CAMBRIDGE SYSTEMATICS

Economic Impact from Maryland's Surface Transportation Spending

1997-2006

final

report

prepared for

Maryland Transportation Commission

prepared by

Economic Development Research Group, Inc.

in association with

Cambridge Systematics, Inc.

September 2006

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Table of Contents

List of Tables

List of Tables
(continued)

List of Figures

Executive Summary

Background

Maryland's surface transportation system of highways and transit plays a vital role in the state economy, enabling the efficient flow of people and goods to, from, and within the State. These facilities and services are continuously improved and maintained through the development and implementation of the *Maryland Transportation Plan* (a long-range vision of the State's anticipated transportation needs) and the annual *Consolidated Transportation Program (CTP)*, which lists and describes capital investments that are budgeted over a six-year period. Since the State's population and economic bases are constantly changing, it is important to examine the way in which public spending on transportation investments affects the economy.

Accordingly, the Maryland Transportation Commission has led a study of the statewide economic implications associated with surface transportation investments from 1997 through 2006.[1] While there are many forms of economic impacts, this study focused on two issues: 1) the way in which MDOT's highway and transit spending flow through the State's economy, and 2) the number of jobs created by MDOT's spending on construction, maintenance, and operation of transportation facilities across the State.

Impacts of State Spending on Highways

The State Highway Administration's (SHA) program of spending over the 1997-2006 period totals $9.3 billion, in inflation[2]-adjusted dollars. This covers SHA payroll (21 percent), operations and maintenance activities (14 percent), and capital projects (65 percent). The flow of these dollars to SHA workers and to supplier businesses leads to additional spending in the economy, which ultimately has a total impact of $23.4 billion in Maryland business activity (output). That includes $7.8 billion in labor income to Maryland workers and supports an average of 17,007 jobs each year over the 10-year

[1] The earlier study by RESI at Towson State University covered economic impacts of highway spending over the 1991-1996 period. This study focuses on the 1997-2006 period. The earlier study did not cover public transit spending, though it also did examine inferred productivity benefits of highway spending. State-of-the-practice economic modeling methods and MDOT's spending program have both changed since that time.

[2] All dollar figures are expressed in year 2004 dollars.

period. (The job total includes 3,279 SHA jobs plus additional jobs associated with supplier businesses and respending of worker income.) This also means that each dollar of state highway spending is associated with a total of $2.50 circulating in Maryland's economy.

Impacts of State Spending on Maryland Public Transit

Adjusting all figures for inflation, the Maryland Transit Administration program of spending over the 1997-2006 period totals $5.9 billion. This covers the MTA's payroll (32 percent), operations and maintenance activities (30 percent), and capital projects (38 percent). The flow of these dollars to MTA workers who are residents and to supplier businesses leads to additional spending in the economy which ultimately has a total impact of $11.7 billion in business activity (sales or output). That includes $4.2 billion in labor income to Maryland workers and supports an average of 8,167 jobs each year over the 10-year period. The job total includes 2,954 MTA jobs plus additional jobs associated with businesses which supply goods and services to the MTA and respending of worker income. This also means that each dollar of MTA transit spending is associated with a total of almost $2.00 circulating in Maryland's economy.

Impacts of Spending on WMATA

Expressed in similar inflation-adjusted dollars, Maryland's contribution toward the operating budget and capital program of the Washington Metropolitan Area Transit Authority (WMATA) over the 10-year interval is $4.9 billion. This supports 2,886 WMATA jobs held by Maryland residents each year on average. The flow of these dollars to WMATA workers and to supplier businesses leads to additional spending in the economy which ultimately has a total impact of $9.9 billion in Maryland business activity (output). That includes $4.1 billion in labor income to Maryland workers and supports an average of 7,529 Maryland jobs each year over the 10-year period. This also means that each dollar of spending for WMATA is associated with over $2.00 circulating in Maryland's economy.

Overall Impacts of MDOT Surface Transportation Spending

MDOT's combined highway and transit outlay towards surface transportation spending over the 1997-2006 period totals over $20.1 billion over 10 years (adjusting all figures for inflation). The statewide economic model used for this study indicates that this spending will generate a total of $44.9 billion of business output over the 10-year period. That

includes $16.1 billion in labor income flowing to Maryland workers and supports an average of over 32,703 jobs each year over the 10-year period. Each dollar of spending on surface transportation in Maryland is associated with over $2.20 circulating in Maryland's economy.

Table ES.1 Summary of the Total Impacts from MDOT Program Outlay Over 10 Years

(in Constant Year 2004 Dollars in Billions)

10-Year Total Impact	SHA	MTA	WMATA (Maryland Portion)	All Agencies
Direct Effect (Total Spending Budget)	$9.3	$5.9	$4.9	$20.1
Total Impact on Economic Output	$23.4	$11.7	$9.9	$44.9
Associated Impact on Jobs over 10 Years	170,068	81,672	75,288	327,028
(Average Jobs each Year)	(17,007)	(8,167)	(7,529)	(32,703)
Associated Impact on Labor Income	$7.8	$4.2	$4.1	$16.1

SHA: State Highway Administration.
MTA: Maryland Transit Administration.
WMATA: Washington Metropolitan Area Transit Authority.

1.0 Introduction

1.1 Background

Maryland's transportation systems create jobs and economic activity through the development and maintenance of various road, rail, air, and marine facilities as well as through the operating services provided for passenger and freight movements. The relationship is complex – a variety of different private providers and public agencies are responsible for these various activities and are involved in making expenditures and collecting revenues associated with them. The impact also is ubiquitous – together these transportation facilities and services touch every aspect of the state economy and the lives of all Maryland residents. There is virtually no element of the Maryland's economy that does not rely on the State's transportation system in order to function.

Maryland's transportation system investments are necessary for reasons of safety, efficiency, and economic competitiveness. These investments also provide a significant economic stimulus in creating jobs, boosting incomes, and spurring additional business activity. This study brings the facts and figures behind these investments to light, to underscore the value to the economy of continued support in the State's highways, transit systems, bikeways, walkways and trails – Maryland's surface transportation system.

1.2 Objective

This study focuses on the cumulative impact of the 1997-2006 capital and operating programs of the Maryland DOT, which includes the budget for its State Highway Administration (SHA), Maryland Transit Administration (MTA) and the subsidy it provides for the Washington Metropolitan Transit Authority (WMATA). It reflects changing priorities for both highway and public transit spending as presented in the Maryland Transportation Plan (a long-range vision of the State's anticipated transportation needs) and the annually updated *Consolidated Transportation Program (CTP)*, which lists and describes capital investments scheduled for construction over a six-year period. While there was an earlier study of the economic impact of state highway spending during the first half of the 1990s,[3] both the State's economic base and the planned transportation investment mix have changed since that time.

[3] *The Economic Impact of Maryland Highway Investment*, RESI at Towson State University, 1998. See Appendix A for comparison of this study to that earlier work.

1.3 Organization of the Study

This report is organized into six sections plus an appendix. This first section provides background information concerning the motivation and scope of this report. The next three sections cover the core analysis: Section 2.0 defines the economic impacts and methods used for analysis. Section 3.0 summarizes the highway and public transit spending budgets of Maryland DOT, which are the drivers of subsequent impacts on the economy. Section 4.0 then presents the analysis findings concerning the flow of dollars within the state economy and their implications for jobs and income within the State.

Section 5.0 provides a comparison of the relative size of public and private sector jobs in the State's transportation-related activities, including air and sea as well as surface (highway, transit, and railroad) modes. Section 6.0 discusses implications of the report findings. Finally, Appendix A compares findings from this study to those of the earlier report which covered a very different package of highway spending.

2.0 Definition and Methodology for Evaluating Economic Impacts

2.1 Types of Transportation Investments

The link between transportation investment and economic outcomes is multifaceted due to differences in the various types of investments and the types of economic outcomes.

We can distinguish *transportation investments* in terms of three categories:

1. **Development of New Facilities –** Including construction of right-of-way (e.g., highways, rail lines), terminals (freight and passenger), vehicles (trains, buses) and operating facilities (maintenance and traffic control equipment);

2. **Maintenance of Facilities and Equipment –** Including labor and materials needed for continued operation and upkeep (to preserve functionality and safety) of right-of-way, terminals, rolling stock, operating control facilities; and

3. **Operation of Services –** Including labor and materials needed for continued operation of bus-, rail-, truck-, or car-related transportation services as appropriate for transporting passengers and/or freight.

It also is important to distinguish public and private roles, which differ by mode. The development and upkeep of highway and roadway facilities is predominantly the responsibility of government, and the SHA carries out this responsibility for most major highways in the State, while local governments operate and maintain the local system. The MTA and WMATA operate most of the public transportation bus and all of the regional subway and light rail systems that Maryland residents use. County-run transit systems provide additional bus and shuttle services. However, Maryland's commuter rail system (MARC) operates on private railroad tracks through arrangements with Amtrak and CSX corporation. Trucking services, which use many public facilities to carry out their operations, are entirely the responsibility of private companies. While state funding of highway investments is focused primarily on capital projects, Maryland's funding for public transit includes a major emphasis on supporting continued operation of existing public transit services.

2.2 Types of Economic Impacts

We can distinguish *economic impacts* in terms of two categories:

1. **Spending Effect –** Tracing how MDOT spending on jobs, materials, and services generates a flow of dollars within the state economy as well as a flow of dollars to businesses outside of the State, which is called *leakage*. This distinction is important in showing how a transportation agency's spending supports businesses, jobs, and worker income within the State.

2. **Productivity and Competitiveness Effect –** Calculating how a given transportation investment program can affect system regional accessibility and mobility enough to affect operating costs and competitiveness for businesses in the State. This is only meaningful if compared to some realistic alternative scenario that would not improve system functionality.

This study focuses on the first of those two categories – how MDOT agency spending (SHA and MTA budgets, as well as WMATA support) generates additional sales, jobs, and wages in Maryland. The second category of impact is more appropriate for analysis when there are choices concerning long-term system quality, maintenance, or major capacity or accessibility improvements.

2.3 Elements of Spending Impacts

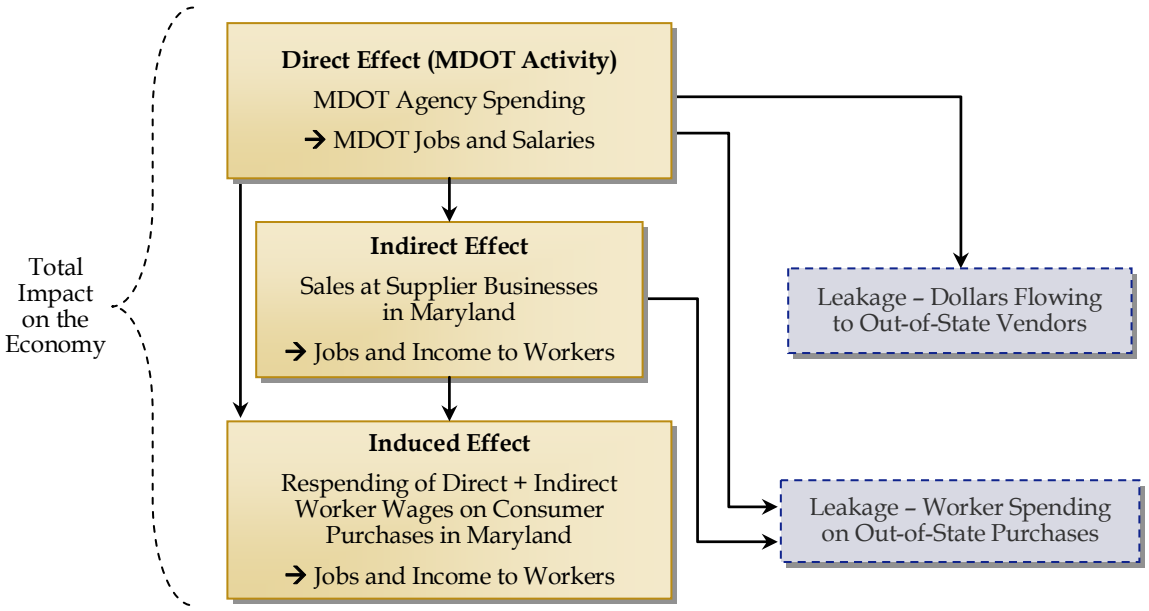
The economic impacts of state transportation spending occur as a consequence of a series of effects, as depicted in Figure 2.1. They fall into three categories:

1. **Direct Effects –** Maryland DOT spending on highways (through the SHA) and on public transit (through the MTA and WMATA expenditures) supports a) worker payroll and, b) orders to vendors for operations and maintenance materials and services, and c) orders to vendors for capital projects.

2. **Indirect Effects –** The extent to which direct spending on vendors supports Maryland suppliers and their workers, as well as other supporting businesses. An example of an indirect effect is a bus manufacturer, supplying buses to MTA, that subcontracts to a Maryland firm to build and install communications equipment. Expenditures which purchase out-of-state goods and services "leak" out of the state economy and are excluded from the benefits estimates (see Figure 2.1).

3. **Induced Effects –** Indirect effects are the portions of worker income, from the direct and indirect jobs occurring within Maryland, that are respent on consumer purchases and that support additional business activities within Maryland.

Figure 2.1 Generation of Economic Impacts Related to MDOT Activities



2.4 Data Sources

Data for this study were derived from the current employment, payroll and operating budgets of the State Highway Administration (SHA) and Maryland Transit Administration (MTA), as well as from previous and current budgets developed in Maryland's annual *Consolidated Transportation Program* (CTP). For transit expenditures, the State's share of capital and operating spending to support the Washington Metropolitan Area Transportation Authority's (WMATA) transit system and the spending for the Maryland Transit Administration (MTA) were accounted for separately in this analysis.

The portion of spending that flows to Maryland businesses and the portion of payroll and jobs going to Maryland residents were estimated on the basis of data from Maryland DOT and a statewide IMPLAN economic model (described in the next subsection). That same economic model also was used to estimate the extent of indirect and induced economic impacts on the state economy.

Additional information on statewide jobs associated with port, airport, and private transportation services is presented in Section 5.0, based on data from the U.S. Department of Commerce (County Business Patterns) and surveys by Martin Associates.

2.5 Impact Analysis Methodology

Economic Impact Model. The indirect and induced economic impacts of investments in Maryland's surface transportation system were estimated using the IMPLAN statewide input-output model for Maryland. IMPLAN is one of the most widely used analysis tools for measuring or estimating the economic impacts associated with plant openings, closings, expansion, contraction and expenditures related to new construction, and ongoing operations of infrastructure and facilities. It shares three fundamental features also found in the other two commonly used economic impact tools within the United States (RIMS-II and REMI):

1. It is based on the *national input-output technology tables*, developed by the U.S. Department of Commerce, Bureau of Economic Analysis. This shows how each type of industry relies on a different mix of its own labor and supplies as well as those purchased from other industries.

2. It is calibrated to reflect *local economic patterns* (of employment, payroll, business sales, and markets sold to) occurring within Maryland. This provides a *default* measure (which can be overwritten with more localized data if available) for each industry that quantifies the extent to which spending benefits other Maryland businesses or households.

3. It distinguishes the *direct effects* from *indirect and induced (spin-off) effects* and measures them in terms of jobs, income, value added, and business sales (output).

The Maryland IMPLAN model was calibrated with region-specific industry data. Besides containing a three-digit North American Industry Classification System (NAICS) code-based industry database (describing employment, sales, productivity, average compensation), the main capability of the IMPLAN model resides in its input-output core. The core combines the structure of relationships between industries, between industries and types of final demands arising in Maryland, the extent to which local suppliers (or conversely import dependence) meet local product demands, and Maryland businesses' role in trade with the rest of the world.

Analysis Assumptions. Several assumptions are used in preparing the raw data from SHA and MTA for use in the IMPLAN model. The assumptions either: a) restate a data input into an IMPLAN input (e.g., labor compensation, or *payroll,* is translated into take home pay), b) create more detail on the spending activities beyond what the raw data portrays, c) rescale dollar concepts (e.g., from dollars to thousands of dollars), or d) capture how much of agency spending is fulfilled by Maryland businesses instead of imports. The principal assumptions are:

- All dollar figures are restated in constant year 2004 dollars, based on inflation factors derived from the *Finance – Cost of Construction Index* series (provided in the MDOT Memorandum dated May 18, 2004).

- SHA/MTA/WMATA income after taxes is 70 percent of the wages paid.

- Ninety-five percent of SHA workers and 98.2 percent of MTA workers are residents of Maryland.

- SHA Capital Program spending data were detailed for the following activities: Planning/Engineering (P/E), Construction, and Right-of-Way (ROW). P/E activities were allocated between private engineering contracting firms and MDOT. For new road capital projects, 70 percent of the P/E activity was allocated to the engineering sector, and for most other types of SHA capital projects, 60 percent was allocated to the engineering sector. The balance of P/E under either case was assigned to DOT labor.

- MTA Capital Program spending data cover bus and rail vehicle purchases (from out-of-state) 15 and 12.4 percent respectively, equipment purchases, 19 percent, and a category of "Other purchases", 53.6 percent. This latter category was assigned predominantly to construction activities, 88.7 percent, and miscellaneous professional services (engineering, legal, environmental consulting, other business services) 5.0 percent, wholesale 3.6 percent and manufacturing, 2.7 percent.

- Maryland funding towards WMATA's Capital Program goes towards bus and rail vehicle purchases (from out-of-state) 8 and 5.5 percent respectively, construction activities, 61 percent, and equipment rehabilitation-repair, 25.5 percent.

- Maryland's operating subsidy to WMATA is allocated to various spending categories in the same proportions as the overall WMATA operating budget (using the FY 2005 detail).

- The Maryland IMPLAN model is calibrated with industry-specific "regional purchase coefficients," which describe the percentage of Maryland DOT vendor purchases that are supplied by Maryland businesses. These values are estimated on the basis of the State's economic mix and structure, and can be replaced when actual MDOT vendor data indicate a different rate of in-state purchasing. Rail car and bus purchases tied to either the MTA or WMATA capital programs are assumed to be filled entirely by out-of-state manufacturers. Table 2.1 shows MDOT's reliance on local purchases for select vendor industries. Each vendor category produces different amounts of additional spending or "spin-off" activity within the state.

Table 2.1 Allocation of MDOT In-State Vendor Spending to Economic Model

	Capital			O&M	
Select Vendors in Maryland	**SHA**	**MTA**	**WMATA**	**SHA**	**MTA**
Engineering Services	90%	-	-	-	-
Construction – *New Roads*	100%	-	-	-	-
Construction – Drainage	91%	-	-	-	-
Construction – Road Repair	-	-	-	100%	-
Construction – Maintenance/Repair	64%	-	-	64%	64%

Table 2.1 Allocation of MDOT In-State Vendor Spending to Economic Model (continued)

	Capital			O&M	
Select Vendors in Maryland	**SHA**	**MTA**	**WMATA**	**SHA**	**MTA**
Construction – Structure Maintenance/Repair	-	100%	-	-	-
Construction – Tunnels	-	100%	100%	-	-
Wholesale	72%	72%	-	-	-
Engine Equipment Manufacturing	-	78%	-	-	-
Instrument Manufacturing	-	93%	-	-	-
Bus Repair	-	-	3%	-	-
Communication Equip Repair	-	-	-	-	80%
Electrical Equipment Repair	-	-	67%	-	-
Facility Support Services	-	-	-	-	38%
Vehicle Repair (Except Autos)	-	-	-	-	90%

Note: Entries denoted with "-" indicate zero allocation based on mapping broad program spending categories to NAICs.

3.0 Public Spending on Surface Transportation Facilities and Services

The amount and composition of MDOT spending over the 10-year interval are described in this section. Working from historical as well as projected MDOT data (see appendix for the annual series), cumulative spending was analyzed in the Maryland IMPLAN model to determine the additional sales, jobs, and labor income generated from MDOT's surface transportation spending. Agency spending on right-of-way (RoW) purchases and *debt-servicing* are excluded from this analysis since those expenditures denote a transfer of income/property, not additional demand for the Maryland economy to garner.

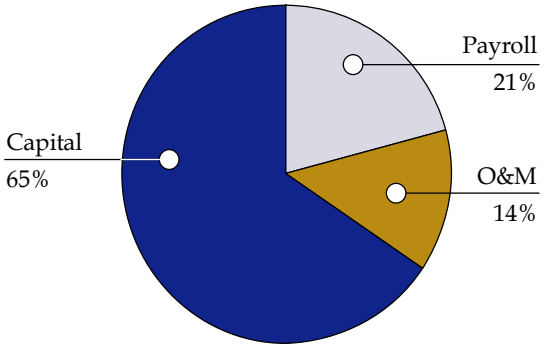
3.1 Composition of Spending

The composition of the projected spending over 1997-2006 is shown in Table 3.1 and is portrayed by program area in Figures 3.1 to 3.3. Table 3.6 below provides additional information about labor expenditures for operations and maintenance

Table 3.1 MDOT Surface Transportation Spending
1997-2006, in Constant 2004 Dollars (000s)

	(1997-2006) 10-Year Period		
	SHA	**MTA**	**WMATA**
Capital Projects	$7,256,049	$2,250,409	$2,010,143
Operating	$2,050,050	$3,717,057	$2,897,824
Total Expenditure	$9,306,099	$5,967,466	$4,907,967
Annual Average Totals	**$930,610**	**$596,747**	**$490,797**

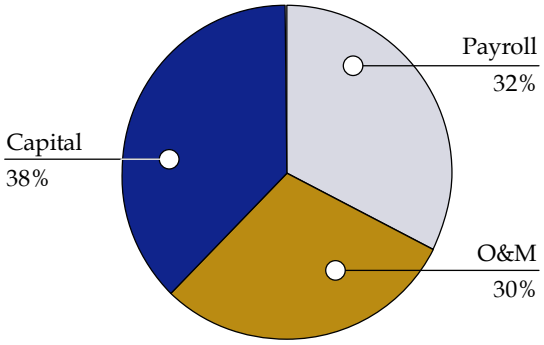
Figure 3.1 Profile of SHA Spending



Spending (Billions of Dollars)	Payroll	O&M (Nonlabor)	Capital*
SHA	$1.95	$1.25	$6.09

* Capital expense net of MDOT wages. Those wages are embedded under *Payroll*.

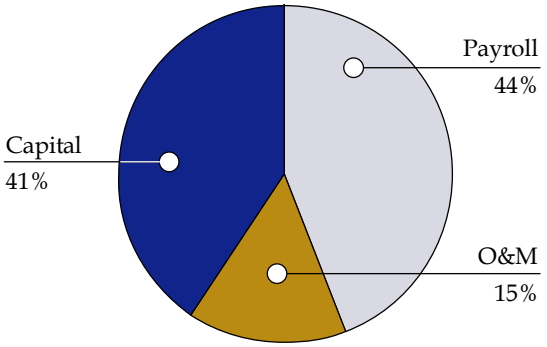
Figure 3.2 Profile of MTA Spending



Spending (Billions of Dollars)	Payroll	O&M (Nonlabor)	Capital*
MTA	$1.94	$1.79	$2.25

* Capital expense net of MDOT wages. Those wages are embedded under *Payroll*.

Figure 3.3 Profile of Maryland Contribution to WMATA



Spending (Billions of Dollars)	Payroll	O&M (Nonlabor)	Capital*
WMATA (Maryland Support)	$2.15	$0.74	$2.01

* Capital expense net of MDOT wages. Those wages are embedded under *Payroll*.

Payroll data reflect total compensation, which includes fringe benefits. Fringe benefits include health benefits and retirement contributions. Health benefits are treated differently than are wages and retirement income in the economic analysis. Once the health benefit is estimated it is modeled separately as in-state sales to health care and insurance providers. The take-home equivalents for pretax wages and pretax retirement contributions are assumed to reflect disposable household income for MDOT workers residing in Maryland. Several of the assumptions detailed in Section 2.0 address how the payroll data were adjusted.

For nonlabor spending by each agency, the impacts generated depend on how much of the initial MDOT purchases come from Maryland businesses. Table 3.2 shows the reliance on Maryland businesses to supply MDOT with the goods and services involved in investing in the surface transportation system.

Table 3.2 Portion of Vendor Spending Flowing within Maryland Economy

	SHA	MTA	WMATA
Nonwage Budget (Thousand 2004 Dollars)[a]	$7,355,292	$4,029,492	$2,754,804
Amount Retained in Maryland	$6,906,649	$2,678,253	$1,825,321
Percent Retained	93.9%	66.5%	66.3%

[a] Projected budget portion pertaining to capital and operations and maintenance (O&M) activities for 1997-2006, in constant 2004 dollars.

SHA spends more on in-state goods and services than does the MTA. This is largely the result of the nature of capital purchases made by highway *versus* transit programs and how much is purchased from out-of-state. The in-state spending on O&M is 71 percent for SHA and approximately 68 percent of the MTA and WMATA budgets.

3.2 Capital Program Spending

Details on the types of MTA and SHA capital projects undertaken between 1997-2006 are shown in Tables 3.3 and 3.4. These tables present the total investment and the allocation between Planning/Engineering activities (P/E) and Construction phases. For the SHA capital program, almost $1.2 billion is spent on P/E across all projects, and the remainder is for Construction.

Table 3.3 MTA Capital Project Spending
1997-2006, in Constant 2004 Dollars (000s)

	Planning/Engineering	Construction	Total excluding RoW
Agency	$66,911	$208,493	$275,404
Bus	$6,074	$300,885	$306,959
Freight	$16,214	$33,558	$49,772
Intermodal	$791	$51,133	$51,925
Local Area Transit System	$10,390	$198,349	$208,739
Light Rail	$47,933	$407,850	$455,783
MARC	$27,359	$464,890	$492,249
Metro	$30,422	$379,157	$409,579
Total	$206,094	$2,044,315	$2,250,410

As described in the discussion on assumptions in Section 2.0, the SHA capital program P/E budget was allocated between MDOT activities and private-sector contractor activities based on the type of capital project being funded. The MTA capital spending data by P/E and Construction phase were allocated to the following categories using MDOT's capital programming databases: bus purchase, equipment purchase, rail vehicle purchase, and "other" purchases.

For Maryland's contribution towards the WMATA capital program, all project dollars were designated for Construction phase activities with the exception of project development under the System Access Plan (SAP). Table 3.5 shows a breakdown of the estimated capital investments made by Maryland towards WMATA.

Table 3.4 SHA Capital Project Spending

Period of 1997-2006, in Constant Year 2004 Dollars (000s)

Fund	Sum Constant Dollars Series Over 10 Years	Phase
Primary Roads	**$1,060,434**	**Total**
	$177,161	Planning/Engineering
	$883,274	Construction
Secondary Roads	**$725,334**	**Total**
	$90,792	Planning/Engineering
	$634,542	Construction
Interstate	**$866,921**	**Total**
	$88,472	Planning/Engineering
	$778,449	Construction
Woodrow Wilson Bridge	**$855,865**	**Total**
	$102,106	Planning/Engineering
	$753,759	Construction
Environmental Projects	**$65,343**	**Total**
	$26,897	Planning/Engineering
	$38,446	Construction
Noise Barriers	**$178,233**	**Total**
	$20,683	Planning/Engineering
	$157,549	Construction
Drainage Improvement	**$53,807**	**Total**
	$19,283	Planning/Engineering
	$34,524	Construction
Rest Area	**$7,951**	**Total**
	$689	Planning/Engineering
	$7,262	Construction
Crash Prevention	**$9,475**	**Total**
	$3,916	Planning/Engineering
	$5,559	Construction
Pilot Program	**$14,675**	**Total**
	$242	Planning/Engineering
	$14,433	Construction
Guardrail End Treatment	**$8,988**	**Total**
	$2,422	Planning/Engineering
	$6,566	Construction
Emergency	**$18,094**	**Total**
	$1,657	Planning/Engineering
	$16,437	Construction
Safety and Spot Improvement	**$360,745**	**Total**
	$99,402	Planning/Engineering
	$261,343	Construction
Resurfacing and Rehabilitation	**$1,190,761**	**Total**
	$70,214	Planning/Engineering
	$1,120,547	Construction

Fund	Sum Constant Dollars Series Over 10 Years	Phase
Sidewalk Project	**$33,001**	**Total**
	$3,649	Planning/Engineering
	$29,352	Construction
Bridge Replacement/ Rehabilitation	**$630,459**	**Total**
	$87,619	Planning/Engineering
	$542,840	Construction
Commuter Action Improvement	**$22,823**	**Total**
	$4,436	Planning/Engineering
	$18,387	Construction
Urban Street Reconstruction	**$72,435**	**Total**
	$12,625	Planning/Engineering
	$59,810	Construction
Comm. Safety Enhancements	**$198,975**	**Total**
	$36,791	Planning/Engineering
	$162,184	Construction
Traffic Management	**$313,186**	**Total**
	$111,649	Planning/Engineering
	$201,537	Construction
CHART	**$120,293**	**Total**
	$28,512	Planning/Engineering
	$91,781	Construction
Intersection Capacity	**$35,665**	**Total**
	$13,079	Planning/Engineering
	$22,586	Construction
Bike Retrofit	**$6,777**	**Total**
	$712	Planning/Engineering
	$6,065	Construction
Highway Safety Facilities and Equipment	**$15,381**	**Total**
	$1,988	Planning/Engineering
	$13,393	Construction
Enhancements	**$96,494**	**Total**
	$7,534	Planning/Engineering
	$88,960	Construction
Facilities and Equipment	**$129,967**	**Total**
	$11,720	Planning/Engineering
	$118,247	Construction
Statewide Planning and Research	**$163,965**	**Total**
	$150,849	Planning/Engineering
	$13,115	Construction
Across All Funds	**$7,256,049**	**Total**

Table 3.5 WMATA Capital Project Spending
Period of 1997-2006, in Constant Year 2004 Dollars (000s)

WMATA Capital Detail	10-Year Outlay
Metrorail Construction	$1,231,295
Metrorail Equipment Rehabilitation and Replacement	$490,971
MetroBus Garage Rehabilitation	$227
MetroBus Purchase	$153,384
Local Bus Capital	$3,872
Parking Garage Shady Grove Metro Station	$2,268
Metrobus/Rail Repair Parts	$10,187
System Access Plan	$117,939
Total	**$2,010,143**

3.3 Operations and Maintenance Spending

Table 3.6 shows the actual and projected 10-year totals on operations and maintenance spending over the 1997-2006 period. As shown in the table, public transportation operations and maintenance spending is larger than for the highway program. Conversely, and as previously discussed, highway capital outlays are higher than those for transit.

Table 3.6 SHA and Transit Spending on Labor and Vendors for Operations and Maintenance
1997-2006, in Constant 2004 Dollars (000s)

	10-Year Expenditure
SHA	
Labor Compensation – O&M	$799,603
Major Contract Maintenance	$320,850
Other Contractual Services	$240,868
Other Operating Costs	$688,729
Total	**$2,050,050**

Table 3.6 SHA and Transit Spending on Labor and Vendors for Operations and Maintenance (continued)

1997-2006, in Constant 2004 Dollars (000s)

	10-Year Expenditure
MTA	
Labor Compensation	$1,937,974
Major Contract Maintenance	-
Other Contractual Services	$902,078
Other Operating Costs	$877,005
Total	**$3,717,057**
Maryland's Operations Subsidy to WMATA	
Labor Compensation	$2,153,163
Major Contract Maintenance	-
Other Contractual Services	$287,291
Other Operating Costs	$457,370
Total	**$2,897,824**

Note: MTA operating data and WMATA's Total Operating Budget detail for FY 2005 did not report a *contract maintenance* category for operating outlays. We assume that those expenditures are included in *Other Operating Costs*.

4.0 Impacts on Maryland's Economy

4.1 SHA-Related Economic Impacts

Table 4.1 presents findings on the total economic impact of SHA spending on O&M and capital improvements over the 10-year (1997-2006) period. The SHA budget, in the first row of the table, is presented in terms of output or purchases, payroll (a portion of the budget), and jobs supported by that payroll over the 10-year period (expressed in job-years). The economic model analysis estimates the indirect and induced effects for the Maryland economy in terms of impacts on output, income, and jobs.

Direct Effect – SHA's projected total budget over the 10-year period from 1997-2006 is over $9.3 billion (expressed in constant 2004 dollars). That includes over $1.9 billion in labor costs for SHA workers, directly supporting approximately 3,279 jobs each year.

Total Economic Impact – Altogether, these results indicate that the SHA budget will lead to over $23.4 billion of business sales in Maryland (supporting over $7.8 billion of wages in Maryland) over the 10-year period. Those wages will support 170,068 job-years, reflecting an average of 17,007 Maryland jobs each year over that period.[4]

These results indicate that SHA's capital spending generates the largest indirect and induced impacts for Maryland. This comes as no surprise, as we saw in Section 3.0 that labor-intensive capital projects constitute 65 percent of SHA's outlays over 10 years. The total impact on jobs can be interpreted as follows: every SHA job is linked to, roughly speaking, another 4.2 jobs elsewhere in the Maryland economy (32,796 versus 137,272).

Figure 4.1 shows the industry distribution of additional Maryland jobs that are supported by SHA spending. These jobs result from the indirect multiplier effect (creating jobs at supplier businesses) and the induced multiplier effect (created as a result of respending of worker income). The results indicate that the construction and service sectors are the largest beneficiary of SHA vendor spending, through new road construction or road rehab activities, however, there also are impacts on wholesale and retail trade (trade), finance/insurance and real estate (FIRE), transportation and public utilities (TCPU) and manufacturing. Note that the category "Other" includes government jobs created by the indirect and induced spending effects.

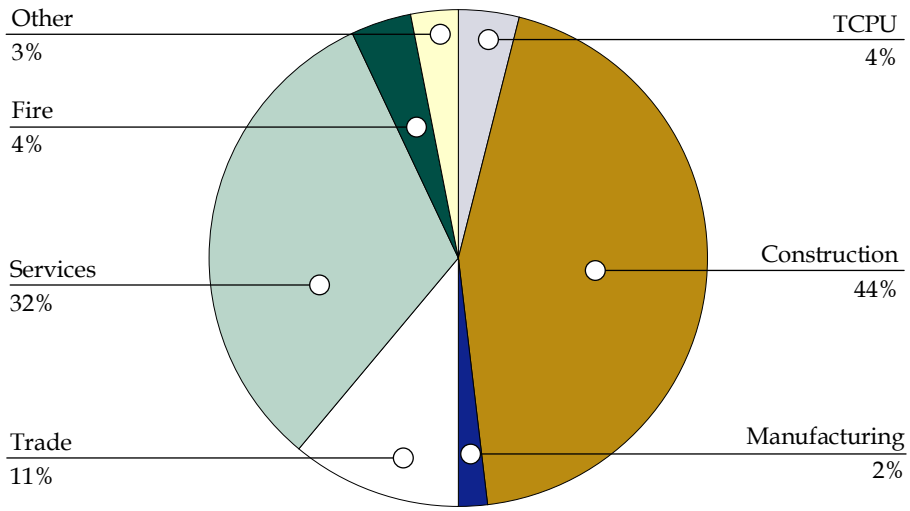
[4] References to jobs and job-years represent the employment supported by MDOT spending on SHA and MTA activities. These figures do not necessarily represent new workers entering the Maryland workforce each year.

Table 4.1 Total Impact on Maryland Economy from SHA Spending
(1997-2006, in Constant 2004 Dollars)

Category of Impact	Output	SHA Labor Income (Share of Output)	Jobs[a]
Direct Effect: SHA Agency Budget (10 years)	**$9,306,099,006**	**$1,950,806,519**	**32,796**
Indirect (Supplier) and Induced (Wage Respending) Effects (10 years)			
Resulting from SHA Worker Wage Respending	$1,664,120,280	$604,968,004	16,360
Resulting SHA Operating and Maintenance Spending	$1,460,372,612	$553,400,664	14,599
Resulting from SHA Capital Spending	$10,933,548,657	$4,668,625,277	106,313
Subtotal	**$14,058,041,549**	**$5,826,993,945**	**137,272**
Total Impact (10 years)	**$23,364,140,555**	**$7,777,800,464**	**170,068**

[a] Value reflects total job-years.

Figure 4.1 Distribution of Additional Maryland Jobs Created by SHA Spending



Additional Jobs = 137,272.

4.2 MTA-Related Economic Impacts

Table 4.2 presents the total economic impact of MTA spending for O&M and capital improvements over the 10-year (1997-2006) period. The MTA budget, in the first row of the table, is shown in terms of output, or purchases, payroll (a portion of the budget) and jobs supported by that payroll over the 10-year period (expressed in job-years). The economic model analysis estimates indirect and induced impacts for the Maryland economy in terms of impacts on output, income, and jobs.

Direct Effect – MTA's projected total budget over the 10-year period from 1997-2006 is over $5.9 billion (expressed in constant 2004 dollars). That includes $1.9 billion of labor costs for MTA workers, which directly support 2,954 jobs each year.

Total Economic Impact – Altogether, these results indicate that the MTA budget will lead to almost $12 billion of business sales in Maryland (supporting over $4 billion of wages in Maryland) over the 10-year period. The total impact on job-years (81,672) reflects an average of 8,167 Maryland jobs each year over the 10-year period.

Table 4.2 Total Impact on Maryland Economy from MTA Spending
(1997-2006, in Constant 2004 Dollars)

Category of Impact	Output	MTA Labor Income (Share of Output)	Jobs[a]
Direct Effect: MTA Agency Budget (10 years)	**$5,967,466,374**	**$1,937,974,324**	**29,536**
Indirect (Supplier) and Induced (Wage Respending) Effects (10 years)			
Resulting from MTA Worker Wage Respending	$1,748,483,691	$673,269,433	18,141
Resulting MTA Operating and Maintenance Spending	$1,744,454,193	$699,335,648	14,375
Resulting from MTA Capital Spending	$2,254,115,000	$935,648,520	19,620
Subtotal	**$5,747,052,883**	**$2,308,253,601**	**52,136**
Total Impact (10 years)	**$11,714,519,257**	**$4,246,227,925**	**81,672**

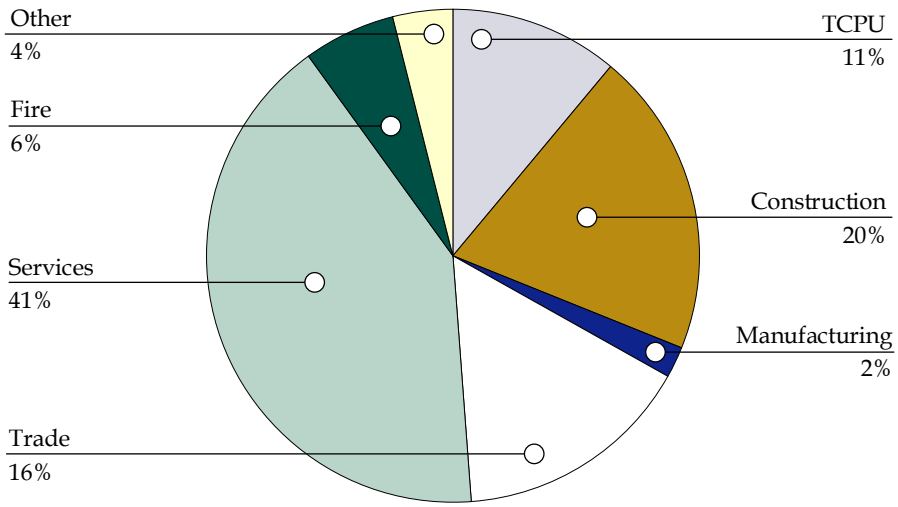
[a] Value reflects total job-years.

Notable in the above MTA impact results is that payroll plays a large role in the MTA budget, causing the induced multiplier effect (respending of worker income) to account for a larger share of the added economic activity in Maryland than does SHA wage respending. The MTA capital spending results also reflect the fact that out-of-state imports play a larger role in the capital program than they do under SHA.

Each MTA job is tied to an additional 1.8 jobs elsewhere in the State. The businesses that are impacted by MTA spending are shown in Figure 4.2. Whereas the construction sector

benefits the most from SHA spending (44 percent of the total), the services sector is where the largest share of additional jobs impacts result due to MTA spending (41 percent). This follows from what is shown above in Figure 3.3 – namely that 62 percent of MTA's annual spending covers labor payments and O&M and these activities typically funnel dollars into services and retail/wholesale trade by virtue of how households spend their disposable income and that O&M activities involve contract services.

Figure 4.2 Additional Maryland Jobs Created by MTA Spending



Additional Jobs = 52,136.

4.3 WMATA-Related Economic Impacts for Maryland

Table 4.3 presents findings on the total economic impact of MDOT's contribution to WMATA's O&M and capital improvements expenditures over the 10-year (1997-2006) period. The Maryland DOT portion of WMATA's budget, in the first row of the table, is presented in terms of output, or purchases, estimated payroll going to Maryland workers (a portion of the budget) and Maryland jobs supported by that payroll over the 10-year period (expressed in job-years). The economic model analysis estimates indirect and induced effects impacts for the Maryland economy in terms of impacts on output, income, and jobs.

Direct Effect – Maryland's WMATA fare box dollars and operating subsidy in large part pay for WMATA workers with Maryland addresses. The labor dollars, $2.15 billion over 10-years (see Figure 3.3) when divided by average compensation from WMATA[5] identifies 28,856 job-years within WMATA held by Maryland residents, reflecting an average of 2,886 jobs each year. The combined effect of capital program spending and operating subsidy and fare box revenues is slightly over $4.9 billion for the 10-year period.

Total Economic Impact – Altogether, these results indicate that the Maryland contribution of over $4.9 billion on capital projects and operating subsidy (inclusive of fare box revenues) over the 1997-2006 period to WMATA will lead to $9.9 billion of business sales in Maryland (supporting nearly $4.1 billion of wages for Maryland workers) over that 10-year period. The total impact on job-years (75,288) reflects an average of 7,529 Maryland jobs each year over the 10-year period.

Table 4.3 Total Impact on Maryland Economy from WMATA Subsidy
(1997-2006, in Constant 2004 Dollars)

Category of Impact	Output	Labor Income (Share of Output)	Jobs[a]
Direct Effect: Contribution to WMATA (10 years)[b]	**$4,907,967,552**	**$2,153,163,076**	**28,856**
Indirect (Supplier) and Induced (Wage Respending) Effects (10 years)			
Resulting from WMATA Worker Wage Respending	$1,672,369,074	$589,855,316	16,824
Resulting WMATA Operating and Maintenance Spending	$718,612,933	$265,886,785	5,465
Resulting from WMATA Capital Spending	$2,552,019,772	$1,054,512,539	24,143
Subtotal	**$4,943,001,779**	**$1,910,254,640**	**46,432**
Total Impact (10 years)	**$9,850,969,331**	**$4,063,417,717**	**75,288**

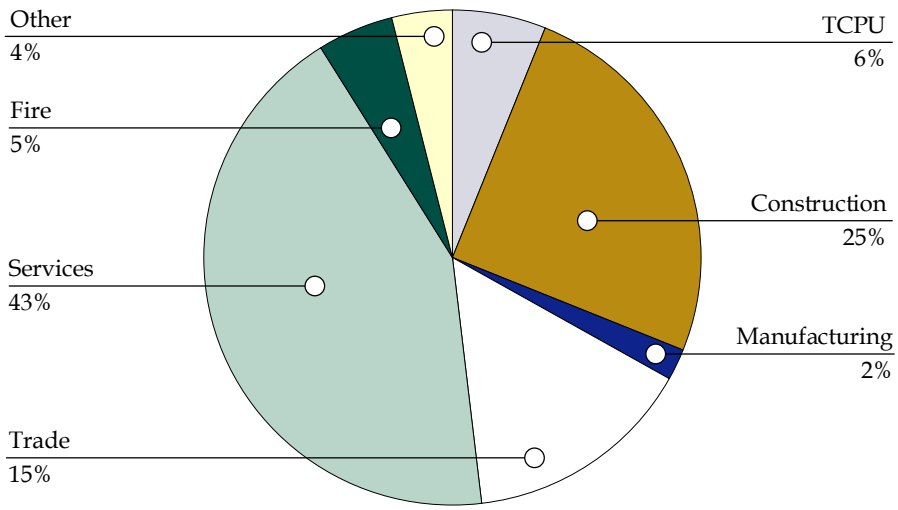
[a] Value reflects total job-years.

[b] Maryland's contribution to WMATA is through a) an operating subsidy and Maryland's fare box revenue, comprising approximately 37 percent of WMATA's Total Operating Budget in 2005, and b) capital program. The statement of direct labor income and jobs reflect the labor compensation (and jobs) associated with Maryland's contribution – not WMATA's total employment.

The businesses that are impacted by MDOT's support of WMATA are shown in Figure 4.3. With similar emphasis on capital spending and O&M spending as MTA budgeting, the additional Maryland jobs supported by WMATA-related spending are distributed across the broad industry sectors in a similar mix as for MTA spending.

[5] Based on FY 2006 data provided by E. Strocko, in 2004$ is $78,263 per worker, including fringe benefits.

Figure 4.3 Additional Maryland Jobs Created by MDOT Support of WMATA



Additional Jobs = 46,432.

4.4 Summary of Economic Impacts from All Surface Investments

The total economic effects of Maryland DOT's spending on surface transportation modes are shown in Table 4.4. Altogether, these results indicate a direct spending budget of over $20.1 billion over the 1997-2006 period, leading to almost $45.0 billion of business sales in Maryland, supporting $16.1 billion of wages for Maryland workers. The total impact on job-years (327,028) reflects an average of 32,703 Maryland jobs each year over the 10-year period.

A comparison of the total impact to the direct effect for each of the measures in the above table indicates an average of 2.2 dollars of total economic output within the Maryland economy is associated with each dollar of MDOT spending on surface transportation. An average of 2.6 jobs within the Maryland economy is supported by each MDOT job.

Caution should be exercised in using these ratio figures. They do confirm that much of the Maryland DOT spending on surface transportation does help to support jobs and business sales elsewhere in the state economy. However, these findings should not be construed to indicate a benefit/cost relationship, since they do not account for the transportation benefits accruing from this spending, nor do they indicate whether transportation spending generates more activity in the economy than other types of government or private sector spending.

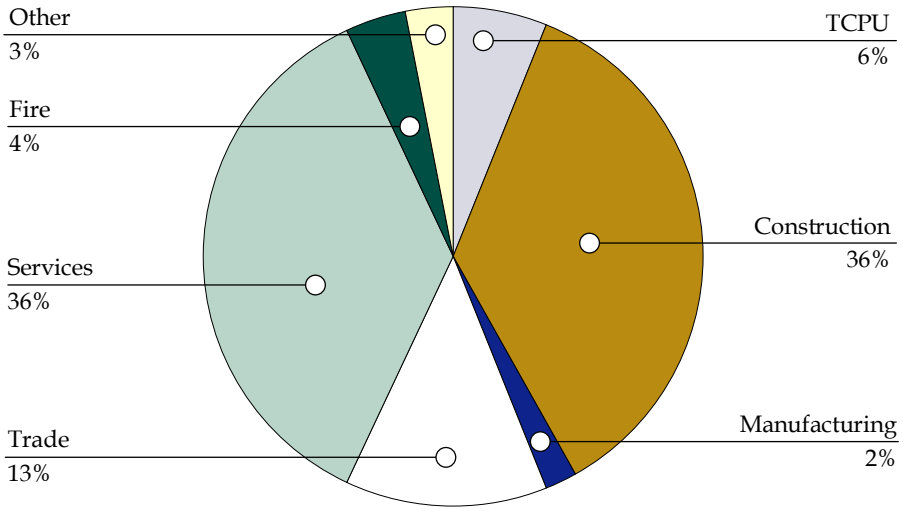
Table 4.4 Maryland's Total Impact from Its Surface Transportation Spending

(1997-2006, in Constant 2004 Dollars)

Category of Impact	Output	Labor Income (Share of Output)	Jobs[a]
Direct Effect: MDOT Agency Budget (10 years)	**$20,181,532,932**	**$6,041,943,920**	**91,188**
Indirect (Supplier) and Induced (Wage Respending) Effects (10 years)			
Resulting from MDOT Worker Wage Respending	$5,084,973,044	$1,868,092,754	51,325
Resulting MDOT Operating and Maintenance Spending	$3,923,439,738	$1,518,623,097	34,439
Resulting from MDOT Capital Spending	$15,739,683,429	$6,658,786,336	150,076
Subtotal	**$24,748,096,211**	**$10,045,502,187**	**235,840**
Total Impact (10 years)	**$44,929,629,143**	**$16,087,446,106**	**327,028**

[a] Value reflects total job-years.

Figure 4.4 Additional Maryland Jobs Created by MDOT Surface Spending Programs



Additional Jobs = 235,840.

When all MDOT's surface spending programs stimulate the Maryland economy we see that both the *Construction* and *Services* sectors equally benefit with the number of jobs supported. These are the predominant areas among Maryland's businesses to be most involved in MDOT surface projects or O&M activities.

5.0 Importance of Maryland's Overall Transportation Infrastructure

5.1 Breadth of Economic Activity Involved in Transportation

While this analysis has focused on state public spending for highways and transit, it is important to note that private companies and local governments also play important roles in developing and operating services for those modes. In addition, both public and private organizations are involved in other modes of transportation, including railroad, aviation, and marine transport. All of these other modes and other public and private organizations also support transportation jobs in Maryland's economy. In this section we examine the magnitude of additional jobs in Maryland that are involved in developing or operating transportation facilities and related services that depend on them.

Table 5.1 summarizes jobs that can be identified as directly related to transportation. It shows that there are over 57,500 jobs directly related to transportation within the State (this is the sum of *direct MDOT supported jobs*, *other public jobs* and *transport services industries*), of which the Maryland DOT spending on highways and transit accounts for 15 percent (approximately 9,119 jobs). While this is only a rough accounting, as reflected in the notes which follow, it indicates the broad nature of jobs involved in developing and operating transportation facilities services in the State. Including Maryland-held WMATA and Washington Local services jobs, direct employment in public sector highway and transit systems comprise 0.29 percent of the State's 3.2 million jobs in 2002.

The accounting of public and private jobs involved in transportation includes the following elements (with limitations as noted):

- **Highways –** SHA jobs are included in the count of direct public jobs. There also are employees at local/county governments that build and maintain local roads, but they are not included here because we are not able to distinguish those local highway jobs from the total local government payroll without a detailed survey of local governments. Additional private providers of services using those highways and roads include trucking and warehousing/logistics companies, and are reported by the U.S. Department of Commerce. There also are significant jobs within companies that operate their own car and truck fleets, but those jobs are not counted here since Maryland firm-level employment data would be needed and then segmented to count only those jobs that serve a strictly transport function within their company's SIC-or-NAICs classification.

- **Public Transit –** MTA and the Maryland portion of WMATA jobs are included in the count of direct public jobs and come under the funding of MDOT as the above analysis has emphasized. Also included are additional providers of public bus/van services that include private bus, charter bus and special needs transportation services. Those jobs in Maryland are reported by the U.S. Department of Commerce.

- **Railroads –** The development, maintenance, and operation of railroad services are provided primarily by private railroad companies. Those jobs in Maryland are reported by the U.S. Department of Commerce.

- **Marine Transportation –** The Port of Baltimore is the State's primary facility for long-distance marine transportation, although there also are other dock facilities elsewhere. A study of the economic impact of the Port (by Martin Associates in 2003) identified public jobs associated with the Maryland Port Administration as well as private sector jobs associated with vessel operations, cargo handling (longshoremen, stevedoring), marine cargo handling (freight forwarders, customs brokers), and terminal operations.

- **Aviation –** Baltimore/Washington International Airport (BWI) is the State's major commercial airline facility, though there are 34 other airports serving commuter air services and general aviation. A study of the economic impact of BWI and statewide general aviation (by Martin Associates in 2003) identified public jobs associated with BWI operation (airport administration, FAA, post office, customs), as well as private sector jobs associated with passenger airlines (aircraft fuel and maintenance services, air charter and cargo services, catering, terminal retailing). The study of direct jobs at general aviation airports did not distinguish local public airport jobs from private fixed-base operator jobs, although the latter is assumed to account for the majority of those jobs.

These numbers are only an approximation of the full number of transportation jobs in Maryland. While they include some notable omissions (particularly local government jobs and private in-house fleet operation and maintenance), they also may reflect some double-counting of trucking and warehousing/logistics jobs that also operate at airport and marine port sites. Nevertheless, they indicate the broad range of transportation activities serving Maryland that lie outside of the Maryland DOT budget.

Table 5.1 Breakdown of Public and Private Jobs in Transportation-Related Sectors of the Economy

Mode	Key Public Agencies and Public Facilities	Direct MDOT Supported Jobs	Other Public Jobs in Transportation	Transport Services Industries
Highway	SHA (State Highway Administration)	3,279[b]	-	19,983[g]
Transit	MTA and WMATA	5,840[c]	4,211[f]	1,441[h]
Subtotal		**9,119**	**4,211**	**21,424**
	Direct MDOT Supported Public-Sector Jobs in Highway and Transit (Percentage of state employment)	**0.29%**		
Railroad	(Private Railroads)	0	-	766[i]
Marine	Port of Baltimore	293[d]	-	11,886[j]
Aviation	BWI and Other Public Use Airports	675[e]	-	9,160[k]
Total		**10,087**	**4,211**	**43,236**
	Direct MDOT Supported Jobs in Transportation (Percentage)	**0.32%**		

Source: County Business Pattern and BEA data series.

[a] Total Maryland Employment (2002) is 3,165,220

[b] Persons employed by the Maryland SHA, does not cover employees of local highway agencies, see Table 4.1.

[c] Includes employees of MTA (2,954) and Maryland's subsidized portion of WMATA jobs held by Maryland residents (2,886), see Tables 4.2 and 4.3.

[d] Port figure has been recast to include only public agency jobs (for consistency with highway and transit accounting).

[e] Airport figure has been recast to include only public agency jobs (for consistency with highway and transit accounting); includes 475 public jobs at BWI Airport plus an estimated 200 jobs at general aviation airports in the State.

[f] Remaining portion of annual WMATA jobs for Maryland not covered by MDOT operating subsidy.

[g] Includes trucking jobs (17,714) and related warehousing/logistics jobs (2,269).

[h] Includes private bus (284), charter bus (640) and special needs (517) bus services.

[i] Employees of private railroads, jobs based in Maryland.

[j] Includes marine shipping and related freight support services at Port of Baltimore.

[k] Includes airlines and aviation-related services at BWI Airport (5,956) and at general aviation airports (3,204 jobs after subtracting an estimated 200 public jobs counted elsewhere).

6.0 Interpretation and Use of These Results

This report has quantified the base of jobs and vendor spending associated with Maryland DOT's budget for highway and public transit programs, and described the implications of these expenditures for the rest of the statewide economy. It is important to understand the nature of these impacts since they shed light on the ways in which state transportation spending affects other elements of the state economy and helps to broadly support jobs for Maryland residents. This analysis has indicated that Maryland DOT spending on highways and public transit indeed generates significant economic activity within the State, totally aside from the value of the investments for supporting passenger and freight movement in the State.

This report has not addressed the impacts of alternative investment strategies to support transportation system performance, household mobility, workforce and business market access, and cost competitiveness for attracting and retaining business in an increasingly global economy. That issue is most appropriately addressed when there are specific alternative spending scenarios being considered. [6]

[6] A 1998 Towson State report examined the general issue of productivity benefits arising per dollar of transportation spending, but it did not actually develop measures of statewide changes in mobility, market access or global competitiveness that would be associated with specific alternative scenarios.

Appendix A

Comparison to Prior Economic Impact Study

Comparison to Prior Economic Impact Study

MDOT last evaluated impacts of their SHA program spending in a 1998 study by RESI – Towson State University. The study addressed the interval from 1991 through 1996, examined 90 percent of SHA spending, and did not include transit investments.

RESI's modeling approach was somewhat different – it included an initial estimation with an input-output model of Maryland but produced its final multiplier impacts of SHA spending using a computable generalized equilibrium (CGE) model.[7] RESI also had available MDOT's vendor database for classifying which industries (SIC) were doing business with SHA.

The table below highlights and compares key aspects of the RESI study and the SHA portion of the current study.

Table A.1 Results from MDOT SHA Studies[a]

	1998 SHA Analysis (RESI CPI Adjusted)[b]	2005 CS & EDR Group (SHA Only)
Time Interval	1991 to 1996	1997 to 2006
Years	6	10
Funding Basis	2004 Dollars	2004 Dollars
Average Annual Expenditures (M)	$997	$931
Job Impact/Year (Thousand)	21	17
Output Impact/Year (B)	$2.88	$2.34
Total Expenditures (M)	**$5,977**	**$9,306**
Total Output (M)	**$17,273**	**$23,364**
Total $ Output/MDOT Dollars	**2.9**	**2.5**

[a] RESI reported in terms of full-time equivalents.

[b] CPI Index – Inflator from Bureau of Labor Statistics, U.S. Department of Labor.

[7] Model was provided by *INFORUM*, University of Maryland-College Park.

It is the last row of the above table that gauges how a dollar of MDOT SHA spending is connected to the State's economy. The difference in this result between the two studies can be explained by a number of factors.

First, the composition of SHA spending over the two intervals must be considered. In the current analysis study period, the shares of average annual SHA budget that support Primary Road Construction, Interstate Construction, and Secondary Road Construction have declined by more than 50 percent in each category compared to the 1991 to 1996 funding period. Since these activities have higher reliance on Maryland provided construction services and related supplies, the shift away from these activities and into newly identified SHA program areas affects the overall multiplier response.

Second, the current analysis of SHA spending shows average annual spending of $931 million. The RESI study evaluated SHA budgeted activities that were more than seven percent greater than MDOT has budgeted annually for the current study interval. Last, it is not clear how the RESI analysis treated the budgeted SHA dollars that went for right-of-way purchases (RoW). As stated at the beginning of Section 3.0, the current analysis excludes the RoW spending from the analysis since, as a transfer of property, it has no basis for the generation of economic impacts in the Maryland economy. If the RESI analysis included RoW in its analysis, the above average annual spending figure ($997 million) would be overstated by approximately 6.6 percent (based on RoW spending from our current study). Secondly, and depending on how they introduced such dollars into their modeling, a multiplier effect was associated with the RoW purchases as well. In order to make a new comparison *without* RoW for the earlier study, one would need to know the unique multiplier effect (value) that the RESI modeling associated with a dollar of RoW spending and then subtract that amount from the RESI reported *Total Output* result.