

Final Report

Rail Line Trolley Feasibility Study



December 1, 2003

Submitted to:



City of Beacon

City of Beacon, New York

Submitted by:



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December 10, 2003

Mr. Joe Braun
City Administrator
City of Beacon
One Municipal Plaza
Beacon, NY 12508

Subject: Rail Line Trolley Feasibility Study

Dear Mr. Braun:

KKO and Associates is pleased to submit one hard copy of our final report to the City of Beacon, New York, for the Rail Line Trolley Feasibility Study. We will also send you a PDF of the final report so you can make further copies.

We at KKO would like to thank you for the opportunity to work on this interesting assignment. I think the report provides a reasonable assessment of Beacon's passenger transportation options for the underutilized rail line. KKO found that passenger rail service on the line would be both technologically and institutionally feasible. However, economic circumstances are not especially favorable for the development of the passenger service at this time. I am confident that eventually as the region develops and East of Hudson congestion grows on I-84, conditions will come to favor the economic development of a passenger rail service serving Fishkill, Glenham and Beacon on the line. When those circumstances come to fruition this study can serve as valuable resource for planning and evaluation.

If you have any questions about the report or if I can be of further assistance please do not hesitate to call me.

Happy Holidays

A handwritten signature in black ink, reading "David Nelson", followed by a long horizontal flourish line.

David O. Nelson
Director

Cc: Mayor Clara Lou Gould (with attachment)
Fred Nangle, MNR (with attachment)
Kay O'Neil, KKO (without attachment)

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City of Beacon, New York

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EXECUTIVE SUMMARY

This report documents the findings of a 2003 study prepared for the City of Beacon, New York exploring the possibility of using Metro-North's underutilized Beacon Line to operate a trolley service between the Metro-North station (with service to Grand Central Terminal in Manhattan) and Main Street in the City of Beacon. The City considered that the trolley could potentially serve several purposes:

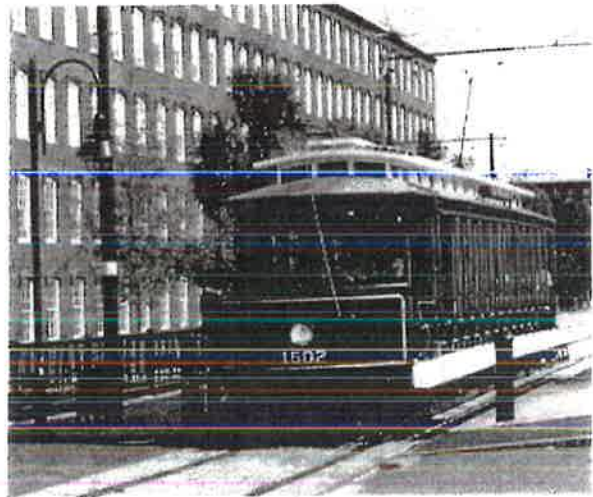
1. It would link downtown Beacon with the main rail depot.
2. It would provide a pleasant travel experience along the Fishkill Creek and become a tourist attraction.
3. It would enhance local mobility in Beacon.

In conducting the study for the City of Beacon, KKO and Associates followed a five-step process.

1. Goals and Objectives
2. Existing and Future Conditions
3. Opportunities and Constraints
4. Service Options
5. Service Evaluation

Task 1: Goals and Objectives

KKO met with city officials and Metro-North to determine their objectives concerning the future of the Beacon Branch. A telephone interview with a planning official from Metro-North Railroad (MNR) indicated that Metro-North plans to maintain the Beacon Line as a route for dead head equipment trains, training trips and work train movements between Beacon on the Hudson Line and Brewster on Metro-North's Harlem Line. Integrating the goals of local and Metro North officials, the overall study goals were distilled to five key points.



Historic "Whistler" Trolley in Lowell, Massachusetts

1. Clarify the technological, institutional and economic factors that influence the overall feasibility of passenger rail service on the Beacon Line
2. Respond to and support the economic and cultural renaissance of Beacon
3. Improve rail travel services for: Manhattan commuters, visitors to Beacon and local residents' mobility
4. Provide a service that invokes nostalgia for the by-gone era of convenient local rail transportation services for small urban communities
5. Continue use of the Beacon Line for Metro-North's current applications including:
 - deadhead equipment trains
 - training trips
 - movement of track materials and work trains
 - occasional excursion trains

Task 2: Existing Conditions

The KKO study team documented existing conditions in the study corridor running between Beacon Station and Fishkill, New York. The description of existing conditions includes:

- Demographics and Travel Patterns
- Existing Public Transportation Services
- Rail Operations
- Rail Infrastructure

Demographics and Travel Patterns - Beacon's population is expected to grow approximately 8% between 1990 and 2020. Forecasts expect 13,552 residents in 2010, and 14,862 in 2020. Dutchess County's population is expected to grow by approximately 16% between 1990 and 2020. The City of Beacon has a population density of over 1,000 inhabitants per square mile.

*We are not
passing this
number*

In 1990, approximately 30,000 Dutchess County residents worked outside of the County. 38.5% worked in Westchester County, 13.6% worked in a NYC borough. Commuting by transit is a fairly rare phenomenon in Beacon but the frequency of transit use by local residents is increasing. In 1990, 4.1% of working Beacon residents used transit to go to work. Of county residents who used transit to go to work, about 50% used Metro-North and 40% used a bus.

Existing Public Transportation Services - Dutchess County owns a 50-bus fleet used for a family of services known as the LOOP. The LOOP includes fixed route, commuter train connection, and demand response services. In 1996, the LOOP carried 617,298 people. 29,106 of those passengers used the commuter rail connection service.

In the last 20 years, Metro-North's Beacon Station has experienced an increase of inbound passenger levels of over 300%. Current ridership approaches 1,800 daily boardings. Metro-North forecasts that 2025 inbound passenger boardings at Beacon will grow by at least 30% over current levels. Metro-North is contemplating adding as many as eight weekday trains to the schedule of services at Beacon over the next twenty years including improvements in both peak and off peak service.

*2003-2025
approx. Huds
= 143.66*

The LOOP feeder bus service to Beacon Station is fairly limited in its scope and attractiveness to commuters. The Dutchess County service includes two routes. Average daily ridership on the combination of both routes is fewer than 30 boardings.

Rail Operations - On the Hudson Line, Metro-North operates extensive rail passenger service between Beacon and New York's Grand Central Terminal. In addition, Amtrak uses the line for its operations between Manhattan and Albany but no Amtrak trains stop at Beacon. CSX and CP freight trains pass through Beacon Station several times each day.

On the Beacon Line, operations are very sparse. Only two trains used the line in Beacon during 2002.

NO TRAINS USE LINE NOW

*No -
6 as
provided*

Total Train Count at Beacon on the Hudson Line

	Weekday	Saturday	Sunday
Metro-North	49	38	38
Freight	6+	6+	5+
Amtrak	20	19	20
Total	75+	63+	63+

Railway Infrastructure – Metro-North’s Hudson Line is among the highest speed rail lines in North America with a maximum allowable speed of 90 miles per hour for passenger trains in either direction on the two main tracks through Beacon. Metro-North’s *Beacon Line* was not designed for such high-speed operations. Passenger trains are restricted to 25 mph maximum speed.

The single track Beacon Line meets the Hudson Line 0.6 miles south of Beacon Station on the west side of the line. A train arriving westward on the Beacon Line can be directly routed through remote controlled switches to any of the three station tracks at Beacon. Headed away from Beacon Station, the Beacon Line parallels the Hudson Line for a distance of approximately 0.5 miles. An abandoned siding on the west side of the Hudson Line connects the Beacon Line with Beacon Station. It is possible that this siding could be restored to provide a convenient point of transfer for passengers from the proposed Hudson River ferry and MNR main line passenger rail services to a Beacon Line trolley. Approximately 1.1 miles south of Beacon Station, the Beacon Line turns eastward and crosses over the Hudson Line on a single-track trestle. Once across the Hudson Line, the character of the Beacon Line is sinuous and serpentine, climbing along the north bank of the Fishkill Creek. After passing Matteawan in downtown Beacon, the Beacon Line continues curving up the Fishkill Valley on a continued grade until it reaches Glenham, approximately 4.7 miles from MNR’s Beacon Station. At Glenham, the grades and curves ameliorate for the 2.1 mile run to Fishkill Station and the Route 9/I-84 Interchange.

Between Beacon and Matteawan, there are two locations where automobiles cross the railway at grade. East of Matteawan, there are thirteen roadway crossings at grade in the less than five miles before the railway reaches Fishkill Station. None of the grade crossings are currently equipped with Automatic Highway Warning Devices (bells, lights or gates).

Task 3: Opportunities and Constraints

The analysis of opportunities and constraints considers the technological, institutional and economic opportunities and constraints that affect the feasibility of operating a rail shuttle “trolley” service on the Beacon Line.

Technological Opportunities – The Beacon Line is in place and maintained for 25mph passenger operations. Rail travel time between Beacon Station and Matteawan Depot in downtown Beacon would be less than ten minutes. Rail travel time between Beacon and Fishkill would be about twenty minutes. Current use of line is low, which provides capacity for a passenger service between Beacon Station and Matteawan with a possible extension to Glenham or Fishkill. It appears that a siding could be restored on the west side of the Hudson Line that

would allow trolleys to access Beacon Station with no potential conflict to operations on the Hudson Main Line.

Technological Constraints - The curvature of the Beacon line will limit the speeds that can be economically achieved. The single track limits opportunities for bi-directional traffic and reduces overall carrying capacity. The curvature limits opportunities to double track or to construct passing sidings west of Matteawan. Without special treatment, highway grade crossings on the line will require trains to sound loud whistles at frequent intervals, creating a potential noise nuisance. There are two highway grade crossings between Beacon and Matteawan and thirteen highway grade crossings between Matteawan and Fishkill. Local officials may wish to avoid the noise, vibrations, and fumes associated with the operation of heavy diesel rail vehicles.

Institutional Opportunities - Potential access to the line for public uses is enhanced due to its ownership by a governmental agency. Metro-North is committed to the support of rail passenger transportation. The City of Beacon appears to have the political resources to support a rail transportation initiative. The political and social climate in Beacon is conducive to change and investment. Aesthetically, the rail alignment presents access to views and landscapes that are not available to highway users.

Institutional Constraints - Federal regulations require a waiver and special operating procedures to use a rail vehicle that does not comply with FRA standards on the rail line (e.g. vintage trolley, lightweight self-powered rail car). Absent an additional waiver, federal standards require trains to sound their whistles at all highway grade crossings. Metro-North's use of the line must be preserved.

Economic Opportunities - Metro-North is a full service passenger railway with access to the resources necessary to design and operate a passenger service on the Beacon Line. Metro-North ownership of the line reduces cost of access for public transportation uses.

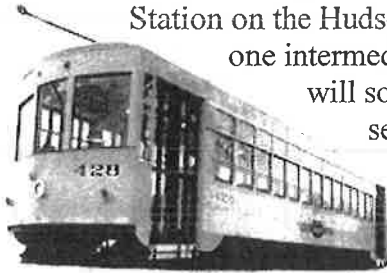
Economic Constraints - The fiscal resources of local governments to directly develop and support the service are negligible. Metro-North labor agreement and work rules may limit flexibility in achieving lowest cost crewing and service designs.

Task 4: Service Options

For feasibility studies such as the Beacon Trolley Study, a typical approach in designing service packages for evaluation is to cover a range of investment, cost and service levels while also designing alternatives that tend to build upon one another in terms of investment. The two service alternatives cover a range from a low cost minimal starter system to a fully developed mature system.

1. **Beacon Matteawan Trolley**: A visitor oriented replica electric trolley service running 2.7 miles between Beacon and Matteawan depots.
2. **Beacon Fishkill Shuttle**: A commuter oriented diesel rail car service running 6.8 miles between Fishkill and Beacon Depot.

Beacon Matteawan Trolley - This trolley service alternative would cater to visitor travel between Beacon Station and attractions in downtown Beacon. Frequent service with a single car would be offered to move tourists and local residents. To contribute to local aesthetic and tourism development goals, a replica trolley is considered for this service alternative. The electric trolley will require overhead wire for propulsion. The 2.7 mile service between Beacon



Station on the Hudson Line to the downtown Matteawan Station is proposed to have one intermediate stop at Dennings Point where the Rivers and Estuaries Center will soon be opening. The estimated end-to-end running time for this service is 8 minutes. Service would be provided five days a week, from Thursday to Monday to coordinate with the Dia:Beacon hours of service. It is envisioned that PDCTC fares would be charged for the trolley with on-board fare collection. Thirty-minute headways would be achieved with one car and a single operator. The service provides 28 to 40 daily trips connecting with 14 to 23 Metro-North trains, operating on existing track with no speed improvements above the current 25mph maximum speed. The service requires the construction of approximately 3,300 feet of new track along the alignment of the existing retired passing siding that runs northbound from the junction of the Beacon and Hudson Lines to the west side of the Metro-North Beacon Station. The service design would also require the installation of 2.7 miles of trolley wire, the construction of a one car car barn for storage and maintenance, and the acquisition of one ADA compliant replica trolley. Since only a single car service is envisioned no signal control system would be required. Upgraded warning devices for two grade crossings could be required.

Beacon Fishkill Shuttle - The commuter shuttle between Beacon Station and Fishkill is proposed to have three intermediate stops at Dennings Point, Matteawan and Glenham. In consideration of rider comfort, grade crossing safety, and to lower regulatory hurdles, an FRA compliant Diesel Rail Car is considered for this service alternative. No overhead wire is required. The estimated end-to-end running time is 20 minutes. The service operates between 4:30am and 10:15pm on weekdays and between 10:00am and 7:00pm on weekends (9:00pm on Saturdays). A single car train with a one-person crew is envisioned. Two sets of equipment provide the peak period services and one car provides service in the midday. A connection is provided to the majority of the peak period Metro-North trains. Fares would be collected with a proof of payment ticket scheme supported by ticket vending machines at each of the five stations.



On weekdays, this service alternative would cater to commuting travel between a Fishkill Park and Ride and New York City via Metro-North. It would also provide mobility for visitors and local residents. The Beacon Matteawan trolley weekend schedule would be operated on

Saturdays and Sundays with extended service on Saturdays. The service design would provide 28 to 46 daily trips connecting with 14 to 27 Metro-North trains.

As with the Matteawan trolley, the Fishkill service would generally operate on existing track with no speed improvements above the current 25mph maximum speed and would require the construction of approximately 3,300 feet of new track. Two short passing sidings on the Beacon Line at Matteawan Station and at Glenham would also be required. The service would cross up to 13 roadways at grade. It is very possible that some of these crossings could be closed or consolidated. Automatic highway warning devices are recommended at all remaining crossings to reduce the likelihood of collisions between rail and highway vehicles. The service also requires the installation of 6.8 miles of CTC signal system and the acquisition of three self-powered diesel rail cars and a three- car car barn to store and maintain the rolling stock.

Task 5: Service Evaluation

The study team estimated the costs and benefits of developing and operating the two service alternatives. The team also compared and contrasted the alternatives relative to their likely operating costs, capital costs, and ridership potential. Funding for the feasibility study was not sufficient to prepare accurate formal forecasts of ridership. Instead the evaluation of benefits in this report is based on qualitative estimates relying on heuristic non-behavioral forecasting techniques. Possible further planning work for a Beacon “trolley” should focus on ridership forecasts.

Evaluation of the Service Alternatives

	Beacon-Matteawan Trolley	Beacon-Fishkill Shuttle
Capital Cost	\$6,516,510	\$27,448,703
Operating Cost	\$1,031,093	\$3,815,366
Estimated Annual Ridership		
Low	76,426	124,799
High	115,000	244,766
Average	95,181	175,605
Capital Cost/ Annual Rider		
Low	\$56.67	\$112.14
High	\$85.27	\$219.94
Average	\$68.46	\$156.31
Operating Cost/ Annual Rider		
Low	\$8.97	\$15.59
High	\$13.49	\$30.57
Average	\$10.83	\$21.73

It is useful to consider the operating cost efficiency of the Matteawan Trolley by comparing the proposed service with other US trolley services already in operation. It is notable that this study’s rough estimate of \$11 operating cost per passenger is much greater than reported for other trolley operations as shown below.

Annual Operating Cost per Passenger for Representative US Trolley Services

	Operating Cost per Passenger	Annual Operating Costs	Annual Passengers
RTA - Orleans & Jefferson	\$1.71	\$8,821,559	5,173,717
City of Detroit DOT	\$8.99	\$349,261	38,859
Memphis Area TA	\$1.18	\$2,575,595	2,179,261
King County DOT	\$3.58	\$1,340,558	374,298
Peer Average	\$3.86		
Matteawan Trolley Average	\$10.83	\$1,031,093	95,181

When future planning studies on the Matteawan Trolley are conducted, refined ridership forecasts and reduced operating costs, particularly Maintenance of Way expenses, would help bring the Matteawan Trolley operating cost per passenger measures closer to \$4 per boarding.

In developing the operating cost estimates, KKO conservatively assumed Metro-North average unit costs for many operating expenses. These costs may be higher than actually necessary for Beacon Trolley operations. Metro-North average unit costs were assumed for right of way maintenance for both alternatives. Metro-North average unit costs for operations and vehicle maintenance were employed for the Fishkill shuttle. If these costs could be reduced, overall operating costs for both alternatives would be much lower and closer to other small city trolley operations. Strategies to potentially reduce the estimated operating costs include the use of volunteer labor to maintain and operate the service, non-profit foundation coordination of funding, and private-public consortia to develop and operate the service.

Comparison of Metro-North and Fishkill Shuttle Performance Measures

	Operating Cost per Vehicle Mile	Operating Cost per Passenger Mile	Annual Operating Cost	Annual Vehicle Miles	Annual Passenger Miles
Metro-North	\$10.18	\$0.26	\$576,780,824	56,647,442	2,185,376,033
Fishkill Shuttle	\$48.60	\$4.56	\$3,815,366	78,500	835,856

The Fishkill Shuttle in some ways is more like a commuter rail operation than the Matteawan Trolley. In the context of the Fishkill Shuttle as a commuter rail line, it is useful to compare the proposed service with the balance of the Metro-North service (see table above). The lightly used Fishkill service operating with single car trains and modest passenger loads would operate with much less favorable operating cost statistics than the balance of the Metro-North system. To explore ways to improve the operating efficiency of the Fishkill Shuttle, additional work on ridership potential would be required. Strategies to reduce operating costs might include reducing the overall fleet size, using non Metro-North labor to operate and maintain the shuttle trains, and re-evaluating the estimated cost to maintain the rail infrastructure at the required standard.

CHAPTER 1. GOALS AND OBJECTIVES

Introduction

This element of the study report describes the goals and objectives of the City of Beacon and MTA Metro-North Railroad (Metro-North) regarding potential passenger rail service along the Beacon Branch.

Methodology

Information on goals and objectives was assembled via personal interviews with public officials from the City of Beacon and telephone conversations with planners from Metro-North Railroad. The interviews included:

- Mayor Clara Lou Gould, City of Beacon, April 30, 2003
- Joseph Braun, City Administrator, City of Beacon, April 30, 2003
- Fred Nangle and Robyn Hollander, Planners, Metro-North Railroad, April – May 2003

A copy of the discussion guide employed to structure interviews with Beacon public officials is found in Appendix A of this report.

Findings

Background - The City of Beacon covers 4.78 square miles in Dutchess County and sits east of the Hudson River and north of Fishkill Creek, approximately 60 miles north of Manhattan. This small city of 13,808 inhabitants is currently served with regional rail service to Manhattan and Poughkeepsie on Metro-North's Hudson Line. A second rail line passes through Beacon along Fishkill Creek that does not serve passenger traffic. This line runs from Danbury, CT to the Hudson Line and connects to all three Metro-North lines (Hudson, Harlem and New Haven) as well as the Beacon Line. The Beacon Line connects downtown Beacon with Metro-North's Hudson Mainline.

The City of Beacon, founded in 1913, was once a substantial manufacturing community with numerous plants and mills along the two rail lines that intersect within city limits:

Hudson Line – The Hudson Line in Beacon is owned by Metro-North Railroad (MNR), a commuter rail component of New York's Metropolitan Transportation Authority. The line is an element of the principal rail route between Albany and New York City. The portion of the line between Beacon and Grand Central Terminal in Manhattan is 59 miles long and as little as 66 rail travel minutes¹. Metro-North serves Beacon 365 days per year with 49 station stops on weekdays.

Beacon Line – Originally known as the Fishkill Line, this rail route once provided substantial east-west freight service across Dutchess County and into Connecticut. Opened through Beacon in 1892, it was built to provide a new link between the Appalachian coal fields and the cities of New England. Later the line was employed by

¹ Travel time varies by time of day and number of scheduled stops on each train trip. The maximum scheduled rail trip time is 108 minutes for the 59 mile journey.

the New Haven Railroad for all manner of freight services to keep east-west capacity on the faster, more direct, New Haven line available for passenger trains. Passenger service on the Fishkill Line was always limited. In 1910, two daily roundtrips stopped in Matteawan Station on Main Street in Beacon providing passenger service between Grand Central Terminal and Millerton. An additional two roundtrips passed through Matteawan, but did not pick up passengers in the city. By 1926, only one daily passenger roundtrip was offered on the Fishkill Line between New York City and Pine Plains.

MNR purchased (and renamed) the Fishkill Line from the Housatonic Railroad in 1995. At this time there is no freight service on the line in New York but the Housatonic retains rights to offer freight service on this line if it wishes. Passenger equipment train movements are limited to equipment positioning dead-head trains running between Beacon and Brewster (on MNR's Harlem Line), occasional crew training trips, and inspection trains. In addition the Housatonic Railroad occasionally runs excursion trains on the Beacon Line. MNR operated two trains through Beacon on the line in 2002.

After the economic decline and social stagnation that characterized many older American mill towns in the middle of the 20th Century, the City of Beacon seems poised to experience a resurgence of economic and cultural activity as its abandoned mills and factories are converted to cultural, institutional, commercial and housing uses. Much of the new economic activity along the Beacon Line is found between the depot on the Hudson Line and Main Street in Beacon at the historic Matteawan Station approximately 2.6 rail miles to the east.

- **Dia:Beacon** – On May 18, 2003, Dia Center for the Arts, one of the world's preeminent contemporary art institutions, opened a new museum to house its renowned but rarely seen permanent collection. *Dia:Beacon* occupies a nearly 300,000-square-foot historic printing factory immediately south of the Beacon Station on the east side of the Hudson Main Line.
- **Rivers and Estuaries Center** – In April 2003, Governor George Pataki announced that a multimillion-dollar institute dedicated to the study of rivers and estuaries would be built in Beacon along the shores of the Hudson River where the Beacon Line crosses over the Hudson Line. The shell of an old paper-clip factory in the state park at Dennings Point will be reclaimed to house the Rivers and Estuaries Center. The center's main campus on Dennings Point will overlook the mouth of the Fishkill Creek, the castle on Bannerman's Island and monumental Storm King at the northern edge of the Hudson Highlands.
- **Proposed Hotel** – A possible hotel encouraged by development of the DIA museum and the River Center is contemplated for an old factory on South Street nestled between the Beacon Line and the Fishkill Creek.
- **Apartment Complex** – An apartment complex is currently under development at the site of an abandoned 19th Century mill along Tioronda Avenue between the Beacon Line and the Fishkill Creek south of the Wolcott Avenue bridges.



- **Tallix** – A sculpture garden has been built, and may be expanded, at a mill site bounding the Beacon Line near Herbert Street approximately .25 miles east of the historic Matteawan Station on Main Street in Beacon.



Goals and Objectives of Local Officials

Local elected and appointed government officials in Beacon are interested in understanding the technical, institutional and economic feasibility of implementing a passenger rail service along the Beacon Line.

Two circumstances seem to motivate local interest in the potential rail service. First, the economic renaissance of Beacon provides the confidence that a passenger service along this reviving rail corridor may be economically beneficial. Second, MNR's intense use of Beacon Station to move travelers up and down the Hudson River corridor spurs interest in further developing the main line station as a transfer point between a passenger rail service from the east and the main North-South rail service. This interest is intensified given MNR's plans to build and operate a passenger ferry service across the Hudson River that would carry passengers from Orange and Ulster Counties to an intermodal rail/ferry terminal at Beacon Station.

Beacon officials hope that a passenger rail service on the Beacon Line would further stimulate and support the economic and cultural renaissance of the community. They anticipate that a rail passenger service could be developed that serves three potential markets:

1. Manhattan commuters
2. Visitors to Beacon
3. Local resident travel

Local officials envision potential Beacon rail passenger service stations along the route at eight locations.

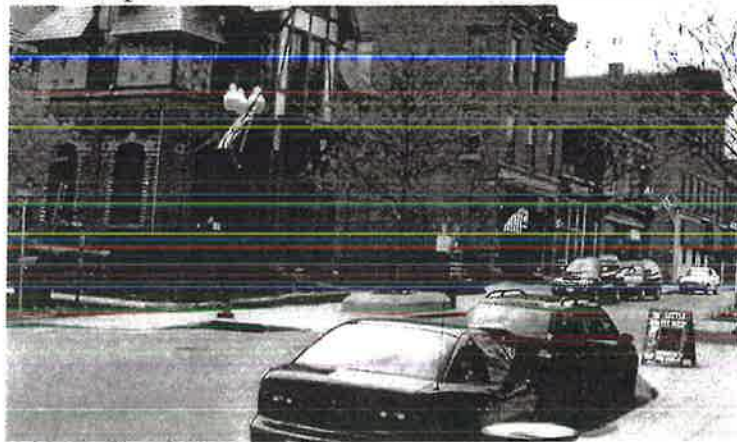
Potential Station	Miles east of MNR Beacon Station	Rationale
Beacon	0.0	<i>Connection with MNR service to Manhattan, Westchester County and Poughkeepsie. Passenger Ferry service to Newburgh. Bus service to Stewart Airport. Dia:Beacon</i>
Dennings Point	1.1	River Institute and Dennings Point State Park
South Avenue	1.6	Potential hotel connections
Tioronda Avenue	2.0	Potential local trip generator at new apartment complex
Matteawan Station	2.7	Connection to downtown retail businesses and cultural attractions Local mobility
Tallix	2.9	Cultural attraction Local mobility to Memorial Park and Beacon High School

Potential Station	Miles east of MNR Beacon Station	Rationale
Glenham	4.7	Improved non-highway access to MNR main line services Local mobility
Fishkill	6.8	Potential park-n-ride in vicinity of junction of railway, I-84 and Route 9. Improved non-highway access to MNR main line services. Local mobility

Study Objectives - Local Beacon officials plan that the study will clarify the technological, institutional and economic factors that influence the overall feasibility of the project. It is hoped that the study will provide a definitive answer concerning the feasibility of implementing a local rail passenger service on the line connecting with the main line services at Beacon Station.

Project Resources - Local resources to develop the new service do not include a substantial potential to commit local funds.

However, local officials note that with opening of *Dia:Beacon*, the announcement of the River and Estuaries Center, the Hudson ferry service, and forecast growth of travel between Dutchess County and points south that political resources on the New York Metropolitan Transportation Authority (NYMTA) Board, in Albany and in Washington, D.C. may exist to provide outside funds to develop and operate a service if it shows the potential to be economically attractive as well as technologically and institutionally feasible.



Main Street in Downtown Beacon

Rail Operator - Beacon officials are not interested in having the rail passenger service operated by the City of Beacon. They envision that the rail passenger service could be operated by Metro-North, or by a third party contractor like the planned ferry service. Beacon officials recognize, given institutional considerations relating to liability insurance and union work rules, that Metro-North may be the most economically attractive potential operator for branch line service.

Rail Service Design - Beacon officials envision that the proposed service would operate a schedule of services that would make it attractive for three potential markets: Manhattan commuters, visitors to Beacon and local resident mobility. It is recognized that visitors to Beacon would not likely be interested in travel east of Tallix, but that a substantial commuter market might exist for a station at Fishkill in the vicinity of the Route 9/I-84 interchange.

Opinions concerning vehicles - Beacon officials are not interested in exploring the feasibility of a rubber-tired shuttle using local highways in the east-west corridor. They envision that the potential visitor market may be enhanced if the rail vehicle invokes nostalgia for the by-gone era of electric streetcars and interurban electric cars. However they recognize that the expense of catenary wire to power an electric "trolley" may adversely impact the economic feasibility of the service. With respect to self-powered vehicles they are sensitive to the potential noise and emissions that might emanate from a diesel powered vehicle. Interest in a push-pull diesel locomotive and coach service is low.

Estuary Trail - Beacon officials are also contemplating the development of an Estuary Trail on the western and southern verge of the railway linking Long Dock at Beacon Station with Main Street at Matteawan Station. The Estuary Trail would provide a recreational and educational path for pedestrians and bicyclists following the banks of the Hudson River and Fishkill Creek. At some locations, it is obvious that the trail would run close to the Beacon Line. There is growing acceptance and popularity for the development and maintenance of recreational trails along active rail lines. The feasibility of such a trail is beyond the scope of this study.

LET'S TALK ABOUT
TRAIL

Goals and Objectives of Metro-North Railroad

MTA Metro-North Railroad is the second-largest commuter rail line in the United States, providing more than 240,000 customer trips each weekday and some 71,800,000 trips per year. A subsidiary of the MTA (Metropolitan Transportation Authority), Metro-North was founded in 1983, when the MTA assumed control of Conrail commuter operations in New York and Connecticut. Metro-North traces its antecedents back to the New York & Harlem Railroad, which began in 1832 as a horse-car line in lower Manhattan. It currently has a fleet of more than 950 cars and engines, 384 route miles, and 775 miles of track.

A telephone interview with a planning official from Metro-North Railroad indicated that Metro-North plans to maintain the Beacon Line as a route for dead head equipment trains moving between Beacon on the Hudson Line and Brewster on Metro-North's Harlem Line. Metro-North also uses the line for the training of rail transportation staff, for the movement of track materials and work trains and for occasional excursion trains. In 1997 Metro-North studied the feasibility of providing passenger rail service on the western end of the Beacon Line from the Hopewell Junction to Brewster North with connections on the Harlem Line to White Plains and New York City. This study concluded that the benefit cost ratio (especially capital expenditures) associated with the proposed project would be unfavorable.

Metro-North intends to keep the line open for its uses listed above. Metro-North may not support or approve of new uses on the line that might infringe on their current use of the line. However, Metro-North is a passenger railroad and would be expected to support the operation of a passenger service on this line if it proves to be economically feasible.

LET'S TALK ABOUT
RAIL TRAIL WITH OPTION LEFT OPEN
FOR TRACK BE COMMING
ACTIVE.

CHAPTER 2. EXISTING CONDITIONS

Introduction

This element of the study describes the existing conditions in the study corridor running between Beacon Station and Fishkill New York. The description of existing conditions includes:

- Demographics and Travel Patterns
- Existing Public Transportation Services
- Rail Operations
- Rail Infrastructure

Methodology

Information on existing conditions was assembled from transportation planning reports provided by Kealy Solomon of the Poughkeepsie – Dutchess County Transportation Council (PDCTC), rail engineering and operating documents provided by Fred Nangle of the MNR, and from a field visit to the corridor on April 30, 2003.

Findings

Demographics – According to the PDCTC's 1998 Transportation Plan for Dutchess County, Update (July 1998), population growth in Dutchess County was very substantial in the 1950's and 1960's, but has subsequently slowed. Beacon's population is expected to grow by about 8% between 1990 and 2020. Forecasts expect 13,552 residents in 2010, and 14,862 in 2020. Dutchess County's population is expected to grow by approximately 16% between 1990 and 2020.

*WE ARE ABOUT
THAT
NOW
ACCORDING TO
LAST CENSUS*

Population density in Dutchess County varies from 50 to over 5,000 people per square mile in the county, with Poughkeepsie having the highest density. The City of Beacon has a population density of over 1,000 inhabitants per square mile.

In 1990, approximately 30,000 Dutchess County residents worked outside of the County. 38.5% worked in Westchester County, 13.6% worked in a NYC borough.

In 1990, 25,000 people worked in Dutchess County who lived outside of Dutchess County. Very few of these workers resided on the Metro-North Hudson line. Only 4.5% were from Westchester County and only 3.4% were from a NYC borough.

The age profile of the residents of the county is expected to shift in the coming two decades to reflect the graying of the "baby boomers". With a much larger fraction of the population in their retirement years, demand for transit services, especially demand responsive and special needs services, is expected to increase.

Travel in the Study Corridor - Commuting by transit is a fairly rare phenomenon in Beacon and in Dutchess County, but the frequency of transit use by local residents is increasing. In 1990, only 2.9% of employed residents in the county used transit to go to work. In Beacon, 4.1% of working residents used transit to go to work, the fifth highest use of transit in the county.

In 1990, of the county residents who used transit to go to work, about 50% used Metro-North and 40% used a bus.

It is reported that the roads in Beacon are relatively uncongested. In 1995, Beacon did not have any roadway segments where reported travel volumes exceeded nominal roadway capacity. ?

The Beacon-Newburgh Bridge is a major feature of the local transportation network. In 1996, approximately 20.7 million vehicles used the Beacon-Newburgh Bridge. 19% were commuter cars, 68.9% were non-commuter cars and 12% were commercial vehicles. Commuter traffic increased by 45% between 1986 and 1996. Other traffic increased by about 30% over the same ten year period.

Existing Public Transportation Services - Dutchess County owns a 50-bus fleet used for a family of services known as the LOOP. The Loop includes fixed route, commuter train connection, demand response, dial a ride and rural paratransit services. The LOOP also provides non-emergency Medicaid transportation service and maintains the Dutchess County Transportation Center in Fishkill. In 1996, the LOOP carried 617,298 people. 29,106 of those passengers used the commuter rail connection service.

There are eight Metro-North stations in Dutchess County: Poughkeepsie, New Hamburg and Beacon on the Hudson line, and Wassaic, Tenmile River, Dover Plains, Harlem Valley/Wingdale and Pawling on the Harlem line. Metro-North also provides limited "hiking service" to Appalachian Trail on the Harlem Line.

The City of Beacon has experienced significant growth in its commuter rail service along Metro-North's Hudson Line. In the last 20 years, Beacon Station has experienced an increase of inbound passenger levels of over 300%, as illustrated in Figure 1². Metro-North forecasts that 2025 inbound passenger boardings at Beacon will grow by at least 30% over current levels. Metro-North is contemplating adding as many as eight weekday trains to the schedule of services at Beacon over the next twenty years including improvements in both peak and off peak service.

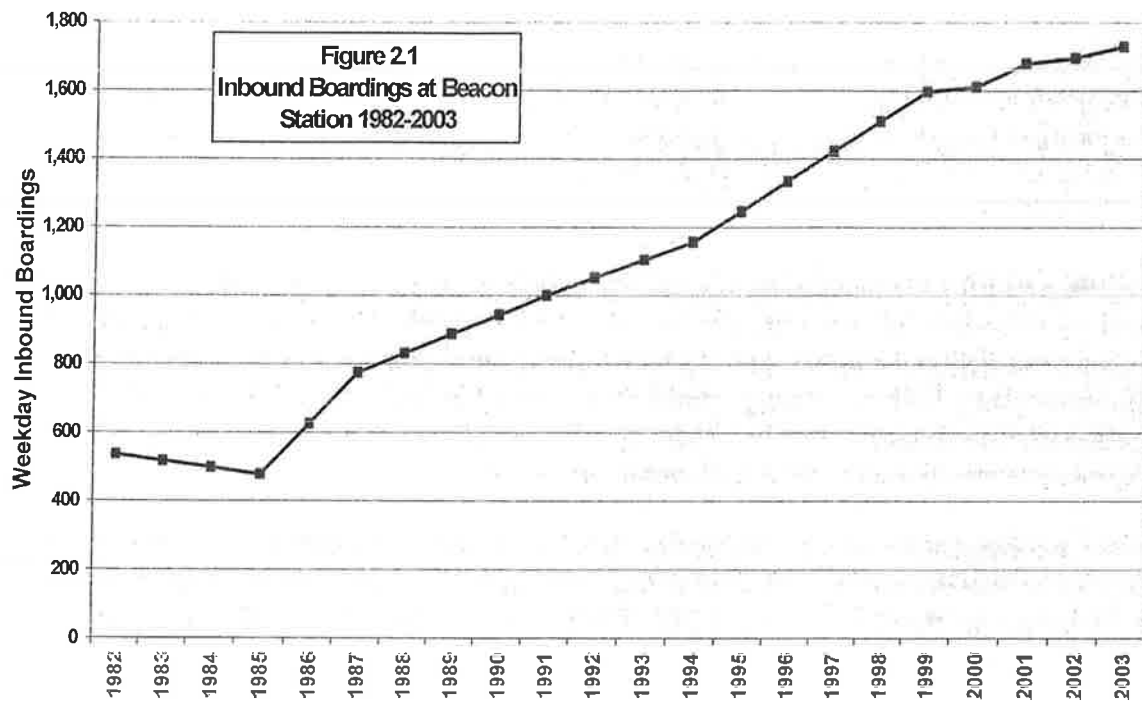
To accommodate the historic dramatic increase (and forecast further increases) in ridership on the Metro-North services calling at Beacon, Metro-North has increased parking at the station several times. It is now planning to operate a Trans-Hudson ferry from a park-and-ride lot in Newburgh that will provide an alternative to the I-84 crossing on the Beacon-Newburgh toll bridge for commuters from Orange County. Metro-



Newburgh – Beacon shuttle bus

² Figure 1 was generated from source data collected by Metro-North. Data for 2002 and 2003 inbound boardings is based on Metro-North forecasts.

North also cooperates with Orange and Dutchess Counties concerning the operation of feeder bus services that allow commuters to leave their automobiles closer to home, including a service between Newburgh and Beacon.



The Dutchess County feeder bus service to Beacon Station from Dutchess Stadium in Fishkill and downtown Beacon is fairly limited in its scope and attractiveness to commuters. The Dutchess County service includes two routes:

- Route 41A is a general purpose LOOP route in Beacon that provides a supplemental connection to nine weekday peak period trains.
- Route 42A is a dedicated commuter connection route designed to provide good connections with peak morning and afternoon trains for Manhattan³.

Table 2.1 Monthly Ridership on the Commuter Connections July 2002 through June 2003		
Month	Route 41A	Route 42A
July	460	78
August	477	83
September	474	119

³ Service was suspended July 1, 2003.

Table 2.1 Monthly Ridership on the Commuter Connections July 2002 through June 2003		
Month	Route 41A	Route 42A
October	532	174
November	489	103
December	470	122
January	415	67
February	497	96
March	650	134
April	538	92
May	538	92
June	527	147
Total	6,067	1,307
Daily Average	24	5

Route 41A bus service is provided from the Transportation Center/ Dutchess (Renegade) Stadium in Fishkill, and mimics the discontinued Route 42A service, as well as serving other areas of Beacon. The connection costs \$1 for a one-way trip, or \$10 a month using a Metro-North Uni-pass. The roundtrip takes approximately 20 minutes. The service drops passengers off by the train, about 10 minutes before departure. Service operates between 6:03am and 7:38am and 5:21pm and 8:08pm and meets four morning trains and five evening trains. Average daily ridership for the service in the last year (July 2002 to June 2003) was 24. In general, ridership has declined from approximately 30 riders a day to below 25 riders a day. Since there were 9 trips per day on Route 41A, the average ridership per trip on the Commuter Connection was less than three riders per trip. Evening ridership is consistently higher than morning ridership.

Route 42A bus service was provided from a park and ride lot at the Transportation Center/ Dutchess (Renegade) Stadium in Fishkill. The connection cost \$1 for a one-way trip, or \$10 a month using a Metro-North Uni-pass. The trip took approximately 10 minutes. There are 100 parking spaces available, with the potential for 90 additional spaces. The service dropped passengers off by the train, about 10 minutes before departure. Service operated between 5:35am and 7:50am and 5:19pm and 8:06pm and met five morning trains and five evening trains. Average daily ridership on the service was five from June 2002 to July 2003. The service was suspended in July 2003.

Table 2.2
Average Daily Ridership on the LOOP Beacon Commuter Connection Route 41A
(2002)

Month	Service Days	AM	PM	Total	Average AM	Average PM	Average Daily
January	22	217	443	660	10	21	31
February	21	225	363	588	11	18	29
March	21	247	401	648	12	20	32
April	22	260	395	655	12	18	30
May	22	193	390	583	9	18	27
June	21	115	301	416	6	15	21
July	22	119	341	460	6	16	22
August	22	131	346	477	6	16	22
September	20	141	333	474	8	17	25
October	23	148	384	532	7	17	24
November	20	139	350	489	7	18	25
December	21	157	313	470	8	15	23
Total	257	2,092	4,360	6,452	9	17	26

Source: Dutchess County Planning & Development

The Leprechaun Connection route also provides some supplemental service to the Metro-North Station. In January 2003, Stewart International Airport, in conjunction with the New York State Department of Transportation (NYSDOT), the Leprechaun Bus Lines and MTA Metro - North Railroad, announced the start of a new service, the Newburgh-Beacon-Stewart Link. The new service builds upon the existing Newburgh-Beacon Shuttle. This bus service is designed to provide passengers from Orange and Dutchess counties an alternate mode of transportation over the Newburgh Beacon Bridge providing connections between Metro - North's Train Station in Beacon, the NYSDOT's Park & Ride Lots (on Route 17K & on Route 9D at the Dutchess County Transportation Center next to the Stadium) and Stewart International Airport. The cost of the ride is \$1 per boarding, or Metro - North commuters can purchase discounted bus/ rail Uni-Tickets. It is understood that the feeder bus services serving the areas west of the Hudson (Orange County) may be substantially more popular than the Dutchess County services.

The City of Beacon and Dutchess County are both interested in providing facilities that encourage travel by pedestrian and bicycle modes. A network of paths proposed for the region includes two paths in Beacon. Beacon officials indicate that an "Estuary Trail" between Beacon and Matteawan Stations is proposed to run along the banks of the Hudson River and Fishkill Creek.

THE BEACON LINK WILL ENHANCE THIS OPTION

Local funding for transit services in Dutchess County is modest with most costs being covered by state and federal grants and user fees. Metro-North's Fare Recovery Ratio was 58.5% in 2001⁴. The overall operating cost per passenger trip in 2001 was \$7.91.

Local Transportation Plans - Dutchess County's 1998 Transportation Plan calls for the following projects that may affect travel in the study corridor.

- Metro-North parking improvements at Beacon,

⁴ Federal Transit Administration National Transit Database 2001.

- Beacon Ferry Pier Restoration,
- Bicycle racks at Beacon's commuter rail station.
- Expanded LOOP service to Hudson Line rail stations, and the construction of new park and ride lots.

Dutchess County would like to encourage the movement of freight on the Beacon Line.

In 1997 Metro-North examined the potential for connecting some of its Harlem Line services with a passenger service on a more easterly portion of the Beacon Line between Brewster North and Hopewell Junction. The study determined that such an initiative would not be economically attractive primarily because curves and grades would limit the velocity that passenger trains could achieve along this segment of the line without relocating and rebuilding the railway.

In 1994, Metro-North conducted a Trans-Hudson Rail Crossing Study examining the feasibility of connecting Orange and Rockland counties with Putnam, Dutchess or Westchester. The study alternatives did not contemplate any use of the Beacon Line to improve rail transit linkages across the Hudson.

Passenger Rail Operations: Hudson Line - Metro-North serves Beacon Station with 49 trains on weekdays, 38 trains on Saturday and Sunday. Travel times between Beacon and Grand Central Station vary from 66 minutes to 108 minutes.

Approximately 20 Amtrak trains pass through Beacon each day running between Manhattan and Albany. Beacon is not a stop for Amtrak trains.

Metro-North offers its commuter service using two fare regimes: a peak fare and an off peak fare. Table 2.3 presents the adult fares for service between Beacon Station and Grand Central Terminal.

Table 2.3		
Metro-North Fares		
	Peak	Off Peak
One Way Purchased on Train	\$18	\$14
One Way Purchased at a MNR Booth	\$14.50	\$11
One Way Purchased Online	\$13.78	\$10.45
Round Trip Purchased on Train	\$32	\$25
Round Trip Purchased at a Booth	\$29	\$22
Round Trip Purchased Online	\$27.56	\$20.90
Ten Trip Pass Purchased at a Booth	\$145	\$93.50
Ten Trip Pass Purchased Online	\$137.75	\$88.83
Weekly Pass Purchased at a Booth	\$96	
Weekly Pass Purchased Online	\$91.20	
Monthly Pass Purchased at a Booth	\$300	
Monthly Pass Purchased Online	\$294	

Source: http://as0.mta.info/mnr/fares/get_fares.cfm September 23, 2003.

Passenger Rail Operations: Beacon Line - At this time, there is no passenger service on the Beacon Line. However, Metro-North, which owns the line, uses the line for employee training and occasional equipment moves.

Rail Freight Operations: Hudson Line - The Hudson Line is used by two separate freight carriers: CSX and Canadian Pacific (CP)⁵. Each carrier operates on the line each night. CSX is the local service provider on the line. CSX provides local service during the day, on an as needed basis from Hudson. Table 2.4 summarizes freight activity on the Hudson Line.

Table 2.4				
Freight Activity on the Hudson Line				
Provider	Train	Frequency	Direction	Time of Day
CSX	Q430	Su, Tu-Sa	NB	Night
CSX	Q431	Su-Sa	SB	Night
CSX	K276	Su-Sa	NB	Night
CSX	K277	M-Sa	SB	Night
CSX	Local from Hudson	As necessary	As required	Variable
CP	Z484	Daily	SB	Night
CP	Z485	Daily	NB	Night

Source: Fred Nangle of Metro-North, April 4, 2003

Currently, there is no freight service on the Beacon Line. However, the Housatonic Railroad has freight operating rights to provide service on the line.

Rail Service Summary – The Hudson Line carries many trains in the course of a given day. Not only is there Metro-North and freight service on the line, but Amtrak uses the corridor to operate its passenger services between New York City and Albany. Table 2.5 details the daily traffic on the Hudson Line.

Table 2.5			
Total Train Count at Beacon on the Hudson Line⁶			
	Weekday	Saturday	Sunday
Metro-North	49	38	38
Freight	6+	6+	5+
Amtrak	20	19	20
Total	75+	63+	63+

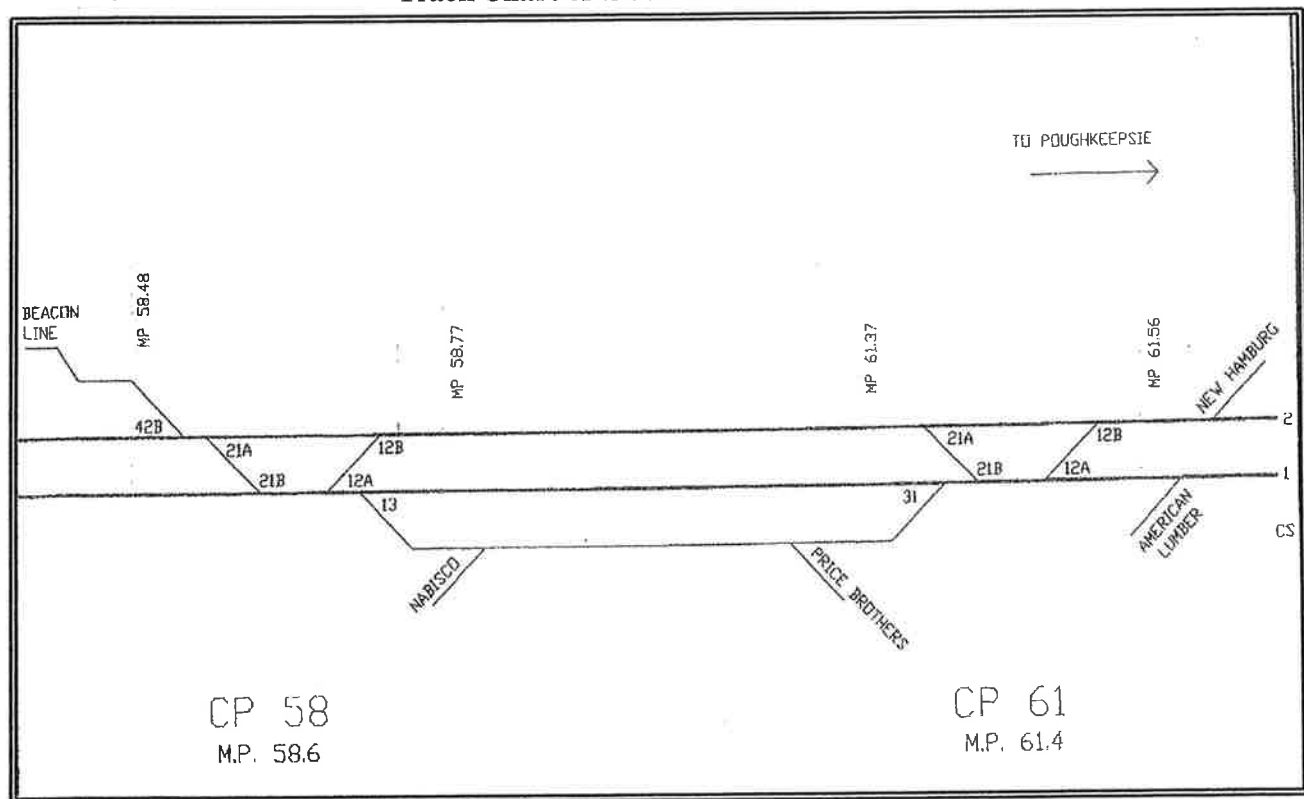
⁵ CP's freight service in this region is also referred to as the Delaware & Hudson.

⁶ Sources: www.mta.nyc.ny.us/mnr/index.html, Fred Nangle of Metro-North and www.amtrak.com. Passenger service data is based on published schedules for April 5, 6, and 7 2003.

Railway Infrastructure – The *Hudson Line* is among the highest speed rail lines in North American with a maximum allowable speed of 90 miles per hour for passenger trains on the two main tracks through Beacon. In the study area, the main line is constructed with continuous welded rail (CWR) and concrete ties to provide a high level of ride quality with an acceptable level of maintenance.

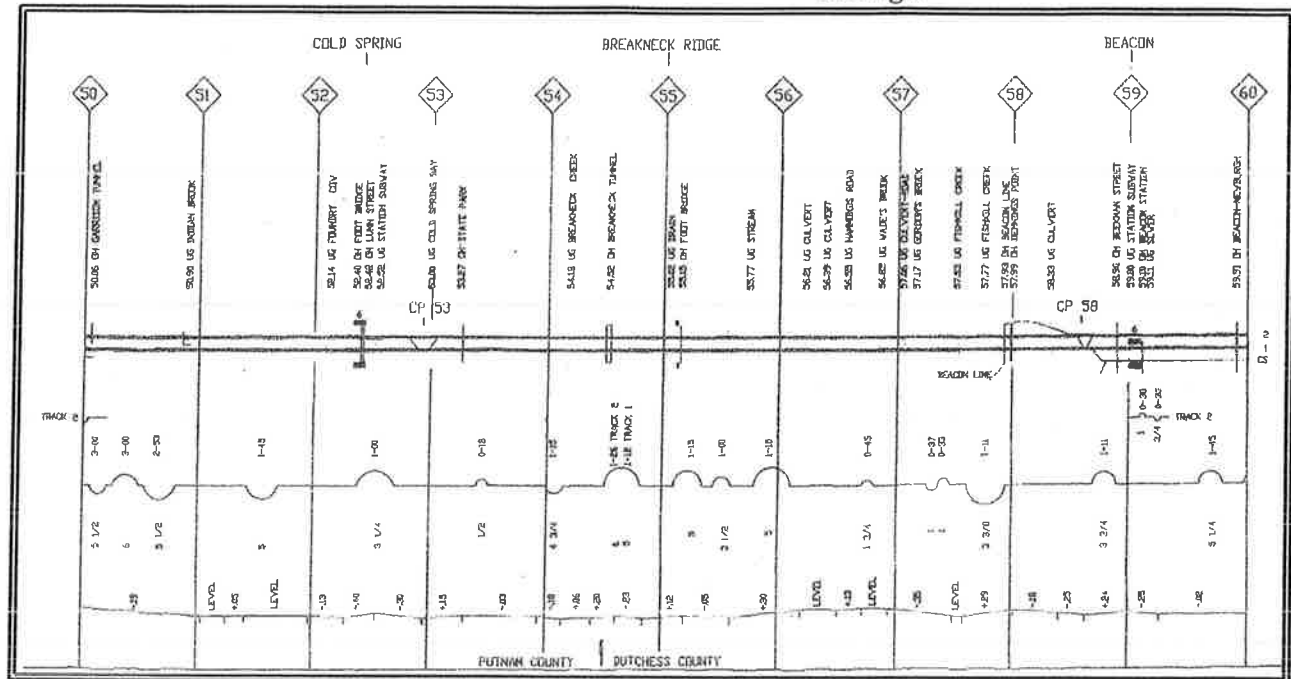
The Hudson Line is generally double tracked; however, between Milepost 58.8 and Milepost 61.4, the line has a 13,200 foot passing siding. Beacon Station is at Milepost 59.0, at the southern end of the passing siding. Metro-North's passenger station consists of two platforms: one on the passing siding and a center aisle platform serving Tracks 1 and 2. It appears that under normal operations, all Metro-North trains use Tracks 1 and 2 to serve Beacon. The platform on the passing siding does not appear to be used during normal operations. It was observed that Amtrak trains, which do not stop at Beacon, are routed on the passing siding. There are two interlockings to the immediate north and south of the passing siding to allow trains to use any of the three tracks through the station.

Figure 2.2
Track Chart of the Hudson Line at Beacon



Source: Metro-North, Fred Nangle, April 2003

Figure 2.3
Track Chart of the Hudson Line MP 50 through MP 60



Source: Metro-North, Fred Nangle, April 2003

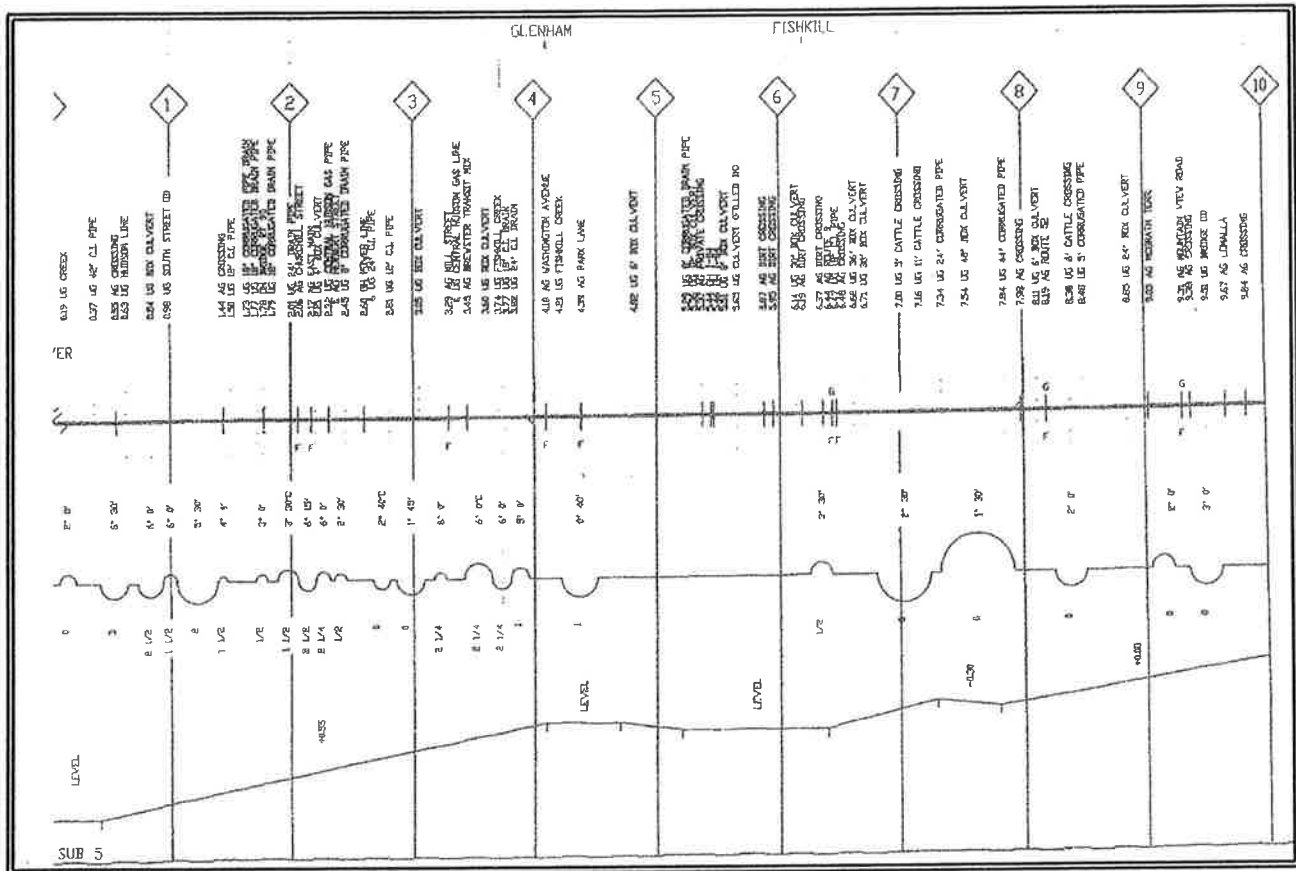
The single track Beacon Line meets the Hudson Line at Milepost 58.5, approximately 0.6 miles south of Beacon Station on Track 2. The control point where the Beacon Line interfaces with the Hudson is called “River” or CP 58. A train arriving westward on the Beacon Line can be directly routed through the network of remote controlled switches at CP 58 to any of the three station tracks at Beacon. Leaving River, the Beacon Line parallels the Hudson Line for a distance of approximately 0.5 miles. Along this segment the line is generally straight (tangent) and level. For a short distance, it hugs the shore of the Hudson River providing glimpses of the river beyond the trees. As the line reaches Dennings Point, the river recedes. A roadway at Dennings Point, leading to the proposed site of the River and Estuary Center, crosses the line.

An abandoned siding on the west side of the Beacon line rusts in the weeds and saplings between “River” and the overpass where Long Dock Road crosses over the Hudson Line immediately south of Beacon Station. It is possible that the new railway could be constructed along the approximate path of this siding and extended under the Long Dock Road overpass to provide a convenient point of transfer for passengers from the ferry and MNR main line passenger rail services to a Beacon Line shuttle/feeder service.

Approximately 1.1 miles south of Beacon Station, the Beacon Line turns eastward and crosses over the Hudson line on a single-track iron trestle. Once across the Hudson Line, the character of the Beacon Line changes from a tangent level railway to a sinuous and serpentine railway climbing along the North Bank of the Fishkill Creek at average rate of approximately 30 feet per mile. There are eight substantial curves between the Hudson Main Line crossing and Matteawan Station at East Main Street (MP2.2) in Beacon. Underscoring the steepness of the grade the

Fishkill Creek has three waterfalls in the less than two miles between Matteawan and the mouth of the Fishkill where it drains into the Hudson.

Figure 2.4
Track Chart of the Beacon Line MP 0 through MP 10



Source: Metro-North, Fred Nangle, April 2003

After passing Matteawan, the Beacon line continues curving up the Fishkill Valley on a continued grade until it reaches the site of the historic Glenham Station, approximately 4.7 miles from MNR's Beacon Station. At Glenham the grades and curves ameliorate for the 2.1 mile run to Fishkill and the Route 9/I-84 Interchange.

Operating Speeds - The Hudson Line is generally operated at 90 miles per hour (mph), however, there are several sections of the line in the study area that are operated at slower speeds.

- The passing siding is operated at 30 mph.
- Between Mileposts 59.7 and 61.4, both main tracks are operated at 80 mph.

The Beacon Line is rated for operations at a maximum of 25 mph for passenger services and 10 mph for freight trains.

Signals and Train Control - The two main tracks and the siding on the Hudson Main Line are Train Control System (TCS) signaled allowing trains to operate on any track in either direction. All trains operating on the line must be equipped with “cab signal” equipment to allow them to operate under the TCS signal control.

Signaling and train control on the Beacon Line is more primitive. Although it appears that the line may once have been controlled with a CTC signal system, today the single tracked Beacon Line is controlled using manual block control methods. The line segment between RIVER, at MP 0.0 and HOPE at MP 12.7 is a single control block that can only be occupied by a single train with express permission of the MNR train dispatcher’s desk in Manhattan.

Track Conditions – According to MNR records, the Hudson Line’s two main tracks are constructed with 132 pound continuous welded rail (CWR) on concrete ties. The rail was installed in 1991. The ties were installed in 1997. The siding is constructed of lighter 127 pound CWR on wooden ties. The siding was last surfaced with systematic replacement of bad ties in 1997.

The April 30, 2003, field visit to the study corridor found that the Beacon Line between River and Matteawan is generally constructed with heavy weight CWR on wooden ties⁷. The tie condition appeared to be fair to good. The rail was installed with a high density of rail anchors generally used to keep rail from moving on the track under stressfully heavy loads. It appears that the line has been maintained to allow heavy trains of stone and gravel to reliably operate on the grades and curves between Matteawan and RIVER.

The field visit found few locations with potential problems concerning ballast or drainage. Evidence of recent washouts was noted at two locations.

In the vicinity of the newly rebuilt Route 9D (Wolcott Avenue) overpass where the highway crosses above the Beacon Line west of Matteawan, there is a short segment of jointed rail with some minor drainage problems.

West of Matteawan, the line is constructed with jointed rail, which has not been engineered or maintained to the same heavy standard as the segment west of Matteawan.

Highway Grade Crossings – Between Beacon and Matteawan, there are two locations where automobiles cross the railway at grade: Dennings Point, one private crossing leading to site of the proposed apartment complex described earlier in this report, Churchill Avenue and East Main Street at Matteawan Station. East of Matteawan, there are thirteen roadway crossings at grade in the less than five miles before the railway reaches Fishkill Station. None of the grade crossings are currently equipped with Automatic Highway Warning Devices (bells, lights or gates).

⁷ Selected photographs from the field visit are found in Appendix B of this report.

CHAPTER 3. OPPORTUNITIES AND CONSTRAINTS

Introduction

Based on the goals and objectives and the existing conditions, the study team developed a narrative describing both the opportunities to provide a rail passenger service on the Beacon Line and the constraints that limit the ability to operate such a service. The analysis integrates the findings of the first two project tasks by mapping the aspirations of the goals and objectives onto the realities of existing conditions to develop an understanding of how existing and future conditions can support or block the achievement of plans.

Goals and Objectives

Distilling the information developed in Chapter 1 to its essential elements, the goals and objectives of local public officials and Metro-North concerning this project consist of the following:

- Clarify the technological, institutional and economic factors that influence the overall feasibility of passenger rail service on the Beacon Line
- Respond to and support the economic and cultural renaissance of Beacon
- Improve rail travel services for: Manhattan commuters, visitors to Beacon and local residents' mobility
- Provide a service that invokes nostalgia for the by-gone era of convenient local rail transportation services for small urban communities.
- Continue use of the Beacon Line for Metro-North's current applications including:
 - deadhead equipment trains
 - training trips
 - movement of track materials and work trains
 - occasional excursion trains

The analysis of goals and constraints considers the technological, institutional and economic opportunities and constraints that affect the feasibility of operating a rail shuttle "trolley" service on the Beacon Line.

Technological Opportunities

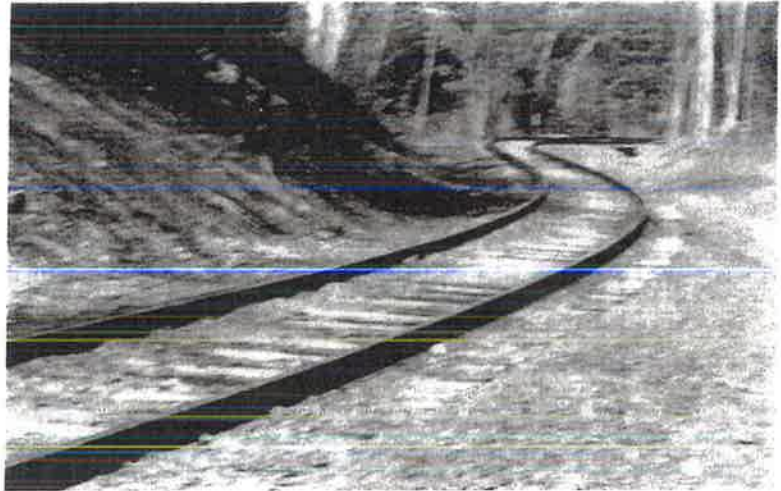
- Rail line is in place and maintained for 25mph passenger operations.
 - Travel time between Beacon and Matteawan would be less than ten minutes.
 - Travel time between Beacon and Fishkill would be about twenty minutes.
- Current use of line is low. This provides capacity for a passenger service between Beacon Station and Matteawan with a possible extension to Glenham or Fishkill.
- It appears that a route could be developed between Beacon Station and RIVER that would allow shuttle trains to access the station with no potential conflict to operations on

the Hudson Main Line. (e.g. a feasible path to extend the Beacon Line along the alignment of the Beacon Landing siding to Beacon Station appears to exist).

- The number of conflicts between a Beacon-Matteawan rail passenger service and other activities in the corridor is limited. (e.g. the number of highway grade crossings is manageable and the number of sensitive receptors near the railway are limited.)
- Currently, no potential conflicts exist with freight train operations on the railway.

Technological Constraints

- The curvature of the rail line will limit the speeds that can be economically achieved.
- The rail line is single track limiting opportunities for bi-directional traffic and reducing overall carrying capacity of the line.
- The curvature of the railway and adjacent land uses limit the opportunities to double track or to construct passing sidings in the study area west of Matteawan.



Track curvature near South Street

- Without special treatment, highway grade crossings on the line will require trains to sound loud whistles at frequent intervals, creating a potential noise nuisance for City of Beacon and other communities along the line.
 - Two highway grade crossings between Beacon and Matteawan.
 - Thirteen highway grade crossings between Matteawan and Fishkill.
- Local officials wish to avoid the noise, vibrations, and fumes associated with the operation of heavy diesel rail vehicles.

Institutional Opportunities

- Potential access to the line for public uses is enhanced due to its ownership by a governmental agency.
- The owner of the line, Metro-North, is committed to the support of rail passenger transportation.

- The City of Beacon appears to have the political resources to support a rail transportation initiative.
- The political and social climate in Beacon is conducive to change and investment.
- Aesthetically, the rail alignment presents access to views and landscapes that are not available to highway users.

Institutional Constraints

- Federal regulations require a waiver and special operating procedures to use a rail vehicle that does not comply with FRA standards on the rail line (e.g. vintage trolley, lightweight self-powered rail car).
- Absent a waiver, federal standards require trains to sound their whistles at all highway grade crossings.
- Due to safety considerations, frequent trains on the railway will require local residents to modify their current use of the railway line as an informal pedestrian corridor.
- Metro-North's use of the line for current purposes must be preserved.

Economic Opportunities

- Metro-North is a full service passenger railway with access to the engineering, mechanical, transportation, and administrative resources necessary to design and operate a passenger service on the Beacon Line.
- Public ownership of the line reduces cost of access for public transportation uses.
- Potential Metro-North operation of the shuttle presents potential to mitigate potentially burdensome premiums for liability insurance.
- Resources of non-governmental entities may be available to leverage funding for the service. (e.g. Dia Foundation, River and Estuary Institute).

Economic Constraints

- Fiscal resources of local governments to directly develop and support the service are negligible.
- Metro-North labor agreement and work rules may limit flexibility in achieving lowest cost crewing and service designs.

CHAPTER 4. SERVICE OPTIONS

This chapter describes two rail shuttle service options developed for evaluation. For feasibility studies such as the Beacon Trolley Study, a typical approach in designing sets of service packages for evaluation is to cover a range of investment, cost and service levels while also designing alternatives that tend to build upon one another in terms of investment. For the City of Beacon, the two service alternatives cover a range from a low cost minimal starter system to a fully developed mature system.

The options were developed to respond to the goals and objectives and the opportunities and constraints information developed in the first three project tasks. Key considerations in the development of the two alternative options included:

1. **Travel Markets to be Served** – A key objective of the project is to connect with Metro-North trains serving Beacon Station on the banks of the Hudson River. With an eastern terminal at Beacon Station, it will be possible to serve three potential travel market segments

- a. Metro-North Commuters
- b. Visitors to Beacon
- c. Local mobility

To serve all these markets most effectively, the shuttle service will need to operate weekdays from early in the morning until the early evening for the commuter market and also on weekend days when Dia:Beacon⁸ and other Beacon tourist attractions are open. Local mobility along the alignment can be served as a byproduct of serving the commuter and visitor markets.

2. **Rolling Stock** – Beacon officials indicated a desire to evoke small town nostalgia with a vintage trolley car linking Beacon Station and downtown Beacon. They also expressed a willingness to consider more modern equipment if vintage equipment showed economic or operational deficiencies.
3. **Metro-North Access to Line** – Metro-North's continued access to its line for its current and future operations must also be accommodated in the design of the service options. The service design must address the capability of the proposed rolling stock and operations with Metro-North's current and future uses of the line.

1. Travel Markets to be Served

One shuttle alternative was devised to focus on visitors to Beacon by providing service between Beacon Station and Matteawan five days each week (Thursday through Monday). The service meets most of the northbound Metro-North trains serving Beacon Station between 10:00am and 6:00pm and meets most of the southbound Metro-North trains serving Beacon Station between

⁸ Dia:Beacon is open Thursday through Monday 11:00am to 6:00pm during the high season.

In the low season, (mid October – mid April) Dia:Beacon is open Friday – Monday 11:00am to 4:00pm.

Dia:Beacon closes on Thanksgiving Day, Christmas Day and New Year's Day.

10:55am and 8:00pm. When the museum is closed, on Tuesdays and Wednesdays, there is no service. This alternative provides limited local mobility and is of limited utility to local commuters.

The second alternative provides commuter service between Fishkill and Beacon Station, and meets Metro-North peak trips to and from Beacon Station. The service is oriented towards moving commuters to Beacon Station and New York City in the morning and away from Beacon Station in the afternoon. Short five minute transfer times between shuttle arrival/departure and Metro-North train departure/arrival are scheduled⁹. The service operates on weekdays between 5:25am and 9:45pm. Weekend service is provided only between Matteawan and Beacon primarily to serve area visitors. This alternative also serves the visitor market and provides limited local mobility.

2. Rolling Stock Options

There are two major options for rolling stock including:

- Replica Trolleys
- Self Powered Rail Vehicles (SPRV)

Replica Trolleys

Vintage trolleys or replicas of vintage trolleys are operated in several locations in the United States including Lowell, MA, Kenosha, WI, Astoria, WA, and Memphis, TN. The lines operated vary in length from one to six miles. The trolley line in Little Rock, AR is scheduled to open in 2004.

<p style="text-align: center;">Table 4.1 Sample of Existing Vintage Trolley Services</p>				
Location	Line Length (miles)	Number of Stations	Fleet	Service Start Date
Astoria, WA ¹⁰	3.0	9	1 American Car Co. car	1999
Dallas, TX ¹¹	3.6	7+	4 miscellaneous cars	1989
Denver, CO ¹²	3.5	6	1 Gomaco replica car	1989
Kenosha, WI ¹³	2.0	17	5 refurbished Toronto PCC cars	2000
Little Rock, AR ¹⁴	2.2	NA	3 Gomaco replica cars	2004
Lowell, MA ¹⁵	1.0	Several	3 Gomaco replica cars	1984
Memphis, TN ¹⁶	4.5	12	15 rehabilitated cars: 14 international, 1 Gomaco replica car	1993

⁹ Loop Buses 41A and 42A provide a seven to ten minute connection time between the bus and Metro-North trains, source: <http://www.dutchessny.gov/loopctcsched.htm#beacon>

¹⁰ Source: <http://www.railwaypreservation.com/vintagetrolley/seattle.htm>

¹¹ Source: <http://www.mata.org/>

¹² Source: <http://www.railwaypreservation.com/vintagetrolley/denver.htm>

¹³ Source: <http://www.railwaypreservation.com/vintagetrolley/kenosha.htm>

¹⁴ Source: <http://www.railwaypreservation.com/vintagetrolley/littlerock.htm>

¹⁵ Source: <http://www.railwaypreservation.com/vintagetrolley/lowell.htm>

¹⁶ Source: <http://www.railwaypreservation.com/vintagetrolley/memphis.htm>. MATA has recently awarded a contract to Gomaco to rehabilitate three other cars purchased for a service expansion.

Table 4.1 Sample of Existing Vintage Trolley Services				
Location	Line Length (miles)	Number of Stations	Fleet	Service Start Date
Portland, OR	2.0	Numerous	4 Gomaco replica cars	1991
San Francisco, CA F Line ¹⁷	5.8	12+	17 PCC, 3 Milan Peter Witts, 4 historic cars	1988, extended 2000
Seattle, WA ¹⁸	2.0	9	5 W2 Melbourne cars	1982
Tampa, FL ¹⁹	2.3	12	8 new ADA accessible Gomaco replica cars	2002

Why build a trolley system?

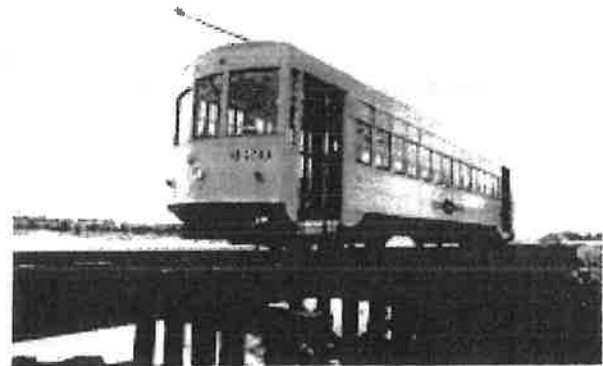
The development of a vintage trolley operation is usually driven by economic reasons, often the desire to help rejuvenate a local business economy, typically by operating as a tourist draw linking shopping with a parking lot. A trolley can be an excellent way to circulate people between local attractions, and at the same time, the trolley ride itself becomes part of the experience, further enhancing the attraction. Establishment of a vintage trolley system can also help attract additional investment because the fixed nature of the trolley infrastructure implies permanence. Kenosha Transit's new streetcar line, for example, was planned as part of the city's redevelopment of a 64-acre former auto plant site on Lake Michigan for housing, business, and recreation.

Vintage trolley systems may be less expensive to build and operate than conventional rail systems. Trolley systems also fit into a traditional community. Quiet, pollution-free electric trolleys blend in well with the community, and their slow scheduled speeds let the passengers enjoy the ride, taking in the local landscape as they travel.

Though most trolley systems serve markets heavily oriented to tourism and recreational traffic, they also provide a high-visibility service that appeals to other transit users, introducing a new generation of riders to the advantages of rail transport.

Trolley Technology

Rolling Stock - The principal U.S. supplier for replica trolleys, Iowa's Gomaco Trolley Company, has been building trolleys since 1982, when it supplied the first of three replicas for a trolley line serving the Lowell, Massachusetts National Historical Park. The firm has since supplied replicas for Portland, Denver, and Memphis. Gomaco has also recently built replica double-truck Birney cars for Tampa (2001) and for Little Rock (2003). Depending upon the specifications and the inclusion of such features as air



Gomaco replica car in service in Tampa, FL

¹⁷ Source: <http://www.railwaypreservation.com/vintagetrolley/sanfrancisco.htm>

¹⁸ Source: <http://www.railwaypreservation.com/vintagetrolley/seattle.htm>

¹⁹ Source: <http://www.railwaypreservation.com/vintagetrolley/tampa.htm>

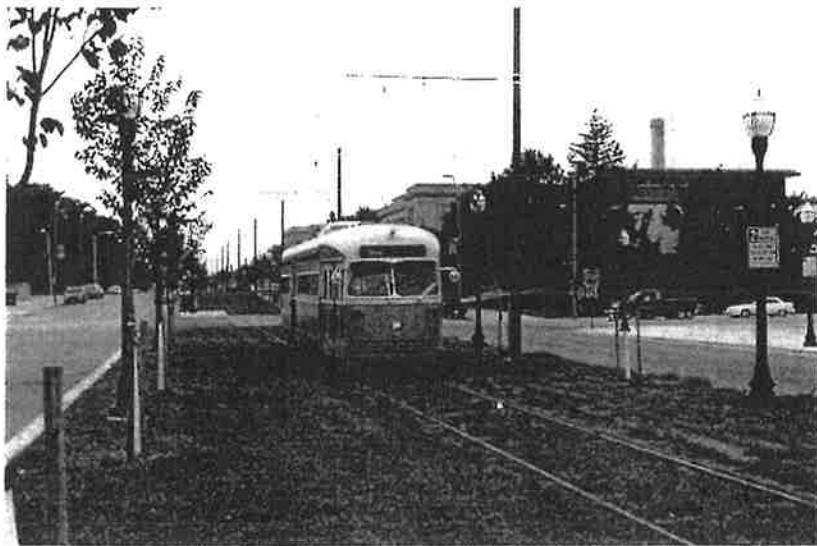
conditioning and onboard wheelchair lifts, replica car costs can range from \$500,000 to \$800,000 per car.

The Federal Railroad Administration has determined that trolley equipment is not constructed to a crashworthiness level to offer an acceptable level of safety for operation in mixed traffic with conventional railway equipment such as freight trains and locomotive-hauled commuter trains. Since the Beacon Line is connected to the nation's conventional rail network and is subject to FRA regulation, operation of trolleys on the Beacon line would require a federal waiver. The waiver would likely be granted if the operation ensures that the trolleys and conventional equipment would not be on the line at the same time.

Rail Width²⁰ - Historic trolleys were built to run on trolley rails that in some cases are slightly narrower than modern light rail and freight rails. Current switches (frogs) are engineered for freight rail width, and authentic trolleys, with their narrower wheels, may derail on entering the switches. The variety of wheels on the different vintage trolleys may also increase the risk of derailment in a mixed operation. Replica trolleys are designed to operate on conventional rail rather than traditional trolley rail.

Power Distribution - The classic trolley is powered by electricity, normally drawn from wire suspended above the track. The choice of overhead wire construction style will impact the appearance of the system. Two principal types of overhead wire construction exist:

Direct suspension trolley wire is typical of urban streetcar systems and consists of a single wire running parallel to the center of the track, suspended at a height of about 18 feet. For Beacon, the wire would be suspended by bracket arms attached to poles next to the track. Carefully designed direct suspension overhead wire can be quite simple and thus be minimally intrusive to the appearance of the area served by the line.



Kenosha, Wisconsin trolley with direct suspension trolley wire

Catenary construction is more typical of interurban trolleys running between cities, modern light rail lines, or electrified main line railroads. Catenary suspension, especially modern designs, is considerably more complex than direct suspension and thus is more visually intrusive and more expensive to build and maintain. Catenary construction is not recommended for the 25mph maximum speed operation on the Beacon Line.

²⁰ Source: Lowell National Historic Park Alternative Transportation System Historic Trolley Study, Final Report, Appendix A December 2002.

DC Propulsion - Trolleys traditionally operate on 600 volts direct current, drawn from an overhead wire (by means of a trolley pole) and returned through the rail (by the wheels)²¹. Since the power to operate all the cars on a line must pass through a single small trolley wire, the capacity of that wire will be exceeded if many cars operate simultaneously. Thus trolley power systems are normally broken into separate "sections", each fed by a different generating source. The need for multiple power sections may be avoided if only a modest single car system is proposed for Beacon.

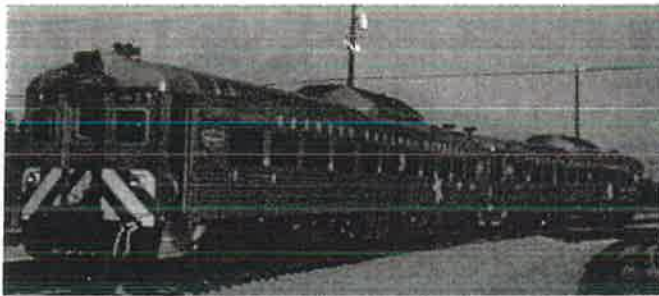
Utility companies are seldom able to supply 600 volt DC power since virtually all utility customers today use alternating current (AC). Generally trolley operators use special facilities (solid state rectifiers) to adjust commercial AC voltage and convert it to direct current. Alternate sources of power such as wind, solar, or water power can also provide DC power. (It is not known if the mill dams along the Fishkill could be adapted to propel the Beacon Trolley.)



Mill Dam at Matteawan Station

Self Powered Rail Vehicles (SPRV)

During the last half century, European and Asian nations have been continuing to develop and extensively deploy diesel self powered rail cars for use on light density passenger lines and for urban transit networks of smaller cities.



Dallas/Fort Worth commuter rail service RDCs

The conventional railroad diesel rail car was designed to overcome the disadvantages of locomotive hauled equipment for light density rail passenger services. Each car is self-propelled allowing shorter train lengths while avoiding the costs of locomotives. In short trains the self propelled cars can offer better fuel economy than a push-pull train and can be adapted to one-person train operation.

The self-propelled cars can also offer more attractive acceleration than the locomotive trains.

The conventional railroad diesel rail car is a special case of the diesel multiple unit (DMU) vehicle. The Transportation Research Board defines the DMU as a "self-propelled rail car using on-board sources of motive power." Motive power may be diesel internal combustion engines or an alternative self-contained, on-board source. Most current DMUs rely on diesel engines. The conventional railroad diesel rail car (RDC) is unusual among DMU's in that it meets Federal

²¹ Modern light rail lines typically use somewhat higher voltage (750 or 1000 volts) to power the higher performance and heavier light rail equipment. Thus if a heritage trolley operation plans to use the track of a light rail system, and if historic cars or replica cars with traditional equipment are to be used, then the cars may have to be modified to operate at this higher voltage. Dedicated heritage trolley lines can simply be built to use 600 volt power.

Railroad Administration safety regulations for operation in mixed traffic on the North American conventional railroad network. Most modern day DMU's are too lightly constructed to meet FRA safety requirements that focus on minimizing the potential for catastrophe should a light passenger vehicle collide with a much heavier rail freight vehicle.



The archetypical conventional rail diesel car is the Budd RDC. Hundreds of Budd cars were built in the 1950's for operation on rail passenger branch lines as well as some main line services. The Boston and Maine and New Haven railroads owned more Budd cars than any other railway in the world. With changes in transportation regulation and economics in the late 1950's the market for RDC's to operate on light density passenger routes almost vanished. Nearly all remaining and restored rail passenger services have enjoyed traffic densities that favor push-pull operations or the operation of electric cars under overhead catenary lines. In the last 40 years very few DMU vehicles qualified to operate in general railroad service have been manufactured in North America. Where RDC's have been required, units remaining from the 1950's have been kept in service or restored to operating condition. The City of Syracuse works with the New York and Susquehanna and Western Railroad to operate a 3 mile tourist oriented service with vintage RDC equipment, 230 miles northwest of Beacon.

Syracuse OnTrak service provided with M-8 RDC vehicles



Colorado Railcar single level DMU

In 2002, Colorado Railcar Manufacturing LLC built a brand new DMU. This new unit complies with federal standards for operation in mixed traffic with conventional railcars. Colorado Railcar is offering two models of its new DMU: a bi-level seating up to 185 passengers and a single level car seating 104 passengers. Both cars are 85 feet long. The single level car weighs 74 tons.

These new models may be especially attractive for the proposed shuttle service because they were designed for tourist traffic. They can be configured with dome windows to facilitate sightseeing. Vista domes are available for either the single level or bi-level car. Conversations with Colorado Railcar indicate that they are confident they can build units that are bi-directional and compatible with one person train operation. The DMU technology is compatible with FRA regulations for general use on North America's conventional railroad network. For the Beacon

line, the Colorado Rail Car product could help address safety concerns of the Federal Railroad Administration and Metro-North.

3. Metro-North Access to the Line

Metro-North maintains the Beacon Line as a route for deadheading equipment trains moving between Beacon on the Hudson Line and Brewster on the Harlem Line. Metro-North also reportedly uses the line for the training of rail transportation staff and for the movement of track materials and work trains. It is also used for the occasional excursion train.

Actual use of the line by Metro-North in 2002 was a total of two trains. The MNR Maintenance of Way Department is known to store work equipment on the Beacon Line near its connection to the Hudson Line. Metro-North has no plans to substantially increase its use of the line in the foreseeable future.

Service Alternatives

This element of the study report describes the two proposed service structures for evaluation in the City of Beacon Trolley feasibility study. They include:

1. **Beacon Matteawan Shuttle:** Visitor Service from Beacon Station to Matteawan
2. **Beacon Fishkill Shuttle:** Commuter Service between Beacon Station and Fishkill

The service structures were designed to operate with the minimum allowable rail infrastructure. The set of service structures was also designed to provide an expansion path wherein service could be incrementally expanded from a shuttle service to a commuter-feeder service.

Methodology

Running Times and Performance Calculations - For each train and station, KKO's scheduling tools make a number of calculations that evaluate alternative rolling stock configurations and station stopping patterns. Representative calculations for a proposed 7 mile 25mph DMU service are shown in Table 4.2.

Each station stop is marked with a 1 in the stop column, and a dwell of 30 seconds is used at each intermediate station. A one minute dwell is employed at Matteawan station in downtown Beacon. In this example, a trip from Fishkill to Beacon with three intermediate stops is projected to take 20 minutes.

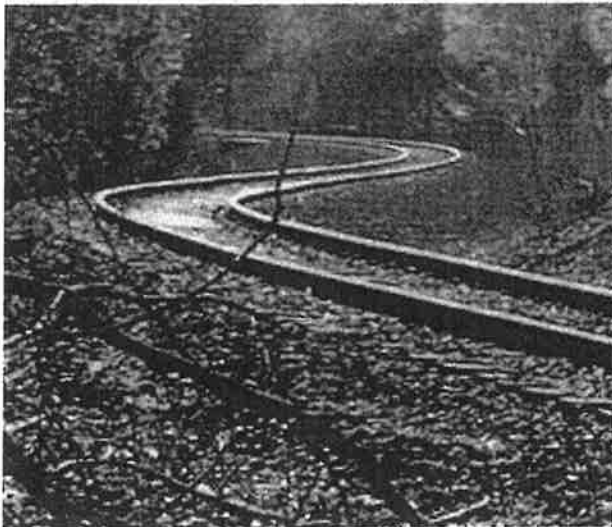
Table 4.2
Representative Service between Fishkill and Beacon Station

<i>Inbound Service</i>		002	Projection Input Data									Distances	
STATION	Mile Post	Projected Departure Time	Depart Time	Avg MPH	Stop ?	Ons*	Offs	Cycle	Accel. & Dec. Time	Line Haul Time	Dwell Time	Accel. & Dec. Miles	Line Haul Miles
<i>Fishkill</i>	6.8	6:00:00	6:00 AM	xxxx	1			a					
Glenham	4.7	6:05:51		25	1	19		a	00:36	04:44	00:30	0.13	1.97
Tallix	2.9	6:10:10		25				a	00:00	04:19	00:00	0.00	1.8
Matteawan	2.7	6:11:57		25	1	56		a	00:36	00:10	01:00	0.13	0.07
Tioronda Ave	2.0	6:13:37		25				a	00:00	01:41	00:00	0.00	0.7
South Ave	1.6	6:14:35		25				a	00:00	00:58	00:00	0.00	0.4
Dennings Point	1.1	6:16:35		25	1	19		a	00:36	00:54	00:30	0.13	0.37
Beacon	0.0	6:20:34		25	1		94	a	00:36	02:20	01:03	0.13	0.97

Maximum Allowable Speed

Several considerations lead to the selection of 25mph as the maximum allowable speed for this service.

- First, the track is presently rated and maintained for 25mph operations. No substantial upgrade would be required to initiate service.
- Second, the density and severity of curves along the railway between Matteawan and CP58 indicate 35mph would be the maximum safe speed at many locations regardless of track maintenance standards.



- Third, the line offers passengers views that would be more difficult to enjoy at higher speeds.
- Fourth, lower speeds may ameliorate safety concerns at highway grade crossings.
- Fifth, the trip durations are generally quite short even at the relatively slow speeds.
- Sixth, passenger comfort through curves would likely be compromised at speeds greater than 25mph.
- Seventh, the maximum operating speed of many vintage trolleys is 30mph.

Station Locations

Beacon Shuttle Depot (MP0.0)

KKO proposes that the Beacon Shuttle station be constructed on the southwest quadrant of the Metro-North Station site to facilitate easy transfer to and from Metro-North trains. The site would also facilitate transfers to the proposed Newburgh Ferry.



Retired siding at Beacon Landing

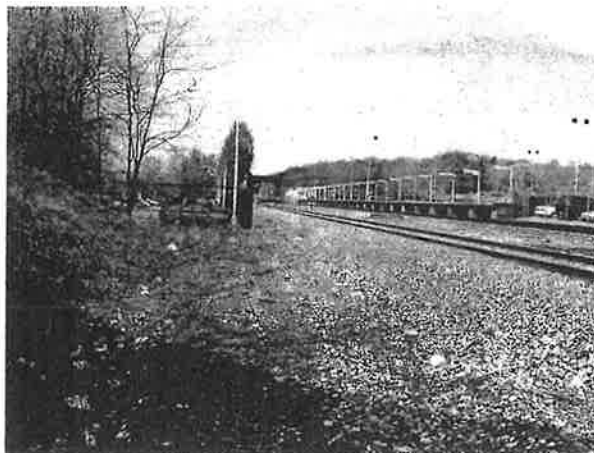
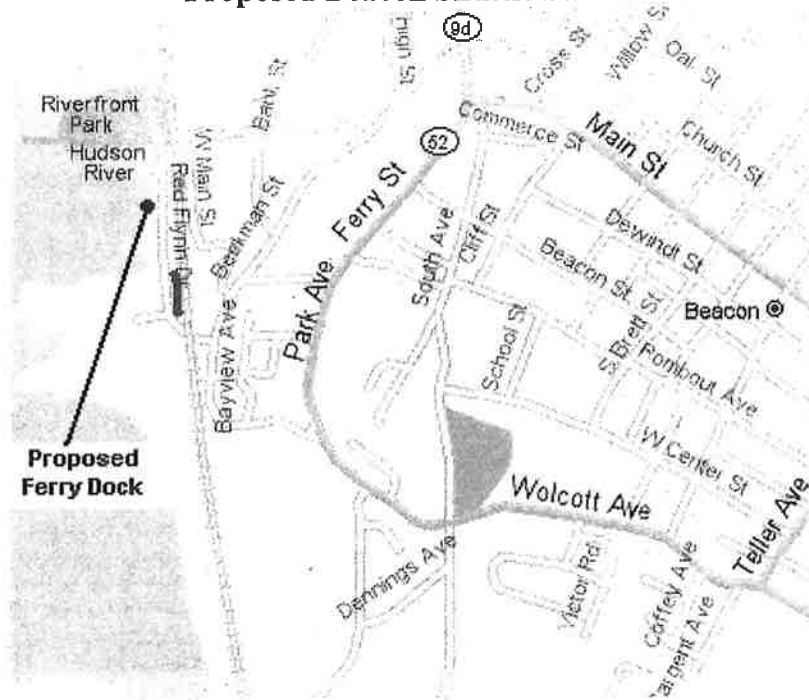


Overgrown retired siding



Connection of retired siding to Beacon Line

Figure 4.1
Proposed Beacon Shuttle Station



Proposed Beacon Shuttle Station Site



Hudson Line & Beacon Landing Parcel

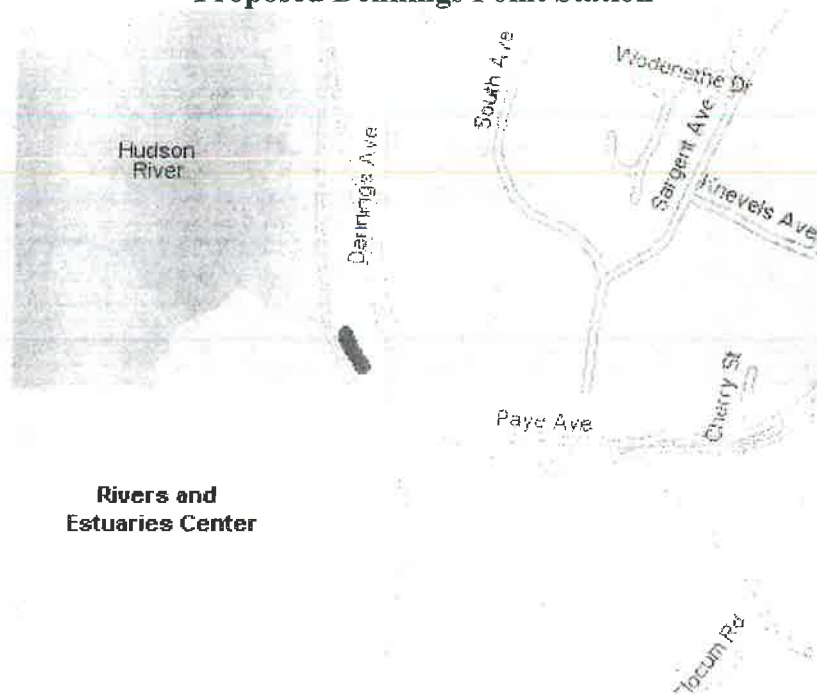
Dennings Point (Rivers and Estuaries Center) Station (MP1.1)

KKO proposes that the station for the Rivers and Estuaries Center site be constructed at the private crossing used to access the site from Dennings Avenue.



Private grade crossing to Dennings Point

Figure 4.2
Proposed Dennings Point Station



Matteawan Station (MP2.7)

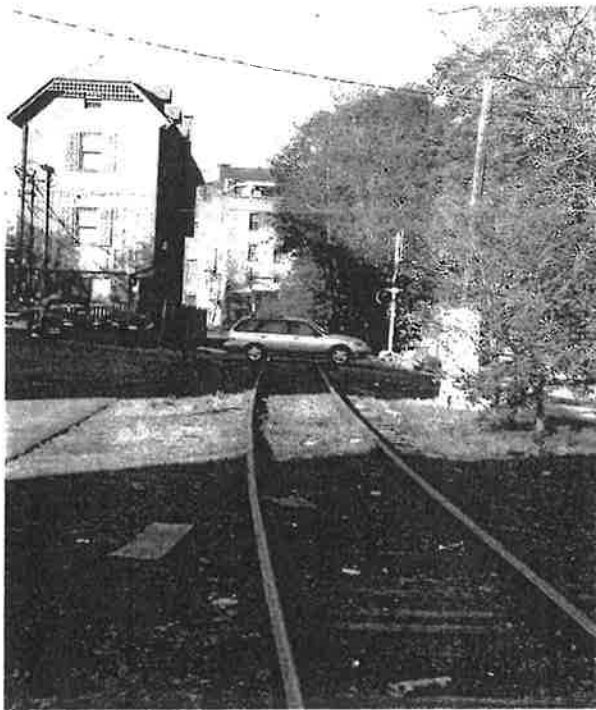
The historic Matteawan station is still standing north of the railway between Churchill Street and East Main Street in downtown Beacon. KKO proposes that the eastern terminus of the Beacon-Matteawan Shuttle service be constructed immediately west of Churchill Street adjacent to municipal land and across from the privately owned historic station.

Figure 4.3

Proposed New Matteawan Station Location



Proposed Matteawan Station Location at Churchill



Proposed Matteawan Station Location



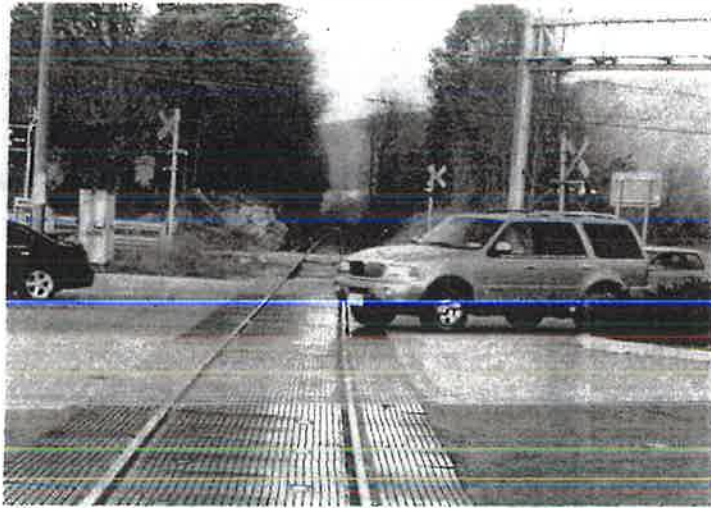
Historic Matteawan Station from Southeast

Glenham

No recommendation is made regarding Glenham Station.

Fishkill Station

It is recommended that a site west of Route 9 be considered for the Fishkill Station to avoid a railway crossing of this busy thoroughfare. The historic Fishkill Station location is immediately west of Route 9 on property that is currently used for store building materials. It has not been determined where a parking lot for rail commuters near the proposed Fishkill Station would be located.

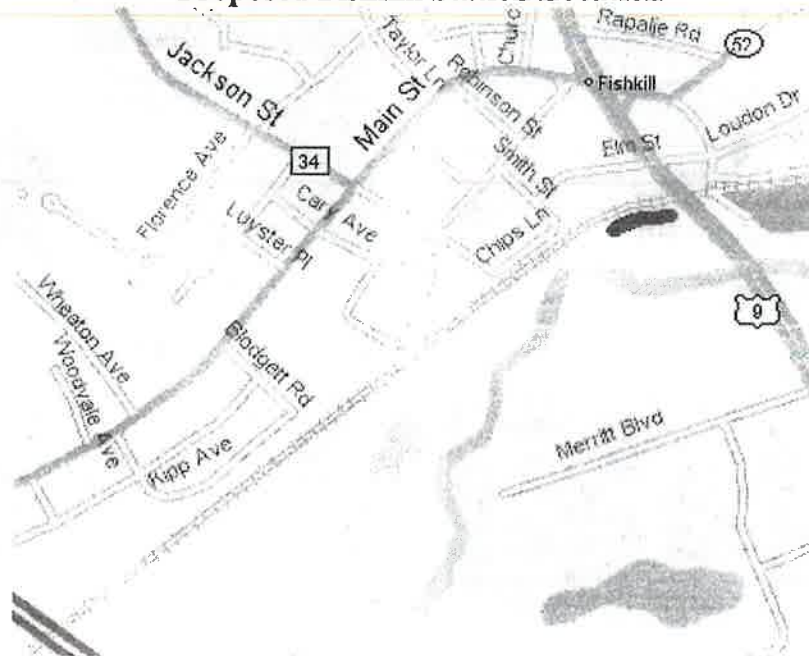


Looking east from proposed Fishkill Station



Existing Fishkill Station

Figure 4.4
Proposed Fishkill Station Location



Service Design

Two service designs were developed to respond to the two service alternatives.

1. **Beacon Matteawan Trolley:** A visitor oriented replica electric trolley service running 2.7 miles between Beacon and Matteawan depots.
2. **Beacon Fishkill Shuttle:** A commuter oriented SPRV service running 6.8 miles between Fishkill and Beacon Depot.

Service design considerations include hours and days of service, stopping patterns, intermodal connections and minimum rail infrastructure requirements.

1. Beacon Matteawan Trolley: Visitor Service between Beacon Station and Matteawan

Service Description - This service alternative would cater to visitor travel between Beacon Station and attractions in downtown Beacon. Frequent service with a single car would be offered to move tourists and local residents between Beacon Station and downtown Beacon at Matteawan. To contribute to local aesthetic and tourism development goals, a replica trolley (such as Gomaco's ADA compliant four-season Birney replica trolley) is considered for this service alternative. The electric trolley will require overhead wire for propulsion between Matteawan and the Beacon Depot. The 2.7 mile service between Beacon Station on the Hudson Line to the downtown Matteawan Station is proposed to have one intermediate stop at Dennings Point where the Rivers and Estuaries Center will soon be opening. The estimated end to end running time for this service is 8 minutes. The running time includes 30 second dwells at the intermediate station, as well as a one minute pad at the terminal station.



Service would be provided five days a week, from Thursday to Sunday to coordinate with the Dia:Beacon hours of service. Dia:Beacon is open from 11:00am to 6:00pm in the high season and the Trolley service is scheduled to operate between 10:10am (depart Matteawan) and 6:50pm (last eastbound from Beacon). In the low season (mid October to mid April) Dia:Beacon closes at 4:00pm and service is scheduled to terminate at 5:30pm. It is envisioned that PDCTC fares would be charged for the trolley with on-board fare collection.

Table 4.3 Northbound Sample Running Times		
Station	Milepost	Sample Time
Beacon	0.0	8:00am
Dennings Point	1.1	8:03am
Matteawan	2.7	8:08am

Schedule - Thirty minute headways would be achieved with one car and a single operator. The schedule of services presented in Appendix C have a minimum of five minute "turns" at Matteawan and Beacon Station. The weekday schedule operates on Thursdays, Fridays, and Mondays, with extended service on Fridays. The weekend schedule is operational on Saturdays and Sundays with extended service on Saturdays. In the low season, the schedule is reduced with service scheduled to stop at 6:58pm on Fridays and Saturdays, and at 5:30pm on Sunday, Monday and Thursday as shown in Table 4.4. KKO estimates that the addition of two stations at South and Tioronda Avenues would add two minutes to the overall trip time and be compatible with the service structure defined.

Table 4.4 Beacon Matteawan Trolley Schedule Statistics				
	First Trip Departs	Last Trip Arrives	Total Trips	MNR Trains Met ²²
High Season²³				
Thursday	10:10am	6:58pm	34	18
Friday	10:10am	8:58pm	40	23
Saturday	10:10am	8:58pm	40	21
Sunday	10:10am	6:58pm	34	17
Monday	10:10am	6:58pm	34	18
Low Season²⁴				
Thursday	10:10am	5:30pm	28	14
Friday	10:10am	6:58pm	34	18
Saturday	10:10am	6:58pm	34	17
Sunday	10:10am	5:30pm	28	14
Monday	10:10am	5:30pm	28	14

The service design would provide 28 to 40 daily trips connecting with 14 to 23 Metro-North trains. In a typical year, the service would operate with 24,494 annual revenue train miles and 2,379 annual revenue train hours. Table 4.5 summarizes the service statistics on a daily and weekly basis.

Table 4.5 Beacon Matteawan Trolley Summary of Service Characteristics					
Service Structure Alternative	Route Miles	Daily One Way Trips	Daily Revenue Miles	Daily Train Hours	Peak Vehicles
1. High Season (183 Days per year)					
Thursday, Sunday, and Monday	2.7	34	91.8	8:48	1
Friday and Saturday	2.7	40	108.0	10:48	1
Weekly		182	491.4	48:00	
2. Low Season (179 Days per year)²⁵					
Thursday, Sunday, and Monday	2.7	28	75.6	7:20	1
Friday and Saturday	2.7	34	91.8	8:48	1
Weekly		122	410.4	39:36	

Infrastructure - The visitor service would generally operate on existing track with no speed improvements above the current 25mph maximum speed. The service would cross two low traffic roadways at grade.

²² Train connection made in 10 minutes or less. Less favorable train connections are not counted in this total.

²³ Dia:Beacon is open from 11:00am to 6:00pm mid April to mid October.

²⁴ Dia:Beacon is open from 11:00am to 4:00pm mid October to mid April.

²⁵ Service is not offered on Thanksgiving, Christmas or New Year's Day.

Table 4.6 Highway Grade Crossings between Beacon Station and Matteawan	
Roadway	Milepost
Dennings Point crossing	1.17
Private crossing	2.06

The service requires the construction of approximately 3,300 feet of new track along the alignment of the existing retired passing siding that runs northbound from the junction of the Beacon and Hudson Lines (CP58) to the west side of the Metro-North Beacon Station (MP59.10). The service design would also require the installation of 2.7 miles of trolley wire, the construction of a one car car barn for storage and maintenance, and the acquisition of one ADA compliant replica trolley. Since only a single car service is envisioned no signal control system would be required. Upgraded warning devices for two grade crossings could be required.

Table 4.7 Rail Infrastructure Requirements Beacon Matteawan Trolley	
Rail Infrastructure	
Track	Rebuild existing retired siding from CP58 to MP59.1
Wire	2.7 miles of direct suspension trolley wire and supporting structures including ac/dc inverter
Sidings	None
Signal Control Improvements	None
Grade Crossing Protection	2
Maintenance Facilities	One vehicle layover facility
Rolling Stock	One Replica trolley

This trolley service would require an FRA waiver for operation. It is likely that this waiver would be granted if Metro-North agreed to limit conventional rail equipment operations on this portion of the Beacon Line to periods when trolleys would not be operating. Conventional rail equipment could operate for at least 13 hours of any day between 9:00pm and 10:00am the following morning. Metro-North's conventional rail equipment could operate all day on Tuesdays and Wednesdays when the trolleys are not operating.

2. Beacon Fishkill Shuttle: Commuter Service between Beacon Station and Fishkill



Service Description - The commuter service between Beacon Station and Fishkill is proposed to have three intermediate stops at Dennings Point, Matteawan and Glenham²⁶. In consideration of rider comfort, grade crossing safety, and lower regulatory hurdles, an FRA compliant SPRV (such as the Colorado Railcar DMU) is considered for this service alternative. Since this service operates seven days a week with a peak vehicle requirement of two units. A fleet of three SPRVs is recommended to provide backup and maintenance

spares. No overhead wire is required for this type of vehicle.

Estimated end to end running time for this service structure is 20 minutes. The running time includes 30 second dwells at the intermediate stations, as well as a one minute pad at the terminal station. The service operates between 4:30am and 10:15pm on weekdays and between 10:00am and 7:00pm on weekends (9:00pm on Saturdays). Two sets of equipment provide the peak period services and one car provides shuttle service in the midday. A connection is provided to the majority of the peak period Metro-North trains. A single car train with a one person crew is envisioned. Fares would be collected with a proof of payment ticket scheme supported by ticket vending machines at each of the five stations.

Table 4.8 Northbound Sample Running Times		
Station	Milepost	Sample Time
Beacon	0.0	8:00am
Dennings Point	1.1	8:03am
Matteawan	2.7	8:08am
Glenham	4.7	8:13am
Fishkill	6.8	8:20am

Schedule – Frequent peak service is achieved on weekdays with two operators. The schedule of services presented in Appendix D has a minimum of five minute “turns” at Fishkill and Beacon Station. The turns are set at 10 minutes outside of the peak period.

On weekdays, this service alternative would cater to commuting travel between a Fishkill Park and Ride Lot adjacent to Route 9 near the exit from I-84 and New York City via Metro-North. It would also provide mobility for visitors and local residents. The weekday schedule operates Monday through Friday. The Beacon Matteawan shuttle weekend schedule would be operated on Saturdays and Sundays with extended service on Saturdays. In the low season, the weekend schedule is reduced with service scheduled to stop at 6:58pm on Saturdays, and at 5:30pm on Sundays as shown in Table 4.9. There is no service on Thanksgiving Day, Christmas or New Year’s Day.

²⁶ Support for passenger rail service to the Village and Town of Fishkill was documented in July 2003 correspondence to Clara Lou Gould, Mayor of Beacon from Joan A. Pagones Town of Fishkill Supervisor, and Mayor James J. Miccio of the Village of Fishkill.

Table 4.9 Beacon Fishkill Shuttle Schedule Statistics				
	First Trip Departs	Last Trip Arrives	Total Trips	MNR Trains Met²⁷
High Season				
Monday through Friday	5:26am	10:13pm	46	27
Saturday	10:10am	8:58pm	40	21
Sunday	10:10am	6:58pm	34	17
Low Season				
Monday through Friday	5:26am	10:13pm	46	27
Saturday	10:10am	6:58pm	34	17
Sunday	10:10am	5:30pm	28	14

The service design would provide 28 to 46 daily trips connecting with 14 to 27 Metro-North trains. In a typical year, the service would operate with 78,865 annual revenue train miles and 6,591 annual revenue train hours. Table 4.10 summarizes the service statistics on a daily and weekly basis.

Table 4.10 Beacon Fishkill Shuttle Summary of Service Characteristics					
Service Structure Alternative	Route Miles	Daily One Way Trips	Daily Revenue Miles	Daily Train Hours	Peak Vehicles
1. High Season (183 Days per year)					
Weekdays ²⁸	6.8	46	239.0	23:35	2
Saturdays	2.7	40	108.0	10:48	1
Sundays	2.7	34	91.8	8:48	1
Weekly		304	1,394.8	137:31	
2. Low Season (179 Days per year)					
Weekdays	6.8	46	239.0	23:35	2
Saturdays	2.7	34	91.8	8:48	1
Sundays	2.7	28	75.6	7:20	1
Weekly		292	1,362.4	134:03	

²⁷ Train connection made in 10 minutes or less. Less favorable train connections are not counted in this total.

²⁸ Most midday trips terminate at Matteawan.

Two one car train sets would be used on weekdays to provide the commuter service, with one set completing 32 one way trips and the second set completing 14 one way trips.

Table 4.11			
Weekday Use of Two Train Sets			
	Start Time	End Time	Total Hours
Set A	6:10am	9:43pm	15:33
Set B	5:26am	8:43am	3:17
	5:28pm	10:13pm	4:45
	Set B hours		8:02

Infrastructure - As with the first alternative, the service would generally operate on existing track with no speed improvements above the current 25mph maximum speed. The service does require the construction of approximately 3,300 feet of new track along the alignment of the existing retired passing siding that runs northbound from the junction of the Beacon and Hudson Lines (CP58) to the west side of the Metro-North Beacon Station (MP59.10). Two short passing sidings on the Beacon Line at Matteawan Station (MP2.7) and at Glenham (MP4.7) would also be required. The service would cross up to 13 roadways at grade. It is very possible that some of these crossing could be closed or consolidated. It is recommended that automatic highway warning devices at all remaining crossings be upgraded to provide reduced likelihood of collisions between rail and highway vehicles.

Table 4.12	
Highway Grade Crossings between Beacon Station and Matteawan	
Roadway	Milepost
Dennings Point crossing	1.17
Private crossing	2.06
Churchill Street	2.68
East Main Street	2.79
Herbert Street	2.94
Mill Street	3.91
Brewster Transit Mix	4.07
Washington Avenue	4.72
Park Lane	5.01
Private Crossing	5.99
Dirt Crossing	6.49
Dirt Crossing	6.57
Dirt Crossing	6.81

The service also requires the installation of 6.8 miles of CTC signal system to operate safely with multiple trains on the single track railway. This service design also requires the acquisition of three SPRVs and a three car car barn to store and maintain the SPRV equipment.

Table 4.13	
Rail Infrastructure Requirements	
Beacon Fishkill Shuttle	
Rail Infrastructure	
Track	Rebuild existing retired siding from CP58 to MP59.1
Wire	None
Sidings	2 short passing sidings at Matteawan and Glenham Stations
Signal Control Improvements	6.8 miles of CTC
Grade Crossing Protection	Up to 13
Maintenance Facilities	Three vehicle layover facility
Rolling Stock	Three self powered rail vehicles

Because the Colorado Rail Car DMU complies with all federal railroad safety regulations no federal waivers would be required for operation. The DMU could operate in mixed traffic with any conventional railway equipment that Metro-North may wish to operate on the line.

CHAPTER 5. SERVICE EVALUATION

This chapter describes the estimates of the costs and benefits of developing and operating the two service alternatives. The chapter also compares and contrasts the alternatives relative to their likely operating costs, capital costs, and ridership potential.

Capital Requirements and Costs

1. Beacon-Matteawan Trolley

Capital elements for the Beacon-Matteawan Trolley include:

- **Track and train control improvements**

A 3,300 foot siding would be required between CP58 and the Metro-North Beacon Station. Additional track into a car barn would also be required. Two hand operated switches would be needed, one at the entrance to the Beacon Landing siding and another to access the maintenance facility.

The line currently operates with a manual block signal system, with one block between River at MP0.0 and Hope at MP12.7. No upgrade of the existing train control system would be required for the one train shuttle service.

- **Grade crossings**

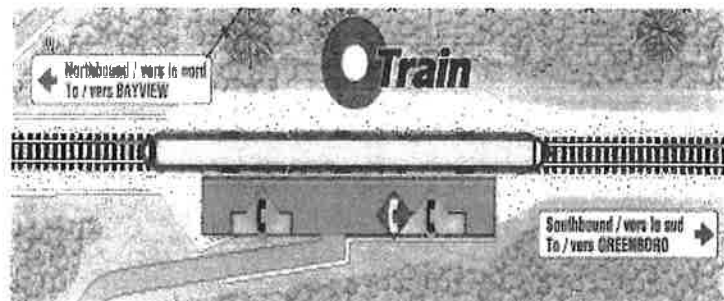
The line crosses two roadways at grade between Beacon Depot and Matteawan. KKO recommends flashers and four quadrant crossing gates at each location to provide the highest level of safety and to minimize potential trolley –automobile collisions.

- **Electric propulsion**

A replica trolley could provide the Beacon-Matteawan Trolley service. Trolleys operate on DC power obtained from an overhead wire. Installation of the overhead wire and supports is included in the estimate of the capital costs. A substation would also be required to provide the necessary voltage for the service. For efficient power distribution, it is recommended that the substation be constructed at the center of the line near South Street.

- **Stations**

A simple single track station with a platform on one side is envisioned for the three stations on the line. The downtown Matteawan station would be designed to be historically pleasing and to fit into the downtown area. With low platforms and wheelchair lifts on board the vehicles, the station designs should not preclude potential freight and work train movements.



Source: www.octranspo.com

- **Maintenance facility**

A small one vehicle maintenance facility (carbarn) would be required to store and maintain the replica trolley equipment. The facility would contain a pit for maintenance as well as a storage track, and basic utilities.

- **Rolling stock**

Gomaco Trolley Company in Iowa is the principal supplier of replica vintage trolleys in the United States. Depending upon the specifications and the inclusion of such features as air conditioning and onboard wheelchair lifts, replica car costs can range from \$500,000 to \$850,000 per car.

- **Contingency**

A contingency factor of 30% is added to the directly estimated cost items to account for such factors as engineering and design, permitting, project management, and unforeseen circumstances.

The total capital cost to develop the Beacon-Matteawan Trolley is estimated at approximately \$6.5 million dollars.

Table 5.1				
Summary of Capital Costs for the Beacon-Matteawan Trolley				
Description	Unit	Quantity	Price	Total
Track and Signal				
Siding to Beacon Station	mile	0.6	\$753,000	\$451,800
Track switches	unit	2	\$25,000	\$50,000
Station and carbarn track	mile	0.3	\$753,000	\$225,900
				\$727,700
Grade Crossings				
Four quadrant gate crossing	unit	2	\$300,000	\$600,000
				\$600,000
Overhead power				
Contact wire	foot	14,256	\$100	\$1,425,600
Wooden line poles	unit	187	\$1,200	\$224,400
Steel line poles	unit	4	\$2,500	\$10,000
Substation	unit	1	\$500,000	\$500,000
				\$2,160,000
Stations				
Beacon Station	unit	1	\$150,000	\$150,000
Dennings Station	unit	1	\$75,000	\$75,000
Matteawan Station	unit	1	\$150,000	\$150,000
				\$375,000
Maintenance Facility				
2,000 sq ft building	foot	2,000	\$150	\$300,000
				\$300,000

Table 5.1 Summary of Capital Costs for the Beacon-Matteawan Trolley				
Description	Unit	Quantity	Price	Total
Vehicles				
One replica streetcar	unit	1	\$850,000	\$850,000
Subtotal				\$5,012,700
Contingency @ 30%				\$1,503,810
Total				\$6,516,510

2. Beacon-Fishkill Shuttle

- **Track and train control improvements**

Like the Beacon-Matteawan Trolley, the service requires a 3,300 foot siding between CP58 and the Metro-North Beacon Station, and additional track into a car barn. Two hand operated switches would be needed, one at the entrance to the siding and another to access the maintenance facility. Three yard switches and six spring switches (passing sidings) are also required, bringing the total to eleven switches. Since the track east of Matteawan is older jointed rail, an allowance of \$1.0 million is recommended to address any unidentified deficiencies.

In addition, a CTC train control system would be necessary to operate more than one train on a single track and manage the safe movement in and out of the three passing sidings.

- **Grade crossings**

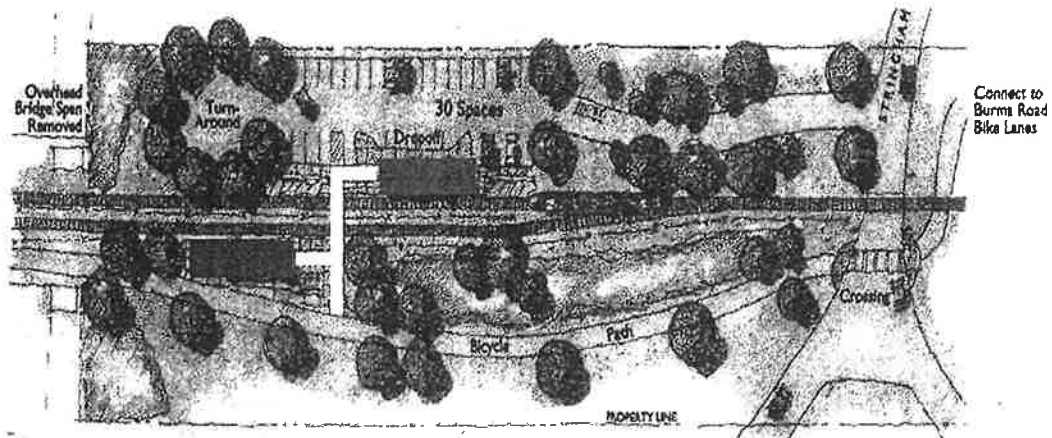
The line crosses thirteen roadways at grade between Beacon Depot and Fishkill. KKO recommends flashers and four quadrant crossing gates at each location to provide the highest level of safety and to minimize potential shuttle –automobile collisions.

- **Stations**

Two types of station are envisioned for the Beacon-Fishkill Shuttle service:

- Single track wayside station with platform on one side for Beacon Depot and Dennings Point
- Station with a 400 foot passing siding and a two staggered platforms (shown in purple) as shown below for Matteawan, Glenham, and Fishkill. A pathway (highlighted in white) would connect both platforms to the parking facility.

The downtown Matteawan station would be designed to be historically pleasing and to fit into the downtown area. The station designs, with mini-high platforms and level boarding to meet ADA requirements, should not preclude freight or work train movements. In addition, KKO has included a \$50,000 allowance for the installation of ticket vending machines to support the recommended one person crew operation and proof of payment scheme.



ENLARGEMENT PLAN - MELVILLE STATION

Source: Aquidneck Island Passenger Rail/Bicycle Path Project,
September 2002 Task II Appendices

- **Parking**

In order to serve as a park and ride facility, parking will be required at the Fishkill station location. KKO notes that approximately 100 parking spaces can generally be constructed on an acre of land. The average price for an acre of commercial/industrial land in Fishkill in 2003 is \$56,397²⁹. Each parking space is estimated to cost approximately \$1,835³⁰ to construct.

- **Maintenance facility**

An overnight layover and maintenance facility would be required. The facility would need to store three train sets as well as provide a lift or pit to service the equipment, fuel depot, and other basic utilities.

- **Rolling stock**

Colorado Railcar Manufacturing, LLC has built an FRA compliant Self Propelled Rail Vehicle (SPRV) that is currently touring the United States for demonstrations. The demonstration car seats 92 with room for up to 200 including standees, and is priced at \$2.9 million. Three similar vehicles would be required for the Beacon-Fishkill service, two to provide peak service with one spare vehicle.

- **Contingency**

A contingency factor of 30% is added to the directly estimated cost items to account for such factors as engineering and design, permitting, project management, and unforeseen circumstances.

²⁹ Source: www.C21countybumpkin.com

³⁰ Source: KKO Fairmount Line Feasibility Study, Final Report October 2002, escalated to 2003 dollars.

The total capital cost necessary to develop the Beacon-Fishkill Shuttle is estimated at approximately \$27.4 million dollars.

Table 5.2 Summary of Capital Costs for the Beacon-Fishkill Shuttle				
Description	Unit	Quantity	Price	Total
Track and Signal				
Siding to Beacon Station	mile	0.6	\$753,000	\$451,800
Track switches	unit	11	\$25,000	\$275,000
Station and car barn track	mile	0.9	\$753,000	\$677,700
CTC signals	mile	7.7	\$600,000	\$4,620,000
Track deficiencies	unit	1	\$1,000,000	\$1,000,000
				\$7,024,500
Grade Crossings				
Four quadrant gate crossing	unit	13	\$300,000	\$3,900,000
				\$3,900,000
Stations				
Beacon Station	unit	1	\$150,000	\$150,000
Dennings Station	unit	1	\$75,000	\$75,000
Matteawan Station	unit	1	\$150,000	\$150,000
Glenham Station	unit	1	\$75,000	\$75,000
Fishkill Station	unit	1	\$150,000	\$150,000
Ticket vending allowance	unit	1	\$50,000	\$50,000
				\$650,000
Parking				
Land acquisition 1 acre	unit	1	\$56,397	\$56,397
100 spaces	unit	100	\$1,835	\$183,490
				\$239,887
Maintenance Facility				
4,000 sq ft building	foot	4,000	\$150	\$3,900,000
				\$3,900,000
Vehicles				
Three SPRVs	unit	3	\$2,900,000	\$8,700,000
Subtotal				\$21,114,387
Contingency @ 30%				\$6,334,316
Total				\$27,448,703

Operating Costs

1. Beacon-Matteawan Trolley

KKO researched the National Transit Database (NTD) to gain a clear understanding of the range of operating costs typically experienced by trolley operators. Five trolley operators provided sufficient detail to inform KKO's estimates.

- New Orleans RTA, New Orleans, LA
- City of Detroit DOT, Detroit, MI
- Memphis Area Transit Authority, Memphis, TN
- King County DOT, Seattle WA
- Kenosha Transit, Kenosha, WI

The operations vary from one to twenty three peak vehicles. The Kenosha operation most closely resembles the proposed Beacon-Matteawan Trolley, with one vehicle in peak service.

- **Transportation**

The transportation costs include the costs for service provision including crew, supervisors and dispatchers, propulsion energy and train supplies. It is assumed that the Poughkeepsie – Dutchess County Transportation Council (PDCTC) would operate the proposed shuttle using specially trained and qualified bus drivers. One person train operation was assumed. One full time supervisor would be responsible for all aspects of trolley operations. On board fare collection is assumed for the service with the same base fare as the current Beacon Trolley³¹.

- o Labor - an average cost of almost \$37.00 per operator hour³² was used for both operators and supervisors. The estimated Dutchess County 2003 average operating employee cost was \$28.14³³ per hour.
- o Propulsion - A unit cost of \$0.75 per vehicle mile was estimated based on the average cost of propulsion for the five peer properties.

- **Mechanical**

The mechanical costs include labor and materials for vehicle maintenance. It is assumed that one full time mechanic would be hired to handle the required maintenance.

- o The annual cost of maintenance labor is estimated using the average annual maintenance labor cost of the five agencies listed above (\$43,000).
- o The annual parts cost per vehicle is also estimated using the average of the five peer agencies (\$6,800).

- **Maintenance of Way**

The maintenance of way (MOW) includes the annual cost of maintaining the track, signals, wire, and structures (bridges, stations, etc) that form the infrastructure of the service. The MOW costs includes both labor and materials. It is assumed that Metro-North would continue to provide the MOW services for the Beacon Line. Actual costs for the Beacon Line could be less than those experienced by Metro-North, but system average figures were applied to be conservative.

- o Metro-North's average MOW expense in 2003 was approximately \$245,600 per track mile.

- **Administration**

Administration costs include revenue collection and accounting, marketing, personnel, training and safety. These costs are estimated at 15% of the MOW, transportation and mechanical costs.

³¹ All day pass is \$2.00. An all day pass for seniors and children (ages 5 –12) and handicapped patrons is \$1.00.

³² Average operator costs for five transit properties listed above, NTD 2001.

³³ NTD2001 inflated by 5% annually.

Insurance costs are also included in the administrative costs. Insurance costs for the service can be minimized if the service is operated under the Dutchess County transit umbrella. The five properties selected as peers above all provide insurance by including the trolley operation in the general municipal or regional transit operation. The Beacon-Matteawan Trolley would add a small number of vehicle miles to the overall PDCTC system miles, and result in a proportionally small overall increase in overall insurance requirements.

Table 5.3		
Summary of Total Vehicle Miles Operated		
	Annual Vehicle Miles	% of Total
Dutchess County Mass Transit ³⁴	1,909,788	98.7%
Beacon-Matteawan Trolley	24,494	1.3%
Total Miles	1,934,282	

The estimated annual operating cost of the Matteawan Trolley service would be approximately \$1.0 million.

Table 5.4				
Summary of Operating Costs for the Beacon-Matteawan Trolley				
	Units	Quantity	Price	Total
Transportation				
Labor	\$/hour	4,460	\$36.92	\$164,595
Fuel	\$/vehicle mile	24,511	\$0.75	\$18,488
				\$183,150
Mechanical				
Labor	\$/employee/year	1	\$43,446	\$43,446
Materials	\$/vehicle/year	1	\$6,827	\$6,827
				\$50,273
MOW				
Metro-North Average	\$/route mile	2.7	\$245,622	\$663,180
Subtotal				\$896,602
Administration		15%	\$896,602	\$134,490
Total				\$1,031,093

³⁴ Dutchess County Mass Transit total vehicle miles in 2001 from NTD.

2. Beacon-Fishkill Shuttle

• Transportation

Transportation costs include the costs for service provision including train crews, supervisors and dispatchers, propulsion energy and train supplies. It is assumed that Metro-North would operate the Fishkill Shuttle using Metro-North engineers with a one person crew. It is recommended that fare collection be achieved by either a proof of payment system or a barrier fare system. Both these methods support one person train operation. One full time supervisor would be responsible for all aspects of shuttle operations. It is assumed that current Metro-North staff would be responsible for the maintenance of the ticket vending machines and the random verification of passenger tickets on board the train. The additional staff is estimated at the same hourly cost as the engineer.

- o The Metro-North average cost of \$95.00 per operator hour³⁵ was used.
- o Fuel costs were the June 2003 average cost for diesel (\$1.09) in New York State.
- o DMU fuel efficiency is assumed to be 2.4mpg.
- o Allowance for maintenance of fare collection/ payment system of \$25,000.

• Mechanical

The mechanical costs include labor and materials for vehicle maintenance. It is assumed that Metro-North would maintain the shuttle vehicles. Metro-North's annual vehicle maintenance costs were estimated using reported direct and indirect costs from a recent budget year. The direct costs include, labor (straight time and overtime directly charged to a particular vehicle or class of vehicles), fringe benefits associated with direct labor, as well as materials and supplies directly charged to a particular vehicle or class of vehicles. The indirect costs (facilities and support costs) include the maintenance of equipment (MOE) costs that are not directly charged to any piece of equipment.

- o The average direct cost for a new vehicle is assumed to be \$63,700³⁶
- o The average indirect cost for a new vehicle is assumed to be \$124,600³⁷.

• Maintenance of Way

The maintenance of way (MOW) forecasts the annual cost of maintaining the track, signals, and structures (bridges, stations, etc) that form the infrastructure of the service. The MOW costs include both labor and materials. It is assumed that Metro-North would continue to provide the MOW services for the Beacon Line.

- o Metro-North's average MOW for the commuter rail network in 2003 was approximately \$245,600 per track mile.

• Administration

Administration costs include revenue collection and accounting, marketing, personnel, training and safety. These costs are estimated at 15% of the MOW, transportation and mechanical costs.

³⁵ Average Metro-North fully loaded engineer rate in 1999 inflated to 2003 dollars.

³⁶ Average Metro-North MOE for a new MU vehicle in 1999 inflated to 2003 dollars.

³⁷ Average Metro-North facilities and support cost for a new MU vehicle in 1999 inflated to 2003 dollars.

Insurance costs are also included in the administrative costs. Insurance costs for the service can be minimized if the service is operated under the Metro-North's transit umbrella. The Beacon-Fishkill Shuttle would add a very small number of vehicle miles to the Metro-North commuter rail system vehicle miles. The overall increase in the insurance requirements for Metro-North should also be proportionally small.

Table 5.5		
Summary of Total Vehicle Miles Operated		
	Annual Vehicle Miles	% of Total
Metro-North Commuter Rail ³⁸	56,647,442	99.9%
Beacon-Fishkill Shuttle	78,865	0.1%
Total Miles	56,726,307	

The annual cost of Metro-North operation of the Fishkill Shuttle would be approximately \$3.8 million.

Table 5.6				
Summary of Operating Costs for the Beacon-Fishkill Shuttle				
	Units	Quantity	Price	Total
Transportation				
Labor	\$/hour	10,724	\$95.30	\$1,021,982
Fuel	\$/vehicle mile	78,500	\$0.45	\$35,554
Fare collection allowance	\$/year	1	\$25,000	\$25,000
				\$1,082,536
Mechanical				
Metro-North Average	\$/vehicle/year	3	\$188,314	\$564,942
				\$564,942
MOW				
Metro-North Average	\$/route mile	6.8	\$245,622	\$1,670,232
Subtotal				\$3,317,710
Administration		15%	\$3,317,710	\$497,656
Total				\$3,815,366

³⁸ Metro-North total commuter rail vehicle miles in 2001 from NTD.

Forecast Ridership

As noted when this project was initiated, the funds allocated for the feasibility study are not sufficient to prepare accurate formal forecasts of ridership. Instead the evaluation of benefits in this report is based on qualitative estimates relying on more primitive forecasting techniques.

A total of three alternative crude forecasting techniques were applied to yield a range of potential ridership estimates for the two alternative services.

“Modified Mode Share Method”

The *Modified Mode Share Method* uses estimates of existing travel in the Beacon market with judgmentally derived estimates of potential trolley mode shares to estimate potential ridership on both of the shuttle alternatives.

The market for Beacon Trolley services consists of three segments: visitors, commuters and local mobility. The trolley’s share of each of the two larger market segments can be considered separately.

- **Visitor Market** – *Dia:Beacon*’s annual visitation forecasts are understood to be 100,000 visitors each year. Visitations in the first few months of operations are well ahead of that forecast³⁹ but ultimately when the novelty of the new attraction diminishes the annual traffic at the museum may slip back to projected levels. No visitor forecasts for the Rivers and Estuaries Institute have been reviewed but it seems reasonable that a minimum of 15,000 persons might visit the Institute each year.

The town of Beacon is the northern gateway to the Hudson Highlands and offers a quaint downtown area with antique shops, boutiques and fine dining. The Beacon-Matteawan Trolley would offer visitors a scenic and historic ride from the Beacon depot to downtown Beacon. If half of the visitors to *Dia:Beacon* and the Rivers and Estuaries Institute took a pleasant and scenic trolley trip along the Fishkill to Matteawan station and returned on the trolley the service would carry 115,000 annual passenger trips.

- **Commuter Market** – Metro-North reports approximately 1,730 weekday boardings (3,460 total passenger trips) at Beacon Depot. The current and historic PDCTC services calling on Beacon Depot appear to have achieved a share of approximately 1.5% of the total market⁴⁰. It might be optimistically assumed that the Fishkill rail commuter shuttle might be able to achieve 5% share of this total market, yielding 172 total passenger trips each weekday. Total annual commuter ridership with a 5% share of weekday commuter travel to and from Beacon Depot would be 42,250 passenger trips each year.

³⁹ The gallery has attracted more than 80,000 visitors in its first 19 weeks of operation, averaging 844 visitors a day.

⁴⁰ 55 average daily boardings and alightings in FY 2003.

Combining these estimates developed via the *Modified Mode Share Method* yields a forecast annual ridership for the Matteawan Trolley of 115,000 passenger trips each year and a forecast annual ridership of 157,250 passenger trips for the Fishkill commuter Shuttle.

Table 5.7 <i>Modified Mode Share Method</i> Annual Ridership Forecast for Shuttle Services	
	Annual Riders
Beacon-Matteawan Trolley	115,000
Beacon Fishkill Shuttle	157,250

Estimates derived using this approximating method provide order of magnitude forecasts that could be substantially refined with additional supporting data and analysis.

“Peers Method”

The *Peers Method* makes the simplistic assumption that the proposed Beacon services could be as successful in attracting riders as other services of similar length elsewhere in the nation. Table 5.8 shows the average daily ridership for five trolley lines that vary in length from 1.0 to 3.6 miles in length and serve a variety of populations. The average daily ridership across all the services is 345 boardings. The San Pedro line was opened in July of 2003 and the high ridership may be influenced by its novelty. However, it should be noted that the San Pedro Line also serves a captive tourist market – the cruise lines that berth at the Port of Los Angeles. The peers below were selected out of the larger pool of trolley services due to the smaller communities that are host to the services. Trolley ridership in Memphis, Seattle and Tampa were indicative of the size of the communities that the services operate in, and ranged from 1,200 to 3,300 average daily riders.

Table 5.8 Summary of Short Trolley Lines Ridership						
Service	State	Start Date	Length of Line	Number of Stations	Days of Service/ week	Average Daily Riders
Astoria Riverfront Trolley Assoc.	OR	1999	3.0	9	7	109
Lowell National Historic Park	MA	1984	1.0	numerous	7	297
Dallas McKinney Ave Trolley	TX	1989	3.6	numerous	7	367
Kenosha Transit Electric Streetcar	WI	2000	2.0	17	6	450
San Pedro Red Line	CA	2003	1.5	4	4	501
Average Daily Riders						345

The Beacon-Matteawan Trolley is proposed to operate 273 days in the year. The Fishkill Shuttle would be operated every day except Thanksgiving, Christmas and New Year’s Day. Based on the crude assumption that the Beacon Trolley could attract as many daily riders each day as the “average” peer trolley, *Peers Method* forecast annual ridership for the Beacon-Matteawan Trolley would be 94,000. The Beacon-Fishkill Shuttle would be forecast to carry approximately 125,000 annual riders.

Table 5.9 <i>Peers Method</i> Annual Ridership Forecasts for Shuttle Services		
	Service Days	Annual Riders
Beacon-Matteawan Trolley	273	94,116
Beacon-Fishkill Shuttle	362	124,799

This methodology does not reflect the differences in service structure and environments among the various peer services. The estimate is a crude benchmark.

“Peers Vehicle Mileage Method”

The *Peers Vehicle Mileage Method* was employed by the Lomorado Group of Denver, Colorado to evaluate a proposed service in Eureka Springs, AR⁴¹. The simple method used a passengers per mile metric to forecast ridership on the service. KKO employed the same metric with the five peer properties listed in Table 5.10 to determine the average number of passengers per vehicle mile. For these five properties, the average passengers per vehicle mile is 3.12.

Table 5.10 Passenger Per Vehicle Mile for Selected Vintage Trolley Systems			
System	Annual Ridership	Annual Vehicle Miles	Passengers Per Vehicle Mile
Astoria Riverfront Trolley Assoc.	30,000	9,456	3.17
Lowell National Historic Park	80,800	N/A	N/A
Dallas McKinney Ave Trolley	132,000	117,446	1.12
Kenosha Transit Electric Streetcar	46,392	18,924	2.45
San Pedro Red Line	114,300	19,968	5.72
Average			3.12

Applying the *Peers Vehicle Mileage Method* to the two proposed Beacon services, as shown in Table 5.11, yields a forecast of approximately 76,000 annual riders for the Beacon-Matteawan Trolley and 245,000 annual passengers for the Beacon-Fishkill Shuttle.

Table 5.11 <i>Peers Vehicle Mileage Method</i> Annual Ridership Forecasts for Shuttle Services		
	Annual Miles	Annual Riders
Beacon-Matteawan Trolley	24,511	76,426
Beacon-Fishkill Shuttle	78,500	244,766

This methodology has similar flaws to the other “Peers Based” method.

⁴¹ Source: www.geekfest.com/trolley/chapterIX.html, author The Lomorado Group of Denver, Colorado.

Summary of Ridership Estimates

The three simple forecasting methods produced a range of potential annual ridership services for both trolley service alternatives. The Beacon-Matteawan Trolley is forecast to attract between 76,000 and 115,000 annual riders. The Beacon-Fishkill Shuttle is forecast to carry between 125,000 and 245,000 commuters and visitors each year. These initial findings are very crude. More detailed ridership analysis is recommended to refine the forecasts.

Table 5.12 Summary of Annual Ridership Forecasts for Shuttle Services		
	Beacon-Matteawan Trolley	Beacon-Fishkill Shuttle
<i>Modified Mode Share Method</i>	115,000	157,250
<i>Peers Method</i>	94,116	124,799
<i>Peers Vehicle Mileage Method</i>	76,426	244,766
Average	95,181	175,605

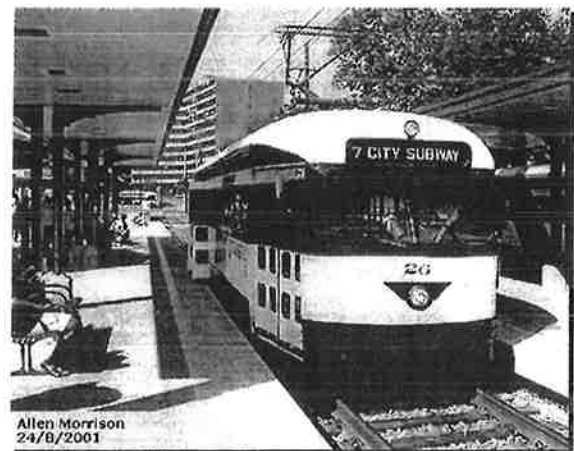
Evaluation

Capital Costs

By making creative adaptive use of the existing infrastructure, the proposed trolley service alternatives could be developed at relatively modest cost compared with most rail transit projects. Either alternative is small enough to qualify for a congressional transit capital appropriation, covering as much as 80% of the project's capital cost, without extensive competition with projects elsewhere in the nation. The Matteawan Trolley would require a capital investment of \$6.5 million, while the longer and more extensive Fishkill Shuttle would require a substantially larger investment of \$27.4 million infrastructure and rolling stock.

Both project alternatives are substantially more expensive than the \$2.5 million estimated by Metro-North for the Newburgh-Beacon Ferry.

Comparing the capital costs elements of the two projects, it is notable that the rolling stock costs for SPRVs for the Fishkill Shuttle are a much larger fraction of the total project cost than the rolling stock is for the Matteawan Trolley (see Table 5.13). Should further planning on the Fishkill Shuttle be conducted it should explore using replica trolleys or an alternative vehicle that is less expensive to acquire. Several trolley service operators obtained used vehicles from other transit agencies both in the United States and abroad (Australia, Italy, Portugal). It may be possible to reduce the capital outlay for vehicles by refurbishing older PCC or similar cars. Boston, Newark, Philadelphia and San Francisco use PCC cars. The Seashore Trolley Museum in Kennebunkport, ME currently has eleven Boston PCC cars for sale⁴².



NJTransit PCC Car

⁴² Six double ended and five single ended cars.

Newark, NJ also may have up to 21 recently retired PCC cars available for sale. The Kenosha and San Francisco trolley services use retired PCC cars obtained from transit properties.

The total capital outlay per annual rider ranges between \$57 and \$220. This range of figures should be compared with other capital projects funded by NYMTA to determine where it lies within the range of capital projects considered and funded in the region.

Operating Costs

The projected annual costs for the two services are approximately \$1.0 million for the Matteawan Trolley and \$3.8 million for the Fishkill Shuttle (see Table 5.13).

Considering the composition of the cost estimate, the fraction of cost assigned to MOW is high compared with other rail transit services. Further detailed analysis with Metro-North would likely find that Metro-North could maintain the single track line with a 25mph maximum speed. If the estimated cost for MOW were halved the operating cost for the Matteawan Trolley would drop by more than 25%.

Table 5.13		
Evaluation of the Service Alternatives		
	Beacon-Matteawan Trolley	Beacon-Fishkill Shuttle
Capital Cost		
Infrastructure	\$4,162,700	\$12,414,387
Rolling Stock	\$850,000	\$8,700,000
Contingency	\$1,503,810	\$6,334,316
Total	\$6,516,510	\$27,448,703
Operating Cost		
Transportation	\$183,150	\$1,082,536
Mechanical	\$50,273	\$564,942
MOW	\$663,180	\$1,670,232
Administration	\$134,490	\$497,656
Total	\$1,031,093	\$3,815,366
Estimated Annual Ridership		
Low	76,426	124,799
High	115,000	244,766
Average	95,181	175,605
Capital Cost/ Annual Rider		
Low	\$56.67	\$112.14
High	\$85.27	\$219.94
Average	\$68.46	\$156.31
Operating Cost/ Annual Rider		
Low	\$8.97	\$15.59
High	\$13.49	\$30.57
Average	\$10.83	\$21.73

It is useful to consider the operating cost efficiency of the Matteawan Trolley by comparing the proposed service with other US trolley services already in operation. It is notable that this study's rough estimate of \$11 operating cost per passenger is much greater than reported for other trolley operations as shown in Table 5.14.

Table 5.14			
Annual Operating Cost per Passenger⁴³			
	Operating Cost per Passenger	Annual Operating Costs	Annual Passengers
RTA - Orleans & Jefferson	\$1.71	\$8,821,559	5,173,717
City of Detroit DOT	\$8.99	\$349,261	38,859
Memphis Area TA	\$1.18	\$2,575,595	2,179,261
King County DOT	\$3.58	\$1,340,558	374,298
Peer Average	\$3.86		
Matteawan Trolley Average	\$10.83	\$1,031,093	95,181

When planning studies on the Matteawan Trolley are conducted, refined ridership forecasts and reduced operating costs, particularly MOW, would help bring the Matteawan Trolley operating cost per passenger measure closer to \$4 per boarding. Strategies to potentially reduce the estimated operating costs include the use of volunteer labor to maintain and operate the service, non-profit foundation coordination of funding (Portland, OR, Tucson, AZ), private-public consortia (Charlotte, NC, Dallas, TX).

Table 5.15					
Comparison of Metro-North and Fishkill Shuttle Performance Measures					
	Operating Cost per Vehicle Mile	Operating Cost per Passenger Mile	Annual Operating Cost	Annual Vehicle Miles	Annual Passenger Miles
Metro-North ⁴⁴	\$10.18	\$0.26	\$576,780,824	56,647,442	2,185,376,033
Fishkill Shuttle	\$48.60	\$4.56	\$3,815,366	78,500	835,856

The Fishkill Shuttle in some ways is more like a commuter rail operation than the Matteawan Trolley. In the context of the Fishkill Shuttle as a commuter rail line, it is useful to compare the proposed service with the balance of the Metro-North service (see Table 5.15). The lightly used Fishkill service operating with single car trains and modest passenger loads would operate with much less favorable operating cost statistics than the balance of the Metro-North system. To explore ways to improve the operating efficiency of the Fishkill Shuttle, additional work on ridership potential would be required. Strategies to reduce operating costs might include reducing the overall fleet size, using non Metro-North labor to operate and maintain the shuttle trains, and re-evaluating the estimated cost to maintain the rail infrastructure at the required standard.

⁴³ Annual operating costs and annual passengers from NTD 2001.

⁴⁴ Source: NTD database for 2001.

Appendix A
Memo of April 29, 2003
David Nelson to Joe Braun

Appendix A

Memo of April 29, 2003

DATE: April 29, 2003

TO: Joe Braun

FROM: David Nelson

SUBJECT: **City of Beacon Trolley Feasibility Study**
Task 1: Goals and Objectives
Topics for Interviews with Public Officials

DISTRIBUTION: *Kay O'Neil, Scott Friemann, Yawa Duse-Anthony - KKO*

Background

Task 1: Goals and Objectives - KKO's project manager will meet with city officials and confer with Metro North to determine the various objectives that each have concerning the future of the currently underutilized segment of the Beacon Branch. City officials will be canvassed concerning the range of passenger uses and travel markets they hope to serve with the proposed new rail passenger service. Potential markets include, but are not limited, to: commuter connections to Manhattan, visitors to Beacon, local resident mobility.

Topics for Interviews with local public officials

1. What circumstances have caused you to be interested in a trolley service between downtown Beacon and the Metro North depot?
2. What benefits do you hope to achieve from developing the trolley service?
3. What travel markets are most important to serve with the trolley?
 - a. Manhattan commuters
 - b. Visitors to Beacon
 - c. Local resident travel
4. Where do you envision the trolley stops?
5. What local resources are available to support the development and operation of the trolley?
 - a. Financial support?
 - b. Political support?
6. What are your goals for this study?
7. What do you need to learn from this study for you to consider it to be a success?
8. Who do you envision operating the trolley?

9. Trolley service characteristics

- a. What fares would you think appropriate for the trolley?
- b. What hours of service and days of service would you think appropriate?
- c. What service frequency would you think appropriate?

10. Would a rubber tired trolley be an acceptable substitute for a rail vehicle?

11. What kind of vehicle to do you envision for the trolley?

Vintage electric streetcar



Modern electric streetcar



Self powered streetcar



Self powered rail car



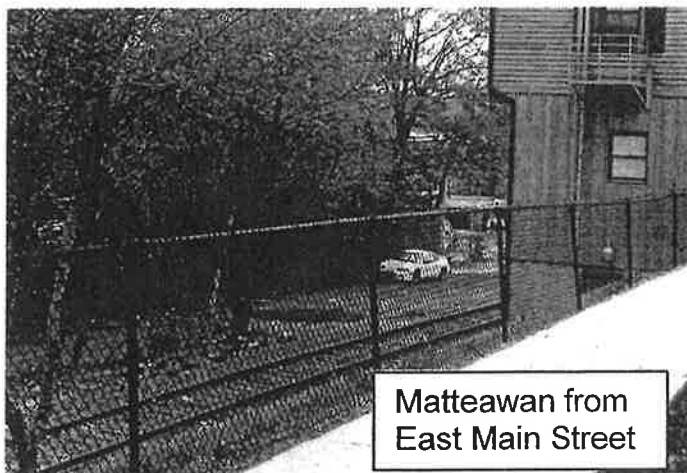
Locomotive with coaches



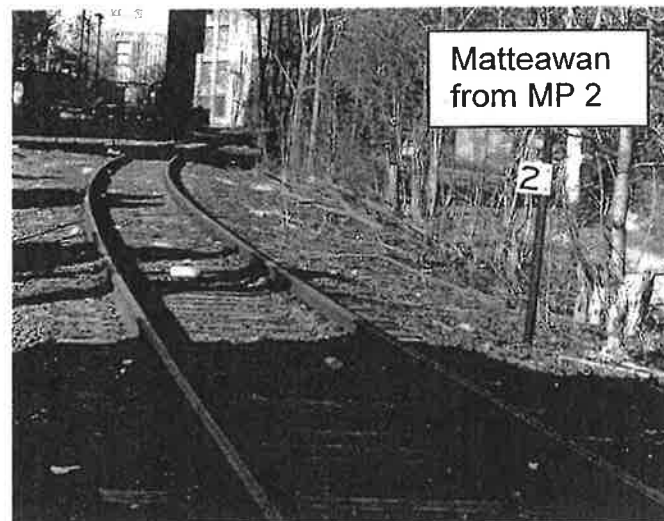
Rubber tired trolley bus



Appendix B
Photographic Record of Corridor Conditions
April 30, 2003



Matteawan from
East Main Street



Matteawan
from MP 2



East to Fishkill



Beacon Line
Crossing Route
9 at Fishkill

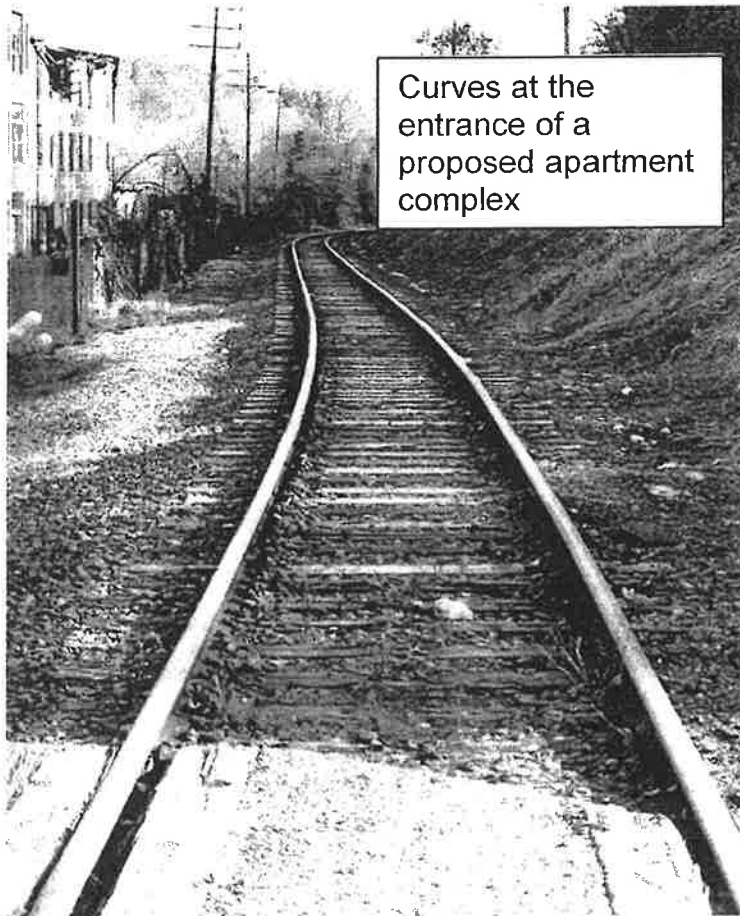
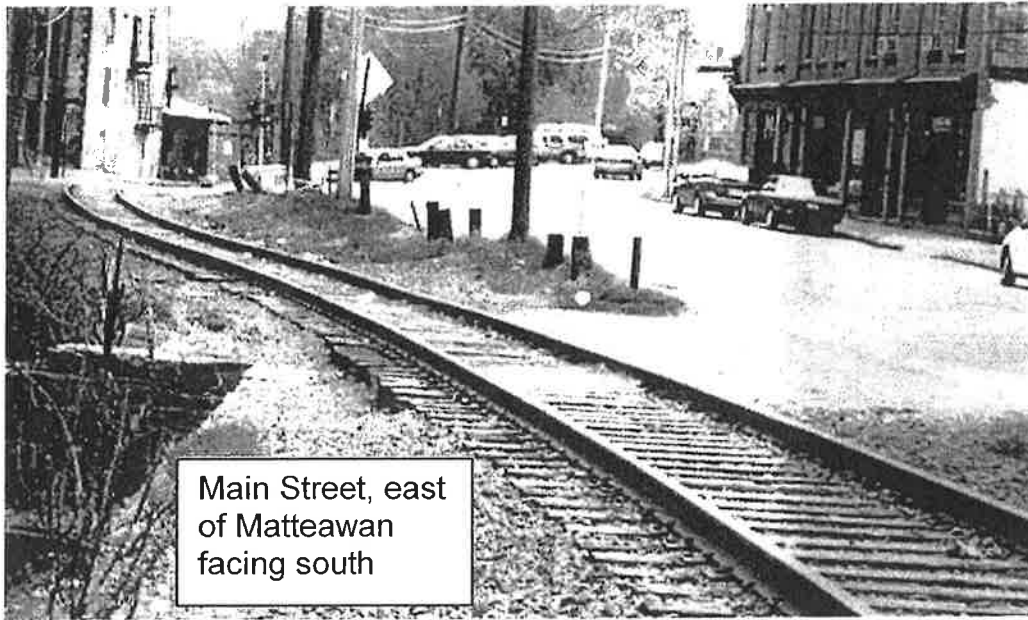


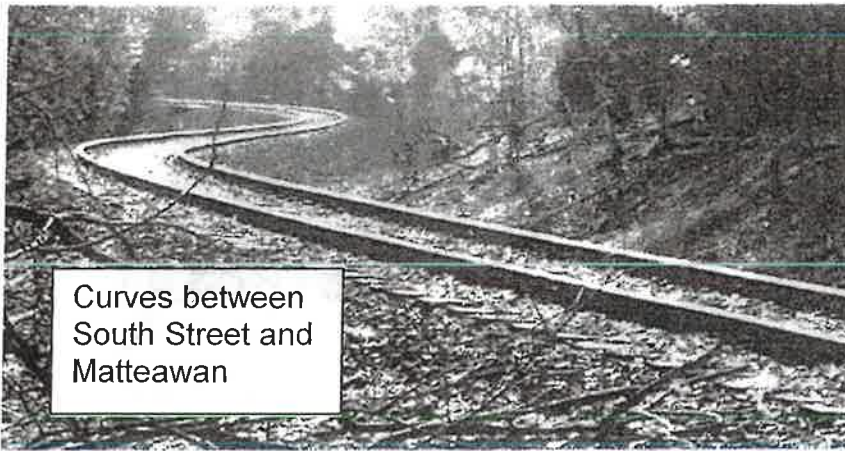
Beacon Line
Crossing the Fishkill
at Glenham



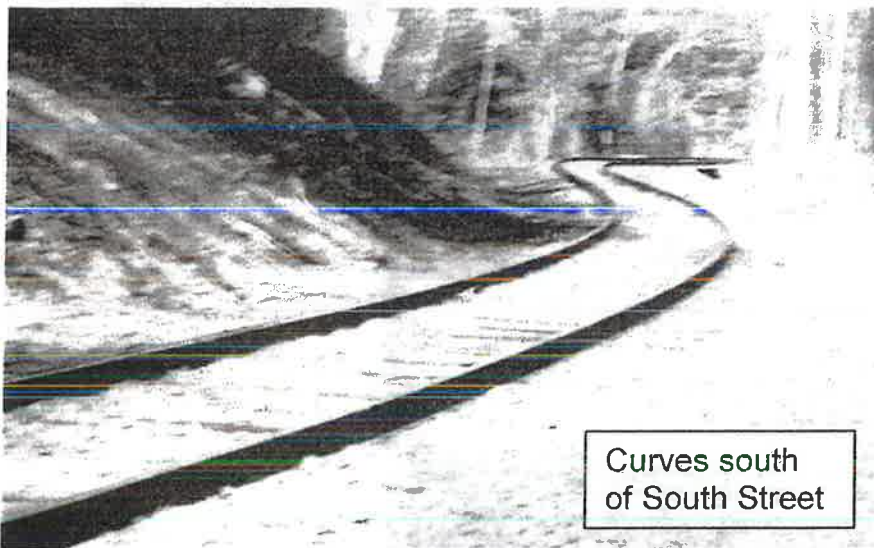
Headed Route 9 Crossing
along Rd the Beacon Line

Track Configuration and Right of Way

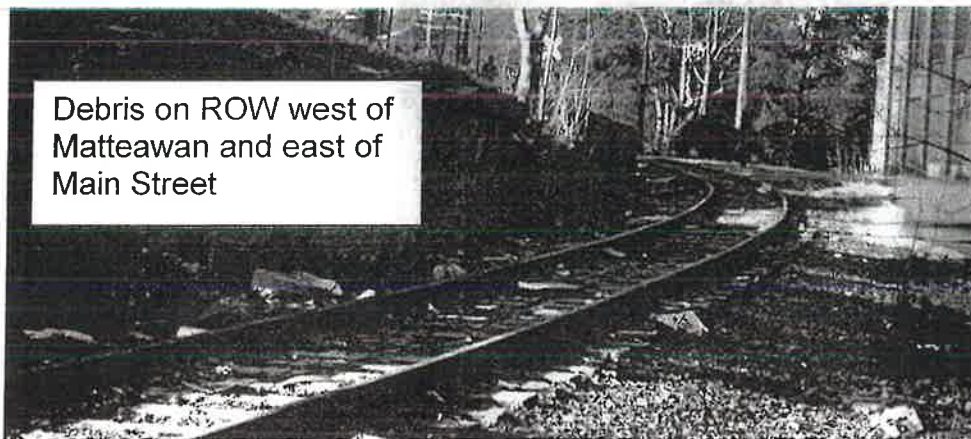




Curves between
South Street and
Matteawan



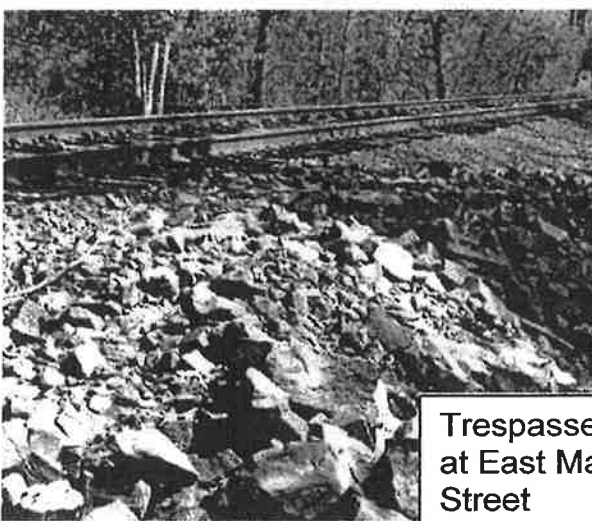
Curves south
of South Street



Debris on ROW west of
Matteawan and east of
Main Street



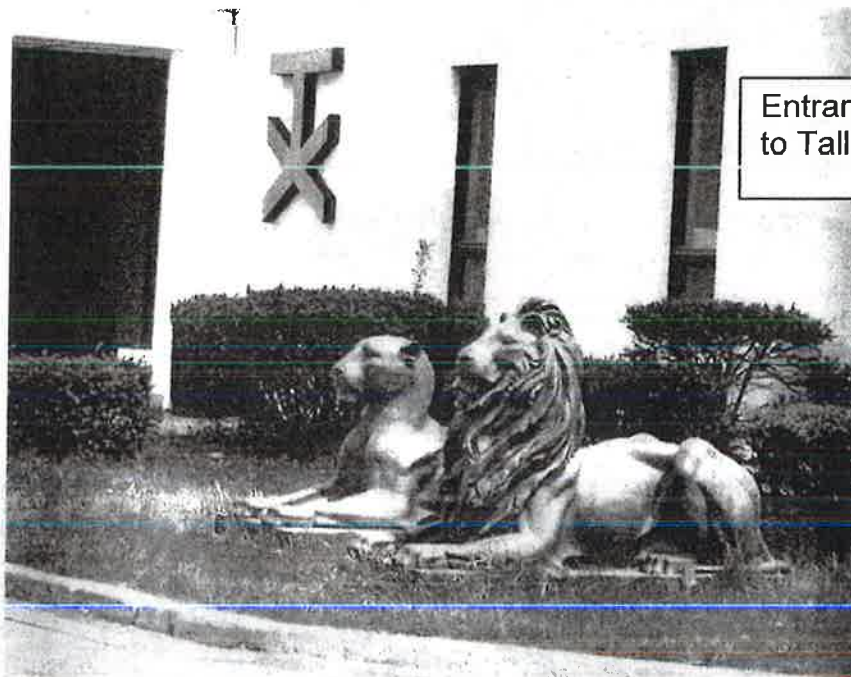
Site of washout
on Hudson



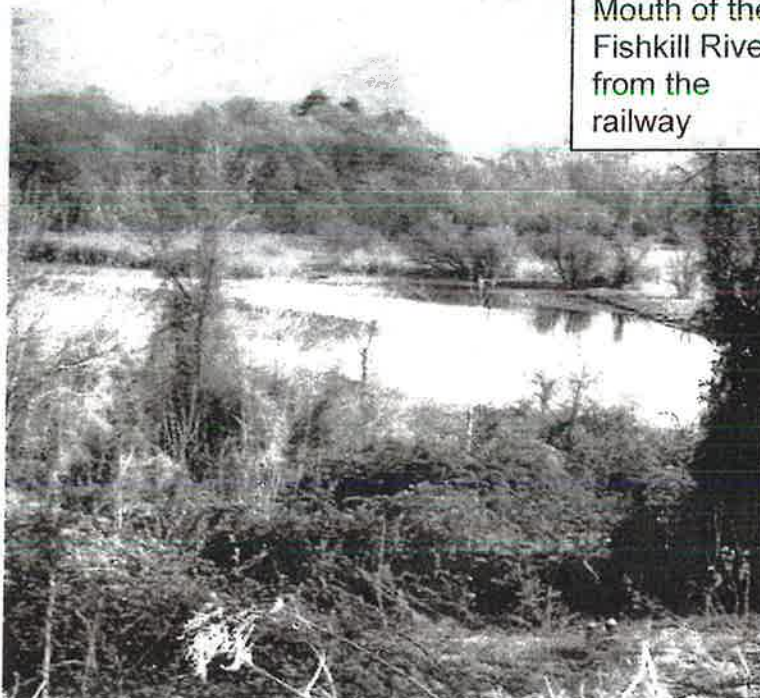
Trespassers
at East Main
Street



Scenic Attractions of the Beacon Line



Entrance
to Tallix



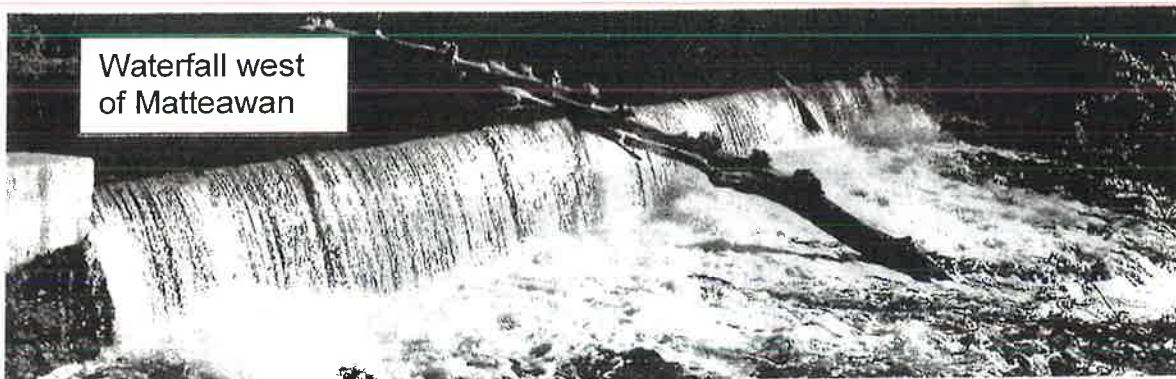
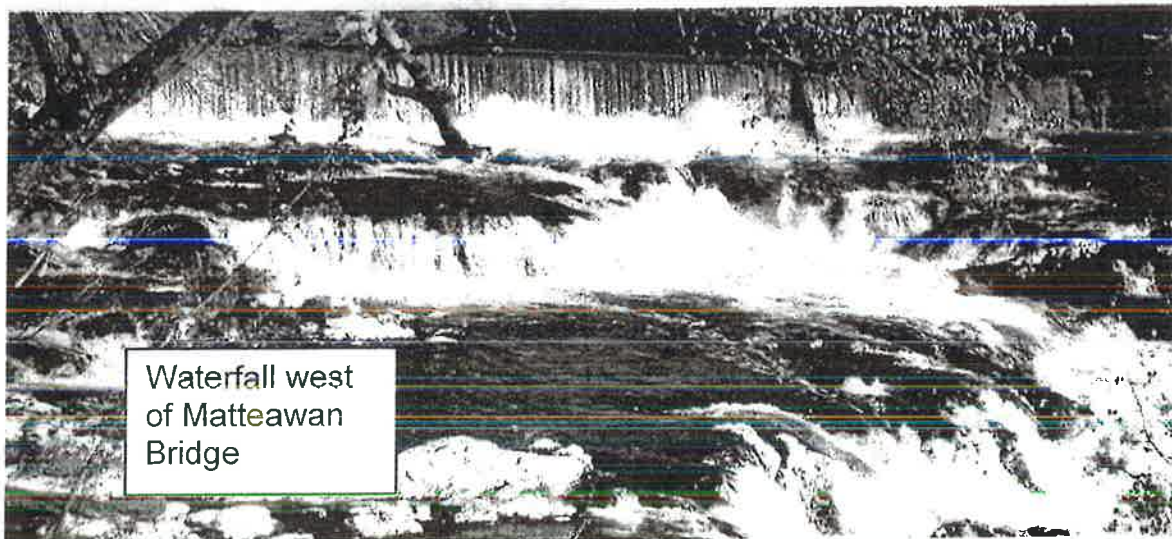
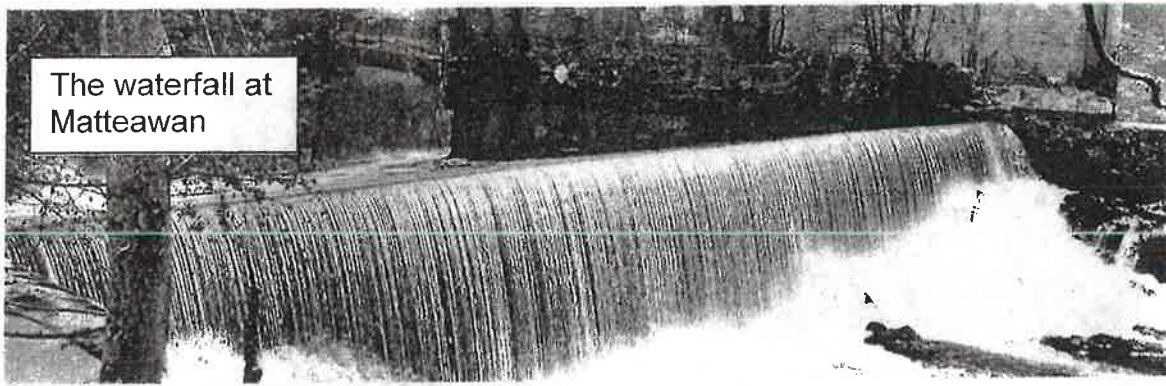
Mouth of the
Fishkill River
from the
railway



North on Main
Street Beacon
from Matteawan



Sculpture
at Tallix

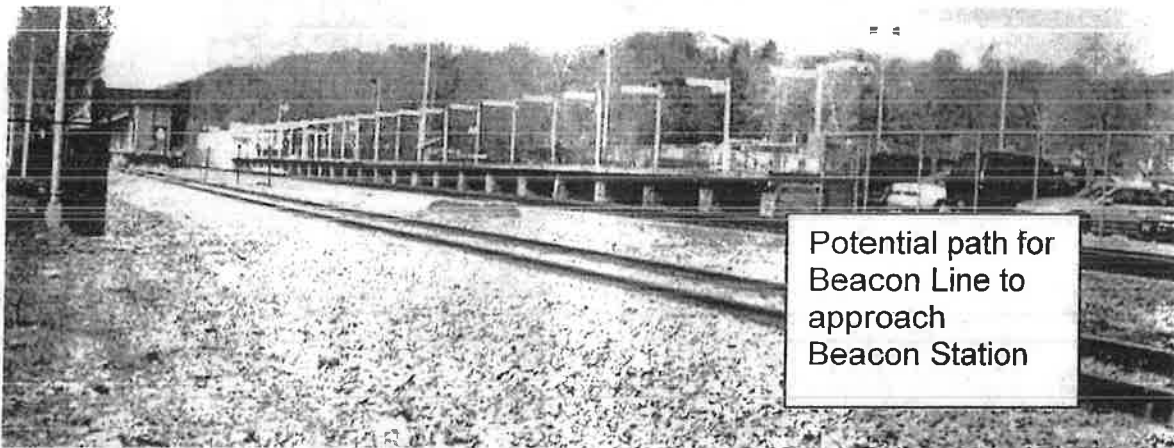


Siding at Beacon Landing

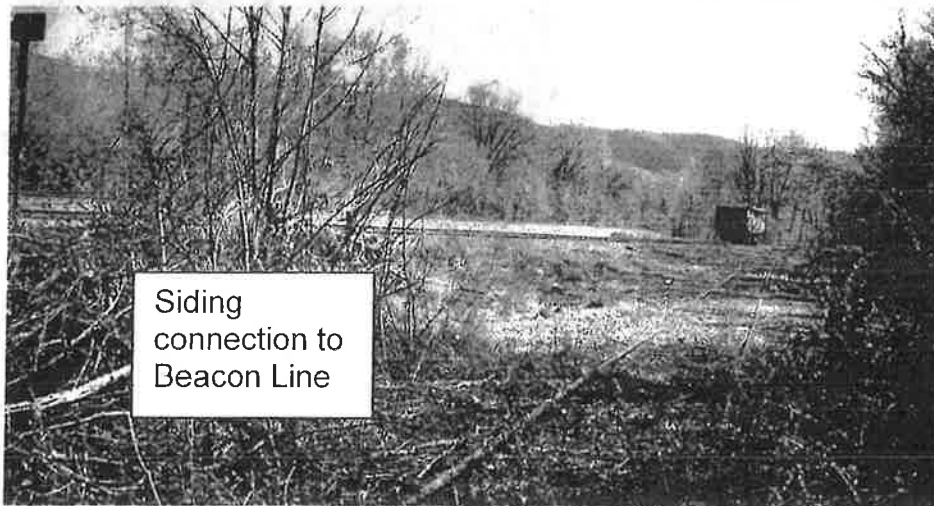




Beacon Landing
near Long Dock
Road overpass



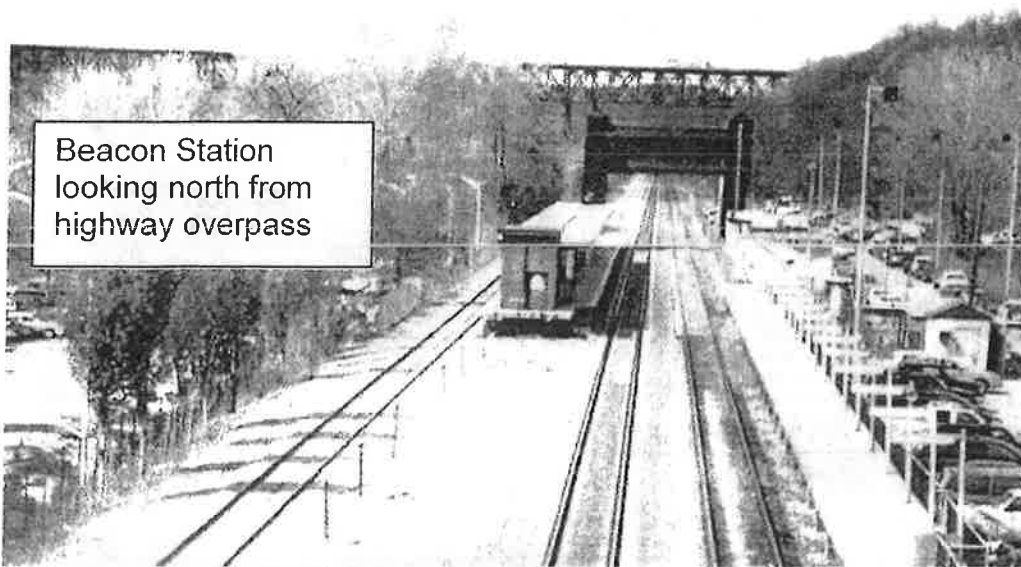
Potential path for
Beacon Line to
approach
Beacon Station



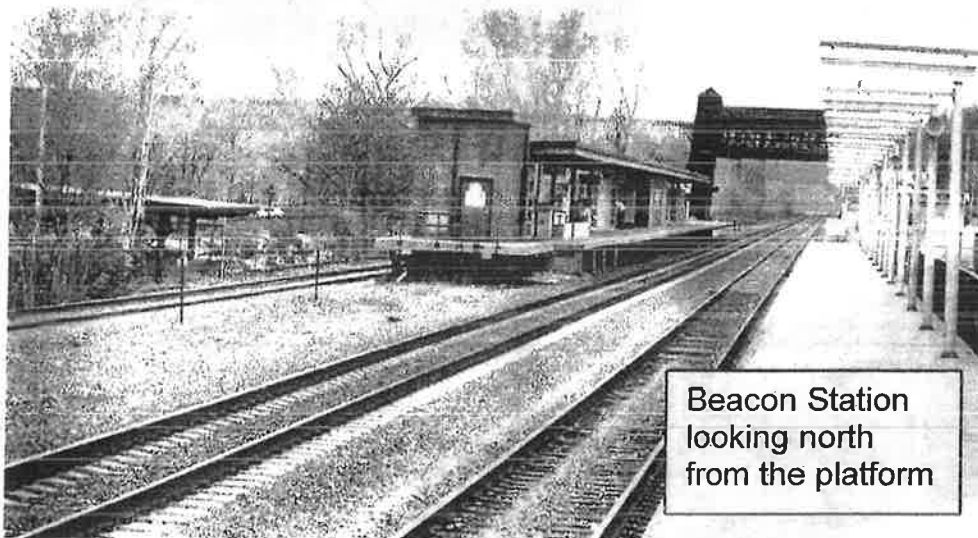
Siding
connection to
Beacon Line

Beacon Area Intermodal Connections

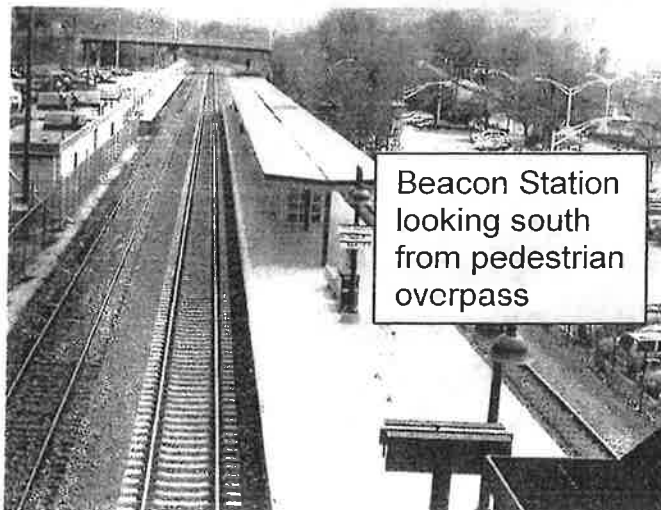




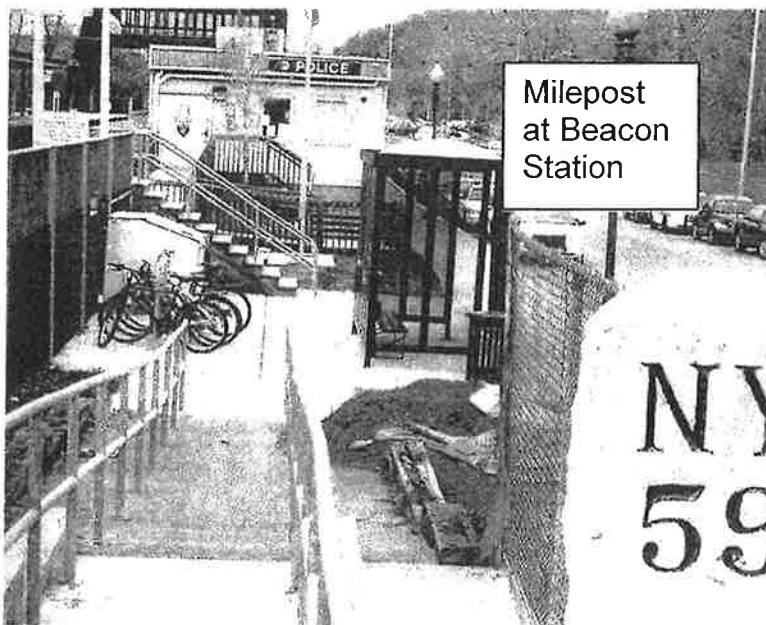
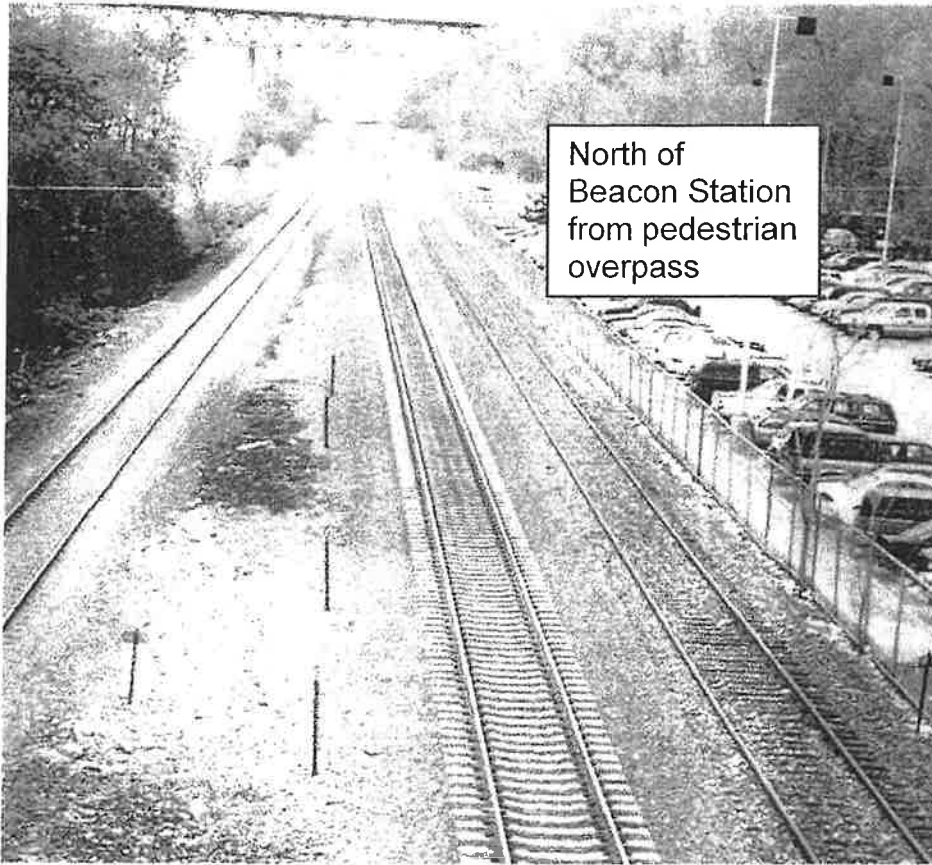
Beacon Station
looking north from
highway overpass



Beacon Station
looking north
from the platform

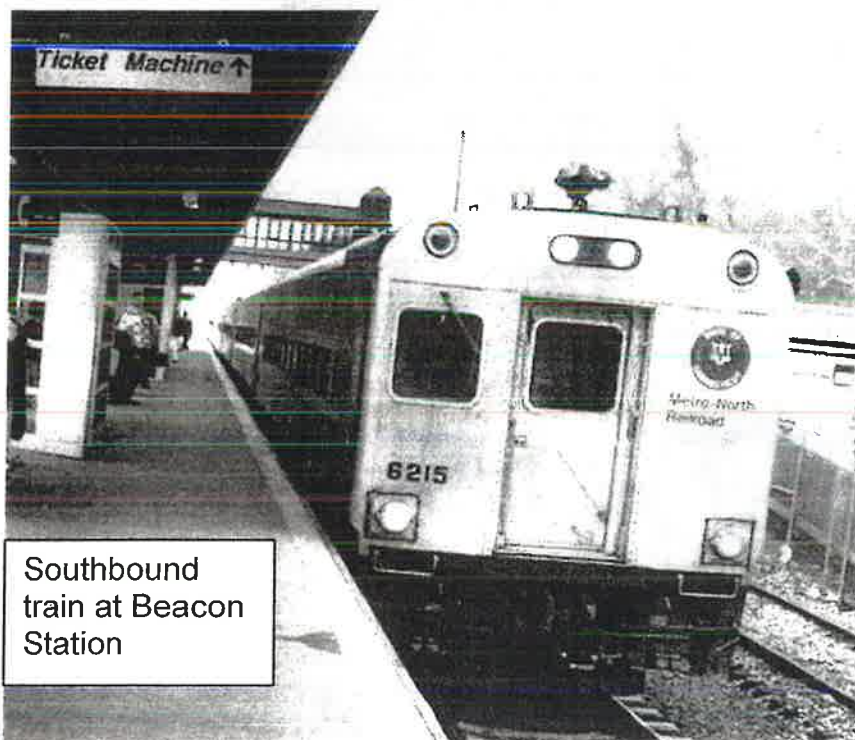


Beacon Station
looking south
from pedestrian
overpass





Site of planned
ferry dock from
platform at
Beacon Station



Southbound
train at Beacon
Station

Appendix C

Beacon Matteawan Shuttle Service Schedule

Appendix C

1. Beacon Matteawan Shuttle: High Season Weekday Schedule

Eastbound Service

Depart GCT	8:53	9:53	10:53	11:53	12:53	14:02	15:12	15:58	17:09	17:13	18:10	18:46	19:18
Arrive Beacon	10:18	11:16	12:16	13:16	14:16	15:19	16:29	17:15	18:15	18:33	19:29	20:03	20:36

Friday Only

STATION	001	003	005	007	009	011	013	015	017	019	021	023	025	027	029	031	033	035	037	039
Beacon	10:23	10:55	11:22	11:55	12:22	12:55	13:55	14:22	14:55	15:22	15:55	16:22	16:50	17:22	17:50	18:22	18:50	19:50	20:22	20:50
Dennings Point	10:26	10:58	11:25	11:58	12:25	12:58	13:58	14:25	14:58	15:25	15:58	16:25	16:53	17:25	17:53	18:25	18:53	19:53	20:25	20:53
Matteawan	10:31	11:03	11:30	12:03	12:30	13:03	14:03	14:30	15:03	15:30	16:03	16:30	16:58	17:30	17:58	18:30	18:58	19:58	20:30	20:58

Westbound Service

Friday Only

STATION	002	004	006	008	010	012	014	016	018	020	022	024	026	028	030	032	034	036	038	040
Matteawan	10:10	10:42	11:08	11:42	12:08	12:42	13:42	14:08	14:42	15:08	15:42	16:08	16:37	17:08	17:37	18:08	18:37	19:37	20:07	20:37
Dennings Point	10:14	10:46	11:12	11:46	12:12	12:46	13:46	14:12	14:46	15:12	15:46	16:12	16:41	17:12	17:41	18:12	18:41	19:41	20:11	20:41
Beacon	10:18	10:50	11:16	11:50	12:16	12:50	13:50	14:16	14:50	15:16	15:50	16:16	16:45	17:16	17:45	18:16	18:45	19:45	20:15	20:45

Depart Beacon	10:55	11:55	12:55	13:55	14:55	15:55	16:50	17:50	18:50	19:50	20:50
Arrive GCT	12:26	13:26	14:26	15:27	16:27	17:20	18:13	19:19	20:18	21:18	22:18

2. Beacon Matteawan Shuttle: High Season Weekend Schedule

Eastbound Service

Depart GCT	8:53		9:53		10:53		11:53		12:53		13:53		14:53		15:53		17:04		18:04		18:53	
Arrive Beacon	10:21		11:17		12:17		13:17		14:17		15:17		16:17		17:17		18:22		19:22		20:17	

Saturday Only

STATION	001	003	005	007	009	011	013	015	017	019	021	023	025	027	029	031	033	035	037	039
Beacon	10:26	10:55	11:22	11:55	12:22	12:55	13:55	14:22	14:55	15:22	15:55	16:22	16:50	17:22	17:50	18:22	18:50	19:50	20:22	20:50
Dannings Point	10:29	10:58	11:25	11:58	12:25	12:58	13:58	14:25	14:58	15:25	15:58	16:25	16:53	17:25	17:53	18:25	18:53	19:53	20:25	20:53
Matteawan	10:34	11:03	11:30	12:03	12:30	13:03	14:03	14:30	15:03	15:30	16:03	16:30	16:58	17:30	17:58	18:30	18:58	19:58	20:30	20:58

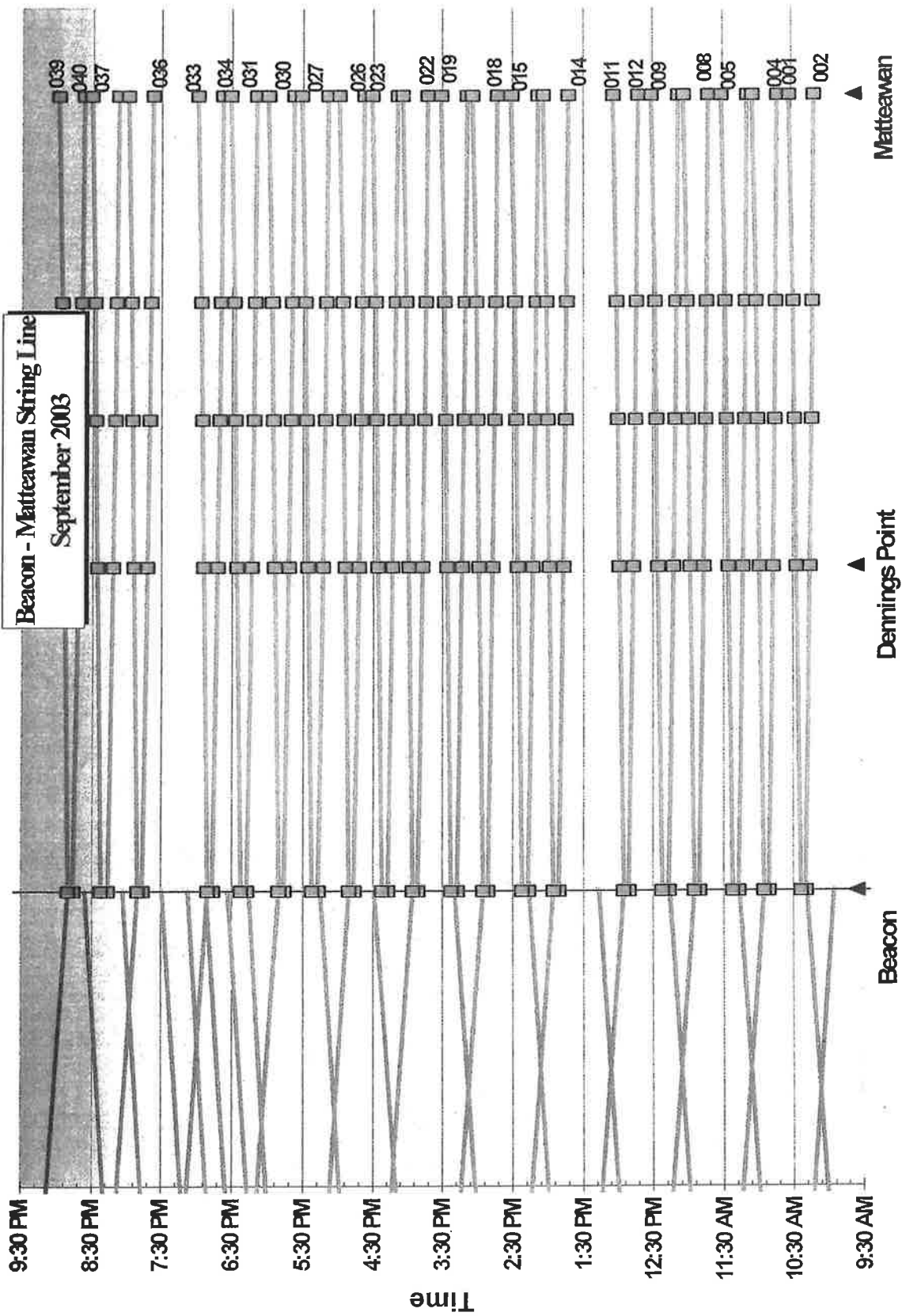
Westbound Service

Saturday Only

STATION	002	004	006	008	010	012	014	016	018	020	022	024	026	028	030	032	034	036	038	040
Matteawan	10:10	10:42	11:08	11:42	12:08	12:42	13:42	14:08	14:42	15:08	15:42	16:08	16:37	17:08	17:37	18:08	18:37	19:37	20:07	20:37
Dannings Point	10:14	10:46	11:12	11:46	12:12	12:46	13:46	14:12	14:46	15:12	15:46	16:12	16:41	17:12	17:41	18:12	18:41	19:41	20:11	20:41
Beacon	10:18	10:50	11:16	11:50	12:16	12:50	13:50	14:16	14:50	15:16	15:50	16:16	16:45	17:16	17:45	18:16	18:45	19:45	20:15	20:45

Depart Beacon		10:55		11:55		12:55	13:55		14:55		15:55		16:50		17:50		18:50		19:50		20:50
Arrive GCT		12:27		13:27		14:27	15:27		16:28		17:27		18:27		19:19		20:24		21:19		22:19

3. Beacon Matteawan Shuttle: Stringline of service



Appendix D
Beacon Fishkill Shuttle Service Schedule

Appendix D

1. Beacon Fishkill Shuttle: Weekday Schedule

Manhattan Bound Service

STATION	002	004	006	008	010	012	014	016	018	020	022
Fishkill	5:26	6:10	6:37	7:20	7:55	8:53				12:30	
Glenham	5:31	6:15	6:42	7:25	8:00	8:58				12:35	
Matteawan	5:37	6:21	6:48	7:31	8:06	9:04	9:37	10:40	11:41	12:41	13:20
Dennings Point	5:42	6:26			8:11	9:09	9:41	10:44	11:45	12:46	13:24
Beacon	5:46	6:30	6:56	7:39	8:15	9:13	9:45	10:48	11:49	12:50	13:28

Depart Beacon	5:51	6:17	6:35	6:44	7:01	7:17	7:44	8:20	9:18	9:50	10:55	11:55	12:55	13:55
Arrive GCT	7:10	7:39	7:47	8:09	8:13	8:43	9:10	9:40	10:38	11:15	12:26	13:26	14:26	15:27

STATION	024	026	028	030		032	034	036	038	040	042		044	046
Fishkill							17:28	18:18	18:50	19:24	20:05		20:53	21:20
Glenham							17:33	18:23	18:55	19:29	20:10		20:58	21:25
Matteawan	14:03	14:40	15:40	16:15		16:54	17:39	18:29	19:02	19:36	20:16		21:04	21:31
Dennings Point	14:07	14:44	15:44	16:19		16:58		18:34		19:40	20:21		21:09	21:36
Beacon	14:11	14:48	15:48	16:23		17:02	17:47	18:38	19:09	19:44	20:25		21:13	21:40

Depart Beacon		14:55	15:55		16:50		17:50			19:50		20:50	
Arrive GCT		16:27	17:20		18:13		19:19			21:18		22:18	

Fishkill Bound Service

Depart GCT					6:51	7:38		8:53	9:53			11:53		12:53
Arrive Beacon					8:15	9:05		10:18	11:16			13:16		14:16

STATION	003	005	007	009	011		013	015	017	019	021		023	025	027
Beacon	6:01	6:40	7:10	7:58	8:23		9:21	10:22	11:22	12:00	13:00		13:38	14:21	15:00
Dennings Point	6:04	6:43	7:13	8:01	8:26		9:24	10:25	11:25	12:03	13:03		13:41	14:24	15:03
Matteawan	6:09	6:48	7:19	8:06	8:31		9:29	10:30	11:30	12:08	13:08		13:46	14:29	15:08
Glenham	6:15	6:54	7:25	8:12	8:37					12:14					
Fishkill	6:21	7:00	7:31	8:18	8:43					12:20					

Depart GCT	14:02		15:12	15:58	16:40	17:09	17:13	17:32	17:50	18:10	18:46	19:18	19:48	20:23
Arrive Beacon	15:19		16:29	17:15	17:59	18:15	18:33	18:51	19:07	19:29	20:03	20:36	21:16	21:48

STATION		029	031	033		035		037	039		041	043	045	047
Beacon		15:58	16:34	17:20		18:20		18:55	19:15		20:08	20:44	21:23	21:53
Dennings Point		16:01	16:37			18:23			19:18		20:11	20:47	21:26	21:56
Matteawan		16:06	16:42	17:27		18:28		19:02	19:23		20:16	20:52	21:31	22:01
Glenham				17:33		18:34		19:08	19:29		20:22	20:58	21:37	22:07
Fishkill				17:39		18:40		19:14	19:35		20:28	21:04	21:43	22:13

2. Beacon Fishkill Shuttle: Stringline of service

