# TABLE OF CONTENTS

## FIGURES



## TABLES

# 1.0 INTRODUCTION

Evaluating the feasibility of a future streetcar system for Red Hook, Brooklyn and the surrounding neighborhoods involves a multi-step process. One key step in this process is the development of a preliminary operations plan. This technical memorandum presents the operating plan for a future Brooklyn streetcar, outlining the key variables that typically affect streetcar service. Development of these operating parameters will be used to guide several components of the Brooklyn Streetcar Feasibility Study, including the potential vehicle labor requirements and energy costs, preliminary operating and vehicle costs, and an estimate of overall capital costs. The variables that could affect future streetcar operations in Red Hook and comprise the operations plan are listed below and described in greater detail in the next section.

### *Service Operations*

In determining the hours of operation and frequency of a future Brooklyn streetcar system, consideration should be given to the existing Red Hook transit service, consistency with the Metropolitan Transit Authority New York City Transit (MTA NYCT) services, and future transit needs. Incorporating these elements into the planning of a future Brooklyn streetcar will allow the streetcar system to seamlessly connect with other transit services (subway, bus, and commuter rail).

### *Vehicle Characteristics*

A general assumption is that a future Brooklyn streetcar system would operate at speeds similar to the existing MTA NYCT bus service in the Study Area. Streetcar vehicles have faster acceleration rates than buses, and based on other streetcar systems in the United States, boarding times are generally faster due to low-floor operations and all-door boarding capabilities. However, it is assumed a future Brooklyn streetcar would operate in mixed traffic (non-exclusive lanes), which could restrict travel speeds to those generally experienced by buses.

The number of vehicles required for a streetcar system is driven by the frequency of service and spare vehicle requirements. Streetcar vehicle layover requirements are typically similar to those required for bus service, which is 15 to 20 percent of the total travel time.

### *Maintenance Requirements*

Streetcar systems require a storage and maintenance facility, or ‘car barns’ for servicing and storing the vehicle fleet, administering system operations, and supporting employees. As such, the servicing and storage of the streetcar fleet should be considered as an integral part of streetcar operations. The storage and maintenance facility should be located within close proximity to the streetcar route and outfitted to maintain the streetcar fleet, both now and in the future.

# 2.0 STREETCAR OPERATIONS PLANNING

## *2.1 Service Operations*

### OPERATING ENTITY

Details on operating entity alternatives will be further developed in the Feasibility Report.

### OPERATING HOURS

In terms of operating hours, the MTA NYCT currently provides 24-hour transit service to and within Red Hook. This service span should be maintained under any future transit service for Red Hook. In order to accomplish this, two potential alternatives have been developed for weekday service. Alternative 1 is 24-hour streetcar service and Alternative 2 is 6 AM to midnight streetcar service and midnight to 6 AM bus service. The late night bus service could potentially be an extension of an existing route.

Alternative 1 has the advantage of being less confusing for passengers and would provide consistent service throughout the day. However, operating costs would be higher and 24-hour service would limit streetcar track maintenance or utility access. The late night bus service in Alternative 2 would provide an allocated period for vehicle and track maintenance, as well as maintenance by others in the corridor, such as utilities.

### SERVICE FREQUENCY

Preliminary headways (defined as the frequency of service or time between vehicles arriving at a stop) have been developed based on the existing headways on the MTA NYCT's B61 bus route. Frequency of service is a key determinant in establishing vehicle requirements for the streetcar system. Proposed streetcar headways are presented in Table 2-1.

Table 2-1:
Proposed Streetcar Headways (minutes)

| | AM PEAK (6 AM – 9 AM) | MID-DAY (9 AM – 4 PM) | PM PEAK (4 PM – 7 PM) | EVENING (7 PM – MIDNIGHT) | LATE NIGHT* (MIDNIGHT – 6 AM) |
|---|---|---|---|---|---|
| Weekdays | 8 | 12 | 8 | 10 | 40 |
| Saturdays | 15 | 15 | 15 | 15 | 40 |
| Sundays | 20 | 20 | 15 | 15 | 40 |

*Could potentially be operated as a bus.

The headways shown in Table 2-1 are similar to the existing B61 headways. The increased demand for transit, as a result of implementing a streetcar system, is assumed to be absorbed by the increased capacity of the streetcar. Actual headways will be adjusted as transit demand changes, similar to the current policy of the MTA NYCT.

### SYSTEM INTEGRATION

Intermodal connections and complete integration with the MTA NYCT existing transit network is essential to the success of a future Brooklyn streetcar. The southern terminal of the streetcar would be the Smith-9th Street Station, which is served by the F-G subway routes. Two alternative northern terminals also connect to existing rail services: Borough Hall, which is served by the 2, 3, 4, 5, A, C, F, N, and R subway routes, and Atlantic Terminal, which is served by the 2, 3, 4, 5, B, D, N, Q, and R subway routes as well as the Long Island Rail Road (LIRR) commuter rail. Additional connections should be established to the Study Area and Focus Area's bus network, including the B63, the B65 along Atlantic Avenue, and the B61, which would potentially undergo significant restructuring. Potential transfer points identified along the various options of the potential alignment are shown in Figure 2-1.

The fare collection method would be determined by the operating entity. However, for consistency of service and operations, the streetcar system should accept the current fare payment methods used by the MTA NYCT, and the fare collection system should be completely integrated with the MTA NYCT.

Fare collection systems on streetcars generally operate without the use of turnstiles, and fare payment is typically on-board vehicles. On-board fare collection has resulted in improved travel times, as it helps reduce dwell times (the time it takes passengers to board) at each stop.

Off-board collection is another option, as used for the MTA NYCT's Select Bus Service (SBS) along Fordham Road-Pelham Parkway and First/Second Avenue. Before boarding the bus, riders pay their fares on the sidewalk at a SBS station stop using their MetroCard or coin machines. When the bus arrives, riders can enter or exit through any of the three doors, holding on to their receipt as proof of payment. This off-board fare collection method has resulted in faster and more reliable service.

## *2.2 Vehicle Characteristics*

### AVERAGE SPEED

A general assumption is that a future Brooklyn streetcar system would operate at speeds similar to the existing MTA NYCT bus service in the Study Area. As such, the scheduled time of the existing B61 from Red Hook to Downtown Brooklyn and the distance between these two locations were used to calculate the average speed of the B61, as shown in Table 2-2.

**Table 2-2:**
**B 61 Average Speed**

| SCHEDULED TIME FROM RED HOOK TO DOWNTOWN BROOKLYN | DISTANCE FROM RED HOOK TO DOWNTOWN BROOKLYN | AVERAGE SPEED |
|---|---|---|
| 15 minutes | 2 miles | 8 mph |

**Figure 2-1: Potential Alignment Options and Transfer Points**

The average speed of 8 miles per hour (mph) is a conservative estimate, assuming a future Brooklyn streetcar would operate in mixed traffic. Without an exclusive streetcar right-of-way, the travel speed of a streetcar system could be similar to the existing bus service. However, streetcar vehicles have faster acceleration rates than buses, and based on other streetcar systems in the United States, boarding times are generally faster due to low-floor operations and all-door boarding capabilities.

## LAYOVER REQUIREMENTS

In general, streetcar systems in the United States have used 15 to 20 percent of the total travel time as recovery time and layover time.

## NUMBER OF VEHICLES

Assumptions for streetcar vehicle requirements are listed in Table 2-3. These estimates were calculated using low and high speed estimates from the Case Study Report and the longest and shortest streetcar route based on the potential alignment options. Using these options produces a range of conservative and aggressive estimates.

**Table 2-3:**
**Vehicle Requirements Range**

| | MEAN SPEED (MPH) | ROUND TRIP DISTANCE (MILES) | REVENUE SERVICE TIME (MIN.) | LAYOVER TIME (MIN.) | TOTAL TRAVEL TIME (MIN.) | PEAK HEADWAY (MIN.) | PEAK VEHICLE REQ. | SPARE | TOTAL FLEET |
|---|---|---|---|---|---|---|---|---|---|
| High speed / shorter route | 10.5 | 7.4 | 42 | 6 | 48 | 8 | 6 | 2 | 8 |
| High speed / longer route | 10.5 | 8.4 | 48 | 7 | 55 | 8 | 7 | 2 | 9 |
| Low speed / shorter route | 7.0 | 7.4 | 63 | 10 | 73 | 8 | 9 | 2 | 11 |
| Low speed / longer route | 7.0 | 8.4 | 72 | 11 | 83 | 8 | 10 | 2 | 12 |

Minutes are rounded to the nearest whole minute

Transit fleets generally have a spare ratio of at least 20 percent of the peak vehicle requirement in order to maintain service during vehicle maintenance. In the case of smaller fleets, such as Seattle's South Lake Union streetcar fleet and a potential Red Hook streetcar fleet, a minimum of at least two vehicles is suggested. Based on these assumptions, between eight and 12 vehicles would be required to run a future streetcar system along the proposed alignment options.

## 2.3 Maintenance Requirements

Streetcar systems require a storage and maintenance facility, or 'car barns' for servicing and storing the vehicle fleet, administering the system operations, and supporting employees. The car barn typically accommodates vehicle storage, cleaning, and maintenance, equipment maintenance, materials storage, operations management and supervision, dispatching, emergency-response communications equipment and supplies, secure parking for nonrevenue vehicles, and employee locker rooms. In addition, due to streetcar systems' historic appeal, maintenance activities may be of interest to the general public. Maintenance shops can be sectioned off with glass to provide a controlled environment for active display of the work activity.

Although these are separate functional areas, for economy of space, the facilities can be constructed as separate portions of a single structure. Moreover, additional space should ideally be provided to allow for system expansion. However, land can be in short supply, particularly in urban areas. Similarly, financial constraints can restrict initial facility size.

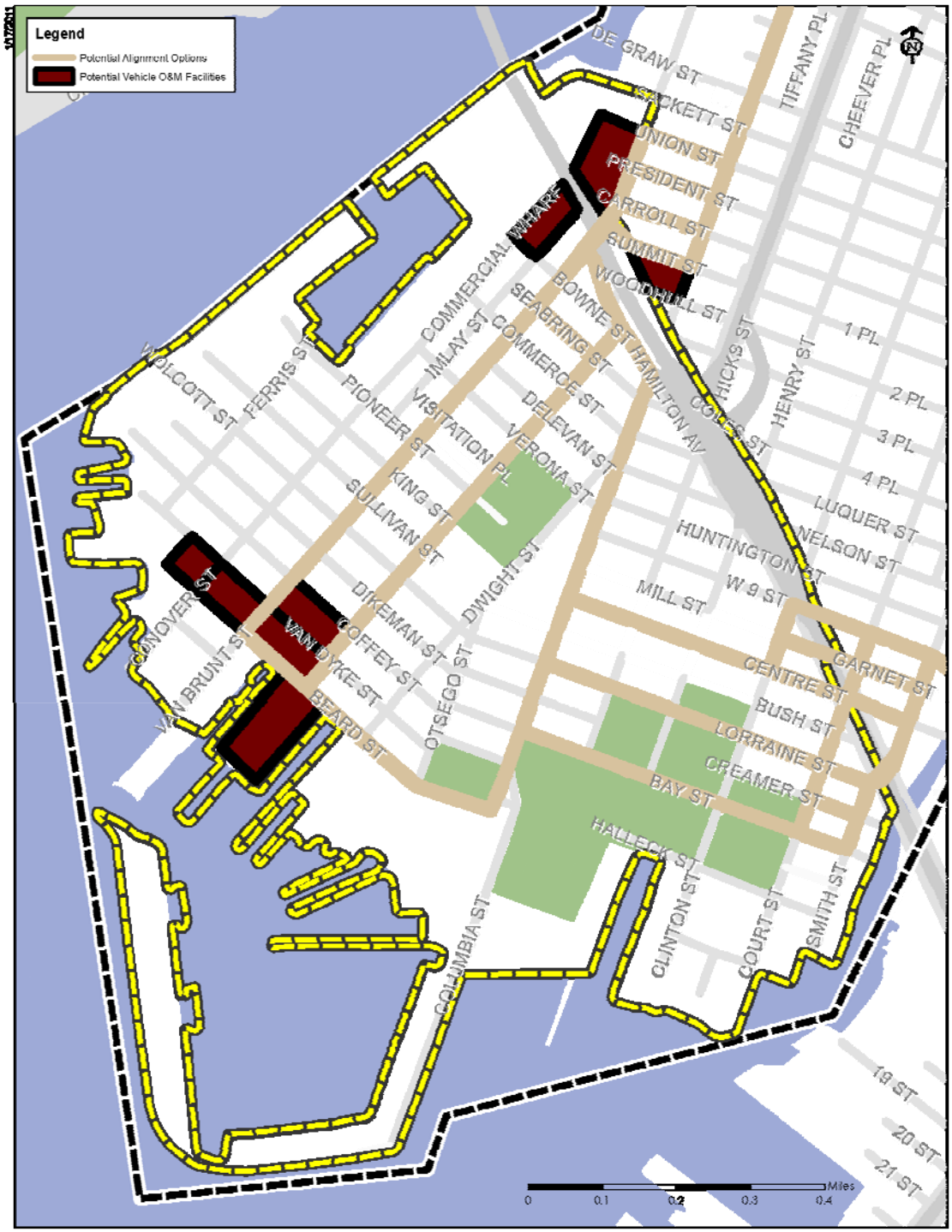
The storage and maintenance facility should be located within close proximity to the streetcar route and outfitted to maintain the streetcar fleet, both now and in the future. The facility should be sized for a minimal, but adequate, maintenance regimen and consist of equipment that is typically required for continuous routine maintenance. For example, removing or replacing motors, removing wheels for re-truing offsite, performing routine repairs, and cleaning and washing streetcar vehicles.

Based on standard transportation planning of similar transit modes in the New York City metropolitan area,[1] the footprint for the entire facility is typically 150 feet wide by 150 feet long, and includes six tracks that can accommodate a minimum of two cars each, to provide space for the total number of vehicles, as indicated in Table 2-3. One track should have a dual structured pit for maintenance repairs to be performed underneath the chassis. This dual structured pit should include a gauge pit, roughly four feet wide between the rails and an open pit, at least twelve feet wide with the streetcar vehicle supported on posts. In addition, the pit track should be long enough to provide walkways for employees to access the pit from both ends with two cars in place. The adjacent tracks could be utilized for internal repairs, cleaning, and washing the cars, as well as covered storage. These five tracks should be at a distance of 25-feet between track centers, providing adequate room for safety and car cleaning activity, and an additional storage or run-through track. Embedded tracks approaching the barn entrance should provide a location for truck deliveries.

For the proper layout of a storage and maintenance facility, the site should be between 1 and 2 acres. Based on this standard, as well as initial field visits, existing land use, zoning requirements, and proximity to the potential alignments, several initial sites have been identified as potentially satisfying these criteria. These sites are identified in Figure 2-2. According to MapPLUTO and the New York City Department of City Planning (DCP), existing MTA NYCT bus depots are zoned manufacturing (between M1-1 and M2-5). The sites identified in Figure 2-2 are either fully or partially zoned as manufacturing and are vacant or underutilized. Additional analysis, involving the New York City Economic Development Corporation (NYCEDC), DCP, and NYCDOT would be needed for the final selection of a streetcar storage and maintenance facility.

[1] Hudson Bergen Light Rail

## Figure 2-2: Potential Vehicle Operation and Maintenance Facilities



# 3.0 CONCLUSION AND NEXT STEPS

This technical memorandum presents the operating parameters appropriate for a future Brooklyn streetcar if determined to be feasible, outlining the key variables that typically affect streetcar service. A summary of the assumptions of these variables is as follows:

### *Service Operations*

- Operating entity: alternatives to be presented in the Feasibility Report
- Operations hours: Alternative 1 – 24-hour streetcar service; or Alternative 2 – 6 AM to midnight streetcar service and midnight to 6 AM bus service
- Service frequency: 8 to 40 minute headways, depending on time of day
- System integration: integration with the MTA NYCT existing transit system, including fare collection and intermodal transfer points

### *Vehicle Characteristics*

- Average speed: 8 miles per hour
- Layover requirements: 15 to 20 percent of trip time
- Number of vehicles: 8 to 12 based on speed, headways, alignment length, layovers, and spare requirements

### *Maintenance Requirements*

- 150 feet x 150 feet facility with six tracks
- 1 to 2 acre site
- Zoned manufacturing

The key variables of service operations, vehicle characteristics, and maintenance requirements for a future Brooklyn streetcar system comprise the operations plan, as outlined in this technical memorandum. Development of these operating parameters will be used to guide several components of the Brooklyn Streetcar Feasibility Study, including the potential vehicle labor requirements and energy costs, preliminary operating and vehicle costs, and an estimate of overall capital costs.