THE DESIRABILITY AND FEASIBILITY OF ALTERNATIVE MEANS OF FINANCING TRANSPORTATION IN VIRGINIA

by

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(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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SUMMARY AND CONCLUSIONS

This report was prepared in response to a request by the Legislature of Virginia through Senate Joint Resolution 76 that a study be conducted on the desirability and feasibility of using alternative methods of financing not presently available to support improvements in transportation facilities in Virginia. The first section of the report shows that, under reasonable expectations, the purchasing power of monies to be available from the major sources of revenue for the state's transportation system during the period 1979 to 1985 will lag far behind the purchasing power of monies available in fiscal year 1977. The second section of the report deals with the feasibility of making changes in the existing tax structure on gas (motor fuel), registration fees, the sales and use tax, and the road tax, and the revenues that the changes can be expected to produce. The third section consists of a discussion of local option sales taxes on gasoline and their potential for generating revenue, bond financing alternatives, and congestion pricing.

A basic analysis of alternative methods of financing is presented below in tabular form, and other major conclusions relevant to funding policy follow.

Basic Analysis of Funding Alternatives

Revenue Source	Currently Used	Ease of Administration	Revenue Potential	Equity
Per Unit Gas Tax	Yes (9¢/Gal.)	Yes	Rate of growth declining. Burden falls as prices rise. Loss of purchasing power will continue for 9¢ tax	High - a user tax
Auto Registration and License Fees	Yes	Yes	Will not likely keep pace with inflation through 1985	High - a user tax
Sales and Use Tax	Yes (2%)	Yes	Under reasonable economic assumptions will keep pace with 1977 purchasing power	High - a user tax
Motor Carrier Road Tax	Yes (2¢/Gal.)	Yes	Very low. Currently generating $6.5-$7.0 million per year	Compared to original level, the share as percentage of gas tax rate has fallen
Retail Gasoline Sales Tax	No	More difficult than per unit tax	Excellent resiliency against inflation. An 18% level is roughly equivalent to current per unit tax and would allow constant purchasing power	High - same as per unit gas tax
Ad Valorem Gas Tax at Wholesale Level	No	Overcomes difficulty associated with retail tax - would not likely be significantly costlier than per unit tax	Same as retail ad valorem tax, but would require higher rate of approximately 25%	High - same as per unit gas tax

Basic Analysis of Funding Alternatives (cont.)

Revenue Source	Currently Used	Ease of Administration	Revenue Potential	Equity
Local Option Sales Tax on Gasoline	No	More costly than per unit tax, but mechanism exists in the state sales tax	For high gas demand localities a 2% tax could generate revenue sufficient for public transportation improvements, but tax could be avoided by purchaser going to non-tax localities	Unclear - unless driving public at large benefits
Bond Financing	No - except "special cases"	Yes, but commitment to bond retirement must be made at issue	Excellent as a supplementary mechanism. Care must be exercised in level of issue to avoid affecting contractor bids and market interest rates	High. Allows those who use facility over long period to pay for it
Congestion Pricing	No	Questionable	Good	Good

1. Under reasonable expectations and the current system of financing, by 1985 the purchasing power of gas tax revenue will lag far behind that for 1977. Assuming a fleet fuel efficiency of 15 mpg and a 4% price inflation, forecasted 1985 revenues will provide almost $38 million less purchasing power. Under an assumption of 6% inflation, the data suggest that reductions in service levels may be required.

2. Under realistic assumptions about modest gains in fleet fuel efficiency (19 mpg by 1985), at least an $.11 per gallon tax will be needed to mitigate the loss in purchasing power resulting from inflation and more energy-efficient vehicles. While a $.10 tax will generate approximately $32 million per year over present revenues for fiscal years 1980-85, the purchasing power of 1985 revenue could be below that for 1977 revenue by as much as $50 million.

3. For a 20,000 mile per year driver, the cost of an $.11 per gallon state tax on gasoline in fiscal 1980 would be approximately $156.70, or $28.49 more than the $128.21 in tax he would pay at the $.09 a gallon rate. Furthermore, if the current $.09 tax remains in effect, the real tax burden in terms of its purchasing power in 1980 will be below the current real burden.

4. For fiscal 1980, an increase in the sales and use tax to 3% could be expected to generate approximately $36 million more than the current 2% tax; however, it is questionable that this increase would be as equitable as changes in the gas tax. Increases in registration and license fees on the order of 15% will not be expected to maintain 1977 purchasing power from this revenue source.

5. A local sales tax on gasoline is a potential revenue source for local transportation improvements. Statewide, a 2% surcharge on the full gross tax price of gas in 1980 would generate between $44 million and $48 million. While some localities would generate $2 million to $5 million per year, most localities would generate much less.

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INTRODUCTION

In May 1978 the Virginia Transportation Research Council was requested by the Virginia Legislature through Senate Joint Resolution Number 76 to conduct a study of the desirability and feasibility of using alternative methods of financing that are not presently available to support transportation improvements in Virginia. This report has been prepared in response to that request.

Several words of explanation regarding the material presented in the report are appropriate. First, the scope of the research was limited, largely by a time constraint, to an examination of certain major sources of revenue such as gasoline excise taxes, registration fees, sales and use taxes, bond financing, and local option sales taxes. Further, federal matching funds were assumed to remain available to the extent that state monies are forthcoming for matching arrangements. Secondly economic forecasts and revenue estimates were used as indicators of orders of magnitude, not as exact anticipated figures. Thirdly, suggestions regarding policy were developed on the basis of the analysis made by the author and are solely his responsibility.

ARRANGEMENT OF DISCUSSION

In addressing the issue of the desirability of alternative funding mechanisms, the first section of the report presents forecasts through fiscal year 1985 under the existing tax structure in both nominal dollars and constant 1977 dollars.* These forecasts are necessary to establish the levels of revenue that likely will be available from state sources if no changes in funding are made during the period 1979-1985. The development and discussion of the model on which these forecasts are based are presented in Appendix A. The second section of the report examines the feasibility of making changes in the existing tax structure on gas, registration fees, the sales and use tax, and the road tax, and gives the revenues that can be expected under the changes. The third section of the report discusses the desirability of local option sales taxes, bond financing alternatives, and congestion pricing.

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*Constant dollar figures are adjusted to reflect unchanged 1977 purchasing power. Nominal dollars reflect only the money value of revenue at a given time.

REVENUE FORECASTS UNDER THE EXISTING TAX STRUCTURE

Using the model described in Appendix A gasoline tax revenue, sales and use tax revenue, and revenue from registration and license fees were forecast for fiscal years 1978 through 1985 under several different economic assumptions. The raw data used in the calculation of the forecasts are given in Appendix Tables B-1 through B-10. Data are presented for: population, nominal wage rates, consumer price indices, disposable income, fleet fuel efficiency, gasoline price, average vehicle speed, total fleet size, VMT, and gasoline demand. The forecasts are presented under the subheads that follow.

Gasoline Tax Revenue

As shown in Appendix Table A-1, the author's best estimate of fleet fuel efficiency ranges from 12.64 to 19.30 miles per gallon for the period 1978-1985. This estimate is consistent with the federal government goal of energy conservation. Forecasts of gasoline tax revenues for the current $.09 per gallon tax are included as column 1 of Table 1. For comparison, the Virginia Department of Highways and Transportation estimates, assuming a fuel efficiency of 12 mpg to 15 mpg for the same period, are presented in column 2.

Table 1

Gasoline Tax Revenue Forecasts Compared With VDHT Estimates (Millions of Dollars)

Fiscal Year	Model Forecast[a]	VDHT Estimate[b]
1978	274.96	279.6
1979	271.80	291.3
1980	274.10	304.3
1981	282.64	315.6
1982	286.56	325.4
1983	289.20	334.6
1984	288.38	341.5
1985	296.46	351.0

[a]Calibrated so that the FY 1978 forecast is equal to 1978 collections.

[b]1978-80 Budget Exhibit for Virginia Department of Highways and Transportation.

The reader should be alerted to the fact that the figures presented in Table 1 are in nominal dollars — that is, they are not adjusted for inflation. Because the purchasing power of the revenues should be of main interest, a comparison of the forecasts of nominal dollars and the amount of revenue required in each year to provide purchasing power equivalent to 1977 purchasing power is presented in Table 2. Two rates of inflation are assumed, 4% and 6%. The 6% rate is probably quite realistic in light of the fact that the Department's construction cost index rose at an average annual rate of 5.68% during the period 1973-78.

Table 2

Gasoline Tax Revenue in Nominal Dollars Compared to Revenue Required to Provide 1977 Purchasing Power (Millions of Dollars)

Fiscal Year	Model Forecast	Dollars Needed For Constant Purchasing	
		4% Inflation	6% Inflation
1978	274.96	295.6	302.2
1979	271.80	307.4	312.7
1980	274.10	319.8	336.3
1981	282.64	332.5	356.4
1982	286.56	345.8	377.7
1983	289.20	359.4	400.5
1984	288.38	374.1	424.4
1985	296.46	388.9	449.8

The figures in Tables 1 and 2 point clearly to a loss in purchasing power of rather drastic proportions over the course of the analysis period. Even if one subscribes to the assumptions that fleet fuel efficiency will be 15 mpg by 1985, and that price inflation will average only 4% per year, which would lead to rather optimistic forecasts of revenue, the 1985 revenue will provide almost $38 million less purchasing power than the 1977 revenue. Should the rate of inflation approach the more realistic level of 6%, it is clear from the data in Table 2 that reductions in the levels of transportation service will likely be required during the period 1979-85.

Sales and Use Tax Revenue

The sales and use tax is the only true ad valorem revenue source for the Department. Because this is a percentage tax

(presently 2% on price of motor vehicles sold), it is tied to the rate of inflation. It is not surprising, then, that the model predicts that the purchasing power of revenues from the sales and use tax will not diminish as long as the economy has moderate growth. Table 3 presents the sales and use tax projections for 2% real growth and 4% real growth. Under both percentages, the purchasing power of the sales and use tax revenue rises. Only in the case where there is no real growth does real revenue not rise — in such a case, it would tend to keep pace with inflation (see Table 3). The reader should note that under the assumed 4% growth the 1978 model forecast underestimated the actual amount collected by only $1.1 million.

Table 3

Sales and Use Tax Projections for 2% and 4% Real Growth Compared to 1977 Purchasing Power Equivalents (Millions of Dollars)

Year	2% Real Growth	4% Real Growth	1977 Equivalent 4% Inflation	1977 Equivalent 6%
1978	62.4	67.8	60.9	62.1
1979	68.3	70.2	64.9	66.4
1980	72.8	79.1	67.6	71.0
1981	79.4	88.9	70.2	75.3
1982	86.6	100.1	73.0	79.8
1983	94.6	112.6	75.9	84.6
1984	103.1	126.7	79.0	89.7
1985	112.6	142.6	82.2	95.0

Registration and License Fee Revenue

Registration and license fee projections under the existing rate structure are presented in Table 4 along with 1977 real dollar equivalents. In this case, the model underestimated 1978 collections by only $1.3 million. It is quite clear that even under modest inflation, real purchasing power of registration and license fees is likely to diminish in the near future.

Table 4

Registration and License Fees and 1977
Real Dollar Equivalents
(Millions of Dollars)

Year	Projected Registration and License Fees	Real 1977 Dollar Equivalents	
		4% Inflation	6% Inflation
1978	77.2	77.1	78.2
1979	78.1	80.2	81.6
1980	79.2	83.4	87.8
1981	80.2	86.7	93.0
1982	81.8	90.2	98.6
1983	82.3	93.8	104.5
1984	83.3	97.6	110.7
1985	85.0	101.5	117.4

The Revenue Forecasts in Perspective

In the Introduction to this report, the author cautioned about the difficulty of forecasting. Nevertheless, the single equation models discussed in Appendix A are fairly sensitive to changes in economic aggregates and, when used with discretion, perform quite well in predicting 1978 revenues. Based upon the forecasts presented above, the following implications are clear.

1. Because of increases in fleet fuel efficiency, revenue from the current gas tax will likely increase only moderately through 1985.

2. Under reasonable assumptions, the real purchasing power of gas tax revenues will likely lag far behind that of 1977 revenues by 1985.

3. The sales and use tax will likely hold its purchasing power under reasonable economic assumptions.

4. Registration and license fees will not likely generate a growth of revenue which will keep pace with inflation through 1985.

5. It is not reasonable to expect that revenues forecasted using the existing tax structure will be sufficient to increase transportation service levels over the period 1979-1985. It is more likely that there will be stringent constraints on the funds available for both maintenance and construction during the period.

CHANGES IN THE EXISTING TAX STRUCTURE AND ALTERNATIVE SOURCES OF REVENUE

The logical approach to an examination of the sufficiency of future revenues is to forecast the revenues, establish the levels of funding required to provide the appropriate levels of transportation services, and compare the forecasts with the required levels of funding. However, the second phase of such a logical approach is far beyond the scope of the current research effort; more exactly, the establishment of appropriate levels of transportation services for the period 1979-1985 would in itself require a research effort of considerable magnitude. Therefore, an alternative analytical approach was taken. Rather than assuming the levels of revenue that would be needed, it was assumed that purchasing power equivalent to at least that provided by 1977 revenue would be required over the period 1978-1985. That such an assumption approximates a reasonable lower bound on revenue needs is justifiable for at least two reasons. First, any shift away from an active construction and maintenance program in the near future is not likely to be well received by the citizens of the Commonwealth. Secondly, the Department's role in environmental and historic preservation, and its rather expensive programs for involvement in public transit and transportation systems management, will likely expand from now to fiscal 1985.

The first part of the analysis that follows is focused on the changes in the structure of taxes that might be required to obtain approximate 1977 purchasing power from existing revenue sources. Then several sources not presently used are discussed.

Changes in the Gas Tax

It is common knowledge that the largest source of state revenue is the excise tax on gasoline. Further, as was pointed out earlier, even assuming modest inflation and very minor gains in fleet fuel efficiency, the best one might hope for is that the purchasing power of the 1985 gas tax revenue will be almost $40 million less than than for the 1977 revenues. If inflation for major Department budget items approaches 6% and moderate gains are made in fleet fuel efficiency (for example, 19 mpg by 1985), the purchasing power of forecasted 1985 gas tax revenue could be as much as $150 million below 1977 levels. (See Tables 1 and 2.)

An examination of incremental increases of $.01 in the gas tax is appropriate at this point. Table 5 presents forecasts in nominal dollars of gas tax revenues for $.09, $.10, $.11 and $.12 per gallon

assuming only minor gains in fleet fuel efficiency of 12 to 15 mpg, and Table 6 presents these forecasts under the assumption of moderate gains in fleet fuel efficiency of 12.6 to 19.3 mpg. The data in Tables 5 and 6 are then plotted against 1977 gas tax purchasing power equivalents at 4% and 6% rates of inflation in Figures 1 and 2, respectively.

Table 5

Forecasts of Gasoline Tax Revenues in Nominal Dollars Assuming Fleet Fuel Efficiency Levels of 12 to 15 mpg (Millions of Dollars)

FY	Tax Rate			
	$.09/Gallon	$.10/Gallon	$.11/Gallon	$.12/Gallon
1978	274.9	307.8	340.6	373.4
1979	277.4	310.6	343.6	376.8
1980	285.3	319.3	353.3	387.3
1981	300.0	335.6	371.1	406.8
1982	316.0	353.4	390.8	428.2
1983	330.1	369.1	408.1	447.0
1984	345.5	386.2	426.9	467.6
1985	371.6	415.1	458.7	502.3

Table 6

Forecasts of Gasoline Tax Revenues in Nominal Dollars Assuming Fleet Fuel Efficiency Levels of 12.64 to 19.3 mpg (Millions of Dollars)

FY	Tax Rate			
	$.09/Gallon	$.10/Gallon	$.11/Gallon	$.12/Gallon
1978	274.9	307.8	340.6	373.4
1979	271.8	304.3	336.8	369.3
1980	274.1	306.8	339.6	372.3
1981	282.6	316.3	350.0	383.7
1982	286.6	320.7	354.8	388.9
1983	289.2	323.6	358.0	392.5
1984	288.4	322.7	357.0	391.4
1985	296.5	331.7	366.9	402.1

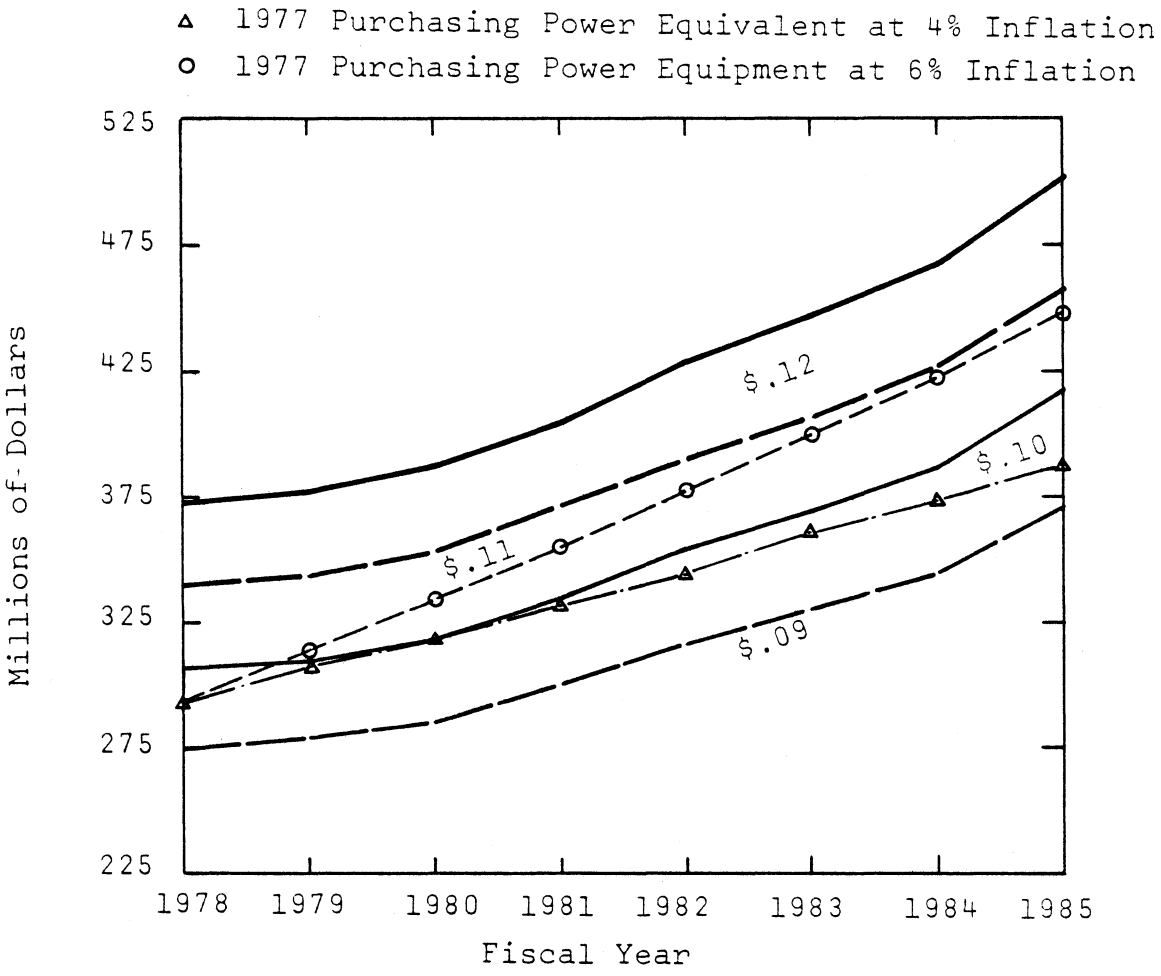

Figure 1. Gas tax revenue forecasts under different tax rates. (Fuel efficiency 12-15 mpg.)

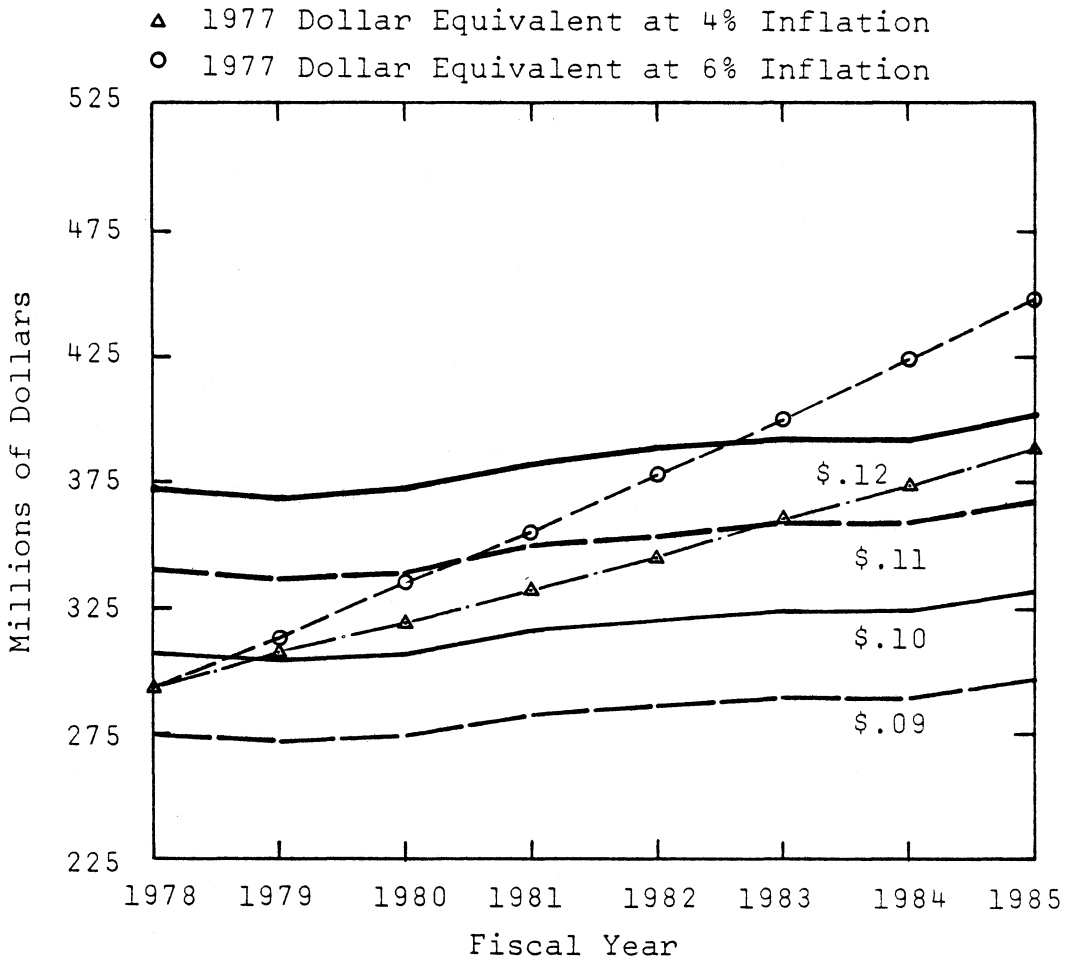

Figure 2. Gas revenue forecasts under different tax rates. (Fuel efficiency 12.64-19.3 mpg.)

In the author's opinion, the data presented in Table 6 and in Figure 2 should receive the most attention. The assumed fleet fuel efficiency used to derive the data for Table 5 and Figure 1 is a bit overcomforting in the sense that there is little room in that forecast for reasonable gains in energy conservation. Nevertheless, those data are presented for inspection as a best situation benchmark.

Referring to Figure 2, the curves show that a $.01 increase in the current gas tax will be expected to generate approximately $32 million additional revenue per year. Placing this in perspective, if the gas tax were raised to $.10 per gallon on July 1, 1979, it would generate in the neighborhood of $200 million more through fiscal 1985 than would the $.09 rate. At first glance one might suppose that to be a rather large increase in funds. However Figure 2 shows rather clearly that if transportation costs rise by as much as an average of 4% per annum, a $.10 per gallon tax will not generate the equivalent of 1977 real purchasing power. In fact, real purchasing power will likely remain below 1977 levels through 1985; and in 1985 the purchasing power of the revenue from a $.10 per gallon tax would be below 1977 purchasing power by more than $50 million. On the other hand, increasing the tax to $.11 per gallon on July 1, 1980, would be expected to provide equivalent 1977 purchasing power for the better part of the analysis period.

Because suggestions to alter the existing tax structure raise the question of adding to the tax burden of the highway users, it is appropriate to analyze the extent to which burdens might be altered by a tax increase. An examination of the facts shows that the tax paid per dollar spent on gasoline is lower now than it was in the decade preceding 1978, and that an increase to $.11 per gallon would impose no greater real burden on the taxpayer in 1979 or 1980 than the real burden was in 1967.

First consider the historical trend of gas tax payments as a percentage of dollars spent on gasoline as the retail gasoline price has risen. Table 7 shows the per unit gas tax as a percentage of the sales price of gasoline exclusive of the state tax. In other words, Table 7 translates the per unit tax to its equivalent sales tax. Per dollar spent on gasoline in 1977 the amount paid in tax is lower at 17.6% than at any time in the previous 13 years. In terms of dollar cost to taxpayers, consider the following situation.

For a driver who typically drives 20,000 miles per year, the data suggest (see Appendix A and Appendix Table B-10) that in 1980 he would demand 1492 gallons of gas and pay a total of $156.70 in state gasoline tax at a tax of $.11 per gallon. If the tax remains at $.09 per gallon, he would pay $128.21 in tax. Thus for the 20,000 mile per year driver the added tax in 1980 would be $28.49. Further, compared to prices in 1975 and incomes in 1975, a $.11 per gallon tax in 1980 would be no higher real tax than the $.09 tax was in 1975.

Table 7

The Historical Trend of the Per Unit Gas Tax in Terms of its Sales Tax Equivalent

Year	Price Per Gal. Exclusive of Tax	Per Gallon Tax	Sales Tax Equivalent
1964	22.0	$.06	27.2%
1965	21.7	.07	32.3
1966	22.2	.07	31.5
1967	22.8	.07	30.7
1968	23.0	.07	30.4
1969	23.7	.07	29.5
1970	24.3	.07	28.8
1971	24.8	.07	28.2
1972	24.4	.09	36.8
1973	27.6	.09	32.6
1974	40.3	.09	22.3
1975	44.8	.09	20.1
1976	46.9	.09	19.1
1977	51.0	.09	17.6

What of an Ad Valorem Tax?

The question of switching to an ad valorem tax (sales tax or percentage tax) has been raised recently by a number of departments of transportation. The reason for their interest is largely attributed to the likely resiliency of the tax during inflationary periods. Similarly, the present author approached the question of a switch from a per unit gas tax to an ad valorem tax. Two options were addressed: the traditional percentage tax on the retail price at the pump and a percentage tax on the wholesale price.

A Tax on Retail Price

Forecasts under two rates of ad valorem tax are presented in Figure 3. Several comments are in order regarding the development of these estimates. While at first look an 18% tax is rather surprising, it describes a level roughly equivalent to the 1977 per unit tax as a percentage of the price of gasoline exclusive of the tax. For example, the revenue which would have been generated in fiscal 1978 by an 18% tax on gas ($277.8 million) is only $3 million higher than that actually collected under the $.09 per gallon tax.

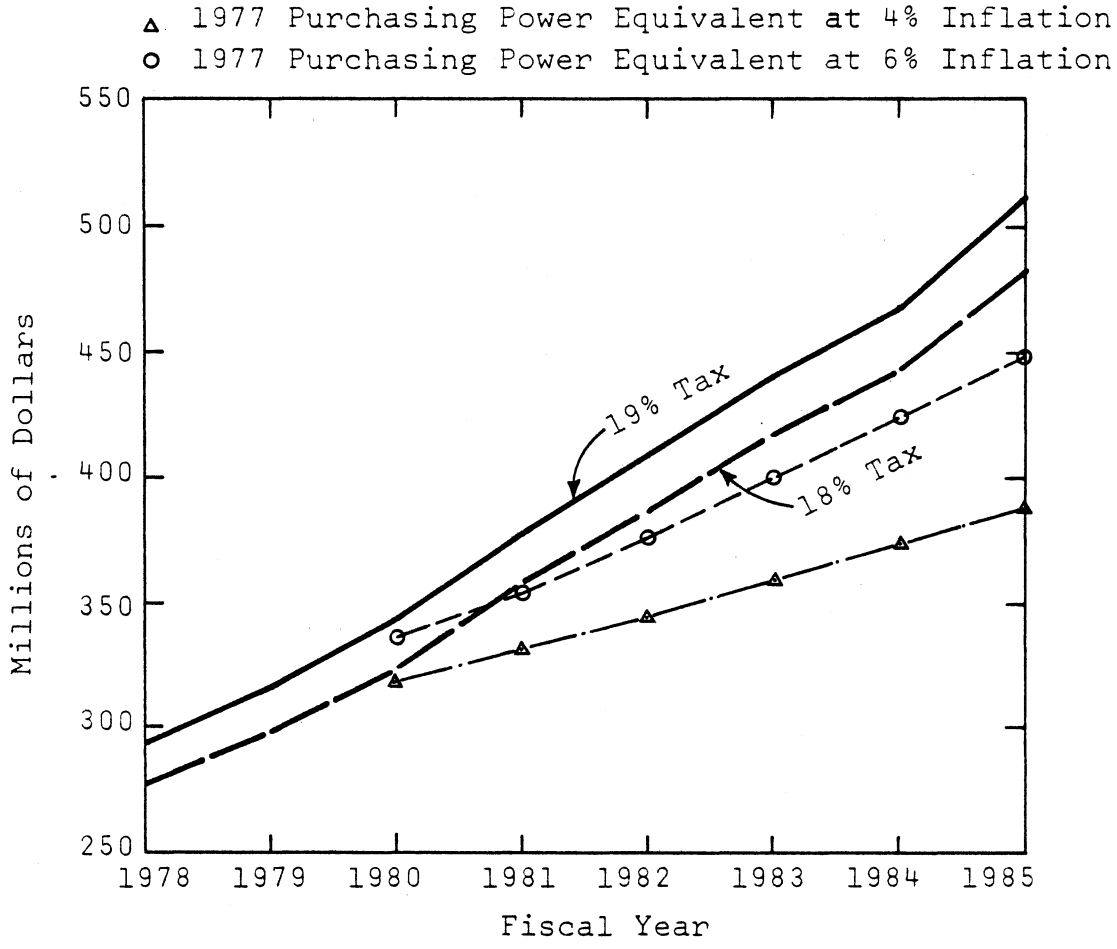

Figure 3. Revenue projections for an ad valorem tax and fleet fuel efficiency of 12.64 to 19.30 mpg.

The forecast for the ad valorem tax is calculated as follows: Using the model described in Appendix A, equation 2 was used to estimate demand for gasoline in gallons; then using the gasoline price data presented in Appendix Table B-7, total sales revenue exclusive of taxes was estimated for each year in the forecast period, and the ad valorem tax rate was multiplied by the market value of total sales to arrive at the tax revenue.

The aforementioned attraction of a resiliency in revenue provided by a tax tied to the price of the item being taxed is poignantly clear when one compares the projection from an 18% tax on the retail price of gas to the constant 1977 dollar equivalents shown in Figure 3. Even at an average inflation of 6%, revenues will likely maintain constant purchasing power. A second potential attraction of an ad valorem tax based on the retail price of gas stems from an impending change in federal income tax legislation. Should the proposed legislation pass, state per unit gasoline taxes would no longer be deductible on federal income tax returns. While a legal determination would be required, a sales tax on gasoline at the retail level might remain deductible under federal income statutes.

The theoretical attractiveness of a retail sales tax on gasoline should not, however, overshadow several other quite important aspects of the tax which must be considered by policy makers. First, from the standpoint of administering it, the retail sales tax is not as attractive as the per gallon tax. Currently, the gas tax is levied on the wholesaler when he sells gas in Virginia; and he, of course, includes it in the price to the retailer. In this case, administrative costs of collection are minimal because there are relatively few collection points. Consequently recordkeeping is not overly burdensome. A changeover to the ad valorem tax on the retail price of gas would, in itself, be costly. However, this initial cost would not approach the long-term cost of tax collection on an annual basis because the new system would require that each retailer become a tax collector and that separate records and monitoring be maintained for each retailer. The second aspect of the tax which requires attention is the likelihood that the percentage tax would be more apparent in the minds of taxpayers and hence would be less acceptable than increases in the per unit tax. For example, on a $10.00 purchase, the buyer would separately pay $1.80 for the tax; the tax thus would be an add-on to price rather than being a part of the price like it is in the case of the per gallon tax. A final point to be considered is that during an inflationary period, an increase in the market price of gasoline would occasion an obvious secondary price increase — that of the percentage tax. Such double price increases may lead to a "price threshold" at which the demand for gasoline would become relatively elastic and thus responsive to

additional price changes. While empirical evidence indicates that price elasticity of demand for gasoline is highly inelastic — that is, unresponsive to price increases — the potential for such a price threshold effect cannot be overlooked.

A Tax at the Wholesale Level

While a sales tax at the retail level is not as attractive as the per unit tax from the standpoint of administration, a sales tax levied at the wholesale level would likely not be as susceptible to costly administration. Since the mechanism for collection already exists at the wholesale level, the main task would be to establish the appropriate tax rate on the wholesale price. While care would have to be exercised in determining the exact wholesale price in Virginia, a reasonable estimate can be obtained in the following manner. The projected average pump price on July 1, 1979, is approximately $.68 per gallon (Appendix Table B-7). Subtracting taxes ($.13), estimated dealer markup ($.09), transportation and storage costs to the dealer ($.02), and marketing costs ($.048) yields a wholesale tax base of approximately $.39 per gallon.* At a wholesale price in this range, a 25% tax on the wholesale price of gas would generate revenue roughly equivalent to an 18% sales tax on the retail price while avoiding some of the difficulties of the retail sales tax noted earlier. Before any determination of the actual wholesale tax rate can be made, an empirical investigation would have to be performed to establish actual wholesale prices.

Changes in Sales and Use Tax

Projections of sales and use taxes were provided earlier in the report. The model predicted that the 2% sales and use tax, unlike the projected gas tax and registration and license fees, would provide real growth in purchasing power through 1985 if the economy of Virginia has a reasonable level of sustained economic growth. Such an expectation is largely due to the nature of the tax. Specifically, it is a percentage tax with a base (automobile sales total revenue) that has experienced growth as prices have risen.

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*This cost breakdown is based upon data presented in the May, 1978, issue of Gulf Consumer News Digest, published by Gulf Oil Corporation.

Very simply, the sales and use tax is quite attractive in terms of its revenue-generating power. For example, an increase in the tax to 3% on July 1, 1979, would be expected to generate approximately $36 million more in fiscal 1980 than can be expected from a 2% sales and use tax. This figure assumes only modest economic growth and no significant changes in the demand for automobiles (see Table 8). Assuming slightly higher economic growth (column 2 of Table 8), an additional $45 million would not be unreasonable to expect from a 3% sales and use tax.

Nevertheless, such an alternative should be placed in perspective. An increase in the sales and use tax from 2% to 3% would generate about $70 million more additional revenue than would a $.01 a gallon increase in the gas tax over the period 1980-1985. However, a 1% increase in the sales and use tax represents a 50% increase in tax paid. For example, on a $5,000 automobile, the current tax is $100, while at 3%, the levy would be $150. Moreover, an increase in the gasoline tax would more evenly distribute the tax burden.

Table 8

Sales and Use Tax Projections for Different Growth Rates and 2% and 3% Tax Rates (Millions of Nominal Dollars)

Fiscal Year	Low Growth		High Growth	
	2%	3%	2%	3%
1980	$ 72.8	$109.2	$ 79.1	$118.6
1981	79.4	119.1	88.9	133.4
1982	86.6	130.0	100.1	150.2
1983	94.5	141.9	112.7	168.9
1984	103.1	154.7	126.7	190.0
1985	112.6	168.8	142.7	213.9

Registration and License Fees

In an earlier section of the report it was argued that under reasonable inflationary assumptions the revenue from registration and license fees is not likely to maintain its 1977 purchasing power through 1985. The model in Appendix A applies the assumptions that (a) the current rate of automobile registrations will not be altered during the analysis period, and (b) that the proportion of heavy truck registrations to automobile registrations will not change over the analysis period. (The model was used also with alternative assumptions regarding automobile demand and the results from forecasts under these assumptions are available.) Table 9 presents estimates of registration and license fees if 10% and 15% increases were made effective July 1, 1979.

Comparing the data in Table 9 to that in Table 4, it is clear that a 15% increase in registration and license fees would not approximate 1977 real purchasing power as forecast by the model. Such an increase would, however, somewhat mitigate purchasing power losses from this revenue source.

Table 9

Registration and License Fee Revenue for Increases of 10% and 15% (Millions of Nominal Dollars)

Fiscal Year	Existing Fees	Increase 10%	Increase 15%
1980	79.2	87.1	91.0
1981	80.2	88.2	92.2
1982	81.2	89.3	93.4
1983	82.3	90.5	94.6
1984	83.3	91.7	95.8
1985	85.0	93.5	97.8

Changes in the Road Tax

For-hire common carriers pay a $.02 per gallon road tax in addition to the $.09 per gallon motor fuel tax. The additional tax is collected by the State Corporation Commission (SCC) and supposedly reflects additional costs occasioned by common carriers. Using data supplied by the Division of Motor Vehicles and the SCC, estimates of the revenue generated by the motor carrier road tax and fuel tax were developed and are presented in Table 10. Beginning with fiscal year 1980, projections were made based on a 6.5% growth trend. Historically, this figure is quite reasonable.

Two points should be called to the reader's attention. First, revenues generated by the road tax and net fuel tax on motor carriers have averaged between 11% and 12% of the motor fuel tax collections since 1970. The other 88% of motor fuel tax collections has come from the tax on fuel used by lighter vehicles such as automobiles and light trucks. Secondly, it is questionable that the road tax as a share of motor fuel taxes has maintained its original level. Consider that the road tax differential was established at $.02 per gallon when the motor fuel tax on other vehicles was $.06; that is, the road tax was 33% of the motor fuel tax. After two increases in the motor fuel tax, the road tax remains $.02 per gallon, or 22% of the motor fuel tax. One must presume that the legislature felt that a 33% differential was equitable for common carriers at the time the road tax was instituted. If that differential is to be maintained, the road tax should be increased by $.01 per gallon. Furthermore, it is emphasized that should the gasoline tax be increased from its current level of $.09, a determination of the appropriate accompanying road tax should be made considering particularly the allocation of highway costs between heavy common carriers and automobile traffic. Table 11 presents the additional revenue that might be expected from a change in the road tax to $.03 per gallon; and shows that the $.03 tax would raise an additional $26.9 million by 1985.

Table 10

Estimates of Revenue Generated by Motor Carriers
at Present Tax Rates
(Millions of Dollars)

Fiscal Year	Net Fuel Tax	Net Road Tax	Total
1971	$17.430	$3.874	$21.304
1972	19.600	4,356	23.956
1973	21.918	4.871	26.789
1974	22.760	5.058	27.818
1975	22.108	4.913	27.021
1976	23.471	5.215	28.686
1977	25.041	5.565	30.606
1978	26.668	5.927	32.595
1979	28.402	6.312	34.714
1980	30.248	6.722	36.970
1981	32.213	7.159	39.320
1982	34.308	7.625	41.933
1983	36.533	8.120	44.653
1984	38.908	8.648	47.556
1985	41.436	9.210	50.646

Table 11

Changes in Road Tax Revenue at $.03 Rate
(Millions of Dollars)

Fiscal Year	Change in Road Tax	Total
1979	$3.156	$ 9.469
1980	3.362	10.085
1981	3.580	10.740
1982	3.812	11.438
1983	4.060	12.180
1984	4.324	12.973
1985	4.605	13.816

ADDITIONAL REVENUE SOURCES

In the literature on public finance, one often reads that "an old tax is a good tax." In many respects, this cliche is true; however, it should not forestall consideration of revenue sources in addition to the ones to which a government has become accustomed.

As the responsibility for the provision of transportation services expands (as has been the case for the Department), it is quite reasonable to consider options other than "old taxes". Therefore, in this section consideration is given to an optional local sales tax on gasoline, the potential for bond financing, and congestion pricing.

The Local Sales Tax Option

Because local public transit is in ever increasing demand, and because the benefits are largely confined to the locality, a local revenue source for funding such improvements is reasonable. One suggested source of local funding is a sales tax option on gasoline at the local level similar to retail sales tax options at the local level. While the initial reaction of local officials to such a proposal may be favorable an examination suggests that other options may be at least as attractive, if not more so.

The proposal should be examined in several aspects. First, what is the revenue potential? Secondly, is the incidence of such a tax likely consistent with the benefits of the tax? And thirdly, what might the effect on state financing be?

Regarding revenue potential, one must first estimate gasoline sales by locality, then apply the sales tax. In a recent study by the Governor's Council on Transportation, local sales taxes were projected by estimating local registrations of automobiles as a percentage of total statewide registrations. This percentage was then applied to an estimate of gallons of gasoline sold statewide and the tax rate was applied to the resulting figure.

In the present study, using data obtained from the Tayloe Murphy Institute on total retail sales of gasoline service stations by locality, estimates of the proportions of total state service station sales by locality were prepared. These proportions were then applied to the forecasts of statewide gasoline demand as estimated by equation 2 to arrive at gasoline demand in gallons by locality. Multiplication of these estimates of demand by projected prices yielded total revenue including state and federal taxes. The sales tax rate was then applied to the total revenue to obtain sales tax surcharge revenues by locality.

Because there are more than 270 localities in Virginia that possess the power to tax, the entire data set is not presented here; it can be supplied on request. However, Figure 4 and Table 12 reveal much about the local option sales tax. If, for example, every locality with taxing power were to place a 2% surcharge on

the full gross price of gas on July 1, 1979, total revenue statewide from the sales tax would be in the neighborhood of $44 million to $48 million for fiscal 1980. By the estimation process described above it was estimated that Arlington County might be expected to generate $1.32 million in fiscal 1980; Fairfax, $4.83 million; Richmond, $2.12 million; Charlottesville, $589,000; and Essex County, $84,720. In other words, for those jurisdictions with a high level of gasoline sales, the local sales tax could generate a level of funding sufficient to undertake worthwhile improvements in local transportation facilities (see Table 12). However, unless the tax were implemented regionally, it could be easily avoided by purchasing in a non-tax or low-tax locality. Further, it is questionable that a local gasoline sales tax approach is appropriate in terms of equity unless the transportation improvement benefits accrue largely to the driving public. If, instead, the benefits of expenditure accrue largely to a non-driving segment of the population, as could be the case for expenditure on public transit, more broad-based types of revenue-producing measures such as local property taxes or increases in the general sales tax may be more appropriate. Finally, in looking at a local gas sales tax option, one should not fail to recognize that, in a sense, a local option sales tax carries with it the very real potential of reducing the ability to generate additional gasoline tax at the state level.

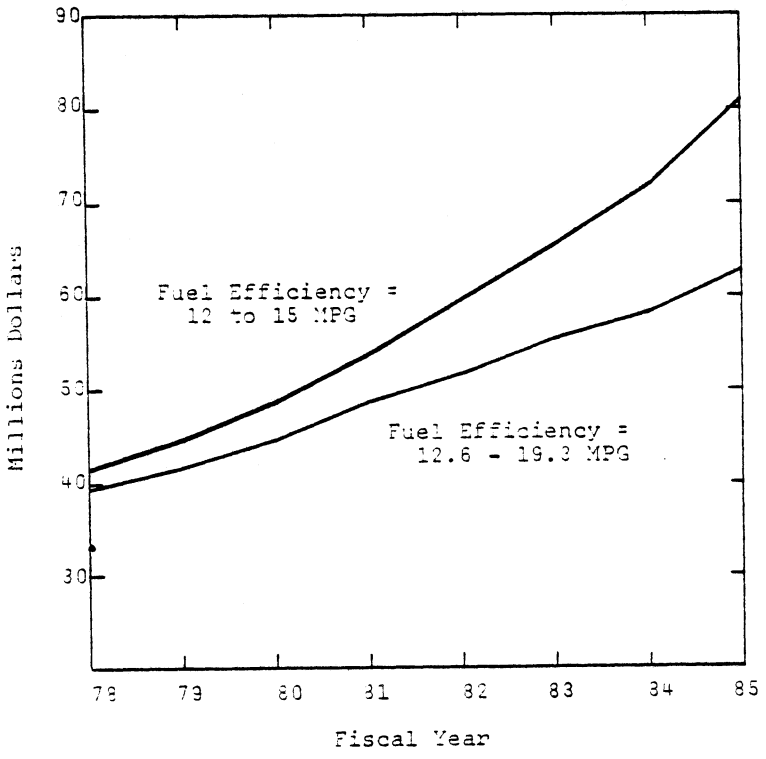

Figure 4. State totals of local option 2% sales tax on full price of gas including $.09/gal. state tax.

Table 12

Local Sales Tax Revenue at 2% Rate
For Selected Virginia Localities

Locality	Fiscal 1980 Revenue
Fairfax County	$4,833,000
Richmond City	2,120,000
Norfolk	1,846,000
Henrico County	1,792,000
Virginia Beach	1,444,000
Fairfax City	1,418,000
Arlington	1,319,000
Prince William	1,319,000
Chesapeake	709,000
Charlottesville	588,628
Essex County	84,720

Bond Financing

Bond financing has been largely avoided as a mechanism for funding transportation facilities in Virginia. With the exception of several revenue bond issues for acutely expensive projects, Virginia has used a pay as you go approach to financing transportation facilities at the state level. The avoidance of deferred payment, one may suspect, is due in large measure to the unsatisfactory experience of other states.

Nevertheless, bond financing, particularly in an inflationary period, should be given serious consideration as an alternative to postponing projects if their costs are likely to increase drastically. Bond financing, or debt financing, cannot be given adequate treatment within the limitations of this report, however, a quite reasonable general case can be made for it.

First, there is nothing inherently evil about debt financing. The fact of the matter is that debt financing gets its bad name from both a poor understanding of the conditions under which debt finance is appropriate and inept debt administration.

First, several general rules can be set forth regarding debt finance. In general, it is inappropriate for funding current-period services. Since services accrue in the current period to users of those services, they should be financed on a pay-as-you-go basis. On the other hand, it is consistent with the principles of public finance to fund a long-term capital investment for a service to be used over many years with a debt issue. From the standpoint of the benefit principle, the retirement of the debt issue over the life of the project allows individuals who benefit from the project in later years to pay for those benefits as they receive them. A prime example might be the financing of a $50 million revenue bond for the construction of a harbor tunnel to be repaid (both principle and interest) by tolls imposed on the users of the facility. Similarly, a general obligation bond may be used to finance several transportation improvements as long as provision is made for retirement of the bond through a bona fide allocation of future funds or through scheduled increases in taxes during the life of the improvements. The danger, of course, is to neglect designing a repayment mechanism at the time of issue and thus to encroach upon funds which should have been used in future periods to provide services in those periods (such as maintenance, snow removal, signing and safety).

Two common fallacies of debt finance deserve attention. The first fallacy is that there is no limit to the debt level a government can issue. Two factors negate such an argument. First, an extremely large debt issue can raise the market interest rate on state and local bonds such that as a funding mechanism they become less attractive. Secondly, in the case of a department of transportation, notification of an extremely large debt issue can encourage contractors to inch their prices upward. Both of these factors significantly reduce the attractiveness of bond financing.

The second fallacy is that there is an added "burden" of debt finance as compared to pay as you go. This argument is also incorrect in the sense that those individuals who buy the bond issue at the offered interest rate are foregoing use of their funds in the current period for the expectation of more funds later on. There is no loss of resources to society in general; there is merely a transfer of funds from one group to another.

The salient fact about debt finance is that the issue of the debt does not avoid the necessity to pay -- it only postpones that necessity. Thus, unless tolls or some other type of user payments are committed to debt retirement, bond issues will not alleviate the necessity to commit additional tax revenue to retire the bond.

Congestion Pricing

In major urban areas where congestion is a pronounced problem, the revenue potential of the transportation systems management strategy known as "congestion pricing" cannot be overlooked.

Economists view urban traffic congestion as the consequence of non-optimal pricing of city streets and highways. While building more highways and increasing capacity on existing routes relieve congestion for a while, inevitably road usage tends to increase until congestion returns. At the root of this problem is the fact that each driver is not required to pay the full costs of using the roads during the rush hour. Quite the contrary, he pays only costs actually incurred by him; he avoids paying for external costs such as the inconvenience of added congestion he imposes on other drivers using the road before he entered the traffic flow. Much of this observed inefficiency in road usage can be eliminated with a sensible system of tolls or "congestion prices" to induce either substitution away from congested routes or to transportation modes other than single passenger automobiles. While "congestion pricing" is attractive theoretically, doubts exist about its potential for relieving traffic congestion. Nevertheless, evidence from the removal of tolls in the Tidewater area clearly indicates that travel demand is quite responsive to tolls where alternative routes are available.* (The removal of tolls at Hampton Roads caused a 33% increase in traffic volume.)

In light of such evidence, severely congested urban areas may find restrictive licensing or some other form of pricing demand for travel to be a viable transportation management and financing tool.

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*The Impact of Toll Charges on Traffic Mix and Flow in Tidewater Virginia. Volumes I, II, III. Virginia Highway and Transportation Research Council, August 1977.

APPENDIX A

A SINGLE EQUATION FORECASTING MODEL

The Virginia Department of Highways and Transportation historically has estimated revenues based upon an approximate 5% annual increase. That is, revenues prior to the year of the oil embargo had grown at about 5% per year in nominal terms. However, estimates so made are not based upon a reasonable economic model. Therefore, the author attempted to develop several simple, yet sensitive, equations to explain historical variations in gas tax revenue, sales and use taxes, and registration and license fees. These are outlined in the following subsections.

Gasoline Sales

In a sense, demand for gasoline is a function of travel demand. Thus, one can indirectly estimate gasoline sales and gas tax revenue once he has estimated changes in travel demand. Data for annual vehicle miles of travel (VMT) were obtained for the 12-year period 1965-1976 and were used as the travel demand variable. There being no evidence favoring a particular functional form, a series of linear regression forms were tested to ascertain which one best fit the 12-year time series. The results showed that a double-log equation including population and a measure of real travel cost yielded an R^2 of .99 and highly significant t-statistics. This functional form shown in equation (1) was deemed acceptable, and parameter estimates were used along with population and real travel cost estimates to forecast VMT from fiscal 1978 through fiscal 1985.

$$\log VMT = -30.6154 + 3.3511 (\log \text{ of population}) + 1.02252 (\log \text{ of travel cost}) \quad (1)$$

$$\text{where travel cost} = \frac{(\text{average occupancy rate} \times \tfrac{1}{2} \text{ real wage rate})}{(\text{average speed} \times \text{rural driving factor} \times \text{urban driving factor}).}$$

With the forecasts of VMT in hand, estimates of gasoline demand for the period 1978-1985 were made with the equation

$$GAL_i = VMT_i / M_i, \quad (2)$$

where

GAL_i = annual gasoline sales in gallons in year i,

VMT_i = total vehicle miles of travel in year i, and

M_i = average fleet fuel efficiency in year i measured in miles per gallon.

Solving equation (2) for GAL_i requires data on the other two variables, VMT_i and M_i. As described above, VMT_i is obtained by equation (1); secondary source material was used to obtain M_i. The Department estimates of fleet fuel efficiency (M_i) are 12 mpg in 1977 and 15 mpg in 1985.[1] The author views these estimates as being too low in light of mandated fuel standards for new automobiles and the long run tendency for consumers to substitute high efficiency for low efficiency automobiles. A recent report by Oak Ridge Laboratories for the Energy Research Development Administration presents several forecasted fleet fuel efficiency series through 1990.[2] Because in the author's judgment the series is too high, he has chosen as more appropriate the series 14.87 mpg in 1978 to 22.72 mpg in 1985 reduced by 20%. This choice implies the series of assumed M_i values presented in Table A-1. The rate of increase in M_i reflects greater fleet fuel efficiency gains in the later years of the analysis period, which is quite reasonable given that more older, less efficient vehicles will be on the road in the earlier years than in the later years.

Using equation (2) and the data described above, estimates of gasoline demand were made and are presented in Table A-2. Then it is a simple step to develop the revenue forecasts.

Table A-1

Estimated Fleet Fuel Efficiencies

Year	Efficiency in MPG
1978	12.64
1979	13.34
1980	14.04
1981	14.74
1982	15.74
1983	16.74
1984	18.02
1985	19.30

[1]Virginia Department of Highways and Transportation Budget Exhibit 1978-80, p. 69.

[2]Transportation Energy Conservation Data Book, Vol. 2, Oak Ridge Laboratories, 1978, pp. 236-239.

Table A-2

Estimated Gasoline Demand in Millions of Gallons

Year	Gasoline Demand
1978	3,283.91
1979	3,248.88
1980	3,274.12
1981	3,369.25
1982	3,412.81
1983	3,442.17
1984	3,433.18
1985	3,522.85

Sales and Use Taxes

The Virginia automobile sales and use tax is a 2% sales tax on the market price of automobiles. The author expected that sales and use tax revenue time series could be approximated by an equation including population and real income. A double-log regression including these variables explained 91% of the variation in sales and use taxes over the period 1965-1976.* Parameter estimates from this regression were then used, along with population and real income projections, to forecast the sales and use tax revenues through 1985 that are given in the body of the report.

Registration and License Fees

The third revenue source modeled is the sum of registration and license fees. Ideally, one should be able to perfectly predict total revenue from registration and license fees by the equation

$$RLF_i = (AF_i \times ARLF_i) + (TF_i \times TRLF_i), \quad (3)$$

where

RLF_i = total registration and license fees in period i,

AF_i = automobile fleet size (historical data show this to be 0.6 in Virginia),

*Several other functional forms were tested; however, their performance was not as acceptable. R^2's were lower as were F-statistics and t-statistics levels on the explanatory variables.

$ARLF_i$ = average automobile registration and license fees per auto in year i,

TF_i = truck fleet size, and

$TRLF_i$ = average truck registration and license fees per truck in year i.

Nevertheless, difficulty in obtaining data on truck fleet size and $TRLF_i$ prohibited using equation (3). As an alternative, the author decided to use a diminutive form of equation (3) multiplied by a scaling factor to adjust for the portion of registration revenue which is generated by trucks. This reduced form of equation (3) is rewritten

$$RLF_i = 1.55 \times (AF_i \times ARLF_i), \qquad (4)$$

with the terms as defined for (3). (Historical data show that total fees run about 1.55 times automobile registration fees.)

APPENDIX B

DATA USED IN DEVELOPING FORECASTS OF REVENUES FROM GAS TAX, SALES AND USE TAX, AND REGISTRATION AND LICENSE FEES, 1978-1985

Table B-1

Population Projections

Fiscal Year	Population
1978	5,097,700
1979	5,163,990
1980	5,231,122
1981	5,299,127
1982	5,368,016
1983	5,437,800
1984	5,508,491
1985	5,620,000

Source: Population Projections, Division of State Planning and Community Affairs, Commonwealth of Virginia, March 1975.

Table B-2

Manufacturing Wage Rate Projections

Fiscal Year	Wage Rate
1978	$4.69
1979	5.10
1980	5.55
1981	6.04
1982	6.58
1983	7.16
1984	7.80
1985	8.49

Source: Virginia Department of Labor and Industry.

Table B-3

Consumer Price Indices
at Various Inflation Rates

Fiscal Year	CPI 4%	6%	8%
1978	181.5	181.5	181.5
1979	188.8	192.0	196.0
1980	196.3	206.5	211.7
1981	204.2	218.9	228.6
1982	212.3	232.0	246.9
1983	220.8	245.9	266.7
1984	229.7	260.7	288.0
1985	238.8	276.3	311.1

Source: Tayloe Murphy Institute, University of Virginia.

Table B-4

Disposable Personal Income
(5% and 8% Trend)

Fiscal Year	Income 5%	8%
1978	$6,836.00	$ 6,836.00
1979	7,178.00	7,383.00
1980	7,537.00	7,974.00
1981	7,914.00	8,612.00
1982	8,309.00	9,301.00
1983	8,725.00	10,045.00
1984	9,161.00	10,848.00
1985	9,619.00	11,716.00

Source: U. S. Department of Commerce, Bureau of Economic Analysis.

Table B-5

Fleet Fuel Efficiency Estimates

Fiscal Year	Baseline	Best Estimate
1978	12.00 mpg	12.64 mpg
1979	12.43	13.34
1980	12.86	14.04
1981	13.29	14.74
1982	13.72	15.74
1983	14.15	16.74
1984	14.58	18.02
1985	15.00	19.30

Sources: Virginia Department of Highways and Transportation; Oak Ridge Laboratories, Department of Energy.

Table B-6

Average Highway Speed

Fiscal Year	Speed
1978	58.6
1979	57.0
1980	57.2
1981	57.6
1982	58.0
1983	58.0
1984	58.0
1985	58.0

Source: Virginia Department of Highways and Transportation.

Table B-7

Gasoline Price Projections Including Current State and Federal Taxes

Fiscal Year	Gasoline Price (cents per gallon)
1978	60.0
1979	64.2
1980	68.1
1981	72.1
1982	76.1
1983	80.3
1984	84.7
1985	89.3

Source: Projections based on 1978 average price as supplied by Virginia Retail Gasoline Association projected at 5% to 7% increase.

Table B-8

Total Automobile Fleet Size Forecasts

Fiscal Year	Fleet Size
1978	3,058,620
1979	3,098,390
1980	3,138,670
1981	3,179,480
1982	3,220,810
1983	3,262,680
1984	3,305,090
1985	3,372,000

Source: Model presented in Appendix A.

Table B-9

VMT Forecasts

Fiscal Year	VMT
1978	41,508,600,000
1979	43,340,100,000
1980	45,968,700,000
1981	49,662,700,000
1982	53,717,600,000
1983	57,622,000,000
1984	61,865,800,000
1985	67,991,000,000

Source: Model presented in Appendix A.

Table B-10

Gasoline Demand Forecasts

Fiscal Year	Gasoline Demand (Millions of Gallons)
1978	3,283.91
1979	3,248.88
1980	3,274.12
1981	3,369.25
1982	3,412.81
1983	3,442.17
1984	3,433.18
1985	3,522.85

Source: Model developed in Appendix A.

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