



# I-270 MULTI-MODAL CORRIDOR STUDY CORRIDOR CITIES TRANSITWAY

# Operating and Maintenance Cost Estimate Report

March 2008

Prepared for: Federal Transit Administration Maryland Transit Administration

## OPERATING AND MAINTENANCE COST ESTIMATE REPORT

## INTRODUCTION

This technical report documents the development of the operating and maintenance (O&M) cost models used for the analysis of transit alternatives for Corridor Cities. This report primarily includes bus and light rail cost estimates, including documentation of data sources and development of the model. The resulting operating and maintenance cost estimates were validated by comparing them to actual expenditures using recent Montgomery County Transit's (MCT) bus and Maryland Transit Administration's (MTA) bus and light rail operation statistics.

The transit models documented in this report conform – to the extent possible given the data – to the Federal Transit Administration's (FTA's) most recently issued technical guidelines for transit alternatives analysis (Procedures and Technical Methods for Transit Project Planning: Review Draft, September 1986 and updates). In particular, the transit cost models utilize the resource buildup approach methodology recommended by FTA and the cost models are fully-allocated models. This means that they test the effects of system changes (such as expansions of the rail or bus system) on costs of all areas of the agency's operation, are capable of testing different levels of costs for many individual elements of the operation, including the wages and salaries of operators and maintenance personnel, costs for fringe benefits, and for fuel. The models, which are derived principally using National Transit Data (NTD), follow FTA's recommended approach of disaggregating and classifying individual expense categories.

Estimating operating and maintenance costs for an alternatives analysis involves two primary steps: 1) development of operating plans and estimation of operating statistics for each transit mode included in each service alternative, and 2) development of O&M cost models and their application to the operating statistics obtained in step 1 to estimate the O&M costs for the new service. The operating statistics (vehicle hours, vehicle miles, etc.) are derived from the final operating plan for each service alternative after the equilibration step in the travel demand process. Equilabration is the step in which the supply of transit service is balanced with the demand as estimated using travel demand models. The final operating plan describes the level of service to be provided in each alternative, including peak and off-peak service for weekdays and weekends.

## GENERAL APPROACH

Figure 2-1 shows the general steps in estimating the O&M costs for an alternatives analysis. The travel demand forecasting portion of the estimation begins with the coding of the proposed transit alternatives into the highway and transit networks and ends with the iterative process of equilibration. During equilibration, the supply (capacity) of transit service in each alternative is adjusted to either match the estimated demand or set to a level based on policy decisions, whichever is larger. Transit supply is represented in travel demand models by the frequency of service (headway) and total travel time, and is generally a coarse representation compared to the many alternative service patterns available to a transit agency's scheduling departments. Furthermore, travel demand models typically model one or two portions of a typical weekday, with factors applied to estimate daily and annual ridership. Thus, the next step after equilibration is to estimate the total operating statistics from the operating plan used to produce the travel demand

model results. The steps in estimating O&M costs from the operating statistics follows a process described in the following sections.



Figure 2-1: Steps in O&M Estimation Process

## COST ESTIMATING METHODOLOGY

The resource build-up approach was used to determine O&M costs for the study alternatives in FTA New Starts projects. Costs are computed in the resource build-up model by estimating the labor and materials needed to provide a given level of service, and then multiplying by the unit costs of said labor and materials. This approach involves disaggregating O&M costs from recent years into categories that can be reasonably assumed to vary with service levels. The bus model, for example, has costs that vary by miles of service (for example, fuel costs), by hours of service (driver labor), and by the number of peak vehicles (bus cleaning). Productivity factors were broken out where reasonable, so that the impacts of new assumptions (such as new fuel costs, labor rates, or fuel efficiency) could be tested directly in the model. The disaggregated costs per unit of service were then summed to produce a cost model that can be used to calculate future costs for each alternative, based on the service characteristics and productivity assumptions defined for that alternative.

The model for Corridor Cities was based on unit costs derived via resource build-up equations and both Montgomery County Transit and Maryland Transit Administration wage and fringe rates that were used throughout the estimation procedures. This report documents the model used and presents the results of the 2030 annual O&M costs for the project alternatives in 2007 dollars. The methodology used in this report is consistent with the FTA guidance suggesting a resource productivity approach to estimating O&M costs.

## OPERATING AND MAINTENANCE COST MODEL DEVELOPMENT

Public transportation in the Montgomery County area is provided by Montgomery County Transit (MCT). Currently MCT operates a network of bus routes operating primarily in mixed traffic, with approximately 12.4 million revenue vehicle miles of bus service per year. The agency also operates a door-to-door paratransit service. MCT's operational and cost experience for bus service was used as the basis for local feeder bus service in each of the alternatives.

The Maryland Transit Administration operates bus, heavy rail, light rail, commuter rail, and paratransit service. MTA reports 23.9 million annual revenue vehicle miles of bus service and 2.1 million annual revenue vehicle miles of light rail service. MTA's operational and cost experience for bus and light rail was used as the basis for BRT and LRT estimates, respectively, in each of the alternatives.

## MONTGOMERY COUNTY TRANSIT BUS MODEL SUMMARY

The basic local feeder bus cost model was calibrated using Montgomery County Transit's National Transit Database (NTD) reports for FY 2003 through 2005. The NTD is the FTA's national database of statistics for the transit industry. The NTD is comprised of data reported by transit agencies across the US, which is then analyzed and compiled into reports published by FTA and made available to the public on the NTD Program website. The types of data collected and reported include:

- Operational Characteristics Vehicle revenue hours and miles, unlinked passenger trips and passenger miles, etc.
- Service Characteristics Service reliability and safety, etc.
- Capital Revenues and Assets Sources and uses of capital, fleet size and age, etc.
- Financial Operating Statistics Revenues, Federal, state and local funding, costs, etc.

The NTD has been expanded in recent years to include data on safety, security, and rural transit.

An average of 2003, 2004, and 2005 actual costs for MCT bus operations were developed for each expense category. Costs were escalated from their year of expenditure to September 2007 dollars using escalation factors derived from Bureau of Labor Statistics Consumer Price Index (CPI) inflation estimates for the Baltimore-Washington area. September 2007 is the most recent month for which CPI data is currently available at the regional level. The factors used to inflate from year of expenditure to September 2007 are listed in Table 3-1.

Year of Expenditure	Escalation Factor
2003	1.157
2004	1.124
2005	1.081

## Table 3-1: Inflation Rates compared to September 2007

Source: Based on US Bureau of Labor Statistics, Consumer Price Index Data for Baltimore Washington DC-MD-VA-WV. Series Id: CUURA311SA0, CUUSA311SA0. Accessed January 2008

Detailed costs that form the basis of the model are presented in Table 3-2. These individual costs were summed to form a cost model based on three service characteristics: service hours, vehicle miles, and peak vehicles (the number of vehicles that operate during peak hours). The costs were then divided by the number of units of each operating statistic to develop unit cost factors for each category. The resulting unit cost factors include:

- \$84,513 X number of buses operated during peak
- \$2.04 X number of annual vehicle miles
- \$52.61 X number of annual vehicle service hours

## MTA BUS MODEL SUMMARY

The Corridor Cities BRT cost model was calibrated using Maryland Mass Transit Administration's NTD reports for FY 2003-2005 for bus service. The detailed costs for the development of the cost factors employed for BRT in each of the Corridor Cities alternatives is presented in Table 3-3. To capture the additional cost of using articulated buses or other unconventional transit vehicles in such areas as fuel, tires and maintenance, for BRT services the cost factor for annual vehicle miles of service was increased by 50%, from \$3.41 for conventional bus service to \$5.11 for BRT. The unit cost factors for bus rapid transit include:

- \$67,727 X number of vehicles in maximum service
- \$79,642 X number of directional route miles (track miles)
- \$5.11 X number of annual passenger car revenue miles
- \$58.52 X number of annual passenger car revenue hours

## MTA LIGHT RAIL MODEL SUMMARY

The Corridor Cities light rail cost model was calibrated using MTA's NTD reports for FY 2003. The year 2003 was chosen because it was the last full year of operation before changes were made to the operational procedure, which coindcided with rail double tracking projects on the existing light rail line. These operational changes distorted operating costs (discussed below in the validation section) to the point where operating cost data from the years since 2003 are a poor predictor of future rail operations. The detailed costs for the development of the cost factors employed in the Corridor Cities model are presented in Table 3-4. The individual costs were summed to form a cost model based on four service characteristics: vehicles in maximum service (peak number of vehicles), track miles, passenger car (to account for multi-car trains) revenue hours and revenue

miles. The rail model distinguishes between labor costs and non-labor costs for operating characteristics.

The unit cost factors for light rail include:

- \$72,581 X number of vehicles in maximum service
- \$191,724 X number of directional route miles (track miles)
- \$5.05 X number of annual passenger car revenue miles
- \$160.63 X number of annual passenger car revenue hours

## VALIDATION

Validation is a process used to indicate that the model is accurate and that the assumptions used in building the model were valid. Of the three years considered in the Montgomery County Transit bus model validation, 2005 had the largest variance between actual and predicted costs, at 5%. For the years 2003 through 2005, the model predicted the inflation adjusted costs to within  $\pm 5\%$  of actual costs. Table 3-5 shows the results of the validation for Montgomery County bus service.

For Maryland MTA bus validation, the year 2004 had the largest varience, 6%, between actual and predicted costs. The MTA bus cost model predicted the inflation adjusted costs to within  $\pm 6\%$  of the actual costs. Table 3-6 shows the results for MTA bus validation.

The Maryland MTA rail model is less accurate than the bus model for predicting the actual costs of individual years. Even under normal circumstances, a light rail model typically is less accurate in predicting the actual costs of individual years because the scale of a light rail system is smaller than that of a bus system. This makes a light rail system model more sensitive to small changes in service patterns from year to year. In addition, as noted in section 3.1.3 above, the light rail model is based on a single year—2003—because the years 2004 and 2005 were affected by significant service changes due to construction. However, it is believed the model can still accurately project costs for a normal year of operation Table 3-7 shows the results of the validation for MTA light rail.

## Table 3-2: Montgomery County Transit Bus O&M Cost Model

## Montgomery County Motor Bus Operating Cost Model

Based on 2003-2005 Sumbittals to National Transit Database NTD ID: 3030 Mode: MB Service: DO September 2007 Dollars

1.0000

## 1. Cost Allocation Model (In September 2007 Dollars) 2003-2005 Average Expenses

		A	nnual Cost		Annu	ial (	Cost & Attribu	utic	on	Exclusive				
	NTDB				Revenue-	.,	Revenue-	_		Access Right-	F	ixed (not in		
Vehicle Operations Labor	Reference	-		Ve	ehicle-Hours	Ve	ehicle-Miles	Pe	eak Vehicles	of-Way Miles		model)	% of Total	-
Operator Salaries and Wages	F-30, 01 a	\$	18,848,339	\$	18,848,339								27%	
Other Salaries and Wages	F-30, 02 a	\$	2,042,763	\$	2,042,763		_						3%	
Fringe Benefits	F-30, 03 a	\$	12,150,682	\$	12,150,682								18%	
Services	F-30, 04 a	\$	485,924	\$ ¢	485,924	¢		¢		¢ _	¢	_	1%	┢
		φ	33,321,100	φ	33,327,700	φ	-	φ	-	φ -	Ŷ	-	45/8	-
Vehicle Operations Materials and Supplie	es													
Fuel and Lubricants	F-30, 05 a	\$	4,415,030			\$	4,415,030						6%	
Tires and Tubes	F-30, 06 a	\$	3,317,787			\$	3,317,787						5%	
Utilities	F-30, 07 a	¢	3,116,176			¢ ¢	3,116,176						5%	
Casualty and Liability	F-30, 09 a	\$	1.117.216			φ \$	1.117.216						2%	
Taxes	F-30, 10 a	\$	-			•	, , -	\$	-				0%	
Miscellaneous	F-30, 13 a	\$	5,749,584					\$	5,749,584				8%	
Expense Transfers	F-30, 14 a	\$	47 000 054	¢		¢	10.050.007	¢	E 740 E94	¢	\$	-	0%	
Sub-rotal		Þ	17,000,201	¢	-	φ	12,030,007	φ	J,/49,J04	<b>р -</b>	ð	-	20%	
Vehicle Maintenance Labor													0	
Other Salaries and Wages	F-30, 02 b	\$	-			\$	-						0%	
Fringe Benefits	F-30, 03 b	\$	508,556			\$	508,556						1%	
Services	F-30, 04 b	\$	1,283,454	¢		\$	1,283,454	¢	_	¢ _	¢	_	2%	
		Ψ	1,752,010	Ψ		Ψ	1,752,010	Ψ	_	Ψ -	<b>•</b>		370	-
				1										
Vehicle Maintenance Materials and Supp	lies													I
Fuel and Lubricants	F-30, 05 b	\$	131,504			\$	131,504						0%	
Other Materials and Supplies	F-30, 06 D F-30, 07 b	¢ ¢	1,549,526			¢ 2	1,549,526						2% 3%	
Utilities	F-30, 08 b	\$				\$	-						0%	
Casualty & Liability	F-30, 09 b	\$	860,905			\$	860,905						1%	
Taxes	F-30, 10 b	\$	-			•		\$	-				0%	
Miscellaneous	F-30, 13 b	\$	-			\$	-				¢		0%	
Sub-Total	1-30, 14 0	φ \$	4.432.431	\$	-	\$	4.432.431	\$	-	\$-	\$	-	6%	
			, - , -				, - , -			*			0%	
Non-Vehicle Maintenance Labor														
Other Salaries and Wages	F-30, 02 c	\$	-					\$	-				0%	
Fringe Benefits	F-30, 03 c F-30, 04 c	\$	144,673					\$ ¢	144,673				0%	
Sub-Total	1 30, 04 0	\$	432,482	\$	-	\$	-	\$	432,482	\$-	\$	-	1%	
Non-Vehicle Maintenance Materials and 3		¢	_					¢	_				0%	
Tires and Tubes	F-30, 06 c	\$	-					\$	-				0%	
Other Materials and Supplies	F-30, 07 c	\$	3,752,300					\$	3,752,300				5%	
Utilities	F-30, 08 c	\$	-					\$	-				0%	
Casualty & Liability	F-30, 09 c	\$	-					\$	-				0%	
Taxes Miscellaneous	F-30, 10 C	¢ ¢	- 488 122					¢ ¢	- 488 122				0% 1%	
Expense Transfer	F-30, 14 c	\$						Ψ \$			\$	-	0%	
Sub-Total	,	\$	4,240,423	\$	-	\$	-	\$	4,240,423	\$-	\$	-	6%	
		\$	4,672,905								Γ		7%	
General Administration		¢	2 /10 264					¢	2 /10 26/				E0/	
Fringe Benefits	F-30, 02 d F-30, 03 d	Ф \$	3,410,364					ֆ Տ	3,410,364				5% 3%	
Services	F-30, 04 d	\$	474,294					\$	474,294				1%	
Fuel and Lubricants	F-30, 05 d	\$	-					\$	-				0%	
Tires and Tubes	F-30, 06 d	\$	- 					\$	· ·				0%	
Other Materials and Supplies	F-30, 07 d	\$	115,150					\$ ¢	115,150				0%	
Casualty and Liability	F-30, 08 d F-30, 09 d	\$ \$	- 12 434					ֆ Տ	- 12 434				0%	
Taxes	F-30, 10 d	\$	-					\$	-				0%	
Miscellaneous Expense	F-30, 13 d	\$	420,705					\$	420,705				1%	
Expense Transfers	F-30, 14 d	\$	-			*		\$	-	<b>^</b>	\$	-	0%	L
Sub-Total		\$	6,339,225	\$	-	\$	-	\$	6,339,225	\$-	\$	-	9%	-
TOTAL		\$	68,564,529	\$	33,527,708	\$	18,275.107	\$	16,761,714	\$ -	\$	-	100%	
Percent		Ĺ	,,								Ť			F
		1				~	o o '	~						
UNITS PER Year				\$ ¢	637,280	\$	8,947,756	\$	198		¢	1.0000		┝
UNIT COST (September 2007 Dollars)		┢		\$	52.61	ې \$	2.04	<del>پ</del> \$	84.513		۹ \$	-		┢──
	I	1		1		*		*	,		1			•

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#### Table 3-3: MTA Bus O&M Cost Model

## Maryland Mass Transit Administration Motor Bus Operating Cost Model

Based on 2003-2005 Submittals to National Transit Database NTD ID: 3034 Mode: MB Service: DO

September 2007 Dollars 1.0000

## 1. Cost Allocation Model (In September 2007 Dollars)

2003-2005 Average Expenses

2003-2005 Average Expenses	1	Annual Cost	Ι Δηηι	ıal (	Cost & Attrib	utic	n		I I
				ŝ	Scheduled	and		Exclusive	
	NTDB		Revenue-		Revenue-			Access Right-	
	Reference		Vehicle-Hours	Ve	hicle-Miles	Ре	ak Vehicles	of-Way Miles	% of Total
Vehicle Operations Labor									
	F-30, 01 a	\$ 50,811,771	\$ 50,811,771						24%
Other Salaries and Wages	F-30, 02 a	\$ 10,351,272	\$ 10,351,272						5%
Fringe Benefits	F-30, 03 a	\$ 40,917,192	\$ 40,917,192						20%
Services	F-30, 04 a	\$ 126,005	\$ 126,005	¢		¢		¢ _	0%
Sub-Total		\$ 102,200,240	\$ 102,200,240	φ	_	Ψ	_	Ψ -	4378
Vehicle Operations Materials and Sur	ı Dies								
Fuel and Lubricants	F-30, 05 a	\$ 10,132,703		\$	10,132,703				5%
Tires and Tubes	F-30, 06 a	\$ 1,000,131		\$	1,000,131				0%
Other Materials/Supplies	F-30, 07 a	\$ 151,752		\$	151,752				0%
Utilities	F-30, 08 a	\$-		\$	-				0%
Casualty and Liability	F-30, 09 a	\$-		\$	-				0%
Taxes	F-30, 10 a	\$-				\$	-		0%
Miscellaneous	F-30, 13 a	\$-				\$	-		0%
Expense Transfers	F-30, 14 a	Ŧ							0%
Sub-Total		\$ 11,284,586	\$-	\$	11,284,586	\$	-	\$-	5%
									0
Vehicle Maintenance Labor									
Other Salaries and Wages	F-30, 02 b	\$ 21,465,895		\$	21,465,895				10%
Fringe Benefits	F-30, 03 b	\$ 14,365,693		\$	14,365,693				7%
Services	F-30, 04 b	\$ 1,508,523		\$	1,508,523				1%
Sub-Total		\$ 37,340,111	\$-	\$	37,340,111	\$	-	\$-	18%
Vehicle Maintenance Materials and Su	upplies								
Fuel and Lubricants	F-30, 05 b	\$ 689,368		\$	689,368				0%
Tires and Tubes	F-30, 06 b	\$-		\$	-				0%
Other Materials and Supplies	F-30, 07 b	\$ 17,102,142		\$	17,102,142				8%
Utilities	F-30, 08 b	\$-		\$	-				0%
Casualty & Liability	F-30, 09 b	\$ 384,350		\$	384,350				0%
Taxes	F-30, 10 b	\$-				\$	-		0%
Miscellaneous	F-30, 13 b	\$-		\$	-				0%
Expense Transfer	F-30, 14 b								0%
Sub-Total		\$ 18,175,860	\$-	\$	18,175,860	\$	-	\$-	9%
									0%
Non-Vehicle Maintenance Labor									
Other Salaries and Wages	F-30, 02 c	\$ 2,698,616				\$	2,698,616		1%
Fringe Benefits	F-30, 03 c	\$ 1,805,972				\$	1,805,972		1%
Services	F-30, 04 c	\$ 1,136,536	•	•		\$	1,136,536	•	1%
Sub-l otal		\$ 5,641,124	\$-	\$	-	\$	5,641,124	\$-	3%
Non-Vohicle Maintenance Materials a	nd Supplies								
Fuel and Lubricante		¢				¢			00/
	F-30, 05 C	ъ - с				¢	-		0%
Other Materials and Supplies		φ - \$ 1.076.047				¢ D	-		U%
	F-30, 07 C	\$ 1,076,217 ¢				¢	1,070,217		1%
Cocupity & Liphility		φ - ¢ 404.070				¢ ¢	-		0%
	F-30, 09 C	\$ 401,073				¢ D	401,073		0%
Niscollapoous	F-30, 10 C	ф -				φ Φ	-		0%
Expanse Transfer	F-30, 13 C	φ - ¢ -				φ Φ	-		0%
Sub-Total	F-30, 14 C	φ - <b>\$</b> 1 <i>4</i> 77 200	¢ _	¢	_	φ \$	-	¢ _	0 /8 1%
		\$ 7 118 414	Ψ -	Ψ		Ψ	1,477,230	Ψ -	3%
General Administration		ψ <i>1</i> ,110,414							370
Other Salaries and Wages	F-30 02 d	\$ 17 406 625				¢	17 406 625		Q0/_
Fringe Benefits	F-30 03 d	\$ 11 643 380				Ψ \$	11 643 380		6%
Services	F-30 04 d	\$ 5 507 584				ŝ.	5,507 584		3%
Fuel and Lubricants	F-30 05 d	\$ -				÷	0,007		0%
Tires and Tubes	F-30_06 d	\$ -				ŝ	-		0%
Other Materials and Supplies	F-30, 07 d	\$ 2.326 235				ŝ	2,326,235		1%
Utilities	F-30 08 d	\$ 3,712,963				\$	3,712,963		2%
Casualty and Liability	F-30, 09 d	\$ 3,433,818				\$	3,433,818		2%
Taxes	F-30 10 d	\$ -				ŝ	-		0%
Miscellaneous Expense	F-30 13 d	\$ 2,666 748				ŝ	2,666 748		1%
Expense Transfers	F-30 14 d	\$ (13,314,853)				ŝ	(13,314 853)		-6%
Sub-Total	1 00, 140	\$ 33.382.508	\$-	\$	-	\$	33,382,508	\$ -	16%
		+ 00,002,000	•	¥		¥		<b>•</b>	1070
TOTAL		\$ 209,507.719	\$ 102,206.240	\$	66,800.557	\$	40,500.922	\$ -	100%
Percent		,,,		7		7	.,		
Units Per Year			1,746,564		19,590,300		598		
UNIT COST (September 2007 Dollars)	)		\$ 58.52	\$	3.41	\$	67,727		

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## Table 3-4: MTA Light Rail O&M Cost Model

## Maryland Mass Transit Administration Light Rail Operating Cost Model

Based on 2003-2005 Sumbittals to National	Transit Database	I	NTD ID: 3034	Mode: LR	Service: DO
September 2007 Dollars		1.0000	based on Consume	er Price Index for al	l urban items in TBD!!!

# 1. Cost Allocation Model (In Year of Expenditure Dollars) 2003-2005 Average Expenses

				1	Annual Cost & Att	ribution		
	NTDB Reference	Annual Cost	Train-Revenue-Hours	Sch	eduled Revenue Car-Miles	Peak Vehicles	Track-Miles	% of Total
Vehicle Operations Labor								
Operator Salaries and Wages	F-30, 01 a	\$ 3,304,988	\$ 3,304,988					8%
Other Salaries and Wages	F-30, 02 a	\$ 6,280,827 \$ 6,415,100	\$ 6,280,827 \$ 6,415,100		1			16% 16%
Services	F-30, 03 a	\$ 0,415,199 \$ 2,077,669	\$ 0,415,199 \$ 2,077,669		I			5%
Sub-Total	1 00, 04 0	<b>\$ 18,078,684</b>	<b>\$ 18,078,684</b>	\$	-	\$-	\$-	46%
Vehicle Operations Materials and Supplie		¢ 9,650		¢	9 650			09/
Tires and Tubes	F-30,05 a	\$ 0,009 \$ -		φ \$	0,039 -			0%
Other Materials/Supplies	F-30, 07 a	\$ 11.279		\$	11,279			0%
Utilities	F-30, 08 a	\$ 1,775,988		\$	1,775,988			5%
Casualty and Liability	F-30, 09 a	\$ -		\$	-			0%
Taxes	F-30, 10 a	\$ -				\$ -		0%
Miscellaneous	F-30, 13 a	\$ - ¢				\$ -		0%
Sub-Total	1-30, 14 a	\$ 1,795,926	\$-	\$	1,795,926	\$ -	\$ -	5%
		\$ 19,874,609				•		
Vehicle Maintenance Labor								
Other Salaries and Wages	F-30, 02 b	\$ 2,912,149		\$	2,912,149			7%
Fringe Benefits	F-30, 03 D	\$ 1,947,664 \$ 160,546		\$ ¢	1,947,664			5% 0%
Services	F-30, 04 D	<b>\$ 5.029.358</b>	\$ -	۹ \$	5.029.358	\$ -	\$ -	13%
		+ 0,020,000	+	Ŧ	0,020,000	•	Ŧ	
Vehicle Maintenance Materials and Supp		¢ 00.040		¢	00.040			00/
Fuel and Lubricants	F-30, 05 D	\$ 38,319 ¢		\$ ¢	38,319			0%
Other Materials and Supplies	F-30, 07 b	\$ 1.986.680		φ \$	1.986.680			0 % 5%
Utilities	F-30, 08 b	\$ -		\$	-			0%
Casualty & Liability	F-30, 09 b	\$ 405,963		\$	405,963			1%
Taxes	F-30, 10 b	\$ -				\$ -		0%
Miscellaneous	F-30, 13 b	\$ -		\$	-			0%
Expense Transfer	F-30, 14 D	३ \$ 2,430,962	s -	\$	2 430 962	\$ -	\$ -	0%
		\$ 7,460,320	÷	Ŷ	2,100,002	•	Ŷ	070
Non-Vehicle Maintenance Labor								
Other Salaries and Wages	F-30, 02 c	\$ 3,926,243					\$ 3,926,243	10%
Fringe Benefits	F-30, 03 c	\$ 2,626,124					\$ 2,626,124	7%
Sub-Total	F-30, 04 C	\$ 2,619,822 \$ 9,172,188	<b>\$</b> -	\$	-	\$ -	\$ 2,619,822 \$ 9,172,188	7% <b>24%</b>
		¢ 0,112,100	÷	Ŷ		•	¢ 0,112,100	2170
Non-Vehicle Maintenance Materials and	Supplies	<u>_</u>					•	
Fuel and Lubricants	F-30, 05 C	\$ - ¢					\$ - ¢	0%
Other Materials and Supplies	F-30,00 C	φ \$ 333.626					φ \$333.626	0 % 1%
Utilities	F-30, 08 c	\$ -					\$ -	0%
Casualty & Liability	F-30, 09 c	\$ 71,524					\$ 71,524	0%
Taxes	F-30, 10 c	\$ -					\$ -	0%
Miscellaneous	F-30, 13 c	\$ -					\$ -	0%
Expense Transfer	F-30, 14 C	३ \$ 405,151	<b>\$</b> -	\$	-	<b>\$</b> -	\$ 405,151	0% <b>1%</b>
		\$ 9,577,339	Ŷ	Ψ		Ŷ	φ <del>1</del> 00,101	170
General Administration		, ,						
Other Salaries and Wages	F-30, 02 d	\$ 728,362				\$ 728,362		2%
Fringe Benefits	F-30, 03 d	\$ 486,768				\$ 486,768		1%
Services	F-30, 04 d	\$ 539,575				\$ 539,575		1%
Fuel and Lubricants	F-30, 05 d	ф -				\$ - ¢ _		0%
Other Materials and Supplies	F-30, 07 d	\$ 224,490				\$ 224.490		1%
Utilities	F-30, 08 d	\$ 655,629				\$ 655,629		2%
Casualty and Liability	F-30, 09 d	\$ 302,188				\$ 302,188		1%
Taxes	F-30, 10 d	\$ -				\$ -		0%
IVIISCEIIANEOUS EXPENSE	F-30, 13 d	\$ 259,402 \$ (1.224.001)				<ul> <li>३ 259,402</li> <li>\$ (1.224.001)</li> </ul>		1%
Sub-Total	1 -30, 14 u	<b>\$ 1,972.323</b>	\$-	\$	-	<b>\$</b> 1,972.323	\$ -	-3% <b>5%</b>
TOTAL		\$ 38,884,591	\$ 18,078,684	\$	9,256,245	\$ 1,972,323	\$ 9,577,339	100%
Percent								
Units Per Year			129.777	I	2.111.865	31	57.6	
Unit Costs			\$ 139.31	\$	4.38	\$ 62,946	<u>\$ 16</u> 6,273	
			\$ 139.31	\$	4.38	\$ 62,946	\$ 166,273	
Average 2003-2005 (September 2007 Dol	lars)		\$ 160.63	\$	5.05	\$ 72,581	\$ 191,724	

N	lontgomery County Transit Validation	Peak Buses	Revenue Vehicle Miles	Revenue Vehicle Hours	Estimated Costs Using Model (Inflated to September 2007 Dollars)	Actual Cost (YOE Dollars)	Inflation Factors	Actual Cost (2007 Dollars)	Difference	Difference %
	Average 2003-2005									
	(Cost Model)	198	8,947,756	637,280	68,564,529	NA	-	68,564,529	-	0%
	2005 (in Model)	207	9,777,269	720,090	75,347,878	66,244,516	1.08	71,373,431	3,974,447	5%
	2004 (in Model)	195	8,512,353	664,930	68,848,227	64,036,866	1.12	71,750,059	(2,901,832)	-4%
	2003 (in Model)	193	8,553,646	526,820	61,497,483	54,264,152	1.15	62,570,098	(1,072,615)	-2%

## Table 3-5: Montgomery County Transit Bus Validation

#### Table 3-6: MTA Bus Validation

Maryland MTA Bus Validation	Peak Buses	Revenue Vehicle Miles	Revenue Vehicle Hours	Estimated Costs Using Model (Inflated to September 2007 Dollars)	Actual Cost (YOE Dollars)	Inflation Factors	Actual Cost (2007 Dollars)	Difference	Difference %
Average 2003-2005				, , , , , , , , , , , , , , , , , , ,	·		· · · · ·		
(Cost Model)	598	19,590,300	1,746,564	209,507,719	NA	-	209,507,719	-	0%
2005 (in Model)	577	19,685,513	1,771,229	209,853,449	198,452,825	1.08	213,817,837	(3,964,388)	-2%
2004 (in Model)	606	19,839,810	1,748,322	211,003,192	177,251,647	1.12	198,601,475	12,401,717	6%
2003 (in Model)	611	19,245,577	1,720,142	207,666,516	187,416,870	1.15	216,103,846	(8,437,330)	-4%

## Table 3-7: MTA Light Rail Validation

						Estimated Costs							Actual
						Using Model			Actual Cost			Actual Cost/	Cost/
	Peak Rail		Passenger Car			(Inflated to			(September			Passenger	Passenger
Maryland MTA Light Rail	Passenger	Passenger Car	Revenue	Track		September 2007	Actual Cost	Inflation	2007		Difference	Revenue	Revenue
Validation	Cars	<b>Revenue Miles</b>	Hours	Miles	Stations	Dollars)	(YOE Dollars)	Factors	Dollars)	Difference	%	Mile	Hour
2005	28	1,494,163	89,811	58	33	25,803,794	36,314,050	1.0774	39,125,629	(13,321,835)	-52%	26.19	435.64
2004	33	2,060,331	122,634	57.6	33	31,554,331	33,687,929	1.1204	37,745,615	(6,191,284)	-20%	18.32	307.79
2003 (Current Cost Model)	33	2,781,102	176,887	57.6	33	39,782,529	34,501,547	1.1531	39,782,529	-	0%	14.30	224.90

#### BRT GUIDEWAY AND STATION COSTS

The fully allocated cost model prepared for the Light Rail system includes all costs associated with the existing MTA Light Rail System located in Baltimore, and thus can be used to project the operating and maintenance costs of both the rail service operation and the rail infrastructure, including the stations and guideway. The bus cost models, in contrast, do not account for the costs of stations, since the passenger facilities of the local and express bus networks are relatively minor. These models also do not include the costs of the BRT guideway, because the buses operate on public streets that are not maintained by the transit system. A BRT guideway, however, would most likely be maintained by the transit system. Methodologies thus have been prepared to capture the additional costs of stations and guideway maintenance for the BRT alternatives.

The methodology for estimating station and guideway cost for BRT systems is based on an analysis of costs for cities that report more than 10 miles of exclusive bus guideway in the National Transit Database. Table 3-8 provides NTD cost and operating information for these systems. Costs associated with maintaining exclusive right-of-way for buses vary greatly from system to system depending on 1) station spacing and scale, 2) whether the alignment is at, above or below grade, and 3) climate (which requires, for example, heating and snow removal), among other factors. Data availability also is limited because most bus systems do not report exclusive bus guideway maintenance separately from other non-vehicle maintenance expenditures. Based on 2005 NTD data for the eight systems shown in Table 3-8, the average value of the number of (full-time equivalent) non-vehicle maintenance employees per directional route mile of exclusive bus was 1.17.

Exclusive bus facility maintenance costs (for both the guideway and stations) were estimated by assuming an average of one maintenance employee per directional mile of exclusive bus right-of-way. Table 3-8 provides data from eight transit agencies that run buses in exclusive right-of-way. This data was used to find the average number of employees and average wages and fringe benefits per route mile. The average annual maintenance cost of \$79,642 per directional mile, as shown in the equation below.

Exclusive Bus Facility Maintenance Labor

= Directional route miles x staff per directional route mile x annual salaries and wages x (1+ fringe).

= Directional route miles x 1.17 staff per directional route mile x \$39,700.19 annual salary and wages x 1+0.643 (average fringe benefits)

= Directional route miles x \$79,642.

## Table 3-8: Cost and Operating Information for Cities with More Than Ten Miles of Exclusive Bus Guideway

2005	NTD ID	Non Rail Exclusive and Controlled ROW miles	Non-Vehicle Maintenance: Other Salaries and Wages	Non-Vehicle Maintenance: Fringe Benefits	Number of Full Time Employees + 1/2 of Part Time Employees	Average Annual Salaries and Wages per Mile	Ratio of Fringe Benefits to Wages	Total Average Salaries and Fringe Per Exclusive ROW mile	Non-Vehicle Maintenance Employees per Exclusive Mile
Dallas, TX	6056	71.5	\$1,931,960	\$1,150,893	50.0	\$27,020.42	59.6%	\$43,116.83	0.70
Hartford, CT	1048	28.8	\$495,034	\$290,496	12.0	\$17,188.68	58.7%	\$27,275.35	0.42
Houston, TX	6008	200.7	\$5,261,281	\$3,514,585	145.2	\$26,214.65	66.8%	\$43,726.29	0.72
Madison, WI	5005	12.5	\$395,445	\$258,182	8.2	\$31,635.60	65.3%	\$52,290.16	0.66
Minneapolis-St Paul, MN	5027	232.0	\$3,305,415	\$2,348,913	83.0	\$14,247.48	71.1%	\$24,372.10	0.36
Pittsburgh, PA	3022	56.5	\$4,575,603	\$2,802,609	94.3	\$80,984.12	61.3%	\$130,587.82	1.67
San Juan, PR	4086	17.1	\$1,472,227	\$950,663	71.0	\$86,095.15	64.6%	\$141,689.47	4.15
Seattle, WA	0001	245.5	\$8,400,120	\$5,617,898	168.6	\$34,216.37	66.9%	\$57,099.87	0.69
Maryland MTA	3034	0.0	\$2,646,128	\$1,772,498	53.0	\$0.00	67.0%	\$0.00	0.00
Average*						\$39,700.31	64.3%	\$65,019.74	1.17

\* Does not include numbers from Maryland MTA

## COST ESTIMATES FOR PROJECT ALTERNATIVES

The estimate of costs for each alternative was determined by multiplying the unit costs by the number of vehicles, hours and miles of service, and in the case of light rail the one way track miles under each alternative. The fully burdened cost comes from adding together the costs generated by these factors as well as the factors for LRT or BRT guideway.

Total estimated costs for the alternatives are shown in Table 4-1, while they are shown graphically for comparison in Figure 4-1. Operating and Maintenance costs were lowest for the No-Build alternatives (\$43.0 million) and were highest for the LRT alternatives (\$74.1 million). The four main build alternatives – two BRT and two LRT – each had very similar levels of operating and maintenance costs, between \$69.9 and \$74.1 million annually.

	Total Cost
1 No Build Transit or Hwy	\$42,999,243
2 No Build Transit / Hwy B1	\$42,999,243
3 TSM / Hwy B1	\$57,792,604
4 LRT / Hwy B1	\$74,143,534
5 BRT / Hwy B1	\$69,858,047
6 LRT / Hwy B2	\$74,143,534
7 BRT / Hwy B2	\$69,858,047

Table 4-1: Annual O&M Costs by Alternative-All Modes

Figure 4-1: Annual Operating Cost by Alternative-All Modes



## LIGHT RAIL COSTS

Operating costs for the proposed light rail services are shown in Table 4-2. As the information shows, operating costs for the LRT alternatives 4 LRT / Hwy B1 and 6 LRT / Hwy B2 are identical.

	LRT Cost	Total Cost
4 LRT / Hwy B1	\$30,000,901	\$74,143,534
6 LRT / Hwy B2	\$30,000,901	\$74,143,534

#### Table 4-2: Annual O&M Costs by Alternative-Light Rail

## **BUS RAPID TRANSIT COSTS**

Operating costs for the proposed BRT services are shown in Table 4-3. The TSM alternative, while not a true BRT alternative, does have some costs assigned to BRT to reflect the enhanced bus service costs that are part of that alternative. As the information shows, the various bus-oriented alternatives vary widely in cost, from \$5.8 million for the TSM alternative, to \$17.9 million for both of the BRT alternatives.

## Table 4-3: Annual O&M Costs by Alternative-Bus Rapid Transit

	BRT Cost	Total Cost
3 TSM / Hwy B1	\$5,842,400	\$57,792,604
5 BRT / Hwy B1	\$17,907,843	\$69,858,047
7 BRT / Hwy B2	\$17,907,843	\$69,858,047

## FEEDER BUS COSTS

Operating costs for feeder bus service to be provided by Montgomery County Transit are illustrated in Table 4-4. The No Build alternatives had a background bus cost of \$43.0 million. The LRT and BRT alternatives increase the background bus costs, ranging from \$44.1 million for the LRT alternatives and almost \$52.0 million for the TSM and BRT alternatives.

## Table 4-4: Annual Feeder Bus O&M Costs by Alternative

	Background Bus Cost
1 No Build Transit or Hwy	\$42,999,243
2 No Build Transit / Hwy B1	\$42,999,243
3 TSM / Hwy B1	\$51,950,204
4 LRT / Hwy B1	\$44,142,633
5 BRT / Hwy B1	\$51,950,204
6 LRT / Hwy B2	\$44,142,633
7 BRT / Hwy B2	\$51,950,204

## INCREMENTAL COSTS OVER NO BUILD

Since the No Build operating cost sets the minimum operating cost of the services in the future even if no changes related to the proposed alternatives were implemented, the operating cost most relevant to the selection of an alternative is the incremental operating cost for each alternative over and above the estimated operating cost of the No Build Alternative. The costs for the TSM and each of the four build alternatives are shown in Table 4-5. As the table shows, the total incremental cost for the TSM alternative is the lowest, \$14.8 million above the No Build cost. The total incremental cost for the BRT alternatives is \$26.9 million, and this attributed to \$9.0 million in expanded feeder bus service costs and \$17.9 million in new BRT service costs. The total incremental cost for the LRT alternatives is \$31.1 million, and this is attributed to \$1.1 million in new feeder bus service costs and \$30.0 million in new LRT service costs.

	Background Bus Cost	BRT Cost	LRT Cost	Total Cost	Incremental Feeder Bus cost	Incremental BRT Cost	Incremental LR cost
3 TSM / Hwy B1	\$52.0	\$5.8		\$57.8	\$9.0	\$5.8	\$0.0
4 LRT / Hwy B1	\$44.1		\$30.0	\$74.1	\$1.1	\$0.0	\$30.0
5 BRT / Hwy B1	\$52.0	\$17.9		\$69.9	\$9.0	\$17.9	\$0.0
6 LRT / Hwy B2	\$44.1		\$30.0	\$74.1	\$1.1	\$0.0	\$30.0
7 BRT / Hwy B2	\$52.0	\$17.9		\$69.9	\$9.0	\$17.9	\$0.0

## Table 4-5: Incremental Annual O&M Costs Compared to the No-Build by Alternative

Note: All costs in Millions of 2007 dollars

## SENSITIVITY TESTING OF OPERATING AND MAINTENANCE COSTS

Two areas of operating and maintenance costs have experienced higher-than-inflation increases in recent years: fuels, energy and lubricants, and the costs of employee fringe benefits due to increasing costs in health care. The change in costs are shown in Table 5-1. For bus costs in fuels and lubricants, between 2000 and 2005 Montgomery County Transit increased 120.1 percent, and Maryland MTA increased by 111.1 percent. The utility costs for MTA light rail, however, only increased 16.0 percent in the same time period, but this also included a service volume decrease of 45 percent since 2000.

Fringe benefits have also increased between 2000 and 2005, although by varying degrees based on agency. Fringe benefits for Montgomery County Transit experienced a 78.6 percent increase in fringe benefit costs on 29.6% percent increase in service volume. Expenditures on fringe benefits increased for MTA's bus service by 37.1 percent, as against an increase in service volume of less than 13 percent. MTA's light rail system saw its costs for fringe benefits increase 160% over the same period while service volume decreased by more than 45% percent.

County Bus         Light Rail         Bus           Fuels and Lubricants Costs (all Categories)         2000         2,434,886         2,056,000         6,264,000           Categories)         2005         5,359,772         2,384,000         13,225,000           Percent Change         120.1%         16.0%         111.1%           Labor Fringe Benefits (all Categories)         2005         7,435,353         4,076,000         47,180,000           Categories)         2005         13,278,585         10,593,000         64,680,000           Percent Change         78.6%         159.9%         37.1%           Revenue Vehicle Hours of Service         2005         583,291         172,000         1,737,000           Percent Change         2005         931,216         90,000         1,922,000           Percent Change         2005         9,822,388         2,736,000         20,828,000           Service         2005         12,729,004         1,494,000         23,493,000           Percent Change         2005         12,729,004         1,494,000         23,493,000           Service         2005         12,729,004         1,494,000         23,493,000           Percent Change         29,6%         -45.5%         12.8%	Corridor Cities		Montgomery	Maryland MTA	Maryland MTA
Fuels and Lubricants Costs (all Categories)         2000 2005         2,434,886         2,056,000         6,264,000           Percent Change         120.1%         16.0%         13,225,000           Labor Fringe Benefits (all Categories)         2000         7,435,353         4,076,000         47,180,000           Categories)         2005         13,278,585         10,593,000         64,680,000           Percent Change         78.6%         159.9%         37.1%           Revenue Vehicle Hours of Service         2000         583,291         172,000         1,737,000           Percent Change         2000         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           Percent Change         2000         12,729,004         1,494,000         23,493,000           Percent Change         2005         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours or sonice)         31.3%         -45.5%         12.6%			County Bus	Light Rail	Bus
Categories)         2000         2,434,886         2,056,000         6,264,000           Percent Change         120.1%         16.0%         111.1%           Labor Fringe Benefits (all Categories)         2000         7,435,353         4,076,000         47,180,000           Percent Change         2005         13,278,585         10,593,000         64,680,000           Percent Change         78.6%         159.9%         37.1%           Revenue Vehicle Hours of Service         2005         583,291         172,000         1,737,000           Percent Change         2000         583,291         172,000         1,922,000           Percent Change         2000         583,291         172,000         1,922,000           Percent Change         2000         9,822,388         2,736,000         20,828,000           Service         2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours or d miles of service)         31.3%         -45.5%         12.6%	Fuels and Lubricants Costs (all				
Categories)         2005         5,359,772         2,384,000         13,225,000           Percent Change         120.1%         16.0%         111.1%           Labor Fringe Benefits (all Categories)         2000         7,435,353         4,076,000         47,180,000           Percent Change         78.6%         10,593,000         64,680,000           Percent Change         78.6%         159.9%         37.1%           Revenue Vehicle Hours of Service         2005         583,291         172,000         1,737,000           Percent Change         2005         931,216         90,000         1,922,000           Percent Change         2005         9,822,388         2,736,000         20,828,000           Service         2005         12,729,004         1,494,000         23,493,000           Percent Change         2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours ord miles of service)         31.3%         -45.5%         12.6%	Categories)	2000	2,434,886	2,056,000	6,264,000
Percent Change         120.1%         16.0%         111.1%           Labor Fringe Benefits (all Categories)         2000         7,435,353         4,076,000         47,180,000           Percent Change         13,278,585         10,593,000         64,680,000           Percent Change         78.6%         159.9%         37.1%           Revenue Vehicle Hours of Service         2000         583,291         172,000         1,737,000           Percent Change         2005         931,216         90,000         1,922,000           Percent Change         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           Percent Change         2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours ond miles of service)         31.3%         -45.5%         12.6%	Calegolies)	2005	5,359,772	2,384,000	13,225,000
Labor Fringe Benefits (all Categories)         2000         7,435,353         4,076,000         47,180,000           Percent Change         13,278,585         10,593,000         64,680,000         78.6%         159.9%         37.1%           Revenue Vehicle Hours of Service         2000         583,291         172,000         1,737,000           Percent Change         2000         583,291         172,000         1,922,000           Percent Change         2000         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           Percent Change         2000         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue vehicle hours and milos of service)         31.3%         -45.5%         12.6%	Percent Change		120.1%	16.0%	111.1%
Categories)       2000       7,435,353       4,076,000       47,180,000         Categories)       2005       13,278,585       10,593,000       64,680,000         Percent Change       78.6%       159.9%       37.1%         Revenue Vehicle Hours of Service       2000       583,291       172,000       1,737,000         Percent Change       2005       931,216       90,000       1,922,000         Percent Change       59.6%       -47.7%       10.7%         Revenue Vehicle Miles of Service       2000       9,822,388       2,736,000       20,828,000         Percent Change       2005       12,729,004       1,494,000       23,493,000         Percent Change       31.3%       -45.5%       12.6%	Labor Fringe Benefits (all				
Contegories/         2005         13,278,585         10,593,000         64,680,000           Percent Change         78.6%         159.9%         37.1%           Revenue Vehicle Hours of Service         2000         583,291         172,000         1,737,000           Percent Change         2005         931,216         90,000         1,922,000           Percent Change         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           Percent Change         2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours and milos of service)         31.3%         -45.5%         12.6%	Categories)	2000	7,435,353	4,076,000	47,180,000
Percent Change         78.6%         159.9%         37.1%           Revenue Vehicle Hours of Service         2000         583,291         172,000         1,737,000           Percent Change         2005         931,216         90,000         1,922,000           Percent Change         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           Percent Change         2005         12,729,004         1,494,000         23,493,000           Percent Change         31.3%         -45.5%         12.6%	Calegones)	2005	13,278,585	10,593,000	64,680,000
Revenue Vehicle Hours of Service         2000         583,291         172,000         1,737,000           Percent Change         2005         931,216         90,000         1,922,000           Percent Change         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           Percent Change         2000         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours and milos of service)         31.3%         -45.5%         12.6%	Percent Change		78.6%	159.9%	37.1%
Contract vehicle vehicle rights of service         2000         583,291         172,000         1,737,000           Service         2005         931,216         90,000         1,922,000           Percent Change         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2005         9,822,388         2,736,000         20,828,000           Percent Change         2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue vehicle hours and milor of service)         31.3%         -45.5%         12.6%	Revenue Vehicle Hours of				
2005         931,216         90,000         1,922,000           Percent Change         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           Percent Change         2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours and milos of service)         31.3%         -45.5%         12.6%	Service	2000	583,291	172,000	1,737,000
Percent Change         59.6%         -47.7%         10.7%           Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours and milor of service)         31.3%         -45.5%         12.6%		2005	931,216	90,000	1,922,000
Revenue Vehicle Miles of Service         2000         9,822,388         2,736,000         20,828,000           2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours and milor of service)         31.3%         -45.5%         12.6%	Percent Change		59.6%	-47.7%	10.7%
Service         2000         9,822,388         2,736,000         20,828,000           2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours and milor of service)         31.3%         -45.5%         12.6%	Revenue Vehicle Miles of				
2005         12,729,004         1,494,000         23,493,000           Percent Change         29.6%         -45.4%         12.8%           Combined Percentage Change (revenue revenue vehicle hours and milos of service)         31.3%         -45.5%         12.6%	Service	2000	9,822,388	2,736,000	20,828,000
Percent Change29.6%-45.4%12.8%Combined Percentage Change31.3%-45.5%12.6%(revenue revenue vehicle hoursand milos of service)12.6%		2005	12,729,004	1,494,000	23,493,000
Combined Percentage Change 31.3% -45.5% 12.6% (revenue revenue vehicle hours and milor of convice)	Percent Change		29.6%	-45.4%	12.8%
(revenue revenue vehicle hours	Combined Percentage Change		31.3%	-45.5%	12.6%
and miles of service)	(revenue revenue vehicle hours				
	and miles of service)				

Table 5-1: Increases in	Fuel-Lubrication	and Labor	Fringe Ben	efit Costs, 2	2000 to 2006,
Compared to Service V	/olume Increase in	n terms of R	evenue Ve	hicle Hours	and Miles of
Service					

Source: NTD, 2000 and 2005

The fully allocated O&M cost model allows for testing of the sensitivity of the cost estimates to extraordinary changes in any cost categories, including effects of extraordinary and superinflationary increases in energy and fringe benefit costs. Table 5-2 shows the level of expenditure and percent of total costs represented by fuel and fringe benefits.

Table 5-2: Fuels-Fluids	and	Fringe	Benefits	Cost	and	Percentage	of	Total	Costs,	2003-
2005 Average		-				-				

	Montgomery	Maryland MTA	Maryland MTA
	<b>County Transit</b>	Light Rail	Bus
Fuel and Lubricants (All Categories) -	\$4,415,030	\$1,775,988	\$10,132,703
Annual Cost		(utilities)	
Percent of Total Costs	6.4%	4.6%	4.8%
Fringe Benefits (All Categories) -	\$14,710,189	\$11,475,755	\$68,732,245
Annual Cost			
Percent of Total Costs	21.5%	29.5%	32.8%

Source: NTD 2003-2005

The cost of fuel and lubricants represents 6.4 percent of Montgomery County Transit's overall operating cost. For Maryland MTA bus fringe benefits are less than five percent of the operating cost, while the cost of utilities for the Maryland MTA Light Rail system likewise is under 5 percent of total cost (fuels and fluids are more significant for the Montgomery County system at 13 percent). This means that, for the bus and light rail systems, a 1 percent increase in fuel costs would translate to only a 0.045-0.06 percent increase in total operating costs amongst the agencies. Put another way, it would take 16-22 percent increase in fuel costs to represent a 1 percent increase in overall operating and maintenance costs. Predicting the future price of motor fuels and lubvricants, and the effects of higher fuel prices on the cost of other elements of a bus operation, is difficult. However, it is important to note that while the trend in fuel prices in the past five years has been upward, the trend during most of the previous 20 years, when adjusting for inflation, had been generally down, and that the price of oil has only recently (March 2008) reached the all time inflation adjusted price peaks of the early 1980s.

Fringe benefits are a much more significant portion of overall costs, representing between 21.5 and 32.8 percent of total costs depending on the agency. This means that a 1 percent increase in fringe benefits costs would increase overall costs by 0.2-0.3 percent; or, about a 2-3 percent increase in fringe benefit prices would result in a 1 percent increase in overall costs. Medical care, the largest element of fringe benefits, has been rising at rates higher than inflation for many years, and can be expected to continue to do so in the future, making it very likely that this important element of operating costs will increase at a rate higher than the background rate of inflation in the future.