Final Report

Reconstruction and Electrification of Trolley Track

City of Kingston
May 2008

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RECONSTRUCTION AND ELECTRIFICATION OF TROLLEY TRACK

I. EXECUTIVE SUMMARY

HDR was retained by the City of Kingston to perform a condition survey of track and other Museum infrastructure and provide recommendations and a cost estimate for electrification of the Trolley Museum of New York system.

A project kick-off and scoping meeting was held on July 17, 2007 at the Trolley Museum of New York, with the HDR project staff and representatives of the Trolley Museum of New York and the City of Kingston. Following this meeting a physical survey of the facilities was performed.

HDR performed a physical survey of the existing conditions at the Trolley Museum of New York. This work was performed between July and August of 2007 by Trolley Museum Staff and HDR personnel.

Track conditions on the 1½ mile mainline, in the yard, and the on two future extensions (Brickyard – Hudson's Landing and Kingston City lines) were examined and photographed.

Each vehicle in the Museum's collection with a potential for use in passenger service was evaluated based on current condition, restoration needs, and wheel profiles.

Existing traction power equipment on hand and in storage was inspected and catenary materials examined, inventoried and evaluated.

HDR personnel became familiar with the Museum's current public passenger-carrying Operations and historic documentation was reviewed.

Two meetings were held with representatives of the City of Kingston, the Trolley Museum of New York, and Central Hudson Gas and Electric personnel. The first meeting was on August 9, 2007, and was held to formally initiate contact with all parties. The second meeting was held on September 14, 2007 and continued the technical discussion addressing the Utility's concerns regarding corrosion and harmonic interference caused by the proposed electrification.

A public meeting was held on November 8, 2007 at Kingston City Hall to describe the project and what it would accomplish. The meeting was well attended.

Based upon the above field survey, discussions and subsequent deliberation, HDR recommends a complete subgrade-to-railhead reconstruction of all trackage that has not been recently rebuilt by Museum forces. This includes all embedded trackage and the two major crossings along the Rondout - Kingston Point line.

For electrification, HDR recommends a commercial, off-the-shelf, twelve-pulse, 1000 kW rectifier substation be purchased to electrify the initial 1½ mile system.

Utility concerns about stray-current effects will be addressed using rail insulation, negative power return feeders, and insulated rail joints in critical locations. Active monitoring of leakage currents will utilize the Utility's existing Bullhorn monitoring system and impressed current network.

Power line harmonics will be reduced to an acceptable level through use of a substation sized larger than the predicted power demand on the Rondout-Kingston Point line, and by state-of-the-art line-filtering equipment devices included with the substation.

The overhead catenary system will be designed to achieve the “look” of a traditional trolley line. The overhead system should use traditional bracket-arm supports or span wires attached to both wooden or telescoping steel poles, depending upon location, with cap-and-cone hangars, grooved 4/0 trolley wire, and traditional “backbone” trolley wire construction techniques. Reconditioned parts should be utilized where possible. The overhead system should be designed to be trolley and pantograph-compatible.

HDR’s examination of the two proposed extensions revealed that they were both in poor condition. Both extensions will require complete tie replacement, track, and subgrade reconstruction, with rail replacement where rail is currently removed. On the Brickyard line to Hudson’s Landing, parts of the causeway and a number of bridges will need reconstruction (including one which has collapsed) before rails can be reinstalled. The grade crossing of Delaware Avenue will also have to be restored, likely with safety devices such as flashers and gates. A number of grade crossings will also have to be similarly re-opened on the Kingston City line segment. Additional items in need of reconstruction include four bridges (two of which will most likely be removed and replaced by fill) and a tunnel which will need to be refurbished.

HDR believes that electrification of the currently active portion of the proposed trolley system, the Rondout-Strand area, can best be accomplished with a deliberate evolutionary approach. The pathway to electrification would be as follows:

1. Reconstruct the existing Rondout - Kingston Point trackage to meet electrification standards.
2. Fully electrify the existing Rondout - Kingston Point Line
3. Reconstruct sufficient trolleys to operate on the newly electrified system
4. Begin planning of reconstruction of the two extension lines (Brickyard – Hudson’s Landing and Kingston City lines)

Finally, integrate trolley operation with mass transit service in the area.

II. INTRODUCTION

The Trolley Museum of New York, which recently celebrated their 50th Anniversary, has been a presence in the City of Kingston since 1983. Prior to that time, TMNY was a "museum without a home", forced to move their historically valuable collection of rolling stock time and time again, all the while continuously looking for a suitable permanent location. The unfortunate scrapping of a number of pieces of historic rolling stock in 1982 prior to their acquisition brought the TMNY to the attention of the City of Kingston, which, with considerable foresight, allowed the TMNY and its collection to finally find a home in Kingston in 1983. The former Penn Central Ulster & Delaware branch line, abandoned in the early 1980s, was leased to the Museum for 99 years and became the basis of Museum operations.

Since the 1980s, considerable progress has been made by the Museum's volunteers. Protection of the most important vehicles in the collection, construction of permanent maintenance facilities, and a visitor's center to allow historical interpretation as part of the ride and overall Museum experience have all come to fruition. However, the greatly-desired electrification of the 1 ½ miles of scenic right-of-way never quite became a reality.

This project begins the next chapter in the history of the Trolley Museum of New York. This package of recommendations, cross sections and cost estimate provides the necessary groundwork to begin the process.

HDR, as one of the leading railroad and transit engineering consultants in America, assists our rail clients in a variety of services. These include studies, preliminary and final design, specifications and cost estimates, resident construction management and quality assurance services, rehabilitation investigations, program and asset management, design-build assistance, and value engineering studies. HDR is pleased to present to the City of Kingston this Report on the Reconstruction and Electrification of Trolley Track.

Scope of Work

HDR's scope of work was identified in the eight tasks and their deliverables as stipulated in the RFQ. The eight tasks are:

1. Hold a Project Scoping Meeting – Deliverable: Meeting minutes. See Appendix E of this report.
2. Provide a Project Outline – Deliverable: Draft and Final Project Outline
3. Hold Meetings with Government Agencies to Discuss Findings from Tasks 1 & 2 - Deliverable: Meeting minutes. See Appendix E of this report.
4. Perform an Analysis of Existing Rail Infrastructure Condition – Existing Rail Report Text, Photographs and Illustrations. (See Section 3 and appendix A of this report).
5. Prepare a Draft Reconstruction and Electrification Report – Deliverable: Draft Reconstruction & Electrification Report with Sub-sections as indicated in a through d.
    a. Develop Track & Right of Way Reconstruction Specifications – Deliverable: Draft Track & Right of Way Reconstruction Specifications.

b. Perform an Evaluation of Electrification Requirements & Recommendations – Deliverable: Draft Evaluation of Electrification Requirements & Recommendations Report.
c. Identify Possible Funding Sources – Deliverable: A list of potential funding organization and agencies.
d. Research Environmental Permits Required from State & Federal Agencies and Provide Summary – Deliverable: Summary of permits and environmental impact information.

6. Community Information Workshop – Deliverable: Public Meeting.
7. Prepare Final Reconstruction & Electrification Report – Deliverable: Final Reconstruction & Electrification Report.
8. Prepare Monthly Progress Reports – Deliverable: Monthly Progress Reports.

Special Considerations

The Museum and the City of Kingston identified two issues of special concern to be addressed during the electrification study. These issues are:

Utility Considerations: Past plans to electrify the Trolley Museum of New York's trackage have met with opposition from the local Utility, Central Hudson Gas & Electric, because of the location of multiple high-pressure gas lines under most of the Rondout-Kingston Point trackage. CHG&E is concerned that stray currents leaking from the rail return traction power circuit may accelerate corrosion of these lines. A second CHG&E concern is with harmonics fed back into the power line from the traction power rectifier.

HDR also looked at the potential for transforming the Trolley Museum of New York's current limited excursion service into a "vintage trolley" streetcar service for Kingston, using the existing Rondout-Kingston Point line and the two extensions (Brickyard – Hudson's Landing and Kingston City).

Environmental Considerations: Environmental permitting will be required for work done on the two lines adjacent to the Kingston Point Lagoon, as this is a registered and protected coastal wetlands area. Some of these permits will require that environmental studies be performed.

The existing Kingston Point line passes through a wetlands area and is subject to erosion from high-water conditions and storms on the Hudson River. Special considerations will be required for the reconstruction of the causeway and track, as well as the installation of catenary poles and a walking trail adjacent to the tracks.

The future reactivation of the line section to the Brickyard – Hudson's Landing area travels around the back side of the Lagoon wetlands area and is in very poor condition. The existing causeway must be reconstructed and a number of bridges replaced. One road crossing must also be re-opened. Although permitting is required, the line is classified as "existing", which simplifies the permitting process compared to constructing a new line through the same area.

III. EVALUATION OF EXISTING INFRASTRUCTURE

A project kick-off and scoping meeting was held on July 17, 2007 at the Trolley Museum of New York, with the HDR project staff and representatives of the Trolley Museum of New York and the City of Kingston.

Following this meeting a physical survey of the facilities was performed. HDR personnel walked the Rondout to Kingston Point tracks, Brickyard line section and Kingston City line section on July 17 and 18, 2007.

On the main track section from the Museum yard area to Kingston Point. Track condition and potential environmental considerations through the wetland and coastal areas were identified. The future Brickyard line through the Kingston Point lagoon area was inspected to the extent possible. The active line segment from the yard to the foot of Broadway, which currently is embedded in concrete, asphalt or brick was walked and inspected.

The Team walked and inspected the accessible sections of the out-of-service Kingston City Line up the hill into Kingston proper inspecting the trackwork, a number of bridges and a tunnel. Sections of track that were rehabilitated by Museum forces were noted.

During all of these inspections, photographs and extensive notes were taken regarding track condition, preliminary location of utilities (especially gas lines), and possible placement of poles for catenary support. This information was used in conjunction with maps, plats, earlier photos, utility drawings and similar information to determine the exact reconstruction methodology to be used.

Field Survey - Track and Rights-of-way

Analysis of Existing Rail Infrastructure Condition

The Reconstruction and Electrification of Trolley Track in Kingston focuses on a primary track study subject area and two secondary track study areas. The primary track study subject area consists of the reconstruction of yard track at the Trolley Museum's car house and the reconstruction of the former Ulster and Delaware Railroad line from the yard west to West Strand Park located at the foot of Broadway and from the yard east to Kingston Point.

Primary Track Study Subject Area: Kingston Point Line & West Strand Line

The West Strand Line track exits the Trolley Museum, crosses East Strand Street and runs along the south side of East Strand Street/Ferry Road. The track, embedded in brick pavers, passes under Frank Koenig Boulevard (Route 9W) and stub ends at Broadway (see Figure 1). There also are remnants of a two spur tracks (see Figure 2) alongside the main track in this area.

The Kingston Point Line track exits the Trolley Museum yard area through the east gate, crosses East Strand Street and runs east along the south side of East Strand Street for about 650 feet (see Figure 3).

At this point, across from Sycamore Street, the track veers away from East Strand Street (see Figure 4), travels behind businesses and over several private grade crossings (see Figure 5). After passing the North Street extension, the single track continues for about 400 feet towards the causeway, where a left-hand turnout leads to the west end of a passing siding track (see Figure 6). The siding track is approximately 1100 feet long on the North side of the mainline track. The rails are spaced at approximate 12 foot centers. From this siding there is a turnout that led to the Brickyard spur of the former Penn Central Railroad (see Figure 7). The spur skirted the west side of the lagoon and headed north across Delaware Avenue. This spur is one of the secondary study areas to be discussed later.

Museum volunteers have over the past several years reconstructed several segments of the existing trackage totaling about 2400 Track Feet (TF). The reconstructed segments include about 75% of the shop/yard track and a 1200 TF segment on the causeway. Most recently a 600 TF section was reconstructed east of the museum near the crossing to Kosco. (See Figure 7A). In addition, the grade crossing over East Strand Street west of the museum has been rebuilt as part of a reconstruction of this section of East Strand Street (see Figure 8).

The track reconstruction effort consisted of removal and stockpiling of rail and Other Track Material (OTM) for re-use; removal and disposal of ties; and the grading down of the existing trackbed to suitable subgrade. Geotextile fabric was then placed on top of the prepared subgrade. Ballast was placed. Skeleton track (see Figure 9) was constructed using second-hand ties in good condition, stockpiled 105# Dudley rail, and stockpiled OTM. Surface ballast was then placed and the track was roughly lined and surfaced.

Overall Track Conditions

The reconstructed track sections are generally in good condition. The remainder of the existing track in the primary track study subject area is in relatively poor condition but can be safely used for the present Museum operation.

The existing rail in ballasted track is generally 105# Dudley. There is a short section of 80# Dudley in the mainline track by the causeway in the area of the siding track. The 80# Dudley is connected to the 105# Dudley with compromise joint bars (see Figure 10). In sections where the track is embedded west of the yard area, girder rail had been used (see Figure 1).

The existing 105# Dudley is generally adequate for re-use. An additional supply of 105# Dudley (as well as some heavier rail sections and girder rail) has been stockpiled at the car yard (see Figure 11), which has been acquired by the museum. The 80# rail should be replaced with 105# Dudley when that section is

rehabbed / reconstructed. The embedded girder rail has deteriorated significantly and should be completely replaced with either a Portland-style girder rail arrangement or a heavier easily obtained rail section with bolt-on girder-guard when the embedded track is reconstructed.

Ties in the existing track are for the most part not fit for re-use. The trolley museum has acquired a number of second-hand ties (see Figure 12), which are stockpiled at the car yard. The stockpiled ties appear to be in good usable condition. In track that has been re-built by museum volunteers, second-hand ties were used as part of a 100% tie replacement. The ties in these sections are in good condition and no tie renewal would be recommended. For the section of track along the east side of the lagoon that has not been reconstructed, about every fifth tie appeared to be in good acceptable condition. The remaining ties in this section are not re-usable.

The alignment for the existing track west of the museum seems to follow the alignment of East Strand. East of the museum, there are several areas which do not appear to follow a defined geometric alignment (see Figure 13). Track gauge for the most part seems to be within an acceptable tolerance for the Museum's present operations. There are, however, a few areas where wide gauge and variable gauge (see Figure 14) would be problematic for the trolley museum's anticipated operations, particularly the use of streetcars with narrow city-tread wheels.

The existing trackbed and ballast in the ballasted track areas have been severely fouled (see Figure 15). The existing ballast would not be suitable for re-use as ballast during any rehabilitation efforts.

The existing OTM is for the most part in re-usable condition. Tie plates consist of a variety of sizes and configurations. There are single shoulder, double shoulder and even some pandrol plates of various sizes. Some of the single shoulder plates of short lengths should not be re-used as they are considered tie destroyers. There is an additional stockpile of OTM at the car yard (see Figure 16), which has been acquired by the museum.

There are a total of 10 turnouts within the primary track study subject area, all of which are either No. 8's or No. 6's. The trolley museum has also stockpiled parts (frogs and switches) of various turnouts (see Figure 17). There are two left hand turnouts in the embedded track along East Strand Street/Ferry Road west of the museum. These two turnouts (see Figure 18) appear to be No. 6's and formerly accessed spur tracks which are no longer in service. It is apparent that the switches have

not been in use for some time and do not appear to be in re-usable condition (see Figure 19).

In the yard area, there are a total of four turnouts currently in service, all of which appear to be No. 8's. From the east gate heading west toward the museum, there is a right-hand turnout from the mainline into the yard/car barn tracks (see Figure 20). Further on the mainline track, there is a left-hand turnout with the diverging move heading toward West Strand Park (see Figure 21). The straight move passes the car barn, goes through the west gate of the yard and along the route which formerly led to Kingston City. This route is another secondary study subject area discussed elsewhere in this report. On the yard lead track (see Figure 22), a right hand turnout takes you to yard track No. 3, a stub ended storage track. Just past this turnout a left-hand turnout leads to yard/car barn track No. 1 with the straight move leading to yard/car barn track No. 2. There is also a 4th yard track which is currently not connected to any of the other yard tracks. All existing turnouts appear to be in workable condition and most of the yard tracks have been reconstructed by museum volunteers over the past several years.

The four remaining turnouts are on/near the causeway. There are two No. 8 turnouts (one right-hand, one left-hand) at either end of the siding track. A third turnout (a No. 8 right-hand turnout) is on this siding track and leads to what once was the cement industrial spur (Brickyard)(see Figure 7). The final turnout is a No. 8 left-hand turnout at the east end of the causeway (see Figure 23) which ends with two short stub tracks. The turnout at the east end of the causeway is part of a section of track which has been recently reconstructed and is in adequate workable condition. The other three turnouts involving the siding track contain some parts that can be salvaged, however, at a minimum, the switch ties would need to be replaced.

West Strand Line State of Existing Track

West of the museum alongside East Strand Street/Ferry Road, the existing embedded track consists of railroad-profile girder rail embedded in a brick pavement. The girder rail has deteriorated so much that in many areas the flangeway has broken off (see Figure 24). There are also areas in which it appears the girder rail has been replaced at some point in time. Where the newer rail meets the original girder rail, the rail end mismatch is severe (see Figure 24). The brick pavers are laid in varying patterns and are generally broken and spalling (see Figure 25), particularly along the rail and within turnouts.

The East Strand Street grade crossing west of the museum was recently reconstructed as part of an East Strand Street reconstruction project. The crossing however was constructed by paving to the top of rail on both sides of each rail. It appears that the flangeway has been created by running the trolley cars over the track causing the indentation in the asphalt on the gauge side of each rail (see Figure 26). The potential for a trolley car to derail through this crossing is increased because of the limited flangeway, the existence of wide gauge within the crossing and the fact that the crossing is on a curve.

West of the museum, the East Strand Street grade crossing is not in very good condition (see Figure 13). The rail appears to be re-usable, but the asphalt pavement crossing surface is cracked and broken up adjacent to the rail. The ties and OTM are not visible for inspection but can be assumed to be in poor condition. The track throughout the crossing does not appear to follow any defined alignment and does not smoothly transition with the ballasted track on either side of the crossing (see Figure 13).

Kingston Point Line State of Existing Track

The ballasted track from the grade crossing to a point across from Sycamore Street has not yet been reconstructed. The track is adjacent to the roadway with the pavement meeting the near rail. The pavement is cracked and broken along the track and in many locations the top of rail is not level with the edge of pavement (see Figure 27). There is very little separation between the track and the roadway which slopes toward the track. Even with several drainage manholes on this side of the road (see Figure 28), much of the storm water runoff appears to end up on the track.

Between Sycamore Street and North Street, the track separates from East Strand Street as it heads toward the causeway. At North Street, the centerline of track is approximately 195 feet from the edge of East Strand Street. A standard ballasted track section would work in this area which consists of a few private gravel grade crossings (see Figure 5). At North Street, the grade crossing is also gravel and leads to the Kingston Gas Works. The track in this section and continuing east toward the causeway in general has not yet been part of the museums reconstruction effort.

Areas of Concern

The main areas that could cause problems for electric trolley car operations are the embedded track alongside East Strand Street west of the museum; the East Strand Street grade crossing west of the museum; the East Strand Street grade

crossing east of the museum; and the track alongside East Strand Street east of the museum from the crossing to the private crossing at North Street extension.

The cause for concern can be traced to two factors. The first factor is the present condition of the existing track in various locations. The second factor is the potential for transmission of stray currents when the line becomes electrified, and the impacts of these currents on the existing gas mains in close proximity to the track.

The presence of gas lines adjacent to and crossing the track is a major concern when introducing electrified trolley operations.

Secondary Study Areas: Brickyard and Kingston City Lines

These two lines are not being considered for restoration at the present time but will be in the future as part of the long-term plans to integrate the Museum's operations with the transportation needs of the City of Kingston. These two areas have been defined as secondary study subject areas.

HDR's review of these lines consisted of inspecting them and noting their overall present condition. Major reconstruction items that would have to be addressed in reconstructing these lines are also discussed.

Kingston City Line Extents

The track to East Chester Street in downtown Kingston exits the Trolley Museum yard area through the west gate, travels along the edge of Hasbrouck Park, circles clockwise around the park alongside Rondout Drive. Adjacent to Rondout Drive, the track crosses three railroad bridges (see Figure 31), including one over Garraghan Drive, and then crosses Maple Street at grade. The track turns north and crosses Murray Street at grade and Delaware Avenue at grade before turning west. The track then crosses 3rd Avenue at grade and 1st Avenue at grade before crossing back over Delaware Avenue and reaching Route 9W.

At Route 9W, the line crosses Route 9W via a bridge (see Figure 32) that was constructed as part of the previous construction of the Route 9W interchange at Delaware Avenue. On the west side of Route 9W, the track continues along the south side of Delaware Avenue and passes through a tunnel (see Figure 33) under the intersection of Livingston Street, Hasbrouck Avenue and Delaware Avenue. The track then travels between Hasbrouck Avenue and Delaware Avenue to East Chester Street.

Brickyard Line Extents

This line starts at the Kingston Point line siding turnout on the south side of the lagoon east of North Street. (see Figure 34) and travels around the western side of the Kingston Point lagoon, crossing Delaware Avenue and proceeding into the general area of the future Hudson's Landing development at the former Brickyard / cement plant site. The Hudson's Landing project will add 1,750 mixed-use residential units, 78,500 square feet of commercial space, a new public waterfront promenade, and 250 acres of open space for recreational uses. Right-of-way for the trolley line is to be incorporated into the development.

Existing Conditions - Secondary Track Study Subject Areas in General

The existing track in the secondary track study subject areas are in various states of disrepair.

The existing rail in ballasted track is generally 105# Dudley. The 105# Dudley is generally adequate for re-use. An additional supply of 105# Dudley (as well as some heavier rail sections and girder rail) has been stockpiled at the car yard (see Figure 35), which has been acquired by the museum.

Ties in existing track are not fit for re-use. The trolley museum has acquired a number of second-hand ties (see Figure 12), which are stockpiled at the car yard. The stockpiled ties appear to be in good usable condition.

Existing Conditions - Kingston City Line

The alignment of the existing track west of the museum along the Kingston Line seems to follow a rough geometric alignment. Any geometric alignment associated with the existing track of secondary the Kingston Line (or the Brickyard Line) can no longer be determined due to the deterioration of the trackbed.

The existing trackbed and ballast in the ballasted track areas of both lines have been severely fouled (see Figure 37), overgrown (see Figure 38), or completely washed out (see Figure 39). The existing ballast would not be suitable for use as ballast during any rehabilitation efforts.

The existing OTM may be in re-usable condition. Much of the track in this area is overgrown, paved over or removed making details of existing conditions difficult to note. Tie plates consist of a variety of sizes and configurations. There are single shoulder, double shoulder and even some pandrol plates of various sizes. Some of the single shoulder plates of short lengths should not be re-used as they are considered to damage ties and are nicknamed "tie destoyers". There is an

additional stockpile of OTM at the car yard (see Figure 16), which has been acquired by the museum.

There are four bridges on this line, three of which parallel Rondout Drive. The first bridge (see Figure 41) closest to the museum is a single span ballasted deck bridge that crosses a grassy area. The second bridge is a three span open deck bridge that crosses over Garraghan Drive, (See Figure 42) a major means of access to Rondout Drive. The last bridge (see Figure 43) is a single span open deck bridge that crosses over a grassy area. Two of these bridges were built over streets that were eliminated when the Rondout Drive housing development and the new 9W was constructed and could be replaced by compacted fill. For all three bridges, the bridge structures appear to need some significant rehabilitation to safely accommodate rail traffic. At a minimum, the bridge timber ties on the second and third bridges need to be replaced in full. A detailed structural inspection would be recommended for all three bridges, to determine exactly what would be required for the rehabilitation of each bridge.

The fourth bridge spans Route 9W (see Figure 32) and was originally constructed as a railroad bridge as part of the construction of the 9W interchange for Delaware Avenue. However, since railroad track was never installed on this bridge, and no maintenance performed on it since it was built, a structural review would be recommended to determine if it is adequate for the intended purpose.

A tunnel (see Figure 33) under the intersection of Livingston Street, Hasbrouck Avenue and Delaware Avenue, previously carried rail traffic along the Kingston Line. However, the rail within the tunnel and its approaches has been removed (see Figure 44) and stockpiled in the tunnel itself (see Figure 45). The deck over the tunnel currently accommodates vehicular and pedestrian traffic.

There are a total of eight at-grade crossings along the Kingston Line. At Maple Street the grade crossing (see Figure 46) was recently repaved to the top of rails and flangeways have been cut into the pavement by Museum hy-rail maintenance trucks passing over the crossing.

Murray Street has recently been paved and the rails of the crossing were paved over (see Figure 47). Likewise at Delaware Avenue, the last time the street was paved, the rails of the crossing were simply paved over (see Figure 48). Also, for the segment of track between Murray Street and Delaware Avenue, a parking area west of the ballasted track has been

paved level with the top of rail right up to the field side of the west rail (see Figure 49)

Similar to Murray Street, 3rd Avenue has also recently been paved and the rails of the crossing were paved over (see Figure 50). The crossing at 2nd Avenue is similar to the first Delaware Avenue crossing in that the last time it was paved, the rails were paved over (see Figure 51). At the 1st Avenue crossing the rails were partially paved over (see Figure 52).

The second Delaware Avenue crossing appears to have been removed when this portion was reconstructed as part of the construction of the Delaware Avenue interchange with Route 9W (see Figure 53). Finally at East Chester Street, the crossing rails still seem to be in place, however some of the adjacent track has been removed (see Figure 54).

Existing Conditions Brickyard Line (Lagoon Line to Hudson's Landing)

There are several railroad bridges over water and one grade crossing over Delaware Avenue for which the track most likely was removed at the time Delaware Avenue was repaved / reconstructed.

It appears there are three short single span open deck bridges along the west side of the lagoon (see Figures 55, 56 & 57). At a minimum, the bridge timber ties on these bridges need to be replaced in full. A detailed structural inspection would be recommended for all bridges, to determine exactly what would be required for the rehabilitation of each bridge. There is also at least one area where the track roadbed has been so severely washed away (see Figures 39 & 58) that bridging this area is a possible solution.

Areas of Concern

Kingston City Line

The main areas that could cause problems for electric trolley car operations are the three railroad bridges along Rondout Drive, all of the eight at-grade crossings, the railroad bridge over Route 9W and the tunnel under the intersection of Livingston, Hasbrouck, and Delaware. Areas where gas lines cross or pass near the track are also a concern. Utility documents indicate a gas main crosses the track near the south end of Rondout Drive and runs along Rondout Drive adjacent to the track.

As all three of the Rondout Drive bridges are in poor condition (see Figures 43, 59 and 60), HDR recommends

that the bridge restoration effort be focused only on the bridge over Garrighan Drive, and the two redundant spans that no longer cross any streets be removed and the track reinstalled on properly compacted fill. Bridges are a continual maintenance item, and these two redundant bridges are in sufficiently poor condition as to require considerable funds to restore to usability – and then will continue to consume maintenance funds well into the future. However, if they are removed, the present high value of steel scrap and the large amount of steel in these two redundant bridges will help offset the cost of installing the replacement fill.

The tunnel under the Delaware Avenue – Hasbrouk – Livingston intersection generally appears in fair condition. Part of the roof of the tunnel is wood and a thorough inspection of the tunnel will be required before any reconstruction work can proceed.

This line has eight at-grade road crossings which will have to be reopened. Currently most of these crossings are paved over. If they have officially been closed and removed from the state records as active grade crossings, they must be legally reopened before construction will be allowed to proceed. None of the crossings now have active warning devices, but they did have them (lights and bells) as recently as early 2006 (see Figure 61).

In the direction from Rondout to Kingston City, the grade crossings are:

- Maple Street – active road; crossing intact.
- Murray Street – paved over; through street. Current limit of hy-rail operation
- Delaware Avenue – paved over; main arterial
- 3rd Avenue – paved over; neighborhood street
- 2nd Avenue – paved over; neighborhood street
- 1st Avenue – paved over; neighborhood street
- Delaware Avenue at 9W Interchange – paved over; main arterial
- East Chester Street – paved over; through street.

All eight of these crossings must be reconstructed. Active warning flashers and bells will be required at all eight crossings, but it may be possible to eliminate or otherwise reduce any disruption caused by the bells at the neighborhood streets, where the line is adjacent to houses and automobile traffic is minimal. Gates may be

required on the two crossings of Delaware Avenue, and at Murray Street and East Chester as well. Each crossing will have to be analyzed closely in terms of sight lines, auto traffic and other factors before a final determination of the type of crossing warning equipment to be used.

Crossings on Streetcar and Light Rail systems may not require warning times as long as the AAR Freight Railroad Standard minimum 20 second warning time for grade crossing warning device activation. Activation times of these warning devices will likely vary depending on the conditions at each crossing location and the speed of the trolley in these areas.

Some trolley museums, such as the Pennsylvania Trolley Museum near Pittsburgh, PA and the East Troy Electric Railroad Museum, regularly operate through active grade crossings. A typical operating procedure through crossings would be:

- Slow to 5 mph on approach to crossing with the trolley completely under control and in coast mode.
- Verify that the flashers are on and bells are ringing and any gates are down.
- Verify that all auto traffic has stopped or is stopping
- Ring the trolley bell or horn (if equipped)
- Proceed through the crossing with power off, prepared to stop, at 5 mph or less.

It is not recommended that the trolley comes to a full stop at all grade crossings, as this often causes a standoff situation (such as that which often happens at 4-way stop signs) where all vehicles can begin to move at the same time.

Brickyard Line to Hudson's Landing

For this study area the areas of concern are the ballasted track structure along the west side of the lagoon, the open deck bridges along the west side of the lagoon, and the grade crossing at Delaware Avenue. The 10" gas main that runs adjacent to the track and crosses Delaware Avenue at the grade crossing area is also a concern.

Utility mapping indicates no other major utilities presently under or near the tracks of this line.

Field Survey - Streetcars

HDR personnel inspected the Museum's fleet of streetcars, railroad and rapid transit equipment, focusing on suitability for vintage trolley passenger operation. Table 1 lists the Museum's streetcar fleet. These vehicles were examined as to overall condition, wheel profiles and condition, single and double ended (one or two control stations) and suitability for use in future planned operations.

Field Survey – Existing Traction Power and Overhead Line Equipment

Currently, the Museum is not electrified although a number of traction power items have been obtained over the years.

The museum presently owns two second hand traction power substations. One is located in the trolley barn and is used to test propulsion units for the museum's vintage fleet of vehicles. The second and much larger unit is located in the yard area and has never been used by the museum.

The substation in the trolley barn has a rating of ±125 kw with an output voltage of 400 volts. This unit has only limited vehicle testing application and is considered unsuitable for powering vehicles either in the trolley barn or in the yard area due to its low ratings.

The substation in the yard is skid mounted and was procured by the museum some two years ago. This substation is a self-contained unit that is housed in a metal enclosure. The substation consists of an incoming utility frequency section with surge protection and a means of isolation of the utility service, a transformer rectifier, a diode rectifier bank, DC breaker, a grounding switch and a substation control and instrumentation section. The unit is of Ohio Brass manufacture and was originally designed and used for a mining application. The unit is rated at a nominal 800 kW, 600 volts DC with a 2300/4160 volt Δ-Y input transformer primary. The AC to DC conversion associated with the substation consists of a 3-phase 6-pulse rectifier. This form of rectification when applied to a traction system generates relatively high amplitude 5th, 7^{th} and 11^{th} harmonic frequencies based on the 60 Hz fundamental frequency. These harmonics, when generated are reflected back into the utility system causing degradation in power quality in the utility systems and to adjacent consumers, increases in utility losses and potential overvoltage conditions. For this reason and without appropriate filtering equipment added to the unit, the use of such rectification equipment is frowned upon by electric utilities.

Electric Utility Service

Electric utility service is presently provided to the trolley museum facility from the local utility, Central Hudson Gas and Electric (CHG&E). The facility is provided with a 208-volt, 3-phase, 4-wire service that is used for barn and yard lighting and general power, and is also used to power the trolley barn substation. The service is derived from the utilities overhead medium voltage distribution network that runs along the Strand and past the trolley museum on a pole line. The medium voltage service consists of a 3-phase, 13.8 kv overhead distribution systems provided with, lightning arrestors, fuse cutouts

and three single phase pole mounted oil filled transformers for service drops. CHG&E has indicated that the 13.8 kV supply along the strand is sufficiently robust for trolley operations in the foreseeable future.

Catenary Hardware

The museum has long planned for electrifying their trolley system and has acquired a great deal of savaged miscellaneous hardware over the years with a view to using it for the proposed electrification construction. As part of the study work, the miscellaneous hardware was randomly inspected and a database created of available hardware, its condition and its applicability to the proposed re-electrification project created. This miscellaneous hardware consisted of the following:

Item	Description	General Condition
1.	Wood Tie Insulators ("Wood Sticks")	Poor condition - majority would not be recommended for re-use
2.	GRV Wire Insulators	Most in serviceable condition and can be considered for re-use
3.	Rubber Bushing Insulators	Majority in reasonable condition and can be considered for re-use
4.	Section Insulator Tips	Good serviceable condition with refurbishment can be considered for re-use
5.	C-2 Curve Segments	Good serviceable condition with refurbishment can be considered for re-use
6.	No-Bo Section Insulators	In varying degrees of serviceability, wear and damage. With refurbishment a number can be considered for re-use.
7.	Single Wire Auto-Tensioning Cantilever	Serviceable condition but based on overhead system requirements may not be considered for re-use
8.	Single Wire Fixed Tensioning Cantilever	Serviceable condition with refurbishment. Can be considered for re-use dependent on system needs
9.	Assorted Clevis Clamps	Good serviceable condition with refurbishment can be considered for re-use
10.	Assorted Pipe Eyes	Good serviceable condition with refurbishment can be considered for re-use
11.	Strut Insulators	Good serviceable condition with refurbishment can be considered for re-use
12.	Horizontal Messenger Saddles	Good serviceable condition with refurbishment can be considered for re-use
13.	Assorted Insulated Swivel Clamps	Good serviceable condition with refurbishment most can be considered for

		re-use
14.	Steady Arms	Good serviceable condition with refurbishment can be considered for re-use

The hardware has all previously been used and varies widely in condition and remaining life. Much of it is salvage from the Philadelphia trolley system. It is estimated that a great deal of work will be required to complete the salvage process of this hardware for its re-use, but this is work which could be done by Museum volunteers. HDR recommends that this historic hardware be used first in areas of high visibility, such as in the Yard area and the in-pavement line section of the Rondout line between the Yard and Broadway.

In addition to the array of hardware the museum has acquired, the museum has in stock a 3000 ft of new grooved 4/0 trolley wire. The wire appears in new condition and is still rolled on its shipping reel. This wire will be directly usable on the main line. The Museum also has about 1200 feet of 2/0 new grooved trolley wire, which would be usable in the yard area.

The HDR team also inspected the right-of-way to determine if any difficulties existed with erecting catenary poles for the overhead contact trolley wire. Special conditions were noted on the Causeway to Kingston Point due to soil conditions and potential environmental impacts, and the embedded track area along the Strand to Broadway due to adjacent buildings and the historic nature of the recent renovation.

Meetings

Meetings formed an important part of the analysis of the system. They allowed institutional knowledge to be documented and concerns to be voiced and discussed. Summaries of the meetings held are as follows with minutes included as Appendix E of this report.

Kick-Off Scoping Meeting

A project kick-off and scoping meeting was held on July 17, 2007 at the Trolley Museum of New York, with the HDR project staff and representatives of the Trolley Museum of New York and the City of Kingston. The topics discussed at this meeting included project scoping, goals and objectives, responsibilities of the participants, existing relevant information, expected deliverables, schedule of public meetings and schedule of meetings with utility company and government agencies.

Meetings with Central Hudson Gas and Electric

Two meetings were held with representatives of the City of Kingston, the Trolley Museum of New York, and Central Hudson Gas and Electric (CHG&E) personnel. Both meetings were held at Kingston City Hall.

Initial Meeting

This meeting was held on August 9, 2007. The meeting served to introduce all of the involved parties, allow the City and Museum to present the intended operating plan and address many questions and discuss possible resolutions. Two representatives were present from CHG&E, one representing the electric power department and the other representing the gas utility department. The CHG&E personnel explained their concerns in detail. The utility's primary concern was the potential for accelerated corrosion of high-pressure gas lines buried under or parallel to the Kingston Point Line's tracks. Their second concern was the possibility of conducted harmonics feeding back into the power lines from the traction power substation.

At this meeting CHG&E provided to HDR a series of plans indicating the gas utility lines in the area and their approximate locations. CHG&E maintains automated remote monitoring facilities using the "Bullhorn" system on these gas lines, as well as sacrificial anode and reverse current active corrosion prevention techniques.
HDR presented information demonstrating an awareness of both of the potential problems and of the standard accepted industry solutions for preventing stray currents from entering the ground and reducing harmonics fed back into the electric utility's system. HDR suggested a 12 pulse filtered traction power rectifier sized larger than the maximum traction demand as a means of reducing potential harmonic issues.

CHG&E agreed that the harmonic problem can be solved using a modern 12 pulse packaged rectifier substation sized larger than needed for operation along the West Strand and Kingston Point Lines. Larger substation capacity and 12 pulse design (with appropriate filtering) greatly reduces conducted harmonics.

Second Meeting
The second meeting was held on September 6, 2007, again at Kingston City Hall. This meeting focused on HDR's planned approach for power line harmonic and stray current mitigation, including taking baseline measurements and active monitoring of streetcar-related leakage currents. HDR presented a detailed methodology that addresses the Utility's concerns over leakage current corrosion and power line harmonics. The Utility agreed that HDR's proposed solutions appeared to provide sufficient mitigation to allow the electrification of the West Strand and Kingston Point lines.

HDR determined that powerline harmonics would best be reduced by a modern, skid-mounted 12-pulse packaged rectifier of 1000 kW that would operate off the Utility's nearby "medium voltage" 13.2 kV powerline on the Strand, generating an output voltage of 650-700 Vdc. This unit would have only one electric service and one AC breaker (no redundancy). There would be multiple output feeders. The slightly higher output voltage will not cause problems with the older streetcars.

HDR determined that this value would be sufficiently larger than the normal demand for the initial West Strand and Kingston Point Lines that it would minimize peak-load harmonics. Similar units are used elsewhere at similar museum operations, such as at the Electric City Trolley Museum in Scranton (see photo below)

The present 13.2 kV line along the Strand is capable of powering the traction power substation. CG&E recently constructed and a new 50 MVA utility substation close to this line to add to its capacity.

For the potential leakage currents, HDR described several techniques which could be used to reduce leakage currents on the tracks above the gas lines. The first step would be to use CHG&E's existing stray current monitoring system to determine a baseline existing leakage current profile.

The primary method of reducing stray current leakage would be through the use of a number of special track construction methods designed to better insulate the running rails from ground. These techniques include installing rubber pads between the rails and the tie plates, negative return feeders to decrease the resistance of the return current path, electrical bonding around all rail joints, cross-bonding the two rails together at regular intervals, track sectionalizing, insulated joints, rubber "boots" around imbedded rails, and installing modern insulated concrete-panel grade crossings.

Secondary methods would be to increase the impressed cathodic protection currents presently used by the Utility, and continuously monitor stray current values whenever the streetcars are running.

CHG&E stated that they do not now have any significant stray current problems in this area. CHG&E agreed that HDR's proposed mitigation techniques are standard accepted industry practice.

Public Meeting

On November 8, 2007 a public stakeholders' meeting was held in the Council Room at Kingston City Hall. This meeting was open to the general public. HDR presented a program describing the project, its goals, and how it would affect the present West Strand Line and Kingston Point Line areas. A question and answer session followed. The meeting was well attended.

IV. RECOMMENDATIONS AND SPECIFICATIONS FOR RECONSTRUCTION OF INFRASTRUCTURE

Track Reconstruction – Broadway to Kingston Point
Recommended Course of Action

The desired final product is an electrified transit trolley system capable of running the various rolling stock on hand at the museum. In the event that sufficient funding could not be found to support this work as a single construction project, a phased approach would allow incremental improvements leading to the final desired product. The phases have been developed so that subsequent steps will not require work of what has already been completed. HDR also recommends completing all of the track reconstruction before installing traction power system.

HDR recommends phasing of track reconstruction work as follows:

Phase 1 – Develop a geometrical alignment and profile for the reconstruction effort so that there is a baseline for all following work to tie into. Develop construction standards based on the anticipated requirements of the transit system.

Phase 2 – Continue the reconstruction of remainder of the yard tracks and the existing ballasted track from Sycamore Street to the causeway. The reconstruction effort should be from the subgrade on up similar to what has already been done in other track sections by museum volunteers. A standard cut spike track section (See Figure T-1 in Appendix B) can be used at this point in time. Use the second-hand ties that have been stockpiled. Re-use the existing 105# Dudley (both in track and stockpiled). Replace the 80# rail section with 105# Dudley when that section is reconstructed. Re-use the stockpiled joints, joint bars, tie plates and cut spikes.

Conduit and pullboxes adequately sized to handle anticipated feeder power cables should be installed at this time in this area to accommodate the installation of negative return feeders for stray current mitigation, and positive current feeders, if it is not desired to mount them on the catenary poles. The cables themselves would be installed as part of the electrification project. The ducts should be installed outside the rails and deep enough that automatic tamping machinery will not interfere with them. An alternative to underground conduit or aerial cable is re-enterable cable trough, such as the Plastibeton system, alongside the tracks. HDR does not recommend this approach, however, due to its expense.

When electrification becomes a reality in the future, the OTM can be replaced with tie pads and pandrol clips with rail insulators. (See Figure T-2 in Appendix B) This rail fastening system is more conducive to the mitigation measures to be employed and this change can be achieved without the need to rebuild the track from subgrade on up again. Phase 2 can overlap with Phase 1.

Phase 3 – Reconstruct gravel grade crossings (See Figure T-3 in Appendix B) using items that will help mitigate stray currents in the future electrified system. Stray current mitigation items would isolate the rail from the rail fasteners, tie plates, ties and subsequently the ground. Modifying the crossing system in the future to mitigate stray currents would more than likely require reconstructing the crossing again. Therefore, with an electric trolley system remaining the ultimate goal, the reconstruction here should accommodate the future mitigation efforts. Phase 3 can occur in conjunction with Phase 2 but after Phase 1 since you would want the crossings installed in their final locations. Buried conduits for feeder cables should also be installed at this time.

Phase 4 - Mechanically line and surface all track that has been previously reconstructed to the geometric alignment and profile developed in Phase 1. This phase should occur after phase 1 but can follow along with Phases 2 and 3 as various reconstructed sections are completed.

Phase 5 – Reconstruct ballasted track immediately adjacent to East Strand Street and the East Strand Street grade crossing east of the museum. The ballasted track structure should be similar to the sections reconstructed in Phase 2. However, there should be a definitive barrier separating the track from the roadway. This barrier (curb) would prevent runoff from flowing onto the trackbed, keep vehicular traffic from fouling the railroad (except at grade crossings), and provide a physical barrier between the railroad and the adjacent gas lines. The subgrade could also be graded away from the roadway. These measures would help mitigate stray currents in the future electrified system, potentially without further modifications to the track structure. If conduits are installed in the previous phases they need to be installed here as well. (See Figure T-4 in Appendix B).

The East Strand Street grade crossing should be similar to the crossings described in Phase 3 only with asphalt instead of gravel (See Figure T-5 in Appendix B). Care should be taken to construct this crossing to the alignment and profile developed in Phase 1. Due to the required modifications of East Strand Street with the track work to be constructed in Phase 5, as well as the existing condition of East Strand Street in this area, there appears to be an opportunity to include this work as part of a potential East Strand Street Reconstruction Project. Buried conduit should be installed when this crossing is rebuilt.

Phase 6 – Reconstruct the embedded track alongside East Strand Street/Ferry Road. The service life of newly constructed embedded track typically needs to be much greater than that of ballasted track. It would be beneficial to consider future electrification plans when reconstructing this track. The existing girder rail has deteriorated significantly and should be replaced with a heavier rail section that can be easily acquired. Use new tee rail (115RE), fasteners and embedment material. There are several way that the flangeway can be created, including tee rail with strap guard, girder rail, rubber rail seal and an elastomeric grout filler.

The existing brick pavers are considered integral to the historical character of this area. The brick pavers should be stockpiled and re-used to the maximum extent possible. There are a few other options for an electrically isolated, historically accurate embedded track system to be constructed. (See Figure T-6 in Appendix B and Figures 66 and 67)

Buried conduit should also be installed with the track, with small pullboxes at the locations where insulated joints or trolley wire feeder spans are installed.

Phase 7 – Reconstruct East Strand Street grade crossing west of the museum. This crossing has recently been reconstructed as part of an East Strand Street reconstruction project. As mentioned previously, there are several issues which would need to be addressed for this crossing to be considered adequate for the desired electric trolley system. Addressing these issues will require a reconstructed grade crossing similar to what would be completed in Phase 5 for the East Strand Street grade crossing east of the museum. Again, install buried conduit along with this reconstruction.

Phase 8 – Rehabilitate ballasted track sections with stray current mitigation items. Remove rail, spikes and tie plates and reinstall rail with pandrol plates, elastomeric tie pads, pandrol clips and rail insulators. (See Figure T-2 in Appendix B), bond all joints and install insulated joints in conjunction with the requirements of the future signal system.

Phase 9 – Construct a new traction power system with overhead trolley wire as described below.

Traction Power and Overhead Equipment Design

Introduction

The scope of the reconstruction and electrification of the trolley system is the provision and implementation of electrified operation for as many of the existing museum fleet of vehicles as is practical. In addition and as a future objective, the designed and constructed electrification infrastructure shall be capable of supporting regular revenue service using modern or vintage trolley cars.

The proposed electrification design shall be based on appropriate proven systems that are cost effective easily maintainable, reliable and do not adversely affect the existing infrastructure.

Proposed Electrified System

The proposed electrified system will consist of one or more traction power substations that convert the electric utility service to a trolley system useable power supply and a right-of-way installed overhead electric distribution system.

The capacity and the number of substations will be dependent on the following variables:

- Electrical loading of both currently owned and future revenue vehicles
- The operating plan, initial and projected and future proposed expansions for the system
- The characteristics of all proposed operating vehicles and in particular their supply voltage limitations
- Proposed alignment particularly grades, curves and number of stations and stops

The form of the overhead distribution system will be developed based on system loading, vehicle constraints, right-of-way physical characteristics. The design approach will be to simplify the system as much as possible but to ensure that the constructed system is aesthetically pleasing, is maintainable and provides the City of Kingston with a safe and reliable power distribution system.

Traction Power

One of the critical items in developing an electrified trolley system is the design of the traction power system and in particular the substation. Inadequate sizing or excessive spacing of the traction power substations will lead to the inability of the system to perform in accordance with vehicle operating parameters and the defined system operating plan. This is particularly true in the case of Kingston where it is planned to operate a number of different vehicles of different eras and from different countries on the system. To assure that the designed substation system will adequately support the operation of the proposed electrified trolley line, an accurate determination has to be made of the required traction power. The following describes the approach taken to assessing traction power requirements, assumptions made, calculations performed and proposed sizing and siting of the traction power substations.

The approach taken for this study has been to develop traction power substation spacing based on worst case operating scenarios of the most energy intensive vehicles that may be operated on the line. The size and siting of substations have been selected based on the most conservative assumptions. This approach has been taken as the system alignment may still require adjustment and the actual characteristics of vehicles to be operated on the system are not accurately known. The assumed model vehicle has been based on the Portland modern streetcar vehicle, as this is representative of modern streetcars from both a performance standpoint as well as capacity. In addition, its electrical operating duty is far greater than that required for any of the existing museum fleet or any future procured vintage trolleys.

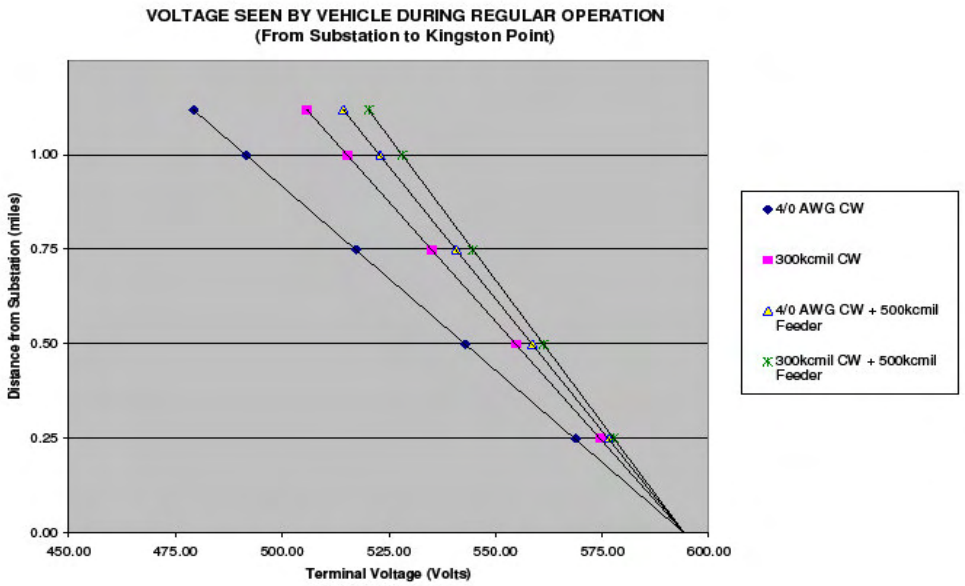
The operating traction power system has been modeled to take advantage of the two rails to reduce the return rail resistance by connecting them in parallel. Where appropriate but without survey data, grades have been modeled and for a worst case scenario of 5.0%.

The system has been configured to isolate the yard and shop from the main line to reduce stray currents and the resulting corrosion.

The defining characteristic for substation spacing is the voltage seen by the vehicle. Using the characteristics of the Portland streetcar provides the worst case voltage drop due to system loading and hence the ability to calculate the maximum acceptable distance that can be fed from one substation and the required spacing between substations.

The optimum spacing of the traction power substations has been based on the results of the modeling simulations and is based on the lowest calculated voltage being above the minimum vehicle inverter operating voltage.

The following graph represents different substation feeding lengths and spacing of substations for four (4) considered contact wire sizes with parallel rail return configuration. All graphs have been based on 15 minute headways at an average speed of 15mph using the Portland modern streetcar that draws far more load than any of the museum vehicles and is representative of a proposed future revenue trolley line.



It is concluded that for the defined operating plan and ultimate system headway one single ended substations with transformer-rectifiers rated at 1,000 kW is appropriate in terms of capacity and impedance for the defined system.

The substation feeds to the OCS have been assumed to be 4-500kcmil feeders operated in parallel. This appears to be more than adequate and could be reduced to 2-500kcmil without a significant difference to system operation unless future headways were reduced to 10 minutes.

It is therefore recommended based on the above study and conclusions that:

- The substation transformer-rectifiers be rated at 1,000 kW with a no-load voltage of 600 volts (See Figure 68 for a similar substation). The existing Ohio Brass skid mounted rectifier unit can not be utilized as part of the new electrification system and may be disposed of.
- The positive feeder cables between the substations and the contact wire disconnect switches be 2 – 500kcmil insulated to 2.0 kV
- The contact wire be 4/0 AWG copper
- The traction power substation be capable of serving the right-of-way for a distance of 1.1 miles (5,807') in either direction from the substation

Overhead Contact System

The overhead contact system (OCS) is defined as all electrical, mechanical and structural equipment between the vehicle contact pick up and the dc positive feeder system. This includes the contact wire; messenger wire; all supporting structures and their foundations and guying systems where necessary; overhead feeders; ancillary wires; hangers; insulators; conductor supports; tensioning devices; cantilever arms; sectionalizing equipment; disconnect switches; lightning arresters and other items necessary for a complete system. The elements of the OCS are sized and described in detail in the traction power section above.

Sectionalization is the electrical separation and isolation of lengths of contact wire from each other and as necessary between substations. Sectionalization allows flexibility of operation during fault conditions to isolate a faulted section and allow the remainder of the system to be energized to recall cars.

Insulated overlaps and section insulators will be used in the OCS as a means of electrically isolating sections of catenary and to enable switching schemes to provide flexibility of operation. Disconnect switches will be installed for isolation purposes and at other designated locations, such as crossovers and the yard leads to provide flexibility of operations during contingency conditions.

The main line traction power distribution system will be electrically separated from the yard and maintenance shop traction power supply. Provisions will be made to connect the shop to the yard and the yard to the main line traction power distribution system as yard and maintenance work dictates and for emergency or contingency conditions.

The intent of this report is to describe and analyze the various approaches to catenary design and make recommendations as to the appropriate catenary

and traction power distribution system for the Reconstruction and Electrification of Trolley track work.

A number of different approaches can be taken to provide reliable overhead contact power distribution for the electrification systems. These approaches have evolved over the last 100 years and have proved extremely effective for their particular application. The following compares and defines commonly used catenary and overhead trolley systems.

1. Single Contact Wire

This system is normally applied where maximum train weight, power demand and speed are very low, usually not more than 40 mph. It consists of a contact wire only; possibly with a short bridle or stitch to the supports to permit the use of longer span lengths and higher speeds up to 55 mph. Single contact wire systems are suitable for streetcar and light rail systems as well as yard and terminals for heavy and commuter rail systems.

2. Simple Catenary

A simple catenary system is the most commonly used type of catenary system and consists of a messenger wire supporting a contact wire by means of wire hangers. The messenger wire performs both a mechanical support function and is used as a current carrying conductor to increase the capacity of the system. The contact wire is designed with optimum sag at a single temperature, typically 60 degrees Fahrenheit.

This type of system is normally used for passenger and freight service where two wires are ample for the required ampacity. The use of mid-span sagged contact wire with a single compatible pantograph permits operation at speeds up to 225 mph. The simple type catenary system is normally used for speeds higher than typical streetcar or light rail operation, but is sometimes used for streetcars or light rail where vehicles are made up of longer multiple car consists and throughput is high. It is also considered for use if traction power substations are spaced large distances apart which would cause excessive voltage drops and degrade system performance.

3. Compound Catenary System

A compound type catenary system can be used for all applications but was primarily developed for the cases of short headways and large train consists. A compound catenary system is used in these situations to eliminate large voltage drops created by the high distribution loads. The configuration includes a main messenger wire with an auxiliary wire suspended beneath it on hangers, which in turn has a contact wire suspended on clamps or hangers beneath it. This system is normally only used for high speed operation and not considered for such low speed and low power/ampacity applications as streetcars or light rail.

4. Low Profile Catenary

Variations of simple catenary designs exist, such as low profile simple catenary, which can be considered as a three-quarter scale version of the

simple catenary type system. Low profile simple catenary produces reduced visual impact due to a smaller system depth (the distance between the messenger and contact wire), 2ft. 0in. to 2ft. 6in. compared to 4ft. 0in. for the standard simple catenary system. This permits both conductors to be supported and registered from a single cross-span wire for improved aesthetics. As a consequence of creating this reduced system height the maximum span between support poles is decreased for the same ampacity of the catenary system. This typically increases the number of poles required by approximately 25 to 30%. If the increase in the number is not acceptable for aesthetic reasons, the catenary system can be reduced in size and weight. As a consequence of this reduction in weight and hence catenary ampacity, parallel positive feeders are installed, typically underground and substitute for this reduction in overhead current-carrying conductors to maintain the overall capacity of the operating system. This form of catenary system is more expensive than the simple catenary system and much more expensive than the single catenary system but in downtown and residential communities it has become the preferred option for streetcar and light rail systems due to its reduced aesthetic impact.

5. Auto-Tensioned Catenary

All the above examples of catenary systems are variable tension catenary systems that are not provided with any form of compensation for expansion due to temperature. The system expands and contracts with temperature and hence the tension of the catenary varies in concert with this expansion and contraction.

A catenary system can be auto-tensioned by means of counterweights, which are mounted on or inside of anchor poles located at each end of a tension length. The anchor pole, counterweight and associated hardware constitute a counterweight assembly. As the catenary conductors expand and contract with variations of temperature, the counterweights will rise and fall thus maintaining a constant conductor tension throughout the specified temperature range. All constant tension catenary systems employ anchor arrangements at the center of each tension length to prevent along track movement of the catenary system. This system is considered for use on light rail systems where temperature extremes are great and increased sag and reduced overhead clearances is unacceptable.

As described above, a number of alternative forms of trolley wire and catenary distribution systems could be applied to the Reconstruction and Electrification of Trolley Track project but, due to the low vehicle speed, low to moderate current demand and considerations of aesthetic and historic impact, it is recommended that a single contact wire system be adopted for the project. This approach will not only be the least expensive but will lead to a robust system requiring only minimal maintenance.

Design and Construction

The design of this single-contact system will reflect the historic nature of the Museum and its streetcars. The overhead contact system will

utilize traditional and historic design materials as much as possible, such as cap-and-cone hangar trolley wire suspension, backbone pulloffs in curves (no trackless trolley hangars), streetcar-style single suspension bracket arms, wooden poles in private right-of-way areas, telescoping metal poles in street-running areas, and traditional wire frogs at switches. Illustrations of these classic overhead design materials are shown in Appendix C.

HDR also recommends that the OCS system be designed so that it is compatible with pantograph-equipped vehicles.

Unfortunately, wooden strain insulators ("wood-sticks") are no longer obtainable, and much of the Museum's inventory of these insulators appears unusable. Once the wood in these insulators deteriorates there is no way to restore them for re-use. Commercially available "Trans-Lite" fiberglass insulators (see Appendix C), available from Impulse NC and other suppliers, may be used instead. Another option is to use porcelain strain insulators such as was done by the Connecticut Company and other traction properties as shown in Appendix C.

Specific Area Requirements – OCS

Feeders: The preferred method of locating feeders is in conduit buried in the trackway. Since negative return feeders will be required to supplement the rail current return as part of the stray current mitigation measures, positive supply feeders can also be installed at the same time. While it is possible to mount the positive feeders on the poles above the contact wire, this creates an undesirable visual impact and thus above-ground mounting is not recommended for use on the Rondout-Kingston Point line.

Frog Positioning: Wire frogs will be temporarily located on the center line of the diverging track and one-third the distance from track switch point to track frog point back from track switch point and anchored securely. They will be subsequently adjusted so trolley poles on all types of vehicles will properly track in the correct direction. Frogs and section insulators will be designed for use by poles or pantographs by using pan jumpers or other methods.

Causeway and Lagoon Area: In certain areas, such as the Kingston Point Causeway, special considerations (such as metal or wooden poles with concrete bases) will be required due to the high water table adjacent to the lagoon and the river. Additionally, installation of line

poles in this area will have an environmental impact that must be addressed. HDR recommends that the poles on the Kingston Point line be located on the lagoon side of the causeway in the area between the eastern end of the siding and Kingston Point. The exact method of inserting the poles and the pole construction will be determined in conjunction with the environmental assessment. See Appendix C which shows pole-mounting techniques, include concrete foundations.

Siding: The existing siding spacing between rails is about 7½ feet, reflecting a centerline track spacing of about 12' 3". At the AAR Plate "C" Clearance maximum clearance zone of 5' 4" from centerline for 10' 8" wide railroad equipment, that means that at least 3 feet of clearance is required from the inner rails on each siding track. This leaves about 1½ feet of room in the center to mount a pole, which is insufficient. Unless the Museum has no equipment wider than about 10 feet, HDR recommends that when the track is reconstructed the centers be moved to 14 feet, or one foot out per track, which would give sufficient room for center-mounted poles with double bracket arms. In the switch point areas span wires will be required to effect transition from double to single track and to properly brace the wire frogs.

Siding to Strand East Crossing: Wooden poles with traditional bracket arm assemblies (See Appendix C) will be used wherever possible. Since wooden poles with a single bracket arm may require back guying, there may be locations where the guys would cause interference at ground level. At these locations special close-in guy anchor techniques will be used. If these are not possible metal poles can always be used, since they do not require back guys.

Strand East Crossing: Span wires across the road will be required to properly mount the contact wire in crossing area. Wooden or metal poles can be used here on both sides of the road.

Yard Area: Because of the number of tracks in the yard area, span wires are recommended. Longer spans can support multiple contact wires over multiple tracks. Additional support wires for these long spans (catenary-style) may be required to distribute tension, or additional wooden poles installed where the track centers permit.

Strand West Crossing: Again, span wires will be required to properly bridge the crossing and backbone the curvature through the crossing to the tangent track parallel to the road. Poles located on the Rondout Creek side of the crossing should be telescoping metal poles. Wooden or metal poles can be used on the Museum side of the crossing, depending on aesthetics. See Appendix C for span wire typical drawings.

Strand West Crossing to Broadway: Telescoping metal poles with bracket arms are recommended. Use of the existing ornamental light

poles should not be considered, as decorative poles of this nature are not structurally designed to withstand the degree of side tension required by a trolley wire span or bracket arm.

Leakage Current Mitigation

The prevention of corrosion to adjacent utilities and structures caused by the operation of the operation of the streetcar system is of critical importance.

Stray Current and corrosion control in the context of the Trolley Museum of New York is intended to intended to realize the design life of the Museum's facilities, minimize maintenance costs associated with deteriorating material, reduce corrosion related failures and reduce detrimental effects to adjacent utilities and structures owned by others.

Trolley Museum of New York's philosophy for stray current control and minimizing stray currents focuses on preventing stray currents at the source as well as providing consideration for adjacent structures and how they can be modified or designed to withstand stray currents.

Stay current corrosion was not systematically addressed until 1910, when the United States National Bureau of Standards (NBS) began an 11-year study of stray-current corrosion. In 1921, the National Bureau of Standards recommended the following measures to reduce the occurrence of stray-current leakage on the transit-system side:

- Provide for adequate track-to-track bonding as a means of reducing the resistance of the negative return path.
- Minimize the distance between the traction power substations, consistent with system economy
- Insulate the negative feeders (rails)
- Utilize a three-wire traction power system.

The first three measures were implemented on many of the transit systems, resulting in decreased amounts of stray-current leakage. The fourth measure, a three-wire system design where the two running rails are neutral and a third and fourth rail are the positive feed and negative return, respectively, was not implemented by the most transit companies most likely due to the added expense of the fourth rail. A notable exception to this is the London Underground which found success with this solution.

It was recognized prior to the NBS report being issued that measures were needed to control stray-current leakage and the subsequent corrosion problems that were occurring, on underground utility structures. Several recommendations were made in the National Bureau of Standards report which were applicable to underground structures. They were the following:

- Consideration regarding stray current should be made in locating new construction near tracks
- Avoid contacting cable with pipes and other structures

- Use conduits in cable construction
- Use insulating joints in pipes and cable sheaths
- Shield structures with an insulating coating
- Interconnect affected structures and railway return circuits.

These measures, used in conjunction with the recommendations for the railway transit system, represented the best approach to reducing stray-current and corrosion in 1921. The general principles behind these measures remain valid today and form the basis for modern stray-current control design. Special note is given to the sixth measure, however. The installation of interconnections, or drainage bonds, between the underground structures and the return circuit, was recognized as acceptable only as a supplemental or temporary measure, since drainage bonds increase the overall amount and magnitude of stray current because of the lower resistance in the parallel resistance paths of the utility and the return rail. Drainage bonds should not be considered as a substitute to the design of return circuits with high, rail-to-earth resistances.

The stray current corrosion program developed for the Trolley Museum of New York will follow these same principals as well as a few select others.

- Stray current prevention must include all disciplines. Track construction methods and maintenance in particular play an important role in preventing stray currents.
- The entire traction power system must be considered when attempting to prevent stray currents.
- Provision of space must be allowed in the substation and along the right of way for stray current mitigation equipment. The mitigation equipment shall consist of a connection to the rectifier negative and provisions for connecting drainage cables, through diodes, disconnect switches and other associated equipment.
- Rail to ground voltage should be measured periodically. Monitoring the rail to ground voltage allows the “health” of the system to be tracked. If the voltage to ground trends down slowly over time, ballast cleaning and track maintenance should be reviewed. If the voltage to ground drops quickly, most likely a spot fault has occurred. Each of these means repairs or maintenance is necessary to prevent corrosion caused by stray currents
- Yard track should be maintained to the same standard as main line track. Typically Yard track is maintained to a lesser standard due to reduced operating speeds. However, these reduced maintenance standards allow an increase in negative return currents seeking sneak paths back to the traction power substation.
- The system shall be double insulated to reduce leakage current and provide protection in the event of a tear down or other equipment failure.
- OCS poles will be solidly grounded as a means to reduce their damage from stray currents in the event of leakage past the double insulation. The ground also serves in the case of an OCS short to the pole. The Yard OCS shall be constructed in the same fashion as the Mainline,

but separated from the Mainline as a means of reducing circulating leakage current.

The traction power return system is typically the portion of the traction power system that sources the most stray currents. This is due to the close proximity of the system to ground, the difficulty of maintaining the return system and the heavy wear the system endures. As such the traction return system will be designed to maximize track to earth resistance with the following key design principals:

- A modern state of the art 12 pulse traction power substation should be utilized to provide power to the system.
- The track shall be electrically isolated from all embedment materials
- Trackside grading must be included to facilitate drainage and reduce puddling. Embedded trackwork is notorious for being difficult to keep dry. Standing water essentially guarantees stray currents.
- The Mainline and the Yard track shall have insulated joints installed to prevent transfer of stray currents.
- The running rails will be continuous welded rail to reduce high resistance rail joints.
- All switch machines and wayside equipment shall be designed to prevent stray currents from using them as a path away from the rail return.
- Special consideration must be given to the construction of all special trackwork. If necessary bathtub type construction methods for embedded special trackwork should be considered.
- Also, the negative return system should have its resistance reduced by means of parallel negative return feeders to make it more attractive and to ensure the design minimizes stray current levels.
- A stray current survey should be performed prior to operation to baseline pre-existing stray current conditions. Any pre-existing stray currents should be considered and measures taken to prevent them from damaging the new system.
- A comprehensive stray current monitoring program coordinated with CHG&E shall be instituted to allow additional testing and monitoring as further validation of the system and maintenance practices.

The measures described above in the, if followed will ensure that stray currents are minimized and that the design lives of installed wayside systems as well as adjacent utility infrastructure will be met.

Streetcar and Trolley Vehicles

The Trolley Museum of New York's collection policy in the past focused on obtaining and preserving historic rail vehicles before they were destroyed. This is the pattern followed by all of America's other trolley museums and is the reason that so many different types of streetcars exist today. The idea of using these vehicles for "circulator" type streetcar service is a recent development that was basically inconceivable back in the 1940s through 1960s when most of these collections were developed.

Streetcar Types

The ideal type of streetcar for the goal of operating an historic streetcar circulator system would be:

- "Double-ended", which means it, has control (driving) stations at both ends and two trolley poles. This vehicle does not need to turn around to change direction.
- New (Replica) or Fully Restored – in other words, all equipment replaced or refurbished and ready for the constant wear and tear that a circulator operation will impose.
- Accessible and in compliance with all ADA requirements

Single-truck vehicles that meet the other requirements are acceptable as well as double-truck vehicles, depending on system demand. Such vehicles have limited passenger capacity due to a significantly smaller length.

The Trolley Museum of New York's collection of electrically-powered streetcars, however, consists of mostly single-ended vehicles. Only the Brooklyn Peter Witt car #8361, Oslo car #3 (which is not owned by the Museum) and the Gothenburg car #79 are double-ended. (The Johnstown streetcar #358, while built as a double-ended electric vehicle, is currently diesel powered.)

Tables 1, 2,3 and 4 list the Trolley Museum of New York's collection of rail vehicles. Note that the rapid transit vehicles listed in Table 2 are not considered suitable for other than occasional excursion operation due to the high current draw and the necessity of high platforms for boarding. All of the rapid transit vehicles have standard railroad profile wheels.

Table One – Trolley Museum of New York Streetcars

Number	Description	Builder	Year Built	Description	Overall Condition	Wheel Condition
3	Oslo Norway car	MAN/Schukert	1897	Double End Single Truck	Excellent	Compromise profile; excellent condition
1504	Brussels, Belgium Car	Brussels Tramways	1910	Single End Single Truck	Good	Very narrow Belgian city profile; worn; Car derails on railroad track. Need replaced with wider profile
79	Gothenburg, Sweden Car	ASEA type M-20	1912	Double End Single Truck	Good	Wider tread with lots of remaining metal - may be usable but need re-profiled.
8361	Brooklyn Peter Witt	J. G. Brill	1925	Single End Double Truck	Fair	Standard US city profile; worn. Need replaced.
358	Johnstown car	St. Louis Car	1925	Double End Double Truck Diesel Powered	Excellent	Excellent; standard railroad profile.
601	Queensborough Bridge	Osgood-Bradley	1930	Double End Double Truck	Very Poor - Un-restorable	N/A
1000	Brooklyn PCC	Clark Equipment	1936	Single End Double Truck	Good	PCC Standard city profile resilient wheels (old style with large retainer nut) good; but city width may require flange-bearing frogs.
3204	Boston MBTA PCC	Pullman Standard	1946	Single End Double Truck	Recently Painted; Poor to Fair	Solid steel wheels; may require replacement if narrow city tread.
3214	Boston MBTA PCC	Pullman Standard	1946	Single End Double Truck	Poor	Solid steel wheels; city profile
3216	Boston MBTA PCC	Pullman Standard	1946	Single End Double Truck	Poor	Solid steel wheels; city profile
3584	Hamburg car	Linke-Hoffman-Busch	1952	Single End Double Truck	Very Good	Odd ; appear to be new wheels but not profiled. May be usable but need re-profiled.
120	Model 55 car	J. G. Brill	1929	Single End Double Truck Diesel Railroad “Doodlebug”	Very Good (undergoing engine maintenance)	Standard railroad profile; good.

Table 2 – Trolley Museum of New York Rapid Transit Cars			
Number	**Description**	**Builder**	**Year Built**
1602A	BMT Q car	Jewett	1907
5600	Lo-V	American Car & Foundry	1925
127	SEPTA N. Broad St.	J. G. Brill	1927
510	H&M "Black Car"	American Car & Foundry	1928
513	H&M "Black Car"	American Car & Foundry	1928
825	R-4 car	American Car & Foundry	1932
401	Delaware Bridge	J. G. Brill	1936
402	Delaware Bridge	J. G. Brill	1936
175	SEPTA S. Broad St.	Pressed Steel	1938
6398	BMT R-16 car	American Car & Foundry	1955

Table 3 – Trolley Museum of New York Rapid Transit Maintenance Cars			
Number	**Description**	**Builder**	**Year Built**
F401	IND flat car	Magor	1931
C211	IRT ex-crane car	Differential Steel	1932
41	R-3 car/Drill Motor	Magor	1932

Table 4 – Trolley Museum of New York – Railroad Locomotives			
Number	**Description**	**Builder**	**Year Built**
9	Diesel Locomotive	Whitcomb	1943

Wheel Profiles

In addition to overall condition, there is the matter of wheels and wheel profiles. Streetcars are built with narrower wheels than railroad standard. In addition, flange depth is considerably less than with railroad wheels.

HDR inspected the Museum's collection of streetcars and also inspected the wheels of the most likely candidates for public operation. The wheel profiles were very different from each other and from any standard profile. The results of the wheel inspection are shown in Table 1.

HDR recommends that the Museum investigate the adoption of a standard wheel profile using a "compromise" wheel profile philosophy similar to that found on modern LRT systems (see Figure 69) showing some various types of compromise wheel profiles.). These wheels have a railroad-wheel width and taper tread, but with a slightly smaller flange to allow for a wider back-to-back gauge at the flange point. Use of this type of wheel will have two major advantages:

- Standard railroad switch frogs can be used throughout the system. Streetcar-type “flange-bearing frogs” will not be needed with wider tread wheels. Flange-bearing frogs cause derailment problems when used with vehicles with railroad wheel profiles.

- The smaller flange of the compromise wheel profile allows it to work adequately with girder rail, girder guard rail, and T-rail with bolt-on guard flangeway sections. The only proviso is that the railhead must be even with or a fraction higher than the surrounding paving, to prevent the wider wheel tread from running on (and wearing) the pavement.

Before committing to specific profile design, however, each vehicle will have to be closely inspected to verify the compatibility of the truck frame to a wider profile wheel. In some specific cases a slightly narrower wheel tread may be required.

Figures 70 through 75 show wheel profiles of some of the streetcars stored in the workshop / carbarn area.

Profiling wheels is not something that can be done at the Museum. Any major wheel shop or railroad or rail transit facility is able to accomplish this work. Note that the entire streetcar does not necessarily need to be transported to the facility; just the trucks (double-trucked car) or wheel-axle sets (4-wheel car). A transit maintenance facility with a wheel-truing machine can profile the wheels while still in the trucks.

Note that if pulling axles for shipment, any journal brasses are <u>not</u> interchangeable between axles and bearing positions. They must be accurately marked to correspond to the correct end of the original axle, so they can be replaced in exactly the same position when the wheel-axle set is reinstalled. The same holds true for motor-axle bearings. If new axles are required, obtain new brasses turned on a lathe to mate precisely with the bearing surfaces of the new axles.

Vehicle Condition and Restoration

The condition of the Museum’s collection of streetcars varies from fully-restored (Johnstown 358) to vehicles requiring major restoration efforts (Boston PCCs, wooden subway cars, etc.). In terms of suitability for future operations, the focus here will be on the prime candidates for future operations as indicated above. These vehicles are: Johnstown 358, Gas-Electric 120, Brooklyn 8361, Gothenburg 79, Brussels 1504, Oslo 3, Brooklyn PCC 1000, and Boston PCC 3204.

<u>Johnstown 358:</u> This streetcar is completely restored in excellent condition and has a diesel engine for propulsion. No changes are required except to restore the doors and windows for operation in inclement weather and some minor cosmetic details. The Museum ultimately desires

to return this vehicle to its original electric propulsion, a major undertaking that will require locating effectively one entire streetcar's worth of propulsion equipment, including new trucks. HDR recommends that top priority be given to completing the window, door and trim work on Johnstown 358. HDR also recommends that Johnston 358 be left with its present diesel propulsion system at least until a number of other streetcars are fully restored for electric operation.

Brill 120: This self-propelled vehicle is presently undergoing engine repair work. Its condition is good to very good. No major restoration work appears to be needed at this time. The wheels on one truck may need to be re-profiled or replaced.

Brooklyn 8361: This double-ended double-truck Peter Witt-style trolley is in fair condition and needs significant body, roof, truck and wheel work before it can be used in service. However, it is complete and at the present time this streetcar is the only restorable double-ended double-truck electric trolley owned by the Museum. As such, it will likely become be the main streetcar for use when the existing line is electrified since it doesn't require "backing up". HDR recommends that the top restoration priority be given to restoring Brooklyn 8361, since until loops or wyes are constructed (at Hudson's Landing and in Kingston City), this streetcar will become the backbone of the electric operations.

Gothenburg 79: This single-truck double-end streetcar is in generally good to very good condition. The wheels appear to be usable as is, but may ultimately require reprofiling. Like Brussels 1504, some minor "cosmetic" work (repainting, interior work) and a complete electrical checkout will be required before this streetcar can be used in excursion service. Note that this streetcar uses a "diamond" pantograph.

Because it is double-ended and can easily be used on the existing Rondout-Kingston Point line without backing up, HDR recommends that restoring this streetcar be made a top priority.

Brussels 1504: This single-truck single-end streetcar is in good condition except for its wheels, which must be replaced with wheels that are compatible with railroad track requirements (compromise type). Some minor "cosmetic" work (repainting, interior work) and a complete electrical checkout will be required before this streetcar can be used in excursion service. Batteries will also be required to operate all of the car's features. 1504 is single-ended, but a sister car, 1511 at the Old Pueblo Trolley museum in Tucson, Arizona (see photo) was modified by member Eric Sitiko to enable operation from the rear platform. HDR recommends that TMNY contact the Old Pueblo museum and obtain details so that a similar modification can be done on 1504. Note that to use 1504 on the present main line, a second trolley pole that can be used when operating in reverse, or a pantograph, will be required.

Oslo 3: This single-truck double-end streetcar is in good to excellent condition. It needs roof and door work and does not at present have a trolley pole. Also, it is fragile and very old and does not belong to the Trolley Museum of New York. It has hand brakes with dynamic braking at the controller as its main braking systems, which require specialized operating techniques to be safely used in traffic. Oslo 3 is on indefinite loan from a private owner, George Hassoldt. HDR recommends that because of its age, private ownership, hand brakes, and historic significance, Oslo 3 be used primarily for display and only occasionally for special events.

Hamburg 3584: This single-ended streetcar is in generally good condition, requiring repairs to some minor interior items and new batteries. The electrical system will need to be thoroughly checked out as well. The wheels, however, are not profiled in any usable manner (they may be blanks) and need to be either properly profiled or replaced. As a single ended car, however, it will require a backup controller and front-mounted pole for use on the Rondout-Kingston Point line.

Brooklyn PCC 1000: This rare first-generation PCC car is in generally fair condition. The body is made of aluminum (the first and only such PCC car ever made). Step wells and some body and interior anti-corrosion work is required, plus a paint job and likely roof re-canvassing. The electrical control system may need significant work, however, before this car could be used in service. The wheels appear good but are city tread width and may need to be replaced with compromise wheels. Such wheels are readily obtainable for PCCs. The car has original "Edison Cell" Nickel-Iron-Potassium Hydroxide batteries that can probably be reconditioned and reused. HDR believes that a single-ended PCC such as 1000 could be used in the operation in a supplemental manner, provided it had a front-mounted trolley pole and a backup controller installed.

Boston PCC 3204: This post-war all-electric PCC is in poor to fair condition. It has been recently painted and positioned near the entrance to the Museum's Visitors Center. While this PCC looks OK with its new paint, it remains in overall poor to fair condition due to long-term storage outside. A thorough restoration would be required, including much body work, before it could be used for the operation. Pullman PCCs have a tendency to rust out to a much greater degree than their St. Louis Car counterparts, mainly due to Pullman's overlapping side metal construction and greater susceptibility to salt damage at floor level and undercar. Window post corrosion (expansion) that freezes openable windows in place can also be a major problem. One minor plus, however, is that the Museum possesses two sister cars that could be used as an interim source of parts if it was desired to return 3204 to operation. As with Brooklyn 1000, Boston 3204 would require a front trolley pole and backup controller to be safely operated on the existing line. It would also need a total electrical system checkout and a new set of batteries.

PCC cars have developed a reputation of being more difficult to maintain for operations in a museum environment. However, HDR believes that this reputation has primarily developed due to an initial preference for older cars in the trolley museum world combined with a lack of good maintenance information. With proper instruction as to the key maintenance requirements and the use of the right type of batteries (2 x 16 volt approx. 56 amp-hour wet-cell Ni-Cad batteries are currently used in Boston and San Francisco), PCC cars can perform equal to or better than older streetcars in terms of reliability. However, as is equally well known, PCC cars do consume more power than conventional streetcars, particularly when accelerating. This has a tendency to create short-duration peak current

draws, which may increase any utility “peaking charges”. This will need to be determined once the system is electrified.

NYCTA R-16 6398: This vehicle is a New York City subway car and is not equipped for street-level boarding. However it has been included as it is almost completely restored and is currently operable. While HDR doesn’t recommend use of subway cars in regular service (high platform stations required, potential evacuation difficulties if a breakdown, and very high current draws), 6398 could be used as a supplement for special events if high-platform stops and a means for evacuation of passengers between platforms were provided. While subway cars have been operated at numerous trolley museums with installed trolley poles, HDR recommends instead that a pantograph be installed on 6398 to protect the overhead wire from excessive arcing when this car is operated. Pantographs have a larger area of contact with the trolley wire, allowing more current to be drawn with a reduced likelihood of wire damage. A pantograph (or two trolley poles that could be run simultaneously) is recommended if 6398 is to be run up the hill on the future line to Kingston.

Restoration Options

While most trolley museums restore their own vehicles with volunteer labor, there is a developing trend to use external restoration shops or hire contract labor for in-house restoration work. While volunteer labor usually results in a like-new “concours” style restoration, the time factor (about 10 years per vehicle) acts to its detriment.

Off-Site Restoration Firms: While railroad wheel shops and motor shops have been traditionally used by trolley museums for wheel and motor work (with the occasional machine shop for custom parts), in times past there was no option for full-body restorations but in-house with volunteers. There were no restoration shops that could be trusted with the unique considerations that a historic streetcar body restoration requires. The thought was that if you sent a trolley to a typical truck body shop without a person on site overseeing the restoration at all times, you might end up with “school bus windows” or something similar as part of the work.

Times have changed. Now there a number of car builders and restorers that have considerable experience and expertise not only in historic trolley restoration but actual ground-up fabrication of replica streetcars to historic plans using historic materials and techniques. Two shops in particular, Gomaco Trolley Company in Ida Grove, Iowa, and Brookville Equipment Company in Brookville, Pennsylvania have a long track record of historic trolley restorations. Gomaco specializes in new trolley construction and rehab work on wood and metal streetcars, and is the best choice if a lot of woodworking is required. Brookville has extensive restoration and

rehabilitation experience with metal cars like PCCs. Both companies would be able to completely restore a streetcar from the wheels to the wire with minimal supervision – a far cry from years past. Although a class 1 streetcar restoration would be expensive (anywhere from $200,000 and up), it could be accomplished in mere months – resulting in a ready-to-run streetcar. It's worth noting that the price for a restoration is cheaper if the car is complete rather than requiring custom fabrication of special parts. Figure 76 shows before, during and after pictures of the restoration of a Melbourne W2 car for the Memphis trolley system.

Another consideration is accessibility. Contract restorers can add required equipment, even to older cars, to make them accessible to wheelchairs without damaging the historic look and feel of the vehicle. Figure 77 shows how Gomaco accommodated a wheelchair lift in a replica semi-convertible trolley. Figure 78 shows a Brookville PCC restoration in progress for Philadelphia.

HDR recommends that as funding becomes available the Trolley Museum of New York should consider using a contract restoration shop to immediately restore, at minimum, Brooklyn 8361, and Gothenburg 79 in conjunction with the electrification and track reconstruction. This would give the Trolley Museum of New York two like-new double-ended trolleys that could form the backbone of the new electrified public operation.

In-House with Hired Restorers: This technique has been adopted successfully by some trolley museums, notably the Pennsylvania Trolley Museum (PTM) near Pittsburgh, as a means of rapidly restoring streetcars in the museum's shops. Either experienced workers (body and sheet metal worker, carpenter, machinist, etc) can be hired for work under direct Museum supervision, or one or more talented volunteers with demonstrated skills can be retained full-time to work on car restoration. A full-time hired volunteer worker can also supervise and work with other hires that may not be as experienced with streetcar restoration. PTM has used this technique with a hired multitalented volunteer (supervised by a Trustee) to successfully restore two streetcars, and plans a third restoration in the near future.

This method has the advantage of providing a means for work to continue 5-6 days a week instead of the typical 1-2 days for volunteer restorations. Most volunteers have "day jobs", so the restoration work usually only takes place on weekends. A full-time individual, paid by the Museum, can quit or take a leave of absence from the day job and devote all time and effort to the restoration work.

Note that for this technique to work the person(s) must be able to work full-time on the restoration at the Museum. This implies that adequate space, tools, and other items (scaffolding, compressed air, welding equipment, etc) can be provided by the Museum. This includes heat for work in the winter (which can economically be done by erecting temporary walls around the work and installing a gas or propane heater). Fine machining and metal

bending/stamping/fabricating work would be contracted out under the direction of the hired restorer. A full-time presence at the Museum (such as an Executive Director) is required while the others work, as it is extremely undesirable and unsafe for one person to work alone.

There is no reason why this technique would not work well at the Trolley Museum of New York. One very important provision, however, is how the restorer(s) is retained as Museum liability and workplace law must be carefully considered.

HDR recommends that the Trolley Museum of New York consider hiring independent restorers to supplement the restoration work, in addition to considering an off-site restorer to quickly obtain needed double-ended electric-powered vehicles for the new operation.

Replica Streetcars: This option is a very viable one and is recommended if the Museum operations ever evolve into a transit-type full-time operation.

Replica streetcars are built new on completely refurbished streetcar trucks using antique plans, materials and techniques. Replica trolleys are presently operating in regular transit service in a number of locations around the country, including Tampa, FL, Little Rock, AK, Portland, OR, Memphis, TN and Lowell, MA.

At present there is only one experienced replica streetcar fabricator, Gomaco Trolley Company, but they can provide replicas of many streetcar designs. Open cars, Birneys (double truck), semi-convertibles and restored foreign streetcars are all listed in their catalog.

Replica trolleys have two major advantages: First, they can be purchased right now and arrive ready-to-run. It is very difficult to locate older, non-PCC streetcars these days. Most trolley museums are not willing to sell any items from their collections; certainly not streetcars in good condition. Second, because replica streetcars are new and ready to run, they can be operated in daily transit service instead of wearing out and possibly damaging older, rare, antique streetcars.

These streetcars are fabricated to original plans, including items such as oak and cherry woods and new brass fittings cast from originals. But they also include the modern features required by transit vehicles, such as air conditioning, wheelchair lifts, and modern PA, announcement and radio systems. Figure 79 shows two types of Gomaco-fabricated replica streetcars.

Replica double-truck double-end Birney cars for Tampa's streetcar system cost around $800,000 each back in 1999. These cars are similar in size, weight and capacity to Brooklyn 8361. Today's cost would likely be in excess of $1 million each. This is more than twice the cost of restoring a complete car; however, the advantages of using these vehicles is significant, especially

if the ultimate plan is to provide transit service between Kingston, the Brickyard, Broadway-Strand, and Kingston Point. HDR thus recommends that the Trolley Museum of New York ultimately plan to acquire two or three replica streetcars as the master plan proceeds.

Restored Historic Streetcars: Occasions do arise where agencies worldwide have vehicles for sale although the availability of restored vintage non-replica streetcars varies and is unpredictable,. The acquisition of numerous single-end standard gauge Milan, Italy cars by both San Francisco (to operate) and Gomaco (for parts and restoration) is a recent example.

Another source that often escapes notice is Australia's Bendigo Tramways. (http://www.bendigotramways.com/). Bendigo Tramways is a municipal organization that purchased the entire tram fleet (and all other items such as parts, carbarns, workshops, uniforms, etc) from the private Bendigo city tramway company, prior to abandonment in 1972, to preserve it and operate a few lines as an historic vintage trolley operation.

At the time of this writing (February 1, 2008) Bendigo has numerous fully-refurbished standard-gauge W2 class trucks, DH10 and CP27 air compressors, K35 controllers, and similar parts for sale, as well as a complete, operable (but un-restored) standard-gauge Melbourne class W2 tram for AU$50,000 (F.O.B. Bendigo).

Additionally, Bendigo, in conjunction with Newstead Tramcars, (http://www.newsteadtramcars.com/) has three fully-restored single-truck ex-Melbourne Type X1 standard-gauge Birney cars for sale for US$390,000 each F.O.B. Bendigo, or delivered to the Northeast USA for approximately US$435,000. They will custom modify them (including full ADA compatibility for US$30,000 each) and even quote an all-inclusive price (plus consumable spare parts) delivered to Kingston. Their price includes a Newstead representative who will help with preparing the streetcar for operation, and will hold classes on streetcar maintenance (and supply manuals). These Birneys are claimed to have been modified to conform to pending American Public Transit Association (APTA) Vintage Trolley Equipment Criteria Standards (safety standards) for vintage trolleys.

Note that under the current US/Australian Free Trade Agreement (effective January 1, 2005), all US-Australian tariff barriers have been removed. Tariffs on Australian-manufactured rail equipment products have thus been eliminated, and US Government funding can now be used to purchase railway equipment from Australia. The new Free Trade Agreement even provides a waiver under the Buy American Act. So for approximately $1.5 million a fleet of three identical fully-restored double-ended single-truck standard-gauge streetcars could be obtained relatively quickly. (see web page illustrations below).

NEWSTEAD TRAMCARS
AUSTRALIA

UPDATE
DETAILS
SPECIFICATIONS
TRAM PLAN
OPTIONS
SPARE PARTS
TERMS OF TRADE
HISTORY
REBUILDING
ABOUT US
CONTACT US
HOME

Details

THREE AUSTRALIAN 'BIRNEY' style STREET CARS (Melbourne "X1" class) US $390,000 each on site at Bendigo, Australia.

NEWSTEAD TRAMCARS, based near Melbourne, Australia, offer for sale three 32 seat streetcar saloons single truck streetcars. The streetcars are in the process of frame-up reconstruction and restoration to **better-than-new** standard (with car 466 now complete and ready to ship). The streetcars are backed up with complete **after-sales technical support** and a **catalogue of spare parts!**

The three streetcars are part of a group of ten "X-1" class cars constructed by the Melbourne and Metropolitan Tramways Board between 1926 and 1928. The "X-1" was designed as an improved version of the US type Brill (USA) Birney cars. The car features four folding doors (at each corner of the car) and carries 15 more passengers than the standard "Birney" configuration.

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The streetcars are being rebuilt under contract by the Bendigo Tramways (www.bendigotramways.com) in its fully-equipped streetcar workshop. The vendors are committed to the highest quality product, which includes accreditation to run in Australia, and which will meet all US operating requirements (including the APTA Heritage Trolley Vehicle Equipment Standard).

The running gear consists of newly constructed truck frames fitted with wheelsets and traction motors from standard Melbourne "W2" streetcars, (the type now running in San Francisco, Memphis, Seattle and other U.S. cities). Rebuilt airbrake and control equipment are also sourced from the Melbourne "W2" cars.

An operating benefit to you of the "X-1" design is the four sets of driver-operated pneumatic folding doors – one at each corner of the car. Loading can be from either side and/or end of the car. Large windows and walk-over upholstered seats make the "X-1" an ideal transit or sight-seeing vehicle. Everyone faces the front! These streetcars can be one-person operated, with room for an optional fare box (not included).

The "X-1" streetcar is a versatile vehicle, operable in all weather conditions. It lends itself to both right-hand AND left-hand drive running. The walk-over seating, and the absence of internal bulk-heads affords every passenger excellent forward views. The gleaming varnished Pacific Maple and Blackwood interiors will enhance the historic feel of this sturdy (steel-framed) piece of streetcar history.

Supplied are easy-to-read step by step manuals for preventative maintenance, periodic maintenance and operation.

Your early order of one or more of these streetcars would enable your transit company to customize the vehicle to your specific requirements. Options include (but are not limited to):-

- Company color scheme;
- Turn indicators, brake and marker lights (fitted to 466);
- P.A. system;
- Seat upholstery fabric and color (light brown transit-grade vinyl fitted to 466);
- Single or dual trolley poles, with either carbon insert shoe or wheel collection;
- Pantograph;
- Driver vigilance (deadman) equipment.

Paint and varnish surfaces will be finished to automotive standard.

The X-1 streetcar provides a smooth, quiet ride in a comfortable, roomy historic vehicle! Safety has been of paramount importance for the operating systems of these rebuilt streetcars. Turn indicators, brake and marker lights are now fitted to 466. Independent control of each of the four doors is at the flick of a switch– at either end. A lock-out switch prevents tampering. Further, an electrical interlock prevents the car operating under power when the doors are open.

Additional support for the purchasers of these cars includes our phone/email technical Help Desk, and a comprehensive catalogue of spare parts. Included in the purchase are the services of a technical staff member who will do the final assembly, commissioning and training of your maintenance and operational staff inquiries. Overnight is our maximum response time for help inquiries!

Click here for other options

NEWSTEAD TRAMCARS AUSTRALIA

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Purchaser's Options

OPTION 1

US $390,000 on site at Bendigo, Australia

OPTION 2

US $420,000 C.F.R. Oakland, CA, USA

OPTION 3

US $425,000 C.F.R. Savannah, GA, USA

Price for C.F.R. al ALL other ports - on application
Price landed on your tracks - on application
Price modified to your requirements - on application

Color scheme:	Finished to your requirements.
P.A. system:	Internal/external speakers w/ microphone handset at each operating position Type
Wheelchair access:	42” entry doorways. (33" wheelchair clearance). Portable external aluminium ramp supplied.
Wheelchair capacity:	Currently, two wheelchairs. Removal of further seats if required.
Roof equipment:	To requirement. Two trolley poles, with trolley retrievers and/or hold-down hooks or pantograph.
Roof treatment:	“Durum” acrylic roof treatment to 466. To requirement.
Destination indicators:	Multiple-destination roller curtain to requirement.
Seats:	To requirement. Upholstered transit grade vinyl seats fitted to 466. Other upholstery type or wooden seats available as options.
Driver’s seats:	Swivelling, height-adjustable upholstered fitted to 466.
Trolley poles:	Wheel or carbon-insert shoe.

Driver vigilance equipment.

Modern Battery Power Streetcars: This option is a new state of the art development. Advances in battery technology have allowed streetcar vehicles to operate under battery power. One possibility for the TMNY lies with an international manufacturer of these vehicles. This manufacturer is looking for a real world site to showcase their vehicles and may be willing to loan a vehicle to the Museum. The vehicle information is as follows:

Kawasaki

Low-floor, Battery-driven LRV

SWIMO

Human friendly, Environmentally friendly, and Maintenance friendly

Human-friendly

Low Floor Structure

SWIMO is a barrier-free light rail vehicle (LRV), friendly to everyone, which has been developed to minimize the height differences between train steps and the vehicle cabin floors to the utmost limit. Additionally, both lead cars have a carbody structure to provide the fully flat cabin floor, thus enabling a wide variety of seat arrangements.
To realize such seat arrangements, SWIMO has electrical and other components mounted on its rooftop even though these components are normally mounted under the floor. SWIMO also utilizes a newly-developed extremely compact truck.

4-truck 100ft (30m) long train configuration (image)

4-truck 60ft (18m) long train configuration (image)

A new concept of vehicle with full of "friendliness"

Low-floor, Battery-driven LRV, SWIMO

"SWIMO", a term coined to denote that key features the vehicle:
Smooth getting on and off of passengers and **S**mooth operation in unelectrified sections **Wi**th running **M**ovem.

Maintenance-friendly

Battery Drive

SWIMO has an on-board battery system, which can respond to voltage drops caused by far distances from the substations, thus making it possible to widen distances between each substations and possibly reduce the total number of them, thereby reducing the overall maintenance costs. Furthermore, up to a certain distance, SWIMO is capable of operating on unelectrified sections without the need of power supply from the overhead lines. With the SWIMO system, it will no longer be a dream to realize a light rail system with trolley overhead sections, hence enhancing the beauty of cityscapes and urban areas.

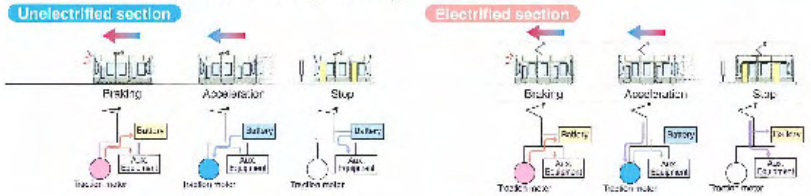
Environmentally-friendly

Storage Battery

Compared to other transportation systems, light rail and other rail systems are environmentally-friendly having a high level of energy efficiency and a low level of CO_2 emissions. Normally, the LRV runs by receiving power from the overhead lines to drive the motor. At braking, the LRV use the motor as a generator to return the power to the overhead line to enhance energy efficiency (regenerative brake). Even though the power is returned to the overhead line, if no other LRV is available to use the regenerative power, the motor will not serve as the generator (regeneration cancelled) and shifts to mechanical braking, thus losing the kinetic energy of the LRV in the form of heat. In order to eliminate such energy waste, SWIMO utilizes an on-board battery to make effective use of the energy generated. In other words, the SWIMO vehicles effectively recaptures the generated power and utilizes the energy stored in the battery as a power supply to drive the motor at starting or to power the auxiliary equipment. In doing so, energy efficiency is enhanced drastically, thereby creating a more environmentally friendly car.

SWIMO

Outline of battery-driven systems



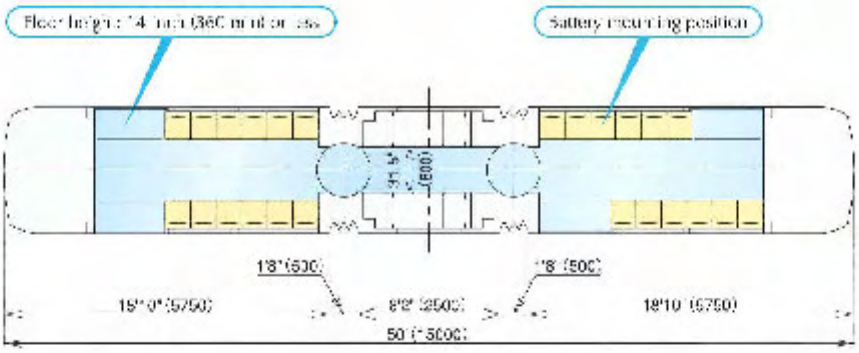
Experimental track for truck running test

Prototype on-board battery

Tram for battery-driven running test
(borrowed from Okayama Electric Railway)

Planned Specifications of Test Vehicle

Power Source	600VDC from overhead line and on-board battery
Carbody structure	3 carbody, 2 trucks articulated structure
Total length	50 ft (15 m)
Floor height	13 inch (330 mm) at doorway / 14 inch (360 mm) at cabin section
Minimum aisle width	31.5 inch (800 mm)
Passenger capacity	63 (including 28 seating capacity)
Maximum operating speed	25 mph (40 km/h)
Maximum design speed	30 mph (50 km/h)
Propulsion system	3-phase induction motor, IGBT inverter control
Type of on-board battery	On-board nickel hydride battery (mounted under seat)
Battery capacity	Approximately 118 kWh
Running distance in unelectrified section	Not less than 6 miles (10 km) under general running pattern
Manufacture	Scheduled in 2007



For inquiries, please contact

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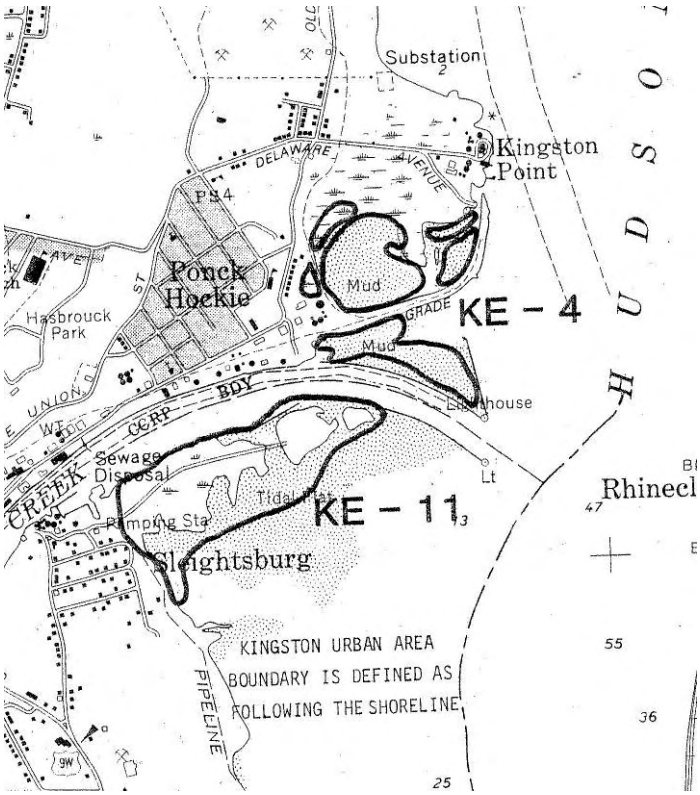
Tel: +1-914-376-4715
E-mail: kawasakirailcar@kawasakirailcar.com

V. ENVIRONMENTAL CONSIDERATIONS

Environmental issues will be addressed by examining maps of wetlands and specific habitat information for the areas along the Rondout-Kingston Point mainline and the two planned extensions. The areas indicated by the maps will be compared to the areas that will be reconstructed or modified. Specific items such as the reconstruction of the Brickyard line and the installation of poles on the lines in the Lagoon area will be examined based on the environmental requirements for the areas where these lines traverse wetland or wildlife habitat areas.

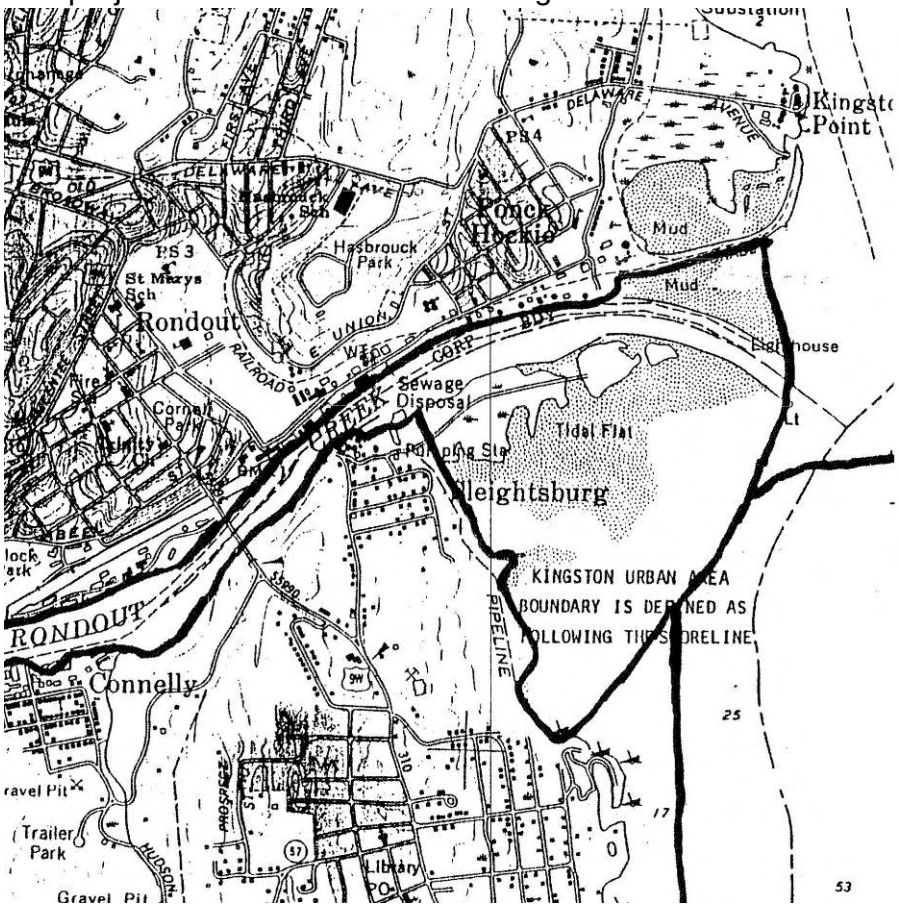
Regulatory Background –The Hudson River in the project area is regulated by the New York State Department of Environmental Conservation (NYSDEC) as a protected Class A watercourse under Article 15 (Protection of Waters Program). A 50-foot buffer zone or adjacent area (as measured from the high water mark) is also regulated under Article 15. The Hudson River and the associated wetlands are also regulated by the United States Army Corps of Engineers (USACE) as "Waters of the United States". USACE has no buffer zone or adjacent area bordering wetlands or watercourses under their jurisdiction. NYSDEC also maps and regulates wetlands equal to or over 12.4 acres in size (and a 100-foot buffer zone or adjacent area) under Article 24 (Freshwater Wetlands Protection Program). NYSDEC Wetland KE-4 (Kingston East, NY NYSDEC Freshwater Wetlands Map), also known as the Kingston Point Marsh, is present on both sides of the tracks. The mapped NYSDEC wetland area is on both sides of the railroad tracks from the existing oil tank farm to a point about a half mile to the east (map section attached) with two other wetland areas mapped to the east adjacent to the railroad grade and near the outlet to the Hudson River. In summary, the operating track route is within bordering the Hudson River and Wetland KE-4 is within the NYSDEC buffer zone under both Articles 15 and 24.



The National Wetlands Inventory map (NWI, Kingston East USGS quadrangle) maps the herbaceous portions of the wetland north and south of the railroad grade as a "PEM 1/2T" (Palustrine emergent, persistent/nonpersistent vegetation, and semipermanent tidal) wetland. The open-water portions of the wetland are mapped by the NWI as

"R1US3N" (Riverine, tidal, unconsolidated bottom, mixohaline [brackish] and regularly influenced by tidal action) wetlands. Based on the July 19th field observations at low tide, the open-water portions of the wetlands north and west of the operating track are smaller than shown on the NWI map and the vegetated areas are considerably larger.

The project site is also within the designated Coastal Zone of the Hudson River, which is managed concurrently by the New York State Department of State (NYSDOS) and by the City of Kingston's Local Waterfront Revitalization Program (LWRP). The LWRP cites the expansion of the Trolley Museum expansion as being part of the Urban Cultural Park Program, and the rehabilitation of railroad travel (Trolley Museum) as being a tourist attraction to waterfront areas. NYSDOS has also designated the mouth of Rondout Creek as a Significant Fish and Wildlife Habitat. The mapped area extends along the south and easterly side of the tracks for approximately one-half mile (map section attached). Aspects of the Significant Fish and Wildlife Habitat are the area's recreational use for fishing and waterfowl hunting, and as a concentration area for osprey during their spring migration.



Environmental Permits Potentially Needed for the Proposed Improvements

NYSDEC – Article 24 (Freshwater Wetlands), Article 15 (Protection of Waters) and 401 Water Quality Certification

USACE – Nationwide Permits (such as Maintenance [#3], Linear Transportation Projects [#14], or Temporary Construction Access and Dewatering [#33]).

NYSDOS – Coastal Zone Consistency concurrence

City of Kingston – Local Waterfront Revitalization Program concurrence

Environmental Considerations – The tidally influenced wetlands south and east of the existing track consist of a mixture of herbaceous plant species. The water chestnut, an invasive plant species, dominates the tidally influenced areas to the south of the track and in the mouth of Rondout Creek. The wetland north and west of and landward of the track consists of herbaceous plants (narrowleaf cattail, yellow water lily, eelgrass, water chestnut, water hemp, and pickerel weed), open water, and a fringe of palustrine forested wetlands. The forested wetland fringe consists mainly of red maple false indigo, willows, and silver maple. A significant portion of the tidal exchange to and from this portion of the wetland runs west of and parallel to the northerly side of the tracks prior to discharging to the Hudson River.

The south and eastern shore bordering the track and facing the Hudson River is subject to wave damage. Evidence of recent erosion and tidal scouring were observed along the easterly side of the tracks. Recent tidal deposition of logs, branches and other plant debris was observed on the south and east side of the tracks. Large bluestone boulders have been placed along portions of the easterly side of the tracks in an effort to protect the shoreline. The north and western side shore ranges from level to moderately steep though no evidence of erosion or bank slippage was observed. A marked gas line runs parallel to the tracks; a formal utility line mark-out will be needed prior to the commencement of any earth moving or excavation work. The agencies will consider any material (utility poles, precast concrete forms, or riprap) place below the high water mark and within the inter-tidal area as fill; the amount of fill proposed will have to quantified in the permit applications.

During the July 19th site inspection the abandoned track route west of Wetland KE-4 was walked. A mixture of forested, shrub-sapling, and tidally influenced herbaceous wetlands are present along most of the route. Though not mapped by NYSDEC or NWI, the wetland complex extends north to and beyond Delaware Avenue. One timber bridge over a small tidal creek is in poor condition and would have to be replaced in the event this route was chosen. This track route is also quite narrow and may require additional fill and stabilization if chosen; fairly extensive tree clearing would also be needed. As part of the environmental review process, some level of compliance with the New York State Environmental Quality Review Act (SEQR) will be needed. It does not appear that any of the proposed work will meet or exceed any of the SEQR Type I thresholds (requiring the preparation of an Environmental Impact Statement). We anticipate that the project will be considered an Unlisted Action

under SEQR and the completion of the Environmental Assessment Form Parts 1 and 2 will satisfy the SEQR process.

Based on preliminary comments received from NYSDOS, HDR discussed the project with Mr. Jeff Zappieri and Ms. Bonnie Devine of NYSDOS. Their comments focused on the preparation of project maps to denote the location of state and federally-regulated wetlands and the Rondout Creek Significant Fish and Wildlife Habitat, erosion and sedimentation control techniques to minimize any effects on the nearby wetlands and watercourses, and environmental aspects of the Significant Fish and Wildlife Habitat. Site plans denoting the boundaries of the protected resources (and the applicable buffer zones for NYSDEC Freshwater Wetlands and protected watercourses and the limits of construction would be prepared as part of the permit applications. Erosion and sedimentation control measures, such as the use of sedimentation booms, silt fences and staked hay bale lines were discussed, though the site limitations (chiefly the steep slopes and tidal current velocities) may preclude use of some techniques in some areas. Their comments will be further addressed in the text and supporting documentation for the permit applications and the Coastal Zone Consistency statement to address the policies in the City of Kingston LWRP.

VI Recommended Future Expansion Tasks

1. Track and Electrification: Future expansion after the initial phase of track reconstruction and electrification will likely focus on reconstructing the two extensions – the Lagoon Line to the Brickyard development, and the uphill line to the City of Kingston. While both of these lines will face unique challenges, there is nothing that would prevent their reconstruction provided the money for the work is available.

2. Indoor Car Storage: Future plans that include restoring vintage trolleys or purchasing replicas will require that additional indoor car barn spaces for storage be constructed. Trolleys that are stored outside, especially in a northeastern climate, will deteriorate rapidly. The Museum's indoor storage facilities are currently completely full.

3. Operations: Reconstruction of the two future extensions will allow the operation of actual transit service. A number of operating scenarios are possible. Completion of the Brickyard residential development and the potential for resumption of cross-Hudson ferry service from Kingston Point to the Metro-North station at Rhinecliff-Kingston provides an additional set of destinations that the trolley system will be poised to serve.

Routing options, however, are finite due to the unique configuration of the track layout. Assuming both extensions are complete, the following are the possible routings:

1. Brickyard Development to Kingston: This line would run from the Brickyard to the siding on the Kingston Point mainline. The streetcar would change ends and direction and proceed to the Museum's yard area at Rondout, then up the hill to

Kingston, ending at Jansen Avenue and East Chester Street, only a few blocks from Kingston City Hall.
2. Kingston Point to Strand-Broadway: This line is basically the present Museum operation.
3. Brickyard Development to Kingston Point Ferry: Assuming the ferry terminal would be at Kingston Point instead of Rondout or the Hudson's Landing area, this line would start at Brickyard and continue completely around the lagoon, through the siding, and out to the reconstructed ferry dock at Kingston Point.
4. Kingston to Kingston Point: From the Jansen Avenue terminus in Kingston to Kingston Point and the reconstructed ferry terminal.

Options 1 and 2 could be operated together, with a transfer platform located somewhere between the North Avenue crossing and the Museum's yard.

Any direct line between Kingston City and the Rondout Broadway-Strand area would require a change of direction, likely in the Museum yard area.

While it is too early to speculate on the potential ridership of any of the above routings, a number of additions or changes would make operations easier. These include:

1. Purchasing sufficient land or easement to allow for a western curve from the Lagoon-Brickyard line to meet up with the Kingston Point line at approximately North Street crossing. This would eliminate the reversing move on the siding on runs from the Brickyard to the Museum area and Kingston City. While the present plats indicate that this curve could be installed by easement on or outright purchase of an approximately 3 acre lot presently used for what appears to be junkyard storage (property ID 56.36-1-22), it does not appear that this property is part of the lagoon wetlands area. If constructed, however, the maximum curvature need not be greater than about a 60 foot radius, which is smaller than that used for typical railroad curves and requires less land area. This radius would accommodate all vintage streetcars, including modern Portland-style streetcar designs.

2. At the Kingston City end of the uphill line an option would be to extend the line further into Kingston. While the connection between the Ulster and Delaware Rondout line has been severed and the land taken by a parking lot, it would be possible to extend the line through imbedded street trackage in Jansen Avenue. A loop would not be needed if the line were extended around the block, perhaps from the present terminus counterclockwise along Janson to Foxhall Avenue, to Broadway, to East Chester Street, and reconnect with the mainline.

3. Another option would be to consider a balloon loop. This would have to be located off-street in an adjoining property. Two potential parcels based on location would be the present 105 car parking lot bounded by Jansen Avenue, Foxhall Avenue and Hasbrouk Avenue, and the former Kingston carbarn site bounded by East Chester Street, Broadway, and Jansen. The parking lot is well-

used however and would probably require eminent domain to secure from its present owners (note that the rail line originally ran through the middle of this property). The former carbarn site is now a highly-contaminated vacant lot that is unlikely to be used for any new construction in the future. Either of these two lots would make an ideal location for a trolley terminus / bus transfer station, with sufficient size to permit a loop track of at least 60 feet radius. Remediation of the former carbarn site, however, might prove cost-effective in the future for this type of use, considering that it is virtually worthless for any new construction at the present time.

4. At least one midpoint siding and one extra end-of-line layover track (similar to the one presently existing at Kingston Point) should be added to properly operate service over the Kingston City uphill line. If a balloon loop is used a passing track could be added, either in the street or adjacent to the loop.

5. A passenger transfer station platform located in the present car yard area would enable shuttles to be operated between Broadway-Strand and the Museum, with transfers to the lines to Kingston Point, Brickyard and Kingston City.

VII Cost Estimate for initial Stage of Electrification

A conceptual level cost estimate for the electrification of the Kingston Point and West Strand Lines is as follows:

Conceptual Cost Estimate for Electrification of Kingston Point & West Strand Lines				
Description	Unit	Qty	Unit $	Computed Total
Wood Poles - Excluding pole hardware	EA	65.00	$1,500.00	$97,500.00
Metal Poles - Excluding pole hardware	EA	35.00	$4,000.00	$140,000.00
Foundations - Generic concrete foundation	EA	100.00	$1,750.00	$175,000.00
Down Guy - Estimated 15% of poles	EA	15.00	$1,400.00	$21,000.00
Positive Parallel Feeder	LF	8500.00	$42.00	$357,000.00
Negative Parallel Feeder - Full length of line	LF	8200.00	$42.00	$344,400.00
OCS General Arm - Full length of line	EA	90.00	$1,800.00	$162,000.00
OCS Feed Arm - General Single bracket arm	EA	10.00	$2,200.00	$22,000.00
Contact Wire (4/0 AWG, Hard Drawn) Assumes 1000ft of Museum owned contact wire provided.	LF	7200.00	$22.00	$158,400.00
Disconnect Switches -	EA	4.00	$7,800.00	$31,200.00
Traction Power Substation - 1000kW, 600VDC	EA	1.00	$1,800,000.00	$1,800,000.00
Cathodic Protection	LS	1.00	$75,000.00	$75,000.00
				$3,383,500.00
Crossing Safety Devices	EA	2.00	$13,000.00	$26,000.00
Track (Ballasted) Assumes use of on hand relay rail and purchased relay rail with a 50% split. Also assumed that 50% of ballasted track already rebuilt by Museum forces.	lF	2640.00	$121.00	$319,440.00
Track (Embedded) Assumes 100% new rail.	lF	1200.00	$650.00	$780,000.00
				$1,125,440.00
Environmental Permitting	LS	1	$50,000.00	$50,000.00
				$50,000.00
Vehicle Modifications	EA	2	$330,000.00	$660,000.00
				$660,000.00
Engineering Design	LS	1	$275,000.00	**$275,000.00**
SubTotal				**$5,493,940.00**
Contingency	%	30	$1,648,182.00	**$1,648,182.00**
Total Electrification Cost				**$7,142,122.00**

APPENDIX A
PHOTOS AND FIGURES

Figure 1 – on E. Strand looking west toward Broadway

Figure 2 – on E. Strand looking east at former spur tracks

Figure 3 – on E. Strand looking west toward museum

Figure 4 – near Kosco looking west toward E. Strand


Figure 5 – at North St. extension looking east toward causeway with gas line marker on far side of crossing


Figure 6 – at west end of siding track looking east

Figure 7 – on siding track looking west at turnout to Brickyard spur track

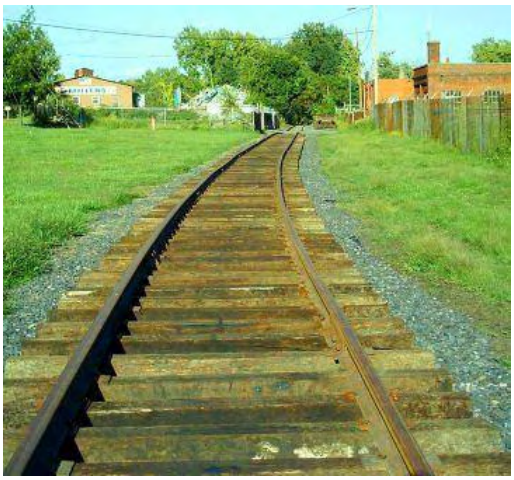


Figure 7A – Volunteer Rebuilt track west of Kosco

Figure 8 – South side of reconstructed E. Strand looking back toward museum

Figure 9 – Car yard skeleton track

Figure 10 – Compromise Joint Bars connecting 80# and 105# Dudley rail

Figure 11 – Rail stockpile at car yard

Figure 12 – Stockpiled second hand ties at car yard

Figure 13 – track alignment east of car yard

Figure 14 – Variable Gauge along E. Strand east of museum

Figure 15 – Fouled ballast near Kosco

Figure 16 – Stockpiled OTM at car yard

Figure 17 – Stockpiled turnout parts at car yard

Figure 18 – Two embedded turnouts east of museum looking west along E. Strand

Figure 19 – Embedded Turnout on E. Strand

Figure 20 –No. 8 Turnout from Mainline to Yard / Shop Lead

Figure 21 – No. 8 Turnout to West Strand Crossing (left)

Figure 22 – Yard Lead Track Turnouts

Figure 23 – Turnout at Kingston Point

Figure 24 – Rail end mismatch and broken flangeway of girder rail in embedded track

Figure 25 – Brick pavers broken in various configurations

Figure 26 – Reconstructed East Strand Street grade crossing

Figure 27 – East Strand roadway track interface

Figure 28 - Drainage Manhole adjacent to track on East Strand

Figure 29 - Markings of 8” High Pressure Gas line in road adjacent to track

Figure 30 – Gas line marker at east end of siding looking east toward causeway

Figure 31 – along Rondout Dr. looking north toward 3 RR Bridges

Figure 326 – on bridge over Route 9W looking east

Figure 33 – looking west toward tunnel beneath Livingston St., Hasbrouck Ave., and Delaware Ave.


Figure 34 – Kingston Point Line siding track looking west at turnout to Brickyard spur track


Figure 35 – Rail stockpile at car yard

Figure 37 – fouled ballast north of Maple Street


Figure 38 – Overgrown ballast between Delaware Ave and Elm St.

Figure 39 – Washed out track west side of lagoon

Figure 41 – Ballasted deck bridge along Rondout Ave closest to museum


Figure 42 – Three span open deck bridge over Garraghan Drive


Figure 43 – Single Span open deck bridge north of Garraghan Drive

Figure 44 – Approach to north side of rail tunnel

Figure 45 – Stockpiled rail inside rail tunnel


Figure 46 – Grade Crossing at Maple Street

Figure 47 – Rails paved over at Murray Street Grade Crossing

Figure 48 – Rails paved over at Delaware Avenue Grade Crossing

Figure 49 – pavement to field side of one rail on section of track between Murray St. and Delaware Ave

Figure 50 – Rails paved over at Elm Street Grade Crossing

Figure 51 – Rails paved over and grown over at 2nd Ave Grade Crossing

Figure 52 - Rails partially paved over at 1st Ave Grade Crossing

Figure 53 – Rails removed at second Delaware Ave grade crossing

Figure 54 – Removed Rails near East Chester St Grade Crossing

Figure 55 – Southernmost open deck bridge along west side of lagoon

Figure 56 – Middle open deck bridge along west side of lagoon

Figure 57 – Northernmost open deck bridge along west side of lagoon

Figure 58 – washed away track roadbed south of Delaware Ave west side of lagoon

Figure 59 – Clearance under southernmost railroad bridge along Rondout Drive

Figure 60 – Retaining wall adjacent to single span open deck bridge along Rondout Drive

Figure 61 – Removed Crossing Flashers at 1st Avenue

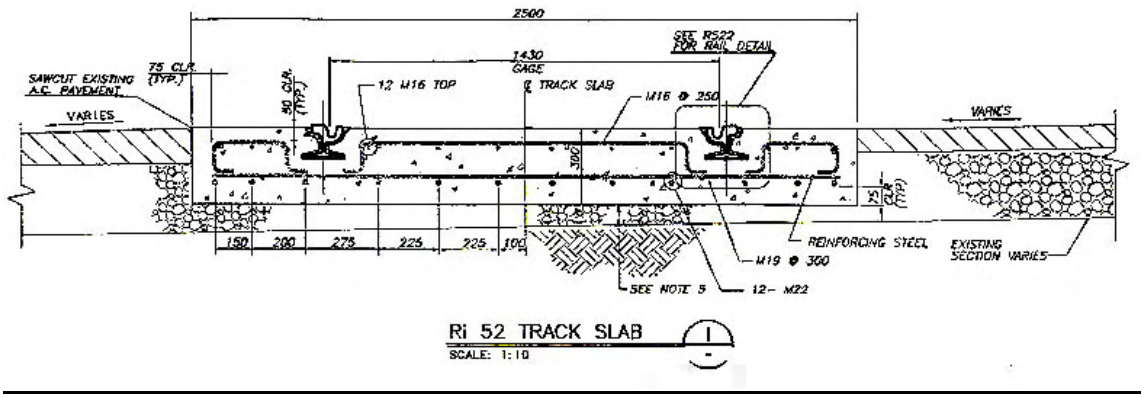


Figure 66 – Girder Rail Track Slab Cross Section

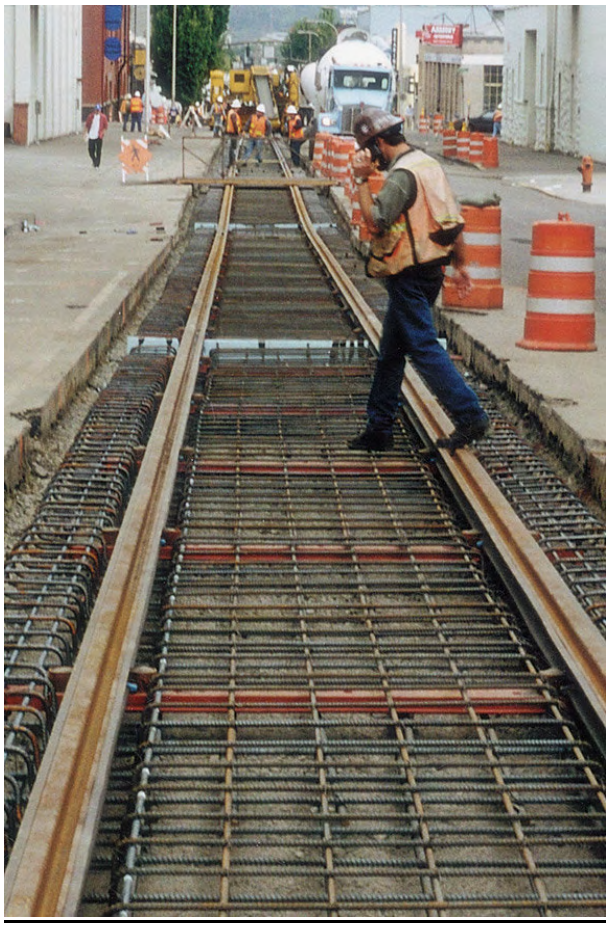
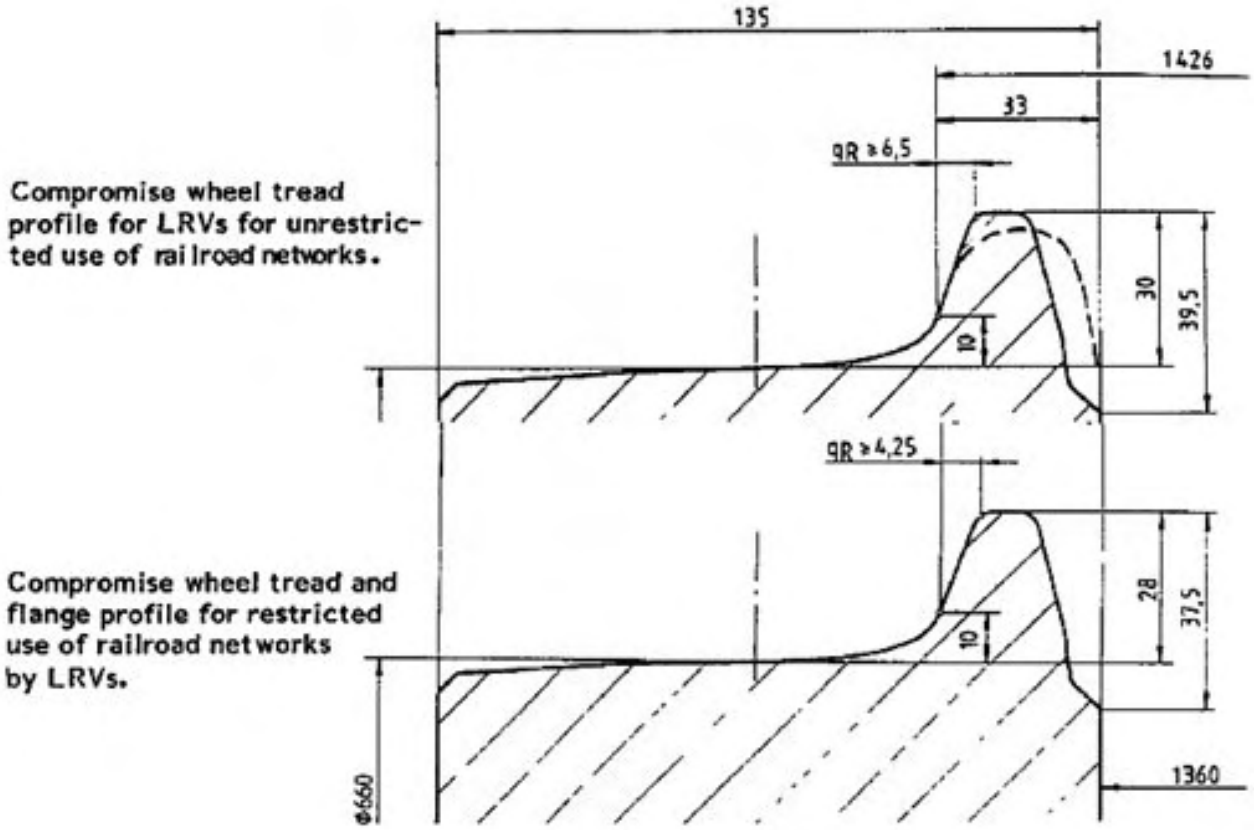


Figure 67 - Girder Rail Track Construction

Figure 68 – Typical Streetcar Substation

Figure 69 - Compromise Wheel Tread Variations



Compromise wheel tread profile for LRVs for unrestricted use of railroad networks.

Compromise wheel tread and flange profile for restricted use of railroad networks by LRVs.

Compromise wheel tread and flange for restricted use because of raised guard rail requiring reduced cross section.

Note: 1426 mm. dimension is between points of contact in 1435 mm. (standard) gauge. 1360 mm. dimension is between the inside wheel surfaces across the gauge. Dotted line denotes approximate flange profile for conventional railroad wheels.

Figure 70 – Wheel Profile Brussels 1504

Figure 71 – Wheel Profile Brill 120 (Power Truck)

Figure 72 – Wheel Profile Brill 120 (Trailing Truck)

Figure 73 – Wheel Profile Gothenburg 79

Figure 74 – Wheel Profile Hamburg 3584

Figure 75 – Wheel Profile Johnstown 358

Figure 76 – Gomaco Restoration of a Melbourne W2 Car for Memphis

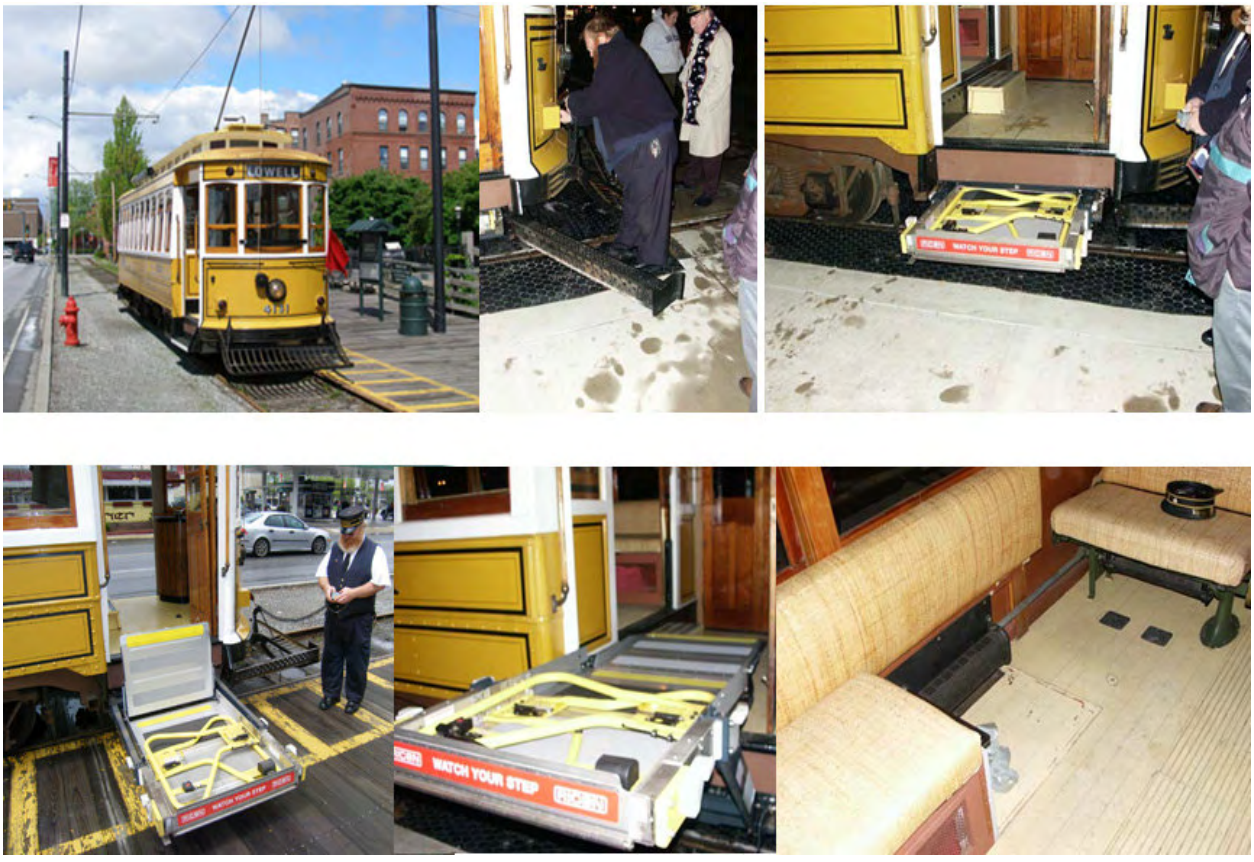
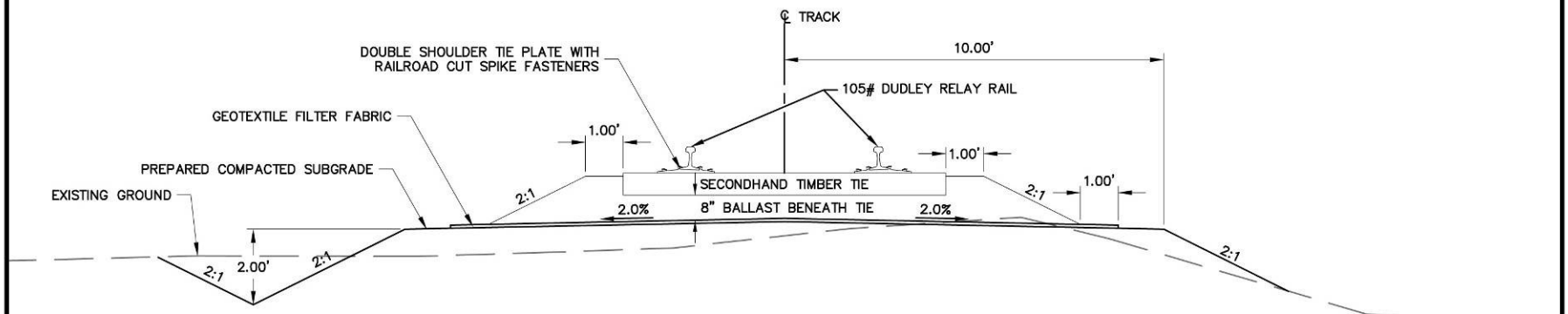


Figure 77 – Wheelchair Lift in a Semi-Convertible Streetcar

Figure 78 – Brookville PCC Restorations for Philadelphia

Figure 79 – Gomaco Replica Streetcars for Tampa (left) and Lowell

APPENDIX B
T SERIES TRACK DRAWINGS



TYPICAL REBUILT TRACK SECTION

CONTRACT NO.

DESIGNED _____ DATE

DRAWN _____ DATE

CHECKED _____ DATE

APPROVED _____ DATE

CITY OF KINGSTON – TROLLEY MUSEUM OF NEW YORK

HDR

500 7TH AVENUE
New York, New York
10016-8728

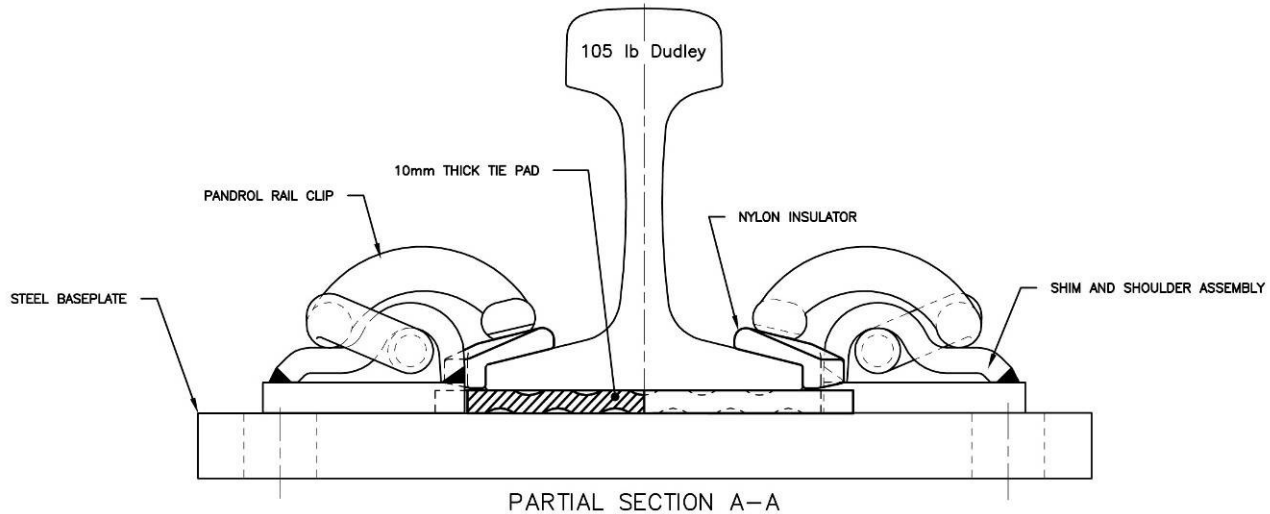
This document was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Reconstruction and Electrification of Trolley Track

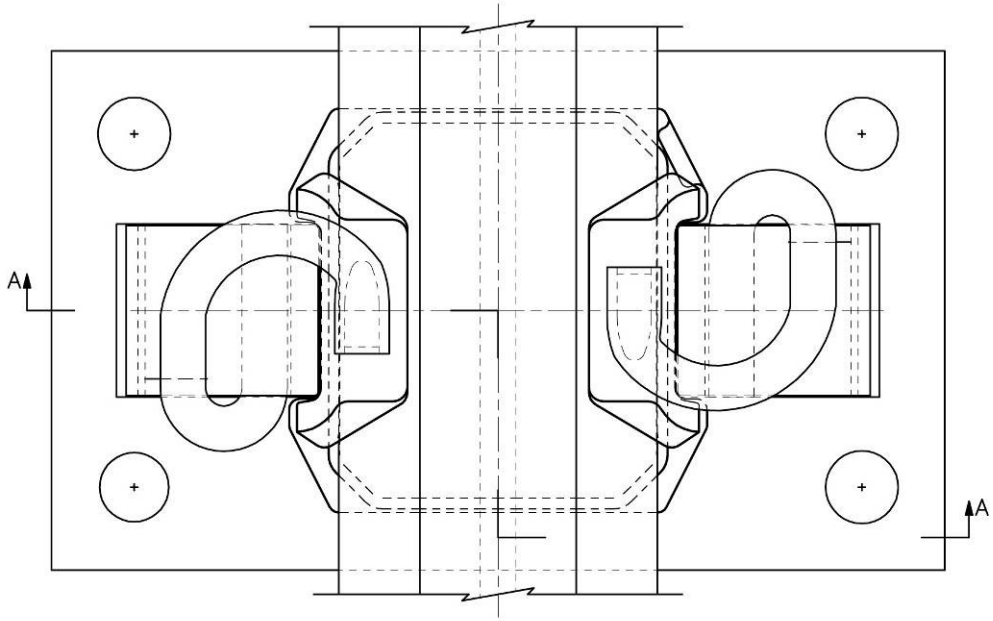
TYPICAL REBUILT TRACK SECTION WITH RAILROAD CUT SPIKE FASTENERS

SCALE

DRAWING NO.
FIGURE T–1



PARTIAL SECTION A–A



CONTRACT NO.

DESIGNED _____ DATE

DRAWN _____ DATE

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APPROVED _____ DATE

CITY OF KINGSTON – TROLLEY MUSEUM OF NEW YORK

HDR

500 7TH AVENUE
New York, New York
10016–8728

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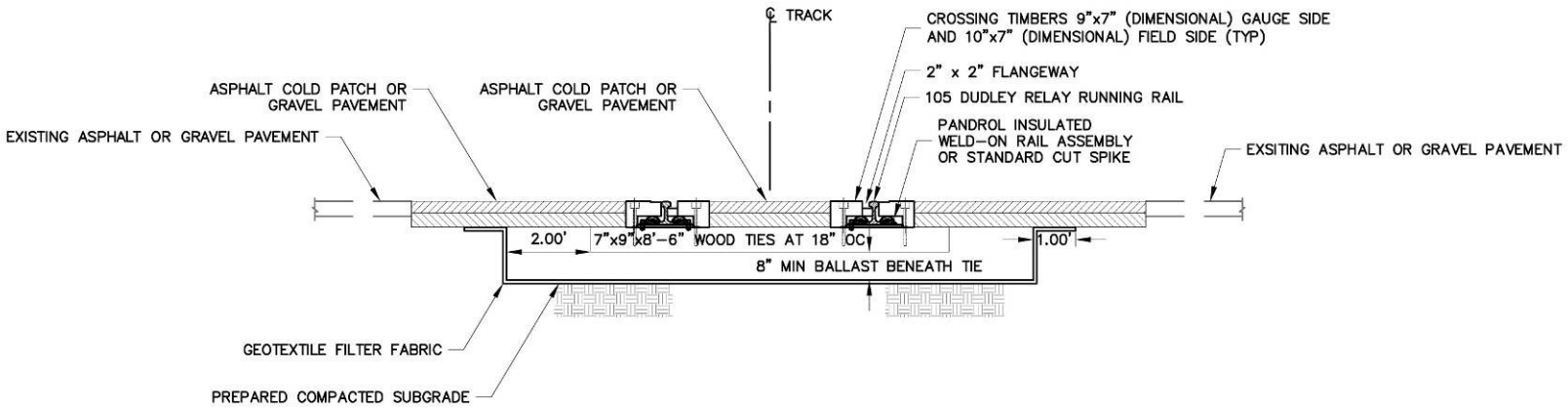
Reconstruction and Electrification of Trolley Track

TYPICAL PANDROL INSULATED WELD–ON RAIL ASSEMBLY

SCALE

DRAWING NO.
FIGURE T–2



TIMBER AND ASPHALT/GRAVEL PRIVATE GRADE CROSSING
TYPICAL SECTION – SINGLE TRACK

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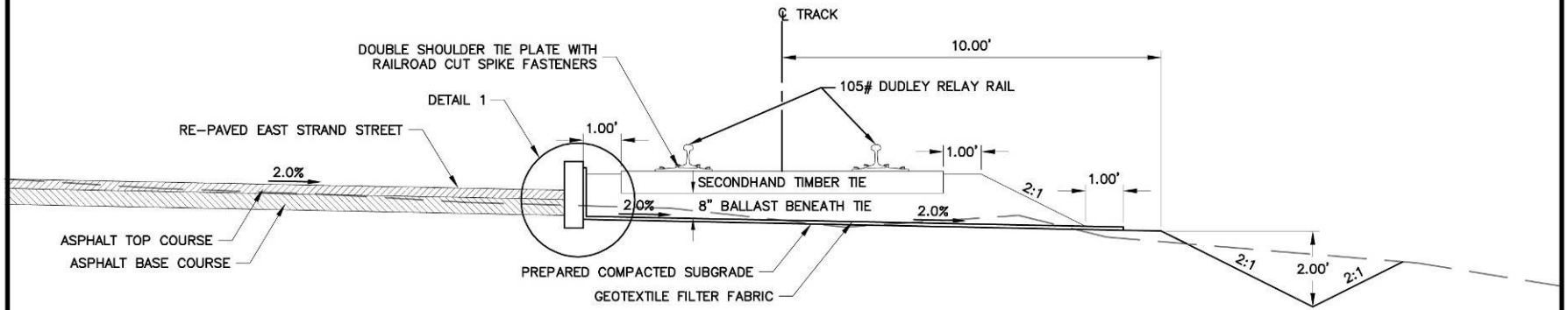
Reconstruction and Electrification of Trolley Track

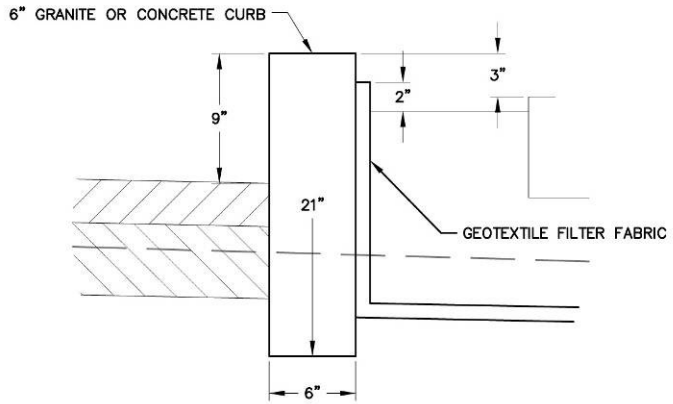
TYPICAL TIMBER AND ASPHALT/GRAVEL
PRIVATE GRADE CROSSING

SCALE

DRAWING NO.
FIGURE T-3



TYPICAL REBUILT BALLASTED TRACK SECTION
ADJACENT TO PAVED ROADWAY



DETAIL 1

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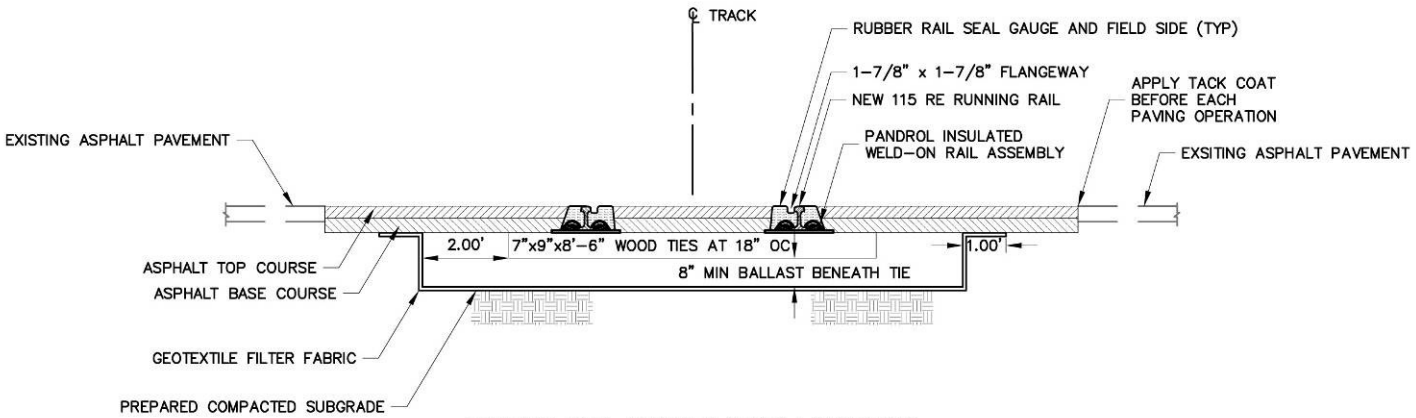
Reconstruction and Electrification of Trolley Track

TYPICAL REBUILT BALLASTED TRACK SECTION
ADJACENT TO PAVED ROADWAY

SCALE

DRAWING NO.
FIGURE T-4



RUBBER AND ASPHALT GRADE CROSSING
TYPICAL SECTION – SINGLE TRACK

CONTRACT NO.

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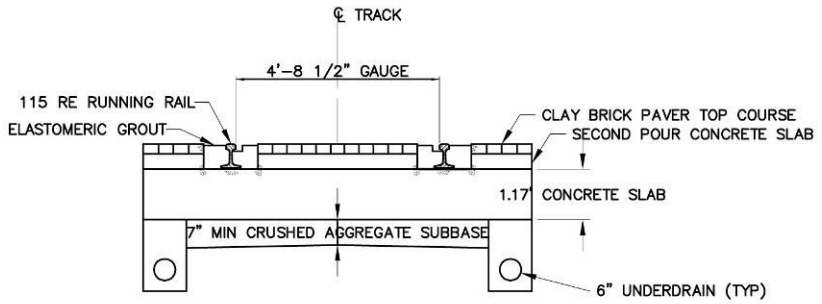
Reconstruction and Electrification of Trolley Track

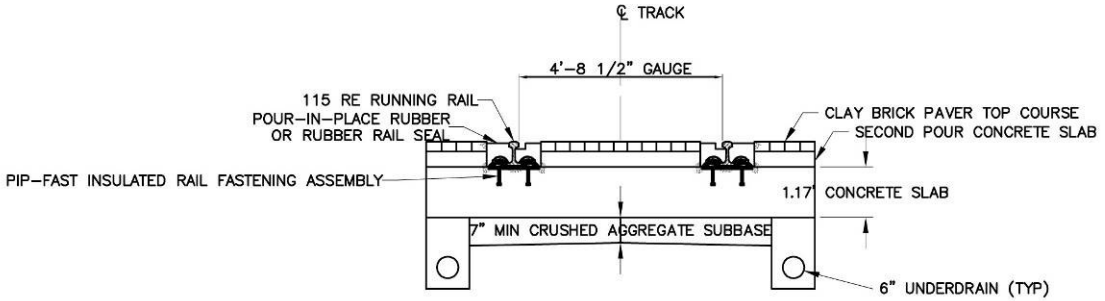
TYPICAL RUBBER AND ASPHALT GRADE CROSSING

SCALE

DRAWING NO.
FIGURE T–5



FLOATING RAIL CONCRETE EMBEDDED TRACK WITH BRICK PAVERS
TYPICAL SECTION – SINGLE TRACK



CONCRETE EMBEDDED TRACK WITH BRICK PAVERS TYPICAL
SECTION – SINGLE TRACK

CONTRACT NO.

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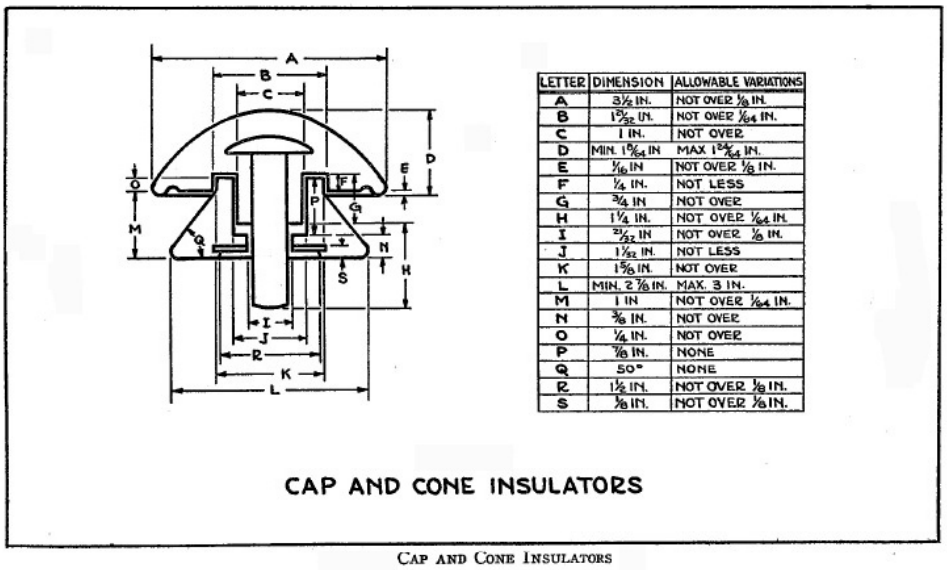
Reconstruction and Electrification of Trolley Track

TYPICAL CONCRETE EMBEDDED TRACK SECTIONS

SCALE

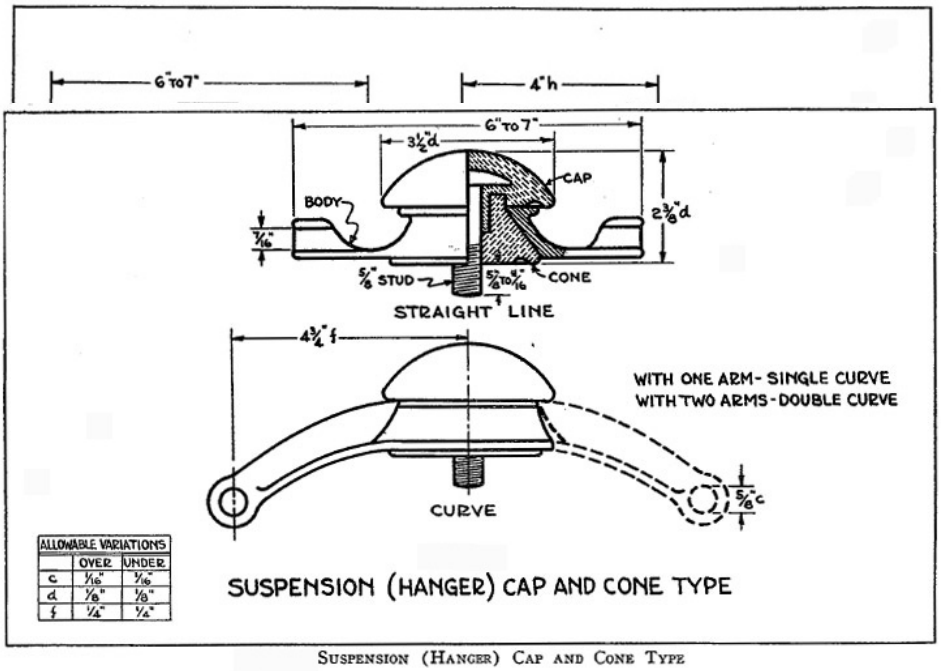
DRAWING NO.
FIGURE T–6

APPENDIX C
TRADITIONAL LINE HARDWARE ILLUSTRATIONS



LETTER	DIMENSION	ALLOWABLE VARIATIONS
A	3½ IN.	NOT OVER 1/8 IN.
B	1 5/32 IN.	NOT OVER 1/64 IN.
C	1 IN.	NOT OVER
D	MIN. 1 5/64 IN	MAX 1 3/64 IN.
E	1/16 IN	NOT OVER 1/8 IN.
F	1/4 IN.	NOT LESS
G	3/4 IN	NOT OVER
H	1¼ IN.	NOT OVER 1/64 IN.
I	21/32 IN	NOT OVER 1/8 IN.
J	1 1/32 IN.	NOT LESS
K	1 5/8 IN.	NOT OVER
L	MIN. 2 7/8 IN.	MAX. 3 IN.
M	1 IN	NOT OVER 1/64 IN.
N	3/8 IN.	NOT OVER
O	1/4 IN.	NOT OVER
P	7/8 IN.	NONE
Q	50°	NONE
R	1½ IN.	NOT OVER 1/8 IN.
S	1/8 IN.	NOT OVER 1/8 IN.

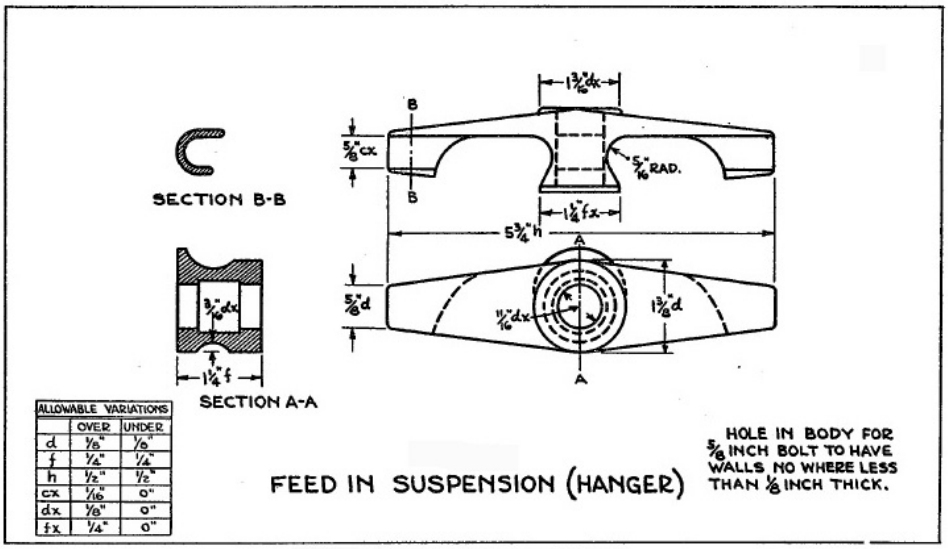
CAP AND CONE INSULATORS



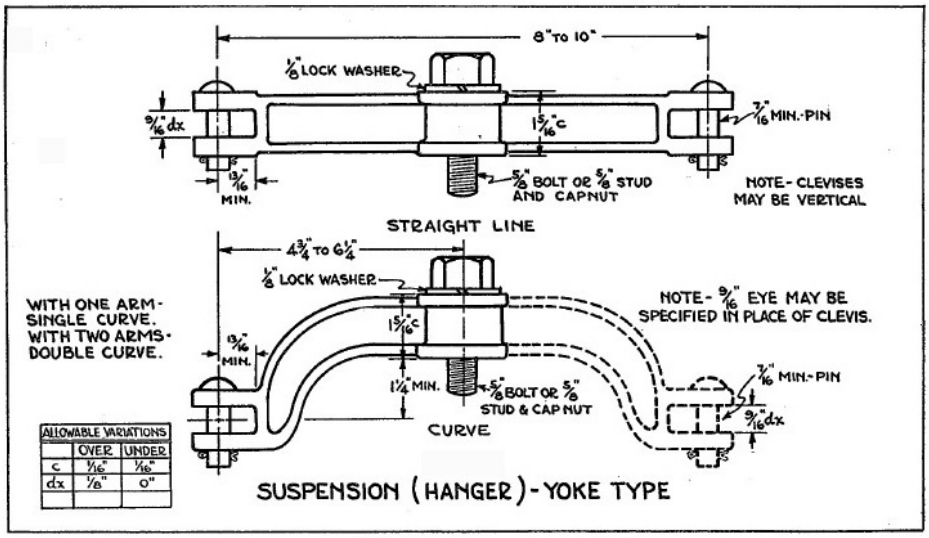
ALLOWABLE VARIATIONS		
	OVER	UNDER
c	1/16"	1/16"
d	1/8"	1/8"
f	1/4"	1/4"

SUSPENSION (HANGER) CAP AND CONE TYPE

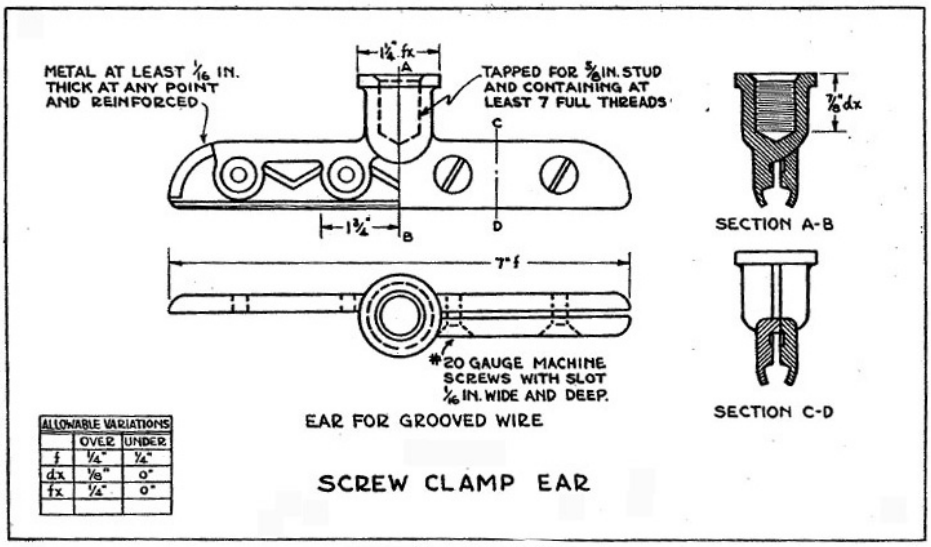
d



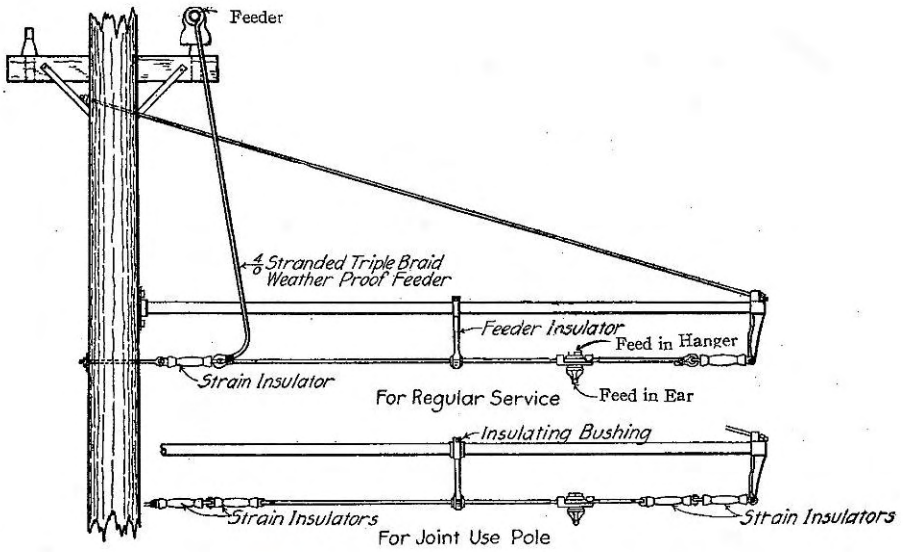
Feed In Suspension (Hanger)



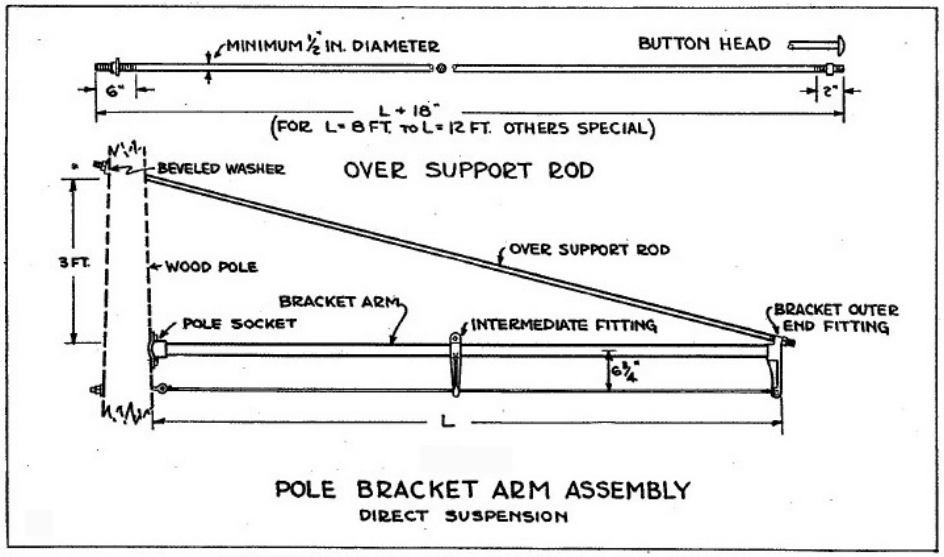
Suspension (Hanger)—Yoke Type



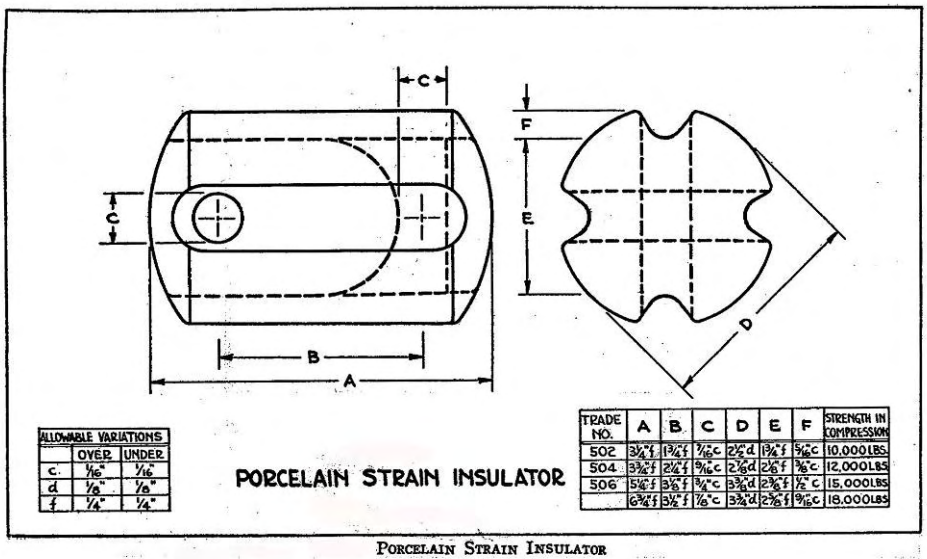
Screw Clamp Ear



Method of Installing Bracket Feed Taps

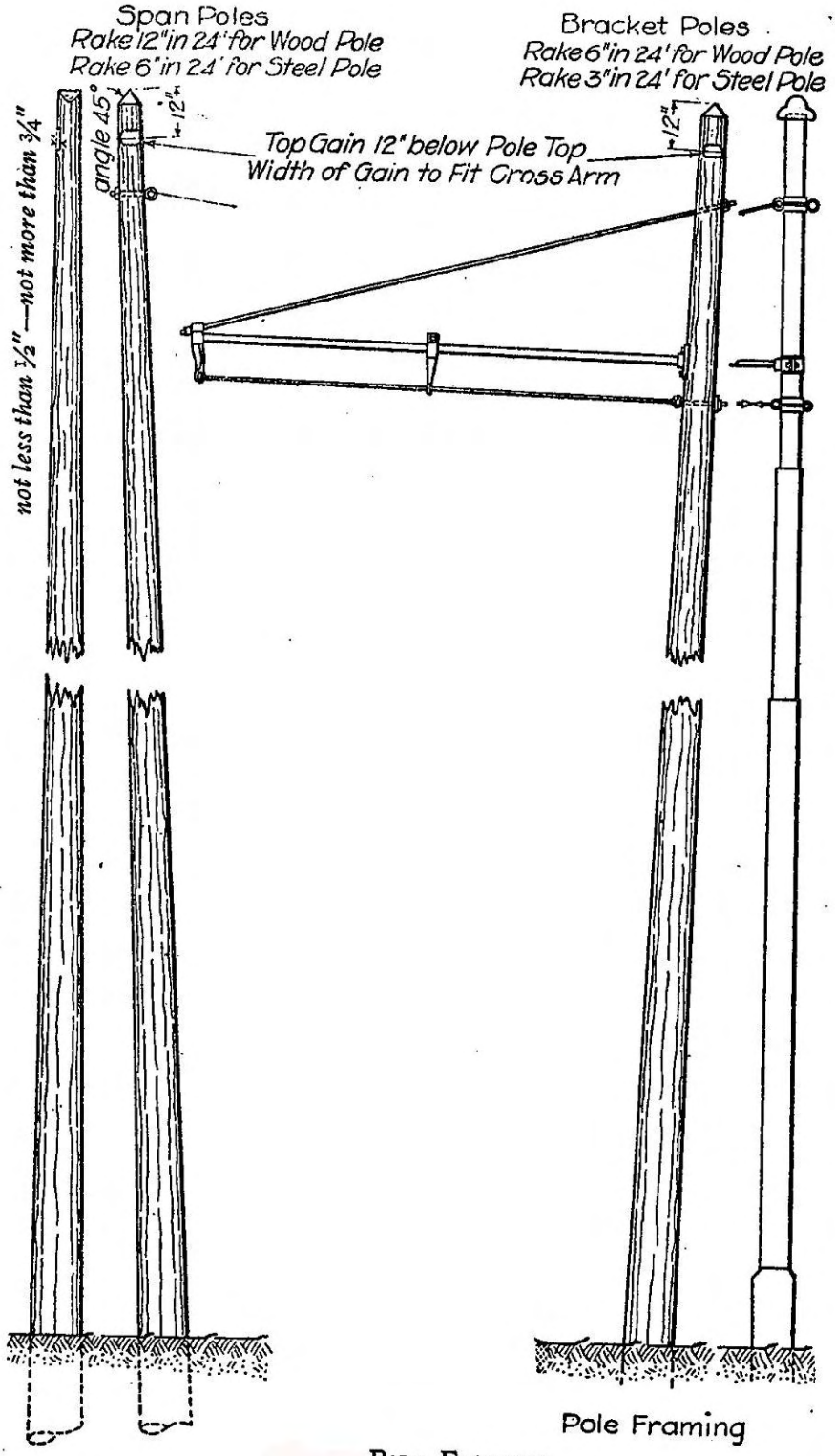


Pole Bracket Arm Assembly—Direct Suspension

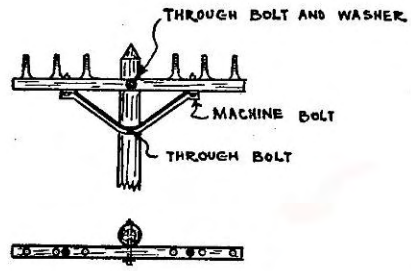


Porcelain Strain Insulator

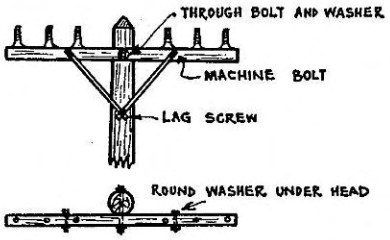
Photograph of the .88" Clevis/Clevis Trans*Lite™



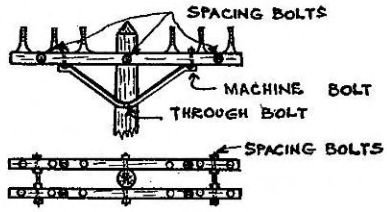
POLE FRAMING



CROSS ARM AND PIN ANGLE BRACING



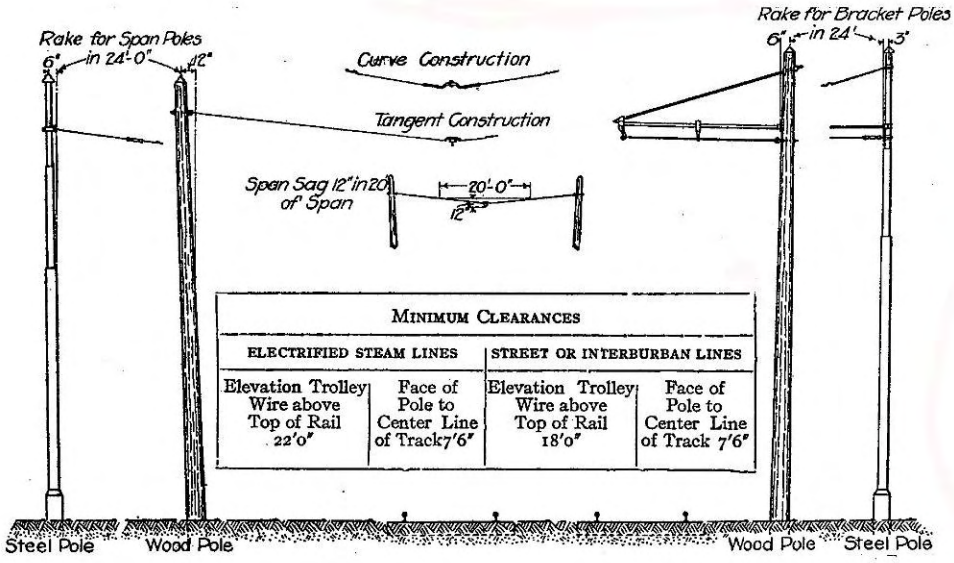
STRAP BRACING



DOUBLE CROSS ARMS.

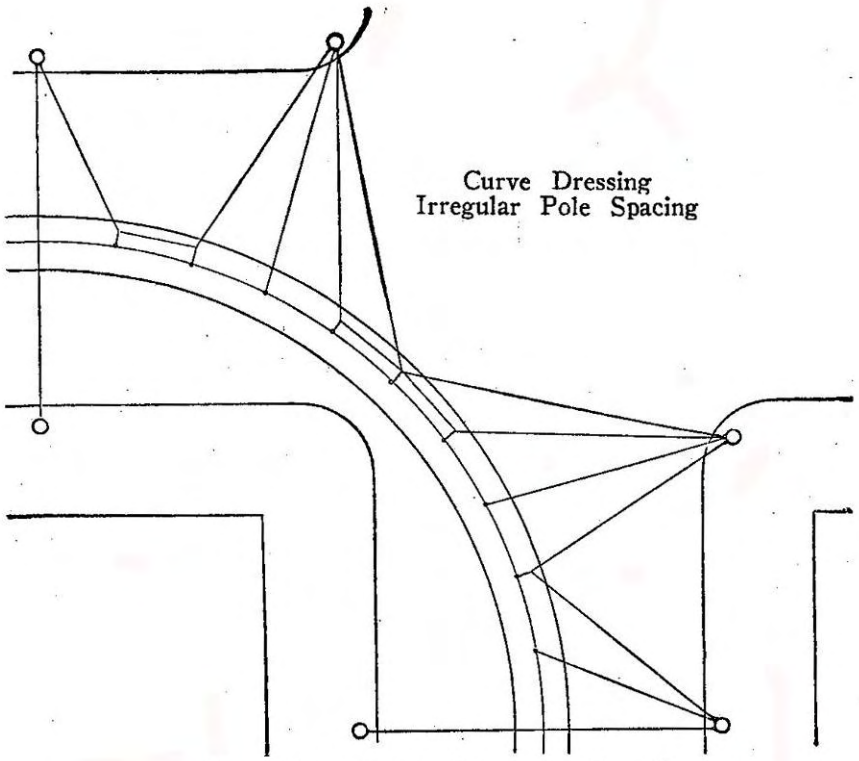
CROSS ARM LOCATION

Cross Arm Location and Assembly

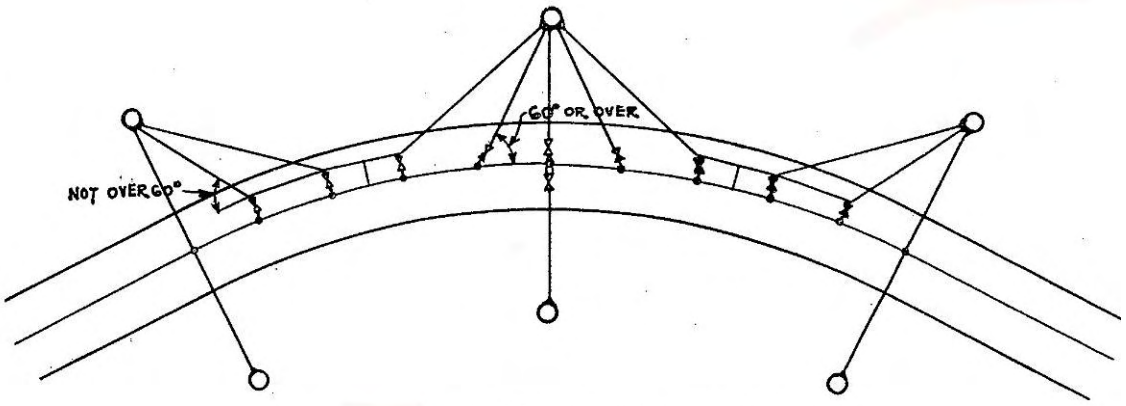


Minimum Clearances			
Electrified Steam Lines		Street or Interburban Lines	
Elevation Trolley Wire above Top of Rail 22'0"	Face of Pole to Center Line of Track 7'6"	Elevation Trolley Wire above Top of Rail 18'0"	Face of Pole to Center Line of Track 7'6"

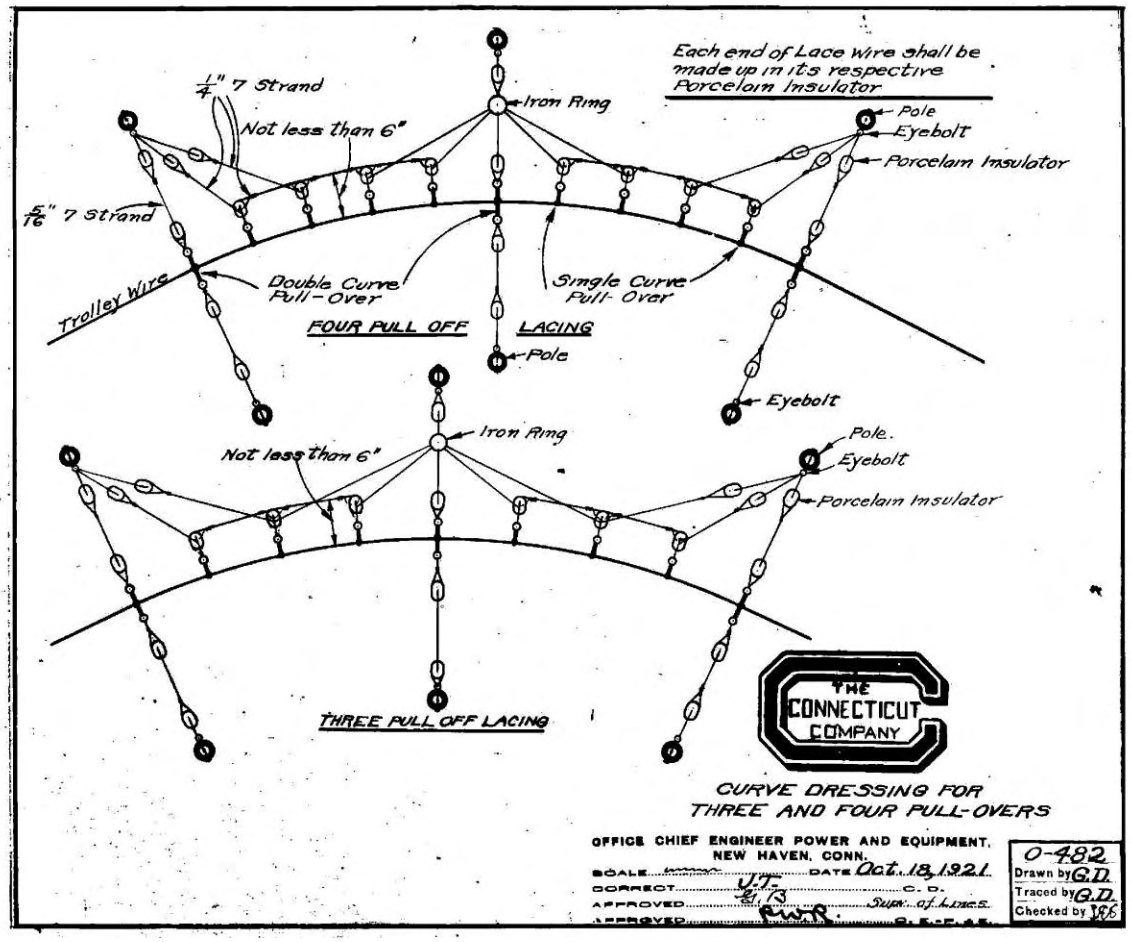
Bracket and Span Support



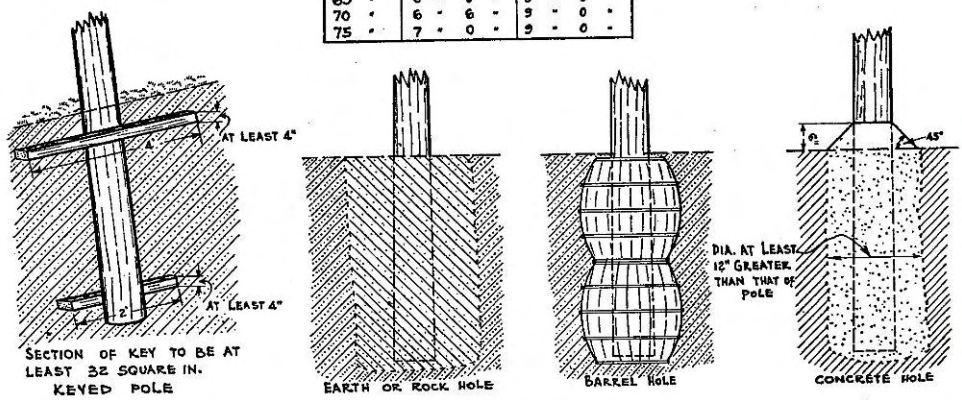
CURVE DRESSING FOR IRREGULAR POLE SPACING



TYPICAL METHOD OF DRESSING CURVES



POLE LENGTH	DEPTH OF HOLE IN ROCK OR CONCRETE		DEPTH OF HOLE IN EARTH	
30 FEET	4 FEET	0 INCHES	6 FEET	0 INCHES
35 "	4 "	6 "	6 "	0 "
40 "	4 "	6 "	6 "	0 "
45 "	5 "	0 "	6 "	6 "
50 "	5 "	0 "	7 "	0 "
55 "	5 "	6 "	7 "	6 "
60 "	5 "	6 "	8 "	0 "
65 "	6 "	0 "	8 "	6 "
70 "	6 "	6 "	9 "	0 "
75 "	7 "	0 "	9 "	0 "



METHOD OF SETTING POLES

APPENDIX D
FUNDING SOURCES

1. INTRODUCTION

Funding to make the items listed in this Report a reality can come from literally dozens of potential sources. These sources fall into the following categories:

- Federal funding, particularly the FTA "Small Starts" program and Sections 5303 (Planning) and 5309 (New Starts)

- State funding grants, reimbursements and loans for transportation facilities, historical restoration, local development, energy conservation, and recreational facilities

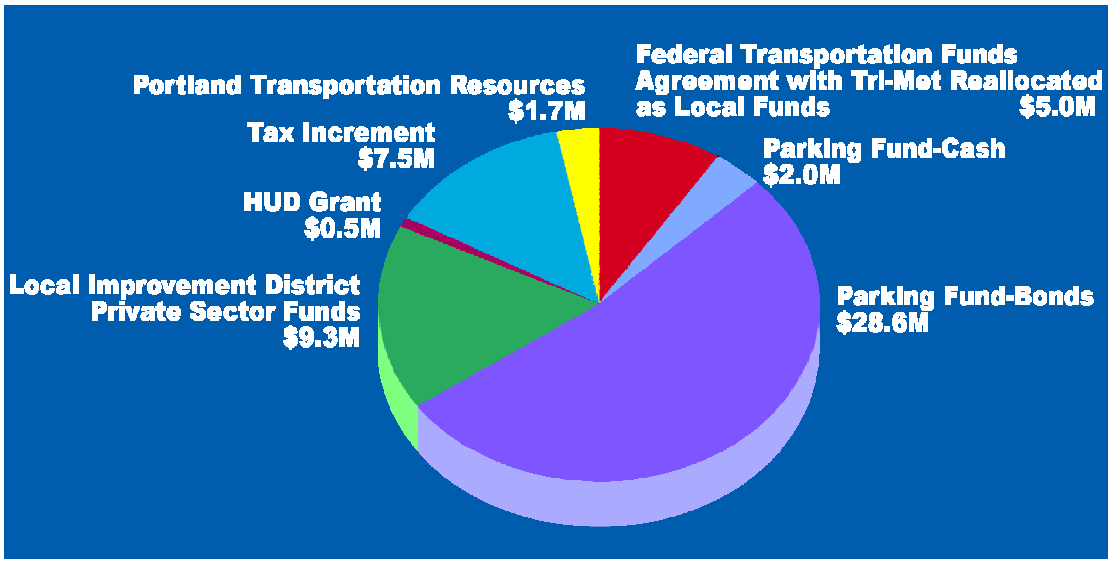
- Local sources obtained through local government, including business development loans, special tax assessment / improvement areas, tax-increment financing, parking taxes, bonds, etc.

- Funding grants from private foundations.

- Other private sources such as voluntary assessments and/or grants from businesses and developers that stand to benefit from improvements (such as restaurants, hotels, convention centers, housing complexes, car rental agencies, etc.), sale of naming rights to vehicles and/or facilities, advertisements in stations and in/on vehicles, and private donations from interested individuals.

These funding sources are summarized in the following table:

FUND SOURCE	PROJECT PHASES		
	PLANNING	EIS/DESIGN	CAP/CONST'N
FTA	X	X	X
HUD	X		
DOT (FLEX FUNDS)	X	X	
NYSERDA	X	X	X
NYPA	X	X	X
UPWP FUNDS	X		
TIF	X	X	X
PARKING AUTHORITY	X		
GO BONDS	X	X	X
PRIVATE/NON-PROFIT	X		
BUSINESS IMP. DIST.	X	X	X
SPEC. ASSESSMENT	X	X	X
FOUNDATIONS	X		



The above pie-chart shows how a mix of various funding sources was used to fund the initial section of the Portland Streetcar circulator project.

2. FUNDING CONSIDERATIONS

For the Trolley Museum of New York, the most necessary items needed when approaching any of the above potential funding sources is to have a thorough, clear-cut development program defined up front, with specific milestones and their costs. In other words, a comprehensive and realistic “Master Plan” for growth based on a concise “Mission Statement”.

No funding agency or government entity is willing to give money to an organization that simply wants to “grow” unless they’ve done their homework to determine exactly what they are, where they want to go, and the form this growth should take. The tangible results of the growth that will occur as the Master Plan for expansion progresses will also increase the organization’s credibility in the eyes of potential donors.

Construction milestones are an extremely important part of any Master Plan. It is impractical to expect that the entire plan will be built all at once; the more realistic approach is to define tangible and independent construction milestones that can begin functioning immediately upon completion. Like establishing credit, the more projects that are completed on-time and within budget as part of the organization’s Master Plan, the easier it will be to obtain funding from both government and private funding sources. A good track record will also open up more funding opportunities, as a portfolio of completed projects can now be presented in conjunction with plans for further development when approaching funding sources.

For example, a milestone to complete restoration of a specific streetcar, rebuild a given length of track, or construct a new building or facility, that was completed

on time and within budget goes a very long way towards demonstrating to donors that the group is a responsible organization that will use any grant money wisely and in exactly the way they say they will. Additionally, there's the obvious PR benefit that accrues from "grand unveilings", "first rides", "ribbon cuttings", and so forth that demonstrate to all that the organization is on the move.

As far as internal organizational changes, the Trolley Museum of New York has already taken the most important step – the hiring of a salaried Executive Director who is present at the Museum on a daily or semi-daily basis. This supplies an essential personal contact to outsiders. Granting agencies are used to dealing with a management structure of this nature, and it also implies a degree of professionalism in the eyes of these agencies that 100% volunteer groups simply can't match.

Organization image is extremely important when fund-raising, especially when dealing with private foundations that are used to working with traditionally-structured museums. The Trolley Museum of New York is an historical organization, a Museum of History, and as such should have a major definitive focus on all of the facets of the history of rail transit, not just building track and restoring streetcars.

While the ride in an antique trolley is the most unique features of a museum such as the Trolley Museum of New York, other facets of the historical experience must also be developed. Outreach programs to schools, seniors, and other community groups help build goodwill as well as generate invaluable public relations for the organization. Historical presentations at the museum itself, whether they be photographic displays, artifacts, or visiting speakers, can also enhance the museum's credibility as the source of rail transit history in the area. A well-developed program to enhance the visitor experience, possibly starting with a short orientation video and progressing to displays, exhibits and equipment tours, and then ultimately to the ride itself, gives the visitors an in-depth feeling for the history that's surrounding them, and makes the museum much more than just a place to go to ride trolleys.

HDR believes that the Trolley Museum of New York is rapidly progressing to establish itself as a Regional History Museum focused on rail transit by implementing or planning to implement the above items.

Unlike many sister trolley museums in the USA, the Trolley Museum of New York seems to be poised at the start of a time of rapid and extensive growth. The Trolley Museum of New York has a unique opportunity to be part of the ultimate growth of rail transportation in the Kingston area. TMNY's extremely fortunate location, in the middle of a prime waterfront development area at Rondout, combined with the existence of a usable right-of-way to Kingston Point (and a possible ferry connection to Rhinecliff for commuters), the planned Hudson's Landing 1750 unit residential and 78,500 square foot commercial development,

and right of way uphill to the heart of Kingston City proper, places the Museum in an excellent position to be the center of the development of a “streetcar circulator” system for the Kingston area.

What does this mean in terms of fund-raising? Simply that funding can be obtained from not only the traditional sources of funding for a museum organization, but also from the same funding sources that are used for funding streetcar circulator projects nationwide.

One aspect related to the multiplicity of potential fundraising categories is how to properly administer the process. As the Trolley Museum of New York is a 502-C-3 nonprofit organization, it can’t coordinate fundraising for items not directly related to the Museum’s mission itself, such as funding for a public circulator system that will primarily serve local transportation needs. One approach successfully used elsewhere (Portland, Tampa) is to form a separate 503-C-3 nonprofit organization to fundraise and administer the expansion of the Museum’s operation into that of a local circulator transportation system. A major advantage of this method is that the new organization can be composed of a Board of Directors with members from the City of Kingston, local businesses and developers, local corporate and political “movers and shakers”, and local transit riders as well as Trolley Museum of New York personnel. An organizational structure such as this demonstrates, particularly to government organizations, that the project has the input and implicit approval of a large portion of the residents of the regional area.

3. A LOOK AT FUNDING SOURCES

With this in mind, we now can examine in more detail the bulleted funding sources list mentioned above and in Table 1.

The categories that best define this project are “Museum of Transportation History” and “Streetcar Circulator”:

1. FEDERAL FUNDING

1.1 FTA Section 5309 Major Capital Investments (New Starts) Small-Starts Program

Congress passed the Small-Starts program as an addition to Section 5309 to encourage smaller transit programs that have heretofore been ignored in favor of large LRT, Commuter Rail and Heavy Rail projects, and to remove much of the “red tape” and delays associated with applying for Section 5309 New Start funding.

Unfortunately, the current FTA administration is continuing to apply project rating standards that were developed for mainline transit megaprojects in the 1970s to potential small-start projects. In other words, a project scores the most points in

the current FTA rating system if it gets cars off the road and decreases a commuter's time to work from suburb to center city. Factors such as spurring redevelopment of city cores, promoting transit-friendly residential development, and making cities more livable and walkable do not enter into the ratings criteria.

The current project rating criteria is, as a result, biased almost entirely towards bus rapid transit (BRT) systems. All projects currently receiving small-starts funding are BRT, except an extension to the extremely-successful Portland Trolley, which ranked very close to the lower cutoff figure using current FTA rating criteria.

HDR recommends that the Trolley Museum of New York and the City of Kingston steer clear of approaching FTA Small-Starts until the next administration is seated in Washington in early 2009.

At the present time long-range planning can begin against the time in a year or two when the ratings standards for Small-Start projects will likely be changed.

(Attached as supplemental information is a writeup explaining the Small Starts program in detail.)

1.2 FTA Section 5303 Metropolitan Transportation Planning Program

The Federal Transit Administration (FTA) appropriates money fund and to provide financial assistance to states and local public bodies to support various types of transportation planning. In order to qualify for metropolitan planning funding an agency must meet Metropolitan Planning Organization (MPO) eligibility. Ulster County has MPO eligibility.

1.3 USDOT and HUD Funding

While not presently used for complete projects, funding can be obtained from these organizations when the goals of the project overlap those of the normal projects sponsored by these organizations. An example is station construction near affordable housing developments, or road construction funds diverted to transit use ("flex funds"). The applicability of approaching such sources will likely become better known as the project progresses.

2. STATE OF NEW YORK FUNDING SOURCES

Funding sources from New York State have a good fit for this project. There are many such funding sources, as listed in Table One, ranging from historical preservation and urban development, to power conservation and railroad reconstruction. Each source has the potential to fund a portion of the planned development.

2.1 NYSERDA (New York State Energy Research and Development Authority)

This state agency primarily funds alternative energy and energy conservation projects. A list of funding categories, both current and upcoming, is attached to this section. While transportation projects are not their main emphasis, they have funded projects for hybrid and alternate-fuel buses in the past, and they have programs to investigate energy savings with advanced transit technologies.

NYSERDA should be investigated once the project has progressed to the development of a streetcar circulator.

At the present time, however, NYSERDA has two categories that may deserve immediate attention.

Grant Category PON 1097 is for projects that reduce power peaking loads from electric generating plants. The SWIMO battery-operated modern streetcar described elsewhere in the report may potentially qualify for funding as a demonstration project under this section. Charging rates for the SWIMO are constant, and peaking currents due to vehicle acceleration are handled by the batteries – resulting in a more even and distributed electric load to the utility. The SWIMO trolley may also qualify for funding under upcoming category PON 1217 - “Advanced Energy Systems for NYC Passenger Mass Transit”

A list of projects funded under NYSERDA and other information is attached to this section.

2.2 NYPA (New York Power Authority)

NYPA is primarily concerned with electric power generation, transmission and use in New York State. They have a number of grant programs relating to energy efficiency, peak load reductions, and electric transportation vehicles. Again, use of the SWIMO would appear to be an immediate candidate for a number of their grant categories.

The index to the NYPA web sites is at the following link:

http://www.nypa.gov/sitemap.htm

Information about NYPA’s hybrid bus and electric vehicle programs is attached.

2.3 Ulster County Transportation Council UPWP (Unified Planning Work Program)

A Unified Planning Work Program (UPWP) for Regional Transportation Planning is developed by the local governmental transportation body (in this case Ulster County). The UPWP serves as a guide for TIP (transportation improvements programs) involving transportation and air quality planning activities.

The Ulster County Transportation Council (UCTC) serves as a Metropolitan Planning Organization (MPO) for the Kingston Urbanized Area as well as a portion of the Poughkeepsie-Newburgh Urbanized Transportation Management Area (TMA). The MPO designation permits members of the UCTC to have the privilege and responsibility for making final decisions concerning transportation planning and programming of Federal aid projects in Ulster County. MPOs are comprised of local elected officials, municipal staff, the State Department of Transportation, Federal Transportation Agencies, Public Transit Operators and other transportation stakeholders who work cooperatively on local and regional transportation planning initiatives.

Programming transportation improvements in Ulster County is one of the UCTC's most important functions. Projects identified in the UCTC's Year 2030 Long Range Transportation Plan are prioritized by the UCTC for placement in the UCTC's five-year Transportation Improvement Program or "TIP" utilizing several project selection processes developed by the UCTC and the New York State Department of Transportation. Any local, county or State agency intending to utilize Federal and/or State funds to advance a transportation project in Ulster County must have the project placed on the UCTC TIP. Projects programmed must comply with Federal laws and guidelines of SAFETEA-LU, Public Involvement requirements, Title VI/Environmental Justice requirements, American with Disabilities Act (ADA) requirements, and the National Environmental Policy Act (NEPA).

One of the most important functions of an MPO is to work cooperatively with the State DOT when programming and administering all Federal dollars for transportation improvements. The purpose of this task is to facilitate the UCTC's Transportation Improvement Program (TIP) update process in cooperation with NYSDOT, and public transit operators.

Every two years, the UCTC initiates a TIP update process to evaluate project priorities against the goals, objectives and recommendations of the Year 2030 Long Range Transportation Plan. A TIP Subcommittee has been established to (1) develop generic cost estimates for use by Ulster County municipalities planning to submit TIP applications; (2) evaluate and consider revising the UCTC's TIP application format to address concerns regarding the application's length and utility; (3) review and consider revising the TIP amendment process; (4) review and consider modifying the TIP project evaluation and project selection methodology; and (5) facilitate the TIP Subcommittee evaluation, scoring, ranking and recommendation of TIP project proposals to the UCTC voting members.

More information can be obtained at this link:

http://www.co.ulster.ny.us/planning/tran.html

2.4 NYSDOT Transportation Enhancements Program

The Transportation Enhancement Program (TEP) is a federal reimbursement program under the "Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users" (SAFETEA-LU), administered by the New York Department of Transportation (NYSDOT).

In recognition that transportation systems are influenced and impacted by more than the condition of the traditional highway and bridge infrastructure, this program enables funding for transportation projects of cultural, aesthetic, historic and environmental significance.
Eligible projects must fall into one or more of the twelve Federal Highway Administration (FHWA) categories. Additionally, the project must have a transportation relationship with the surface transportation system and must be available for public access and use.

This program enables many sponsors and applicants to participate. The TEP requires the project sponsor or applicant to front the cost of the project and request reimbursement. Each project requires a minimum matching share of 20% of the total project cost. Innovative finance features are available to minimize the cash outlay for applicants and sponsors.

Under the Federal TEA-21 program (SAFETEA-LU's predecessor) in two rounds (years 2000 and 2002) approximately 150 projects were funded, with roughly $90M in federal monies committed and $140M overall, when matched with local funds. In October 2006, the Department announced the approval of the first round of SAFETEA-LU TEP multi-year funding. Ninety-seven (97) projects were approved, with more than $91 million in federal funds committed and $145 million overall.

NYSDOT has a 78 page handbook describing the TEP program and the 12 qualified categories at this link:

https://www.nysdot.gov/portal/page/portal/programs/tep/tep-repository/guidebook_0.pdf

This program has applicability to the Trolley Museum of New York rehabilitation plans under the following headings:

Category 7: Rehabilitation and Operation of Historic Transportation Buildings, Structures or Facilities (Including Historic Railroad Facilities and Canals)
Eligibility Principle: A project for rehabilitation and operation of historic transportation buildings, structures or facilities must be for a building, structure or facility historically used for a surface transportation purpose or function and must provide for public access and use. Rehabilitation should be consistent with the Secretary of the Interior's Standards for Preservation Projects.

Category 12: Establishment of Transportation Museums
Eligibility Principle: A transportation museum or transportation display must be for surface transportation. For multiple-purpose museums, the costs borne through TEP funds must be limited to the share attributable to a surface transportation focus.

Category 7 can be used for funding for track reconstruction and rehabilitation projects. In the last round in 2006, the Adirondack Railroad received funding totaling $2,350,000 for the restoration of their Big Moose to Beaver River rail line.

However, there are a number of hurdles to be overcome before this source can be considered for TMNY track restoration projects. First, this is a reimbursement program – the money for track reconstruction must be obtained up front. Secondly, the local sponsor (in this case the City of Kingston) must put up at least 20% of the total value of the requested reimbursement. Lastly, the railroad right-of-way to be refurbished must be listed on the National Register of Historic Places, which at the present time the Ulster and Delaware lines are not.

While it is probably too late to apply for a second-round TEP grant from the current SAFETEA-LU funding, HDR recommends that the Trolley Museum of New York seriously consider starting the application process for placing the Ulster and Delaware right-of-way on the National Register of Historic Places. Although this is a costly and time-consuming process, it has significant benefits when applying for funding related to historic restoration, and is required for NYSDOT TEP funding.

Category 12 is designed primarily for the establishment of a new transportation museum. While funding under Category 12 cannot be used for rehabilitation of existing museum structures, vehicles or physical plant, or acquisition of new exhibits or cars, it can be used for the construction of new buildings, such as a second carbarn or larger visitor's center. It may also be usable for electrification of the Museum since this is required to operate the historic collection. Qualification details for Category 12 are found on page 23 and 24 of the TEP Program Handbook at the link above.

The link below lists projects awarded TEP funding in 2006:

https://www.nysdot.gov/portal/page/portal/programs/tep/tep-repository/tep-program.pdf

2.5 OTHER NYSDOT TRANSPORTATION FUNDING

New York State also makes funding available for covering transit system operating costs under the Statewide Transportation Operating Assistance

(STOA) program. This is applicable only for revenue transit operations. See the following link:

https://www.nysdot.gov/portal/page/portal/divisions/policy-and-strategy/transit-bureau/public-transportation/state-transit-operating-assistance#A8

The NYDOS Title 11 Environmental Protection Fund is another source of applicable funding (this report was funded as part of an award made in 2007 by the Title 11 Fund). Since the Kingston Point line and the Lagoon Line to the Kingston Point Development run through a shoreline area, these funds are applicable. This funding is a 50/50 match of the project costs listed on the application. More information can be found at this link:

http://nyswaterfronts.com/grantopps_EPF.asp

3. LOCAL FUNDING SOURCES

3.1 Business Improvement Districts and Special Assessments

This method has been used in Portland and Tampa for placing a voluntary tax assessment on property and business owners along a proposed streetcar line to help finance construction and operation. Since the payers of this assessment stand to gain through increased business and property values with the streetcar, it is often not difficult to pass a slight tax increase to cover the cost of construction.

The Rondout area is developing at a rapid rate, and may be a candidate for such a Business Improvement District assessment once development has progressed further eastwards. At present there do not appear to be sufficient businesses along Rondout to make this method feasible, although there is a lot of property currently held in speculation of future development.

3.2 Public-Private Partnerships

This method involves the City, the developers, and the Museum in development and expansion of the trolley line. Already, the developer of the Hudson's Landing project is planning to include space for the trolley line to reach into the heart of the development. Further involvement of developers can be sought is areas just east of the Museum's main facility. This area is prone to flooding, and a curb and flood mitigation reconstruction of The Strand in this area may be extremely feasible for a private-public partnership arrangement.

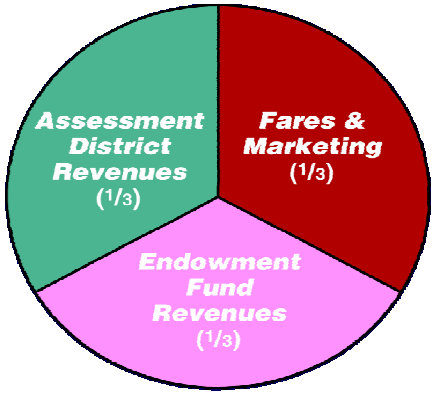
Other areas may include sites in Kingston city, where the line extension will change the values of properties in the downtown areas where the trolley will operate

3.3 Private Foundations

There are literally hundreds of private foundations that can be approached for funding and grants that can be used for projects at the Trolley Museum of New York. As stated previously, the only prerequisites are a good Master Plan and an Executive Director. A list of private funding sources in New York State and the types of organizations they fund is attached to this appendix.

4. OPERATING COST FUNDING

While it may be a bit early to consider funding for a future expansion of the Museum's operation into a Streetcar Connector, here are some ideas that have been used successfully by modern streetcar circulator systems around the country.



The pie chart shows how the $1.2 million annual operating costs for the Tampa Trolley are obtained.

Assessment district revenues are just as usable for operating the system as they are for initial construction, and they are a recurring source of funding. The Tampa assessment is 0.0033 mils.

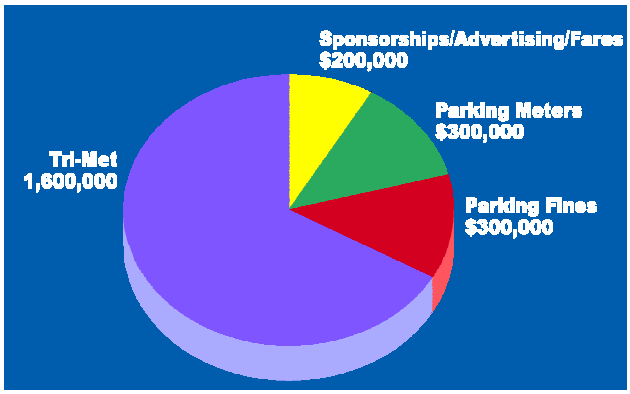
Fares and marketing account for another third of operating revenue. Marketing includes chartered cars and advertising.

The Endowment Fund consists primarily of sponsorships. System Sponsorship is $1 million (TECO, the local power company, paid $1 million for a System Sponsorship, which includes the right to name the line (The "TECO Line), which appears on all cars, stations and the system map. They also sponsor 4 special events every year.

For $250,000 an individual Streetcar Sponsorship is available. This consists of the right to name the streetcar, with the name appearing on the exterior and interior and on the system map, and sponsorship of 2 special events per year.

Station Sponsorship is $100,000. The sponsor's name is placed in the station, and includes sponsorship of 1 special event per year.

Another approach to funding operating costs is taken by Portland. In this pie chart bulk of the $2.4 million annual operating costs is obtained from the local transit agency, Tri-Met, with the remainder coming from sponsorships, advertising, fares, parking meters and parking fines.



Operating costs for streetcar circulators are not that far removed from the operating costs of buses. Circulator systems operated by the local transit agency become part of their system, and are thus eligible for a share of operating funds.

5. POWER POINT SLIDES

Attached is a set of slides from past HDR presentations that lists in graphic form the many sources of funding for streetcar circulator systems. Keep in mind that while these systems are new-starts and do not involve a trolley museum or historic trolleys, many of the same sources are available for use to both upgrade and electrify the Trolley Museum of New York and assist with the development of an adjacent Streetcar Circulator system.

The City of Kingston

Funding – Private Support of Streetcar Projects

HDR

Streetcar Funding

- Where Does Funding Stand?
- How Fast Do You Want to Move?
- Common Funding Characteristics
  - They are All Different
  - They are All Complex
- Private Support Can Mean:
  - 100% Local Funding or
  - Private Funds for Capital/O&M Costs
- Public and Private Leadership and Investment are Essential

Non-Federal Transit Funding

- **Streetcar Funding Using Non-Federal (5309) Funds Can Accelerate Project Development**
- **"Buy America" Provisions are Avoided**
- **NEPA Requirements are Minimized**
- **Local "System Ownership" is Emphasized**
- **Community Pride is Enhanced**
- **Multiple Sources of Federal, State, and Local Funds Are Required**

Streetcar Funding Sources

- **State Funding**
  - **State Transit or Rail Service Development Programs**
  - **State "Strategic Intermodal System" funding**
  - **State Environmental Clean Air and Conservation Grants**
  - **Legislative earmarks**
  - **State Infrastructure Bank loans**

The City of Kingston

HDR

Streetcar Funding Sources

- **Local Funding Provided in Concert with the City of Kingston**
  - **City's Share of Regional Funds From Voter-approved Sales Tax**
  - **City General Obligation Bonds**
  - **Parking Revenues (Meters, Garages, Fines)**
  - **Tax Increment Financing**
  - **Special Assessment Districts**

The City of Kingston

HDR

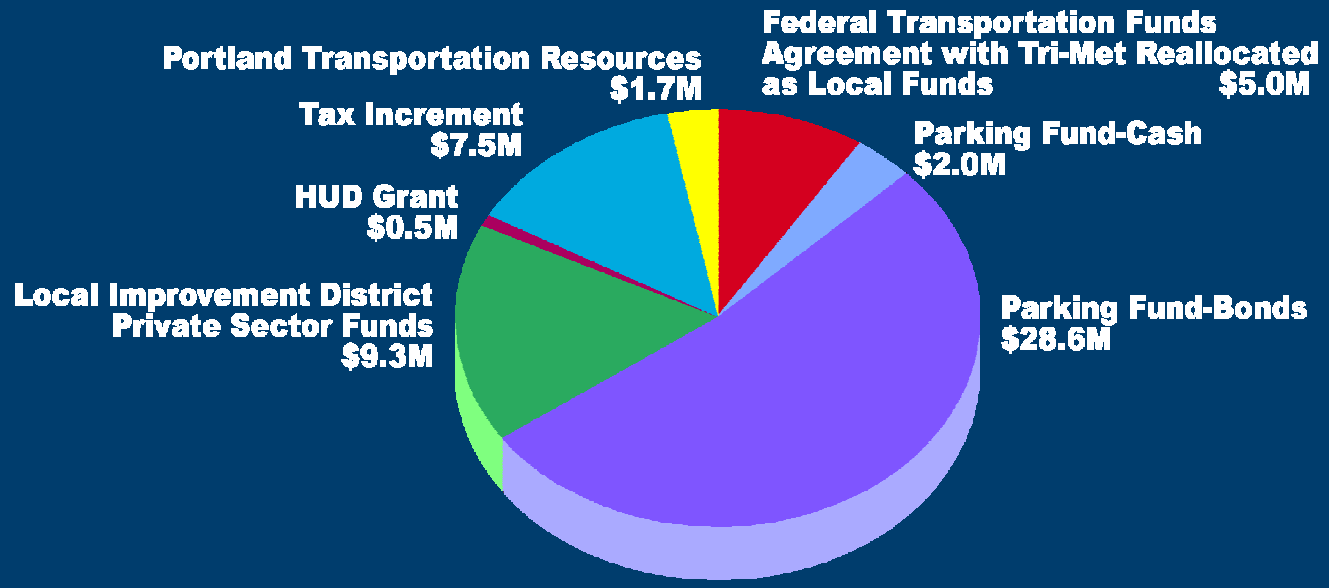
Streetcar Funding Sources

- **Local Funding**
  - **Business Improvement Districts**
  - **Fares, Advertising and Sponsorship**
  - **Already-programmed Street Improvement/Reconstruction Projects**
  - **Hotel/Motel/Tourist Tax**
  - **Transit Agency Funding (In Lieu)**

The City of Kingston

HDR

Portland Fund Sources



Total $54.6 Million

The City of Kingston

HDR

Tampa Fund Sources

- $60 M
- Project Specific State/ Intermodal Funds
- CMAQ
- Flexible Federal Funds
- Section 5303 and 5309 FTA Funds
- Gas Tax
- City Impact Fees

A Local Implementation Tool

- **The Use of Private Non-profits**
  - **Portland Streetcar, Inc**
    - **501 3c Non-Profit Corporation, a Quasi-**
    - **independent Implementation Entity**
    - **Governed by a Board of Directors**
    - **Mission: To implement Portland Streetcar to Benefit the Livability and Economic Vitality of Portland and its Central City**
    - **Mostly Private-sector Board, Plus the City Transportation Commissioner**
    - **PSI Selected Designers/Contractors with City Approval**
    - **Contracts with Tri-Met for Operations and Maintenance**

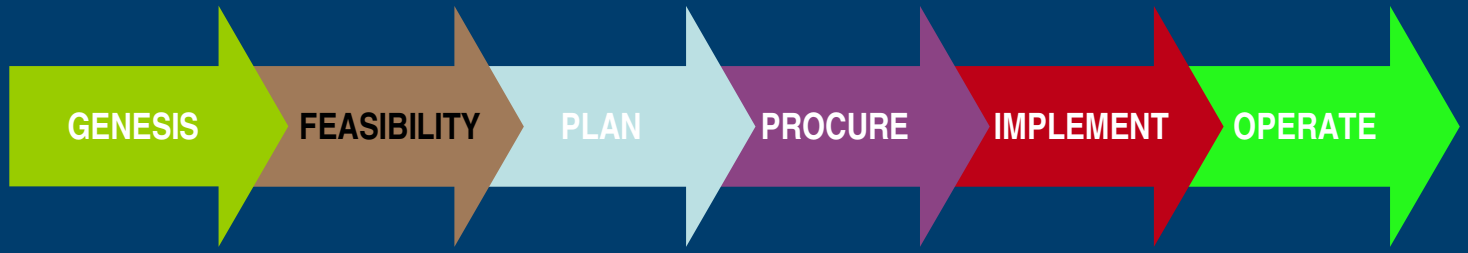
Portland Streetcar, Inc

A Local Implementation Tool

- Benefits of the Non-profit Approach
  - Single point of leadership/accountability in City government
  - Portland Streetcar, Inc - Not Just an Advisory Committee or Steering Committee - but Real Power
  - Private Property Owner Buy-in and Credibility
- Other Similar Applications
  - Tampa Historic Streetcar, Inc
  - http://www.tecolinestreetcar.org/
  - Atlanta Streetcar, Inc. http://www.atlantastreetcar.org/

Public/Private Partnerships

- Public Sector Agencies Joining Private Sector Entities in a Business Relationship to Achieve Commonly-shared Goals



Sustaining Member: National Council on Public Private Partnerships

The City of Kingston

HDR

Public Private Partnerships

- $1.5 B Project
- Market Demand Analysis
- Pre-development Services
  Planning
  Design Revision
  Programming/Construction
  Phasing Charrettes
- Program Development
- Financial Analysis
- Developer Selection
- Contract Negotiations
- Air Rights Marketing Plan
- Amtrak Negotiations
  Support
- Innovative Financing
  Strategies

Moynihan Station - James Farley Building

The City of Kingston

HDR

Public Private Partnerships

Joseph Scelsi Intermodal Transportation Center, Walpole, MA

The City of Kingston

HDR

Powerful P3 Results

- **P3 Involvement Can Span All Planning Phases – Planning, Design and Construction**
- **P3 Can Augment State, Local and Federal Funds**
- **P3 Funds Can Be Used to Supplement Operating Funds**
- **Public/Private Development Projects Will "Follow the Tracks"**

The City of Kingston

Funding – Private Support of Streetcar Projects

HDR

Updated Guidance for Project Sponsors Considering New Starts and Small Starts Projects

By David Vozzolo

This brief article is another in a series to provide an update on the status of the federal New Starts and Small Starts programs for transit capital investment projects, and to provide recommendations for project sponsors considering pursuit of these funds.

Current Status

At the end of 2007, the Federal Transit Administration (FTA) reports about 25 projects in the New Starts and Small Starts pipeline in varying stages of preliminary engineering, final design and Small Starts project development. As discussed in previous articles, the number of New Starts projects in the pipeline is lower than anytime since the mid-1990s.

With an implementation goal of just two years, New Mexico decided to forgo applying for New Starts funding to keep its Rail Runner Express on schedule.

By December 2007, FTA had approved six projects in Small Starts project development, including one streetcar and five enhanced bus/bus rapid transit (BRT) projects, and had approved two of these BRT projects for construction grant agreements. FTA anticipates approving as many as 10 additional projects into Small Starts project development in early 2008, including eight enhanced bus projects and two commuter rail improvement projects. Industry concerns expressed in this writer's last *TransitLine* update (June 2007) continue to apply in that the current Small Starts project rating and funding decision-making processes do not adequately credit connectivity and economic development benefits of urban circulators and streetcar projects.

In early February 2008, the fiscal year 2009 budget was released and the Annual New Starts Report submitted to Congress, naming the latest round of New Starts and Small Starts projects recommended for federal funding. Note that this action reflects the last annual program budget and project funding recommendations released by the current presidential administration.

Status of Rulemaking

The New Starts program continues to be regulated by the December 2000 Final Rule on Major Capital Investments, periodically updated through policy guidance and amended procedures. The most recent update is the *Final Guidance on New Starts/Small Starts Policies and Procedures* released in June 2007. The Small Starts program, introduced in SAFETEA-LU in 2005, is not regulated by any formal rule in place to date, but is directed by FTA interim policies and procedures. FTA released its most recent Updated Interim Guidance for Small Starts in July 2007.

New Starts funding was used to make Pittsburgh's North Shore Connector project possible.

In August 2007, FTA published a Notice of Proposed Rulemaking, providing an opportunity for comment on proposed changes to New Starts and formal implementation of the new Small Starts program. Over 140 industry comments were submitted by the November 2007 deadline.

HDR is actively engaged within the industry on program policies and procedures, working closely with the American Public Transportation Association (APTA), the New Starts Working Group, the Community Streetcar Coalition, Reconnecting America–Center for Transit Oriented Development, and other national organizations. This writer was the APTA lead in drafting comments to the proposed rule and coordinated closely with other organizations. In general, industry comments called for FTA to:

- Simplify rating and project development process
- Increase emphasis on land use and economic development benefits
- Consider mix of quantitative and qualitative measures
- Reduce emphasis on current measure of cost effectiveness in ratings and funding decisions
- Save time and cost in planning project delivery

Many congressional leaders have expressed concern that implementation has not been consistent with new direction provided in SAFETEA-LU to simplify the process and expedite project delivery. The House Transportation and Infrastructure Highways and Transit Subcommittee held hearings in May and September 2007 on the proposed rule for New Starts and Small Starts and was critical of the current and proposed project evaluation framework and many of the administration's policies included in the rule.

Congressional and industry concerns have been more formally expressed in the 2008 Omnibus Appropriations Bill, passed by the House and Senate in December 2007, in effect prohibiting FTA from promulgating regulations. The bill states "None of the funds provided or limited under this act may be used to issue a final regulation under section 5309 of title 49, United States Code, except that the Federal Transit Administration may continue to review comments received on the proposed rule (Docket No. FTA-2006-25737)." Following this congressional action, the next steps in the rulemaking process are unclear.

Program Changes Anticipated

The reauthorization of SAFETEA-LU, which is scheduled to expire in 2009, will provide an opportunity to introduce significant structural change to the New Starts and Small Starts programs. It is quite possible that a new administration and a new Congress will take a different approach to regulation and stewardship of the program.

(continued on page 8)

(continued from page 7)

However, it is important to remember that a new authorization may not yield a direct, formal change in policies and procedures for at least a couple years.

HDR is active with national trade and advocacy organizations now addressing and outlining program changes for new authorizing legislation. While no one can be certain of the outcome, the following points are already being discussed:

- Expect changes to the New Starts program, particularly related to simplification of planning, project development and advancement requirements
- Anticipate potential new federal funding sources which may be available as a result of climate change and energy conservation, with a focus on distribution of funds to metropolitan areas
- Awareness that program requirements need to be more flexible to accommodate alternative project delivery mechanisms and public-private partnerships
- Increased emphasis on land use and economic development benefits of transit investment, including ways to leverage value capture at station areas through private investment and joint development
- Potential consideration for funding decisions based on a system or program of projects rather than current focus on one project at a time

The Good and the Bad

For project sponsors considering pursuit of New Starts or Small Starts funding, there's good news and bad news.

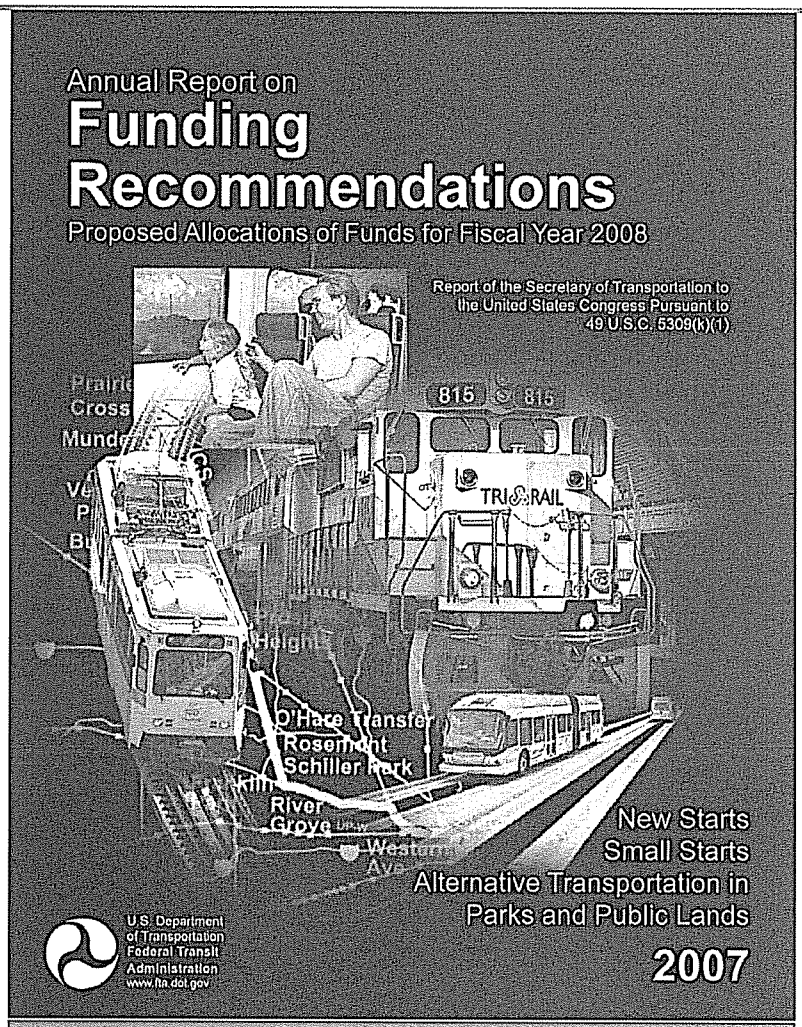
The bad news is:

Many project sponsors continue to experience difficult and time consuming challenges advancing projects through the maze of New Starts and Small Starts program requirements. We see little, if any, evidence suggesting substantive changes in program policies and requirements until a change in administration. Specifically, this administration is deeply committed to the current definition and application of cost effectiveness and to its policy that projects must achieve a medium cost effectiveness rating for an FTA funding recommendation. Project sponsors comment that it is getting increasingly difficult for agencies that have not built New Starts investments in the past or are planning projects in new corridors that are not considered extensions of existing fixed guideway investments. Small Starts project sponsors note that only enhanced bus/ BRT projects have been funded by FTA to date and that current program requirements do not adequately credit connectivity and economic development benefits of urban circulators and streetcar projects.

The good news is:

Congressional leaders in both parties have expressed dissatisfaction with current program policies and requirements and have taken formal action to disallow long-term codification of these policies in regulation. FTA is showing some signs of flexibility in application of program requirements (though still directed by overall administration policy) and Congress continues to fund the program and support individual projects, as evidenced by the 2008 appropriations. Finally, all signs point to significant program changes with a new administration and with a new authorization.

It is clear that in the short term, over the next year or so, New Starts project sponsors will continue to face challenges in advancing projects in a timely manner and the Small Starts program will likely continue to place urban circulators and streetcars at a disadvantage. Therefore, our best general advice is that project sponsors look to position their projects for anticipated changes and opportunities.



FTA released the 2008 Annual Report on Funding Recommendations February 5.

Recommendations for Project Sponsors

HDR typically suggests to its clients that early on we complete a systematic review of the proposed program of projects and consider a deliberate strategy to pursue or not pursue federal discretionary funds for specific projects. These decisions are based on a number of factors, including anticipated project competitiveness in the New Starts/ Small Starts rating process, project schedule and cost constraints, staging within a regional program of projects, and congressional and local political and financial support for the project.

Project sponsors who feel the need to advance projects within a short timeframe over the next year or so and who have the financial capability and political will to deliver the project without federal discretionary funding should seriously consider this option. Sponsors should consider whether a reasonable and viable starter line could be implemented with local funds, while needing to ensure that federal program requirements are addressed to secure potential federal funding for extensions in the near future.

If project sponsors are early in planning studies and a decision on the need for federal funding is anticipated within a couple years, they should keep their options open to pursue New Starts and Small Starts funds. As stated, there are encouraging signs for a positive change in program requirements and opportunities for a wide range of modes and technologies in both New Starts and Small Starts.

In all cases where federal funds are under consideration in the short-term or long-term, it is critical that project sponsors ensure they continue to comply with and anticipate federal requirements related to metropolitan planning, environmental laws and regulations, procurement, the Americans with Disabilities Act and other FTA grant and project requirements.

This author offers one last set of general advice for agencies that are considering pursuit of New Starts or Small Starts funds for the first time, and particularly for non-traditional project sponsors such as municipalities or other local/regional organizations. As you may be experiencing now or will soon see, this program is like no other. Many of the program requirements are statutorily mandated by Congress and, in their defense, FTA is under extreme pressure overseeing this program as a steward of the federal investment. It may help to keep the following lessons learned in mind as you proceed:

- Be aware that the process takes longer than you expect
- Be conservative with project schedule and cost estimates due to delay, inflation and FTA oversight
- Keep elected officials and board members in the loop as the project advances—no one likes surprises
- Be open to scaling the project—you may need to alter the scope and phasing to meet FTA requirements
- Be prepared for hard choices on project details, cost effectiveness and operating issues as the project advances

HDR will continue to work with project sponsors to ensure that critical early planning and project development

(continued on page 16)

(New & Small Starts... continued from page 9)

decisions can take advantage of the evolving federal requirements for New Starts and Small Starts streetcar projects. HDR will also continue as a leader in the industry to work toward positive change in program policies, procedures and opportunities.

About the Author

David Vozzolo, Senior Transit Program Manager and Vice President, provides counsel on planning, financing and project delivery for transit projects nationwide. David previously served as Deputy Associate Administrator for the Federal Transit Administration's Office of Planning and Environment. He can be reached at david.vozzolo@hdrinc.com.

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For more information on HDR's Transit Program, visit our home page on the World Wide Web: http://www.hdrinc.com/

Volume 2 Issue 2
February 2008

Nameplate photo courtesy of Terry Halsey

- Current Opportunities
- Upcoming Opportunities
- Completed Opportunities
- Doing Business with NYSERDA
- Standard Forms & Agreements
- External Funding
- Recently Signed Contracts

Current Funding Opportunities

Technical questions should be directed to the appropriate project managers. The main NYSERDA phone number is toll-free 1-866-NYSERDA or local (518) 862-1090; extensions and e-mail addresses for the project managers are listed below.

Sign up to receive e-mail updates for new Funding Opportunities

TITLE	DESCRIPTION	CONTACT NAME	DATE DUE
Flexible Technical Assistance (Flex Tech)	Customers seeking FlexTech assistance for buildings - Provides costsharing on technical assistance services tailored to answer customer-specific energy questions. Services are performed by pre-qualified FlexTech Consultants.	Mark Gundrum ext. 3256	Continuous
Multifamily Building Performance Program	An opportunity for businesses providing energy efficiency services to multifamily buildings to participate in NYSERDA's "Multifamily Building Performance Program".	Shelley Allen, TRC Energy Services, (212) 221-8488	Continuous
New York ENERGY STAR® Products Program	Seeks retail, distribution and manufacturing partners that sell ENERGY STAR® products in New York State, to assist in promoting energy efficiency, and awareness and sales of ENERGY STAR labeled appliances and lighting products. Benefits include: cooperative advertising support; custom promotional opportunities; Point-of-purchase materials; and more.		Continuous
PON 809 SMALL COMMERCIAL LIGHTING PROGRAM INCENTIVES	The New York State Energy Research and Development Authority (NYSERDA), as administrator of the New York Energy $martK Program, requests applications for incentives	1-866-NYSERDA or info@nyserda.org	06/30/08 REVISED ON: 05/05/08

	for effective, energy-efficient lighting projects performed by participants in the Small Commercial Lighting Program ("SCLP" or "Program").		
RFQ 925 Financing for Assisted Home Performance with ENERGY STAR	Seeking statements of qualifications from lending institutions to provide financing and program support services to borrowers to finance improvements through NYSERDA's Assisted Home Performance with ENERGY STAR® Program.	David A. Friello Ext. 3355	07/30/08 REVISED ON: 07/03/07
PON 1050 Solar Electric Incentive Program	It's an innovative program from the New York State Energy Research and Development Authority (NYSERDA) that provides cash incentives for the installation of new Solar Electric or Photovoltaic (PV) systems by Eligible Installers.	1-866-NYSERDA or info@nyserda.org	12/31/09
PON 1060 **New York Energy $mart[SM]** Loan Fund Application Information and Forms	The Loan Fund invites financial institutions to participate in and customers to apply for low interest financing for energy efficient improvements, new construction, and renewable technology projects.	1-866-NYSERDA or info@nyserda.org	07/31/09 REVISED ON: 04/14/08
RFQ 1081 Home Energy Rating System Provider	Participating in the New York ENERGY STAR Labeled Homes Program Services This solicitation is for the acceptance of HERS Providers in the New York ENERGY STAR Labeled Homes Program. The HERS Providers awarded under this solicitation are authorized to oversee the HERS Raters operating underneath them. Only homes rated by raters operating under an accreditted HERS Provider are eligible to receive the ENERGY STAR Label.	Brian Atchinson Ext. 3382	12/31/08
PON 1093 New York State Bio-Fuel Station Initiative: Driving Energy Independence for the Empire State	Accelerating the installation of retail E85 and biodiesel service stations throughout New York. The goal of the program is to create an expanded network of stations for the public and private vehicles that are capable of being operated on these renewable fuels.	Patrick Bolton Ext. 3322	05/01/09 REVISED ON: 04/29/08
PON 1097	The purpose of this program	Chris Smith	06/30/08

Peak Load Reduction Program	is to increase electric grid reliability and load factor by providing incentives for system coincident peak demand reduction in New York State. Please see our Peak-Load Reduction Program fact sheet overview.	Ext. 3360	REVISED ON: 02/29/08
PON 1098 Wind Incentives for Eligible Installers	First-come, First-served Financial Incentives for small wind systems that offset customers' electric usage (end-use).	1-866-NYSERDA or info@nyserda.org	12/31/09 or until funds are fully committed, whichever comes first
PON 1101 Enhanced Commercial/Industrial Performance Program	This solicitation will merge the Commercial/Industrial Performance Program and the Smart Equipment Choices Program into one. Providing performanced-based incentives and prescripitive incentives for energy efficiency upgrades in existing buildings. Please see our Enhanced Commercial/Industrial Program fact sheet.	Eric Mazzone Ext. 3371	Electric: 06/30/08 Gas: 06/30/08 REVISED ON: 03/31/08
PON 1116 Development at the Saratoga Technology + Energy Park	The New York State Energy Research and Development Authority (NYSERDA) invites proposals from business entities or developers (Company, Developer, or collectively, Applicant) seeking to construct a building and related improvement at the Saratoga Technology + Energy Park (STEP) in the Town of Malta, Saratoga County, New York.	Kevin Hunt Ext. 3259	12/31/09 REVISED ON: 10/04/07
PON 1124 Clean-Energy Business Growth & Development	NYSERDA will partner with companies to reduce the financial and market risk of commercializing innovative technologies, supporting entrepreneurial enterprise and implementing new business models that will enable adoption and diffusion of clean energy technologies.	Vicki Colello Ext. 3273	Round 1: 09/05/07 Round 2: 02/04/08 Round 3: 08/04/08 Added: Pre-Bid Conference Call Information REVISED ON: 11/02/07
PON 1146	Promote the adoption of	Sarah Osgood	05/30/09

RPS Customer-Sited ADG-to-Electricity Program	emerging anaerobic digester technologies that offer direct benefits to customers through the use of financial incentives in the form of capacity buy-down and performance-based payments to offset the construction, installation, and operation of the systems.	Ext. 3301	
PON 1150 Renewable Portfolio Standard Customer-Sited Tier Fuel Cell Program	The New York State Energy Research and Development Authority (NYSERDA),administrator of the New York Renewable Portfolio Standard (RPS) Program, is accepting applications to receive financial incentives to support the purchase, installation, and operation of stationary Fuel Cell Systems in New York State.	Scott Larsen Ext. 3208	05/29/09 REVISED ON: 03/14/08
PON 1171 Municipal Water and Wastewater Research, Development and Demonstration Program	The New York State Energy Research and Development Authority announces the availability of $1.5 million to support projects that result in quantifiable energy, economic and environmental benefits to New York State's municipal water and wastewater treatment sector.	Kathleen O'Connor Ext. 3422	Round 1: 03/27/08 Round 2: 09/25/08
PON 1176 Renewable, Clean Energy, and Energy Efficiency Product Manufacturing Incentive Program	This solicitation is designed to expand the level of renewable, clean energy, and energy efficient product manufacturing in New York by offering an incentive for building a manufacturing plant and subsequently producing clean energy products in New York State.	Jennifer Harvey Ext. 3264	06/30/11 or until funds are fully committed, whichever comes first
PON 1184 School Power...Naturally Program Upgrade and Expansion	The New York State Energy Research and Development Authority (NYSERDA) Program Opportunity Notice (PON) 1184 seeks proposals to maintain, upgrade, and expand the technical and educational capabilities of our School Power...Naturally program.	Judy Jarnefeld Ext. 3293	Due Date : 05/22/08
RFP 1186 Professional Services for the Sale of Emissions Allowances	Through rules and regulations promulgated by the Department of Environmental Conservation , NYSERDA will be responsible for selling nitrogen oxide allowances under the Clean Air Interstate Rule ("CAIR") The	Kevin Hale Ext. 3266	Due Date : 05/21/08

	objective of this solicitation is to select a qualified firm to provide NYSERDA market advice and brokerage services for the sale of these allowances.		
PON 1190 Industrial Process & Product Innovation (IPPI)	The program will support research, development, demonstration, commercialization and deployment of energy-efficient products targeted at industrial applications and innovative and underutilized manufacturing process improvements.	Miriam Pye Ext. 3370	Round 1 : 03/05/08 Round 2: 07/02/08 Round 3: 11/05/08
PON 1193 Environmental Technology: Improved Environmental Performance for Power Generation	The New York State Energy Research and Development Authority (NYSERDA) announces the availability of $1,500,000 to support projects to mitigate environmental impacts of power generation critical to maintaining fuel diversity and system reliability in New York State; and that result in quantifiable energy, environmental, and economic benefits to the state.	Barry Liebowitz Ext. 3248	Round 1 : 05/20/08 Round 2 : 10/15/08
PON 1196 Clean Energy Technology Training, Accreditation, & Certification	The New York State Energy Research and Development Authority (NYSERDA) seeks proposals to meet a range of workforce training needs. Funding is available to facilitate workforce education in the area of emerging clean energy technologies. Training initiatives can be developed and implemented as continuing education opportunities, college credit courses, certificate programs, two-year degree programs, etc. Emerging technologies include: photovoltaic (PV), wind (both wholesale and customer-sited), fuel cells, anaerobic digesters, solar thermal, and geothermal. Respondents to this PON should focus on enhancing skills of current workers and developing new skills for workers in a new occupation.	Lee Butler (716) 842-1522	6/24/08
PON 1197 Technical Assistance	The program is seeking applications from facilities interested in energy efficiency technical evaluations, peak-load reduction studies, energy	Rachel Adams Ext. 3016	11/30/09 REVISED ON: 03/25/08

	procurement analysis, proposals that study the feasibility of implementing combined heat & power (CHP) and renewable generation, and Peak_Load Curtailment Plans.		
PON 1200 Environmentally Preferred Power Systems and Energy Storage Technologies	The New York State Energy Research and Development Authority (NYSERDA) seeks proposals to support the development, demonstration, and commercialization of environmentally preferred power systems and energy storage technologies	Jim Foster Ext. 3376	Round 1: 07/16/08 Round 2: 01/14/09 REVISED ON: 05/12/08
PON 1206 DATA CENTER and SERVER EFFICIENCY	This New York State Energy Research and Development Authority (NYSERDA) Program Opportunity Notice (PON) 1206 seeks proposals to support the development and/or demonstration of innovative and emerging data center and server technologies. Preferred technologies are those that can increase end-use energy efficiency, reduce electric demand or are of strategic importance to New York State's energy, economic and environmental future.	Joe Borowiec Ext. 3381	Round 1: 05/01/08 Round 2: 11/13/08
PON 1207 Solid-State Lighting Research, Development, Demonstration & Standards/Enabling Activities	The New York State Energy Research and Development Authority(NYSERDA)invites proposals to(A)develop new high-efficiency solid-state lighting (SSL) products/or systems, (B) demonstrate and evaluate high-efficiency SSL systems, and (C) test SSL products/or systems and make the test results available to a broad audience. For more information please view the Workshop Invitation.	Marsha Walton Ext. 3271 For more information Workshop Invitation and Agenda	05/28/08
PON 1208 Electric Power and Distribution (EPTD) Program	The primary objectives of this solicitation are 1)To demonstrate a wide array of technologies that improve the performance of the electric power delivery system in New York State, and 2) To develop innovative strategies that support sustainable investment and continued	Mark Torpey Ext. 3316	Round 1: 06/04/08 Round 2: 12/03/08

	improvement of the electric power delivery infrastructure.		
PON 1215 Next Generation and Emerging Technologies for Residential Buildings	The New York State Energy Research and Developm ent Authority (NYSERDA) seeks proposals to perform product development and demonstration projects worthy of research categorization that will benefit residential buildings. The technologies should promote improvement to the containment, production, distribution and/or durability of the energy systems in the building. The energy systems typically involved perform or enhance the delivery of heating, cooling, or hot water distribution.	Greg Pedrick Ext. 3378	Round 1: 05/15/08 Round 2: 09/10/08
PON 1217 ADVANCED ENERGY SYSTEMS FOR NYC PASSENGER MASS TRANSIT	The New York State Energy Research and Development Authority (NYSERDA) Program Opportunity Notice (PON) 1217 seeks proposals to support activities leading to the study, development, qualification and/or demonstration of innovative products and systems that reduce the energy use of passenger transit systems under the jurisdiction of the New York City Metropolitan Transportation Authority (MTA).	Frank Ralbovsky Ext. 3260	Round 1: 07/24/08 Round 2: 01/07/09
PON 1222 New Construction Program Financial Incentives	Incentives are available for the purchase and installation of energy-efficient equipment that reduces electric energy consumption in new and substantially renovated buildings.	1-866-NYSERDA or info@nyserda.org	03/31/09
PON 1223 ADVANCED TRANSPORTATION TECHNOLOGIES	This New York State Energy Research and Development Authority (NYSERDA) Program Opportunity Notice (PON) 1223 seeks proposals to support development, demonstration, and commercialization of innovative transportation products, systems and services.	Joe Wagner Ext. 3228	Round 1: 07/08/08 Round 2: 12/17/08

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Technical questions should be directed to the appropriate project managers. The main NYSERDA phone number is **toll-free 1-866-NYSERDA or local (518) 862-1090**; extensions and e-mail addresses for the project managers are listed below.

Sign up to receive e-mail updates for new Funding Opportunities

TITLE	DESCRIPTION	CONTACT NAME	DATE DUE
PON 992 New York State Clean Air School Bus Program, Round 2	Solicits applications for projects that maximize the environmental and energy benefits of introducing emission-reducing technology fo diesel-fueled buses into school bus fleets and accelerating the introduction of these emission-reduction technologies into the market.	Carl Mas Phone: Ext. 3294	Spring 2008
RFP 1074 Biofuel Station Initiative: Marketing and Advertising	This RFP will select a contractor to perform advertising and marketing for E85 in New York State.	Patrick Bolton Phone: Ext. 3322	Spring 2008
PON 1151 Pilots for Time Sensitive Price and Load Management in Multi-Family Housing	To conduct pilot projects in MF housing to demonstrate and monitor the behavioral, economic and peak load impact of time sensitive rates and fleet managed high efficiency room AC units.	Joe Borowiec Phone: ext. 3381	Spring 2008
PON 1158 School Bus Idling Reduction in Westchester, Putnam, and Dutchess Counties	The School Bus Idling Reduction Project will award funding through a competitive solicitation to eligible parties to fund the cost of diesel fuel-fired coolant heaters for currently operating school buses.	Carl Mas Phone: Ext. 3294	Winter 2007-08
RFQ 1175 STEP - Gazebo Construction	To select a contractor to construct a gazebo at STEP, to be used by STEP tenants and the general public.	Kevin Hunt Phone: Ext. 3259	
RFP 1177 Back-Up Power Demonstration for 107 Hermes Rd., STEP	To purchase up to two deomonstration back-up power generation systems for the 107 Hermes Road building that is currently under construction at STEP.	Kevin Hunt Phone: Ext. 3259	
PON 1196	This solicitation will provide funding to	Adele	Spring

Clean Energy Technology Training, Accreditation, and Certification	institutions such as BOCES, two-and four-year colleges, labor and trade groups, and accreditation and certification organizations for the facilitation of workforce education in clean energy technology areas.	Ferranti Phone: Ext. 3206	2008
PON 1200 Environmentally Preferred Power Systems and Energy Storage Technologies	The objective of this solicitation is to attract proposals for projects in the Power Systems area with a focus on renewable energy and energy storage technologies.	J. Foster Phone: Ext. 3376	April 2008
RFQ 1210 & RFP 1218 White Tag Pilot Program	Research, create, and audit a pilot, small-scale White Tag market, to gain the knowledge necessary to administer a robust, legitimate, and transparent White Tag market in New York.	B. Millstein Phone: Ext. 3014	Summer 2008
PON 1213 NEW YORK CITY PRIVATE FLEET PROGRAM	This solicitation is designed to encourage the use of alternative-fuel vehicles (AFVs) and emission controls by private-sector companies and non-profit entities operating vehicles in New York City.	P Bolton Phone: Ext. 3322	June 2008
PON 1216 Early Stage Support for Developers of Renewable and Clean Energy Technologies	The goal of the program is to expand the focus of NYS incubators and business support networks to target very early stage renewable energy/clean energy technology companies.	J. Jarnefeld Phone: Ext. 3293	December 2008
PON 1217 Advanced Energy Systems for NYC Passenger Mass Transit	The objectives of this solicitation are to foster the implementation of advanced or underutilized technologies that can save energy within the NYC MTA's mass transit system.	F. Ralbovsky Phone: Ext. 3260	Fall 2008
PON 1219 Building Efficiency Program	This solicitation will merge the Enhanced Commercial/Industrial Performance Program (ECIPP) and the Peak Load Reduction Program (PLRP) into one program to be called the Building Efficiency Program. This program will offer incentives for a variety of energy projects which include: Pre-Approved measures, Energy Efficiency measures, Demand Response-Load Management, and Combined Heat and Power.	T. Baldyga Phone: Ext. 3354	June 2008
RFP 1220 Grid Impact of Plug-in Hybrid Electric Vehicles	The objective of this solicitation is to select one contractor to assess the impact of increased penetration of Plug-in Hybrid Electric Vehicles (PHEVs) on the electric grid infrastructure and air quality in New York State.	S. Osgood Phone: Ext. 3301	July 2008
PON 1223 Advanced Transportation	Develop, demonstrate and commercialize transportation technologies leading to energy-	J. Wagner Phone: Ext. 3228	July 2008

Technologies	efficient and environmentally-sound transportation products		
PON 1234 New York State Ethanol Distributor Program: Driving Energy Independence for the Empire State	Provide cost-shared assistance to mid-stream distributors of ethanol to install the necessary equipment to distribute the fuel to the retail stations.	P. Bolton Phone: Ext. 3322	July 2008
PON 1236 Energy Productivity in Innovative Local Food Production Systems	The main objective is to help support innovative local food production systems, such as Controlled Environment Agriculture (CEA), greenhouse technologies, and aqualculture.	W. Reinhardt Phone: Ext. 3257	September 2008 and December 2008

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Clean Transportation

Electric-Drive Vehicles: Moving Into the Future

NYPA is helping introduce the next generation of clean-fueled vehicle--the Plug-In Hybrid Electric Vehicle (PHEV)

The New York Power Authority has helped make New York State a pacesetter in electric-drive and clean transportation technologies. The programs and partnerships we're helping to establish help improve air quality and reduce dependence on foreign oil.

The Empire State's aggressive efforts to promote electric transportation include rigorous vehicle emission standards, tax incentives and Clean Water/Clean Air Bond Act funding for electric-drive vehicles (all electric and hybrid electric) and other clean-fueled vehicles in mass transit and government fleets. In addition, New York State's Executive Order No. 111 directed that state agency fleets convert entirely to clean-fueled vehicles by 2010.

The Power Authority is the nation's largest supplier of electricity for mass transit, powering the subway and commuter trains of metropolitan New York. Today, NYPA is playing a significant role in these efforts to help New York State achieve a cleaner, greener future.

This vision stretches beyond New York's borders, as well. The New York Power Authority is an active member of the Electric Drive Transportation Association (EDTA), an international consortium of more than 100 energy producers, automotive manufacturers and their suppliers, state and local governments and others working to promote electric transportation.

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News:

April 9, 2008 - Astoria Park Vehicles Go "Clean & Green" To Reduce Air Emissions through Efforts of Queens Boro Prez, Queens Clean Air Project Partners and NYC Parks & Recreation (Jointly issued with Clean Air Communities, Queens Borough President's Office, NYC Parks & Recreation Dept.) (includes photo, caption, fact sheet and remarks)

February 7, 2008 - Airport, Delta & NY Power Authority Turn Up The "Green" (Albany Airport press release and NYPA President and CEO Roger B. Kelley's remarks)

New York Power Authority Clean Transportation Update - past issues
September 2007; October 2006, March 2006, August 2004; January 2004

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Clean Transportation (cont'd)

Other Programs

- **Hybrid-Electric Transit Buses** –Working with the  Metropolitan Transportation Authority (MTA) and New York State Energy Research and Development Authority (NYSERDA), we supported the development of a prototype hybrid-electric transit bus for New York City Transit and then helped that agency buy 10 hybrid-electric transit buses for use on city streets. Following the successful demonstration of these buses, the MTA took delivery of an additional 325 for New York City and an additional 500 are on order. In 2002, this program won the Clean Air Excellence Award from the U. S. Environmental Protection Agency.

  More recently, we teamed up with NYSERDA again and the Roosevelt Island Operating Corporation to purchase four hybrid-electric buses for Roosevelt Island residents and visitors. These stylish red buses now provide most of the bus service on the 147-acre island, located in the East River off Manhattan.

  

  The hybrid buses are all designed with an electric-drive system which includes a battery pack and an electric motor. The mechanical energy from braking is converted back into electrical energy and supplies additional power to accelerate and climb hills. The hybrid technology, combined with a diesel particulate filter and the use of ultra-low-sulfur fuel, have reduced the emissions of particulate matter by 90 percent, nitrogen oxides by 40 percent and greenhouse gases by 30 percent. Fuel consumption for the hybrid buses is 25 to 35 percent less than for a standard diesel bus, and all of these buses are being made in New York State, providing jobs at upstate companies.

- **School Bus Emission Reduction Program** – As part of a $23 million program to offset emissions of air pollutants in four New York City boroughs, we initiated a $6 million program to install pollution control systems on up to 1,500 city school buses in service with the New York City Board of Education. The program, which is being implemented in the Bronx, Brooklyn, Queens and Staten Island, converts bus fueling facilities to dispense ultra-low-sulfur fuel and equips buses with emission control devices such as diesel oxidation catalysts (DOCs). The use of ultra-low-sulfur fuel, along with exhaust system modifications like DOCs, reduces emission levels of particulates, carbon monoxide,

Contents:

sulfur oxides and total hydrocarbons.

- **Hybrid Electric Trucks -** In 2006, we assisted Charmer Sunbelt, the largest beverage distributor in the United States, in the development of a pilot project, involving two hybrid trucks to see whether hybrid technology can be used to power the class 7 heavy duty trucks that help carry Charmer's beverages nationwide. The trucks went into full-service in January 2007. They are being used in beverage deliveries throughout New York City's five boroughs and western Nassau County. During their operation the trucks will also be used to document fuel savings and performance characteristics compared to conventional trucks. The hybrid trucks are estimated save 35 percent in fuel costs, and are anticipated to reduce emissions of hydrocarbons by 76 percent, carbon monoxide by 77 percent, nitrogen oxides by 39 percent and particulate matter by 64 percent.

- **Airport Electrification -** In 2006, we assisted Delta Airlines with replacement of their diesel operated, ground support vehicles with electric models at the Marine Air Terminal of LaGuardia Airport. We co-funded the cost of high-tech rapid chargers and helped Delta find additional financing. The Marine Air Terminal project retired almost the entire fleet of Delta's ground support equipment (15 pieces) and replaced it with a fleet of electric powered vehicles and a computer-controlled rapid battery charging system. The project is expected to remove 19.2 tons of harmful pollutants from the atmosphere each year, including 12.4 tons of nitrogen oxides, 0.8 tons of particulate matter, 4.6 tons of carbon monoxide, and 1.4 tons of hydrocarbons. Over the service life of the fleet, the project is anticipated to reduce harmful emissions by 256.4 tons. We are currently working on similar programs at Westchester County airport in Harrison, Stewart International Airport in Newburgh, and Albany International Airport.

- **Electric School Buses** – We introduced the first two all-electric school buses to operate in the Northeast.

- **Delivery Vans** – Following a successful NYPA-funded demonstration project to use all-electric trucks for mail delivery in Manhattan, which we undertook with the New York City DOT, the Northeast Alternative Vehicle Consortium and Solectria Corp., the U.S. Postal Service (USPS) purchased 20 two-ton capacity electric delivery vans. Known as CitiVans, they have replaced diesel

trucks that traveled short distances and idled for extended periods. More recently, NYPA purchased eight CitiVans for mail delivery in the Bronx and two for the Flushing Post Office in Queens as part of the program to offset emissions of air pollutants in four New York City boroughs. With the two original vans from the demonstration project, the USPS now has a total of 32 CitiVans in its fleet. This is "e-mail" in its truest sense—mail delivery with an all-electric delivery van.

- **Green Zones** – Several customers from around the state have signed on to one of our latest programs which aims to replace traditional gasoline- and diesel-fueled vehicles and equipment with cleaner, more efficient electric and hybrid-electric vehicles and outdoor power equipment. The program is targeted for parks, college campuses, and other limited access areas—or green zones. In addition to improving air quality, the program is also geared toward identifying test markets for new technologies and products, such as our new custom-designed Club Car Carryall truck which is equipped with a bank of batteries and accessory outlets to power electric outdoor equipment used in the field. We work with our Green Zones partners to identify products (both commercially available and new technologies) that could adequately replace older equipment and provide technical assistance and co-funding to help with their purchase and implementation. As part of the program, participants are asked to provide data on the performance of the new vehicles and equipment and we calculate resulting emissions reductions and fuel savings.

- **Green Fleets** – We've assisted in the introduction of more than 200 light-duty electric cars to a number of NYPA customers as part of a program to help our customers replace gas-powered vehicles. By sharing these vehicles with large numbers of users, we're further expanding public awareness of the benefits of EV technology.

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COMMUNITY RESOURCE GUIDE

Created by the Neighborhood Preservation Coalition of New York State
with Funding from the New York State Division of Housing and Community Renewal

Private Foundation Providing Support for Organizations Throughout New York State

These foundations fund housing, community development, and services throughout New York State. Contact them to receive up-to-date grant guidelines and their annual report, or follow the link to their website.

Name and Address	Phone	Relevant Focus
Annie E. Casey Foundation 701 St. Paul Street Baltimore, MD 21202	(410) 223-2894	Community Support and Services for Children and Families
AOL Time Warner Foundation 75 Rockefeller Plaza, 4th floor New York, NY 10019	(800) 818-1066	Equipping Children for a Better Future; Extending Internet Benefits to All; Engaging Communities in the Arts; and Empowering Citizens and Civic Participation
AT&T Foundation 32 Avenue of the Americas, Room 2417 New York, NY 10013	(212) 387-4801	Education, Civic & Community Services
Ben & Jerry Foundation 30 Community Drive South Burlington, VT 05403-6828	(802) 846-1500	Grassroots Organizing
Charles Stewart Mott Foundation Mott Foundation Building 503 S. Saginaw St., Suite 1200 Flint, MI 48502-1851	(810) 238-5651	Civil Society, Environment, Poverty
Citigroup Foundation 850 Third Avenue, 13th Floor New York, NY 10043 e-mail: citigroupfoundation@citi.com	(212) 559-9163	Affordable Housing, Economic Development, Welfare-to-Work Initiatives, Community Infrastructure Improvements
Corning Foundation MP-LB-02 Corning, New York 14831	(607) 974-8722	Education, Culture, Community Services
DeWitt Wallace - Reader's Digest Fund 2 Park Avenue, 23rd Floor New York, NY 10016	(212) 251-9700	Education, Arts, Communities
Discount Foundation 6712 Tildenwood Lane Rockville, MD 20852-4320	(301) 468-1288	Job Creation, Living Wages
Enterprise Foundation 10227 Wincopin Circle, Suite 500 Columbia, MD 21044-3400	(800) 624-4298 (410) 964-1230	Housing, Community Safety, Workforce Development, Child Care, Nonprofit Management
Fannie Mae Foundation 4000 Wisconsin Ave., NW North Tower, Suite One	(202) 274-8000	Affordable Homeownership and Housing Opportunities, Capital for Communities

Washington, DC 20016-2804		
F.B. Heron Foundation 100 Broadway, 17th Floor New York, NY 10005	Fax (212) 404-1805	Economic Development, Child Care, Home Ownership, Community Development
Ford Foundation 320 East 43rd Street New York, NY 10017	(212) 573-5000	Asset Building & Community Development; Peace & Social Justice; Education, Media, Arts & Culture
Fleet Boston Financial Foundation Foundation & Philanthropic Services 100 Federal Street, MA DE 10020B Boston, MA 02110	(617) 434 - 4846	Community Development, Economic Development, Affordable Housing, Youth, Public Education, Arts & Culture
Funding Exchange 666 Broadway, Suite 500 New York, NY 10012	(212) 529-5300	Social & Economic Justice
Gannett Foundation 7950 Jones Branch Drive McLean, VA 22107 Communities in Which Gannett Does Business (Submit proposal to local newspaper publisher or station manager)	(703) 854-6069	Education, Neighborhood Improvement, Economic Development, Youth, Community Development, Environment, Culture
G.E. Fund 3135 Easton Turnpike Fairfield, CT 06431	(203) 373-3216	Education, Public Policy, Environment, Workforce Development, Trade, Non-Profits, Matching Gifts
Hannaford Charitable Foundation P.O. Box 1000 Portland, ME 04104		Health, Education, Civic Improvements, Cultural Organizations, Economic Development
Hasbro Children's Foundation 32 West 23rd Street New York, NY 10010		Health, Education, Social Services, Universally Accessible Playspaces
HSBC Community Development Department 452 Fifth Avenue New York, NY 10018	(212) 525-7933	Affordable Housing, Community and Economic Development, Environment
Ittleson Foundation, Inc. 15 E. 67th Street New York, NY 10021	(212) 794-2008	Mental Health, AIDS, Environment
John D. & Catherine T. MacArthur Foundation Office of Grants Management 140 S. Dearborn Street Chicago, IL 60603	(312) 726-8000	Housing, Community Development, Youth
JP Morgan Chase Foundation 1 Chase Manhattan Plaza, 5th Floor New York, NY 10081	(212) 552-1112	Arts & Culture, Housing & Neighborhood Development, Human & Supportive Services, Precollegiate Education
The Kresge Foundation 3215 W. Big Beaver Road P.O. Box 3151 Troy, Michigan 48007-3151	(248) 643-9630	Bricks and Mortar, Community Capital
Leviticus 25:23 Alternative Fund, Inc. 928 McLean Avenue Yonkers, NY 10704-4103	(914) 237-3306	Loans for Housing, Day Care Facilities, Small Business
Local Initiatives Support Corporation (LISC) 733 3rd Avenue, 8th Floor New York, NY 10017	(212) 455-9800	Rural Development, Housing, Economic Development, Community-Building, Organization and Leadership Cultivation
Metropolitan Life Foundation 1 Madison Ave. New York, NY 10010-3690	(212) 578-6272	Economic Development, Community & Social Services, Community Revitalization
Merrill Lynch & Co., Inc.		

Global Philanthropy & Community Relations 2 World Financial Center, 6th Floor New York, NY 10281	(212) 236-4319 (212) 236-0279	Education, Arts, Culture, Health, Environment
Needmor Fund 1840 Folsom St. #110 Boulder, CO 80302	(303) 449-5801	Community Organizing (non-CDC)
Newman's Own Charitable Grants Paul L. Newman - c/o Newman's Own 246 Post Road East Westport, CT 06880		Children and Youth, Health, Education, Elderly, Environment, the Arts, Handicapped, Literacy, Substance Abuse Education, Programs for the Needy Including Housing and Food
Norman Foundation, Inc. 147 East 48th Street New York, NY 10017	(212) 230-9830	Community-Based Economic Development, Environment, Social Well-Being
Peace Development Fund P.O. Box 1280, 44 N. Prospect Street Amherst, MA 01004	(413) 256-8306	Community Organizing, Social Change
The Penney Family Fund C/O Common Counsel Foundation 1221 Preservation Parkway Oakland, CA 94612-1206	(510) 834-2995	Sustainable and Livable Communities; Quality Early Childcare and Learning, Youth Development, Public Education; Community Economic Development; Money and Influence in Politics; and Fiscal Issues at the State and Local Level
Pew Charitable Trust 2005 Market Street, Suite 1700 Philadelphia, PA 19103-7077	(215) 575-9050	Culture, Education, Environment, Health & Human Services, Public Policy, faith-Based Initiatives
Poverty & Race Research Action Council 3000 Connecticut Avenue NW, Suite 200 Washington, DC 20008	(202) 387-9887	Advocacy, Organizing and Social Science Research
Public Welfare Foundation 1200 U Street, NW Washington, DC. 20009-8851	(202) 965-1800	Community Economic Development & Participation; Criminal Justice; Disadvantaged Elderly & Youth; Environment; Health; Human Rights & Global Security; Population & Reproductive Health; Technology Assistance
Resist 259 Elm Street Somerville, MA 02143	(617) 623-5110	Activist Organizing, Social Change
RGK Foundation 1301 West 25th Street, Suite 300 Austin, TX 78705-4216	(512) 474-9298	Health, Education, Human Services, Community Affairs
Rockefeller Foundation 420 Fifth Avenue New York, NY 10018	(212) 869-8500	Economic Development, Health, Culture & Arts, Agriculture
Seedco 915 Broadway, 17th Floor New York, NY 10010	(212) 473-0255	Affordable Housing, Workforce Development, Community Economic Development
Surdna Foundation, Inc. 330 Madison Avenue, 30th Floor New York, NY 10017	(212) 557-0010	Community Revitalization, Organization Development, Environment
Verizon Foundation	(Online applications only)	Literacy, Community Technology Development, Workforce Development
W.K. Kellogg Foundation 1 Michigan Avenue East Battle Creek, Ml 49017-4058	(616) 968-1611	Health, Food Systems & Rural Development, Youth & Education, Volunteerism
William Randolph Hearst Foundations 888 Seventh Avenue, 45th Floor New York, NY 10106	(212) 586-5404	Affordable Housing, Social Services, Economic Development, Capacity Building

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APPENDIX E
MINUTES OF MEETINGS

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Meeting Notes

Subject:	Kickoff Meeting
Client:	City of Kingston
Project:	Reconstruction and Electrification of Trolley Track
Project No:	
Meeting Date:	July 18, 2007
Meeting Location:	Visitor Center at Trolley Museum
Notes by:	Mihir Shah

Attendees:

Steve Finkle – City of Kingston
Richard Bause – TMNY
Evan Jennings – TMNY
Bill Brandt – TMNY
Richard Edling – TMNY
Jon McGrew – TMNY
Steve Ladin – TMNY
Gareth Rees – HDR
Greg Walz – HDR
Bob McPherson – HDR
Mihir Shah - HDR

Topics Discussed:

Project scope and goals & objectives, responsibilities of the participants, existing relevant information, expected deliverables, public meetings and meetings with utility company and government agencies.

Action/Notes:

500 Seventh Avenue
New York, NY 10018-4502

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www.hdrinc.com

1. The prime objective of this trip was to gather information and perform site inspection. Meeting began with the discussion of scope of work.
2. Mr. Greg Walz, Project Manager, briefly described the responsibilities of HDR team members.
3. Mr. Finkle acknowledged that he had received the contract agreement from HDR and that it was being reviewed by the City for approval.
4. The city and TM (Trolley Museum) officials have desired to schedule public meetings at the earlier stages of the project rather than later as was described in the proposal; although it should be noted that lot of city people take vacation during the month of August, and therefore scheduling of meetings should be coordinated accordingly.
5. Track layout on the east strand may cause some concerns. The placement of catch basins for drainage along the along the track and curb line separation issues may arise. Mr. Finkle suggested that the office of DPW (Department of Public Works?) should be involved to resolve this issues at appropriate time.
6. It was strongly suggested by the TM that the recommendations to be provided in the final report which will be submitted by HDR should take into account all the rehabilitation work that has been performed by the volunteers in order to minimize the project cost during construction.
7. Mr. Finkle said that he would arrange a meeting with the president of the utility company in next two weeks. HDR will attend the meeting to discuss the harmonics and stray current issues that might arise during the electrification process.
8. TM also indicated that they have probably 12 year old layout drawings of gas utility, a copy of which will be provided to HDR.
9. As part of gathering all existing information, HDR requested to receive a copy of property line maps. TM does not have a complete set; but Mr. Finkle suggested that they are available on the county website. The planning office has it on a separate layer as part of their GIS records.
10. HDR stated that a general layout of poles for overhead catenary system along with corresponding line hardware and signage and pavement marking along the road will be depicted in our design drawings and final report.
11. The city and TM officials jointly suggested that the local waterfront vitalization plan be adapted in the final report so that it might provide more significance when used for applying for grants and funding.
12. It was generally agreed that meetings with government agencies such as DEC, Army core of Engineers and any other agencies that might have permitting regulations and authority should be conducted in a timely manner. Issues related to erosion control, storm water and flooding control and issues related to vegetation adjacent to the track should be discussed.
13. TM noted that there might be wheel gauge and flange problems. It was decided that Mr. Greg Walz shall come back to Kingston in next couple of days and measure wheel profiles. He will also discuss in detail with TM about which vehicle they would want to be used as their main fleet.
14. Other things to be considered for the final report are that currently there are some parking problems. Many times drivers park their cars on the tracks. Noise issues at the crossings are also a concern. Currently there are three public crossings and one private crossing.

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Meeting Notes

Subject:	Meeting with Central Hudson Gas & Electric Representatives
Client:	City of Kingston, New York
Project:	Reconstruction and Electrification of Trolley Track — Project No: 67022
Meeting Date:	August 9, 2007, 1:30 PM — Meeting Location: Kingston City Hall
Notes by:	Gregory Walz

Attendees:

Steve Finkle – City of Kingston
Richard Edling – TMNY
Steve Ladin – TMNY
Bill Brandt - TMNY
Gareth Rees – HDR
Greg Walz – HDR
David Merte – Central Hudson Gas Operations Director
David Dittmann II – Central Hudson Engineering Manager

Topics Discussed:

This meeting was held to formally initiate contact between HDR, TMNY and Central Hudson Gas & Electric, and to begin technical disscussions on applicable stray current mitigation techniques applicable to TMNY's future electrification system

Action/Notes:

1. The meeting began at 1:30 pm. After introductions by Steve Finkle the floor was turned over to Gareth Rees of HDR, who will be designing the traction power system for TMNY, and David Merte, Director of Gas Operations for Central Hudson.

2. Mr. Rees stated that the recommended size of the DC substation for TMNY is 500 kW. Upon enquiries, Mr. Dittmann stated that there is sufficient capacity available at the main TMNY site to operate a unit this size. 13,200 volt feeders are available on the poles along the Strand.

3. Mr. Rees stated that the existing substation purchased by TMNY from a sister museum is totally unusable for this application. All agreed. A new, state-of-the-art 500 kW substation will also have the advantage of greatly reducing harmonics fed back to the utility's power lines, a consideration that is very important to Central Hudson.

4. The new substation is roughly estimated to cost between $250,000 and $300,000 exclusive of any CHG&E charges. This price includes all switchgear, transformers, rectifiers and monitoring devices. This rectifier would ideally be located in the existing TMNY yard area, near the power line on the Strand. It was pointed out that there is a concrete pad behind the present shop building that could be used for the substation. (Subsequent site inspection of this pad revealed questions as to possible water runoff from the hillside and the cost of the necessary extension of the 13.2kV line service drop a considerable distance in from the street.)

5. Mr. Merte and Mr. Rees then begin a detailed discussion of the gas line layout. Mr. Merte brought maps and drawings with him that showed all of the gas utility lines existing in the area of TMNY's main line tracks, and the details as to size, gas pressure, type of pipe, type of construction, and existing electrolysis mitigation measures.

6. There are many more lines in the vicinity of TMNY's tracks than was first believed. In addition to the high pressure line, there are also low pressure and distribution lines running in this area. Up to 12 inch lines are present, and 4 inch to 10 inch high-pressure lines. Further, the type of pipe varies from century-old cast iron (very vulnerable to electrolysis damage) to modern coated steel. Mr. Merte said the current Kingston Holder (Regulator) Station on Rondout Creek was at one time the gas plant, so the original gas lines for Kingston fanned out from this location. Over the years it has remained a nexus. Mr. Merte said that all of the current gas lines in this area are in very good shape.

7. As the discussion proceeded, Mr. Rees discussed his experience with similar problems during the construction of the Tampa Streetcar, including the various techniques that will be examined. Mr. Rees and Mr. Merte were in agreement as to the industry-standard mitigation approaches that will be investigated. Mr. Rees said further that selection of any particular method will depend on calculations based on the amount of current flowing in the rails, the amount of time this current flows, and the location of the tracks relative to the gas lines.

8. Central Hudson currently uses a number of techniques to protect these gas lines. These include cathodic protection (from a separate power supply) and remote-monitored test stations. The "Bullhorn" web-based system of remote monitoring is used on 13 rectifier circuits.

9. It was emphasized that mitigation procedures will be focused both on track construction techniques and measures that may be required to be added to CHG&E's existing gas line electrolysis mitigation system. Track techniques include rubber pads under rails on ties, elastomeric encapsulation of rails in bricks or streets, extra bonding around joints and crossbonding, etc. Sectionalization of the yard/shop area is another factor that will be investigated.

10. Items to be considered directly involving CHG&E's existing techniques include additional sacrificial anodes buried in the ground, and an increase in the "impress current" from the existing rectifier plant used to reduce corrosion of the gas lines. Mr. Rees stated that CHG&E's existing test stations will be used to determine the effectiveness of any techniques utilized for leakage current reduction by taking an initial "quiescent" reading of the currents already present, and then a reading with maximum estimated current flowing in the rails with all mitigation techniques utilized. Testing could also be done regularly at time intervals such as 3 months, 6 months, etc. depending on what is seen.

11. HDR's scope of work regarding CHG&E's electric and gas systems will be focused on two areas: Electric: Electrical design procedures to minimize harmonics fed back into the utility's power grid; and Gas: Design and continual testing/monitoring to control leakage currents. In other words, design the system properly to minimize harmonics and leakage currents, then set it up for continuous automatic leakage current monitoring using the existing Bullhorn system.

12. Mr. Merte gave all of the maps and drawings that he brought with him to HDR.

13. A TMNY file of information dating back to 1996, including correspondence with CHG&E about electrification of TMNY tracks was also given to HDR.

14. All felt that a further meeting in the near future is required. This meeting was set for Thursday, September 6 at 1:30 in City Hall.

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Meeting Notes

Subject:	Second Meeting with Central Hudson Gas & Electric Representatives
Client:	City of Kingston, New York
Project:	Reconstruction and Electrification of Trolley Track — Project No: 67022
Meeting Date:	September 6, 2007, 1:30 PM — Meeting Location: Kingston City Hall
Notes by:	Gregory Walz

Attendees:

Steve Finkle – City of Kingston
Glen Moffett – TMNY
Steve Ladin – TMNY
Bill Brandt - TMNY
Gareth Rees – HDR
Greg Walz – HDR
David Merte – Central Hudson Gas Operations Director
David Dittmann II – Central Hudson Engineering Manager

Topics Discussed:

This meeting was held to continue the technical discussions began at the 8-9-07 meeting on applicable harmonic reduction and stray current mitigation techniques applicable to TMNY's future electrification system.

Action/Notes:

1. The meeting began at 1:30 pm. After introductions by Steve Finkle the floor was turned over to Gareth Rees of HDR, who will be designing the traction power system for TMNY.

2. Mr. Rees distributed a number of handouts to accompany his discussion on the options available in the design of the traction power system and the design of the trackwork. Two of these handouts are attached.

3. **Traction Power:** Mr. Rees' presentation began with a discussion of the traction power system. The recommendation is for a single–ended unit, 300 kW to 500 kW, 12 pulse, that will operate off "medium voltage" of 13.2 kV. This would have only one electric service and one AC breaker (no redundancy). There would be multiple output feeders.

4. A 500 kW unit would handle all of the museum's present needs. Operating voltage would be between 650 and 700 Vdc. The slightly higher voltage will not cause problems with most older streetcars. The unit would be skid-mounted so it could be lifted into place complete and ready to connect. All items required to transform the 13.2 kV input power to 650 V dc would be contained in the unit.

5. After a discussion about the AC service, Mr. Dittmann stated that pole fusing would be installed in the line to the substation, using standard "K speed" fuses. Mr. Dittmann said he would provide information on these fuses. 13.2kV feeders would be run underground from the pole connection to the substation. TMNY would be responsible for the cable installation; CHG&E would spec the exact type of cable to be used and connect the cable to the 13.2 kV line. Thus CHG&E's interface would be the fused interrupters; TMNY's interface would be the substation's AC circuit breakers.

6. Mr. Dittmann also stated that the 13.2 kV system along the Strand is a relatively "stiff system." A new

50 MVA substation was recently built close to this line. Mr. Dittmann stated that he will provide HDR with the source impedance of the 13.2 kV line. This is needed to perform the calculations to determine the impact on other customers of the operation of the streetcars in terms of voltage drops, harmonics, etc.

7. A lengthy discussion then began on where to site the substation. Mr. Walz stated that the location behind the car shop was examined and appeared to be big enough and out of the way, but it had some disadvantages – too close to the hillside (possible flooding and/or land movement) and far from the power line located on poles on the Strand (which would increase the cost of the underground 13.2 kV feeder system). Any wall construction to protect the unit would also add to the cost at this location Other locations discussed included adjacent to the iron fence (where picnic tables are now) and in the parking lot. Mr. Finkle was concerned about the appearance of the unit; a suggestion was made to mount the substation inside an attractive structure with a removable roof (to allow the substation to be moved if necessary). Another option would be to locate it on sewage treatment plant property if an agreement with them could be reached.

8. Mr. Dittmann said that provision would have to be made for an electric meter in an accessible place. While remote meter reading is coming to CHG&E, physical access will still be occasionally required.

9. After discussion, a suggestion was made that access to the substation unit itself would likely be required by the fire department. HDR will work with the City of Kingston to determine specifically what access the fire department will require.

10. The proposed substation unit is about 60 x 35 feet, and about 9 ½ feet high. Fencing will be required around it; minimum fence clearance to the unit is 10 feet.

11. Scheduled trolley service is the ultimate operational goal. When this occurs the loading will change significantly. An additional substation may be required when scheduled service is initiated. The ideal is one substation approximately every mile.

12. Mr. Dittmann distributed an electric rate chart. Presently the museum is a Service Class 2 customer with no demand charges. The cutoff for non-demand service, however, is 10 kW, so, based on the proposed transformer size, the new substation would place TMNY into the demand-metered category. TMNY would also be in the "primary metered" category, as the line transformers would be owned by TMNY instead of the utility (traction power transformers are unique to the equipment and different from utility transformers).

13. Mr. Dittmann also stated that exceeding 1,000 kW would place the museum into Service Class 3. All felt this would be unlikely with the proposed unit. It was pointed out that the Service Class is determined per service connection; in other words, a second substation would have its own service connection and not change the load characteristics of the first substation. Only a single service is envisaged for now.

14. Mr. Rees assured Mr. Dittmann that the harmonic characteristics of the substation would meet or exceed the IEEE 519 Table 10.3 standards. Mr. Dittmann said that CHG&E will require calculations that demonstrate compliance with this standard. Mr. Rees said that he had done similar calculations for Metro-North based on problems they had meeting this standard with Amtrak's Acela trains operating on their system.

15. Mr. Finkle asked about potential rate classifications for special users like TMNY. There's apparently an "economic development rate" for Class 2 users that was discussed, but did not seem to apply to TMNY's unique usage characteristic. Mr. Finkle felt that maybe a new rate class could be developed.

16. **Stray Current Mitigation:** Mr. Rees stated that continuous monitoring would be required to assure that stray currents are kept under control over time. The first step, however, is to measure the baseline current (current with no traction power) and use this as the reference. Higher impress currents on CHG&E's active stray current mitigation system may be required.

17. Mr. Rees then turned to the second handout, which described the proposed stray current mitigation methods. The following three categories include the principal mitigation design parameters to be followed:

1. Increase Resistance of Running Rail to Soil

- Construct main line track with minimum rail to soil resistance of 300 ohms/1000'. This is a de-facto "industry standard".
- Construct main line track within 100' of gas main crossing track with minimum rail to soil resistance of 1000 ohms/1000'
- Isolate substation return circuit from ground (use diode grounding)
- Segment sections of the track with insulated joints (limit parallel rail to soil paths)
- Install insulated joints 300' each side of gas main crossing the tracks
- Isolate yard tracks from main line
- Develop track maintenance procedures to prevent track resistance degradation over time

2. Decrease resistance of Current Return Path, Trolley to Substation

- Cross-bond running rails every 400'. Cad welds would likely be used, and these would be coated to protect them from pitting and corrosion.
- Voltage equalization: run parallel rail return feeders for 300' each side of a gas main crossing the tracks for each return rail.
- Tie the parallel rail return feeders to rail every 50'. These feeders would be 500 mcm and would parallel the rails to lower the return path resistance.
- Space substations about one mile apart whenever possible

3. Stray Current Monitoring

- Baseline monitoring consists of:
    - Drainage current
    - Voltage between protected pipes and substation negative bus
- Used to determine if mitigation measures operating correctly and track receiving adequate maintenance
- Monitoring consist of:
    - Visual inspection
    - Rail to soil potential per ampere to determine resistance
    - Drainage current
    - Voltage between protected pipes and substation negative bus

19. Mr. Rees stated that continuous monitoring would be required to assure that stray currents are kept under control over time. The first step, however, is to measure the baseline current (current with no traction power) and use this as the reference. Higher impress currents on CHG&E's active stray current mitigation system may ultimately be required.

20. Mr. Rees requested information as to CHG&E's current mitigation system. This information was provided by Dave Merte of Central Hudson as follows: Central Hudson has two rectifiers currently protecting piping in the proposed trolley area. The first is the Delaware Avenue rectifier with a ground bed on the east Kingston point. The Delaware Avenue rectifier has a nameplate of 8.2 amps DC. Central Hudson is currently using 3.4 amps DC but expect to increase that to nameplate within the next year. The second rectifier is the Sleightsburg rectifier with a ground bed in the Rondout Creek south of Kingston. This rectifier has a nameplate of 12.1 amps and is currently running about 5.6 amps. Central Hudson expects to also increase its output to nameplate in the next year or so.

21. Dave Merte of Central Hudson stated that they are not aware of any stray current on their pipelines in the area at the present time.

22. Mr. Rees circulated a sample Design Criteria Manual document and a book of drawings from Tampa showing cathodic protection practices.

23. **Other items:** HDR will continue work on the draft reports.

24. Mr. Walz requested an inventory of restored overhead line hardware from TMNY. These items were noted during the August visit when some unrestored line items were inventoried by HDR.

25. This ended the meeting with CHG&E. Further discussion was held on the topic of public meetings.