JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION

THE VIRGINIA GENERAL ASSEMBLY

VEHICLE COST RESPONSIBILITY IN VIRGINIA

A report in a series dealing with highway and transportation issues in Virginia.

REPORT OF THE

JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION

ON VEHICLE COST RESPONSIBILITY IN VIRGINIA

TO

THE GOVERNOR

AND

THE GENERAL ASSEMBLY OF VIRGINIA

SENATE DOCUMENT NO. 13

COMMONWEALTH OF VIRGINIA
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COMMONWEALTH of VIRGINIA

Joint Legislative Audit and Review Commission

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November 30, 1981

The Honorable John N. Dalton, Governor
The Honorable Members of the General Assembly
State Capitol
Richmond, Virginia 23219

Ladies and Gentlemen:

We are pleased to enclose the report on highway cost responsibility in Virginia. The report was prepared by the Joint Legislative Audit and Review Commission with the cooperation of a study committee designated by Senate Joint Resolution 50 of the 1980 Session.

Sincerely,

Theodore V. Morrison, Jr.
SJR 50 Committee Chairman

Richard M. Bagley
JLARC Chairman

TVM:RMB/jmi

VEHICLE COST RESPONSIBILITY IN VIRGINIA

November 30, 1981

Joint Legislative Audit and Review Commission

This report contains the findings and conclusions of an analysis of highway tax equity. The study was mandated by Senate Joint Resolution 50 of the 1980 session. An interim report on the study methodology was provided to the General Assembly in January 1981.

In order to carry out the study a project team headed by JLARC research staff was established. Engineering and technical expertise was provided by the Department of Highways and Transportation, the Virginia Highway and Transportation Research Council, and the Department of Motor Vehicles. In addition, comments and technical suggestions were sought from an advisory committee representing a cross section of highway interests.

The cost responsibility concept involves an empirical investigation of the relationship between the costs of highway construction and maintenance incurred on behalf of various vehicle classes, and the revenue contributed by those vehicle classes to support highway programs. Costs include all public expenditures on the State's highways. Virginia supports all highway expenditures from special funds derived principally from user charges. State user charges include motor fuel taxes, sales and use tax, vehicle licensing fees, and proportionate registration fees from heavy trucks. Federal aid for highways is received from federal user charges on motor fuel, vehicle purchases and use, and the sale of certain related items such as tires. Ideally, the amount of revenue contributed by individual highway users should equal the costs incurred to build and maintain a highway system for their use.

A JLARC REPORT SUMMARY

The analysis found that Virginia's highway tax structure is essentially equitable in that the total imbalance between costs and revenue is only three percent. Passenger cars and panel and pickup trucks overpay their responsibility slightly, while tractor-trailers underpay their responsibility by less than one percent. Medium weight trucks underpay by substantial percentages which range up to 38 percent for two-axle, six-tire vehicles. These vehicles are a relatively small proportion of highway users and their underpayment does not greatly affect the total equity imbalance. Nevertheless, the General Assembly may wish to review the tax structure as it applies to these highway users to address equity concerns.

Examination of the cost responsibility study results projected for the range of likely spending in FY 1984 shows that the equity relationships could be kept fairly stable through the mid-decade. In other words, although Virginia is facing both real declines in its highway program and increased emphasis on rehabilitating older roads, the shift in spending priorities will not, by itself, greatly affect the overall equity relationships. Care

COST ALLOCATION AND REVENUE ATTRIBUTION SUMMARY

	Class I	Class II	Class III	Class IV
Cost Allocation	70.9%	8.5%	4.5%	16.1%
Revenue Attribution	74.0%	6.1%	3.9%	16.0%
Difference between Costs and Revenue in FY 1980 Payments	Overpaid $18.9 mil.	Underpaid $14.1 mil.	Underpaid $4.0 mil.	Underpaid $0.8 mil.
Percent Overpayment/Underpayment	Overpaid 4.2%	Underpaid 38.1%	Underpaid 16.9%	Underpaid 0.8%

should be exercised, however, in examining any future highway tax proposals to evaluate their equity implications.

Cost responsibility analysis needs to take into consideration the dynamic fiscal and technological environment of highway tax policy. Changing factors such as vehicle design, travel patterns, and economic conditions will alter the equity relationship over time. Therefore, examination of highway user costs and revenue contributions should be repeated periodically. An updated study should be completed in 1985 for use in the 1986-88 budget review.

PREFACE

The assignment of doing a cost responsibility study for the General Assembly presented us with a formidable challenge. Not only was it necessary to marshal a host of technical resources to help make the complex analysis possible, but it was equally important to design a methodology that accurately measured highway construction and maintenance practice in Virginia. The study took about 18 months to design and complete. We were fortunate to have received excellent cooperation from numerous individuals in federal and state agencies. We believe this study accomplishes the objective of providing the General Assembly with reliable information on the equity of Virginia's highway tax structure.

Several factors were of key importance to this effort:

- The study process was an open one, with representation from as many interested parties and transportation industries as we could identify.

- The study methodology was based on the best technical information available and is, we believe, a state-of-the-art effort.

- Two innovations, "clustering" construction projects according to design characteristics, and allocating costs by using a three-part classification scheme, gave better recognition to Virginia's actual design and maintenance practices.

The study team was acutely aware that the legislature would be facing a number of critical decisions regarding both future levels of highway construction and maintenance in the State and methods of financing those activities. We believe this report is especially well suited to serving those legislative decision-making needs.

On behalf of the commission staff, I wish to acknowledge the cooperation and assistance provided by staff of the Department of Highways and Transportation, the Virginia Highway and Transportation Research Council, the Division of Motor Vehicles, the State Corporation Commission, and representatives of the Virginia Highway Users Association, the Virginia Railway Association, the Automobile Club of Virginia, the Conservation Council of Virginia, the American Trucking Association, and the American Railway Association.

We also wish to acknowledge the substantial budgetary commitment made to this study by the Department of Highways and Transportation, especially the provision of computer services for the analysis.

Ray D. Pethtel

Ray D. Pethtel
Director

January 19, 1982

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I. OVERVIEW AND FINDINGS

The construction and maintenance of Virginia's highways are financed primarily by taxes levied on highway users. With revenues from motor fuel taxes, vehicle licensing fees, and sales taxes on automobiles and trucks, over 99 percent of State funds for highway maintenance and construction is generated by user charges.

A basic principle of user tax equity and a balanced tax structure is that revenues derived from each user be equal to the costs the public bears in providing serviceable highways for that user. While such a balance is difficult to achieve, knowing the relationship between taxes and highway use and service cost is a first step in designing an equitable tax structure. The process used to assess the balance between user tax revenues and the cost of the highway system is generally referred to as a cost responsibility study.

This study is the sixth examination by the General Assembly of the distribution among vehicle classes of costs and revenues related to highway construction and maintenance. The issue was first reviewed in 1932 and was studied again in 1940, 1952, 1963 and 1980. Each review used available technical information to assess particular questions concerning the balance between revenues paid by highway users and costs incurred by the Commonwealth. This, however, is the State's first comprehensive cost responsibility study.

The cost responsibility study was mandated by Senate Joint Resolution 50 of the 1980 Session of the General Assembly. The resolution directed JLARC "to study the fair apportionment and allocation of the cost of building and maintaining the roads and bridges of the Commonwealth between motor vehicles of various sizes and weights." The resolution called for a complete report prior to the 1982 Session.

The General Assembly designated a joint subcommittee to assist in developing findings from the studies mandated by SJR 50. The joint subcommittee consisted of appointees from JLARC, the House Roads and Internal Navigation Committee, the Senate Transportation Committee, the House Finance Committee, and the Senate Finance Committee. The subcommittee approved the methodological concept for the study and was briefed at several stages in the report process.

THE STUDY PROCESS

The cost responsibility study was initiated in July 1980 with the designation of a study team. The team was headed by JLARC research staff and included engineering and research personnel from the Virginia Department of Highways and Transportation and the Virginia Highway and Transportation Research Council.

An important innovation in the study design was the effort to involve transportation industry representatives and other interested parties throughout the study process. An advisory group was established, consisting of representatives of the American Trucking Association, Virginia Highway Users Association, Virginia Railway Association, Automobile Club of Virginia, and the Conservation Council of Virginia. These persons were consulted at key points in the study process to provide technical comment and to ensure adequate communication between the interested parties.

A preliminary study design was prepared in November 1980, after extensive review of proposed methods and after several meetings with technical advisory groups. Comments on the design were solicited from the advisory group and from State agencies involved in highway revenue collection and transportation policy development. Revisions stemming from those comments were incorporated into the study design, and a revised methodology was presented to the legislative steering committee.

A public hearing on the proposed methodology was held in December 1980, and in January 1981, a published report on methodology was distributed to the General Assembly and to other interested groups and individuals. Since January 1981, the study design has been refined and implemented.

This report is organized into two chapters. The first chapter describes the study topic, reviews several elements of the study design, and presents the findings and conclusions of the analysis. The second chapter presents detailed descriptions of the analysis of costs and revenue attribution.

The Cost Responsibility Concept

An underlying consideration of a cost responsibility study is that a highway system is built to accommodate a variety of vehicles that have a wide range of requirements. In cases where construction and maintenance expenditures are made on behalf of particular vehicle classes, those costs should be borne by the vehicle classes that require them. Such expenditures would include those for providing wider or stronger pavement to accommodate larger or heavier vehicles, raising overpasses for truck clearance, or maintaining ferries which carry only automobiles.

In other cases, expenditures are made which cannot be directly related to particular vehicle characteristics. All vehicles benefit from supervision of highway maintenance. These types of expenditures must be examined to determine the most equitable measure of demand for those services or facilities. Separating costs associated with specific vehicle classes from those which are common to all vehicles is an important facet of the cost responsibility analysis.

The end result of a cost responsibility study is an assessment of equity in user charge payments. In a basic sense, such a study seeks to determine whether individual highway users pay taxes and fees which offset the cost of building and maintaining the highways for their personal use. An equitable tax structure will produce a balance between payments and costs for which each highway user is responsible. Expressed quantitatively, equity in the user tax structure is achieved when:

[Individual user charges paid] - [Individual cost responsibility] = 0

If a positive remainder is produced, individual users are overpaying relative to their cost responsibility. A negative remainder indicates underpayment. Any deviation from zero indicates some inequity which may warrant legislative or executive consideration.

Study Time Frame

Two principal options for selecting a study time frame existed. The more straightforward option used expenditure and revenue information for the most recent fiscal period. Data for this option were generally available, which limited the need to estimate costs and revenues.

The second option was to project both expenditures and revenues to a future time period. This approach required substantial estimation of future workloads, inflation rates, traffic patterns, and revenue collections. Although this option was the more complex, an analysis of costs and revenues for any current period might not be adequate for determining equitable cost sharing under future conditions. The second approach provided better information on cost responsibility in a changing fiscal and technical environment.

After careful consideration, the options were combined, and two time frames were selected for analysis. A base period was chosen as yielding the most accurate data and providing a benchmark for evaluating equity within a dynamic technical and fiscal environment. A future time frame was also chosen to assess how changing expenditure patterns, travel trends, revenue collections, and other factors might affect cost responsibility between the base period and the mid-decade. Designating a dual time frame offered the highest likelihood of developing comprehensive cost responsibility findings.

Fiscal year 1980 was the study's base period. As the most recently completed fiscal year at the study's inception, FY 1980 provided readily obtainable expenditure and revenue data, as well as information on actual travel patterns and vehicle weights. Because Virginia is experiencing changes in several areas which could affect cost responsibility relationships, FY 1984 was selected as a short-term future period suitable for study.

Vehicle Class Selection

SJR 50 called for a study of cost apportionment among vehicles of various sizes and weights. In theory, a separate estimate of the relationship of user charge payments to cost responsibility could be calculated for each individual who uses the highway system. Since calculating millions of individual equations is not possible, however, cost responsibility analysis requires a method for classifying users in some meaningful fashion.

Highway users might be classified according to various criteria. One option would be to segregate users according to the purpose of their travel--such as commuting, touring, or travelling on business. Although many options are possible, the classification scheme most directly related to the cost responsibility concept is based on the type of vehicle used.

Classification by vehicle type recognizes that the cost of construction and maintenance varies with the size and weight of vehicles using the highway. The most obvious variable cost, pavement depth, is determined by vehicle weight. Other important costs which vary with vehicle weight and size include those associated with lane width, shoulder width, and bridge construction. Some special-purpose facilities, such as truck weighing stations or commuter express lanes limited to automobile and bus traffic, are also directly related to specific vehicle types.

Once vehicle type has been selected for the classification scheme, a second consideration is the number of categories to be used. An important limitation on the number of categories is the availability of data. As a general rule, vehicles should be grouped into a manageable number of categories based on (1) costs directly associated with size and weight characteristics, (2) the way in which vehicles are defined by law and are taxed, and (3) the way in which traffic and vehicle registration data are collected.

Based on these three criteria, five vehicle classes were initially selected to provide a basis for subsequent allocations of costs and attribution of revenues. Initial plans called for separating five-axle tractor-trailers from three- and four-axle tractor-trailers. Subsequent review of the data, however, revealed that sufficient detail was not available to treat three- and four-axle combinations as a separate category. Since over three quarters of all traffic and 91 percent of the key pavement stress variable attributable to tractor-trailers is generated by five-axle combinations, it did not appear that grouping all tractor-trailers into a single category would significantly change the study findings. Therefore, four categories were used in the final study classification:

1. *Class I.* All passenger cars, pickup trucks, panel trucks, and motorcycles.

2. *Class II*. All two-axle, six-tire trucks and buses.

3. *Class III*. All three-axle, single-unit trucks and buses.

4. *Class IV*. Three-, four-, and five-axle tractor-trailers (also known as combinations).

Cost Definitions

As a tool in evaluating highway financing, a cost responsibility study must first allocate the costs that are included in highway system expenditures during the study period. Costs associated with the highway system must be defined and estimated, and procedures for distributing costs between vehicle classes must also be developed.

For the base period, actual expenditures for highway construction, maintenance, and related activities were used to define the cost base. For the mid-decade, budget proposals submitted by the Department of Highways and Transportation (DHT), along with assumptions about federal aid, were used to estimate costs.

In defining costs, care had to be exercised to ensure that actual or proposed expenditures reflected fully the cost to the public of providing a highway system. If some expenditures, particularly those for maintenance, were being deferred, then present costs would have been underestimated and passed to future taxpayers. Because available evidence indicated that maintenance expenditures were not being deferred in significant amounts, expenditures were judged to be a reliable measure of costs.

All highway costs were divided into the four categories shown below. The costs of mass transit assistance and several other State programs were excluded.

(1) Roadway Construction - All costs necessary to build or rebuild a roadway, including design engineering, right-of-way acquisition, site preparation, pavement construction, and traffic and roadside improvements.

Reconstruction costs were included in this category if rebuilding occurred along with improvements in capacity, alignment, grade or other features of roadway geometry ($387.9 million).

(2) Bridge Construction - Costs for the construction and reconstruction of bridges and tunnels ($99.0 million).

(3) Maintenance - Costs incurred to preserve and restore existing roadways, bridges, and tunnels ($246.6 million).

(4) Other Costs - Costs not attributable directly to construction or maintenance. These were primarily costs for general administration, capital outlay, and buildings and grounds maintenance of the Department of Highways and Transportation ($52.0 million).

The basic principle of cost allocation is that costs which can be clearly linked to the special needs of particular vehicles are "occasioned" by those vehicles and should be assigned to them. Costs which cannot be clearly linked to particular classes are "common" to all vehicles and should be allocated in a manner which is considered equitable.

For each cost category, therefore, costs incurred because of specific vehicle characteristics are separated from those which are common. The occasioned costs are then distributed to vehicle classes based on the characteristics which caused the costs to be incurred. For example, pavement depth is occasioned primarily by a measure of vehicle axle weight. Most pavement costs are therefore best distributed by approximating the way in which vehicle axle weight determines pavement depth. A separate allocation must be conducted for each type of cost included in highway system expenditures.

In addition to costs occasioned by a specific vehicle characteristic, costs are also occasioned by the demand for a facility or its upkeep. For instance, traffic signs are required because a demand for the roadway exists. For this study, these costs are attributed by a measure of demand - the use of the roadway.

Common costs, which cannot be linked to specific vehicle characteristics, are best assigned on the basis of relative use of the highway system. In keeping with a user charge principle of highway financing, the more each vehicle class uses the highways, the larger its responsibility for the common costs of the highway system. The proportion of vehicle miles travelled by each vehicle class on the highway system was used to allocate common costs.

Revenue Definitions

The second major effort in a cost responsibility study is to identify the sources of user charge revenues used to fund highways and to attribute those revenues to the vehicle classes which paid them. To determine equity relationships, a comparison is then made between the costs charged to each vehicle class and the revenues paid by the class.

Revenues were defined as funds collected from Virginia's highway users which went to support highway system expenditures. Because federal taxes paid by Virginia's highway users are available to support the State's highways, they were also included. Some fees-for-service were excluded, such as operator permits and title registrations, which are used to recover the costs of providing specific services and are not available to support construction and maintenance activities.

The following revenue sources were examined:

(1) State fuel and road taxes ($281.3 million);
(2) State sales and use taxes ($64.3 million);
(3) Vehicle registration fees ($82.8 million);
(4) International Registration Plan collections ($13.0 million); and
(5) Federal fuel, sales, use, and excise taxes ($164.9 million).

Revenue totals for each source were provided by the official collection agency--in most cases, the Division of Motor Vehicles. Totals for federal taxes were derived using estimating techniques developed by the Federal Highway Administration (FHWA) for their own cost responsibility study. Use of these estimating techniques improved accuracy in the revenue attribution over FHWA's published reports.

Methods used to attribute revenues to specific vehicle classes were based on the way the taxes are levied. For example, both State and federal motor fuel taxes are levied as a cents-per-gallon charge included in the retail price of fuel. Because both vehicle fuel efficiency and miles traveled were known for each vehicle class, it was possible to determine the amount of fuel consumed and the taxes paid by each class.

STUDY FINDINGS AND CONCLUSIONS

The study findings for 1980 show a generally equitable highway user tax structure in place in Virginia. Of the $604 million paid by highway users in federal and State user charges, less than $19 million (3.1 percent) was paid by any user class beyond its cost responsibility. All of the $19 million overpayment came from operators of passenger cars, panel and pickup trucks, while all heavy truck classes were found to be underpaying their cost responsibility. Medium weight two-axle trucks underpay by the largest proportion--38 percent.

The 1980 study results were then applied to two scenarios for highway construction and maintenance in the mid-decade. This analysis was used to estimate the likely changes in cost responsibility relationships by vehicle class as the result of expected shifts in the size and nature of the highway budget.

Base Period (1980) Findings

The results of the FY 1980 cost allocation and revenue attribution analysis are shown in Table 1. Costs and revenues are expressed as a percentage of total expenditures and payments respectively. The underpayment or overpayment for each vehicle class is then shown in 1980 dollars and as a percent of total payments.

Table 1

COST ALLOCATION AND REVENUE ATTRIBUTION SUMMARY

	Class I	Class II	Class III	Class IV
Cost Allocation	70.9%	8.5%	4.5%	16.1%
Revenue Attribution	74.0%	6.1%	3.9%	16.0%
Difference between Costs and Revenue in FY 1980 Payments	Overpaid $18.9 mil.	Underpaid $14.1 mil.	Underpaid $4.0 mil.	Underpaid $0.8 mil.
Percent Overpayment/Underpayment	Overpaid 4.2%	Underpaid 38.1%	Underpaid 16.9%	Underpaid 0.8%

Table 1 shows a total "imbalance" between revenues and costs of about $19 million, or 3.1 percent of the $604.0 million contributed by the State's highway users. Class I vehicles (passenger cars, panel and pickup trucks) overpaid by $18.9 million, or 4.2 percent of their contribution, while all truck classes were found to be underpaying.

The most serious underpayment in the base period analysis is the underpayment by Class II and Class III vehicles--the medium weight trucks. In FY 1980, Class II trucks underpaid their cost responsibility by 38 percent; Class III trucks underpaid by almost 17 percent.

The reason for this underpayment is the fact that Class II and Class III trucks operate at weights which require significantly stronger pavements and bridges to accommodate their use. For example, although Class II trucks represent less than four percent of the total traffic stream in Virginia, they are responsible for 14 percent of pavement construction costs, 8 percent of bridge construction costs, and 22 percent of pavement maintenance costs. Despite this heavy cost responsibility, Class II trucks are exempt from the two-cent road tax surcharge, and they pay an average registration fee of less than $60 annually. In FY 1980, a large portion of the cost of providing highways suitable for medium weight trucks was subsidized by Class I vehicles.

Projections for the Mid-decade

The 1980 base period findings can be used to provide information on possible changes in State tax policy over the next several biennia. These projections should take into account anticipated changes in travel patterns, traffic volume, construction and maintenance costs, federal aid policy, vehicle fuel efficiency, and other factors. In order to make projections the study team developed two sets of assumptions about spending levels. The two scenarios use 1984 spending levels to represent the most likely direction for Virginia's highway construction and maintenance program through the mid-decade:

> Minimum Budget. The minimum budget is based on a review of current revenue projections for the highway trust fund as well as legislative and statutory history regarding highway funding priorities. It is assumed that the General Assembly will ensure that sufficient State funds are available to match Virginia's federal aid apportionment and avoid the lapse of aid funds to which the State is entitled. This will provide for a minimum construction budget of slightly more than $300 million annually in 1982-84 and $325 million in 1984-86.
>
> The minimum budget includes maintenance, administration and transfer payments at the levels requested by DHT in its 1982-84 budget submission. The minimum budget by its nature will be governed by federal aid requirements. Most importantly, a minimum budget will provide little funding flexibility to address construction needs on those portions of the urban and secondary systems which are not included on federal aid-qualified routes. As a result, a number of high priority projects will not receive funding under the minimum budget scenario.
>
> High Priority Budget. In the JLARC report *Highway Construction, Maintenance and Transit Needs in Virginia* a cross section of high priority construction needs was identified for all systems. Using this analysis as a base, a second set of funding assumptions was developed for application to the cost responsibility review. This high priority budget includes $94 million in 1982-84 construction spending above the minimum budget level, and provides for a more balanced program across all highway systems. Maintenance, administrative, and transfer payments are included at requested levels.

These two scenarios develop assumptions about the overall size of the construction and maintenance budget. In addition, each scenario assumes a shift in spending between categories. The most important of these is an expected increase in spending for pavement reconstruction and repair. Much of the interstate primary pavements are aging and subject to increasingly heavy traffic volume and vehicle weights. In addition, federal aid for repair of interstate pavements is expected to increase. Whereas pavement reconstruction and maintenance expenditures were 25 percent of the 1980 budget, by 1984 these are expected to increase to between 31 and 33 percent of total spending.

Projections of Cost Allocation. Table 2 shows the costs allocated to each vehicle class for 1984 under the two scenarios. The findings for the 1980 base period are included for comparison. It should be noted that the budget levels reflect the impact an overall of decline in expected revenues. For example, the more optimistic high-priority budget shows little increase in spending over the 1980 total. The minimum budget for 1984 would be less than 1980 spending.

Table 2

PROJECTIONS OF MID-DECADE COSTS ALLOCATED
BY VEHICLE CLASS
(FY 1984 budget projections)

	Highway Construction and Maintenance Budget Levels
FY 1980 Base Period (actual)	\$785.5 million
FY 1984 minimum (projected)	\$774.0 million
FY 1984 high priority (projected)	\$796.6 million

COST RESPONSIBILITY
BY VEHICLE CLASS

	I	II	III	IV
FY 1980 Base	70.9%	8.5%	4.5%	16.1%
FY 1984 High Priority	69.5%	8.9%	5.0%	16.6%
FY 1984 Minimum	68.6%	9.1%	5.1%	17.2%

The table highlights two important points about the cost allocation projection. First, in general, the proportions are relatively stable. That is, Class I cost allocation declines by 2.3 percent from 1980 to 1984, while no truck class shows more than about a one percent increase in proportionate responsibility for costs. This suggests that no fundamental shift in the cost relationships is expected over the range of likely highway budgets.

At the same time, costs allocated to truck classes do show an increase because more of total highway spending is expected to be targeted on pavement reconstruction and repair. Since all truck classes were underpaying their cost responsibility in 1980, the data in Table 2 suggest a gradual worsening of equity relationships through the mid-decade.

Projection of Tax Equity. The cost responsibility analysis can be applied to determine the revenue contribution from each vehicle class which would be necessary to equitably fund a given highway program. In this manner, the analysis can provide information from which to develop tax options which produce full user tax equity.

How this analysis can be used is shown in the following example. Table 3 presents a projection of revenue payments by vehicle class for FY 1984. The pattern of payments reflects projected changes and trends in travel and vehicle sales, as well as the Federal Highway Administration's (FHWA) estimates of vehicle fuel efficiency for the mid-decade. Of key importance is the FHWA's estimate of 30 percent increased fuel efficiency by 1985 for the typical passenger car.

Table 3

AN EXAMPLE SHOWING PROJECTIONS
OF USER TAX EQUITY FOR MID-DECADE
(FY 1984 projections; dollars in millions)

		Revenue Contributions		
Vehicle Class	Proportional Cost Responsibility	Projected Revenues Under Current Structure	Required Additional Contribution	Proportional Contribution With Additional Revenue
I	69.5%	$455.6	$ 55.8	69.5%
II	8.9	45.4	19.9	8.9
III	5.0	23.4	13.2	5.0
IV	16.6	107.0	15.1	16.6
Total	100.0%	$631.4	$104.0	100.0%

In this example, additional revenues totalling $104.0 million would be necessary to fully fund the high-priority budget (Table 3). This total would have to be contributed in different amounts by the four vehicle classes, according to their responsibility for costs. To produce revenue payments which perfectly balance with cost responsibility, Class I vehicles would have to contribute $55.8 million of the additional $104.0 million. Classes II, III, and IV would have to contribute an additional $19.9 million, $13.2 million, and $15.1 million, respectively.

Conclusion

The analysis of vehicle cost responsibility indicates that the existing highway user tax structure is essentially equitable. Analysis of the mid-decade projections indicate that these results could be kept stable for the most probable range of highway projects. The two larger vehicle classes, Class I (passenger cars, panel and pickup trucks) and Class IV (tractor-trailers), come close to balancing their allocated costs with their revenue payments.

In contrast, Class II and Class III trucks underpay their cost responsibility by a substantial percentage. These two classes contain relatively few vehicles and the impact of this underpayment on overall equity is less significant. Still, in the interest of equity the General Assembly may wish to review existing taxes as they apply to Class II and III trucks with the intent of bringing revenue payments for these vehicles more in line with their allocated costs.

An examination of highway trust fund expenditures and revenues, described in the JLARC study *Highway and Transportation Financing in Virginia*, projected substantial shortfalls between revenues and funding requirements beginning in FY 1984. A number of options were presented in the report to address the projected shortfalls. The findings of the cost responsibility study were used in the development of the various options to ensure consistency with equity considerations.

Cost responsibility analyses similar to that described in this report should be repeated periodically to examine the effect of changing conditions on the equity of highway user tax policy. For this reason, the General Assembly should mandate that the Department of Highways and Transportation incorporate cost responsibility as a component of its biennial budget development process. A full scale study need not be repeated biennially but should be considered periodically. A new study in 1985 for consideration in the preparation of the 1986-88 budget would be a reasonable target. A discussion of equity implications should be included in each budget submission, however.

In order to conduct future studies most efficiently, DHT will need to make provisions for several special research efforts. These include ways in which data are currently collected and maintained by DHT. Since cost responsibility studies are important for legislative decision-making, any future study should also have active legislative member and staff involvement.

A Note on Study Interpretation

The findings and detailed methods described in Chapter II of this report reflect a number of elements unique to Virginia. Although cost responsibility studies by other states and the federal government provide useful points of comparison and a check on the reliability of the analytic approach, there are considerable differences between state highway systems, tax policies, and spending patterns which suggest the need for caution in the use of comparisons. For example, a major limitation in comparing the results of the various federal studies with State findings is the fact that the former focus only on the higher-volume federal-aid roads and include virtually no maintenance spending. Differences between state systems can be equally as important.

An overriding consideration in the interpretation of the Virginia study is the fact that Virginia is one of four states which maintain virtually all county roads within the state system. These secondary roads account for 43,000 miles of Virginia's 65,000-mile system. Secondary roads impose a large additional cost on the Virginia highway program which is not reflected in the spending patterns of most other states. Fully 40 percent of maintenance spending as well as 16 percent of construction spending is for secondary roads. In contrast, Oregon, whose cost responsibility analysis is often cited for comparison with other states, has only slightly more than 10,000 miles of state highway with less than one-quarter of this mileage on the secondary system. Therefore, a comparison of study results between Oregon and Virginia, for example, would need to account for these differences.

II. 1980 COST RESPONSIBILITY ANALYSIS

This chapter presents a detailed description of the analysis of costs and revenues by vehicle class for the FY 1980 base period. The chapter has five major sections: (1) allocation of roadway construction costs; (2) allocation of bridge construction costs; (3) allocation of maintenance costs; (4) allocation of other costs; and (5) attribution of revenues to the four vehicle classes.

ROADWAY CONSTRUCTION COSTS

Roadway construction expenditures totalled $387.8 million in FY 1980, and comprised about 50 percent of total costs. Included in roadway construction are all costs of designing a project, acquiring right of way, preparing the construction site, laying pavement, and preparing the roadway for traffic.

Cost Subcategories

Roadway construction costs were divided into four subcategories:

1. *Site Preparation and Roadway Geometry:* Cost of preparing the construction site for traffic, excluding pavement costs.

2. *Pavement:* Cost of pavement construction, including materials for sub-base, base, and surface pavement.

3. *Design and Construction Engineering:* Cost of designing a project, including preliminary surveys, engineering inspections and estimates, materials testing, and project monitoring.

4. *Right-of-Way:* Cost of acquiring land within the roadway corridor, including demolition of existing buildings and relevant legal fees.

In order to allocate roadway construction costs to each vehicle class, subcategory costs were broken down further by highway system. Allocation of costs for site preparation and roadway geometry and for pavement construction was based on analysis of a representative sample of roadway construction projects, weighted to equal total FY 1980 expenditures for the two subcategories. The procedure for drawing a sample and grouping projects for analysis is described below. Design and construction engineering and right-of-way were treated as demand-occasioned costs for all vehicle classes and are described in following sections.

Project Sampling

In order to determine empirically how construction costs vary in relation to the size and weight characteristics of the traffic stream, a sample of 170 construction projects was selected for analysis. These 170 projects included all roadway construction completed in FY 1980. Analysis of the projects showed there was (1) balance among the Interstate, Primary, Secondary, and Urban highway systems, (2) geographical balance, and (3) diversity in project cost, size, and nature of construction in a typical program. As a final check on the representativeness of the sample, the DHT construction engineer, in concert with DHT construction division personnel, certified that the project sample represented a typical year.

Because the 170 projects completed during FY 1980 had been initiated over several years, it was necessary to standardize prices for like activities and material quantities. Failure to standardize prices would have caused the higher inflated prices of projects initiated more recently to weigh disproportionately in the overall sample. Item prices were standardized to mid-FY 1980 levels.

Project Clustering

Grouping the sample was necessary to ensure that projects with similar characteristics would be analyzed together. Grouping projects also helped reduce to a manageable level the number of projects to be analyzed.

Most cost responsibility studies reviewed as part of the study literature search simply group projects by administrative or functional classification. However, these classifications often overlap in significant design and traffic features which are used as the basis of cost allocation. In Virginia, the four road systems (Interstate, Primary, Urban, Secondary) contain considerable overlap in this regard. Therefore, the sample projects were grouped into clusters which were similar in design characteristics.

The process of grouping projects into clusters consisted of four steps.

Step 1. Projects involving only special improvements to roadway facilities, such as safety projects, were grouped into one cluster. Projects which involved only the construction of left turn lanes and intersection improvements were placed in another cluster. Costs of these special clusters were treated separately from the remaining clusters.

Step 2. Secondary projects were segregated from Interstate, Arterial, Primary, and Urban projects (IAPU) because of significant differences in actual design standards and practices for the two groups.

Step 3. The number of lanes and lane width for each project were used to divide the secondary projects and IAPU projects into four subgroups. For example, IAPU projects were divided into subgroups of: "2-lane, less than 12 foot lane" projects; "2-3 lane, 12 foot lane" projects; "4-5 lane, 12 foot lane" projects; and "6 or more lanes, 12 foot lane" projects.

Step 4. Within each subgroup of IAPU projects, clusters were formed by computing the mean and standard deviation for the logarithm of expected daily 18,000 pound Equivalent Single Axle Loads. Beginning at the mean, cluster boundaries for each subgroup were established by moving up or down one standard deviation at a time. By this procedure, all IAPU projects were enclosed in clusters.

Secondary projects were clustered in a similar fashion except that a weighted average daily traffic total (which is used to design pavements for secondary roads) was substituted for the logarithm of expected ESALs.

Twenty clusters were identified through this process: 11 clusters of IAPU projects, 7 clusters of secondary projects, one of special improvement projects, and one of left turn lanes and intersection improvements. Table 4 shows the traffic characteristics for the IAPU clusters and 7 secondary clusters.

Clustering produced groups of projects which shared key design criteria. Clustering also allowed a reduction of workload in allocation procedures without the distortion of findings resulting from aggregation bias, which generally exists if projects are not homogeneously grouped. And, as indicated earlier, the clusters were used in allocating the cost of site preparation and roadway geometry and of pavement construction.

Table 4

CLUSTER TRAFFIC CHARACTERISTICS

IAPU Clusters

Subgroup Number and Characteristic		Number of Projects	Mean Ave. Daily Traffic	Mean Daily Expected ESALs
1	2 lanes, less than 12' lanes	2	975	19.5
2		3	1,436	65.3
3	2-3 lanes, 12' lanes	7	3,134	40.7
4		3	7,573	372.0
5	4-5 lanes, 12' lane	8	9,670	67.0
6		19	7,374	162.0
7		10	2,196	371.0
8		6	6,393	745.7
9		2	15,048	1416.0
10	6 or more lanes, 12' lanes	4	22,126	611.5
11		5	56,211	1256.6

Secondary Clusters

Subgroup Number and Characteristic		Number of Projects	Mean Weighted Ave. Daily Traffic
1	2 lanes, less than 12' lanes	10	79.3
2		24	295.0
3		7	708.6
4		8	1,982.5
5	2 lanes, 12' lanes	3	623.5
6		7	4,187.1
7	4 lanes, 12' lanes	2	18,263.0

Source: JLARC Analysis of DHT Traffic Data.

Site Preparation and Roadway Geometry

Site preparation includes all activities directly related to the construction of a road, except the laying of pavements. In general, the activities include mobilizing the construction crew and equipment, clearing and grubbing, excavating, grading, installing drainage facilities, and providing improvements such as signs, signals, seeds, and plants. Together these activities amounted to $181.0 million in FY 1980, or about 47 percent of roadway construction expenditures.

Site preparation requirements and costs vary with the size of vehicles that the roadway is designed to carry. Wider vehicles, for example, require wider lanes and shoulders, and the costs of excavation, drainage structures, and other materials are thereby increased. Heavier vehicles require thicker pavements and generate higher excavation costs associated with preparing deeper trenches for pavement.

Truck Occasioned Costs. To determine the proportion of costs occasioned by large, heavy vehicles, an incremental technique was applied. Design standards currently used by DHT were examined to identify what aspects of roadway design could be reduced if the roadway were used only by small, light vehicles (Class I). With safety and speed considerations held inviolate, two size-related reductions were possible for most clusters:

(1) Lane width could be reduced by one foot, from 12 feet to 11 feet; and

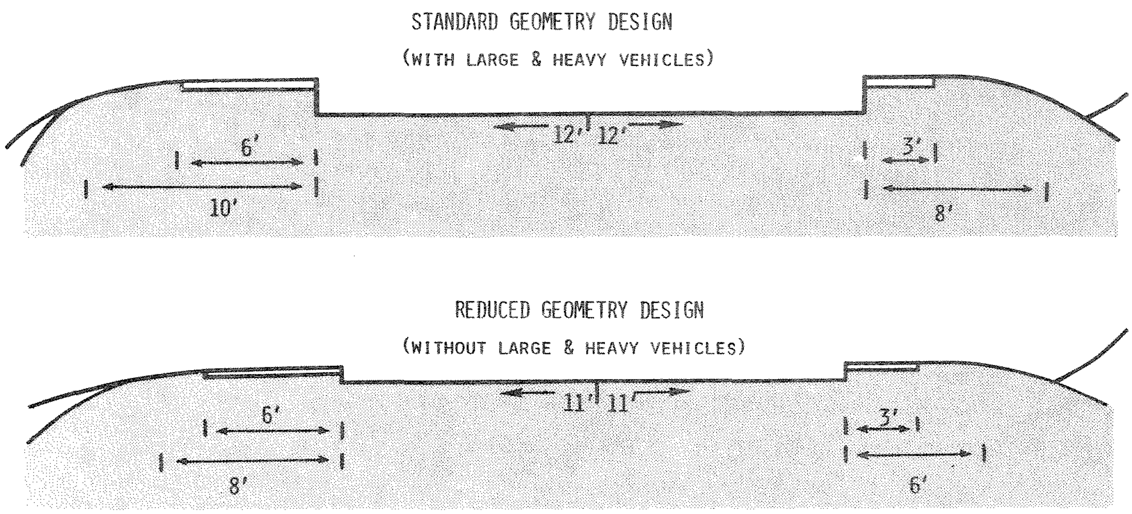
(2) Cut and fill shoulder widths could be reduced by amounts varying from 40 percent on interstate highways to 22.22 percent on primary roads, with no reduction possible on secondary roads.

As is discussed in the next section, when heavy vehicles are removed from the traffic stream, thinner pavements are possible. And redesigning site preparation requirements for a thinner pavement allowed a reduction in trench depth. Because the degree of trench depth reduction depended on the depth of the original pavement, the amount of reduction was computed for each cluster. The roadway cross-section shown in the accompanying figure illustrates the reductions possible for two lanes of a four lane, divided highway.

Assumptions about cost reductions were empirically tested. DHT design engineers were asked to re-design actual projects to determine the cost reductions associated with removing large, heavy vehicles from the traffic stream. This procedure ensured that cost reductions were based on actual design practice rather than on theoretical estimates.

Figure 1

EXAMPLE OF GEOMETRY REDUCTIONS



Source: DHT Location and Design Data.

A project from each cluster was selected for re-design, in order that differences in geometric designs (two lanes <u>versus</u> four lanes) would be accounted for. Preference in selection from a cluster was given to projects which included all major cost elements of site preparation and roadway construction, which were in the modal highway system for the cluster, and which helped produce a geographic distribution of projects.

The difference between the site preparation and roadway geometry costs for the standard design and the reduced design was then used as an estimate of that portion of costs occasioned by trucks. Table 5 illustrates the results of the reduction for one project, which shows a nine percent reduction from standard to reduced design.

Table 5

SAMPLE DESIGN COST REDUCTION

Site Preparation	Standard Design	Reduced Design	Cost Difference
Mobilization	$ 230,441	$ 190,889	$ 39,552
Excavation	2,043,665	1,787,778	255,887
Drainage	292,222	288,706	3,516
Traffic/Roadside Improvements	785,101	782,994	2,107
Total	$3,351,429	$3,050,367	$301,062

Source: DHT Location and Design Data.

The degree of reduction possible for each cluster was determined by applying the proportional reduction generated from the project re-design to the site preparation and roadway geometry cost for the entire cluster. For example, if a nine percent reduction was produced by the project re-design, then nine percent of all site preparation and roadway geometry costs for the cluster was assumed to be the responsibility of the truck classes.

Geometry Allocation Results. Costs associated with the truck-occasioned increment were assigned to Class II, III, and IV vehicles, on the basis of their proportions of average daily truck traffic in the cluster. Costs associated with the reduced design were assumed to be a function of the general demand for the basic roadway facility. The cost of the reduced design was therefore charged to all vehicles on the basis of their proportion of average daily traffic on roads in the cluster. Total cost responsibility for each cluster was first summed and then weighted to equal total FY 1980 expenditures for site preparation and roadway geometry. Table 6 shows the results of that allocation.

Table 6

ALLOCATION SUMMARY
SITE PREPARATION AND GEOMETRY

	Costs Allocated	(%)
Class I	$148,110,216	(81.8%)
Class II	12,293,351	(6.8)
Class III	4,007,191	(2.2)
Class IV	16,567,328	(9.2)
Total	$180,978,086	(100.0)

Pavement Construction

Pavement expenditures for the base period totalled $106.7 million and represented about 28 percent of roadway construction costs. Pavement construction included pavements which were laid in construction and reconstruction projects during FY 1980. Other pavement work, such as rehabilitation and replacement, was included in maintenance costs.

Some pavement costs are occasioned by vehicles because they demand wider lanes and thicker pavements. Based on the preceding analysis, one foot of each 12-foot lane is required solely for large vehicles. As was the case with site preparation, costs associated with this width increment are therefore truck-occasioned.

In addition, pavement depth for the entire lane width is occasioned by factors related to axle weights and the repetitions of axle weights. Pavement cost allocation must therefore be sensitive to both the axle weights and volume of traffic on the roadways.

Pavement Design. Pavement engineering design criteria were used to determine the relationship between axle weight and traffic volume on one hand and pavement depth on the other. The design criteria were originally developed in the American Association of State Highway Officials (AASHO) Road Tests conducted in Ottawa, Illinois, and were modified in Virginia to serve as the basis for pavement design. The AASHO tests led to development of a standard measure of axle weights, related to the way in which axle weights impact on pavement. This measure is known as an 18,000 pound Equivalent Single Axle Load (ESAL).

The axle weights of any vehicle, whether heavy or light, single or tandem, can be expressed in terms of ESAL. For example, one passenger car passing over a roadway produces .0004 ESALs, while a tractor-trailer loaded to Virginia's maximum legal weight produces 3.872 ESALs. A medium-sized, fully-loaded dump truck produces 1.91 ESALs.

DHT uses ESAL measures to determine required pavement strength. From this, the required combination of pavement thickness and materials can be derived. In practice, estimates of daily ESALs ten years in the future are used to generate the ESAL estimates for each project. ESAL estimates for the tenth year, regarded by DHT as the design year, are sensitive both to axle weights and the number of weight repetitions over the life of the pavement. Design year ESAL estimates are used to compute an index of the necessary pavement thickness (referred to as T.I. or thickness index or thickness unit).

Pavement Allocation Methods. Standard pavement design uses the total number of expected ESALs for all traffic to determine the required pavement thickness. Separating the total pavement into increments allocable to individual vehicle classes requires careful consideration of the relationships inherent in pavement design practice.

The basic objective is to separate a given thickness of pavement into two components: (1) a component which is directly related to the expected vehicle weights using the road, and (2) a component which is principally the result of the strength and bonding requirements necessary to preserve the pavement through weathering cycles. The first component is allocated to the vehicles which create the demand for the pavement because of their weight. The second component is more appropriately considered a demand-occasioned cost since it is required by the demand for the roadway.

After careful consideration by the Planning Committee and Virginia pavement experts, two methods for allocating pavement costs were judged to be superior--the minimum pavement and the avoidance methods. Both methods rely on the relation of ESAL to pavement thickness.

Minimum Pavement Method. The minimum pavement method begins by determining the amount of pavement to be laid if weight were so small as to be an inconsequential factor in pavement design. DHT pavement engineers concluded that in Virginia minimum pavement equals 3.6 thickness units, the practical equivalent of six inches of crushed stone base covered by a sealant coat. Pavement thickness required above 3.6 thickness units must be concluded to be related to the axle weights of vehicles in the traffic stream.

The minimum pavement is best conceived as meeting the demand for the basic roadway facility. Accordingly, costs associated with the minimum pavement can be allocated by a measure of relative roadway use. In this study, the cost of the minimum pavement for each cluster was allocated by each vehicle class's proportion of average daily traffic (ADT) for the cluster.

Because all pavement above the 3.6 level is weight-related, pavement above the minimum is allocated by the proportion of ESAL contributed by each vehicle class. Handling the weight-related portion of pavement in this manner distributes equitably the inherent economy of scale in construction between vehicle classes.

The minimum pavement method was used as the primary allocation method for this study. It is also currently being proposed for use by the Federal Highway Administration (FHWA) in its cost allocation study, and has been endorsed as a concept by the American Consulting Engineers Council.

Avoidance Method. The second method considered by the JLARC study team, known as the avoidance method, produces results strikingly similar to the minimum pavement method. The avoidance method seeks to determine the amount of pavement which could be avoided if a particular vehicle class were removed from the roadway. The avoided portion of pavement becomes the unique responsibility of the class that has been removed from the roadway.

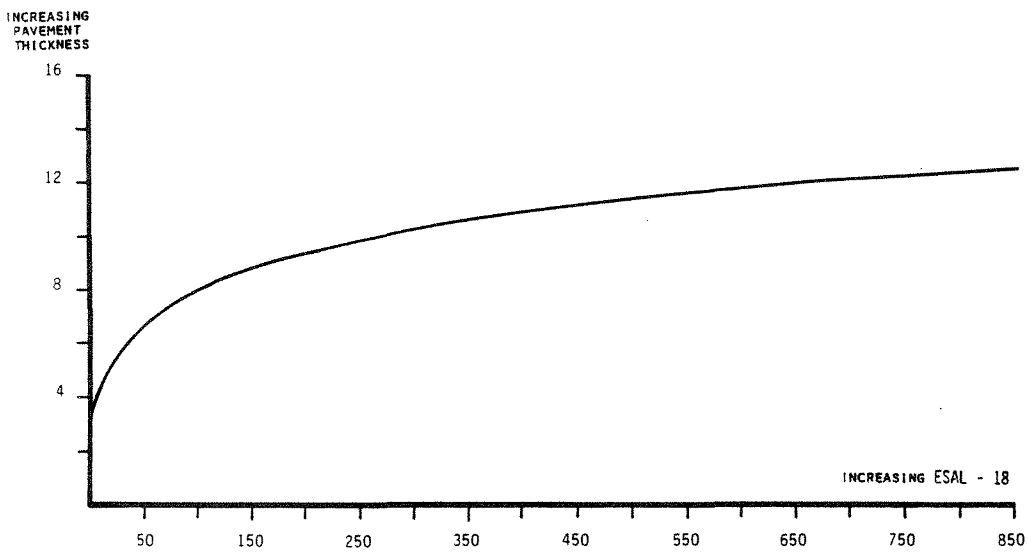
To determine the avoided portion, each vehicle class's contribution to total ESALs is removed in turn, and the required pavement thickness is recalculated. The difference between the standard pavement and the reduced pavement is the increment occasioned by that vehicle class.

The avoidance method also incorporates the concept of a minimum pavement as the basic portion which would be built if weight were not a factor. As with the minimum pavement method, this portion is best allocated according to the proportional ADT for each cluster.

After the minimum pavement and the avoidance portion have been allocated, an unallocated residual pavement remains. This residual results from the nonlinear relationship between ESALs and pavement thickness. The design curve has a steep slope in the lower ESAL range and a flatter slope as ESALs increases. Because the avoidance portion

Research Note. *The allocation of pavement costs is a controversial subject. The debate focuses on the nonlinear shape of the pavement design curve and the fact that the marginal rate of increased pavement thickness requirement decreases as more ESAL are assumed. The figure below illustrates that relationship.*

PAVEMENT DESIGN CURVE



Since large trucks are responsible for most ESALs, it might appear relatively inexpensive to add pavement to the basic road to make it suitable for heavy trucks. This is not the case. The pavement design equations consider the pavement as a unit and not as a series of increments similar to layers of a cake. Treating the analysis otherwise gives large trucks the benefit of an economy of scale which is inconsistent with the practical application of the pavement design equations. For a full discussion of the topic see the Federal Highway Administration "Second Progress Report on the Federal Highway Study," Appendix IV, and the 1979 report of the Congressional Budget Office "Guidelines for a Study of Highway Cost Allocation."

Table 7

SAMPLE OF PAVEMENT ALLOCATION METHODS
(Thickness Index = 13.90)

Minimum Pavement Method

Class	Pct. Average Daily Traffic	Pct ESAL	Minimum Pavement (T.I.)	Weight-Related Pavement (T.I.)	Total	(%)
I	90.0%	1.0%	3.24	.10	3.34	(24.0)
II	6.1%	32.8%	.22	3.38	3.60	(25.9)
III	2.2%	29.2%	.08	3.01	3.09	(22.2)
IV	1.7%	37.0%	.06	3.81	3.87	(27.9)
Total	100.0%	100.0%	3.60	10.30	13.90	(100.0)

Avoidance Method

Class	Pct. Average Daily Traffic	Pct ESAL	Minimum Pavement (T.I.)	Avoided Portion	Residual Portion	Total	(%)
I	90.0%	1.0%	3.24	.07	.07	3.38	(24.3)
II	6.1	32.8	.22	1.08	2.28	3.58	(25.8)
III	2.2	29.2	.08	.96	2.02	3.06	(22.0)
IV	1.7	37.0	.06	1.25	2.57	3.88	(27.9)
Total	100.0%	100.0%	3.60	3.36	6.94	13.90	(100.0)

for each class is calculated along the flatter range of the design curve, the avoidance plus minimum pavement portions do not equal total pavement.

The residual pavement, like all pavement above the 3.6 minimum, is weight-related. It is, therefore, best allocated by the proportional contribution of ESALs for each class.

Calculation Example. The results of applying the two methods to one cluster are shown in Table 7. As was previously stated, the proportional pavement responsibility of the four vehicle classes is approximately equal for the two methods. In the example, Class I pavement responsibility was 24.0 percent for the minimum pavement method, as compared to 24.3 percent for the avoidance method. Class IV responsibility was 27.8 percent and 27.9 percent for the minimum pavement and avoidance methods respectively. Again, the minimum pavement method was used as the primary pavement allocation method for this study because of its ease of computation and expected consistency with the FHWA approach.

The minimum pavement method was applied to each of the 18 roadway construction clusters. Pavement depth for each cluster was calculated from the mean number of ESALs and the mean Soil Support Value for all projects within the cluster. Average daily traffic and ESAL proportions were computed by totalling the ADT and ESAL totals for the projects within each cluster.

The minimum pavement method was used to allocate the costs which correspond to 11 foot wide pavements in each cluster. The remaining foot of pavement in clusters with 12 foot lanes was also attributed by the minimum pavement method, excluding Class I traffic. Class I vehicles, as has been previously stated, do not require the extra lane width and, therefore, do not share in costs for that portion.

Pavement Allocation Results. The final step in allocating total pavement costs to the four vehicle classes was to sum cost responsibility for each cluster. Total cost responsibility for each class was then weighted to equal total pavement costs for FY 1980. The results of the pavement allocation are summarized in Table 8.

Table 8

PAVEMENT COST ALLOCATION SUMMARY

Class	Cost Responsibility	(%)
I	$ 29,816,503	(28.0)
II	14,908,285	(14.0)
III	9,644,816	(9.0)
IV	52,285,167	(49.0)
Total	$106,654,771	(100.0)

Design and Construction Engineering

Design and construction engineering includes all costs of designing a construction project, from preliminary surveys through project monitoring. Costs in this subcategory totalled $41.8 million for the base period.

Review of DHT design practices and policies indicated that the costs of design and construction engineering represent the engineering overhead necessary for roadway construction and are not related to characteristics of vehicle classes in the traffic stream. Because they are not size- or weight-related, design and construction engineering costs were allocated to all vehicles as a demand-occasioned cost. A relative use measure, proportional vehicle miles of travel (VMT) by system for each class, was used as the allocator. The allocation is summarized in Table 9.

Table 9

DESIGN AND ENGINEERING COST ALLOCATION SUMMARY

Class	Cost Responsibility	(%)
I	$ 37,363,548	(89.3)
II	1,319,078	(3.2)
III	488,185	(1.2)
IV	2,653,843	(6.3)
Total	$ 41,824,654	(100.0)

Right-of-Way

All costs of acquiring land within a roadway corridor are included in the right-of-way subcategory. About $58.4 million was spent in FY 1980 for land purchase, demolition of existing buildings within the corridor, and relevant legal fees.

Although right-of-way widths can be influenced by the expected traffic mix, there is not an easily demonstrable connection between the cost of right-of-way and the characteristics of vehicles in the traffic stream. In practice, right-of-way widths have been determined by a combination of tradition, standards, and expected traffic mix and volume. In many cases, DHT acquisitions have been guided by the maximum width allowed by policy in order to take advantage of added safety, aesthetic, and noise-buffering benefits.

In the absence of a clearcut link between traffic and right-of-way costs, the rationale for allocating costs disproportionately among vehicle classes is weakened. For this study, therefore, right-of-way costs were allocated as demand-occasioned by vehicle classes, based on the relative use of the particular highway system. Table 10 presents the results of the right-of-way allocation.

Table 10

RIGHT-OF-WAY ALLOCATION SUMMARY

Class	Cost Responsibility	(%)
I	$ 52,581,332	(90.0)
II	1,931,920	(3.3)
III	700,649	(1.2)
IV	3,212,811	(5.5)
Total	$ 58,426,712	(100.0)

Roadway Construction Summary

Table 11 summarizes the allocation for all FY 1980 roadway construction expenditures. As expected, the two subcategories whose costs are occasioned by vehicle size or weight, site preparation and pavement construction, show lower proportional Class I and higher Class II, III, and IV responsibility. In contrast, the two subcategories classified as common costs, design engineering and right-of-way, show higher proportional Class I and lower Class II, III, and IV cost responsibility.

Table 11

ROADWAY CONSTRUCTION ALLOCATION SUMMARY
(FY 1980)

	Class I	Class II	Class III	Class IV
Design & Construction Engineering	$37,363,548	$ 1,319,078	$ 488,185	$ 2,653,843
Right-of-Way	52,581,332	1,931,920	700,649	3,212,811
Site Preparation & Geometry	148,110,216	12,293,351	4,007,191	16,567,328
Pavement Construction	29,816,503	14,908,285	9,644,816	52,285,167
TOTAL	$267,871,599	$30,452,634	$14,840,841	$74,719,149
Percentage	(69.1%)	(7.9%)	(3.8%)	(19.3%)

BRIDGE CONSTRUCTION COSTS

Bridge construction costs totalled just over $99 million in FY 1980, or about 13 percent of the total cost base. Costs included were expenditures for both constructing and reconstructing bridges and tunnels, although no tunnel construction costs were incurred in FY 1980.

Five bridge designs were judged to be representative of all bridge construction projects. Allocation of expenditures was based on an incremental reduction of the standard design for each bridge type. The cost of each increment was assigned to vehicles requiring the strength added by each increment.

Grouping Bridge Designs

In order to develop typical bridge designs, DHT personnel analyzed all bridge projects completed during the 1970s for the following characteristics:

(1) total length;
(2) span configuration;
(3) type of crossing; and
(4) expected gross weight load-bearing capacity.

Average bridge lengths were computed for the interstate, primary, and secondary highway systems, and a typical span configuration was developed for each of the three systems.

The most significant cost determinant within each highway system was the difference between grade crossings and stream crossings. Consequently, separate stream and grade crossing designs were developed for the interstate and primary systems. Because virtually no grade crossings are built on secondary roads, only one design was necessary to represent secondary bridge construction projects.

Allocating Bridge Costs

Bridges can be designed to carry incrementally heavier loads, and vehicles requiring the added structural strength or size provided by added increments can be assigned the cost of those increments. Consequently, an incremental method was used to allocate the costs of bridge construction.

To develop this approach, DHT Bridge Division personnel prepared four designs for each of the five bridge types:

(1) adequate for all vehicles (Class I-IV);

(2) adequate for all but Class IV vehicles (Classes I-III);
(3) adequate for all but Classes III-IV vehicles (Classes I-II); and
(4) adequate for Class I vehicles only.

The cost reductions produced by successively reducing the standard design, which is adequate for all vehicles, produced the increments occasioned by each class of larger and heavier vehicles. Expressed as a ratio, the cost reductions equal:

$$\frac{\text{Cost to build bridge for other class vehicles}}{\text{Cost to build bridge for Class IV vehicles}}$$

Table 12 summarizes the cost ratios for all five bridge designs.

Table 12

BRIDGE DESIGN COST RATIOS

System	Crossing Type	Increment	Cost Ratio
Interstate	Grade Crossing	1	.695
		2	.893
		3	.961
		4	1.000
Interstate	Stream Crossing	1	.783
		2	.876
		3	.970
		4	1.000
Primary	Grade Crossing	1	.720
		2	.901
		3	.963
		4	1.000
Primary	Stream Crossing	1	.752
		2	.910
		3	.983
		4	1.000
Secondary	Stream Crossing	1	.765
		2	.939
		3	.987
		4	1.000

Source: DHT Bridge Division.

Sample Calculation. Expenditures for bridges built as stream crossings on the secondary system totalled $7,509,326 in FY 1980. The cost ratios, incremental proportions, and vehicle classes occasioning each increment are shown in Table 13.

Table 13

SECONDARY SYSTEM STREAM-CROSSING
COST RATIOS AND OCCASIONING VEHICLE CLASSES

Increment	Cost Ratio	Increment Equals	Increment Occasioned By
1	.765	76.5%	Classes I-IV
2	.939	17.4%	Classes II-IV
3	.945	4.8%	Classes III-IV
4	1.000	1.3%	Class IV

Source: DHT Bridge Division Data. JLARC Calculations.

The cost of each increment was spread among occasioning classes on the basis of use of the secondary highway system. Because bridge expenditures represent totals for each design type and are not tied to specific bridge projects, a system-wide use measure was necessary. The proportion of Vehicle Miles Traveled (VMT) for each vehicle class on each highway system was used as the intra-increment allocator. Table 14 summarizes the allocation of secondary stream crossing expenditures.

Table 14
SECONDARY SYSTEM STREAM-CROSSING BRIDGES
SAMPLE CALCULATION
(Total = $7,509,326)

Increment	Class I	Class II	Class III	Class IV
1	$5,352,850	$ 263,679	$ 87,318	$ 40,787
2	--	880,141	290,462	136,020
3	--	--	245,501	114,947
4	--	--	--	97,621
	$5,352,850	$1,143,820	$623,381	$389,375

Calculation Summary. Table 15 summarizes the cost allocation for all five bridge designs. In general, if large and heavy vehicles are removed from the traffic stream, larger cost reductions are possible on interstate bridges than on primary bridges, and larger reductions are possible on primary than on secondary bridges. This clearly reflects the greater width and length of interstate and primary bridges

Table 15

SUMMARY
BRIDGE CONSTRUCTION COST ALLOCATION
(FY 1980)

Bridge Type	Class I	Class II	Class III	Class IV	TOTAL
Interstate Grade Crossing	$19,449,700	$1,867,439	$ 900,100	$10,617,147	$32,904,386
Interstate Stream Crossing	11,429,250	677,685	427,431	4,628,177	17,162,543
Primary Grade Crossing	15,324,551	2,356,368	1,199,393	4,442,171	23,322,483
Primary Stream Crossing	12,424,715	1,677,678	927,306	3,074,867	18,104,566
Secondary Stream Crossing	5,352,850	1,143,820	623,281	389,375	7,509,326
Total	$63,981,066	$7,722,990	$4,147,511	$23,151,737	$99,003,304
Percent	(64.5%)	(7.8%)	(4.2%)	(23.4%)	(100.0%)

largely to accommodate higher truck volumes. Consistent with this fact, Class IV vehicles (Tractor-trailers) show the highest cost responsibility for Interstate grade crossing bridges (33%) and the lowest cost responsibility for Secondary stream crossing bridges (8%). In contrast, Class I vehicles show the lowest cost responsibility for Interstate bridges (59%) and the highest responsibility for Secondary bridges.

MAINTENANCE COSTS

Maintenance costs exceeded $246.6 million in FY 1980 and represented about 31 percent of all costs for the base period. Four maintenance categories were aggregated from more than 100 activity codes for which DHT keeps expenditure data--pavement repair, shoulder maintenance, special purpose facilities, and all other maintenance activities. After consultation with DHT maintenance engineers, activities were grouped together based on the nature of cost-occasioning relationships in each.

Pavement Repair and Replacement

Pavement maintenance refers to an assortment of activities designed to inhibit or reverse the effects of pavement deterioration. The activities range from seal coating, skin patching, and pothole filling to resurfacing existing roadways. Pavement maintenance accounted for $89.4 million, or 36 percent of maintenance costs in the base period.

A principal concern in allocating pavement maintenance cost is determining the amount of pavement deterioration owing to axle weights, and therefore occasioned by vehicle classes, and the amount caused by environmental factors unrelated to vehicle use. Although the AASHO road tests establish the direct relationship between the number of equivalent single axle loads (ESALs) and pavement deterioration, the results do not address all questions of pavement maintenance allocation. The tests lasted only two years, an insufficient period to simulate normal weathering cycles. Moreover, because little routine maintenance of the pavement surface was performed during the tests, pavement deterioration was accelerated.

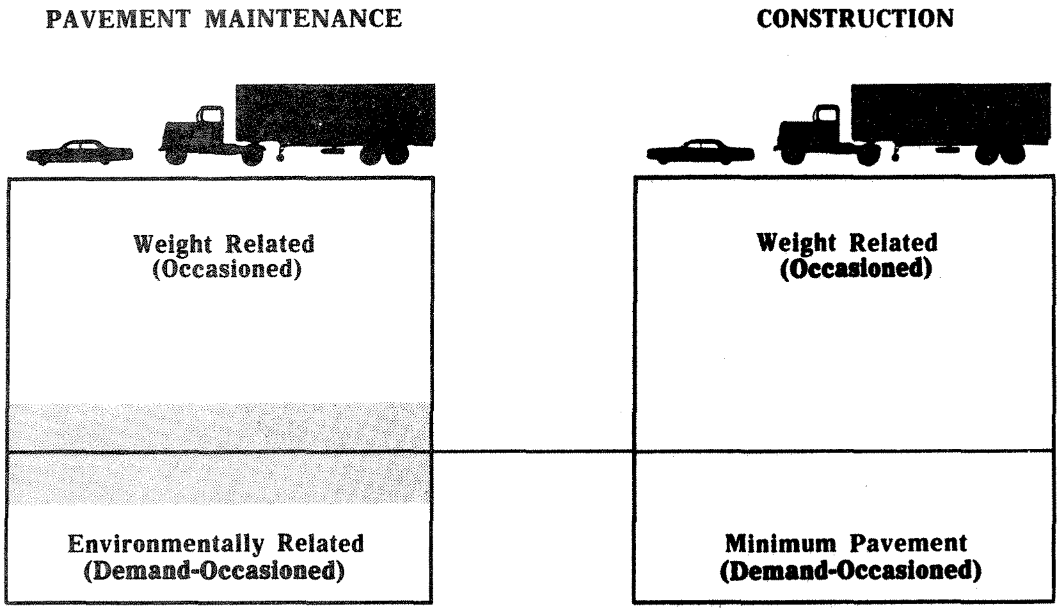
In recognition of the gaps in technical knowledge regarding pavement damage over time, the Federal Highway Administration has contracted with consultants to produce estimates of the proportion of pavement deterioration resulting from weight and the proportion resulting from environmental conditions. The study results are not expected before late 1981 and are likely to be subject to much additional review. In lieu of empirically confirmed results, estimates regarding weight and environmental deterioration must be developed judgementally.

A group of pavement engineers assembled by the FHWA judged 70 percent of pavement damage to be weight-related and 30 percent to be environmentally related. Other states have developed different judgements in their cost responsibility studies. Georgia, for example, estimated that 75 percent of pavement maintenance was weight-related. Oregon used 90 percent as its estimate.

This study uses an alternative approach. We characterized the problem, as shown in the accompanying figure, as a line through a range of potentially reasonable estimates of weight-related versus environmentally related deterioration. The range of potential estimates is shown as the shaded area and can be labeled the "zone of uncertainty." As Figure 1 illustrates, a decision was made to draw the line through the zone of uncertainty on the same basis as the division between weight-related and minimum pavement components in the roadway construction allocation.

Figure 2

PAVEMENT MAINTENANCE ALLOCATION ILLUSTRATION



Besides providing results which were compatible with those derived from estimates used in other states, using an estimate related to construction allowed the study results to be sensitive to highway system differences. Therefore, intuitive expectations of greater deterioration caused by relatively more weight-related stress on the interstate system were met. This allocation method yielded a declining weight-related portion as the number of ESALs on the system declined, as shown in Table 16.

Table 16

PAVEMENT ALLOCATION

System	Environmentally Related Portion	Weight-Related Portion
Interstate	22.6%	77.4%
Primary	34.0	66.0
Secondary	46.9	54.1

The proportions shown in Table 16 were used to allocate pavement maintenance costs for each system. Because pavement maintenance costs were incurred systemwide, systemwide allocators were used. Costs equivalent to weight-related portions were allocated by each vehicle class's proportion of ESALs on the highway system. The cost of environmentally related portions were allocated as a demand-occasioned cost by proportional VMT on each system. Table 17 shows the results of the computation.

Table 17

PAVEMENT MAINTENANCE ALLOCATION SUMMARY

Class	Cost Responsibility	(%)
I	$36,653,712	(41.0)
II	19,897,918	(22.3)
III	13,310,626	(14.9)
IV	19,492,399	(21.8)
Total	$89,354,655	(100.0%)

Shoulder Maintenance

About $9.8 million was spent in FY 1980 to repair or replace roadway shoulders. Although shoulder maintenance was a relatively small cost component for the period, allocation can be based on an incremental analysis.

DHT design standards for roadway shoulders vary by highway system, from 15 foot cut-and-fill shoulders on interstate highways, to 8 and 6 foot cut-and-fill shoulders on secondary roads. A portion of the shoulder width on most roads is added to accommodate the wider wheelbases of trucks. Maintenance costs equivalent to the added width must, therefore, be regarded as truck-occasioned.

During the analysis of roadway construction expenditures, DHT engineers re-designed typical projects chosen from each project cluster. The re-design determined the degree of cost reduction possible if trucks were removed from the traffic stream. Reduction in shoulder width was an element of the project re-design.

The re-design showed that if trucks were removed from the traffic stream, shoulder reductions ranging from 40 percent on the interstate system to zero percent reduction on the secondary system would be accomplished (Table 18). The proportional reductions for each

Table 18

BASIC SHOULDER AND TRUCK-OCCASIONED INCREMENTS BY SYSTEM

System	Basic Increment	Truck-Occasioned Increment
Interstate	66.00%	40.00%
Primary	77.78	22.22
Secondary	100.00	0

system were concluded to be the truck-occasioned increments. Maintenance expenditures equal to the proportion of truck-occasioned shoulder width were also identified as truck-occasioned. All other shoulder maintenance was concluded to be the cost associated with maintaining the basic roadway shoulder. The cost of truck-occasioned increments were shared by all trucks (Classes II-IV), while the costs of the basic shoulder were shared by all vehicles (Classes I-IV).

In order to allocate total costs, costs were disaggregated by highway system. Because maintenance occurred systemwide, systemwide allocators were used. Each vehicle class's proportion of vehicle miles travelled on the applicable highway system was used to allocate the costs of the basic increment, while proportional VMT for the truck classes was used to allocate the costs of the truck-occasioned increment. Table 19 summarizes the allocation of shoulder maintenance costs.

Table 19

SHOULDER MAINTENANCE ALLOCATION SUMMARY
(All Systems)

Class	Cost Responsibility	(%)
I	$7,971,461	(81.0)
II	791,996	(8.0)
III	275,044	(2.8)
IV	805,544	(8.2)
Total	$9,844,045	(100.0)

Special Purpose Facilities

About $5.7 million was spent in FY 1980 to maintain facilities for the use of specific vehicle classes. In this study, maintenance costs for special purpose facilities were assigned directly to the vehicle classes using these facilities. For example, maintenance costs for reversible lanes on Shirley Highway in northern Virginia, where trucks are prohibited, were assigned to Class I vehicles. In contrast, maintenance costs for weigh stations, used solely by trucks, were assigned to the truck classes.

Where use was shared by more than one vehicle class, actual use data, if available, were used to allocate costs. In the absence of actual use data, proportional VMT on the system in which the facility is located was used as the allocator. Table 20 details the division of special purpose facilities among classes.

Table 20

USERS OF SPECIAL PURPOSE FACILITIES

Class I	Truck Classes	Joint Use
Reversible Lanes	Weigh Stations	Rest Areas, Waysides
Holiday Safety Service Patrol		Toll Ferry (16-ton Limit)
Historical Markers		
Toll Free Ferry (Cars Only)		

Table 21 summarizes the allocation for maintenance costs on special purpose facilities.

Table 21

SPECIAL PURPOSE FACILITIES
ALLOCATION SUMMARY
(All Systems)

Class	Cost Responsibility	(%)
I	$4,112,407	(71.7)
II	452,021	(7.9)
III	151,545	(2.6)
IV	1,017,729	(17.8)
Total	$5,733,702	(100.0)

All Other Maintenance Costs

About $142 million was spent in FY 1980 for maintenance which has no demonstrable relationship to vehicle size or weight. Costs in this category included the following:

- snow and ice control;
- signs and traffic control;
- ditches and drainage; and
- vegetation control.

Also included in this category were general expenses related to the administration and supervision of all maintenance activities conducted by DHT, and a transfer payment made to Henrico and Arlington counties for undefined road purposes, as part of a commitment by those localities to maintain their own local roads.

Although these maintenance costs are related to the demand for the roadway, there is no evident occasioning mechanism. Snow and ice control costs, for example, are determined both by the severity of winter weather and by a DHT policy which prescribes the frequency of road clearing. Vegetation control costs are also determined largely by policy, while signs and traffic control devices are used by all vehicle operators generally in proportion to their amount of travel.

Because no occasioning mechanism related to vehicle characteristics was demonstrable for these activities, they were regarded as demand-occasioned. Again, a use measure--the proportional VMT by system--was used as the allocator of each system's maintenance costs for these activities. Table 22 shows the allocation results.

Table 22

ALLOCATION OF ALL OTHER MAINTENANCE COSTS
(All Systems)

Class	Cost Responsibility	(%)
I	$128,857,348	(90.9)
II	5,746,502	(4.1)
III	2,280,354	(1.6)
IV	4,811,360	(3.4)
Total	$141,695,564	(100.0)

Maintenance Summary

Table 23 shows the cost allocation for all maintenance categories. As expected, those costs regarded as occasioned, pavement

Table 23

MAINTENANCE COST ALLOCATION SUMMARY

	Class I	Class II	Class III	Class IV
Pavement Repair	$36,653,712	$19,897,918	$13,310,626	$19,492,399
Shoulder Maintenance	7,971,461	791,996	275,044	805,544
Special Purpose	4,112,407	452,021	151,545	1,017,729
All Other Maintenance	128,857,348	5,746,502	2,280,354	4,811,360
Total	$177,594,928	$26,888,437	$16,017,569	$26,127,032
Percentage	(72.0%)	(10.9%)	(6.5%)	(10.6%)

repair and shoulder maintenance, show higher Class II, III, and IV responsibility and lower Class I responsibility.

In contrast, those costs which are treated as demand-occasioned costs show much higher Class I responsibility. Because the majority of maintenance costs are not occasioned by specific vehicle characteristics, maintenance cost allocation is skewed, by definition, toward vehicles using the highways in greatest proportion--passenger cars.

OTHER COSTS

"Other" costs include general administration, leave, holiday and sick pay, buildings and grounds maintenance, and DHT capital outlay expenditures. In FY 1980, $52 million was expended in this category. General overhead costs are categorized as common costs. A measure of relative use of the highway system was judged to be the most equitable allocator of these costs. Costs in this category were allocated on the basis of vehicle class proportions of vehicle miles travelled (VMT). Table 24 summarizes the allocation of these "other" costs.

Table 24

ALLOCATION SUMMARY
OTHER COSTS

Class	Cost Responsibility	(%)
I	$47,534,457	(91.4%)
II	1,596,093	(3.1)
III	577,089	(1.1)
IV	2,282,361	(4.4)
Total	$51,990,000	(100.0%)

REVENUE ATTRIBUTION

Once costs are allocated to vehicle classes it is necessary to determine revenue payments by vehicle class to provide a base for a cost responsibility comparison. This section apportions revenues paid by Virginia highway users to both State and federal trust funds.

Revenue Base

Revenues included in this cost responsibility study were defined as those revenues contributed by users of Virginia's highways which went to support highway construction and maintenance activities. The following revenue sources support these activities:

(1) State motor fuel and road taxes;
(2) State motor vehicle sales and use taxes;
(3) State vehicle license fees;
(4) International Registration Plan (IRP) Collections;
(5) Federal fuel taxes;
(6) Federal sales taxes;
(7) Federal use taxes; and
(8) Three federal excise taxes.

Revenue sources excluded from revenue attribution were those fees-for-service which are assessed in order to recoup service costs. For example, operator permit fees are intended to recover the cost of operator testing and licensing, as well as some aspects of enforcement, rather than to support highway construction and maintenance. Revenues from operator permits are therefore appropriately eliminated from the revenue attribution. Other fees in this group include those for vehicle title registrations, dealer licenses, copying and certifying charges, motor carrier permits, and highway permits. Together, these fees-for-service represent less than five percent of FY 1980 collections.

Table 25 shows the revenue sources and FY 1980 totals included in the revenue attribution procedures.

Table 25

REVENUE BASE
(FY 1980)

Revenue Source	Amount	(%)
State		
State Motor Fuel and Road Taxes	$281,266,964	(46.5)
State Sales and Use Taxes	64,380,032	(10.7)
Vehicle License Fees	80,830,001	(13.4)
IRP Collections	12,570,906	(2.1)
Federal		
Federal Motor Fuel Taxes	115,277,428	(19.1)
Other Federal Taxes	49,633,658	(8.2)
Total	$603,958,989	(100.0)

Source: DMV, SCC.

Attribution of Revenue from State Sources

Each of the four State user charges was examined separately to attribute the shares of revenue to vehicle classes. In each case the revenues attributed were equal to FY 1980 revenue totals reported by the collection agency. Table 26 shows the results of the revenue attribution for State user charges.

Table 26

STATE REVENUE ATTRIBUTION
(FY 1980)

Class	Fuel and Road Tax	Sales and Use Tax	Vehicle License Fees	IRP Collections	(%)
I	$215,282,072	$62,130,031	$56,874,133	$ --	(76.2)
II	18,108,521	402,050	4,746,790	125,709	(5.3)
III	9,110,079	495,504	3,956,414	452,553	(3.2)
IV	38,766,292	1,352,447	15,252,664	11,992,644	(15.3)
Total	$281,266,964	$64,380,032	$80,830,001	$12,570,906	(100.0)

State Fuel and Road Tax. In FY 1980, Virginia levied a nine cent-per-gallon tax on motor fuel. For vehicles with more than two axles, the equivalent of a two cent-per-gallon surcharge was assessed on all mileage driven in the State. Fiscal year 1980 collections for the combined motor fuel and road tax totalled $281.3 million.

Gasoline consumption and, therefore, fuel and road tax contributions are dependent upon the number of vehicle miles traveled (VMT) in the State and upon vehicle fuel efficiency. Estimates of 1980 VMT by vehicle class were developed by applying 1978 VMT proportions by vehicle class to 1980 VMT totals provided by DHT. Partial data for 1980 VMT by vehicle class were checked against 1978 VMT proportions and were found reliable.

Fuel efficiency estimates for 1980 were generated by FHWA for use in this cost responsibility study. To compute gasoline consumption, each vehicle class's annual VMT was divided by its fuel efficiency estimate. Gallons of gasoline consumed were then multiplied by the appropriate tax level (9 cents for Classes I and II; 11 cents for Classes III and IV). The attribution procedure yielded results accurate to one-third of one percent of actual fuel and road tax collections. Results were then weighted so that totals equalled actual FY 1980 collections.

Sales and Use Tax. A sales and use tax of two percent of the sale price is levied on vehicles purchased in Virginia. Fiscal year 1980 collections for sales and use tax totalled $64.4 million.

To attribute shares of the sales and use tax to the four vehicle classes, the Division of Motor Vehicles collected data over a six-month period on the sales of 505,914 vehicles and trailers. These data provided the proportional contributions of each vehicle class (for both power units and trailers in the case of tractor-trailor combinations). These proportions were used to attribute the $64,380,032 total to each vehicle class.

Vehicle License Fees. Virginia levies an annual license fee on vehicles registered in the State. The fee schedules are graduated by weight, with separate assessments on most private and for-hire vehicles. Detailed data on license fee collections by weight class are routinely collected and published as legislative documents by the Division of Motor Vehicles (Senate Document 3).

Because detailed data on contributions by weight groups are available, the principal attribution procedure involved aggregating weight groups into the vehicle classes used in this study. A 1979 DHT truck weight study provided the basis for this aggregation.

The license fees attribution was first computed for single unit trucks (Classes II and III) by apportioning the license fees for various weight groups (Senate Document 3) by the proportion of vehicles from Classes II and III in each weight group (1979 Truck Weight Study). The single unit fees were added to the combination unit fees cited directly in Senate Document 3 (Class IV), to form the total of truck license fees. This amount was subtracted from the total vehicle license fees to determine license fees contributed by Class I vehicles.

International Registration Plan. Virginia belongs to a consortium of states which share truck license fees on the basis of relative miles traveled in each of the member states. In FY 1980, IRP collections totalled about $12.6 million.

Senate Document 3 contains detailed data on IRP collections by weight groups. Collections for tractor-trailer combinations (Class IV) are specified directly. As with license fees, therefore, the principal attribution involved aggregating weight group collections into the study's four vehicle classes.

On the basis of the DHT Truck Weight Study, single unit truck contributions were divided between Classes II and III according to their proportion of the weight groups paying the fee. The proportions of collections derived from Senate Document 3, including the total for Class IV, were used to distribute net IRP collections for FY 1980.

Attribution of Federal Revenue Contributions

The federal trust fund receives user charges from six sources:

(1) Motor fuel tax: four cents per gallon.

(2) Sales tax: 10 percent on the wholesale price of vehicles over 10,000 pounds.

(3) Use tax: $3.00 per 1,000 pounds on vehicles over 26,000 pounds.

(4) Parts and accessories tax: eight percent of the wholesale value of certain parts and accessories for vehicles over 10,000 pounds.

(5) Tires and tubes tax: 10 cents per pound on each.

(6) Lubricating oil: six cents per gallon.

Total FY 1980 contributions generated by these charges from Virginia's highway users were $164.9 million.

FHWA staff conducting a federal cost responsibility study have developed methods for deriving the federal user charge contributions by vehicle classes. In response to special request, FHWA staff used their mathematical model to produce a set of factors which estimate contribution per vehicle mile traveled or per vehicle for Virginia's vehicle classes. Factors derived by FHWA were used instead of published highway statistics, which FHWA staff consider too inaccurate for a cost responsibility study.

The factor which best approximated the way in which the tax is incurred was selected. Data on FY 1980 vehicle miles traveled or number of vehicles were then multiplied by the FHWA factor to determine the vehicle class contribution for each federal user charge.

The results of the calculations are shown in Table 27.

Table 27

ATTRIBUTION OF FEDERAL REVENUES BY VEHICLE CLASS

	Class I	Class II	Class III	Class IV
Fuel	$ 93,407,428	$ 7,790,000	$ 2,980,000	$11,100,000
Sales	--	1,878,778	3,432,000	8,709,093
Use	--	194,948	1,488,226	4,686,825
Tires	16,368,665	797,972	424,084	2,227,840
Oil	1,519,775	92,447	44,846	274,068
Parts	1,519,775	2,979,378	1,019,411	1,976,537
Total	$112,815,643	$13,732,523	$ 9,388,567	$28,974,353
Percentage	(68.4%)	(8.3%)	(5.7%)	(17.6%)

Revenue Attribution Summary

A summary of revenues attributed from the four State and six federal user charges is shown in Table 28. Class I vehicles contributed $447.1 million, or 74 percent of the total revenue contributed in FY 1980, compared to the $156.8 million (25.9 percent) contributed by Classes II, III and IV.

Table 28

REVENUE ATTRIBUTION SUMMARY
(FY 1980)

Class	State Taxes	Federal Taxes	Total	(%)
I	$334,286,236	$112,815,643	$447,101,879	(74.0)
II	23,383,070	13,732,523	37,115,593	(6.1)
III	14,014,550	9,388,567	23,403,117	(3.9)
IV	67,364,047	28,974,353	96,338,400	(16.0)
Total	$439,047,903	$164,911,086	$603,958,989	(100.0)

Because of changes in revenues caused by increasing fuel efficiency and the FY 1981 change in State motor fuel tax rates, among other things, these figures are subject to adjustment for every period beyond FY 1980.

RESPONSES

The following groups participated on the Cost Responsibility Advisory Committee and submitted comments on the report findings:

- Virginia Highway Users Association
- Virginia Railway Association

The following organizations, consisting of Class II and Class III vehicles users, filed a response under the common identification, "Committee for Equitable Road Taxes":

- The Virginia Agribusiness Council
- The Virginia Beer Wholesalers
- The Virginia Building Material Association
- The Virginia Coal Association
- The Virginia Dairy Products Association
- The Virginia Poultry Federation
- The Virginia Ready-Mixed Concrete Association
- The Virginia Retail Merchants Association
- The Virginia Soft Drink Association
- The Virginia State Feed Association
- The Virginia Wine Wholesalers Association
- The Car and Truck Rental Association of Virginia
- The Retail Merchants Association of Greater Richmond, Virginia

JLARC staff notes have been inserted into the two Virginia Railway Association responses where they were believed necessary to correct statements of fact. Comments have not been made about the other responses because they are primarily limited to conceptual matters. Our printing of the responses without comment, however, should not be construed as indicating our agreement with those statements. On the contrary, we believe this cost responsibility study is consistent with the "state-of-the-art," and is especially well suited to serve legislative decision-making responsibilities.

Virginia Railway Association

700 Building, Suite 1130, 700 East Main St., Richmond, Virginia 23219, (804) 649-2485

W. Bruce Wingo
Executive Director

November 16, 1981

Mr. Ray D. Pethtel, Director
Joint Legislative Audit & Review Commission
910 Capitol Street, Suite 1100
Richmond, Virginia 23219

Dear Ray,

Enclosed are our written comments on the JLARC Cost Responsibility Study which we discussed submitting to you at our meeting on October 30, 1981. Should you desire any further or clarifying information on our comments, please contact Dr. Linley, Dr. Hoffer, or myself.

We would welcome any information on your revenue options should it be available prior to November 30 as it will certainly affect our testimony before JLARC and the SJR 50 Subcommittee. As you know, we do wish to make a presentation on the thirtieth and request that you add the Virginia Railway Association to your list for comment.

We appreciated the opportunity to meet with you and members of your staff on October 30 and hope that our comments at that meeting and the enclosed written comments will be of assistance to you in finalizing your cost allociation report.

Cordially,

Bruce

W. Bruce Wingo
Executive Director

Member Lines

Baltimore and Ohio Railroad
Chesapeake and Ohio Railway
Chesapeake Western Railway

Clinchfield Railroad
Interstate Railroad
Louisville and Nashville Railroad
Norfolk and Portsmouth Belt Line Railroad
Norfolk and Western Railway
Norfolk, Franklin and Danville Railway
Norfolk Southern Railway

Richmond, Fredericksburg and Potomac Railroad
Seaboard Coast Line Railroad
Southern Railway

JLARC Staff Note: The written response of the Virginia Railway Association was supplemented with a prepared briefing presented to the SJR 50 subcommittee on November 30, 1981. The prepared briefing expanded on several of the Association's criticisms beyond the material included in the written response dated November 16. These subsequent materials have been included where appropriate in the following discussion to ensure that all members of the General Assembly have access to the full response.

RESPONSE OF VIRGINIA RAILWAY ASSOCIATION TO THE JLARC COST RESPONSIBILITY STUDY

Introduction

The following comments on the JLARC Cost Responsibility study are based on the publications made available through October 6, 1981. These comments are founded on the assumption that the SJR 50 charge to JLARC was to provide analysis on which the General Assembly could develop a long range, equitable tax structure that would generate sufficient revenues to meet Virginia's transportation needs. As will be detailed here, we believe that this study does not fulfill this mandate.

The following issues are addressed: (1) Highway disinvestment in Virginia (2) the use of the cluster methodology (3) roadway construction cost allocation (4) the allocation of bridge costs and (5) revenue attribution.

Highway Disinvestment

Highways are a social capital stock that can be compared to the capital stock of a business. Highways wear out, are maintained and are replaced in a manner similar to business capital. Just as businesses must account for the deterioration of their capital through the concept of depreciation, so must the Commonwealth account for the deterioration of its highway system.

As a business acquires more capital (the Commonwealth builds more highways), the dollar amount of depreciation each year will increase. If depreciation is not adequate, the business will disinvest. Since the VDHT does not maintain a depreciation schedule or accumulate sinking funds, highway disinvestment is difficult to determine.

Under certain conditions, such as a constant real quantity of construction expenditures over a long period, maintenance and replacement expenditures represent a reasonable proxy for depreciation. That is, the same level of service could be maintained by expending constant real dollars per lane mile of highway.

If, however, there has been a bulge or a secular increase in highway construction, maintenance and replacement expenditures may not reflect actual depreciation since a constant per cent of highways are not wearing out each year. Such is the case in Virginia. [S.D. 12, p. 7, 1981]. Thus the maintenance and replacement expenditures may not reflect the full cost of highway depreciation. One dictum is certain: per lane mile expenditures for maintenance and replacement cannot decrease in real terms without having disinvestment.

The staff of JLARC initially acknowledges the problem of disinvestment [S.D. 12, pp. 5-6], but assumes it away by stating, "The evidence in Virginia indicates that maintenance is not being deferred to a degree which could reasonably affect the study results." Based on this statement, which has little or no empirical support, the staff develops Recommendation 1 which proposes to define highways costs as actual and projected Virginia Department of Highways and Transportation (VDHT) expenditures.

The disinvestment hypothesis should have been rigorously examined in light of an abundancy of literature which argues that the country as a whole has disinvested in highways [Senate Document 9, 1980: General Accounting Office, Transportation Issues in the 1980's, p. 18] and in light of VDHT officials' statements that in the late 1970's Virginia had undergone a moderate amount of deferred maintenance [GAO, "Questionnaire Summary," CED-79-94A].

The validity of JLARC's results is dependent upon the no disinvestment assumption. Has there been disinvestment in Virginia's highways or, even more important, was disinvestment occurring in the survey year, 1980? If disinvestment was occurring in 1980, then the cost allocation results are highly suspect because the total VDHT costs for 1980 were understated.

An examination of the evidence shows that there was disinvestment in the survey year 1980. Table I shows allocations by VDHT for maintenance in different ways. Allocation is analyzed first because it indicates planned expenditures by VDHT. (Secondary road maintenance and construction are included in maintenance figures). Column 2 shows actual dollar allocations. Column 4 adjusts the allocations for changes in highway maintenance costs (Column 3) and thus represents real allocations. Column 5 is Column 4 divided by lane miles or constant dollar per lane-mile allocations.

JLARC Staff Note. Column 2 of Table 1, which is labeled "maintenance allocations," includes both construction and maintenance funds for the secondary system. This has the effect of overstating maintenance spending on the secondary system and total system, and it invalidates the per lane-mile allocations in those two categories (Column 5). Table 1 indicates total system maintenance allocations (Column 2) for the four-year period of $895,121,000. Actual allocations were $620,741,000, an error of $274,380,000 over the four years (31 percent).

Table I

MAINTENANCE ALLOCATIONS BY VDHT IN DOLLARS, CONSTANT DOLLARS, AND PER LANE MILE 1977-1980 F.Y.

(1) Fiscal Year	(2) Maintenance[1] Allocations in (000)	(3) VDHT[2] Maintenance Cost Index	(4) Maintenance Allocations In Constant $ (000)	(5) Maintenance Allocations In Constant $ Per Lane Mile
PRIMARY SYSTEM				
1977	$ 54,648	100.0	$ 54,648	$2,757
1978	55,158	112.4	49,073	2,455
1979	54,534	116.9	46,650	2,327
1980	62,732	130.5	48,070	2,385
INTERSTATE SYSTEM				
1977	$ 19,487	100.0	$ 19,487	$5,158
1978	21,851	112.4	19,440	4,994
1979	22,611	116.9	19,342	4,765
1980	22,668	130.5	17,370	4,137
SECONDARY SYSTEM[3]				
1977	$118,244	100.0	$118,244	$1,363
1978	149,288	112.4	132,818	1,526
1979	150,298	116.9	128,570	1,471
1980	163,602	130.5	125,365	1,427
TOTAL SYSTEM				
1977	$192,379	100.0	$192,379	$1,744
1978	226,297	112.4	201,332	1,815
1979	227,443	116.9	194,562	1,744
1980	249,002	130.5	190,806	1,700

[1] From Table C, Financial Supplement to VDHT Annual Reports.
[2] VDHT Maintenance Cost Index; 1977 = 0.
[3] Includes Construction Allocations.

It should also be noted that allocations are used by DHT on an accrual basis for accounting purposes. In other words, balances are carried forward from year to year and are not necessarily intended to reflect planned spending levels in any given year. For example, primary system maintenance allocations differed from expenditures for each of the four years cited in Table 1 (1977-1980) by 15%, 20%, 26% and 5%, respectively. Interstate system allocations and expenditures differed on an annual basis by 4%, 5%, 11% and 8% over the period. For this reason, we believe it is misleading to use allocations as a basis for measuring actual annual work activity as has been done in Table 1.

For the primary system, per lane-mile allocation has decreased by 13% from 1977 to 1980. For the rapidly aging interstate system, the decline is even more pronounced, being approximately 20% over the same period. Allocations have been used in Table 1 rather than expenditures because allocations represent what VDHT is attempting to accomplish from year to year based on their estimates of what is feasible.

Planned expenditures show a disposition toward a reduction in lane-mile maintenance, indicating planned disinvestment. It is important, however, to examine actual expenditures before passing judgment.

Table II uses expenditures for maintenance analyzed in a similar manner with the useful addition of a dividing maintenance expenditures into maintenacne and maintenance replacement. Maintenance consists of expenditures for items such as grass mowing, snow removal, potholes, etc. Replacement maintenance is primarily major rehabilitation work such as resurfacing, replacing guardrails, signs, or drainage structures, or bridge rehabilitation.

As can be seen, maintenance expenditures have been increasing secularly since FY 1973. These increases are true for maintenance in current dollars, in constant dollars and in constant dollars per lane-mile for each of the systems. This is consistent with an expanding system and also reflects the nondeferrability of these items. Snow removal depends on snowfall; grass cutting until recently depended on the miles to cut and the weather, and potholes obviously require attention.

Maintenance replacement expenditures, however, are those which one would a priori assume would be deferred if revenues were not sufficient to maintain the same level of service. Indeed, they are residual expenditures in that an increased snow removal burden or any other unexpected expense would be paid out of replacement allocations. Thus one would expect them to be more erratic.

As expected, maintenance replacement expenditures have been more erratic over the same period. It is here one must look to determine if any disinvestment trend exists. Table II shows that in current dollars for the whole system, replacement maintenance expenditures in FY 1980 were approximately the same as in FY 1977

Table II

Maintenance and Maintenance Replacement Expenditures in Current Dollars, Real Dollars and Real Dollars per Lane Mile, by System and Total, 1973-1980 FY

Fiscal Year	Main[1/] (000)	M-R[1/] (000)	Index[2/]	Deflat Main (000)	Deflat M-R (000)	L-M	Deflat Main/L-M (000)	Deflat M-R/L-M (000)
PRIMARY SYSTEM								
1973	14,549	11,830	74.2	19,608	15,943	19,198	1,021	830
1974	17,028	10,642	87.7	19,416	12,135	19,519	995	622
1975	18,747	11,894	90.9	20,624	13,085	19,725	1,046	663
1976	20,103	9,800	95.1	21,139	10,305	19,778	1,069	521
1977	24,942	21,743	100.0	24,942	21,743	19,818	1,259	1,097
1978	29,402	36,937	112.4	26,158	32,862	19,985	1,309	1,644
1979	31,936	36,671	116.9	27,319	31,370	20,046	1,363	1,562
1980	36,814	22,509	130.5	28,212	17,248	20,154	1,400	855
INTERSTATE SYSTEM								
1973	5,237	3,721	74.2	7,058	5,015	3,454	2,048	1,452
1974	6,227	3,923	87.7	7,100	4,473	3,507	2,025	1,275
1975	7,123	4,607	90.9	7,836	5,068	3,564	2,199	1,422
1976	7,255	3,921	95.1	7,629	4,123	3,605	2,116	1,144
1977	10,686	7,973	100.0	10,686	7,973	3,778	2,828	2,110
1978	12,857	8,004	112.4	11,439	7,121	3,893	2,938	1,829
1979	14,392	10,648	116.9	12,311	9,109	4,059	3,033	2,244
1980	16,772	7,702	130.5	12,852	5,902	4,199	3,061	1,406
SECONDARY SYSTEM								
1973	24,697	14,126	74.2	33,284	19,038	85,565	389	222
1974	27,070	13,888	87.7	30,867	15,836	85,852	360	184
1975	29,954	12,740	90.9	32,953	14,015	86,262	382	162
1976	31,920	12,208	95.1	33,565	12,837	86,387	389	149
1977	35,313	34,492	100	35,313	34,492	36,743	407	398
1978	41,290	68,586	112.4	36,735	61,020	87,035	422	701
1979	47,038	87,548	116.9	40,238	74,891	87,427	460	857
1980	58,100	44,419	130.5	44,521	34,038	87,880	507	387
TOTAL SYSTEM								
1973	44,483	29,687		59,950	39,996		3,458	2,504
1974	50,325	28,452		57,383	32,444		3,380	2,081
1975	59,824	29,241		61,413	32,186		3,627	2,247
1976	59,278	25,929		62,333	27,265		3,574	1,814
1977	70,941	64,208		70,941	64,208		4,484	3,605
1978	83,549	113,527		74,332	101,003		4,669	4,174
1979	93,366	134,867		79,868	115,370		4,856	4,666
1980	111,689	74,630		85,585	57,188		4,968	2,648

1/ From Table D Financial Supplement Annuals VDHT
2/ VDHT Maintenance Index; 1977 = 100

despite an aging of the system. When deflated for cost changes, real replacement maintenance expenditures in FY 1980 were less than in 1979, 1978, or 1977. When put into lane-mile real expenditures, the decline becomes even more pronounced. Real replacement maintenance expenditures per lane-mile are 26% less in FY 1980 than in 1977 and are only 6% higher than in 1973. Of course, the aging highway stock would dictate increasing expenditures. Real replacement maintenance per lane-mile for the interstate system, which is used by the heaviest vehicles disproportionately, fell by one-third between FY 1977 and FY 1980, despite aging of the system.

JLARC Staff Note. Data in Table II do not provide a sound base for the conclusions in the text regarding disinvestment. One key problem is the use of total maintenance replacement expenditures in calculating per lane-mile spending. Many maintenance replacement activities cannot logically be related to changes in lane-miles of highway. For example, bridge repair, ferry maintenance, weigh station maintenance, and spending on a limited section of roadway due to storm or flood damage are independent of changes in system lane-miles. Flood damage repair in FY 1979 alone totalled over $60 million which cannot be put into the kind of ratio shown in the last column of Table II.

When these expenditures are considered, it is apparent that maintenance replacement spending has been increased since 1976. Maintenance replacement spending per lane mile, indexed for inflation, was $172 in 1974-76, $247 in 1976-78 and $255 in 1978-80.

A second problem with Table II involves certain types of construction spending. Construction, particularly reconstruction, often serves maintenance replacement purposes as well. For example, if a road is widened existing pavement is often overlaid at the same time. Current work on I-95 is one illustration. This expenditure would be included under the broad category of construction spending in the data sources used for Table II. However, not considering these types of expenditures--which totalled over $66 million for roadway and bridge work in 1980--understates the resources actually used to preserve the existing highway investment.

One could counter that FY 1980 maintenance replacement expenditures were an anomaly and that a similar situation occurred in 1977. If 1980 was an anomaly, it certainly should not have been used as the survey year for basing cost allocation. Based on JLARC's analysis, one must conclude that VDHT was over maintaining highways in the mid-70's, or they were undermaintaining them in FY 1980. Maintenance expenditures in real terms have declined despite the obvious necessity for real expenditures to increase as the highway system has aged. While this is prima facia evidence of disinvestment in 1980, other evidence supports the disinvestment hypothesis.

In 1979, the General Accounting Office made a report to the U. S. Congress, "Excessive Truck Weight: An Expensive Burden We Can No Longer Support. In developing the Report, the GAO sent a questionnaire to all states asking for information on highway conditions and truck weight laws and enforcement programs. The questionnaire responses from the states were subsequently published in a "Questionnaire Summary."[2]

In responding, VDHT officials indicated that deferred maintenance at that time was a "moderate problem" in Virginia.[3] The causes of this deferred maintenance were inflation and weather, and to a smaller extent the aging of the highway system.[4] While the condition of the several highway components varied as compared to 1973,[5] the predominant causes of the highway deterioration were lack of funds, the aging highway system, the highway design, heavy trucks and illegally overweight trucks.[6] Deferred maintenance contributed to the observed highway deterioration to a "moderate extent."[7] Thus, the VDHT respondant(s) reiterated that disinvestment through deferred maintenance was occurring in Virginia during the late 1970's. To the extent that deferred maintenance was taking place, the JLARC methodology has underestimated costs.

JLARC Staff Note. The response cites only one portion of the 1979 GAO report and does not consider the DHT response to a more recent GAO examination of the same topic. For example, the response quotes DHT's 1979 response to a GAO survey which indicated that deferred maintenance was a "moderate problem." It does not report a further response on the same survey, which indicates that pavement and guardrails were "generally better" maintained than five years previously. Indeed, of the types of facilities listed, only drainage was conceded to be "generally worse" maintained than it had been five years earlier.

In another GAO report (Deteriorating Highways and Lagging Revenues: A Need to Reassess the Federal Highway Program March 5, 1981), Virginia was found to be one of the few states with little or no deferred maintenance. As the report indicates, "Virginia and New Mexico officials stated that they had little deferred maintenance." In another section, Virginia was the only one of nine case study states which reported its highways in "stable condition."

Finally, it should be noted that the cost responsibility planning and advisory teams included DHT maintenance engineers and pavement specialists who must be considered authoritative on the condition of Virginia's highway system. On numerous occasions, including meetings attended by Virginia Railway Association representatives, this issue was discussed. In the opinion of the experts rendered at that time, Virginia has not deferred maintenance of pavements and bridges which has resulted in premature, avoidable, structural damage or deterioration.

Finally, one must consider if the behavior of the VDHT over the last three years is consistent with that of an agency able to render the same level of service as in the past? JLARC in its August Report on the VDHT financial needs, in large part disavows the assumptions behind their own Recommendation 1. JLARC notes that "there is no conclusive way to estimate need for maintenance funds. Needs are fitted to anticipated revenues." [August Report Maintenance].

JLARC Staff Note. We concur. There is little question that the information base for maintenance replacement can be improved. Several of our highway and transportation reports include recommendations to that effect.

In conclusion, the cost allocation methodology employed by JLARC is founded on the assumption that no highway disinvestment occurred in FY 1980. Moreover the methodology assumes that there has not been disinvestment in the past and that projected expenditures are not disinvestment level expenditures. However, examination of the evidence can only lead one to conclude othewise. Since all costs for FY 1980 have not been counted, JLARC has underestimated total costs and thus necessarily underestimated allocated cost by class.

Use of the Cluster Methodology

Most recent highway cost allocation studies have relied on the AASH(T)O Ottawa tests completed in the early 1960's. As the economist involved in the JLARC study has noted, . . . the evidence and formulas developed in that $27 million study are generally accepted by the engineering community and are applicable to current cost allocation studies.[1]

Unlike other states such as Oregon and Georgia, JLARC rejected using AASH(T)O results directly, but instead chose a new research technique. New research techniques are not necessarily to be avoided, nor are they necessarily inherently suspect. They do, however, require justification for use over traditional techniques. That is, they should provide superior results to the traditional technique in order for their use to be justified. One criterion should be that the results have a stable time dimension. The results should not vary from one time period to another unless the question one is asking varies or the basic parameters of the methodology vary. The cluster approach used by JLARC does not have a stable time dimension.

JLARC Staff Note. The statement that "JLARC rejected using AASH(T)O results directly is erroneous. The AASH(T)O road tests established the basis for relating weight to pavement stress. Since that time, 18,000 pound Equivalent Single Axle Loads have been accepted in Virginia and elsewhere as the standard measure of weight-related pavement stress for design purposes. JLARC used ESALs as the measure for allocating all weight-related pavement and pavement maintenance costs.

The response also indicates that the study used a "new research technique." In fact, the JLARC study adopted the two-increment approach first proposed by the Congressional Budget Office and used in the current Federal Highway Administration cost allocation study. This approach has been widely supported, including an endorsement in concept by the American Consulting Engineers Council and the American Railway Association.

With JLARC's approach, allocated costs are heavily influenced by the mix of projects undertaken by VDHT in the survey year. The staff is fully cognizant of this and acknowledges the capriciousness of the allocated cost result, depending on the mix of projects undertaken during the "survey year." For instance, during the next two biennia as the interstate system approaches its life expectancy [S.D. 12, p. 7], the mix of projects will include more reconstruction. To the extent that reconstruction costs are charged to the several vehicle classes in a different proportion than new construction, JLARC's allocated costs per vehicle class will change. The lack of a time dimension means that the results will differ significantly every time a study is undertaken, since the project mix will differ [S.D. 12, p. 12]. Consequently, JLARC is anticipating doing such a study every two or three years.

It is difficult to see how such an approach would have credibility in the private sector where capital is depreciated over its usable life and prices are charged to recover and replace that capital when it is consumed. In this manner, the depreciation is reflected in prices that change smoothly over time.

Using JLARC's methodology, any such smoothing would be lost. The road user tax rates and the road user tax structure would resemble a yo-yo, changing frequently as the mix of VDHT projects change. It would be difficult to have a rational tax policy based on such a methodology. The methodology, moreover, is potentially dangerous to all parties that are affected by the road user tax structure.

JLARC Staff Note. The representativeness of the 1980 construction and maintenance spending patterns were certified by DHT before the start of the study. Proposed increases in reconstruction spending on interstate highways, as noted in the response, were included in the projections for tax policy consideration.

The statement in the response that "resulting road user tax rates would resemble a yo-yo" is erroneous. Projections of mid-decade cost responsibility by vehicle class, based on the 1980 analysis but including expected variations in spending patterns such as increased interstate reconstruction, show little overall change in proportionate cost responsibility. For example, Class I responsibility drops 1.4% (70.9% to 69.5%) for the most likely spending program, with the decrease being redistributed over the three classes of trucks. Therefore, the 1980 study results as applied to the mid-decade provide an especially reliable base for tax policy analysis and decision-making.

The exposure draft called for repeating the cost responsibility analysis in 1985 for the 1986-88 biennium, not "every two or three years" as stated in the response. Periodic repetition of the study is a reasonable and responsible check on changing conditions and cannot be construed as suggesting that there is reason to believe that the results will "differ significantly every time a study is undertaken" as stated in the response.

Tax policies have not in the past been subject to wide fluctuations. The Virginia road tax structure on heavier vehicles has remained basically unchanged since 1956. We doubt that many elected officials would choose to make another quarter century tax policy decision on the basis of a single year snapshot which has little time dimension.

One other issue should be raised concerning the snapshot methodology. Assume that it was accepted and a new cost allocation estimate recalculated every two to five years. It does not take much imagination to see that some highway user interests would seek to delay initiating projects which impacted disproportionately on their vehicle class. For instance, if there were a large number of reconstruction projects on interstate highways in a given period, owners of class IV vehicles would have a higher cost allocation. If the projects were heavily oriented toward secondary roads, then classes I and II would have a higher cost allocation. Given the magnitude of possible shifting due to the cluster methodology, the benefits could be quite high from concentrating certain projects during projects of no cost allocation study.

The JLARC study used a projected 10-year traffic mix on the highway construction projects to assign costs among vehicle classes. No attempt was made to use the system-wide traffic mix. The latter could significantly differ from the traffic mix on the few projects in the cluster. The projects were grouped on the basis of pavement and road design (ESAL's), rather than on the type of highway (interstate, primary, secondary, etc.). Thus JLARC argues that it cannot match its projects with system miles.

Yet, it did that very thing for bridges. Bridges were grouped according to the system designation (interstate, primary, etc.). To allocate costs, total system mileage mix was used, not the projected median year traffic mix for each bridge.

Thus system mileage is used for bridges, and projected median year project mix mileage for highways. Yet revenue attribution is derived from total system miles. To be consistent JLARC should have allocated costs for highways on system mileage as it did for bridges.

JLARC Staff Note. The response stated that the "study used a projected 10-year traffic mix on the highway construction projects to assign costs among vehicle classes." This is incorrect. Actual 1980 traffic mix was used to assign non-weight-related construction costs.

Using systemwide traffic mix for weight-related construction allocation, as is suggested in the response, would produce invalid results for a cost responsibility analysis. Apportioning current construction requires that the data base reflect current construction patterns. Construction today does not mirror the State's 60,881 mile system which includes over 40,000 miles of low volume secondary roads. Rather, construction is concentrated on a subset of the system--

and economic growth. These routes tend to require much stronger pavements to accommodate heavier vehicles and increased traffic volume than the average highway segment. Therefore, it is logical to assign pavement costs among vehicle classes in proportion to their contribution to expected pavement requirements for that subset of the system. To do otherwise, to use a systemwide traffic mix, would be to implicitly argue that Virginia is constantly reconstructing a perfect model of the existing system. This is not the case.

With regard to bridges, the issue is quite different. New bridges in Virginia are designed to accommodate maximum vehicle weights with a substantial margin for safe operation. Therefore, the design standard for bridges is more of a constant, that is, it may vary by system and span length (as reflected in the five classifications used in the study), but not from one location to the next depending on individual projections of traffic. Therefore, application of system VMT to the five classifications of bridges provides adequate sensitivity to traffic mix as it relates to bridge construction.

In light of the above, it is doubtful that the JLARC methodology provides as accurate a cost allocation result as that which has been obtained using an AASH(T)O based methodology.

Inconsistency of Roadway Construction Cost Allocation Methodology

The roadway construction cost allocation [S.D. 12, pp. 12-27] methodology contains some gross inconsistencies. Site preparation-geometry and pavement construction costs were allocated among the classes under the assumption that the lighter vehicle classes needed one less foot of roadway for each lane and two less feet of shoulder. Thus the incremental lane and shoulder widths were charged solely to the larger vehicles, being "truck occasioned." This methodology was used in deriving cost allocation estimates for pavement construction and site preparation-geometry.

However, right-of-way acquisition and design-construction engineering costs were allocated to the several classes on the basis of vehicle miles travelled, thus assuming no difference in right-of-way or design construction requirements between cars and 80,000 lb. trucks. Yet examination of this issue would indicate otherwise. Take right-of-way, for instance; if we take the example shown on S.D. 12, p. 15, a four-lane interstate highway would need 12 less feet of pavement and shoulder if it were built for only lighter vehicles. Thus, <u>ceteris paribus</u>, 12 less feet of right-of-way would be needed. In the January report, it was noted that the typical mean right-of-way width for an interstate highway was 250 feet. If this roadway was built for lighter vehicles only, a minimum savings of 5% in right-of-way could be achieved. Yet in deriving right-of-way acquisition costs, no provision was made for this obvious truck-occasioned cost; instead, the entire right-of-way acquisition cost was apportioned on a vehicle mile travelled basis.

Furthermore; if any cut of fill is needed for the right-of-way, the increase in the right-of-way needed becomes a multiple of the increased pavement width. This is necessarily so, because of the base needed for a stable fill or the slope for a stable cut. To the extent that grades on the highways are less steep to accommodate trucks, the cuts and fills are more than would be required for cars alone.

Design and construction engineering costs were also apportioned among the several vehicle classes on the basis of VMT, using the argument that this represents "engineering overhead." Yet as noted above, in deriving the cost allocation estimates, some pavement construction and site preparation work was determined to be truck occasioned. Unless the marginal cost of designing and engineering the incremental pavement and site preparation was zero, then this last increment of design and engineering costs should be also allocated as truck occasioned. To not do so is to say that the marginal cost of the incremental design, incremental survey work, monitoring the extra width all are zero. Take the example from a previous paragraph. With shoulder and pavement at a minimum 12 feet wider, any bridge spanning the new roadway must be at least 12 feet longer. Is the marginal cost of designing a 12 feet longer bridge zero?

Right-of-way requirements would also vary for interchanges since the turning radius for an automobile is less than that for a large truck. To the extent additional lanes or approach lanes occur, the required right-of-way to accommodate trucks increases.

JLARC justifies its assignment of right-of-way costs totally by VMT's because "VDHT acquisitions have been guided by the maximum width allowed by policy." [Exposure draft, Oct. 6, 1981 p. 26]. It must be assumed, however, that "policy" must be shaped by considerations involving design standards, width requirements etc., and that the extra 12 feet must have been included in policy calculations. To assume otherwise is to assume that VDHT purchases land at thousands of dollars per acre without regard to the required width of the highway, interchanges, etc. Such an assumption is hardly flattering to VDHT.

JLARC Staff Note. The decisions on how best to apportion right-of-way, design and engineering costs were based on a review of actual practice rather than theoretical considerations. For example, contrary to the inference in the response, there is no evidence that buying 12 feet less right-of-way would reduce costs. Right-of-way acquisition must consider multiple objectives in deciding what property to purchase. Considerations of access, fairness to the property owner in terms of the economic value of residual property, and possible needs for future expansion of the roadway are just a few of the considerations which far outweigh land width in determining how much land is needed.

The Allocation of Bridge Construction--Reconstruction Costs

The study's bridge cost allocation methodology has two difficiencies which result in an underestimation of heavy truck cost allocation.

In its August report, JLARC reported the VDHT's assessment of bridge conditions in Virginia. Of the $259 million needed for bridge replacement, $145 million or 56% is for replacement of those classified as "structurally deficient, in need of replacement." The number of bridges needing replacement (75) strongly suggests highay disinvestment.

The issue of bridge replacement, however, is not limited to the issue of disinvestment. The criteria for bridge replacement require close examination. The deficient bridge classification can have numerous meanings. One, it could be insufficient for even class I vehicles. Two, it could be sufficient for classes I and II, but not for the heavier classes of vehicles. Or, it could be sufficient for all but the largest classes. Usually, the VDHT classifies bridges as structurally deficient when they do not meet the criteria of supporting all vehicle classes.

This presents a curious problem. Assume that an existing bridge can accommodate classes I and II vehicles for the next twenty years with only normal maintenance. Next assume that the bridge is termed structurally deficient because it will not carry all classes of vehicles. When the new bridge is built, the JLARC cost methodology would have approximately 65 to 70% of the bridge replacement cost charged to class I and class II vehicles when they did not need the new bridge. The vehicles that cause the new bridge to be built are only allocated 30 to 40% of the cost.

Another bridge issue apparently unaddressed is the additional length of the overpass bridges necessitated by the extra roadway width that VDHT has determined to be truck occasioned. Using the JLARC example discussed in the previous section, we find that bridges spanning interstate highways must be at least 12 feet longer due to truck traffic. The total cost of that 12 feet should be charged as truck occasioned. Instead, the extra length was deemed to be a common cost, and thus 90% of it was charged to automobiles.

Heavy Truck Attribution Analysis

The JLARC analysis of heavy truck revenue attribution in the several reports issued to date can be critiqued as being misleading, as having omissions, as not being fully developed and as having a faulty methodology.

The subsection titled "State Revenues Derived from Heavy Trucks" (October 6, pp. 52-53) is misleading. First, it is argued that since Virginia has a motor fuel surcharge on heavier vehicles that this removes the incentives to purchase fuel out-of-state and enables Virginia to capture higher revenues from heavy trucks than other states.

While it is true that Virginia has enforced a motor carrier fuel reporting law since 1942, whereby carriers have been required to equate their fuel purchases with use, by 1975 only seven of the contiguous 48 states did not have such a law. States not having such a requirement were either very large, very small, levied a high third structure tax or didn't tax motor fuel at all. If anything, the argument could be made that 20 states have more stringent reporting requirements than Virginia, since they require carriers to file monthly.

JLARC Staff Note. Frequency of audit, not frequency of reporting, is the key factor in stringency of enforcement. Virginia ranked second among the ten southeastern states in audit frequency for motor fuel tax collections.

Secondly, the section is misleading for it implies that Virginia collects a disproportionate amount of revenue from heavy trucks. While Virginia's nominal user tax structure on larger vehicles ranks among the highest in the East, Virginia's effective tax collections rank it with states which have much lower nominal tax rates. This anomoly results from Virginia's relatively high registration fees on larger vehicles, which can be effectively and legally avoided under Virginia's registration reciprocity agreements. The JLARC reports issued to date do not address the serious equity problem that exists from the disparity in Virginia user payments between resident and non-resident carriers.

Sales and Use Tax Revenue Attribution to Heavy Trucks

Sales and use tax revenues were attributed to the several classes on the basis of data collected for six months in 1980 by DMV (October 6, p. 46). This methodology overstates the revenue that should be attributed to heavy trucks. During the base period, automobile sales in the U. S. were at their 20 year nadir. Heavy truck sales had not fallen correspondingly. Table III shows U. S. automobile, light truck, and heavy truck registrations for the years 1978-1980. As can be seen from the table, heavy truck registrations as a percent of automobile and light truck registrations increased from 1.30% to 1.75% between 1978 and 1980. This represents a 35% increase in penetration over 1978, the last "normal" year for motor vehicle sales. Accordingly, sales and use tax revenues attributed to heavy trucks have been overstated.

JLARC Staff Note. The data in Table III refers only to new vehicle sales at the national level. The sales and use tax in Virginia *is collected on all vehicles sold-new and used. To the extent that Table III reflects a decline in vehicle sales, the conclusion should be that passenger car contributions are understated, not that truck contributions are overstated.*

Table III

U.S. Heavy Truck, Light Truck and Total New Car Registrations
1978-1980

Year	Heavy Truck	Light Truck (000)	New Car (000)	Heavy Truck / Light Truck & Auto
1978	191,837	3,772	10,946	.0130
1979	213,174	3,255	10,335	.0157
1980	193,410	2,283	8,761	.0175

Source: Automotive News Market Data Books, 1980 and 1981.

Finally, it is interesting to note the per mile revenue attribution by vehicle class derived in the study. Table IV, column (a) shows JLARC's estimates of per mile Virginia and Federal user tax payments in FY 1980. This payment pattern has been described by JLARC as ". . . a reasonably equitable tax structure [October 6, p. 50]." The JLARC data show that in FY 1980 on a per mile basis, class III vehicles paid 7.16 cents per mile is total user charges while the larger, heavier class IV vehicles paid 5.70 cents per mile. Thus, class IV vehicles paid 25.6 percent less per mile in user taxes than did class III. Column (c) represents an index of cost responsibility by vehicle class on all roads (federal aid and secondary) as determined in the AASH(T)O Road Tests. If we let automobile user payments in FY 1980 have a magnitude of 1, column (b) shows that class III vehicles paid 5.7 times what automobiles paid per mile, while class IV vehicles paid only 4.5 times what automobiles paid in Virginia and federal user charges in 1980.

In column (d), we again assign automobile costs a magnitude of 1. As can be seen in column (d), the AASH(T)O results assigned progressively higher allocated costs as vehicle size increased. Thus while class III vehicles were allocated costs 3.2 times that of autos, class IV vehicles were allocated a per mile costs 7.3 times that of autos. Yet JLARC's own data indicates that on a per mile basis class IV vehicles paid less per mile in user charges than class III vehicles. These results were described as equitable.

JLARC Staff Note. The Virginia Railway Association elaborated on these points in its November 30 briefing of the SJR 50 subcommittee by producing a graph of cost per-vehicle-mile for each vehicle class. This graph has been included as Figure 1. The relationship as shown by the Virginia Railway Association was erroneously calculated. Figure 2 presents the corrected cost-per-mile separately for both the interstate/ urban/primary systems and the secondary system. The great differences in traffic mix and costs for construction and maintenance between the State's higher volume roads and the secondary system make combining the two calculations into a single graph meaningless.

At the November 30 briefing the Virginia Railway Association also handed out a second graph which purported to show revenue payments per-vehicle-mile (Figure 3). These calculations were also erroneous and appear to be based on data from two different fiscal years. The corrected calculations are shown in Figure 4.

Conclusion

In conclusion, we believe that the JLARC study is deficient in a number of areas. These deficiencies are serious enough to preclude using the results of this study as the basis for tax policy. As noted throughout the paper, not only have VDHT costs been understated significantly, but those costs which were used were misallocated among vehicle classes. Unfortunately, the end results of the study are not usable for establishing tax policy.

Table IV

Total Virginia and Federal User Payments per mile of travel
FY 1980, by vehicle class and ASSH(T)O Road Test cost responsibility

Vehicle Class	(a) FY 1980 User payments per mile[1]	(b) Magnitude with auto=1	(c) AASH(T)O cost resp. by vehicle type[2]	(d) Magnitude with auto=1
I	1.26¢	1	.32	1
II	3.41¢	2.7	.54	1.7
III	7.16¢	5.7	1.008	3.2
IV	5.70¢	4.5	2.346	7.3

[1]Table 26, Oct. 6, 1981 ÷ Table 5, S.D. 12. 1979 mileage.

[2]"Supplementary Report of the Highway Cost Allocation Study" Table 3, 1965.

Figure 1

Costs-per-mile as Shown
by Virginia Railway Association

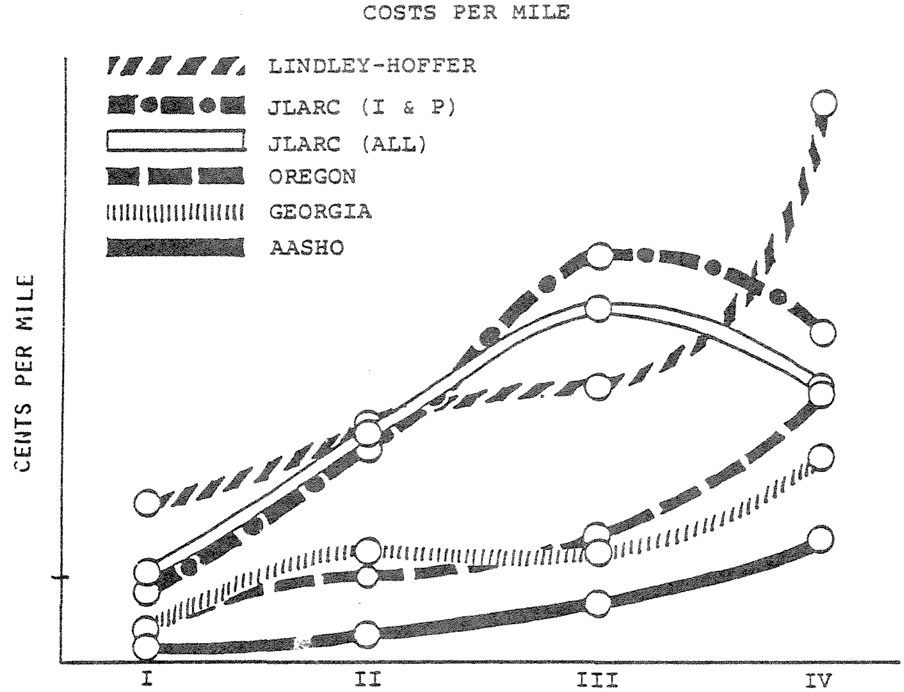


Figure 2
Costs-per-mile Based on
Actual Data

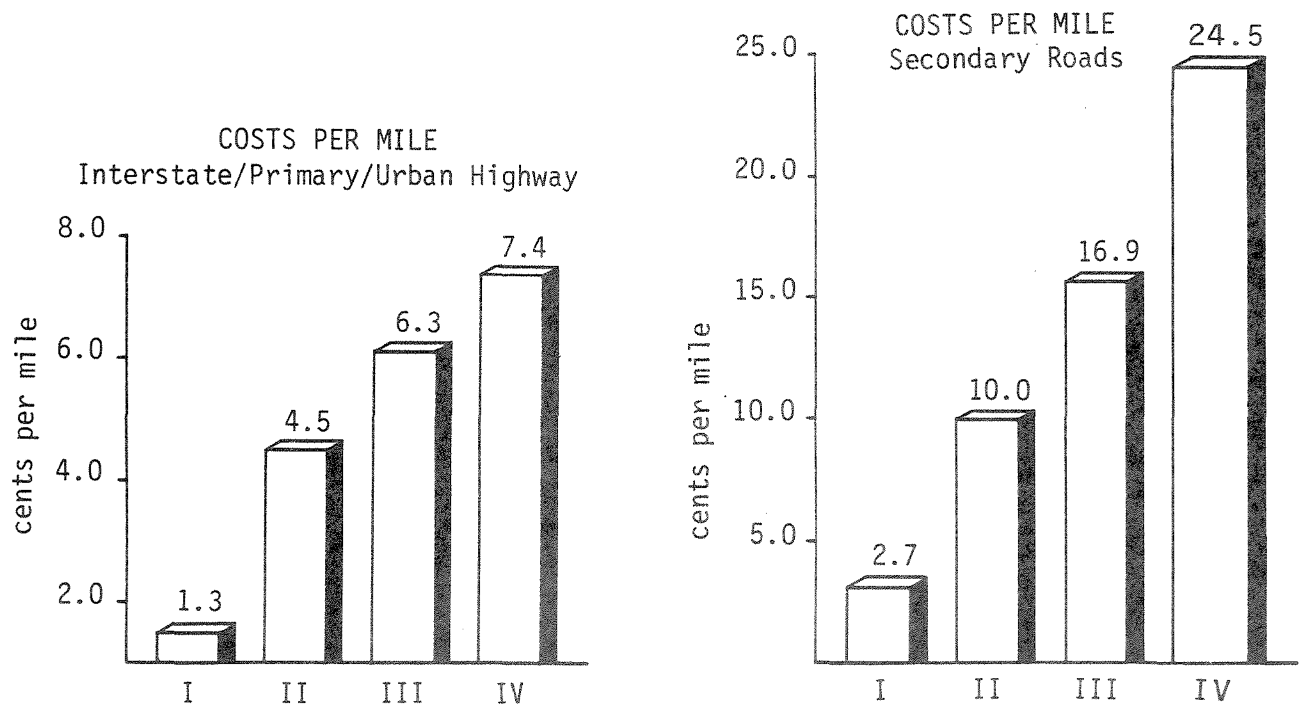


Figure 3

Revenue Contribution-per-mile
as Shown by Virginia Railway Association

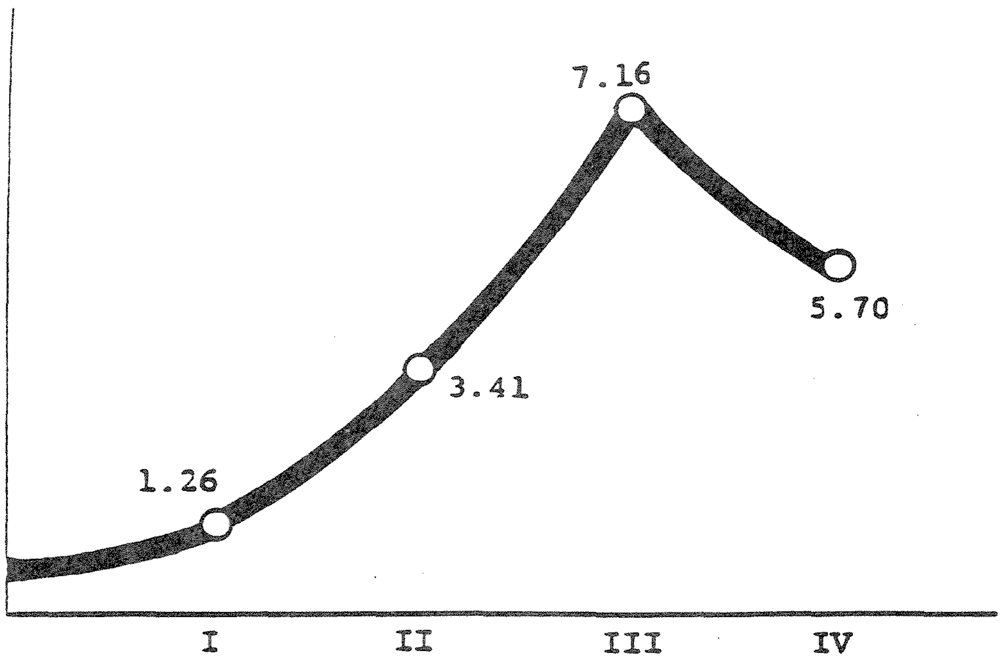
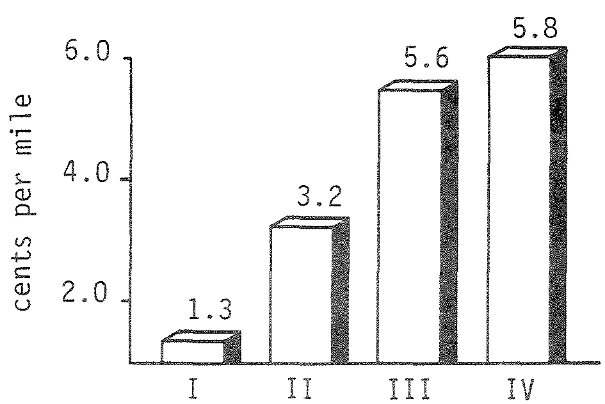


Figure 4

Revenue Contribution-per-mile
Based on Actual Data



Virginia Railway Association

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W. Bruce Wingo
Executive Director

December 30, 1981

Mr. Ray D. Pethtel
Director
Joint Legislative Audit and Review Commission
Suite 1100, Capitol Street
Richmond, VA 23219

Dear Mr. Pethtel:

We would like to take this opportunity to address the points raised by you in your letter of December 17, 1981. Before addressing the issues in detail, however, we would like to put the issue of a cost allocation study into perspective. The purpose of any cost allocation study is to provide a basis for implementing tax policy. The impetus for the present SJR50 study was the realization that there may exist a "highway problem." That is, the present highway user tax structure and tax rates may be inadequate to provide a financial base to adequately maintain and expand the Virginia Highway System.

Over the last several months the SJR50 Subcommittee and the General Assembly have been exposed to a number of JLARC staff presentations and reports, to several cost allocation studies undertaken in other states and to the results of the most recent Federal study. In addition, interested parties such as the Virginia Railway Association and the American Trucking Association have presented written and oral comments to the JLARC staff and the Subcommittee. Each of these reports, presentations and critiques should be evaluated in light of three issues:

(1) Is the present level of financial support for the highway system in Virginia adequate to maintain the present system and to expand it in a judicious manner into those subdivisions of the Commonwealth where there exists an increasing demand for highways? Two ways to examine this question are to determine if there is disinvestment in highways at present, and to compare expenditures on highways with other taxes

and the personal income level of the Commonwealth.

(2) Are the users of highways paying their "fair share" of highway costs? More specifically, are they paying their allocated cost responsibility given that we have satisfactorily determined what that cost responsibility is in the Commonwealth.

(3) Is the tax structure equitable in its tax collections? Does the structure collect from both in state and out of state users the appropriate amounts per vehicle class? Can any of the tax be avoided, thus setting up interclass inequities? And is the tax burden imposed on the appropriate users within the classes (i.e., heavier vehicles within a class pay higher user taxes)?

The Virginia Railway Association in both written and oral presentations has expressed concerns that the JLARC study has not adequately addressed the issues above. In the paragraphs appended we shall address the points you've made. In doing so we shall attempt to provide insight on the three issues outlined above.

Sincerely,

W. Bruce Wingo (mw)

W. Bruce Wingo
Executive Director

WBW:rw

Enclosures

cc: The Honorable Theodore V. Morrison, Jr.
Members, SJR50 Subcommittee

Disinvestment

Mr. Pethtel points out that maintenance replacement spending per lane mile has grown in real terms by 49 percent over the last three biennia. This is irrelevant. The staff in conducting the study chose a methodology that took only 1980 expenditures into account. That real per lane mile expenditures have increased over time has no bearing on the present analysis, for the staff chose to count only 1980 expenditures. We reiterate that in 1980 replacement maintenance expenditures were almost one-half of the 1979 level. As we pointed out in our presentation, if 1978 or 1979 replacement maintenance expenditures had been used rather than the 1980 expenditures, allocated costs would have increased by almost one-third.

On numerous occasions we have suggested that in conducting the study the staff should have taken costs over a longer time period, not 1980, or any single year, alone. The staff chose otherwise. They cannot now argue that over several biennia real replacement expenditures per lane mile have increased. From the staff's methodology, only 1980 expenditures are relevant and 1980 expenditures were low by any recent measure. Accordingly, as we have stated before, the staff has understated highway costs.

It is interesting to note that in an unpublished exposure draft, the staff produces the same result (Table 2, p. 32). Here the staff notes how replacement maintenance expenditures in 1980 fell by 25 percent from those in 1979. But in the exposure draft published on November 30 (Table 1, p. 5), the staff fails to show this decline by presenting only biennium data. As we have noted above, 1980 data, not biennium data, were used in the analysis.

Finally, data on maintenance replacement expenditures for FY 1981 have recently become available. As has been acknowledged, an aging highway system such as ours requires increasing real replacement maintenance expenditures per lane mile to prevent disinvestment. However, in 1981 replacement maintenance expenditures in Virginia continued to decline. On a real per lane mile basis, they are only at 53 percent of their 1979 levels.

JLARC Staff Note. The trend analysis clearly shows an increasing commitment to maintenance replacement spending. Biennial rather than annual data for this particular trend analysis are the correct base for reasons described previously. The study team continues to believe that the three-quarters of a billion dollar spending base in 1980 is a fair representation of the Commonwealth's highway program for the purposes of a cost responsibility study.

Costs Per Mile Comparison

The Virginia Railway Association presented an analysis showing a lower per mile cost for Class IV vehicles than for Class III vehicles. This analysis was based on JLARC's cost data from its

October Exposure Draft and mileage data from the JLARC Methodology Report. The mileage data were for 1979 while the cost data were for 1980. In Mr. Pethtel's critique of the VRA presentation, the JLARC staff for the first time presented their results on a cost per mile basis. To derive these results, the staff used previously unpublished vehicular mileage data. If we use their system-wide cost responsibility data by vehicle class and divide by vehicular miles traveled, <u>the same results first pointed out in the Association's presentation remain fact</u>. That is, on a system-wide basis, the staff attributes a higher cost allocation per mile traveled to Class III vehicles than to the larger, heavier Class IV trucks. Class III vehicles have an allocated cost of 8.45 cents per mile, while the largest vehicles, Class IV, have an allocated cost of 8.00 cents per mile. This decline is true if total vehicular miles by class are used or if adjusted vehicular miles are used. The latter mileage excludes toll road mileage on the interstate system as well as mileage in Arlington and Henrico counties.

The same downward shape is obtained if the percentage allocated cost by vehicle class results (October Exposure Draft, Table 27, p. 50) are divided by the 1980 percentages of vehicular mileage travel data by class obtained from the staff. Here, Class II vehicles have a cost responsibility 3.96 times that of their percent of miles, while Class IV vehicles have a cost responsibility only 3.70 times that of their percent of miles.

If the results presented in the November 30 Draft (Table 8, p. 60) are used, the cost responsibility discrepancy worsens. Class III vehicles cost responsibility increases to 4.10 while Class IV vehicle responsibility declines to 3.68.

The cost responsibility per mile results presented by Mr. Pethtel in his figure 2 were obtained by calculating class cost responsibility separated for the interstate/primary/urban system and for the secondary system. Only by separating the systems can it be shown that the study allocated a larger per mile cost responsibility to Class IV than to the smaller Class III vehicles. Yet the staff in the presentations of its results to the SJR50 Subcommittee has always presented cost and revenues sytem-wide (October Exposure Draft, p. 50; November Exposure Draft, p. 60). Only in rebutting the VRA presentations does the staff revert to a disaggregated system analysis. <u>The fact remains, that for the Virginia highway systems as a whole, on a per mile basis, the staff has concluded smaller Class III trucks have a higher cost responsibility than larger Class IV trucks</u>.

<u>JLARC Staff Note</u>. Combining data for interstate/primary/urban systems with the secondary system as was done by the Railway Association consultants for their cost per mile analysis is meaningless. Vast differences in traffic volume, physical characteristics, and basic purpose between the higher-volume and secondary systems have been documented in this report.

Revenue Contributions Per Mile

Mr. Pethtel points out that the VRA revenue contributions per mile were derived by dividing the JLARC staff's 1980 costs by class by the 1979 mileage by class. As noted above these represent the only logically consistent mileage data JLARC had released. In Figure 4, of Mr. Pethtel's letter, Class III and Class IV vehicles pay on a per mile essentially the same user fees: 5.6 cents and 5.8 cents respectively. Compare this flat revenue payment by Class III and IV in Figure 4 with the cost results per mile derived in Figure 2. Combining the two graphs in Figure 2, we find that allocated costs per mile for Class IV vehicles is 8.0 cents. This 2.2 cents per mile differential between costs per mile and allocated revenue per mile represents an underpayment for Class IV vehicles of 36.3 million (2.2 cents/mile x 1.649 billion miles). Yet JLARC in its November 30 draft reports an underpayment for Class IV vehicles of only 1.4 million dollars (November 30, p. 60).

Mr. Pethtel explains that even if Class III vehicles paid more per mile in user taxes than Class IV, there should be no cause for alarm. Virginia, he explains, collects a significant percentage of highway revenues from two taxes which are not directly related to highway use. Thus it would be reasonable for Class III vehicles to pay more on a per mile basis than Class IV, even if the cost per mile for Class IV is higher than for Class III.

Two points should be made. First, this anomaly between user payments per mile by Class III and Class IV vehicles can be explained by the fact that in Virginia almost two-thirds of the Class IV mileage is done by out of state vehicles that pay, for the most part, neither Virginia registration fees nor the Virginia sales and use tax. Thus, we are adding a tremendous number of Class IV miles with little additional revenue. Class III vehicles on the other hand, are basically intrastate. Virginia collects both the registration fees and the sales and use tax from these vehicles. It is not so much the low mileage of Class II vehicles which results in the flat Virginia revenue structure as the large number of miles traveled in Virginia by out of state vehicles which pay little more than the Virginia motor fuels road use tax. Virginia motorists and motor carriers necessarily subsidize out of state carriers.

JLARC Staff Note. Combining the cost per mile estimates as is done above results in calculations based on excessively gross and invalid statistics. This renders the above estimate of Class IV underpayment invalid as well. The fact that Virginia-registered vehicles subsidize out-of-state vehicles of the same class is self-evident. Out-of-state vehicles, including trucks from non-IRP states, are exempt from Virginia registration fees under reciprocity agreements allowed by state statute and customary in all states. Revocation of the reciprocity statute has been and remains a prerogative of the General Assembly, but it is one which does not necessarily follow from the current analysis of cost responsibility.

Second, Mr. Pethtel makes an excellent point, one which we have been trying to make: Virginia's tax structure is insensitive to weight and distance. It should also be changed so as to incorporate weight and distance. Virginia basically has the staff and expertise already in place to enforce a tax that would not be sensitive to where a firm is domiciled or where one registers the vehicle but only to the weight of the vehicle and the number of miles that vehicle travels in Virginia. Such a tax is necessary to close the gap between what Mr. Pethtel has pointed out in the disparity between costs per mile and allocated revenue per mile. Raising registration fees and/or the sales and use tax would only compound this inequity.

JLARC Staff Note. The analysis does not show that Virginia's tax structure is insensitive to weight and distance. In fact, fuel taxes and weight-graduated registration fees are designed to be sensitive to weight and distance, and are becoming more so as the fleet fuel efficiency of passenger cars increases and the corresponding overpayment of Class I vehicles decreases. The sales and use tax is not related to distance travelled and only indirectly to vehicle weight. However, in combination, Virginia's current tax structure provides sufficient sensitivity to weight and distance factors to provide overall equity among the four vehicle classes. A weight-distance tax as proposed by the Railway Association is a legitimate alternative tax policy. But adoption of such a major tax structure revision does not necessarily follow from the current analysis of cost responsibility.

Cluster Analysis

We feel that Mr. Pethtel misinterpreted our criticism of the cluster analysis used by JLARC. We are cognizant that JLARC used the ASSH(T)O derived ESAL concept to arrive at pavement cost allocation. We feel that this is the most concise portion of the study. It is the appropriate method to determine pavement costs. Our concern with the cluster approach used by JLARC is the method of allocating costs to classes on mileage basis, and that the cluster sample was for too short of a period of time. We feel that the cluster approach could be made a sound research methodology if it were properly applied.

Some of the necessary conditions to render the cluster methodology acceptable, but which were not followed by JLARC are:

(1) The time period of projects used must extend for a much longer period than one year in order to insure a representative sample. JLARC's results are marred by the fact that costs are understated because of the previously mentioned disinvestment problem.

(2) JLARC uses miles traveled per class to assign common costs and some costs which are not common costs. Assignment of costs to classes based on miles traveled must be assigned consistently. Ultimately all the costs and VMTs are averaged in the JLARC methodology. However, how they are averaged can affect results. For instance, site preparation costs assignable to trucks (Classes II, III,

and IV) were assigned to each class on the basis of their respective travel by class in each cluster. Class II might be 60% of the truck traffic for example and be assigned 60% of the site preparation costs assignable to trucks only. The resulting dollar figures along with other dollar costs were totalled for each class over the clusters. An approach that is statistically more in keeping with a sample methodology would be to accumulate truck assigned costs for site preparation over all clusters and assign the total on the basis of the percentage of each class's mileage of the total truck mileage.

For non-weight related, common costs, JLARC states in Recommendation 12 of Methodology For A Vehicle Cost Responsibility Study that "common costs should generally be apportioned on the basis of relative miles traveled on the highway system by each vehicle class." (p. 19) It is our understanding that JLARC attempted to do this. Mr. Pethtel states in the letter that "In fact we used actual 1980 traffic mix to assign non-weight related construction costs." Tables 6, 7, 20, 22, of the exposure draft are all cost allocations based on VMTs of the system. Each has a different percentage allocation for each class indicating that secondary-interstate, primary-urban miles were applied to secondary and non-secondary costs.

On non-weight related costs we assume that midpoint (ten year) estimates of mileage were used as was told to us at the October 30, 1981 meeting with the JLARC staff. This mileage is what is expected on the projects in the year 1990 and constitutes only the project mileage. Thus, we have a peculiar combination of miles. For non-weight related costs, 1980 system-wide mileage is used to allocate costs. For weight related costs that were allocated by mileage, 1990 project mileage was used. Again, statistically it would have been more appropriate to use system-wide 1980 mileage to allocate all costs based on mileage. When it was suggested at the October 30, 1981 meeting that this be tried, the reply was that the clustering process used to cluster projects was on the basis of design and construction and not by system and thus such could not be done. Yet in allocating common costs, the staff has separated the systems into at least secondary and non-secondary in order to come up with the different percentages in the Tables 6, 7, 20, 22. If common costs were broken down and allocated at the interstate level, the primary level and the urban level, then it would have been a simple matter for the staff to use system-wide 1980 miles for all costs. If the staff separated only secondary and non-secondary, it arbitrarily assumed that common costs could be spread across very dissimilar systems, i.e., the urban system versus the primary system versus the interstate system. There is as much difference between much of the primary system and the interstate system as between the primary system and the secondary system.

It is difficult to determine what impact the inconsistent application of mileage has had on the study. It is likely that its impact is what has resulted in JLARC assigning Classes II and III almost double the cost responsibility percentages for NON-SECONDARY roads than occurs in most other studies. We have pointed this out in both written and oral presentation and it has not been refuted since it is based on JLARC's presentations.

JLARC Staff Note. The above discussion reflects the Railway Association position that aggregated system-wide VMT is a more reliable statistic than cluster-specific data. This is not the case. The cluster approach was designed specifically to avoid the serious aggregation bias which would result from using gross system-wide data. Therefore, the study team believes that the study results are superior to what would be obtained by the method advocated by the Railway Association.

Additional Comment

One remaining serious deficiency of the JLARC study deals with their inappropriate comparison in percentage terms and their over-under payment results. In Table 27 (Exposure Draft, October, 1981) and Table 8 (Exposure Draft, November, 1981) JLARC compares percentages of cost responsibility per class with percentages of revenues per class. The revenue percentages are subtracted from the cost percentages and the remainder multiplied by revenues per class to arrive at dollar figures for over- or under-payment.

This analysis is extremely questionable because JLARC staff takes percentages of two different bases and subtracts them from one another. Very simple mathematics dictates that subtracting one percentage from another requires a common base. The bases used are not common, in Table 27 costs are $776,812,461 and revenues are $603,958,989. For Class I cost responsibility is 70.9% of $776,812,461 and revenues are 74.0% of $603,958,989. Thus, 70.9% cannot be subtracted from 74.0% and arrive at any meaningful results. The different (3.16493) percent could be multiplied by $603,958,989 as JLARC did and arrive at 19.1 million dollars or times $776,812,461 and get 24.6 million dollars. Neither of the two are correct. Indeed, over- or under-payment can be calculated in this manner only if total costs equal total revenue. Since total costs include 173 million dollars of fortutious Federal revenue, some provision must be made for accounting for that money. It can only be ignored if it is assumed that $603,958,989 was a sufficient amount to have spent on highways in the Commonwealth. JLARC uses only 1980 costs so it must be concluded that the appropriate amount to have spent on highways was $776,812,461. JLARC has argued vigorously that the use of only 1980 costs was legitimate and that the amount spent did not result in highway disinvestment. Neither have they stated that $776,812,461 was an excessive amount of spending.

Thus, since $776,812,461 is the required amount, having been spent in 1980, it is important to determine the responsibility for raising the 173 million that would have been necessary had not the Commonwealth been fortunate enough to receive more than its "share" of Federal money, a condition likely to not reoccur.

Based on JLARC's figures, one can subtract total revenues by class from total costs by class and determine the under payment by class. For Class I $103,376,000, Class II $28,513,000, Class III

$10,397,000, and Class IV $30,567,000. Thus we are able to determine the subsidy that occurred because of Federal revenues over and above "normal" amounts. The difference between the results is significant. In Table 8, November Exposure Draft, Class IV under payment is 10% of the under payment of Class II, and 37% of the under payment of Class III. By correctly calculating the under payment, Class IV under payment is 107% of Class II and 294% of that of Class II.

JLARC Staff Note. The above discussion indicates a general misunderstanding of the cost responsibility concept on the part of the Railway Association consultants. Virginia has benefited for the last two decades by the receipt of federal highway funds in excess of Virginia highway-user payments. The allocation of costs and revenues as presented in the above discussion treats the federal overmatch of approximately $172 million as funds for which Virginia highway users should be charged. This would have the effect of making a tax policy recommendation that Virginia highway user taxes be increased by 29 percent across-the-board to make up for a nonexistent funding deficit.

There is no evidence that the role of federal aid in funding Virginia's highway program in 1980 was not "normal" as inferred by the Railway Association. Should future federal action result in drastic reductions in federal aid, increasing State user charges to compensate is only one of the policy options open to the Governor, the General Assembly, and the Highway and Transportation Commission.

Conclusion

In conclusion, the Virginia Railway Association reaffirms its criticism of the JLARC study and feels that the results are very questionable in terms of a basis for tax policy. The JLARC study does not compare well with those of other states nor the new Federal study soon to be released officially. The reluctance of JLARC to modify any part of its study in response to basic statistical and methodological critique has resulted in a far lower quality effort than the staff is capable of producing. Before tax policy is developed, the JLARC staff should retrace its steps and modify its study procedure to produce a more accurate and meaningful result.

VIRGINIA HIGHWAY USERS ASSOCIATION
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L. RAY ASHWORTH
Executive Vice-President

DALE BRAZALE
Assistant to the Vice-President

December 14, 1981

Mr. Ray D. Pethtel
Commonwealth of Virginia
Joint Legislative Audit and
Review Commission
Suite 1100
910 Capitol Street
Richmond, Virginia 23219

Dear Ray:

Enclosed is a report to the Virginia Highway Users Association from CounselTrans Inc., 6110 Executive Boulevard, Suite 120, Rockville, Maryland 20852, entitled "Problems With JLARC Cost Allocation Methodology". I would appreciate if you would enclose these remarks in your official report.

My sincere best wishes.

Sincerely,

L. Ray Ashworth

LRA/mp
Enc:

Report to Virginia Highway Users Association on:

PROBLEMS WITH JLARC COST ALLOCATION METHODOLOGY

By CounselTrans Inc.

Since the nineteen thirties when the obligation of state levels of government to build coordinated systems of arterial highway became firmly established, attention has been given to the complex problems of establishing: (1) a firm continuing revenue base from which to fulfill these obligations; and (2) a system of equitable charges for the varying uses of the state roads. These became even more complex with the increasing state obligations for large systems of secondary roads and streets.

Accordingly, since that time, many bases, propositions and methodologies have been put forward for a combined solution to these problems, namely, the equitable allocation of highway costs among users and other beneficiaries of highways.

To date, it is obvious that no perfect methodology has been found -- one that all affected interests can accept without qualification. Even the most renowned and generally acceptable to date, the Incremental Analysis or Solution, has its drawbacks and detractors.

Accordingly, the research community is always looking for methods with more general acceptability or improvement to old methods that will produce the same result.

Early in its study, judging from the available reports, the Joint Legislative Audit and Review Commission (JLARC) of the Virginia General Assembly, made a thorough review of the various methodologies applied in the past and some new methodologies currently being proposed and applied in other states and at the national level.

As a result, the determination was made that the best of the past methodologies, the Incremental Analysis,was generally sound in concept but that: (1) its application in Virginia would have to be modified to some degree because of limitations on available data; and (2) there was a potential to modify and improve the method in some controversial and complex areas where its rationale and results have been under fire from various groups.

At least one of the major drawbacks of the Incremental Analysis has been the vast amount of detailed data required for a refined application. Practically no state transportation department has all of the data readily on file. Even in the Virginia Department of Highways and Transportation, which has more than most departments because of the state administration -- with exceptions -- of all road systems, the data situation is far from ideal. Obtaining all of the required data would involve a very expensive and time consuming study, not contemplated by the General Assembly.

Accordingly, JLARC set forth to adapt the incremental method to the Virginia situation with two objectives: (1) to modify it to make the best use of available data and minimize their deficiences; and (2) to improve the method, possibly in both simplifying it and making it more generally acceptable.

In evaluating the results of the JLARC study, CounselTrans recognizes this background as well as the extreme difficulty of undertaking the task which JLARC undertook.

The Incremental Analysis is based on the logical presumption that all users should be taxed in proportion to costs incurred by the government to provide for their specific accommodation on the highway plant -- the costs-occasioned principle. Unfortunately, because highways are built for a conglomerate user population where designers do not distinguish all vehicular features in relation to everything provided in highway construction, it is very difficult to relate highway components and motor vehicle requirements. It is even more confusing to determine how rehabilitation and maintenance requirements relate to the specific demands of different vehicles.

Accordingly, the problems of allocating highway costs, using the costs-occasioned principle, become very complex. They become even more so when there is lack of complete scientific knowledge on the behavior of some road elements in response to the various factors which contribute to their depreciation and need for ultimate renewal. This is true in the case of highway pavements. The relative degree to which environmental factors and loading contribute, independently or together, is unknown at present.

With all of the contingent problems, JLARC has done a very credible job in putting forth a simplified cost-occasioned methodology with considerable overall merit.

Unfortunately, however, it does have some serious defects in theory and application -- not easy to recognize but nevertheless there -- in a few areas which critically affect the study results. They tend to produce biases against heavy vehicles.

The problems result from new procedures adopted for the allocation of pavement costs to replace those traditionally used in the Incremental Analysis. These are based on a prevalent theory of pavement consumption which fails to make proper allowance for distinct differences in highway performance and design technology. Highway design relationships are being applied in situations where they do not actually apply without substantial modification.

Current pavement design theory was fundamentally established by the AASHO Road Test conducted in 1958-61. Pavement performance theory, as related to its practical behavior under different environmental conditions, has been the subject of continuing research. It is sufficient to say that the AASHO Road Test design equations, while they may still be an adequate instrument for pavement design, do not apply, without substantial modification, to the problem of defining pavement performance as related to time and vehicular load applications.

The technical area is so complex that the average highway designer is unaware of the substantial differences in the two areas of theoretical knowledge. Personnel of CounselTrans, Inc., have a distinct advantage in having been on the National Advisory Committee for the AASHO Road Test for practically its full duration -- a few months lacking at the very beginning. These personnel have also been extensively involved, recently, in practical pavement performance research.

The results of the defects in the JLARC procedures are not of serious consequence to heavy vehicles because simplifications of the traditional methodology, adopted because of shortages of completely adequate data, balance the charges against different vehicles largely not to reflect the theoretical problems.

Nevertheless, in the areas where the defects occur, the same methodologies should not be applied in future studies. Therefore, to fully document the inherent problems in the JLARC procedures, CounselTrans has prepared the attached Analysis of Procedural Defects which, it is hoped, will contribute to a better understanding of pavement performance principles as related to highway cost allocation.

Being aware of the difficulties involved in fully comprehending all of the different theoretical and practical considerations involved, CounselTrans is prepared to provide more elaborate technical demonstrations of the problems now inherent in new JLARC methodology, if necessary.

ANALYSIS OF PROCEDURAL DEFECTS

This brief analysis of the adequacy and basic equity of cost allocation procedures utilized by the Joint Legislative Audit and Review Commission (JLARC) of the Virginia General Assembly has been developed at the request of the Virginia Highway Users Association.

It finds that many of the procedures utilized in the study, as described in the report dated November 30, 1981, entitled "Exposure Draft: Cost Responsibility in Virginia; Technical Working Paper," are thoroughly supportable from the standpoint of equity and reasonableness as well as adherence to the premise that the various classes of motor vehicles should be taxed in accordance with the costs they occasion on Virginia highways.

Some of the procedures, however, are not technically sound in adhering to the adopted premise. While the subject is complex, the shortcomings of these procedures can be demonstrated, using the full body of research knowledge currently available.

This paper will attempt to describe the technical problems with the methodology in as straightforward terms as possible, because of their effect in causing the results to depart from the objectives of theoretical supportability and complete equity.

DESIGN EASLS AND PAVEMENT CONSUMPTION

A fundamental problem occurs in the way in which a pavement design variable known as equivalent single axle loads (ESALs) is used in the allocation of portions of pavement cost under both of the JLARC methodologies: The Minimum Pavement Method and The Avoidance Method.

Several facts concerning the use of ESALs in pavement design formula as well as the relationship between ESALs as used in design and as they may apply to actual pavement consumption over time must be described in order to appreciate the difficulty with the methodology.

It is also necessary to describe the difference between changes in a factor known as Present Serviceability Index (PSI) and pavement consumption. The PSI is simply a number on a scale used to measure and report pavement condition.

Pavement consumption, on the other hand, may be described -- for cost allocation purposes -- as the changes in net worth of an original pavement from the time it was placed in service to any other point in its life history. The point which is most relevant is the point at which damage sustained by a pavement is corrected by an overlay. The cost related to the amount of overlay necessary to completely restore the serviceability of the original pavement can practically be construed to be equal to the loss of original pavement net worth (when constant dollar values are utilized.)

The following facts are then relevant:

- Highway pavements are resurfaced or repaired long before the pavement is totally destroyed.
- All of the pavement provided on a highway is not consumed over the normal working life of a pavement. If a pavement were allowed to deteriorate fully over its design life, it would typically possess 45% to 55% of its original net worth.
- This is the full amount of deterioration that could be ascribed to design ESALs under the worst of circumstances. In this case, the maximum range of original pavement net worth that could be allocated on the basis of design ESALs would be 45-55% of its original cost.
- It, however, constitutes extremely poor policy, from the standpoint of cost-effectiveness, to allow pavements to deteriorate to this degree. It is very doubtful that VDH and T would permit it and the condition of Virginia highways certainly does not suggest this as the prevailing policy.1/
- At the optimal point of overlay (from the standpoint of minimal annual expenditure to preserve pavements) the pavement will have lost only 10% of its original or design net worth. This is the only amount of original pavement that is consumed.
- At the optimal point of overlay, the PSI value will commonly be in the neighborhood of 3.1. The original age of the pavement will be between 10 and 13 years. It will have received 60% of its design ESALs. The overlay requirement to restore original service capability will ideally be between 1" and 2" (asphalt pavements). 2/
- Some states have essentially adopted this optimal overlay policy (e.g., Ohio). A few, not including Virginia, have let their pavements deteriorate too far, undoubtedly because of lack of funding.
- Most states are letting their pavements deteriorate somewhat below the optimal overlay point, possible to a PSI in the range of 2.7 or 2.8.

1/ A policy like this would result in annual costs to preserve reasonable travel conditions that would be several times optimal annual costs, producing a large wastage of highway funds.

2/ While this is the best prediction that can be made in general, there is considerable variance in the behavior of individual pavement sections

- At this more practical sub-optimal point, the loss of pavement original net worth may be between 20% and 30%. This is all of the pavement that will be consumed. It will have received 70-80% of its design ESALs.

- If all of the pavement provided in design is presumed to be consumed in direct proportion to design ESALs, the rate of consumption per ESAL will be approximately 2½ times the rate actually experienced up to the most likely point of overlay.1/

Because of misunderstandings on the applicability of design methodology, which are quite widespread currently, JLARC procedures essentially employ this unrealistic, much expanded rate of alleged cost responsibility per ESAL to allocate substantial portions of pavement cost under both methodologies. It is mitigated somewhat by the minimum pavement consideration which does not, however, make anywhere near the proper allowance for pavements which will not be consumed with any degree of reasonableness in pavement overlay policy.

This results in substantial overcharges per ESAL in relation to costs actually occasioned. This, in turn, is reflected in per vehicle charges that are proportional to the number of ESALs they apply. In other words, a vehicle imposing 500 times the ESALs of a passenger car will receive 500 times the overcharge. It follows, therefore, that these pavement allocation procedures tend to produce results that are strongly biased against heavy vehicles.

ADDITIONAL PROBLEM IN AVOIDANCE METHOD

Related to the same basic failure to distinguish between pavement design provisions and actual pavement performance as related to time and rehabilitation and overlay policies, another type of error occurs in the "avoidance method," also tending to produce charges against heavy vehicles in excess of their real responsibilities under costs-occasioned principles.

In understanding this problem, it is necessary to realize that the "avoidance method" does not treat "increments" in the same way as the Incremental Analysis (layer on a cake concept) where the final pavement is an accumulation of increments one on top of another. Instead, it removes a vehicle class from the design consideration altogether and works out a new design to determine the avoided vehicle's increment. This vehicle class is then replaced to determine a new avoided vehicle's increment. Inherent in this method must be the avoided vehicle's design influence during the entire pavement life.

ESALs, or the axle loads they represent, do not occur at one point in time but are spread over the lifetime of the pavement design they influence. In effect, every vehicle class for which the high-

1/ This is conservative depending on how the design ESAL rate is calculated.

way is designed is anticipated to apply axle loads or ESALs at intervals along the entire design curve shown on page 20 of the Exposure Draft. For example, at the bottom scale value of 150, axle load applications over the first two or three years of pavement life may be represented.1/ The vehicle class to be removed in the design consideration applies part of both these applications and those occurring later on the design curve: those from the possibly second or third to the 15th year.

If a vehicle class is removed from the design consideration, its ESALs need to be removed along the entire design curve. Thus, there is no justification for presuming the avoided portion of pavement is on the flat portion of the design curve. (See Exposure Draft, page 22).

This assumption, reflected in the avoidance methodology, tends to give credit for minimum pavement contributions to ESAL support entirely to vehicles with low single axle load equivalencies or ESAL values.

MAINTENANCE ALLOCATION

There are two problems with the maintenance cost allocation. Both of these stem from the same widespread misunderstanding of pavement design and performance relationships.

In the first place, inherent in pavement design is a provision for an amount of pavement to be consumed by each vehicle class over the design service life of the facility. This is the proportional amount of the design that is actually provided for this class less an appropriate allowance for that which will remain unconsumed. In the design-related construction allocation process, this portion of the pavement has already been charged to the appropriate vehicle class. In other words, this vehicle class has already paid, in advance, for the consumption expected of it.

The indicated consumption is the amount of pavement deterioration which can be ascribed to particular conditions of loading. It presumably is the same for any pavement under its specific loading conditions, unless the design rate of loading is exceeded, because all pavements are deteriorating at basically the same rate or, in other words, over the same design period. Theoretically, maintenance expenditures should be the same on every pavement.

In other words, unless it can be shown that there are <u>differential</u> expenditures on different pavements that can be specifically ascribed to loading, there is no sound basis for allocating maintenance expenditures on the basis of relative loading. It actually constitutes double-charging since vehicles already have been charged in advance for the amounts of consumption related to them

1/ Scale representations in terms of equivalent thicknesses and numbers of ESALs are not given.

There may be and probably are some differential maintenance costs due to loading but it has never been demonstrated that these are significant proportion of normal surface maintenance costs.1/

In effect, because actual load-maintenance relationships are not properly represented, JLARC methodology results in double-charging for pavement consumption. While the maintenance cost is that for the system as a whole, the use of a methodology involving design-based construction cost allocation precludes the coincidental use of a consumption philosophy if double-charging is to be avoided. Inherent in the employment of the design/construction orientation is the implication that all previous construction has been properly compensated for by the different vehicle classes unless the study should indicate that the current tax structure is significantly out of line with cost allocations based on the design/construction philosophy.

The other significant problem with the maintenance allocation methodology is the use of design-based ESALs as a distribution vehicle involving previously discussed theoretical errors associated with this kind of an allocation

OTHER JLARC ALLOCATIONS

JLARC allocations of other road cost components are based on reasoning which appears thoroughly sound, much of it following the direction of conventional incremental technology.

The considerable simplification of procedures from those employed in the traditional incremental analysis, probably because of lack of data which was considered too expensive an undertaking to develop, has had two effects on the results of the study which are worthy of note. It is well to understand these as background for possible modifications of the methodology in future studies.

First, the way motor vehicle classifications have been combined, without consideration of specific weight categories of vehicles within these classes, effectively compensates for the biases against heavy vehicles inherent in some of the other methodology. The only probable way these biases are reflected is in a relatively low responsibility charge for Class 1 vehicles.

Second, the same simplification does weaken the bridge cost assignments (with unknown effects on the results). It is a case where bridge costs are affected considerably by differences in vehicular weight characteristics within the broad class groupings. They are influenced by gross vehicle weight, axle weights and distances between axles depending, to some extent, on the length of the bridge. It is quite possible, for example, for a heavy single-unit three axle vehicle, operating legally, to influence bridge costs as much or more than combination vehicles operating at greater gross weights.

1/ There is a compensating indication, in fact, that heavy pavements (constructed for heavy loads) have more environmental resistance than light pavements and may result in less maintenance cost.

The use of vehicle miles of travel (VMT) to allocate the portion of pavement identified as the basic pavement is more lenient than most applications of the incremental method which have used axle miles for allocating this cost element.

NET EFFECT OF JLARC PROCEDURES

The problems with the JLARC procedures, presented here, have been pointed out more to assist in assuring a sound basis for future studies than to be critical of the efforts of the JLARC staff aimed toward the development of new, more efficient and less expensive cost allocation methodologies.

The results are not apparently out of line with those that would have been obtained under the best application of past methodology. It is not believed that any specific user group is greatly disadvantaged by the study.

There is no method of highway cost allocation so far developed that does not have some theoretical or practical shortcomings.

Committee for Equitable Road Taxes

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December 22, 1981

Mr. Ray D. Pethtel, Director
Joint Legislative Audit and
Review Commission
Suite 1100
910 Capitol Street
Richmond, Virginia 23219

Dear Mr. Pethtel:

As counsel for the Committee for Equitable Road Taxes, I am writing to express the concern of the Committee regarding the results of the Highway and Transportation Study undertaken by JLARC in response to Senate Joint Resolution No. 50, particularly insofar as the vehicle cost responsibility results appear to show that Class II trucks (two-axle, six-tire trucks) and Class III trucks (three-axle, single-body trucks) are substantially underpaying their "fair-share" of highway user taxes.

Users of Class II and III vehicles have not heretofore taken the opportunity to comment upon JLARC methodology, data sources, or other components of the study, probably because, at the outset of the study, it was not apparent to them that their interests would be so substantially affected as the tentative results appear to show. It has only been since the publication of preliminary results seeming to show substantial underpayment on the part of Class II and III users, and suggesting that the burden of user taxes upon these groups should be dramatically increased, that efforts have been made to examine the validity of these results from the perspective of Class II and III users.

Our concerns in the area of equitable cost allocation were initially raised when preliminary study results appeared to show that Class II and III vehicles, which are responsible for approximately three percent (3%) of the traffic on the highway system, were responsible for approximately eight percent (8%) of the system maintenance and construction costs. Costs allocated to various vehicle classes on a per mile basis also appear to us to be much higher than expected for Class II and III users, and much lower than expected, (i.e., not significantly greater than the Class II and Class III cost per mile) for Class IV trucks (tandem trucks). Revenue attribution to each particular class of vehicle user is accomplished through the use of miles per gallon estimates for each class, coupled with total vehicle miles traveled for that class. A small error in these estimates could dramatically affect study findings on equitable cost allocation. The results of our preliminary analysis into these, and other, areas of the study indicate that findings in the area of equitable cost allocation may be incorrectly estimated in favor of Class I and Class IV users, and against Classes II and III.

As a result of these initial determinations, the Committee for Equitable Road Taxes has been formed in order to fund a thorough analysis of study results. The Committee is still growing, but at this time its members include:

The Virginia Agribusiness Council
The Virginia Beer Wholesalers Association
The Virginia Building Material Association
The Virginia Coal Association
The Virginia Dairy Products Association
The Virginia Poultry Federation
The Virginia Ready-Mixed Concrete Association
The Virginia Retail Merchants Association
The Virginia Soft Drink Association
The Virginia State Feed Association
The Virginia Wine Wholesalers Association
The Car and Truck Rental Association of Virginia
The Retail Merchants Association of Greater Richmond, Virginia

As noted above, the Committee has retained a professional engineering and planning services company to examine JLARC data sources, methodologies, and results, and will receive a report sometime in early January, 1982. It is our hope that, prior to the use of the results of the JLARC study as the basis for changes in tax policy which would increase the amount of taxes paid by Class II and III users relative to other classes, the Committee would be afforded an opportunity to complete its investigation of the JLARC study and respond to its findings.

With kindest regards, I am

Sincerely yours,

Walter

Walter A. Marston, Jr.

SWP:sbw

JOINT LEGISLATIVE AUDIT AND REVIEW COMMISSION

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