rail system. This independence allows for it to be as technologically advanced as desired. However, the LRT being considered in this stage of the process includes some elements operating at-grade within street ROWs, and such operations limit the use of automation technology and eliminate some forms of light-rail technology from consideration. For example, neither an Automated Guideway Transit (AGT) system nor a monorail system can operate in-street, as in-street operation requires an operator in active control, capable of reacting to any intrusions into the ROW by pedestrians or other vehicles, so that the system has the ability to stop suddenly. Exclusive-guideway alternatives were considered in the AA process and eliminated due to their cost and low ridership.

As with the BRT alternatives/options, the application of ITS technology to this corridor will be useful for the LRT operation. Vehicle tracking, passenger information, signal priorities, and responsiveness to incidents can all be applied to the LRT operation to improve reliability, reduce travel times, and improve passenger service. Where the LRT is operating in-street, the traffic-control system can be designed to be responsive to both the needs of the LRT vehicle and of the pedestrians accessing LRT stations.

Full-corridor LRT was dropped from consideration in the AA Report for several reasons. It was found to be less effective than commuter rail in serving both cross-corridor passengers and Manhattan-bound passengers, requiring many transfers (at Suffern, Exit 14, Tarrytown, White Plains, and Port Chester to connect with Manhattan-bound service). The combination of high construction costs for a grade-separated ROW and low ridership results led to the highest net costs per passenger and per passenger-mile, making it the least cost-effective scenario studied. However, the project team decided to re-examine this scenario and update the transportation analyses to be current with the DEIS alternatives and options studied in this report.

3.3 Description of LRT Alternatives/Options

3.3.1 Full-Corridor LRT

This alternative provides a combination of high-speed and in-street light-rail service from Suffern to Port Chester, with transfer provisions to existing commuter rail lines (Figures 3-3 and 3-4). The alignment utilizes a fully grade-separated option along portions of the I-87/I-287 corridor to minimize travel times, and in-street components along multilane arterials to literally bring the transit service closer to where local patrons would have better access to the service and to provide better connectivity to key destinations.

Light-rail design criteria were based on acceptable guidelines for other LRT systems currently operating within the United States. Both the grade-separated and in-street LRT segments within the corridor would be configured as a two-track system utilizing overhead catenary electrification. To ensure safety of operation, adequate lateral clearance would be provided between the LRT vehicles and adjacent traffic (with or without positive separation, such as raised medians and railings). The in-street alignment would follow the existing topography of the local roadways.

Track centers would be spaced at 18 feet (desirable), (14 feet minimum), with a dedicated ROW width of between 34 feet (minimum) and 40 feet (desirable). LRT can operate on steeper grades (up to 10 percent for short distances) and tighter curvatures than CRT. As a result, LRT would have relatively shorter and shallower viaducts and shallower depths of retained cuts/retained fills.

The LRT alignment would link all five north-south rail lines in the corridor via transfer facilities. Where connections would be made to other transit modes and to existing park-and-ride facilities, they would be constructed with provisions for bus circulation, kiss-and-ride, and parking facilities. At those locations where space for parking would not be readily available, a passenger-friendly, state-of-the-art LRT station would be provided. The possible stations and facilities proposed are as follows:

- **Rockland County**:
  - LRT to CRT Transfer Facilities: Port Jervis Line transfer in Suffern; Pascack Valley Line transfer at Route 59 in Spring Valley.
  - LRT Stations with park-and-ride facilities: Airmont Road and Palisades Mall.
  - LRT Stations: East Suffern, Monsey, Pascack Road, Grandview Avenue, Nanuet Mall, NY304, West Nyack and Nyack.
- **Westchester County**:
  - LRT to CRT Transfer Facilities: Hudson Line transfer at Tappan Zee Station; Harlem Line transfer at White Plains; New Haven Line transfer at Port Chester.
  - LRT Stations with park-and-ride facilities: Elmsford/Route 9A, Greenburgh, Hillside Avenue, Purchase and Boston Post Road.
  - LRT Stations: Meadow Street, Benedict Avenue, Greenburgh, County Center, Galleria Mall, Westchester Mall, Westchester Avenue, Platinum Mile (with Jitney Service), Purchase, and South Ridge Street.

3.3.1.1 Rockland County

Suffern Terminus/Port Jervis Line Transfer

At its western end, LRT would use the existing Piermont Line ROW, and its western terminus would coincide with a relocated NJ Transit Suffern Station at the intersection of Routes 59 and 202. A possible transfer station would be developed, combining service to both LRT and commuter rail. To facilitate the LRT connection, the existing NJ Transit Suffern Station would be relocated to the north, to be closer to the Piermont Line terminus at Routes 59 and 202 and to provide expanded parking.

East of Suffern

East of the Route 59 at-grade crossing in Suffern, the alignment would remain at grade within the Piermont Line ROW for a distance of approximately two miles before entering the I-87/I-287 ROW near Airmont Road. A possible East Suffern LRT Station could be located just to the west of Hemion Road. Just east of Airmont Road a proposed LRT station and park-and-ride lot would be located possibly at the site of a commercial facility along the south side of I87/I-287. The alignment would enter the I-87/I-287 ROW directly east of the Airmont Road Station and would remain on the south side of the existing highway. A possible LRT station to serve the Monsey community could be located in the vicinity of where Route 59 crosses over the Thruway in Monsey.

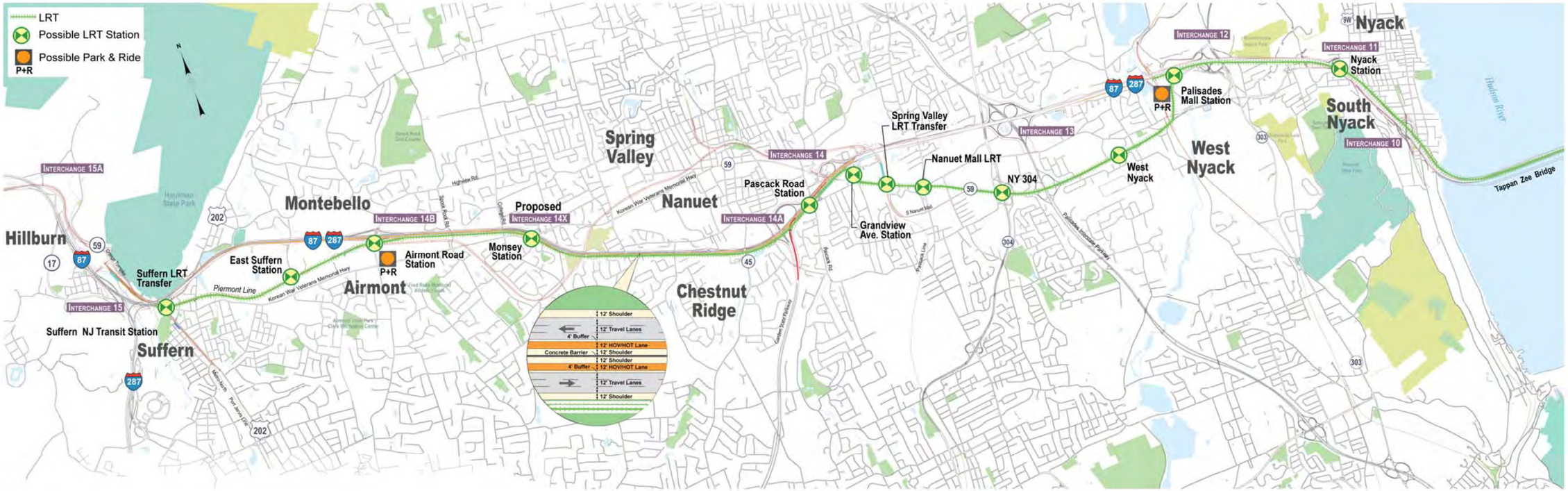
Spring Valley/Nanuet

East of Monsey the proposed LRT alignment would remain on the south side of the Thruway until Interchange 14A (Garden State Parkway). A station could possibly be located just east of Pascack Road, between the highway and Old Nyack Turnpike. The alignment would then turn south onto Route 59 and transition to in-street service along Route 59. The in-street LRT alignment would continue east along Route 59 through Nanuet (as Nyack Turnpike and West Nyack Road) for a distance of approximately four miles. Wherever the LRT alignment would cross an existing intersection at grade, the intersection would be reconstructed and equipped with transit-signal priority to maintain the LRT service schedules. In Nanuet, the LRT would provide transit service through the heavily commercialized shopping area that includes the Nanuet Mall. Where the alignment crosses the Pascack Valley Line a possible station would be provided, offering transfer capability to commuter rail service on the Pascack Valley Line.

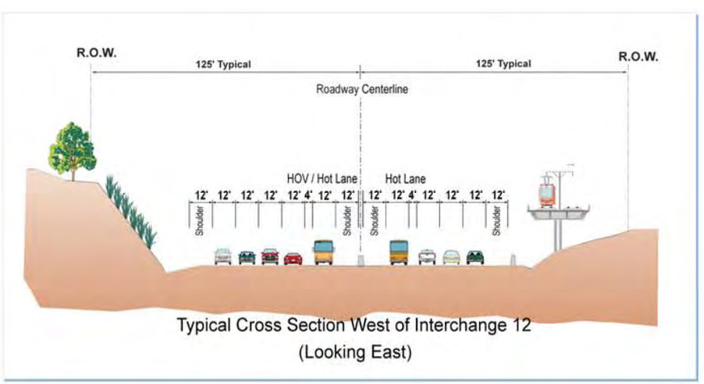
Throughout this segment the LRT would be built in the median, with at-grade platform stations spaced approximately one mile, or less, apart. These proposed stations would be located on Route 59, possibly at the following crossroads:

- Grandview Avenue (west side of Route 59).
- Pascack Valley Line Transfer Station.
- Nanuet Mall (west of Main Street/Middletown Road).
- NY304 (west of Smith Street).
- West Nyack (near Strawtown Road).

After passing over Western Avenue and the tracks of the West Shore Line, the alignment would turn north on a viaduct across westbound Route 59 and follow the west side of the Palisades Mall ring road to the Palisades Mall Station at Parking Lot J. From Parking Lot J, the LRT would move back into the I-87/I-287 ROW on a viaduct, span over the Interchange 12 (NY303) ramps and Route 303, and transition to the south side of I-87/I-287.

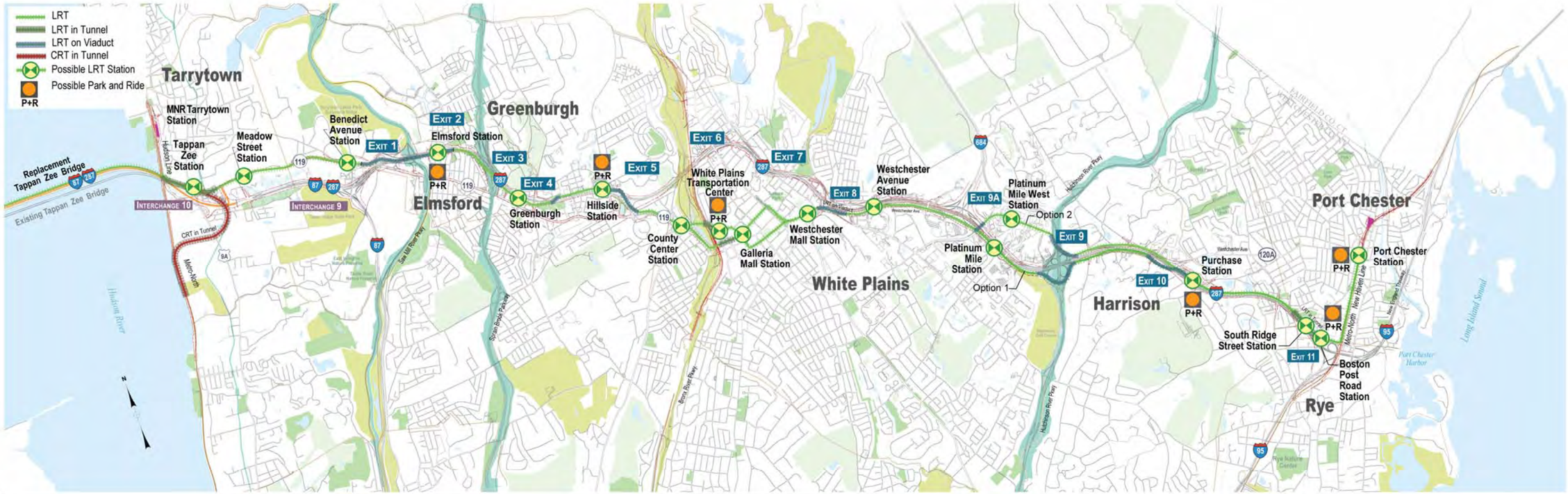


Alignment Quantities				
	Cut & Cover Tunnel	Viaduct/Major Bridge	At Grade, Retained Cut, or Fill	Total
Full Corridor LRT - Rockland	2,500 ft	3,500 ft	75,850 ft	81,850 ft (15.5 Miles)

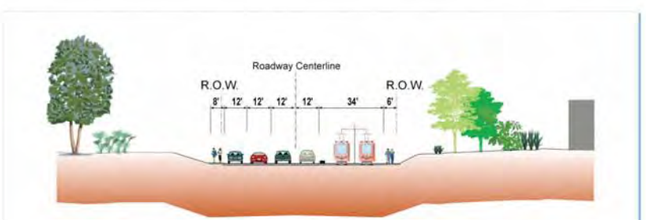


Typical Cross Section West of Interchange 12
(Looking East)

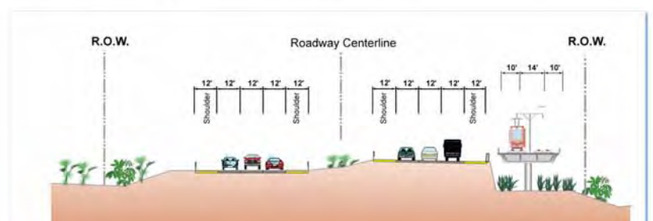
Figure 3-3 Full-Corridor Light Rail Transit in Rockland County



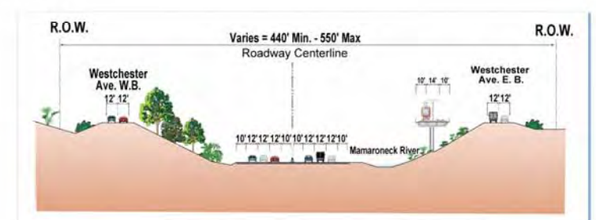
Alignment Quantities				
	Cut & Cover Tunnel	Viaduct/Major Bridge	At Grade, Retained Cut, or Fill	Total
Full Corridor LRT - Westchester	5,500 ft	40,000 ft	34,900 ft	80,400 ft (15.2 Miles)



Typical Cross Section - Along Route 119 in Tarrytown
(Looking East)



Typical Cross Section in Elmsford
(Looking East)



Typical Cross Section - East of White Plains
(Looking East)

Figure 3-4 Full-Corridor Light Rail Transit in Westchester County

Nyack/South Nyack

East of Route 303, the alignment would remain along the south side of the I-87/I-287 ROW. A proposed station could possibly be located east of Mountainview Avenue at Interchange 11 (US 9W/NY Route 59). Continuing east, the alignment would descend toward the Hudson River following the highway, with a shift of the alignment from the south side to the north side of the Thruway. The south-to-north alignment shift, achieved with the LRT crossing beneath I-87/I-287, would be necessary to facilitate aligning the LRT with the rehabilitated or replacement Tappan Zee Bridge.

3.3.1.2 Westchester County

Tarrytown

From the rehabilitated or replacement bridge, the alignment would continue – possibly elevated or in tunnel – into the Tappan Zee Station on the north side of the toll plaza for transfer to Manhattan-bound CRT. The CRT connection would be made by a proposed two-track CRT alignment from the Hudson Line extending north to the proposed station. The CRT would dead-end at the station.

After crossing Broadway, the LRT would transition to an at-grade alignment on the south side of Route 119, which would be widened from Broadway to the vicinity of White Plains Road – a distance of approximately one mile – to maintain the existing five-lane roadway configuration and a safe, segregated LRT alignment. A possible center-platform Meadow Street LRT Station could be located just east of Meadow Street, along the south side of Route 119.

Greenburgh

East of White Plains Road, Route 119 widens sufficiently to accommodate the LRT alignment and projected traffic. The LRT alignment would continue along the south edge of Route 119 to a proposed Benedict Avenue Station, which would be an at-grade station possibly located east of Benedict Avenue and opposite the office parks between Route 119 and I-287. To the east of this station, as Route 119 approaches I-287, the alignment would ascend on a viaduct, cross Route 119 and continue on the north side of I-287, then swing over to the south side of I-287 as it passes above the Saw Mill River Parkway, the Saw Mill River, Vreeland Avenue, and Central Avenue. A possible elevated Elmsford LRT Station and park-and-ride facility directly adjacent to I-287 is proposed between Nepperhan Road and North Central Avenue (Route 9A).

East of the station, the viaduct would continue and then transition into a retained cut and pass beneath the southbound lanes of the Sprain Brook Parkway. The alignment then rises up over the northbound Sprain Brook to avoid impacting the relatively shallow Catskill Aqueduct. The overhead transmission lines just east of the parkway would need to be reconstructed to a higher elevation to clear the LRT alignment. A proposed LRT Greenburgh Station could be located possibly at the existing *Bed, Bath and Beyond* and *Syms* commercial sites south of I-287.

The alignment would then climb above Knollwood Road and cross to the north side of I-287 just west of Manhattan Avenue. Just west of Hillside Avenue, a possible at-grade LRT station and park-and-ride facility is proposed. The alignment would then pass under Hillside Avenue and rise up onto a viaduct, cross back to the south and align on the east side of the Exit 5 westbound entrance ramp, then continue along the east side of Route 119 (Tarrytown Road) as it proceeds towards downtown White Plains. (An alternative I-287 alignment being considered would continue the LRT on the south side of I-287 east of Knollwood Road and possibly locate a station in the vicinity of Manhattan Avenue.)

An alternative alignment through Elmsford would be to continue the LRT on Route 119 (Main Street). However, the available ROW on Main Street narrows, and the roadway moves through a commercial district with congested travel lanes and parking along both curbs. In order to avoid both further congestion to the local roads and land-use impacts, the use of Route 119 through Elmsford as an LRT alignment was eliminated from consideration.

White Plains

As the LRT continues on the east side of Route 119, a station is proposed at the Westchester County Center, possibly at the intersection with Central Avenue. Directly after the County Center Station, the alignment turns east and crosses the Bronx River Parkway at a reconstructed intersection. The alignment would continue through the existing parking lot and turn south, parallel to the Metro-North Harlem Line bike trail, then cross under the tracks in a short tunnel to emerge onto Water Street, which is on the north side of the WPTC. A possible station would be provided along Water Street that would allow for a transfer to the Metro-North Harlem Line. An alternative alignment being considered for the entry into White Plains would have the LRT continue on Route 119 and turn east just north of Hamilton Avenue and cross under the Harlem Line. The LRT transfer station would be located on the north side of Hamilton Avenue.

There are a number of potential LRT routes through downtown White Plains (see Subchapter 3.3.1.3). Some of the routes considered include Hamilton Avenue, Main Street, and Martine Avenue, and a possible combination of these. Other routes are also possible, and would be further studied in the DEIS if LRT is the selected mode. In addition to the transfer station at the WPTC, and regardless of the chosen route, two additional LRT stations are proposed in downtown. One would possibly be in the vicinity of the Galleria Mall, and the other at the Westchester Mall.

The LRT alignment would leave downtown White Plains along Westchester Avenue on a viaduct that would continue over the I-287 Exit 8W ramps and follow along the south side of Westchester Avenue to a proposed elevated Westchester Avenue Station, possibly located at the intersection with Anderson Hill Road. The alignment would then cross Westchester Avenue and continue to the east in the vegetated area between the south edge of I-287 and Westchester Avenue. The alignment would be mostly at-grade, but would also have some elevated sections, to pass over I-287 ramps and bridges.

Harrison

After passing Exit 9A (I-684), the next proposed station would be the Platinum Mile Station, which could be located between Bryant Avenue and Corporate Park Drive. This station would include provision for a jitney service that would serve the many corporate offices within the Platinum Mile and other large office parks in the area. (An alternative alignment option would take the LRT alignment out of the I-287 ROW and bring it north and through the Platinum Mile office parks. A station would be located along this alignment to serve the office parks. The alignment would return to the I-287 ROW and continue on the north side to the proposed Purchase Station described below).

The LRT alignment adjacent to the south side of I-287 would continue eastward on a viaduct pass to the south of the Hutchinson River Parkway (Exit 9), then cross over to the north side of I-287. A possible elevated Purchase Station and park-and-ride facility could be located just east of Exit 10. The LRT alignment would continue on viaduct over Bowman Avenue, then descend and remain at-grade for a possible South Ridge Street Station. The alignment would continue at-grade and drop under South Ridge Street and High Street.

Rye/Port Chester Terminus

East of High Street the alignment would be in a retained cut, to pass beneath Boston Post Road and into the large shopping mall, where a possible LRT station and park-and-ride facility would be located north of the I-95 interchange. Beyond the station, the LRT alignment would turn north and proceed along the west side of the New Haven Line ROW and continue north to the Port Chester Station, where the LRT alignment would terminate. The station would incorporate facilities for a transfer to commuter rail service on the New Haven Line. While a Rye Station terminus was considered, the Port Chester Station was thought to offer greater potential to induce TOD and serve a larger transit-dependent population.

3.3.1.3 White Plains

A separate study (NYSDOT et al, August 2008) was done to determine the alignment of the LRT routes in White Plains. As White Plains is the central hub of the corridor, and traffic in White Plains is the most congested urban traffic in the corridor, special consideration was given to the routing through White Plains. Crossing White Plains from west to east, connecting to the WPTC and Metro-North Station, and serving the other activity centers is not easily accomplished. Key destinations, as shown on Figure 2-15, include the Galleria Mall, the White Plains Mall and the Westchester Mall, the complex of county buildings along Martine, and the White Plains City Hall.

Similar performance measures to those for BRT were also developed to compare LRT alignment options in White Plains:

- **Minutes Run Time**: Walk time between Metro-North White Plains Station and the Westchester Mall is about 22 minutes. Therefore, transit run times should be less than half walk times to offer a serious advantage to travelers.
- **Traffic Lanes Crossed:** This measure was used only for LRT routes. It was intended to measure the potential for traffic to affect transit operations. The more lanes a route must cross the greater the prospect for traffic interference. Obviously, this measure could also indicate the potential for the transit system to disrupt street traffic.
- **90° Turns**: Sharp turns reduce speeds significantly. Depending on turn geometry and gradients, some tight turns would slow operations to a crawl and induce significant wheel squeal.
- **Length in Miles**: The shorter a route that provides equivalent coverage, the less costly and more efficient that route will be both to build and operate. Because LRT systems involve street modifications for paving, curb and gutter changes and drainage inlet redesign/replacement, the longer a route the more costly it will be to construct. Similarly, the longer the route the more train miles and time will be required to provide the same level of service, requiring more operating dollars as well. Therefore, length of route was used as a measure of higher costs – both operating and construction.
- **Walk Distances to Key Destinations**: Walk distances of ½ mile to transit are observed, but most transit users walk ¼ mile or less to their destinations/stations. Therefore, walk distance is a surrogate for ridership potential. The options that required walk distances substantially greater than ¼ mile were judged to offer less access than the others.

All the alignment options considered use dedicated lanes on existing streets for the LRT operation, crossing streets at-grade, and using preemptive traffic signals. Nineteen options were tested (Table 3-1). As a result of that evaluation, four alignment options – LRT White Plains Options 2, 4, 5 and 12 – are being considered for further analysis (Figures 3-5 to 3-8). Variations of these alignments may result from the detailed traffic analysis to be performed in the DEIS if LRT is the selected mode. Those options not being considered further involved many combinations of north-south and east-west streets, too numerous to describe here. In general, these street combinations crossed too many traffic lanes, involved too many 90° turns, removed too many traffic lane miles, and were too far from walk destinations to merit further consideration.

Table 3-1

Summary of LRT Options in White Plains

Alignment Option	Crosstown Travel Time Excessive	Too Many Traffic Lanes Crossed	90° Turns	Too Many Traffic Lane Miles Removed	Too Far to Walk to Key Destinations
1					●
2					
3		●			
4					
5					
6		●	●	●	●
7		●	●		●
8		●	●	●	●
9	●	●	●	●	●
10	●	●	●	●	●
11	●	●	●	●	
12					
13	●		●	●	●
14	●	●	●	●	
15		●		●	
16				●	●
17		●		●	
18					●
19	●	●		●	

Note: ● Does not meet criterion.

Figure 3-5 LRT White Plains Alignment Option 2

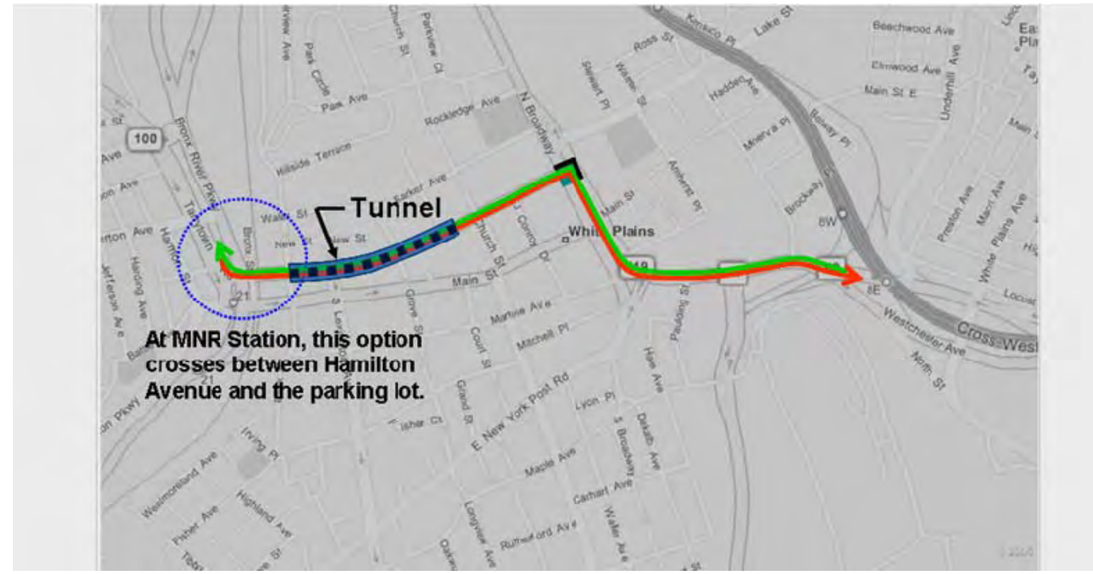


Figure 3-7 LRT White Plains Alignment Option 5

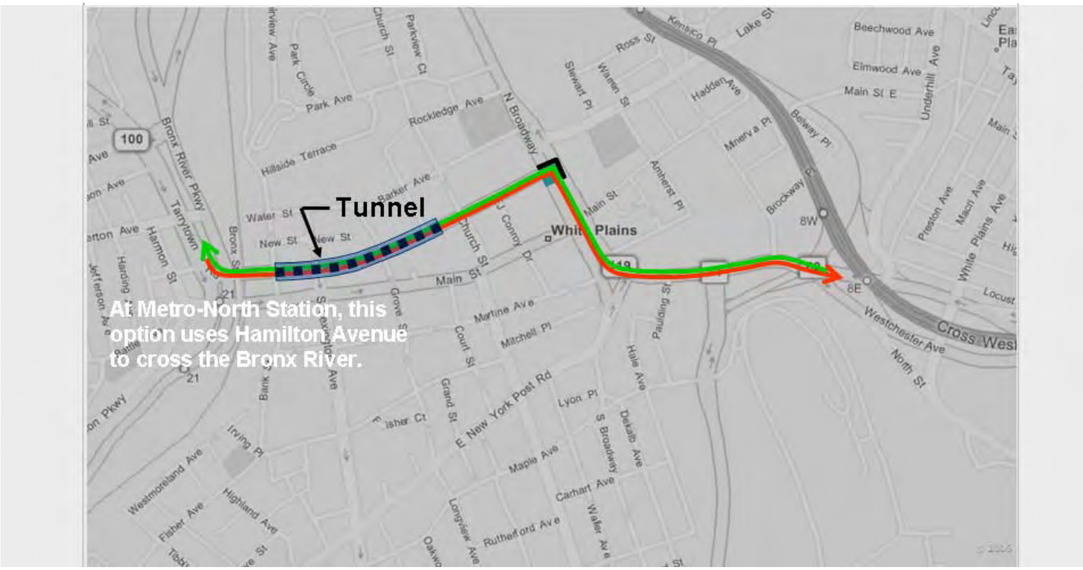


Figure 3-6 LRT White Plains Alignment Option 4

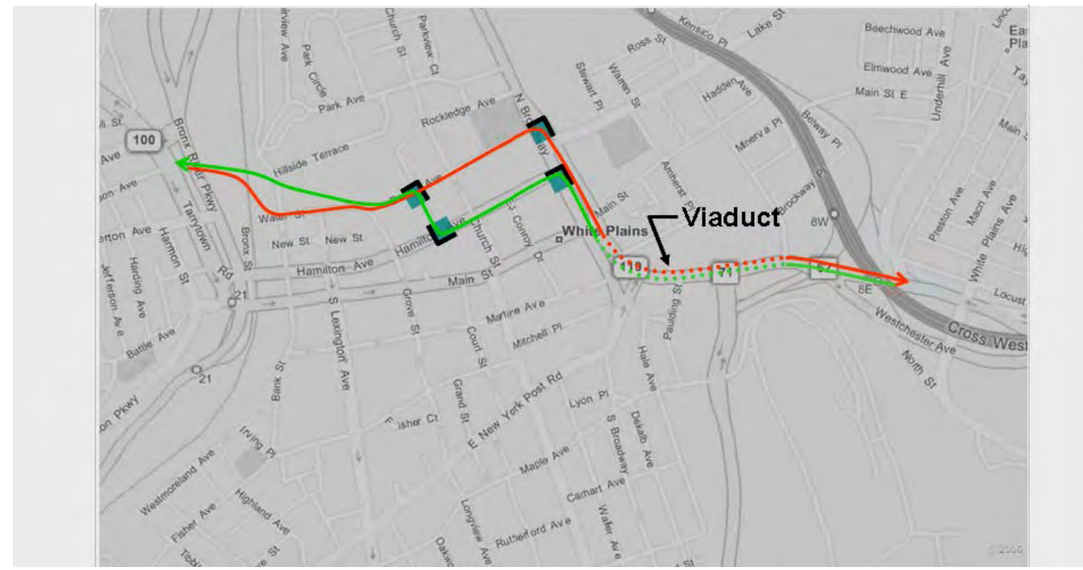


Figure 3-8 LRT White Plains Alignment Option 12

3.3.2 Option 4B – LRT in Westchester County

Although full-corridor LRT was dropped from consideration in the AA report (January 2006), LRT as a transit mode in Westchester County was retained in Alternative 4B, and combined with CRT in Rockland County that offered service to GCT.

The LRT alignment and service plan in Westchester County for Alternative 4B is basically identical to that proposed for full-corridor LRT. The only significant difference occurs in Tarrytown, where the LRT western terminus would be at the existing Metro-North Tarrytown Station. From this transfer station the LRT would travel south along the east side of the Hudson Line tracks to the Tappan Zee Bridge, then turn east and climb to connect with the proposed Tappan Zee Station. Two options are being considered for this connection:

- The LRT alignment enters the underground CRT station for a cross-platform transfer.
- LRT rises above grade on a viaduct leading to an elevated LRT station that would require a vertical transfer to the underground CRT platform.

For either option at the proposed Tappan Zee Station, the LRT would continue to the east through Westchester County as a hybrid alignment, as proposed for the full-corridor LRT alignment, with its eastern terminus at the existing Port Chester Metro-North Station.

BRT

LRT

CRT