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Memorandum

To/Attention	Joanne Haracz	**Date**	September 30, 2016
From	IBI Group	**Project No**	38482
Cc			
Subject	Incremental Bus Operating and Maintenance (O&M) and Vehicle Capital Costs for Kendall Square Mobility Task Force 'Unconstrained' Scenario		

Following Task Force Meeting #7, the City of Cambridge had identified a set of bus service changes (the 'unconstrained scenario') that represented an increase in resource requirements relative to a 'constrained' scenario. The 'constrained scenario" is cost neutral and would not require more bus O&M expenditures, or more vehicles, than the base case for 2040. This memorandum conveys our estimates of the additional vehicle capital and annual O&M costs for the 'unconstrained' scenario. Our team coordinated on the development of the two scenarios for CTPS to model.

Operating and Maintenance Costs

We developed unit O&M costs from the MBTA's year 2014 reports to the FTA's National Transit Database (NTD). All the costs herein are therefore expressed in year 2014 dollars. Overall, MBTA's unit costs for bus operation have risen at a slightly higher rate than inflation as measured by the Consumer Price Index.

The unit costs represent a combination of all four cost categories in the NTD cost accounting system:

- Vehicle operations, comprising:all activities associated with vehicle operations, including:
    - Revenue vehicle operation;
    - Revenue vehicle movement control;
    - Scheduling of transportation operations;
    - Transportation administration and support;
    - Ticketing and fare collection; and
    - System security.

- Vehicle maintenance, comprising all activities associated with revenue and non-revenue (service) vehicle maintenance, including:
    - Vehicle inspection and maintenance;
    - Servicing (cleaning, fueling, etc.) vehicles;
    - Repairs due to vandalism and accident repairs of revenue vehicles; and

    - Administration of vehicle maintenance, including storage and service facilities

- Non-vehicle maintenance, typically comprising the following for bus systems:
    - Repair of buildings, grounds and equipment as a result of accidents or vandalism;
    - Maintenance of: vehicle movement control systems;
    - Maintenance of fare collection and revenue management equipment;
    - Dedicated busways
    - Passenger shelters and stations, operating station buildings, grounds and equipment;
    - General administration buildings, grounds and equipment; and
    - Administration of non-vehicle maintenance

- General & administrative, comprising:
    - Transit service development;
    - Injuries and damages;
    - Safety;
    - Personnel administration;
    - Legal services;
    - Insurance;
    - Data processing;
    - Finance and accounting;
    - Purchasing and stores;
    - Engineering;
    - Office management and services;
    - Customer services;
    - Market research; and
    - Planning.

The unit costs were derived using three distinct driving variables, so as to be able to account for differences in operating speed among routes, and whether the service change required a change in the total fleet. They include marginal allowances for the 'indirect' costs above based on both MBTA's reporting and an analysis of all operating bus systems in the US in 2002. These unit costs were:

- $59,550 per vehicle operated in maximum service (VOMS), *i.e*. the number of buses required to operate the peak period service relative to the 'constrained' scenario;

- $85.39 per revenue vehicle-hour (RVH) required to operate the service for 250 weekdays (the normal number operated in a calendar year) relative to the 'constrained' scenario; and
- $5.49 per revenue vehicle-mile (RVM) to operate the service for 250 weekdays relative to the 'constrained' scenario

All services were assumed to operate with the standard 40-foot single unit transit buses currently used for the MBTA routes serving Kendall Square.

For each bus service identified as being improved for the 'unconstrained' scenarios, or services introduced as part of it, the incremental values of the driving variables and the estimated annual O&M cost are shown in Table 1. These incremental cost estimates assume route operating times under current (2016) conditions. If year 2040 CTPS results suggest longer operating times would prevail then, the City might wish to adjust the VOMS and RVH upward accordingly, and re-estimate the costs.

Table 1. Estimated Incremental Annual O&M Costs for 'Unconstrained' Scenario (2014$)

Route(s)	VOMS	RVH	RVM	O&M Cost
64	0	2,846	28,875	$402,000
68	1	5,894	84,740	$1,028,000
70/70A	0	6,785	68,750	$957,000
85	1	2,056	33,607	$420,000
87	1	2,117	34,526	$430,000
88	1	4,456	69,960	$824,000
92A	6	8,021	73,700	$1,447,000
CT4	8	28,755	416,295	$5,217,000
L-K Shuttle	1	1,563	20,900	$308,000
TOTAL	19	62,493	831,353	$11,033,000

Costs for the EZ Ride bus service are not estimated because this service is not operated by the MBTA. In terms of RVH, it is estimated that the increase over offering the present schedule would be 68 percent.

Vehicle Capital Costs

In June of 2015, the MBTA placed a $222.2 million dollar order for 325 40-foot buses for delivery in 2016 and 2017. The average unit cost was $683,692; backing off two years June 2016 to June 2014) using the Producer Price Index WRU1413 (Truck and Bus Bodies), the unit cost in 2014 dollars would be $664,084. To provide both operating and maintenance spares, an addition of 18 percent should be made to the incremental VOMS in Table 1. The total estimated incremental fleet cost for the 23 MBTA buses including spares would be $15,274,000. .

Given increasing demand, it is likely that the EZ Ride service would be provided by 40-foot buses by 2040. It is estimated that with a 20% spare allowance (more appropriate for smaller fleets) the total EZ Ride fleet for the unconstrained scenario would be seven (7) such vehicles more than for the constrained scenario.