



## 9.0 OPERATING AND MAINTENANCE COSTS

This chapter presents proposed methodology and results for estimating operating and maintenance (O&M) costs for the Rush Line Corridor AA. All alternatives are being compared to a No-Build and TSM Alternative. Descriptions of all alternatives can be found in Chapter 7. Further detail on O&M cost methodology and results can also be found in **Appendix J**.

### 9.1 Purpose

As noted by the FTA, the projection of O&M costs is an important part of planning New Starts projects. O&M cost projections are important for two reasons:

- **Cost Effectiveness Measures.** The projection of design-year O&M costs is a critical input to the determination of the New Starts measures of cost effectiveness
- **Financial Planning.** The projections of annual O&M costs are vital to the development of financial plans that cover multiple years of construction and operation of the New Starts projects.

The FTA requires the use of a resource-driven allocated cost model for O&M costing in a New Starts project. Resource-driven models assign specific costs to specific service characteristics (e.g. train operator costs assigned to annual revenue train-hours). Costs for that particular item (e.g. train operators) are then determined by each alternative's service characteristics (e.g. annual revenue train-hours). The Rush Line Corridor AA is not yet in the FTA New Starts program. However, proposed O&M cost methodology has been defined in a manner that is consistent with FTA New Starts requirements.

### 9.2 Bus and LRT Cost Methodology

All of the Rush Line alternatives reflect modification to corridor bus service. Some of the alternatives also include modifications to Metro Transit LRT service. Bus and LRT O&M costs were estimated with the same O&M cost methodology that is being used for the Central Corridor LRT project. This model is consistent with Federal Transit Administration requirements for a resource driven allocated cost model. Basic assumptions in this resource build-up model are:

- Variable costs increase or decrease based on changes in system or service characteristics

- Calibration productivity and consumption rates will continue into the future and are the basis for future cost estimates.

The Central Corridor O&M cost model is based on unit costs derived from Metro Transit's FY2007 actual bus and rail operating expenses and system/service characteristics. The model does adjust a few specific costs to be consistent with known cost changes that are reflected in Metro transit's 2008 budget.

The Rush Line Corridor alternatives include new bus service outside of the Regional Transit Capital Communities (formerly the Transit Taxing District) into areas that presently do not have fixed route transit service. If service to these areas is part of the selected alternative(s), it is possible that multiple transit providers could provide the service. At this stage in the project, it is unknown who those other transit providers may be, or what their cost characteristics will be. Therefore, for purposes of this initial evaluation of alternatives, the Metro Transit bus cost model was applied to all bus service statistics for Rush Line Corridor alternatives. Refinements to this assumption may be appropriate in future phases of this project.

### **9.3 BRT O&M Cost Methodology**

The bus cost methodology described in the previous section is suitable for estimating typical local and express bus operations. However, the Rush Line Corridor Alternatives Analysis (AA) includes four BRT alternatives which include components that have O&M costs unique from typical bus O&M costs. The maintenance costs for unique BRT-related components are difficult to ascertain – particularly at this early stage of the AA study process when BRT components are not specifically defined. Therefore, adjustments have been applied to specific cost items as a means to capture potential additional costs related to BRT service.

The first BRT cost adjustment was to account for the potential use of unique buses. The type of bus used for BRT operations can vary widely. Some BRT projects may propose the use of standard transit buses. In those instances, there would be little or no difference in bus vehicle maintenance costs from typical bus operations and maintenance. Oftentimes, a unique vehicle is proposed for the BRT service. Thus, BRT fuel costs and maintenance costs of unique components on the buses may be higher than for a standard transit bus. The type of bus that would be used for the Rush Line Corridor BRT alternatives is yet to be defined. Therefore, select bus-related O&M costs have been inflated by 25 percent as a placeholder until specific BRT vehicle features are known in future studies for this Corridor.

The second BRT cost adjustment was to account for BRT station maintenance costs. Possible station features for the Rush Line BRT alternatives have yet to be defined. Therefore, this study chose to estimate potential BRT station-related maintenance costs on the basis of Metro Transit LRT station O&M costs.

The third BRT cost adjustment was to account for exclusive BRT bus lanes. Maintenance costs for exclusive bus lanes are often difficult to determine and depend on additional features along the bus lanes (e.g., signal prioritization/pre-emption, electronic signage). A recent study of maintenance costs incurred by Mn/DOT and other jurisdictions in Minnesota found average road maintenance cost to be \$5,000 per lane mile. Until more is known about possible BRT busway and/or dedicated bus lane features, it is suggested that a unit cost of \$5,000 per lane-mile be assumed for BRT bus lane maintenance costs.

## 9.4 Commuter Rail O&M Cost Methodology

Commuter rail O&M costs were estimated with a spreadsheet model that is based on the Northstar Corridor's projected first year operating budget. The proposed spreadsheet model is based on Northstar's FY 2010 expenses, the first full year of operations. The Northstar budget presents commuter rail costs in eight categories. Unit costs were developed for each of the line item costs. The spreadsheet cost model then applies individual unit costs to Rush Line Corridor commuter rail operating statistics.

## 9.5 Cost Model Application

The prior sections of this chapter have presented the methodologies used for estimating corridor bus, LRT, BRT and commuter rail costs. All of the methodologies require the calculation of various service statistics (see right panel) for each Rush Line Corridor alternative:

These service statistics were calculated for each Rush Line Corridor alternative based on the service plans described in the project's Operations Plans Report. For the rail alternatives, peak hour ridership forecasts were reviewed to determine train consist requirements.

Table 9-1 presents service statistics and Table 9-2 presents estimated annual O&M costs for each Rush Line Corridor alternative. It is important to keep in mind that these service statistics and costs are for modeled Year 2030 alternatives (but in 2008 dollars). This table presents anticipated incremental changes in service statistics and costs. As an example, Table 9-1 identifies 16 peak buses for the No-Build Alternative in addition to buses currently operating in the Corridor.

### *O&M Cost Model Service Statistics*

#### *Local/Express Bus*

- Peak buses
- Annual revenue bus-hours
- Annual revenue bus-miles
- Transit centers
- Number of maintenance and storage yards.

#### *BRT*

- Peak BRT buses
- BRT stations with and without park-and-ride lots
- Annual revenue bus-hours
- Annual revenue bus-miles
- Directional route-miles of dedicated bus lanes
- Number of maintenance and storage yards.

#### *LRT*

- Peak rail cars
- Stations with and without park-and-ride lots
- Terminal stations
- Annual revenue train-hours
- Annual revenue car-miles
- Directional route-miles of track
- Number of maintenance and storage yards.

#### *Commuter Rail*

- Peak locomotives
- Peak passenger cars
- Annual train trips
- Annual revenue train-hours
- Annual revenue train-miles
- Annual revenue car-miles
- Number of passenger stations
- Route miles
- Yards.

**Table 9-1: Estimates of Annual Operating Statistics  
(Incremental Statistics Over Existing)**

Transit Mode	No-Build	TSM	BRT 1A	BRT 1B	BRT 2A	BRT 2B	C. Rail 1A	C. Rail 1B	LRT 1A	LRT 1B	Modified LRT 1B
<b>Statistics Local/Regional Bus</b>											
Ann. Rev. Bus-Miles	442,626	1,382,301	533,916	937,836	638,211	459,711	361,281	531,876	673,911	704,511	704,511
Ann. Rev. Bus-Hours	29,107	86,057	42,367	53,077	33,569	27,449	33,051	43,489	35,779	35,694	35,694
Peak Buses	16	30	8	14	10	7	10	10	19	15	15
<b>Bus Rapid Transit</b>											
Ann. Rev. Bus-Miles	n/a	n/a	1,453,500	787,500	468,700	713,700	n/a	n/a	n/a	n/a	n/a
Ann. Rev. Bus-Hours	n/a	n/a	51,700	34,400	29,000	35,900	n/a	n/a	n/a	n/a	n/a
Peak Buses	n/a	n/a	14	10	8	10	n/a	n/a	n/a	n/a	n/a
Operating Divisions	5	5	5.5	5.5	5.5	5.5	5	5	5	5	5
Stops/Stations	n/a	n/a	13	10	9	11	n/a	n/a	n/a	n/a	n/a
Lane Miles	n/a	n/a	34.3	34.3	22.2	45.4	n/a	n/a	n/a	n/a	n/a
<b>Light Rail Transit</b>											
Ann. Rev. Car-Miles	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	403,900	1,137,000	1,380,700
Ann. Rev. Train-Hours	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	21,500	27,300	36,900
Peak Cars	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5	12	18
Stations	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	6	8	8
Route Miles	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	7.4	11.1	11.1
<b>Commuter Rail</b>											
Ann. Rev. Car-Miles	n/a	n/a	n/a	n/a	n/a	n/a	787,500	836,800	n/a	n/a	n/a
Ann. Rev. Train-Hours	n/a	n/a	n/a	n/a	n/a	n/a	15,000	15,000	n/a	n/a	n/a
Peak Cars	n/a	n/a	n/a	n/a	n/a	n/a	5	5	n/a	n/a	n/a
Stations	n/a	n/a	n/a	n/a	n/a	n/a	9	8	n/a	n/a	n/a
Route Miles	n/a	n/a	n/a	n/a	n/a	n/a	76.5	78.3	n/a	n/a	n/a

**Table 9-2: Estimates of Annual O&M Costs**

Transit Mode	No-Build	TSM	BRT 1A	BRT 1B	BRT 2A	BRT 2B	C. Rail 1A	C. Rail 1B	LRT 1A	LRT 1B	Modified LRT 1B
<b>Costs</b>											
<b>Corridor O&amp;M Costs</b>											
Local Bus	\$3,555,453	\$9,705,305	\$5,544,012	\$7,448,482	\$5,441,732	\$4,505,896	\$3,225,637	\$4,202,477	\$4,650,052	\$4,492,250	\$4,492,250
Bus Rapid Transit	n/a	n/a	\$10,999,506	\$7,122,252	\$5,444,429	\$7,228,738	n/a	n/a	n/a	n/a	n/a
Light Rail Transit	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	\$6,934,062	\$11,563,538	\$13,381,876
Commuter Rail	n/a	n/a	n/a	n/a	n/a	n/a	\$33,565,512	\$34,052,453	n/a	n/a	n/a
<b>Total Corridor Costs</b>	<b>\$3,555,453</b>	<b>\$9,705,305</b>	<b>\$16,543,518</b>	<b>\$14,570,734</b>	<b>\$10,886,161</b>	<b>\$11,734,634</b>	<b>\$36,791,149</b>	<b>\$38,254,930</b>	<b>\$11,584,114</b>	<b>\$16,055,788</b>	<b>\$17,874,126</b>
Change over No Bld.	n/a	\$6,149,852	\$12,988,065	\$11,015,281	\$7,330,708	\$8,179,181	\$33,235,896	\$34,699,477	\$8,028,661	\$12,500,335	\$14,318,673
Change over TSM	n/a	n/a	\$6,838,213	\$4,865,429	\$1,180,856	\$2,029,329	\$27,065,844	\$28,549,625	\$1,878,809	\$6,350,483	\$8,168,821
<b>Efficiency Local/Regional Bus</b>											
Cost per Rev. Bus-Mile	\$8.03	\$7.02	\$10.38	\$7.94	\$8.53	\$9.80	\$8.93	\$7.90	\$6.90	\$6.38	\$6.38
Cost per Rev. Bus-Hour	\$122.15	\$112.78	\$130.86	\$140.33	\$162.11	\$164.16	\$97.60	\$96.63	\$129.97	\$125.85	\$125.85
<b>Bus Rapid Transit</b>											
Cost per Rev. Bus-Mile	n/a	n/a	\$7.57	\$9.04	\$11.62	\$10.13	n/a	n/a	n/a	n/a	n/a
Cost per Rev. Bus-Hour	n/a	n/a	\$212.76	\$207.04	\$187.74	\$201.36	n/a	n/a	n/a	n/a	n/a
<b>Light Rail Transit</b>											
Cost per Rev. Car-Mile	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	\$17.17	\$10.17	\$9.69
Cost per Rev. Train-Hour	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	\$322.51	\$423.57	\$362.65
<b>Commuter Rail</b>											
Cost per Rev. Car-Mile	n/a	n/a	n/a	n/a	n/a	n/a	\$42.62	\$40.69	n/a	n/a	n/a
Cost per Rev. Train-Hour	n/a	n/a	n/a	n/a	n/a	n/a	\$2,237.70	\$2,270.16	n/a	n/a	n/a

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