Appendix 1.12 Operating & Maintenance Cost Methodology Report

Volume 1

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NY Metropolitan Transportation Authority

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NOVEMBER 2022

IBX

Contents

1. Objective

The objective of this technical memorandum is to describe the methodology that will be used to determine the preliminary, high-level, order of magnitude, future one-year operating and maintenance (O&M) costs for up to three selected short list alternatives (hereafter referred to as Feasible Alternatives) for the Interborough Express (IBX) project. The O&M costs will also help provide a cost comparison between the Feasible Alternatives.

2. Scope

The O&M costs will be developed for the build year, which is assumed to be 2045, and will present the one-year O&M costs to operate each of the Feasible Alternatives as defined by the operating plan to be developed during this study.

3. Study Alignment

The study alignment consists of the full length of the Bay Ridge Branch and the Fremont Secondary Branch. The Bay Ridge Branch is currently a freight-only rail corridor that starts at the 65th Street car float facility in Sunset Park, Brooklyn where freight cars are trans-shipped by car float from/to the Greenville Yard in Jersey City, New Jersey, connecting to the national railroad network. The Bay Ridge Branch corridor runs in a crescent shaped alignment between Sunset Park, Brooklyn and Middle Village, Queens, where it transitions to the Fremont Secondary and terminates, but does not connect with, the southern approach to the Hell Gate Bridge in Woodside, Queens.

The IBX Study will examine the feasibility of developing a public transit mode along the Bay Ridge Branch and Fremont Secondary while maintaining freight rail service. This study assumes growth in the volume of rail freight in the corridor. This includes consideration of the potential future use with the development of the Cross-Harbor Freight Tunnel, which, among other options, is currently being studied further by the Port Authority of New York & New Jersey (PANYNJ).

The public transit mode for the BRC has not been determined. The Initial List of Access Alternatives encompasses 12 concepts arranged by mode, including Bus Rapid Transit (BRT), Light Rail Transit (LRT), subway, commuter rail (electrified and diesel), commuter rail DMU railcars and Automated Guideway Transit (AGT). This study will analyze the comparative benefits of each of these alternatives and select up to three Feasible Alternatives that will be forwarded for O&M cost estimation.

4. O&M Cost Methodology

The process is dependent upon several precedent tasks to be performed by the study team to define and provide critical inputs, as these would serve as the drivers for O&M cost estimation. These include:

4.1. Definition of the Feasible Alternatives

For the concepts that comprise the three selected Feasible Alternatives, the following will be defined:

1. Vehicles/trains

The vehicle equipment model or type will be defined as specifically as possible. This specificity does not imply an endorsement of a particular equipment manufacturer; rather it is needed to determine the vehicle or train performance (as applicable) which will serve as an input into the vehicle (or train) simulations.

- **BRT --** a bus type comparable to the New Flyer battery electric articulated bus currently used by New York City Transit (NYCT) would be used to simulate vehicle performance and carrying capacity.
- **Subway** -- a subway car type comparable to the forthcoming R-211 or the existing R-179 (both of which are B-Division railcars) or the current A-Division railcar would be used to model vehicle performance and trainset capacity.
- **Commuter rail** -- the LIRR's M7 or M9 EMU (Electric Multiple Unit) railcar and diesel (DE-30) or dual-mode (DM-30) locomotives with passenger coaches (C-3) would be used to simulate vehicle performance and trainset capacity.
- **Diesel Multiple Unit (DMU) railcar** -- an FRA compliant vehicle such as the Stadler Flirt DMU—which is currently in service by TEXRail in Fort Worth, Texas—would be used to simulate vehicle performance and trainset capacity.
- **Automated Guideway Transit (AGT)** -- a vehicle similar to the Bombardier Mark II (now branded as MOVIA) linear induction motor vehicle—and used by AirTrain JFK and by TransLink in Vancouver, Canada would be used to simulate vehicle performance and capacity.
- **LRT** -- a vehicle similar to the Kinki Sharyo LRV used by Newark Light Rail and by the Hudson-Bergen Light Rail would be used to simulate vehicle performance and trainset *capacity.*

Expected outputs:
For each alternative: 1) Type of vehicle or train to be simulated, 2) number of vehicles per train for the rail alternatives, 3) average operating speed by mode, 4) roundtrip running (cycle) times (including layovers at terminals).

2. Station locations and size

For each Feasible Alternative, the proposed station location will be defined, along with the size and scale, including the proposed platform lengths, number of platforms per station, and major station components. The size of the station varies by mode—the BRT platform typically accommodates 1-2 vehicles per platform per direction, LRT 1-4 vehicles per platform per direction, subway 10 cars per platform per direction, commuter rail EMU 4-12 cars or diesel or dual-mode locomotives with passenger coaches (4-12 cars), commuter rail DMU 1-4 cars and AGT 1-4 cars per platform per direction.

The required station elements that serve as primary cost drivers will be identified. For example, since much of the Bay Ridge Branch is in open cut or on embankment, a decision will need to be made as to whether elevators or ramps or a combination will be used to provide ADA access between the street level and the platform level based upon station location.
Expected outputs: For each alternative: 1) Location of stations, 2) number of stations, 3) scale of each station (size, square footage, platform length, canopy length, etc.), 4) high level assessment of the components that drive O&M costs (i.e. vertical circulation elements, enclosed

or climate controlled passenger facilities, etc.). All of these design elements will be done at a high-concept level.

3. Staffing method

The staffing levels associated with each alternative will be defined, as this is another cost driver. This includes determining the level of on-vehicle staffing, whether stations will be staffed or unstaffed—and the like.

Expected outputs: For each alternative: 1) On-vehicle/train staffing levels (operations), 2) At-station staffing levels (if any; operations), 3) maintenance staffing for the guideway, 4) maintenance staffing for stations, 5) staffing at vehicle maintenance facilities, 6) staffing for vehicle dispatch, 6) general administration staffing.

4.2. Definition of service patterns for each Feasible Alternative

The service pattern for each Feasible Alternative will be defined. This will identify span of service, frequency of service during the operating day and night time periods, whether there are short turn service patterns to serve high ridership segments, etc.

Expected outputs: 1) revenue service hours, 2) revenue service miles.

4.3. Definition of operating entity for each Feasible Alternative

For each Feasible Alternative, a type of operating entity will be identified. An understanding of the type of operating entity and its associated O&M cost structure will be important for determining the operating costs for the Feasible Alternatives. As the study does not assign a specific operating entity for these modes, the following assumptions will be made:

- For the BRT and subway modes, NYCT's cost data as reported to the National Transit Database (NTD) will be used. A determination will be made as how to treat the BRT guideway costs since NYCT's BRT currently uses city streets maintained by New York City Department of Transportation (NYCDOT) or New York State Department of Transportation (NYSDOT). Similar bus guideway currently in operation in the United States would be used for cost data such as the Pittsburgh, PA busway or Los Angeles (Orange Line) BRT line.
- For the commuter rail mode, LIRR's cost data as reported to the NTD will be used.
- The LRT and AGT modes are not currently operated by any of the MTA agencies. Comparable costs will be used from applicable peer agency NTD or CUTA (Canadian Urban Transit Association) for Canadian agency data. For the LRT mode, NJ TRANSIT's LRT cost data from the NTD will be used and adjusted to match NYCT wage rates and operations, if applicable, for either bus or subway train operators.
- For AGT, the nearest operating AGT mode to the study area is the AirTrain JFK system, operated under contract by Bombardier for the Port Authority of New York & New Jersey. This cost data is not reported to the NTD and the cost breakdown is proprietary. Therefore, TransLink's cost data from Vancouver, Canada would be used, as they operate North America's largest AGT system. Cost data obtained from CUTA would be adjusted to match NYCT wage rates and operations, and the Canadian dollar converted to US dollar values.

Expected output: Definition of agency cost structure for the Feasible Alternatives.

4.4. Establish ridership for each Feasible Alternative

Ridership estimates for each Feasible Alternative will be developed as part of Task 10, the results of which will be utilized for the O&M studies to predict revenue vehicle requirements for each alternative as an input to determine the O&M cost..

4.5. Develop the initial, high-level, concept of operation

A high-level operating plan using several key inputs will be defined as part of Task 10, and will be developed based on:

- ✓ Station locations and size for each alternative
- ✓ Vehicle types
- ✓ Service operating concepts
- ✓ End-to-end travel times, and average operating speed, as determined by BRT/train performance simulators
- ✓ Span of service
- ✓ Service frequency
- ✓ Definition of operating entity
- ✓ Staffing concept
- ✓ Forecast ridership

Expected output: For each Feasible Alternative:

- ✓ Annual vehicle operating hours
- ✓ Annual vehicle operating miles
- ✓ Peak fleet size, including spare vehicle requirements
- ✓ Number of guideway lane miles/track miles.

4.6. Select a base year that is representative of typical annual operating costs

The NTD 2018 cost database is the most recent year of information currently available and would be used. This year was generally free of unusual major service disruptions for NYCT and other peer agencies, such as NJ TRANSIT's light rail and TransLink's AGT operations.

4.7. Apply four-supply variable model

The 2018 NTD submissions will be used to develop unit costs to estimate O&M costs for each Feasible Alternatives. For the BRT and rail modes, a four-supply variable will be used to estimate the O&M costs using the following unit costs:

- ➢ Cost per vehicle revenue hour
- ➢ Cost per vehicle revenue mile
- ➢ Cost per vehicle required in maximum service
- ➢ Cost per guideway mile.

BRT is proposed to use the four-variable cost model approach rather than the three-variable cost model traditionally used to estimate the cost of bus operations since BRT operations on the BRC study alignment would use dedicated bus lanes and enhanced bus stops or stations; these costs are best estimated under a four-variable factor model.

4.8. Apply unit costs

To calculate the unit cost of the individual variables, the costs associated with each of the expense items for operating and maintaining transit service is assigned to one of the variables summed, and then divided by the number of units of the supply variable to which it is assigned.

> For example, the annual costs associated with revenue vehicle hours for a particular mode are divided by the annual number of revenue vehicle hours operated that year to calculate the unit cost for the vehicle revenue hour variable.

The cost drivers of the O&M model are:

1) Estimated revenue vehicle hours
2) Revenue vehicle miles
3) Peak vehicles
4) Total guideway miles.

The calculations of service statistics and units of service will be based on the proposed service plan for each alternative. **Table 1** shows a typical assignment of the different expenses to these four cost driver categories; these line items may vary to accommodate study needs.

Table 1 Typical Assignment of Expense Items

	Assignment of Expense Items			
	Revenue Vehicle Hours	Revenue Vehicle Miles	Peak Vehicles	Guideway Miles
Vehicle Operations Labor				
Operator Salaries and Wages	X			
Other Salaries and Wages	X			
Fringe Benefits	X			
Services	X			
Vehicle Operations Materials and Supplies				
Fuel and Lubricants		X		
Tires and Tubes		X		
Other Materials/Supplies		X		
Utilities		X		
Casualty and Liability		X		
Miscellaneous			X	
Vehicle Maintenance Labor				
Other Salaries and Wages		X		
Fringe Benefits		X		
Services		X		
Vehicle Maintenance Materials and Supplies				
Fuel and Lubricants		X		
Tires and Tubes		X		
Other Materials and Supplies		X		
Utilities		X		
Casualty & Liability		X		
Miscellaneous		X		
Non-Vehicle Maintenance Labor				
Other Salaries and Wages				X
Fringe Benefits				X
Services				X
Non-Vehicle Maintenance Materials and Supplies				
Fuel and Lubricants				X
Tires and Tubes				X
Other Materials and Supplies				X
Utilities				X
Casualty & Liability		X		
Miscellaneous				X
General Administration				
Other Salaries and Wages			X	
Fringe Benefits			X	
Services			X	
Fuel and Lubricants			X	

Tires and Tubes			X	
Other Materials and Supplies			X	
Utilities			X	
Casualty and Liability		X		
Miscellaneous Expense			X	

4.9. Apply lump sum costs

There may be certain cost elements that do not lend themselves to unit pricing and may need to be treated as lump sum, as proportionate or aggregate costs. Example of this include general administration, insurance—and the like. These cost elements will also be added as line items, consistent with FTA cost estimating procedures.

4.10. Apportion shared costs

One or more of the Feasible Alternatives may share some of the same tracks with rail freight services. A method to allocate the O&M costs for those common elements between two (or more) railroad track users will be developed, and the costs will be apportioned, based on an agreed upon service volume metric.

4.11. Prepare service summary

The Feasible Alternatives will be summarized in a service summary table that lists:

- Annual revenue vehicle service hours
- Annual revenue vehicle service miles
- Peak vehicle requirement
- Lane/track miles of guideway

4.12. Calculation of cost estimates

Cost estimates will be calculated by multiplying the operating statistics for each of the Feasible Alternatives by the unit cost factors by mode and then summing the products of each variable for each alternative, as shown in **Table 2**.

Table 2 Calculation of Cost Estimates

Estimated Future Revenue Vehicle Hours	X	Revenue Vehicle hour Cost Factor	=	Estimated O&M Cost associated with Revenue Vehicle Hours
Estimated Future Revenue Vehicle Miles	X	Revenue Vehicle Mile Cost Miles	=	Estimated O&M Cost associated with Revenue Vehicle Miles
Estimated Future Vehicles Required in Peak Service	X	Vehicles Required in Maximum Service Cost Factor	=	Estimated O&M Costs associated with Vehicles Required in Peak Service
Estimated Future Guideway Miles	X	Guideway Miles Cost Factor	=	Estimated O&M Costs associated with Guideway Miles
				Estimated Total O&M Costs

4.13. Inflate to Build Year

Once the O&M costs have been determined in current year dollars, they will be inflated to the Build Year, which is currently assumed as 2045. The study team will confer with the Client as to the appropriate inflation rate to use.

4.14. Create summary table

The O&M cost results will be presented in a summary table to provide a comparison between the three Feasible Alternatives. Because of the high-level nature of this order of magnitude cost estimate, a range of +/- 10 percent of the calculated O&M cost is proposed.

5. Deliverables

- Draft 2045 preliminary, order of magnitude O&M operating costs for each Feasible Alternatives.
- O&M technical memorandum documenting the methodology and results.