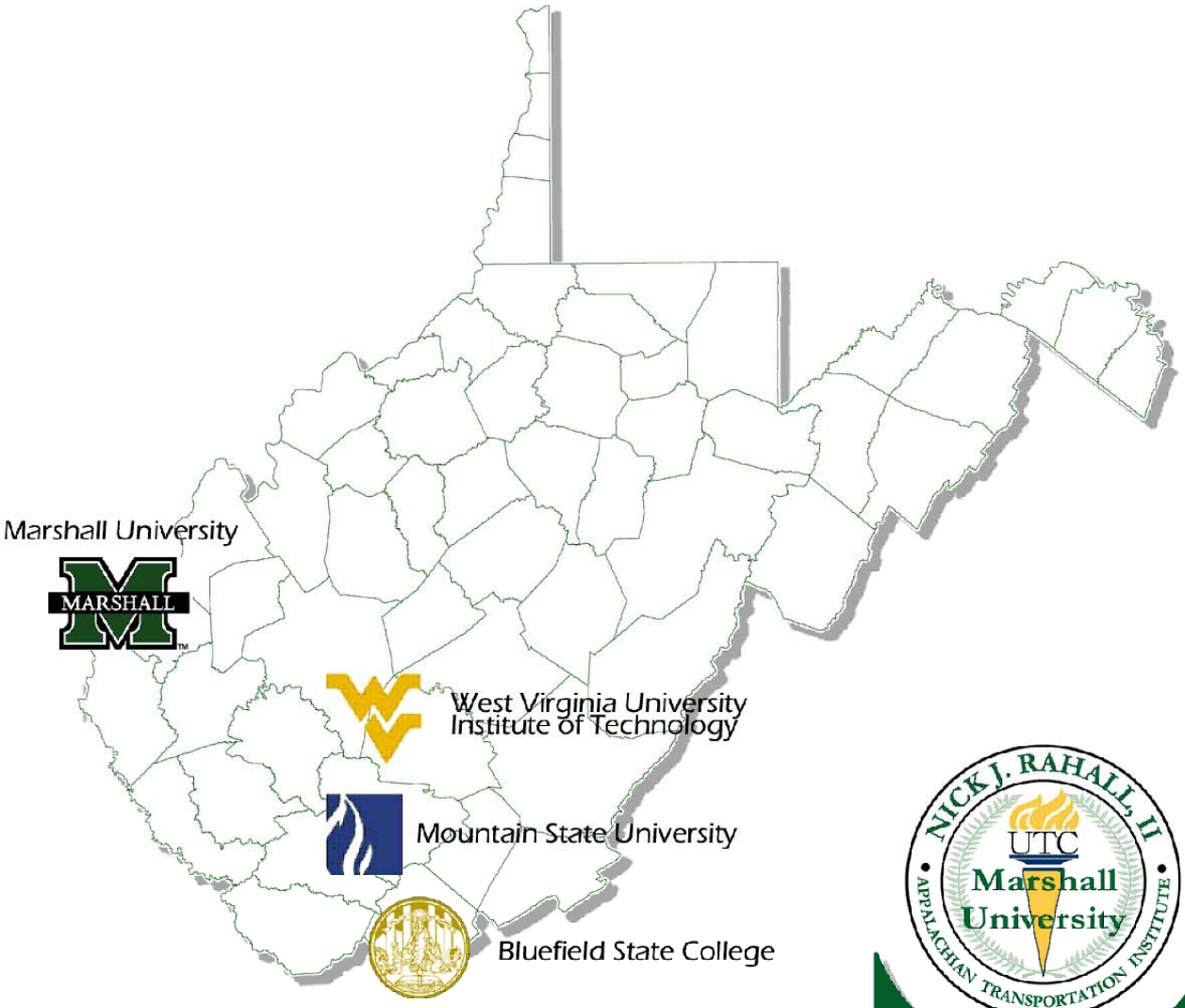
TRP 99-33 Innovative Highway Finance Options



NICK J. RAHALL, II
APPALACHIAN TRANSPORTATION INSTITUTE
UTC
Marshall University

Marshall University
West Virginia University Institute of Technology
Mountain State University
Bluefield State College

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
TRP 99-33 Innovative Highway Finance Options	February 2005
	6. Performing Organization Code RTI
7. Author(s) Michael J Hicks, Ph.D.	8. Performing Organization Report No.
9. Performing Organization Name and Address Nick J. Rahall II, Appalachian Transportation Institute at Marshall University, 1 John Marshall Drive, Huntington, WV 25755	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. TRP 99-33
12. Sponsoring Agency Name and Address U S Department of Transportation, Research and Innovative Technology Administration University Transportation Centers Program, RDT-30 1200 New Jersey Ave., SE Washington DC, 20590	13. Type of Report and Period Covered FINAL
	14. Sponsoring Agency Code

15. Supplementary Notes
N/A

16. Abstract
Construction, operation and maintenance of West Virginia's roads and highways is becoming increasingly challenging. A variety of factors currently complicate the planning process and slow construction, challenge operations and delay maintenance. These challenges are primarily driven by the economic and population changes that affect the State.

This study reviews financing options for highway construction that present key challenges and opportunities to the West Virginia Division of Highways. In particular we review the current method of providing financing for public goods within the State. This analysis includes a description of the basic highway funding process and outlines the motivation for the State's adoption of this financing mechanism.

Extensive simulations of tax rate changes follows this on the maintenance and construction of highways under current federal law. This section provides key estimates of tax elasticity's for the State's major tax instruments as well as other results of importance for policymakers. Importantly, we discuss the efficacy of adding direct tax increases or instruments in support of highway construction, operation and maintenance.

The next section describes innovative financing as described by the U.S. Department of Transportation's recent experiments in highway financing. This suite of innovative finance options primarily represent the relaxing or adjustment of administrative rules on matching funds. The limits to their application to West Virginia are discussed.

The major innovation in financing that offers possibilities to West Virginia are Public Private Partnerships. To better understand the issues involved in Public Private Partnerships, this section describes the issue in some detail with a focus on highway construction and operations.

Finally, the long run viability of the current financing system will require adjustment of taxation policy to better align highway demand with the changing technology that is available to motorists and government. This section describes issues involving gas taxes and road pricing and their impact on the financing of West Virginia's highways.

17. Key Word	18. Distribution Statement
Highway Financing, Financing, DOT	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
		45	

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the Department of Transportation, University Transportation Centers Program, in the interest of exchange. The U.S. Government assumes no liability for the contents or use thereof.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the accuracy of the data presented herein. The contents of this report do not reflect the official views or policies of the West Virginia Department of Transportation. The use of trade names does not signify endorsement by the authors

Innovative Highway Finance Options

February 2005

Prepared for the
West Virginia Department of Transportation

Rahall Appalachian Transportation Institute
Transportation Research Project-99-33

Michael J. Hicks, Ph.D.
Air Force Institute of Technology
And
Marshall University

CONTENTS

Michael J. Hicks, Ph.D.
Assistant Professor, Air Force Institute of Technology
and
Research Professor
Center for Business and Economic Research
Marshall University
One John Marshall Drive
Huntington, West Virginia 25755
hicksm@marshall.edu
304.696.6251

Note: The analysis and findings represented herein reflects the view of the principal investigator and do not necessarily represent the views of Marshall University or any of its related activities

Executive Summary

This study provides an analysis of several issues that influence the ability of the State of West Virginia to construct, operate and maintain highways. Specifically the study evaluates the current State financing structure and provided simulations of tax rate changes. The study evaluated the new trend of innovative highway financing that has garnered much attention of policymakers around the nation. This was accompanied by a review of public private partnerships. The final analysis provided by this study was an evaluation of long term financing considerations as they pertain to highways in West Virginia. There were many important findings.

First, we evaluated the capacity of the State to more speedily undertake highway infrastructure investment at lower cost. To do this we reviewed the State's current tax and financial status and provided simulations of tax revenues that could be dedicated to new road construction. Under the most favorable conditions we found that a 5% across the board tax increase, in all but education property taxes, would yield only about 7.78 additional interstate highways miles per year or roughly 1,526 additional miles of road resurfaced. This representative simulation highlights the revenue constraints West Virginia faces. Importantly these data did not include fiscal year 2002 or later data when conditions worsened.

It is clear from these results that, absent dramatic federal intervention, any noticeable change in the rate of road construction in the State will require a sweeping reevaluation of fiscal priorities coupled with a very large tax increase. While we always believe reexamination of fiscal priorities is warranted, even if change is not, there is little to recommend across the board tax increases to generate highway infrastructure construction.

The second issue we examined was innovative highway financing. After and exhaustive year of analysis we came to the conclusion that the much heralded innovative financing mechanisms for highway infrastructure construction are not innovative, but merely modify existing rules to provide flexibility. Rural areas enjoy fewer options than do urban areas under the new rules (though there's no evidence that the options for rural areas have shrunk). This is unfortunate since West Virginia has engaged in the test programs for innovative financing with extreme rigor. Sadly, innovative highway financing seems to offer little beyond what the State is currently doing to fund highway construction.

There is one bright spot in terms of highway financing options. That is public private partnerships. The relationship between private sector firms and public sector infrastructure development is growing increasingly important to the State. Though the benefits may not be widespread, there are areas in the State where private public partnerships offer real cost savings to the State. These cost savings can manifest themselves through federal match options that treat private match favorably as well as in cutting the direct construction costs. As with earlier innovative financing rules, the Department of Transportation is working to employ this resource where possible. Public private partnerships offer a welcomed opportunity for some region. They are not a panacea.

We believe that a comprehensive educational program for State officials in the legislative branch and especially in economic development be undertaken to explain financing issues more clearly. At point it would be useful for more State residents to appreciate the very high level of highway infrastructure investment that has occurred in the State over the past 40 years. Indeed, only eight states have enjoyed a higher ratio of allocations to payments from the federal highway funds. We also recommend that the State consider a benefit cost analysis rule for privatization activities. These steps should make private public partnerships more amenable and effective in coming years.

We reviewed the issues of gasoline taxation and road pricing. We found that real tax collections per mile driven have declined by more than half in the past 40 years and offer little

sign of recovery. We also found that there are likely only three scenarios where road pricing would likely offer any real benefits in the State. These are State administered highway tolls, some congestion fees, and in local revenue enhancement programs designed to provide expenditures to meet unforeseen local demand for infrastructure.

Our most important recommendation is a reexamination of the *Gasoline Excise Tax* rates. These included the observations that: Gasoline Excise Tax revenues pay for a small portion of total roadway costs in the State, higher real GET rates have proven historically sustainable, the impact of higher GET rates would likely reduce automobile exhaust emissions and finally, the revenues are desperately needed. We believe that considerable latitude in rate setting is possible and that this issue will be addressed by other states within the region. In addition to considering discretionary GET rate changes we believe it would be useful for the State to consider implementing an inflation indexed GET rate.

1. INTRODUCTION

Construction, operation and maintenance of West Virginia's roads and highways is becoming increasingly challenging. A variety of factors currently complicate the planning process and slow construction, challenge operations and delay maintenance. These challenges are primarily driven by the economic and population changes that affect the State.

This study reviews financing options for highway construction that present key challenges and opportunities to the West Virginia Division of Highways. In particular we review the current method of providing financing for public goods within the State. This analysis includes a description of the basic highway funding process and outlines the motivation for the State's adoption of this financing mechanism.

Extensive simulations of tax rate changes follows this on the maintenance and construction of highways under current federal law. This section provides key estimates of tax elasticity's for the State's major tax instruments as well as other results of importance for policymakers. Importantly, we discuss the efficacy of adding direct tax increases or instruments in support of highway construction, operation and maintenance.

The next section describes innovative financing as described by the U.S. Department of Transportation's recent experiments in highway financing. This suite of innovative finance options primarily represent the relaxing or adjustment of administrative rules on matching funds. The limits to their application to West Virginia are discussed.

The major innovation in financing that offers possibilities to West Virginia are Public Private Partnerships. To better understand the issues involved in Public Private Partnerships, this section describes the issue in some detail with a focus on highway construction and operations.

Finally, the long run viability of the current financing system will require adjustment of taxation policy to better align highway demand with the changing technology that is available to motorists and government. This section describes issues involving gas taxes and road pricing and their impact on the financing of West Virginia's highways.

2. CURRENT FINANCING STRUCTURE

West Virginia's system of tax collection is designed to finance government goods and services and, in some instance, provide incentives for citizens to modify behavior, such as in curbing smoking or promoting educational achievement. Many of the tax instruments are aligned to expenditures on specific government goods or services. Examples of these are the

Timber Severance Tax that finances operations at the Department of Natural Resources and the *Gasoline Excise Tax* that finances road construction and maintenance. The direct application of revenues from one tax instrument to a particular purpose is an artificial distinction imposed either by the legislature or the courts. Tax revenues, like all money, are fungible. So, while current laws may restrict the application of revenues to certain specific activities (sometimes motivated by interpretation of federal statues) this analysis will largely ignore these distinctions. This is not a criticism of the current tax structure but is simply a device for meeting the purposes of this study. We should note that good tax policy links the incidence of taxation to demand for goods, but this need not occur in specific instruments.

2.1 PURPOSE

The purpose of this chapter is to examine the impact of dedicating tax rate increases from a variety of instruments to the operations, maintenance and construction of the State's roadways. To perform this task we examine each of the major tax instruments in the State and discuss the revenue impacts of adjusting rates. We also discuss the economic impact of the simulations on highway construction and maintenance. To accomplish this we categorize the tax instruments by the fund they are currently aligned with. This is one of many suitable methods of classification in these types of analysis.

This is followed by a brief discussion of the major federal highway expenditure programs and the federal match rates established by each. This component is a simulation model of road operations, maintenance and construction impacts of various tax rate changes. An economic impact of selected tax rate changes follows. We end with summary and conclusions.

2.2 West Virginia's Tax System

The largest of West Virginia's tax instruments is *the Personal Income Tax* that collects just under a quarter of the State's total revenues in recent years. In declining order of magnitude the remaining General Fund and Road Fund taxes are *Consumer Sales and Use Taxes,* followed by *Business and Occupation, Severance* and the *Corporate Net Income Taxes*. Miscellaneous taxes account for just under 20 percent of total collections. See Table 2.1 for 2001 collections in each area of the General Revenue Fund and Table 2.2 for 2001 collections of State Road Fund taxes.

Table 2.1, General Revenue Funds in 2000-2001

General Revenue Fund	Collections
Business and Occupation Tax	$177,400,000
Corporation Net Income Tax	112,900,000
Personal Income Tax	1,020,700,000
Consumers Sales Tax	852,500,000
Use Tax	75,600,000
Cigarette Tax	31,800,000
Inheritance Tax	17,500,000
Beer Tax and Licenses	8,000,000
Insurance Tax and Fees	62,600,000
Racing Fees	2,000,000
Liquor Profits	10,500,000
Charter Tax	3,800,000
Property Tax	3,600,000
Property Transfer Tax	6,600,000
Miscellaneous	6,600,000
Departmental Collections	11,100,000
Interest Income	31,400,000
Business Franchise Registrations Fee	1,300,000
Lottery Transfers	800,000
Severance Tax	163,200,000
Business Franchise Tax	101,400,000
Telecommunications Tax	15,200,000
Miscellaneous Transfers	300,000
Special Revenue Transfer	1,500,000
Prior Years Refunds	200,000
Total	**$2,718,500,000**

Source: West Virginia Department of Tax and Revenue

Table 2.2, State Road Fund Collections

State Road Fund	Collections
Road Taxes	$224,400,000
License Tax	77,400,000
Privilege Tax	154,400,000
Wholesale Fuel & Use Tax	71,300,000
Other Income	24,000,000
Total	**$551,500,000**

Source: West Virginia Department of Tax and Revenue

This analysis will not treat *Real* and *Personal Property Taxes* for three reasons. First, there has been an ongoing effort by the current administration to not alter the current level or distribution of funds to K-12 education even during a challenging budgetary period. Second, the Recht Decision that removed the funding level and formulae from the legislature's hands was in place during the greatest part of this research effort.[1] Third, the demonstration of the taxing

[1] The Recht Decision in the 1975 case of *Tomblin v. Gainer* established a school funding equalization formula that was judicially, not legislatively established. Judge Recht nullified this decision this year. The

capacity of the State's other instruments will be sufficiently clear in the following sections that treatment of the *Real* and *Personal Property Tax* in the simulation model is unnecessary.[2]

2.3 ISSUES IN TAXATION

West Virginia's system of taxation has been subject to considerable scrutiny in recent years. This scrutiny has included the very broad and bipartisan examination of taxes that was conducted during the Underwood Administration culminating in a series of reports and papers known as the Agenda for Fair Taxation.[3] The Wise administration has also conducted a review of Tax Incentive programs and revamped the existing structure to ease compliance and extend several tax credits to smaller businesses.[4] Finally, the State's system of taxation has been examined at the national level as part of a comprehensive analysis of state tax systems following the nearly universal revenue shortfalls experienced by states in 2002.[5]

Though each of these reviews had different analytical missions, a basic finding in the first and last studies was that West Virginia's system of taxation is regressive and does not match the incidence of taxation with demand for government services. Most obviously, West Virginia disproportionately taxes physical capital and equity. The result of this distortionary tax system is the punishment of investment in productivity enhancing capital. All three studies concluded that the system was unnecessarily complex. The requirement for the second study mentioned above (Tax Incentives) is a prime example of the ineffectiveness of West Virginia's tax system since effective systems do not require special dispensation from government to motivate business investment.

Though the full range of issues surrounding our current system of taxes is far beyond the reach of this analysis a few issues emerge that suggest that the capacity to extend the current tax system may be limited. This is important since the simulations of this study directly evaluate rate increases.

The first issue that emerges from this analysis is that simple rate increases would likely make the system more regressive. For example, increases in *Gasoline Excise* or *Sales and Use Taxes* would disproportionately tax the poor since they would collect a higher proportion of income from low income households.[6] Second, any distribution of rate increases that are less regressive

---

detail of this formula is available in Burton, Hicks and Kent, *The Fiscal Implications of Judicially Imposed Surface Mining Restrictions in West Virginia*, 2001, Appendix E. Center for Business and Economic Research, Marshall University.

[2] Detail on local option property tax rates and currently levy information is detailed in Burton, Hicks and Kent, *The Fiscal Implications of Judicially Imposed Surface Mining Restrictions in West Virginia*, 2001, Appendix E. Center for Business and Economic Research, Marshall University.

[3]Burton and Thompson. *West Virginia's Economy and System of Taxation: A Base Analysis*. Center for Business and Economic Research, Marshall University, July 1, 1998 and The Governor's Commission on Fair Taxation, *Recommendations to the Governor*, December, 1999.

[4]Analysis and Recommendations for West Virginia Tax Incentives, West Virginia Department of Tax and Revenue and West Virginia Development Office, January 9, 2002.

[5] See Johnson and Tenny *The Rising Regressivity of State Taxes*, January 2002, Center on Budget and Policy Priorities, Washington, D.C.

[6] The Johnson and Tenny study noted the only discretionary tax change in West Virginia was the 1993 increase in Gasoline Excise Tax rates, making the overall system more, not less regressive. There is some ongoing debate regarding the regressivity of gasoline taxes. For a more complete discussion see J. Poterba, "Is the Gasoline Tax Regressive?" Tax Policy and the Economy, MIT Press, 1991.

would likely increase the negative response of tax revenues to rate changes. So, increasing the *Personal Income Tax* rates for high income consumers would potentially increase the price elasticity of demand for these consumers as a higher proportion of their income is spent on luxury goods. Also, across the board rate hikes will have an uncertain effect on business investment, a common criticism of the current tax system.

The magnitudes (and indeed the certainty) of these effects are empirical issues far beyond the scope of this study. This does however point out the importance of carefully scrutinizing tax rate changes prior to implementation in order to avoid an undesired effect.

2.4 TAX INCIDENCE AND INDUSTRY

The burden of taxation across industry sectors in West Virginia is markedly disproportionate to relative levels of production and employment. Clearly, some difference in relative taxation is warranted based upon differential demands on public services created by different industries. For example, firms that generate high levels of demand on public services should bear a higher rate of taxation to compensate for this difference. Firms with high levels of external costs that fall within the public sector, or firms with high regulatory costs should be disproportionately taxed. These suppositions are consistent with quality tax systems and are generally cause for some of the complexity and multiplicity of tax instruments. It would be better, from an administrative standpoint, to have specific tax instruments to meet these differentials. This is so that later changes could be promulgated more effectively as industry demand for government services changes.[7] As we mentioned previously, tax incidence, not disbursement matters in affecting consumer behavior.

Though assessing the degree of differential burdens across industries is well outside the scope of this study it is useful to examine the degree that collections disproportionately affect industries. In order to examine this we illustrate a *Tax Intensity Index*. This *Index* is created from the ratio of the proportion of total tax collections to the proportion of output by major industry sector in the State. In this Index a value of 1 suggests that the proportion of total taxes paid is identical to the proportion of output produced by that industry. Values less than one suggest a lower than proportionate tax incidence while values greater than one suggest a higher than proportionate tax incidence for this industry. See Table 2.3.

[7] There are also constitutional issues in taxation as the equal protection clause of the Constitution has been interpreted as forbidding differential rates in the same instrument for different industries. This leads to activities being directly taxed. For example the Timber Severance Tax is a tax on a specific activity. The application of such taxes typically must meet the 'rational basis test.' For a relevant example see *Allegheny Pittsburgh Coal v. County Commission of Webster County* (1989).

Table 2.3, Tax Intensity Index for West Virginia

	Output		Taxes		
Industry	**In millions**	**Proportion**	**Actual**	**Proportion**	**Tax Intensity Index**
Agriculture	$236	0.7%	$1,074,490	0.1%	0.16
Mining	$2,882	9.1%	$231,159,816	26.2%	2.89
Construction	$1,722	5.4%	$12,011,402	1.4%	0.25
Manufacturing	$6,613	20.8%	$53,034,875	6.0%	0.29
TCPU	$4,684	14.7%	$264,077,064	29.9%	2.03
Wholesale	$1,976	6.2%	$25,080,032	2.8%	0.46
Retail	$3,428	10.8%	$21,556,492	2.4%	0.23
FIRE	$4,154	13.1%	$116,815,364	13.2%	1.01
Services	$6,140	19.3%	$157,348,978	17.8%	0.92
Total	**$31,835**	**100.0%**	**$882,158,513**	**100.0%**	

Note: *TCPU is transportation, construction and public utilities while FIRE is finance and real estate.*

As this Index clearly illustrates, the mining and transportation, communications and public utilities industries pay a highly disproportionate share of State tax revenues. Agriculture (and forestry) construction, manufacturing, and trade pay a very low share of taxes when compared to their total production. Services and finance, insurance, and real estate pay close to proportionate levels of taxes. If we were to disaggregate these data even further it would be apparent that electrical power generation bears most of the dis-proportionally in the TCPU category. Similarly, taxes on medical care of all types heavily increase the total level of services taxes, leaving other service providers relatively untaxed.

The issue of large differentials in tax intensity or proportionality is important for understanding the simulations of tax rate changes on revenue that we present later in this study. It may also be a root cause of the much of the State's inability to raise revenue.

2.5 TAX EFFORT AND CAPACITY

The relative level of a state or region's capacity to tax and the degree to which a region taxes itself are important tools in understanding the flexibility the region enjoys in raising additional revenue. The most recent comprehensive analysis of state tax effort and capacity was performed by the *Advisory Committee on Intergovernmental Relations* (ACIR) in the early 1990's. While over a decade old, West Virginia's tax system has not been modified so our relative rankings will not have changed substantially.

The ACIR provided several indices of which two are most important for our purposes. The first measure of tax capacity is the Representative Revenue System (RRS), which applies a nationally representative system of taxes to all states and compares the relative ability of each state to raise revenues in this system. West Virginia's 1991 RRS ranking was 50th out of 51 states (and the District of Columbia). This suggests that the ability of the state to raise revenues from a shifting of tax rates is next to the lowest in the nation. There is no evidence this condition has improved in the ensuing decade and a half.

The second measure, Tax Effort, evaluates the extent to which states use available tax bases. In this measure West Virginia ranked 12th of the 51 states. Through this scale West Virginia is collecting taxes at a little over 100 percent of its relative capacity to do so.

Together the RRS and the Tax Effort metrics suggest West Virginia's revenue raising capacity is limited relative to most other states. This is notable since the simulation that follows will assess the road construction, operation and maintenance impact of higher levels of taxation.

Also, common sense suggests that West Virginia will be challenged in raising revenue even without exigent demands on public goods and services. West Virginia is not a densely populated state. We have many counties and endemic poverty in many places. The fixed costs of providing basic services (County Council's, School Boards, Police Protection, Court House Maintenance) all suggest that the discretionary level of expenditures in West Virginia will be limited by the high costs of basic services.

2.6 HIGHWAY FINANCING

The West Virginia Division of Highways allocates revenues to a number of activities related to the construction operation and maintenance of highways. These activities range from debt service to safety programs. Some of these expenditures may be employed to leverage federal grant monies authorized for specific types of infrastructure construction and operations. These matching requirements are extremely complex and subject to a frequently changing set of guidelines and innovative applications. These guidelines and innovative applications typically make very minor adjustments to the overall matching requirements.[8]

As a general rule the most advantageous match scenarios exist for state (and local or private) funds for construction of the Appalachian Development Highway System, other federal highway construction and miscellaneous other construction. For these the typical match is a 80/20 federal to state share. Bridge renovations enjoy the same 80/20 federal to state match. Road resurfacing enjoys a 90/10 match. The Federal governments provide specific funds for some safety and congestion relief and other military related construction that is a very minor part of the total infrastructure operation and construction expenditures in the State.

In large measure the match discussion is a moot point. West Virginia has made it a practice to exhaust its available Federal match dollars. Indeed, the State is using funds beyond the available match to engage in construction and maintenance, as required. Federal legislation provides for the reallocation of unused match from one state to others, but in practice there seems to be almost none available.

3. OPTIONS WITHIN THE CURRENT TAX STRUCTURE

West Virginia's current tax structure is designed to provide a number of key public goods and services. Among these are the construction, operations and maintenance of highways. The demand for increased levels of these services and the desire for increased levels of these services creates pressure on policymakers to locate and distribute resources. This chapter attempts to explain in general detail issues regarding financing options with the current tax structures. As with any discussion of this nature, the focus will be on financial constraints. We begin with simulations of changes in tax collections.

3.1 SIMULATIONS, ELASTICITY, RATES AND COSTS

In fiscal simulation, the greatest challenges lie in estimating the appropriate revenue elasticity's and tax revenue responses to rate changes. Absent history of discretionary rate changes estimating the revenue response to rate changes effectively is problematic. This problem is further exacerbated by the non-linear nature of elasticity's across potential ranges of rate changes. Notably it has been a decade since the last discretionary rate change of an important instrument in West Virginia (with the exception of the Gasoline Excise Tax). In order to provide point estimates of revenue increases we will bound the simulations with the highest revenue estimates derived from a potential rate change. This occurs when consumers reduce their

[8] Financing highway construction is subject to a great deal of complexity in the administration of individual projects. For example, bridges, off ramps and other components of a project all have slightly different financing criterion. Also, the method of financing may change the cost.

patterns of consumption based on tax changes. Though inherently skewed this method provides the revenue ceilings associated with rate changes. In a second simulation we provide a more probable value of revenue responses to rate changes. A reasonable criticism of these estimates is that, while yielding very little additional highway infrastructure, they are likely optimistic.

Another important question is how responsive taxes are to changes in the overall economy (or output). This is called tax elasticity of output. One use of this is that it would tell us whether or not infrastructure expenditures that generate economic growth would yield higher levels of tax revenues in the future, absent tax structure or rate changes. Notably there is no research to support a hypothesis that gross infrastructure expenditures generate additional economic activity. At the very best only particular projects offer the potential for economic growth in a region, and even this hypothesis has been rejected in a number of studies.[9] However, in an inelastic tax system increased expenditure on infrastructure would not yield greater future revenues to offset the changed mix of discretionary spending even if economic growth resulted. So knowing how elastic our State's tax system is should motivate a decision to reallocate discretionary spending towards infrastructure. In order to estimate the tax elasticity's of income we decompose the tax into its tax-to-base and base-to-income elasticity's. This is illustrated in Equation 3.1 where the value of elasticity is represented as *n*.

Equation 3.1

$$\eta_{TB} = \frac{\partial T}{\partial B}\frac{B}{T}$$

$$\eta_{BY} = \frac{\partial B}{\partial Y}\frac{Y}{B}$$

$$\eta_{TY} = \frac{\partial T}{\partial Y}\frac{Y}{T} = \frac{\partial T}{\partial B}\frac{B}{T}\frac{\partial B}{\partial Y}\frac{Y}{B} = \eta_{TB} * \eta_{BY}$$

where T is the tax revenues, B is tax base and Y is Gross State Product. The elasticity's for each are represented by 0 with appropriate subscripts (tax to base or base to output). This is expressed empirically by the equation:

Equation 3.2

$$\ln(T) = \alpha_0 + \alpha_1 \ln(B) + \mu_i$$

$$\ln(B) = \beta_0 + \beta_1 \ln(Y) + \mu_i$$

where T is the tax revenues, B is tax base and Y is Gross State Product. The final term is a normally distributed error term. The estimated elasticity's for selected West Virginia Tax instruments are presented in Table 3.1.[10]

[9] see E. Thompson and A Chandra "Does Public Infrastructure Effect Economic Activity? Evidence from the Rural Interstate Highway System" *Regional Science and Urban Economics*. V. 30. 200. pp. 457-490.
[10] Estimation results for all 50 regression results are available from the author. Data from 1990 through 2000 were used for all estimated elasticities. These incorporate rate changes.

Table 3.1, Estimated Tax Output Elasticity's (selected Taxes)

Tax	Elasticity	Tax	Elasticity
B&O**	0	Road Taxes	0.4232
CNIT**	0	License Tax	0.224
PIT	1.9136	Privilege Tax	1.7696
Sales Tax	0.858	Wholesale Fuel & Use Tax	0.09
Use Tax	3.1832	**Total State Road Fund**	**0.7268**
Cigarette Tax	1		
Property Tax	2.024		
Property Transfer Tax	1.978		
BFT	1.0672		
Telecomm	0.484		
Total General Revenue Fund	**0.8832**		

*Estimates not significantly different from zero **These are declining tax instruments due to tax avoidance or other behavior modification. Hence should be treated as declining revenue sources.

Clearly, there is a wide range of elasticity's for different tax instruments. This is consistent with economic theory and experience. Most instruments for which we found a zero elasticity value had positive elasticity's, but these estimates were not statistically significant from zero. This could be caused by either a change in the underlying elasticity's due to a structural change in the tax instrument, or simply insufficient observations or of actual values that are indistinguishable from zero. Notably most of those instruments for which the elasticity's were not statistically significant from zero we expect a near zero elasticity. Overall, these results are not inconsistent with economic theory. Though we will not examine the issue in detail, the B&O, CNIT and PIT may suffer from firms leaving municipalities, and shifting organizational structure to effect tax avoidance. Also, the recent increases in capital gains components to PIT may lead to an overestimation of PIT elasticity's. These elasticity's form a basis for our second set of simulations in which we provide a more realistic set of consumer responses to rate changes. Again it is useful to note that actual estimation of the elasticity of taxes with respect to rates requires recent discretionary tax rate changes within the range employed by the simulation. That being largely unavailable (except for the *Gasoline Excise Tax*) we will evaluate the relationship between these rates and the elasticity of revenues with respect to output to generate our second set of simulations. In this process some judgment is employed to modify findings from other studies for West Virginia.

The resulting simulations provided below are presented in order from the highest to most probable revenue estimates. In both sets of simulations we adjust rates by 1, 3.5, 5 and 10 percent for all tax revenue collections.[11] Table 3.2 outlines the actual assessment rate change ranges for the principal instruments under consideration.

[11] While a seemingly small value, the 1 percent across the board tax increase employed in this simulation is larger overall than any other tax increase the author has knowledge of for any State or Nation in modern times.

Table 3.2, Rate Effects of Simulations on Major Tax Instruments

Tax	Result of 1% Rate Change
Business and Occupation Tax	0.0005% to 0.044% depending on industry
Corporate Net Income Tax	0.09%
Personal Income Tax	0.03 to 0.065% depending on tax bracket
Consumer Sales Tax	0.06%
Business Franchise Tax	0.007% of equity
Gasoline Tax	0.25 cents per gallon

In the following simulations we translate tax rate changes into infrastructure maintenance and operations under basic elasticity assumptions. The revenue and elasticity assumptions are straightforward as are the simplifications of the highway financing formulas. To translate the revenue changes into construction and maintenance we employ average construction costs for highways and resurfacing. These estimates are derived from several sources. Estimates of highway construction are based on average recent expenditures on Appalachian Development Corridors and similar highway construction in the State. We use the figure of $21 million per four-lane mile in our simulations. For highway resurfacing we calculated the State average mile cost from data collected by the Infrastructure Council on resurfacing expenditures and miles completed in all West Virginia Counties. The mean, un-weighted cost per mile of resurfacing was $75,000, for a 2-lane road over this three-year period ending in fiscal year 2000.[12] These data provide the basic elements of the simulation model we present below.

3.2 THE HIGH REVENUE SIMULATION

In the first simulation model we estimate the ceiling of potential revenue collections. To do this we assume expenditure responses to tax rate increases is zero. This means that a 1 percent increase in rates will result in a 1 percent increase in collections. This is undoubtedly the upper bound on revenue collections associated with a 1 percent rate increase. Under this scenario new revenues of roughly $27.2 million would be realized within the General Revenue Fund and $5.5 million into the highway Fund. Assuming all of these additional revenues are dedicated to new highway construction this would yield roughly 1.5 miles of new four-lane construction. If these revenues were dedicated wholly to road resurfacing they would permit the State to resurface 445 miles of roads. Table 3.3 illustrates the full results of the model on the revenues accruing to the General Revenue Fund while Table 3.4 illustrates the impact to the Highway Fund. A summary of both appears in Table 3.5. Summary of simulations for 3.5%, 5% and 10% across the board tax increases are contained in Tables A.1, A.2 and A.3 in the Appendix to this report..

12 For more detail see Hicks and Simpson, "Highway Program Financing Options." *Transportation Research Board, National Academy of Sciences,. Proceedings, Transportation and Economic Development 2001.* The actual data were obtained from Mallory, K. *West Virginia Infrastructure & Jobs Development Council, 2000 Report.*

Table 3.3, Simulation of 1% Across the Board Tax Increase on Highway Infrastructure Investment, General Revenue Fund Only

FUND AND SOURCE	Actual	Sensitivity	Result	Difference	Highways, 4 lane	Miles Resurfaced
General Revenue Fund						
Business and Occupation Tax	177,400,000	1	179,174,000	1,774,000	0.08	24
Corporation Net Income Tax	112,900,000	1	114,029,000	1,129,000	0.05	15
Personal Income Tax	1,020,700,000	1	1,030,907,000	10,207,000	0.49	136
Consumers Sales Tax	852,500,000	1	861,025,000	8,525,000	0.41	114
Use Tax	75,600,000	1	76,356,000	756,000	0.04	10
Cigarette Tax	31,800,000	1	32,118,000	318,000	0.02	4
Inheritance Tax	17,500,000	1	17,675,000	175,000	0.01	2
Beer Tax and Licenses	8,000,000	1	8,080,000	80,000	0.00	1
Insurance Tax and Fees	62,600,000	1	63,226,000	626,000	0.03	8
Racing Fees	2,000,000	1	2,020,000	20,000	0.00	0
Liquor Profits (a)	10,500,000	1	10,605,000	105,000	0.01	1
Charter Tax	3,800,000	1	3,838,000	38,000	0.00	1
Property Tax	3,600,000	1	3,636,000	36,000	0.00	0
Property Transfer Tax	6,600,000	1	6,666,000	66,000	0.00	1
Miscellaneous	6,600,000	1	6,666,000	66,000	0.00	1
Departmental Collections	11,100,000	1	11,211,000	111,000	0.01	1
Interest Income	31,400,000	1	31,714,000	314,000	0.01	4
Business Franchise Registrations Fee	1,300,000	1	1,313,000	13,000	0.00	0
Lottery Transfers	800,000	1	808,000	8,000	0.00	0
Severance Tax	163,200,000	1	164,832,000	1,632,000	0.08	22
Business Franchise Tax	101,400,000	1	102,414,000	1,014,000	0.05	14
Telecommunications Tax	15,200,000	1	15,352,000	152,000	0.01	2
Miscellaneous Transfers	300,000	1	303,000	3,000	0.00	0
Special Revenue Transfer	1,500,000	1	1,515,000	15,000	0.00	0
Prior Years Refunds	200,000	1	202,000	2,000	0.00	0
TOTAL GENERAL	**2,718,500,000**		**2,745,685,000**	**27,185,000**	**1.29**	**362**

Table 3.4, Simulation of 1% Across the Board Tax Increase on Highway Infrastructure Investment

(Highway Fund Only)	Actual	percent change	Sensitivity	Result	Difference	Highways, 4 lane	Miles Resurfaced
Gasoline and Motor Carrier							
Road Taxes	224,400,000	1%	1	226,644,000	2,244,000	0.11	29.92
License Tax	77,400,000	1%	1	78,174,000	774,000	0.04	10.32
Privilege Tax	154,400,000	1%	1	155,944,000	1,544,000	0.07	20.59
Wholesale Fuel & Use Tax (a)	71,300,000	1%	1	72,013,000	713,000	0.03	9.51
Other Income (b)	24,000,000	1%	1	24,240,000	240,000	0.01	3.20
TOTAL STATE ROAD FUND	**551,500,000**	**1%**	**1**	**557,015,000**	**5,515,000**	**0.26**	**73.53**

Table 3.5, Summary of Simulation of 1% Across the Board Tax Increase on Highway Infrastructure Investment (General Revenue and Highway Fund)

	Actual	percent change	Sensitivity	Result	Difference	Highways, 4 lane	Miles Resurfaced
TOTAL GENERAL	2,718,500,000	1%	1	2,745,685,000	27,185,000	1.29	362
TOTAL STATE ROAD FUND	551,500,000	1%	1	557,015,000	5,515,000	0.26	73.53
Total	**3,270,000,000**			**3,302,700,000**	**32,700,000**	**1.55**	**445.53**

3.3 The Expected Revenue Simulation

In the second simulation model we estimate the more realistic responses of revenue collections to rate changes. To do this we apply revenue elasticity's of tax rates that are derived from general estimates of responsiveness of taxes to rate changes. A fair criticism of these is that even these are generous.

Under this scenario new revenues of roughly $23.8 million would be realized within the General Revenue Fund and $5.5 million into the Highway Fund. Assuming all of these additional revenues are dedicated to new highway construction this would yield roughly 1.4 miles of new 4-lane construction. If these revenues were dedicated wholly to road resurfacing they would permit the State to resurface 391 miles of roads. Table 3.6 illustrates the full results of the model on the revenues accruing to the General Revenue Fund while Table 3.7 illustrates the impact to the Highway Fund. These are summarized in Table 13.8. Appendix A Tables Table A.4, A.5 and A.6 present the range of options under different tax rate scenarios, as with the earlier simulation.

Table 3.6, Simulation of 1% Across the Board Tax Increase on Highway Infrastructure Investment, Expected Earnings

	Actual	percent change	Sensitivity	Result	Difference	Highways, 4 Lane	Miles Resurfaced
General Revenue Fund							
Business and Occupation Tax	177,400,000	1.00%	1	179,174,000	1,774,000	0.08	24
Corporation Net Income Tax	112,900,000	1.00%	1	114,029,000	1,129,000	0.05	15
Personal Income Tax	1,020,700,000	1.00%	0.92	1,030,090,440	9,390,440	0.45	125
Consumers Sales Tax	852,500,000	1.00%	0.92	860,343,000	7,843,000	0.37	105
Use Tax	75,600,000	1.00%	0.92	76,295,520	695,520	0.03	9
Cigarette Tax	31,800,000	1.00%	1	32,118,000	318,000	0.02	4
Inheritance Tax	17,500,000	1.00%	0.92	17,661,000	161,000	0.01	2
Beer Tax and Licenses	8,000,000	1.00%	0.92	8,073,600	73,600	0.00	1
Insurance Tax and Fees	62,600,000	1.00%	0.92	63,175,920	575,920	0.03	8
Racing Fees	2,000,000	1.00%	0.92	2,018,400	18,400	0.00	0
Liquor Profits (a)	10,500,000	1.00%	0.92	10,596,600	96,600	0.00	1
Charter Tax	3,800,000	1.00%	0.92	3,834,960	34,960	0.00	0
Property Tax	3,600,000	1.00%	0.92	3,633,120	33,120	0.00	0
Property Transfer Tax	6,600,000	1.00%	0.92	6,660,720	60,720	0.00	1
Miscellaneous	6,600,000	1.00%	1	6,666,000	66,000	0.00	1
Departmental Collections	11,100,000	1.00%	1	11,211,000	111,000	0.01	1
Interest Income	31,400,000	1.00%	1	31,714,000	314,000	0.01	4
Business Franchise Reg. Fee	1,300,000	1.00%	0.92	1,311,960	11,960	0.00	0
Lottery Transfers	800,000	1.00%	0.92	807,360	7,360	0.00	0
Severance Tax	163,200,000	1.00%	0	163,200,000	0	0.00	0
Business Franchise Tax	101,400,000	1.00%	0.92	102,332,880	932,880	0.04	12
Telecommunications Tax	15,200,000	1.00%	0.88	15,333,760	133,760	0.01	2
Miscellaneous Transfers	300,000	1.00%	1	303,000	3,000	0.00	0
Special Revenue Transfer	1,500,000	1.00%	1	1,515,000	15,000	0.00	0
Prior Years Refunds	200,000	1.00%	1	202,000	2,000	0.00	0
General Revenue Fund	**2,718,500,000**	**1.00%**	**0.9**	**2,742,301,240**	**23,801,240**	**1.13**	**317**

Table 3.7, Simulation of 1% Across the Board Tax Increase on Highway Infrastructure Investment, Expected Earnings

	Actual	percent change	Sensitivity	Result	Difference	Highways, 4 lane	Miles Resurfaced
Gasoline and Motor Carrier							
Road Taxes	224,400,000	1.0%	0.92	226,464,480	2,064,480	0.10	27.53
License Tax	77,400,000	1.0%	1	78,174,000	774,000	0.04	10.32
Privilege Tax	154,400,000	1.0%	1	155,944,000	1,544,000	0.07	20.59
Wholesale Fuel & Use Tax (a)	71,300,000	1.0%	0.92	71,955,960	655,960	0.03	8.75
Other Income (b)	24,000,000	1.0%	1	24,240,000	240,000	0.01	3.20
TOTAL STATE ROAD FUND	**551,500,000**	**1.0%**	**1**	**557,015,000**	**5,515,000**	**0.26**	**73.53**

Table 3.8, Summary of Simulation of 1% Across the Board Tax Increase on Highway Infrastructure Investment, Expected Earnings

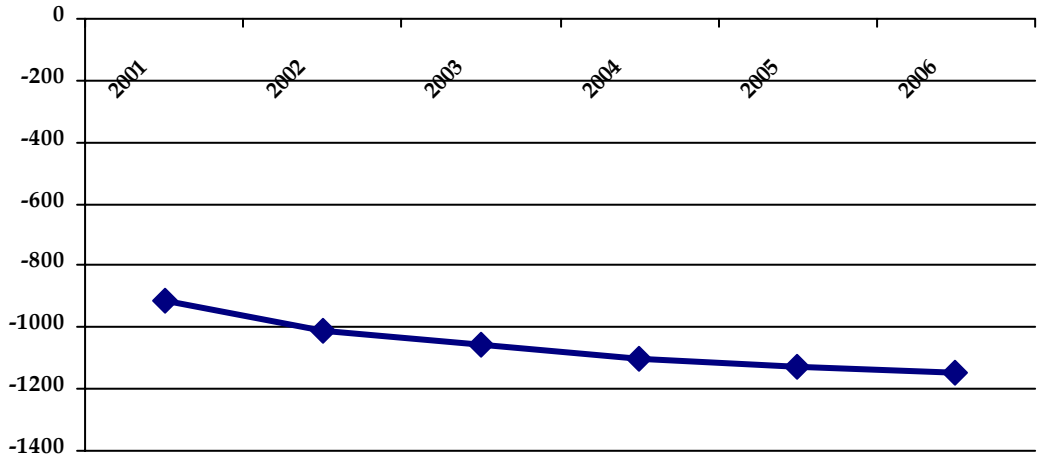
	Actual	Result	Difference	Highways, 4 lane	Miles Resurfaced
TOTAL GENERAL	2,718,500,000	23,801,240	23,801,240.00	1.13	317
TOTAL STATE ROAD FUND	551,500,000	557,015,000	5,515,000	0.26	73.53
Total	**3,370,000,000**	**580,816,240**	**29,316,240**	**1.40**	**390.88**

3.4 The Economic Ramifications of Tax Rate Increases

In order to appreciate the magnitude of a 1 percent tax increase under the simulation presented above it is useful to examine the dynamic impact of the rate increase on employment and output. While it is well outside the scope of this research to present an exhaustive analysis of the impact of tax increases on overall economic activity a single example would be instructive.

Using the Regional Economic Model of West Virginia produced by REMI, Inc. we model the impact of a 1 percent increase in the CNIT in the State. Results are shown in Figure 3.1.

Figure 3.1, Employment Impact of 1% Corporate Net Income Tax Increase



Clearly, the impact of only the CNIT would range between 900 and 1200 jobs per year for each of the five years after the modeled impact (recall we used data through 2000). Notably this impact would be partially offset by the construction expenditures from additional highway construction. Also, under some conditions, the expenditures associated with the tax increase would attract federal matching funds to further offset this impact. However, the impact would certainly not occur in the first year. Also, there is much doubt as the economic benefits of some types of infrastructure construction and operation. In order to evaluate whether or not benefits would accrue to the State as a result of increased taxation a more detailed examination of the specific infrastructure under consideration is necessary. This discussion is undertaken to point out that the gross benefits of infrastructure investment should be compared to costs to get a net benefit. This net benefit is often not positive.

3.5 Summary

The combination of a relatively inelastic tax base, expensive construction and maintenance and generally low tax base makes revenue enhancement in West Virginia a challenging public policy issue. The relative inelasticity of our tax system suggests muted revenue benefits of increased infrastructure expenditure under the current system of taxation.

In order to illustrate the challenges in generating revenues for public infrastructure construction we illustrated tax rate increase of 1 percent across all instruments in both the General Revenue and Highway Funds. We provide two scenarios with differing tax responses to rate changes. We then translate these new revenues into additional federally sponsored highways and road resurfacing in order to illustrate the actual infrastructure impacts.

Clearly, given these findings, rapid increases in the rate of highway construction are very unlikely without dramatic adjustments in existing budgetary priorities matched with large tax increases.

4. INNOVATIVE HIGHWAY FINANCING

Decentralization of government programs in the 1980's and 1990's led directly to a number of flexible financing options connected to existing highway construction legislation. Leading this wave was a suite of investment and cash flow instruments tested under the auspices of an FHWA Test and Evaluation Project (TE-045) from 1994 through 1996. During this period, FWHA approved 88 state level proposals for projects that specifically employed these financing mechanisms. Many of these financing instruments have since been incorporated into later highway construction legislation, most notably ISTEA-21 and National Highway System Designation Act of 1995.

In 1995, the Federal Transit Administration published a Federal Register notice on innovative financing outlining the mechanisms employed by that organization to facilitate capital investment. These mechanisms involved proposal options for Federally financed projects submitted to the FTA.

In both cases these financing mechanisms are innovative in the sense that they permit states to use existing legislative requirements flexibly. They are not innovative in the sense that they introduce previously unknown methods for paying for construction and operations of infrastructure. Nonetheless, these mechanisms provide the basic set of what is commonly known as 'Innovative Financing.' In this section we review the major program adjustment that are identified by FHWA, FTA and others as innovative financing mechanisms.

4.1 OBJECTIVE AND SCOPE OF INNOVATIVE FINANCING

The objectives of the TE-045 efforts were four-fold. The first of these was to increase investment by permitting states to leverage their current spending to attract greater levels of financial capital – both public and private (though not federal). Second, to accelerate projects thereby increasing the present value of benefits. Third, promote the use of new and complex ISTEA financial provisions. Finally accumulate experience with these financial instruments as a basis for future legislative changes and to sponsor state level proposals for alternative financing. See Table 4.1.

Table 4.1, Innovative Financing Mechanisms

Option	Description	Legislative Update
Flexible Match	Permits Non-State contributions to directly offset State share.	Approved in National Highway Designation Act
Section 129 Loans	Permits loans to broader set of projects with identified revenue streams	Approved in National Highway Designation Act
ISTEA Section 1044 Toll Credits	Allows longer accumulation and smoothing of revenue streams to permit continued MOE of state funding	FHWA Administrative approval
Reimbursement of Bond Financing Costs	Extends Federal reimbursement beyond principal to a larger suite of financing costs.	Approved in National Highway Designation Act
Post-ISTEA Advance Construction	Smooths use of advance construction authorization under ISTEA	Approved in National Highway Designation Act
Partial Conversion of Advance Construction	Allows use of estimated future obligations in lieu of up front State contributions	FHWA Administrative approval
Phased Funding	Permits estimated phased State commitment in lieu of up front actual costs.	No longer considered
Tapered Match	Permits changes in match level that may occur with project or State match type.	Continuance of testing
STP Simplification	Permits the bundling of smaller projects together to minimize administrative costs and spread Match ratios across different types.	Continuance of testing

Notably, West Virginia has been *very aggressive* in pursuing and experimenting with innovative financing techniques. Since the last comprehensive comparison the State has engaged in several more innovative financing projects. As of the publication of the last comparative study, West Virginia, with just under three and a half percent of the country's total innovative projects, has participated in this program in proportions far exceeding population, road mileage or dollars expended on highways. A sample of West Virginia's Innovative Highway Finance Options is illustrated in Table 4.2.

Table 4.2 Innovative Financing in West Virginia

Project Name	*County*	*Private Partner*	*Cost*
Coalfields Expressway	McDowell	McDowell County Commission	Ongoing
Twisted Gun Golf Course	Mingo	Mingo county Economic Development Authority and Premium Energy Coal Company	$2.4 Million
Snowshoe Access Road	Pocahontas	Snowshoe Resort	$2.4 Million
Rawl Road (WV 49)	Mingo	Norfolk southern RR	$1 Million
Service Roads (8 miles)	Lincoln	Heartland Coal	$3 Million*
Service Roads (8 miles)	Wayne	Pen Coal	$2 Million*
Wood Products Industrial Access road	Mingo	Mingo County Redevelopment Authority and Hobet Mining	$1.9 Million
Connection of Buffalo Creek Rd to WV 85	Boone and Logan	Eastern Associated Coal	$1 Million*
McDowell CR 1/5	McDowell	Red Ash Coal Corporation	$0.5 Million*
WV 161	McDowell	MidVol Coal	$2.8 Million
Fairground Race Track Road	Mingo	Several Companies	$2 Million*
King coal Highway (Red Jacket Section)	Mingo	Mingo County Redevelopment Authority, Premium Energy Coal Company	$300 Million
Mountaineer Racetrack Bridge	Hancock	Mountaineer Race Trac	$45 Million

***Denotes funding entirely by private sector.**

4.2 INNOVATIVE FINANCING SINCE TE-045

Many of the programs evaluated under TE-045 have subsequently been approved either administratively, are still under review or were included in follow-up legislation. To date, only phased funding has been curtailed from experimentation under TE-045. The remaining suite of financing options remains available to states for potential implementation. The actual use of these projects requires case specific planning, and is not a generalizable process to highway financing. Indeed, for each type of innovative financing mechanism permitted for testing under TE-045 extensive individualized efforts to structure the finance will be required.

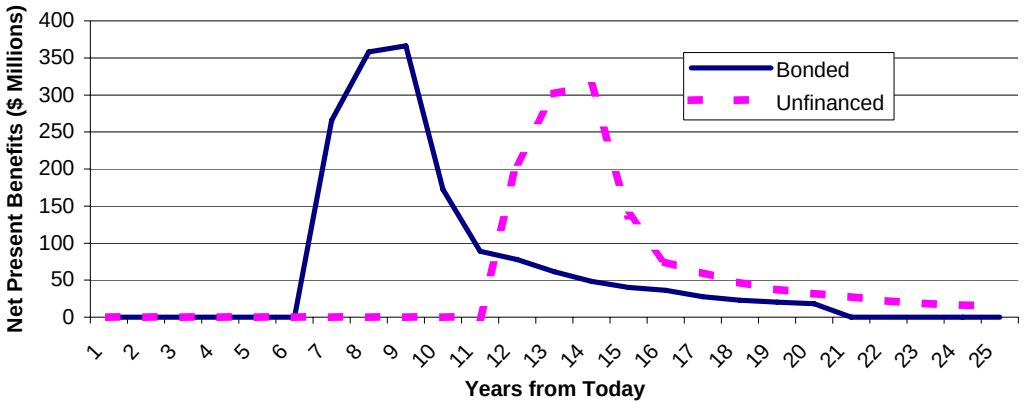
For example, the reimbursement of bond financing costs, though seemingly a simple process, would require a detailed accounting of bond issuance costs, including administrative, interest rate, et cetera. There are no 'cookie-cutter' approaches to these financing options. As we will see later, the process becomes more involved with the most potentially useful programs.

Borrowing for infrastructure through one of the TE-045 programs continues to offer states more flexibility. One of the major benefits of borrowing is the earlier realization of benefits associated with highway construction. To illustrate these benefits, we offer an hypothetical example of highway benefits that can be achieved through network benefits to the region.

The hypothetical net benefits we present in the following summary analysis include increase in the regional purchase coefficients, reduced economic migration away from the area, increase tourist expenditures on retail, hotel, gasoline and other associated activities. Our simulation also included a modest (less than one half of a percent) increase in labor productivity associated with a new road. These are all regional net benefits, so construction, etc. would cancel out with the tax costs associated with the project.

We then provide examples of current benefits, discounted into the future. We estimated these hypothetical impacts using REMI, Inc. models for West Virginia.[13] Using an inflation adjusted discount rate within the range commonly applied to West Virginia bonds, we estimate the net benefits in two streams. The earlier impacts are those that the region can enjoy under a bond financing arrangement, while the later, and smaller benefits are those associated with infrastructure financed from current revenues. See Figure 4.1.

Figure 4.1, Financed and Unfinanced Net Benefits



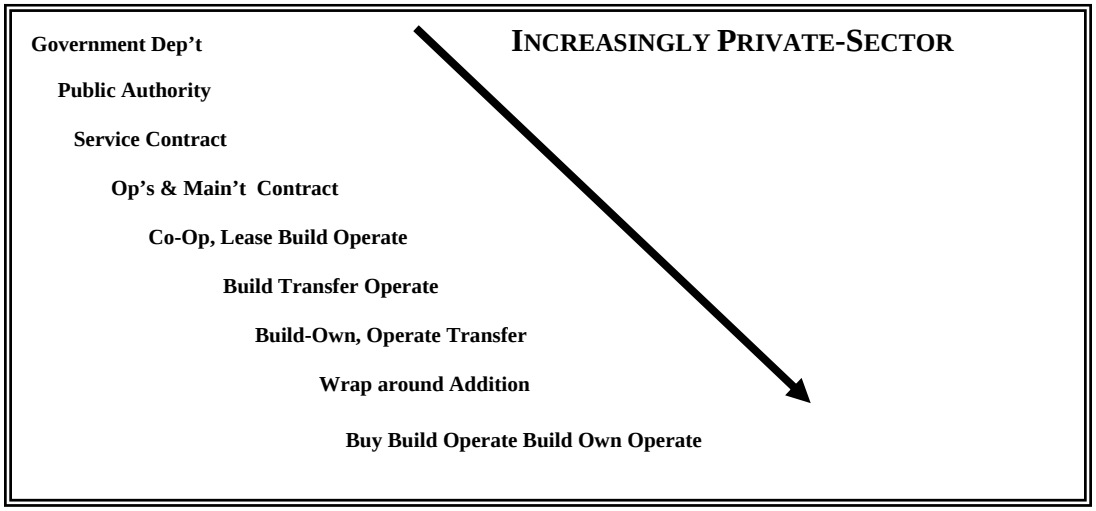
The most probable extension of innovative financing techniques that emerges as viable for the WVDOT is the integration of public-private partnerships into the innovative interpretation of Federal Guidelines.

[13] The REMI, model is produced by Regional Economic Models, Incorporated. This is the dominant regional economic simulation model available.

5. PUBLIC PRIVATE PARTNERSHIPS

Jointly constructed, financed or operated infrastructure are the most important innovation in infrastructure finance to emerge in the past quarter century. The blending of public and private activities in what has been a purely governmental operation emerged in the early 1980's in Europe and the United States. These types of ventures provide flexibility, higher efficiency, and lower cost alternatives to traditional government construction activities. The spectrum of public private partnerships is illustrated in Figure 5.1.

Figure 5.1, Forms of Private Public Partnerships



Source: Adapted from Table 9.2, Privatization and Public-Private Partnerships, E.S. Savas, 2000, pp 241.

5.1 TYPES OF PUBLIC PRIVATE PARTNERSHIPS

Government Intensive

Each of these forms of privatization provides options for West Virginia. The first five types of PPP's ranging from Government Department through Cooperatives are common in West Virginia. Examples of pure government operations include DEP on-site inspections and DOH Courtesy Patrols.

These are almost wholly public ventures funded through taxes and user fees at the state or local level. Public authorities, notably Port, Airport and Economic Development provide modest departure from the purely public sector role. Both Public Authorities and Government departments employ lease and contract arrangements for some services. Finally co-operatives provide the least government intensive form of service and infrastructure provision that is still wholly government controlled. Examples of co-operatives are extensive in the provision of local water and sewer services.

Mixed-Form

A suite of lease, building and operating mixes provides examples where government owns a component of infrastructure, but builds and distributes services from that infrastructure from a mix of public and private entities. Under various forms of these arrangements the

government permits private agencies to build on government land, leasing the property back to the private sector for fixed duration contracts.

These are among the most complex of Public-Private Partnerships since they involve asymmetric risk for the parties involved. On the public sector side, the desire to provide the service requires some risk taking in the permitting of the private sector to engage in the operation of a service to the private sector. This unbalanced risk requires a great deal of planning, and professional assessment to mitigate. The challenges of the risk are even more daunting since the benefits and costs often do not coincide temporally. Private firms constructing highways often fail to enjoy benefits until many years after the initial financing and building of the road. Other, less costly infrastructure items also suffer this concern. Adding to the asymmetry is the inevitability of political changes that make long-term investment and contracting with state and local governments difficult for firms. Governments will also find that these long-term relationships impose severe planning and contracting challenges.

For private sector firms, changes in regulatory arrangements by a government engaged in a principal-agent arrangement are very threatening. To mitigate the risk of private companies failing or governments changing the rules, these types of leases and operating arrangements are typified by extensive contractual arrangements between both parties. Examples of these types of PPP's include hotel and restaurant concessions at parks and locally owned civic centers.

Private Sector Intensive

Forms of PPP's that are more private than public include full-scale ownership or operation of a facility or add-on facility by the private sector. Examples of these are long-term or in perpetuity contracts for the provision of services (such as private toll bridges). These types of PPP's are common where complete privatization of a service is a goal.

5.2 CRITICISMS OF PUBLIC PRIVATE PARTNERSHIPS

Privatization of government services has increased rapidly in recent years. Internationally a wide variety of nations are engaged in devolving ownership from government to the private sector. Within the United States the trend has grown also, but is much less pronounced. Indeed, with the exception of land ownership, the United States has enjoyed the greatest proportion of productive capacity owned by the private sector of any nation in modern history.

Even with a strong history of private ownership, criticism of the privatization trend has emerged. Within this arena there are both philosophical and practical arguments against privatization. The philosophical arguments for government provision are outside the scope of this study.

In practical terms, arguments against public private partnerships revolve around the ability of government to insure continuous operations, preserve quality and maintain flexibility. Few government officials who have written about their experiences with privatization offer evidence to support these concerns. Former Democratic Indianapolis mayor Stephan Goldsmith argues:

> Because privatization means many things, it is easy for adversaries to threaten the public with "loss of control," presumably suggesting that vendors will not be responsive to the public. The truth is that we possess many more tools to control the quality and price of a private contractor or winning public employees than we do those employees acting in a typical government bureaucracy. As a result of the bidding procedure, we can impose fines for poor quality or missed deadlines, more easily reward performance, and if necessary simply cancel the contract rather than navigate the excruciating procedures required to actually fire a civil service employee. In each of our competitive initiatives, the city retained and even enhanced its control over services. In all too many American cities, mayors and city managers operating in monopolistic governments have very little control. Competition and marketization dramatically increased government control by giving policymakers more tools for putting their policies into effect and better yardsticks for measuring performance. The only control politicians lose is the ability to hire workers on the basis of patronage instead of productivity" [from *The Twenty-First Century City: Resurrecting America*, pg 70, as quoted in *Privatizaton and Public Private Partnerships*].

There is an extensive history of privatization in a number of U.S. cities and states. From the extensive case history of these private ventures it is clear that practical concerns may be ameliorated through public dialogue, rigorous contracting and education.

The education of public officials regarding the scope of public private partnerships is an important undertaking for the executive branch. This may be especially true in states where the public sector role in economic activity has been so dominant.

5.3 SOME POTENTIAL BENEFITS OF PUBLIC PRIVATE PARTNERSHIPS

The joint public and private financing of infrastructure offers many potential benefits. These benefits may accrue either as direct benefits or in cost reductions. We will review these shortly, however before outlining the potential benefits of public private partnerships it is important to dispel a few myths regarding benefits.

First, transferring costs from the public to the private sector is not a benefit. For benefits to accrue from a transfer of costs there must be a concomitant reduction in costs. Second, reducing costs on infrastructure projects does not imply employment reductions. On the contrary, lower cost infrastructure investment results in increased employment and earnings.

Benefits to public private partnerships accrue when infrastructure is constructed at lower costs to society – either public or private. Benefits are also generated when projects are constructed more quickly, potentially increasing the present value of benefits.

Lower costs may be achieved by the private sector through scale and scope economies. Simply, private firms may be able to organize resources in research and development, engineering and operations management that public sector activities cannot. If this results in lower costs it is known as economies of scale.

Private firms may also employ many types of infrastructure design, construction and management. Oftentimes these firms can provide different, but related, services to different government entities that reduce costs. Cost savings achieved through this mechanism are known as economies of scope.

Care must be made to identify cost related savings as they are generated through the purchasing process as it is of concern to many stakeholders. Privatization that simply transfers costs does not necessarily reduce costs. For example, hiring of workers without healthcare benefits to reduce costs may have the undesired effect of increasing Medicaid costs for the State. This is noted only to imply that careful analysis of privatization in each project is needed. At the state level a comprehensive policy on cost/benefit analysis of privatization is warranted.

The more rapid completion of projects possible through public private partnerships is due to capital constraints at the local level. Much infrastructure is constructed through a matching process with state or federal funds. So, reductions in the match requirements may, in essence, leverage greater spending by other fiscal authorities. For example, the construction of a new bridge by a state often requires a 20/80 spending match with the federal government. If a telecommunication firm wishes to use this bridge to carry fiber optics, and will assist in the construction costs, this makes financing easier for the State, for two reasons. First, every dollar in cost reduction helps the State reduce its total costs and in most cases would count as match for additional bridge construction. In this way, the cost reduction may permit faster overall construction of the infrastructure. In this case, any net benefits that occur in later periods (such as traffic benefits) will now occur at a less discounted date. Again, care must be made in analysis of this project, since cost savings merely transferred to the private sector or another fiscal body are not benefits.

5.4 SUMMARY

Recent advances in highway financing techniques are almost wholly derived from administrative changes to existing highway financing techniques. These administrative changes are commonly known as innovative financing.

The most truly innovative highway financing mechanism is the growth and expansion of privatization of public goods and services. This is commonly referred to as public private partnerships. Methods of financing infrastructure that use both private and public funds for construction, operation and maintenance fall under this rubric.

Both the suite of administrative changes known as innovative highway financing and the public private partnerships that are becoming common, share the need for extensive, project specific planning. There is no common blueprint for implementing either technique. Instead, each will require specific planning efforts specifically targeting financing.

6. LONG TERM FINANCING CONSIDERATIONS

The West Virginia Department of Transportation has expressed concern for the long-term viability of the highway financing system. This well placed concern was described thusly:

> "Any future change in motor fuel availability, consumption rates or price, without changes to the tax rates or structure, will have a significant impact on future tax revenue collections" *pg 2, West Virginia Highways, Sources of Revenue, 2001*.

At issue is the question as to whether or not the current tax base is sufficiently elastic to provide continued financing to meet future demand for highway construction, operations and maintenance. The tax instrument that raises the greatest concern is the Gasoline Excise Tax. The potential challenge to the Gasoline Excise Tax is how will increased efficiencies and inflation change collections relative to motor vehicle use and demand for highways.

This question is germane since gasoline consumption is affected both by economic activity and regulation. Any technological or regulatory changes (e.g. increasing Corporate Average Fuel Efficiency or CAFE standards) may result in a substitution of consumption towards other fuel sources. Also, vehicle miles traveled and the actual efficiency of use (not just technical standards) affects revenue collections.

Additionally, alternative revenue sources may offer attractive options to mitigate the impacts of revenue flow changes to existing tax instruments. Chief among the alternative revenue sources that should be considered is road pricing. This chapter proceeds as follows. First, we analyze issues within the current federal and state taxation of gasoline. This is followed analysis of road pricing and a brief summary.

6.1 The State of Gasoline Taxation

A thorough treatment of West Virginia's Gasoline Excise Tax collections is outside the scope of this study. However, the following treatment of long run responsiveness to changes in actual efficiency of miles traveled and revenue responsiveness are useful in a broader understanding of the issue.

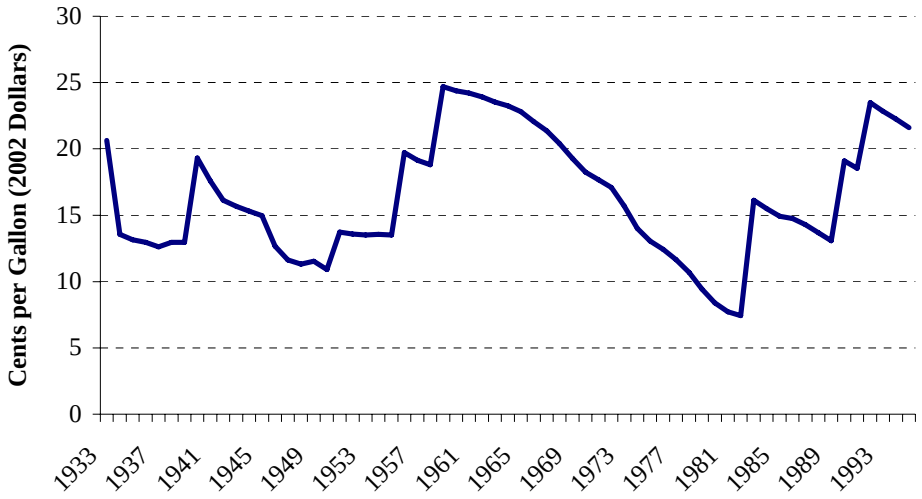
The United States has taxed gasoline as a specific commodity for over 75 years. [14] The initial purpose of the tax was simply to aid in federal revenue collections during the darkest days

[14] The Revenue Act of 1932 established the Gasoline tax at 1 cent per gallon. See Brian Francis, *Gasoline Excise Taxes, 1933-2000*. Internal Revenue Service.

of the Great Depression. Though some states had taxed gasoline prior to World War One, it was not until after the federal tax was established that most states began consistently taxing gasoline.

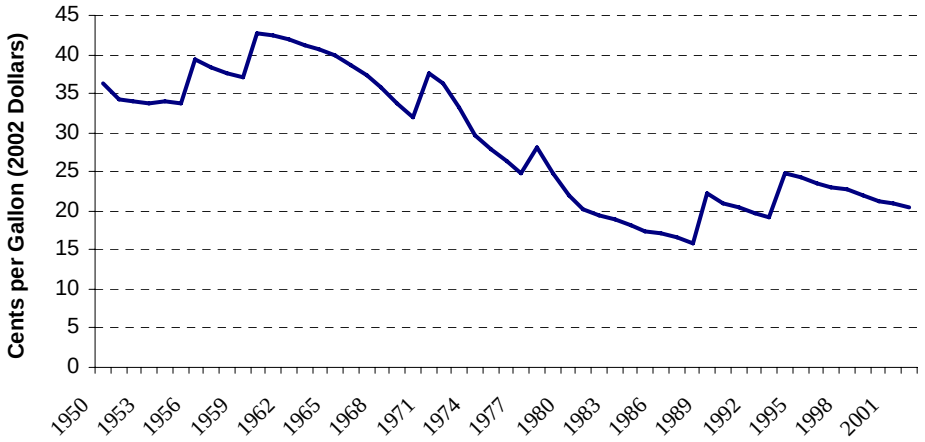
The Highway Revenue Act of 1956 created the Highway trust Fund and raised gasoline taxes from 2 to 3 cents per gallon. This legislation dedicated these funds to highway construction. In inflation adjusted terms that tax today is nearly identical to the rate consumers experienced in 1932. See Figure 6.1.

Figure 6.1, Inflation Adjusted Federal Gasoline Tax
Source: Authors calculations using Federal tax rates, the Consumer Price Index



West Virginia also levies a Gasoline Excise Tax, and has done so since 1950. Unlike the Federal tax, West Virginia's tax has failed to maintain its rate against inflation. In inflation adjusted terms, West Virginia's gasoline tax is roughly half of what was levied at its peak in the early 1960's. See Figure 6.2.

Figure 6.2, Inflation Adjusted Gasoline Excise Tax in West Virginia
Source: Authors calculations using WV tax rates, the Consumer Price Index



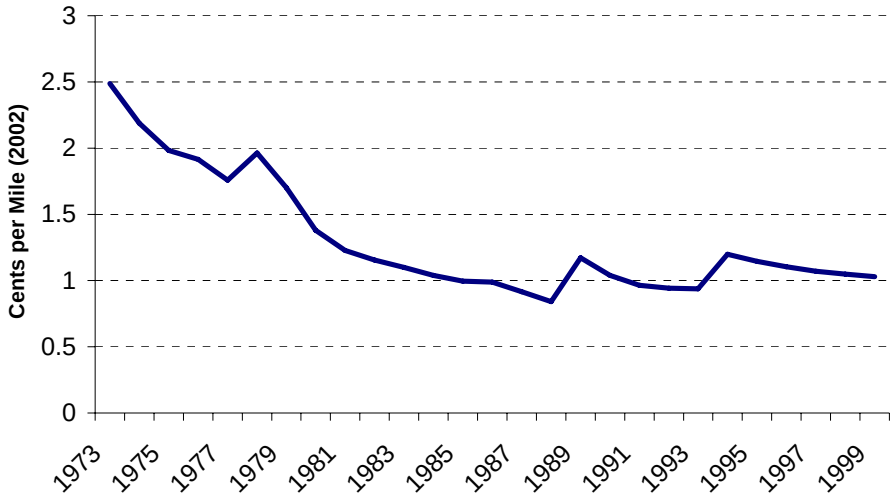
The real reduction in the Gasoline Excise Tax rate clearly reduces the State's ability to fund highway construction operations and maintenance. In addition, there have been other

issues that affect the stability of the Gasoline Excise Tax. These are increasing fuel economy and higher vehicle weights. Both of these issues serve to weaken the link between tax incidence and cost to public infrastructure.

Higher vehicle weights increase the cost of maintaining highways. If user fees do not capture the increased cost the incidence of taxation is severed from the consumers causing the cost. This is poor tax policy. Determining the optimal fee structure under these conditions is well outside the scope of this research. However, it is important to recognize this feature of the current structure.

Increasing fuel efficiency, while clearly good for the economy and the environment, can also lead to decreased revenues generated by the Gasoline Excise Tax. The introduction of CAFE standards combined with changing commuter patterns has resulted in increased efficiency per non-commercial mile driven in the past three decades.[15] Notably, this has occurred despite the increased popularity of less fuel efficient SUV's that are exempt from CAFÉ standards. Indeed, when combining the loss of revenues due to inflation with increased fuel efficiencies and more efficient driving habits, there has been a 150 percent reduction in Gasoline Excise Tax collections per mile driven since 1973. See Figure 6.3.

Figure 6.3, Real Gasoline Excise Tax Collections per Non-Commercial Mile Driven in West Virginia,



Source: Authors calculations using WV tax rates, the Consumer Price Index and national fuel efficiency data.

This value is a good proxy for the revenue collections per unit of maintenance and operations cost in the State. It only misses changes to costs of maintenance due to technological, regulatory or vehicle weight changes.

Gasoline Excise Tax collections for the State have shown a strong upward trend in the past two decades. However, in real terms, the GET collections peaked in 1978, and declined until the early 1990's when rate changes took effect. The rebound in collections has narrowed the gap, and by the late 1990's the GET collections were modestly above their earlier peak. In contrast, real personal income in the State rose by 11.7 percent over the same time period.

The lesson to absorb from these data is that Gasoline Excise Tax revenues have not kept pace with the economy as a whole, inflation or changes to technology that reduce revenues without an associated impact on costs. This strongly suggests that a reexamination of the current

[15] See Puentes and Prince "Fueling Transportation Finance: A Primer on the Gas Tax" Center on Urban and Metropolitan Policy, Brookings Institute, March 2003.

rate structure is warranted. In particular indexing the State Gasoline Excise Tax rate to inflation is a policy that warrants consideration.

In order to evaluate the landscape that would influence a change in the Gasoline Excise Tax rate we performed several different panel analysis of the rate across all 48 conterminous states and the District of Columbia from the early 1970's through the present employing different specifications (e.g. tests of per capita consumption, revenues, etc.). This empirical analysis provided some interesting insights. Before we discuss them we will briefly present the basic model.

We employed a fixed and random effects tests as well as linear specifications (not illustrated) for the State of West Virginia. These are commonly employed methods for analyzing large areas, of many regions over varying time periods. The models displayed remarkable ability to predict the dependent variables (gas consumption and tax collections). The chief problem with these types of models is misspecification (not using all the correct variables) and inherent flaws in the data. We have employed several control variables to mitigate the first problem. The data themselves were collected from federal sources (Regional Economic Information Systems, State Personal Income, and the National Tax Database). The basic model, where quantity consumed is a function of price, taxes, demographic variables, takes a specific form:

Equation 6.1

$$\log(gas) = c_{i,t} + \beta_{i,t}\log(pop) + \beta_{i,t}\log(PI/CPI) + {}_{i,t}\log(GTR*100) +$$
$$\beta_{i,j}\log(100*GTR_i/\sum i) + \beta\, T + \beta_{i,j}\log(100*FedGTR) +$$
$$\beta_t\log(MPG) + \beta_t\log(GASPRICE/CPI) + \phi + \varepsilon_{i,t}$$

The results from one of the several specifications we performed is illustrated below. This is a fixed effects model, without the intercepts illustrated.

Table 6.1, Panel Regression of the Log of Gasoline Consumption

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG (POP)	0.488877***	0.065176	7.500845	0
LOG (PI/CPI)	0.359446***	0.047126	7.627326	0
LOG (Gas Tax Rate*100)	-0.03422***	0.00812	-4.21499	0
LOG (Regional Avg GTR*100)	-0.04399**	0.017419	-2.52512	0.0117
TREND	-0.00111	0.002154	-0.51553	0.6063
LOG (FED GAS TAX Rate *100)	-0.00246	0.004883	-0.50307	0.615
LOG (MPG)	-0.31673***	0.047207	-6.70936	0
LOG (GASPRICE/CPI)	-0.12753***	0.012479	-10.2197	0
Autoregressive Component (1 lag)	0.717403***	0.031322	22.90384	0
R-squared	0.99	Mean dependent var		14.14779
Adjusted R-squared	0.99	S.D. dependent var		0.971085
S.E. of regression	0.027553	Sum squared resid		0.706047
F-statistic	153130.3	Durbin-Watson stat		2.033919
Prob(F-statistic)	0			

denotes statistical significance to the .05 level, * to the .01 level using students T-statistics.

The dependent variable here is the logarithm of Gasoline Consumption, annually from 1973 to 2000 in the 48 conterminous states and the District of Columbia. The independent

variables included population, real personal income, gas excise tax rates, average gas excise tax rates in adjoining states, a trend, the federal gas tax rate, federal estimates of fuel efficiency per mile driven, the national average of real gas prices and an autocorrelation component. Other specifications included spatial autocorrelations, longer lags and other small adjustments. None of the specification changes altered the results significantly.

The first finding is that real gasoline tax collections among the sample were most affected by real personal income and population in the states. Rising incomes and populations increased consumption. These were offset also by increased fuel efficiency, a trend that persisted through the study period. The impact of increased efficiency, at the margin, was lower than both real income and population increases. However, in a second test we found that, on a per capita basis collections declined as population increased. This suggests residents of larger states likely have other transportation options than those in less populated states.

Our tests also found that higher levels of excise tax rates had very small to un-measurable impacts on consumption when correcting for most other factors. The responsiveness of gasoline consumption to federal gas tax rates was not statistically different from zero. For state tax rates the impact was virtually zero with an elasticity of –0.03.

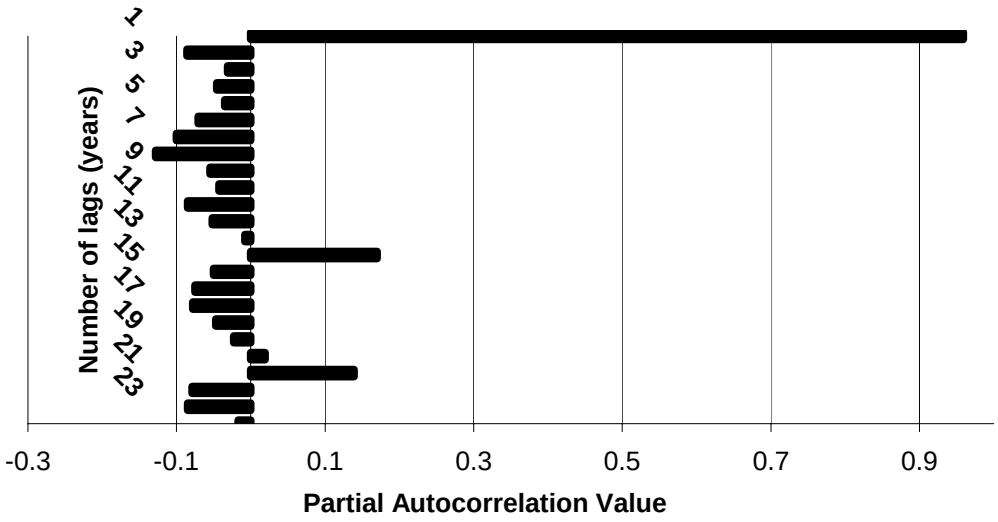
The price elasticity of demand was roughly four times (in absolute value terms) as large as the tax elasticity demand, or roughly –0.12. Notably state and federal taxes are, on average, between a quarter, and a third of total consumer gasoline prices as of this writing. This supports most *a priori* beliefs regarding gas price elasticity of demand. See Table 6.2 for a review of other elasticity studies.

Table 6.2, Short Run Elasticity of Gasoline Demand, with Respect to Price

Study	Value	Subject
Hicks, 2005, this study	-0.127	Total gasoline usage, in panel study of 48 states
Goodwin, 1992	-0.27	Total Gasoline usage, United Kingdom
Luk & Hepburn, 1993	-0.12	Total Gasoline usage, Australia
Johansson & Schipper, 1997	-0.10 to –0.40	Various studies
Mayeres, 2000	-0.16	Essential trips in the U.S. (commuter traffic)
DeJong & Gunn, 2001	-0.06 (-0.20)	Business (commuting) in Europe
Hagler Bailly, 1999	-0.15	Canadian road gasoline

The impact of rates in surrounding states was also minimal to non-existent. This most likely reflects the reality that rate changes across states are closely timed. The parallelogram displayed in the following figure illustrates the very close time correlation of rates. In this graph, the correlation of rate changes is displayed. The very high value on the first lag (near the maximum correlation) shows how strongly West Virginia and each of the surrounding states (Pennsylvania, Kentucky, Maryland, Ohio and Virginia) synchronize rate changes. The cause of this synchronization should be of considerable interest, however determining which factor contributes most, among several competing options is well outside the scope of this study.

Figure 6.5, Partial Autocorrelation of GET Rate Changes, WV and Bordering States



Further evidence of synchronized rate changes is a time series test for cointegration. This test measures the 'co-movement' of gas excise tax rates across West Virginia and its border states. This numeric test confirms the partial autocorrelation function illustrated above. Yet another tests, that of Granger Causality, also confirms these findings.[16] The nationwide panel also suggests that border effects (here tested as a spatial autocorrelation and recursive spatial autocorrelation) play a minimal role in state gasoline excise tax revenues. A summary interpretation of these tests is that border effects of rate changes have been largely muted since West Virginia and its bordering states tend to change rates with much synchronization. While that may not always be the case, within the past 30 years, there's little evidence of consumers changing gasoline consumption patterns in the region due to rate differentials across the states bordering West Virginia.

These findings offer some important policy considerations. Among these is balancing the trend in real gasoline tax rates with expectations regarding road maintenance, operations and construction in the State. Any positive adjustment in West Virginia's Gasoline Excise Tax would likely generate nearly proportional revenue increases. This estimate matched with an understanding of border state rate changes makes a policy discussion regarding Gasoline Excise Tax rates in West Virginia worthwhile.

A brief comment on alternative fuel taxes is warranted. While there are increasing interests in alternative fuels, it seems highly unlikely that anything other than gasoline additives are likely to present themselves in the short run. Taxing alternative fuels poses the unwanted risk of diminishing their use. This is likely very important as West Virginia has a region along the Ohio River that suffers some of the highest levels of airborne emissions in the United States. Of course, most of these emissions are not automobile related, nonetheless, reducing demand for alternative fuels, at least until they are more entrenched, is not a viable revenue strategy. Also, though a full analysis is unwarranted in this research, it is almost certainly very poor public policy, and will likely remain so for at least the coming decade.

[16] Cointegration tests are a form of hypothesis testing that confirms the co-movement around some partial equilibrium value. A useful example of this is that a random movement of a man and a dog across a field may not yield any discernable pattern, except that they are connected by a leash. The cointegration estimates the size of the leash. Granger Causality is a simple test for time series correlation in lagged values. The presence of Granger Causality suggests one variable can be used to predict or forecast another variable. There is no inference of actual causation in this statistic or test.

Other financing considerations also emanate from our understanding of changing technology and consumption patterns. Among these are considerations regarding road pricing of transportation infrastructure in the State. The following sections treat this issue in West Virginia.

6.2 Road Pricing

Road pricing of infrastructure is probably the oldest financing form, and is currently applied as toll collections along the West Virginia turnpike. The term road pricing applies to efforts to generate revenue, manage congestion, or alter travel behavior through alternative modes, timing, etc.

The most common types of road pricing are toll roads, congestion pricing, High Occupancy Toll (HOT) lanes, Cordon Areas, Road Space Rationing and Vehicle Use Fees (e.g. mileage fees). West Virginians will be most familiar with toll roads. Before discussing some possible road pricing options for West Virginia, we first should dispel some misconceptions.

It is often mistakenly believed that toll roads are designed solely to pay for a new piece of infrastructure. While that is often the case, this is not perhaps the best application of tolls. Uncertainty regarding traffic demand and long repayment periods often lead to high finance charges for toll roads. If tolls are to constitute a primary revenue generator it is probable that tolls be assessed on existing roads to pay for new consumption. This approach is useful for several reasons. First, current roads have known (or knowable) traffic loads that lend themselves well to estimating revenues. Second, tolls on existing roads constitute the best measurement of local road traffic. It is local traffic that economists have the most difficulty in estimating when calculating road usage. Finally, tolls on existing roads employed to finance future regional construction closely match tax incidence with demand. This is a feature of all good tax systems.

The second most common application of road pricing is to change consumer travel patterns, primarily to avoid congestion. West Virginia does not have congestion problems that are similar in any magnitude to the vast majority of urban areas in the world. Indeed, roughly 80 percent of the nations population lives in regions with traffic congestion much worse than the most congested West Virginia roadways. This does not mean that road pricing is inappropriate for West Virginia, or even that reducing congestion should not be a goal, only that revenue enhancement is more likely to motivate road pricing than is congestion.

Another important issue in road pricing is the rapid improvements in intelligent transportation systems that dramatically cut the administrative costs of many types of collections. Table 6.3 outlines several collections options, ranking their appropriateness.

Table 6.3, Road Pricing Fee collection Options
(adapted from Victoria Transportation Policy Institute, TDM Encyclopedia

Type	Description	Equipment Costs	Operating Costs	User Inconvenience	Price Adjustability
Pass	Motorists must purchase a pass to enter a cordoned areas.	Low	Low	Medium	Poor to medium
Toll Booth	Motorists stop and pay at a toll booth	High	High	High	Medium to high
Electronic Tolling	An electronic system bills users as they pass a point in the road system	High	Medium	Low	High
Optical vehicle recognition	An optical system bills users as they pass a point in the road system	High	Medium	Low	High
GPS	GPS tracks vehicle location. Data are sent to a central computer that bills users	High	Medium	Low	high

As we can observe, there are several options for collecting fees. The West Virginia Turnpike currently employs tollbooths with electronic tolling. GPS tracking of public vehicles (e.g. school buses) is being tested at the Rahall Appalachian Transportation Institute. Optical vehicle recognition is being employed by the City of London, in the most ambitious congestion fee application, which began this year. Passes are used in a number of European cities where roads are not compatible with high levels of traffic. Each of these technologies or methods has benefits and costs. The degree to which each is employed depends on the needs and resources available to the community employing them.

6.3 Traffic Effects of Road Pricing

The impact of road pricing on traffic is critical, even to a revenue enhancement program. Clearly, increasing the price for consumers to travel will induce some proportion of travelers to drive together, use alternative routes or modes, changes times of travel (in case of peak time pricing) and change destinations and frequency. The degree to which each of these occurs is a subject of much study, and for any application in West Virginia would certainly need to be the subject of an additional study. Indeed, the USDOT's Federal Highways' Administration has an ongoing grant program for pilot value pricing in states. Absent specific West Virginia information, examples of impacts in other regions have been estimated and may be useful in better understanding the scope of impacts.[17] See Table 6.4.

Table 6.4, Traffic and Revenue Impacts of Congestion Pricing

Region	$/vehicle mile	Miles Driven	Annual Revenue ($millions)
SF Bay Area	.13	-2.8%	$2,274
Sacramento	.08	-.15%	443
San Diego	.09	-1.7%	896
South Coast	.19	-3.3%	7,343

Source: Harvey & Deakin, 1997 of completed California private highway revenues

6.4 Equity and Environmental Concerns

As mentioned at the outset, Gasoline Excise Tax increases offer the real possibility of making a current tax structure more regressive. This is an important policy consideration, especially given the very regressive nature of West Virginia's current tax system, which consistently ranks among the worst in the nation. This requires a balanced public policy approach. The GET pays for a small portion of the states overall highway infrastructure costs. This severs incidence from demand, a hallmark of a good tax system. So, increases in the GET would better meet one standard of a quality tax system while diverging from another. This is what makes taxation policy difficult. One easy answer is that behavioral modification can be made to occur by levying excise taxes, with equity concerns addressed through income taxes or credits. The same concern affects road pricing, a regressive form of taxation.

There is a long history associated with equity concerns. Concerns about 'double taxation' or 'paying twice' for the same infrastructure cloud the political economy of road pricing. Indeed price setting itself becomes a non-trivial issue. For example pricing goods in a private sector competitive market yields the optimal outcome where prices reflect both the marginal or

[17] Other effects of road pricing should be noted. These include the "rebound effect" where revenue collections lead to road building that generates additional population and traffic increases that mitigate the benefits of congestion pricing.

incremental cost of production and the minimum average cost. This yields allocative and productive efficiency. Since public sector activities are produced in "lumpy" or discrete quantities it is improbable that this happy coincidence of optimal competitive prices is possible.[18] The absence of competitive markets means that equity concerns must be addressed. Again, for excise taxes, mitigating equity concerns can chiefly be achieved through income taxes, while user fees may require a combination of income tax adjustments (credits) and pricing techniques.

Requiring users to pay different rates based upon their price responsiveness is an inherent part of many road pricing mechanisms. This is known as price discrimination. This is why commercial vehicles pay higher tolls (though infrastructure cost differentials are often used to justify toll and tax differences, it is the demand curve that actually matters). One concern beyond simple price discrimination often occurs when infrastructure experiences increasing returns to scale. Under this very likely scenario, marginal costs are beneath average costs (as is almost always the case with non-commercial traffic). Under this scenario allocatively efficient prices (Price = Marginal Cost) will not cover costs, while tolls sufficient to cover costs will reduce traffic beneath the socially desirable level (when all costs are internalized). Under this rather common scenario, Ramsey Pricing offers an attractive option. Though challenging to implement in practice, Ramsey Pricing preserves the mix of road use (say between commercial/non-commercial traffic) while covering costs. This is performed by pricing so that the ratio of prices minus marginal cost to prices, (P-MC)/P, is equal to the inverse of the price elasticity of demand for each consumer. In practice this means separating consumers by use. Adam Smith perhaps outlined the intellectual antecedents to these approaches in 1776:

> "When the toll upon carriages of luxury coaches, post chaises, &c. is made somewhat higher in proportion to their weight than upon carriages of necessary use, such as carts, wagons and the indolence and vanity of the rich is made to contribute in a very easy manner to the relief of the poor, by rendering cheaper the transportation of heavy goods to all the different parts of the country." *Wealth of Nations, 1776*.

Concerns regarding the environment are also an important consideration. Parts of West Virginia suffer high levels of airborne pollutants. While automobiles play a very small role in these emissions, they are one area that can be more readily addressed through short-term policy adjustment. Perhaps a more important environmental issue for West Virginia is the impact on urban form of some form of gasoline taxation or road pricing. West Virginian's commute farther distances than the average American, and while average fuel efficiency (due to interstate drives) is most likely higher than the average American commute, this offers several potential environmental concerns. Chief among these are the problems associated with, in our case, rural sprawl. That is the very low population density of regions. While the environmental impacts of this are not yet well known, the fiscal costs to the State are enormous. Rural sprawl that is permitted in part by policy favoring automobiles likely contributes to a number of equity and fiscal issues in our State. These include school funding, health care access and other basic service issues.

One final important issue should be reiterated. Researchers have long mastered the capacity to effectively estimate system wide transportation demands within the context of highways. So, changes to highway infrastructure that result in changed network effects can be evaluated well within a cost benefit framework. Local demand is less effectively estimated. Road pricing efforts by local communities may offer a revealed preference for additional infrastructure construction. In other words, the willingness of a community to pay for key infrastructure changes through tolls on existing highways will likely provide evidence of that community's demand for the infrastructure. This is a calculation that is often necessary to provide justification for additional highway construction. This is a regional equity issue.

[18] This would be the case even with managers in the public sector having market mechanisms to set prices.

6.5 Summary

In this chapter we have offered an analysis of the gasoline tax and road pricing. We have concluded that road pricing is unlikely to emerge in the short run as a major revenue enhancement tool for local communities. Its application at the state level may be warranted as a revenue generation tool. This issue likely requires more detailed scrutiny with a site specific focus.

In contrast, our analysis clearly suggests that consideration of revenue enhancement through the Gasoline Excise Tax be considered by the legislature. Though we have not specifically discussed non-revenue issues in great detail, it is likely that environmental considerations play a part in this analysis. Similarly, the common finding that the current rate of gasoline taxes is not sufficient to pay for highway costs should motivate consideration of rate changes either through discretionary efforts or through inflation indexing of the rate.

7. SUMMARY AND CONCLUSIONS

The data and analysis presented in the preceding chapters was designed to answer several questions regarding the capacity of the State to more speedily undertake highway infrastructure investment at lower cost. To do this we reviewed the State's current tax and financial status and provided simulations of tax revenues that could be dedicated to new road construction. Under the most favorable conditions we found that a 5% across the board tax increase, in all but education property taxes, would yield only about 7.78 additional interstate highways miles per year or roughly 1,526 additional miles of road resurfaced. This representative simulation highlights the revenue constraints West Virginia faces. Importantly these data did not include fiscal year 2002 or later data when conditions worsened.

It is clear from these results that, absent dramatic federal intervention, any noticeable change in the rate of road construction in the State will require a sweeping reevaluation of fiscal priorities coupled with a very large tax increase. While we always believe reexamination of fiscal priorities is warranted, even if change is not, there is little to recommend across the board tax increases to generate highway infrastructure construction.

The second issue we examined was innovative highway financing. After and exhaustive year of analysis we came to the sad conclusion that the much heralded innovative financing mechanisms for highway infrastructure construction are not innovative, but merely modify existing rules to provide flexibility. Rural areas enjoy fewer options than do urban areas under the new rules (though there's no evidence that the options for rural areas have shrunk). This is unfortunate since West Virginia has engaged in the test programs for innovative financing with extreme rigor. Sadly, innovative highway financing seems to offer little beyond what the State is currently doing to fund highway construction.

There is one bright spot in terms of highway financing options. That is public private partnerships. The relationship between private sector firms and public sector infrastructure development is growing increasingly important to the State. Though the benefits may not be widespread, there are areas in the State where private public partnerships offer real cost savings to the State. These cost savings can manifest themselves through federal match options that treat private match favorably as well as in cutting the direct construction costs. As with earlier innovative financing rules, the Department of Transportation is working to employ this resource where possible. Public private partnerships offer a welcomed opportunity for some region. They are not a panacea.

We believe that a comprehensive educational program for State officials in the legislative branch and especially in economic development be undertaken to explain financing issues more

clearly. At point it would be useful for more State residents to appreciate the very high level of highway infrastructure investment that has occurred in the State over the past 40 years. Indeed, only eight states have enjoyed a higher ratio of allocations to payments from the federal highway funds. We also recommend that the State consider a benefit cost analysis rule for privatization activities. These steps should make private public partnerships more amenable and effective in coming years.

We reviewed the issues of gasoline taxation and road pricing. We found that real tax collections per mile driven have declined by more than half in the past 40 years and offer little sign of recovery. We also found that there are likely only three scenarios where road pricing would likely offer any real benefits in the State. These are State administered highway tolls, some congestion fees, and in local revenue enhancement programs designed to provide expenditures to meet unforeseen local demand for infrastructure.

Our most sweeping recommendation is a reexamination of the Gasoline Excise Tax rates. GET revenues pay for a small portion of total roadway costs in the State, higher real GET rates have proven historically sustainable, the impact would likely reduce automobile exhaust emissions and finally, the revenues are desperately needed. To be clear, we are not yet recommending an increase in the GET rate. We believe that considerable latitude in rates is possible and that this issue will be addressed by other states within the region.

8. REFERENCES

An Evaluation of the TE-045 Innovative Finance Research Initiative", Feb. 1997 <http://wwwfhwa.dot.gov/innovativefinance/evalcov.htm>

Aschauer, David A., "Is Public Expenditure Productive?" *Journal of Monetary Economics* 23(2) 1989, 177-200.

Aschauer, David A., "Why is Infrastructure Important?" *Source: Munnell,-Alicia-H., ed. Is there a shortfall in public capital investment?* Proceedings of a conference held at Harwich Port, Massachusetts, June 1990. Conference Series nº. 34, Boston: Federal Reserve Bank of Boston, 1990, pages 21-50.

Aschauer, David A., "The Role of Public Infrastructure Capital in Mexican Economic Growth," *Economia-Mexicana* 7(1) 1998, 47-78.

Bobur, Alimov; McMillen, Stanley; Shrestha, Hemantha, "The Economic Impact of the Proposed Gasoline Tax Cut in Connecticut", *Connecticut Center for Economics Analysis* 2000.

Creedy, John and Gemmel, Norman, "Income Tax Revenue Elasticities with Endogenous Labour Supply", *New Zealand Treasury,* Working Paper 02/22, 2002.

Creedy, John and Gemmel, Norman, "The Revenue Responsiveness of Income and Consumption Taxes".

Cummings et al., "Measuring the Elasticity of Substitution of wages for Municipal Infrastructure: a Comparison of the Survey and Wages Hedonic Approaches," *Journal of Environmental Economics and Management* 13(3) 1986, 269-76.

Deno, Kevin T., "The Effect of Public Capital on US Manufacturing Activity: 1970-1978," *Southern Economic Journal* 55(2) 1988, 400-11.

Diamond, Jack, "Government Expenditure and Growth," *Finance and Development* 27(4) 1990, 34-36.

Eberts, Randall W., "Some Empirical Evidence on the Linkage between Public Infrastructure and Local Economic Development, *Industry Location and Public Policy, Edited by H.W. Herzog Jr. And A.M. Schlottmann, 1991*

Economic Affairs, *Journal of the Institute of Economic Affairs,* Vol 18 nº 4, Dec. 1998.

Estache, Antonio and Valletti, T.M., "The Theory of Access Pricing: and Overview for Infrastructure Regulators", *Centre for Economic Policy.*

Ethier, Wilfred J., "National and International Returns to Scale in the Modern Theory of International Trade," *American Economic Review* 72(3) 1982, 389-405.

"Financing Federal-Aid Highways," *Office of Legislation and Strategic Planning,* Aug. 1999.

Ford, Robert and Poret, Pierre, "Infrastructure and Private Sector Productivity," *OECD Economic Studies* 0(17) 1991, 63-89.

Fox, William F. and Murray, Matthew N., "Local Public Policies and Interregional Business Development," *Southern Economic Journal* 57(2) 1990, 412-27.

Francis, Brian, "Gasoline Excise Taxes, 1993-2000" *IRS, Statistics of Income Bulletin*, 2001.

"Fuel Taxes: Increasing Fuel Taxes and Fees", *TDM Encyclopedia - Victoria Transport Policy Institute,* May 2003.

Francis, Brian, "Gasoline Excise Taxes, 1993-2000" *IRS, Statistics of Income Bulletin*, 2001.

Garcia-Mila, Teresa, "Some Empirical Evidence on Government Purchase Multipliers," *Economics Letters* 31(4) 1989, 375-80.

Garcia-Mila, Teresa and McGuire, Therese J., "The Contribution of Publicly Provided Inputs to States' Economies," *Regional Science and Urban Economics* 22(2) 1992, 229-41.

Glomm, Gerhard, and Ravikumar, B., "Public versus Private Investment in Human Capital Endogenous Growth and Income Inequality," *Journal of Political Economy* 100(4) 1992, 813-34.

Harmatuck, Donald J., "The Influence of Transportation Infrastructure on Economic Development," *Logistics and Transportation Review* 32(1) 1996, 63-76.

Harmse, Chris and Matlanyane, Aledaide, "Revenue Implications of Trade Liberalization in South Africa", University of Pretoria.

Harrington, Winston and Krupnick, Alan, "Public Support for Congestion and Pollution Fee Policies for Motor Vehicles: Survey Results", Oct. 1996.

Haughton, Jonathan, "Estimating Tax Buoyancy, Elasticity, and Stability", *Harvard Institute of International Development and Suffolk University,* 1998.

Holtz-Eakin, Douglas and Schwartz, Amy Ellen, "Infrastructure in a Structural Model of Economic Growth," *National Bureau of Economic Research Working Paper* August 1994, page 21.

Holtz-Eakin, Douglas and Lovely, Mary E., "Scale Economies, Returns to Variety, and the Productivity of Public Infrastructure," *Regional Science and Urban Economics* 26(2) 1996, 105-23.

Huelten, Charles R. and Schwab, Robert M., "Public Capital Formation and the Growth of the Regional Manufacturing Industries," *National Tax Journal* 44(4) 1991, 121-34.

Huelten, Charles R. and Schwab, Robert M., "A Fiscal Federalism Approach to Infrastructure Policy," *Regional Science and Urban Economics* 27(2) 1997, 139-59.

Knapp, Karl, "Comparative Data Report on State Transportation Programs", Nov. 1997.

Komanoff, Charles. "Environmental Consequences of Road Pricing" A Scoping Paper for the Energy Foundation. April 1997.

"Light-Duty Automotive Technology and Fuel Economy Trends through 1999", *Environmental Protection Agency,* Sep. 1999.

"Light-Duty Automotive Technology and Fuel Economy Trends: 1975 through 2001", *Environmental Protection Agency,* Sep. 201.

Litman, Todd, "London Congestion Pricing: Implications for Other Cities", *Victoria Transport Policy Institute,* Jun. 2003

Lynde, Catherine and Richmond, J., "The Role of Public Capital in Production," Review of *Economics and Statistics* 74(1) 1992, 37-44.

Martin, Philippe and Rogers, Carol A. "Trade Effects on Regional Aid," Collective Articles on Expanding Membership of the European Union, edited by Baldwin, Haaparanta, and Kiander. Cambridge University Press, 1995, pages 166-88.

Mekky, Ali, "Forecasting Toll Revenues for Fully Electronic Highways Operating Under Transponder and Video-Imaging Systems", 1998

Michael, Joel, "Taxation and Equal Protection" *House Research - Short Subjects: The Constitution and the Legislature,* 2002.

"Mileage Fee (Data & Fee Collection Center)", 2003

"Pricing Information" *Federal Highway Administration*

Morrison, Catherine J., and Schwartz Amy E., "State Infrastructure and Productive Performance," *National Bureau of Economic Research Working Paper: 3981, 1992, pages not available.*

Munnell, Alicia H., " How does Public Infrastructure Affect Regional Economic Performance?" *New England Economic Review* 0(0) 1990, 11-32.

Nadiri, M. and Mamuneas, Theofanis, "The Effects on Public Infrastructure and R&D Capital on the Cost Structure and Performance of U.S. Manufacturing Industries, *New York University Economic Research Reports:* 91-57 1991, page 35.

Neill, Jon R., "Fueling the Engine of Growth with Investments in Infrastructure: A Lesson from Neoclassical Growth Theory," *Journal of Macroeconomics* 18(3) 1996, 521-29.

Nijkampf, Peter, "Infrastructure and Regional Development: A Multidimensional Policy Analysis," *Empirical Economics* 11(1) 1986, 1-21.

Passenger Car Efficiency: US 1973-1999.

Prince, Ryan and Puentes, Robert, "Fueling Transportation Finance: A Primer on the Gas Tax", *Center on Urban and Metropolitan Policy,* Mar. 2003.

"Rebound Effects: Implications for Transport Planning", *TDM Encyclopedia - Victoria Transport Policy Institute,* Sep 2002.

Rubin, Laura S., "Productivity and the Public Capital Stock: Another Look," *Board of Governors of the Federal Reserve System Economic Activity Section Working Paper Series:* 118 1991, page 18.

Shah, Anwar, "Dynamics of Public Infrastructure, Industrial Productivity and Profitability," *Review of Economics and Statistics* 74(1) 1992, 28-36.

State Gas Tax Report, DOE, Energy Information Administration

"State Transportation Funding Trends and Comparative State Assessment" *Transportation Funding Series, Special Report nº 2,* Dec. 2001

State of West Virginia Department of Transportation, "Statewide Transportation Policy Plan – 2002-2022", 2002.

"TEA 21 Reauthorization – Its Importance to TXDOT".

"The Effects of Peak Period Pricing on Proposed Highways in the Portland Metropolitan Area, *Oregon Department of Transportation,* Sep. 2002.

The Jerome Levy Economics Institute of Bard College Report, Aug. 1997, Vol. 7 # 3 page 15-16.

The National Council for Public-Private Partnerships, "Building Public-Private Partnerships Today", 1996.

The National Council for Public-Private Partnerships, "For the Good of the People: Using Public-Private Partnerships to Meet America's Essential Needs"

"Transportation Elasticities: How prices and other factors Affect Travel Behavior", *TDM Encyclopedia - Victoria Transport Policy Institute,* Mar 2003.

"Transportation Finance for the 21st Century", *Resource papers,* 1997.

"Transportation Infrastructure Finance and Innovation Act"

"West Virginia Highways: Classification Systems, Characteristics and Usage".

"West Virginia Highways: Revenues and Expenditures – State Revenue" *West Virginia Division of Highways*, 2001.

"West Virginia Highways: Revenues and Expenditures" *West Virginia Division of Highways*, 2001.

"West Virginia Highways: State and National Highway-Related Milestones" *West Virginia Division of High Ways*, 2001.

Stover, Mark E., "The Role of Infrastructure in the Supply of Housing," *Journal of Regional Science* 27(2) 1987, 254-67.

World Wide Web Reports

http://www.fhwa.dot.gov/policy/vppp.htm "Value Pricing Pilot Program".

http://www.lmoga.com/taxrates.htm "State Gasoline Taxes"

http://www.ncppp.org/issuepapers/index.html Aug. 21 2002.

http://www.cba.uiuc.edu/leuthold/ecn415/labs/lab10.html "Lab 10: Consumption Tax Elasticities"

Wylie, Peter J., "Infrastructure and Canadian Economic Growth," *Canadian Journal of Economics* 29(0), Sp. Iss. Part 1 April 1996, pages S 350-55.

APPENDIX A

Table A.1, Simulation of Across the Board Tax Increase on Highway Infrastructure Investment , 1, 3.5%, 5% and 10%

	1%		3.50%		5%		10%	
	Fed Highways, 4 lane	Miles Resurfaced	Fed Highways, 4 lane	Miles Resurfaced	Fed Highways, 4 lane	Miles Resurfaced	Fed Highways, 4 lane	Miles Resurfaced
General Revenue Fund	0.08	23.65	0.30	82.79	0.42	118.27	0.84	236.53
Business and Occupation Tax	0.05	15.05	0.19	52.69	0.27	75.27	0.54	150.53
Corporation Net Income Tax	0.49	136.09	1.70	476.33	2.43	680.47	4.86	1,360.93
Personal Income Tax	0.41	113.67	1.42	397.83	2.03	568.33	4.06	1,136.67
Consumers Sales Tax	0.04	10.08	0.13	35.28	0.18	50.40	0.36	100.80
Use Tax	0.02	4.24	0.05	14.84	0.08	21.20	0.15	42.40
Cigarette Tax	0.01	2.33	0.03	8.17	0.04	11.67	0.08	23.33
Inheritance Tax	0.00	1.07	0.01	3.73	0.02	5.33	0.04	10.67
Beer Tax and Licenses	0.03	8.35	0.10	29.21	0.15	41.73	0.30	83.47
Insurance Tax and Fees	0.00	0.27	0.00	0.93	0.00	1.33	0.01	2.67
Racing Fees	0.01	1.40	0.02	4.90	0.03	7.00	0.05	14.00
Liquor Profits (a)	0.00	0.51	0.01	1.77	0.01	2.53	0.02	5.07
Charter Tax	0.00	0.48	0.01	1.68	0.01	2.40	0.02	4.80
Property Tax	0.00	0.88	0.01	3.08	0.02	4.40	0.03	8.80
Property Transfer Tax	0.00	0.88	0.01	3.08	0.02	4.40	0.03	8.80
Miscellaneous	0.01	1.48	0.02	5.18	0.03	7.40	0.05	14.80
Departmental Collections	0.01	4.19	0.05	14.65	0.07	20.93	0.15	41.87
Interest Income	0.00	0.17	0.00	0.61	0.00	0.87	0.01	1.73
Business Franchise Reg Fee	0.00	0.11	0.00	0.37	0.00	0.53	0.00	1.07
Lottery Transfers	0.08	21.76	0.27	76.16	0.39	108.80	0.78	217.60
Severance Tax	0.05	13.52	0.17	47.32	0.24	67.60	0.48	135.20
Business Franchise Tax	0.01	2.03	0.03	7.09	0.04	10.13	0.07	20.27
Telecommunications Tax	0.00	0.04	0.00	0.14	0.00	0.20	0.00	0.40
Special Revenue Transfer	0.00	0.03	0.00	0.09	0.00	0.13	0.00	0.27
TOTAL GENERAL	**1.29**	**362.47**	**4.53**	**1,268.63**	**6.47**	**1,812.33**	**12.95**	**3,624.67**

Table A.2, Simulation of Across the Board Tax Increase on Highway Infrastructure Investment

	1%		3.50%		5%		10%	
	Fed Highways, 4 lane	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**
Road Taxes	0.11	29.92	0.37	104.72	0.53	149.6	1.06	299.2
License Tax	0.04	10.32	0.12	36.12	0.18	51.6	0.36	103.2
Privilege Tax	0.07	20.59	0.25	72.05	0.36	102.93	0.73	205.86
Wholesale Fuel & Use Tax (a)	0.03	9.51	0.11	33.27	0.16	47.53	0.33	95.06
Other Income (b)	0.01	3.20	0.04	11.2	0.05	16	0.11	32
STATE ROAD FUND	0.26	73.53	0.91	257.36	1.31	367.66	2.62	735.33

Table A.3, Simulation of Across the Board Tax Increase on Highway Infrastructure Investment

	1%		3.50%		5%		10%	
	Fed Highways, 4 lane	Miles Resurfaced	Fed Highways, 4 lane	Miles Resurfaced	Fed Highways, 4 lane	Miles Resurfaced	Fed Highways, 4 lane	Miles Resurfaced
TOTAL GENERAL	1.29	362.46	4.53	1268.63	6.47	1812.33	12.94	3624.66
STATE ROAD FUND	0.26	73.53	0.91	257.36	1.31	367.66	2.62	735.33
Total	**1.55**	**436**	**5.45**	**1526**	**7.78**	**2180**	**15.57**	**4360**

Table A.4, Simulation of Across the Board Tax Increase on Highway Infrastructure Investment 1, 3.5%, 5% and 10%, with more Realistic Responses

	1%		3.50%		5%		10%	
	Fed Highways, 4 lane	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**
General Revenue Fund	0.08	23.65	0.30	83	0.42	118.27	0.84	237
Business and Occupation Tax	0.05	15.05	0.19	53	0.27	75.27	0.54	151
Corporation Net Income Tax	0.45	125.21	1.57	438	2.24	626.03	4.47	1252
Personal Income Tax	0.37	104.57	1.31	366	1.87	522.87	3.73	1046
Consumers Sales Tax	0.03	9.27	0.12	32	0.17	46.37	0.33	93
Use Tax	0.02	4.24	0.05	15	0.08	21.20	0.15	42
Cigarette Tax	0.01	2.15	0.03	8	0.04	10.73	0.08	21
Inheritance Tax	0.00	0.98	0.01	3	0.02	4.91	0.04	10
Beer Tax and Licenses	0.03	7.68	0.10	27	0.14	38.39	0.27	77
Insurance Tax and Fees	0.00	0.25	0.00	1	0.00	1.23	0.01	2
Racing Fees	0.00	1.29	0.02	5	0.02	6.44	0.05	13
Liquor Profits (a)	0.00	0.47	0.01	2	0.01	2.33	0.02	5
Charter Tax	0.00	0.44	0.01	2	0.01	2.21	0.02	4
Property Tax	0.00	0.81	0.01	3	0.01	4.05	0.03	8
Property Transfer Tax	0.00	0.88	0.01	3	0.02	4.40	0.03	9
Miscellaneous	0.01	1.48	0.02	5	0.03	7.40	0.05	15
Departmental Collections	0.01	4.19	0.05	15	0.07	20.93	0.15	42
Interest Income	0.00	0.16	0.00	1	0.00	0.80	0.01	2
Business Franchise Reg. Fee	0.00	0.10	0.00	0	0.00	0.49	0.00	1
Lottery Transfers	0.00	0.00	0.00	0	0.00	0.00	0.00	0
Severance Tax	0.04	12.44	0.16	44	0.22	62.19	0.44	124
Business Franchise Tax	0.01	1.78	0.02	6	0.03	8.92	0.06	18
Telecommunications Tax	0.00	0.04	0.00	0	0.00	0.20	0.00	0
Miscellaneous Transfers	0.00	0.20	0.00	1	0.00	1.00	0.01	2
Special Revenue Transfer	0.00	0.03	0.00	0	0.00	0.13	0.00	0
TOTAL GENERAL	**1.13**	**317**	**3.97**	**1,111**	**5.67**	**1,586**	**11.33**	**3,173**

Table A.5, Simulation of Across the Board Tax Increase on Highway Infrastructure Investment

	1%		3.50%		5%		10%	
	Fed Highways, 4 lane	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**
Road Taxes	0.10	27.53	0.34	96.34	0.49	137.63	0.98	275.26
License Tax	0.04	10.32	0.13	36.12	0.18	51.60	0.37	103.20
Privilege Tax	0.07	20.59	0.26	72.05	0.37	102.93	0.74	205.87
Wholesale Fuel & Use Tax	0.03	8.75	0.11	30.61	0.16	43.73	0.31	87.46
Other Income	0.01	3.20	0.04	11.20	0.06	16.00	0.11	32.00
TOTAL STATE ROAD FUND	**0.26**	**73**	**0.92**	**257**	**1.31**	**367**	**2.63**	**735**

Table A.6, Simulation of Across the Board Tax Increase on Highway Infrastructure Investment

	1%		3.5%		5%		10%	
	Fed Highways, 4 lane	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**	**Fed Highways, 4 lane**	**Miles Resurfaced**
General Fund	1.13	317.35	3.97	1,110.72	5.67	1,586.75	11.33	3,173.50
Road Fund	0.26	73.53	0.92	257.37	1.31	367.67	2.63	735.33
Total	**1.40**	**390**	**4.89**	**1,368**	**6.98**	**1,954**	**13.96**	**3,908**