



**Virginia's Long-Range Multimodal
Transportation Plan
2007-2035**

**Summary of Findings:
Economic Impact of Transportation
Infrastructure Improvements in
Virginia**

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BACKGROUND AND OBJECTIVES

Overview. This document summarizes key findings on the economic impact of transportation infrastructure improvements in Virginia based on projects and programs approved for development over the six year period of 2009-2014. It also describes tools and methods developed for the Commonwealth to enable state agency staff to assess the economic impact of future transportation investments spanning all modes. Table 6, located at the end of this document contains a summary showing the study's "bottom line" results in terms of jobs, income and output. The full report with a technical summary is scheduled for completion in December 2009.

Approach. There are three key considerations that defined this economic impact study:

- 1) **Multi-Modal Approach.** A core principle of VTrans2035, Virginia's long-range transportation planning process, is that transportation infrastructure planning should be made on a comprehensive, multi-modal basis that can optimize the complementary relationships of highway, transit, rail, air and marine modal investments. Accordingly, the economic impact study and its analysis methods address economic impacts and benefits on a multi-modal basis. This approach complements and is consistent with prior efforts of individual modal agencies to assess the economic impact of their own facilities and programs. However, it is not intended to compete with or replace those other modal-specific analysis methods and studies.
- 2) **Focus on Economic Vitality.** One of the explicit goals of VTrans2035 is the economy – to improve Virginia's economic vitality and facilitate the coordination of transportation, and economic development planning activities. Accordingly, the economic impact analysis focused on measuring the extent to which planned transportation investments will provide desired impacts on expanding Virginia's economic base by enhancing both passenger and freight movements. It examined these impacts in terms of jobs and income produced by various industries throughout the Commonwealth.
- 3) **Performance Measures.** The Office of Intermodal Planning and Investment initiated efforts to improve capabilities for measurement of transportation system performance, value to taxpayers and impact on communities. The economic impact study supports and enhances these performance measurement efforts by applying state-of-the-art methods to assess the effect of different types of transportation investments and different aspects of transportation conditions on the economy. This includes measures of:
 - *Short-term jobs and income* supported each year by capital spending and ongoing operations and maintenance spending;
 - *Long-term jobs and income* generated as a result of improvements in transportation conditions; and
 - *Return on investment* in terms of jobs per dollar and benefit-cost ratios.

TRANSPORTATION IN VIRGINIA

Virginia's transportation infrastructure – including roads, rail lines, aviation facilities, marine facilities and associated freight and passenger terminals – enable a broad range of passenger and freight movements. They provide access for households and businesses, and make Virginia a cost-effective location for commerce and a broad range of economic activity.

Operation of transportation facilities and services directly account for around 236,000 jobs in Virginia. This includes:

- Highway-related jobs: approximately 64,000 working in trucking (for freight carriers, for in-house fleets or as independent drivers), plus 4,000 taxi drivers, 55,000 working at vehicle repair and gas stations, and 19,000 in freight distribution/warehousing;
- Rail and bus jobs: approximately 15,000 working for public transportation and private bus services, plus 5,000 working for railroads and 16,000 school bus workers;
- Multi-modal port jobs: approximately 38,000 working at airports and over 10,000 working at marine ports;
- Administration jobs: approximately 10,000 working at transportation government agencies, including state (VDOT, DRPT, DOAV and VPA) and regional agencies.

Yet that is only one small part of the role of transportation in the economy. In a very real sense, every job in Virginia depends on transportation infrastructure for some combination of: (a) commuting to work, (b) deliveries of materials and products to users, and (c) visits to business and recreation destinations. However, the future of that economic base is not guaranteed; it will depend on preservation or enhancement of Virginia's competitiveness as a place to live and locate business activities. The capacity and effectiveness of Virginia's transportation systems to handle future demand, and the quality and cost of service it provides, can potentially have a positive or negative impact on the future economic growth within the Commonwealth. This specific concern – the impact of transportation improvements planned for the future – is the focus of the economic impact study.

ANALYSIS OF SIX-YEAR PLANNED INVESTMENTS

The study team conducted a three-step process. First, the team estimated spending for the six-year time period of 2009-2014 based on the "Commonwealth Transportation Fund Allocation Summary" for those years. This included both *capital investment* on vehicles and facilities (such as roads, runways, docks, terminals, buses and trains) and *operations* (such as road maintenance, port equipment operators, bus drivers and public agency management).

More detailed breakdowns of planned spending and specific capital improvements were provided for highway investments by the Virginia Dept. of Transportation's "Six Year Improvement Plan," for transit and rail investments by the Virginia Dept. of Rail and Public Transportation's "Six Year Projection for Rail and Public Transportation Improvement Program," for aviation investments by the Virginia Dept. of Aviation's "State Airport System Plan," and for port investments by elements of the Virginia Port Authority's "2040 Master Plan." Additional

information on transportation investments made by other public and private agencies, plus direct federal funding to airports, was also included as shown in Table 1.

Table 1.

Projected Transportation Capital Investment and Operations Spending Over Six Years

Projected Capital Investment (Total 2009 – 2014)	Total Over Six Years (millions)
Highways: Capital Construction (incl hwy system + earmarks)	\$ 6,455 m
Public Transportation & Rail : Capital Projects	\$ 2,441 m
Aviation: Capital Projects: functional improvements	\$ 314 m <i>(also incl. FAA funding)</i>
Aviation Capital Projects: safety/conformity projects	\$ 467 m <i>(also incl. FAA funding)</i>
Port : Capital Construction Projects	\$ 745 m
TOTAL CAPITAL INVESTMENT \$	\$ 10,422 m

Estimated Operations Spending (Total 2009-2014)	Total Over Six Years (millions)
Highways: Ongoing Operation & Maintenance	\$ 10,641 m
Public Trans: Ongoing Operations Support	\$ 1,066 m <i>(state & federal funds)</i>
Air ports: Terminal Operations (wages)*	\$ 7,442 m
Marine ports: Ship & Harbor Operation (wages) *	\$ 1,854 m
VDOT Administration	\$ 1,465 m
TOTAL OPERATIONS SPENDING \$	\$ 22,468 m

** These air and marine port numbers reflect payroll associated with terminal and harbor operations (79% of total wages at Dulles and Reagan National airports, 95% of wages at other airports and 56% of wages at Virginia ports). Additional revenues associated with ground transportation, freight forwarders, freight exports and visitor spending are not included here, though they are discussed in economic impact studies of the Virginia Port Authority, Virginia Dept. of Aviation and Metropolitan Washington Airports Authority. Those reports show total business revenues of approximately \$2 billion/year at Hampton Roads marine ports facilities, \$6.5 billion/year at Dulles and Reagan National Airports, and over \$610 million/year at other airports in Virginia.*

The profiles of operations spending for highways and public transportation were based on VDOT and DRPT budgets. However, the profiles of operations for major airport and marine port facilities are of a different nature, for these are multi-modal terminals in which large parts of their operations are conducted by private airlines, marine shipping lines, railroads and trucking companies, as well as vendors who provide other sales and services to travelers and shippers. Accordingly, public elements of these port/terminal operations cannot be isolated in the same way as government funding of highway, train and bus service operations and maintenance. Instead, Table 1 shows worker wages associated with those port/terminal operations, while a footnote discusses broader economic elements also occurring at these facilities.

The analysis reported here is based on a profile of planned transportation investment in Virginia. Of course, the actual level of transportation spending that will occur during the 2009-2014 period is subject to continual change as economic conditions and state tax revenues shift over time.

However, these were the allocations and projects forwarded by Virginia's public transportation leadership using state and federal formulas and procedures and, thus, represent the best information available at the time. For these reasons, the numbers shown here should be interpreted as merely indicative of the general magnitude of impacts associated with the given scale and mix of transportation investments. Furthermore, as the programming and allocations are modified, the results should be generally very similar if the changes in spending are not dramatic.

In the second step, the analysis team analyzed the impacts of these scenarios on planned transportation facility capacity, use and conditions. The latter ranged from projected traffic and congestion on highway facilities, to growth of freight passing through port facilities. The project team applied a series of available performance measures and analysis tools to assess how passenger and freight volumes, speeds, travel distances and service reliability will differ among two alternative scenarios – one in which the planned investments are made, and another in which those investments are not made and transportation conditions are allowed to further degrade. The highway analysis made use of a new “sketch planning” tool that was developed as part of this study to assist VDOT in analyzing effects of future projects on highway travel conditions, access and inter-modal connectivity.

The third step was application of a multi-modal economic analysis tool known as TREDIS (Transportation Economic Development Impact System) to estimate overall impacts on the Virginia economy. This type of structural analysis system has been applied in numerous states across the country, but the version applied here was built upon a model of the Virginia economy, its specific flows of imports and exports, and ways in which different Virginia industries depend on transportation for workers, materials and product deliveries.

This economic analysis process was used to calculate two types of impacts on the Virginia economy. First, it calculated *short-term spending impacts*, which are the effects of money spent on capital investment and operations (during the period of 2009-2014) on the flow of income supporting business activity and jobs during those years in which the spending occurs. It also calculated *long-term productivity impacts*, which are the continuing effects of improved transportation conditions on economic productivity and competitiveness, and hence economic growth, for years after the investment was made (which in this case were calculated out to the year 2035). Both types of impact were measured in terms of additional employment, increased business output, value added and wages.

SHORT-TERM ECONOMIC IMPACT OF TRANSPORTATION CAPITAL AND OPERATIONS SPENDING

The short-term spending impact included three elements: It first considered *direct effects* of capital and operations spending on money flowing to Virginia workers and to contracted suppliers, construction companies and operators. It then considered *indirect effects* generating additional orders to supplier industries (which provide parts, materials and supporting services). It also included *induced effects* on consumer spending generated by the additional (direct and indirect) wages of workers living in Virginia. Adjustment was also made for the fact that 50% of the Reagan National Airport workers and 29% of the Dulles Airport workers do not live in Virginia and hence tend to spend their incomes elsewhere.

Economic Impact of Transportation Infrastructure Improvements in Virginia

The results, shown in Table 2, indicate that the \$33 billion of expected capital investment and operations spending over six years will support over \$56 billion of business output (sales revenue) with an average of over 78,000 jobs per year (totaling 468,000 job-years). This translates to 14 additional jobs in the Virginia economy for every one million dollars in transportation spending. Table 4, shows that over the longer-term, 2010-2035, every one million dollars in transportation spending leads to 59 more jobs in the Commonwealth.

That economic growth will, in turn, return roughly \$2.3 billion of additional revenue back to state and local governments over the six years (including \$410 million of income taxes, \$695 million of sales taxes and \$481 million of property taxes). Table 3 summarizes the tax revenue impacts.

Table 2.

Short-Term Spending Impact of Capital and Operations Budgets*

Category	Total Effect on Virginia Economy, 2009-2014		
	Total Over 6 Yrs	Avg. Year	Per \$ Million Spent
Capital Investment Spending (\$ mil)*	\$ 10,422	\$ 1,737	--
Employment (Jobs)	142,082 (<i>job-yrs</i>)	23,680	14
Business Output (\$ mil)*	\$ 18,780	\$ 3,130	1.8
Value Added (GDP ¹)(\$ mil)*	\$ 9,740	\$ 1,623	0.9
Worker Income (\$ mil)*	\$ 7,518	\$ 1,253	0.7
Capital + Operations Spending (\$ mil)*	\$32,890	\$5,481	--
Employment (Jobs)	468,850 (<i>job-yrs</i>)	78,142	14
Business Output (\$ mil)*	\$56,172	\$9,360	1.7
Value Added (GDP)(\$ mil)*	\$29,302	\$4884	0.9
Worker Income (\$ mil)*	\$20,340	\$3,890	0.6

* All values are in constant year 2008 dollars. Dollar amounts in different rows cannot be added together. Specifically, worker income is a subset of value added, and value added is the portion of business output that does not go for materials and supplies.

¹ GDP = Gross Domestic Product, which here represents the dollar value of final goods and services produced within the Commonwealth of Virginia. (It represents total output minus the cost of materials brought in from outside.)

Table 3.

Short-Term Tax Revenue Impact of Capital and Operations Budgets*

Revenue Category	State /Local
Household + Business Income Tax	\$ 410
Sales Taxes	\$ 695
Property Tax	\$ 481
Social Insurance Payments	\$ 20
Other Taxes & Fees	\$ 696
TOTAL	\$ 2,302

** All values are in constant year 2008 dollars.*

LONG-TERM ECONOMIC IMPACT OF TRANSPORTATION SYSTEM IMPORVEMENTS

The long-term benefit of capital investment in transportation facilities is the improvement in travel conditions which lead to economic cost savings and productivity enhancement for Virginia residents and businesses. These improvements occur through four types of impacts on transportation system users:

- Direct cost savings due to reduced user time delay & expense
- Direct cost savings due to enhanced safety & reliability
- Direct cost savings due to enhanced intermodal capacity & connectivity
- Additional growth enabled by elimination of air, sea and rail capacity constraints

Those user benefits, in turn, lead to direct, indirect and induced effects on household living costs, business operating costs, productivity and competitiveness. They enable more jobs and business activity to take place in Virginia, which also reduces the “leakage” of income and savings that might otherwise flow to businesses located outside of Virginia. The results (shown in the Table 4) indicate that the \$10.4 billion of capital investment will enable continuing economic growth totaling \$81 billion of additional business output over 25 years. That represents an average of \$3.1 billion/year of additional business output, although the level will rise over time to reach \$13.6 billion/year of additional output by 2035. Associated with this economic growth will be an average of over 23,000 more jobs, rising to over 101,000 more jobs by 2035.

Table 4.

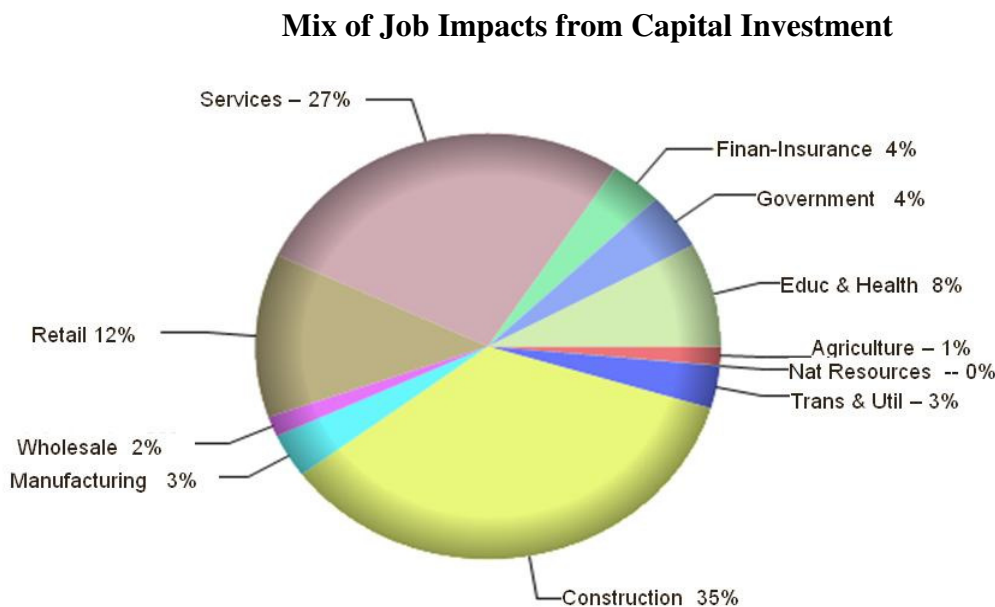
**Long-Term Economic Growth Impact of Transportation System Improvements
from Planned Six-Year Program of Capital Investments**

Impact Category	Avg. Year 2010-2035	Year 2035 Impact	Sum of 2010-2035	Per \$mil of Capital Investment
Employment (Jobs)	23,523	101,932	611,590	58.8
Business Output (\$ mil)*	\$ 3,137	\$ 13,594	\$ 81,566	\$ 7.8
Value Added (\$ mil)*	\$ 1,539	\$ 6,668	\$ 40,006	\$ 3.8
Worker Income (\$ mil)*	\$ 1,025	\$ 4,441	\$ 26,645	\$ 2.6

** All values are in constant year 2008 dollars. Dollar amounts in different rows cannot be added together. Specifically, worker income is a subset of value added, and value added is the portion of business output that does not go for materials and supplies.*

These long-term economic impacts of planned capital investments should be interpreted carefully. It is important to note that these impacts represent the difference between a scenario in which needed investments are made and a scenario in which those capital investments are not made. So in a very real sense, the capital investments are enabling a continued level of economic growth while the failure to invest would lead to a lower level of economic growth. It is also notable that the magnitude of long-term economic impacts enabled by capital investment dwarf the short-term spending impacts of capital investment that were previously shown. In addition, the mix of Virginia’s economic sectors that are aided by the capital investment are shown in Figure 1. It shows that fully 96% of the job impact generated by capital investment are private sector jobs.

Figure 1.



TOTAL ECONOMIC IMPACT AND RETURN ON INVESTMENT

Adding together the short-term spending impacts and the long-term improvement impacts lead to the following overall job impacts:

- Capital Investment Spending 142,100 job-yrs over 6 yrs (23,700/yr)
- Operations Spending 326,700 job-yrs over 6 yrs (54,400/yr)
- Total Six-Year Spending 468,800 job-yrs over 6 yrs (78,100/yr)
- Long-Term Impact 611,600 job-yrs over 26 yrs (23,500/yr)
- Total 1,080,400 job-yrs total

While the focus of this study was on the calculation and measurement of impacts on the economy, the information collected as part of this analysis also made it possible to calculate measures of “benefit/cost ratio” and “economic return on investment.” Both of these measures apply a discount rate to calculate the present value of cost, revenue and benefit streams that occur over periods of time. The advantage of this process is that it corrects for the fact that most of the costs are incurred in the first six years, while the benefits occur in later years. The process of discounting adjusts for the time value of money over-and-above the effect of inflation. (In a general sense, it can be viewed as adjusting for the real interest cost of borrowing money that is above the inflation rate, or the value of what the money might otherwise be earning if loaned out or invested in some other way.)

Table 5.

Return on Investment*

Benefit/Cost Findings	Value (\$ millions)
Present Value of Cost Stream (2009-2014)	\$ 9,167
Present Value of Benefit Stream (2010-2035)	\$ 36,645
Net Present Value (=Benefits - Costs)	\$ 27,478
B/C Ratio (=Benefits / Costs)	4.0
Economic Impact Findings	Value (\$ millions)
\$ Value Added per \$1 million of capital investment	3.8

** Using a 4% real discount rate; all values expressed in constant 2008 dollars, with capital investment defined to exclude \$467 million of regulatory-required airport safety improvements that were not intended to affect economic productivity.*

Two different measures are shown in Table 5. One is the economic impact ratio, which reflects value added (wage income and business profit income) generated per dollar of transportation investment. That calculation comes directly from the economic impact analysis results. The other measure is the benefit/cost ratio. It is similar to the economic impact ratio in that it also recognizes long-term cost savings and productivity gains as benefits, but it differs in that it also adds the value of non-money benefits (such as personal time and safety) while ignoring spending

impacts on the economy. These differences nearly offset each other, and as a result, the two ratios end up similar – with a 4.0 to 1 benefit/cost ratio and a 3.8 to 1 ratio of value added per dollar of investment.

These findings confirm that there are significant returns associated with the current packages of planned transportation investments in Virginia. They also demonstrate how the Commonwealth of Virginia can systematically apply economic impact tools and methods to assess other projects and programs that may arise in the future.

Table 6.

<u>Summary of Findings</u>
For every \$Million of Capital Investment & Operations Spending
<ul style="list-style-type: none">• Short-term effect: 14 immediate jobs in VA during same year of spending• Long-term effect of capital improvement: 59 job-years over 26-yrs (2.3 per year)
Total Impact of \$33 billion spending on Six-Year Plan
<ul style="list-style-type: none">• \$56 billion of business sales in Virginia generating \$29 billion of worker wages• 468,800 Job-yrs over 6 yrs. (78,100/yr)• At least \$2.3 billion of state and local tax revenues• Plus long-term (26 yrs): \$82 billion of business sales; 611,590 Job-yrs (23,500/yr), of which 96% are private sector
Return on Capital Investment (<i>net present value</i>)
<ul style="list-style-type: none">• Benefit-Cost Ratio of 4.0 to 1 (total benefit per investment dollar)• Economic Return Ratio of 3.8 to 1 (gross domestic product per investment dollar)